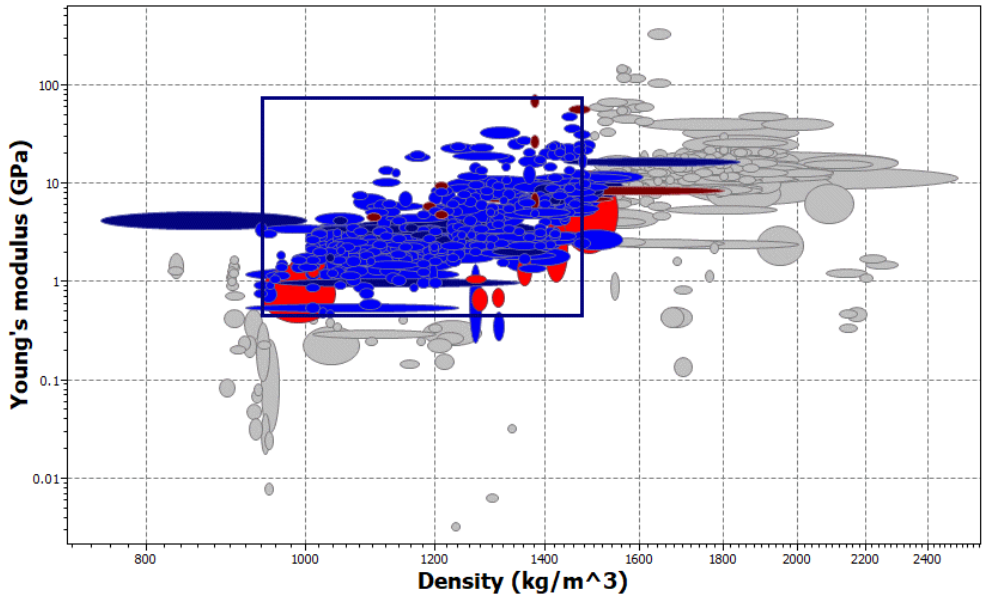
GRANTA SELECTOR

Getting Started with Granta Selector

Selection Stages and Engineering Solver



1 About these exercises

The Getting Started exercises provide an overview of the key tools and features in *Granta Selector*, and form a set of tutorials to help you familiarize yourself with the software. You can choose whether to work through them in order, or complete only the exercises relevant to you. They are intended for use with *Granta Selector 2021 R2*, and may not work correctly with earlier or later versions of *Granta Selector*.

There are also Quick Start Videos provided online to teach you about *Granta Selector*. These can be used independently of the videos, or alongside them, to test and check your knowledge.

This set of exercises covers how to use each of the three types of selection stage in *Granta Selector*, and how to use the Engineering Solver tool to calculate material properties for use in the Limit Stage.

Document conventions

In this document:

❖ Each step of the exercises is shown on a gold background, like this.

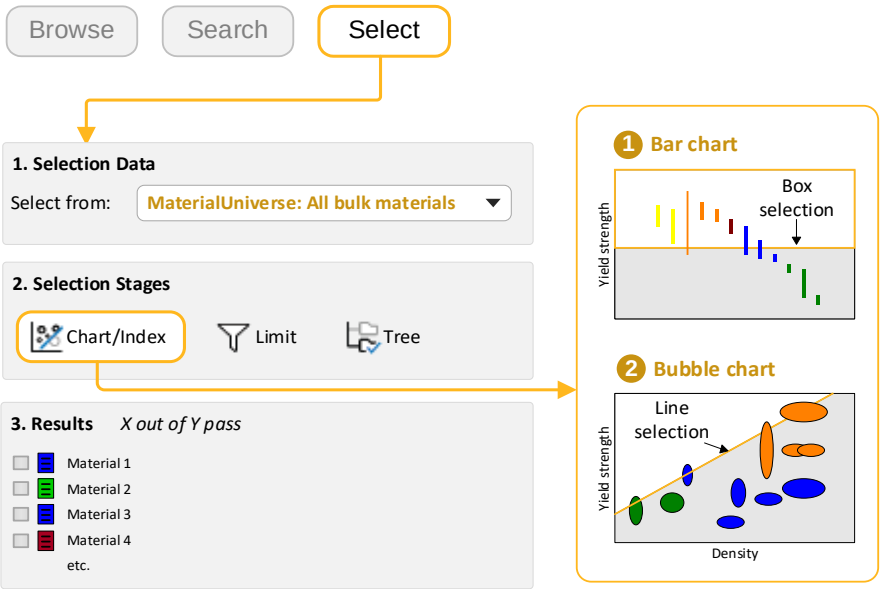
More detailed instructions appear below the main instruction.

Text on elements in the software (such as buttons, dialogs and tabs) appears in bold, **like this**. The names of records, datatables, and documents are emphasised *like this*. Words and numbers that you type as you follow the instructions appear in monotype, `like this`.

2 Exercises

Exercise 1: Selection using a Chart Stage

When plotted on a Chart Stage, records can be filtered using the **Index line** and **Box selection** tools. This provides a more qualitative approach to filtering.

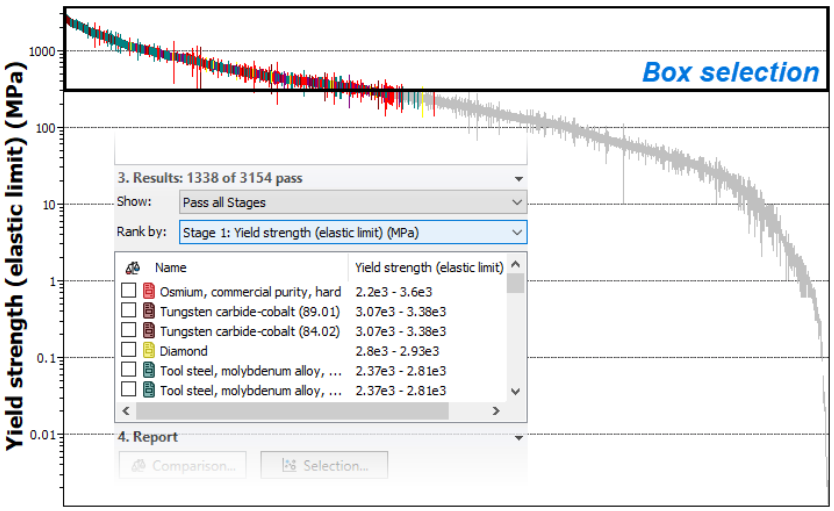


❖ Make a bar chart of Yield strength (σ_y)

Set the y-axis to *Yield strength (elastic limit).*

❖ Use a box selection to identify materials with high values of Yield strength

Click **Box selection**, then drag to define the selection box.



❖ Add Density (ρ) to the other chart axis

Click **Chart Settings**, and on the **X-Axis** tab, select *Density* as the axis attribute.

❖ Use an **Index Line** to identify materials with high values of specific strength σ_y / ρ

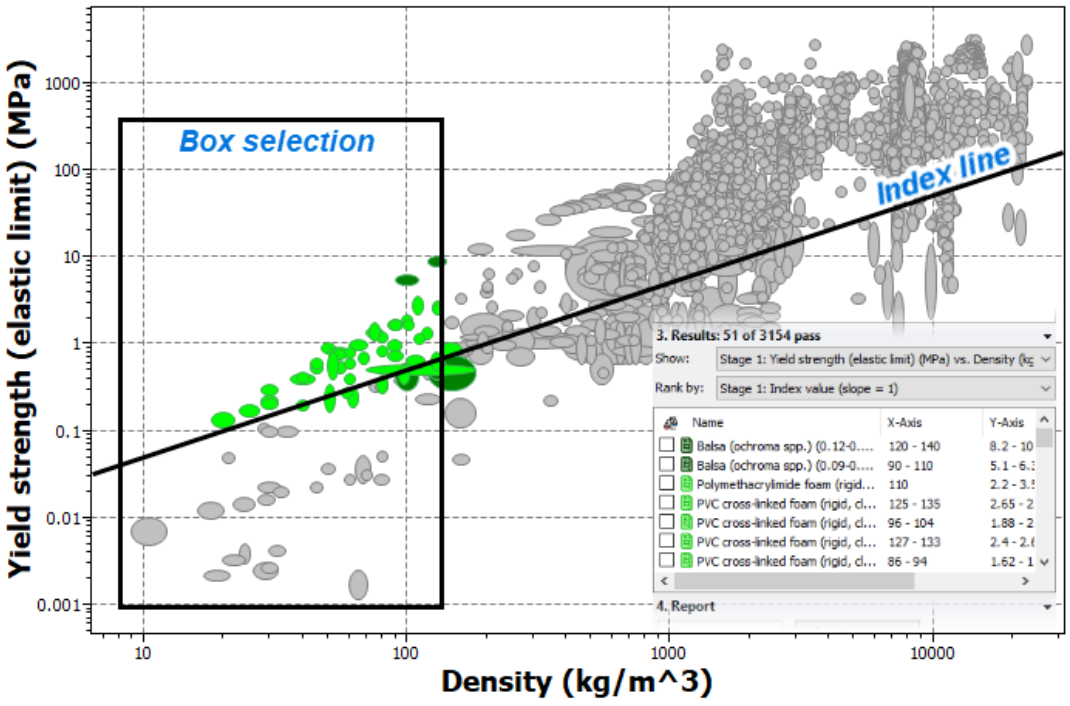
Click **Index line**.

By default, the slope of the line is 1 and the objective is **Maximize the index**. This will result in selection of materials above the line, for high values of σ_y / ρ.

Click **OK** and then click the chart to position the line through a particular point.

Drag the line upwards to refine the selection to fewer materials.

❖ Add a **Box selection** to the chart to identify materials with low Density that maximize the index.



❖ Rank the results list by specific strength (Yield strength / Density)

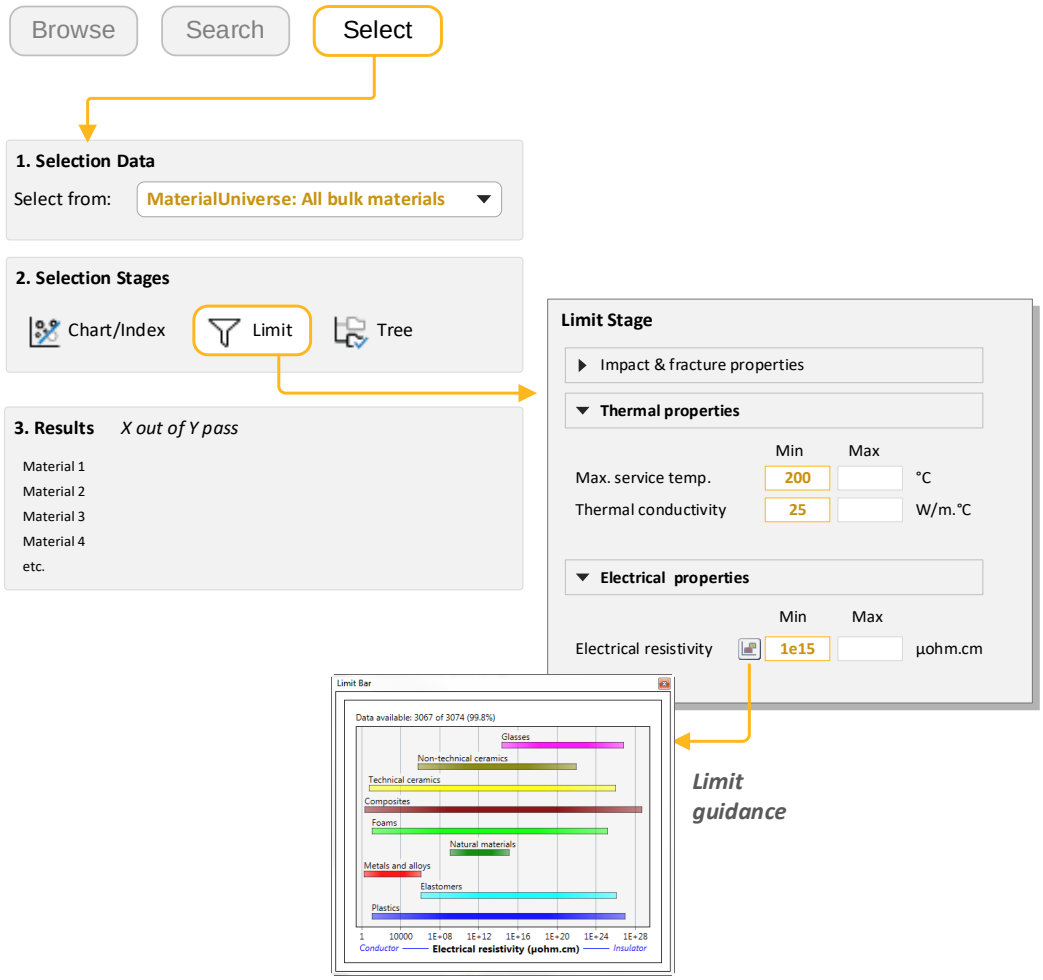
Show: Stage 1: Yield strength v. Density

Rank by: Stage 1: Index value.

Example results: *Balsa*, *Polymethacrylimide foam*, *PVC*.

❖ Delete all stages

Exercise 2: Selection using a Limit Stage



❖ Select materials with specific thermal and electrical properties.

Create a new Limit Stage and enter the following criteria:

Max. Service Temperature	> 200 °C
Thermal Conductivity	> 25 W/m.°C
Electrical Resistivity	> 1e15 µohm.cm

Use the limit bars for guidance on suitable values. Enter the limits – minimum or maximum as appropriate – and click **Apply**. If a reference record is set, its values for each property will be shown to the right of the min/max entry boxes.

Example results: *Aluminum nitride*, *Alumina*, *Silicon nitride*.

Note: These exercises have been written using the unit settings 'US Dollar (USD)' and 'Metric'. If you use different settings, the selection criteria and figures will differ. To change the settings, click **Settings** on the toolbar, and click the **Units** tab.

❖ Filter the results further to select only materials with non-opaque *Transparency*.

On the Limit Stage under **Optical, aesthetic and acoustic properties**, set the *Transparency* to *Translucent*, *Transparent*, and *Optical quality*.

Click **Apply**.

Example results: *Alumina (translucent)* and *Diamond*.

❖ Delete this stage.

Exercise 3: Calculate Limit values using the Engineering Solver

Design requirements are often specified in terms of geometry, loading, and maximum deflections. The **Engineering Solver** tool converts these engineering requirements into material properties, which can then be applied in Limit stages to screen for suitable materials.

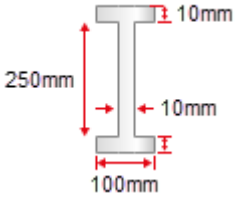
❖ Open the **Engineering Solver**.

Click **Solver** on the main toolbar.

❖ Select the loading geometry *Beam in bending*.

This model estimates the minimum strength and stiffness values required for a beam with the specified geometry and load conditions.

❖ Set up the geometry for an I-beam with the following cross-section dimensions:



Use the **Cross-section** list to select *I-section*. Enter the following dimensions and use the lists at the end of each line to select the correct units:
Breadth, b = 100mm; Depth, d = 250mm; Thickness, t = 10mm; Web thickness, t_w = 10mm; Length, l = 5m.

❖ Set up the design parameters for a cantilever with an end load of 5kN.

Load condition = *Cantilever End load*; *Load* = 5kN; *Safety factor* = 1.5; *Maximum deflection* = 50mm.

The results will automatically populate. You should see that the minimum required *Young's Modulus* is 133GPa and the minimum *Yield Strength* is 108MPa. You can change the units for the results using the adjacent lists.

Keep the Engineering Solver window open.

❖ Select materials based on the results from the Solver tool.

Create a new Limit stage using subset *All bulk materials*, and enter the minimum *Young's modulus* and *Yield strength (elastic limit)* from the Engineering Solver.

Make sure that the results units in the Engineering Solver and Limit Stage match; change the results units in the Engineering Solver if they do not match those in the Limit Stage.

Example results: *Aluminum*, *Alumina*, *Beryllium*, *Bronze*, *Carbon Steel*...

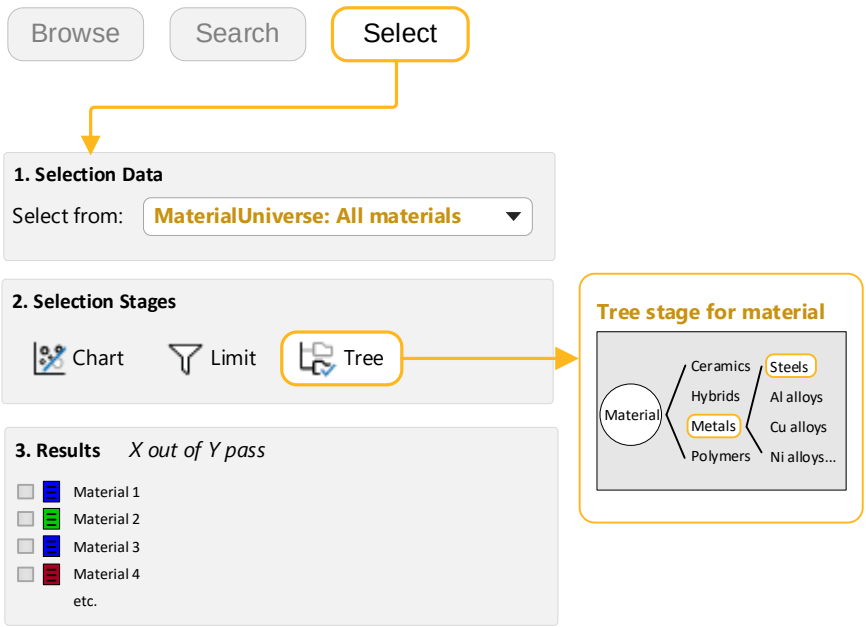
As you can see, a large number of results are returned. Further selection stages can be applied to narrow down the list of potential materials (for example, setting a maximum *Price*).

Exercise 4: Selection using a Tree Stage

Using a Tree selection stage, you can filter records based on their links to records in other data tables, or based on the database hierarchy (tree).

❖ Find materials that can be molded.

Under Selection Stages, click **Tree**. In the Tree Stage window, select *ProcessUniverse* and navigate to *Molding*. Select *Molding*, click **Insert**, then click **OK**.



❖ Click **Show** to see a list of the materials in *MaterialUniverse* to which this process is linked.

❖ Delete this stage.

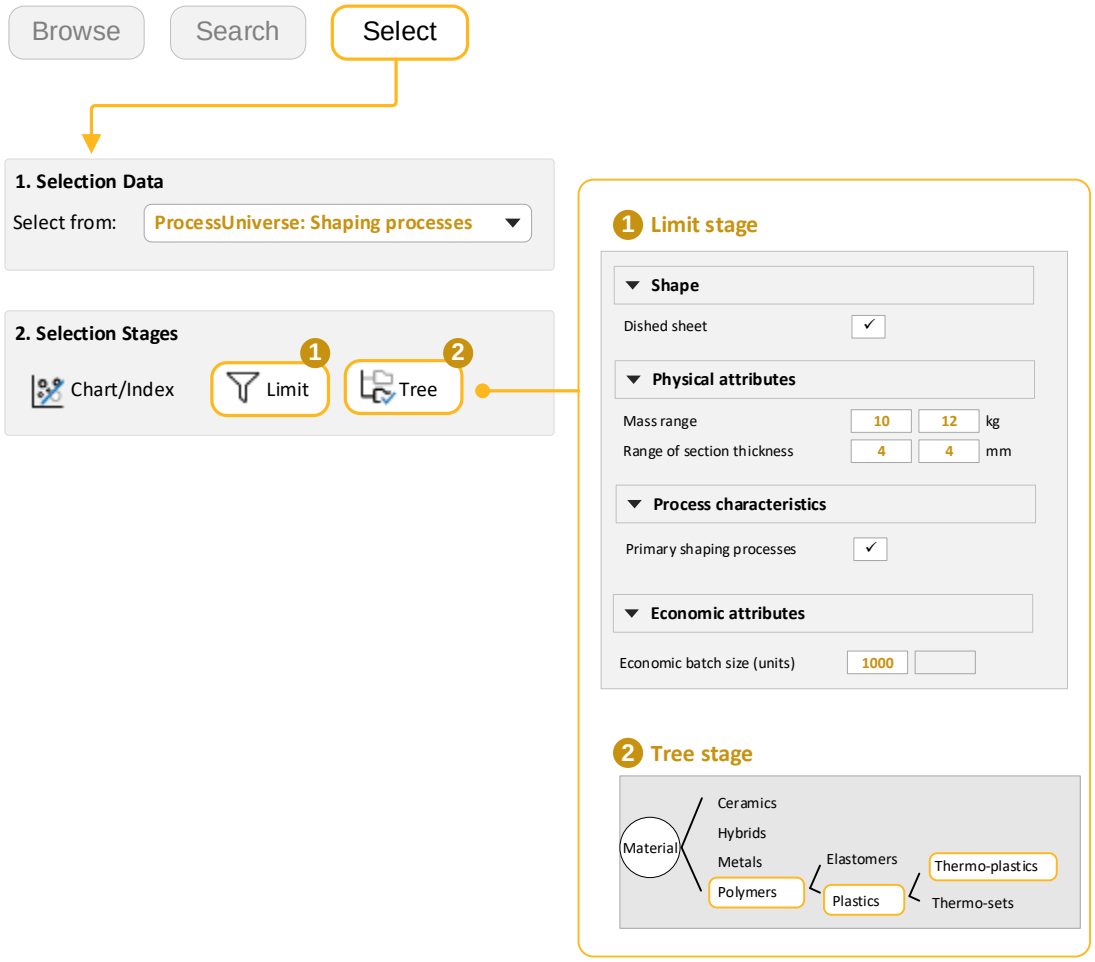
❖ Find processes to join *Steels*.

In the Selection Project pane, under **Selection Data**, select *ProcessUniverse: Joining processes*.

Under Selection Stages, click **Tree**. Select *MaterialUniverse*, expand *Metals and alloys*, select *Ferrous*, and then click **Insert** followed by **OK**.

❖ Delete this stage.

Exercise 5: Selecting processes using Limit and Tree Stages



❖ Choose the Selection Data.

Select from: > ProcessUniverse > Shaping processes.

❖ Find *Primary shaping processes* for a component with specific shape, physical, and economic properties.

Add a Limit Stage with five criteria:

Shape:	*Dished sheet*
Mass range:	10 - 12 kg
Section thickness:	4 mm
Primary shaping process:	*Yes*
Economic batch size:	> 1000

❖ Filter the results to only include **Thermoplastic** materials

Add a Tree Stage and select **MaterialUniverse > Polymers > Plastics > Thermoplastics**.

Example results: *Compression molding*, *Rotational molding*, *Thermoplastic composite molding*.

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