A   P   P   N   O   T   E   S^{SM}

FloTHERM V10.1 Upgrade Tutorial

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Last Modified: February 10, 2015
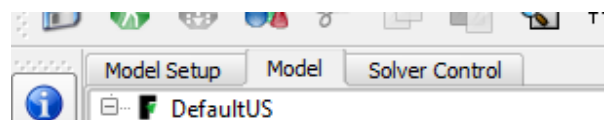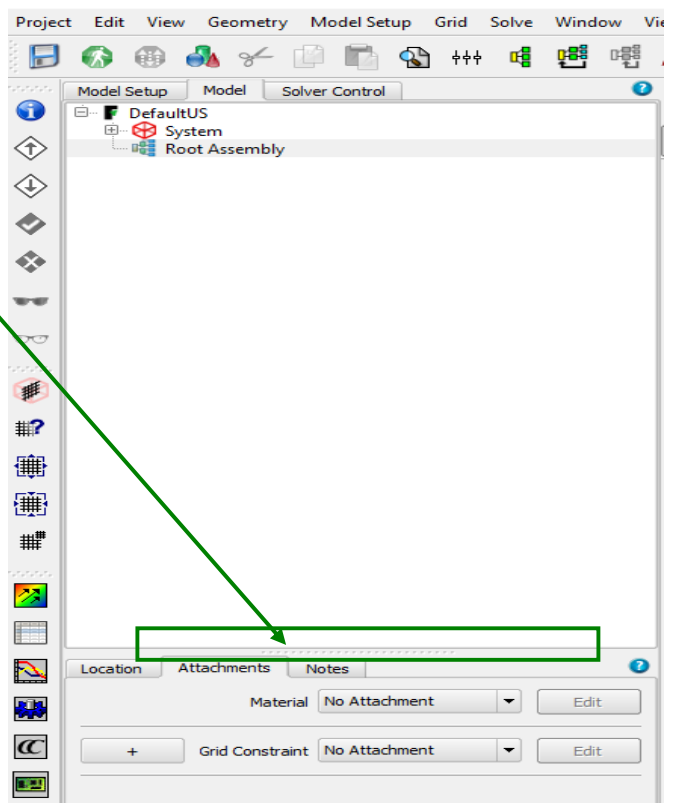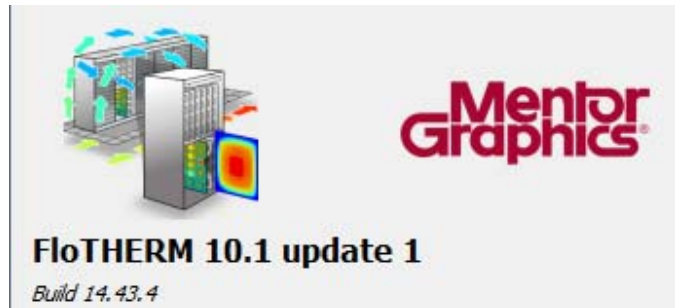
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Introduction

This is a simple tutorial to help you get familiar with the new FloTHERM project manager (V10) and drawing board interface.
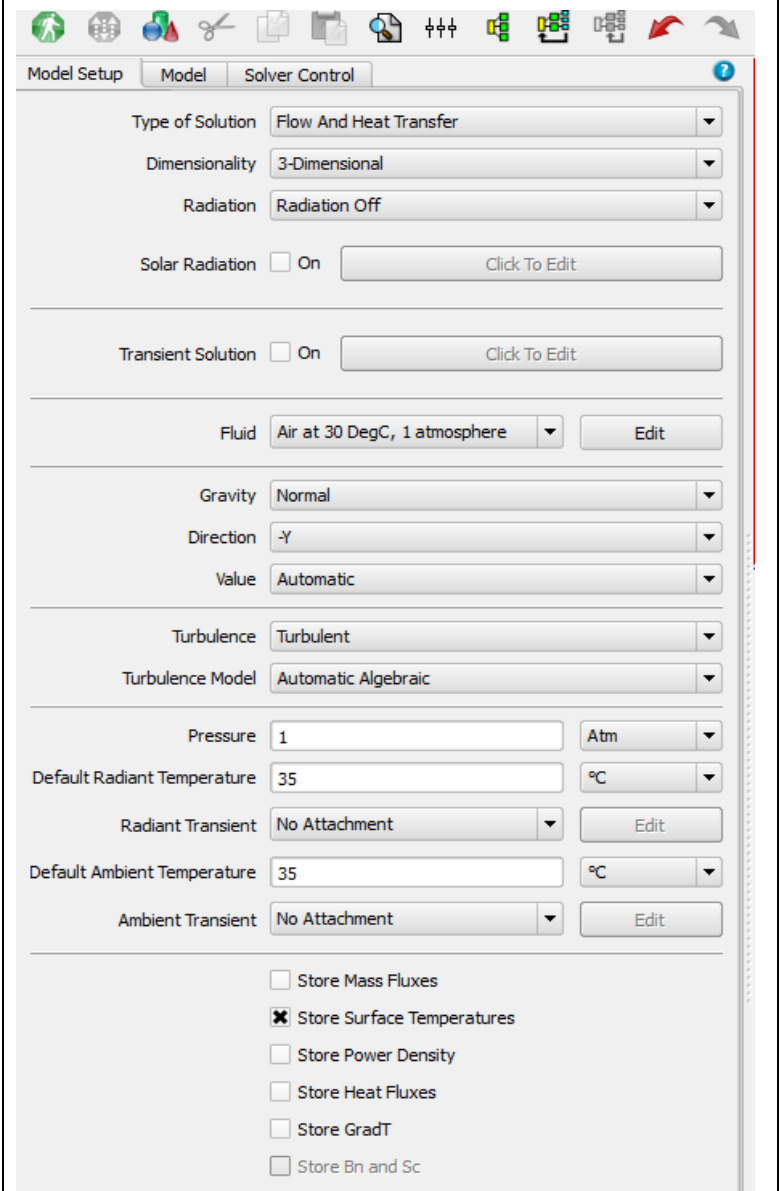
It is intended for users familiar with the operation of previous FloTHERM versions (V9.3 and prior).

Tutorial

— Launch FloTHERM V10

— Note the new user interface, the integration of drawing board and message window into project manager

— Select Root Assembly and note the property sheet below in project manager area. All attributes for all objects are attached through that property sheet, no floating windows

— Move the cursor to the bottom of the project manager just above the property sheet till it turns to a double arrow, then click and move to resize the property sheet

— Note the three tabs on top of project manager area: Model Setup, Model, Solver Control

Click on Model Setup tab. Familiarize yourself with the modeling options: type of solution, dimensionality, radiation and so on

Click on Solver Control tab. Notice that all solver control options are integrated into this location

Click on Model tab. This will resume the project tree in project manager

Model Setup	Model	Solver Control

- DefaultUS
  - System
  - Root Assembly

Model Setup	Model	Solver Control

Solver Option: Multi Grid

Outer Iteration: 500

Fan Relaxation: 1

☐ Activate Plate Conduction

☐ Use Double Precision Solver

☐ Network Assembly Block Correction

☐ Multi Grid Damping

☐ Freeze Flow

☐ Store Error Field

Estimated Free Convection Velocity: 40   ft/min

Monitor Point

☐ Monitor Point Convergence For Temperature

☐ Monitor Point Transient Termination Criteria

Variable: Pressure

Inner Iterations: 50

Termination Residuals

Type: Automatic

Factor < Increase Decrease >

Value: 0.0004384958   kg/s
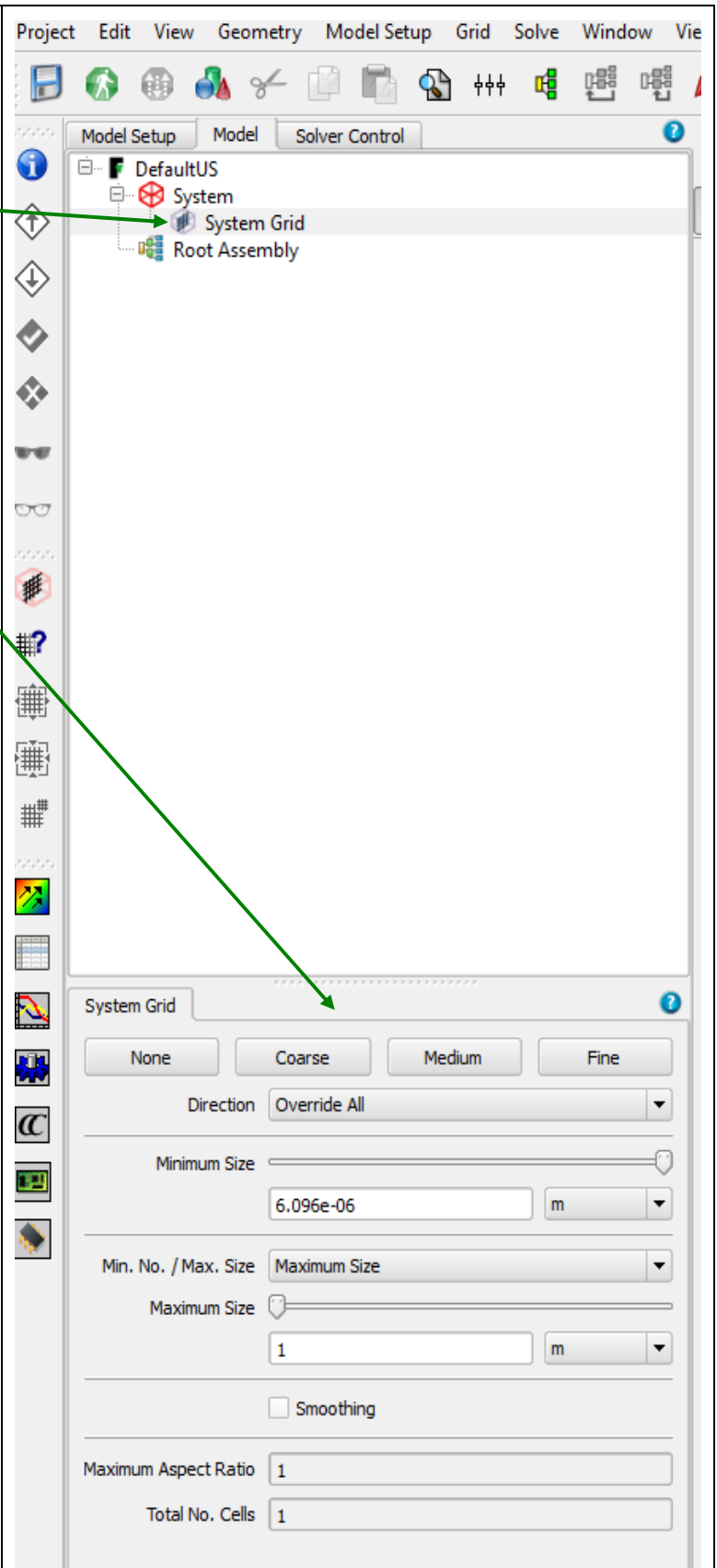
Initial Variables

Initial Value: Automatic

Click on System grid icon on the left vertical side of project manager:

Notice that "System Grid" node is added to the project manager tree just above Root Assembly.

Also note that all the control in System Grid is now available in the property sheet area.

Exercise

— Save as "V10_tutorial"

■ Create an assembly

— Select the root assembly

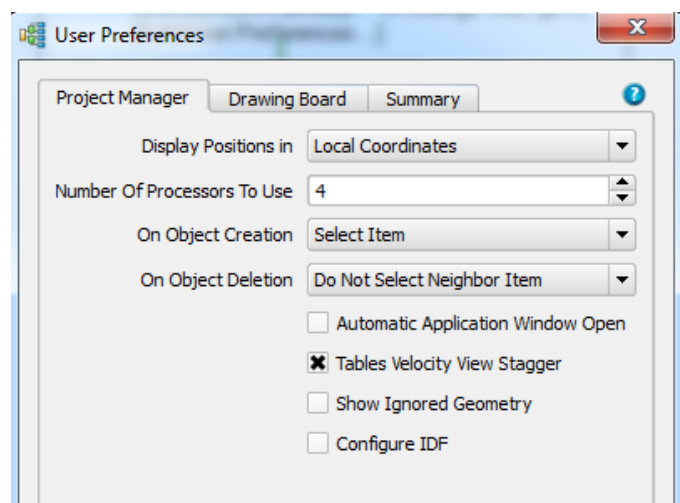— In the "project manager create" pallet, click on the subassembly icon

(Simply click on the left red arrow to activate the project manager

pallet:)

■ Notice how the new subassembly wasn't selected automatically? To change that, go to [Edit/User Preferences…]


■
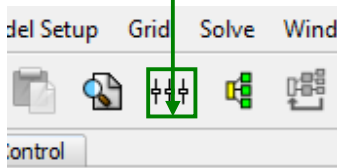
— Set "On Object Creation" to Select Item

- Delete the subassembly you just created, and create a new one
- In the property sheet that opens in the bottom left
  — Change the name to be V10. Click on Location tab first and then:
    – Apply data using Enter, or a click away
    – No more 'Apply/OK' in V10
  — Click on the Notes tab, and enter a note saying "my first V10 assembly"
  — Click on the Attachments Tab
    – Attach a material from the library (library is now on far left), Alloys/Steel (Mild) - Double click to attach

A
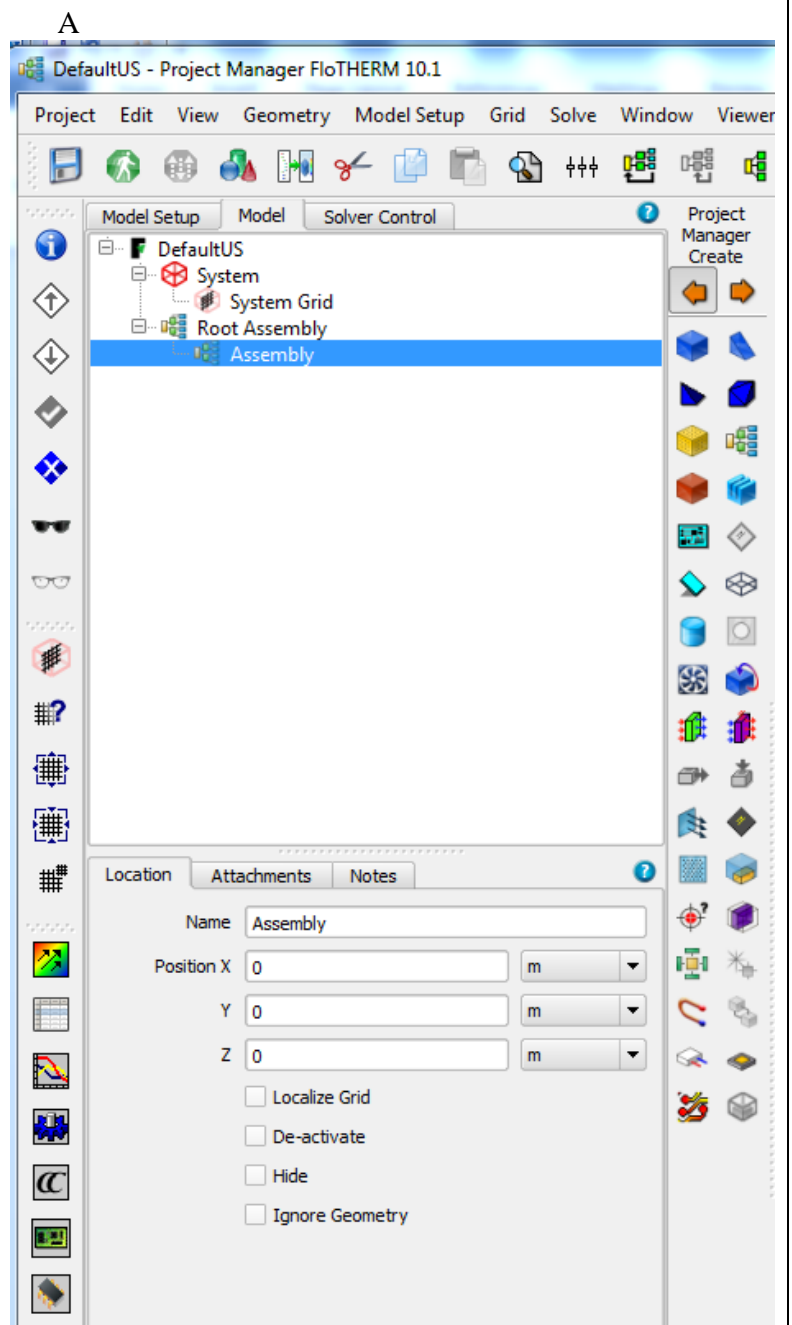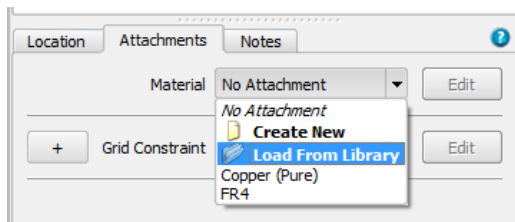
- ■ Close the library manager by clicking on this icon

  — Or 'F7' shortcut, same as V9

- ■ The project manager tree and property sheet are a bit squeezed, lets resize the window

  — Move the cursor to the right of the pallet, till it turns to a double arrow, then click and move to resize
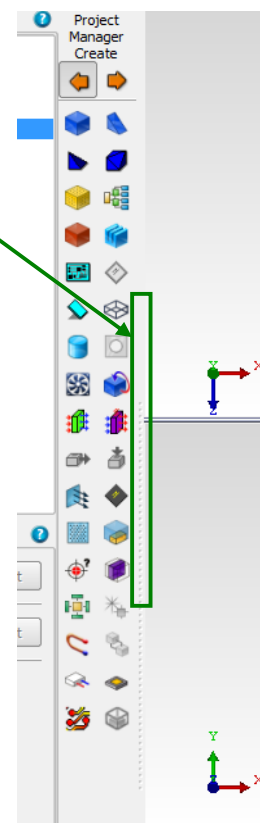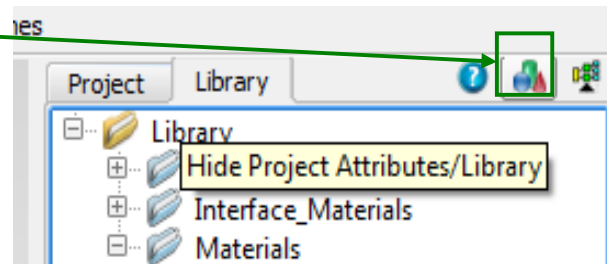
Creating Cuboids

- Select the Subassembly 'V10'
    - Create 3 cuboids using Project manager create pallet
    - Create 2 cuboids using the drawing board create pallet
        - Click the Right Arrow to switch pallets
        - You will need to draw them in a drawing board area
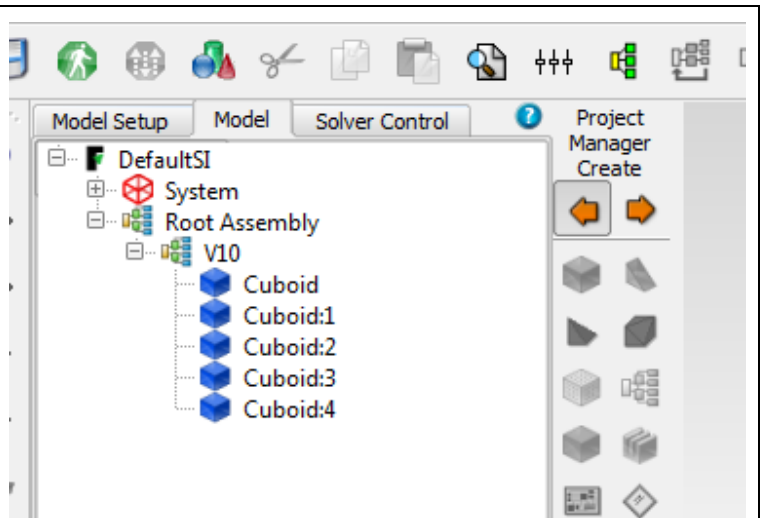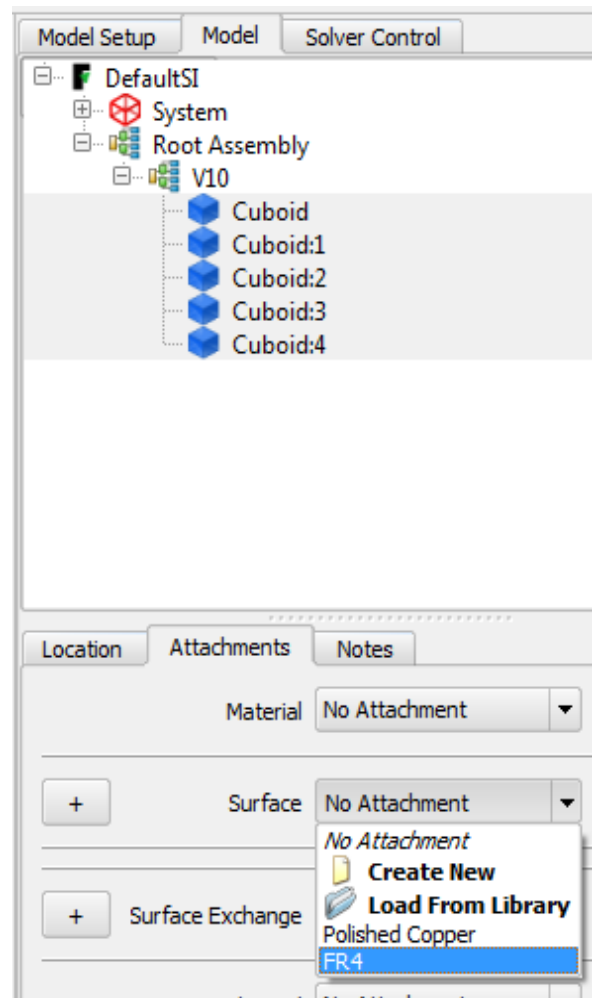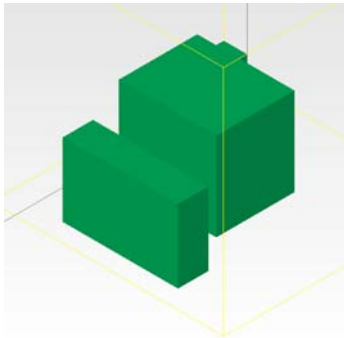
Creating Cuboids

■ Switch to Solid mode

— Or press 's' on the keyboard

In V10 now you can display objects in drawing board in solid mode too.

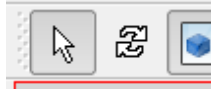■ Click on the single, 4 view, horizontal, and vertical split icons to find a view you prefer

■ In the Project Manager node tree shift select all cuboids, and attach the surface property "FR4"
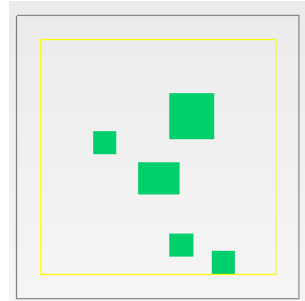
Creating Cuboids

■ In the drawing board, switch to "Select" mouse mode

■ In a Y/Z plane view adjust the positions of the cuboids so none are overlapping

— Click to select, then drag

■ 'Rubber band' select all the cuboids

■ With all cuboids selected, set the X size = 155 mm in Project Manager Property Sheet

— Select the Location tab

— Change units to mm first
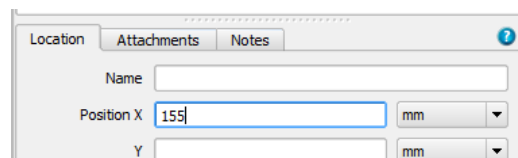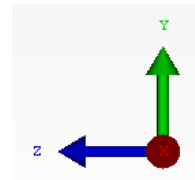
Creating Cuboids

■ Select one cuboid, and attach a 'create new' material

— Call the new material "Cheeseburger"

— Orthotropic conductivity 100, 100, 0.3

— Attach a 'Create New' surface to Cheeseburger with a yellow color, call it "Cheese"
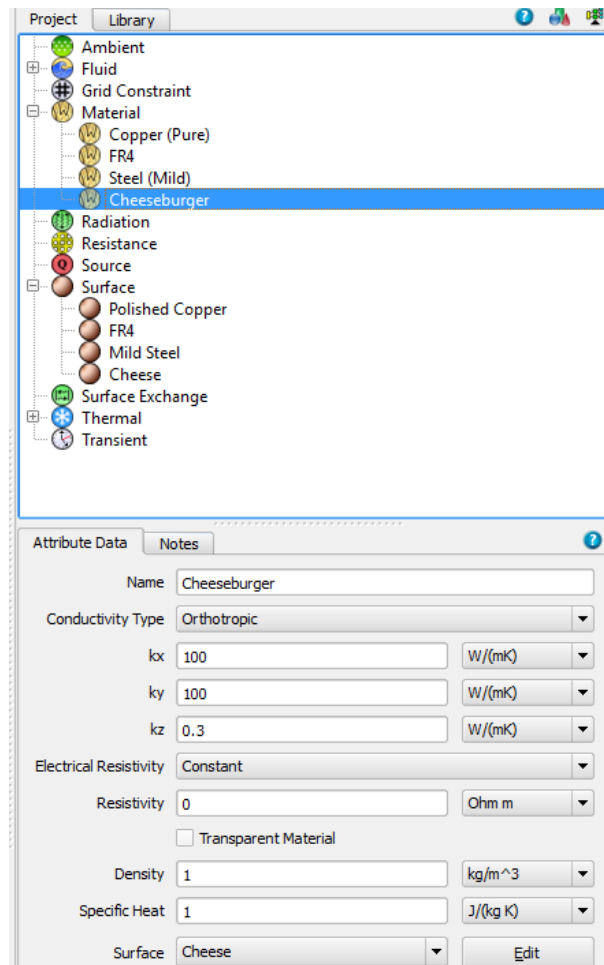
Creating Cuboids

- Why didn't the color change?

  — Because we explicitly stated the surface for all 5 cuboids was FR4, which supersedes the color of the material

  — Try to set the surface for this one cuboid to "no attachment"

    – Notice [Cheese] now appears as it's surface, inherited from cheeseburger material

- Cheeseburger will be used in future projects

  — Create a new folder in the Library Manager, and call it "V10_tutorial"

  — Select that new folder

  — Switch to the Project tab

  — Right click on Cheeseburger material and select "save to selected library'

- Close the Library Manager
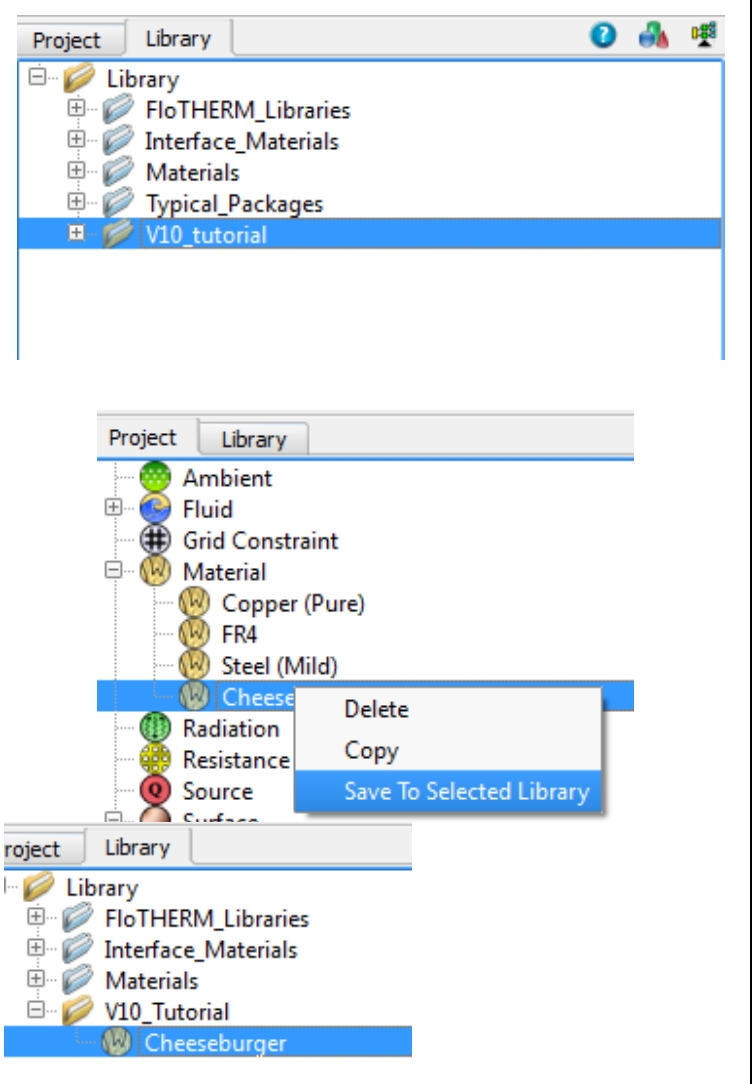
Creating Cuboids

- Attach a grid constraint to one of the cuboids
    - Click the + button in the attachment tab to expand the Grid Constraints
    - Xo Direction, Create New
        - Minimum Number = 50
    - Yo Direction, Create New
        - Minimum Number = 10
    - Zo Direction
        - Select the new grid constraint created for the Yo direction
- Localize the mesh ("l" key or local mesh icon)
- Show the grid ("g" key)
- Can not see the localized mesh?

   - Press 'w' for wireframe
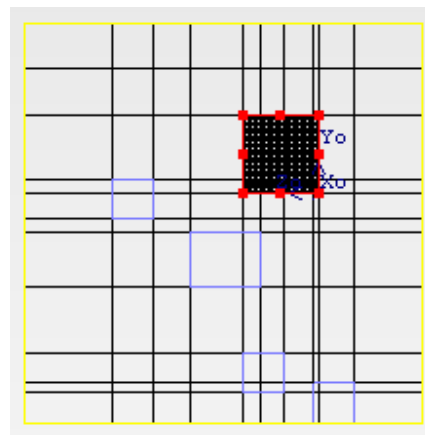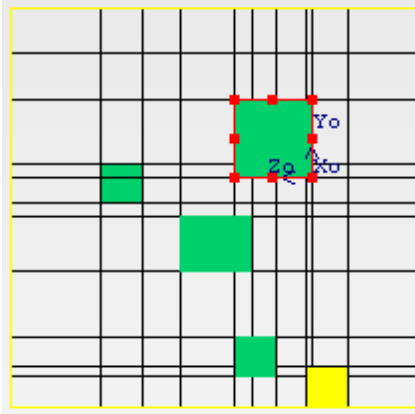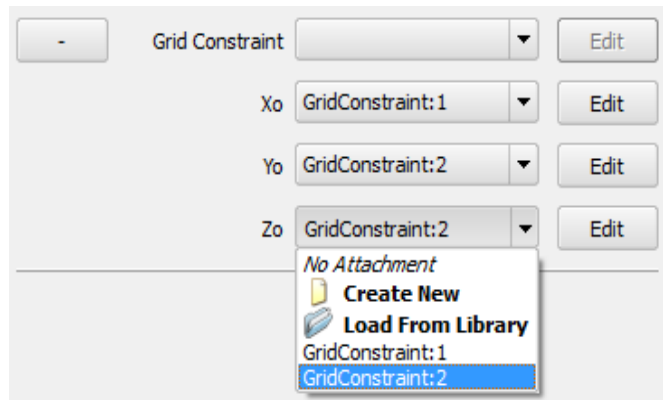
Work plane

- In the top tool bar, is a work plane tool
    - Switch to a single window view
    - Move the slider to show the grid at any position of the plane
    - De-select the "project grid on work plane"
    - Move the position of the work plane again
        - Notice the difference?
    - Try this in other view orientations
   - Hide the grid and make solid when you are done
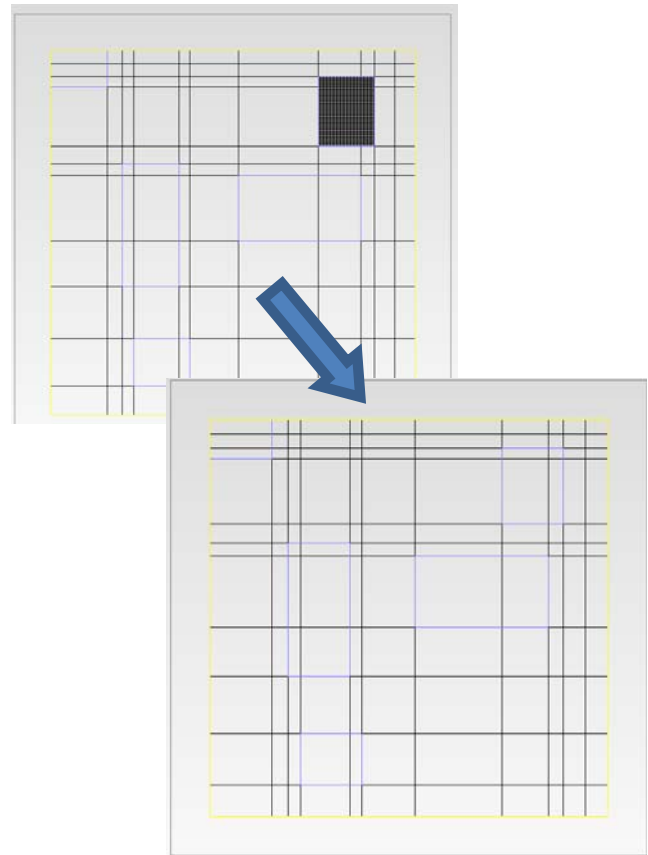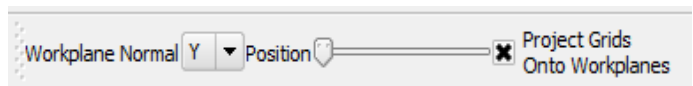
Moving Cuboid

■ Select one cuboid, and rotate it 90
   degrees about the X axis
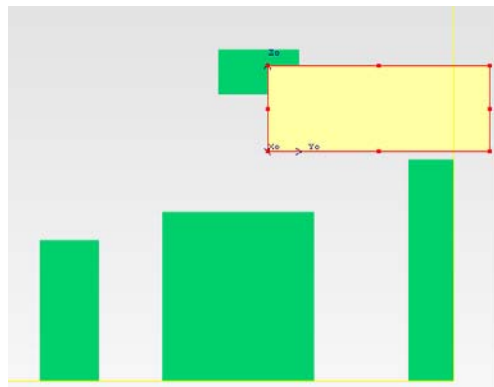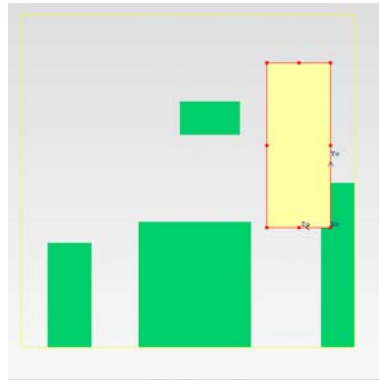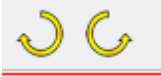
Moving Cuboid

- We would like to move this cuboid so that it's edge lines up with one of the other cuboid edges
    - Select desired cuboid in the drawing board window
    - Hold down "alt" key
    - Use left/right or up/down arrows to move the cuboid from one edge to the next
- Hide this cuboid
- Select 2 other cuboids, and align both their centers
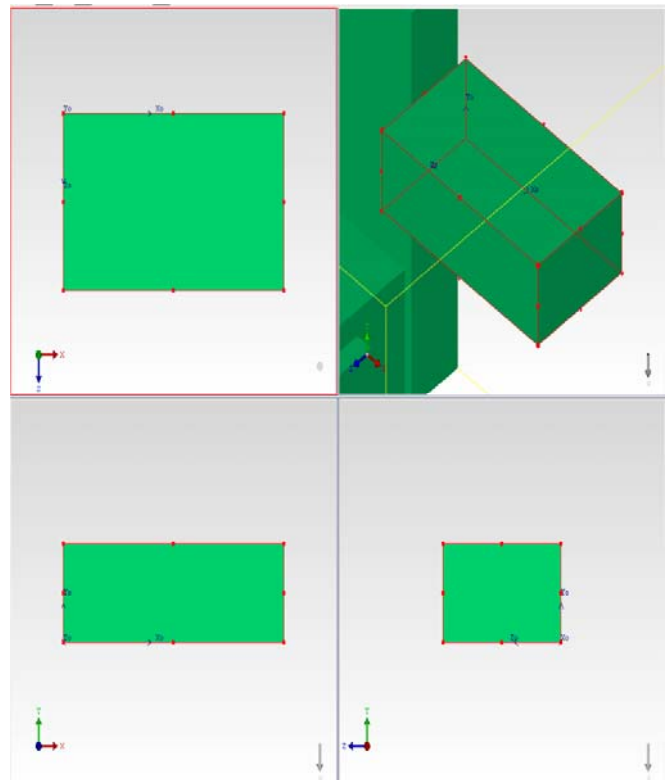   - Ctrl select 2 cuboids, click on align tool, and select center button
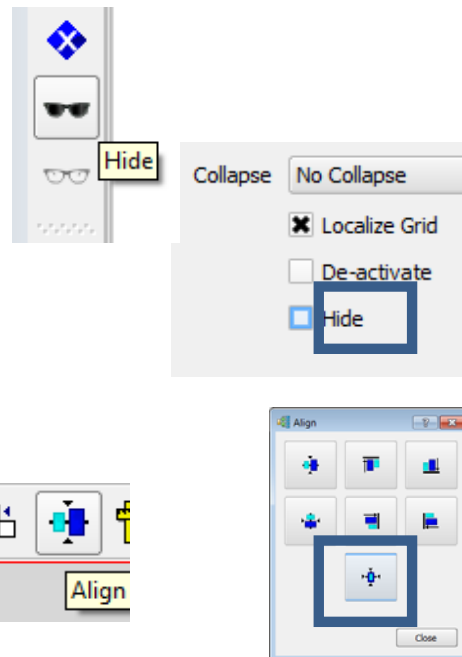
View Selected

- Often it's hard to find in the graphics window, the selected object in the Project Manager tree
- Set the drawing board to Solid View, and set to 4 views
- Select Cuboid:1 in Project Manager tree
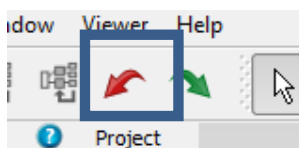- Use the "v" key to zoom in on that object in all 4 views
  - Shortcut to:

[Viewer/View Selected]

Undo

- Save model
- Click [Edit/Undo] (ctrl-Z or

) multiple times till when only the V10 subassembly was made

- Where did we save this model? Look at the bottom of the window to find the Solution Directory listed, among other important information

Title: Default Project with SI Units Solution Directory: C:\Program Files (x86)\MentorMA\flosuite_v10\flotherm\flouser\ Number of Selec

Rack and Cooler SmartParts

- 2 new SmartParts have been added for Data Center Modeling
    — Rack
    — Cooler
- Create both using the Project Manager Pallet
- Both will default with one supply and one extract object
    — Support multiple supplies/extracts
- Examine the construction tab for Rack and Cooler

Location	Construction	Attachments	Notes	

Power Dissipation Rate	3000	W
Flow Type	Volume Flow Rate	
Volume Flow Rate	0.2265348	m^3/s
☒ Airflow Adjustment		
Critical Temperature	35	°C
Factor	80	

Location	Construction	Attachments	Notes	

|		
Flow Type	Remote Rack Temperature Control	
Rack Inlet Temperature	Average	
Maximum Flow Rate	1.368648	m^3/s
Minimum Flow Rate	0.5427396	m^3/s
Target Temperature	25	°C
Temperature Set Point		
Location	Supply	
Temperature	20	°C
Capacity		
Capacity Limit	Variable	
Airflow	1.368648	m^3/s
Airflow Reference Exponent	0	
Capacity Curve	Click To Edit	

Fan Derating Model

- Go to Project – New, click on the application example tab, and launch the "Fan RPM Derating" model
- Save As V10_Fan_Tutorial
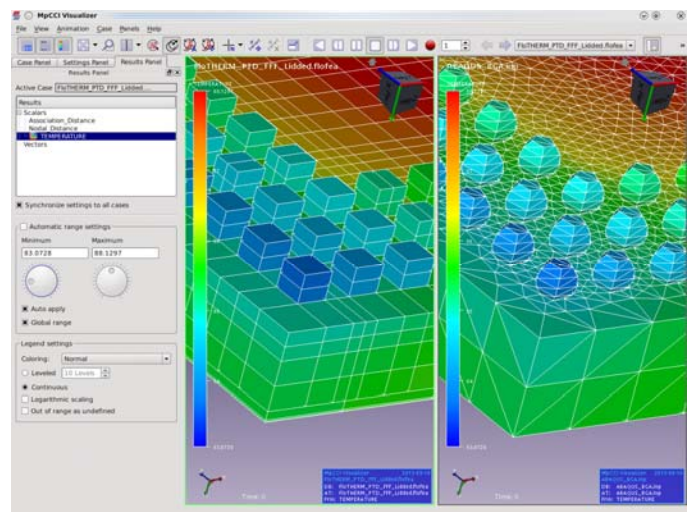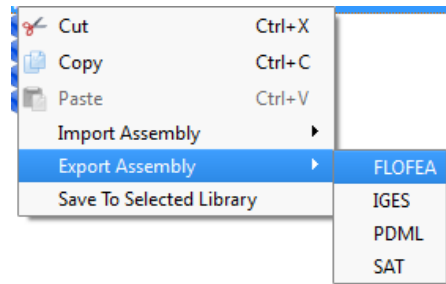- Hit F6 to expand all
- Measure the Y distance between U7 and U9
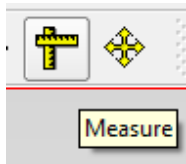
- — Click on the measure tool
- — Ctrl click to select U7 and U9
- — Graphically, move the mouse over the corners of the selected cuboids till a cross appears, then select that vertex for measurement
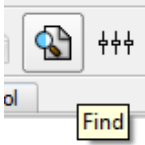- — Clear to remove the measurement from the screen
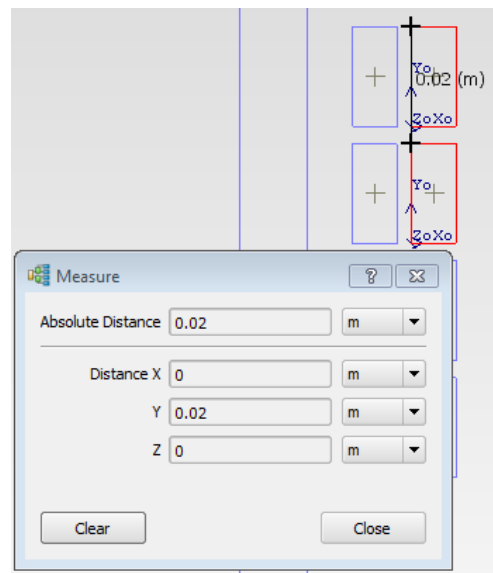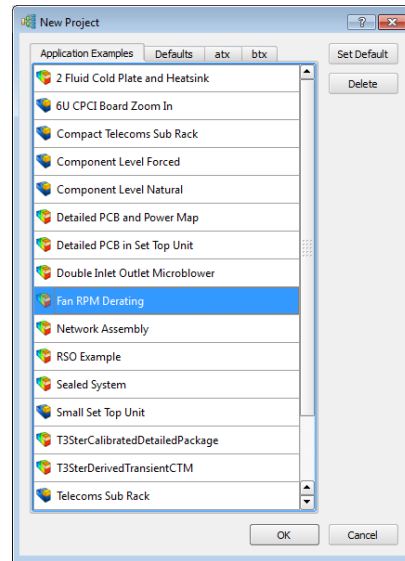
FloFEA

- As this model has results, we can export the FloTHERM solid temperatures for use in a stress analysis

- Select the Root assembly and export a FloFEA file

- This requires a 3rd party software, from Fraunhofer, called MPCCI mapper

   — http://www.mpcci.de/mpcci-software/release-infos-v43/fsimapping-from-flothermfloefd-to-fea.html

Find tool

■ Click on the Find Icon

— Under "Extended Criteria" tab, search for all Cuboids, that contain "U" in their name and that have a X size smaller then 10 mm

– All these find criteria are in 'Common'

— Notice how all the cuboids were selected in the tree

— Check the filter option and click Find again

– Notice how the tree is collapsed to just those objects
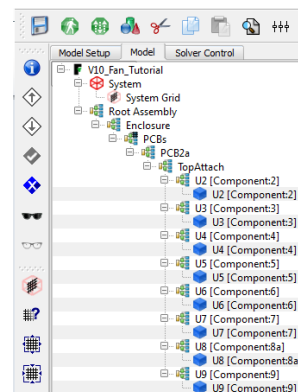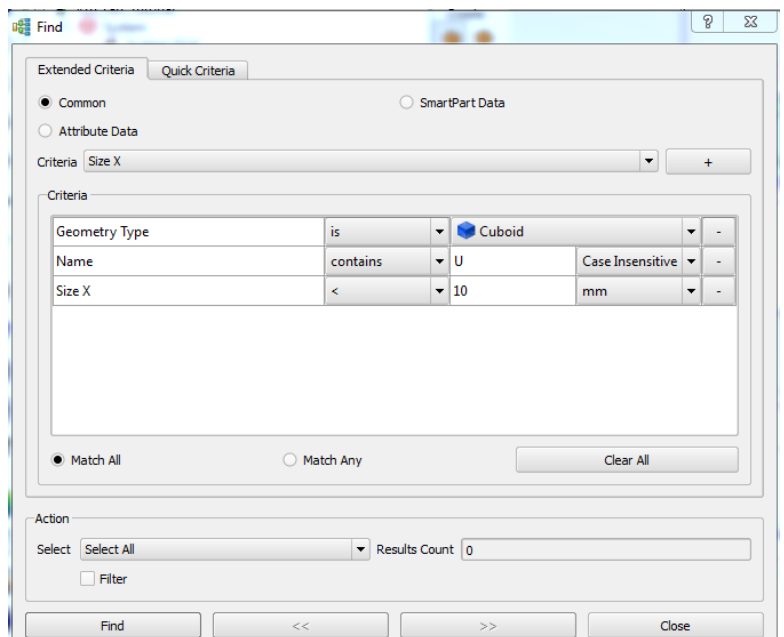
■ Try other searches, like

— Heatsinks modeled in Detail

— Everything that is Hidden

— Everything with a localized grid

— Fan with Power On

— Everything with a orthotropic conductivity

— Everything with a conductivity greater then 100 W/mK

— Anything with a surface resistance to solid not equal to 0

— Etc.

— Close the tool when you are done

Also try :Quick criteria" tab.

Summary Columns

■ Click on the summary column icon

— This expands out the project manager tree, with info icons related to all the possible attributes in our model

■ Use the summary column to check if all parts

— have materials attached

— are keypointed

— And check the total power in this system

Summary Columns

- Check the root assembly for total system power
    - Summed power from child objects appears in brackets, assigned power to an object does not
- Check the second column for any object with no keypoints
    - There should be none
- To check this column works,
    - Edit the system grid
        - Set minimum cell size to 10 mm
    - Black X's should now appear in the column

    - Hover over the black X to see which faces of the object are not keypointed
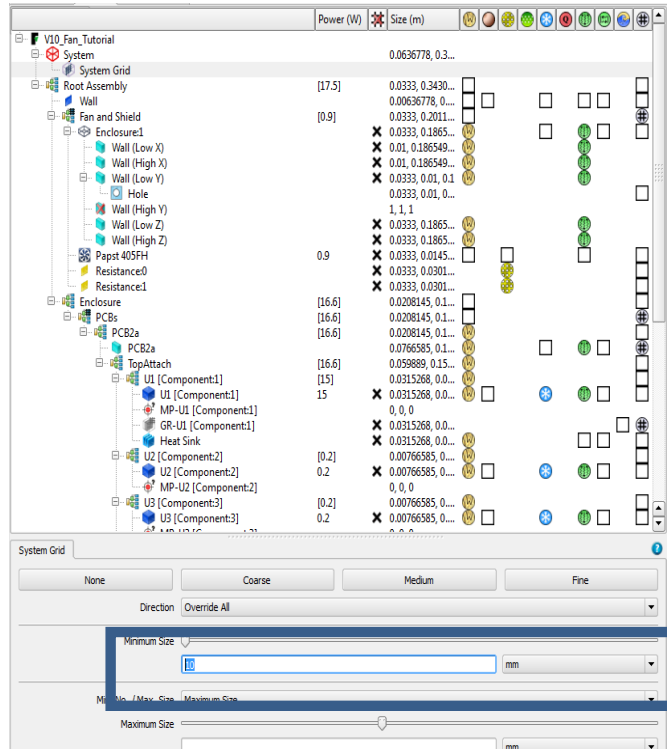
Summary Columns

- In the materials column, objects with a black square outline, indicate a material could be attached, but isn't

- Hover the mouse over the material icon in the enclosure row to find the material that is attached to that object

- Other questions. What objects have:

    — Thermal powers?

    — Radiation?

    — Grid Constraints?

Transient

- Set this model to be a transient
    - Model Setup – Transient Solution
    - Check Transient Solution On/Off
        - Leave default settings
        - Check "continue with existing project"
    - Select the Papst fan, go to the attachment tab, and create new transient attribute
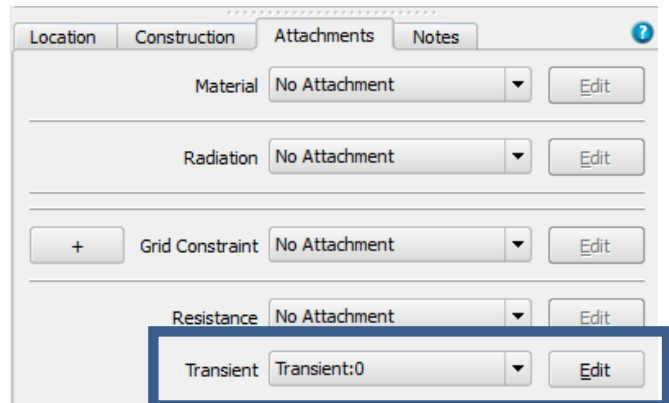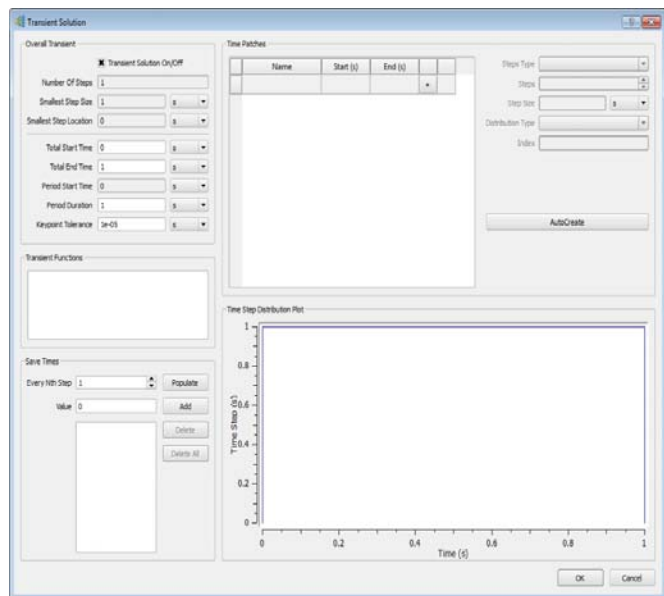
Transient

- Change the Transient tab to "Multiplier vs. Temperature"

    - This will let the derating factor of the fan be modified based on the temperature of a monitor point

    — Click Activate

    — Pull down to select Monitor point for U1

    — Click to edit the transient temperature chart

    — Define a chart similar to the one shown

    — Ok to exit this window, and close the project manager
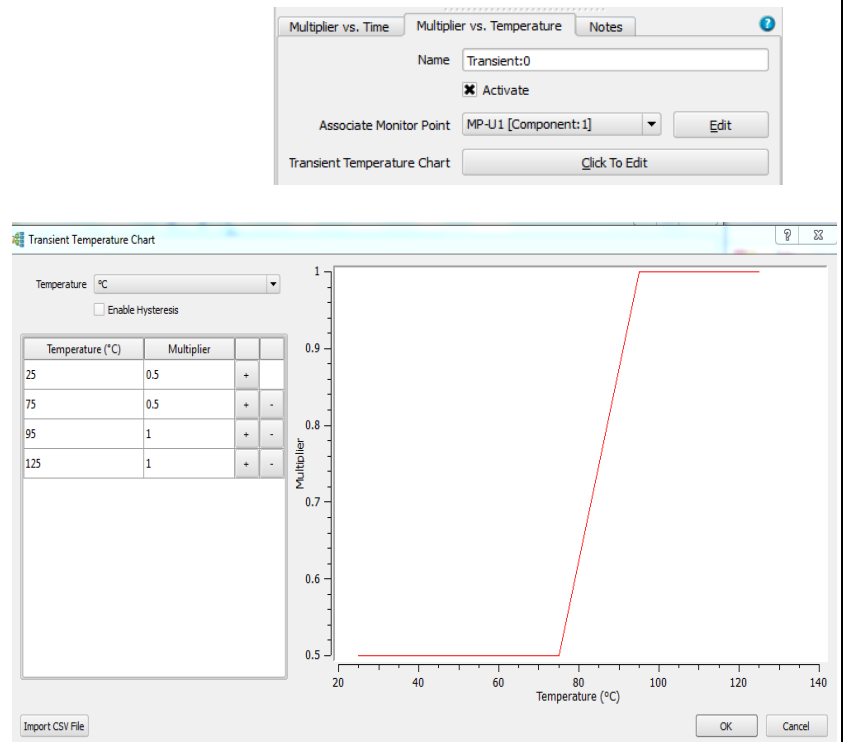
Solver Setup

- ◼ Activate the parallel solver
    - — [Edit/User Preferences] Number of processors to use > 1
- ◼ Enable Multi-Grid solver
    - — In Project manager tree, select Solver Control Tab
        - – Pull down Solver Option to be Multi Grid
    - — Notice the Variable Control options are at the bottom of the window

Model Setup	Model	Solver Control	?

Solver Option	Multi Grid
Outer Iteration	500
Fan Relaxation	0.6

- ☐ Activate Plate Conduction
- ☐ Use Double Precision Solver
- ☐ Network Assembly Block Correction
- ☐ Multi Grid Damping
- ☐ Freeze Flow
- ☐ Error Field

Estimated Free Convection Velocity	0.2	m/s

Monitor Point

- ☐ Monitor Point Convergence For Temperature
- ☐ Monitor Point Transient Termination Criteria

Variable	Pressure
Inner Iterations	100

Termination Residuals

Type	Automatic

Factor
< Increase Decrease >

Value	1.452083e-05	kg/s

Initial Variables

All Initial Values	Automatic
Initial Value	Automatic

Solver Setup

- Activate 'Monitor Point Transient Termination Criteria'
    - Select MP-U1, and set temperature to 100
    - Add another criteria, for MP-U2, at 125 degC

Model Setup	Model	Solver Control	

Solver Option	Multi Grid
Outer Iteration	500
Fan Relaxation	0.6

- ☐ Activate Plate Conduction
- ☐ Use Double Precision Solver
- ☐ Network Assembly Block Correction
- ☐ Multi Grid Damping
- ☐ Freeze Flow
- ☐ Error Field

Estimated Free Convection Velocity	0.2	m/s

Monitor Point

- ☐ Monitor Point Convergence For Temperature
- ☒ Monitor Point Transient Termination Criteria

Monitor Point	Temperature (°C)		
MP-U1 [Component:1]	100		-
MP-U2 [Component:2]	125	+	-

Model Setup

- Click on the Model Setup Tab
- Enable Stored Variables for
  — Heat Fluxes
  — Gradient Temperature
  — Bottleneck and Shortcut numbers
- Change the default ambient and radiant temperature to 25 degC

Model Setup	Model	Solver Control	

Type of Solution	Flow And Heat Transfer
Dimensionality	3-Dimensional
Radiation	Radiation On
Solar Radiation	☐ On Click To Edit
Transient Solution	☒ On Click To Edit
Fluid	Air at 30 DegC, 1 atmosphere Edit
Gravity	Normal
Direction	-Y
Value	Automatic
Turbulence	Turbulent
Turbulence Model	Automatic Algebraic
Pressure	1 Atm
Default Radiant Temperature	25 °C
Radiant Transient	No Attachment Edit
Default Ambient Temperature	25 °C
Ambient Transient	No Attachment Edit

Capture Index

☐ Calculate

Stored Variables

☐ Mass Fluxes
☒ Surface Temperatures
☐ Power Density
☒ Heat Fluxes
☒ GradT
☒ Bn and Sc

Auxiliary Variables

Ambient

- Click on the Model Tab, and select the System Node
  — Select the Boundaries Tab
  — In the Ambient pull down
    – Load from Library
    – Double click 25 degC ambient
  — In the Ambient Pull down, select the newly loaded 25 degC ambient

List of Some Useful Shortcuts

- V   Zoom to selected object in all views
- F9   Toggle between Object Select and View Manipulate
- F6   Expand All
- G   Show/Hide grid
- Cntrl-Z Undo
- Alt+Arrow   Object snap moving (ensure object select mode is active)
- L/R Arrow   Move workplane to next grid cell
- Cntrl+drag   Graphical object copy
- Shift+drag   Constrain object move to one direction
- Middle mouse button click+drag   Object move only, not resize
- Select a viewport without losing object selection:
    - Click with middle mouse button

Some Selected new functionalities in V10.1

1.1 Undockable Drawing Board graphics area	The Drawing Board area may be optionally undocked from (and redocked with) the Project Manager node tree via the [Window] menu or toolbar icon. The undocked Drawing Board can then be moved over to a second monitor display.
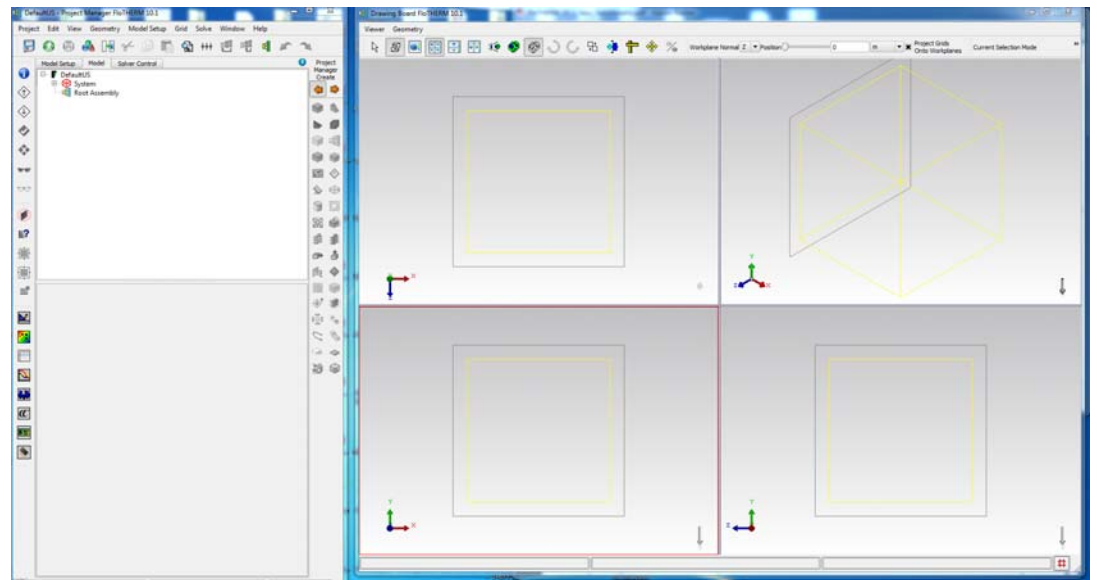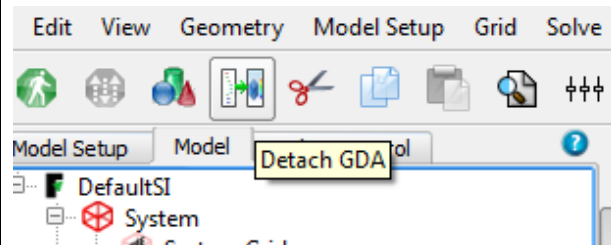
|	
Project Manager IDFPreferences	The default and filtering settings used when using the Project Manager IDF import feature are available in the User Preferences dialog. These
	are shown only if the 'Configure IDF' box is checked.
Note that these settings only apply to Project Manager IDF import (via the right-click assembly import). IDF import through FloEDA Bridge is handled seperately.	
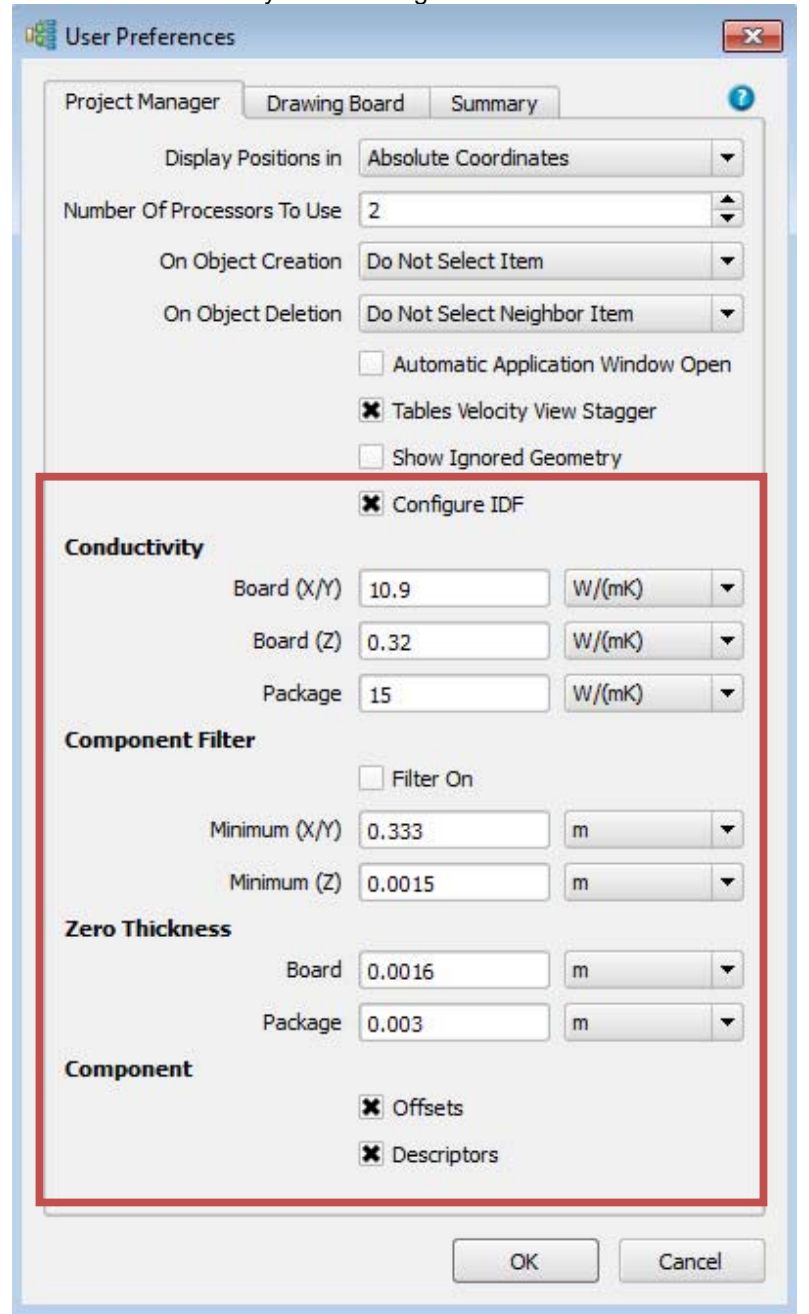
Note the following options under Drawing Board tab of User Preferences windows:

Display of Axis on Selected Objects

Display of the Solution Domain

Display of Workplane Outline
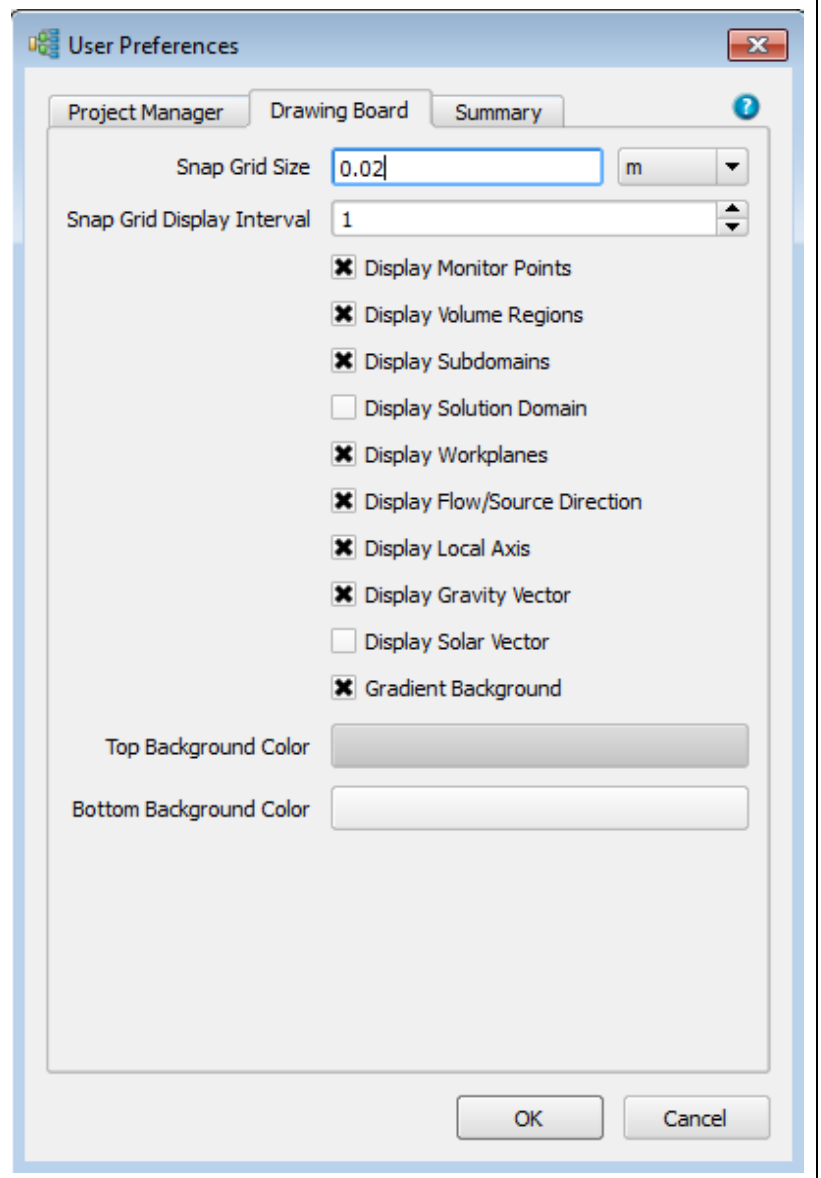
De-keypointed Indication Tolerance	Whether an object is indicated as having one or more faces dekeypointed in the Summary Columns can now be controlled via a %tolerance value in the 'Summary' tab in the [Edit/User Preferences…] dialog
	Objects that resize less than this amount, in the direction that has a dekeypointed face, will NOT be indicated as being de-keypointed
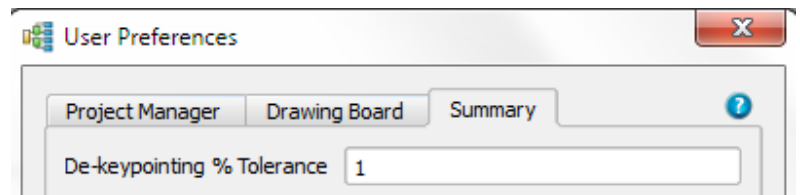
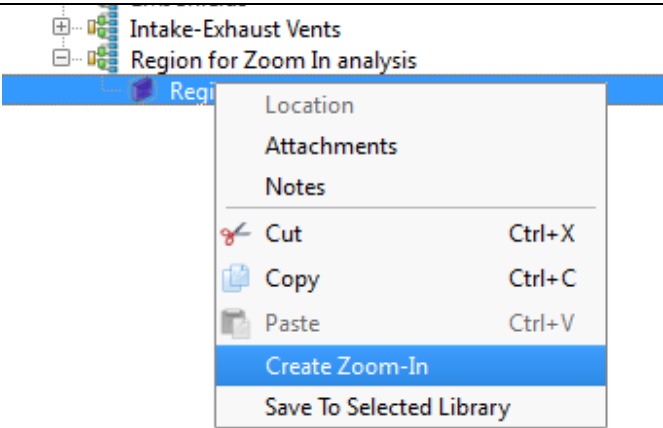|	

Configurable display of Integrated Summary Columns	**User Preferences**
	
	Project Manager Drawing Board **Summary**
	
	De-keypointing % Tolerance 0.1
	
	☒ Power
	☒ De-keypointed
	☒ Size
	☒ Material
	☒ Surface
	☐ Resistance
	☐ Ambient
	☒ Thermal
	☐ Source
	☐ Radiation
	☐ Surface Exchange
	☐ Fluid
	☐ Grid Constraint
	☐ Cold Aisle Group
	☐ Cold Aisle Sub-Group
	☐ Hot Aisle Group
	☐ Hot Aisle Sub-Group
	☐ Cooler Group
	
	OK Cancel
	
	Model Setup Model Solver Control
	
	Power (W) Size (m)
	Compact Telecoms Sub Rack RBB
	  System 0.536047, 0.8001, 0.208001
	  Compact Rack [840] 0.536047, 0.8001, 0.208001
	    Enclosure Walls 0.536047, 0.8001, 0.208001
	    Fans 0.536047, 0.0508001, 0.208
	    Cards [640] 0.480662, 0.423, 0.165
	    Card Cage 0.536047, 0.535864, 0.166962
	    Power Supply assembly [200] 0.536047, 0.135331, 0.208001
	    EMI Shields 0.536047, 0.4484, 0.165
	    Intake-Exhaust Vents 0.536047, 0.8001, 0.208001
	    Region for Zoom In analysis 0.0508, 0.423, 0.165

Find Command	Find command extended to have two tabs: 1. Quick Criteria. This is the simpler Find command previously available in v9.3 and earlier. 2. Extended Criteria. This is the query based Find command introduced in FloTHERM v10.0.
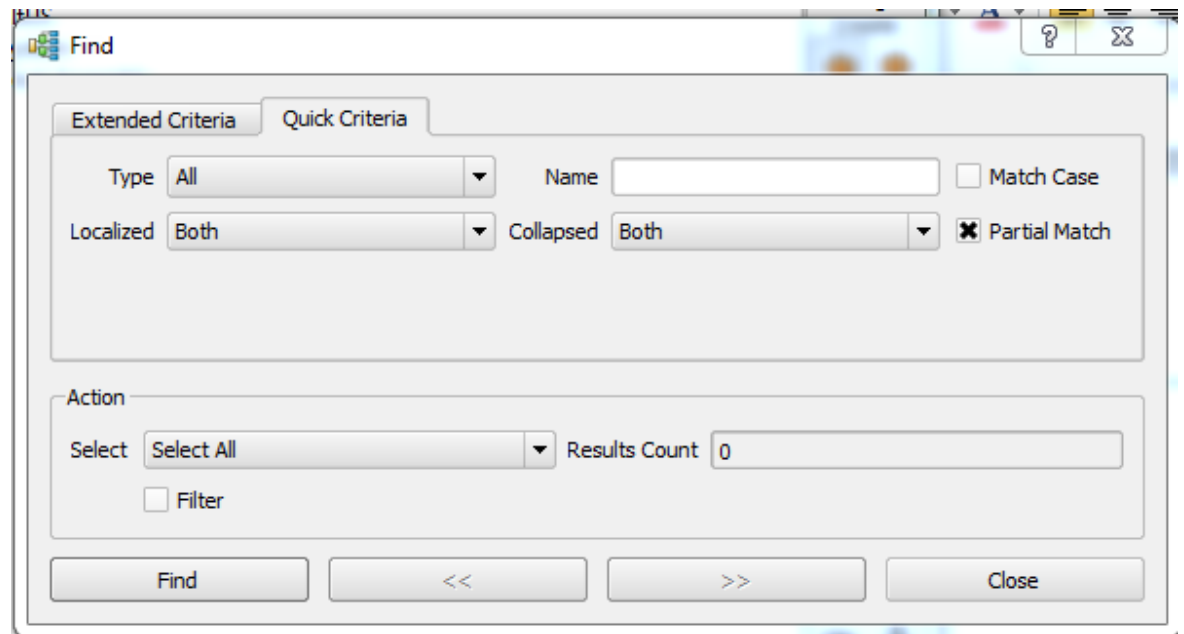
Zoom-In Model Creation	
Solar calculation performance improvements	The solar calculation has been made more efficient, and now offers support for multiple cores. The time required to complete the solar calculation is now much improved with the average improvement for a range of models shown below.

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