TUTORIAL VIDEO 12

12 The fibre module: short-fibre composites from tensile curves

Calibrate a short-fibre composite from its tensile curves, map Moldflow fibre orientation onto the part, export the mapped materials and check them against a tensile run.

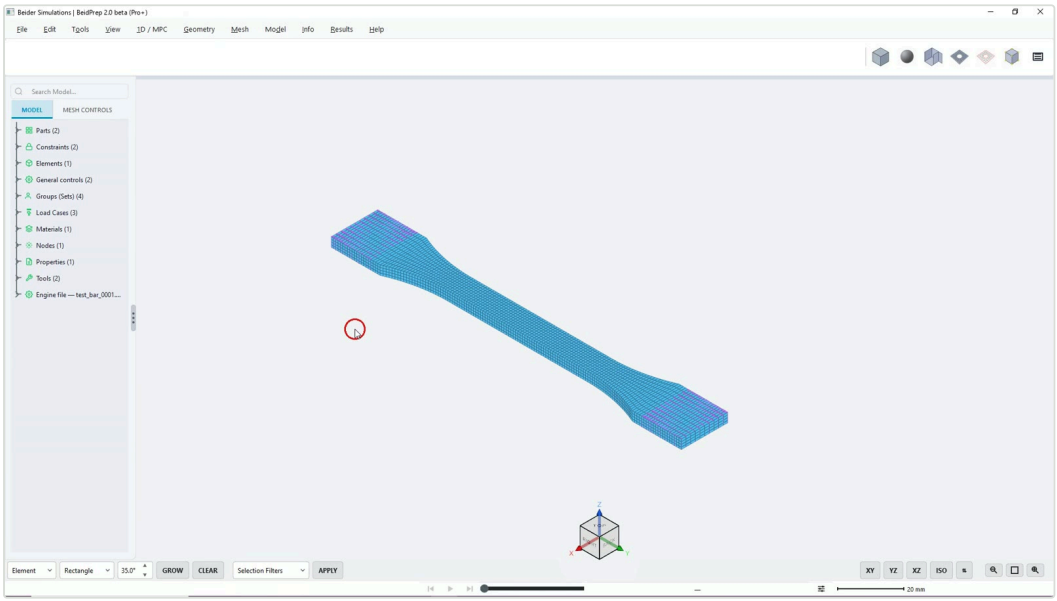
Tutorial files	folder `12_Fibre_module` — open `deck\test_bar_0000.rad` first (this video also needs the results zip)
Video	Watch video 12 on YouTube
Download files	Download the tutorial files (97 MB) Download the solver results (225 MB)

1 Opening

video 0:00

This video brings the fibre directions from the Moldflow filling results onto a test bar.

The material is PA6 GF50, 50 % glass fibre, calibrated here from its own tensile curves.



The screen at 0:14 in the video.

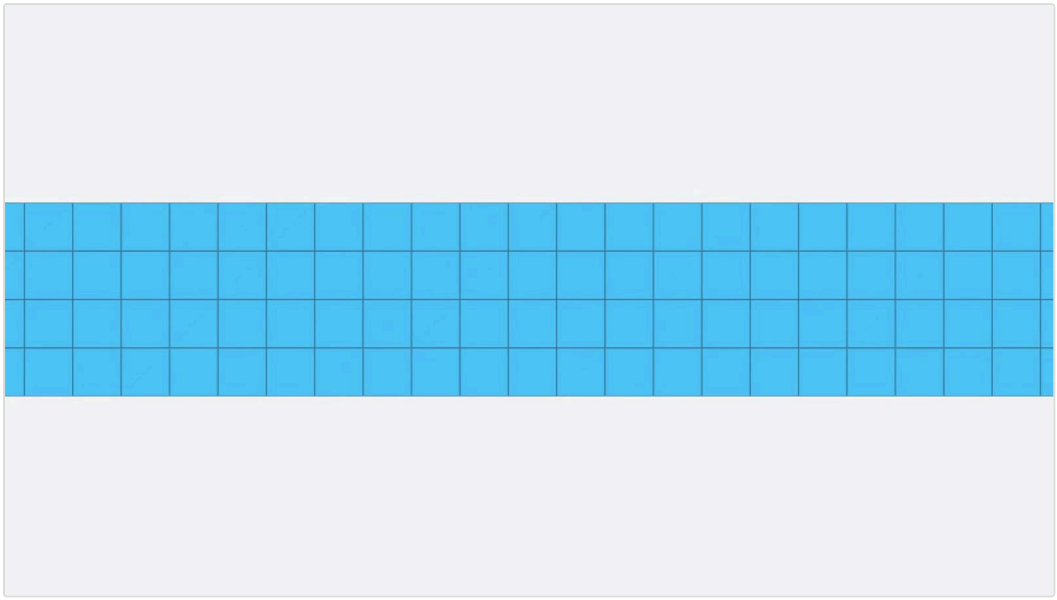
2 The case, Hexa mesh

video 0:14

The bar is cut from a plate that was filled from two gates.

Where the two flow fronts meet they leave a weld line, and here it crosses the bar's narrow section.

The bar comes in already meshed with hexahedra, four layers through its four millimetres: the fibre module works on solid elements, and BeidPrep 2.0 doesn't generate solid meshes yet.



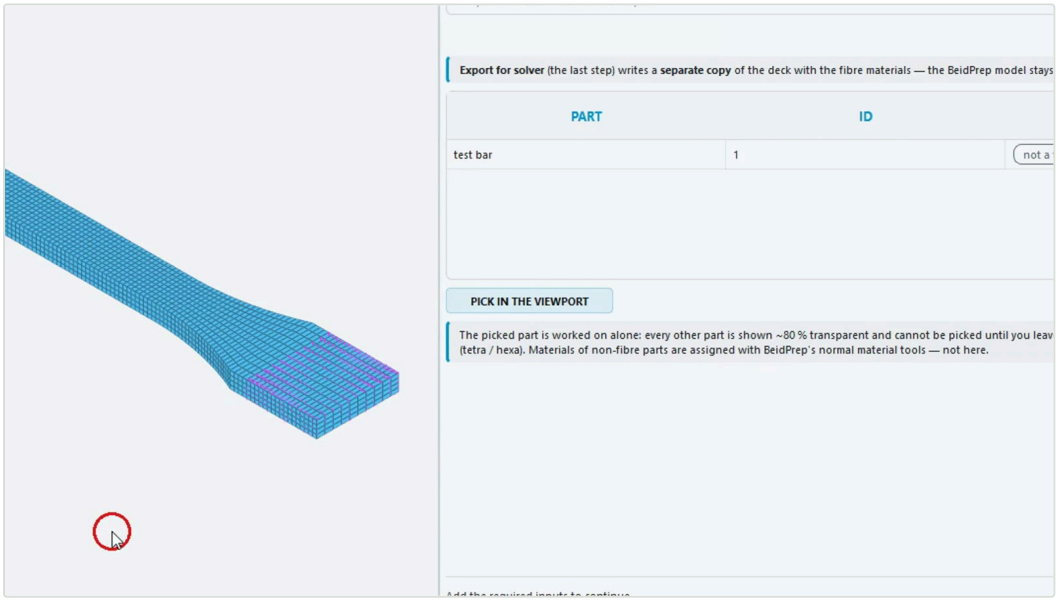
The screen at 0:36 in the video.

3 Open the module

video 0:37

1. On the Model tab, click Fibre module.

   The panel works in four steps: the part, the material, the orientation, and the export.



The screen at 0:47 in the video.

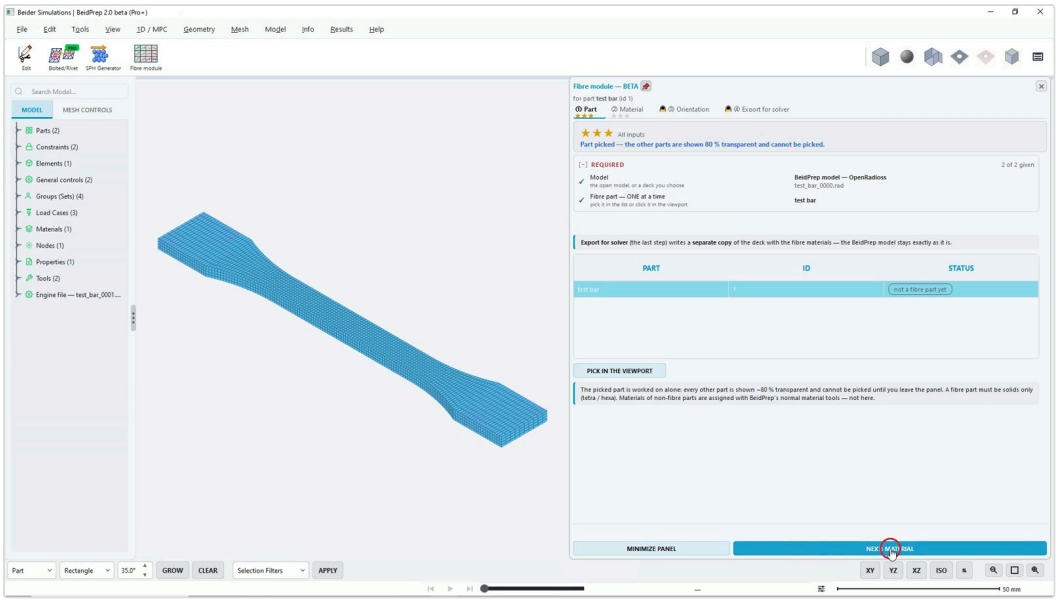
4 Part

video 0:47

Step one is the part.

1. Click the bar: the module works on one short-fibre part at a time, meshed with solids.

   Your model is not changed. The last step writes a copy for the solver.



The screen at 0:59 in the video.

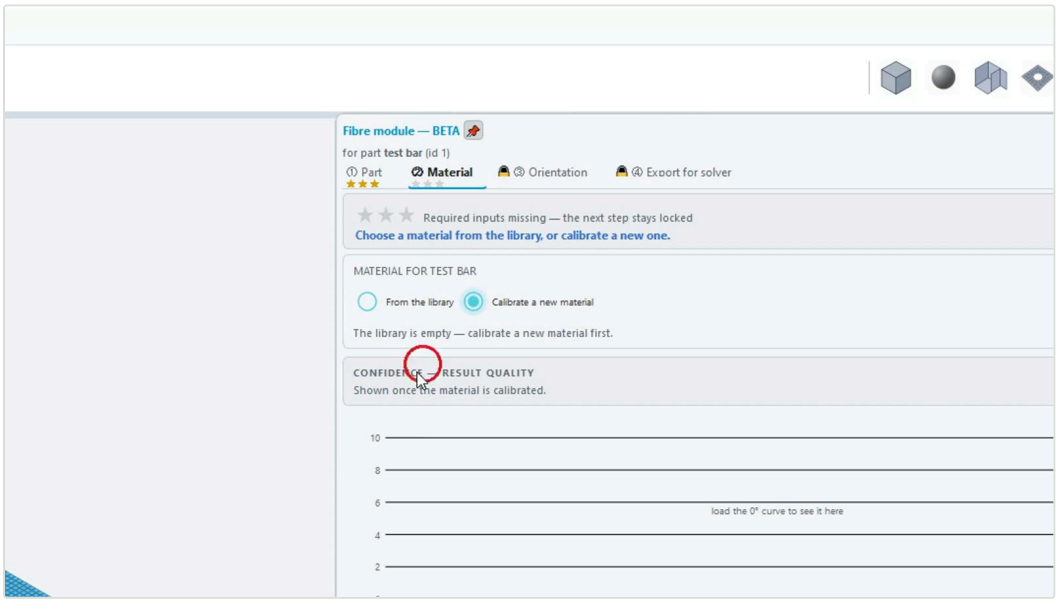
5 Material

video 1:00

Step two is the material.

1. Pick one already calibrated from the library, or calibrate a new one from your own tensile curves.

   This video starts from the curves.



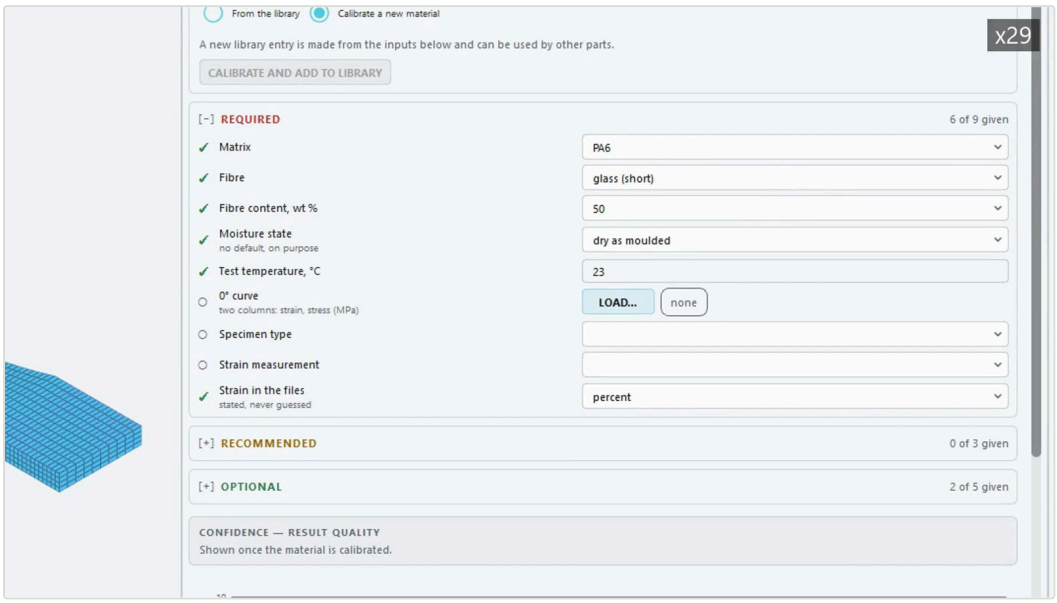
The screen at 1:11 in the video.

6 Required

video 1:13

The required inputs describe the material and the test.

Polyamide 6, short glass fibre, fifty percent by weight, dry as moulded, tested at twenty three degrees.



The screen at 1:24 in the video.

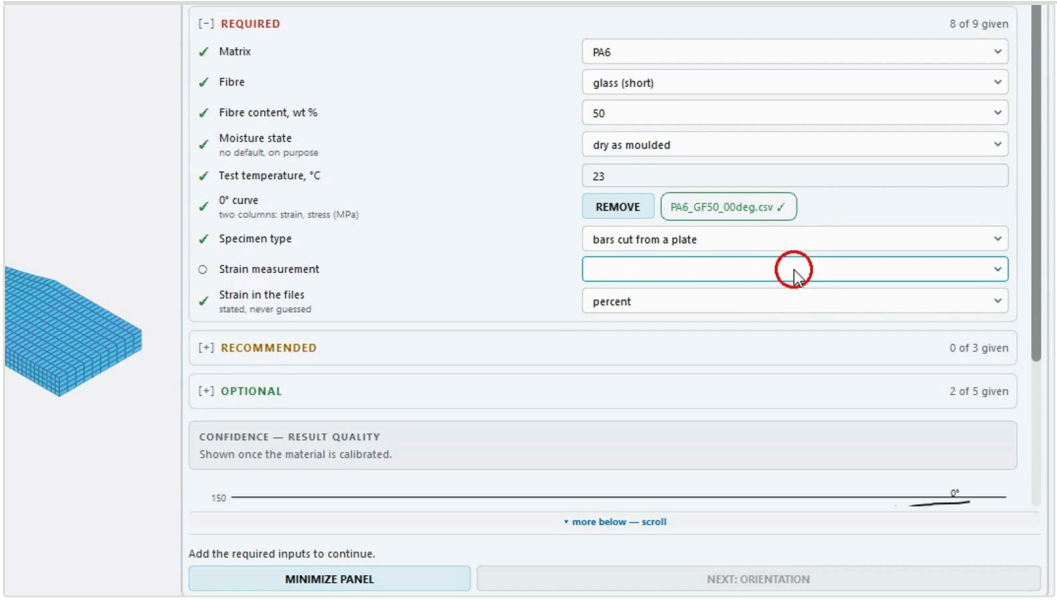
7 0° curve

video 1:25

1. Load the zero degree curve, pulled along the flow.

   The bars were cut from a plate, the strain was measured with an extensometer, and the file gives it in percent.

   In the video: **PA6_GF50_00deg.csv** in file dialog.



The screen at 1:36 in the video.

8 Recommended, Confidence LOW

video 1:37

The forty five and ninety degree curves are recommended, not required.

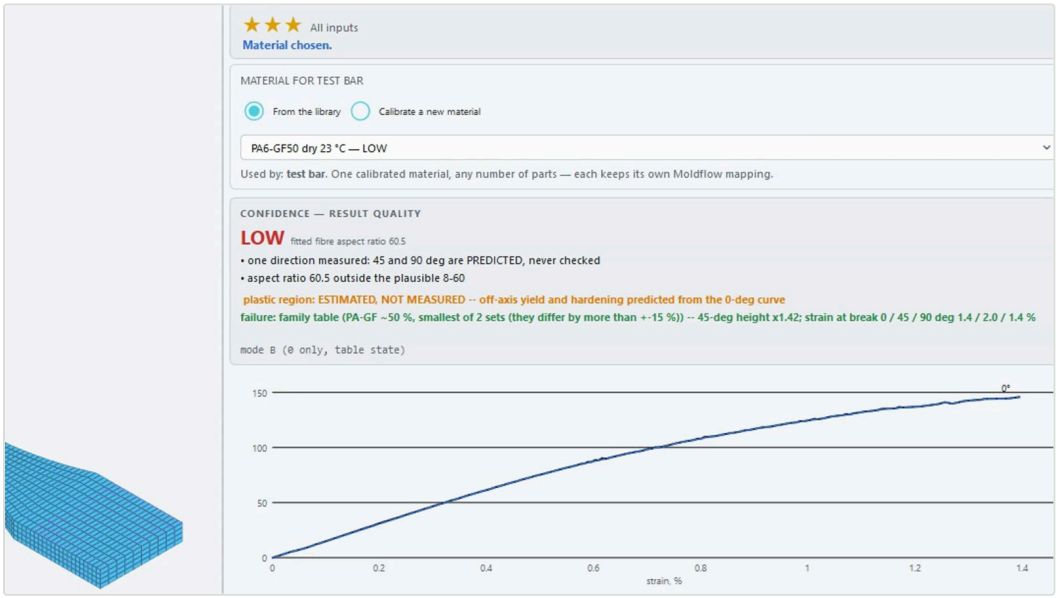
1. Leave them empty for now, and press Calibrate and add to library.

The confidence card says LOW, and it says why.

Only one direction was measured: forty five and ninety degrees are predicted, never checked.

And the fitted fibre aspect ratio, sixty point five, is outside the plausible range of eight to sixty.

The plastic behaviour is estimated, not measured.



The screen at 2:06 in the video.

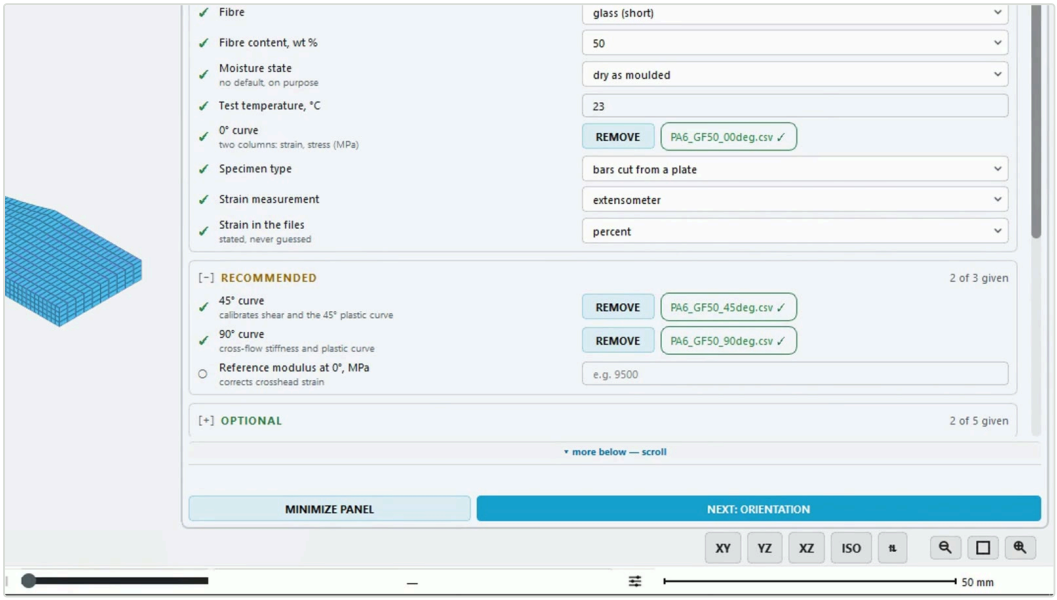
9 Add 45° and 90°

video 2:06

1. Now add the forty five and ninety degree curves.
2. Choose Calibrate a new material again: the form keeps what you entered.
3. Load both curves, and calibrate again.

   In the video: **PA6_GF50_45deg.csv** in file dialog.

   In the video: **PA6_GF50_90deg.csv** in file dialog.



The screen at 2:20 in the video.

10 Confidence MEDIUM

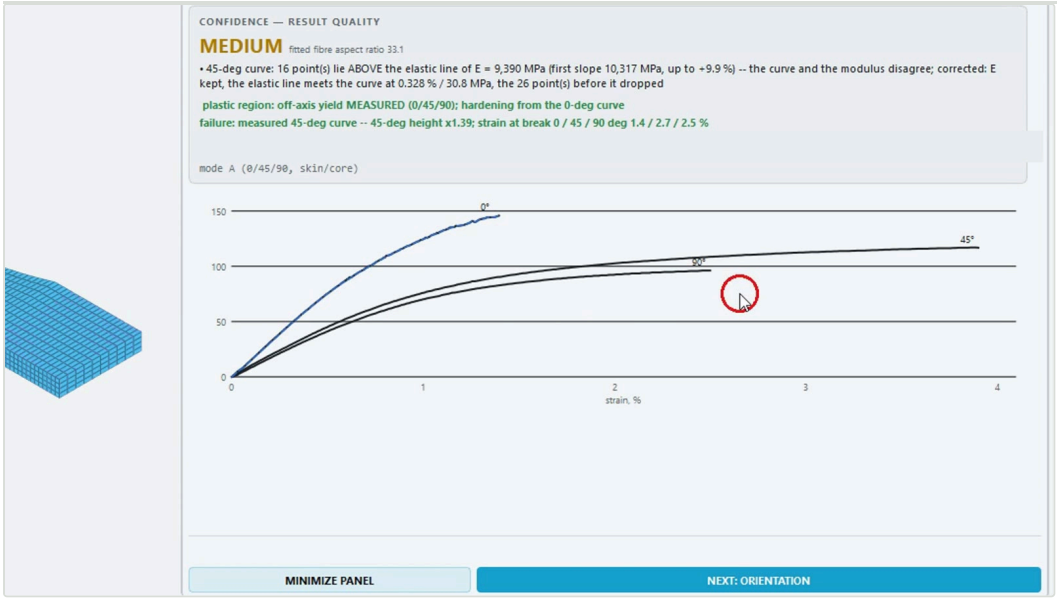
video 2:24

The confidence rises to MEDIUM.

The fitted aspect ratio is now thirty three, inside the plausible range, and the yield off the fibre axis is measured.

One reason is left: the forty five degree curve starts above its elastic line.

The plot shows the three measured curves, and in blue, dashed, the master curve the solver uses.



The screen at 2:46 in the video.

11 Library, Moldflow files

video 2:46

Both calibrations are now in the library, under the same name, each with its confidence.

1. Keep the MEDIUM one for this bar.

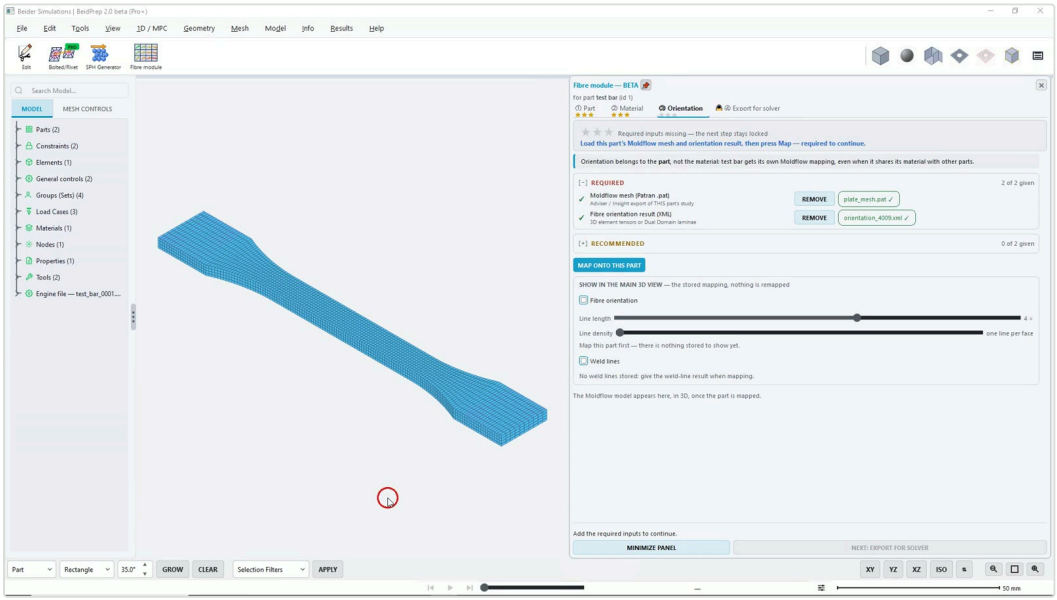
   Step three is the orientation.

2. Load the Moldflow mesh, and the fibre orientation result.

   The orientation belongs to the part: another part can use the same material with its own mapping.

   In the video: **plate_mesh.pat** in file dialog.

   In the video: **orientation_4009.xml** in file dialog.



The screen at 3:11 in the video.

12 Weld-line file, Map

video 3:11

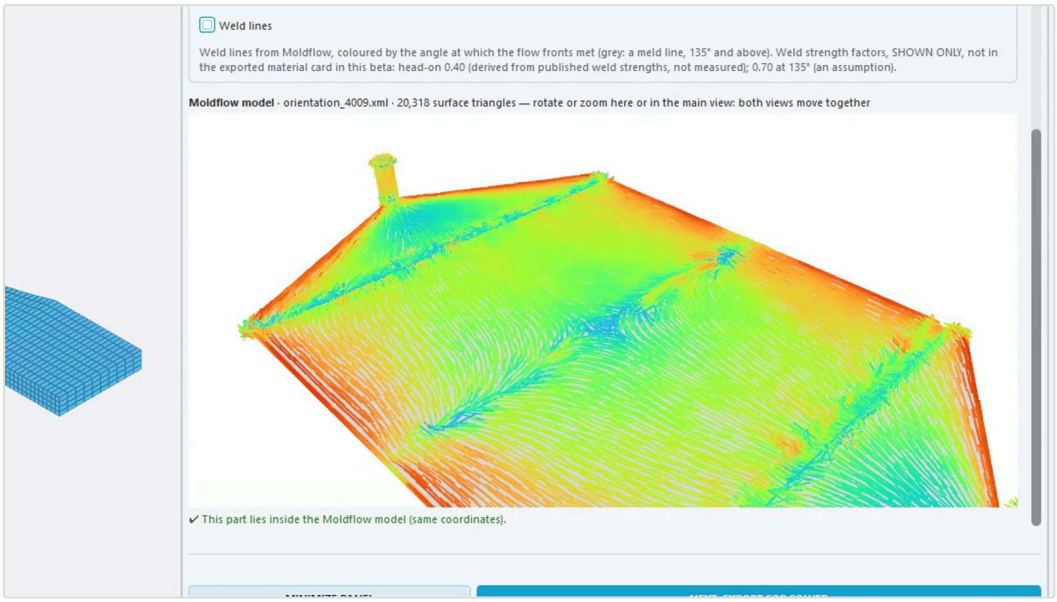
The weld-line result is optional.

1. Load it in its own row.
2. Press Map onto this part.

BeidPrep first checks that the bar lies inside the plate, then gives every element its fibre direction.

The linked view now shows the plate the results come from.

In the video: **weld_lines_1722.nod** in file dialog.



The screen at 3:35 in the video.

13 Fibre colours, Weld lines

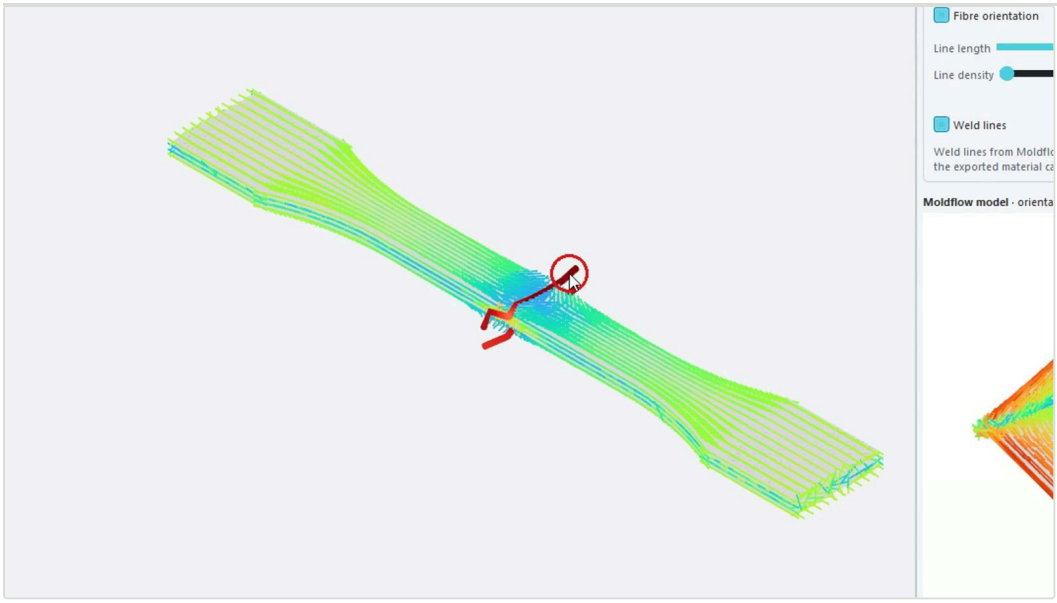
video 3:36

Under Show in the main 3D view, Fibre orientation colours the bar by fibre direction.

Tick Weld lines.

The weld line is drawn as a tube across the narrow section, coloured by the angle at which the flow fronts met.

The legend gives the angles.



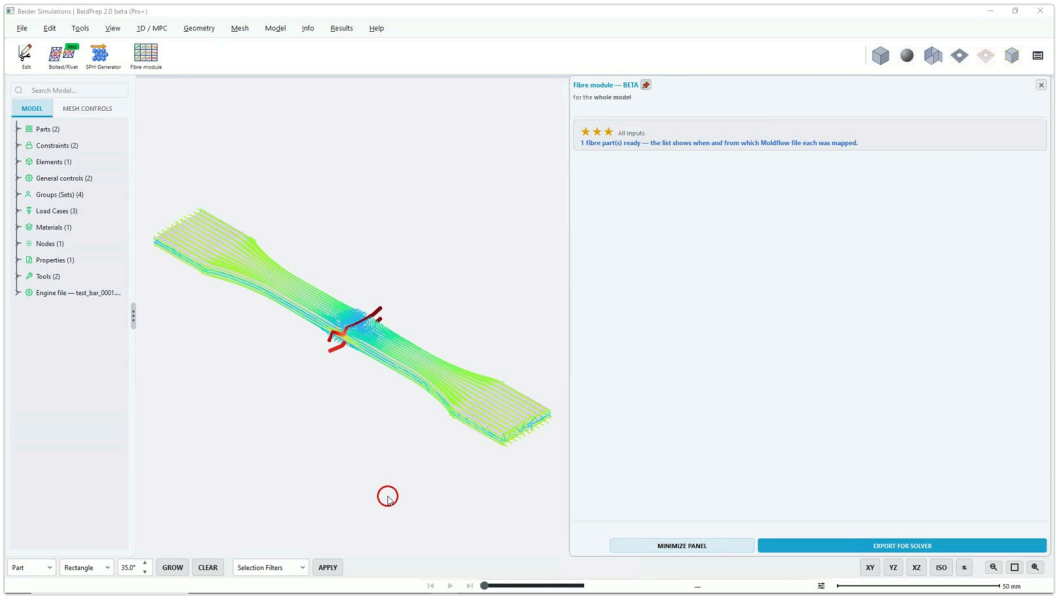
The screen at 3:51 in the video.

14 Export

video 3:54

Step four is the export.

Export for solver writes a copy of the deck for OpenRadioss: the fibre elements are sorted into material groups, and each element keeps its own fibre direction.



The screen at 4:07 in the video.

15 Tensile run, Strain

video 4:08

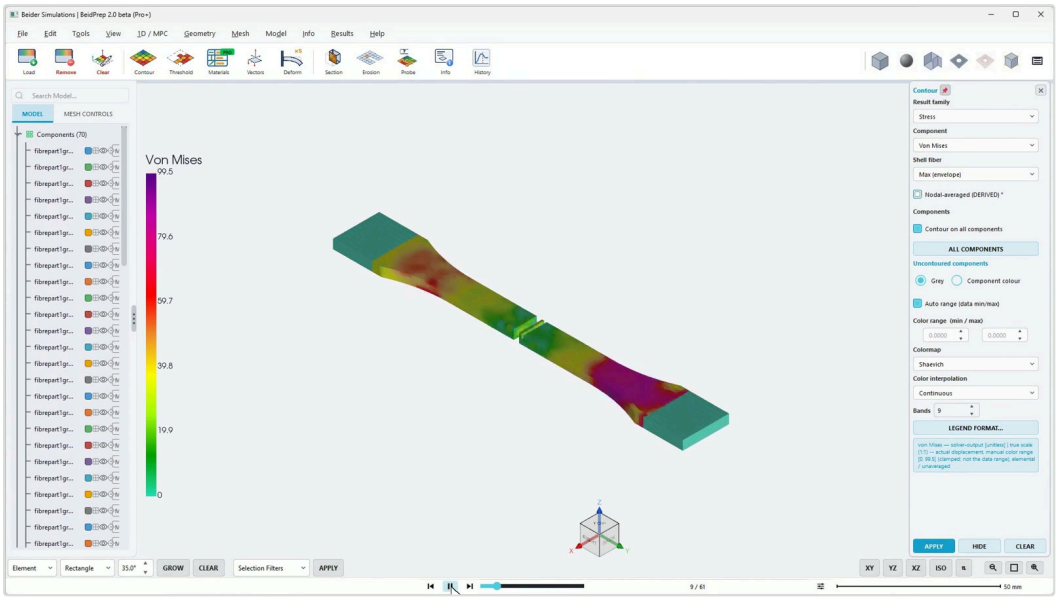
The bar is then pulled in OpenRadioss, like a tensile test.

1. Click Load on the Results tab, and open the run.

Contour shows the von Mises stress.

2 Play the run, and watch where the strain gathers.

In the video: **test_bar_fibreA001** in file dialog.



The screen at 4:25 in the video.

16 Force against time

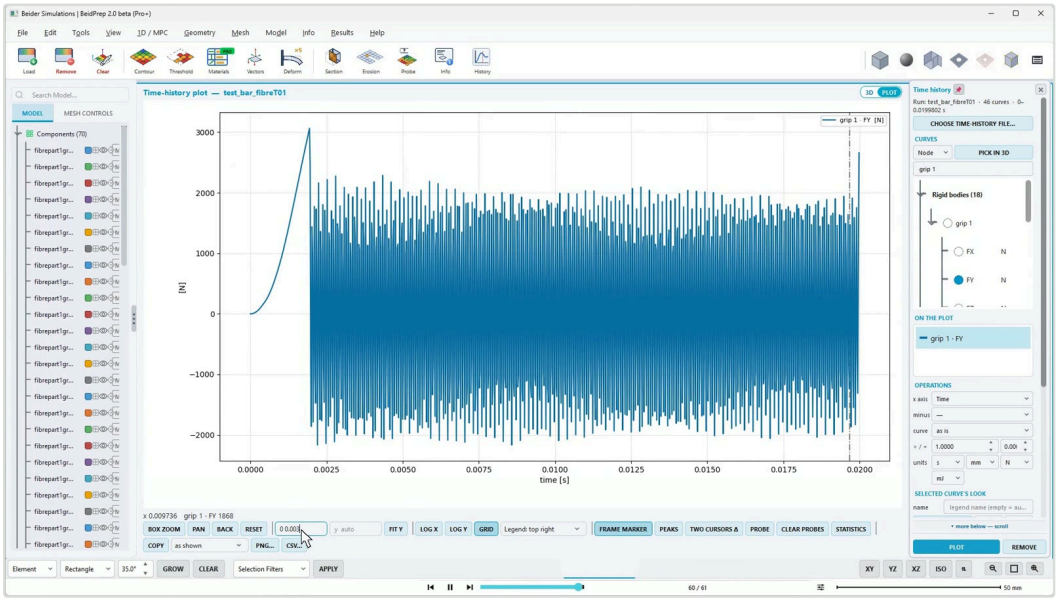
video 4:27

History plots the grip force against time.

1 Show the first three milliseconds, where the bar is pulled and breaks.

In the video: **grip 1** in filter box.

In the video: **0 0.003** in x range field.



The screen at 4:42 in the video.

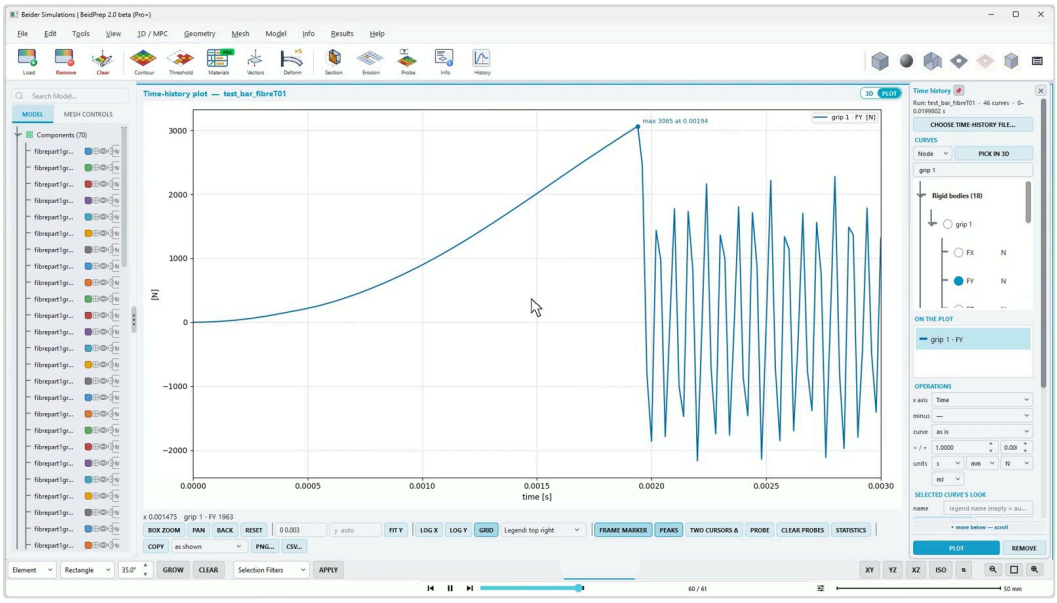
17 Peak, Close

video 4:44

Peaks marks the highest force: about three thousand and sixty newtons, at just under two milliseconds.

Then the bar breaks: the force drops, and the grip only rings around zero.

That is the fibre module: a material calibrated from your own curves, and the Moldflow filling results mapped onto your part, with its weld lines.



The screen at 5:05 in the video.

Steps and pictures are taken from tutorial video 12. Every picture is a frame of the video.