

Running an optimisation and viewing results

Running an optimisation

Once you have loaded a project and configured the settings, the optimisation can now be run by either:

- Clicking the **Run** icon on the Insight toolbar; or
- Clicking the **Run** button in the main user interface.

Hypervolume plot

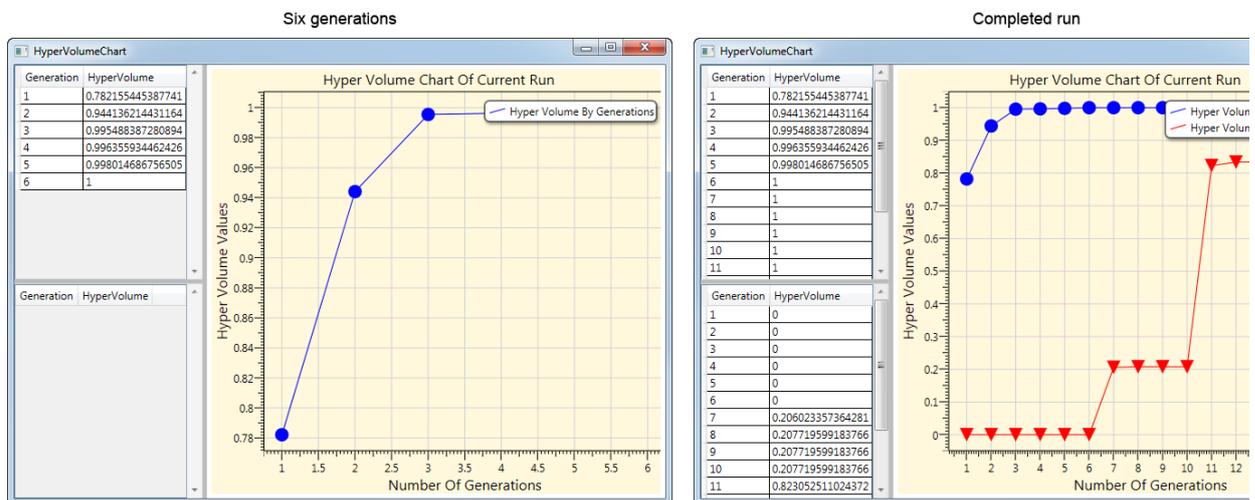
During the optimisation run (when using the interface only), after more than a generation is complete, you will be able to view the hypervolume plot – an indication of how the Pareto Front (selection of optimal results) is converging. The hypervolume provides an indication of the convergence of the model results towards the Pareto Front. It is calculated based on the distance between a maximum non-optimal solution and the modelled results. In effect, the larger the hypervolume, the closer the results are towards reaching the Pareto optimal solution.

Insight provides two plots of hypervolume when using the user interface (shown in Figure 1). The blue hypervolume plot is calculated whilst Insight is running, without knowing what the maximum non-optimal solution is. The red hypervolume plot is calculated at the end of the optimisation run, using the maximum non-optimal solution as reference. The hypervolume is a useful indication of how much the optimal solutions are changing – if the hypervolume plot is flattening out, this is a sign that more generations are unlikely to produce more optimal results.

To view the results of an optimisation run, choose **File » Import results**. This will load the Results dialog where you can view the results in various graphical and tabular formats using the corresponding tabs.

Optimisation run results are compared to the Pareto Front. The Pareto Front is the set of solutions which have differing performance on each of the objectives. A solution is not on the Pareto Front if there is an alternative that is better on at least one of the objectives but no worse on any objectives. In this case the solution is discarded as the alternative is clearly preferable. If the Pareto Front solutions are not changing, the optimiser may have satisfactorily completed its multi-objective search.

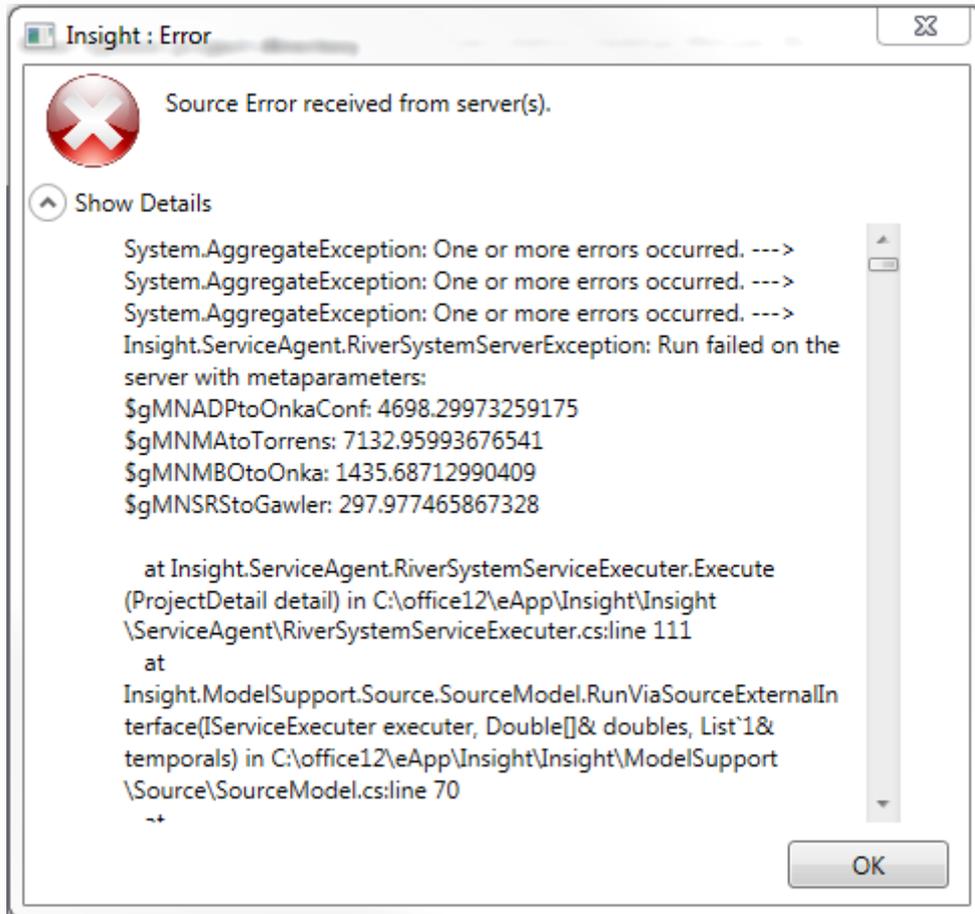
Figure 1. Insight results, hypervolume plots



On completion of the run, you will be prompted to save the results, which can then be viewed at a later stage if required.

Note: During an optimisation run, if a project is running, on an individual server and fails, an error message reports the individual decision variable values that failed. An example of error is shown in Figure 2.

Figure 2. Insight, optimisation run error



Viewing optimisation results

Two-dimensional graph

Click the **2D Graph** tab to view two-dimensional scatterplots of the results. The example shown in Figure 3 has three objectives defined: **\$reliabilityNeg**, **\$unitcost** and **\$Yieldneg**. The drop-down menus for the x and y axes list all the objectives specified in the optimisation. To view the graph for a particular relationship, choose the relevant items from the drop-down menus and click **Plot**. The points on the graph are forming the Pareto Front for this optimisation.

The Filter Properties dialog (Figure 4) allows you to view the results in a specified range:

- Choose the type of plot (scattered or pareto) in the **Plot Option** drop-down menu;
- In the **Selected Filter** drop-down menu, choose the filter and click **Edit Filter**;
- This opens the Edit Filter dialog (shown in Figure 2) showing the entire range of values.
- You can change the filter's name using the **Filter Title** panel.
- Edit any value by double clicking on the cell you wish to change and enter the required value (in the **Lower Filter** or **Upper Filter** columns); and
- Click **OK** to save changes close the Edit Filter dialog or **Cancel** to quit without saving.

Figure 3. Insight results, 2D graph

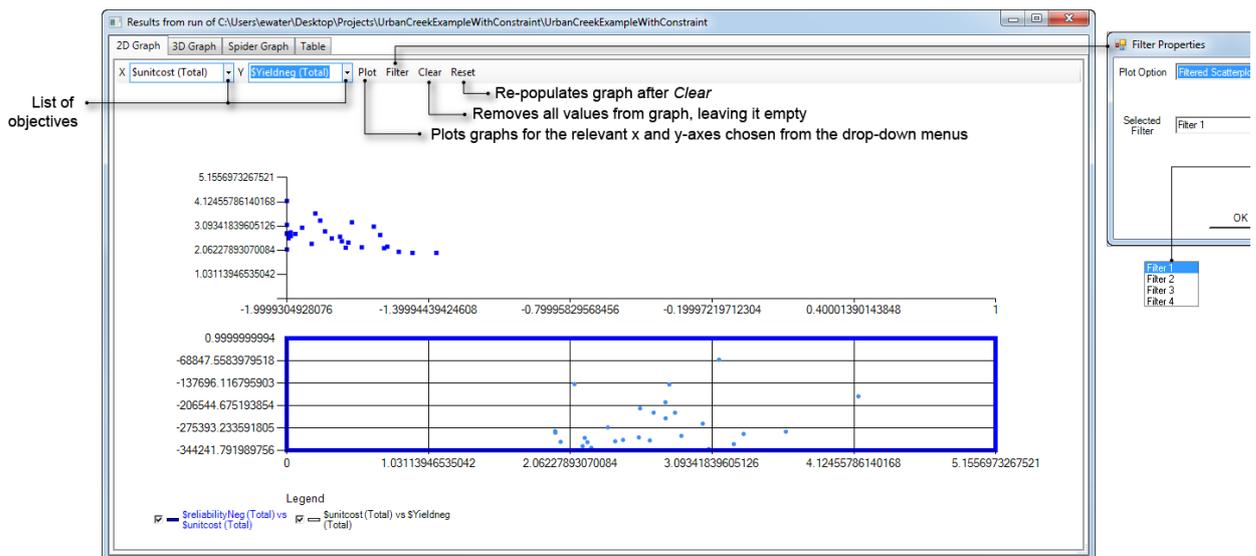
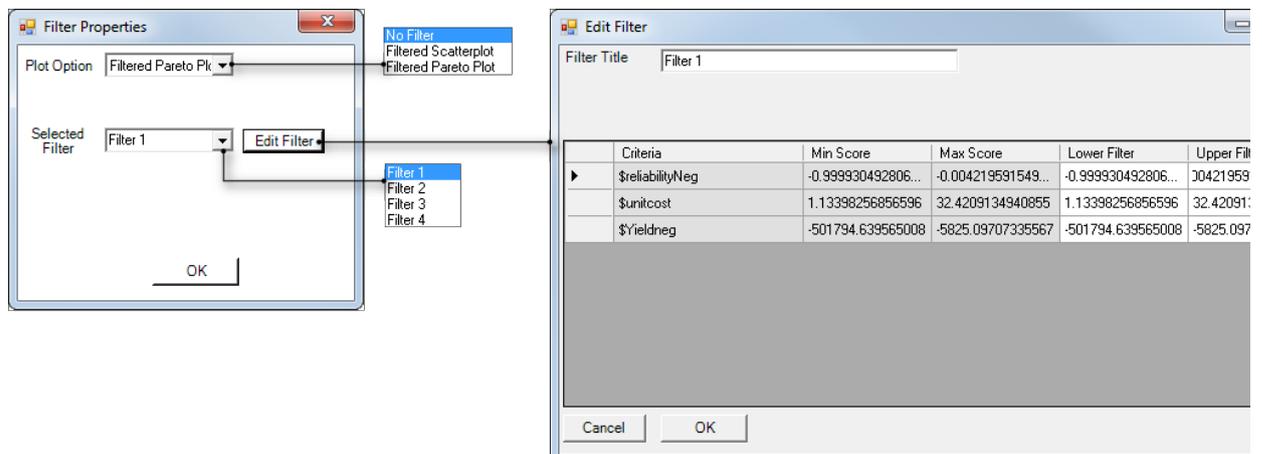


Figure 4. Insight results, Filter properties



Three-dimensional graph

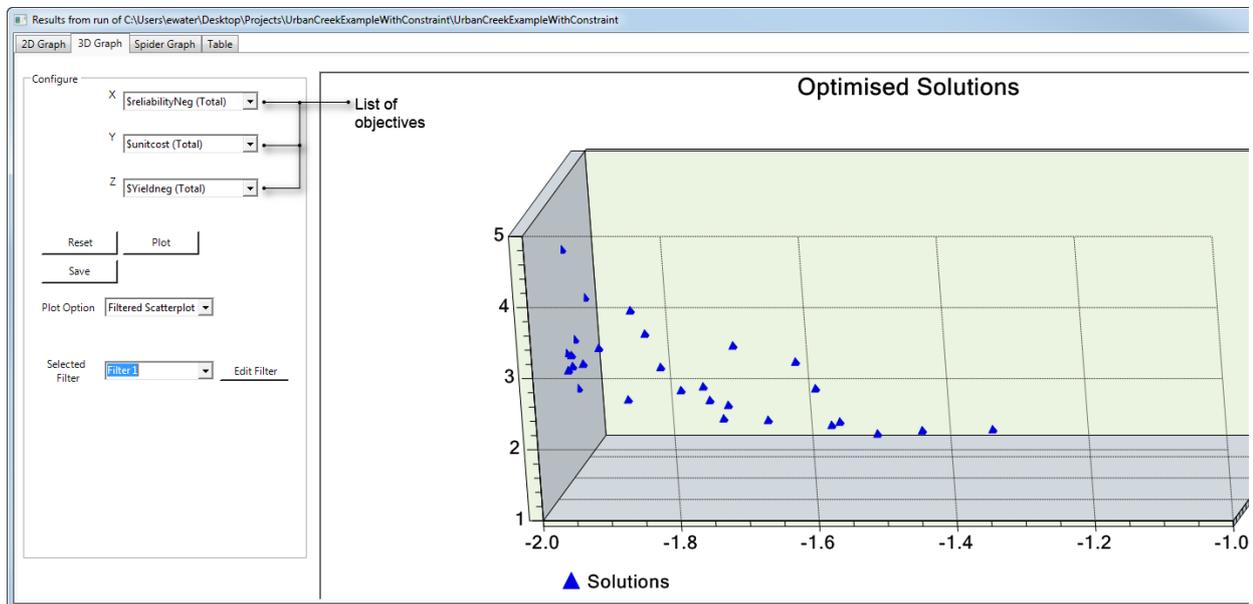
Click the **3D Graph** tab to view a three-dimensional plot of the computed optimised solutions (shown in Figure 5). Just as with the two-dimensional graph, the individual solutions form a Pareto Front. The x, y and z-axes represent the objectives that were specified in the project. These can be changed using their corresponding drop down menus in the Configure panel on the left. Click **Plot** to change the axes; **Reset** to revert it back to its original state, and **Save** to save the results of the 3D graph to a file.

Additionally, you can filter the graph view to a specified range using the **Filter Properties** dialog under the **Plot Option** drop-down menu.

You can also rotate the three-dimensional graph to make the results more meaningful, visually:

- Press the Ctrl key on your keyboard and hold it down for the duration of the exercise;
- Right-click on the 3-D graph once;
- Right-click again and hold down the mouse button; and
- Move the mouse to rotate the entire graph.

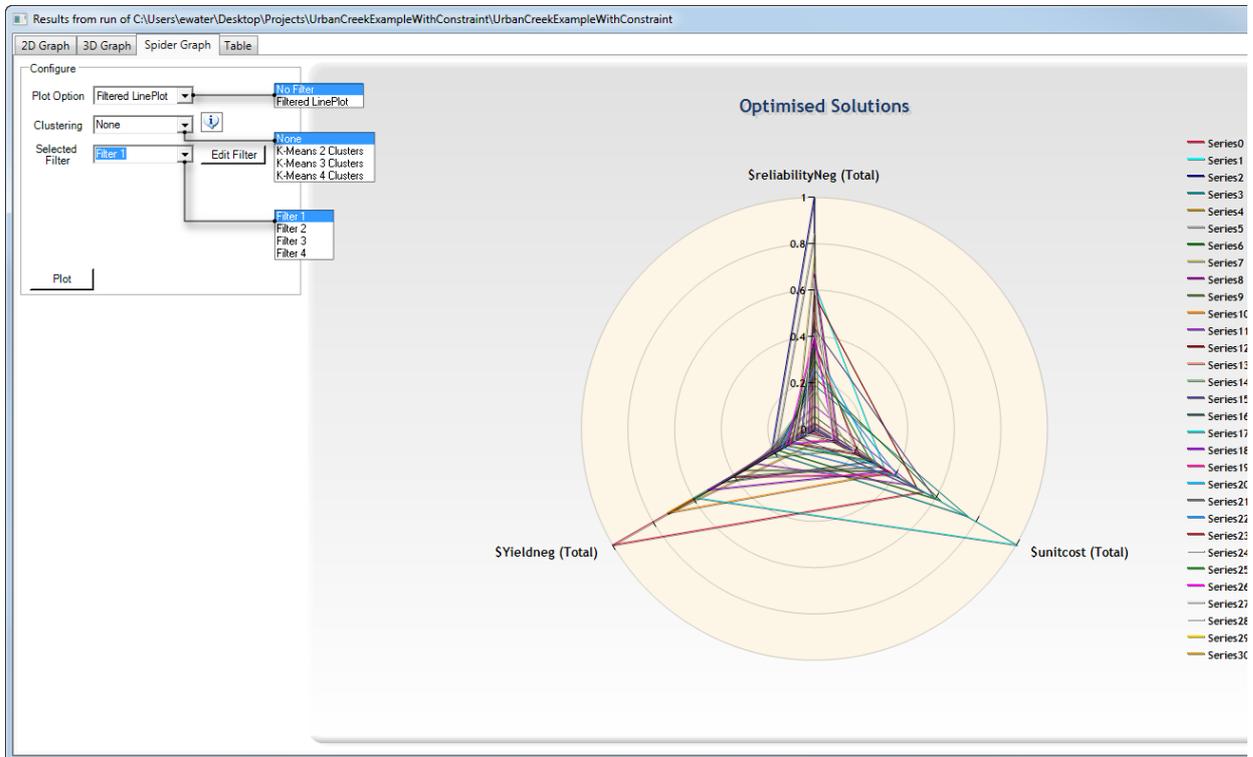
Figure 5. Insight results, 3D graph



Spider graph

The third tab in the Results dialog shows the optimised results in a spider graph (as shown in Figure 6). You can use the Filter feature (as described previously) to view a filtered spider graph of the results.

Figure 6. Insight results, Spider graph



Table

The final tab in the Results dialog shows all the results of the optimisation in a table. Figure 7 shows an example of the table, with all optimised solutions for each objective and decision variable specified in Insight. Note that the green arrow on the right allows you to save the decision variable to the Source project.

Figure 7. Insight results, Table

Individual	\$demand	\$pipecapacity	\$reliabilityNeg (Total)	\$unitcost (Total)	\$Yieldneg (Total)	\$Constraint	\$totalcost (Total)	\$totaldemand (Total)	\$totalpump (Total)	\$totaltreat (To
NsgaSolution00000	2.25442517100974	45.3422426180524	-1.9999304928076	3.14183062740557	-64866.5754455123	12.7455748289903	203799.793429625	32434.4149353158	65362.0665951709	64866.5754455
NsgaSolution00001	14.9061788555236	81.6623752809775	-1.60519213198709	2.70523501893754	-344241.791989756	0.0938211444764008	931254.950672501	214455.195194369	343916.517396102	344241.7919898
NsgaSolution00002	14.4840003573371	19.170823766097	-1.36748091676561	1.95037626990477	-284957.469130831	0.5159996426629	555774.285724894	208381.313140966	284573.311034275	284957.469130
NsgaSolution00003	10.5981045371464	98.9582898409848	-1.87982633193237	3.62808755469201	-286626.388328253	4.4018954628536	1039905.63234006	152474.929975907	286357.486869871	286626.388328
NsgaSolution00004	4.87096693782574	9.6282034340771	-1.99993049280705	2.09107591623384	-140152.331702095	10.1290330621743	293069.165426267	70078.6013344796	140642.589768223	140152.331702
NsgaSolution00005	13.7260559242379	20.8981572243631	-1.46839255823072	1.95135153984327	-289973.414472438	1.2739440757621	565840.068844403	197476.766581976	289590.782513097	289973.414472

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Real decisions

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Objectives

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Constraints

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Tracked variables