TUTORIAL VIDEO 11

11 Time histories: energies, contact force, peaks

Plot time histories from an OpenRadioss T01 file: energies, a contact force and its peak, the derivative and your own curves, two cursors, statistics, and a PNG for your report.

Tutorial files	folder `11_Time_histories` — open `wingbay_i_bird_4ms_0000.rad` first (this video also needs the results zip)
Video	Watch video 11 on YouTube
Download files	Download the tutorial files (97 MB) Download the solver results (225 MB)

1 Opening

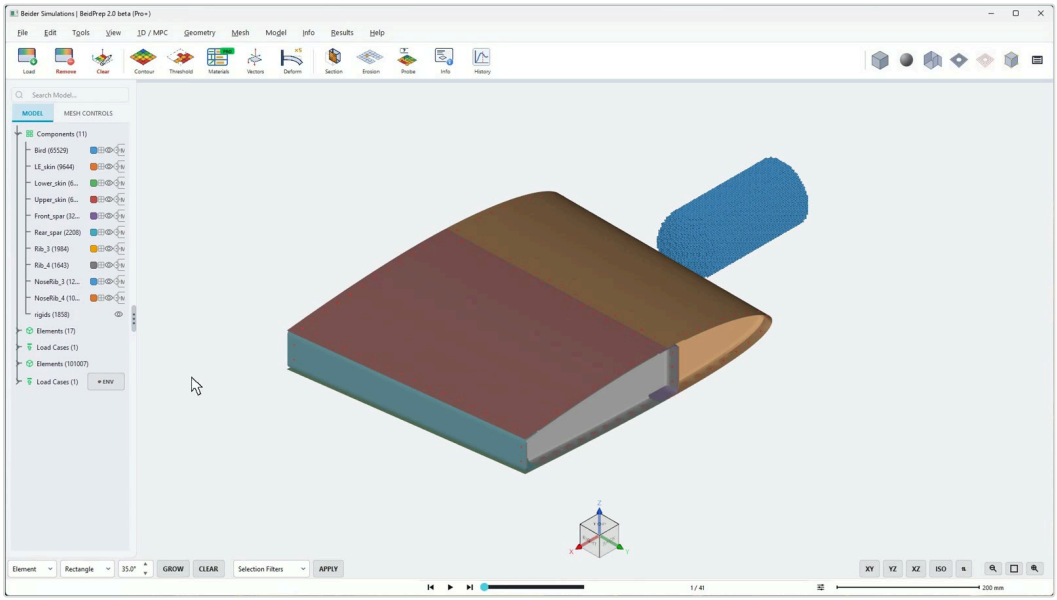
video 0:00

A bird strike run writes two kinds of results.

Animation files show the model at a few moments.

The time history records chosen values every microsecond.

This video shows how to plot it.



The screen at 0:12 in the video.

2 T01 file, History

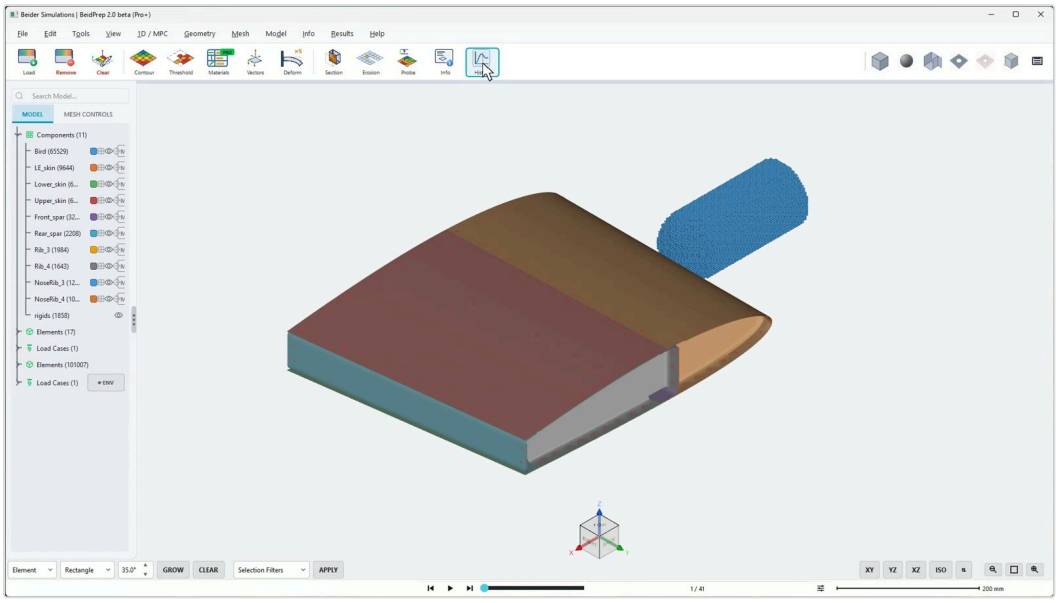
video 0:12

1. Open the run's results first, as video ten shows.

   The time history file ends in T zero one.

It sits beside the animation files.

2 On the Results tab, press History.



The screen at 0:24 in the video.

3 Run line, Curves

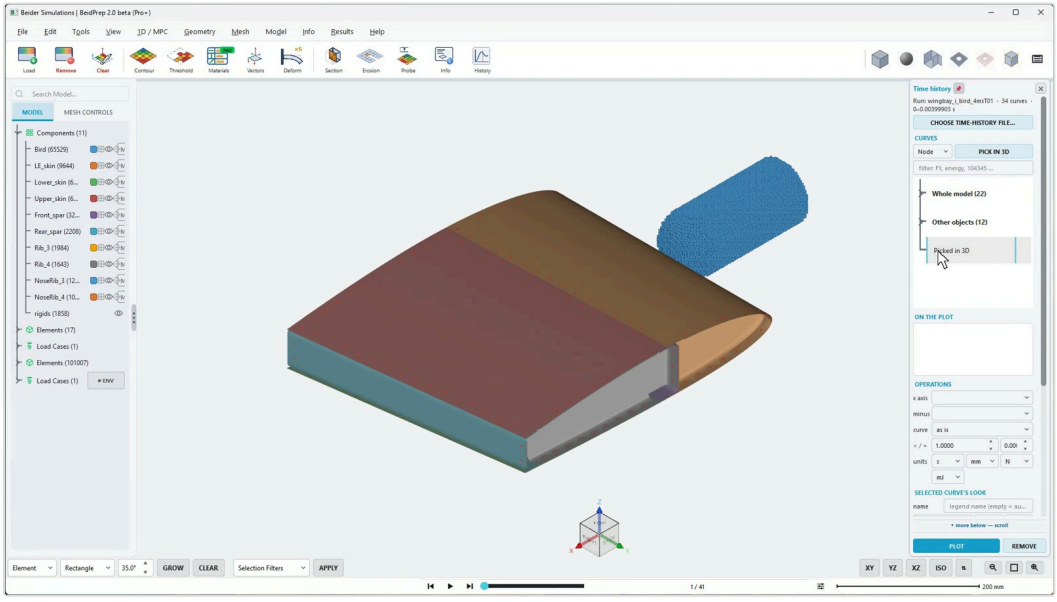
video 0:25

The panel opens on the right, and reads the file at once.

Run, at the top, names the file it read.

Under Curves, every recorded curve is listed by object.

Each group shows how many curves it holds.



The screen at 0:38 in the video.

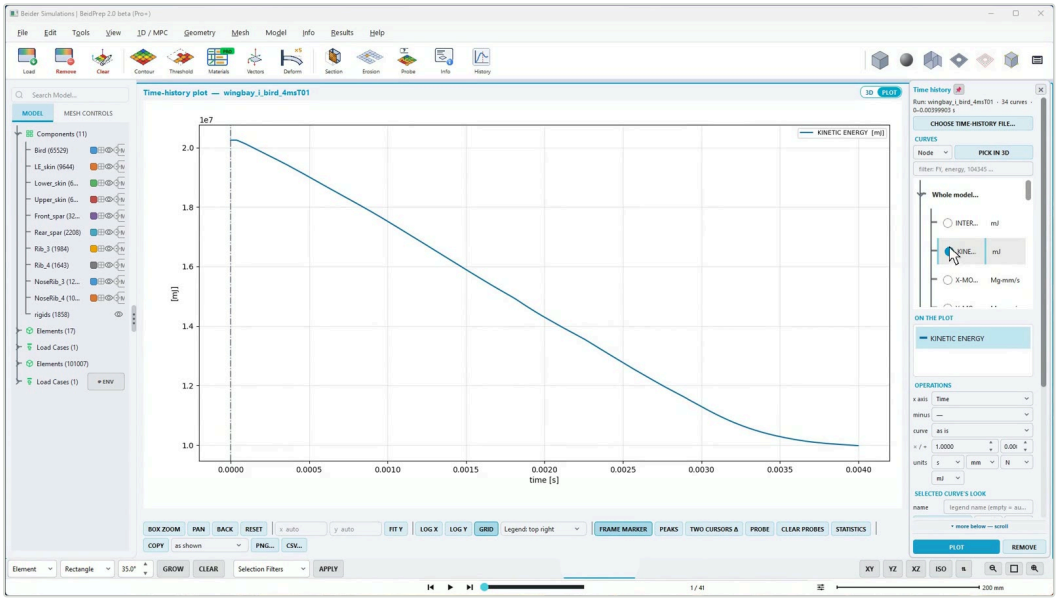
4 Whole model, Kinetic

video 0:38

Whole model holds the energies of the run.

1. Open it.
2. Tick kinetic energy.

   The plot replaces the 3D view at once.



The screen at 0:48 in the video.

5 Internal

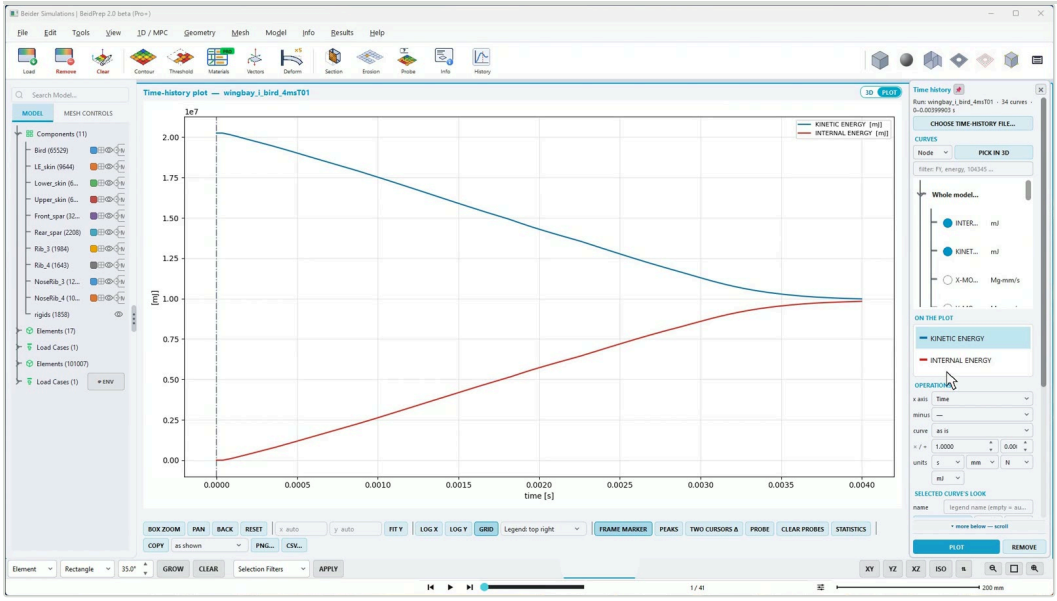
video 0:48

1. Tick internal energy as well.

   The bird slows down.

   Kinetic energy falls, and internal energy rises.

   It goes into the skin and the spar.



The screen at 0:59 in the video.

6 Hourglass, Click to jump

video 0:59

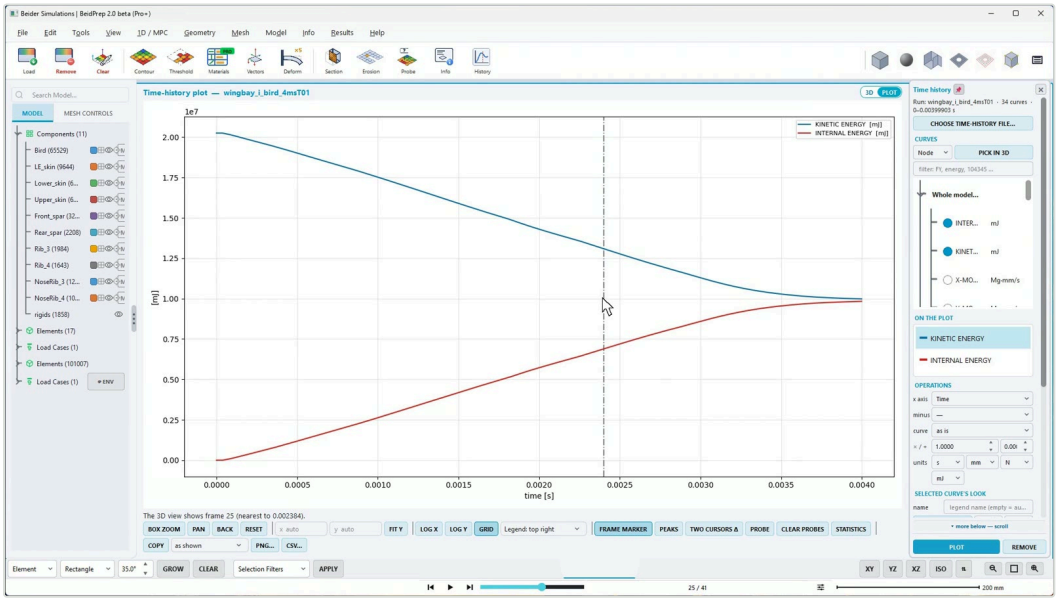
1. Tick hourglass energy.

   It stays under two percent of the start.

   That is what you want in a shell model.

   A grey dash-dot line marks the frame shown in 3D.

2. Click on the plot, and the 3D view jumps to that time.



The screen at 1:13 in the video.

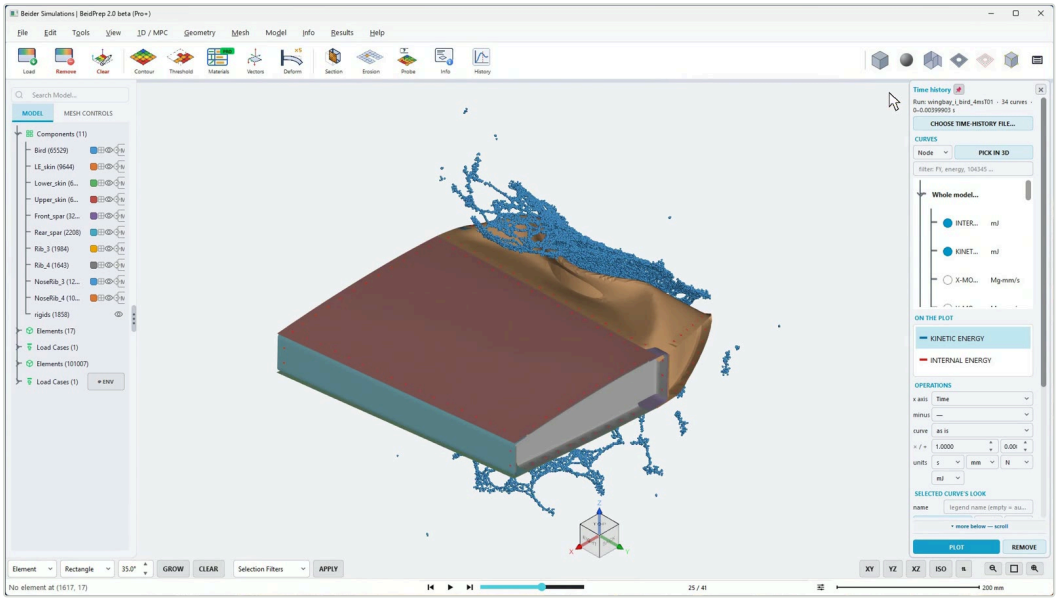
7 Back to 3D

video 1:13

The top right switch goes back to the 3D view.

Here is the wing at that moment, just as the skin starts to tear.

1. Switch back to the plot.



The screen at 1:22 in the video.

8 Contact force, Impulse

video 1:23

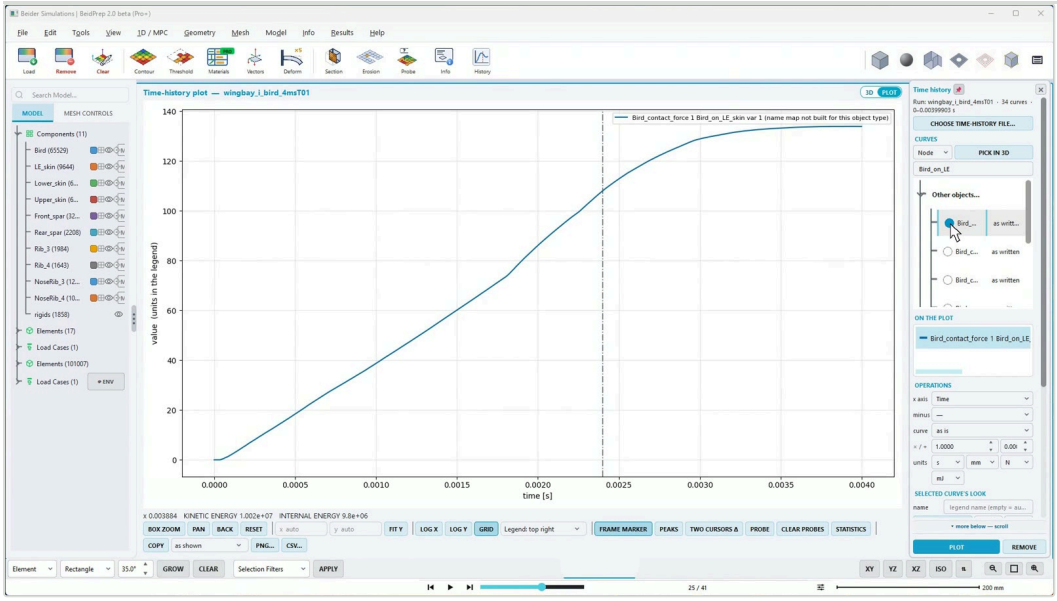
Now the force of the bird on the skin.

The contact curves are under Other objects.

The solver writes this force as an impulse, so the curve only grows.

Var one is the normal force along x, the flight direction.

In the video: **Bird_on_LE** in filter box.



The screen at 1:38 in the video.

9 d/dt, Scale and name

video 1:38

1. Under Operations, choose d by d t.

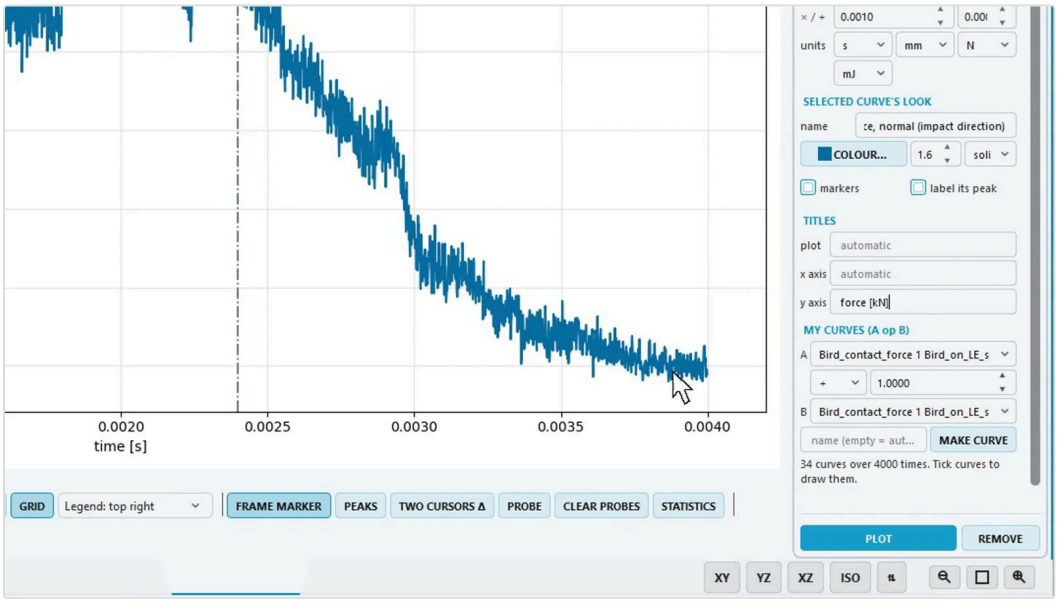
   The curve becomes the force.

2. Scale it by one thousandth to read kilonewtons, and give the curve a name.

   In the video: **0.001** in x / + scale field.

   In the video: **Contact force, normal (impact direction)** in Selected curve's look -> name.

   In the video: **force [kN]** in Titles: y-axis title.



The screen at 1:49 in the video.

10 Peaks, Probe

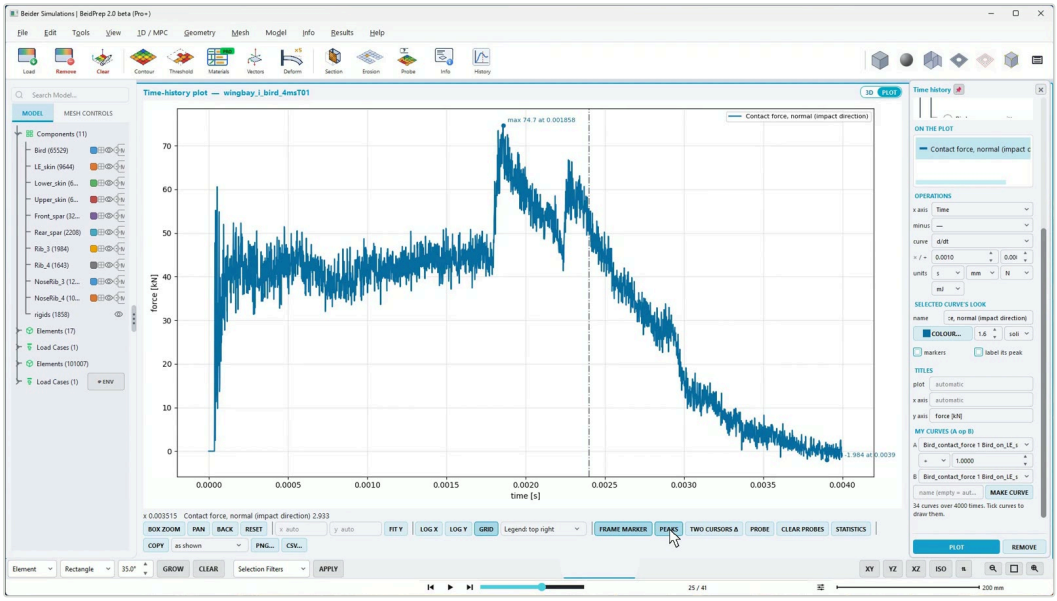
video 1:49

1. Press Peaks.

   The largest force is about seventy-five kilonewtons.

   It comes at one point nine milliseconds, just before the skin tears.

   Probe reads a value only on the curve: a click beside it finds no curve.



The screen at 1:59 in the video.

11 Two cursors, Box zoom

video 2:04

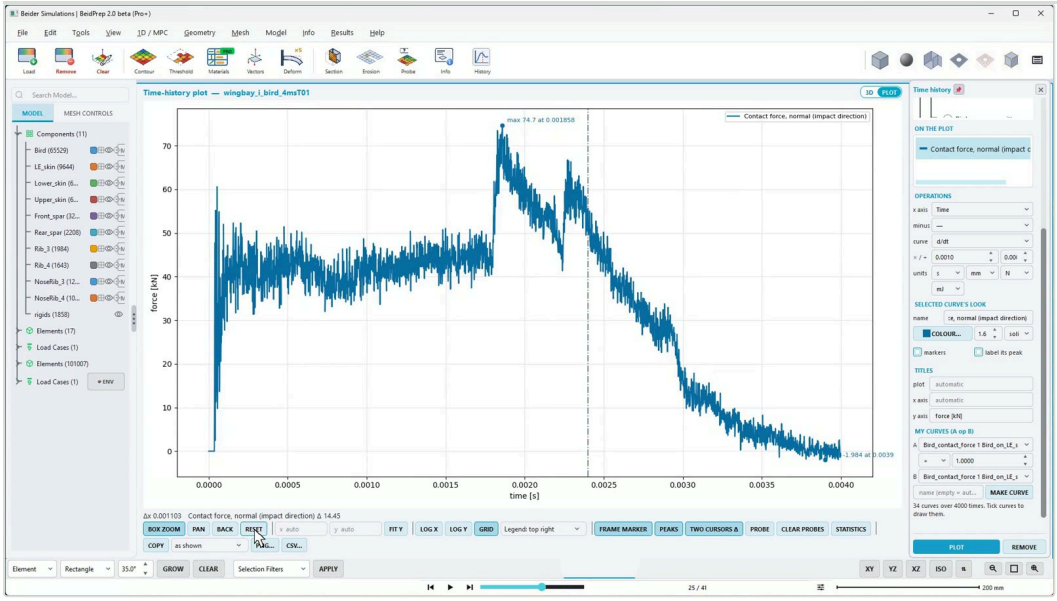
1. To compare two moments, press Two cursors and click twice.

   The differences appear under the plot.

   Box zoom looks closer.

2. Drag a box around the peak.

   Reset brings the full view back.



The screen at 2:20 in the video.

12 Statistics, My curves

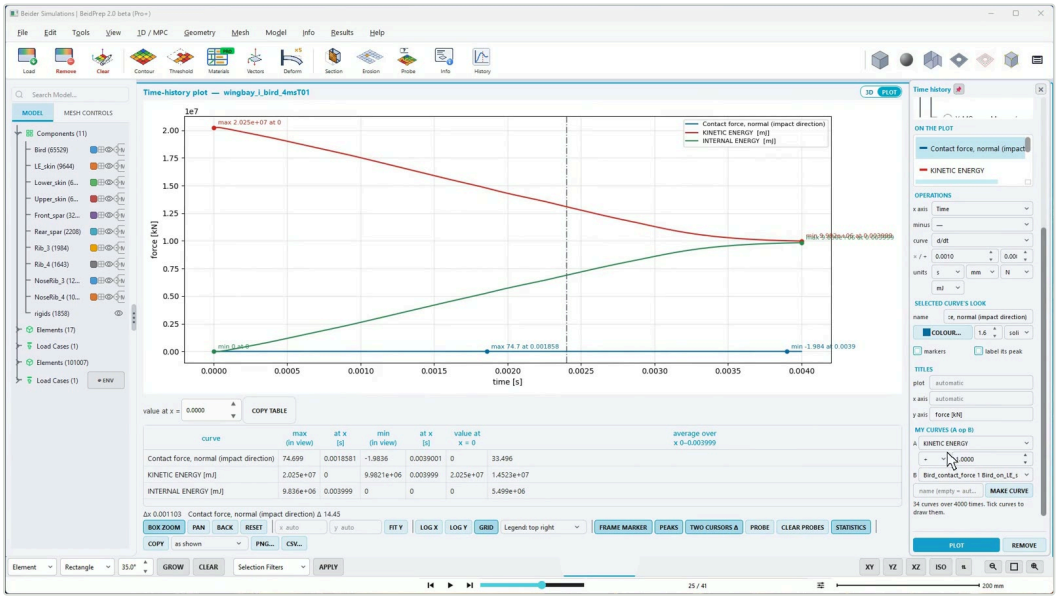
video 2:21

Statistics gives each curve's maximum, minimum and average.

It uses the range on screen.

Under My curves you can combine two curves.

1. Add kinetic and internal energy.



The screen at 2:33 in the video.

13 Energy balance, Save PNG

video 2:36

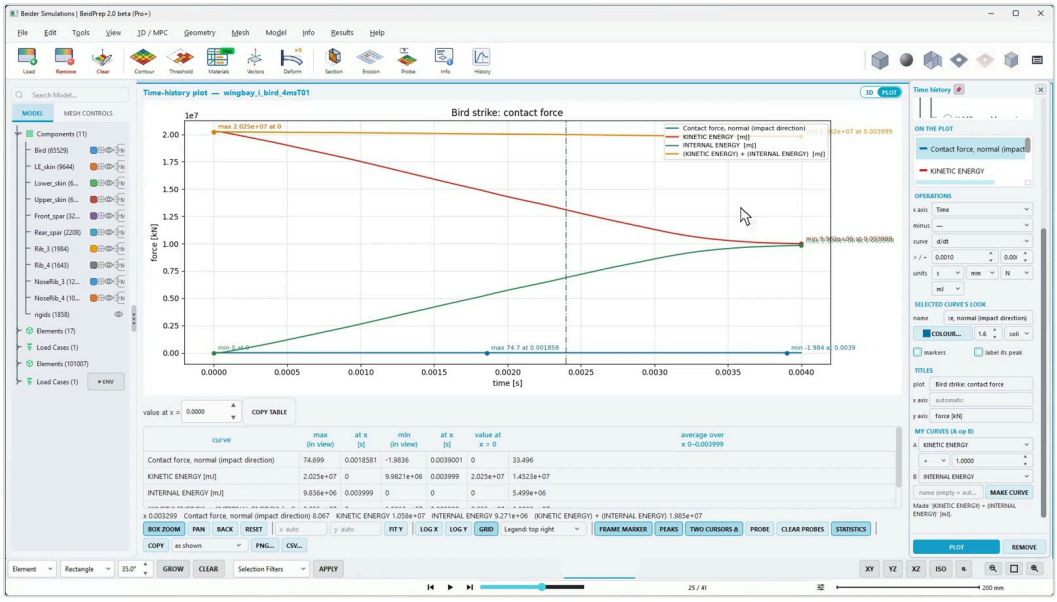
The sum stays close to the start value.

That is the energy balance check: here the error is about two percent.

1 Give the plot a title, then save it.

P N G saves a picture; C S V saves exactly the drawn curves as numbers.

In the video: **Bird strike: contact force** in Titles: plot title.



The screen at 2:54 in the video.

14 Close, Summary

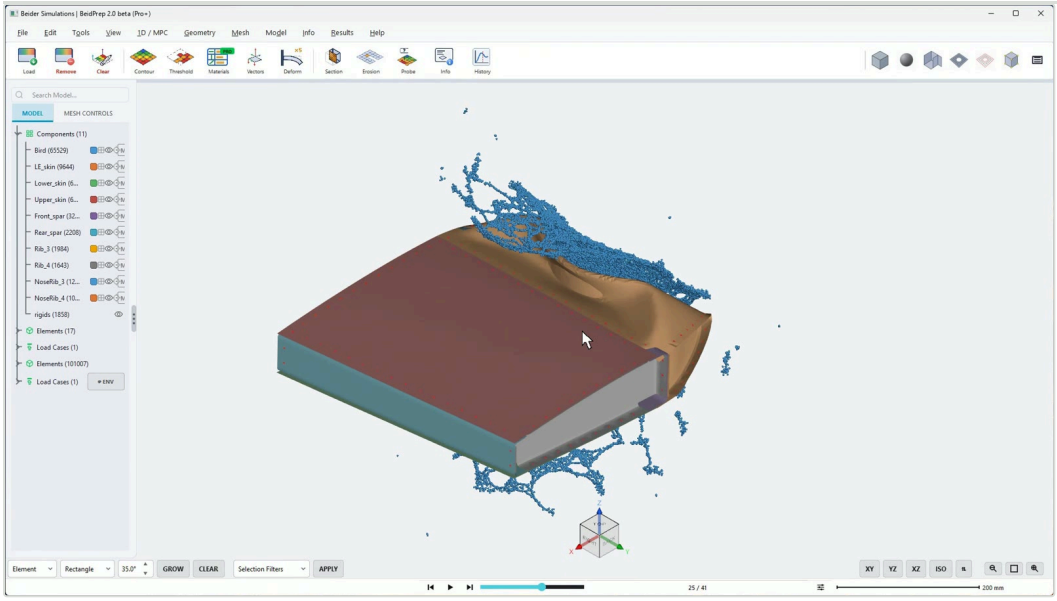
video 2:54

1 Press the cross at the top to close the tool.

The 3D view comes back.

That is the History tool: curves by object, operations, probes and statistics.

It all comes from the file the solver wrote.



The screen at 3:08 in the video.

Steps and pictures are taken from tutorial video 11. Every picture is a frame of the video.