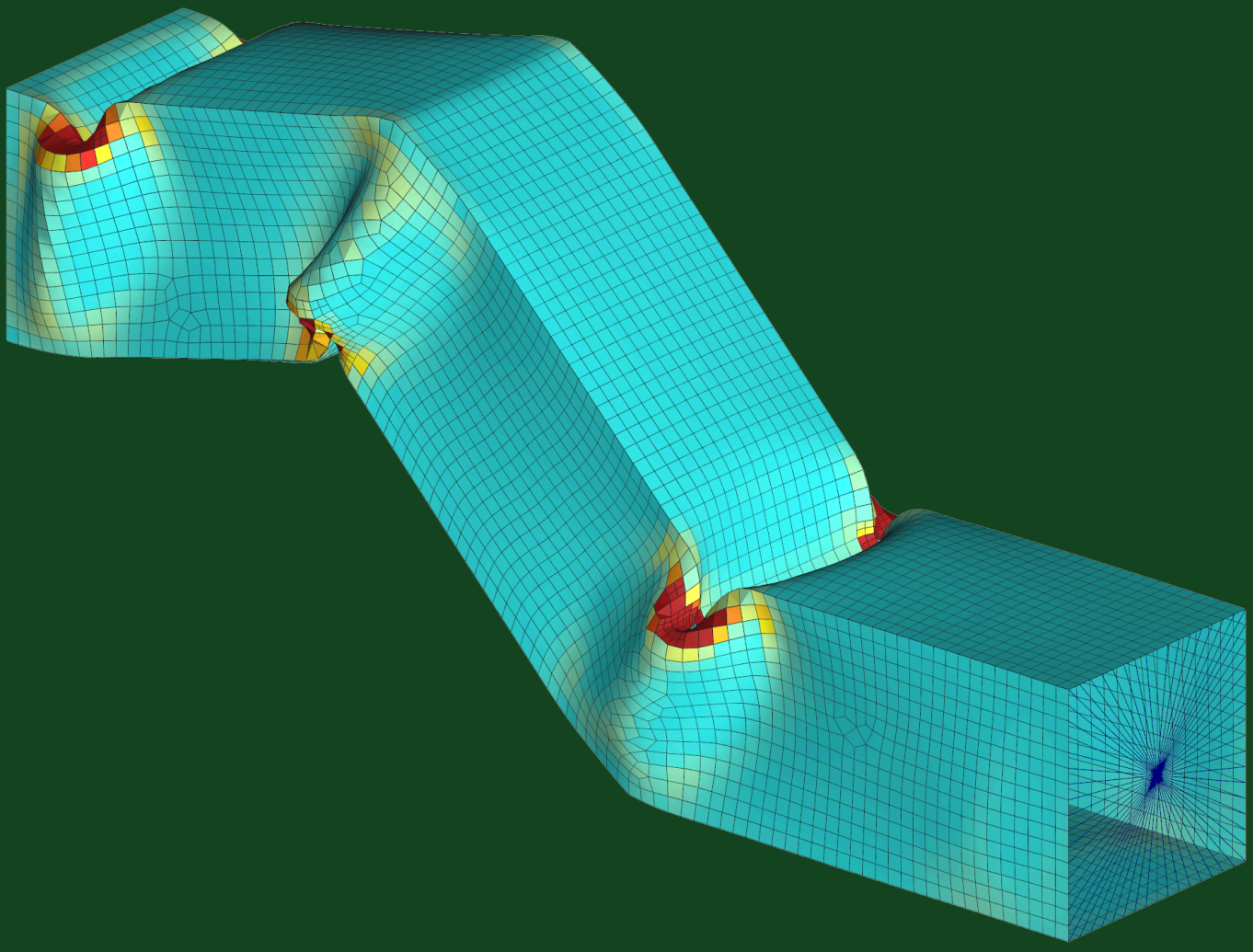
BEIDER SIMULATIONS

BeidPrep 2.0.0 beta User Manual

Pre- and post-processing for OpenRadioss



Every picture in this manual is made by the program itself from the author's own models.

A personal note

BeidPrep was built over countless hours, in every spare minute I had over the past year: late nights and early mornings, weekends, on the couch, at red lights, between workouts, alongside my consultancy work. None of it would have been possible without my wife, Alina, who carried our family through all the time I spent immersed in this project, and without the patience of our two daughters. This release is as much theirs as it is mine.

I built the tool I always wanted as an engineer: one that writes decks the solver accepts, never changes your work without telling you, and makes good engineering faster. I hope it saves you time, and I'd be glad to hear how you use it.

Konstantin Arhiptsov

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How to use this manual

Who it is for

Engineers who build OpenRadioss models. You know finite elements and the solver's cards; you do not need to know programming. Everything in BeidPrep is done with the mouse, the panels and the card forms.

Two parts

Part I, the guide, follows a project from start to finish: open or import, mesh, connect, build the cards, export, run, and read the results. Read the chapters you need, in any order.

Part II, the reference, lists every panel and every control in it: what it does, its choices and its default. It is for looking things up, not for reading through.

Where to start

- **New to BeidPrep?** Start with *Getting started*: open a deck, mesh a part, export and look at the results.
- **Then** follow *From CAD to crash results*, a complete crash model built step by step.
- **Looking for one task?** Use the contents, or the bookmarks in your PDF reader's side panel. Every reference in the text, such as *chapter 13* or *section 8.4*, is a link.
- **Something not working as written?** Section 15.5 lists the known issues of this release.

Names of buttons and fields are in **bold**, as the program shows them. Features marked Pro or Pro+ are in those editions only.

PART I

The guide

From an empty screen to results: getting started, a complete crash model built step by step, and one chapter per task — meshing, connectors, cards, export, running and results. Read the chapters you need, in any order.

Getting started

This chapter takes you once around BeidPrep, in the order you will meet it: open a deck, look around it, mesh a part from CAD, export the deck, and look at the results of a run. Each step takes a few minutes and points to the chapter that tells the full story.

Before you start

- **BeidPrep is installed and starts** (chapter 2). It opens with an empty model.
- **OpenRadioss is on your computer** if you want to run the deck you make. BeidPrep 2.0 writes the deck; OpenRadioss runs it (section 12.4).
- **A deck to open.** Any OpenRadioss Starter file will do: `name_0000.rad` or `name.rad`. The pictures use a 5 mm shell mesh of a sheet-metal part.
- **A STEP file** for the meshing step. The pictures use a small S-shaped part made of surfaces, ready to mesh.

> **Free, Pro and Pro+** Everything in this chapter works in the Free edition. Where a control needs Pro or Pro+, it carries a badge and is greyed out without the licence (section 1.3 lists the two places that work differently).

1. Open a deck

1. Press `Ctrl`+`I`, or click **Import Model** on the **File** tab.
2. Click *Browse…* and choose the deck's Starter file.
3. Leave *New Project (replaces current model)* chosen and click **OK**.

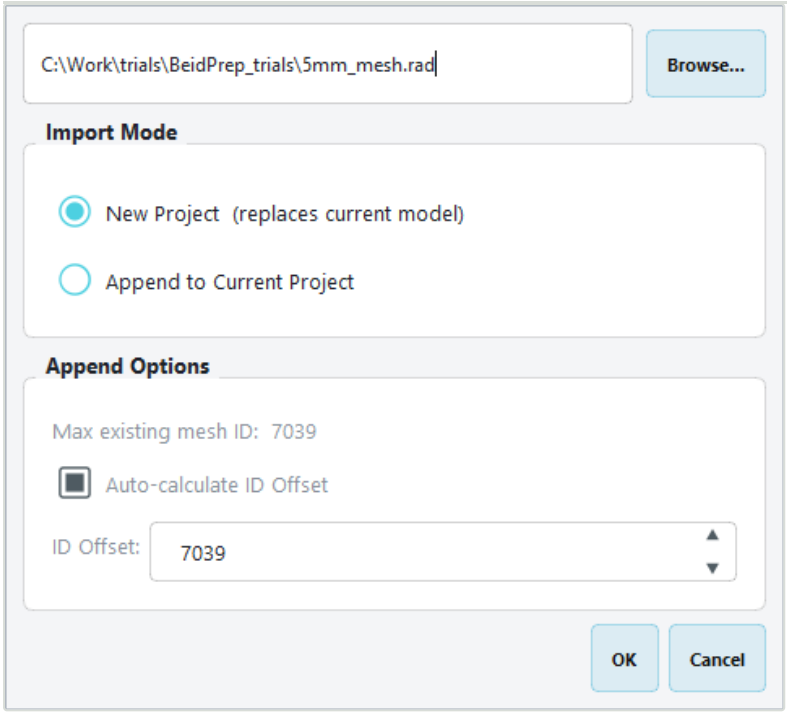


Figure GS.1 — The *Import Model* window: the file, and *New Project*.

The Engine file (`name_0001.rad`) is opened with it if it sits in the same folder, and every include file the deck names is read too. The model appears in the 3D view and its cards in the model tree on the left.

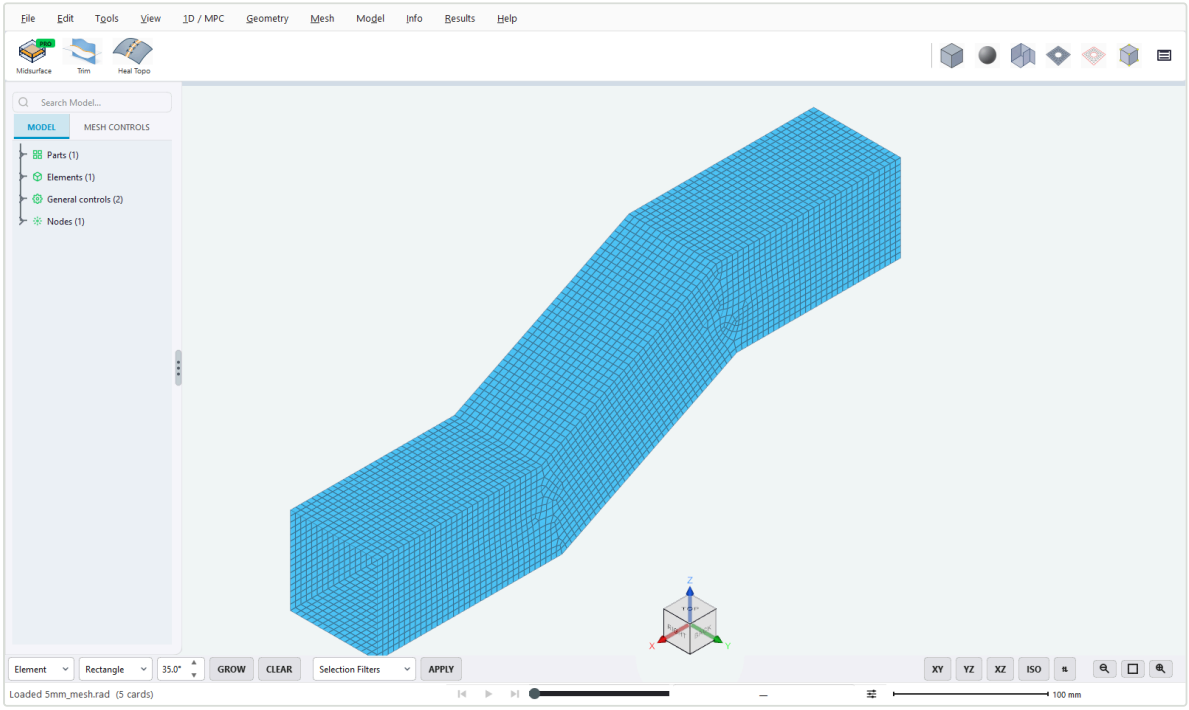


Figure GS.2 — A deck open: the ribbon at the top, the model tree on the left, the 3D view in the middle, the bottom bar below.

The window's parts are named in section 3.1. **Append to Current Project** in the same window adds a second deck to the one already open, raising its node and element numbers by an offset so they

do not clash (section 4.4). `Ctrl` + `O` opens a BeidPrep model (`.beid`); a deck chosen there is imported the same way.

2. Look around

Turn, move and zoom

Everything happens with the mouse in the 3D view. The view cube in the lower right corner turns the view to a standard direction with one click.

In the 3D view	Effect
Left click	picks what is under the pointer, for the tool in use (chapters 5 and 9)
Shift + left drag	turns the view
Right click	opens the menu for what is under the pointer
Shift + left drag	turns the view
Shift + right drag	moves the view sideways
Middle drag	moves the view sideways
Wheel forward	zooms in or out

The model tree

The tree lists the deck by kind: parts, elements, materials, properties, groups, loads and the rest. Expand a kind to see its cards. The **eye** on a part's row hides or shows it in the 3D view; a right-click on the row offers **Isolate** (this part only) and **Show All**. The search box above the tree finds a card by its title, keyword or number (chapter 5).

Open a card

Click a card in the tree — a part, a material, a property. Its fields open in the card editor as a form: one box per value. Change a value and the deck changes with it; `Ctrl` + `Z` undoes it.

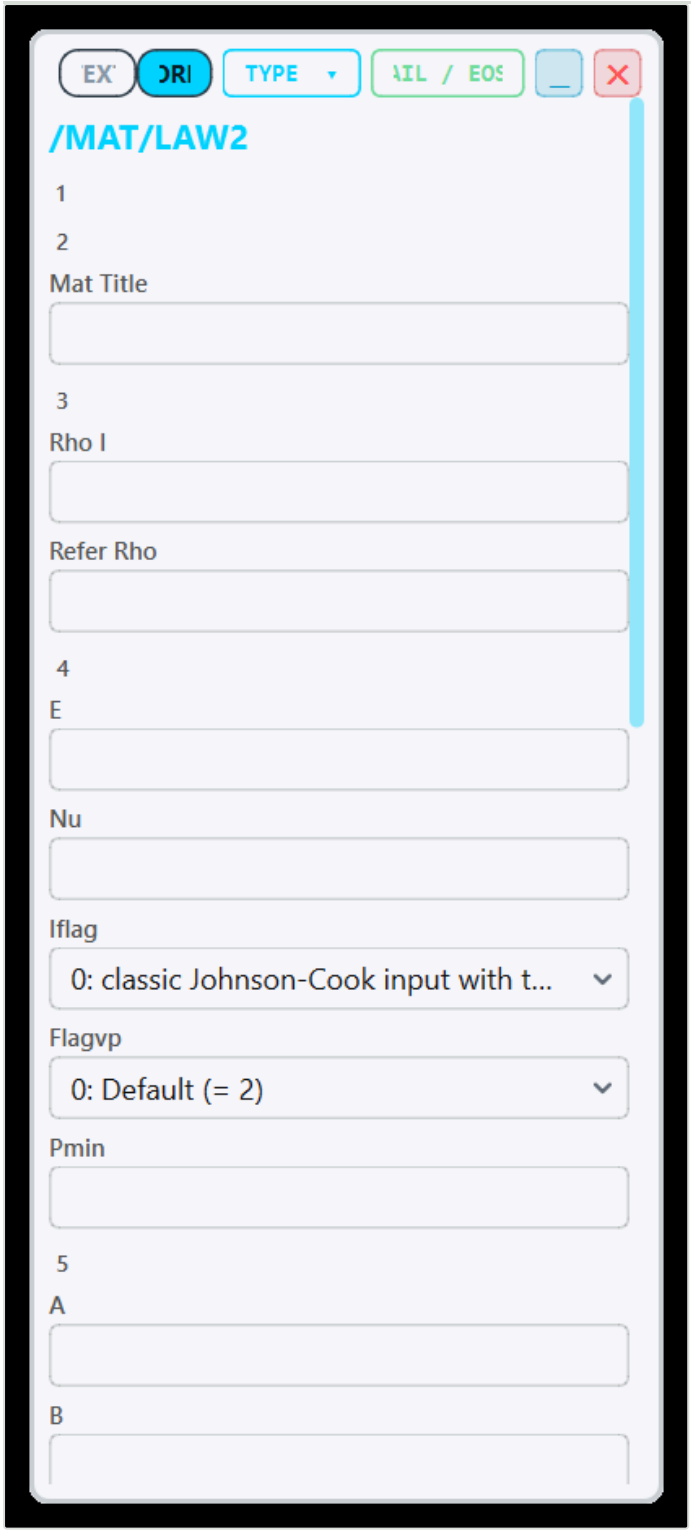


Figure GS.3 — A card open as a form in the card editor.

Some card types open as text rather than a form: their fields have not yet been checked against the OpenRadioss Starter, so BeidPrep shows the card's own lines and does not guess where each value sits. Section 6.3 explains the two views, and **Info** → **Card support** lists which card types open as forms.

3. Mesh a part

Now make a mesh of your own from CAD. Start on an empty model: click **New** on the **File** tab (`Ctrl` + `N`). If you have unsaved work, you are asked to save it first.

Bring in the CAD

1. Click **Import CAD** on the **File** tab.
2. Click *Add Files…* and choose the STEP file.
3. Leave the other settings as they are and click **OK**. The part appears in the 3D view and in the tree.

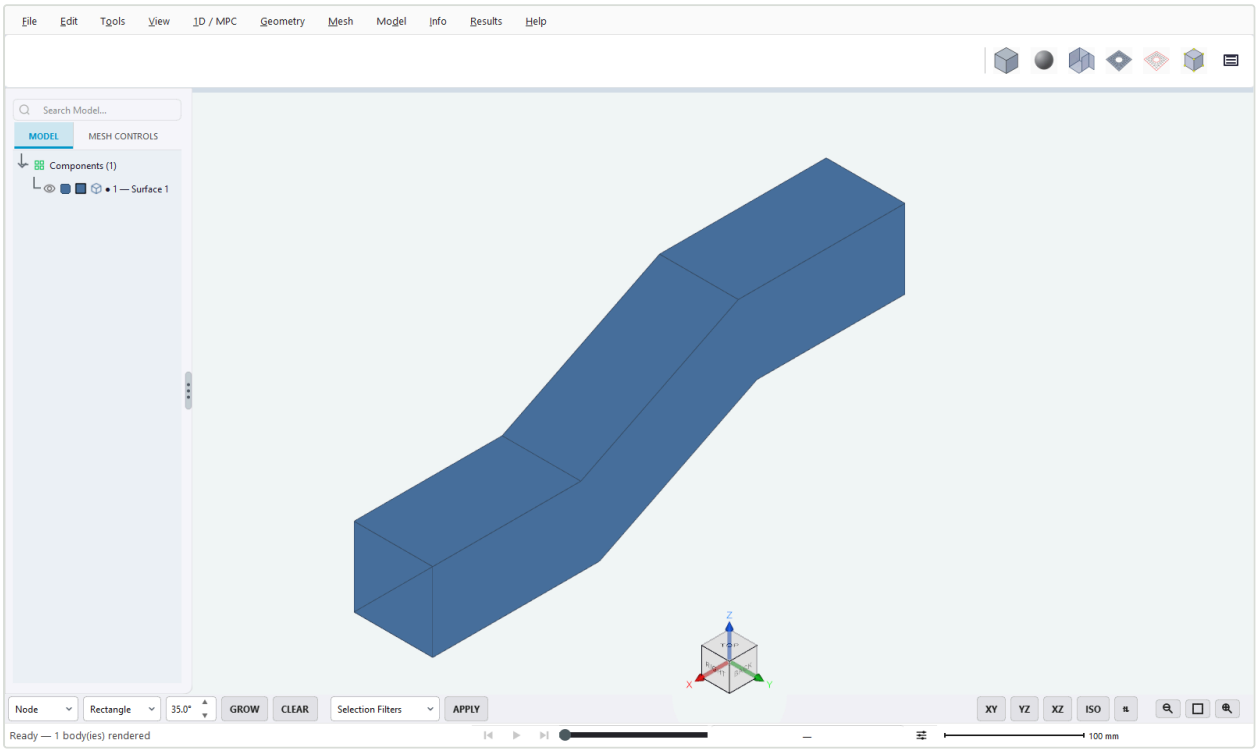


Figure GS.4 — The part as it comes in from the STEP file.

A thin-walled solid — a pressed or moulded part with two skins — is meshed on its mid-surface: make it first with **Midsurface** on the **Geometry** tab (section 7.2). A part that is already a surface is meshed directly.

Preview the mesh

1. Click **2D Mesh** on the **Mesh** tab. The *2D Mesh Setup* panel opens on the right.
2. Select the faces to mesh in the 3D view: click a face, or drag a rectangle around the whole part. Selected faces turn magenta.
3. Type the **Global Element Size** — the length of an element edge, for example 5 — and choose the **Element Type**: *Quad-Dom* gives quads, with triangles only where a quad would be poor.
4. Click **Preview Mesh**. The mesh is drawn on the faces but is not yet part of the model.

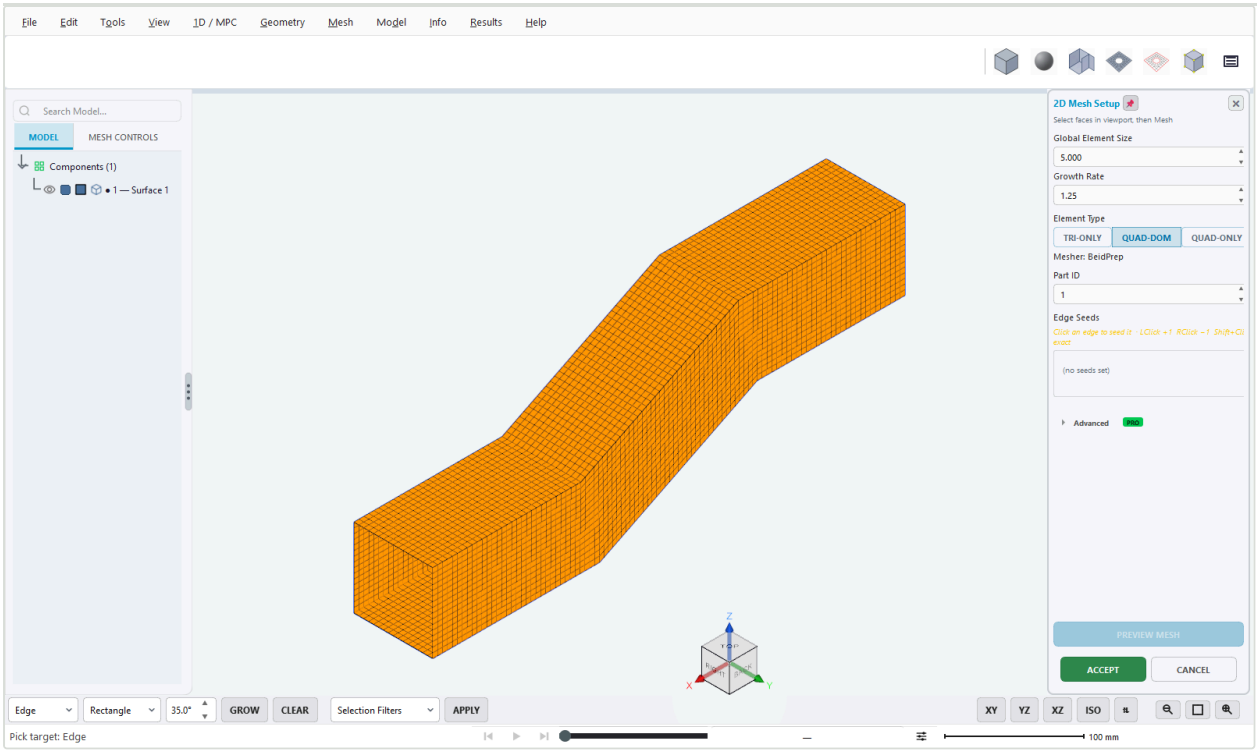


Figure GS.5 — The mesh previewed, with the *2D Mesh Setup* panel beside it.

Too coarse along an edge? Click the edge: its number of nodes appears on it. Each further click on it adds one node, or press on it and drag upwards; the faces next to it re-mesh to match at once (section 8.3).

Accept, and read the check

Click **Accept**. The mesh becomes part of the model, and BeidPrep checks it at once. The panel shows the verdict in one line:

- green *Mesh check:* — the mesh is connected (every node shared where faces meet) and of good quality;
- red *MESH CHECK FAILED* — it names what it found: a crack, a hanging node, a collapsed element or a very sharp angle. Section 8.4 says what each one means.

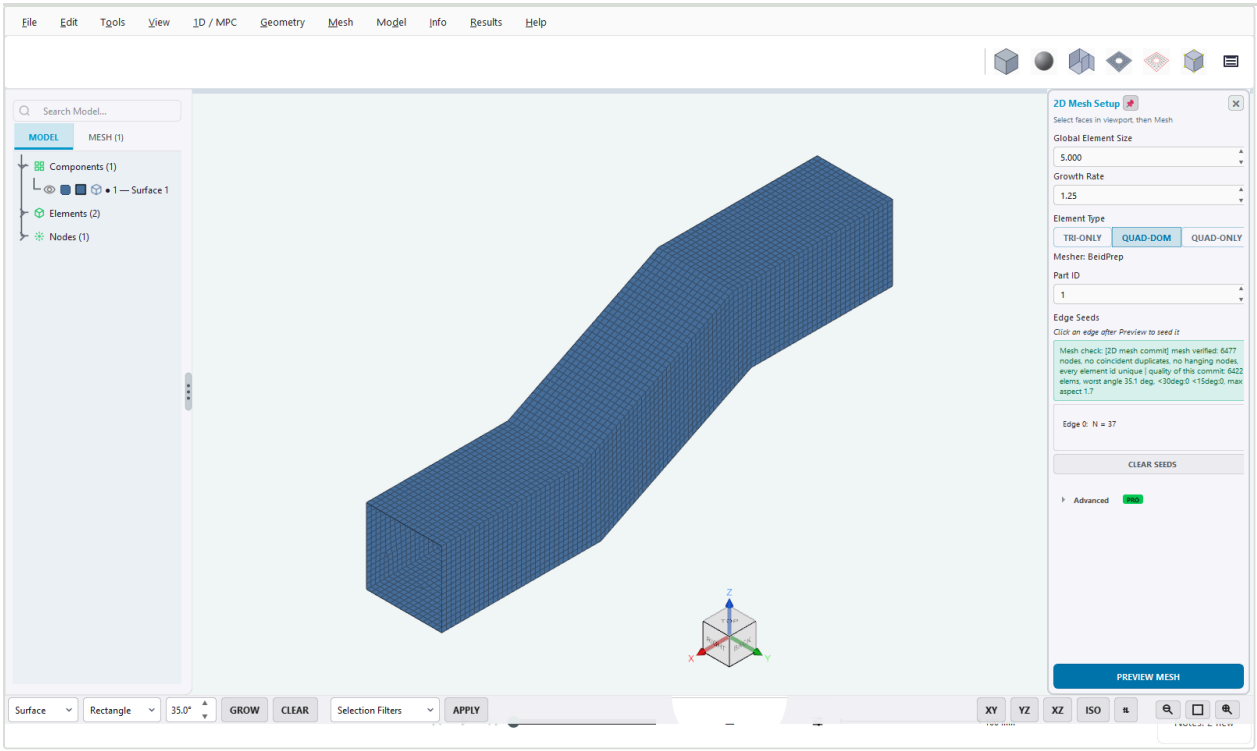


Figure GS.6 — After **Accept**: the mesh in the model and the check's verdict.

Quality on the **Mesh** tab colours every element by a quality measure, so you can see where the poor ones are (section 8.5).

4. Export the deck

Press `Ctrl`+`E`, or click **Export** on the **File** tab.

A model made from CAD in this session has a mesh but not yet the two cards every deck needs: the `/BEGIN` card, which gives the units, and a part for the elements. So the first time, Export writes nothing: a window *Export — the model is not complete* names them and offers a button for each. Click **Create /BEGIN…** and type your units in its form (BeidPrep never guesses them), click **Create /PART 1…**, close the window, and press `Ctrl`+`E` again. Now a save window asks for a folder and a base name, for example `bracket`.

BeidPrep writes the Starter file `bracket_0000.rad`, and the Engine file `bracket_0001.rad` when the model has Engine cards. Cards you did not touch are written back exactly as they were read (section 4.6).

Before anything is written, BeidPrep checks the whole deck once for what would stop the solver: a card that names a number no card defines, an empty group another card still needs. On a clean deck the check is silent and the status line names the files written. If it finds something, a window lists it and asks *Export anyway?* — **Cancel**, the default, writes nothing so you can fix the cards it names (chapter 12).



Figure GS.7 — The deck written: the status line names the files.

> **A mesh is not yet a model** The deck you just exported holds the mesh and its part. Before OpenRadioss can run it, it needs a material and a property for the part, supports, loads, and the Engine file's run settings. You add them as cards in the tree (chapter 6); the card editor explains every field.

5. Look at the results

Run the deck with OpenRadioss: choose **Tools → Run analysis...**, pick a folder and press **Run** (chapter 18) — BeidPrep exports the model and runs the Starter on `name_0000.rad`, then the Engine on `name_0001.rad`. You can also run them yourself, in the folder where the deck was written. The run writes animation files, `nameA001`, `nameA002` and so on, each one moment of the run.

1. Click **Load** on the **Results** tab and choose the first animation file, `nameA001`. BeidPrep reads all the run's animation files with it.
2. In the tree, open **Load Cases** and click the run's load case.
3. Click **Contour**, choose a **Result family** — displacement, stress, strain, plastic strain — and press **Apply**. The model is coloured by it, with a legend.
4. Click **Deform** and press **Apply** in its panel to see the deformed shape.
5. Press **Play** on the bottom bar, or drag the time slider, to move through the run. The colours and the shape follow the moment shown.
6. Click **Probe**, then a node or an element, to read its values.

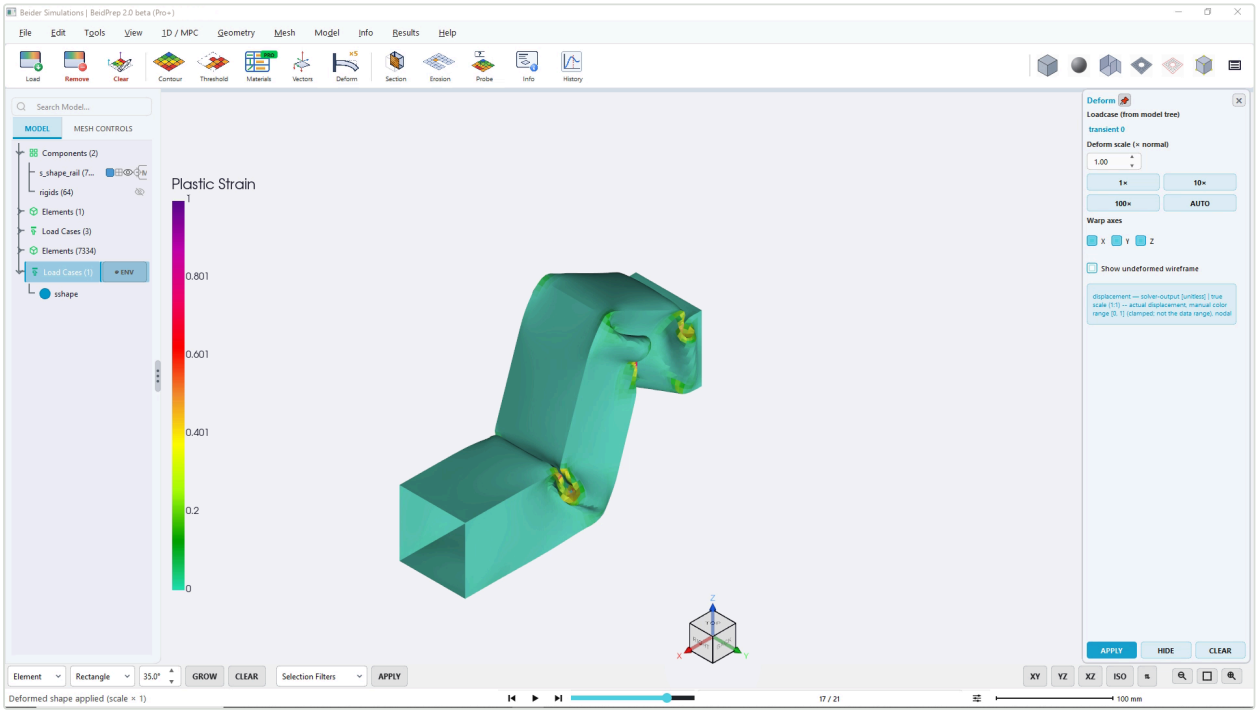


Figure GS.8 — A result on the deformed part, the time slider at a late moment.

Remove on the **Results** tab closes the results and brings back the model. Chapter 13 explains every result tool, and section 13.4 follows this same part through a full crash example: the cards it needs, the run, the deformed shape, the failed elements, the reaction force and the energy check.

Where to go next

To…	Read
know every part of the window	chapter 3
open include files, append decks, save your work	chapter 4
show, hide and colour what you see	chapter 5
add and edit cards: materials, properties, loads	chapter 6
make mid-surfaces and clean up CAD	chapter 7
control the mesh: seeds, advanced settings, quality	chapter 8
fix the mesh by hand: move, merge, split, fill	chapter 9
connect parts: rigid links, springs, bolts	chapter 10
understand a message the export check shows	chapter 12
find one control and what it does	Part II, the reference

From CAD to crash results

> **Demonstration** This chapter shows the workflow on a demonstration case. The material values come from published sources, but the model has not been compared with a test. Use it to learn the steps, not as a design result.

This tutorial builds a complete crash model from a CAD file, entirely in BeidPrep, runs it with OpenRadioss and reads the results: an S-shaped steel rail, crushed along its length between a fixed end and a moving end. Each step names the tool and the chapter that explains it in full.

T.1 The case

Item	Value
Geometry	`s-shape_crash.step`: a thin-walled S-shaped rail made of surfaces, 480 mm long, an 80 × 80 mm box section
Units	mm, ms, kg → force in kN, stress in GPa, energy in J; 1 mm/ms = 1 m/s
Mesh	quad-dominant shells, 5 mm
Shells	2.0 mm, five points through the thickness, formulation QEPH (Ishell 24), thickness change on
Material	4340 steel, Johnson–Cook with Johnson–Cook failure (values and sources in section 13.4)
Ends	the end at the largest x fixed; the end at the smallest x pushed along x at 6 m/s, its other five directions fixed
Contact	self-contact of the rail
Adaptive meshing	one level, where a shell thins
Time step	the solver's own, with a floor; the run stops if mass added to keep the floor reaches 5 %
Run	40 ms (240 mm of crush); animation every 2 ms; time history every 0.01 ms

T.2 Bring in the CAD and mesh it

1. Click **New** on the **File** tab, then **Import CAD**, and open `s-shape_crash.step` with the default settings. The rail is a surface model, so it is meshed directly (no mid-surface).
2. Click **2D Mesh** on the **Mesh** tab, select every face of the rail, set **Global Element Size** to 5 and **Element Type** to *Quad-Dom*, and click **Preview Mesh**.

3. Click **Accept** and read the check: it must be green (connected, good quality). The rail has about 6,400 shells.

Chapter 8 explains the 2D Mesh panel and the check.

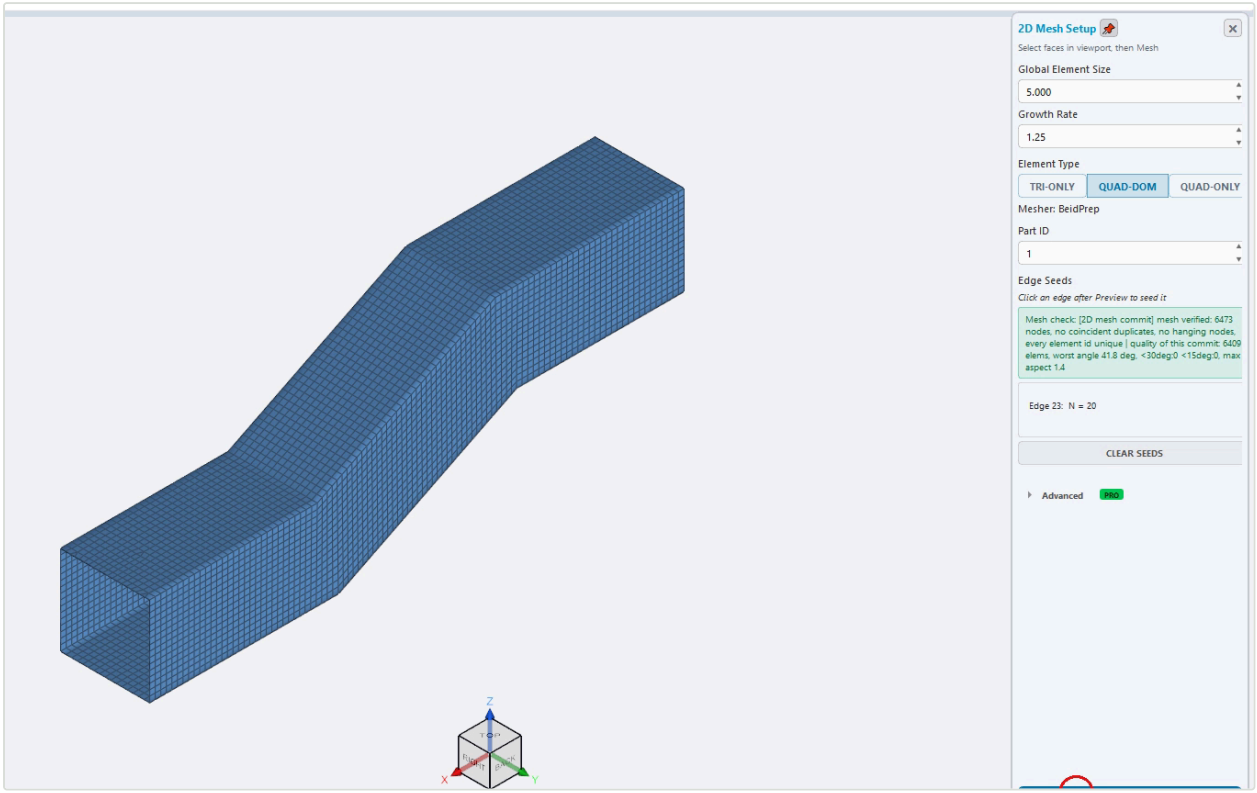


Figure T.1 — The accepted mesh. The check line under **Edge Seeds** is green: 6,473 nodes and 6,409 shells, connected, worst angle 41.8°.

T.3 The deck's first cards: units and the part

1. Right-click an empty place in the model tree and choose **General controls** → **/BEGIN**. Type the run name, for example `sshape`, and the six units: kg, mm, ms for both the input and the work units. BeidPrep fills in the input version (2026) itself.
2. The shells already belong to part 1, listed under **Components** with the CAD's name. Click it and press **CHANGE CARD TO /PART**; the tree then lists it under **Parts**.

T.4 The material and its failure

1. Right-click the tree and choose **Materials** → **Elasto-Plastic** → **/MAT/LAW2** (Johnson–Cook). Type a title and, from section 13.4's table: density 7.83e-6 (kg/mm³), E 208 (GPa), ν 0.3, a 0.792, b 0.51, n 0.26, c 0.014, and the reference strain rate 0.001 (1/s written in 1/ms).
2. On the material's form, press **+ FAIL / EOS** and choose **Add failure model (/FAIL)** → **/FAIL/JOHNSON**. The status line says it was created for material 1. Type D1 0.05, D2 3.44, D3 −2.12; leave D4 and D5 blank (0, no rate or temperature effect).

A field with a set of options opens a list that explains each option. The values and their sources are in section 13.4.

T.5 The shell property

Right-click the tree and choose **Properties** → **Shell** → **/PROP/TYPE1**, the shell property. Set **Ishell** to 24 (QEPH: physical hourglass control, no artificial stiffness), **N** to 5 integration points, **Thick** to 2.0, **Ithick** to 1 (the shells thin as they stretch, which adaptive meshing watches) and **Iplas** to 1. Then give the part this property and the material: click the part under **Parts** and choose the property in the **Prop ID** list and the material in the **Mat ID** list (both 1 here).

T.6 The two ends

1. **Rigid ends.** Click **RBE2** on the **1D / MPC** tab. Tick *Calculate indep. node as average of dependents*, drag a rectangle around the end at the largest x to select its nodes, press **USE SELECTION** and **CREATE**. The status line names the main node made at their middle and the number of nodes tied to it. Do the same at the smallest x.
2. **A group for each main node.** The group the RBE2 panel writes holds the nodes it ties, not the main node. So make one node group per end: right-click the tree, choose **Groups (Sets)** → **/GRNOD/NODE** (under *Node Groups*) and type the end's main node number in **Item ID1**. The number is in the status line after **CREATE**, and in the RBE2's **Node ID** when you click it under **Constraints**. To see the main node on screen, press **ISO** (bottom right): from the side (**XZ**) the rail's near wall hides it.
3. **The fixed end.** Right-click the tree and choose **Load Cases** → **Boundary Conditions** → **/BCS**. Fix all six directions and choose the fixed end's main-node group as its group (**Grnd ID**).
4. **The moving end.** A `/BCS` on the moving end's main-node group that leaves only x free (the other five fixed); a `/FUNCT` (**Tools** → **/FUNCT**) that is 1 from time 0 to 1000; and an `/IMPVEL` (**Load Cases** → **Imposed Motion** → **/IMPVEL**) on that group along x, scaled to 6 (mm/ms), using the function — the group and the function are chosen from their lists.

T.7 Self-contact

As the rail folds, its walls meet. The contact needs a surface, so make one first: right-click the tree, create `/SURF/PART` (**Groups (Sets)**) and choose the rail in its list. Then create a self-contact (**Interfaces** → **Penalty Contact** → **/INTER/TYPE24**) and choose that surface in its **Surf ID1** list, so the walls cannot pass through each other.

T.8 Adaptive meshing

Adaptive meshing lets OpenRadioss split a shell into four smaller ones during the run, where the result needs it. Create `/ADMESH/GLOBAL` with one level, and `/ADMESH/SET` on the rail (chosen from its

part list) with a thickness error of 0.04 mm and the angle criterion set to 179.9° — so only thinning, not bending, splits a shell.

> **Trap 1: adaptive meshing slows a run** Each refinement level makes shells four times smaller, and the contact is then searched on every one of them. Measured on this case on one thread: a cycle took 42 ms without the contact, and 811 ms with the contact and two levels. One level is plenty here.

T.9 The run settings (Engine cards)

The Engine file holds how the run goes. Create, in the Engine file's part of the tree:

- `/RUN` — the end time, 40 (ms). Its run name follows `/BEGIN`.
- `/DT/NODA/CST` — time-step scale 0.9 and a minimum time step of 1.1e-4 ms. The solver uses its own stable time step; only where a shell's step would fall below the minimum is mass added to keep it.
- `/STOP` — a total added-mass limit of 0.05 (5 %): if it is ever reached, the run stops and says so.
- `/ANIM/DT` — start 0, every 2 ms; and the outputs: `/ANIM/ELEM/EPSP` (plastic strain), `/ANIM/ELEM/VONM` (von Mises stress), `/ANIM/SHELL/TENS/STRESS/ALL` and `/ANIM/SHELL/TENS/STRAIN/ALL` (the shell tensors), `/ANIM/SHELL/THIC` (thickness), `/ANIM/VECT/DISP` (displacement).
- `/TFILE` every 0.01 ms, with `/TH/NODE` for the fixed end's main node (REACX, REACY, REACZ: the reaction force; the node number is typed) and `/TH/PART` for the rail, chosen from its part list (IE, KE, HE: internal, kinetic and hourglass energy).

> **Trap 2: mass scaling with adaptive meshing** A refined shell is four times smaller and its time step about half as long, so mass scaling meant for the original mesh can go on adding mass all through a run. Measured on this case: a first run that asked for a target of 2 % added mass, with two refinement levels, ended with 72.7 % — a different, much heavier rail. With one level, a fixed minimum time step and the 5 % stop, the same crush added none. Always read the added mass at the end of a run (section T.10).

T.10 Run it

1. Choose **Tools** → **Run analysis...**, pick a folder, set the threads (8 here) and press **Run** (chapter 18). BeidPrep exports `sshape_0000.rad` and `sshape_0001.rad` and runs the Starter, then the Engine.
2. Watch the **Live** box: in this run the time step stayed between about 0.00016 and 0.00023 ms, above the 0.00011 ms minimum, so no mass was added and the mass error stayed at zero. On eight threads the 40 ms took 55 minutes.

T.11 The results

1. Click **Load** on the **Results** tab and choose `sshapeA001` (chapter 13); then click the load case *sshape* in the tree.

2. Click **Contour**, choose *Plast Strn Layer 1* and press **Apply**, and drag the time slider to the end. The folds carry the highest plastic strain; the straight walls stay almost elastic.
3. Click the grid icon on the rail's row in the tree to turn its mesh lines on and see the refined shells in the folds: up to about 990 shells were split during the run.
4. **Erosion** with *Hide* leaves holes where shells failed and were removed: 9 in this run, in the sharpest folds.

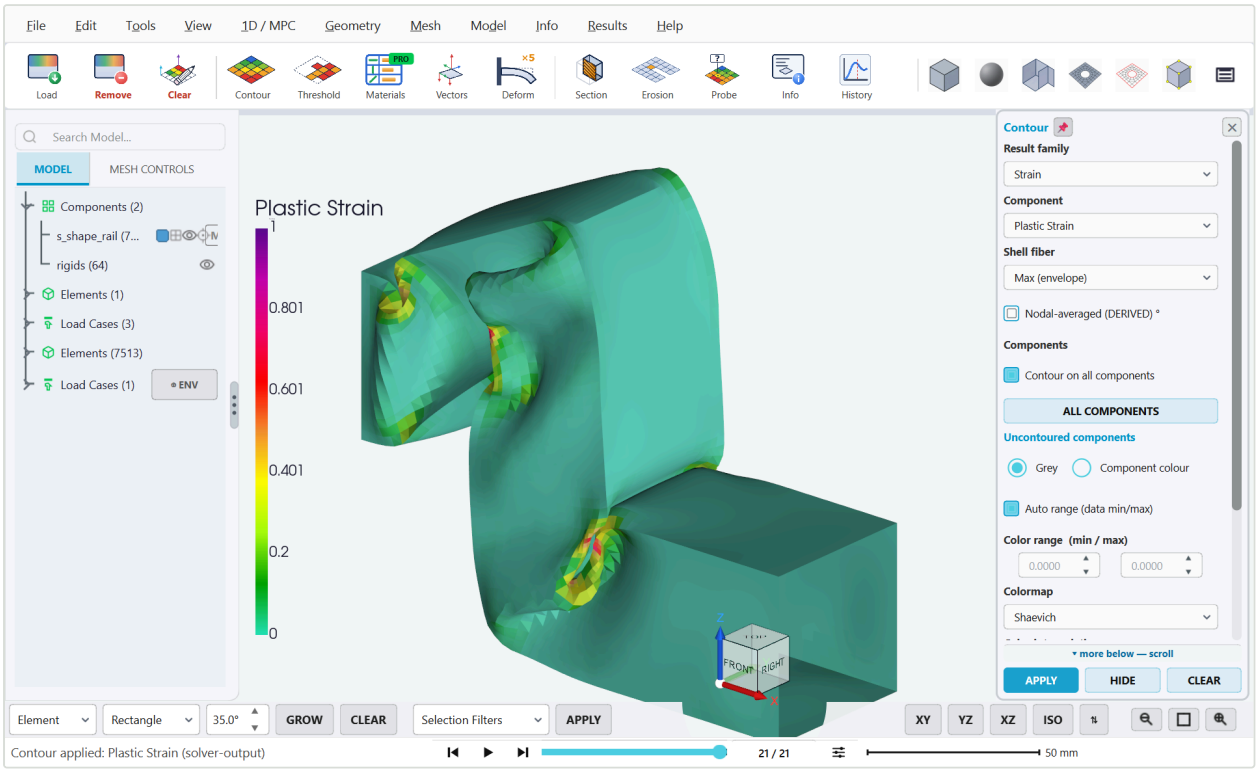


Figure T.2 — The rail at 40 ms, coloured by plastic strain.

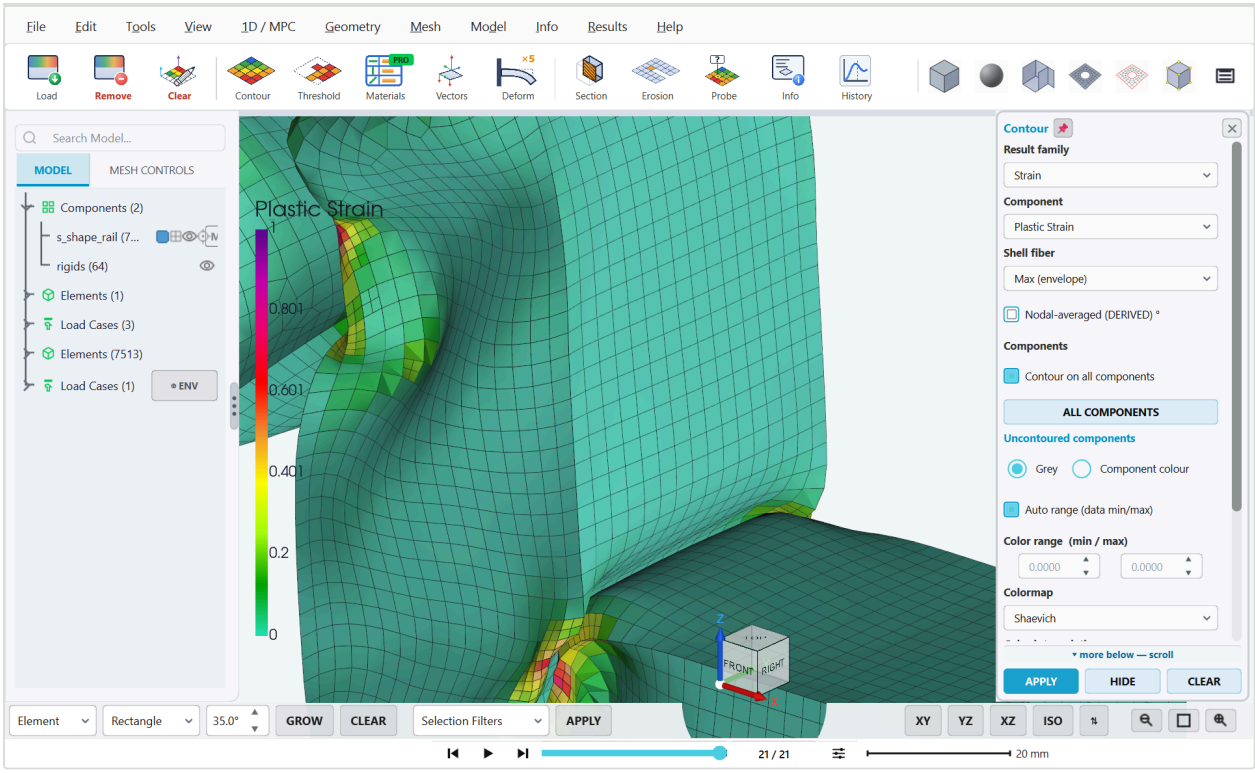


Figure T.3 — Mesh lines on: the smaller shells in the folds were split during the run.

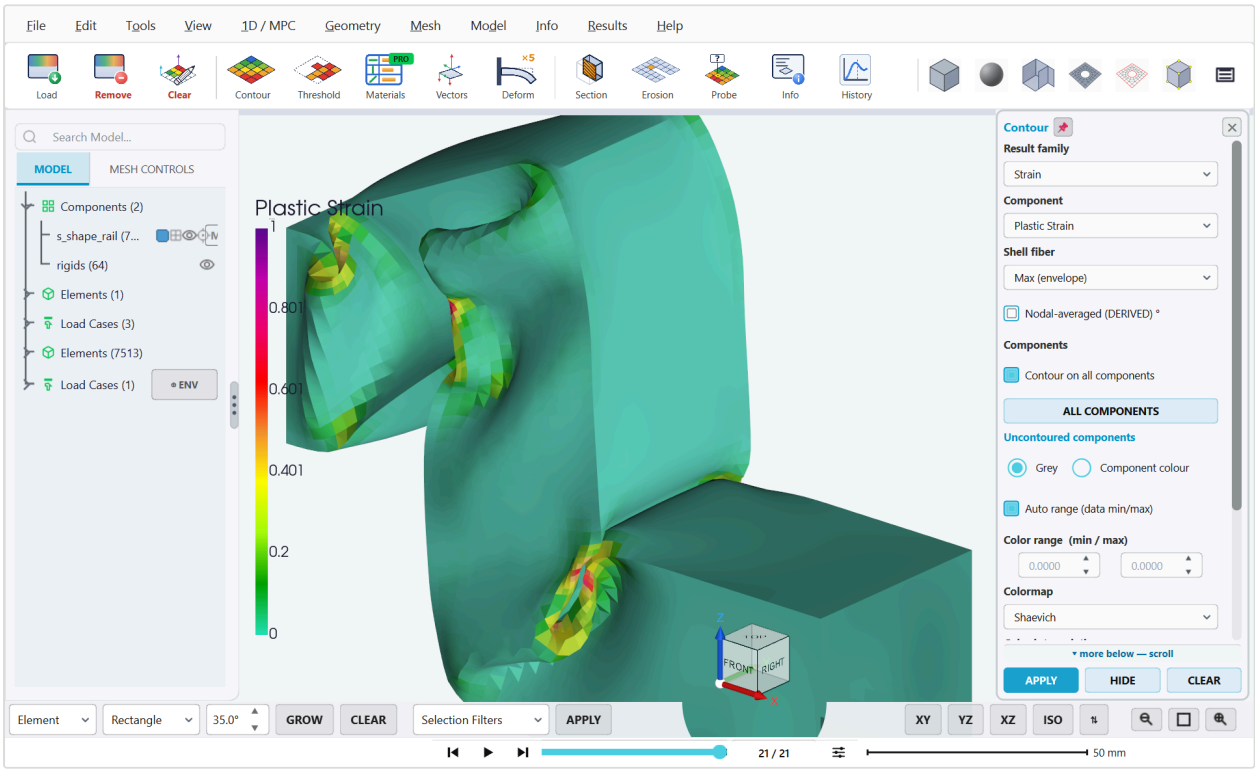


Figure T.4 — **Erosion** on: the failed shells are removed from the view.

T.12 The force and the energies

1. Click **History** on the **Results** tab (chapter 17). Under *Nodes*, tick the fixed end's REACX: the force the fixed end takes as the rail crushes. It averages about 84 kN; it is drawn below zero because it

pushes against the x direction.

2. Under *Parts*, tick the rail's internal energy and hourglass energy. The hourglass energy should stay small against the internal energy; here it ends at 0.18 %.
3. As a check: the internal energy at the end (about 20,200 J) divided by the 240 mm of crush gives the same 84 kN average force.

> **Reaction forces in the time-history file** OpenRadioss writes a node's reaction force to the time-history file added up over time (an impulse). BeidPrep's History tool turns it back into a force before showing it.

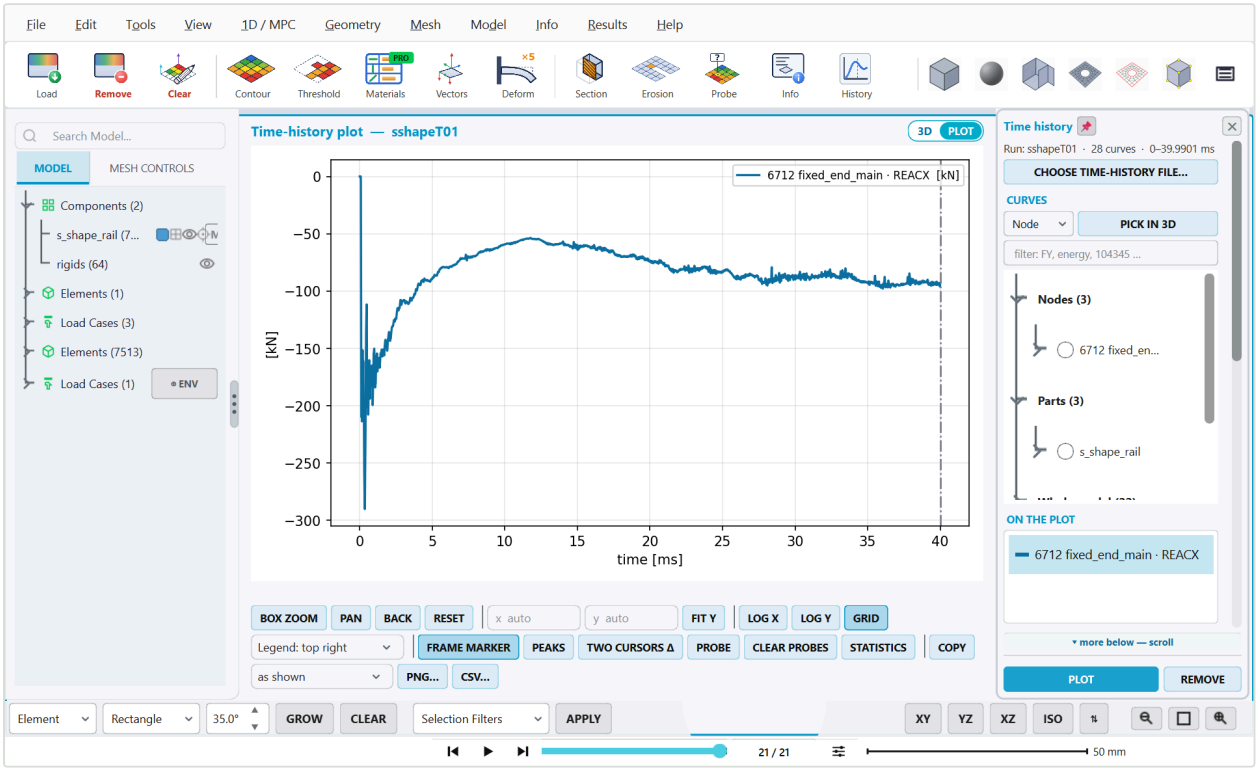


Figure T.5 — The fixed end's reaction force: a short spike at the start, then about 84 kN while the rail folds.

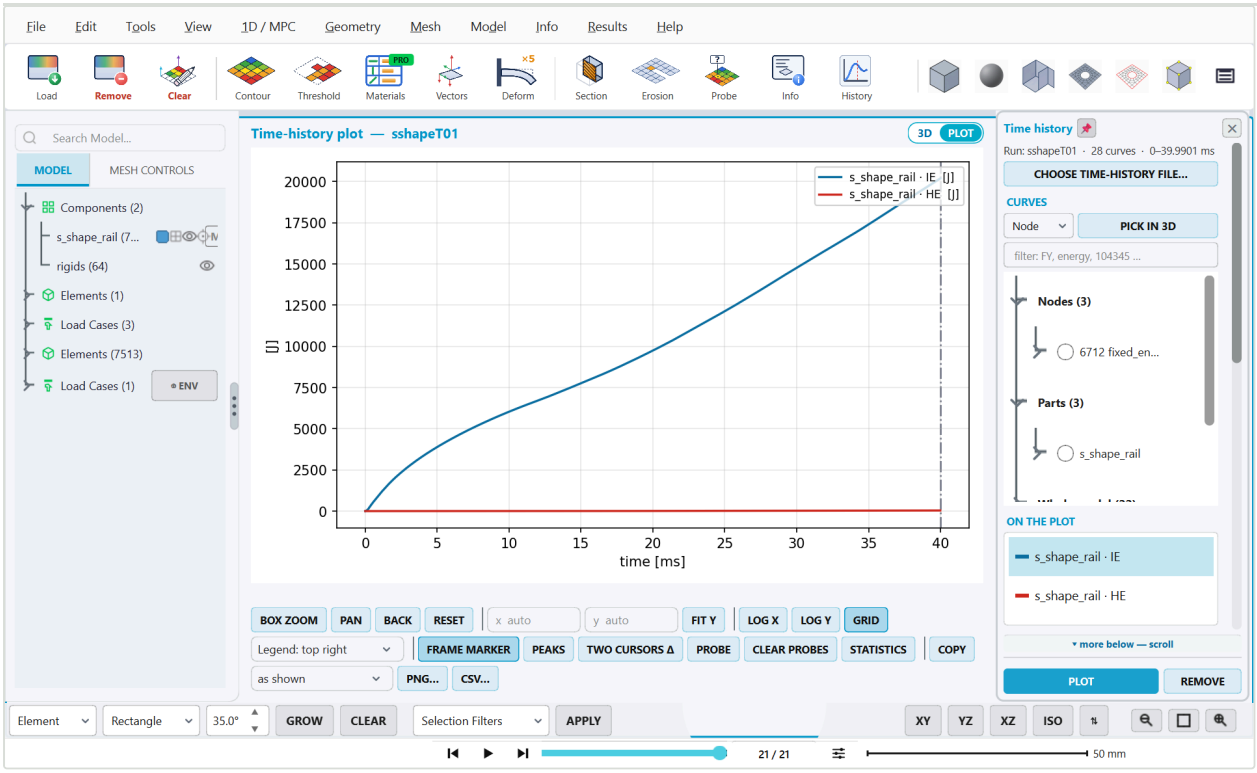


Figure T.6 — The rail's internal energy (blue) and hourglass energy (red, near zero).

1 Introduction

BeidPrep prepares models for the OpenRadioss solver and shows their results. You bring in CAD geometry or an existing solver deck, mesh it, connect the parts, edit the solver cards in forms instead of fixed columns, check the deck and write it out, ready to run.

1.1 What BeidPrep does

- **Opens and writes OpenRadioss decks** (`.rad`): the Starter file with its Engine file and its include files. A card you do not edit is written back exactly as it was read (chapter 4).
- **Brings in other data:** LS-DYNA keyword files (`.k`) and CAD geometry from STEP or IGES files (chapters 4 and 7).
- **Prepares CAD:** mid-surfaces of thin-walled parts, trimming, and cleaning up faces before meshing (chapter 7).
- **Meshes** CAD faces with shell elements, with a preview before you accept, a quality check and a check that the mesh is connected (chapter 8).
- **Edits the mesh:** create, move, merge and project nodes; split, combine and fill elements (chapter 9).
- **Connects parts** with beams, springs, rigid links (RBE2), load-spreading links (RBE3), and bolt or rivet connections found at holes that line up (chapter 10).
- **Edits every card in a form** with a description of each field, checks that every reference points to a card that exists, and updates references when an id changes (chapter 6).
- **Shows results:** OpenRadioss animation files and Nastran `.op2` files, as contours, deformed shapes, arrows, cuts and animations (chapter 13).
- **Maps fibre directions** from a Moldflow study onto a part and writes a fibre-reinforced material for it (chapter 14, Pro+).

BeidPrep works with OpenCourant (the continuation of OpenRadioss) but doesn't include it; the installer can download it for you from its official source (section 2.2).

Open this manual at any time with Help > Manual, the F1 key, or the Manual button on the ribbon.

> **Your responsibility** BeidPrep assists qualified engineers, and the user is responsible for checking every model and result.

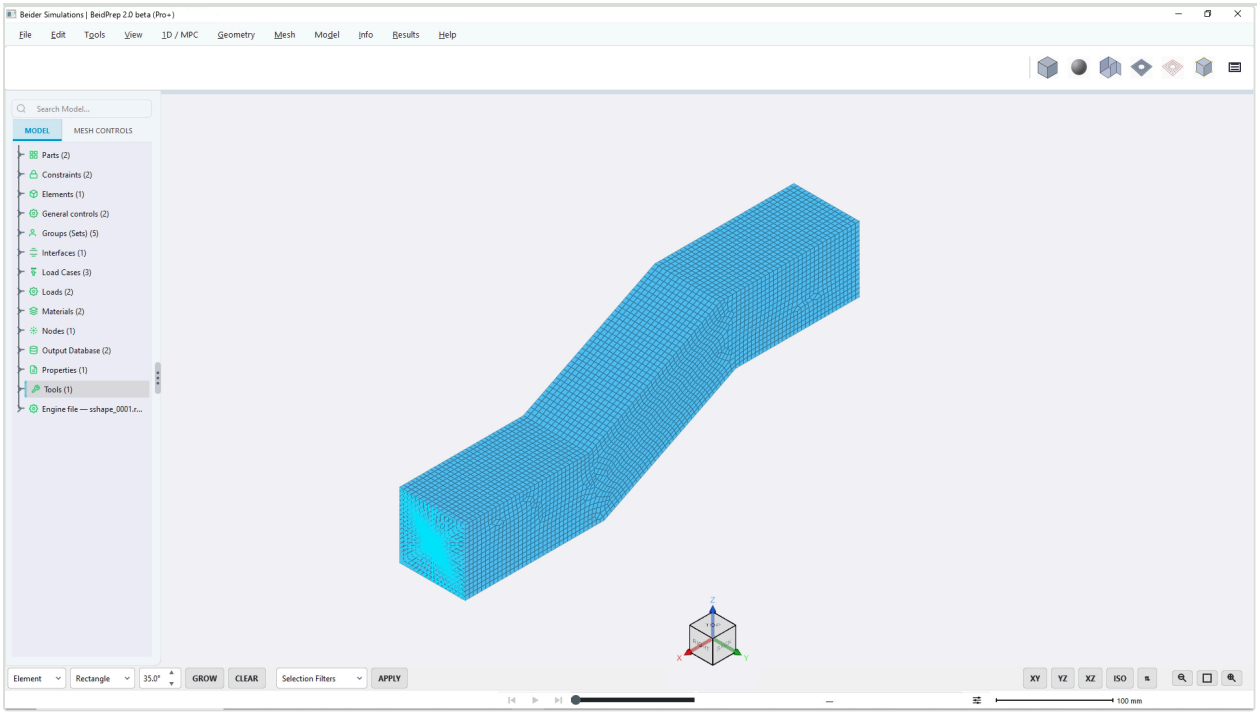


Figure 1.1 — BeidPrep with a meshed part loaded.

1.2 Card support

A card type opens as a form when BeidPrep knows its layout. Before a card type is offered as a form, it is checked with the OpenRadioss Starter itself. The list of checked card types, with the deck versions each was checked at, is in the program under **Help** → **Card support** (also on the **Info** tab). Its exact meaning:

> **Card support** For these card types, BeidPrep has verified, using the OpenRadioss Starter, that every field you edit is written where the Starter reads it. This does not verify your model or your results.

A card type that is not on the list opens as text: you see and edit the card's lines as they are in the file, and BeidPrep writes them back unchanged.

1.3 Free, Pro and Pro+

BeidPrep comes in three editions. Every edition opens, edits, meshes, checks and writes decks; the higher editions add tools for larger or more specialised work.

Edition	What it adds
Free	Opening and writing decks, the card editor and groups, CAD import and clean-up, meshing with BeidPrep's own mesher, the mesh quality check, the editing tools for single items (projecting a whole set of nodes at once included), rigid bodies (RBE2, RBE3) and 1D elements, the export checks, running the solver, the result viewer and the History tool, and SPH particles in a box or a sphere.
Pro	Everything in Free, plus: the mid-surface tool (chapter 7); bolted and rivet connectors (chapter 10); material strengths in the results, so they show safety factors (chapter 13); the Advanced section of 2D Mesh; and the bulk and advanced options inside the editing tools — removing the collapsed elements and collapsing short edges in Node Equivalence, morphing a region when moving nodes, washers around many holes at once, and removing all holes below a diameter. In the SPH Generator, Pro adds filling a closed shape, and the particles' mass, material and initial velocity (chapter 19).
Pro+	Everything in Pro, plus: the Claude connection — Claude working in BeidPrep with you, including letting Claude run the analysis and making a PowerPoint presentation (chapters 16 and 18); the Fibre module — calibrating a fibre material, mapping a Moldflow result, writing the fibre-reinforced deck and the nonlinear design check (chapter 14); and in the SPH Generator, the bird for bird-strike analysis and the contact between the particles and the structure (chapter 19).

Most Pro and Pro+ controls carry a green badge in every edition; without the licence they are shown greyed out, with a tooltip saying what the licence adds, so you can see what each edition contains. Two places work differently: in the SPH Generator, the rows your licence does not include are not shown at all (the tabs keep their badges), and the **Fibre** button shows its badge only in an edition below Pro+, where you can still open the Fibre panel and look around.

> **BeidPrep 2.0 beta** Every copy of the beta runs as **Pro+ until 31 December 2026, Free from 1 January 2027**, on any computer. On 31 March 2027 the beta stops, unless you load the free licence file (section 15.1). BeidPrep works without an internet connection.

1.4 How this manual is organised

Chapters 2 and 3 get you started: installing BeidPrep and finding your way around its window. Chapters 4 to 6 cover the deck itself: opening and saving, the model tree, and the card editor. Chapters 7 to 11 follow the modelling work: CAD, meshing, mesh editing, connectors, groups and sets. Chapter 12 covers the checks and writing the deck, chapter 13 the results, chapter 14 the Fibre module. Chapter 15 covers licences, known issues and reporting a problem. The appendices list the keyboard shortcuts and the supported card types.

Every picture is taken from the program itself, with the controls the text explains numbered. Names of buttons, tabs and menus are written in **bold**, as they appear on screen. Card keywords are written like `/PART`.

> **Note** Boxes like this one hold a tip or a point to watch.

2 Installation and the solver folder

This chapter installs BeidPrep, takes you through its first start, and gets you a solver: the installer can download OpenCourant for you, or you tell BeidPrep where your own solver is.

2.1 What you need

- A 64-bit Windows computer and an account that may install programs (the installer asks for administrator rights, because BeidPrep goes into *Program Files*).
- The installer file, *BeidPrep_2.0.0-beta_Setup.exe*.
- A solver, for the tools that run one. BeidPrep works with OpenCourant (the continuation of OpenRadioss) but doesn't include it; the installer can download it for you from its official source. If you already have OpenRadioss or OpenCourant, BeidPrep only needs to know where it is.

2.2 Installing

1. Run the installer and allow it to make changes when Windows asks.
2. **Licence agreement.** Read the End User Licence Agreement and choose *I accept* to go on.
3. **Destination.** The default folder is *C:\Program Files\BeidPrep 2.0 beta*.
4. **Additional tasks.** Tick the desktop icon if you want one.
5. **Solver.** The page says: *BeidPrep works with OpenCourant (the continuation of OpenRadioss) but doesn't include it; the installer can download it for you from its official source.* Choose one of two:
    - *Download the OpenCourant solver (recommended)*, ticked by default. The next page asks for its folder (*C:\OpenCourant* unless you change it); it must be a folder of its own, outside BeidPrep's folder, and it stays there if BeidPrep is uninstalled. OpenCourant is free software under the GNU AGPL v3 from its own project (*opencourant.org*), not part of BeidPrep, and its licence comes with it. It is downloaded from github.com and checked when you press *Install*; no personal data is sent. If the download fails or does not pass its check, the installer says so and installs BeidPrep without it: then download OpenCourant yourself and set its folder later (section 2.4).
    - *I already have a solver.* The next page asks for the main folder of your OpenRadioss or OpenCourant — the one that holds *exec\starter_win64.exe*. If the folder holds no Starter and Engine, the installer says so and lets you choose again or leave the field empty. You can leave it empty and set the folder later (section 2.4).
6. **Finish.** Leave *Launch BeidPrep 2.0 beta* ticked to start it at once.

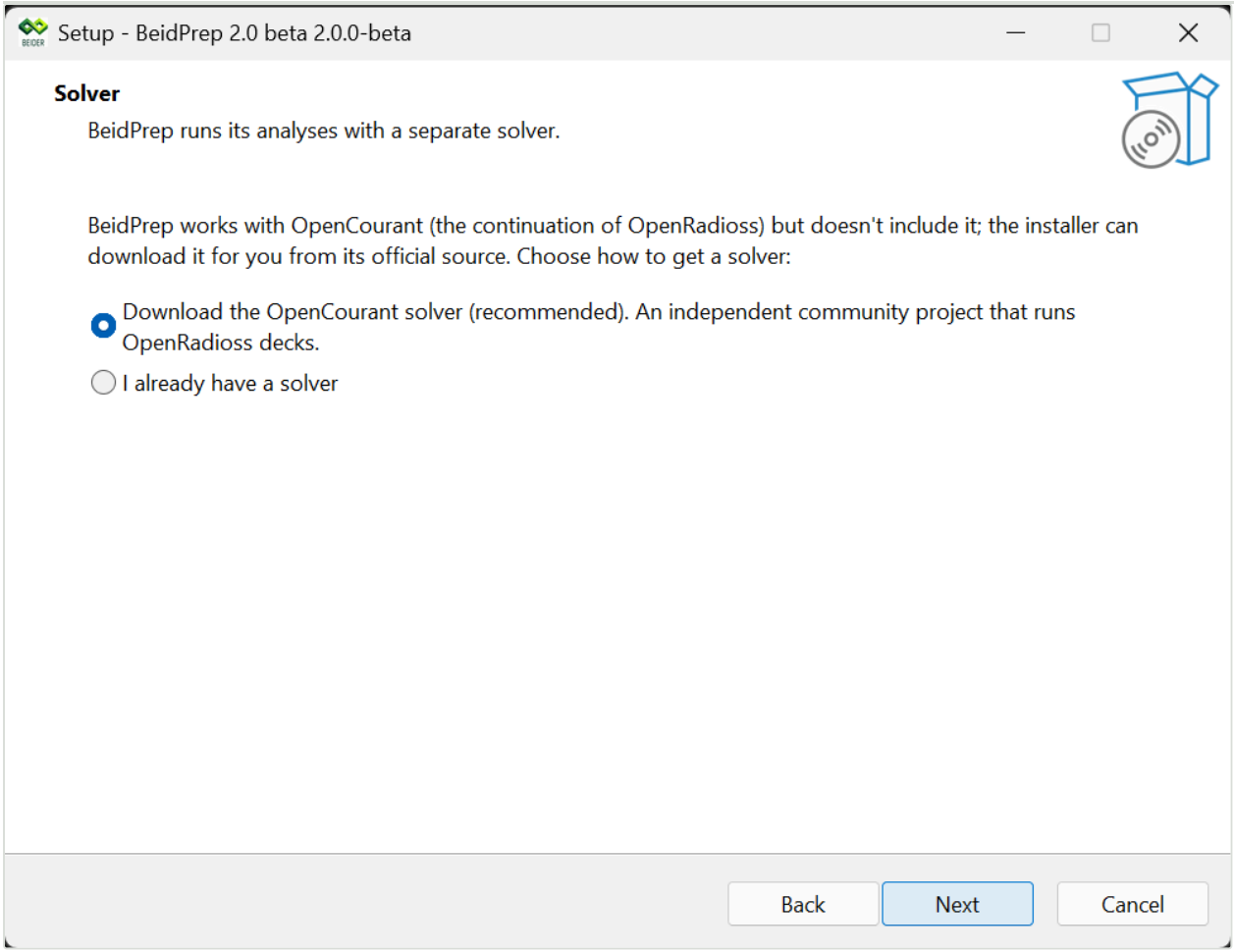


Figure 2.1 — The installer's solver page.

> **An older version** If BeidPrep 1.0.1 or an earlier 2.0 beta is installed, the installer removes it first and then installs the new version in its own folder. Your settings are kept (section 2.5).

2.3 The first start

The first time you start the installed program, one window shows three things: the engineering notice (BeidPrep assists qualified engineers, and you are responsible for checking every model and result), the beta dates, and the licence agreement. The licence agreement names OpenCourant and the other programs BeidPrep works with as separate products of their owners, under their own licences, and says that every result and generated model is provided as is and must be checked by a qualified engineer before it is relied on. Choose *I accept* to start working; *I do not accept* closes the program.

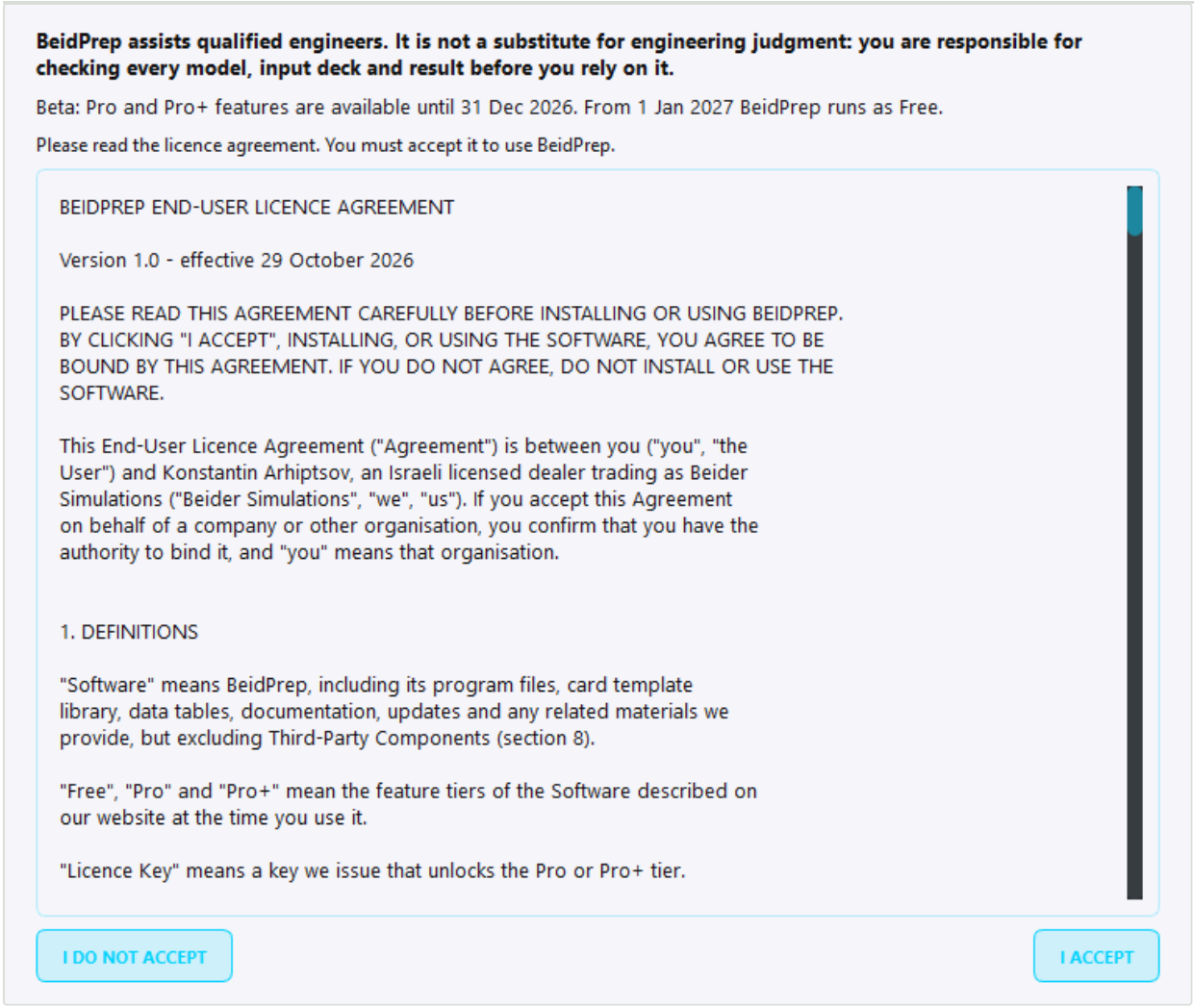


Figure 2.2 — The first-start window.

BeidPrep remembers your answer. The window appears again only if the text of the licence agreement changes in a later version. The beta runs as Pro+ until 31 December 2026 and as Free from 1 January 2027 (section 1.3). It stops on 31 March 2027 unless you load the free licence file (section 15.1).

2.4 Setting or changing the solver folder

Open **Tools** → **Solver folder...** and choose the main folder of OpenRadioss or OpenCourant. You may also choose its *exec* folder; BeidPrep then uses the folder above it. BeidPrep checks that the folder holds a Starter and an Engine (*exec\starter_*.exe* and *exec\engine_*.exe*) and answers with the folder it will use, or with the reason it was not set.

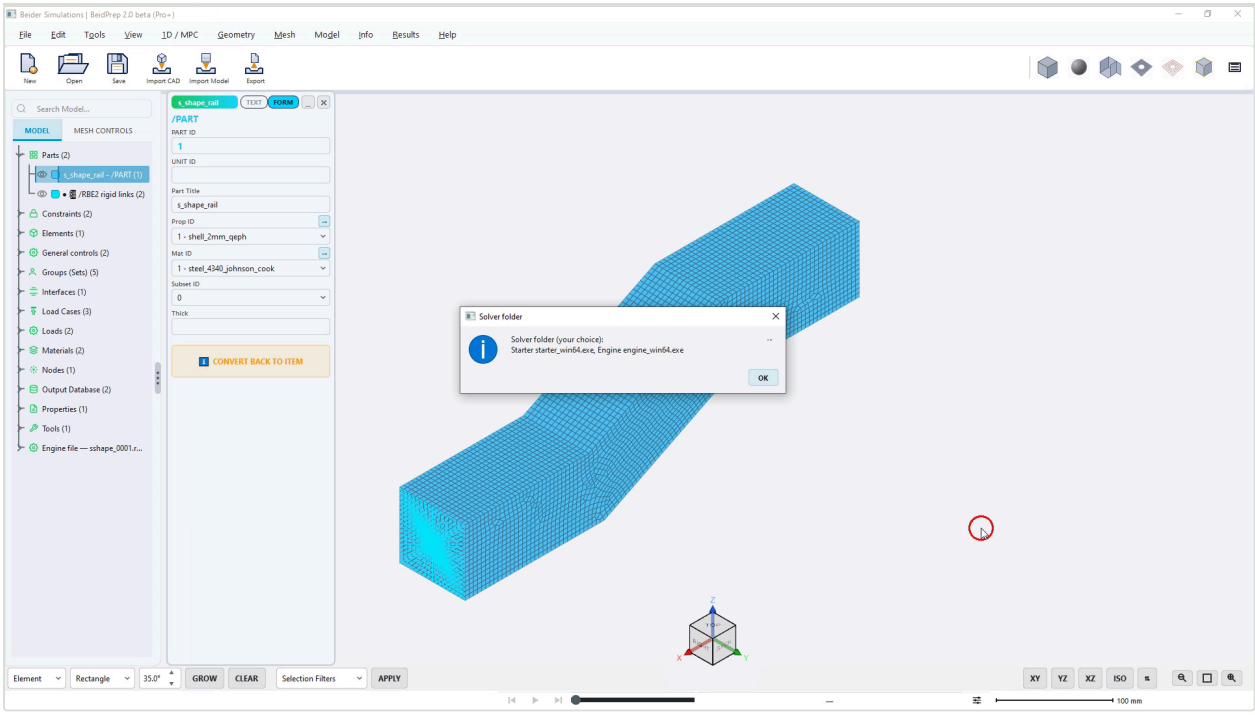


Figure 2.3 — **Tools → Solver folder…**

- A folder that holds several Starters (for example the plain and the single-precision ones) uses the plain 64-bit one.
- If the folder is later moved or deleted, BeidPrep stops using it and tells you; set it again here.
- The check only looks for the program files. Whether the solver runs is shown the first time a tool runs it.

2.5 Where BeidPrep keeps your settings

Your settings are stored in your own Windows profile, in *%APPDATA%\BeidPrep*: the solver folder you chose, your answer to the licence agreement, and the date check of the beta. Uninstalling BeidPrep or installing a new version leaves this folder in place.

2.6 Uninstalling

Use *Settings* → *Apps* in Windows, or **Uninstall BeidPrep 2.0 beta** in the Start menu folder. The program folder is removed; your settings folder (section 2.5) and your own model files are not touched.

3 A tour of the interface

This chapter names every part of the BeidPrep window and says what it is for. Later chapters show how to use each one.

The pictures show BeidPrep 2.0 Pro with a 5 mm shell mesh loaded. The numbers point at the controls; the list under each picture explains them in the same order.

3.1 The main window at a glance

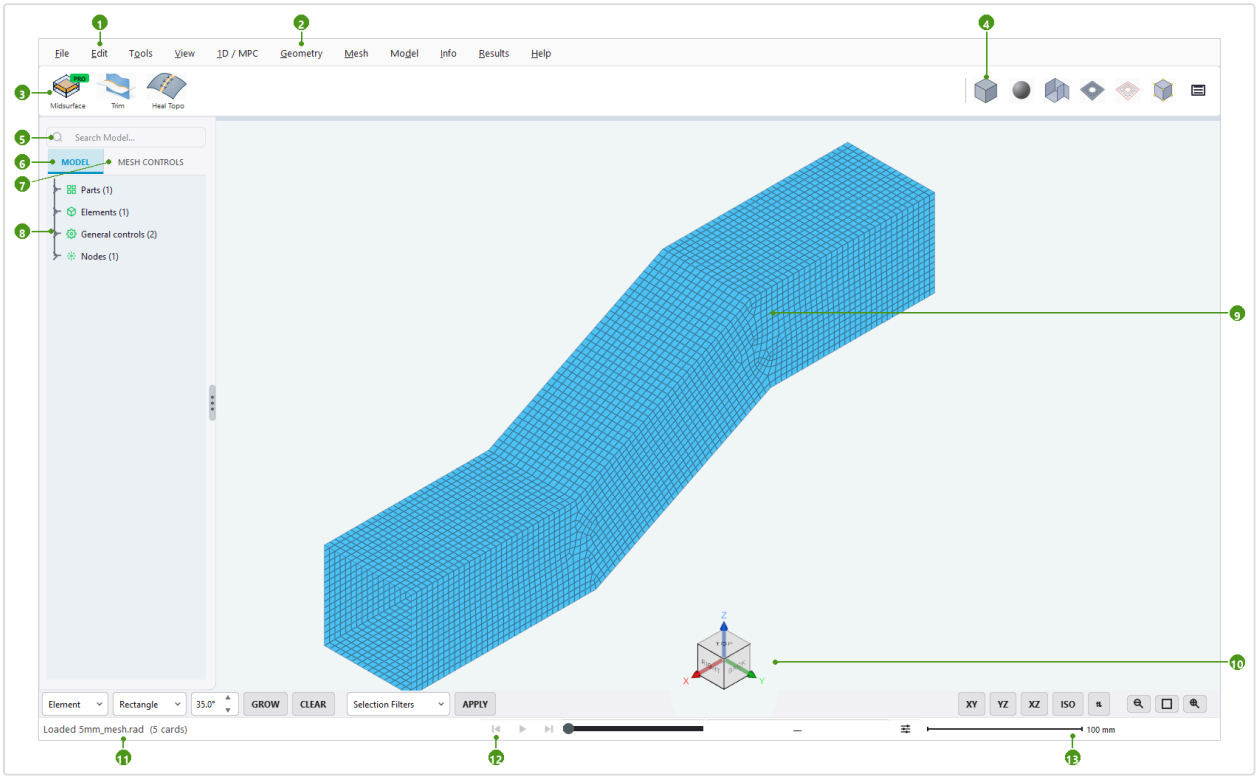


Figure 3.1 — The main window, with the **Geometry** ribbon tab open.

1. **Drop-down menus.** *Edit*, *Tools* and *View* open ordinary menus, and so does *Help* at the right end of the menu bar (section 3.2).
2. **Ribbon tabs.** *File*, *1D / MPC*, *Geometry*, *Mesh*, *Model*, *Info* and *Results* are not menus: a click opens that tab's tools in the ribbon below. Clicking the same tab again closes it (section 3.3).
3. **Ribbon.** The tools of the open tab, one tile per tool, with its name under the icon. Hold the pointer over a tile to read what it does.
4. **Display buttons.** How the model is drawn: CAD and mesh style, edges, points and the camera (section 3.4). They act at once and work with every tab.
5. **Search box.** Type here to find a card in the model tree (chapter 5).
6. **MODEL tab** of the tree panel: the cards of the deck, by category.

7. **MESH CONTROLS tab** of the tree panel: the meshing settings of the CAD bodies you mesh in BeidPrep (chapter 8).
8. **Model tree.** Every card of the deck, grouped by category, with the number of cards in brackets (section 3.5).
9. **3D view.** The model. The mouse turns, moves and zooms the view (section 3.6). Along its bottom edge, the selection bar sets what a click picks and how.
10. **View cube.** Shows how the model is turned; the red, green and blue arrows are the global X, Y and Z axes. Click a face of the cube to look along that axis.
11. **Status line.** What the program just did — here, the file loaded and the number of cards read.
12. **Playback controls.** Step and play through result states (section 3.7).
13. **Scale bar** (section 3.7).

> **Free, Pro and Pro+** A tool that needs a Pro or Pro+ licence carries a green badge. With such a licence the tool works as normal. Without it the tool stays visible but greyed out, so you can see what a higher edition adds — except in the SPH Generator, which leaves out the rows your licence does not include, and the **Fibre** button, which shows its badge only below Pro+ (section 1.3). Your edition is named in the window title ("BeidPrep 2.0 beta (Pro+)", for example). The Free edition also shows "BeidPrep 2.0 beta (Free)" at the bottom right of the 3D view and on time-history plots.

The tree panel floats over the 3D view. Drag the handle on its right edge (the three dots) to make it wider or narrower.

3.2 The drop-down menus

Four entries of the menu bar open ordinary menus: *Edit*, *Tools* and *View*, and *Help* at the right end. *File* is a ribbon tab (section 3.3).

- **Edit** holds *Undo* and *Redo* for changes to the model, and *Clear Undo History*, which empties the undo list: the changes it held can no longer be undone.
- **Tools** holds *Solver folder…*, where BeidPrep finds the OpenRadioss solver it uses for checks and runs (chapter 2); *Run analysis…*, which runs the model (chapter 18); and *Connect Claude…* (chapter 16).
- **View** sets how the window looks: the *Background*, the *Visuals* settings and *Show Edges*. *Copy 3D View to Clipboard* and *Copy Window to Clipboard* copy a picture you can paste into a report.
- **Help** starts with *Manual*, which opens this manual in your PDF viewer; the `F1` key does the same from anywhere in the window. If the manual is not installed with your copy, a box gives the website address where you can read it. Below it are *Known issues*, *Card support*, *Report a problem*, *Load licence file…* (section 15.1) and *About*; most are also on the **Info** tab (chapter 15).

Each menu, pictured with every entry: Reference R3.1.

3.3 The ribbon

The ribbon shows the tools of one tab at a time (Figure 3.1, items 2 and 3).

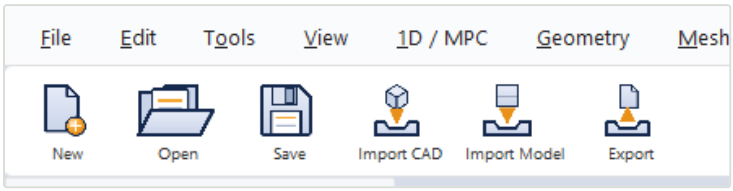


Figure 3.2 — One tab open: File.

Tab	What its tools are for	Chapter
File	New, open, save; import CAD and decks; export the deck	4, 7, 12
1D / MPC	Beams, springs and rigid links between parts	10
Geometry	Work on imported CAD before meshing: mid-surfaces, trimming, clean-up	7
Mesh	Shell meshing and the quality check	8
Model	*Edit* (the editing toolbar) and *Bolted/Rivet* (bolt and rivet connections)	9, 10
Info	This manual, model information, measuring, known issues, card support, reporting a problem, About	15
Results	Loading results and the result tools	13

Report a problem only prepares the message in your own e-mail program: nothing is sent until you send it yourself (chapter 15). Every tab, pictured with each tile and its description: Reference R3.2.

3.4 The display buttons



Figure 3.3 — The display buttons, right of the ribbon.

Each button switches one display setting; a click moves to the next setting. Its tooltip says what the next click does and, for most buttons, the current setting.

1. **CAD display.** How imported CAD bodies are drawn: solid with edges, solid, or edges only.
2. **CAD look.** Classic or glossy shading for CAD bodies.
3. **CAD edges.** Plain, or coloured by how the faces connect: a colour change along an edge shows a gap in the CAD before you mesh it.

4. **Mesh display.** Solid or see-through elements.
5. **Open mesh edges.** A click shows in red the edges that belong to one element only. On the outline of a part that is normal; a red line inside a part means the mesh is not connected there.
6. **CAD points.** Shows or hides the points of the CAD geometry.
7. **Camera.** Orthographic (true proportions, no perspective) or perspective.

3.5 The model tree

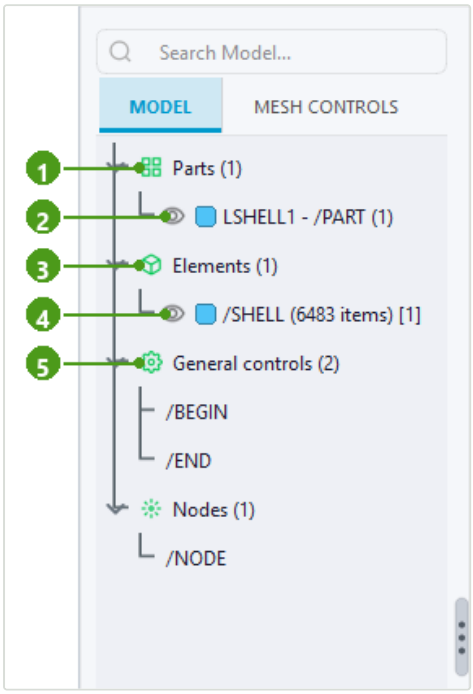


Figure 3.4 — The model tree, categories opened.

The tree lists every card of the deck by category. Open a category with the arrow on its left. Chapter 5 shows how to select, show and hide cards from the tree, and chapter 6 how to open a card in the card editor.

1. **A category** (here *Parts*). The number in round brackets is how many cards it holds.
2. **A card**: its title, its keyword, and in round brackets its own number — here the part *LSHELL1*, which is `/PART` number 1.
3. **The Elements category.** Element cards of the same type are gathered on one row.
4. **An element row.** */SHELL (6483 items) [1]*: the shell elements, 6,483 of them, belonging to part number 1. The numbers in square brackets are the parts whose elements the row gathers.
5. **General controls**: cards that control the whole deck — here `/BEGIN` and `/END`, which open and close it.

Two small buttons sit on the rows of parts and elements:

- **The eye** shows or hides those elements in the 3D view. A crossed-out eye means they are hidden.

- **The colour square** is the colour they are drawn in. Click it to choose another colour.

Right-click in the tree to create a new card. The menu offers the card families by category.

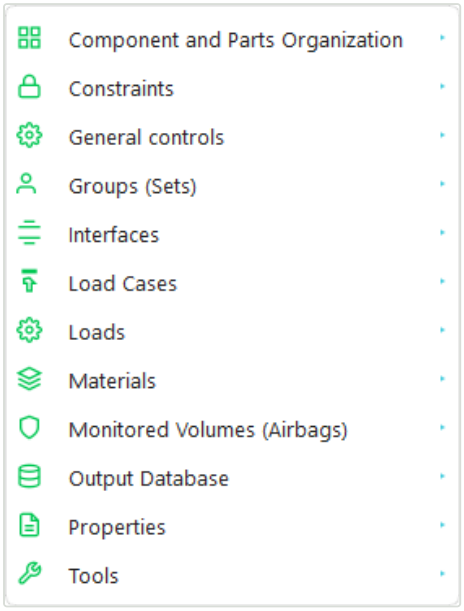


Figure 3.5 — Right-click in the tree: create a card.

3.6 The 3D view and the mouse

The 3D view shows the model. The view cube in its lower right corner turns the view to a standard direction with one click. The table lists what each mouse gesture does in the 3D view; it was measured in the program, not copied from a specification.

In the 3D view	Effect
Left click	picks what is under the pointer, for the tool in use (chapters 5 and 9)
Shift + left drag	turns the view
Right click	opens the menu for what is under the pointer
Shift + left drag	turns the view
Shift + right drag	moves the view sideways
Middle drag	moves the view sideways
Wheel forward	zooms in or out

3.7 The bottom bar

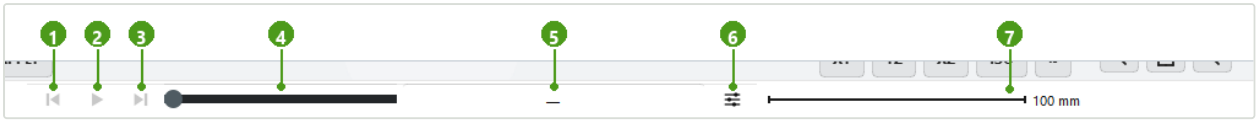


Figure 3.6 — The bottom bar.

1. **Step back** one result state.
2. **Play / Pause.** Plays the result states as an animation (load a result in the Results tab first).
3. **Step forward** one result state.
4. **Time slider.** Drag to go to any result state.
5. **State readout.** Shows a dash while no results are loaded.
6. **Playback settings:** frames per second, looping and direction.
7. **Scale bar.** The length of the bar in model units at the current zoom.

Items 1 to 6 work once results are loaded (chapter 13).

3.8 Floating panels

Most tools open a panel at the right of the window. Its title bar carries some of these buttons; the reference part of this manual does not repeat them.

Button	What it does
Pin (📌)	On the tool panels (2D Mesh, the result tools and others). Pinned (the default), the panel sits against the right side of the window. Click to let it float, so you can drag it by its title bar anywhere; click again to pin it back.
Minimise (_)	On the card editor. Folds the panel to a strip, out of the way of the 3D view. Click again to open it; nothing you entered is lost.
Close (×)	On every panel. Closes the panel and ends its tool.

3.9 The Claude connection

Tools → Connect Claude... Pro+ lets Claude Code on your computer read the open model and, only if you allow it, change it, each change shown to you first. You choose how much it may read and whether it may change anything. Chapter 16 explains the steps and exactly what leaves your computer.

→ Every control of these panels, one by one: **Reference R3: the main window, menus and dialogs**, page 131

4 Opening and saving decks

BeidPrep works on OpenRadioss decks as they are: the Starter file, its Engine file and its include files. This chapter opens a deck, brings in other models, and saves your work in the two ways BeidPrep offers.

4.1 Two kinds of file

File	What it holds	Made with
OpenRadioss deck (`name_0000.rad`, `name_0001.rad`, include files)	The solver cards: what OpenRadioss runs.	**File → Export**
BeidPrep model (`.beid`)	Everything in your session: the solver cards, the CAD bodies, the mesh and its meshing settings.	**File → Save**

Use a `.beid` model while you are still working on CAD and meshing, and export the deck when you want to run it. A deck you opened as a deck can be exported again at any time.

4.2 Opening a deck

Press `Ctrl`+`I`, or click **Import Model** on the **File** tab, choose *New Project*, and pick the deck's Starter file (`name_0000.rad` or `name.rad`). (`Ctrl`+`O` opens a BeidPrep model, section 4.5.)

- **The Engine file comes with it.** If a file named `name_0001.rad` sits beside the Starter file, it is opened too, and its cards appear in the same tree.
- **Include files are read.** Every file the deck names with `#include` is opened, in the order the Starter reads it. The status line says how many include files were read and names any that could not be found.
- **Files written by the solver are read-only.** An initial-state file (`.sta`) included in the deck can be viewed but not edited; BeidPrep never rewrites it.
- Large decks take a while: a progress window shows while the files are read.



Figure 4.1 — A deck just opened: the status line counts the cards read.

If you have unsaved work, BeidPrep asks first whether to keep it, before anything is replaced.

4.3 Deck versions (`/BEGIN`)

The `/BEGIN` card of a deck names the input version it is written for (for example 2019 or 2026). The Starter reads some cards differently from one version to the next: a field can be new, or no longer read. BeidPrep shows each card's form **as the Starter reads it at the deck's version**: a field the Starter does not read at that version is not shown, and its value in the file is kept exactly as it was.

Help → **Card support** lists, for each card type, the versions at which it has been checked with the Starter (section 1.2).

4.4 Bringing in other models

Import Model on the **File** tab (`Ctrl`+`I`) opens a window with two choices:

- **New Project** replaces the current model with the file you choose.
- **Append to Current Project** adds the file to the model you have open. Its node and element numbers are raised by an **ID offset** so they do not clash with yours; the window proposes the highest number already in use.

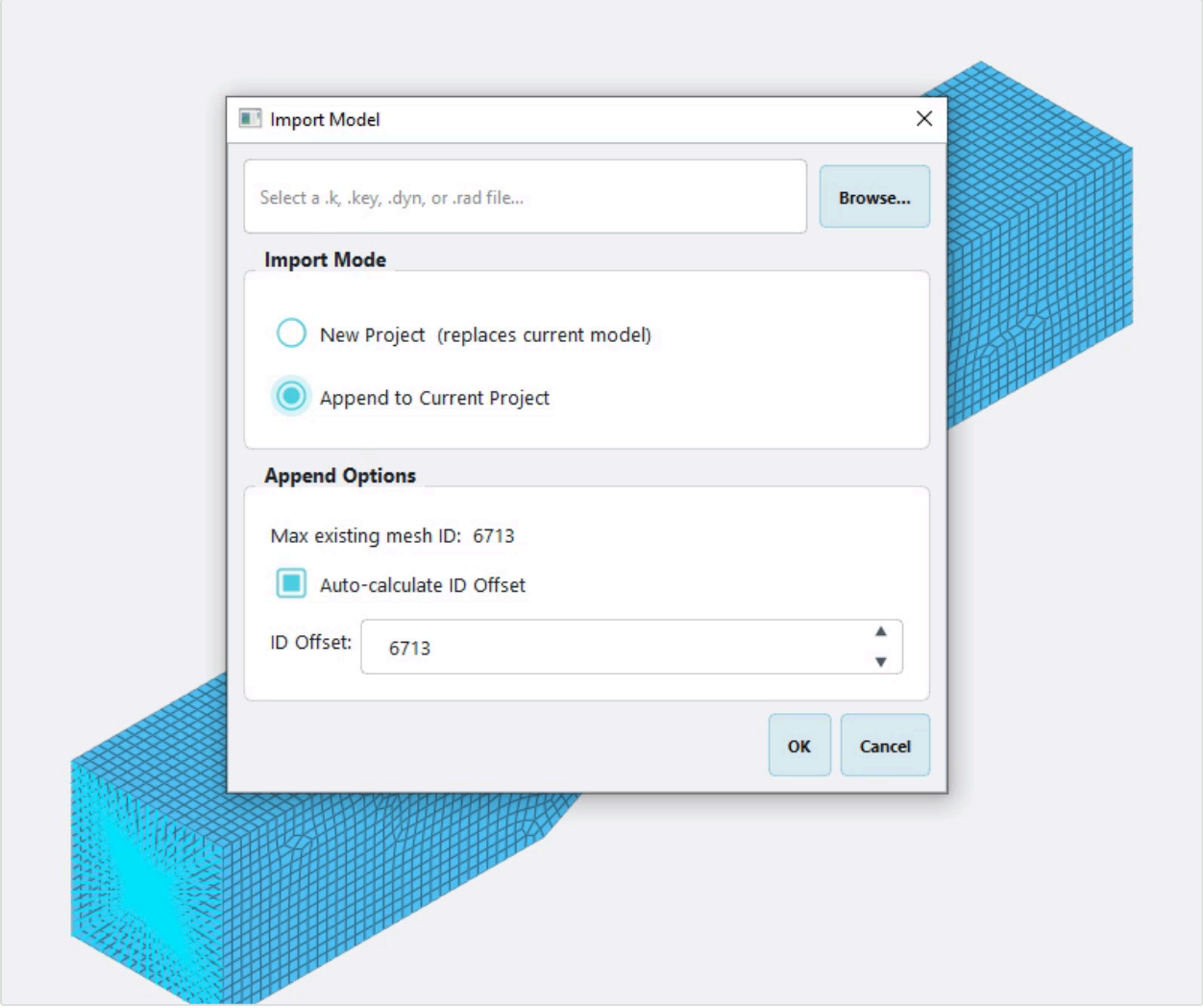


Figure 4.2 — The Import Model window.

LS-DYNA keyword files (`.k`) are converted to an OpenRadioss deck first. The converted deck is written beside the `.k` file, under the same name with the extension `.rad`, and then opened or appended. Check the converted cards before you run them.

A converted deck's `/BEGIN` card has a run name and the version 2026, but **no units**. Open it (**General controls → /BEGIN** in the tree) and type the units of the model; until they are typed, **Save** refuses and names the blank fields, because BeidPrep never guesses units.

CAD geometry comes in with **Import CAD** (STEP or IGES); chapter 7 covers it.

4.5 Saving your work (`.beid`)

Save on the **File** tab (`Ctrl`+`S`) writes the whole session to one `.beid` file. The first time it asks for a name; after that it saves straight to the same file. **Save As** (`Ctrl`+`Shift`+`S`) saves under a new name. **Open** (`Ctrl`+`O`) reads a `.beid` back, with the CAD bodies, the mesh, the meshing settings, the part colours and the cards as you left them. If you choose an OpenRadioss or LS-DYNA deck in the Open window, BeidPrep imports it, as **Import Model** does; any other file is refused with a plain message.

> **Save is not export** `Ctrl`+`S` saves the BeidPrep model. The deck OpenRadioss runs is written by **Export** (`Ctrl`+`E`, section 4.6).

4.6 Exporting the deck

Export on the **File** tab (`Ctrl`+`E`) writes the OpenRadioss deck. Give it a base name; BeidPrep writes the Starter file as `name_0000.rad` and, if the model has Engine cards, the Engine file as `name_0001.rad`. Every card goes back to the file it came from:

- a file you did not change is written back **byte for byte** as it was read;
- an edited card is written into its own file, include files included, and the main file keeps its `#include` lines exactly;
- a new card goes to the Starter or Engine file it belongs to.

Before writing, BeidPrep walks the deck once for references that point to nothing — a part whose property does not exist, an interface whose surface has been emptied, and the like. If it finds any, a window names them and asks *Export anyway?*; the default answer is *Cancel*. Chapter 12 explains the messages.

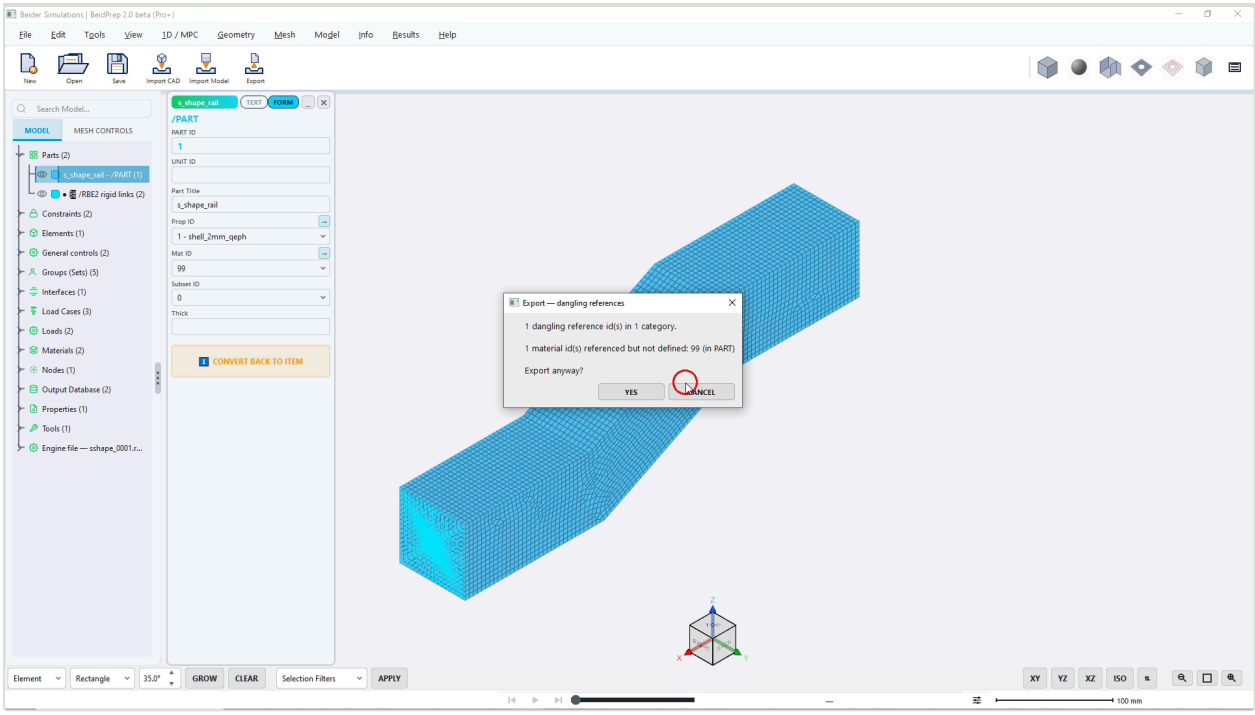


Figure 4.3 — The export check found a reference to nothing.

> **When a save is refused** A save that would break the include rules — for example an edit inside a read-only solver file — is refused. The status line and a message say which rule refused it; nothing is written.

→ Every control of these panels, one by one: **Reference R4: the file dialogs**, page 143

5 The model tree and visibility

The model tree on the left of the window lists every card of the deck. This chapter finds cards, shows and hides parts, gives them colours, and deletes what you no longer need.

5.1 Finding a card

Type in the search box above the tree. The tree keeps only the rows whose text holds what you typed — the card's title, keyword or number — and opens the categories that hold a match; categories with no match are hidden. Upper and lower case do not matter. Clear the box to see the whole tree again.

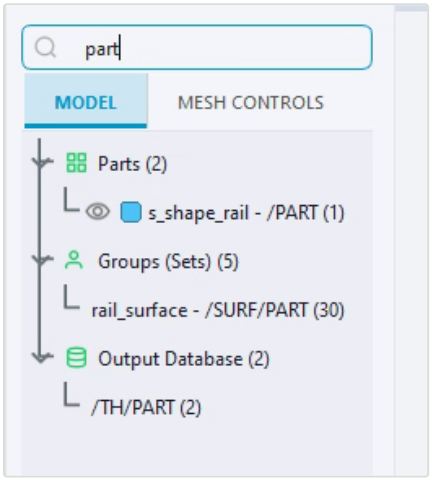


Figure 5.1 — The tree after typing *part* in the search box.

5.2 Showing and hiding

Each part and element row carries an **eye**: click it to hide or show those elements in the 3D view. A right-click on a part or element row offers more:

Menu entry	What it does
Hide / **Show**	Hides or shows this part's elements.
Isolate	Shows this part only and hides every other.
Show All	Shows every part again.
Change Color	Picks the colour the part is drawn in (the same as clicking its colour square).
Change Mesh Style	Switches how this part's elements are drawn, for example solid or see-through.
CAD View Mode	For a part made from a CAD body: *Solid + Edges*, *Solid (no edges)*, *Transparent* or *Hidden*.
Set as Active Part	Makes this the part that new 1D elements (beams, springs) are created in (chapter 10). The active part is shown in bold.
Delete	Deletes the card (section 5.4).

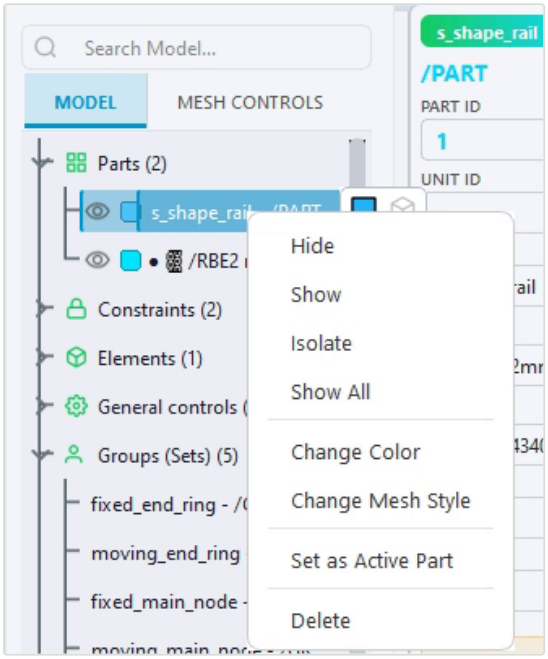


Figure 5.2 — Right-click on a part.

Hiding changes only what you see. Hidden parts stay in the deck and are exported as usual.

5.3 Selecting from the tree

Click a card in the tree to open it in the card editor (chapter 6). The card editor and the tree stay in step: the card you open is the one the tools act on.

5.4 Deleting

Select a part, an element row or a node row and press `Delete`, or right-click it and choose **Delete**. (CAD bodies, mesh controls and connectors have their own Delete in their right-click menu. Materials, properties, groups and loads are not deleted from the tree.) On an element row that gathers several element cards, Delete removes all of them. BeidPrep never leaves the deck pointing to something that no longer exists. Before anything is removed, a window lists what the delete removes or changes, and says so in capitals when the deck may no longer run; **Yes** deletes, **No** keeps everything, and **Show Details...** gives the full list. In short:

- deleting a part also removes its elements, and the nodes no remaining element uses;
- node and element groups are never deleted; the removed items simply leave them;
- if a delete leaves a list empty that another card needs — for example the surface of a contact — a message names that card in plain words, and the export check stops on it later (chapter 12).

Edit → **Undo** (`Ctrl`+`Z`) brings a deleted card back.

5.5 The MESH CONTROLS tab

The second tab of the tree panel lists the mesh controls: the meshing settings of each CAD body you mesh in BeidPrep. Right-click in it for **New Mesh Control...**; right-click a control for **Edit Recipe...** and **Delete** as well, or double-click it to open it again with its settings. Chapter 8 covers meshing. Once the model has mesh controls, the tab shows how many: **MESH (1)** in Figure 5.3.

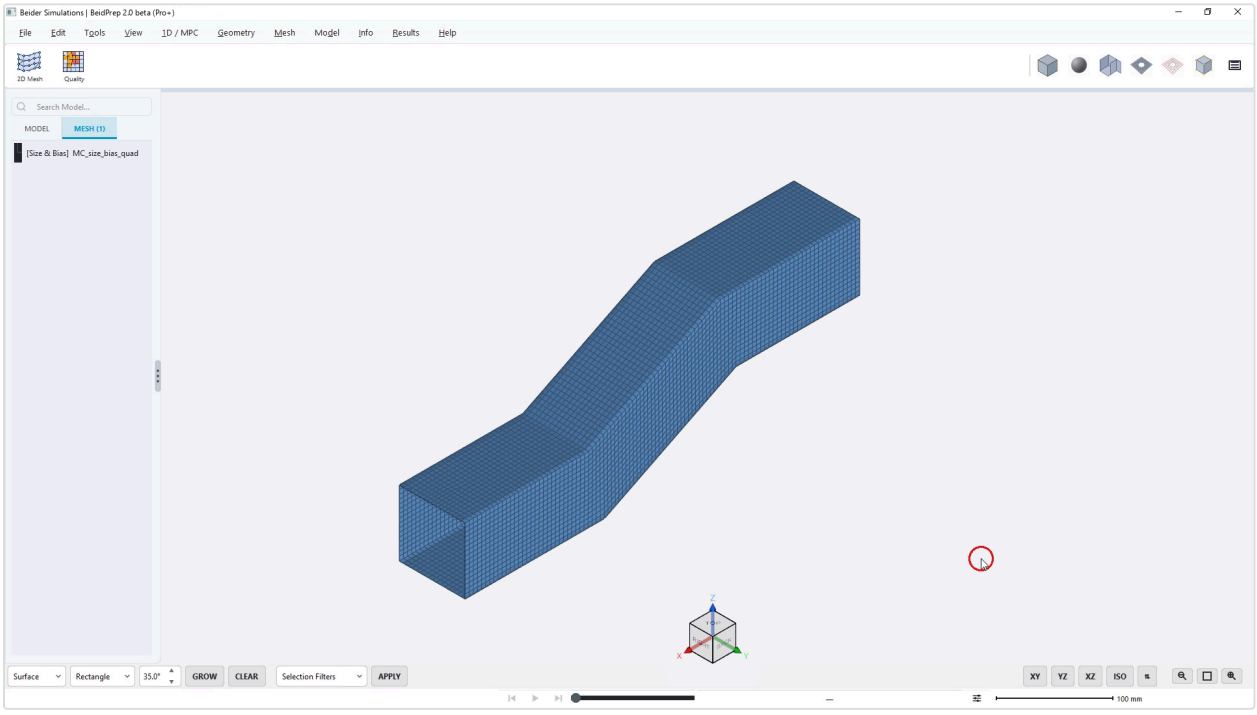


Figure 5.3 — The MESH CONTROLS tab, here MESH (1): one mesh control on the meshed S-rail.

→ Every control of these panels, one by one: **Reference R5: the model tree**, page 146

6 The card editor

Every card of the deck can be opened and edited in the card editor, on the right of the window. A card BeidPrep has checked opens as a form, with a description of each field; any other card opens as its own text, which you edit column by column.

6.1 Opening a card

Click a card in the model tree. The card editor shows its keyword, its title and its fields, grouped in the rows the solver reads.

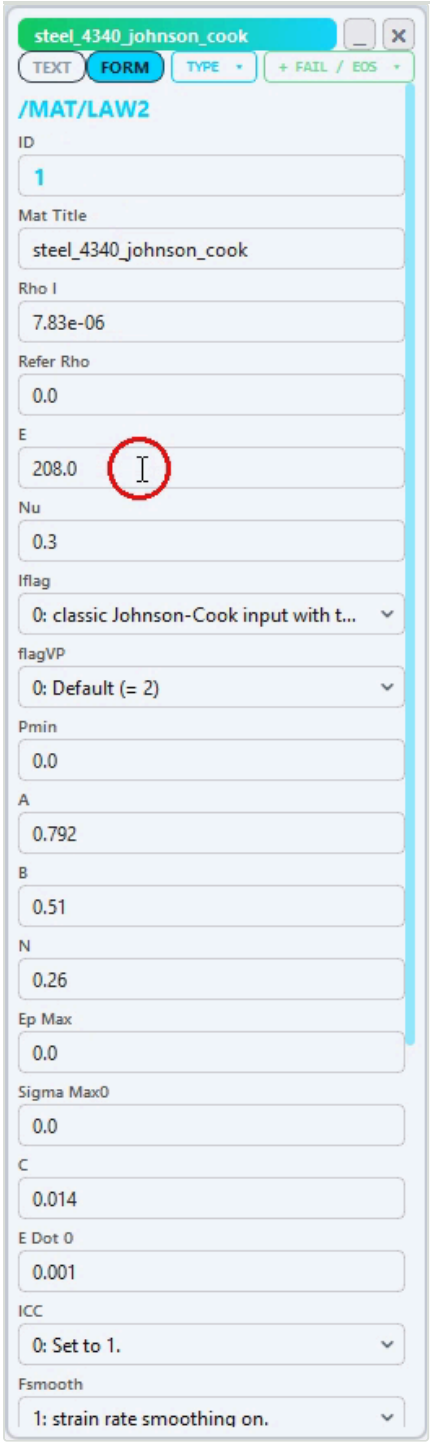


Figure 6.1 — A card open as a form.

6.2 Kinds of field

- **Numbers and text.** Type the value and press `Enter` or move to another field. The value is written into the card in the columns the solver reads it from.
- **Options.** A field with a fixed set of values is a drop-down list, and each entry says what it means. Some options change the card itself: rows that are read only for a certain option appear when you choose it and disappear when you choose another.

- **References.** A field that names another card — a material, a property, a curve, a group, a surface — is a list of the model's cards of that kind, each shown with its number and title: open it and choose the card (a number typed into it is kept too). While the model has no card of that kind yet (or more than 500 of them), the field is a plain box: type the card's number. A field that names a node or an element is always a plain box: type its number.
- **The card's own number** is shown but cannot be typed over. BeidPrep keeps every reference to it in step with the card.

> **Notes in amber** An amber line at the top of a card's form is a plain note, never a block: for example "*Curve x values must increase: point 3 (x = 0.4) is not greater than point 2 (x = 0.6)*" on a `/FUNCT` curve, or a known solver limitation of one field. Your value is kept as you typed it. (The Function Editor below is stricter: it will not save such a curve.)

Curves (`/FUNCT`)

A curve card has an **Open Function Editor** button. The editor shows the points as a table beside their plot: add points with *+ Row*, paste columns from a spreadsheet with `Ctrl` + `V` or *Import Excel*, drag points on the plot with *Edit Points (Drag)*, or trace a curve from a picture with *Digitize*. Type a value by double-clicking its cell; *Refresh Plot* redraws the curve. *Save & Close* writes the points into the card — but only when every x is larger than the one before: otherwise it says, in red, *Not saved* and names the row, and the editor stays open. Only x has to increase: y may rise and fall freely, as in a sine-wave acceleration.

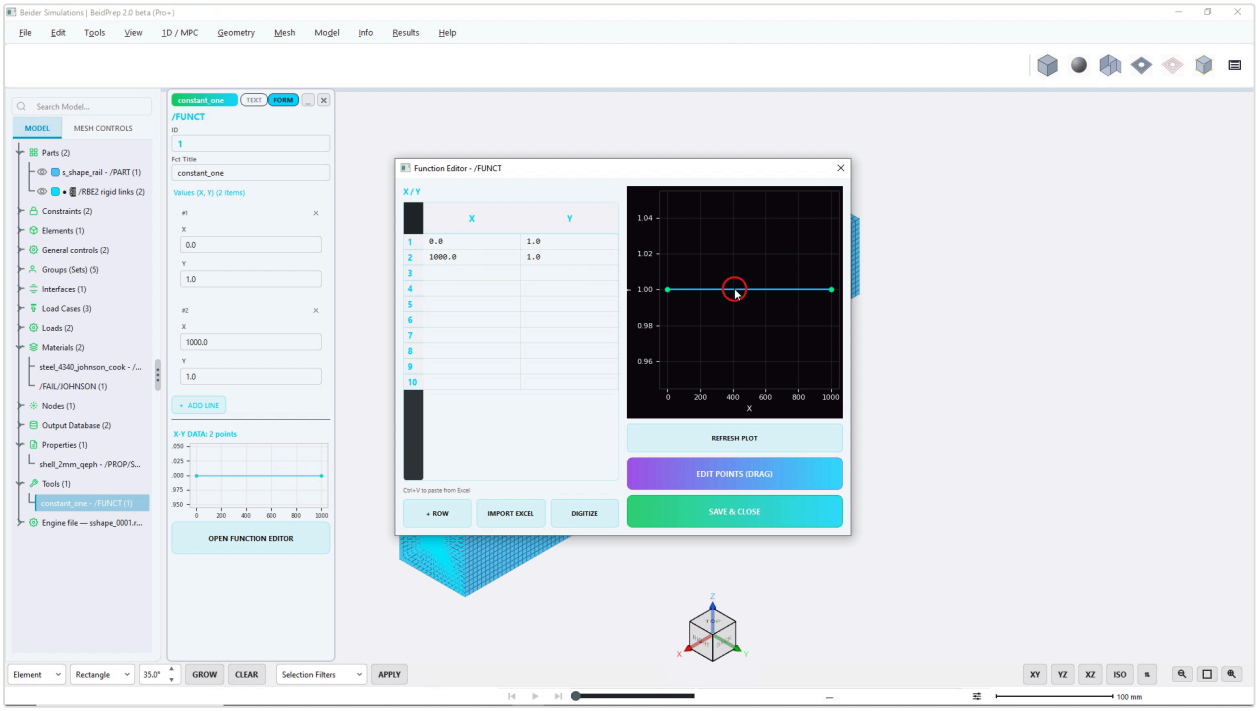


Figure 6.2 — The Function Editor.

6.3 Cards shown as text

A card type BeidPrep has not fully checked with the Starter — or a card that holds a field that is not checked — opens as **text**: the card's real lines, with a column ruler above them.

- Typing **overwrites** characters; it never inserts, so no column moves.
- Checked fields are highlighted normally; fields that are not checked are shown in **red**, and the card carries a badge. The red highlight only shows where BeidPrep thinks the field is: in red columns BeidPrep writes exactly the characters you typed, where you typed them.
- The **Text / Form** switch on the card's bar shows the checked fields as a form; the form never shows a field that is not checked.
- When you export, BeidPrep lists every card that holds edits in fields that are not checked, so you can review them before you run (chapter 12).

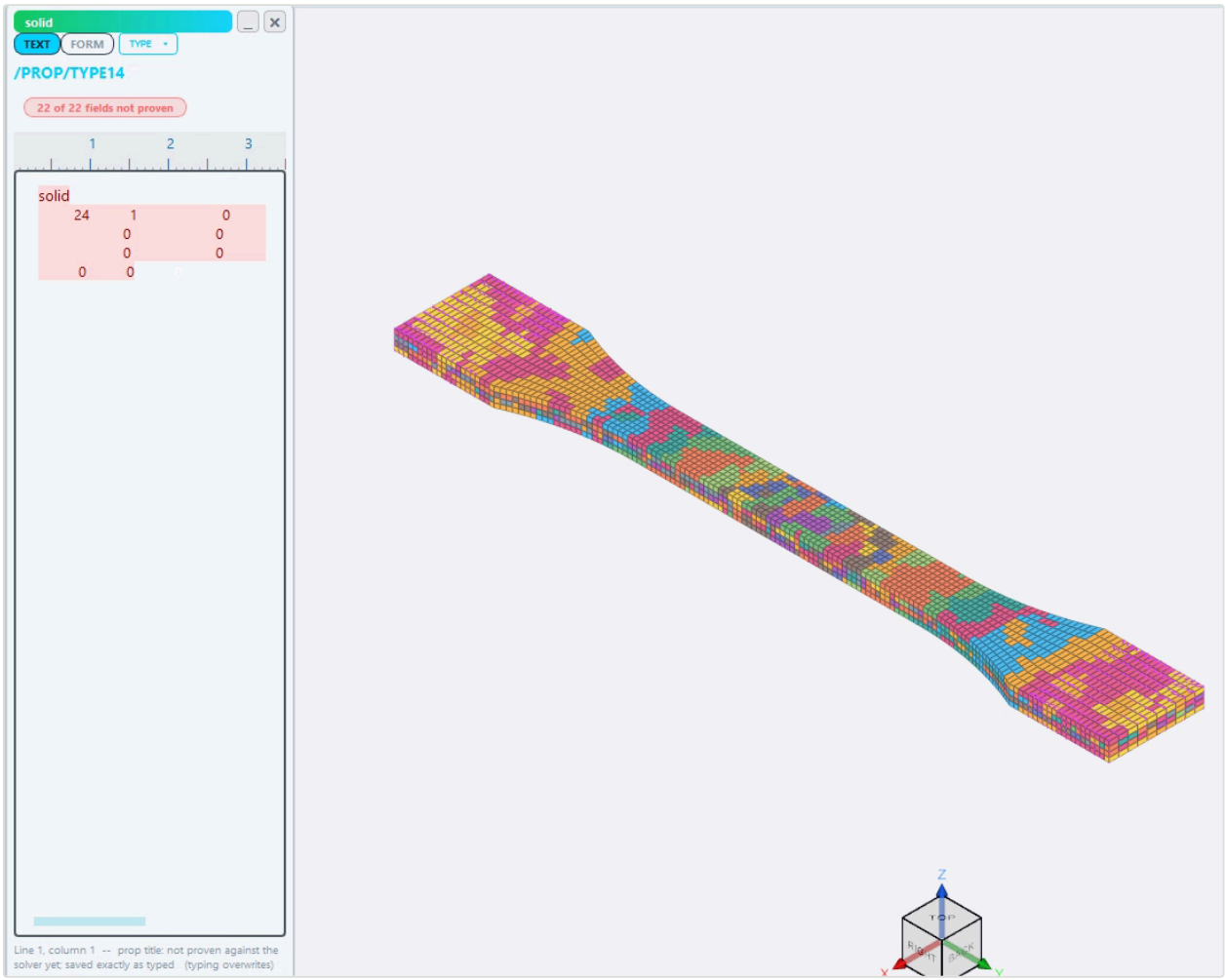


Figure 6.3 — A card shown as text: the ruler over its columns, the badge counting the fields that are not checked (here all 22 of a solid property), and those fields in red.

6.4 Creating a card

Right-click an empty place in the model tree. The menu lists the card families by category, some with a second level (for example **Materials** → **Elasto-Plastic** → **/MAT/LAW2**); choose one to create a new

card of that type, with the next free number, open in the card editor. Only card types whose every field has been checked with the solver are offered here; a card type with fields not yet checked is listed with a note saying so.

6.5 Undo

Every edit in the card editor can be undone with **Edit** → **Undo** (`Ctrl`+`Z`) and redone with **Edit** → **Redo**; the menu names the edit each one will undo or redo. In the text view, keystrokes typed in one quick burst are undone together. **Edit** → **Clear Undo History** forgets them all.

6.6 Where the field descriptions come from

The form's field names, descriptions, units, defaults and options were written for BeidPrep, field by field, by reading the solver's published documentation: the Starter input pages of the Radioss Reference Guide [1]. Where those pages are silent or unclear, the input-format files and the Starter source of OpenRadioss [2] were read as well.

The form's columns are not taken on trust from the documentation. For every card type shown as a form, BeidPrep has checked with the OpenRadioss Starter that every field you edit is written where the Starter reads it (**Help** → **Card support** lists the card types and deck versions). This does not check your model or your results.

[1] Altair Engineering, *Radioss Reference Guide*, Starter input pages, help.altair.com/hwsolvers/rad/ (read 14–30 September 2026).

[2] OpenRadioss, open-source Starter and Engine, github.com/OpenRadioss/OpenRadioss (GNU Affero General Public Licence 3.0): the Starter source and the input-format files in *hm_cfg_files*.

→ Every control of these panels, one by one: **Reference R6: the card editor**, page 148

7 Importing and preparing CAD

CAD geometry is the starting point when you mesh in BeidPrep. This chapter brings it in, makes mid-surfaces of thin-walled parts, cuts bodies, and cleans up the faces before meshing.

7.1 Importing CAD

Click **Import CAD** on the **File** tab. The *Import CAD Geometry* window opens.

1. **Files to import.** Click *Add Files…* and choose one or more STEP or IGES files; *Remove* takes one off the list. The files are read one after the other.
2. **Topology Healing (Sewing)**, off by default. Ticked, it joins loose surfaces into water-tight shells, within the *Tolerance* you set (default 0.00001). A sewn file stays one body: it is not split into its separate bodies.
3. **General Fuse (Imprinting)**, off by default. Ticked, it imprints bodies that touch onto each other. It is slow for large assemblies.
4. **Viewport quality**: how finely the CAD is drawn — *Fast* (0.5 mm, smoothest to turn), *Balanced* (0.2 mm, recommended) or *Fine* (0.05 mm, accurate curves, slower). It changes only the drawing, never the geometry that is meshed.

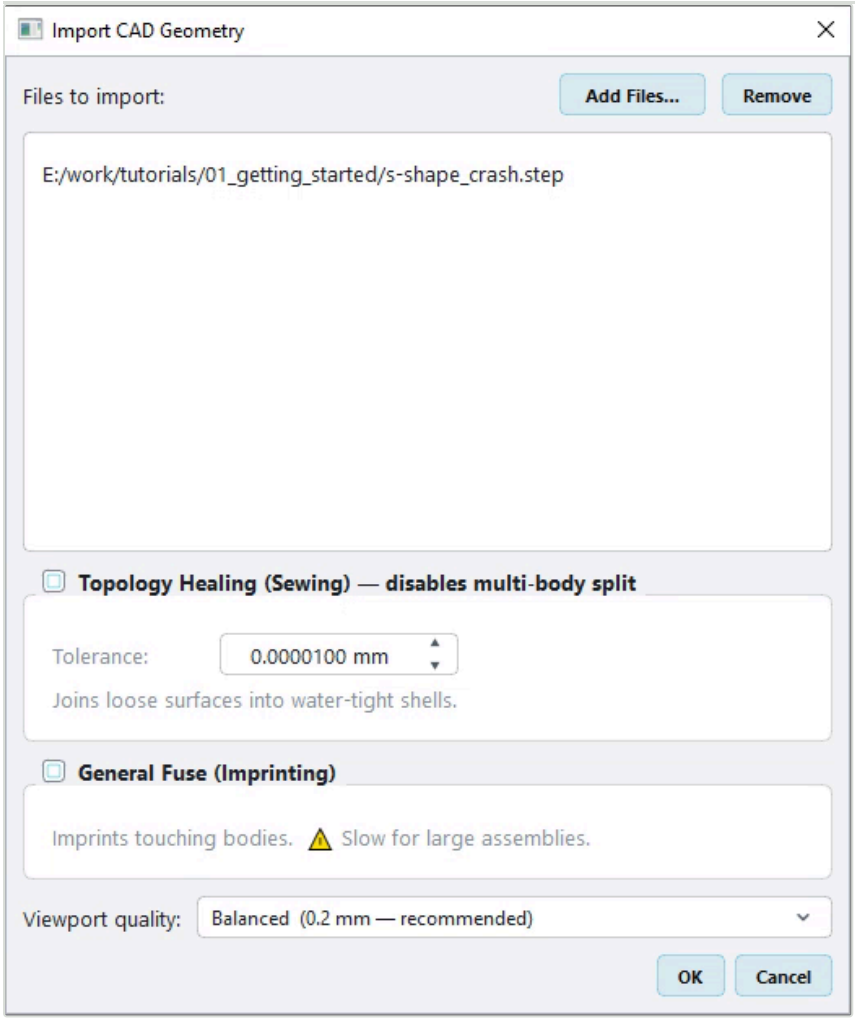


Figure 7.1 — The *Import CAD Geometry* window.

Each body appears in the model tree and in the 3D view. If a file cannot be read, a message at the end lists it; the other files are kept.

How CAD is drawn is set with the display buttons (section 3.4) and, per body, with **CAD View Mode** in the body's right-click menu (section 5.2). **CAD edges** coloured by how faces connect is the quickest way to find a gap before you mesh.

7.2 Mid-surfaces (Pro)

A thin-walled solid — sheet metal, or a moulded plastic part with ribs, bosses and drafted walls — is meshed with shells on its mid-surface. Click **Midsurface** Pro on the **Geometry** tab.

1. The panel opens ready to pick: click the solid in the 3D view. Its name appears after *Source*; ⊕ *Pick Body* picks another, *Clear* starts again.
2. *Solid Opacity* makes the solid see-through, so you can see the mid-surface inside it.
3. Choose *Create new Item* to keep the solid, or *Replace selected body* to put the mid-surface in its place.
4. Click **Extract Midsurface**. While it runs, **Stop** ends it; nothing is added and the model is unchanged. When it finishes, the status bar reads *Midsurface: N face(s) made in T s* and the mid-

surface is a new body, ready to mesh.

What it builds

The tool reads the solid as a set of walls — plates, ribs, bosses, flanges — and gives each wall its own mid-surface: halfway between the wall's two faces, also where the wall is drafted or changes thickness. Where walls meet, their mid-surfaces are joined along a shared edge — a rib to the plate it stands on, a boss to its floor — so the mesh on them is connected.

Thickness

The tool measures how thick each wall is and sorts the walls into **thickness groups**: each wall's median thickness is rounded to the *Thickness step* (0.1 mm unless you change it before the run), and walls with the same rounded value form one group. The panel lists them, for example *Rib_4_t2.5 — 2.5 mm, 3 walls, 12 faces*.

When **Extract Midsurface** finishes, every group is already its own **part** with its own shell property (`/PROP/SHELL`) of that thickness, named after the solid and the thickness (*Rib_4_t2.5*), and the body's parts sit together in one subset (*midsurface_Rib_4*). They are listed in the model tree before you mesh, and the faces are drawn in their parts' colours. When you mesh the mid-surface, each face's elements go into its part. The parts have no material yet: give each one its material before you export.

Faces whose thickness could not be measured go into their own part, *Rib_4_t_unknown*, with a thickness of 0. Type their thickness in that part's property form. If you mesh that part and leave its thickness at 0, the export warns (*Export — parts OpenRadioss will stop on*), because OpenRadioss stops on a meshed shell with no thickness.

- **Ctrl+Z** right after the run removes the mid-surface and all its parts in one step.
- The *Thickness step* box is greyed out once the parts exist. For another step: **Ctrl+Z**, set the step, and run **Extract Midsurface** again.
- Deleting the mid-surface body also removes its parts that are still empty (no elements and no material); a part you gave a material or elements is kept. The delete can be undone.
- You can rename the parts; BeidPrep keeps track of them by id.

What it reports, and what it leaves out

The tool does not guess. A region of the solid that it cannot read as a wall is **left out**: it gets no mid-surface, rather than one that could be wrong. A wall that was made but could not be joined to the walls it meets is kept, but its edges stay free there. After the run, the panel says how many of each:

- *N region(s) LEFT OUT — no midsurface there (orange)*: these regions are drawn orange on the model;
- *N wall(s) made but NOT JOINED (magenta)*: these walls are drawn magenta.

Below it, a list names each region with the reason, its area in mm^2 and where it is, for example *Region 2 — not supported, 140 mm2, near (35, 12, 4)*. Click a row and the view flies to it. *Show in 3D* shows or hides the coloured regions. The message box at the end of the run lists the same regions, and a

mesh of such a body reports *MESH INCOMPLETE*. If nothing in the solid can be read as walls, no body is made and the message says *No midsurface could be made for this solid*.

Check the list before you mesh: a left-out region is a gap in your model, and a wall that is not joined is a crack. Model the left-out regions by hand, or join the free edges with the mesh-edit tools (chapter 9).

[Picture coming in the next version]

Figure 7.2 — A sheet-metal bracket and its mid-surface.

Holes in a mid-surface can come out with rough outlines. **Heal Topo → Repair Chamfer-Projected Holes** replaces them with clean circles (section 7.4).

7.3 Trimming

Click **Trim** on the **Geometry** tab to cut a body. Choose the *Target body* (*Apply to*, or *Pick* it in the view), then define the cutting plane in one of two ways, chosen at the top of the panel:

- **Trim by Face:** click *Pick Trim Face* and click a flat face of the geometry. The face's plane is shown as an orange rectangle. A face that is not flat is refused.
- **Trim by Plane:** the panel sets the selection bar at the bottom of the 3D view to *Point*; click points on the geometry. The first point is the plane's origin (white); one, two or three more points (orange) give its direction. Click *Compute Plane from HUD Points*; *Clear HUD Points* starts again.

The panel says when the points cannot define a plane — for example when they lie on one line.

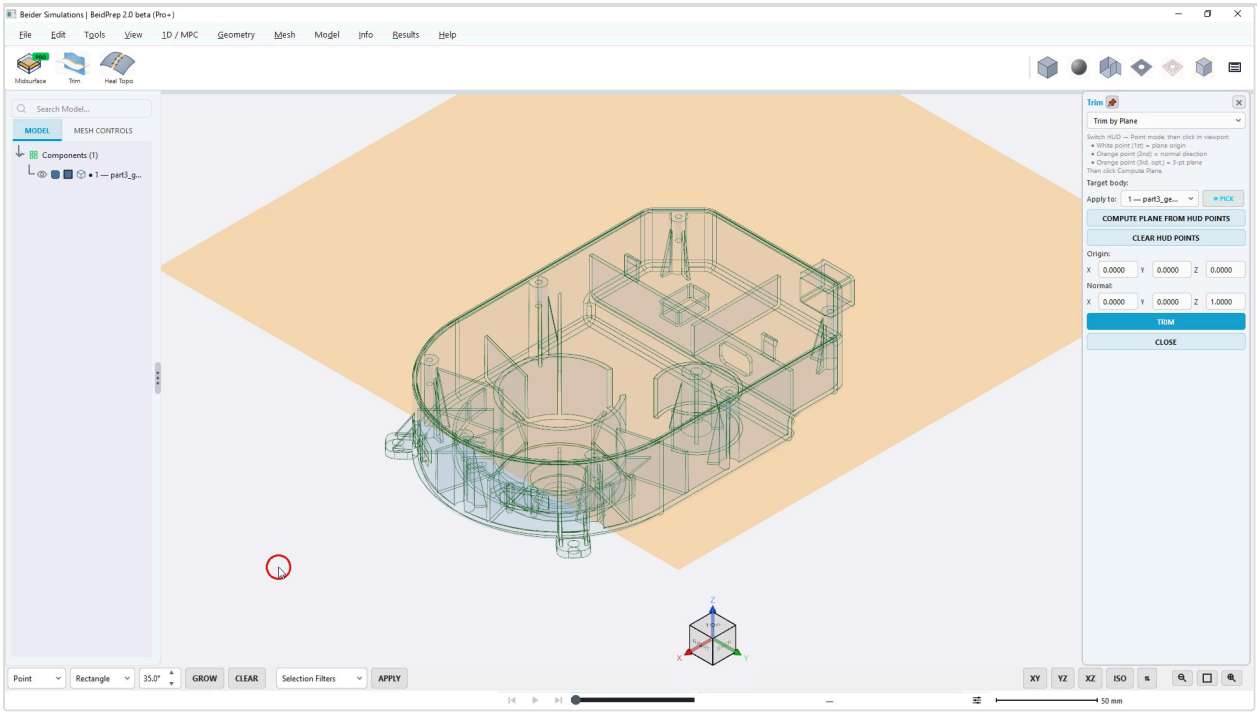


Figure 7.3 — Trimming a body by a face.

7.4 Cleaning up before meshing (Heal Topo)

Heal Topo on the **Geometry** tab opens a menu of clean-up tools:

Tool	What it does
Heal face-soup topology (graduated sewing)	Connects the faces of freshly imported CAD that should touch but do not. For bodies imported without sewing.
Repair Chamfer-Projected Holes	Replaces rough hole outlines left by the mid-surface tool with clean circles. Use before meshing.
Consolidate Fragments	Removes the small leftover faces around each bolt hole, keeping every hole at its exact size. Use before meshing and before placing washers on many holes.

> **Nothing is dropped** The clean-up tools repair faces and edges; they never silently delete one to get past a problem. If a repair would lose a face, an edge or a hole outline, the tool stops with an error instead.

Washers around bolt holes and removing small holes are in the editing toolbar on the **Model** tab (chapter 9).

→ Every control of these panels, one by one: **Reference R7: the CAD panels**, page 153

8 Meshing

BeidPrep meshes CAD faces with shell elements. You set an element size, preview the mesh, adjust the number of elements on any edge, and accept. Every accepted mesh is checked at once: it must be connected and of good quality.

8.1 Starting a mesh

1. Import the CAD (chapter 7) and, for thin-walled solids, make the mid-surface.
2. Click **2D Mesh** on the **Mesh** tab. The *2D Mesh Setup* panel opens and the selection type at the bottom left switches to *Surface*.
3. Select the faces to mesh in the 3D view: click a face, or drag a rectangle around the faces you want. Selected faces turn magenta.

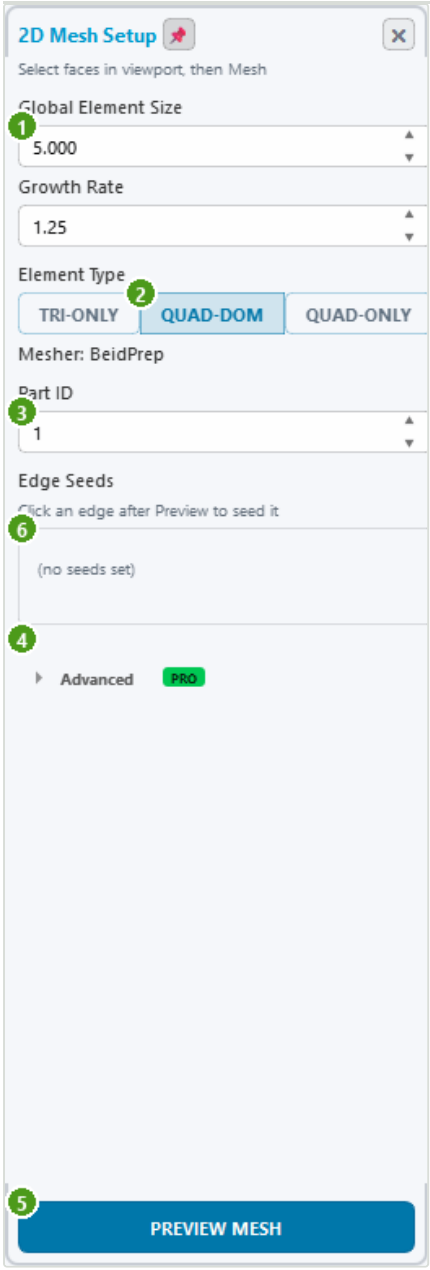


Figure 8.1 — The 2D Mesh Setup panel.

1. ('near', 'Global Element Size')
2. ('text', 'Quad-Dom')
3. ('near', 'Part ID')
4. ('text', 'Advanced')
5. ('text', 'Preview Mesh')
6. ('cls', 'QListWidget', 0)

8.2 Settings

Setting	What it does
Mesher	The panel reads *Mesher: BeidPrep*: every mesh is made with BeidPrep's own surface mesher (section 8.6), and there is nothing to choose. Element Fill and the re-mesh after an edge-seed change use the same mesher, and a model saved with an earlier version meshes with it too. If BeidPrep's mesher cannot be loaded, a red line under the heading says *BeidPrep's mesher cannot be loaded (reason) -- meshing is not possible.*
Global Element Size	The target length of an element edge.
Growth Rate	How fast elements grow from small to large away from refined areas.
Element Type	Three buttons; *Tri-Only* is chosen when the panel opens. *Quad-Dom*: quads, with triangles where quads would be poor. *Quad-Only*: quads only; it may leave a few triangles where an all-quad mesh isn't possible. *Tri-Only*: triangles only.
Part ID	The part the new elements go into.

Under **Advanced** Pro — the whole section needs a Pro licence; in the Free edition you can open it and read it, but its setting is greyed out. It holds one setting:

Setting	What it does
Edge Grading	The *Bias* of a seeded edge (8.3): 1.0 spaces its nodes evenly, above 1 crowds them towards the edge's start, below 1 towards its end.

> **Scrolling the panel** Scroll the panel with its scroll bar. The mouse wheel also scrolls it, but when a number box passes under the pointer the wheel changes that number instead.

8.3 Preview and edge seeds

Click **Preview Mesh**. The mesh is drawn on the faces in orange but not yet added to the model, and the selection type switches to *Edge*. Now you can change the number of nodes on any edge (its *seed*), with the mouse only:

- Click an edge: it is highlighted, its node count *N* appears on it, and the counts of the other edges appear too. Each further click on the same edge adds one node, and the faces on both sides re-mesh at once.
- Or press on the edge and drag upwards to add nodes; the faces re-mesh when you let go.
- To crowd an edge's nodes towards one end, open **Advanced** and set *Bias* under *Edge Grading* while the seeded edge is selected.

- The **Edge Seeds** list shows every seeded edge with its N, and the share of quads in the mesh. The neighbouring faces follow the new count, so the mesh stays connected across the edge.

When you change a setting after a preview, the panel says *Parameters changed — click Preview to remesh*.

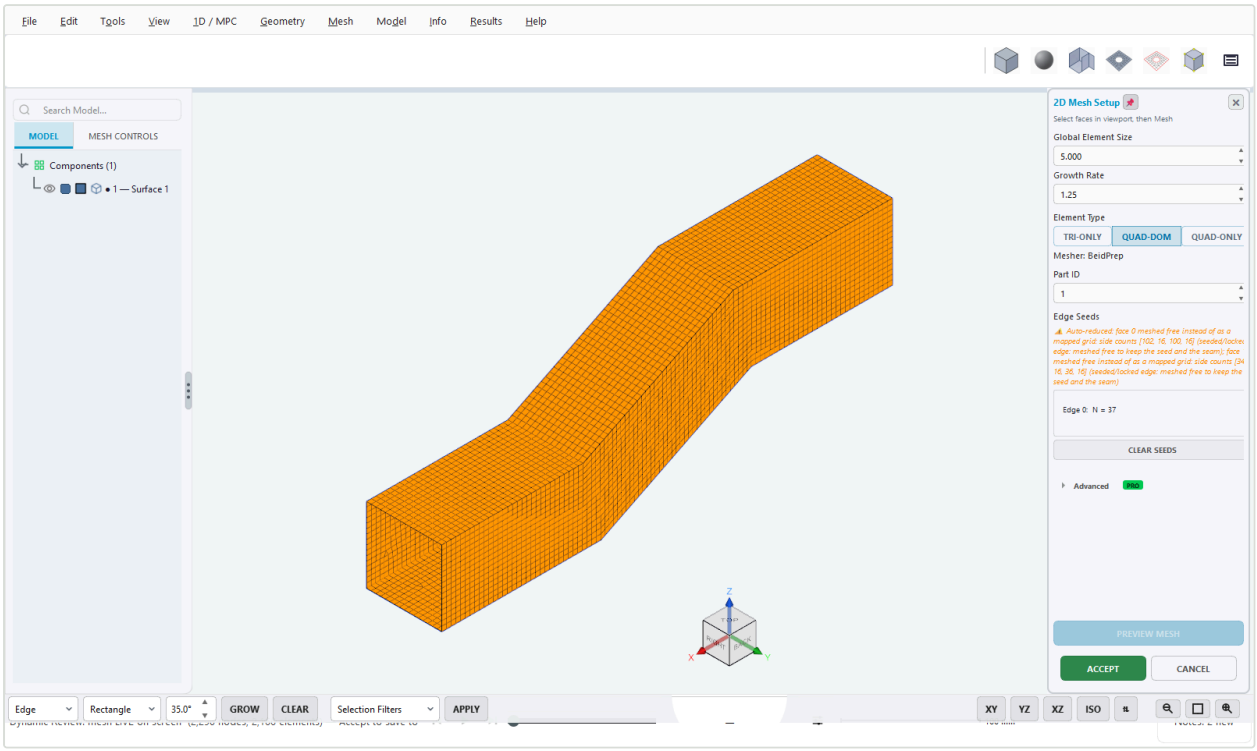


Figure 8.2 — A previewed mesh with one edge seeded.

8.4 Accepting, and the check after it

Accept adds the mesh to the model (it turns from orange to the part's colour), and the panel stays open for the next faces; **Cancel** discards the preview and the face selection. Every Accept runs the mesh check on what was just added, and the panel shows the verdict:

- a green *Mesh check:* line when the mesh is connected and of good quality;
- a red *MESH CHECK FAILED* — line, naming the problem, when it finds a crack (two nodes at the same place that are not joined), a hanging node (a node in the middle of a neighbour's edge), collapsed elements or an interior angle below 5°.

On the model, the elements the check finds are coloured: inverted elements red, failed elements orange. If a face is left without elements, a *Faces without elements* box appears once, at **Accept**, saying how many and naming each face with its reason — *excluded by healing*, *sliver collapsed into a CAD micro-edge*, *excluded before meshing* or *mesher failed*. At **Preview** and after a seed change no box opens: the same sentence goes to the status bar and to the notes list (the **Notes** button at the right of the status bar). While the meshing panel is open, those faces are labelled in magenta in the view; the labels go when the panel closes, and the faces stay in the notes list. The verdict names them and points to the tools that fix them — **Node Move**, **Align**, **Project**, **Split** and **Combine** (chapter 9) — and to **Mesh** → **Quality** (section 8.5).

> **Connected comes first** Quads are preferred, triangles are acceptable, a disconnected mesh is not. When a structured face cannot match the node count of an edge that is already meshed, BeidPrep meshes that face freely, absorbing the difference with triangles inside it, and says so. An edge that is already meshed never moves.

8.5 Checking quality

Click **Quality** on the **Mesh** tab to open the *Mesh Quality Check*. It measures every element by the usual criteria — aspect ratio, skew, warpage, taper, Jacobian, and the smallest and largest interior angles of quads and triangles — and rates the mesh from *Perfect* to *Fail*. Choose a criterion to colour the elements by it, and filter to see where the poor ones are.

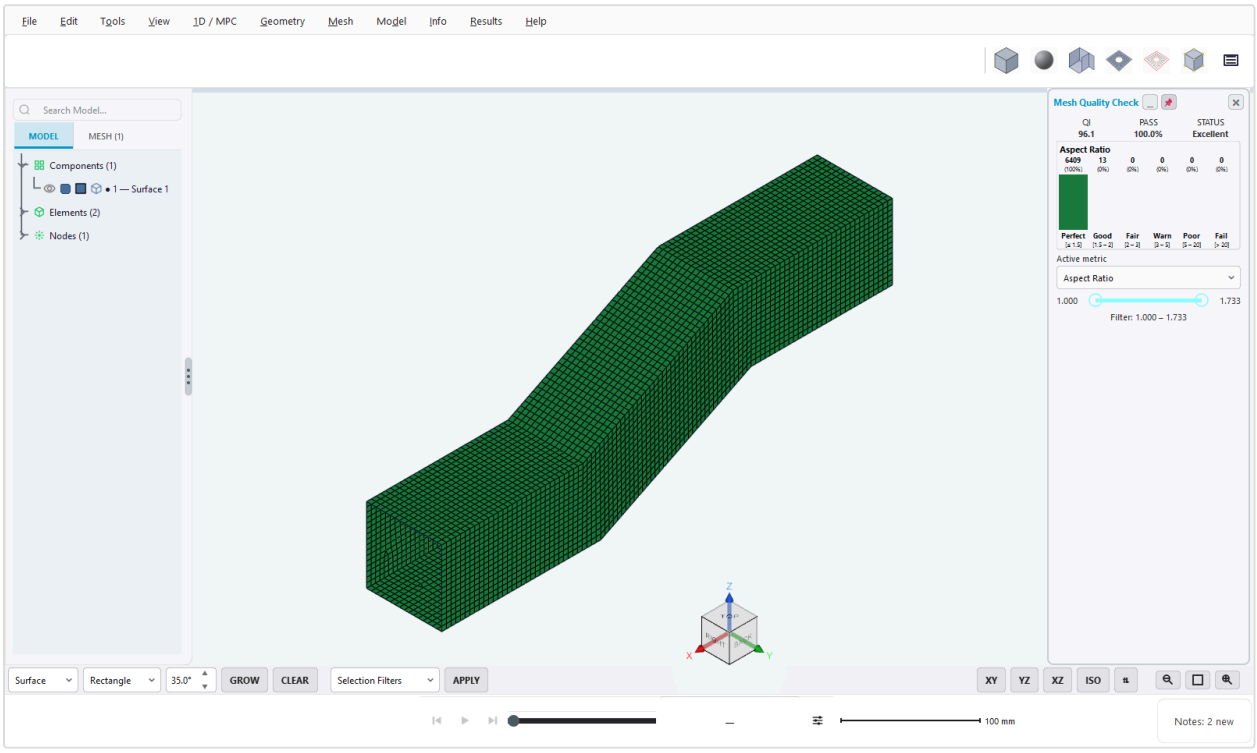


Figure 8.3 — The Mesh Quality Check.

Washers around holes, and the tools that fix single elements, are in the editing toolbar (chapter 9).

Quality that follows your edits

The *Mesh Quality Check* can stay open while you edit the mesh. When another panel opens, the quality check folds to a strip at the bottom of the panel column and its colours stay on the model. Move a node with **Node Move**: as soon as you let go, the elements around it take their new colours, so you see at once whether the move made them better or worse. (Node Move is **Move** under **Node** in the editing panel: **Model** tab, **Edit**.) The strip's maximize button shows the updated figures and histogram, folding the other panel to a strip at the top. Every mesh edit — splitting, merging, deleting — and `Ctrl`+`Z` and `Ctrl`+`Y` update it the same way, measuring only the elements the edit touched.

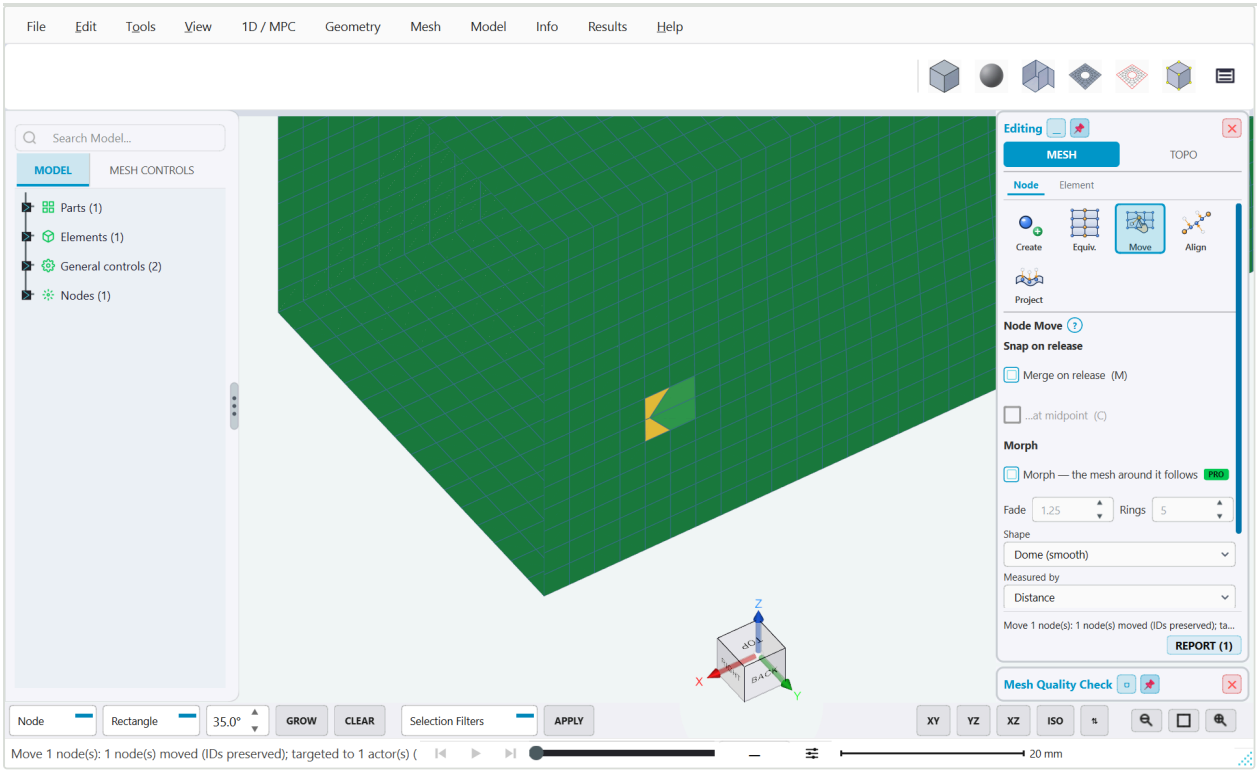


Figure 8.4 — Node Move open, the quality check folded to a strip below it, its colours still on the model.

8.6 The BeidPrep mesher

The BeidPrep mesher is BeidPrep's own surface mesher. It is built on the open-source mesh generator Netgen (used under the GNU LGPL, see section 15.2), extended with BeidPrep's own algorithms for quad meshing, structured faces and mesh quality. These algorithms were written from published methods; no code from other meshers was copied into them.

→ Every control of these panels, one by one: **Reference R8: the meshing panels**, page 159

9 Mesh editing

The editing toolbar fixes and adjusts a mesh and its CAD by hand: nodes and elements on the MESH tab, CAD points, edges and faces on the TOPO tab.

9.1 The editing toolbar

Click **Edit** on the **Model** tab. The editing toolbar opens with two tabs, **MESH** and **TOPO**. Click a tool to open its panel.

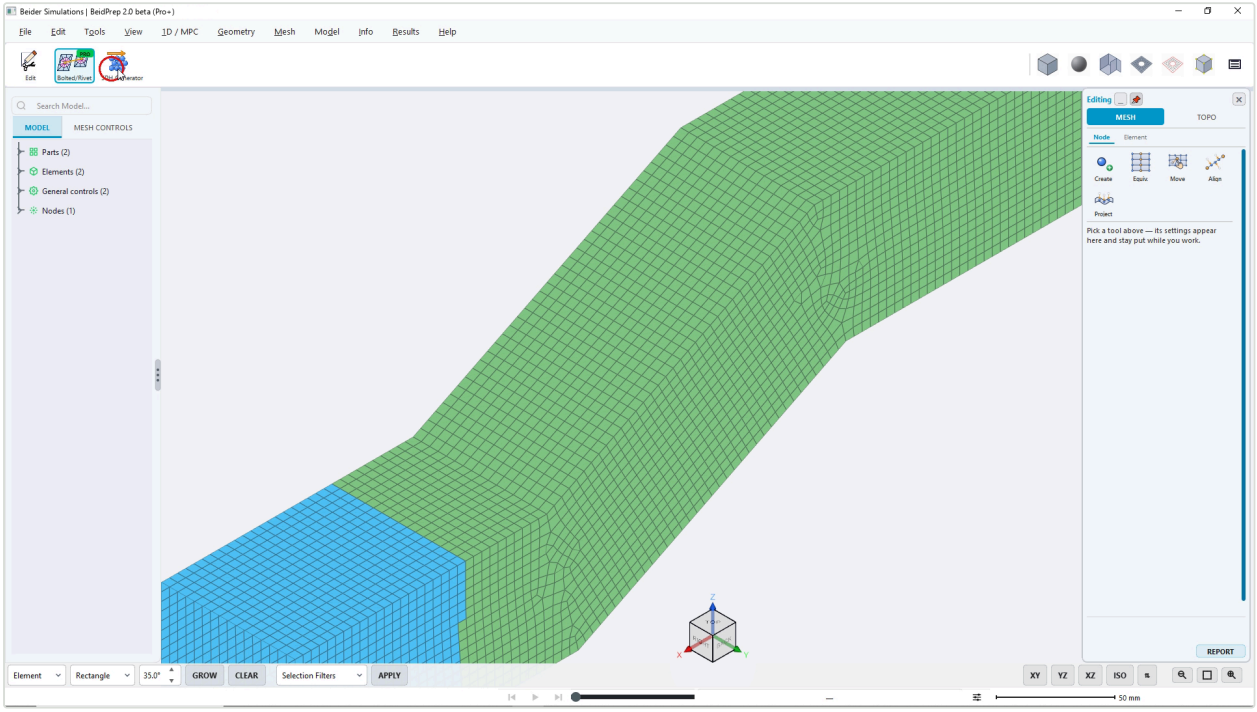


Figure 9.1 — The editing toolbar, MESH tab.

Every panel works the same way:

- The panel says what it still *Needs* — for example two nodes — and you pick them in the 3D view. A panel with several pick rows starts with its first row picking; press *Pick* on the next row to fill that one.
- **Preview**, where the tool has one, shows the result before anything changes.
- The tool's own button (*Create*, *Split*, *Apply*…) applies it; the report line says what was done.
- **Edit** → **Undo** (`Ctrl`+`Z`) undoes the last edit.

> **Pro** Inside some panels, an option carries the green Pro badge — for example removing elements and edge collapse in Node Equivalence, Morph in Move, washers on many holes at once, and removing all holes below a diameter. Every other control of the editing toolbar is in every edition, projecting a whole set of nodes at once included.

9.2 MESH tab

Tool	What it does
Node → Create	Create new nodes: at typed coordinates (*X Y Z*), *Between 2 nodes* or *points*, or at the *Centre / 3 nodes* or *points* (the centre of an arc). A node that would land on an existing one is refused, unless you tick *Allow duplicates*.
Node → Equiv.	Merge nodes closer than a distance you set, so the parts' meshes connect. With *Thin solid* ticked (the default), nodes on opposite sides of a thin wall are never merged.
Node → Move	Move nodes by dragging them. With *Merge on release* ticked (key `M`), a node dragged close to another snaps to it and releasing merges them. Hold `N` while dragging to move along the node's normal. With *Morph* the mesh around the node follows smoothly.
Node → Align	Line nodes up on the straight line between two nodes.
Node → Project	Move nodes onto a surface, plane or line.
Element → Combine	Join two triangles into one quad.
Element → Split	Split a quad into two triangles.
Element → Fill	Fill a hole in the mesh with new elements, between two runs of nodes that are kept exactly.
Element → Normals	Make the shell normals of a connected area all face the same way as an element you pick. While its panel is open, a shell seen from its back is drawn yellow, so you can see which way each one faces (R9.9).

To delete elements or nodes, select them in the 3D view, right-click and choose **Delete**; the same rules as a tree delete apply (section 5.4).

Node Equivalence

Set the *Merge tolerance*: nodes closer than this distance are merged, nearest pair first; a node with several close neighbours merges with the nearest one. Choose the parts in the *Components* list (or click them in the 3D view). **Preview** marks the nodes that would merge; **Apply** merges them.

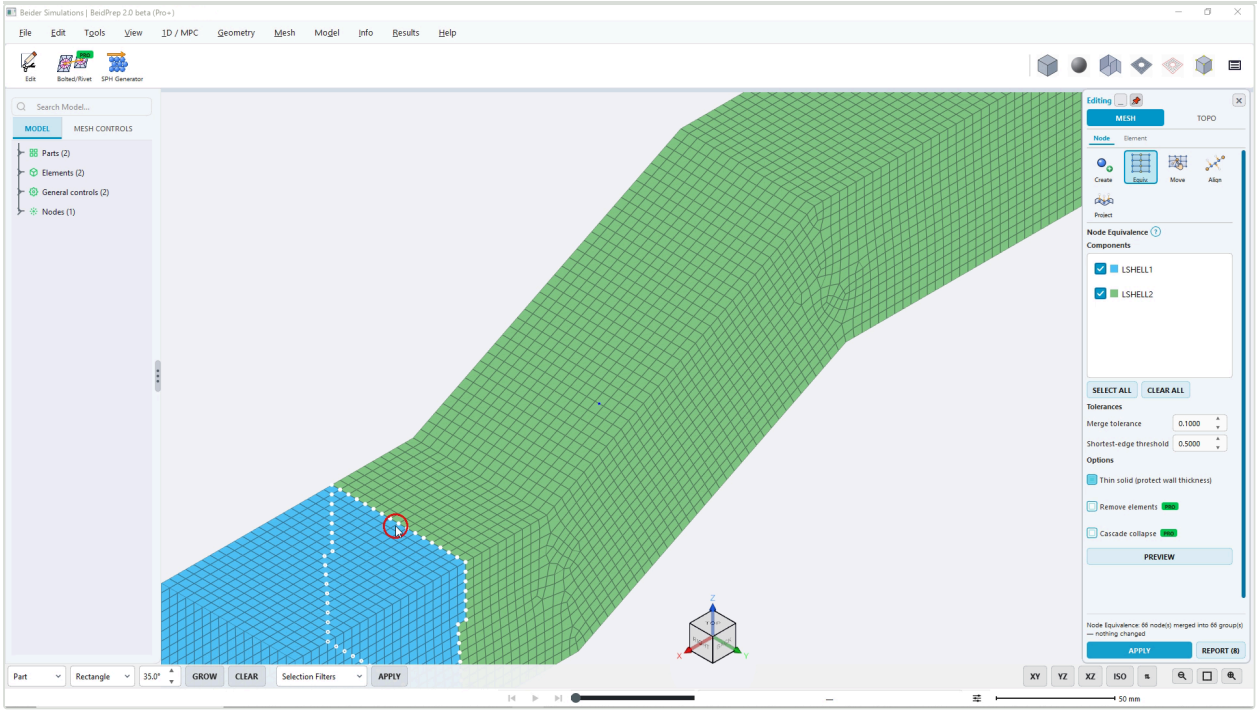


Figure 9.2 — Node Equivalence, the nodes that would merge marked.

With *Remove elements* (Pro), edges shorter than the threshold are removed too, deleting the elements that collapse; *Cascade collapse* keeps removing edges that become too short after earlier removals. No node moves more than twice the threshold from where it started.

Moving nodes with Morph

With *Morph* on, the rings of elements around the dragged nodes follow the drag. *Rings* sets how many follow (at 1, only the dragged nodes move); *Fade* sets how quickly the movement dies away; the shape is a *Dome* (smooth, like a pulled sheet) or a *Cone* (a sharp peak at the node).

9.3 TOPO tab

Tool	What it does
Edge → Washer	Add a ring of faces around bolt holes, for a clean ring of elements there: *Single* (click a hole edge) or *Multiple* (Pro: scan a body and place them all).
Face → Defeature	Remove holes smaller than a radius you set: *One hole*, or *Find holes* and remove *All below Ø* (Pro).

To cut a body, use **Trim** on the **Geometry** tab (section 7.3).

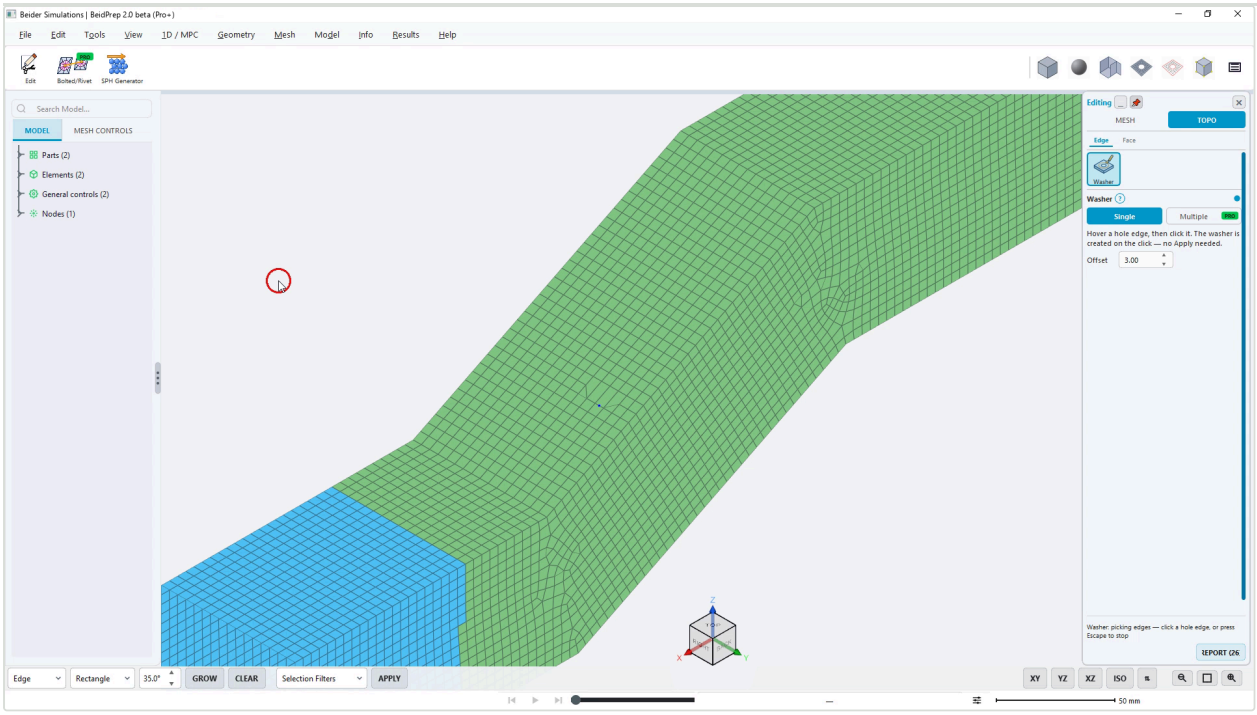


Figure 9.3 — The editing toolbar, TOPO tab: **Edge** → **Washer** open (Single, offset 3 mm).

After a TOPO edit, mesh the changed faces again (chapter 8).

→ Every control of these panels, one by one: **Reference R9: the mesh editing panels**, page 163

10 Connectors

Connectors join parts: beams, trusses and springs between two nodes, rigid links that tie nodes together, links that spread a load, and bolt or rivet connections placed automatically at holes that line up.

10.1 1D elements: beam, truss, spring

Click **1D Element** on the **1D / MPC** tab. In the *Create 1D Element* panel:

1. **Type:** *BEAM*, *TRUSS* or *SPRING*.
2. **Node 1** and **Node 2**: pick them in the 3D view or type their numbers. A beam also takes a **Node 3** that orients its cross-section.
3. **Part:** an existing part whose property suits the element type, or *New part* with a *New property* of the right type and a material (an existing one, or *New material (LAW1 elastic)*), each with its name.
4. Click **Create**. The button stays off, with the reason written under it, until everything the element needs is given.

An element always goes into a part whose property fits it, with the values you typed — never into a part the solver would refuse.

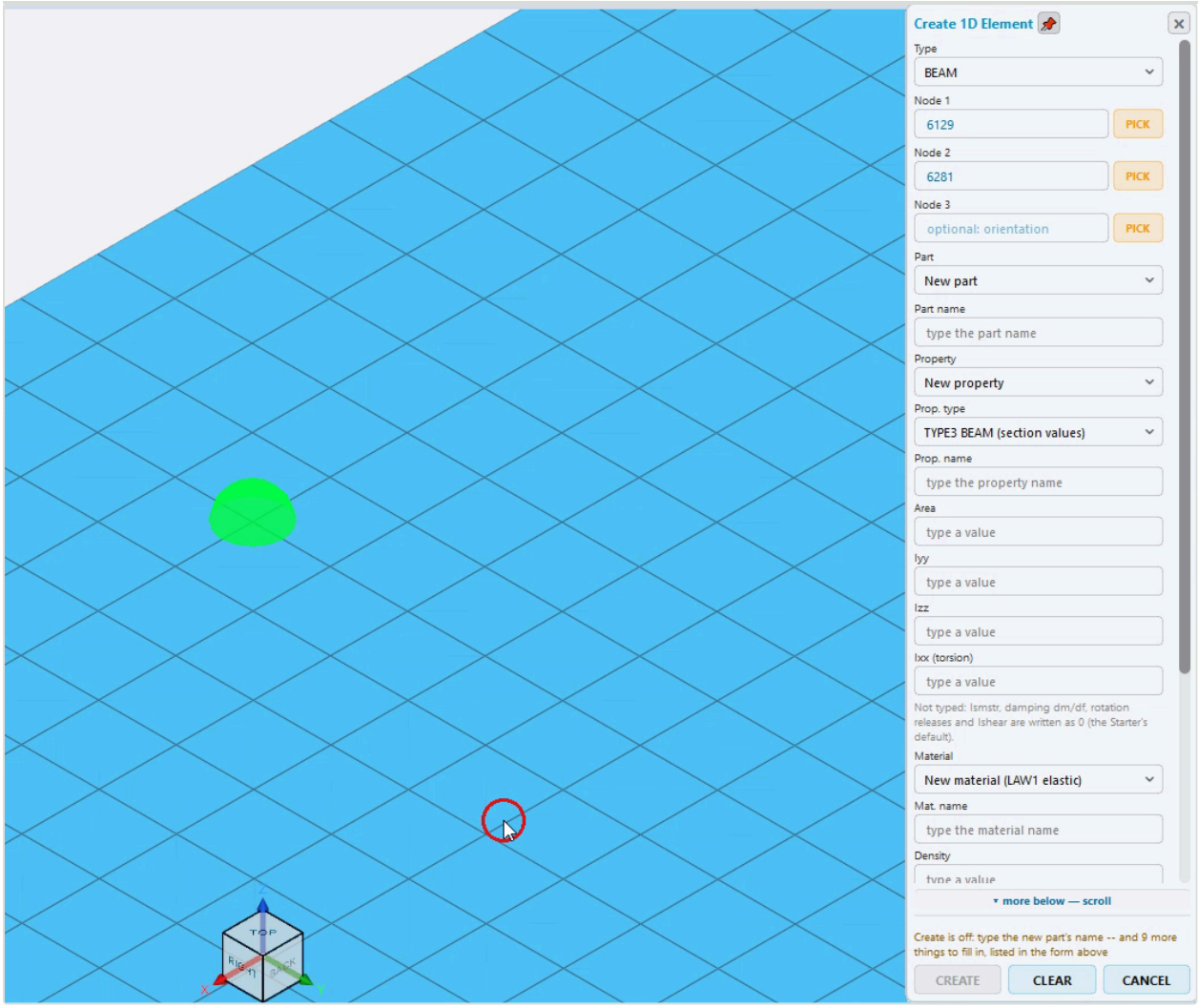


Figure 10.1 — The *Create 1D Element* panel.

10.2 RBE2: a rigid link

An RBE2 ties a set of *dependent* nodes rigidly to one *independent* node, so they move together. Click **RBE2** on the **1D / MPC** tab.

1. Select the dependent nodes in the 3D view (selection bar set to *Node*) and click **Use Selection**.
2. Pick the independent node, or tick *Calculate indep. node as average of dependents* to create one at their centre.
3. Choose the degrees of freedom that are tied (*DOF (dependent)*) and click **Create RBE2**.

10.3 RBE3: spreading a load

An RBE3 spreads a load or mass at one node over a set of nodes, without making them stiffer. Click **RBE3** on the **1D / MPC** tab, select the independent nodes and click **Use Selection**, pick the dependent (reference) node, set the degrees of freedom and the *Weight*, and click **Create RBE3**.

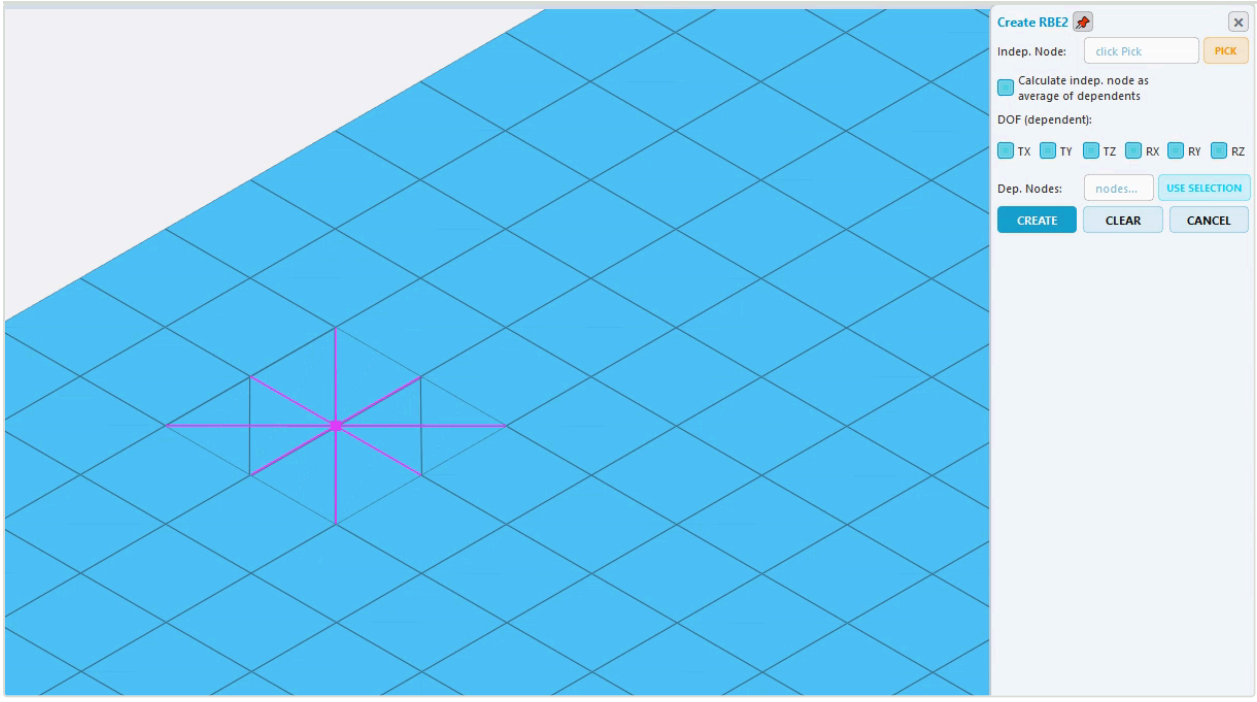


Figure 10.2 — An RBE2 tying the nodes around a hole to its centre.

10.4 Bolt and rivet connections (Pro)

Click **Bolted/Rivet** Pro on the **Model** tab. The *Bolted / Rivet Connector* panel finds holes that line up through the parts and joins each pair with a connection.

1. **Components:** tick at least two CAD bodies in the list, or click them in the 3D view. The list holds the model's CAD bodies (chapter 7); a deck opened without CAD shows an empty list.
2. **Discovery:** set which holes count — *Min diameter* and *Max diameter* (the default range covers M3 to M27 fasteners), how round a hole must be (*Circularity*), how parallel two hole axes must be (*Axis tolerance*), and the *Min span* and *Max span* between the two hole centres. Click **Discover Groups**. If it finds nothing on plates with only one or two holes, raise *A/A* ≤ (100 is a safe start): the default 15 rejects a hole in a face much larger than the hole. Discover Groups says so itself: when it finds no holes, it tells you how many it skipped because of *A/A* ≤.
3. **Detected Groups** lists what was found; untick a group to leave it out.
4. **Generation:** choose the element that joins each hole's rim to its centre (*Spider*: RBE2 or RBE3) and the element that joins the two centres (*Shank*: RBE2, the default, or RBE3, SPRING, BEAM or TRUSS). An RBE3 spider needs a BEAM or SPRING shank: a node may not be dependent in two rigid links driven by different nodes, so the panel offers RBE3 for the spider or the shank, never both.
5. Click **Apply**. If the number of connections is unusually large, BeidPrep asks *Generate many connectors?* before going on — often a sign that the filters are too wide.

[Picture coming in the next version]

Figure 10.3 — Rivet connections between a wing rib's flanges and the skins.

→ Every control of these panels, one by one: **Reference R10: the connector panels**, page 176

11 Groups and sets

Groups collect nodes, elements, parts or surfaces under one number, so that a load, a contact or an output can name them all at once. This chapter creates groups, fills them from the 3D view, and explains how they behave when the mesh changes.

11.1 Kinds of group

Card	Holds	Typical use
`/GRNOD`	nodes	boundary conditions, imposed velocities, time histories
`/GRSHEL`, `/GRBRIC` and the other element groups	elements of one type	outputs, element deletion
`/SURF`	element faces (segments)	contact surfaces, pressures
`/LINE`	element edges	line contacts
`/SUBSET`	parts, as an assembly	organising a large model

They are listed in the tree under *Groups (Sets)*, each with its own number. Create a new one with a right-click in the tree (section 6.4). These group types can be created and edited as forms:

- `/GRNOD/NODE` — a list of nodes;
- `/GRNOD/PART` — every node of the listed parts;
- `/GRSHEL/SHEL` — a list of shell elements;
- `/SURF/PART` — the surface of the listed parts;
- `/SURF/SEG` — a list of element faces, each given by its nodes.

Other group types in a deck you open are shown and kept, as text (section 6.3). In `/GRNOD/PART` and `/SURF/PART` each entry is a list of the model's parts: choose the part. Node and element numbers are typed. When you type a number into a group, BeidPrep checks that the model holds it: a node, part or element number that does not exist is refused, the status line says so (for example *Part 999 does not exist in this model — the group was not changed*), and the group is not changed.

11.2 Filling a group from the 3D view

Two group types are filled directly from a selection:

- `/GRNOD/NODE` takes **nodes**: set the selection bar to *Node* and select them.
- `/SURF/SEG` takes **element faces**: select the faces of the elements.

Open the group in the card editor and click **Add from Selection**; the selected items are added to the group's list. **Clear All** empties the list. The other group types are edited by typing their numbers — part numbers, element numbers — into the card's fields.

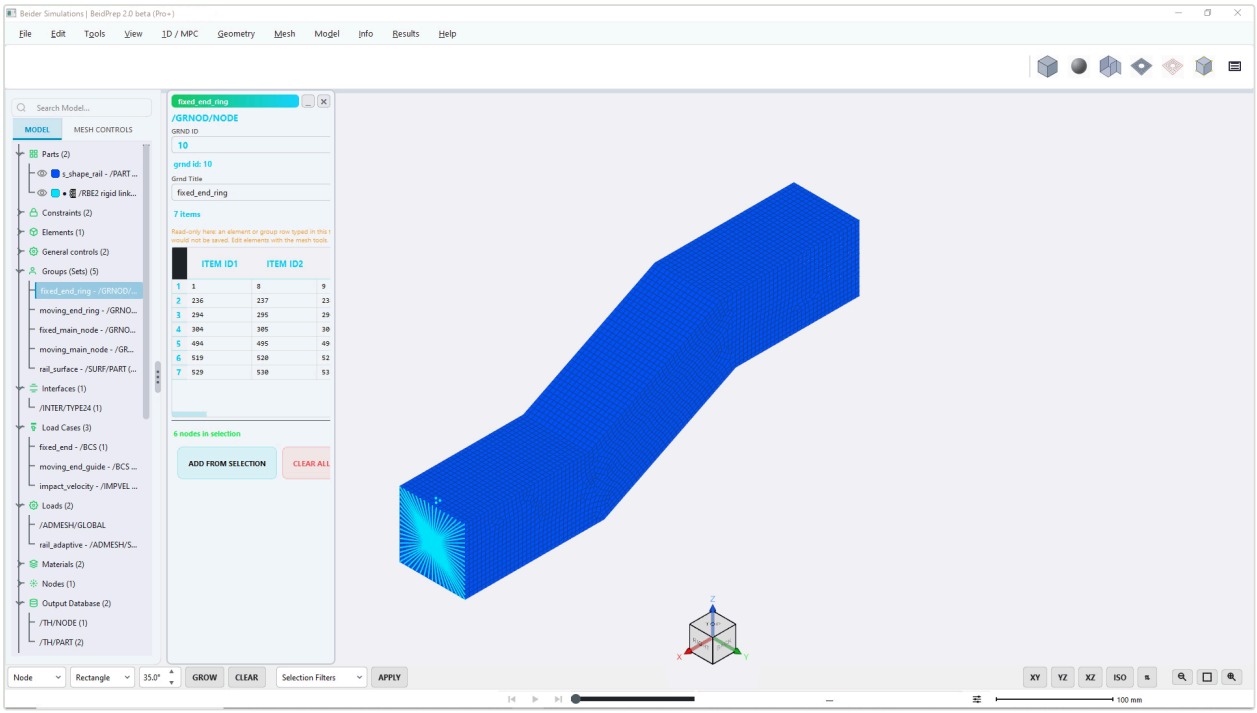


Figure 11.1 — A node group, filled with **Add from Selection**.

11.3 Subsets

A `/SUBSET` gathers the parts whose `/PART` card names it. In the tree, Hide, Show, Isolate and the eye of a subset act on all of its parts at once — the quickest way to look at one assembly of a large model.

11.4 When the mesh changes

- A group is **never deleted** by a mesh edit or a delete: the removed nodes or elements simply leave it (section 5.4).
- When nodes are merged, a group that held the removed node holds the node it was merged into.
- If a group becomes empty and another card needs it — for example a contact needs its surface — BeidPrep names that card, and the export check stops on it (chapter 12).

12 Exporting and the checks before export

When you export, BeidPrep checks the whole deck once for what would stop the solver or make it read something you did not intend. This chapter explains each message and how to answer it.

12.1 Exporting

Click **Export** on the **File** tab and give the deck a base name. Section 4.6 explains which files are written. Before anything is written, the check below runs; on a clean deck it is silent and the status line confirms the files saved.

12.2 What the check looks for

Finding	What it means
Dangling references	A card names a number no card defines — for example a part whose material was deleted. The message counts them, per kind, and names the numbers and the card families that hold them.
Empty lists another card needs	A group or surface that became empty while another card still uses it — for example the surface of a contact. Where the Starter refuses the empty list, the window says the deck *will not run as written*; otherwise that it *may not run as written*.
Edits in fields not checked	Cards you edited as text in fields BeidPrep has not checked with the Starter (section 6.3), listed so you can review them before you run.
Parts OpenRadioss will stop on	A part with no material, or a meshed part whose shell thickness is 0 (for example a mid-surface's *_t_unknown* part, section 7.2). This is a warning: the files are still written, but OpenRadioss stops on the model until every part has a material and every meshed part a thickness.

If the deck includes a file that could not be read, a number that file might define cannot be confirmed: the message calls it **UNPROVEN** and names the file, instead of reporting an error.

12.3 Answering the message

The window's title says which kind of finding it is — *Export — the deck will not run as written*, *… may not run as written*, *… dangling references*, *… empty groups* or *… edits in fields the Starter has not proven* — and the text lists what was found. An empty group is legal: the solver accepts it with a warning, and whatever uses it acts on nothing. It asks *Export anyway?*

- **Cancel** (the default) writes nothing. Fix the cards it names — open them from the tree, correct the reference or fill the list — and export again.
- **Yes** writes the deck as it is. Use it when you know why the finding is there, for example a number defined in a file you will add later.

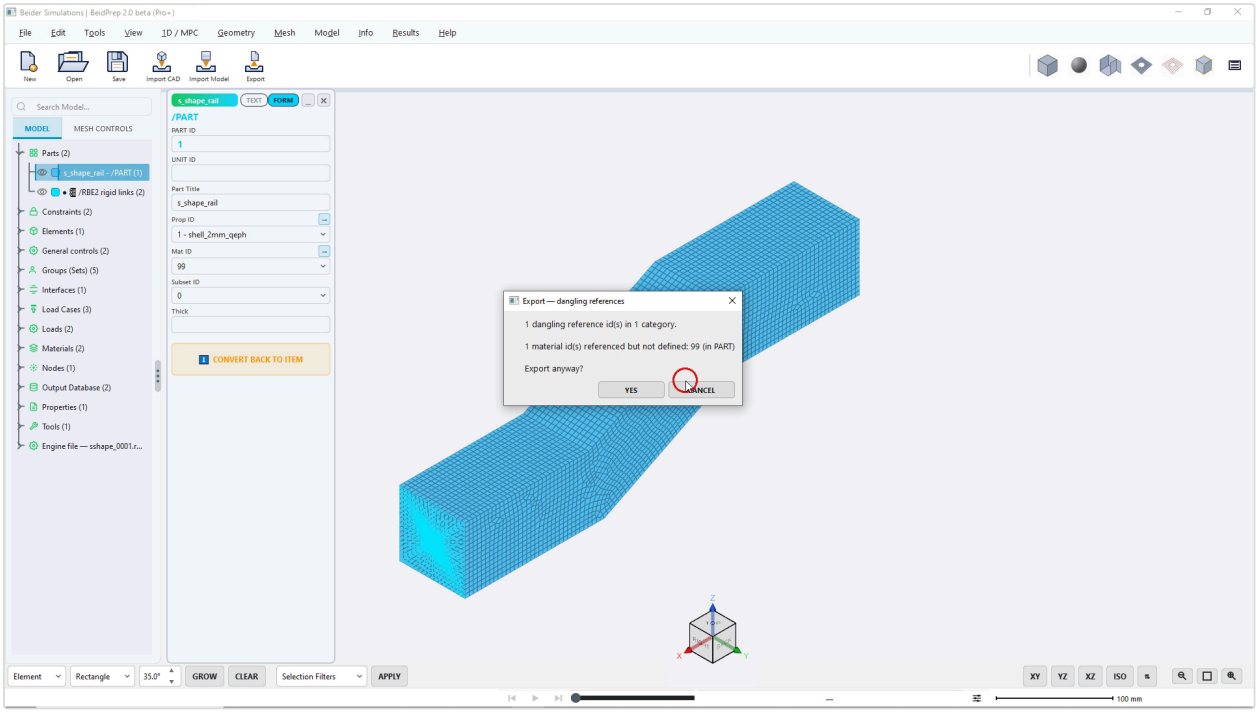


Figure 12.1 — The export check, naming a reference to a deleted material.

> **What the check does not do** It checks the deck's references and lists; it does not run the solver and does not judge your model or results. Run the OpenRadioss Starter on the exported deck before the full run.

12.4 Running the deck

Tools → Run analysis… runs the model with your own OpenRadioss: the Starter, then the Engine, and shows how the run is going. Chapter 18 explains it step by step. You can also run an exported deck yourself: the Starter on `name_0000.rad`, then the Engine on `name_0001.rad`, in the folder where the deck was written. Open the results in BeidPrep afterwards (chapter 13).

13 Results and post-processing

BeidPrep shows the results of a run on the model: colours by a result, the deformed shape, arrows, cuts, failed elements and the values at any node or element, played through time.

13.1 Loading results

Click **Load** on the **Results** tab and choose either

- the first OpenRadioss animation file of a run, `nameA001`: BeidPrep reads the run's other animation files (`nameA002`, …) with it — each file is one moment of the run; or
- a Nastran `.op2` results file, with its `.fem` model.

While results are loaded, the model tree shows the result's *Components*, *Elements* and *Load Cases*. Click the run's load case under *Load Cases* before you use **Contour** or **Threshold**. **Remove** closes the results; **Clear** removes the colours, filters and arrows but keeps the deformed shape and the model.

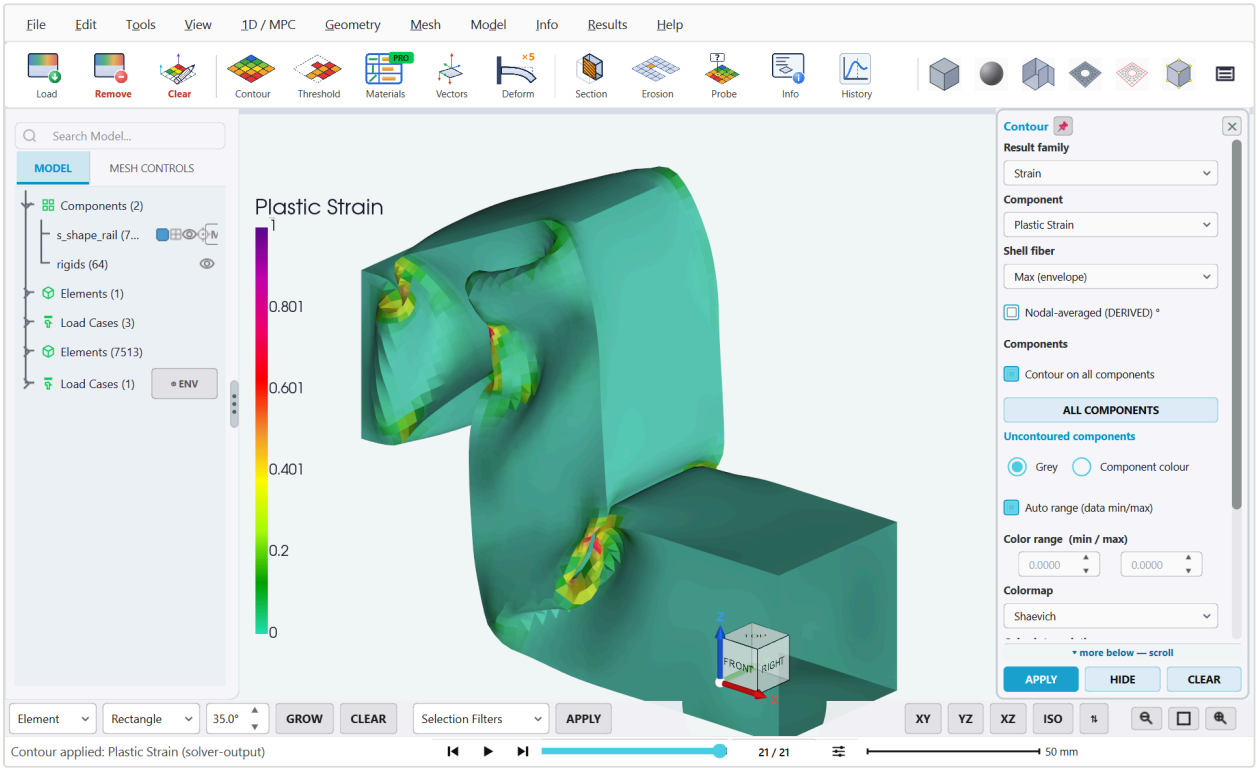


Figure 13.1 — Plastic strain on the deformed model.

13.2 The result tools

Each tool opens its panel on the right. Nothing changes in the 3D view until you press the panel's **Apply**; **Hide** takes its display away and **Clear** resets it.

Tool	What it does
Contour	Colours the model by a result, such as stress or displacement, for the selected load case or moment: choose the *Result family* and the *Component*, then **Apply**.
Threshold	Shows only the elements whose result lies in a range you set.
Materials Pro	Enter each material's strengths, so the results can show safety factors.
Vectors	Shows arrows for displacement or support reaction forces at the nodes.
Deform	Shows the model in its deformed shape.
Section	Cuts the model with a plane to see inside it.
Erosion	Shows, hides or greys the elements that failed during the run (*Show*, *Hide*, *Grey*).
Probe	Click a node or element to read its number, position and result values.
Info	A summary of the model and the selection, which can stay pinned on the 3D view.
History	Plots the run's time-history curves — reaction forces, energies and the other recorded values — against time or against each other (chapter 17).

13.3 Playing through time

With animation files loaded, the playback controls on the bottom bar step through the moments of the run: **Step back**, **Play / Pause**, **Step forward**, and the time slider to go to any moment. The readout shows which state is shown, for example *20 / 21*. The button at the right of the readout opens the **Playback** panel: speed in frames per second, direction, looping, and a cache that makes a replay faster (section 3.7). Contours, deformation and arrows follow the moment shown.

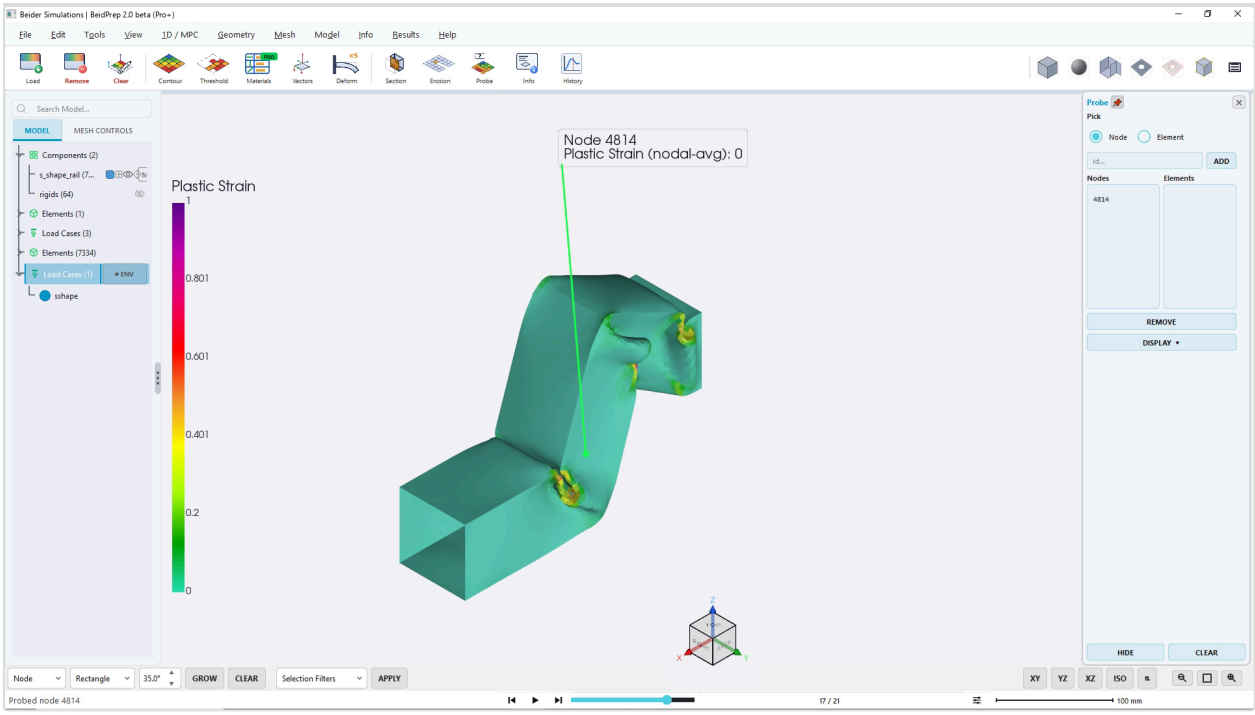


Figure 13.2 — Reading an element's values with **Probe**.

13.4 A worked example: a crash demonstration

> **Demonstration** This example shows the workflow, not a validated design. The material values come from published sources (listed below), but the model has not been compared with a test.

The part is the S-shaped rail of *Getting started*: a thin-walled steel section, 480 mm long, meshed in BeidPrep with 5 mm shells. Every card of the model was made in BeidPrep, with the tools named in brackets:

- **Material and failure** — a Johnson–Cook steel (`/MAT/LAW2`) with Johnson–Cook failure (`/FAIL/JOHNSON`): an element is deleted when its accumulated damage reaches one (card editor, chapter 6).
- **Property** — 2 mm shells with five points through the thickness, a formulation with physical hourglass control, and thickness change switched on, so the shell thins as it stretches.
- **Ends** — a rigid link (`/RBE2`) ties each end's ring of nodes to a main node at the section's centre (chapter 10). One main node is fixed in every direction; the other is driven along the rail at a constant 6 m/s (`/IMPVEL`), free only along the rail, so in 40 ms the ends close by 240 mm.
- **Contact** — the rail's own walls may not pass through each other as it folds (`/INTER/TYPE24` , self-contact).
- **Adaptive meshing** — where a wall thins, OpenRadioss splits each shell into four, one level (`/ADMESH`). Only thinning triggers it, not bending.
- **Time step** — the solver's own stable step, with a floor below which mass would be added (`/DT/NODA/CST`), and a stop if the added mass ever reaches 5 % (`/STOP`). In this run the floor was never reached: no mass was added.

- **Output** — animation every 2 ms with stresses, strains, plastic strain, von Mises stress, thickness and displacement; time history of the reaction force at the fixed end and of the part's energies.

> **Two traps, measured on this case** **Mass scaling with adaptive meshing can add a lot of mass.** A first run asked OpenRadioss for a target of 2 % added mass with two refinement levels; the refined shells' small time step made it add mass all through the run, and it ended at 72.7 % — a different, much heavier rail. One refinement level and a fixed minimum time step, with a stop at 5 %, gave none at all. **Self-contact with adaptive meshing slows a run sharply**: the contact is searched again on every refined shell. On one thread, a cycle took 42 ms without the contact and 811 ms with it and two levels. Check the added mass and the time per cycle early in a run (chapter 18 shows both live).

The steel is 4340 steel, with the Johnson–Cook constants published by Johnson and Cook [1]. Two open publications reproduce them [2], [3]:

Value	Symbol	Value used	Source
Density	ρ	7,830 kg/m³	[2]
Young's modulus	E	208 GPa	[2]
Poisson's ratio	ν	0.30	[2]
Yield stress	A	792 MPa	[1]; [2], [3]
Hardening modulus	B	510 MPa	[1]; [2], [3]
Hardening exponent	n	0.26	[1]; [2], [3]
Strain-rate coefficient	C	0.014	[1]; [2], [3]
Failure constants	D1, D2, D3	0.05, 3.44, −2.12	[1]; [2], [3]

E and ν follow from the bulk modulus (173.3 GPa) and shear modulus (80 GPa) given in [2]. D4 and D5 are set to zero: the example leaves out the effect of strain rate and temperature on failure.

[1] G. R. Johnson, W. H. Cook, “Fracture characteristics of three metals subjected to various strains, strain rates, temperatures and pressures”, *Engineering Fracture Mechanics* 21 (1985) 31–48, doi:10.1016/0013-7944(85)90052-9.

[2] B. Banerjee, “Material point method simulations of fragmenting cylinders”, arXiv:1201.2439 (2012), Table 1. Open access.

[3] S. Sulaiman, A. Roshan, M. K. A. Ariffin, “Finite element modelling of the effect of tool rake angle on tool temperature and cutting force during high speed machining of AISI 4340 steel”, *IOP Conference Series: Materials Science and Engineering* 50 (2013) 012040, doi:10.1088/1757-899X/50/1/012040. Open access.

Running it

Choose **Tools** → **Run analysis…**, pick a folder and press **Run** (chapter 18): BeidPrep exports `sshape_0000.rad` and `sshape_0001.rad` and runs the Starter, then the Engine. On eight threads the 40 ms took about an hour. The run writes the animation files `sshapeA001` … and the time-history file `sshapeT01` beside them. Load the animation files with **Load** (section 13.1).

The deformed shape and plastic strain

Click the load case *sshape* in the tree, then **Contour**: choose *Plast Strn Layer 1* (the outer layer of the shell) and press **Apply**; drag the time slider to the last state. The colours show where the steel has yielded: the folds and the bends of the S carry the highest plastic strain, and the straight walls between them stay almost elastic.

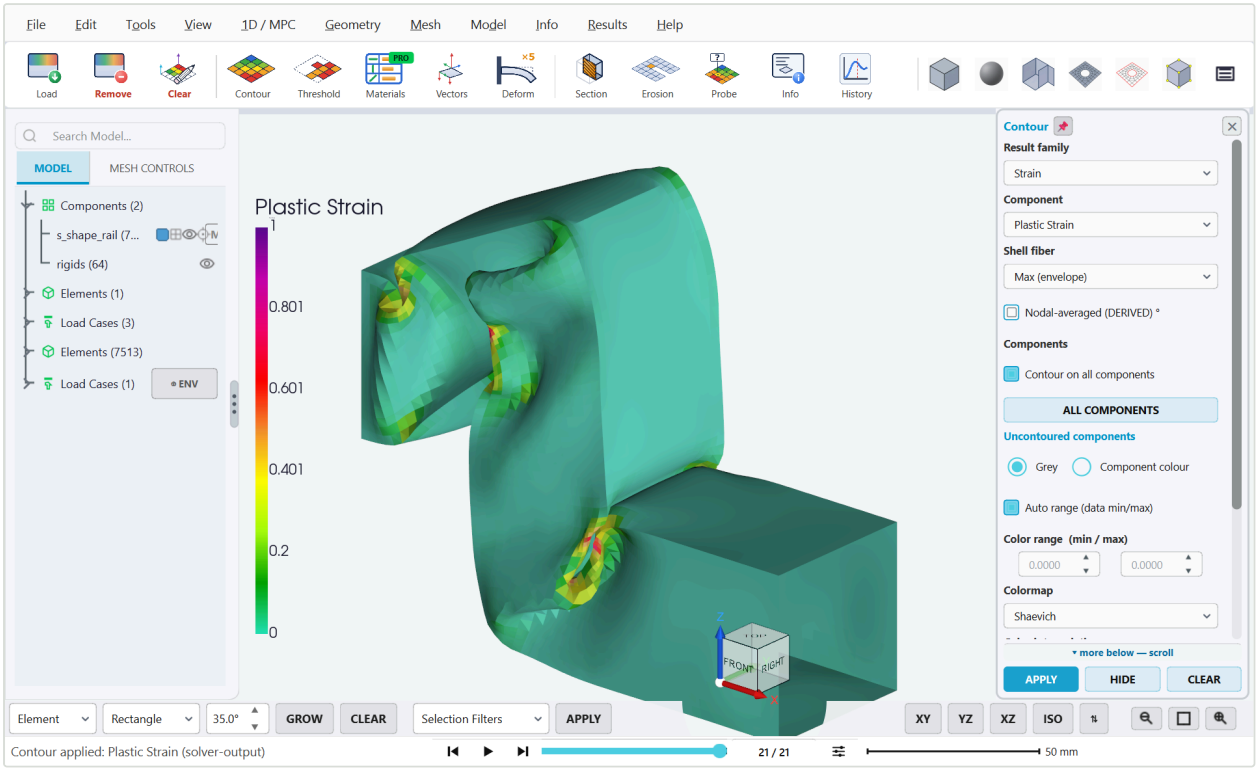


Figure 13.3 — The rail at the end of the run, coloured by plastic strain.

Adaptive meshing

Where the walls fold, OpenRadioss has split the shells into smaller ones during the run. BeidPrep draws the new elements where they were made: click the grid icon on the rail's row in the tree to turn its element edges on, and the finer mesh shows in the folds beside the 5 mm mesh of the straight walls.

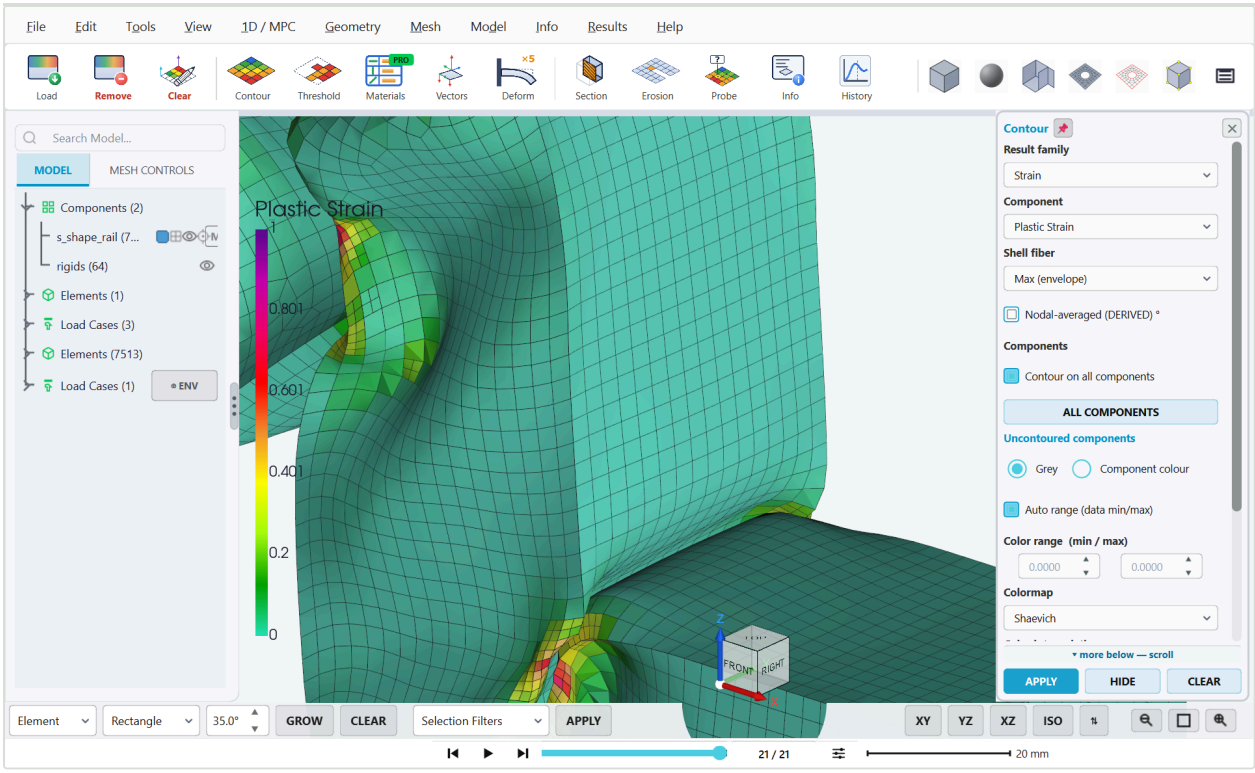


Figure 13.4 — A fold close up, element edges shown: the refined shells made during the run.

Failure

Elements whose damage reached one were deleted during the run. Click **Erosion** and choose *Hide* to leave holes where they failed, or *Grey* to show them greyed. In this example 9 shells failed, in the sharpest folds, where the wall is stretched hardest.

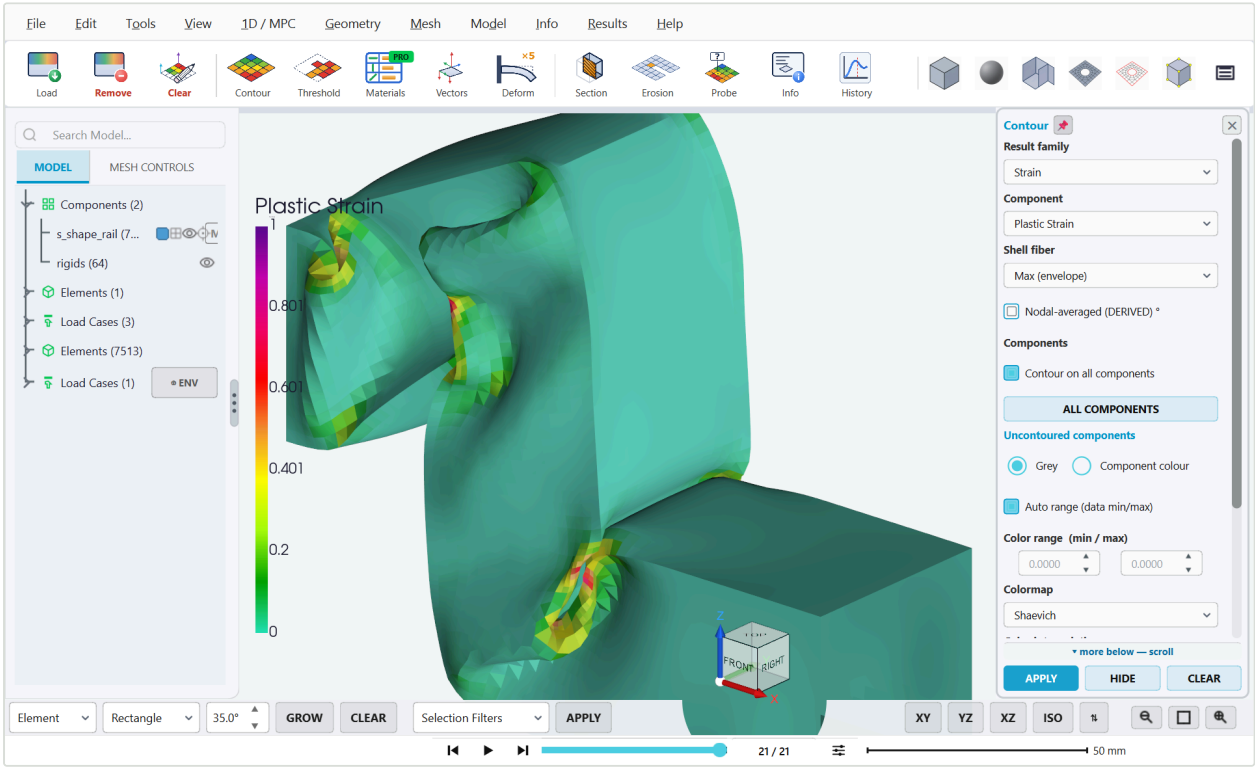


Figure 13.5 — The failed elements, shown faded by **Erosion**.

The reaction force

Click **History** on the **Results** tab. BeidPrep reads the run's time-history file beside the animation files and lists its curves by object. Under *Nodes*, tick the fixed end's force along the rail and the plot takes the 3D view's place; a grey dash-dot line marks the moment the 3D view shows and follows the time slider, so you can see the shape that goes with each peak. **PNG…** and **CSV…** under the plot keep the picture or its numbers. Chapter 17 explains the History tool in full.

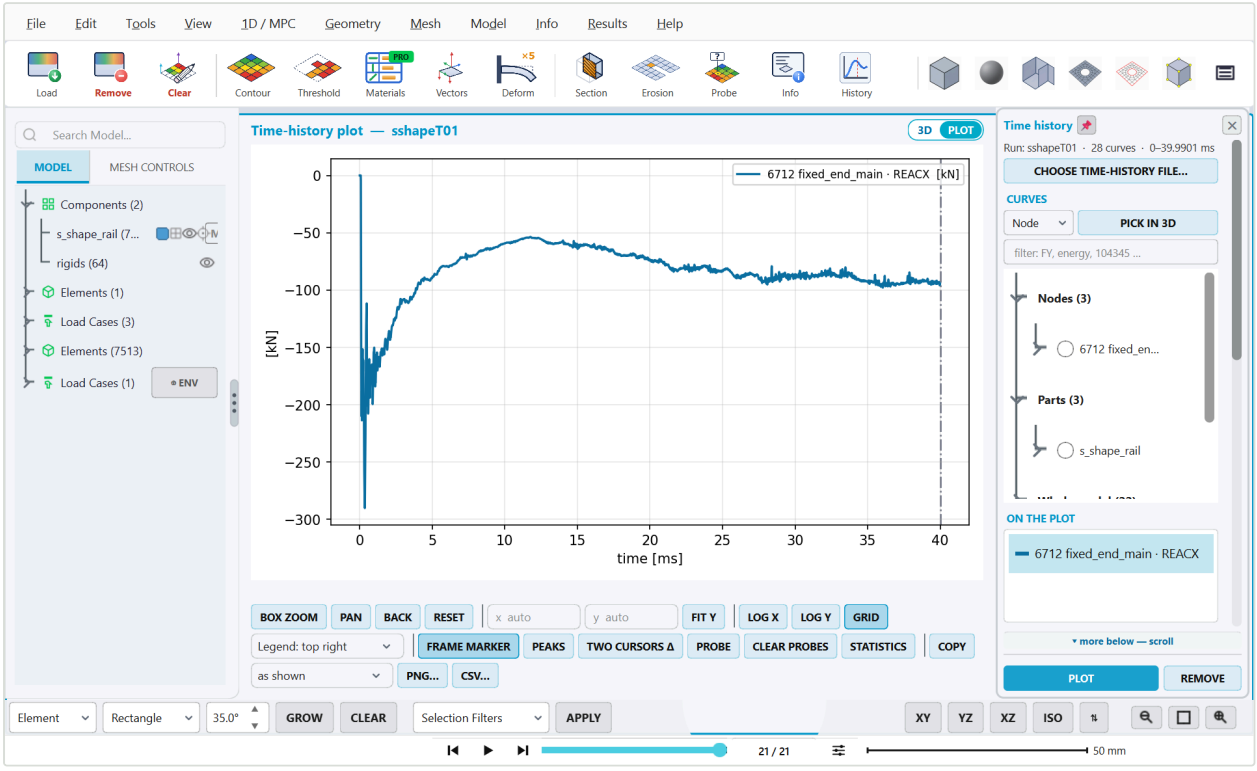


Figure 13.6 — The force at the fixed end against time. Each peak is a fold starting; the force drops as the fold collapses.

Checking the energies

A run's energies tell you whether to trust it. With shells, the one to watch is the **hourglass energy**: energy taken by a numerical mode of the element that has no physical meaning. Under *Parts* in the History tool, plot the rail's internal energy and its hourglass energy together. The hourglass energy should stay small against the internal energy; a widely used rule of thumb is under 10 %. Under *Whole model*, the total energy should stay close to the work put in by the moving end: a jump means something in the model is not right.

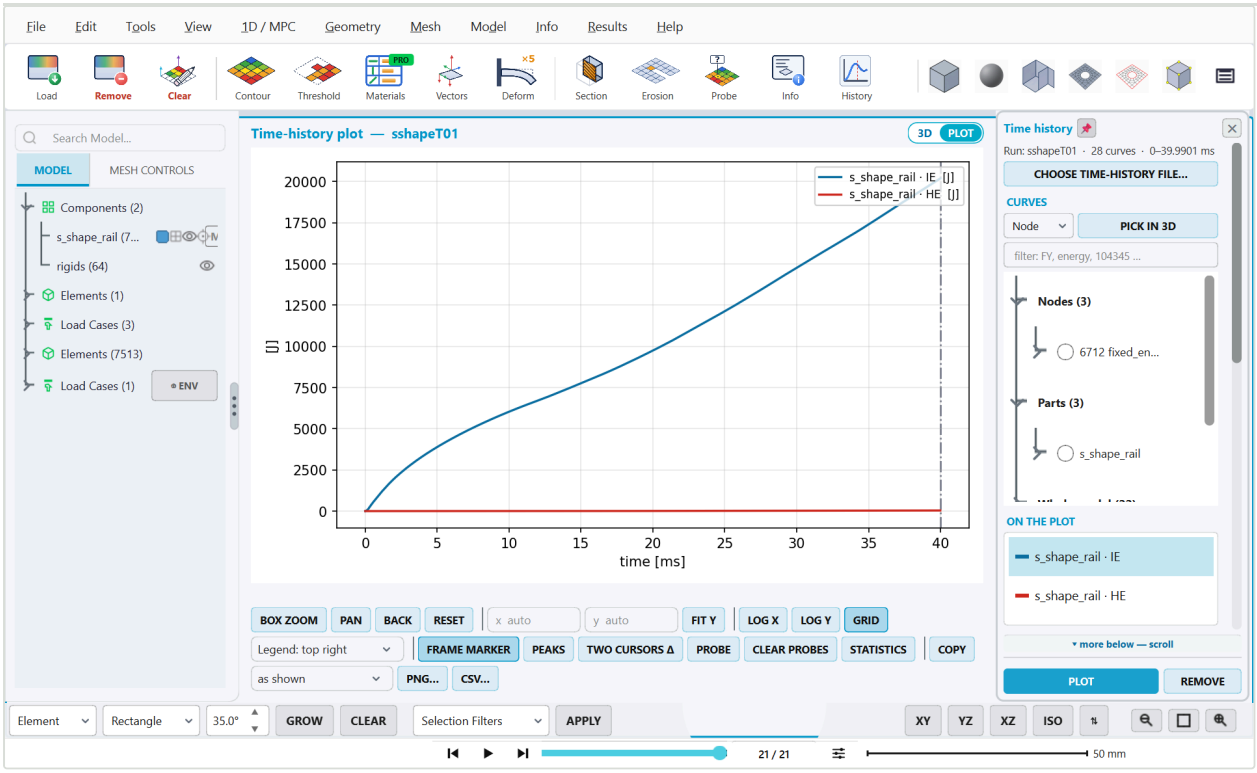


Figure 13.7 — The rail's internal energy and hourglass energy.

→ Every control of these panels, one by one: **Reference R13: the results panels**, page 182

14 The fibre module (Pro+)

Short-fibre plastics are not the same in every direction: the fibres lie the way the melt flowed into the mould, and the part is stiffer and stronger along them. The fibre module takes the fibre directions from your own Moldflow injection-moulding study, puts them on the elements of your BeidPrep model, and gives each element a material that is stiff and strong in the direction its fibres really run. The OpenRadioss deck it writes is ready to run.

> **Pro+** The fibre module needs a Pro+ licence. With Pro or Free you can still open it and look at every step, input, curve and view. Only the three actions are locked: calibrating a material, mapping a Moldflow result and writing the solver copy. A locked button carries a padlock; clicking it shows a short note next to the pointer saying what the licence adds.

The module is marked **BETA** in BeidPrep 2.0: it is complete and checked, and the results it gives should be compared with tests before they are relied on for design decisions.

14.1 What you need

The module works from your own data. It does not come with fibre directions or test curves for your part.

- **A solid mesh of the part** in your BeidPrep model: tetra (/TETRA4, /TETRA10) or hexa (/BRICK) elements. A fibre part must be solids only. BeidPrep 2.0 cannot generate solid meshes yet, so import the model already meshed with solids (.rad, or LS-DYNA .k/.key/.dyn).
- **The Moldflow study of that same part**, exported from Moldflow Adviser or Insight:
  - the Moldflow mesh as a Patran file (*.pat*);
  - the fibre orientation result as XML: the 3D element tensors, or the Dual Domain laminae;
  - recommended: the Moldflow analysis log, which shows the fibre settings the study used.
- **Tensile test curves of the material**, as two-column files (strain, stress in MPa): the 0° curve at least, and if you have them the 45° and 90° curves. You only need these once per material. A calibrated material goes into the library and any part can use it.

The Moldflow mesh and your BeidPrep mesh do not need to be the same mesh, but they must describe the same part, in the same position and the same units.

14.2 Opening the module

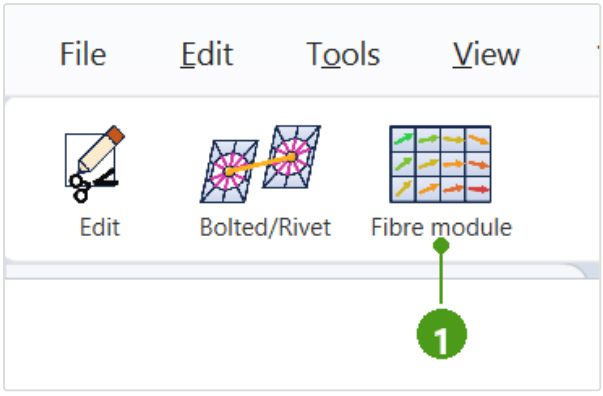


Figure 14.1 — The **Fibre module** tile on the **Model** tab.

Click **Fibre module** on the **Model** tab. The panel opens on the right of the window. While it shows a part, every other part is drawn see-through and cannot be picked, and the model is fitted into the part of the view the panel leaves free. **Minimize panel** puts it away; everything you entered is kept, and the **Fibre module** tile brings it back.

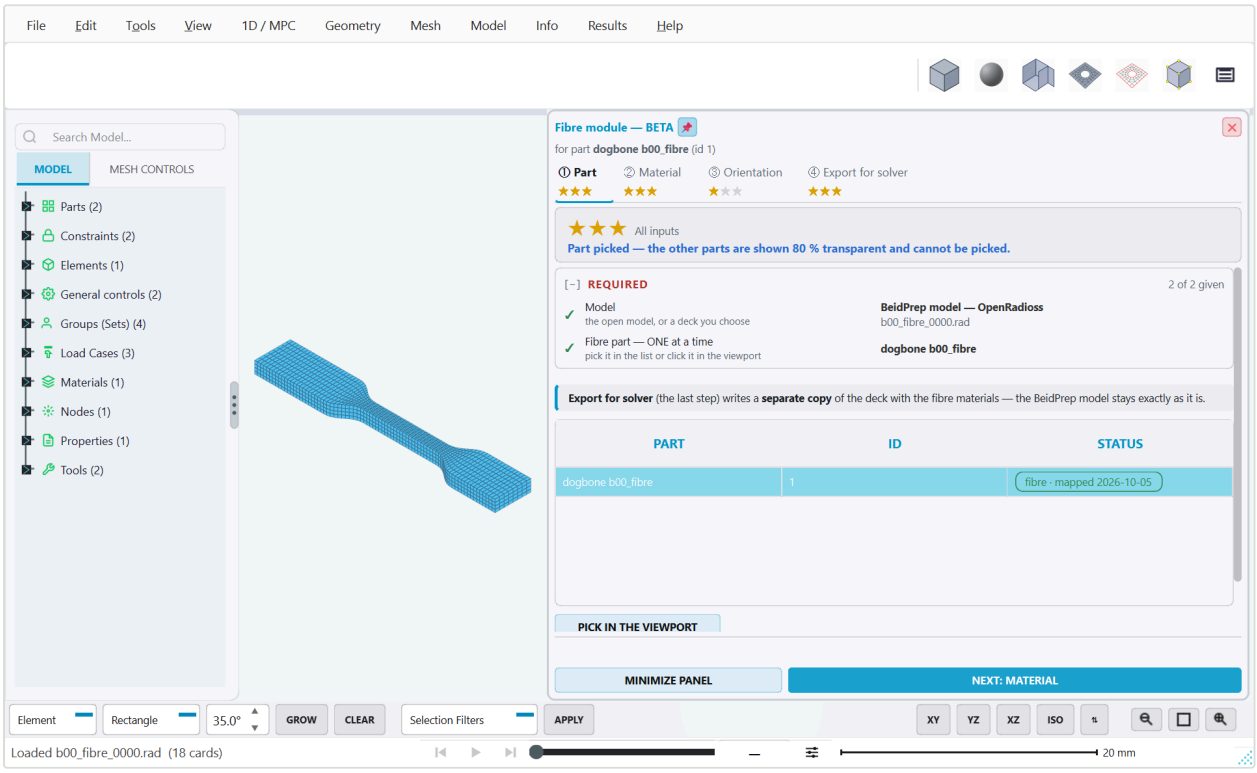


Figure 14.2 — The panel, with its four steps along the top.

- **The four steps:** *Part*, *Material*, *Orientation* and *Export for solver*. They unlock in order. The stars under each step show how complete its inputs are, and the line under them says what would add the next star.
- **Required inputs** of the open step. A step cannot finish without them.
- **Recommended inputs.** The step works without them, but the result is better with them.
- **Optional inputs**, folded away until you open them.

- **Progress line.** While an action runs, its last progress line shows here, with *Cancel*. The rest of BeidPrep stays usable while it runs.

14.3 Step 1 — Part

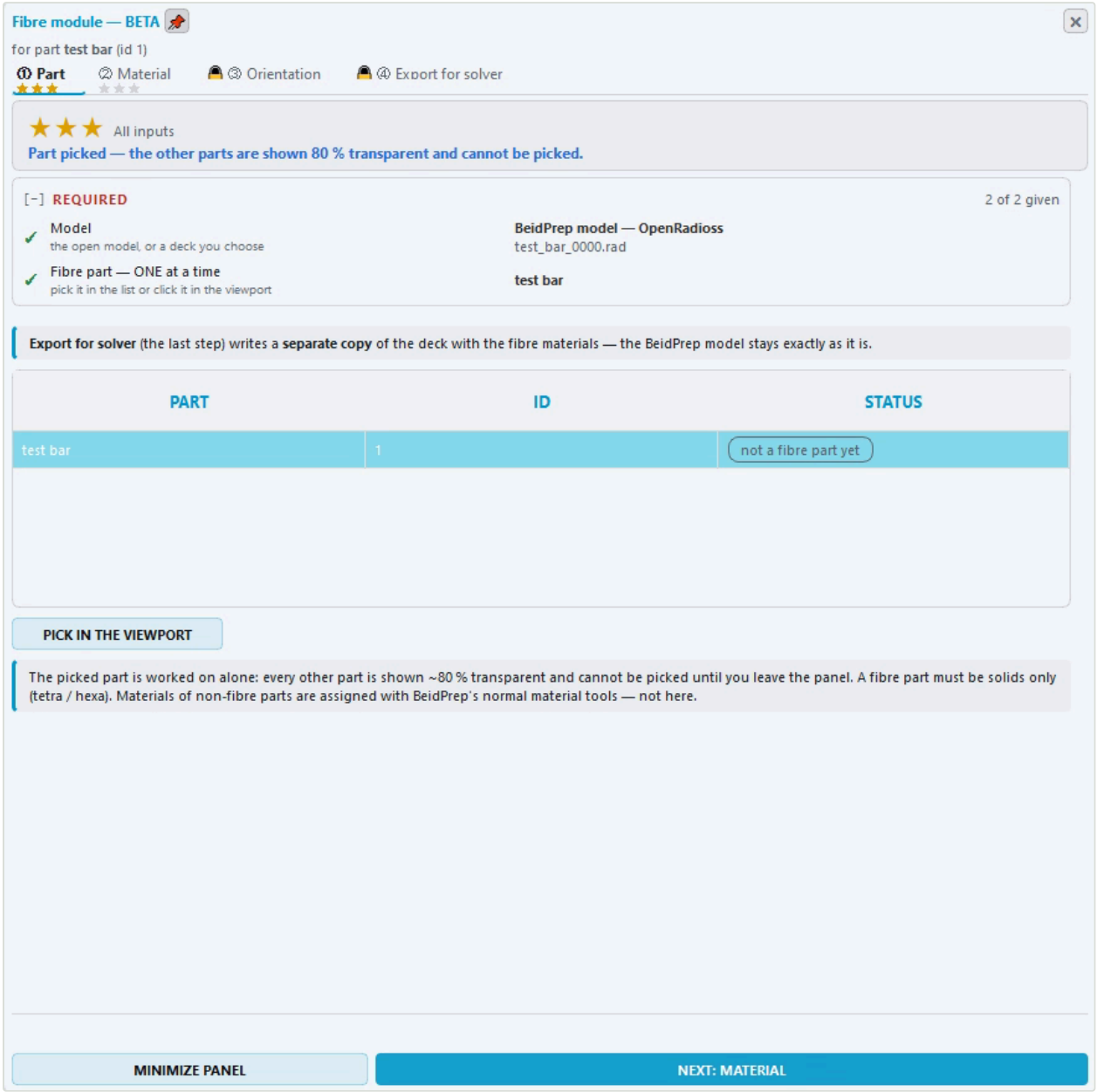


Figure 14.3 — Step 1: the test bar picked as the fibre part. The panel notes that the export writes a separate copy and the BeidPrep model stays as it is.

Choose the part that is made of the fibre-filled plastic: click its row in the table, or click **Pick in the viewport** and then click the part in the 3D view. The table lists every part with its state: *not a fibre part yet*, *fibre · material only* or *fibre · mapped* with the date of its mapping.

The panel works on **one part at a time**. Do steps 1 to 3 for each fibre part; step 4 then writes all of them together.

14.4 Step 2 — Material

Each fibre part needs a calibrated fibre material. Choose **From the library** to use one you have calibrated before. One material can serve any number of parts, and each part keeps its own fibre directions. Choose **Calibrate a new material** to make one from your test curves.

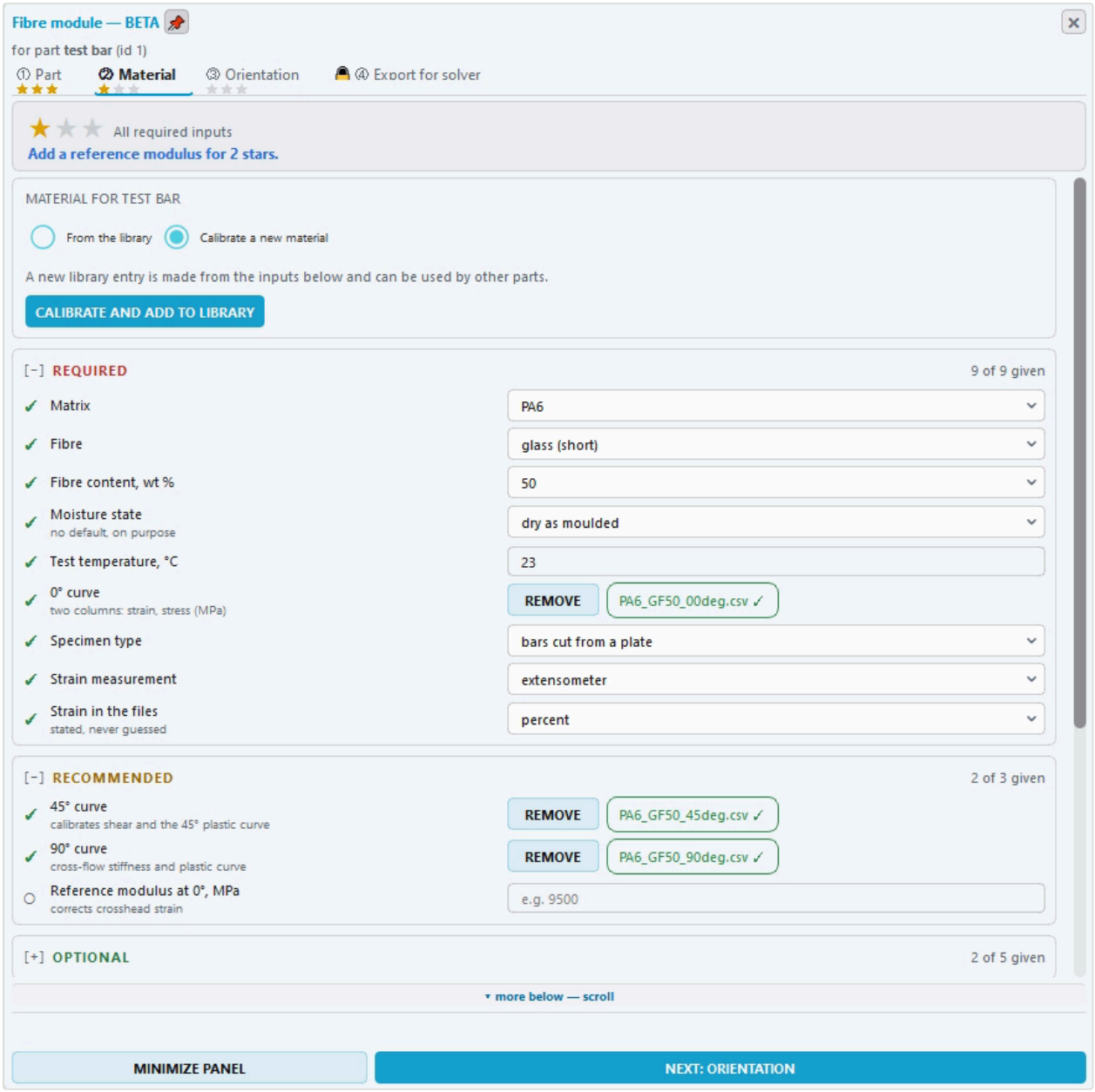


Figure 14.4 — Step 2, *Calibrate a new material*: all required inputs given (PA6, short glass fibre, 50 wt %, dry as moulded, 23 °C, the 0° curve, bars cut from a plate, extensometer, percent) and the 45° and 90° curves under Recommended. In a narrow panel the confidence and the curve plot sit below the inputs.

For a new material, give:

- **Required:** the matrix plastic (PA66, PA6, PP, PBT, PPS, POM, PC, PPA, PET, PA12, PA46, PEEK), the fibre (short glass or short carbon), the fibre content in weight %, the moisture state (dry as moulded or conditioned; there is no default, on purpose), the test temperature, the 0° curve, the specimen type (bars cut from a plate, or a moulded dogbone), how the strain was measured

(extensometer, crosshead or unknown), and whether the strain in your files is in percent or as a fraction.

- **Recommended:** the 45° curve (it sets the shear stiffness and the 45° yield), the 90° curve (the stiffness and yield across the flow), and the 0° reference modulus. The reference modulus corrects curves measured with the crosshead, which make the material look softer than it is.
- **Optional:** the grade or trade name, whether the material is recycled, the matrix modulus at the test temperature, an off-axis yield factor, and whether to limit the alignment to the test specimen's.

Click **Calibrate and add to library**. The module works out the fibre state of your test specimen and fits the fibres' length and the matrix to your curves, then adds the result to the library.

Confidence. Every calibrated material is rated **HIGH**, **MEDIUM** or **LOW**, with the reasons listed: for example, crosshead strain without a reference modulus, a curve taken from a datasheet rather than measured, or a fitted fibre length outside the usual range. BeidPrep never refuses your data. It corrects what can be corrected, says what it did, and tells you how much to trust the result.

14.5 Step 3 — Orientation

The fibre directions belong to the **part**, not to the material: each part gets them from its own Moldflow study, even when it shares its material with other parts.

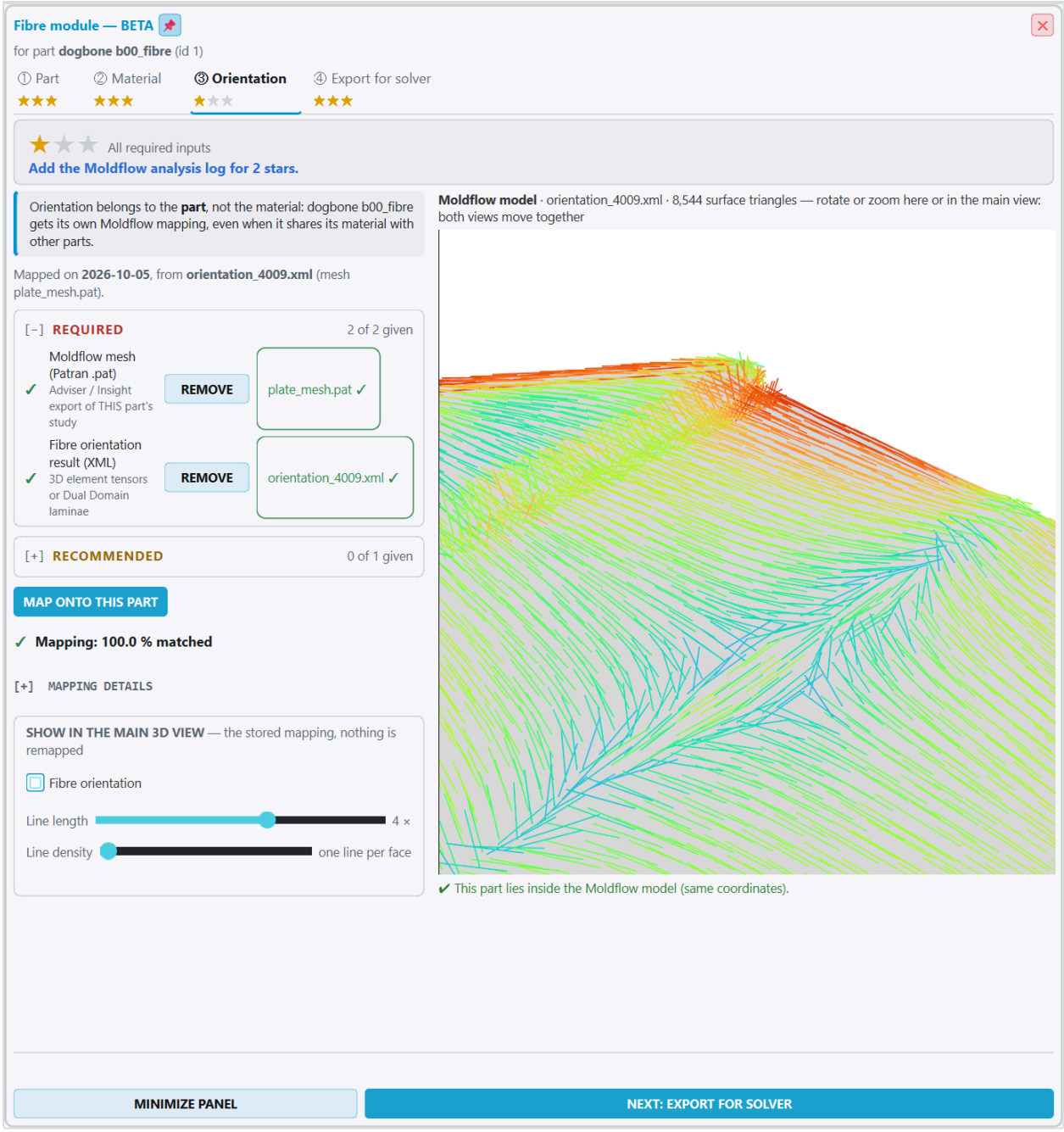


Figure 14.5 — Step 3 after mapping: both Moldflow files given, 100 % of the elements matched. On a wide panel the Moldflow model is shown in 3D beside the inputs; on a narrower one, below them.

- **Moldflow mesh** (Patran *.pat*) of this part's study.
- **Fibre orientation result** (XML).
- **Moldflow analysis log** (recommended). The fibre settings the study used are shown under it.
- **Map onto this part** puts the Moldflow fibre directions on every element of the part.
- **Mapping result:** the share of elements that found their Moldflow match.
- **Mapping details:** elements matched; elements filled from their neighbours (flagged); elements left with the deck's own material.
- **Moldflow view.** The Moldflow model in 3D. It turns with the main view, so the two can be compared side by side.

Check the mapping before you go on. A low match usually means the two meshes do not sit in the same place or the same units, or that the Moldflow study is of another part.

14.6 Seeing the fibres on the model

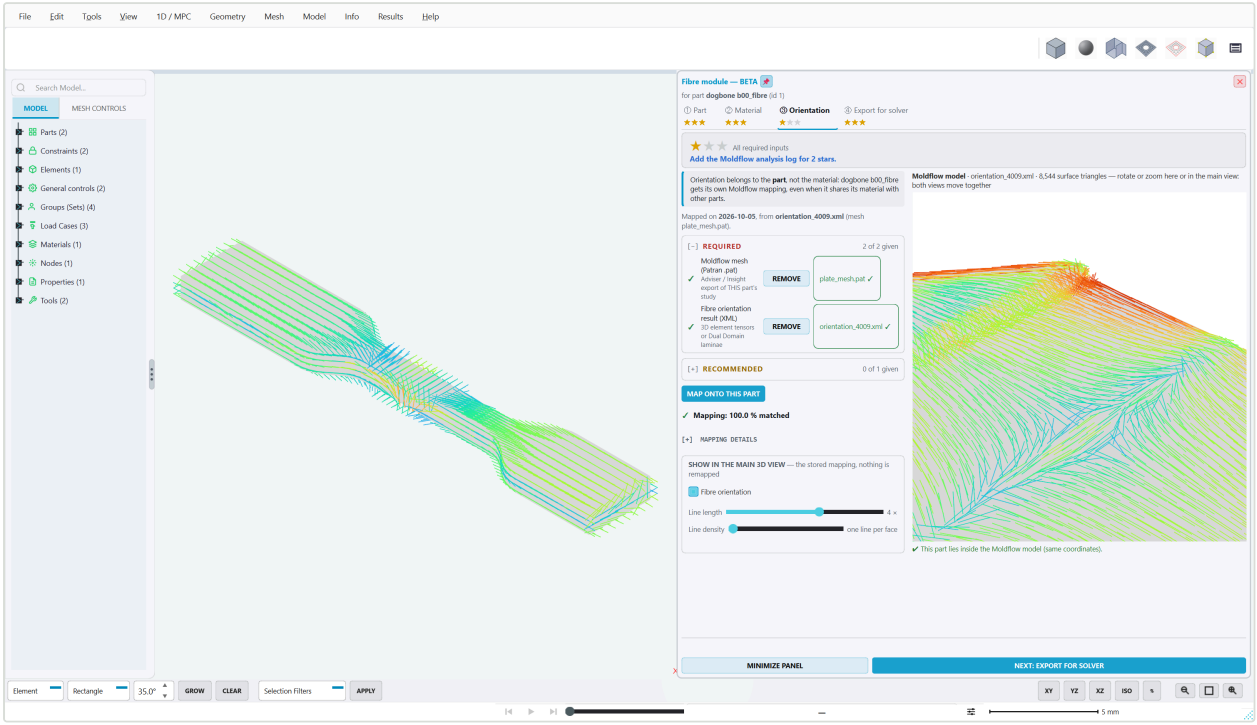


Figure 14.6 — Left, the main view: the fibres mapped onto the specimen. Right, in the Orientation step: the Moldflow part with its own fibres. The two views turn and zoom together.

Tick **Fibre orientation** in the panel to show short lines along the fibres on the part's surface, coloured by how strongly they are aligned. The part is drawn plain while the lines are shown. The lines have no arrowheads: a fibre has no direction.

To check the mapping, compare it with its source: once the part is mapped, the Orientation step shows the Moldflow part with its fibres in a 3D view of its own, drawn the same way. Turn or zoom either view and the other follows, so the same place is in front of you in both. On a wide window this view sits beside the step's inputs; on a narrower one it is below them — scroll the panel down to it.

A mapped fibre part carries a fibre marker in the model tree. Its menu shows when and from which file the part was mapped, and offers *Edit fibre setup* (opens the panel on that part), *Fibre orientation* (the same display) and the line length and line density.

14.7 Step 4 — Export for solver

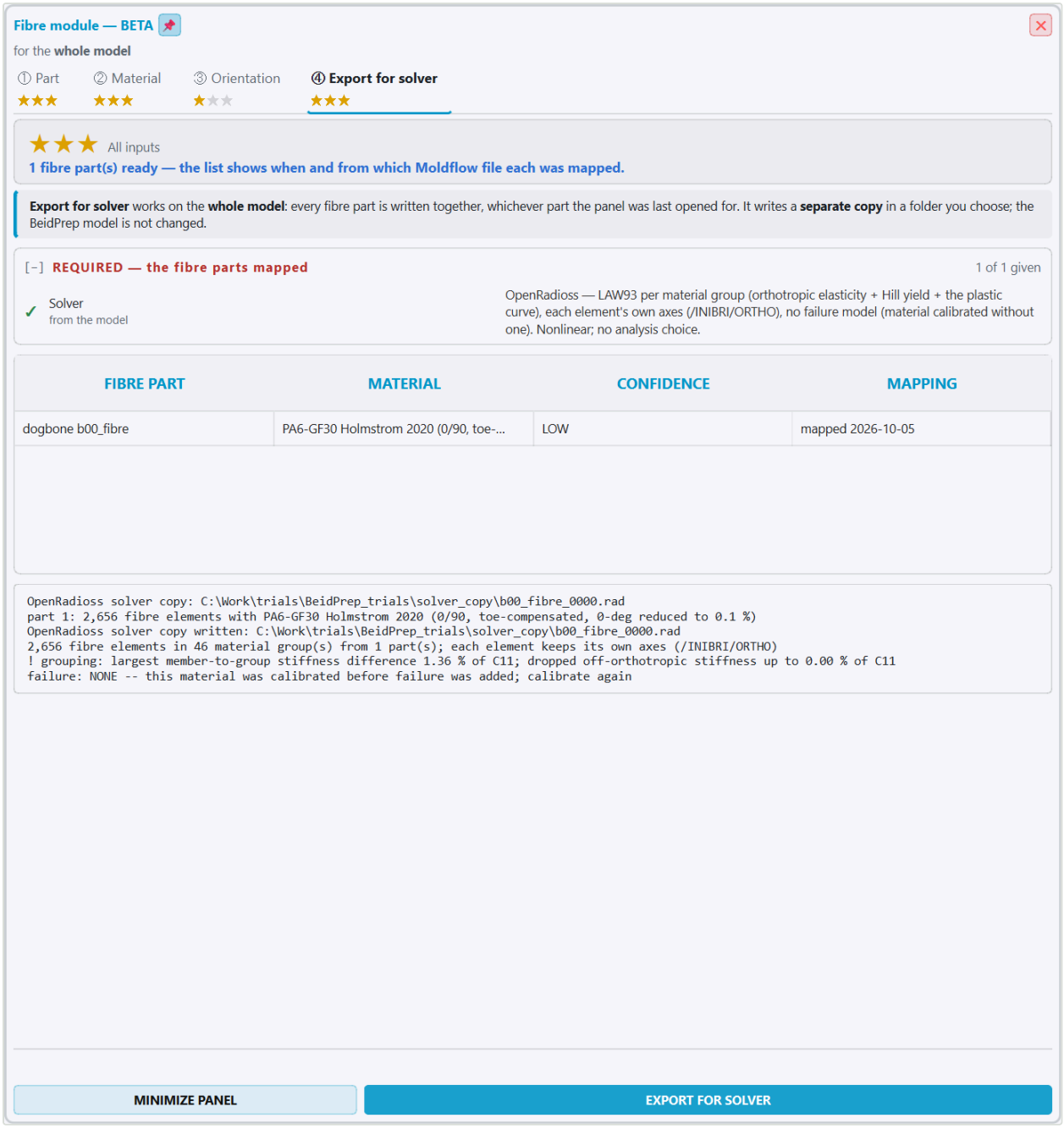


Figure 14.7 — Step 4: every fibre part of the model, written together.

Export for solver works on the **whole model**: every fibre part is written together, whichever part the panel was last opened for. Choose an empty folder; the module writes a **separate copy** of the deck there, under the same file names, so the Engine file still matches the Starter file. **Your BeidPrep model is not changed.**

What the copy contains, compared with your deck:

- Each fibre part is split into **material groups**: elements whose fibres are aligned alike share a new part with its own material. The original part's place in your subsets is kept.

- Each group gets one `/MAT/LAW93` (stiff and strong along the fibres, softer across them, with the plastic curve from your calibration) and, when the material was calibrated with a failure model, one `/FAIL/ORTHBIQUAD` (failure that depends on the direction).
- One `/INIBRI/ORTHO` gives **every fibre element its own fibre axes**, so the direction is per element, not per group.
- Every list that named the original part (node groups, part groups, surfaces, time histories) now also names its group parts, so your loads, contacts and outputs still reach every element.
- Every other line of the deck is copied unchanged.

The export report lists the groups, the elements in each and every list it extended. The confidence of the result is that of the least confident material used.

14.8 Demonstration: tensile bars from a one-gate and a two-gate plate

> **A demonstration, not a validation.** No tests exist for these plates. The results show what the fibre directions alone change. The model has no weaker bond at the weld line, so a real weld line would be weaker still. How far the material itself can be trusted is in section 14.9.

The same part is moulded two ways and the same three tensile bars are cut from each moulding. The only difference between the two sets of bars is where the fibres point — and that changes which bar is strong.

The case

- **Plates.** A 200 × 200 × 4 mm plate, filled through a fan gate along one edge, and the same plate filled from both edges. In the two-gate plate the melt fronts meet across the middle and leave a weld line there.
- **Moulding.** Moldflow Adviser, a 3D mesh with 10 layers through the thickness (about 300,000 tetrahedra per plate), BASF Ultramid B3EG6 (PA6 with 30 % glass fibre).
- **Bars.** ISO 527-2 type 1B, cut at 0°, 45° and 90° to the flow and centred on the plate. In the two-gate plate the weld line crosses the 0° bar's gauge at right angles and runs along the 90° bar.
- **Chain.** Every bar went through the module as described in sections 14.3 to 14.7: the Part, the calibrated material of section 14.9, the Orientation step (each bar recognised as a cut-out of the plate), and the export to OpenRadioss. The six bars were then pulled to failure.

Where the fibres lie

Away from the weld line the fibres follow the flow. At the weld line they turn across the flow, so they run along it. The fibre module shows Moldflow's weld line on the mapped bar (section 14.6), coloured by the angle at which the two fronts meet.

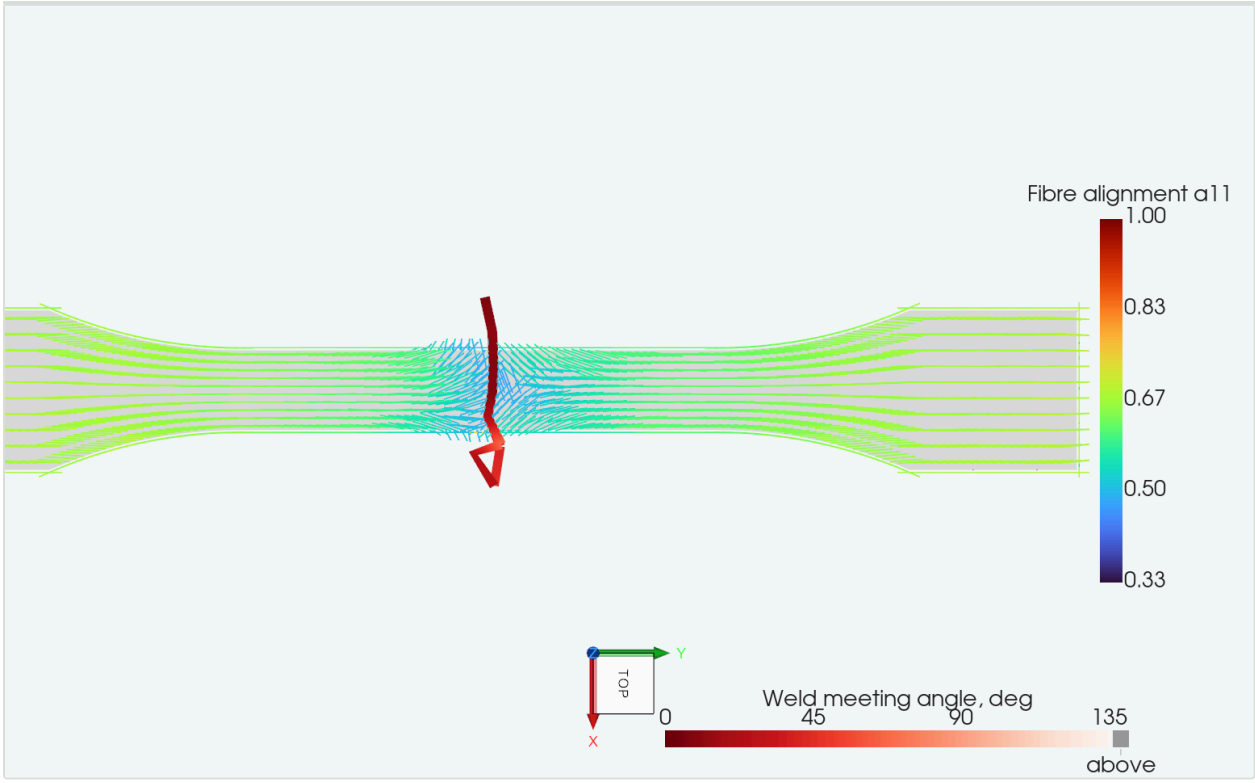


Figure 14.8 — Demonstration: the 0° bar from the two-gate plate in the fibre module. The weld line (thick line, coloured by the meeting angle) crosses the gauge; next to it the fibres (short lines, coloured by how strongly they are aligned) turn across the bar.

What the fibres change

Bar	One-gate plate: peak stress	Strain at break	Two-gate plate: peak stress	Strain at break
0° (along the flow)	136 MPa	3.7 %	86 MPa	2.1 %
45°	94 MPa	4.5 %	88 MPa	3.6 %
90° (across the flow)	79 MPa	4.5 %	115 MPa	3.2 %

Demonstration results of the six OpenRadioss runs (BeidPrep's fibre material, no test data).

In the one-gate plate the order is the familiar one: the bar along the flow is the strongest, the bar across it the weakest. In the two-gate plate it turns over. The 0° bar loses more than a third of its strength and breaks at the weld line, because there its fibres lie across it. The 90° bar gains, because along the weld line its fibres run with it.

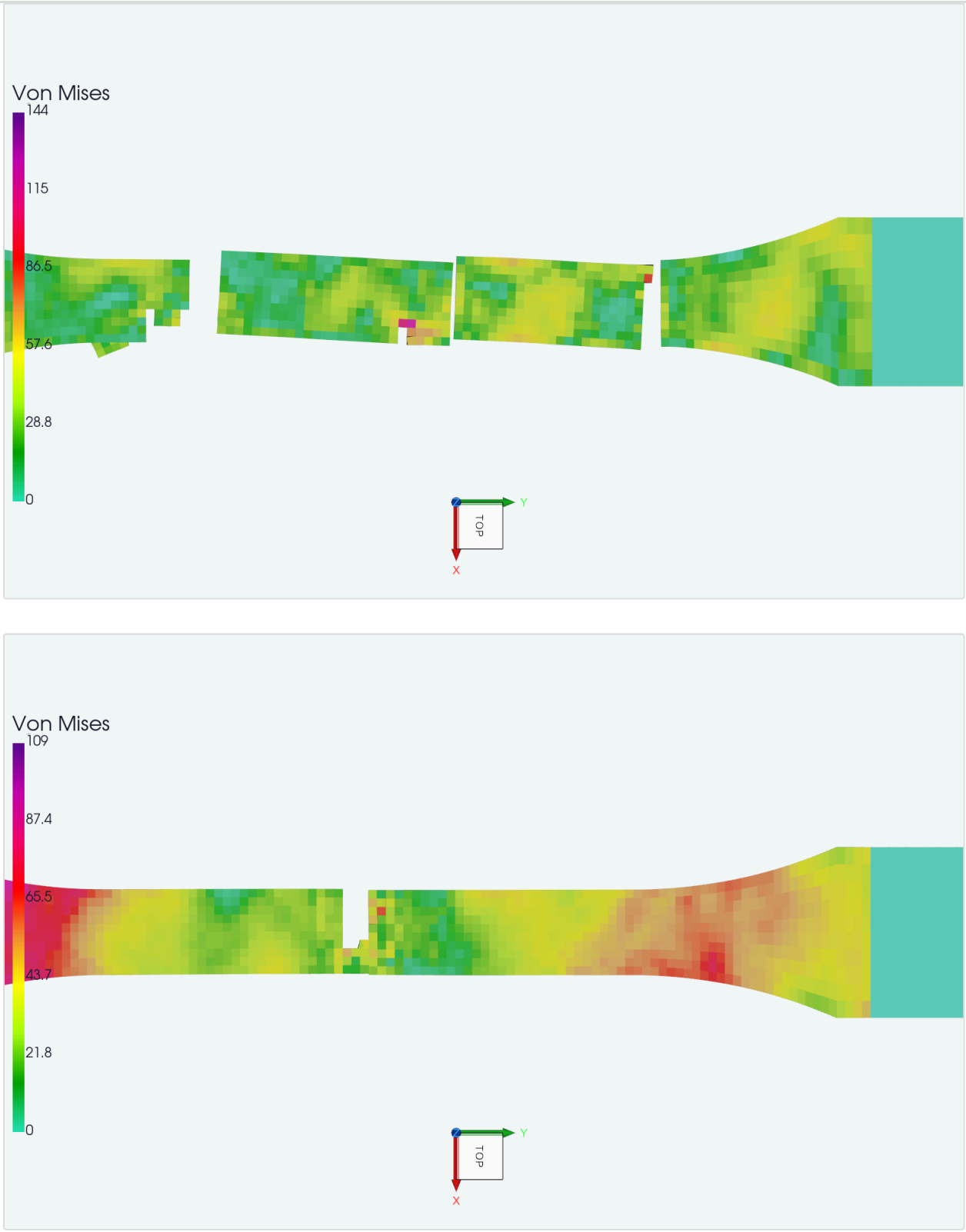


Figure 14.9 — Demonstration: the 0° bars just after they break, von Mises stress in MPa, in BeidPrep's results viewer (deformation drawn five times larger). Top: from the one-gate plate. Bottom: from the two-gate plate, broken at the weld line in the middle of the gauge.

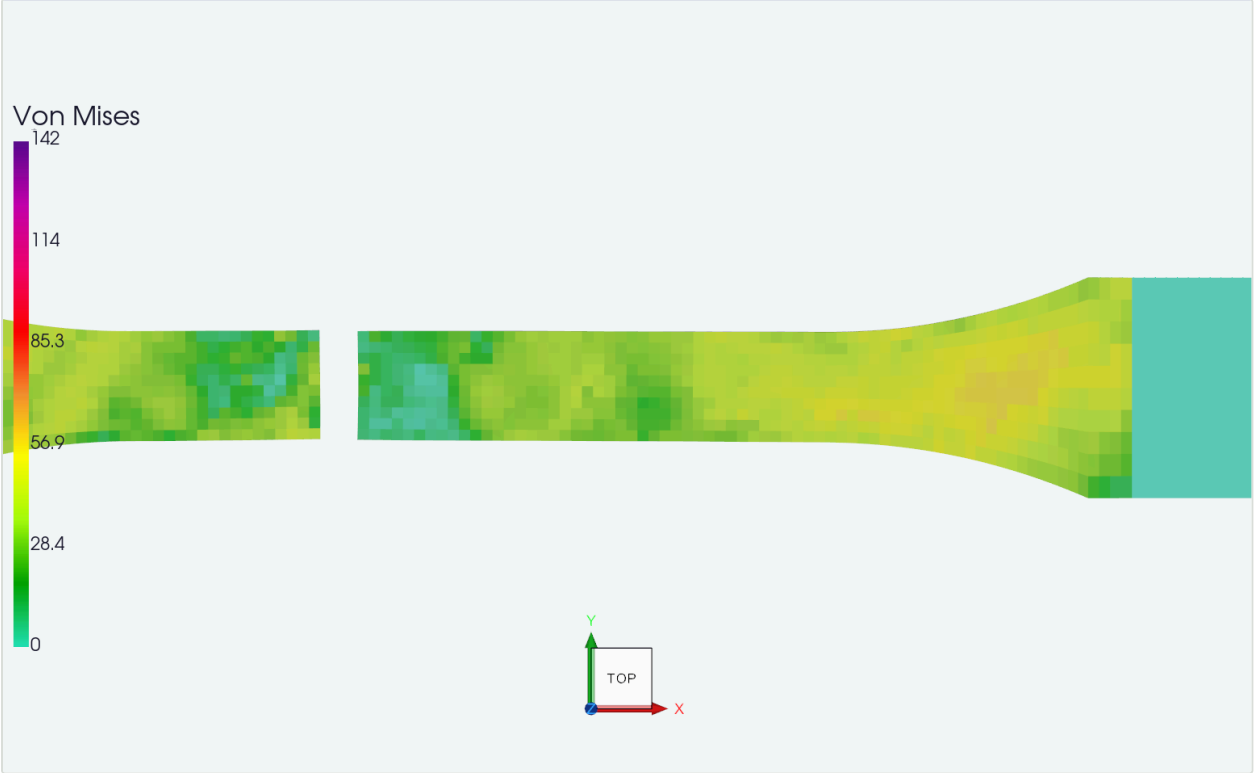


Figure 14.10 — Demonstration: the 90° bar from the two-gate plate just after it breaks (von Mises stress, deformation drawn five times larger).

> **The lesson.** The same bar, cut from the same place in the same material, is the strongest of three or among the weakest depending on how the part was gated. An isotropic material gives the same answer for both mouldings. Where the fibres lie in your part decides how it behaves.

The stresses are shown as von Mises stress: plastic strain is not yet offered by the results viewer for these solid-element runs.

What this demonstration does not include

- The strength loss of the weld itself: the module carries the fibre directions at the weld line, not the weaker bond where the fronts meet.
- Tests of these mouldings: none exist. The material is checked against published measurements of another plate (section 14.9).

The material was calibrated on published measurements: Holmström et al. [1, 2] (section 14.9). The measured curves themselves are not reproduced.

14.9 Validation and references

This section says how the fibre module was checked and lists the published work it rests on. Numbers in square brackets refer to the list at the end. The published work is described here in our own words: no figure, table or curve is copied from it.

The method, and where it comes from

The module treats a fibre-filled plastic as a plastic matrix holding short, stiff fibres.

- **Fully aligned fibres.** The stiffness of a matrix with every fibre pointing one way is worked out by the Mori–Tanaka method [3, 4]. It rests on Eshelby's solution for one inclusion in an endless matrix [5], in the form Tandon and Weng gave for fibres of any length-to-diameter ratio [6].
- **Real fibre directions.** In a moulded part the fibres point in many directions. Moldflow gives that spread as an orientation tensor, and the module averages the aligned stiffness over it, as described by Advani and Tucker [7]. The average needs more than the tensor Moldflow gives, so the module rebuilds the rest from the most even fibre spread that matches it [8].
- **Yield.** The yield differs along and across the fibres. The module describes it with Hill's yield criterion for materials that are not the same in every direction [9].
- **Curves measured with the crosshead** include the give of the machine and grips. With a reference modulus the module removes that give, so the curve's first slope equals the reference modulus.

Default properties of the plastics and fibres, used when you do not give your own, come from the manufacturers' datasheets [17]. Glass fibre is taken as equally stiff in every direction, which a measurement across the fibre supports [18]. Carbon fibre is much softer across the fibre than along it, and published values for that softness differ widely [18, 19]. A carbon-fibre material therefore names this uncertainty among its confidence reasons. Across the published range it moved the calibrated result by no more than 5.5 %. The matrix's Poisson's ratio is taken as 0.38 for every plastic: an assumption, not a measurement, because no datasheet read for the database gives one.

Validation: calibrated on two angles, checked on five it never saw

The material was calibrated on two published tensile curves of a PA6 plate with 30 % glass fibre, at 0° and 90° to the flow [1, 2]. The same publication also measured the plate at 15°, 30°, 45°, 60° and 75°. Those five curves were held back: the calibration never saw them. A straight specimen with the plate's fibre state through its thickness was then turned to each angle and run through the whole chain — BeidPrep's calibration, its export and an OpenRadioss run. The table gives the difference between the run and the measurement:

Angle to the flow	Modulus	Stress at 3 % strain	Strain at break
0° (calibration)	+0.2 %	+0.2 %	−6.0 %
15° (held back)	+3.2 %	−4.1 %	−20.9 %
30° (held back)	+8.2 %	−9.4 %	−39.8 %
45° (held back)	+5.3 %	−11.4 %	−60.6 %
60° (held back)	+0.2 %	−18.2 %	−47.0 %
75° (held back)	−7.1 %	−21.7 %	−24.0 %
90° (calibration)	−3.9 %	−22.9 %	−16.4 %

Our own runs, with the program's default settings, compared with the measured averages of [2]; a minus sign means the run is below the measurement.

What it shows. The stiffness is within 8.2 % at every angle, including the five the calibration never saw. Away from the flow direction the stress in the plastic range comes out *below* the measurement, so the material errs on the safe side there. The run breaks earlier than the test at every angle, never later. With only 0° and 90° curves, the yield across the fibres is not measured, and the module sets it on purpose from published data for the material family, choosing the most cautious value (next paragraph). A 45° curve of your own replaces that choice with your measurement.

Published data built into the module

- **Yield across the fibres, without a 45° curve.** For glass-filled PA6 and PA66 the factor on the predicted off-axis yield was set from seven published data sets [1, 10, 11]. For each set, the factor that would reproduce its measured yield was worked out. The module uses the lowest of them (0.89), so its yield is not above the test on any of the seven. The factors of the seven sets range from 0.89 to 2.23. A material family with fewer than three published sets gets a flat 10 % reduction instead, and the calibration notes say that the family has no data.
- **Failure across the angles** (`/FAIL/ORTHBIQUAD`). The strain at break changes with the angle to the fibres, and is highest near 45°, where shear dominates. The height of that peak is the one number set per material. It is chosen in three ways, in this order:
  - from your own 45° curve, scaled by 0.696. That is the largest factor that never predicted a later break than four published data sets measured at six or seven angles [1, 2, 12].
  - without a 45° curve, from a table of published values for the matrix family, the fibre and the fibre content [1, 10, 11, 12, 13, 14, 15].
  - for a family with no published data, no peak at all.

  The panel and the export always say which way was used and why. The table above shows the result on the PA6 plate of [1, 2], with only the 0° and 90° curves given: the run breaks 6 % to 61 % earlier than the test, never later.

Copyright and licences

This chapter quotes no figure, table or curve from the works below. The measured curves of [2] are published under the Creative Commons Attribution–NonCommercial 3.0 licence. They are not reproduced in this manual and not supplied with BeidPrep. What appears here are our own comparisons with them, as agreement figures. The pictures in this manual are all taken inside BeidPrep.

References

[1] P. H. Holmström, O. S. Hopperstad, A. H. Clausen, “Anisotropic tensile behaviour of short glass-fibre reinforced polyamide-6”, *Composites Part C: Open Access* 2 (2020) 100019. doi:10.1016/j.jcomc.2020.100019

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[3] T. Mori, K. Tanaka, “Average stress in matrix and average elastic energy of materials with misfitting inclusions”, *Acta Metallurgica* 21 (1973) 571–574. doi:10.1016/0001-6160(73)90064-3

[4] Y. Benveniste, “A new approach to the application of Mori–Tanaka's theory in composite materials”, *Mechanics of Materials* 6 (1987) 147–157. doi:10.1016/0167-6636(87)90005-6

[5] J. D. Eshelby, “The determination of the elastic field of an ellipsoidal inclusion, and related problems”, *Proceedings of the Royal Society of London A* 241 (1957) 376–396. doi:10.1098/rspa.1957.0133

[6] G. P. Tandon, G. J. Weng, "The effect of aspect ratio of inclusions on the elastic properties of unidirectionally aligned composites", *Polymer Composites* 5 (1984) 327–333. doi:10.1002/pc.750050413

[7] S. G. Advani, C. L. Tucker, "The use of tensors to describe and predict fiber orientation in short fiber composites", *Journal of Rheology* 31 (1987) 751–784. doi:10.1122/1.549945

[8] C. V. Chaubal, L. G. Leal, "A closure approximation for liquid-crystalline polymer models based on parametric density estimation", *Journal of Rheology* 42 (1998) 177–201. doi:10.1122/1.550887

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[11] Y. S. Cho, B. Jeon, J. Min, K. Kang, H. Lee, "A multi-scale approach for finite element method structural analysis of injection-molded parts of short fiber-reinforced polymer composite materials", *Applied Sciences* 15 (2025) 7434. doi:10.3390/app15137434

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[13] J. Lee, H. Lee, N. Kim, "Fiber orientation and strain rate-dependent tensile and compressive behavior of injection molded polyamide-6 reinforced with 20% short carbon fiber", *Polymers* 15 (2023) 738. doi:10.3390/polym15030738

[14] M. Perin, Y. Lim, G. A. Berti, T. Lee, K. Jin, L. Quagliato, "Single and multiple gate design optimization algorithm for improving the effectiveness of fiber reinforcement in the thermoplastic injection molding process", *Polymers* 15 (2023) 3094. doi:10.3390/polym15143094 — for the PA66 with 30 % glass fibre data it reports from [15].

[15] A. Isaincu, D. Micota, V. Ungureanu, L. Marşavina, "Numerical investigation on the influence of fiber orientation mapping procedure to the mechanical response of short-fiber reinforced composites using Moldflow, Digimat and Ansys software", *Materials Today: Proceedings* 45 (2021) 4304–4309. doi:10.1016/j.matpr.2020.12.792

[16] ASTM D638, *Standard Test Method for Tensile Properties of Plastics*, ASTM International, Appendix X1 (toe compensation).

[17] Manufacturers' datasheets, for the default properties at 23 °C (tensile modulus, density, yield): Moplen HP500N (LyondellBasell, PP); Ultramid B3S (PA6), Ultramid A3K (PA66), Ultradur B 4500 (PBT) and Ultraform N2320 003 AT (POM), all BASF; Grilamid L 20 G (EMS-Grivory, PA12); Stanyl TW341 (PA46) and Arnite A04 900 (PET), DSM, now Envalior; Makrolon 2405 (Covestro, PC); Fortron 0214 (Celanese, PPS); Victrex PEEK 450G (Victrex); glass fibre technical data (R&G Faserverbundwerkstoffe); TORAYCA T300 (Toray, carbon fibre).

[18] R. Maurin, P. Davies, N. Baral, C. Baley, "Transverse properties of carbon fibres by nano-indentation and micro-mechanics", *Applied Composite Materials* 15 (2008) 61–73. doi:10.1007/s10443-008-9057-3

[19] J. Yan, H. Ma, X. Wang, H. Li, B. Li, Q. Wei, Z. Cao, "Direct measurement of transverse compressive properties of polyacrylonitrile-based single carbon fibers", *Materials* 18 (2025) 3018. doi:10.3390/ma18133018

14.10 Limits

- **Solid parts only.** A fibre part must contain tetra or hexa elements only. The mapping reads only a part's solid elements, and the export refuses a fibre part that also holds other elements. A part that also holds pentahedra (/PENTA6) is refused too. BeidPrep 2.0 cannot generate solid meshes yet: import the model already meshed with solids, as an OpenRadioss deck (.rad) or an LS-DYNA keyword file (.k, .key, .dyn), which BeidPrep converts to .rad when it opens it.
- **OpenRadioss only** in this release. The output is an OpenRadioss deck.

- **Short glass or carbon fibres** in the matrix plastics listed in 14.4.
- **The fibre directions are those after moulding.** They do not change during the run, and weld lines from the Moldflow study are not used.
- **Refused, with the card named:** a deck in which the fibre part is named by a card that can hold only one part (for example `/ADMAS`, `/PROP/TYPE14` or `/IMPDISP/FGEO`); a group, surface or list card BeidPrep cannot read inside (for example `/GRBRIC/PART`); and a deck that uses `#include` files. The export stops and names the card rather than write a deck in which some elements would lose their loads.
- **Elements without a Moldflow match** are filled from their neighbours when they can be, and flagged. Elements that cannot be filled keep the deck's own material. The mapping details count both.
- **A calibration is only as good as its curves.** One 0° curve gives a usable material; 45° and 90° curves and an extensometer or reference modulus make it a trustworthy one. The confidence rating says which you have.

→ Every control of these panels, one by one: **Reference R14: the fibre panel**, page 190

15 Licences, known issues and reporting a problem

This chapter covers the editions and the beta period, the licence texts shipped with BeidPrep, and how to report a problem.

15.1 The beta and the editions

BeidPrep 2.0 beta runs as **Pro+ until 31 December 2026 and as Free from 1 January 2027** (section 1.3), on any computer. The edition is decided when the program starts.

From 1 January 2027 BeidPrep starts as Free and says so. Models built with Pro or Pro+ features keep opening, running and exporting; only creating and editing with those features steps down.

On 31 March 2027 the beta stops. To keep using BeidPrep after that date, load the free licence file (below). From 27 February 2027 BeidPrep reminds you of this at every start.

The beta checks the computer's date. If the date is set more than a day earlier than a date BeidPrep has already seen, or than the date the program was built, BeidPrep starts as Free and says so in the status line and in a message, naming both dates. Correct the computer's date and start BeidPrep again.

Loading the licence file

The beta stops on 31 March 2027. To keep using BeidPrep after that date, load the free licence file:

1. Download the licence file, *free.lic*, from *beidersim.com/beidprep*. It is free.
2. In BeidPrep, choose **Help** → **Load licence file...** and select the file you downloaded. The same **Load licence file...** button is also in the reminder shown from 27 February 2027, and in the window BeidPrep shows instead of opening after 31 March 2027.
3. BeidPrep checks the file and shows the date it now runs until. A file that has been changed is refused.

You can load the file at any time before 31 March 2027. You do not need an internet connection to load it: you can copy the file from another computer, for example on a USB stick. The same file works on every computer.

The online status check

BeidPrep works without an internet connection. When your computer is online, it reads a small status file from `https://beidersim.com/beidprep/status.json` at every start and once a day while it is open. It sends nothing about you, your computer or your models: no identifier, no licence data, no cookie and no version number. As with any website, the server sees your computer's internet address. If the file cannot be reached, BeidPrep says nothing and works on.

The status file can also carry a message from Beider Simulations, shown in a window titled *BeidPrep*; close it and work on. Or it can stop the beta. If that happens while BeidPrep is open and you have unsaved work, the message ends with *You have unsaved changes. Save them before BeidPrep closes.* and offers **Save and close** or **Close without saving**; with nothing unsaved it offers **Close BeidPrep**. After a stop, BeidPrep does not start, even offline, until the status file allows it again.

BeidPrep accepts only status files signed by Beider Simulations; a changed, old or expired file is ignored. It remembers the last status, a stop and the latest date it has seen in `%APPDATA%\BeidPrep\beta_status.json`.

15.2 The About box

Click **About** on the **Info** tab, or choose **Help** → **About**. The About box shows the version (*BeidPrep 2.0.0 beta*), the beta dates, the sentence *BeidPrep works with OpenCourant (the continuation of OpenRadioss) but doesn't include it; the installer can download it for you from its official source.*, and two buttons:

- **License agreement** shows the End User Licence Agreement you accepted at the first start (section 2.3).
- **Open full third-party notices** lists the components BeidPrep includes and their licences, among them the LGPL components (Qt, PySide6, Open CASCADE, Netgen) whose source code is available from Beider Simulations.

Netgen. This program uses Netgen under the GNU LGPL. The modified Netgen sources are available at `https://github.com/BeiderSim/beidprep-netgen-patches`.

15.3 Card support

Card support on the **Info** tab (also **Help** → **Card support**) lists every card type checked with the OpenRadioss Starter, the deck versions it was checked at, and at each version whether it opens as a *Form* (every field checked) or as *Text*, with the number of fields checked (for example *Text (12 of 14 fields verified)*). The list is built from the program's own check records each time it opens, so it always matches what the program does.

15.4 Reporting a problem

Click **Report a problem** on the **Info** tab, or choose **Help** → **Report a problem**. Your own e-mail program opens a new message to *beidprep@beidersim.com*, with a subject, a line asking for the steps that show the problem, your BeidPrep version, and numbered lines for the steps. Fill in the steps — a picture of the screen helps — and send it.

> **Nothing is sent by BeidPrep** The message is sent only when you press *Send* in your e-mail program. If no e-mail program is set up, BeidPrep shows the address and the line so you can write the message yourself.

15.5 Known issues

Known issues on the **Info** tab (also **Help** → **Known issues**) lists the known problems of this beta that can affect your model or your work, grouped by area, each in plain words with what to do about it. Every line ends with a reference number (for example *ref. P327*): quote it when you write to us about that problem. The list ships with the program, so it opens without a network connection.

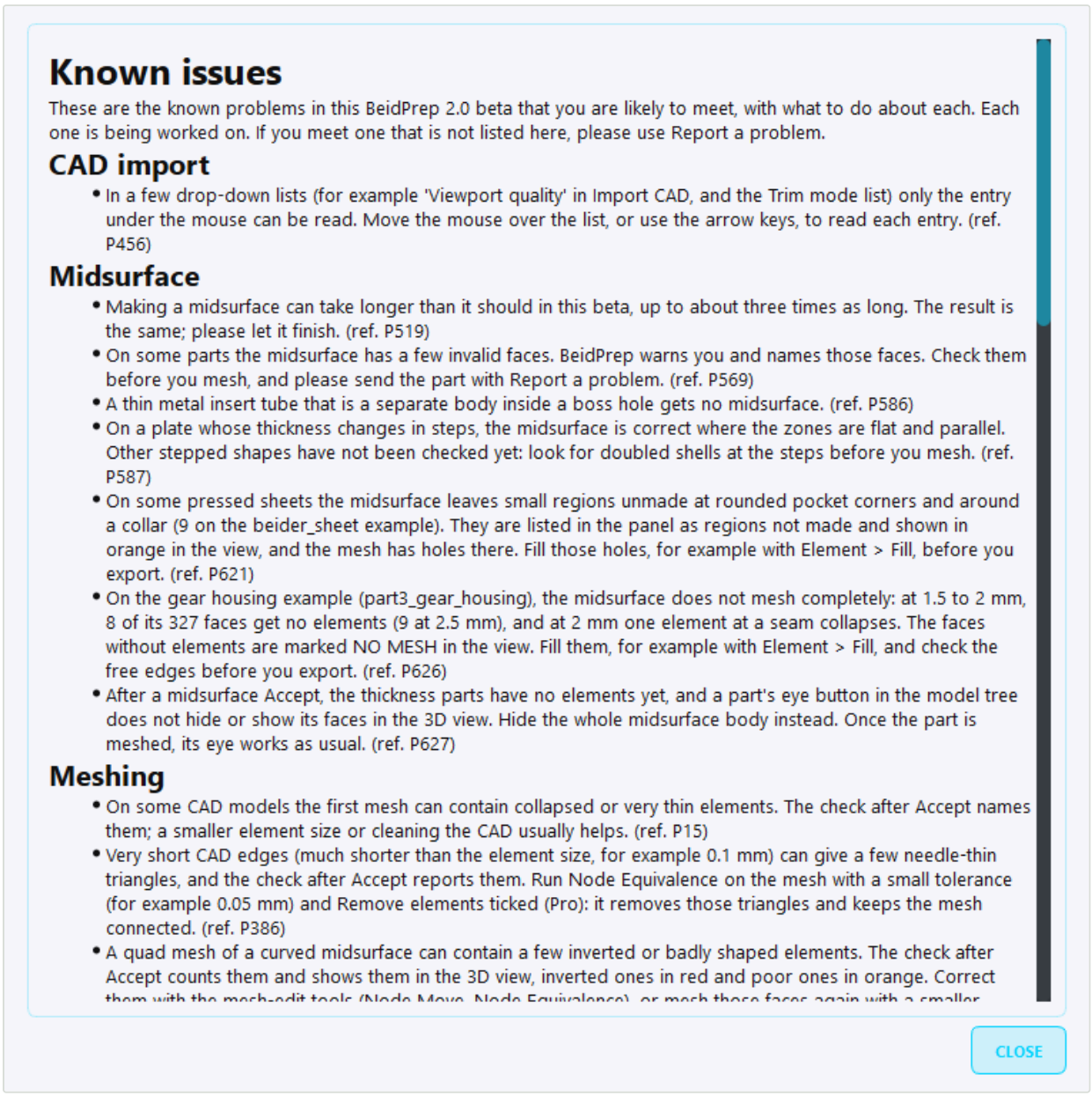


Figure 15.1 — The Known issues window.

At the time of this manual, the list reads:

These are the known problems in this BeidPrep 2.0 beta that you are likely to meet, with what to do about each. Each one is being worked on. If you meet one that is not listed here, please use Report a problem.

CAD import

- In a few drop-down lists (for example 'Viewport quality' in Import CAD, and the Trim mode list) only the entry under the mouse can be read. Move the mouse over the list, or use the arrow keys, to read each entry. ref. P456

Midsurface

- Making a midsurface can take longer than it should in this beta, up to about three times as long. The result is the same; please let it finish. ref. P519
- On some parts the midsurface has a few invalid faces. BeidPrep warns you and names those faces. Check them before you mesh, and please send the part with Report a problem. ref. P569
- A thin metal insert tube that is a separate body inside a boss hole gets no midsurface. ref. P586
- On a plate whose thickness changes in steps, the midsurface is correct where the zones are flat and parallel. Other stepped shapes have not been checked yet: look for doubled shells at the steps before you mesh. ref. P587
- On some pressed sheets the midsurface leaves small regions unmade at rounded pocket corners and around a collar (9 on the beider_sheet example). They are listed in the panel as regions not made and shown in orange in the view, and the mesh has holes there. Fill those holes, for example with Element > Fill, before you export. ref. P621
- On the gear housing example (part3_gear_housing), the midsurface does not mesh completely: at 1.5 to 2 mm, 8 of its 327 faces get no elements (9 at 2.5 mm), and at 2 mm one element at a seam collapses. The faces without elements are marked NO MESH in the view. Fill them, for example with Element > Fill, and check the free edges before you export. ref. P626
- After a midsurface Accept, the thickness parts have no elements yet, and a part's eye button in the model tree does not hide or show its faces in the 3D view. Hide the whole midsurface body instead. Once the part is meshed, its eye works as usual. ref. P627

Meshing

- On some CAD models the first mesh can contain collapsed or very thin elements. The check after Accept names them; a smaller element size or cleaning the CAD usually helps. ref. P15
- Very short CAD edges (much shorter than the element size, for example 0.1 mm) can give a few needle-thin triangles, and the check after Accept reports them. Run Node Equivalence on the mesh with a small tolerance (for example 0.05 mm) and Remove elements ticked (Pro): it removes those triangles and keeps the mesh connected. ref. P386
- A quad mesh of a curved midsurface can contain a few inverted or badly shaped elements. The check after Accept counts them and shows them in the 3D view, inverted ones in red and poor ones in orange. Correct them with the mesh-edit tools (Node Move, Node Equivalence), or mesh those faces again with a smaller element size. ref. P482
- On a midsurface with many faces, a mesh preview can leave some faces without elements. The program says MESH INCOMPLETE and names those faces. Please send the message and the model if you see it. ref. P521
- On some sheet parts the mesh can contain an almost flat element at a sharp corner. The check after Accept names it as a collapsed element. Please send the model if you see it. ref. P526

- Washer settings are not kept when a model is saved and opened again. Set the washers again before you mesh a model you have re-opened. ref. P511
- On some parts the Washers panel reports a washer as created, but the mesh around that hole gets no washer rings. After meshing, look at each bolt hole; if the rings are missing, please send the part with Report a problem. ref. P560
- With Quad-Only, changing a seed next to an accepted mesh can give a few collapsed elements. The check after Accept names them; please send the model with Report a problem. ref. P564
- A bend strip narrower than the element size can get one sliver element. Use an element size no larger than the narrowest bend strip. The check after Accept names the sliver when it happens. ref. P571
- Where two CAD surfaces touch along a line but do not share an edge, the mesh has hanging nodes there; any mesher would give the same. The check after Accept names them. Sew or imprint the touching edges in your CAD program, then import and mesh again. ref. P574
- Clear Seeds empties the seed list but does not change the node counts already set on the edges, or the mesh. To change an edge, set its new count on the edge itself. ref. P422
- In a model you have saved and opened again, a body that already has a mesh can only be re-meshed whole. Meshing only some of its faces is refused: select all its faces (or the body in Solid mode), or delete its elements first. ref. P641
- Re-meshing a body is refused while anything uses its nodes or elements by number (for example an RBE2, a BC on a node group, an accelerometer or an element group), or while its mesh shares nodes with another body. The message names what is attached: delete or detach it, re-mesh, then attach it again. References by part are not affected. ref. P642
- After Create washers, a face next to a washer may get no elements; the mesh check says MESH INCOMPLETE and names the face. Two cases: (1) next to a small hole at a coarse element size: raise the node count (seeds) on that face's edges until the nodes are about 2 mm apart, or use an element size of 4 mm or smaller -- while the preview is shown the mesh updates by itself, otherwise press Preview; (2) where the washer ring touches the edge of its face (narrow flanges, thin bands), seeds do not help: undo the washer on that hole. A MESH INCOMPLETE warning on a zero-area face means no element is actually missing. ref. P645
- If you change the CAD of a meshed body, save and reopen the model, and mesh it again, the old mesh stays and a second mesh is added. Delete the body's mesh before changing its CAD. ref. P647
- If you reopen a saved model and change seeds during Preview on a body that touches another body's mesh (for example its midsurface), the mesh may crack at thin edges; the Accept check shows MESH CRACKED. Set the seeds before Preview, or re-mesh without changing seeds during Preview. ref. P648
- Where two separate bodies touch, the Accept check can say MESH CRACKED and name nodes of the other body. If the bodies are meant to be separate (for example a skin and a rib, or a part and its midsurface), this can be ignored. ref. P649
- A strong bias on a long edge can leave a face without elements; Accept warns MESH INCOMPLETE. Use a smaller bias or more nodes on that edge. ref. P650

Elements

- Element Fill can take up to about 20 s on very large models; the result is correct. ref. P546

- 10-node tetrahedra (/TETRA10) cannot be edited one element at a time (delete, split, merge, or move to another part): BeidPrep refuses and changes nothing. ref. P243
- The reference checks do not see the nodes of 10-node tetrahedra (/TETRA10), so deleting a node that only a /TETRA10 uses is not flagged. Check /TETRA10 parts before you export. ref. P184
- A click near the edge of the model can pick a node on a hidden face behind it. Click on the node itself, not on the background beside the model, and check the marker of the picked node before you edit it. ref. P605
- After Element Split, press Esc before you select elements in the 3D view: the Split panel's node pick stays on until then. ref. P613
- If you move a node across the opposite edge of a triangle, the triangle folds over, and the quality check still passes it. After moving nodes by hand, look at the area with the mesh shown, and undo a move that folds an element. ref. P623
- On a midsurface mesh, the shell normals can face different ways from one CAD face to the next. Before you export, make them face the same way with Element > Normals: pick one element facing the way you want. While the Normals panel is open, the back of every shell is drawn in yellow, so you can see which way each one faces. ref. P624
- A node that no element uses is drawn as a green dot, but a surface in front of it can cover it. Turn the view, or hide the part in front, to see it. ref. P628
- On a model opened from a file, Move to Part puts the moved elements in a second element block of the target part (the solver reads it correctly), and the export does not warn about a part without a material; the Starter check then names that part. Give every part a material before you export. ref. P545

Cards

- When a drop-down field is blank in the deck, the form can show the list's first choice instead of the value the solver uses for a blank. The deck is not changed unless you choose a value. ref. P82
- When a deck written for OpenRadioss 2019 or 140 is opened together with its Engine file, the deck's version can be lost, and cards from newer versions are then offered. Check the version shown for the deck before you add cards. ref. P537
- On a new /IMPVEL card the Dir box shows X, but no direction is saved until you choose one. Pick the direction in the box before you export. ref. P608
- In the card panel's TEXT view only part of each line fits; scroll sideways to see the other columns. ref. P620
- Material laws not yet offered for new cards: LAW19, LAW25 (COMPSH), LAW28 (HONEYCOMB), LAW5 and /MAT/JWL, LAW46, LAW62, LAW69, LAW79, LAW121 and /MAT/XIA. In a deck written for an older OpenRadioss version (2019 to 2024) a few more are not offered, LAW2 among them. A deck that already contains them opens, and these cards are shown as text. They will be added in an update after the beta. ref. P547

Export

- In an Engine-file card, a blank field followed by a filled field on the same line can be saved so that OpenRadioss reads the values in the wrong places and stops. Type the default value into every blank field that comes before the last field you fill. ref. P406

- OpenRadioss itself: when a model has both penalty and kinematic rigid walls, the Starter can check a kinematic wall against the wrong nodes. Use one rigid-wall type per model until this is fixed in OpenRadioss. ref. P320
- When a part has no material, the export warning 'parts without a material' can appear twice for one export. Close it both times; the export itself is not affected. ref. P610
- OpenRadioss cannot run from a folder, run name or solver folder with non-English letters (for example Hebrew, Cyrillic or Chinese). BeidPrep checks before starting and offers one click to run in C:\BeidPrep_runs instead. ref. P644

Fibre

- Fibre, one-curve calibration (only the 0° curve given): for grades with a softer matrix, such as heat-stabilised PA6, the predicted 45° and 90° stiffness and strength can be up to about 30 % too high. The confidence card warns when this is likely. For these grades, give the 45° and 90° curves. ref. P556
- Fibre: Export for solver refuses a model that has /TH/NODE or /TH/RBODY cards. Workaround: remove them before the export, add them to the solver copy afterwards. ref. P612
- Fibre materials: the tensile curve you enter is used as ENGINEERING stress. If you enter a TRUE-stress curve, the solver material is too strong past yield (unsafe side), by about the strain itself: measured +3 % at 3 % strain, growing to +18..+33 % at peak for PA6-GF15 (breaks at 9-19 % strain) and +7..+9 % for PA6-GF30. Enter engineering stress-strain data, or convert first: engineering strain = e^(true strain) - 1, engineering stress = true stress / e^(true strain). ref. P615
- Fibre module: solid elements only: 4- and 10-node tetrahedra (/TETRA4, /TETRA10) and 8-node hexahedra (/BRICK). A fibre part must contain only these; a part that also holds pentahedra (/PENTA6), shells or other elements is refused. BeidPrep 2.0 can't generate solid meshes yet, so use the module on a model you import already meshed with solids: an OpenRadioss deck (.rad), or an LS-DYNA keyword file (.k, .key, .dyn), which BeidPrep converts to .rad when it opens it. ref. P617

Results

- History: the curves of a contact's time history (/TH/INTER) are listed as 'var 1' to 'var 6' instead of their names. The names will be added in an update after the beta. ref. P553
- Results playback is slow on large models when several views are on at once: on our Blade impact test model, playing the animation with deformation, a velocity contour on one part, a section cut and velocity vectors all switched on runs at about 9 frames per second (full-screen window). ref. P646

Program

- At 150 % Windows display scaling, the panels on the right are shorter than the 3D view, so some of their content can be cut off. 100 % or 125 % scaling avoids it. ref. P270
- After you reopen a saved .beid model, a CAD body you had hidden is shown again and drawn over the mesh. Hide it again; the model and the deck are unchanged. ref. P611
- BeidPrep can stop responding while a UI automation or accessibility tool (for example screen-recording automation or test software that reads the window's controls) is attached to it. Close such tools before you start BeidPrep. ref. P609

15.6 The Help menu

The **Help** menu, at the right end of the menu bar, holds **Known issues**, **Card support**, **Report a problem** and **About** — the same windows as the **Info** tab. When this manual is installed with the program, the menu also has **Manual**, which opens it in your PDF viewer.

16 Working with Claude

BeidPrep can let Claude Code, running on your own computer, work with the model you have open: look at it, answer questions about it, and — only if you allow it — build it, run it and read its results, each change shown to you first. You decide how much of the model Claude may read and whether it may change anything. Nothing is connected until you switch it on.

> **Pro+** The Claude connection is part of BeidPrep Pro+. In the other editions the window explains this and **Connect** is greyed out.

16.1 Connecting, step by step

1. Choose **Tools** → **Connect Claude…**. The window opens beside the model, and BeidPrep stays usable. A model does not need to be open.
2. Under **What Claude may read**, choose *Keep local*, *Structure only* or *Full* (section 16.2). The choice covers this model, new models, and models in Claude's folder.
3. Under **What Claude may change**, choose *Read only*, *Ask before each change* or *Claude works freely* (section 16.3). Every time BeidPrep starts, this is back to *Read only*.
4. If Claude is to import CAD, export a deck or run the analysis, press **Choose folder…** and pick **the one folder** Claude may use. Claude sees the names of the files in it, never where it is, and can read and write nowhere else.
5. Press **Connect**, the wide button at the top of the window. A *Claude connected* sign appears at the right of the status bar, and the button becomes **Disconnect**.
6. The first time only, tell Claude Code where to find BeidPrep: press **Add to Claude Code** and confirm, and BeidPrep adds itself to Claude Code. Or, under **Or run this once in a terminal yourself**, press **Copy the line** and run that line once in a terminal.
7. Ask Claude in plain words, for example *"Which part has the most elements?"* or *"Build the model from the CAD and the problem description in the folder."*
8. Every request Claude makes is listed in the window's **Action log**. Press **Disconnect**, or close BeidPrep, to stop.

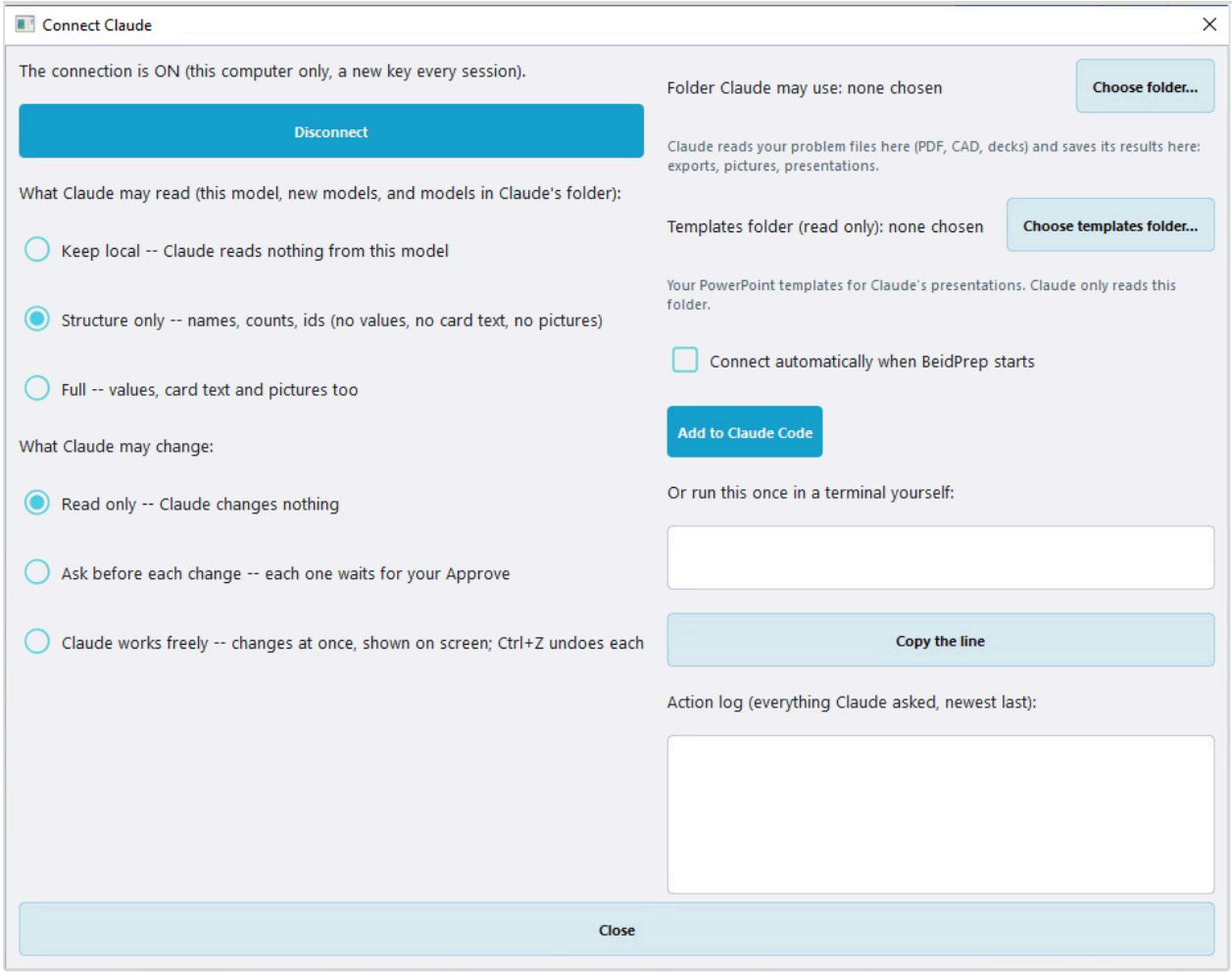


Figure 16.1 — The *Connect Claude* window after **Connect**: what Claude may read, what it may change, its folder and the Action log. (The terminal line is left blank in this picture.)

Which Claude model to use

BeidPrep works with whatever model your Claude app uses; nothing in BeidPrep depends on a particular model. We tested it with Claude Sonnet 5.5 and Claude Opus 5.5 (October 2026): Claude built a crash model from its CAD and a written problem description three times with each. Every build was complete and the solver's input check found no errors. Sonnet 5.5 was faster (about 1½ minutes against 2) and costs less, so we recommend it. You choose the model in your Claude app (in Claude Code, with `/model`).

16.2 What leaves your computer

Claude Code sends what it reads from BeidPrep to Claude. So the read level you choose decides what leaves your computer:

Level	What Claude can read	What leaves your computer
Keep local	Nothing from the model. Claude can change the view (show and hide parts, turn the view, colour the results, move to a frame), and ask about card *types* in BeidPrep's library.	Nothing about the model, only whether each request worked, and what a card type is for and which values it takes.
Structure only (the default)	Names, counts and numbers: the parts, the cards, the CAD bodies, the result series and curves, the state of a run.	The model's **file name** (never its folder), counts, part and card **titles as you wrote them**, card numbers and keywords, the names of result fields, series and curves, and the numbers a run reports (its progress, energy error, added mass, how it ended).
Full	Everything above, plus the values.	All of the above, plus the **values of a card**, **pictures** of the 3D view and of the History tool's plots, time-history **curve values**, and the **peak value** of a result with its unit and the element or node where it is.

> **Titles are sent as written** At *Structure only* and *Full*, the titles of your parts and cards leave your computer exactly as they are in the deck. If a title or a value must stay private, for example a customer's part name, choose *Keep local*.

What never leaves

- **Folders and file paths.** Only a file's name is sent, never where it is.
- **The layout of BeidPrep's card library.** Claude learns a card type's fields by name and meaning, and the values a card holds, but never how a card is written: no card text, rows, columns or widths.
- **Program code and error messages.** Every answer and every error is checked before it is sent. If it looks like a folder path, a program file name or an error trace, Claude receives only *"The action failed."* and the details stay in the log on your computer.
- **Anything from other programs or other files.** Claude sees only what BeidPrep shows it, through the actions below. A problem description in Claude's folder is read by Claude Code itself, not by BeidPrep.

16.3 Letting Claude change the model

The second choice in the Connect window decides whether Claude may change anything:

- **Read only** (the default, and again at every start): every change is refused.
- **Ask before each change**: nothing happens when Claude asks. A bar appears over BeidPrep — *"Claude wants to: …"* in one sentence — with **Approve** and **Reject**. Only after Approve does the change run.
- **Claude works freely**: each change runs at once, and a line at the top of the 3D view says what Claude is doing — for example *"Claude is editing Create 3 cards: /MAT/LAW1 (steel), /PROP/SHELL (t2), /PROP/SHELL (Ctrl+Z undoes it)."*

When Claude creates several cards in one go, BeidPrep makes and checks all of them first and answers Claude at once, then shows the new cards **one by one** in the tree while Claude prepares the next ones. The bar never sits under an open panel: it moves out from under it.

Either way, one change runs at a time; each change is made through the same path as the program's own buttons, so every check the program has applies; and each change is **one** step on the undo list, so one **Ctrl+Z** undoes it, card and values together. Changes that write files or use the computer (importing CAD, exporting a deck, running the analysis) cannot be undone, and their sentence on the bar says so.

Every value has a source

When Claude creates a card, every value it writes must name where it comes from: your own words, or a quote or page of the document you gave it. A value without a source is refused, and Claude is told never to invent one. A value the document does not give is left blank, and the solver uses its default; the description of each field tells Claude that default where it is known.

Some values are never Claude's: the card's own number (BeidPrep gives it, as when you create a card), and the input version of */BEGIN*, which BeidPrep fills in with 2026 exactly as when you create it yourself. The run name and the file names are your choice: Claude asks you for them.

16.4 What Claude can do

Claude can only ask BeidPrep for one of these actions. The *Level* column is the lowest read level that allows it; actions marked *change* also need *Ask before each change* or *Claude works freely*.

Looking at the model

Action	What it does	Level
Describe the open model	The file name, and how many parts, elements of each type, nodes and cards of each kind.	Structure only
List the parts	Each part's number, title, element count, and whether it is shown; 200 at a time.	Structure only
List the cards	The cards by keyword or category: keyword, number and title.	Structure only
Read one card	The values of one card, field by field.	Full
Describe the imported CAD	The CAD bodies (name, number of faces, size), or one body's faces (type, area, centre).	Structure only
Show parts, **Hide parts**, **Show only these parts**	The same as the eye in the tree.	Keep local
Set the view	Turns the 3D view to a named direction, or fits the model.	Keep local
A picture of the 3D view	BeidPrep's own drawing of its view (not a copy of your screen).	Full
Select nodes by place	Selects and highlights nodes, for example all nodes at one end of a rail, ready for an RBE2 or a node group.	Structure only
List the files in Claude's folder	Names, sizes and kinds of the files in the one folder you chose.	Keep local

Card types

Action	What it does	Level
Search the card types	Finds card types by plain words — *"which card imposes a velocity?"* — and returns the best five with what each is for. The search runs on your computer, over BeidPrep's library.	Keep local
Describe a card type	What a card type is for, whether Claude can create it now, and its fields: each one's meaning, unit, choices, when the solver reads it, and the solver's default when it is left blank.	Keep local

Building the model (change)

Action	What it does	Undo
Import a CAD file	A STEP or IGES file from Claude's folder, as **File** → **Import CAD**.	no
Mesh faces of a CAD body	As the 2D Mesh panel: Preview, then Accept, with the check after Accept. If the check is not green, Claude is told to stop and tell you.	yes
Create a card	One card of a type BeidPrep has proven against the solver, every value with its source. Each value is read back from the card before the change counts as done; if any did not arrive, the whole change is undone and reported.	yes
Assign a material and a property to a part	As typing them into the part's card.	yes
Create an RBE2, **Create a node group**	On the selected nodes, as the RBE2 panel and the group buttons do.	yes
Export the deck	Into Claude's folder, as **File** → **Export** with its checks. A model with a blank field that would stop the Starter is refused, and each such field is named.	no

Running the analysis (change)

These use the same run as **Tools** → **Run analysis** (chapter 18), and only if you ticked **Claude may run the analysis** in that window. Your limits there apply: Claude cannot use more threads than you allow, a run longer than your time limit is stopped, and processes and extra solver arguments are yours alone.

Action	What it does	Level
Run the analysis (change)	Exports the model into Claude's folder and runs the Starter, then the Engine, with the number of threads Claude chooses within your limit.	Keep local
Check the analysis run	How the run is going — phase, per cent done, cycle, time, time left, and the Engine's own current state (time step, energy error, energies, mass error) — and at the end how it ended, the Starter's errors and warnings, and the energy error and added mass of the last cycle.	Structure only
Send the Engine a command (change)	The Engine's own commands, as the Run window's buttons: stop cleanly (a restart file is written), kill, or write an animation, restart or output file now — at once or at a later cycle.	Keep local
Summarise a run	The same end-of-run summary from a run's own listings, also for a run made outside BeidPrep.	Structure only

Reading the results

Action	What it does	Level
List the results	The result series in the model's folder and in Claude's folder: a number for each, its run name and how many frames it has.	Structure only
Open a results series	Opens one series in the results viewer, as the Load button does, and returns a summary: frames, elements, nodes, first and last time, and the result fields.	Structure only
List the result fields	Each field's name as the Contour panel shows it, and its family.	Structure only
Show a field as a contour, **Go to a frame or a time**	As the Contour panel and the playback slider.	Keep local
Find the peak of the shown field	The highest value on screen, with its unit and the element or node where it is.	Full
List the time-history curves	The curves the History tool offers (chapter 17), with their group and unit.	Structure only
Get curve values	Up to eight curves as numbers or CSV, in the History tool's units, with each curve's maximum and minimum over every point.	Full
Plot curves	The History tool's own plot of up to eight curves, as a picture.	Full

All curve values come through the History tool, so forces stored by the solver as impulses come out as forces. Claude is told never to read the solver's files itself.

Making a presentation (change)

Action	What it does	Level
List the presentation templates	The names of the PowerPoint templates in your *Templates folder*, the folder you choose with **Choose templates folder...** in the Connect window. Claude only reads that folder.	Keep local
Make a PowerPoint presentation	Claude describes the slides — titles, points, pictures it has taken, tables — and BeidPrep builds the presentation from one of your templates, in Claude's folder. It writes a file, so it needs *Ask before each change* or *Claude works freely*. Open the presentation in PowerPoint before you send it: the text fit is an estimate.	Keep local

A long action, such as importing CAD or reading a large time-history file, returns at once; Claude then asks **the state of a long action** until it is done.

16.5 Safeguards

- **Only this computer.** BeidPrep accepts the connection only from your own computer, with a new secret key for each session. The key is deleted when you disconnect.
- **You decide every change.** *Read only* at every start; with *Ask before each change*, nothing changes until you press Approve.
- **Nothing runs behind your back.** While BeidPrep is busy — a window open, a mouse button held, a long job running — Claude's request is refused with a plain sentence, not queued for later.
- **One folder.** Claude reads and writes files only in the folder you chose, by name.
- **Requests are checked first.** An unknown action, a value of the wrong kind or out of range, or a card type BeidPrep has not proven, is refused before anything happens.
- **Everything is logged.** Every request, refused ones included, is in the Action log, which is also kept in BeidPrep's settings folder.

16.6 How the Claude connection was tested

Before release, the S-rail crash case of the tutorial was built by Claude **29 times** (7–8 Oct 2026), each time in a fresh BeidPrep and a fresh Claude Code session, from the same PDF and the same four requests:

1. “Read the PDF in this folder and build the model in BeidPrep. If the PDF doesn't give a value, keep the solver's default and tell me. Don't run it yet.”
2. “Call it rail crash, no spaces.”
3. “Before we run it: which values did you decide yourself, and which did you leave to the solver?”
4. “Export it.”

The runs used three Claude models: 17 on Claude Code's default model, 9 on Sonnet and 3 on Opus. Between runs, BeidPrep's own Claude actions were made faster, one change at a time.

Checked	Result
The exported deck read by the OpenRadioss Starter	28 decks exported, **0 Starter errors** in every one; one run ended without exporting
The values Claude wrote, card by card, across the 28 decks	The material, its failure model, the part, the end time and the outputs were the same in every deck. The decks were **not identical**: the contact settings, how the imposed velocity was split between its function and its scale, the group numbering and the history outputs differed from run to run, and in one run a node group held other nodes
Claude's review (request 3)	named between 2 and 6 of the 6 points a careful engineer would raise
Time to build	from 289 s (first build) down to 92–121 s with the final actions

> **What this means for you** Claude builds a deck the solver accepts, from your document, every time it was tried. It does not build the same deck every time, and it can make a choice you would not. Review the model before you run it, as you would a colleague's — request 3 above is a good start, and every value Claude wrote carries its source.

→ Every control of these panels, one by one: **Reference R16: the Claude connection**, page 199

17 Time histories

A run writes two kinds of results: the animation files, which show the whole model at a few moments, and the time-history file, which records chosen values at every few microseconds. The History tool plots that file: forces, displacements and energies against time, or one against another.

17.1 Opening the History tool

1. Open the run's results (chapter 13). The time-history file is the one ending in *T01*, written beside the animation files.
2. On the **Results** tab, press **History**. The panel opens on the right and reads the run's *…T01* file at once. **Run:** at the top names the file it read.
3. If the file is somewhere else, press **Choose time-history file…** and pick it.

Reading does not change the model or the results. The History panel only opens when you ask for it.

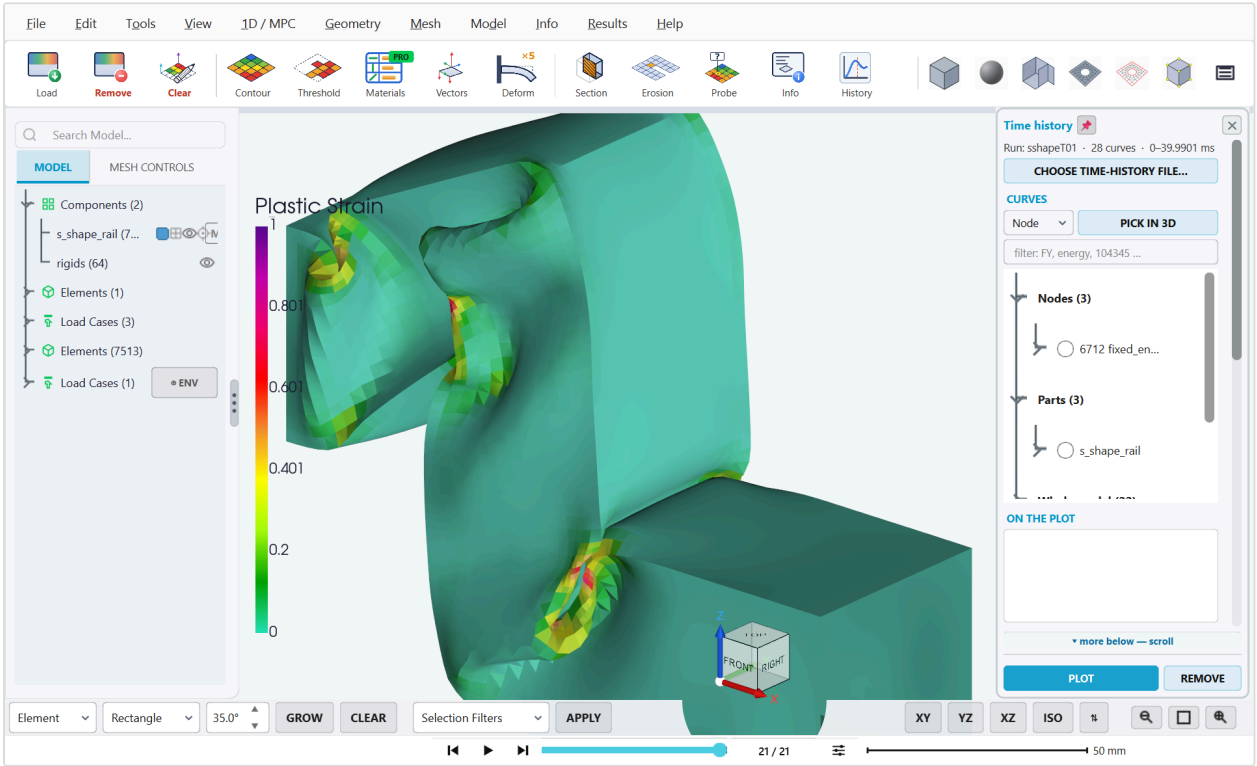


Figure 17.1 — The History panel open on the crash demonstration run (13.4): **Run:** names the file it read, 28 curves.

17.2 Choosing curves by object

Under **CURVES** every recorded curve is listed in a tree, by object:

- **Rigid bodies**, **Sections**, **Nodes** and **Parts**: open an object to see its variables. Ticking the object's own box ticks all of its variables.
- **Whole model**: the energies and masses of the whole run, such as internal energy, kinetic energy, hourglass energy and the added mass.
- **Other objects**: everything else the run recorded.
- **My curves** (section 17.7) and **Picked in 3D** (section 17.3).

Each group shows how many curves it holds, for example *Rigid bodies (18)*. A group the run did not record is not listed.

Ticking a curve draws it at once. Type into the filter box to narrow the tree, for example *FY*, *energy* or a node number.

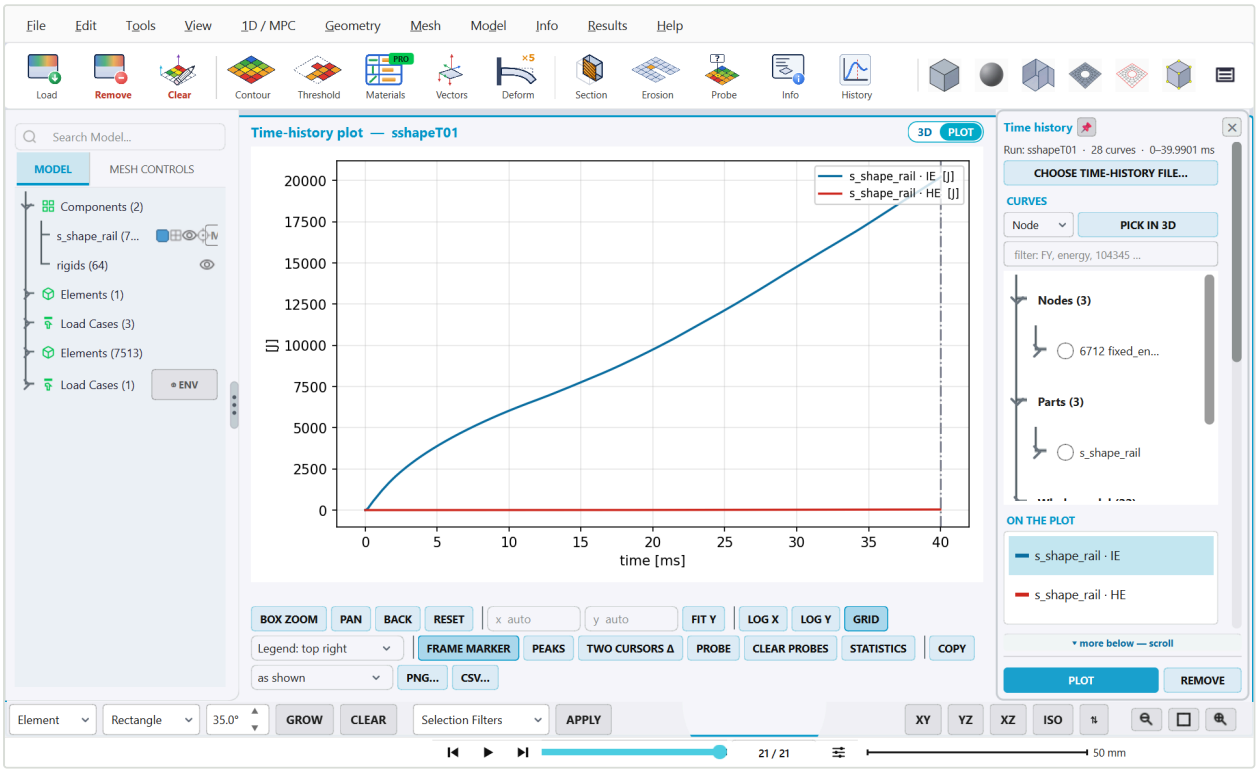


Figure 17.2 — Two of the rail part's variables ticked and plotted: its internal energy (IE) and hourglass energy (HE).

17.3 Choosing curves by picking in 3D

1. Press **Pick in 3D**.
2. Click a node, or an element of a part, in the 3D view.
3. The node's or the part's curves appear under **Picked in 3D**, and one of them is ticked and drawn at once (for a node, its x displacement, *DX*). Tick the others you want.

Only objects the run recorded have curves. A node or part with no time-history output gives nothing to tick; add it to the run's time-history cards (chapter 6) and run again.

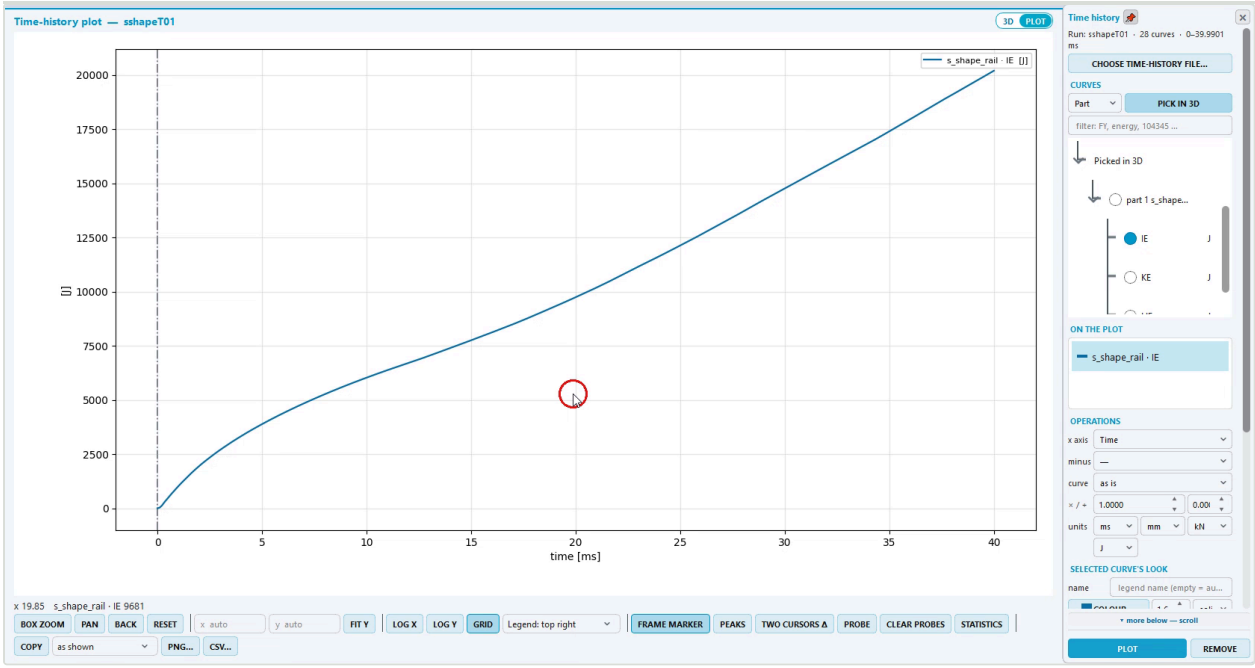


Figure 17.3 — The rail part picked in the 3D view: its curves (IE, KE, HE) under **Picked in 3D**, and its internal energy (IE) ticked and plotted.

17.4 The plot

Ticking a curve shows the plot in the 3D view's place: a pane titled *Time-history plot* — and the file's name. The **3D | PLOT** switch at its top right goes back to the 3D view and to the plot again; **Plot** in the panel also brings the plot back. The panel's ✕ closes the tool and brings the 3D view back.

- A grey dash-dot line marks the moment the 3D view shows, and follows the playback slider.
- With *Time* on the x axis, click on the plot (with no zoom, pan, cursor or probe mode on) and the 3D view jumps to that time. With a curve on the x axis a click does nothing.
- Click a curve's name in the legend to hide it; click again to show it.

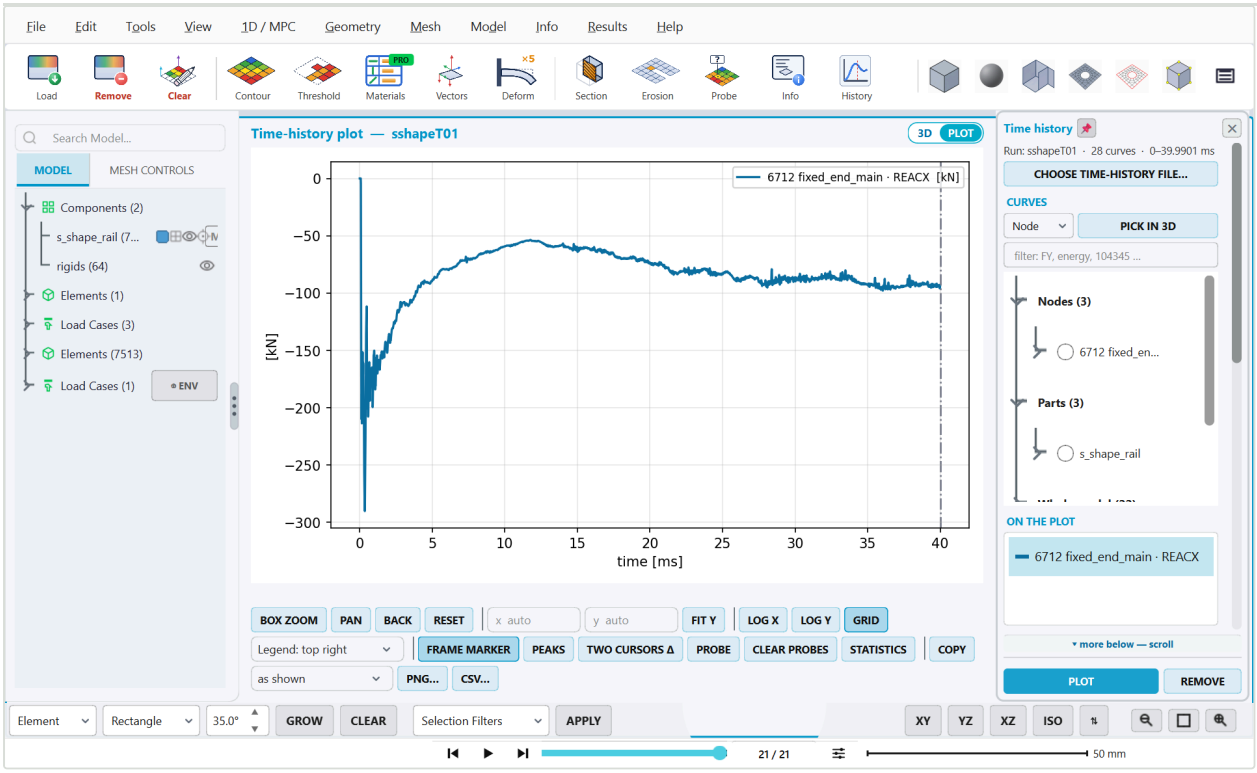


Figure 17.4 — The plot in the 3D view's place: the fixed end's reaction force, with the grey dash-dot frame line at the last frame (40 ms).

The controls under the plot

Along the bottom of the plot, wrapping onto more rows when the window is narrow:

Control	What it does
Box zoom, **Pan**, **Back**, **Reset**	Zoom into a dragged box, move the plot, step back one zoom or pan, return to the full view.
x and **y** ranges	Type two numbers, for example *0 – 20*; leave empty for automatic.
Fit y	Fits the y axis to the curves inside the current x range.
log x, **log y**	Logarithmic axes. Refused, with the reason under the plot, when a value in view is zero or negative.
Grid, **Legend**	Grid lines on or off; where the legend sits.
Frame marker	The grey dash-dot line at the 3D view's frame, on or off.
Peaks	Marks each curve's maximum and minimum.
Two cursors Δ	Click two times on the plot: the differences between them are shown.
Probe, **Clear probes**	Section 17.5.
Statistics	Section 17.8.
Copy, **PNG...**, **CSV...**	Section 17.9.

The value under the cursor is shown on its own row above these controls.

A curve's look and the titles

Select a curve under **ON THE PLOT**. Under **SELECTED CURVE'S LOOK** you set its colour, line thickness, line style, markers and legend name, and can label its peak with its value and time (for example *max 5.444 kN at 5.06 ms*). Under **TITLES** you type the plot's title and the x- and y-axis titles. **Remove** takes the selected curve off the plot.

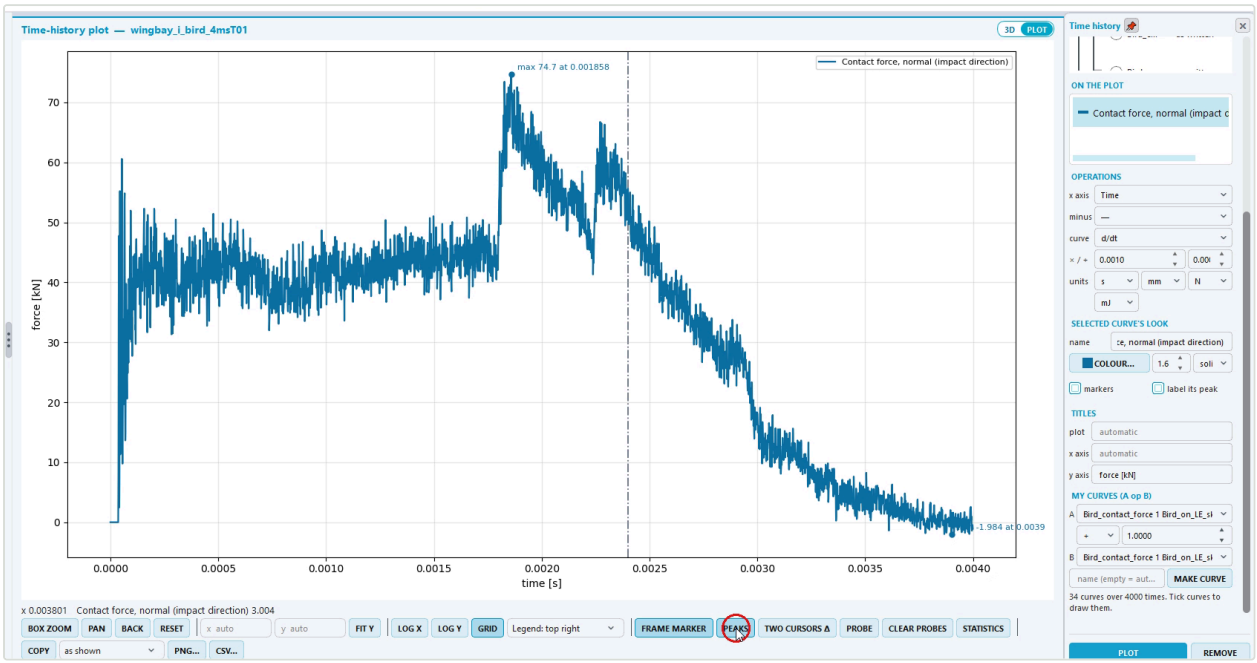


Figure 17.5 — The bird's contact force on a wing bay, with **Peaks** on: the maximum and the last value are labelled. On the right, **SELECTED CURVE'S LOOK** and **TITLES** (the y-axis title typed: force [kN]).

17.5 The probe

Press **Probe**, then click a point on a curve. A label with the curve's name and its x and y stays on the plot. Click more points for more labels; **Clear probes** removes them all. The probe always shows a value the file actually holds, the nearest recorded point, never a value in between.

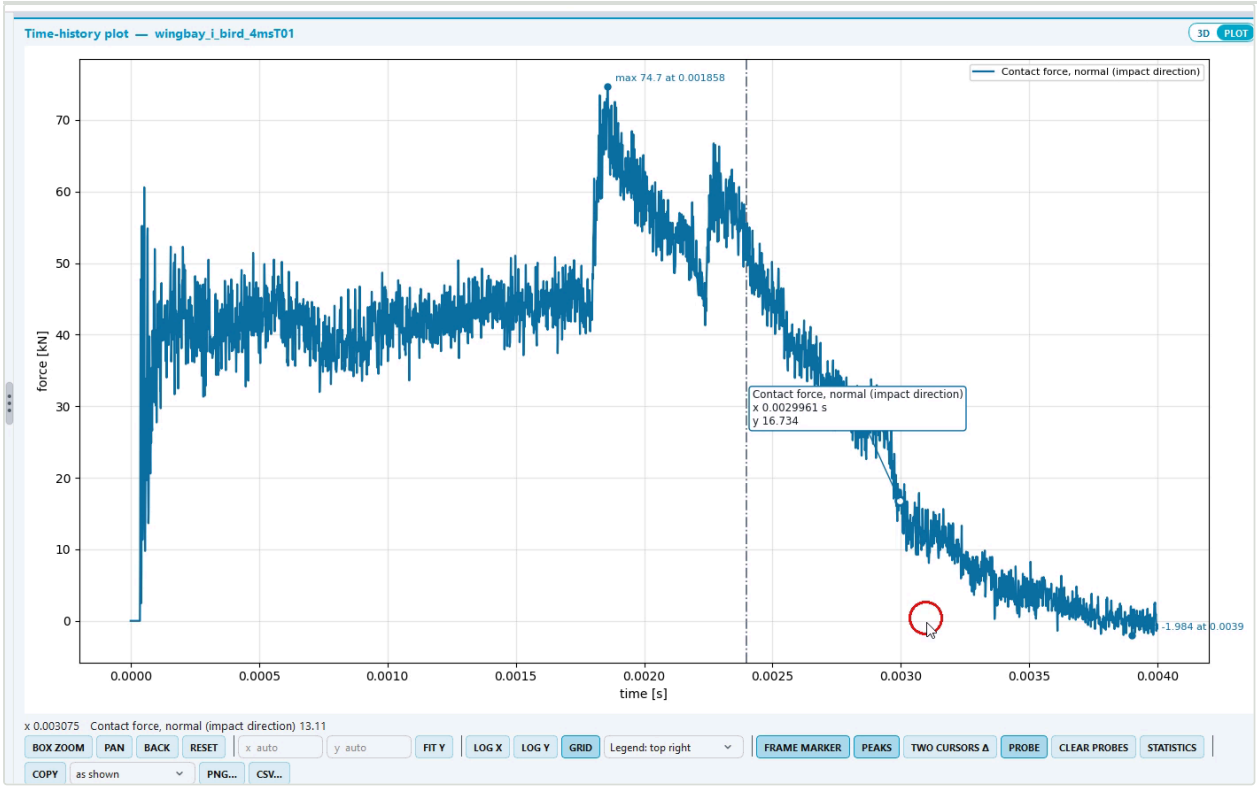


Figure 17.6 — A probe label on the contact force: the curve's name, its time and its value at the nearest recorded point.

17.6 Operations on a curve, and x against y

Under **OPERATIONS**:

- **x axis**: *Time*, or any curve. With a curve on x you plot one value against another, for example force against displacement. **minus** subtracts a second curve from the x curve, like an extensometer between two nodes.
- **curve**: the selected curve *as is*, its time derivative (d/dt) or its time integral ($\int dt$).
- **× / +**: scales the selected curve by a number and adds an offset.
- **units**: four boxes, for time, length, force and energy: the units the values are shown in, for example kN instead of N.

Rigid-body and section forces are written to the file as impulses. The History tool turns them back into forces before showing them, so what you see is a force.

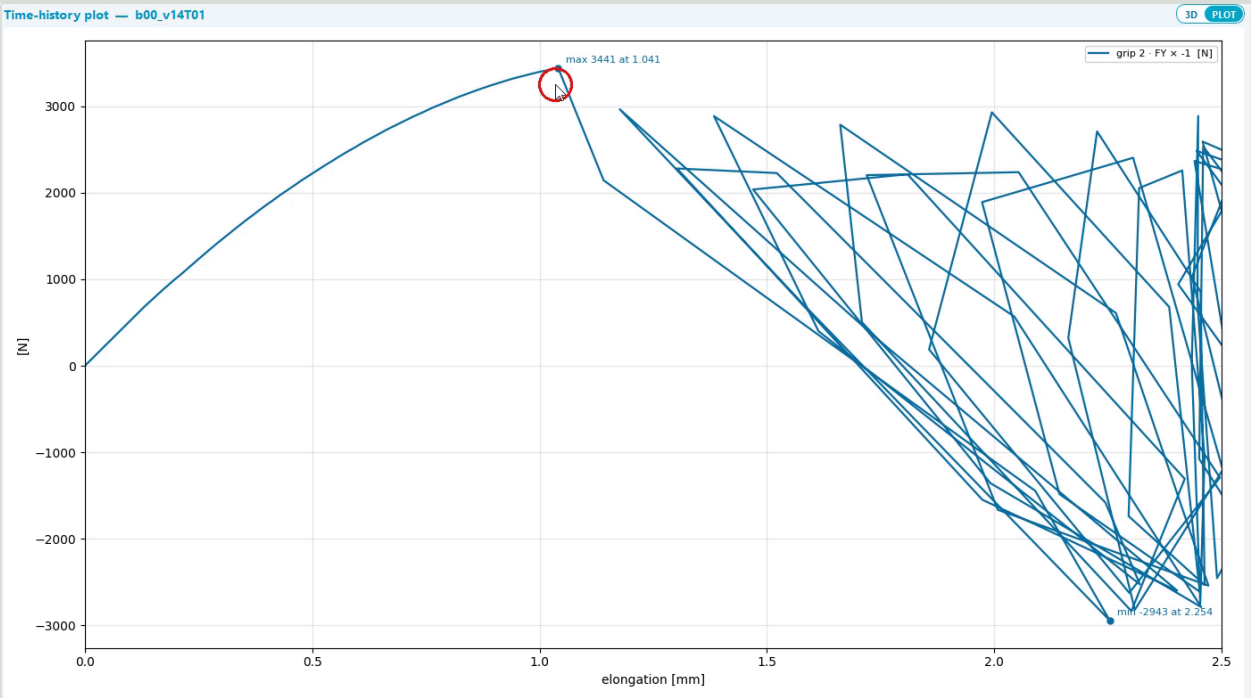


Figure 17.7 — One curve against another: a tensile bar's grip force (y) against the stretch of its gauge (x, a curve made as one node's displacement minus another's). **Peaks** marks the maximum, 3,441 N at 1.041 mm. The bar breaks just after it; from there the gauge nodes spring back and forth, so the line folds back on itself.

17.7 Making curves: A + B, A − B, A × B

Under **MY CURVES (A op B)** choose two curves and an operation: *A* + *B*, *A* − *B*, *A* × *B* or *A* × *a number*, give it a name if you want one, and press **Make curve**. The new curve is listed under **My curves** and works like any other: you can tick it, style it, probe it and use it as x.

- Adding and subtracting need the same kind of value (two forces, two energies); otherwise BeidPrep says why and makes nothing.
- Multiplying combines the units: a force times a displacement gives N·mm.
- Curves of one file share their time points, so nothing is interpolated.

17.8 Statistics

Press **Statistics**: a small table under the plot gives, for every curve on the plot, its maximum and minimum with where they occur, its value at an x you type (**value at x =**), and its average. All of them follow the x range on screen, so zoom in to measure one stretch of the run. The average covers the part of each curve shown, between its first and last point inside the view, and is weighted by time, so unevenly spaced points do not bias it. (The table's heading names the axis range, which can reach a little past the curve's ends.) **Copy table** puts the table on the clipboard.

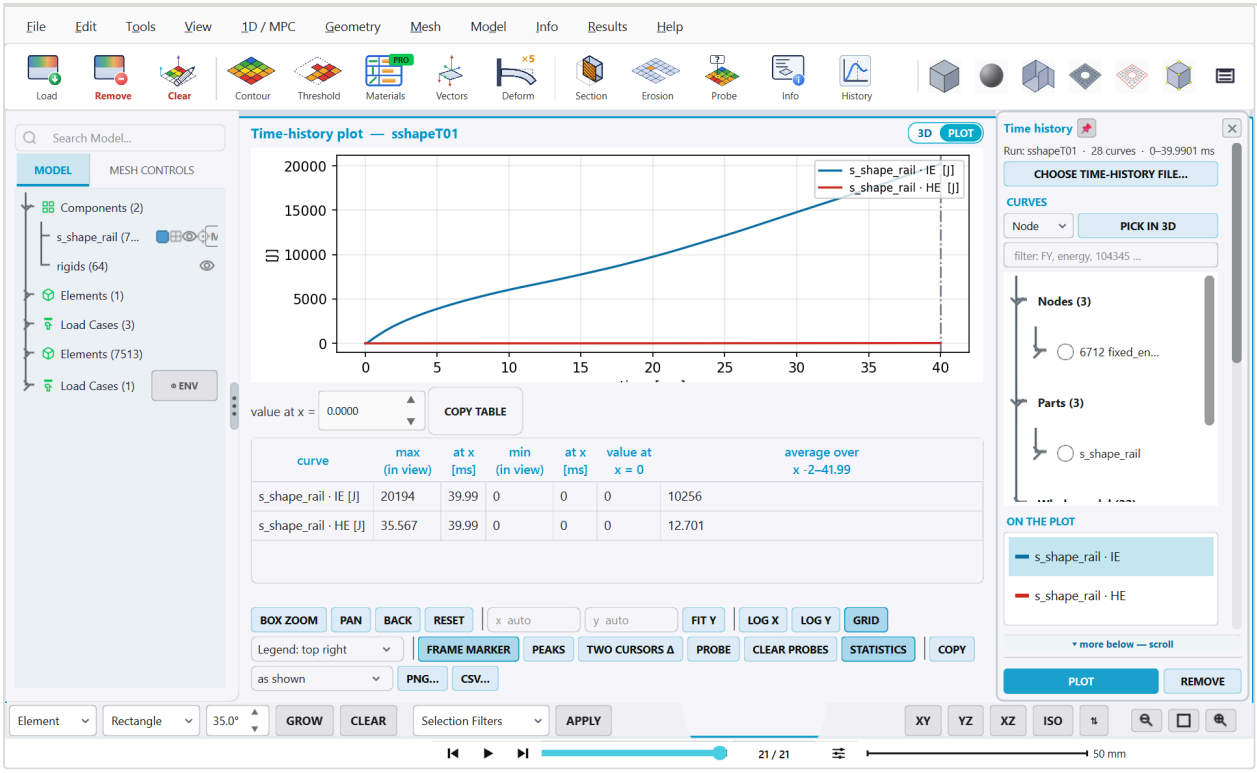


Figure 17.8 — The statistics table under the rail's energy curves.

17.9 Exporting

- **Copy** puts the plot on the clipboard as a picture.
- **PNG...** saves the plot as a picture, as shown or at a size you choose.
- **CSV...** saves exactly the drawn curves as numbers: after any operation, units, scale and offset. Open it in a spreadsheet.

17.10 Known limits in 2.0

- Reading a large time-history file (...T01) needs much more memory than the file's own size while it is read. Close other programs first, or plot a shorter run.
- In the History tool, the curves of contacts, rigid walls, springs and elements are listed as 'var 1', 'var 2' and so on in 2.0. Only nodes, parts, rigid bodies and sections show the names of their variables.

Every control is listed in the reference chapter R17.

→ Every control of these panels, one by one: **Reference R17: the History tool**, page 202

18 Running the analysis

BeidPrep can run your model with your own OpenRadioss, the Starter and then the Engine, and show how the run is going: the time reached, the time left, and the Engine's own time step and energies. When the run ends, open its results as in chapter 13.

18.1 Starting a run

1. Check that the model has a */BEGIN* card with a run name, at least one part, and a */RUN* card with its end time (Tstop). The run name names the files; Tstop is how BeidPrep shows the progress.
2. Choose **Tools** → **Run analysis...**. The window opens over the 3D view, and BeidPrep stays usable.
3. Press **Choose folder...** and pick the folder to run in. BeidPrep remembers it.
4. Set **Threads (-nt)**. **Processes (-np)** can be more than 1 only when Intel MPI is installed; OpenRadioss does not include it. **Extra arguments** are passed to the solver as you type them. These three are remembered for the next run.
5. Press **Run**. BeidPrep exports the model into the folder as *<run name>_0000.rad* (the Starter file) and *<run name>_0001.rad* (the Engine file), with the same checks as **File** → **Export**, then starts the Starter and, if it finds no errors, the Engine.

If the Starter finds errors, the Engine is not started, and the window says how many and to read *<run name>_0000.out*, the Starter's listing, where each error is explained.

A model without a */BEGIN* run name, a part or a */RUN* card is refused, and the window says which is missing. If the drive has less than 100 GB free, the window says so before the run: a crash run can write tens of gigabytes.

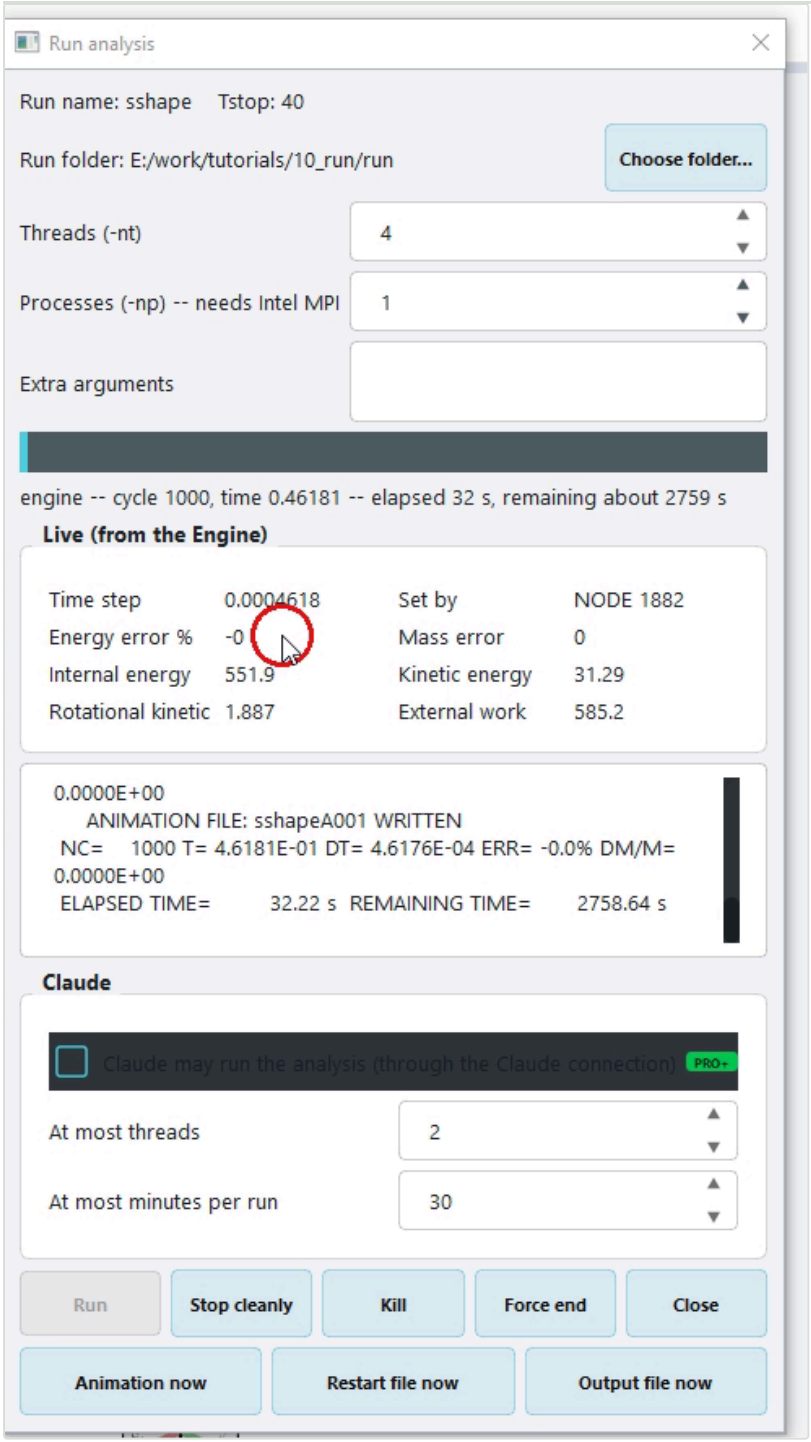


Figure 18.1 — The **Run analysis** window during a run: the progress line, the **Live** box filled by the Engine, and the Engine's last lines.

18.2 Following a run

While the run goes, the window shows a progress bar (the time reached against Tstop), the cycle, the elapsed time and the time left, and the Engine's last lines. The **Live (from the Engine)** box shows what the Engine itself reports, refreshed every few seconds: the **time step** and the element that sets it, the **energy error**, the **mass error**, and the internal, kinetic and rotational kinetic energy and the external work. A growing energy error or mass error is the first sign that a run is going wrong.

Only one run goes at a time.

18.3 Stopping a run, and files on demand

The buttons send the Engine its own control commands. The Engine reads them at its next check, within ten cycles:

- **Stop cleanly**: the Engine ends and writes a restart file.
- **Kill**: the Engine ends without a restart file.
- **Animation now**, **Restart file now**, **Output file now**: the Engine writes that file at once and goes on.
- **Force end**: ends the solver's processes at once, for an Engine that no longer answers.

A run ended with Stop cleanly or Kill still prints *NORMAL TERMINATION* in its listing, followed by *USER BREAK*; BeidPrep reports it as stopped, not finished.

> **Disk space** When a run is stopped or fails, BeidPrep deletes the temporary and restart files that the run itself made, so they do not fill the disk. Results and listings are kept.

18.4 Letting Claude run the analysis (Pro+)

In the **Claude** box, tick **Claude may run the analysis (through the Claude connection)** Pro+ to let Claude start runs (chapter 16). It is off by default. Your limits apply to every run Claude starts:

- **At most threads**: Claude cannot ask for more.
- **At most minutes per run**: a run Claude started that goes on longer is stopped.

Processes and extra arguments are yours alone; Claude cannot set them. Claude runs in the one folder you chose for it in **Tools** → **Connect Claude**.

The controls

#	Control	What it does	Default
1	**Choose folder...**	The folder the run is written to.	the last one
2	**Run name**, **Tstop**	From the model's */BEGIN* and */RUN*; shown, not edited here.	
3	**Threads (-nt)**	Threads for the Starter and the Engine.	the last value
4	**Processes (-np)**	More than 1 only with Intel MPI.	1
5	**Extra arguments**	Passed to the solver as typed.	the last value
6	**Run**	Exports the model and starts the Starter, then the Engine.	
7	**Stop cleanly**, **Kill**, **Force end**	Section 18.3.	
8	**Animation now**, **Restart file now**, **Output file now**	Section 18.3.	
9	**Live (from the Engine)**	Time step and the element that sets it, energy error, mass error, energies, external work.	
10	**Claude may run the analysis** Pro+	Lets Claude start runs (section 18.4).	off
11	**At most threads**	Claude's thread limit.	half the computer's
12	**At most minutes per run**	Claude's time limit.	30
13	**Close**	Closes the window; a run that is going goes on.	

→ Every control of these panels, one by one: **Reference R18: the Run analysis window**, page 207

19 SPH Generator

The SPH Generator fills a shape with SPH particles and creates the cards that go with them. Its **Bird** tab creates a bird strike that matches published tests, in four steps: how big the bird is, how fast it flies, what it hits, and where.

19.1 Opening it

On the **Model** ribbon tab, click **SPH Generator**. The panel opens in the panel column beside the 3D view, on the tab you used last. It has three tabs:

Tab	Edition	What it creates
Standard	Free	A box or a sphere of particles, their property (*/PROP/TYPE34*) and their part. With Pro, also the material and an initial velocity; with Pro+, also a contact.
Fill	Pro	Particles filling a closed shape, up to a level you choose. With Pro+, also a contact.
Bird	Pro+	A complete bird strike: the bird, its material, its speed, the contact with what it hits and the force output.

Every edition shows all three tabs. A tab your licence does not include carries its PRO or PRO+ tag, and its **Create** button is off and says why. Rows your licence does not include are not shown.

19.2 Creating a bird

1. **Bird size.** Choose the bird type, **Gelatin test projectile** or **Chicken**, then **1.8 kg (4 lb)** or another mass.
2. **Speed** in m/s.
3. **What does it hit?** Press **Pick** and click the part.
4. **Flight direction and aim point.** Choose the direction the bird flies in: −X, +X, −Y, +Y, −Z, +Z, **Along current view**, or **Normal to surface** (flat panels only). Then press **Pick** and click the node to aim at.

The panel then says what the bird hits first and at what angle, for example *Hits Panel_skin at 35°*, and what **Create bird** will make: *a 1.8 kg bird, contact with Panel_skin, force output*. Press **Preview** to see the bird in the 3D view, then **Create bird**.

The part you pick in step 3 is already selected in the **Contact** list below (19.5). Add any other part the bird can reach, such as a rib behind the skin.

The bird is placed on the line through the aim point along the flight direction, just before the first surface it would touch, so it never starts inside a part:

- If another part is in the way before the one you picked, the panel names it as a warning. The bird still starts before the first surface it meets.
- If the line never meets the part you picked, **Create bird** is refused with the reason.
- **Normal to surface** is refused on a curved part: choose a direction instead.

Advanced (closed at first) holds the direction as a vector (with **Flip**), the particle spacing, the start gap and the contact gap. They follow the bird type, mass and speed; typing another value puts the bird **Outside tested range** until you change the speed, the mass or the type again. **Reproduce a test case** lists the 16 NASA tests of 19.6: picking one builds that test's whole deck in an empty model (kg, mm, ms) — the bird, the rigid wall, its force output and the run length — exactly as it was run.

One **Create bird** is one step: **Ctrl+Z** removes the bird and every card it made.

19.3 Standard shape

1. Choose **Box** or **Sphere**. A box needs two opposite corners and two nodes along one edge (the box is aligned to that edge); a sphere needs its centre node and a radius.
2. Set the **Spacing** (the distance between particles) and the **Packing** (cubic or hexagonal). The smoothing length is set from the spacing unless you type one.
3. Set the **Density** and press **Create**.

Without Pro, the particles, their property and their part are created, and nothing else: the part has no material, and the panel says *Particles created without a material. Assign one before export.* The export check also names such a part. Add the material, a velocity and a contact as you would anywhere else in BeidPrep.

With Pro, the same tab has the **Total mass** or the **Density** in place of the density row (type one, the other is shown; the density is set so the mass comes out exactly), a **Material** (a new LAW6, or one already in the model) and an **Initial velocity**. With Pro+ it also has the **Contact** section (19.5).

In the beta the material is a new LAW6 or one already in the model. LAW5/JWL (with the detonation setup), LAW3 and LAW2 come after the beta.

19.4 Fill closed shape (Pro)

1. Choose what to fill: closed shell elements, a solid CAD body or a closed CAD surface, and pick it. The panel checks that the shape is closed and shows its volume; an open shape is refused.
2. Of **Fill %**, **Mass** and **Density**, set two; the third is computed. Setting mass and density gives the fill level (*fill to mass*).
3. Pick the fill direction: two nodes (a vector) or three nodes (the normal of their plane); **Flip** reverses it. Particles fill from the low end.
4. For shell elements you can also put particles on the shell nodes.

Spacing, packing, material and velocity work as on the Standard tab; with Pro+ the tab also has the **Contact** section (19.5).

19.5 Contact (Pro+)

All three tabs have a **Contact** section. **Add TYPE7 contact** is on when the panel opens.

1. Choose the parts the particles can hit: select them in the list right under the switch, or press **Pick in 3D** and click them in the 3D view. A click adds the part to the list, and a second click removes it. The selected parts are shown in light orange. A part you remove from the list is out of the contact, even if you clicked it in 3D.
2. Press **Create**. The particles become the secondary side (a node group of all of them). The selected parts become the main side: one segment group of their outer faces, which covers shells and the outside of solids. The gap is set from the particle spacing.

If the contact is on and no part is selected, **Create** is off and the panel says why. Select a part, or switch the contact off to create the particles without a contact.

19.6 Comparison with published tests

Agreement with the cited tests under the stated conditions only. It does not guarantee results for your structure. You remain responsible for verifying your model. Not a substitute for certification testing.

The Bird tab says **Matches tests** only inside a tested band of bird type, mass and speed: gelatin 1.80–1.83 kg at 310–312 m/s or 110–111 m/s; gelatin 1.00–1.01 kg at 49–50 m/s; chicken 1.80–1.83 kg at 308–310 m/s or 107–111 m/s. Between the tested speeds and masses of a type it says **Scaled from tested cases**, everywhere else **Outside tested range**. The same status is written into the cards the bird creates, as comment lines the solver ignores.

What was tested. The measured impact force of 1.82 kg gelatin birds fired at 310 m/s against a rigid Hopkinson bar (NASA/TM-20260001925). The simulated force is filtered the same way as the test's. A test passes when the impulse is within ±5 %, the steady force (mean over 0.3–0.6 ms) within ±15 % and the end of the force pulse within ±15 % of the test. The 110 m/s tests of the same report are compared too, but not judged: their force is recorded only for the first 1.2 ms of a 2 ms impact.

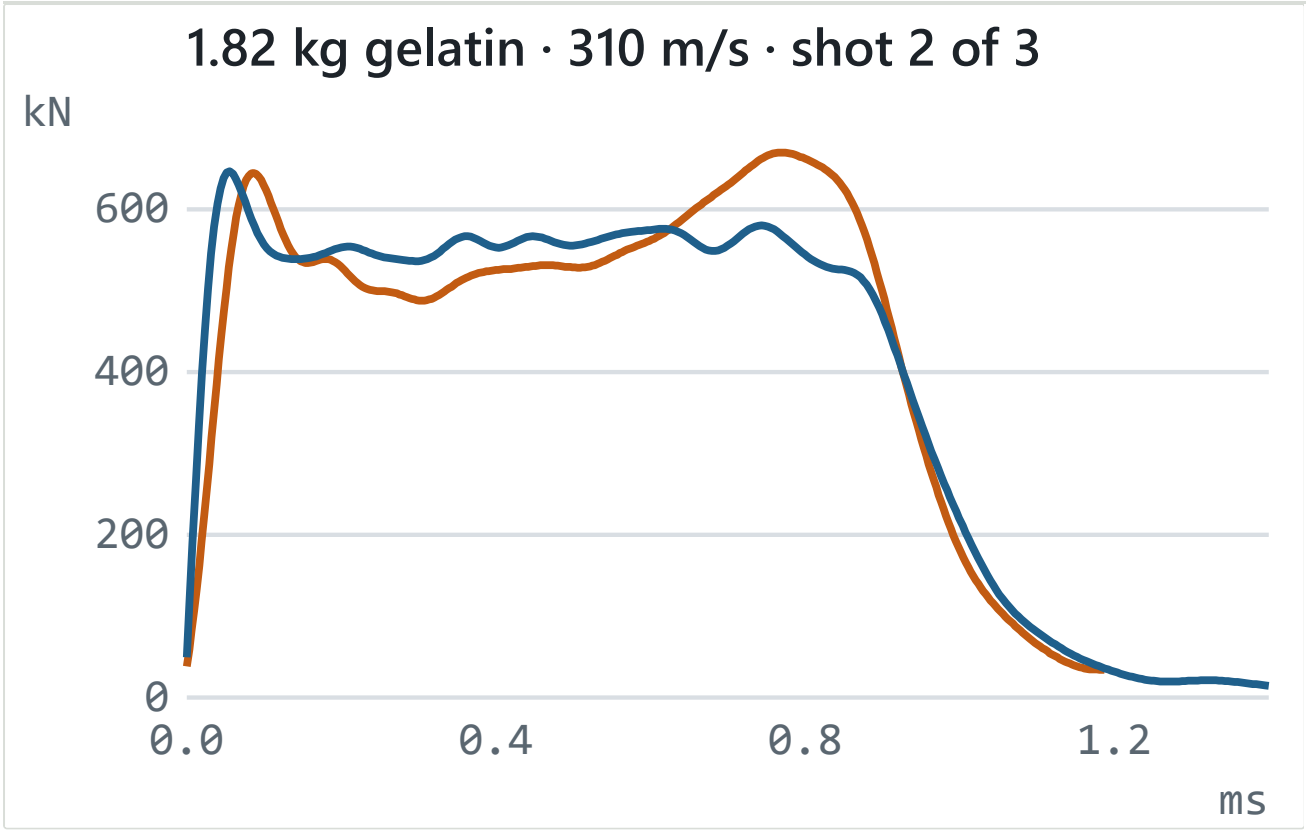


Figure 19.1 — Force against time, 1.82 kg gelatin bird at 310 m/s: the test (orange; source: NASA TM-20260001925, digitised by Beider Simulations) and BeidPrep (blue), both filtered the same way.

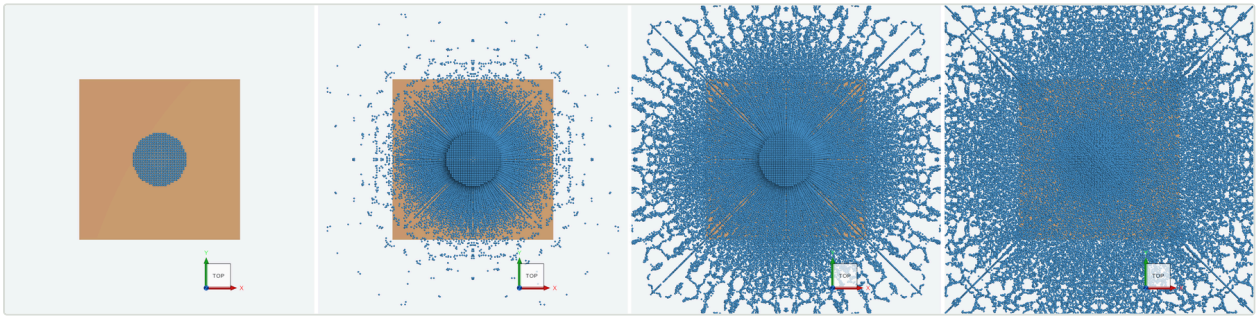


Figure 19.2 — What a correct bird impact looks like in Results: 1.82 kg gelatin bird at 310 m/s, seen along the flight path, at 0, 0.3, 0.8 and 1.2 ms (left to right). The bird (blue particles) arrives on the centre of the wall, flattens and spreads across it in all directions; the wall (tan) is a separate component with its own colour, and hiding it leaves the bird on screen. If the bird and the wall share one colour or one entry in the component list, or the bird looks see-through, the results were not read correctly. The even four-way pattern, with streaks towards the corners, comes from the bird's regular square particle layout and a centred, head-on impact; a real bird splashes less evenly. Made in BeidPrep from the OpenRadioss results.

Results. All three 310 m/s gelatin tests meet the criteria with the bird the panel builds, on the OpenRadioss build BeidPrep ships: impulse +0.5 to +1.5 %, steady force −0.6 to +6.5 %, pulse end +2.5 to +3.0 %. At 110 m/s, where the test records only the first 1.2 ms, the gelatin bird is within −0.4 to −1.3 % on impulse and −6.4 to −12.5 % on steady force (reported, not judged). The bird's material and equation-of-state values are the published ones (Ćwiklak et al. 2022, Table 1). The full report is *Bird strike: comparison with published tests* (Beider Simulations, 2026).

Limits. What is compared is the bird's load on a flat rigid surface, head-on; how a structure responds depends on your model of it. Oblique impacts and deformable targets are outside the tested range.

Real birds. At 310 m/s the real chickens pushed harder than the gelatin test birds. The gelatin bird is 7–13 % below the real chickens' steady force; the chicken bird is 17–26 % above it at 310 m/s and 14–24 % below at 110 m/s. At 49 m/s the 1 kg gelatin bird is within −14.6 to +10.2 % on impulse and −17.6 to +4.8 % on steady force, over the part of the impact the test records.

Sources. Pereira J.M. et al. (2026), *Measurement of Artificial and Real Bird Impact on a Very Rigid Flat Surface*, NASA/TM-20260001925 (measured values used with this citation). Ćwiklak J., Kobiałka E., Goś A. (2022), *Experimental and Numerical Investigations of Bird Models for Bird Strike Analysis*, Energies 15, 3699 (CC BY 4.0; the bird's material values).

→ Every control of these panels, one by one: **Reference R19: the SPH Generator**, page 209

PART II

Reference

Every panel of the program, with every control in it: what it does, its choices and its default. This part is for looking things up, not for reading through: find the panel in the contents or the bookmarks, or follow a link from Part I. Window buttons common to every panel are explained once, in section 3.8.

Reference R3: the main window, menus and dialogs

R3.1 Menu bar

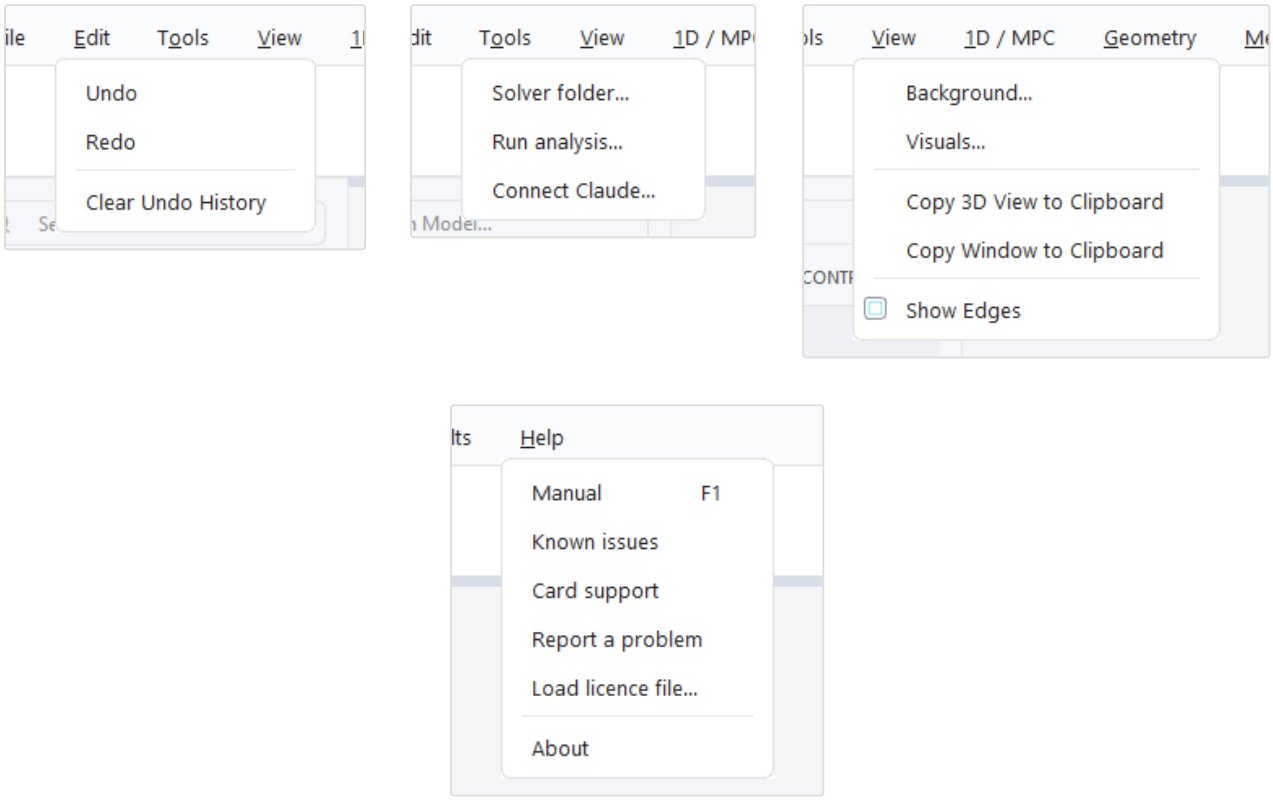


Figure R3.1 — The drop-down menus: Edit, Tools, View and Help.

Menu entry	What it does
Edit → Undo (`Ctrl` + `Z`), **Redo** (`Ctrl` + `Y`)	Takes back the last change, or does it again. Greyed when there is nothing to undo or redo.
Clear Undo History	Forgets every step so far; they can no longer be undone.
Tools → Solver folder...	Where your OpenRadioss is installed (chapter 2).
Run analysis...	Exports the model and runs it with your OpenRadioss (chapter 18, R18).
Connect Claude... Pro+	Your switch for the Claude connection and what Claude may read and change (chapter 16, R16).
View → Background...	The background colours (R3.6).
Visuals...	Light and surface settings (R3.7).
Copy 3D View to Clipboard, **Copy Window to Clipboard**	A picture of the 3D view, or of the whole window, ready to paste into a report.
Theme → Dark, **Light**	The window's colours.
Show Edges	Draws the element edges on the mesh.
Help → Manual	Always the first entry of the Help menu. Opens this manual in your PDF viewer; `F1` does the same from anywhere in the window. If the manual is not installed with your copy, a box says so and gives the website address, *https://beidersim.com/beidprep*.
Known issues, **Card support**, **Report a problem**, **About**	The same windows as the tiles of the **Info** tab (R3.2).
Load licence file...	Loads the licence file you downloaded (section 15.1).

R3.2 Ribbon tabs and tiles

A tab opens its row of tiles. Results tiles are in R13, editing tools in R9. Each tab is pictured below with its tiles numbered left to right; the text after each name is the program's own description, the one you see when you hold the pointer over the tile. The table after the pictures says where each tile is explained.

File

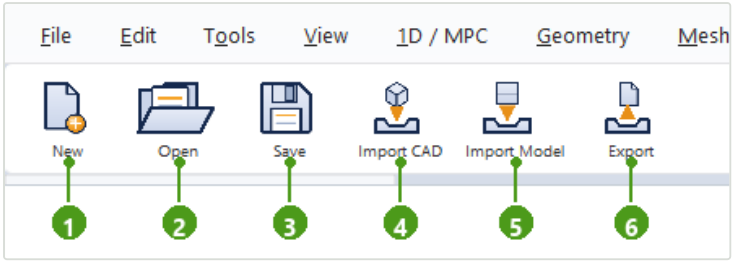


Figure R3.2 — The File tab.

1. **New.** Start a new, empty model. You are asked to save unsaved work first. Shortcut: Ctrl+N
2. **Open.** Open a saved BeidPrep model (.beid). A solver deck (.rad, .k) chosen here is imported. Shortcut: Ctrl+O
3. **Save.** Save the model to its .beid file (a name is asked the first time; Ctrl+Shift+S: Save As). Shortcut: Ctrl+S
4. **Import CAD.** Bring in CAD geometry from a STEP or IGES file, ready to mesh.
5. **Import Model.** Bring in a solver model: an OpenRadioss deck (.rad) or an LS-DYNA keyword file (.k). With a model open, it is added to it. Shortcut: Ctrl+I
6. **Export.** Write the model as an OpenRadioss input deck (.rad), ready to run. Shortcut: Ctrl+E

1D / MPC

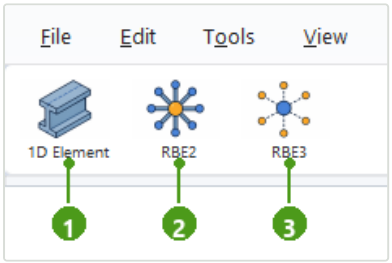


Figure R3.3 — The 1D / MPC tab.

1. **1D Element.** Create beam, truss or spring elements between nodes.
2. **RBE2.** Tie a set of nodes rigidly to one main node, so they move together (RBE2).
3. **RBE3.** Share a load or mass at one node out over a set of nodes, without making them stiffer (RBE3).

Geometry

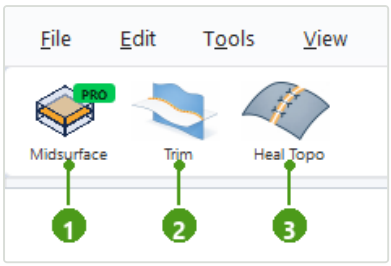


Figure R3.4 — The Geometry tab.

1. **Midsurface.** Make a mid-surface of a thin-walled solid, such as sheet metal, to mesh it with shells.
2. **Trim.** Cut a body with a plane or a face.
3. **Heal Topo.** Clean up CAD before meshing: connect faces that should touch, and tidy the faces around bolt holes.

Mesh

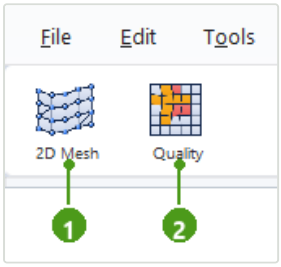


Figure R3.5 — The Mesh tab.

1. **2D Mesh.** Mesh CAD faces with shell elements: set the size, adjust edge seeds, preview, then accept.
2. **Quality.** Check the mesh for poor elements (angles, stretch, collapsed elements) and see where they are.

Model

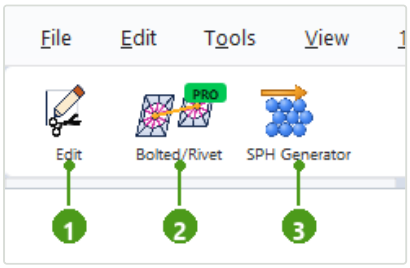


Figure R3.6 — The Model tab.

1. **Edit.** Open the editing tools for nodes, elements and CAD geometry.
2. **Bolted/Rivet.** Connect parts at bolt or rivet holes: finds holes that line up through the parts and joins them with a beam and rigid links.

3. **SPH Generator.** Create SPH particles: a box or sphere, a filled closed shape, or a validated bird for bird-strike.

Info

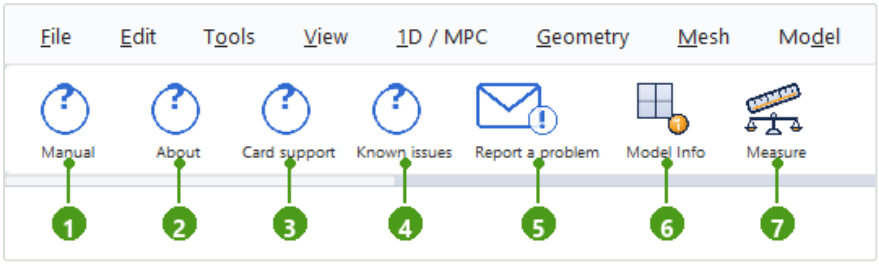


Figure R3.7 — The Info tab.

1. **Manual.** Open the BeidPrep user manual (PDF) in your PDF viewer. Also Help > Manual and the F1 key.
2. **About.** Version, licence and credits.
3. **Card support.** Which card types BeidPrep has checked with the OpenRadioss Starter, for each deck version.
4. **Known issues.** The known problems in this beta that can affect your model or your work, and what to do.
5. **Report a problem.** Report a problem: opens your email program on a message to beidprep@beidersim.com. Please include your BeidPrep version and the steps that reproduce the problem. BeidPrep sends nothing itself.
6. **Model Info.** Statistics of the open model: nodes, elements and more.
7. **Measure.** Measure the distance between two points you click.

Results

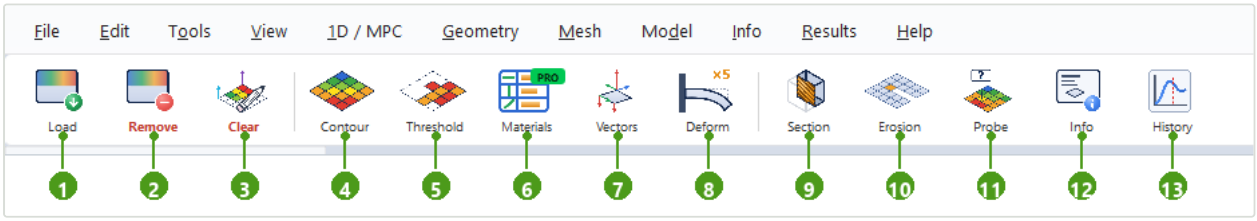


Figure R3.8 — The Results tab.

1. **Load.** Open results to view: a Nastran .op2 file (with its .fem), or OpenRadioss animation files (... A001, A002 ...).
2. **Remove.** Close the results that are open.
3. **Clear.** Clear the result colours, filters and arrows. The deformed shape and the model stay.
4. **Contour.** Colour the model by a result, such as stress or displacement, for the selected load case.
5. **Threshold.** Show only the elements whose result lies in a range you set.

6. **Materials.** Enter each material's strengths, so the results can show safety factors.
7. **Vectors.** Show arrows for displacement or support reaction forces at the nodes.
8. **Deform.** Show the model in its deformed shape.
9. **Section.** Cut the model with a plane to see inside it.
10. **Erosion.** Show, hide or fade the elements that failed during the run, with a count per part.
11. **Probe.** Click a node or element to read its id, position and result values.
12. **Info.** A summary of the model and the selection, which can stay pinned on the 3D view.
13. **History.** Plot the run's time history: reaction forces, energies and other recorded curves over time.

Where each tile is explained

Tile	What it does
File, **1D / MPC**, **Geometry**, **Mesh**, **Model**, **Info**, **Results** (tabs)	Each shows its tiles below.
New	Starts a new, empty model; you are asked to save unsaved work first.
Open	Opens a saved BeidPrep model (*.beid*).
Save	Saves your work as a BeidPrep model (*.beid*).
Import CAD	Brings in CAD from a STEP or IGES file (R4.2).
Import Model	Brings in an OpenRadioss deck (*.rad*) or an LS-DYNA keyword file (*.k*); with a model open, it is added to it (R4.1).
Export	Writes the model as an OpenRadioss deck, ready to run (chapter 12).
1D Element, **RBE2**, **RBE3**	R10.1 to R10.3.
Midsurface, **Trim**, **Heal Topo**	R7.
2D Mesh, **Quality**	R8.
Edit (Model)	Opens the editing toolbar (R9).
Bolted/Rivet	R10.4.
Fibre module Pro+	R14.
SPH Generator (Model)	SPH particles: a box or sphere, a filled closed shape, or a bird for bird strike (chapter 19, R19).
Manual (Info)	Opens this manual in your PDF viewer, the same as **Help** → **Manual** and F1 (R3.1).
About	Version, licence and credits (R3.9).
Card support	Which card types BeidPrep has checked with the OpenRadioss Starter, for each deck version (section 1.2).
Known issues	The known problems of this beta that can affect your work, by area, each with what to do and a reference number (chapter 15).
Report a problem	Opens your e-mail program with a report ready to fill in; BeidPrep sends nothing itself (chapter 15).
Model Info	R3.8.
Measure	R3.10.

R3.3 Display buttons

The column of buttons beside the 3D view. Each shows its present state when you hover over it.

#	Control	What it does	Default
1	**CAD display**	Each click steps through: solid with edges, solid, wireframe.	solid with edges
2	**CAD look**	*Classic* or *Glossy* shading.	Classic
3	**CAD edges**	Plain, or coloured by how they connect: red = open edge (a gap), green = shared by two faces, yellow = by three or more.	plain
4	**Mesh display**	Solid or see-through elements.	solid
5	**Open mesh edges**	Shows in red the shell edges with an element on one side only: gaps and borders. Solids are not checked.	off
6	**CAD points**	Shows or hides the CAD points.	hidden
7	**Camera**	*Orthographic* (no perspective, true proportions) or *Perspective*.	Orthographic

R3.4 Selection bar

Above the 3D view. Chapter 3.4 shows it in use.

#	Control	What it does	Default
1	**What** to pick	*Element*, *Node*, *Part*, *Face*, *Point*, *Surface*, *Edge* or *Solid*.	Element
2	**How** to pick	*Rectangle*, *Circle* or *Lasso* drag; *Pick by Face* (a click takes a whole smooth face); *By Part*.	Rectangle
3	**Angle**	With *Pick by Face*: where the surface bends more than this, the face ends (0 to 89°).	35°
4	**Grow**	Adds the neighbouring elements to the selection.	
5	**Selection Filters**	Keeps only the selected faces of one kind: *Washer Faces*, *Meshed* or *Unmeshed*.	none
6	**ring/hole area ≤**	With *Washer Faces*: how large a face around a hole may be, compared with the hole, to count as a washer ring. 4 suits solid CAD; mid surfaces may need 12 to 20.	4
7	**Apply** (filter)	Applies the filter: box-select faces, choose a filter, then click it.	
8	**XY**, **YZ**, **XZ**, **Iso**, ⇅	Views from the top, the right, the front, an isometric view, and the view turned 180°.	
9	**Zoom Out**, **Fit / Reset view**, **Zoom In**	−, ⊞ and + beside the views.	

R3.5 Right-click in the 3D view

Menu entry	What it does
Delete	Deletes the selection. Nodes no element uses any more go with it; groups lose the deleted members (chapter 9).
Hide, **Isolate**, **Show All**	Hide the selection, show only the selection, show everything again.
Copy (Move to Part…)	Moves the selected elements into another part: a short dialog asks which.
Move Elements to Part dialog	Choose the part, then OK.
Transform…	Moves or turns the selection (the dialog below).
Save to Clipboard	Copies the selection as text: faces as a `/SURF/SEG` card, or the numbers of the elements, nodes or parts.
Delete Selected, **Isolate**, **Show All Bodies**	With CAD faces or bodies selected: delete them, show only them, or show every body again.
Properties…, **Show**, **Promote to /PART →**, **Delete Component**	On a CAD body: its properties (R7.4), show it again, turn it into a part, delete it.

Transform dialog

#	Control	What it does	Default
1	**Operation**	*translate* or *rotate*.	translate
2	**Direction / Axis vector** (x, y, z)	The direction to move along, or the axis to turn about.	1, 0, 0
3	**Magnitude**	mm for a move, degrees for a turn.	1.0
4	**Rotation Center**	The point the turn is about, X Y Z. Shown for *rotate* only.	0, 0, 0
5	**Node ID...**, **Pick from Viewport**	Take the centre from a node number, or from a click in the 3D view.	
6	**Preview Ghost**	Shows where the selection would go, without moving it.	

R3.6 Background

#	Control	What it does	Default
1	**Top Color**, **Bottom Color**	Click to choose; the background fades from top to bottom.	
2	**Default**	Back to the program's colours.	

R3.7 Visuals

#	Control	What it does	Default
1	**Key light**	The directional light that gives form and shadows (0 to 2).	1.3
2	**Fill light**	The light from the camera (0 to 2).	1.3
3	**Shininess**	How glossy surfaces look (0 to 1).	0.35
4	**SPH size**, **SPH opacity**	For SPH particles in results: their size and how solid they look.	1×
5	**Fast points (no lighting — higher fps)**	Draws SPH particles as flat points, for smoother animation.	off
6	**Default**	Back to the values above.	

R3.8 Model Info

#	Control	What it does	Default
1	**Model statistics** table	The source file, the total number of elements and the count of each element type, and the number of cards in each category of the tree.	

R3.9 About and the licence agreement

Control	What it does
Open full third-party notices	The licences of the software BeidPrep includes.
License agreement	The agreement you accepted at the first start.
I accept, **I do not accept**	At the first start: BeidPrep opens only once you accept the licence agreement shown above the buttons.

R3.10 Measure Distance

The selection bar switches to *Point*; click two points on the model.

Control	What it does
Compute	Shows the straight distance between the two points, in mm, in the panel and in the status bar.
Clear Picks	Forgets the points; click two new ones.

R3.11 Buttons on every floating panel

Control	What it does
✕	Closes the panel.
📌 (pin)	Pinned: the panel sits at the right of the window. Click to let it float; click again to pin it back.
_ (minimise)	Folds the panel to a strip; click the strip to open it again.

Before a large delete, a confirmation lists what will go: *Show Details* gives the full list (chapter 9).

R3.12 Boxes, notes and the Notes list

BeidPrep opens a box only when something failed, nothing was made, an export is refused, or it needs an answer. Everything else is a *note*: one line in the status bar, kept in the Notes list.

Control	What it does
Notes (status bar, right)	Reads *Notes: N new* when notes arrived since you last looked. Click it to open the Notes list.
Notes list	Every note of this session, newest last, with its time and where it came from (for example *Preview*). It does not block the window; leave it open while you work. It keeps the newest 300 notes.
Show all hidden messages again	In the Notes list: every box you hid with *Don't show this again* is shown again from now on. The button then says how many.
Don't show this again	In a box that only informs or asks a question with a usual answer (a status message, *Preview still running*, ...): that kind of box stops opening and its text goes to the Notes list instead. For a question, the answer you gave when you ticked it is used from then on, and the note says so. Undo it with **Show all hidden messages again**.
Delete box: **Yes**, **No**	Asked before a delete that would leave a deck that will not run, or may not run; the text says why. **No** is the default. A long list ends with a *more* line and goes on under *Show Details*.
Don't ask me again	In the Delete box: ticked with **Yes**, such deletes stop asking.
Create /BEGIN, **Create /PART ...**, **Close**	In the box *Export — the model is not complete* (or, as a warning that does not stop the save, *parts without a material*, or *parts OpenRadioss will stop on* when a meshed part's thickness is 0): one button for the missing /BEGIN and one for each missing /PART. Each creates its card and opens its form, then reads, for example, */PART 1 created*. Fill the form and export again (chapter 12).

← The task-by-task guide to these panels: **chapter 3, A tour of the interface**, page 30

Reference R4: the file dialogs

R4.1 Import Model

Opens from **File** → **Import Model**. Used in chapter 4.

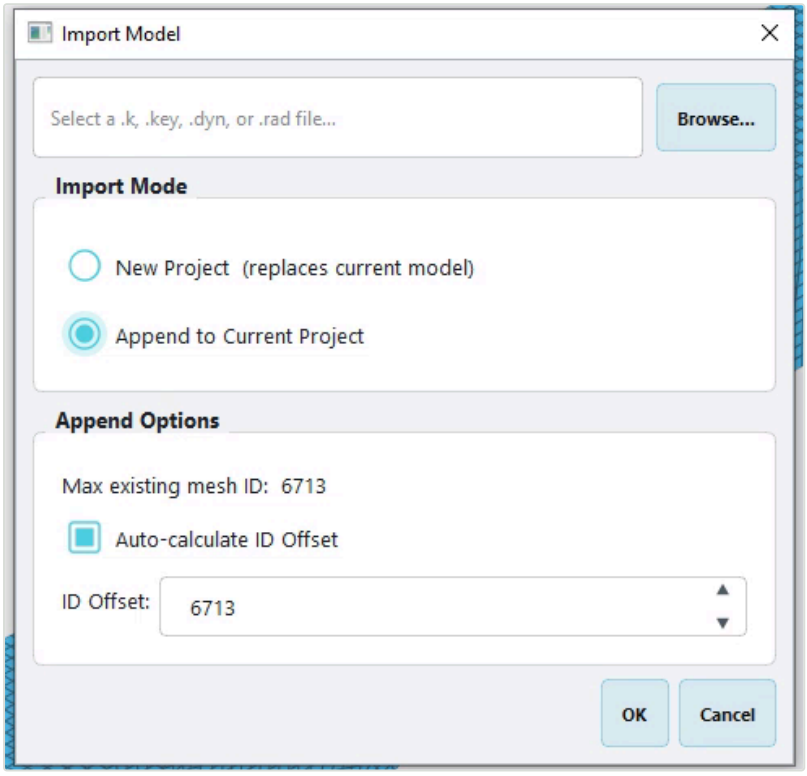


Figure R4.1 — The Import Model dialog, *Append* chosen.

#	Control	What it does	Default
1	**File**	The deck to bring in: an LS-DYNA keyword file (*.k*, *.key*, *.dyn*) or an OpenRadioss deck (*.rad*).	empty
2	**Browse…**	Chooses the file.	
3	**New Project (replaces current model)**, **Append to Current Project**	Open it as the only model, or add it to the open one.	New Project
4	**Auto-calculate ID Offset**	Append only: numbers the added nodes and elements above the highest number already in the model, so nothing clashes. The line above it shows that highest number.	on
5	**ID Offset**	Append, with the box above unticked: the number added to every node and element number of the imported deck.	the highest number

R4.2 Import CAD

Opens from **File** → **Import CAD**. Used in chapter 7.

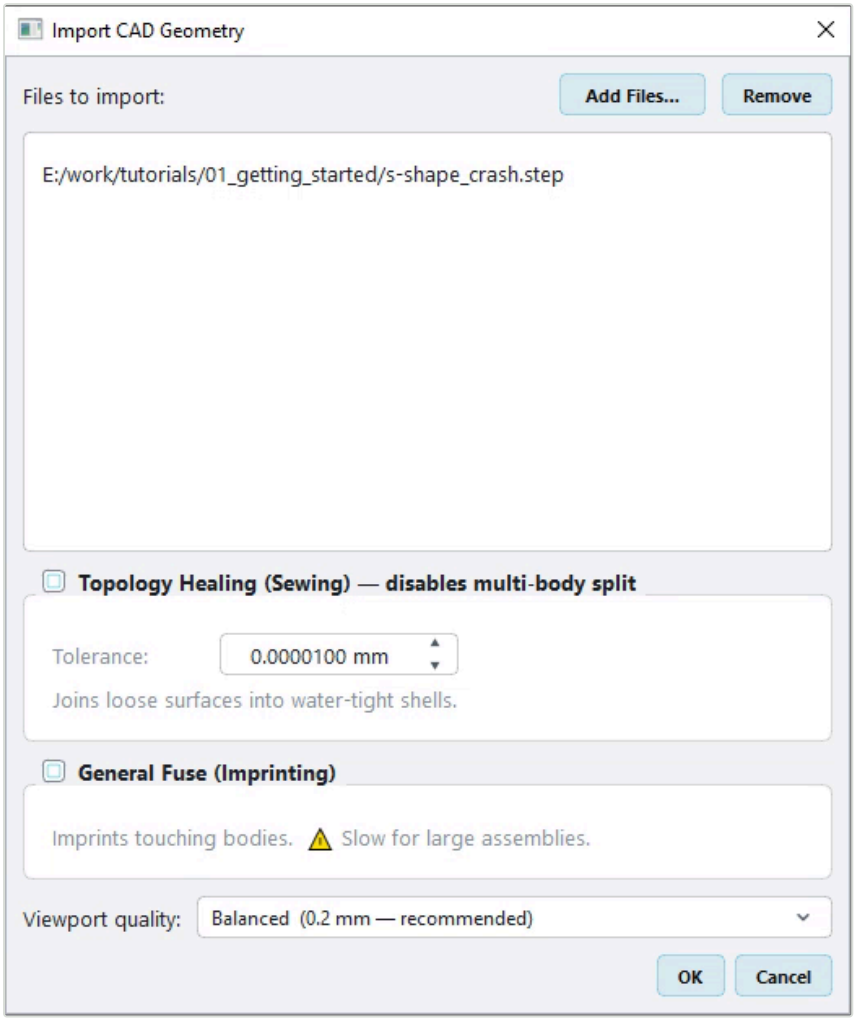


Figure R4.2 — The Import CAD dialog.

#	Control	What it does	Default
1	**Files to import**	The STEP or IGES files to bring in together.	empty
2	**Add Files...**, **Remove**	Add files to the list, or remove the selected one.	
3	**Topology Healing (Sewing)**	Joins loose surfaces into closed shells while importing. It keeps the file as one body instead of splitting it into several.	off
4	**Tolerance**	How far apart two edges may be and still be sewn.	0.00001
5	**General Fuse (Imprinting)**	Imprints bodies that touch onto each other, so their meshes can share nodes. Slow for large assemblies.	off
6	**Viewport quality**	How finely the CAD is drawn: *Fast* (0.5 mm, smoothest rotation), *Balanced* (0.2 mm) or *Fine* (0.05 mm, accurate curves, slower).	Balanced

← The task-by-task guide to these panels: **chapter 4, Opening and saving decks**, page 36

Reference R5: the model tree

R5.1 The tree and its row buttons

#	Control	What it does	Default
1	**Search Model...**	Shows only the rows that match what you type.	empty
2	**Model tree**	Every card of the model, by category. Click a row to open its card (R6); right-click for the menus below.	
3	**MESH CONTROLS** tab	The mesh recipes: one row per set of faces meshed with the 2D Mesh panel.	
4	**Eye**	Shows or hides the row's part, group or body. A group's eye shows or hides everything in it. The buttons of a row appear when the mouse is over it.	shown
5	**Colour square**	Changes the colour of the part, body or connector.	
6	**Mesh style**	How the part's mesh is drawn: surface, wireframe, or surface with edges. Each click steps on. On a results part it shows or hides the mesh lines.	
7	**CAD style**	How the part's CAD is drawn: solid with edges, solid, see-through or hidden. Greyed when the part has no CAD.	
8	**Rigid elements** eye	Shows or hides all rigid (1D) elements at once.	shown
9	**Fibre mark**	On a fibre part: its fibre state; click it for the fibre menu (R14.5).	
10	**Isolate** (results)	Shows only this part; click again to show all.	
11	**M** (results)	Opens the part's material strengths (R13.3).	
12	**Envelope** (results)	On: tick several static load cases to see their worst value combined. Off: one load case at a time. Modal and PSD results are always one at a time.	off

R5.2 Right-click menus in the tree

Menu entry	Where	What it does
Hide, **Show**, **Isolate**, **Show All**	a card row	Hide or show that part or group, show only it, or show everything.
Change Color	a card row	The part's colour.
Change Mesh Style	a card row	Steps through surface, wireframe, surface with edges.
CAD View Mode	a part or CAD body	How its CAD is drawn.
Set as Active Part	a part	New elements made by the meshing and editing tools go into it.
Delete	a card row	Deletes the card; references to it are cleared first, so nothing points at a card that is gone (chapter 9). `Delete` does the same.
Properties…, **Change Colour…**, **Promote to /PART →**, **Delete Component**	a CAD body	As in R7.4.
Show All Connectors, **Rename…**	a connector part	Show every connector; give the part a new name.
Add Component	the Items heading	Adds an empty component (an item) to put CAD bodies in.
Item and the card list	empty space	A new card: choose a category, then the keyword. Only the keywords the deck's version accepts are offered.
New Mesh Control…	the MESH CONTROLS heading or tab	Opens the 2D Mesh panel (R8.1).
Edit Recipe…	a mesh control	Opens the 2D Mesh panel with that recipe's settings.

← The task-by-task guide to these panels: **chapter 5, The model tree and visibility**, page 41

Reference R6: the card editor

Opens when you click a card in the tree. Used in chapter 6.

R6.1 The card bar



Figure R6.1 — The card bar of a material card.

#	Control	What it does	Default
1	**Card name**	The keyword and number of the open card.	
2	**Text**, **Form**	Shown for a card whose fields BeidPrep has not all proven with the Starter. *Text*: the card's own lines with a column ruler; proven fields as usual, unproven ones in red, and what you type there is written exactly as typed. *Form*: the proven fields only. Every card holding edits in unproven fields is listed at export.	Text for such a card
3	**Type** button	On a material or property: changes the card's type within its family. The number and title are kept, and you see what is carried over first (R6.4).	
4	**+ FAIL / EOS** ▾	On a material: adds an extra card to it, such as a failure model or an equation of state.	
5	_, ✕	Minimise the panel to a strip, or close it (R3.11).	

R6.2 The form

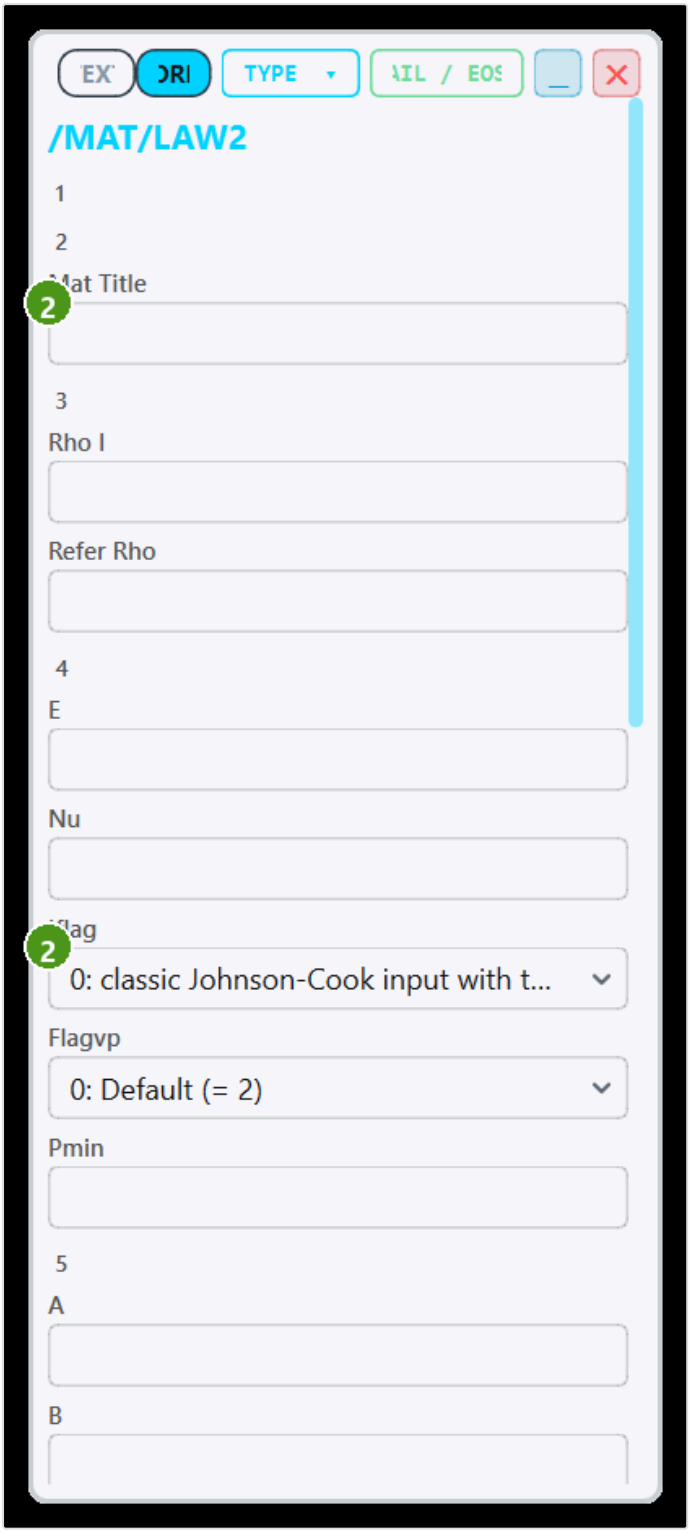


Figure R6.2 — A material card in the form.

#	Control	What it does	Default
1	**Keyword-line boxes**	The numbers on the card's keyword line, such as the card's own number.	
2	**Field boxes**	One per field, in the card's order, each with its label; hover over a label for the field's meaning. A field with set choices is a drop-down that shows each choice in words. A field that names another card is a list of the model's cards of that kind, each with its number and title; with no card of that kind yet, or more than 500, it is a plain box for the number. Node and element numbers are always typed.	as in the file
3	→ (reference)	Beside a field that points at another card: shows that card's values below.	
4	**+ Add line**	For a list of lines (a curve, a list of numbers): adds an empty line at the end.	
5	✕ (line)	Removes that line; `Ctrl`+`Z` brings it back.	
6	**Data table**	For a card with many lines (nodes, elements, group members): its lines in a table; large cards show the first 500.	
7	**View All … Items**	Opens every line in a window of its own, with a search box. Read only.	
8	**Add from Selection**, **Clear All**	On a group: adds what is selected in the 3D view, or empties the group.	
9	**Open Function Editor**	On a function (`/FUNCT`): opens its editor (R6.3).	
10	**⬇ Convert back to Item**	On a part made from a CAD body: removes its `/PART` card and makes it a plain item again.	
11	**ID**, **Name**, **Color**, **⬆ Change card to /PART**	On an item: its number (read only), its name, its colour, and turning it into a part.	

A card BeidPrep has no form for opens as its plain lines (R6.2 row 6), editable as text.

View All window

Control	What it does
Search	Shows only the lines that contain what you type.
Lines table	Every line of the card.

R6.3 Function Editor



Figure R6.3 — The Function Editor.

#	Control	What it does	Default
1	**Points** table	The X and Y values. `Ctrl` + `V` pastes columns copied from Excel.	
2	**+ Row**	Adds a point.	
3	**Import Excel**	Reads the points from an Excel file.	
4	**Digitize**	Takes points from a picture of a plot (below).	
5	**Refresh Plot**	Redraws the curve from the table.	
6	**Edit Points (Drag)**	Opens the curve in a window where you drag the points; **Done** brings them back.	
7	**Save & Close**	Writes the points into the card.	

Plot Digitizer

Six steps, each named at the top of the window: load the picture; click two points on the X axis and two on the Y axis, typing each one's value; then click the points on the curve (green marks).

Control	What it does
Load Image	Opens the picture of the plot.
Undo Last Point	Removes the last click.
Done (digitizer)	Puts the points in the table.
Done (drag window)	Closes the drag window of row 6 and keeps the moved points.

R6.4 Change type

#	Control	What it does	Default
1	**Types** list	The other types of the card's family; hover for what each is.	
2	**Carried over**, **Dropped**	What the new type keeps (each value, from and to), and what it cannot keep, with the reason. Nothing changes yet.	
3	**Change type**	Changes it. One `Ctrl` + `Z` takes it back.	

← The task-by-task guide to these panels: **chapter 6, The card editor**, page 44

Reference R7: the CAD panels

The **Geometry** ribbon tab holds **Midsurface**, **Trim** and **Heal Topo**. The CAD tools for holes and washers are in the editing toolbar (R9.10, R9.11).

R7.1 Midsurface (Pro)

Opens from **Geometry** → **Midsurface**. Used in chapter 7.

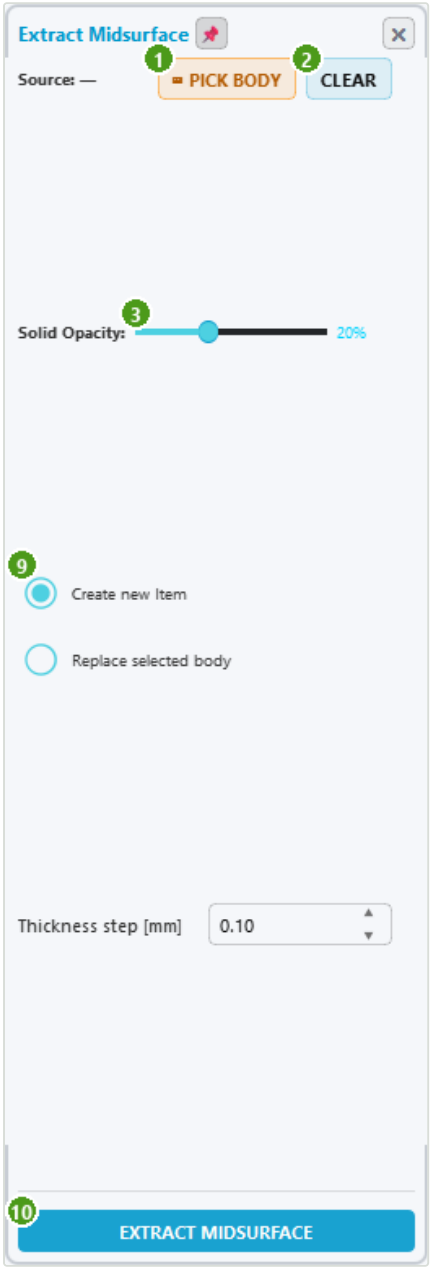


Figure R7.1 — The Midsurface panel.

Makes the mid-surface of a thin-walled solid — sheet metal or a ribbed moulded part — so it can be meshed with shells.

#	Control	What it does	Default
1	⊕ **Pick Body**	Click it, then click the solid in the 3D view; *Source* shows its name.	
2	**Clear**	Forgets the picked solid.	
3	**Solid Opacity**	How see-through the solid is drawn while you work (5 to 50 %), so the new surface shows inside it.	20 %
4	**Create new Item**, **Replace selected body**	Keep the solid and add the mid surface as a new body, or put the mid surface in the solid's place.	Create new
5	**Extract Midsurface**	Runs it. The work runs in the background; the status bar reports when it ends.	
6	**Stop**	Shown while it runs: ends the run.	
–	**Thickness step [mm]**	Each wall's median measured thickness is rounded to this step; walls with the same rounded value form one thickness group. Greyed out once the run has made its parts: for another step, press **Ctrl+Z** (it removes the mid-surface and its parts), set the step and run **Extract Midsurface** again.	0.10
–	**Thickness groups**	Shown after a run: one row per group, for example *Rib_4_t2.5 — 2.5 mm, 3 walls, 12 faces*. When the run ends every group is already its own part and shell property with that name (material empty), all in one subset per body (*midsurface_Rib_4*); meshing fills them (section 7.2). The row *Rib_4_t_unknown* lists faces with no measured thickness: their part's thickness is 0 until you type it in the property's form.	
7	Result line	Shown after a run if something could not be made: *N region(s) LEFT OUT — no midsurface there* (orange in the view) and/or *N wall(s) made but NOT JOINED* (magenta).	
8	Region list	Each left-out region: name, reason, area in mm² and where it is. Click a row and the view flies to it.	
9	**Show in 3D**	Shows or hides the left-out regions on the model.	

R7.2 Trim

Opens from **Geometry** → **Trim**. Used in chapter 7.

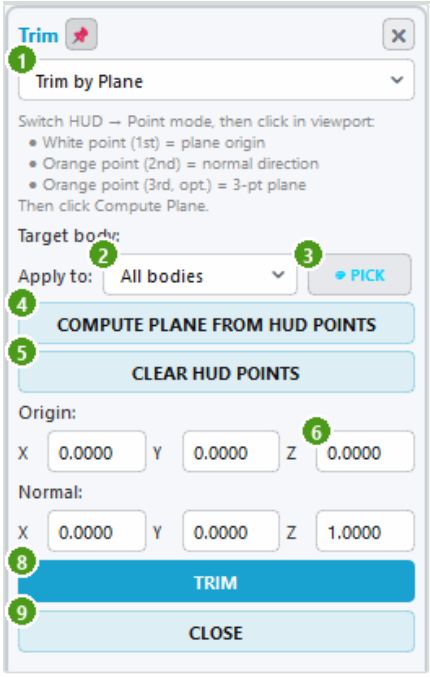


Figure R7.2 — The Trim panel, *Trim by Plane*.

Cuts a body with a plane, or with the plane of a flat face.

#	Control	What it does	Default
1	**Trim by Plane**, **Trim by Face**	Cut with a plane you define, or with the plane of a flat face you pick.	Trim by Plane
2	**Target body** (**Apply to**)	The body to cut, or *All bodies*.	All bodies
3	⊕ **Pick**	Click it, then click a body in the 3D view to choose it.	
4	**Compute Plane from HUD Points**	Fills *Origin* and *Normal* from three points picked with the selection bar set to *Point*.	
5	**Clear HUD Points**	Removes the picked points from the view.	
6	**Origin**, **Normal**	A point on the cutting plane and the direction it faces, X Y Z each.	0,0,0 and 0,0,1
7	**Pick Trim Face**	Trim by Face: click it, then a flat face; its plane shows as an orange rectangle. A curved face is refused.	
8	**Trim**	Cuts the body.	
9	**Close**	Closes the panel.	

R7.3 Heal Topo

Opens from **Geometry** → **Heal Topo**, a short menu. Used in chapter 7.

Menu entry	What it does
Heal face-soup topology (graduated sewing)	Connects the faces of freshly imported CAD that should touch but do not. Opens the dialog below.
Repair Chamfer-Projected Holes	Replaces rough hole outlines left by the mid-surface tool with clean circles. Use before meshing.
Consolidate Fragments	Removes the small leftover faces around each bolt hole, keeping every hole at its exact size. Use before meshing and before a multi-hole Washer.

Heal Topology dialog

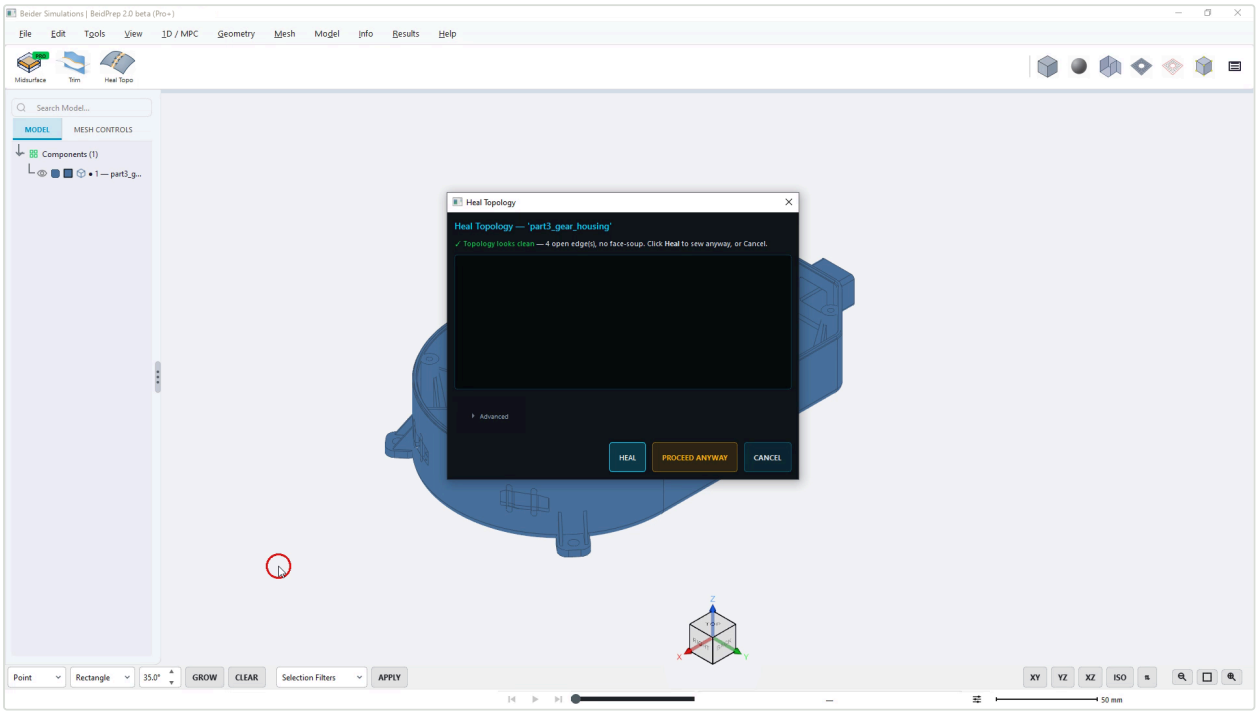


Figure R7.3 — The Heal Topology dialog, *Advanced* open.

Heal works only on CAD as imported; a mid surface or an already healed body needs none. With several such bodies the program first asks which one.

#	Control	What it does	Default
1	**Log**	What the analysis found, and later what the healing did. A failed heal says so here.	
2	**Advanced**	Shows the settings below.	closed
3	**Face-soup verdict**	Whether the body is a loose collection of faces, and the figures behind that.	
4	**Gate threshold (adjusted free-edge ratio)**	The share of open edges above which the body counts as loose faces (0.01 to 0.50).	0.10
5	**Fragment overlapping faces (BOPAlgo_Builder)**	Also splits faces where they overlap. Slow.	off
6	**Heal**	Sews the faces, trying finer tolerances first, in the background.	
7	**Proceed anyway**	Leaves the body as it is and lets meshing go on.	
8	**Cancel**	Closes the dialog; nothing changes.	

R7.4 CAD body properties

Opens from a right-click on a CAD body in the 3D view → **Properties...**

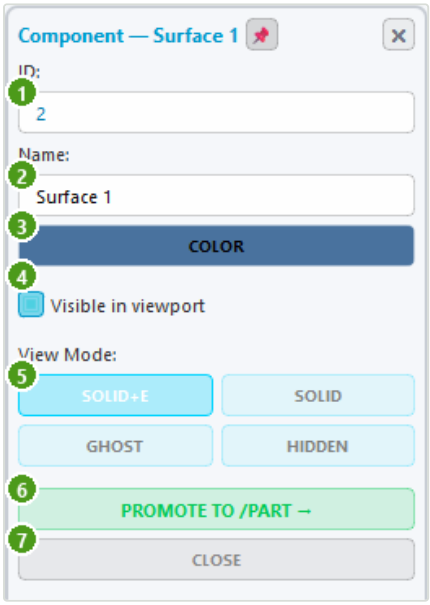


Figure R7.4 — The properties of a CAD body.

#	Control	What it does	Default
1	**ID**	The body's number. Read only.	
2	**Name**	The body's name, as the tree shows it.	
3	**Color**	Opens a colour chooser for the body.	
4	**Visible in viewport**	Shows or hides the body.	on
5	**Solid+E**, **Solid**, **Ghost**, **Hidden**	How the body is drawn: solid with its edges, solid only, see-through, or not at all.	
6	**Promote to /PART →**	Turns the body into a part of the model, with its name.	
7	**Close**	Closes the panel.	

← The task-by-task guide to these panels: **chapter 7, Importing and preparing CAD**, page 49

Reference R8: the meshing panels

R8.1 2D Mesh Setup

Opens from **Mesh** → **2D Mesh**. Used in chapter 8.

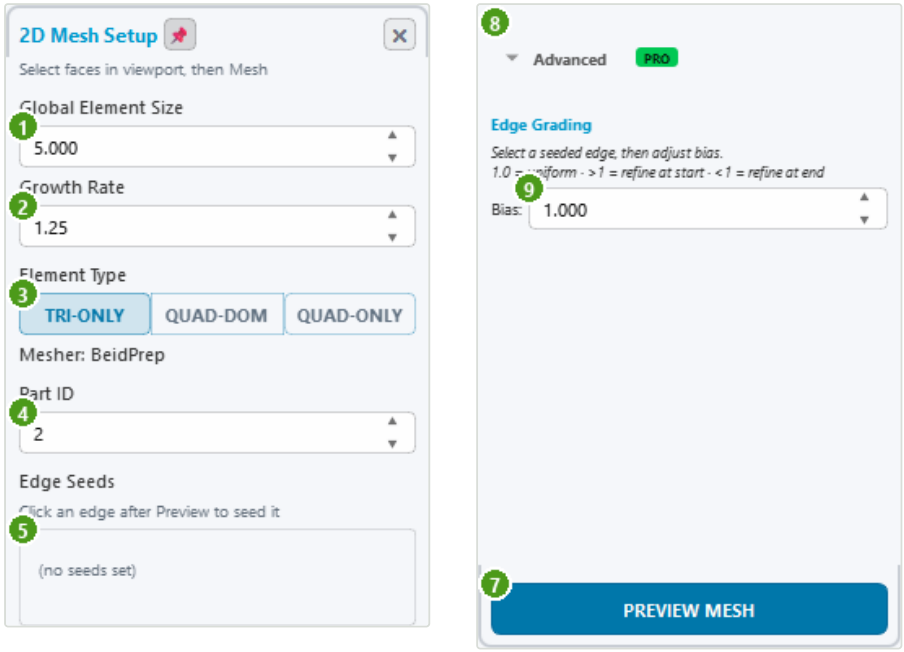


Figure R8.1 — The 2D Mesh Setup panel, *Advanced* open. It is one tall panel, shown in two halves: the top down to *Edge Seeds* on the left, and from *Advanced* onward on the right.

#	Control	What it does	Default
–	**Mesher: BeidPrep**	A heading, not a choice: every mesh is made with BeidPrep's own surface mesher (chapter 8.6), Element Fill and the seed-edit re-mesh included. If the mesher cannot load, a red line under it says *BeidPrep's mesher cannot be loaded (reason) -- meshing is not possible*.	
1	**Global Element Size**	The target length of an element edge, in model units.	5.0
2	**Growth Rate**	How fast elements grow from small to large away from refined areas: 1.05 very gradual (more elements), 2.00 abrupt. 1.25 suits crash and impact.	1.25
3	**Tri-Only**, **Quad-Dom**, **Quad-Only**	The element type: triangles only; quads with triangles where a quad would be poor; quads only, though it may leave a few triangles where an all-quad mesh isn't possible.	Tri-Only
4	**Part ID**	The part the new elements go into.	the next free part number
5	**Edge seeds** list	Every edge you seeded, with its node count *N* and bias. Seed an edge by clicking it after *Preview Mesh* (chapter 8.3).	empty
6	**Clear Seeds**	Removes every seed. Shown once an edge is seeded.	
7	**Preview Mesh**	Meshes the selected faces on screen, without adding the elements to the model. After a change of setting the panel asks you to preview again.	
–	**Stop** (in place of Preview Mesh)	Shown while a Preview runs. Discards the unfinished Preview and replaces the mesh process; your model is not changed. A Preview that runs long also asks, in a *Preview still running* box, whether to **Keep waiting** or **Stop**; the box has *Don't show this again* (R3.12).	
–	**Replace the mesh**, **Cancel** (above Preview Mesh)	Shown when you preview a body that already has a mesh from before the model was opened: *Body X already has a mesh (n elements in part P). Replace it? Replace the mesh* previews again, and Accept then deletes the old elements and the nodes no other element uses before it adds the new mesh; one Ctrl+Z brings the old mesh back. *Cancel* keeps the old mesh and meshes nothing. When a re-mesh is refused, the same red line says why, with no buttons (15.5, ref. P641 and P642).	
8	**Advanced** Pro	Opens or closes the advanced settings below: one setting, *Bias* (9), under *Edge Grading*. It is Pro: in the Free edition it still opens, so you can read it, but the setting is greyed out.	closed
9	**Bias**	For the seeded edge selected in the 3D view: 1.0 spaces its nodes evenly; values away from 1 crowd them towards one end (0.05 to 20).	1.0

#	Control	What it does	Default
10	**Accept**	Adds the previewed mesh to the model and runs the mesh check (chapter 8.4).	
11	**Accept → Reselect**	Accepts, and lets you select the next faces straight away.	
12	**Cancel**	Discards the preview; nothing is added.	

> **Trap** *Tri-Only* is the starting choice. For a quad mesh, choose *Quad-Dom* or *Quad-Only* before the first preview.

R8.2 Mesh Quality Check

Opens from **Mesh** → **Quality**. Used in chapter 8. It can stay open while an editing panel is used; its colours and figures follow every mesh edit (section 8.5).

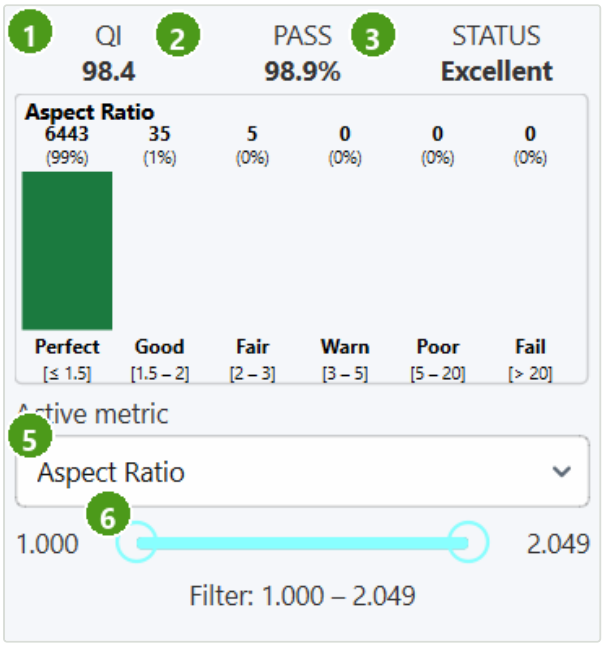


Figure R8.2 — The Mesh Quality Check panel, metric *Aspect Ratio*.

The check runs by itself when the panel opens; there is no Run button. While the panel is open the CAD is hidden and the elements are coloured from green (good) to red (poor) for the chosen metric.

#	Control	What it does	Default
1	**QI**	Quality index, 0 to 100: every element scores by its worst metric (100 perfect, 85 good, 65 fair, 45 warning, 25 poor, 0 fail) and QI is the average.	
2	**PASS**	The share of elements that are perfect, good or fair.	
3	**STATUS**	QI in words: *Excellent* (90 and over), *Good* (75), *Acceptable* (60), *Cleanup* (45), *Issues* (below 45).	
4	**Histogram**	How many elements fall in each quality band of the chosen metric, with the count and the share above each bar.	
5	**Active metric**	The metric shown: *Aspect Ratio*, *Skew*, *Warpage*, *Taper*, the smallest and largest interior angle of quads and of triangles, *Jacobian (Gauss)* and *Jacobian (Corner)*.	Aspect Ratio
6	**Range slider**	Drag either end: elements outside the range are hidden in the 3D view as you drag, so only the ones you are looking for stay. The numbers at its ends show the range; the line under it what is filtered.	the whole range

Closing the panel shows the CAD again and restores the normal colours.

← The task-by-task guide to these panels: **chapter 8, Meshing**, page 54

Reference R9: the mesh editing panels

The editing toolbar opens from **Model** → **Edit**. Its **MESH** tab holds the node and element tools, its **TOPO** tab the CAD tools. A tool's panel opens under the tiles; the previous panel is hidden, not closed, so its settings stay as you left them.

Tile	What it does	Panel
Create (MESH, Node)	Creates nodes: at typed coordinates, between two nodes, and more.	R9.1
Equiv. (MESH, Node)	Merges nodes that lie closer than a tolerance.	R9.2
Move (MESH, Node)	Moves nodes by dragging them.	R9.3
Align (MESH, Node)	Lines nodes up on a straight line.	R9.4
Project (MESH, Node)	Moves nodes onto a plane or a CAD face.	R9.5
Combine (MESH, Element)	Joins two triangles into one quad.	R9.6
Split (MESH, Element)	Splits a quad into two triangles.	R9.7
Fill (MESH, Element)	Fills a gap in the mesh with new elements.	R9.8
Normals (MESH, Element)	Turns the shells of a connected area all the same way.	R9.9
Washer (TOPO, Edge)	Adds a ring of faces around bolt holes.	R9.10
Defeature (TOPO, Face)	Removes holes smaller than a size you set.	R9.11

R9.0 Controls every editing panel shares

These are explained once here and not repeated in each panel's table.

Control	What it does
? beside the title	Writes what the tool still needs into the report line, for example *Needs: two nodes for the line*.
Mode buttons	The row of buttons under the title (for example *Two nodes* / *Two points*). One is chosen at a time; the rows below change with it.
Pick row	A labelled box that collects what you click in the 3D view: nodes, points, elements or a CAD face. The box lists what was picked.
Pick	Arms its row: the next clicks in the 3D view go into this row. `Tab` moves to the next row. The first row is armed when the panel opens.
×	Empties its row.
path	Element Fill only. On: each click extends a chain of nodes along the mesh edges from the last node, so a run of nodes takes two clicks instead of one per node.
(select body)	The CAD body to work on. Click it for a list of the bodies.
Pick (body)	Click it, then click a body in the 3D view.
Needs line	What the tool still needs before it can run, for example a node to pick.
Apply	Runs the tool. Its text names the action (*Create*, *Align to line*, *Split* ...). It stays off until the tool has what it needs; hover over it to read why. A tool that acts on the click itself has none.
Report line	The latest result in one line, for example *412 of 480 nodes projected, 68 outside target*. Hover over it to read a long message whole.
Report	Opens the history of the panel's messages under the report line. *Report (3)* means three messages arrived that you have not opened.

Every tool's change is one step of **Undo** (`Ctrl` + `Z`). `Esc` clears what the panel has picked.

R9.1 Node Create

Opens from **Model** → **Edit** → **MESH** → **Node** → **Create**. Used in chapter 9.

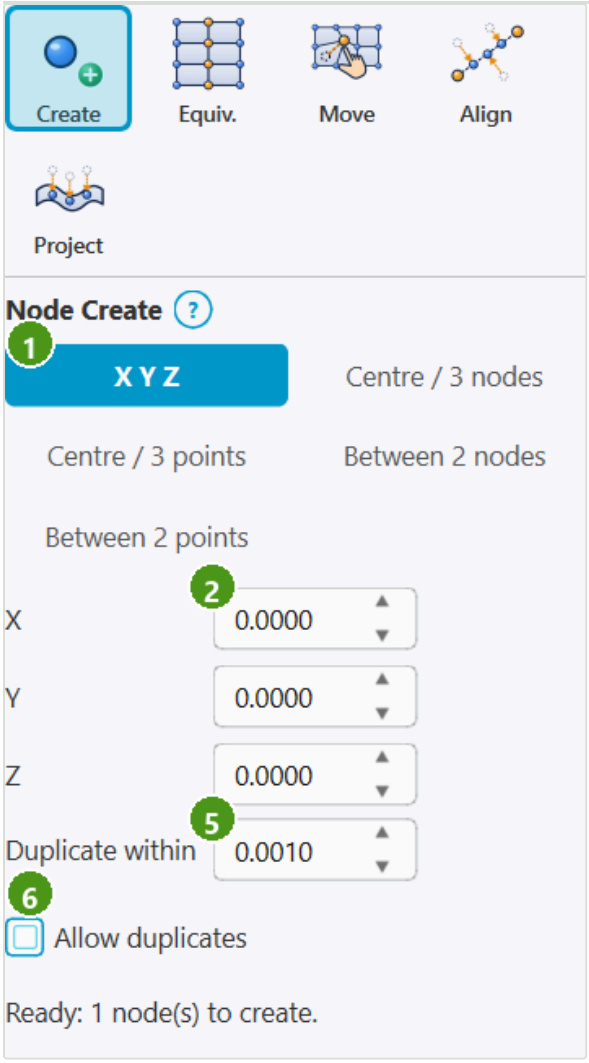


Figure R9.1 — The Node Create panel, mode *Between 2 nodes*.

#	Control	What it does	Default
1	**X Y Z**, **Centre / 3 nodes**, **Centre / 3 points**, **Between 2 nodes**, **Between 2 points**	Where the new node goes: at typed coordinates; at the centre of the circle through three picked nodes or points; or evenly spaced between two picked nodes or points, the two ends excluded.	X Y Z
2	**X**, **Y**, **Z**	The coordinates of the new node, in model units. Mode *X Y Z* only.	0, 0, 0
3	**Nodes** / **Points** pick row	The three (centre) or two (between) nodes or points to work from.	empty
4	**Nodes to create**	How many nodes go between the two picked ones (1 to 999). Between modes only.	1
5	**Duplicate within**	A new node closer than this to an existing node counts as a duplicate.	0.001
6	**Allow duplicates**	Off: a duplicate is refused and the existing node is named. On: it is created and reported.	off

A new node belongs to no element yet; it is drawn as a loose node until an element uses it.

R9.2 Node Equivalence

Opens from **Model** → **Edit** → **MESH** → **Node** → **Equiv.** Used in chapter 9.

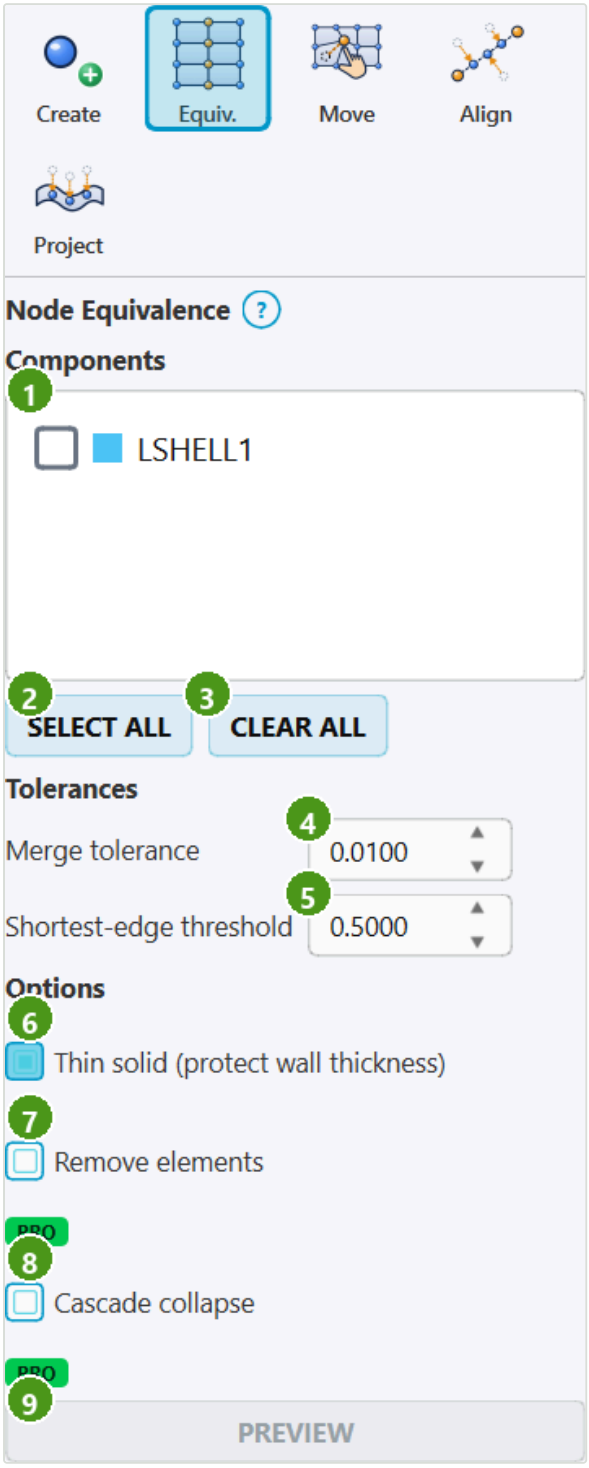


Figure R9.2 — The Node Equivalence panel.

#	Control	What it does	Default
1	**Components** list	The parts to work on: only nodes inside the ticked parts are merged. In the 3D view, a left-click adds a part, a right-click removes it, a box drag does either for many.	none ticked
2	**Select all**	Ticks every part.	
3	**Clear all**	Unticks every part.	
4	**Merge tolerance**	Nodes closer than this distance are merged, nearest pair first; a node with several close neighbours merges with the nearest.	0.01
5	**Shortest-edge threshold**	Edges shorter than this are removed when *Remove elements* is ticked.	10 % of the element size
6	**Thin solid (protect wall thickness)**	Never merges nodes on opposite sides of a thin wall. Untick it only on purpose: with a large tolerance the two sides of a wall weld together.	on
7	**Remove elements** Pro	Also removes edges shorter than the threshold, deleting the elements that become flat. Unticked, only nodes are merged.	off
8	**Cascade collapse** Pro	Keeps removing edges that become too short after earlier removals. No node moves more than twice the threshold from where it started.	off
9	**Preview**	Marks the nodes that would merge. Changes nothing.	

Apply stays off until at least one part is ticked.

R9.3 Node Move

Opens from **Model** → **Edit** → **MESH** → **Node** → **Move**. Used in chapter 9.

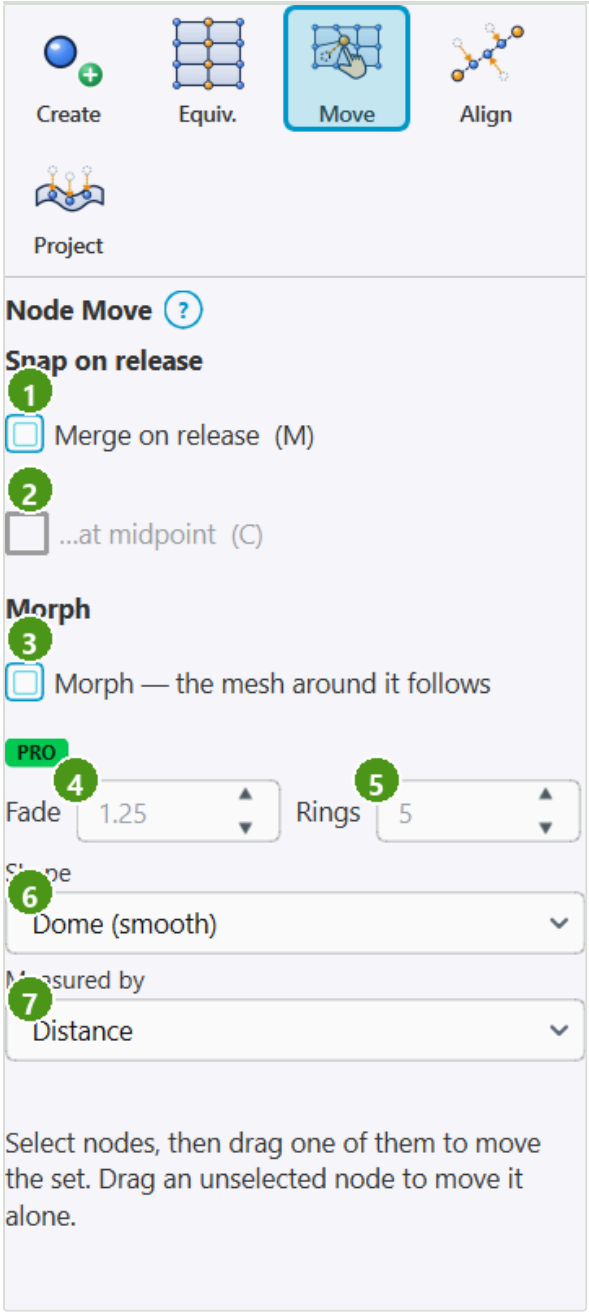


Figure R9.3 — The Node Move panel, *Morph* on.

Press on a node in the 3D view and drag it; nothing is written until you let go. Selected nodes move together. A node moves in the plane of its elements; hold N while dragging to move it along its normal instead. There is no Apply button.

#	Control	What it does	Default
1	**Merge on release (M)**	A node dragged close to another snaps to it, and letting go merges the two; the node you dropped onto keeps its number. `M` switches it during a drag. "Close" is about 30 % of the local element size, so it does not change with the zoom.	off
2	**...at midpoint (C)**	The merged node goes halfway between the two instead of onto the target. Active only while *Merge on release* is on; `C` switches it.	off
3	**Morph — the mesh around it follows** Pro	The surrounding elements follow the drag, fading out ring by ring, so nothing tears. Merge and midpoint are off while Morph is on.	off
4	**Fade** Pro	How quickly the movement fades from ring to ring; higher is a sharper fade (above 1, up to 10).	1.25
5	**Rings** Pro	How many rings of elements follow (1 to 30). At 5, rings 1 to 4 follow; at 1, only the dragged nodes move.	5
6	**Shape** Pro	*Dome (smooth)*: like a pulled sheet. *Cone (exponential)*: a sharp peak at the dragged node.	Dome
7	**Measured by** Pro	*Distance*: the same fade whatever the element size. *Rings*: a fixed number of element layers.	Distance

> **Trap** Looking almost edge-on to the plane of the elements, or almost straight down the normal while holding `N`, the drag stops and says why: one pixel of mouse travel would move the node too far. Turn the view a little and it carries on.

R9.4 Node Align

Opens from **Model** → **Edit** → **MESH** → **Node** → **Align**. Used in chapter 9.

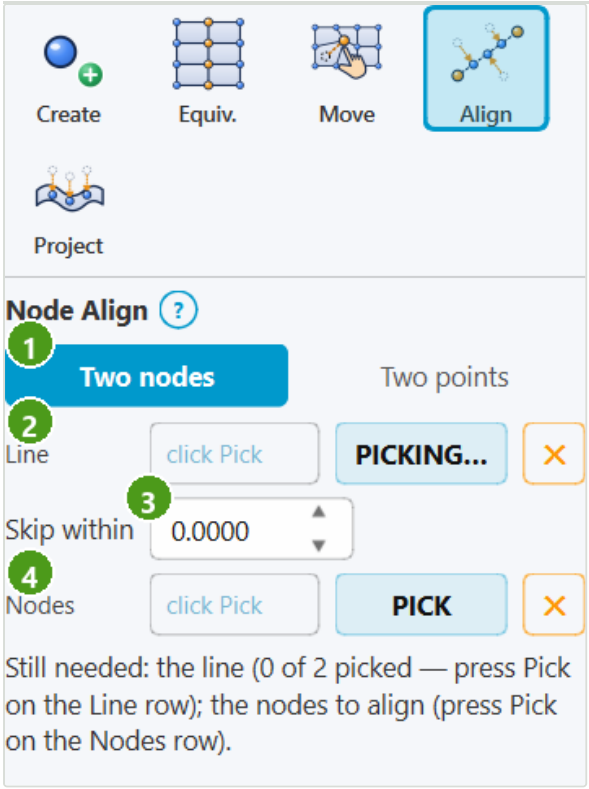


Figure R9.4 — The Node Align panel.

Moves each node straight onto a line, keeping its position along the line. It does not space the nodes evenly.

#	Control	What it does	Default
1	**Two nodes**, **Two points**	The line runs through two picked nodes, or through two picked positions on the model.	Two nodes
2	**Line** pick row	The two nodes or points of the line (yellow).	empty
3	**Skip within**	Nodes already this close to the line are left where they are.	0
4	**Nodes** pick row	The nodes to move onto the line (blue). Each click adds.	empty

R9.5 Node Project

Opens from **Model** → **Edit** → **MESH** → **Node** → **Project**. Used in chapter 9.

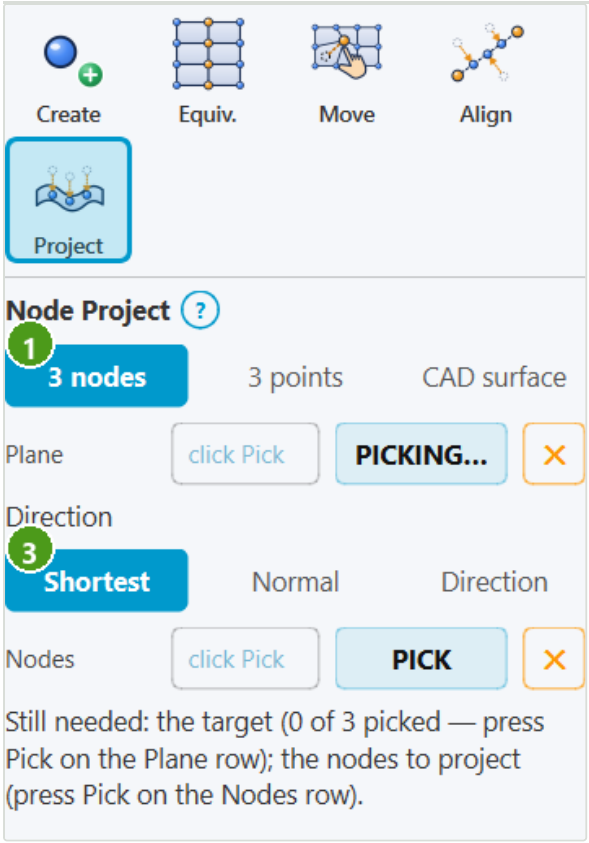


Figure R9.5 — The Node Project panel, target *CAD surface*.

Moves nodes onto a target. A node whose path misses the target is skipped, and the report line counts the skipped nodes.

#	Control	What it does	Default
1	**3 nodes**, **3 points**, **CAD surface**	The target: the plane through three picked nodes or points, or a picked CAD face.	3 nodes
2	**Plane** / **Surface** pick row	The target's nodes, points or face.	empty
3	**Shortest**, **Normal**, **Direction**	How a node travels: the shortest way onto the target; along the target's normal; or along a direction you set by picking nodes in the **Vector** row.	Shortest
4	**Edge margin**	How far beyond a CAD face's edge a node still counts as landing on it. *CAD surface* only.	0
5	**Nodes** pick row	The nodes to project.	empty

> **Note** A node projected onto a CAD face lands on it, but the program does not record that it belongs to that face: a later Node Move can drag it off again. The report line says so after each apply.

R9.6 Element Combine

Opens from **Model** → **Edit** → **MESH** → **Element** → **Combine**.

#	Control	What it does	Default
1	**Tris** pick row	The two triangles to join into one quad. They must share an edge; anything but a triangle is refused.	empty

R9.7 Element Split

Opens from **Model** → **Edit** → **MESH** → **Element** → **Split**.

#	Control	What it does	Default
1	**Quad** pick row	The quad to split into two triangles. Anything but a quad is refused.	empty
2	**Corner** pick row	A corner of that quad: the split runs from it to the opposite corner, so a corner and its opposite give the same split.	empty

R9.8 Element Fill

Opens from **Model** → **Edit** → **MESH** → **Element** → **Fill**. Used in chapter 9.

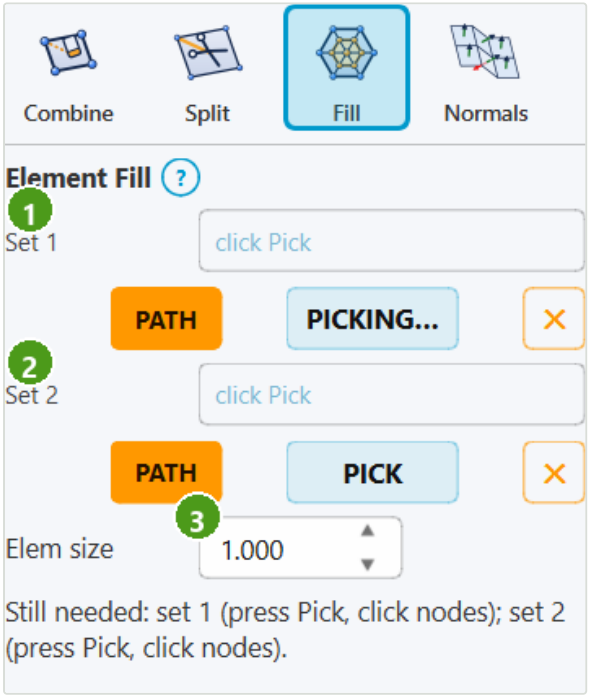


Figure R9.6 — The Element Fill panel while previewing.

Meshes the gap between two runs of existing nodes. The nodes of both runs are kept exactly; the new elements join them.

#	Control	What it does	Default
1	**Set 1** pick row	The first run of nodes (yellow), in order. With *path* on, a click extends the run along the mesh edges.	empty
2	**Set 2** pick row	The second run (blue). A single node is allowed: the fill then fans out to it.	empty
3	**Elem size**	The element size inside the fill. Filled in from the edge lengths of the two runs until you change it.	from the runs
4	**Preview** (the Apply button)	Meshes the gap on screen only. The report line gives the element counts and the worst angle.	
5	**Joining edge A**, **Joining edge B**	The number of nodes on the two new edges that join the ends of the runs (2 to 9999). Hover over a row to see its edge. In the 3D view a click adds one, a right-click takes one away, a drag up or down changes it quickly. Shown while previewing.	from the length
6	**flip set 2**	Joins set 2 the other way round. The program chooses the uncrossed way; tick it only if the preview shows the fill twisted.	chosen
7	**Accept**	Adds the previewed elements to the model and runs the mesh check. One `Ctrl`+`Z` undoes it all.	
8	**Cancel**	Discards the preview; the picked runs stay.	

R9.9 Shell Normals

Opens from **Model** → **Edit** → **MESH** → **Element** → **Normals**.

#	Control	What it does	Default
1	**Seed** pick row	One shell element. *Align normals* turns every shell connected to it the same way as this one and reports how many it turned.	empty
2	**Show back sides in yellow**	While the panel is open, a shell you see from its back is drawn yellow; a shell you see from its front keeps its part colour. After *Align normals* the whole connected area shows one colour: the part colour from the side the seed faces, yellow from the other side. Closing the panel restores the normal drawing.	on

> **Tip** Look at the area from the side the seed faces. Before *Align normals*, yellow patches there are shells facing the other way; after it, they take the part colour. On a curved or boxed part you see some walls from behind wherever you look from, so check it from more than one side. **Ctrl+Z** undoes the flip.

R9.10 Washer

Opens from **Model** → **Edit** → **TOPO** → **Edge** → **Washer**. Used in chapter 7.

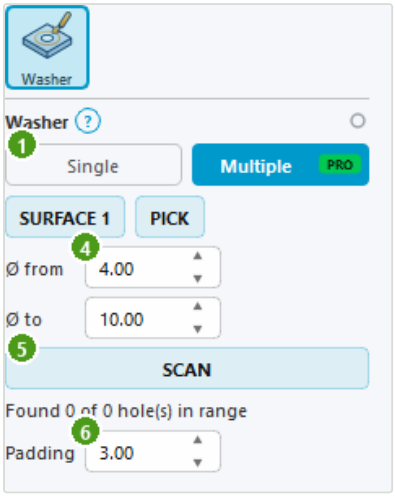


Figure R9.7 — The Washer panel, mode *Multiple*, after a scan.

Adds a ring of faces around a bolt hole, so the mesh gets a clean ring of elements there.

#	Control	What it does	Default
1	**Single**, **Multiple** Pro	*Single*: one hole at a time, made on the click. *Multiple*: every hole of a body within a size range, in one go.	Single
2	**Offset**	Single mode: the width of the ring, from the hole's edge outwards (0.01 to 500). Hover over a hole edge and click it; there is no Apply.	3.0
3	**(select body)**, **Pick** Pro	Multiple mode: the body to scan (see R9.0).	
4	**Ø from**, **Ø to** Pro	Only holes with a diameter in this range are found.	4.0 to 10.0
5	**Scan** Pro	Finds the holes and rings them in the 3D view; the line under it counts them. `Ctrl`+right-click on a ring leaves that hole out, `Ctrl`+left-click takes it back.	
6	**Padding** Pro	Multiple mode: the width of each ring.	3.0

Everything under *Multiple* is Pro. In *Multiple* mode the Apply button reads *Create washers*. A body made of many loose fragments is refused: consolidate it first (chapter 7).

R9.11 Defeature

Opens from **Model** → **Edit** → **TOPO** → **Face** → **Defeature**. Used in chapter 7.

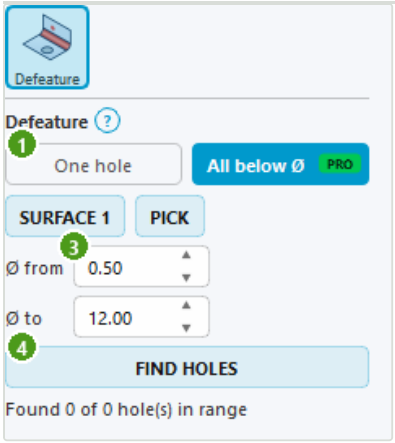


Figure R9.8 — The Defeature panel after *Find holes*.

Removes holes from the CAD faces: the face is rebuilt without them.

#	Control	What it does	Default
1	**One hole**, **All below Ø** Pro	Remove one chosen hole, or every hole found in the range at once.	One hole
2	**(select body)**, **Pick**	The body to work on (see R9.0).	the first body
3	**Ø from**, **Ø to**	Only holes with a diameter in this range are found.	0.5 to 12.0
4	**Find holes**	Finds the holes and rings them. `Ctrl`+right-click on a ring leaves a hole out, `Ctrl`+left-click takes it back. In *One hole* mode leave exactly one.	

The Apply button reads *Remove holes*. Changing the body or the range clears the rings: press *Find holes* again.

← The task-by-task guide to these panels: **chapter 9, Mesh editing**, page 60

Reference R10: the connector panels

The **1D / MPC** ribbon tab opens the first three panels; **Model** → **Bolted/Rivet** opens the fourth.

R10.0 Rows the creation panels share

Control	What it does
Node box	The node number. Type it, or press *Pick*.
Pick	Click it, then click a node in the 3D view: its number goes into the box.
Use Selection	Takes the nodes selected in the 3D view into the row; the box then shows how many.
Create	Writes the cards into the model. It stays off, with the reason in red under the form, until everything the cards need is there.
Clear	Empties the form.
Cancel	Closes the panel without writing anything.

R10.1 Create 1D Element

Opens from **1D / MPC** → **1D Element**. Used in chapter 10.

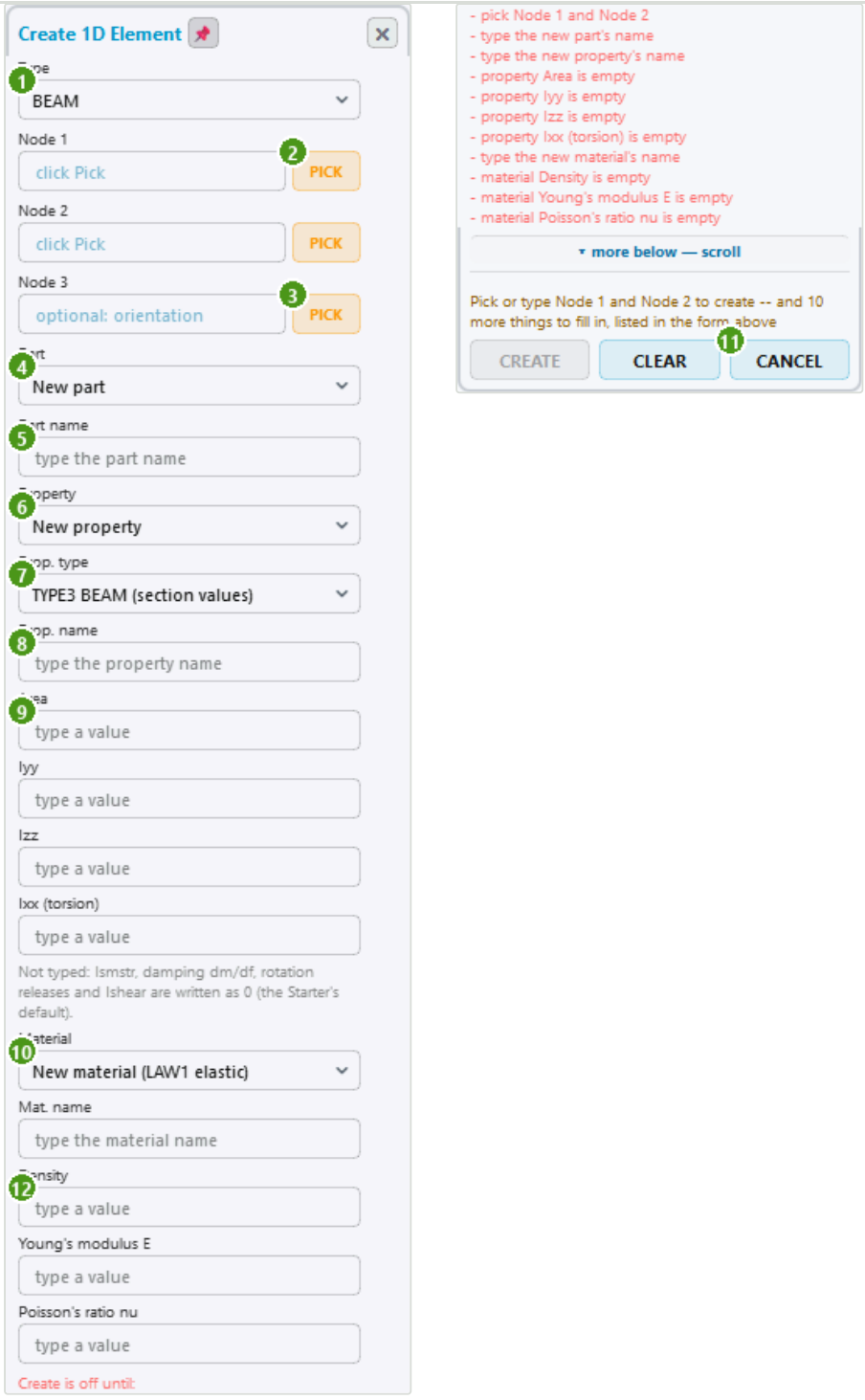


Figure R10.1 — The Create 1D Element panel, *New part* chosen. It is one tall panel, shown in two halves: the element, its part and its property on the left, and the material from *Material* onward on the right.

Nothing is filled in for you: an empty box is a reason *Create* stays off, never a default.

#	Control	What it does	Default
1	**Type**	The element: *BEAM*, *TRUSS* or *SPRING*.	BEAM
2	**Node 1**, **Node 2**	The element's two end nodes.	empty
3	**Node 3**	Optional: a third node that sets the element's orientation.	empty
4	**Part**	The part the element goes into: an existing part whose property fits the element type, or *New part*.	
5	**Part name**	The new part's name.	empty
6	**Property**	An existing property that fits, or *New property*.	
7	**Prop. type**	The new property's type: TYPE3 BEAM, TYPE2 TRUSS, or for a spring TYPE4 SPRING (axial) or TYPE13 SPR_BEAM (6 degrees of freedom).	
8	**Prop. name**	The new property's name.	empty
9	**Property values**	The values the type needs: *Area, Iyy, Izz, Ixx* (beam); *Area* (truss); *Mass, Stiffness K* (spring); *Mass, Inertia* and six stiffnesses, none negative (SPR_BEAM). The grey line under them says which values are written as 0, the Starter's own default.	empty
10	**Material**	Shown when the property needs one: an existing material, or *New material (LAW1 elastic)*.	
11	**Mat. name**	The new material's name.	empty
12	**Material values**	*Density* and *Young's modulus E* (above 0) and *Poisson's ratio nu*.	empty

R10.2 Create RBE2

Opens from **1D / MPC** → **RBE2**. Used in chapter 10.

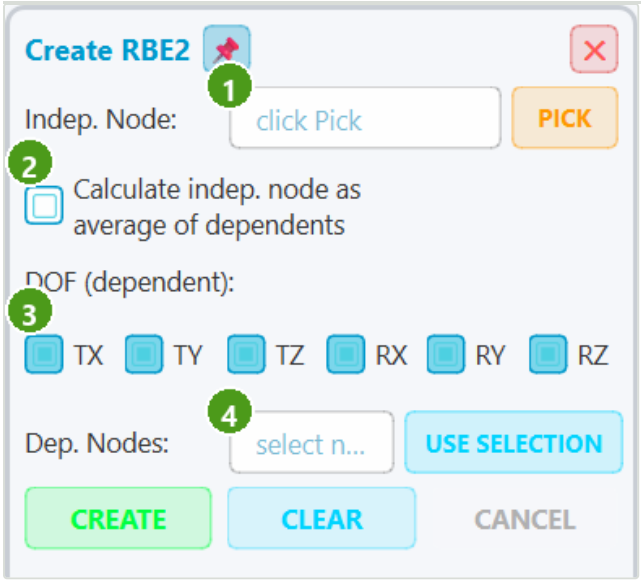


Figure R10.2 — The Create RBE2 panel.

Ties a set of nodes rigidly to one main node, so they move together. Writes a node group and an `/RBE2` card.

#	Control	What it does	Default
1	**Indep. Node**	The main node.	empty
2	**Calculate indep. node as average of dependents**	Creates a new main node at the average position of the tied nodes instead; the box shows *(auto)*.	off
3	**DOF (dependent)**: **TX TY TZ RX RY RZ**	Which movements of the tied nodes follow the main node: the three translations and the three rotations.	all on
4	**Dep. Nodes**	The tied nodes: select them in the 3D view, then press *Use Selection*.	empty

R10.3 Create RBE3

Opens from **1D / MPC → RBE3**. Used in chapter 10.

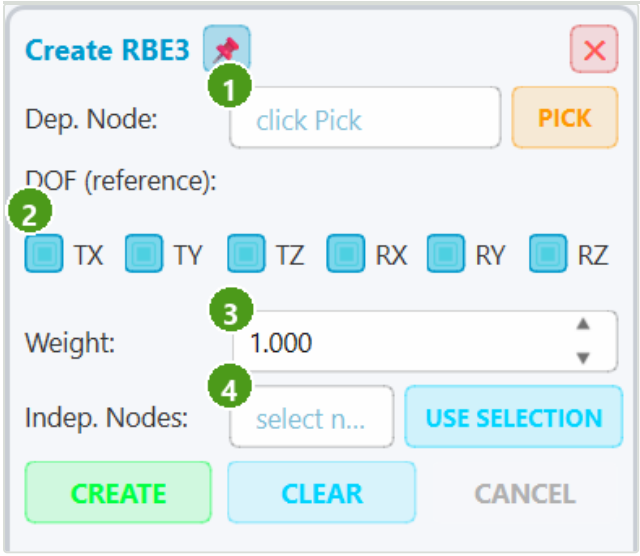


Figure R10.3 — The Create RBE3 panel.

Shares a load or a mass at one node out over a set of nodes, without making them stiffer.

#	Control	What it does	Default
1	**Dep. Node**	The reference node, where the load or mass sits.	empty
2	**DOF (reference)**: **TX** … **RZ**	Which movements of the reference node are taken from the set.	all on
3	**Weight**	The weight of the set's nodes in the average (0.001 and up).	1.0
4	**Indep. Nodes**	The set: select the nodes in the 3D view, then press *Use Selection*.	empty

R10.4 Bolted / Rivet Connector (Pro)

Opens from **Model** → **Bolted/Rivet**. Used in chapter 10.

[Picture coming in the next version]

Figure R10.4 — The connector panel, *Discovery* open, after *Discover Groups*.

Finds holes in different parts that line up, and connects each line of holes: a *spider* ties each hole's edge nodes to a centre node, a *shank* joins the centres. Hover over the **?** beside a setting for its explanation.

#	Control	What it does	Default
1	**Components** list	The parts to search; the count above it says how many are ticked. Tick at least two.	none
2	**Discovery**	Opens or closes the search settings below.	closed
3	**Min diameter**, **Max diameter**	Only holes in this range count. Below the minimum are tool reliefs; 30 mm covers M3 to M27.	2.0 / 30.0 mm
4	**Circularity ≥**	How round a hole must be: 1.0 a perfect circle, 0.5 about a slot, 0.3 an elongated cut-out. Higher accepts drilled holes only.	0.30
5	**A/A ≤**	The face area divided by the hole area, at most. Rejects a large plate that merely contains a hole, so a plate with only one or two holes needs a much larger value (two plates with one Ø17 mm hole each come to about 87). If Discover Groups finds nothing, raise A/A ≤ (100 is a safe start).	15.0
6	**Axis tolerance**	How far two holes' axes may differ and still count as one bolt. Curved parts need about 10°.	10°
7	**Min span**	Pairs of holes closer than this are rejected. 0 is off: a lap joint with no gap is valid.	0 mm
8	**Max span**	Pairs farther apart than this are rejected: a connector across a large gap adds false stiffness. Bolted and riveted joints are typically 5 to 20 mm.	20 mm
9	**Discover Groups**	Searches the ticked parts with these settings.	
10	**Detected Groups** table	One row per line of holes: a tick to use it, the bolt size (*Bin*), the number of holes, the span, and the state: *OK*, or *UNMSH* when a hole has no mesh around it yet (that hole is skipped, with a warning).	all ticked
11	**Spider**: **RBE2**, **RBE3**	The element that ties each hole's edge to its centre. RBE3 is greyed for now: it needs a beam or spring shank, which the panel cannot write yet; hover over it for the full reason.	RBE2
12	**Shank**	The element joining the centres: *RBE2* or *RBE3* (rigid), *SPRING*, *BEAM* or *TRUSS*. The last three need a part with a property and a material, so *Apply* refuses them with that reason for now.	RBE2
13	**Component pattern**	The name of the parts the connectors go into; *{bin}* becomes the bolt size, so *1D_Bolts_{bin}* gives *1D_Bolts_M5*.	1D_Bolts_{bin}
14	**Apply**	Writes the connectors for every ticked group. An unusually large number asks you to confirm first.	

← The task-by-task guide to these panels: **chapter 10, Connectors**, page 64

Reference R13: the results panels

The **Results** ribbon tab. The panels share three buttons at the bottom:

Control	What it does
Apply	Shows the result with the panel's settings. Switches (ticks) apply as soon as you change them while a result is shown.
Hide	Takes the result off the model and keeps the panel's settings.
Clear	Takes the result off and puts the settings back to their defaults.

R13.0 The Results tab

Tile	What it does
Load	Opens results: a Nastran *.op2* file (with its *.fem*), or OpenRadioss animation files (*...A001, A002 ...*).
Remove	Closes the results that are open.
Clear (tile)	Takes off result colours, filters and arrows; the deformed shape and the model stay.
Contour	R13.1
Threshold	R13.2
Materials	R13.3
Vectors	R13.4
Deform	R13.5
Section	R13.6
Erosion	R13.7
Probe	R13.8
Info	R13.9
History	R13.11

Playback strip

Shown at the bottom of the 3D view for results with several frames.

#	Control	What it does	Default
1	**Step back**, **Play / Pause**, **Step forward**	One frame back, run or stop, one frame on.	
2	**Frame slider**	Drag to any frame; the counter beside it shows *frame / frames*.	first frame
3	**Playback settings** (⚙)	Opens the settings below.	
4	**Speed (FPS)**	Frames per second, 1 to 99.	10
5	**Direction**	*Forward* or *Reverse*.	Forward
6	**Loop (repeat instead of stopping at the end)**	Starts again from the first frame.	off
7	**Cache frames for fast replay**	Prepares each frame once, then replays faster; uses about 0.6 GB per 100 frames.	on for a run over time
8	**Steps (static/modal)**	How many frames animate a static or vibration-mode result (2 to 100). A run over time uses its own frames.	10

Choosing the result and the parts

Contour and Threshold start with these rows.

#	Control	What it does	Default
1	**Result family**	What to show, for example stress or displacement; the list holds what the file contains.	the first
2	**Component**	Which value of the family, for example von Mises or one direction.	
3	**Shell fiber**	For shells: the larger of top and bottom (*Max (envelope)*), *Top (Z2)*, *Bottom (Z1)* or *Mid (membrane)*.	Max
4	**Nodal-averaged (DERIVED)**	Off: each element's own value, as the solver wrote it. On: smoothed by averaging at the nodes, calculated by BeidPrep; compare it only with a tool that averages the same way.	off
5	**… on all components**	On: every part. Off: only the parts you choose: tick them in the list or click them in the 3D view (right-click removes).	on
6	**All**, **None**	Tick or untick every part in the list.	

R13.1 Contour

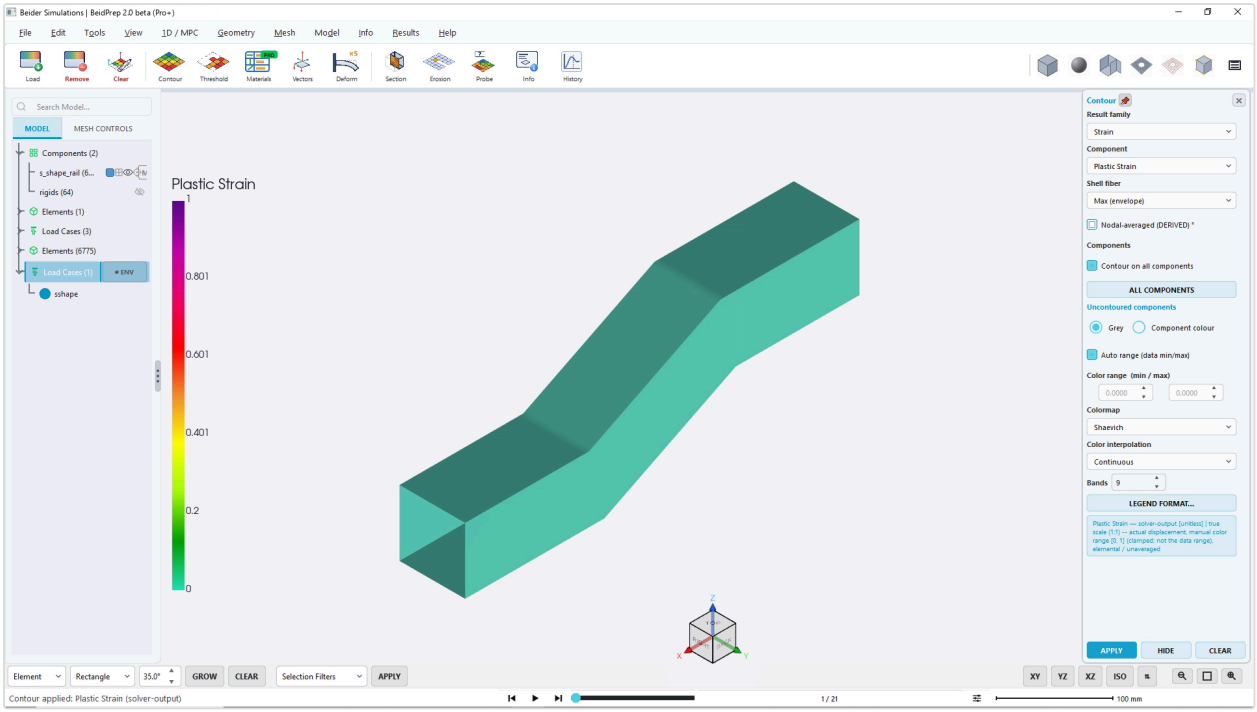


Figure R13.1 — The Contour panel.

#	Control	What it does	Default
1	**Grey**, **Component colour**	Parts you did not choose are grey, or keep their own colours.	Grey
2	**Auto range (data min/max)**	On: the colour scale covers this result's range. Off: you set it, so several load cases share one scale; values beyond it take the end colours.	on
3	**Color range** (min / max)	The ends of the scale when *Auto range* is off.	
4	**Colormap**	*Shaevich*, *Rainbow*, *Turbo*, *Viridis*, *Cool–Warm* (for signed values), *Grayscale*, and *Safety (red → green)* for safety factors, where low is bad.	Shaevich
5	**Color interpolation**	A smooth ramp (*Continuous*) or bands (*Discrete*).	Continuous
6	**Bands**	How many bands when *Discrete*.	9
7	**Legend format...**	Opens the legend settings (R13.10); they apply to every legend.	

R13.2 Threshold

#	Control	What it does	Default
1	**Keep range** (min / max)	Only elements whose value lies in the range are shown.	
2	**Auto (full range)**	Sets the range to the whole result, so everything shows; then narrow it.	
3	**Show elements OUTSIDE the range**	Keeps the extremes instead of the range.	off

R13.3 Materials (strengths) (Pro)

Strengths turn stresses into safety factors.

#	Control	What it does	Default
1	**Load mapped field…**	Loads the fibre directions mapped onto this mesh. Needed for a run with a plain material; a fibre material carries its own.	
2	**Materials in the deck**	Choose the material to enter strengths for; hover over a row for its state.	the first one used
3	**Form**	*orthotropic* (strengths along, across and at 45° to the fibres) or *isotropic* (one yield strength).	orthotropic
4	**Strengths**	Orthotropic: tensile along and across the fibres, and shear or the 45° value, are required; compressive ones are optional (0 = as in tension); *weld-line* where fibres have no direction. Isotropic: yield in tension, required; in compression, optional.	empty
5	**Save strengths**	Saves them for the chosen material. Stays off until the required ones are filled; hover to see which are missing.	

R13.4 Vectors

#	Control	What it does	Default
1	**Vector field**	Displacement or reaction forces at the nodes, as the file holds them.	
2	**Auto range (frame magnitudes)**	As in Contour.	on
3	**Color range**, **Colormap (vectors)**	As in Contour.	
4	**Arrow scale (× normal)**	How long the arrows are drawn: at 1× a typical arrow is about 5 % of the model's size. The legend shows the true values.	1×
5	**1×**, **10×**, **100×**, **Auto**	Quick scales; *Auto* returns to 1×.	
6	**X**, **Y**, **Z**	Which directions are drawn.	all
7	**Vector sum (resultant)**	On: one combined arrow per node. Off: one arrow per direction, X red, Y green, Z blue.	on
8	**Uniform arrow size (direction only)**	All arrows the same length.	off
9	**Show value labels (largest N)**	Labels the largest arrows with value and direction, for example *400.6 +X+Y*.	off
10	**Max**, **Size**	How many labels (up to 200) and their text size.	50, 12
11	**Show model beneath (context)**	Draws the model under the arrows.	on

R13.5 Deform

#	Control	What it does	Default
1	**Deform scale (× normal)**	How much the deformed shape is exaggerated: at 1× a typical movement shows as about 5 % of the model's size. The legend still shows the real displacements.	1×
2	**1×**, **10×**, **100×**, **Auto**	Quick scales; *Auto* returns to 1×.	
3	**Warp axes**: **X Y Z**	Which directions of the movement are shown.	all
4	**Show undeformed wireframe**	Draws the original shape as a faint outline.	off

R13.6 Section

#	Control	What it does	Default
1	**Plane normal**: **X Y Z**	Cuts across that axis.	Z
2	**Normal** boxes	Any other direction, typed as X Y Z.	
3	**Position**	Drag to sweep the cut through the model.	the middle
4	**Flip side (keep the other half)**	Shows the other half.	off
5	**Show section plane**	Draws a faint plane where the cut is.	off
6	**Slab (keep a band, not a half-space)**	Keeps only a band around the plane.	off
7	**Slab width**	The band's width.	10 % of the model

R13.7 Erosion

#	Control	What it does	Default
1	**Show**, **Hide**, **Grey**	The elements that failed during the run: drawn as usual, hidden, or as a see-through ghost that shows where material failed.	Show
2	**Ghost colour**	The ghost's colour, in *Grey* mode.	grey
3	**First eroded by** table	Per part: how many elements failed, and the time of the first.	

R13.8 Probe

#	Control	What it does	Default
1	**Node**, **Element**	What a click in the 3D view reads: a callout shows its number, position and values.	Node
2	**id...** and **Add**	Adds a callout by number (`Enter` works too). If elements of several kinds share the number, a list asks which.	
3	**Nodes**, **Elements** lists	The callouts on the view.	
4	**Remove**	Removes the callout selected in either list.	
5	**Display** ▾	Opens the settings below for the look of the callouts.	closed
6	**Font** size and number format	Text size (8 to 40) and how values are written, for example *{:.4g}* (4 significant figures) or *{:.3e}*.	13, {:.4g}
7	**Font colour...**, **Background colour...**	Choose the colours; choosing a background colour also fills the box.	
8	**Filled background**	Off: the callout is see-through. On: filled, white unless you chose a colour.	off
9	**Box around text**	Draws a frame round each callout.	on

Here *Hide* stops picking and keeps the callouts; *Clear* also removes them.

R13.9 Info

#	Control	What it does	Default
1	**Pin**	Keeps the summary of the model and selection on the 3D view, lower left.	
2	**Unpin**	Takes it off.	

R13.10 Legend format

#	Control	What it does	Default
1	**Font family**	The legend's font.	
2	**Numbers size (pt)**, **Title size (pt)**, **Info line size (pt)**	Text sizes.	15, 16, 12
3	**Bold**, **Italic**	The style.	off
4	**Legend title**	Your own title; empty uses the result's name.	empty
5	**Hide legend title**, **Hide info line (top-left provenance HUD)**	Hide the title, or the line at the top left that says which file and result are shown.	off
6	**Number of ticks**	2 to 15 numbers on the scale.	6
7	**Number notation**	*General* (1.2, 120), *Scientific* (1.2E2) or *Plain* (120.0).	General
8	**Decimal places**	0 to 8.	3
9	**Reset**	Back to the defaults.	

R13.11 History

The History tool has its own chapters: how to use it in chapter 17, every control in R17.

← The task-by-task guide to these panels: **chapter 13, Results and post-processing**, page 72

Reference R14: the fibre panel

Opens from **Model** → **Fibre module**, or from a fibre part's right-click menu. Pro+ Used in chapter 14.

R14.0 Around every step

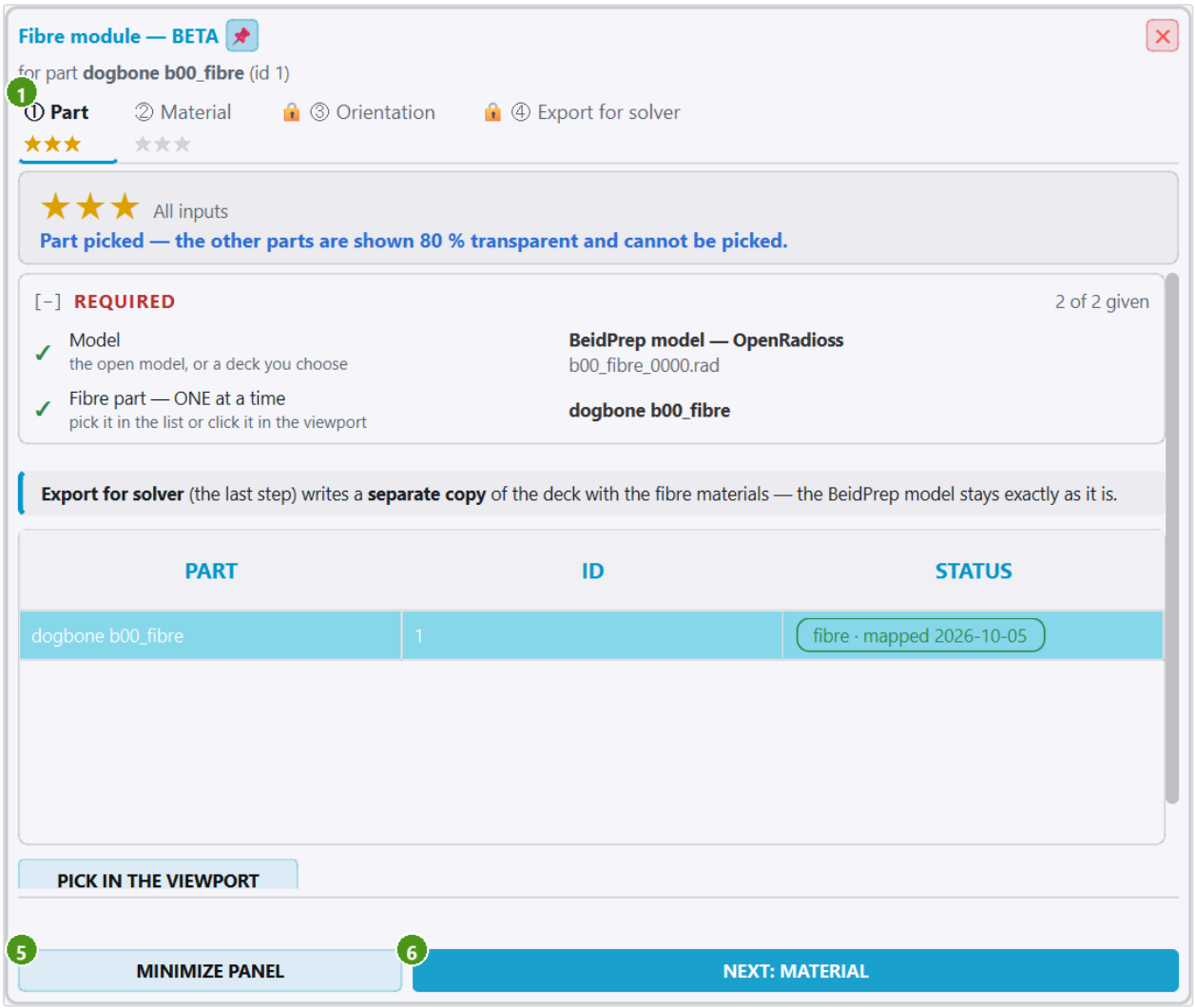


Figure R14.1 — The Fibre module panel on the ISO 294 test bar.

#	Control	What it does	Default
1	**Step bar**: **Part**, **Material**, **Orientation**, **Export for solver**	Go to a step. A step opens once the one before it has its required inputs; the stars under it show how complete it is (one: required given, two: recommended too, three: everything).	Part
2	**REQUIRED**, **RECOMMENDED**, **OPTIONAL**	The input groups of a step. Click a heading to open or close it; it counts how many of its inputs are given.	Required open
3	**Load** (file rows)	Chooses a file for the row; the row then shows its name, with a button to remove it.	
4	**Cancel**	Shown while a calculation runs: stops it.	
5	**Minimize panel**	Puts the panel away; your inputs are kept. Reopen it from the Model tab.	
6	**Next**	Goes to the next step; on the last step it reads *Export for solver*. It stays off, with the reason under it, until the step's required inputs are given.	

A button with a lock (🔒) in front belongs to a tier your licence does not include; pressing it says which.

R14.1 Step 1 — Part

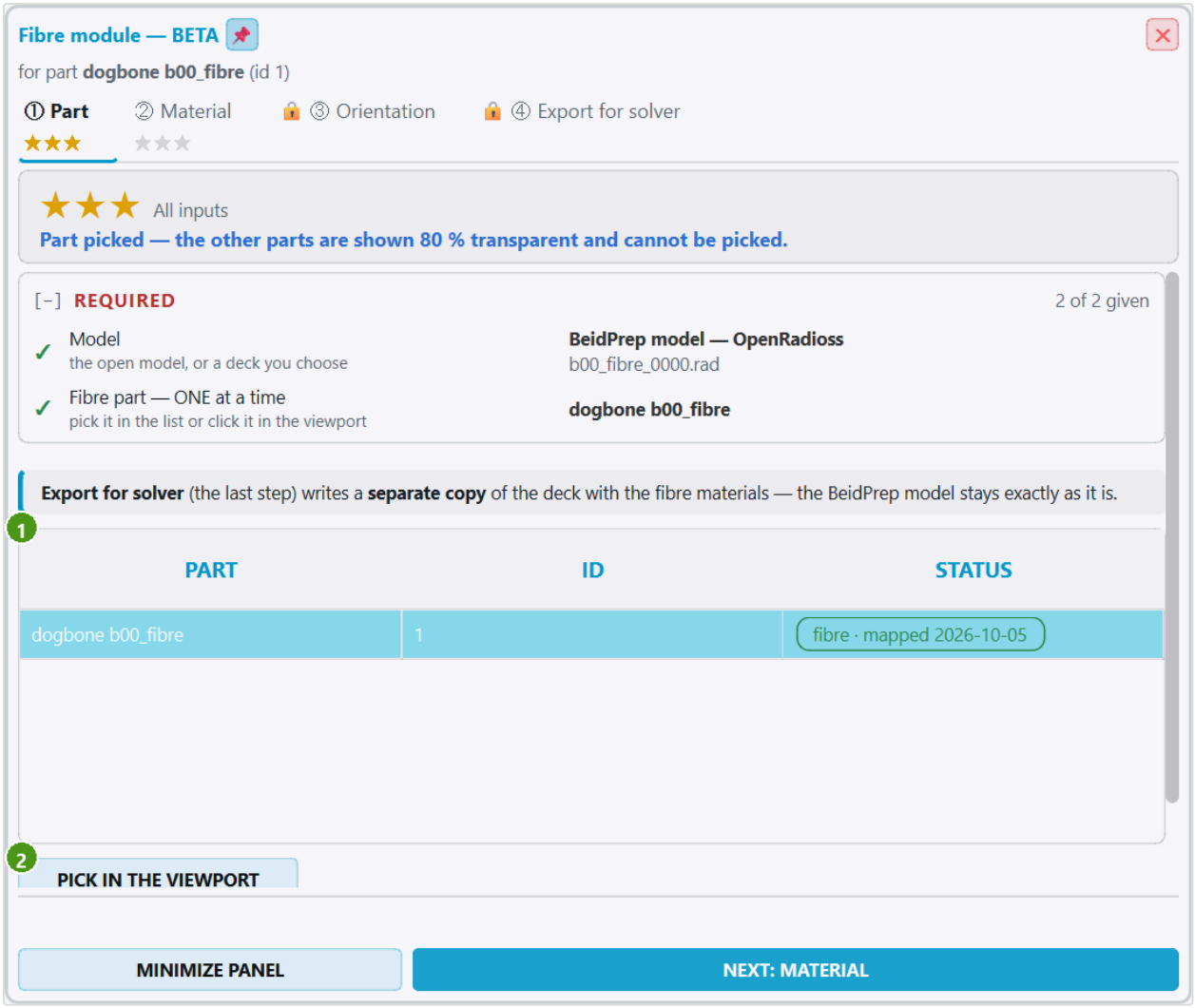


Figure R14.2 — Step 1, Part.

#	Control	What it does	Default
1	**Parts** table	Every part, with its number and fibre state: *not a fibre part yet*, *material only*, or *mapped* with the date. Choose ONE part to work on.	
2	**Pick in the viewport**	Click it, then the part in the 3D view. The part is then worked on alone; the others are drawn about 80 % transparent.	

R14.2 Step 2 — Material

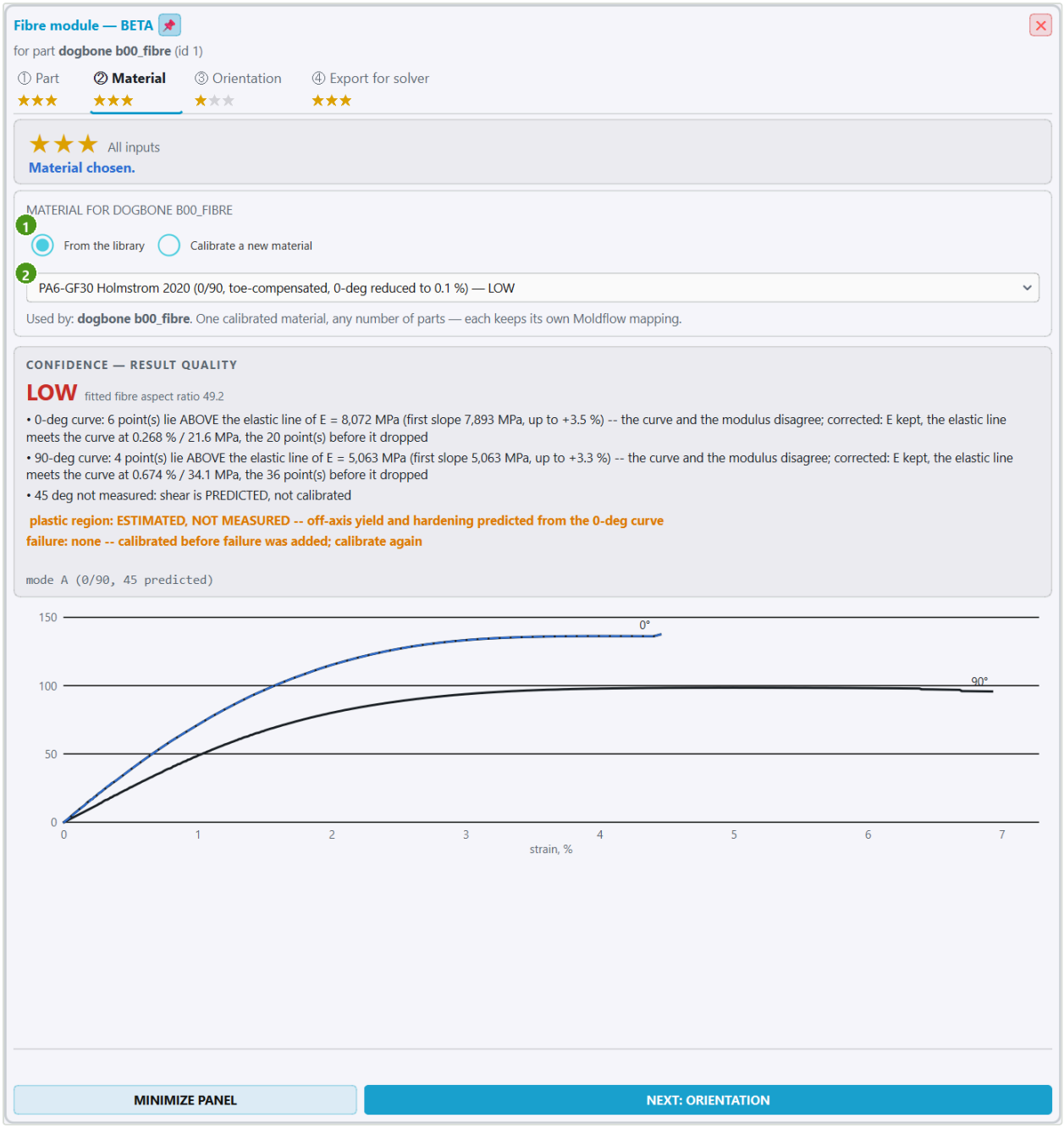


Figure R14.3 — Step 2, Material, from the library.

#	Control	What it does	Default
1	**From the library**, **Calibrate a new material**	Use a material already calibrated, or make a new one from your test curves. One material can serve any number of parts.	
2	**Library** list	The calibrated materials, each with its confidence. *Used by* names the parts that share it.	
3	**Calibrate and add to library**	Fits a new material to the inputs below and adds it to the library.	
4	**Matrix**	The plastic: PA66, PA6, PP, PBT, PPS, POM, PC, PPA, PET, PA12, PA46, PEEK.	none
5	**Fibre**	*glass (short)* or *carbon (short)*.	none
6	**Fibre content, wt %**	10 to 50.	none
7	**Moisture state**	*dry as moulded* or *conditioned*. No default, on purpose: it changes the material a great deal.	none
8	**Test temperature, °C**	The temperature of the tests.	empty
9	**0° curve**, **45° curve**, **90° curve**	The test curves as files of two columns, strain and stress (MPa), along the flow, at 45° and across it. 0° is required; 45° calibrates shear, 90° the cross-flow behaviour.	
10	**Specimen type**	*bars cut from a plate* or *moulded dogbone (0°)*.	none
11	**Strain measurement**	*extensometer*, *crosshead* or *unknown*.	none
12	**Strain in the files**	Whether the files give strain in *percent* or as a *fraction*. Stated, never guessed.	percent
13	**Reference modulus at 0°, MPa**	Recommended: corrects strain measured at the crosshead.	empty
14	**Grade / trade name**, **Recycled**	Optional records, for example *Ultramid A3EG6*.	empty, no
15	**Matrix modulus at this temperature, MPa**	Optional; empty uses the database value at 23 °C, or a fitted one.	empty
16	**Off-axis yield factor**	Optional; used only on predicted 45°/90° curves. Empty uses the family default.	empty
17	**Limit alignment to the test specimen**	ON or OFF.	ON

Beside the form: the confidence card and the curves (measured and fitted).

R14.3 Step 3 — Orientation

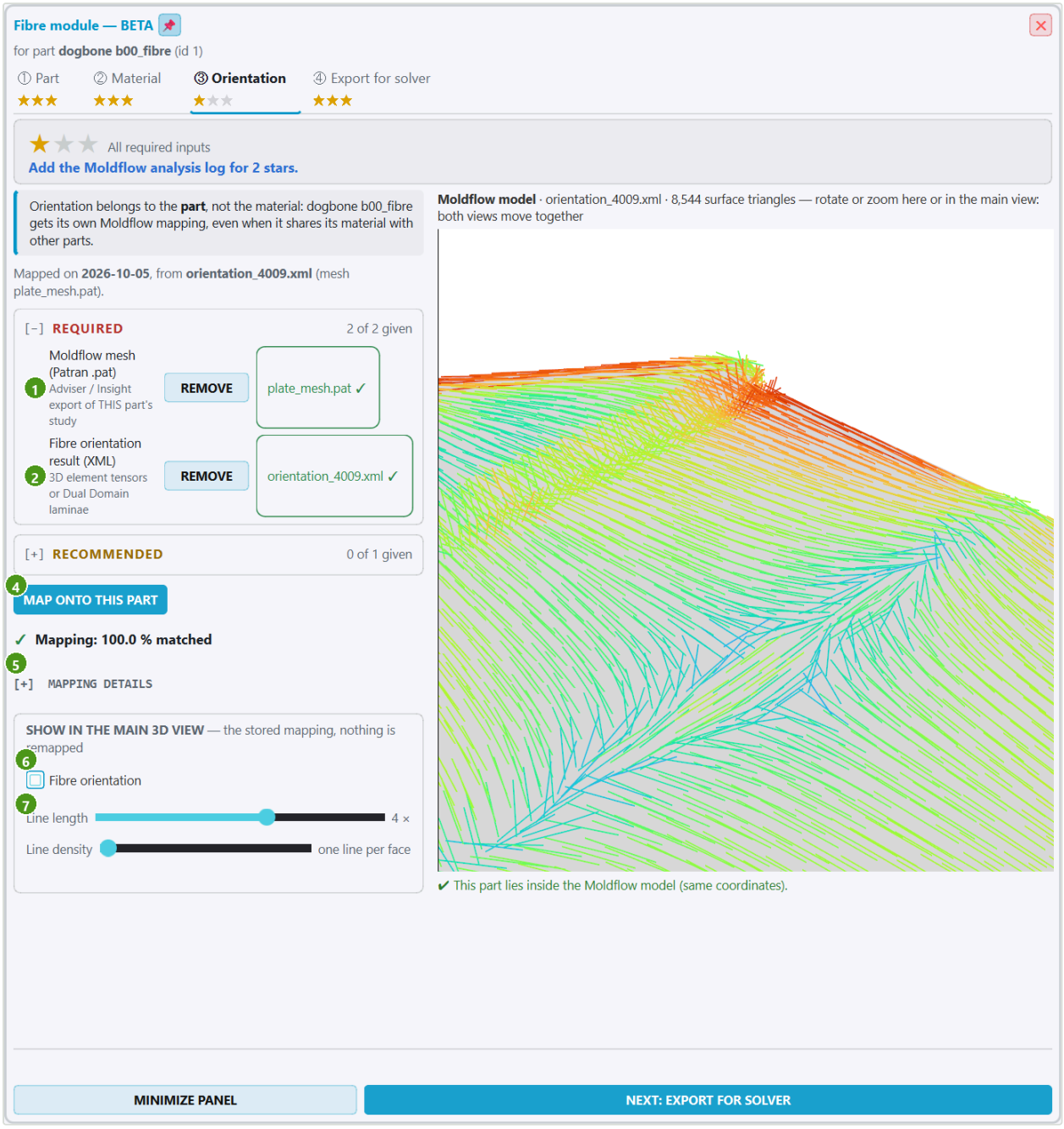


Figure R14.4 — Step 3, Orientation.

Orientation belongs to the part, not the material: each part gets its own Moldflow mapping.

#	Control	What it does	Default
1	**Moldflow mesh (Patran .pat)**	Required: the mesh exported from this part's Moldflow study.	
2	**Fibre orientation result (XML)**	Required: the orientation result (3D element tensors or Dual Domain layers).	
3	**Moldflow analysis log**	Recommended: shows the fibre settings the study used.	
4	**Map onto this part**	Carries the orientation onto your mesh; the line under it gives the share of elements matched.	
5	**Mapping details**	Opens the counts: elements matched, filled from neighbours (flagged), left with the deck's own material.	closed
6	**Fibre orientation**	Shows short lines along the fibres in the main 3D view, coloured by how well they are aligned. Needs a mapping.	off
7	**Line length**, **Line density**	How long the lines are (1× to 8×) and how many faces get one (every face down to 1 in 20).	4×
8	**Weld lines**	Shows the Moldflow weld lines stored with this part's mapping, coloured by the angle at which the flow fronts met (grey: a meld line, 135° and above). The note below it gives the weld strength factors, shown only: in this beta they are not in the exported material card. Greyed out when the mapping has no weld-line result: give that result when mapping.	off

Once the part is mapped, the Moldflow model is shown in 3D beside the inputs when the panel is wide enough; on a narrower panel it is shown below them.

R14.4 Step 4 — Export for solver

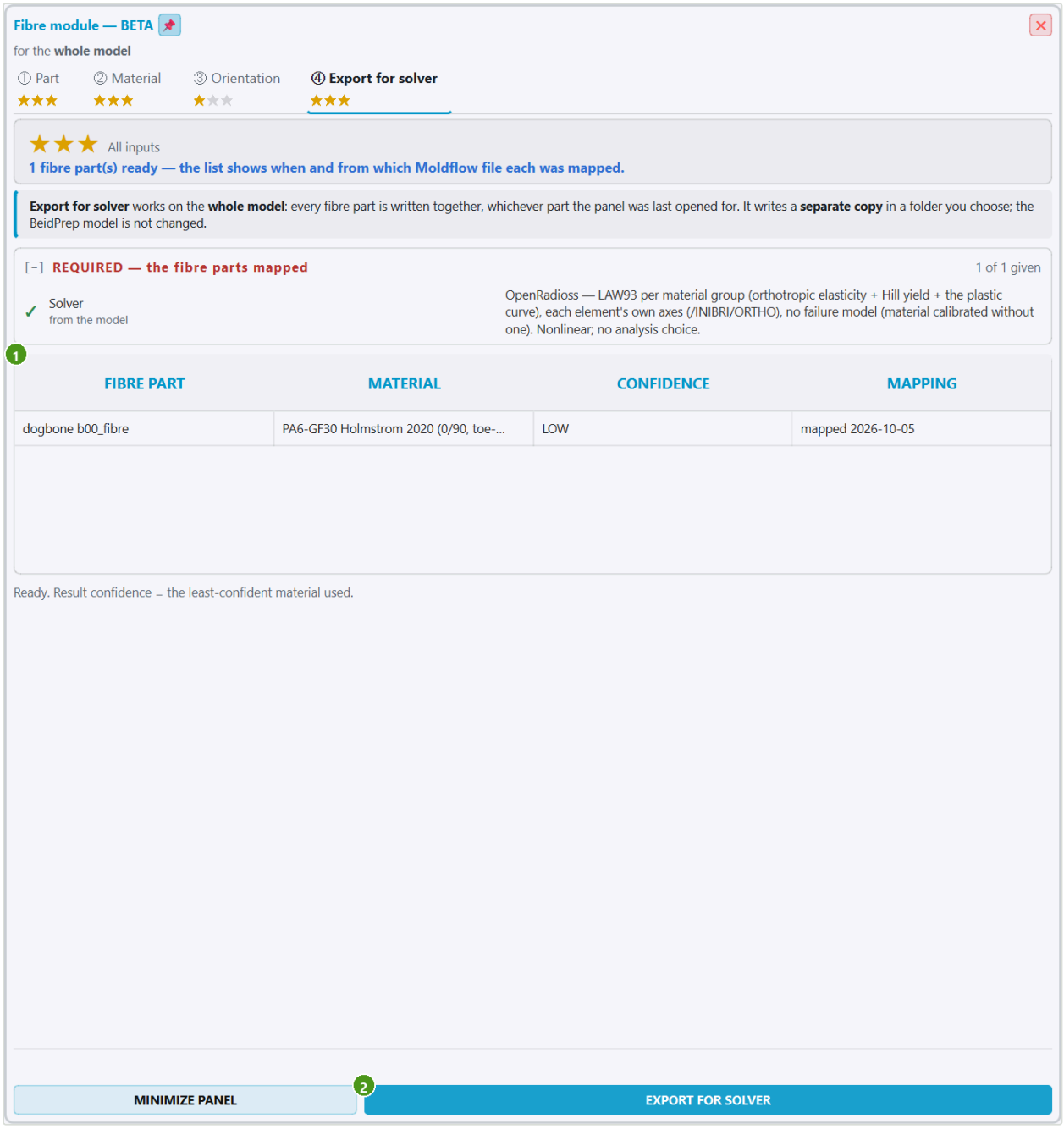


Figure R14.5 — Step 4, Export for solver.

#	Control	What it does	Default
1	**Fibre parts** table	Every fibre part of the whole model, with its material, confidence and mapping. All are written together.	
2	**Export for solver**	Writes a separate copy of the deck, in a folder you choose, with the fibre materials (LAW93 per material group, each element's own axes, and /FAIL/ORTHBIQUAD when the material was calibrated with a failure model). The BeidPrep model is not changed. The result's confidence is the least confident material used.	

R14.5 The fibre part's right-click menu

Menu entry	What it does
Edit fibre setup	Opens the panel on this part.
Fibre orientation	Shows or hides the fibre lines of this part (ticked when shown).

← The task-by-task guide to these panels: **chapter 14, The fibre module (Pro+)**, page 80

Reference R16: the Claude connection

Opened with **Tools** → **Connect Claude…** (chapter 16). In the editions below Pro+ the window explains that the connection is part of Pro+, and every control in it is greyed out.

R16.1 The Connect Claude window

Two columns: on the left the switch and what Claude may read and change; on the right the folders, the connection to Claude Code and the action log.

#	Control	What it does	Default
1	**Connect / Disconnect**	Turns the connection on or off. The line above it says its state: *The connection is ON (this computer only, a new key every session)*.	off
2	**What Claude may read** (this model, new models, and models in Claude's folder)	*Keep local*: Claude reads nothing from the model. *Structure only*: names, counts and ids, no values, no card text, no pictures. *Full*: values, card text and pictures too. It can be chosen with no model open; it then applies to this session's new models and to models in Claude's folder (chapter 16.2).	the model's own choice
3	**What Claude may change**	*Read only*: Claude changes nothing. *Ask before each change*: each change waits for your **Approve** (R16.2). *Claude works freely*: changes at once, shown on screen; `Ctrl` + `Z` undoes each (chapter 16.3).	Read only, at every start
4	**Use this folder**	Shown when Claude Code is working in another folder than the one chosen: *Claude Code is working in … — use this folder?* One click makes it Claude's folder; it is never set without you.	
5	**Choose folder…**	The one folder Claude may read your problem files from (PDF, CAD, decks) and save its results to: exports, pictures, presentations. The line beside it names it.	none chosen
6	**Choose templates folder…**	The folder of your PowerPoint templates for Claude's presentations. Claude only reads it. Remembered.	none chosen
7	**Connect automatically when BeidPrep starts**	At each start BeidPrep connects with the folder and the two levels last chosen here.	off
8	**Add to Claude Code**	Registers BeidPrep with Claude Code once, after your OK; the line beside it says how it went.	
9	**Or run this once in a terminal yourself**	The same registration as a command line, read only, for anyone who prefers to type it.	
10	**Copy the line**	Puts that line on the clipboard.	
11	**Action log**	Everything Claude asked, newest last.	
12	**Close**	Closes the window. The connection stays as it is.	

R16.2 The approval bar

With *Ask before each change*, a bar appears over BeidPrep for each change Claude asks for: *Claude wants to:* and the change in one sentence. It moves out from under an open panel.

#	Control	What it does	Default
1	**Approve**	Runs the change. It is one step on the undo list.	
2	**Reject**	Refuses it; nothing changes, and Claude is told.	

← The task-by-task guide to these panels: **chapter 16, Working with Claude (Pro+)**, page 104

Reference R17: the History tool

Opened with **History** on the Results tab (chapter 17). The controls panel sits on the right; the plot takes the 3D view's place.

R17.1 The controls panel

#	Control	What it does	Default
1	×	Closes the tool and brings the 3D view back.	
2	**Run:** and **Choose time-history file…**	The file read; choose another …*T01* (also T02, T03) for a run whose file is elsewhere. The dialog does not block the program.	the *T01* beside the animation files
3	**Curve tree**	Every recorded curve by object: Rigid bodies, Sections, Nodes, Parts (object, then variable; an object's box ticks all of it), Whole model, Other objects, Picked in 3D and My curves, each with its count, for example *Rigid bodies (18)*. Ticking draws the curve at once.	none ticked
4	**Filter**	Shows only the curves whose name contains the text, for example *FY*, *energy* or a node number.	empty
–	**Choose OpenRadioss folder…**	Only in the orange box that replaces the tree when the curves could not be read (no solver folder, no converter, or a file it refuses); the box says why. Opens the same chooser as **Tools** → **Solver folder…**; once a folder is set, the file is read again.	
5	**Node / Part**	What a click in the 3D view picks.	Node
6	**Pick in 3D**	Click a node, or an element of a part, in the 3D view: its curves are listed under *Picked in 3D* and one is ticked (for a node, *DX*).	off
7	**ON THE PLOT**	The drawn curves with their colours. Select one to change its operation, its look or to remove it.	
8	**x axis** and **minus** (under *OPERATIONS*)	What the x axis shows: *Time*, a curve, or a curve minus another (an extensometer between two nodes).	Time
9	**curve**	The selected curve *as is*, its time derivative *d/dt*, or its time integral ∫*dt*.	as is
10	**× / +**	Scale factor and offset for the selected curve.	1 and 0
11	**units**	Four boxes: the display unit of time, length, force and energy. Only the display changes; the file is never rewritten.	the deck's units
12	**Remove**	Takes the selected curve off the plot.	
13	**Plot**	Shows the plot in the 3D view's place. Disabled until curves have been read.	

Selected curve's look and the titles

#	Control	What it does	Default
1	**Legend name**	The selected curve's name in the legend.	empty = automatic
2	**Colour…**	The curve's colour.	one per curve
3	**Line thickness**	From 0.5 to 6, in steps of 0.5.	
4	**Line style**	Solid, dashed, dotted or dash-dot.	solid
5	**markers**	A marker at every recorded point.	off
6	**label its peak**	Labels the curve's maximum with its value and time.	off
7	**TITLES**	The plot's title and the x- and y-axis titles.	empty = automatic

My curves (A op B)

#	Control	What it does	Default
1	**A**, **operation**, **B**	*A* + *B*, *A* − *B*, *A* × *B* or *A* × *a number*. Adding and subtracting need the same quantity.	
2	**Number**	The number for *A* × *number*.	1
3	**Name**	The new curve's name.	empty = automatic
4	**Make curve**	Adds the curve under *My curves*.	

R17.2 The plot

#	Control	What it does	Default
1	**Time-history plot —** *file*	The pane's title: the plot in the 3D view's place.	
2	**3D** | **Plot**	At the pane's top right: back to the 3D view, and to the plot again.	
3	Click on the plot	With no zoom, pan, cursor or probe mode on and time on x: the 3D view jumps to the nearest frame. With a curve on x, nothing happens.	
4	Click a legend entry	Hides or shows that curve.	

The bar under the plot

#	Control	What it does	Default
1	Read-out	The x and y under the cursor, and messages such as a refused log axis.	
2	**Box zoom**	Drag a box on the plot to zoom into it.	off
3	**Pan**	Drag the plot to move it.	off
4	**Back**	Steps back one zoom or pan.	
5	**Reset**	Back to the full view; typed ranges are cleared.	
6	**x** and **y** range	Two numbers, for example *0 – 20*; the first must be the smaller.	empty = auto
7	**Fit y**	Fits y to the curves inside the current x range.	
8	**log x**, **log y**	Logarithmic axis; refused, in words, when a value in view is zero or negative.	off
9	**Grid**	Grid lines.	on
10	**Legend**	Where the legend sits: top right, top left, bottom right, bottom left, outside the plot, or hidden.	top right
11	**Frame marker**	The grey dash-dot line at the 3D view's frame.	on
12	**Peaks**	Marks each curve's maximum and minimum.	off
13	**Two cursors Δ**	Click two times on the plot: the differences between them.	off
14	**Probe**	Click a point on a curve: its name, x and y stay on the plot (the nearest recorded point).	off
15	**Clear probes**	Removes every probe label.	
16	**Statistics**	The statistics table under the plot (below).	off
17	**Copy**	Puts the plot on the clipboard as a picture.	
18	**Picture size**	The size *PNG…* saves at: as shown, 1200 × 800, 1920 × 1080, or 3000 × 2000 for print.	as shown
19	**PNG…**	Saves the plot as a picture.	
20	**CSV…**	Saves exactly the drawn curves as numbers (after the operation, units, scale and offset).	

Statistics

#	Control	What it does	Default
1	**Table**	Per curve on the plot: maximum and minimum with where they occur, the value at x, and the time-weighted average over the part of the curve shown (between its first and last point inside the view). All follow the x range on screen.	
2	**value at x =**	The x for the *value at x* column (linear between the two points around it).	
3	**Copy table**	Puts the table on the clipboard.	

← The task-by-task guide to these panels: **chapter 17, Time histories**, page 113

Reference R18: the Run analysis window

Opened with **Tools** → **Run analysis...** (chapter 18). It does not block the program; every setting is remembered for the next run. The window during a run is pictured in Figure 18.1.

R18.1 The window

#	Control	What it does	Default
1	**Run folder** and **Choose folder...**	The folder the run writes into: the exported deck and everything the solver writes.	the last run's folder
2	**Threads (-nt)**	The Engine's threads, from 1 to the number of processor cores.	half the cores
3	**Processes (-np)**	Several solver processes. Needs Intel MPI; without it the label says so and the box stays at 1.	1
4	**Extra arguments**	Anything else passed to the solver, typed as on its command line.	empty
5	Progress bar and status line	How far the run is, and what it is doing.	
6	**Live (from the Engine)**	What the running Engine reports, refreshed every few seconds: *Time step* and the element that *Set by* it, *Energy error %*, *Mass error*, *Internal energy*, *Kinetic energy*, *Rotational kinetic* and *External work*. A dash until the Engine reports.	
7	Log	The run's messages, newest last.	
8	**Run**	Exports the model into the run folder, with the same checks as **File** → **Export**, then starts the Starter and, if it finds no errors, the Engine (chapter 18.1).	
9	**Stop cleanly**	The Engine's /STOP: it ends at its next check (within 10 cycles) and writes a restart file.	
10	**Kill**	The Engine's /KILL: it ends at its next check, without a restart file.	
11	**Force end**	Ends the solver's processes at once, for an Engine that does not answer.	
12	**Close**	Closes the window.	
13	**Animation now**, **Restart file now**, **Output file now**	The Engine's /ANIM, /RFILE and /OUTP: a new animation file, the restart file or an output file, written at its next check (within 10 cycles), while the run goes on.	

> **Letters in paths** Keep the run folder, the run name (/BEGIN) and the OpenRadioss folder free of Hebrew, Cyrillic, Chinese and other letters your Windows language setting cannot show in an old program; spaces and accented letters (é, ü) are fine. If a path breaks this, the Run window says so, and its **Run in C:\BeidPrep_runs** button writes the model there, runs it and opens the results from there.

R18.2 Claude Pro+

The *Claude* box sets what Claude may do with the run (chapter 18.4). In the other editions it is greyed out with its badge.

#	Control	What it does	Default
1	**Claude may run the analysis** (through the Claude connection)	Lets Claude start runs, within the two limits below.	off
2	**At most threads**	The most threads a run Claude starts may use.	half the cores
3	**At most minutes per run**	The longest a run Claude starts may last.	30

← The task-by-task guide to these panels: **chapter 18, Running the analysis**, page 121

Reference R19: the SPH Generator

Opened with **SPH Generator** on the Model tab (chapter 19). Three tabs: **Standard**, **Fill** (Pro) and **Bird** (Pro+). Rows your licence does not include are not shown.

R19.1 Standard

#	Control	What it does	Default
1	**Box**, **Sphere**	The shape to fill.	Box
2	**Corner 1**, **Opposite corner**, **Edge direction (2 nodes)**	For a box: two opposite corner nodes, and two nodes along one edge; the box is aligned to that edge.	
3	**Sphere centre**, **Sphere radius**	For a sphere: its centre node and its radius.	50 mm
4	**Spacing**	The distance between particles.	5 mm
5	**Packing**: **Cubic**, **Hexagonal**	How the particles are stacked.	Cubic
6	**Smoothing length h (0 = auto)**	The SPH smoothing length; 0 sets it from the spacing.	0
7	**Density**	Below Pro: the particles' density. With Pro the next rows replace it.	1000 kg/m³

Mass, material and velocity Pro

On the Standard and Fill tabs. Not shown below Pro.

#	Control	What it does	Default
1	**Total mass** / **Density** (Standard only)	Give one; the other is shown. The density is set so that the mass comes out exactly.	Total mass, 1 kg
2	**Material**	*New LAW6*, or *Use existing:* a material already in the model.	New LAW6
3	**Initial velocity (m/s)**	Three boxes: X, Y and Z.	0, 0, 0

Contact Pro+

On all three tabs. Not shown below Pro+.

#	Control	What it does	Default
1	**Add TYPE7 contact**	Creates a contact between the particles (the secondary side, set automatically) and the parts listed below; its gap is set from the spacing.	on
2	**Impacted components** list	The parts the particles can hit: select them here. A click in the 3D view adds or removes a part in this list, so the list is what the contact uses.	none (Bird: the part it hits)
3	**Pick in 3D**	Click parts in the 3D view to add or remove them.	

R19.2 Fill Pro

#	Control	What it does	Default
1	**Shape to fill**	*Closed shell elements*, *Solid CAD body* or *Closed CAD surface*.	Closed shell elements
2	**Shape**	Pick it. The panel checks that it is closed and shows its volume; an open shape is refused.	
3	**Fill %**, **Mass**, **Density**	Which two you set; the third is computed.	
4	**Fill fraction**	How full, in percent.	100 %
5	**Mass**	The particles' total mass.	1 kg
6	**Density**	The particles' density.	1000 kg/m^3
7	**Fill direction**: **2 nodes**, **3 nodes (plane)**, and **Direction nodes**	The direction the shape fills along: a vector between two nodes, or the normal of three nodes' plane. Particles fill from the low end.	2 nodes
8	**Flip**	Reverses the fill direction (on the Bird tab: the direction vector).	off
9	**Particles on shell nodes too**	For shell elements: also a particle on each shell node.	off
10	Spacing, packing, material and velocity	As on the Standard tab (R19.1).	

R19.3 Bird Pro+

#	Control	What it does	Default
1	**Bird type**	*Gelatin test projectile* or *Chicken*.	Gelatin test projectile
2	**Bird size**	*1.8 kg (4 lb)* or *Other mass*, which shows a box for the mass in kg.	1.8 kg
3	**Speed**	In m/s.	310 m/s
4	**Part it hits**	Pick the part. It is also selected in the Contact list.	
5	**Flight direction**	−X, +X, −Y, +Y, −Z, +Z, *Along current view*, or *Normal to surface* (flat parts only).	the last one used
6	**Aim point**	Pick the node to aim at. The panel then says what the bird hits first and at what angle, and what **Create bird** will make.	
7	**Advanced**	Opens the rows below. Changing anything in it except the direction puts the bird *Outside tested range*.	closed
8	**Direction vector** and **Flip**	The flight direction as three numbers; **Flip** reverses it.	from 5
9	**Spacing**, **Start gap**, **Contact gap**	The particle spacing, the gap before the first surface, and the contact gap. They follow the bird type, mass and speed; a typed value stays until the speed, the mass or the type changes again.	set by the bird
10	**Reproduce a test case**	One of the 16 NASA tests: builds that test's whole deck (bird, rigid wall, force output, run length) exactly as it was run. Needs an empty kg-mm-ms model.	(none)

← The task-by-task guide to these panels: **chapter 19, SPH Generator**, page 125

A Keyboard shortcuts

A.1 Files

Keys	What they do
`F1`	Open this manual (the same as **Help** → **Manual**; section 3.2)
`Ctrl` + `N`	New, empty model (asks about unsaved work first)
`Ctrl` + `O`	Open a BeidPrep model (`.beid` , section 4.5); an OpenRadioss or LS-DYNA deck chosen here is imported, as with `Ctrl` + `I`
`Ctrl` + `S`	Save the BeidPrep model to its `.beid` (a name is asked the first time only; section 4.5)
`Ctrl` + `I`	Import a model: an OpenRadioss deck with its Engine file, or an LS-DYNA file, as a new model or added to the open one (sections 4.2 and 4.4)
`Ctrl` + `E`	Export the OpenRadioss deck (section 4.6)
`Ctrl` + `Shift` + `S`	Save As: the BeidPrep model under a new name
`Ctrl` + `Shift` + `O`	The same as `Ctrl` + `O`

A.2 Editing

Keys	What they do
`Ctrl` + `Z`	Undo
`Ctrl` + `Y` or `Ctrl` + `Shift` + `Z`	Redo
`Delete`	Delete the selected card in the tree (section 5.4)
`Tab` / `Shift` + `Tab`	In an editing panel with several pick rows: go to the next / previous row (chapter 9)
`Esc`	Stop the pick of the open editing panel

A.3 While dragging a node (Node Move)

Keys	What they do
`M`	Merge on or off: a node dropped onto another merges with it
`C`	Centre on or off (with merge on)
hold `N`	Move along the node's normal instead of in its plane

A.4 Mouse in the 3D view

See the table in section 3.6.