



Computer Simulation of Fluid Flow, Heat Flow,  
Chemical Reactions and Stress in Solids.

**PHOENICS  
Today**

**PHOENICS December 2012**

# PHOENICS 2012 December



# Contents

PHOENICS  
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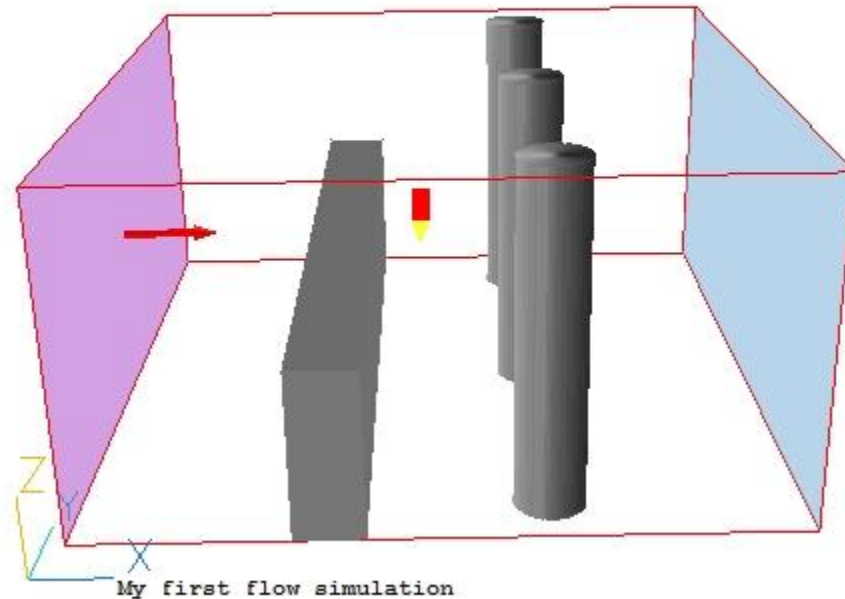
- This presentation shows some of the new features in PHOENICS 2012
- The talk is in five parts:
  - Pre-processor (VR-Editor)
  - Post-processor (VR-Viewer)
  - Solver (Earth)
  - General improvements (common to all modules)
  - Highlights of earlier improvements



# VR Editor Improvements

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- Inlet objects have a vector arrow showing the direction of flow:

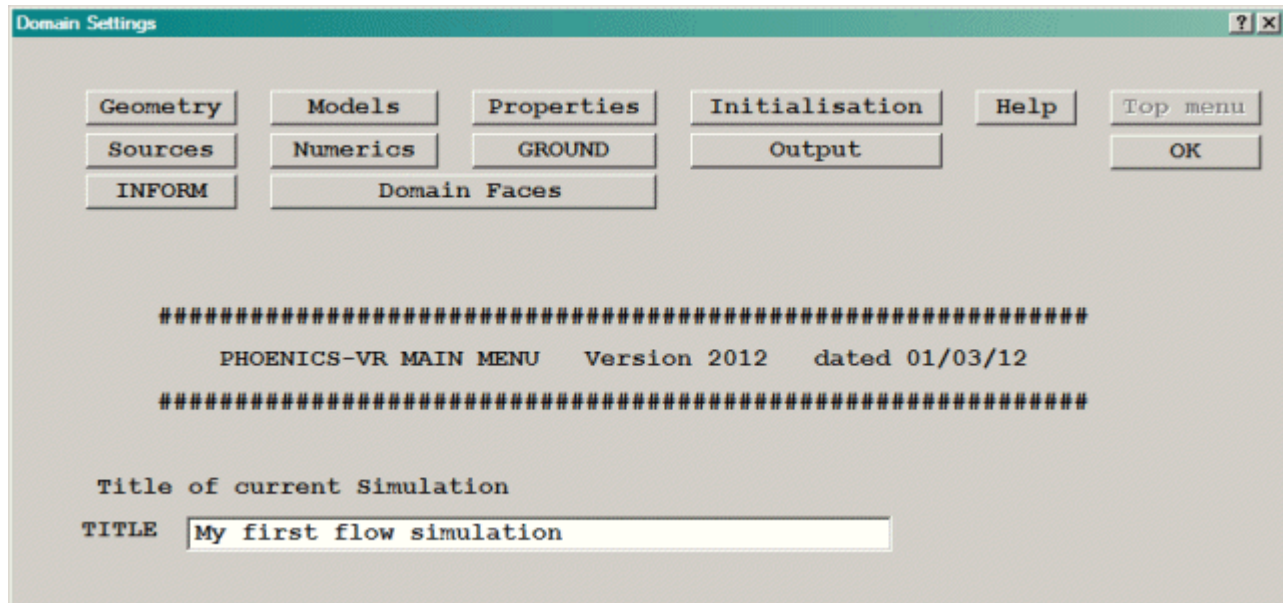




# VR Editor Improvements

PHOENICS  
Today

- Main Menu allows setting of domain edge boundary conditions:





# VR Editor Improvements

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- **Wall Yes** - create a **PLATE** object at this domain face. The name (for X) will be DOM\_XMIN\_W or DOM\_XMAX\_W
- **Open Yes** - create an **OUTLET** object at this domain face. The name (for X) will be DOM\_XMIN\_O or DOM\_XMAX\_O
- **Flow Yes** - create an **INLET** object at this domain face. The name (for X) will be DOM\_XMIN\_I or DOM\_XMAX\_I
- Objects are created with default settings – the user must set any non-default values.
- Existing PLATE, OUTLET or INLET objects (with any name) that cover a whole domain face will be recognised and will set the flags on the dialog.

Set Domain Edge Conditions

Choices for domain edge boundary conditions:  
WALL - impermeable friction boundary (PLATE)  
OPEN - fixed pressure boundary (OUTLET)  
FLOW - fixed flow boundary (INLET)  
For symmetry condition set all to No

Xmin:	Wall	<input type="button" value="No"/>	Open	<input type="button" value="No"/>	Flow	<input type="button" value="No"/>
Xmax:	Wall	<input type="button" value="No"/>	Open	<input type="button" value="No"/>	Flow	<input type="button" value="No"/>
Ymin:	Wall	<input type="button" value="No"/>	Open	<input type="button" value="No"/>	Flow	<input type="button" value="No"/>
Ymax:	Wall	<input type="button" value="No"/>	Open	<input type="button" value="No"/>	Flow	<input type="button" value="No"/>
Zmin:	Wall	<input type="button" value="No"/>	Open	<input type="button" value="No"/>	Flow	<input type="button" value="No"/>
Zmax:	Wall	<input type="button" value="No"/>	Open	<input type="button" value="No"/>	Flow	<input type="button" value="No"/>



# VR Editor Improvements

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- Activation of transient restarts made easier.
- On the 'Time step settings' dialog, set 'First step number'  $> 1$  and a dialog will offer to activate the restart.
- All necessary file names will be deduced.

Time step settings

Global settings:-

Time at start of step 1  s

Time at end of last step  s

First step number

Last step number

Restart file names:-

Solution file

Cut-cell file

Region settings:- (Currently 1 regions)

Free all regions

Reg	End Time	Steps	Distributn	Power	Symmetric	Step powr
1	<input type="text" value="1.000000"/>	<input type="text" value="100"/>	<input type="text" value="Power law"/>	<input type="text" value="1.000000"/>	<input type="text" value="No"/>	<input type="text" value="Free"/>



# VR Editor Improvements

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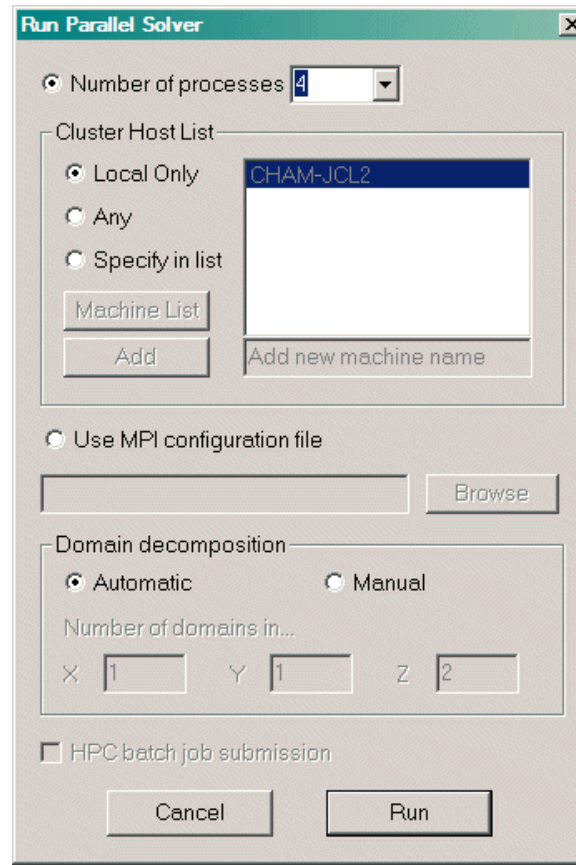
- Object names can be up to 12 characters long.
- The Q1 can be saved to a different name without saving all the output files 'File – Save Q1 As...'.



# VR Editor Improvements

PHOENICS  
Today

- The dialog for starting parallel has been updated to allow more flexibility.



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# VR Editor Improvements

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Today

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- The facilities for repairing and manipulating CAD data during and after import have been improved.
- The new DatMaker utility can:
  - Mend holes
  - Ensure all facets point outwards
  - Repair folded facets
  - Split an object into separate bodies
  - Merge objects
  - Subtract objects



# VR Editor Improvements

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- Often problems with geometry detection can be eased or removed by merging several touching or overlapping objects into one.
- The same applies to subtracting an air space from a surrounding blockage.



# VR Editor Improvements

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- DatMaker is now used by default when importing single or multiple CAD files, to translate the CAD to DAT format.
- The supported formats are, as before,
  - STL - Stereo lithography file. This is available in many popular CAD programs as an export format.
  - DXF - Drawing Exchange Format File (AutoCAD)
  - 3DS - Autodesk 3ds Max
  - WRL - Virtual Reality Modelling Language file
  - DW - Files generated by DesignWorkshop from [Artifice](#)
  - AC - Files generated by AC3D from [Invis](#)
  - IV - Files generated by Open Inventor

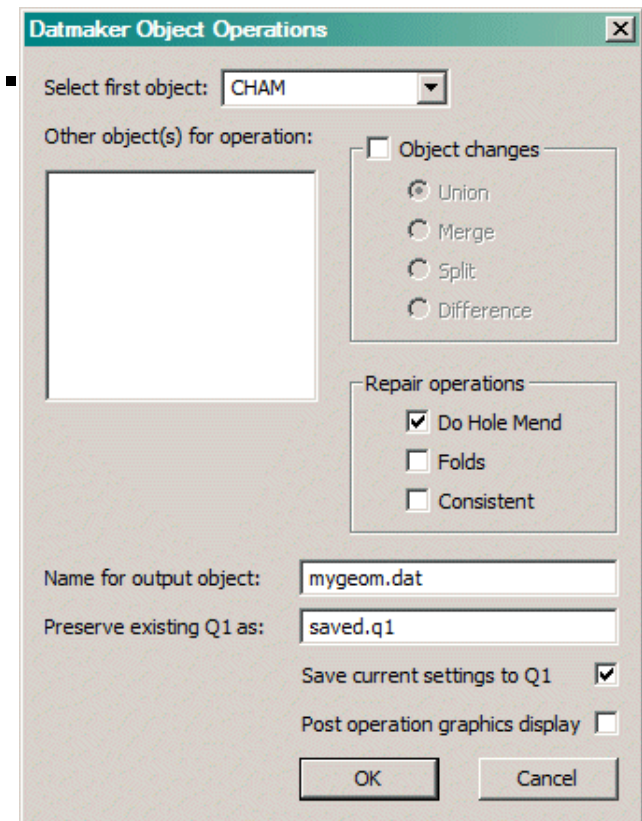


# VR Editor Improvements

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- DatMaker can also be used to perform operations on objects already created in VR.
- Existing objects can be merged, split or subtracted, as shown in the next slides.

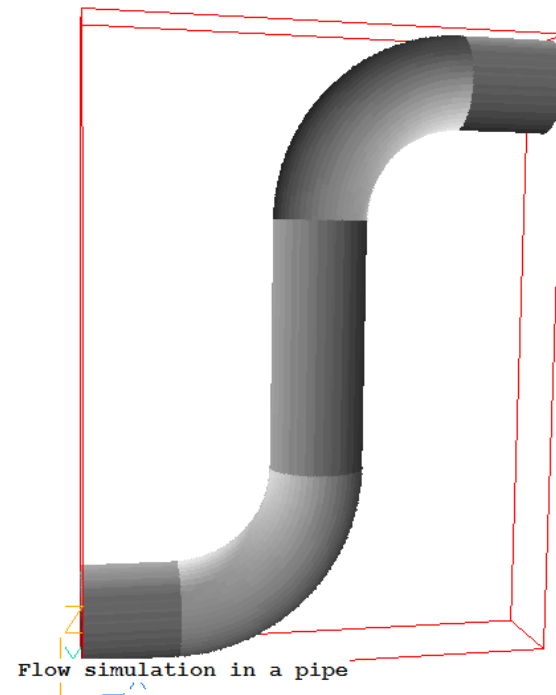




# VR Editor Improvements

PHOENICS  
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- Here there are 5 air blockages making a channel through a hidden solid

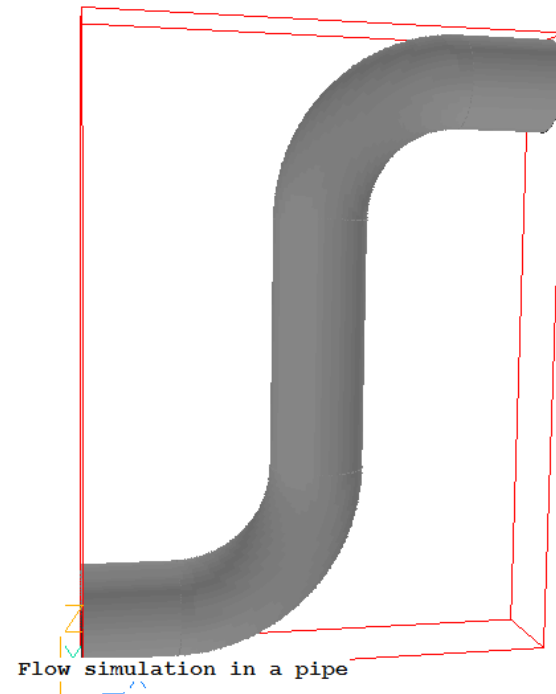




# VR Editor Improvements

PHOENICS  
Today

- Now they have been merged into one object



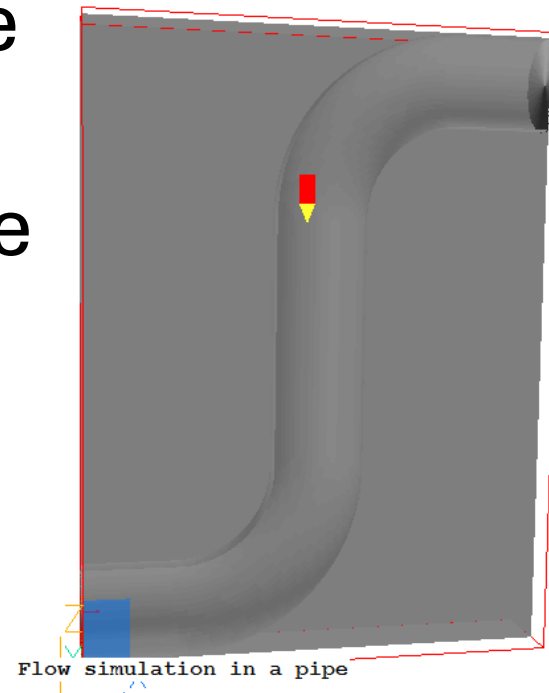


# VR Editor Improvements

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- And now subtracted from the solid leaving a channel.
- A clipping plane is used to reveal the inside of the solid.



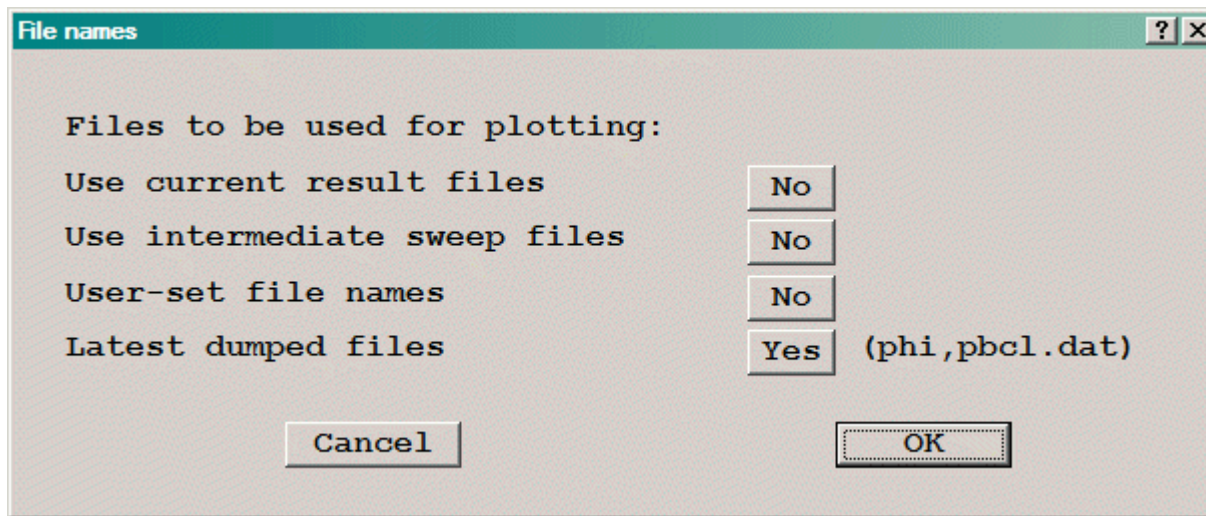


# VR Viewer Improvements

PHOENICS  
Today

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- Start-up dialog offers most recent set of results:



- New function key F9 always loads most recent set of results.

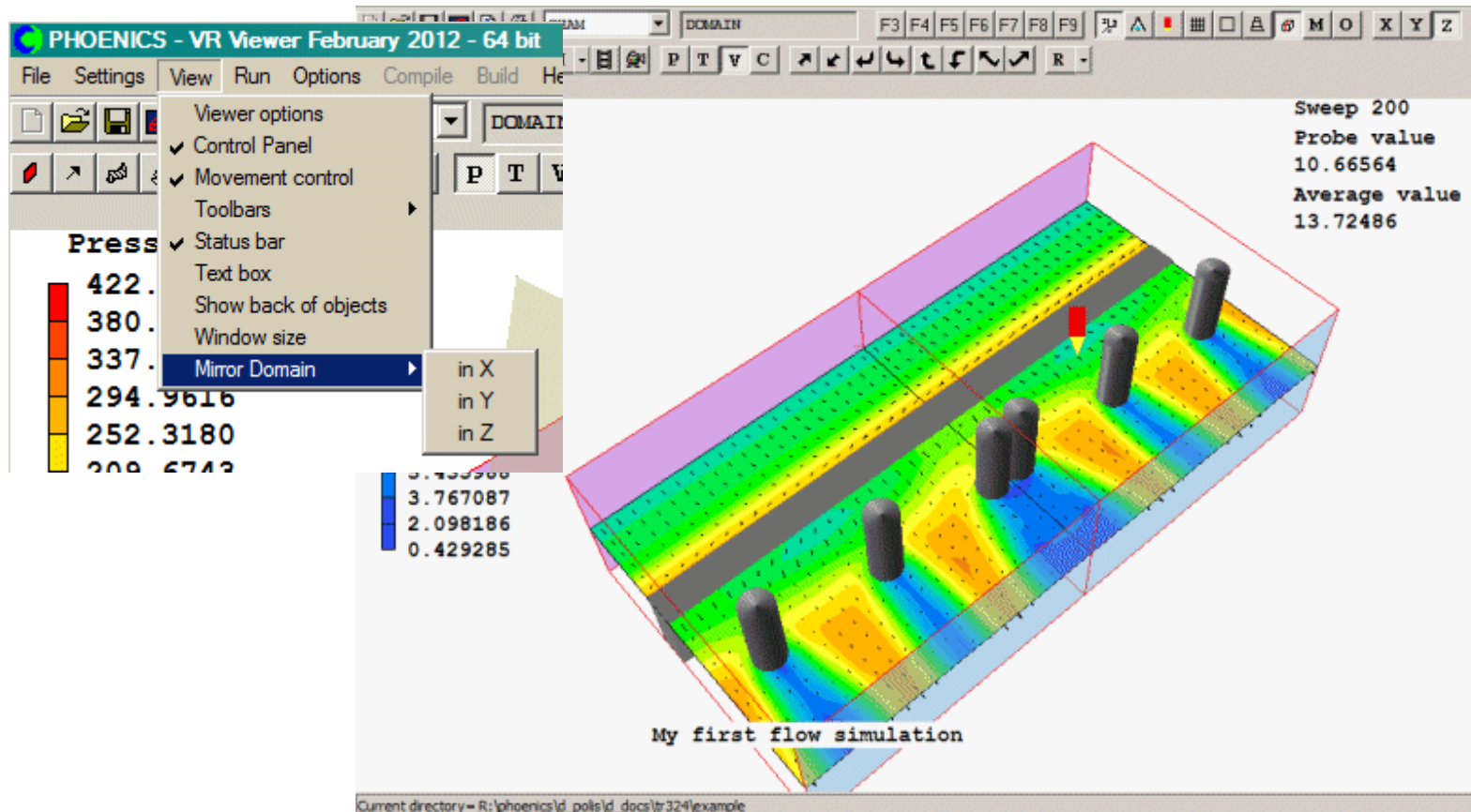




# VR Viewer Improvements

PHOENICS  
Today

- The domain can be mirrored in any direction



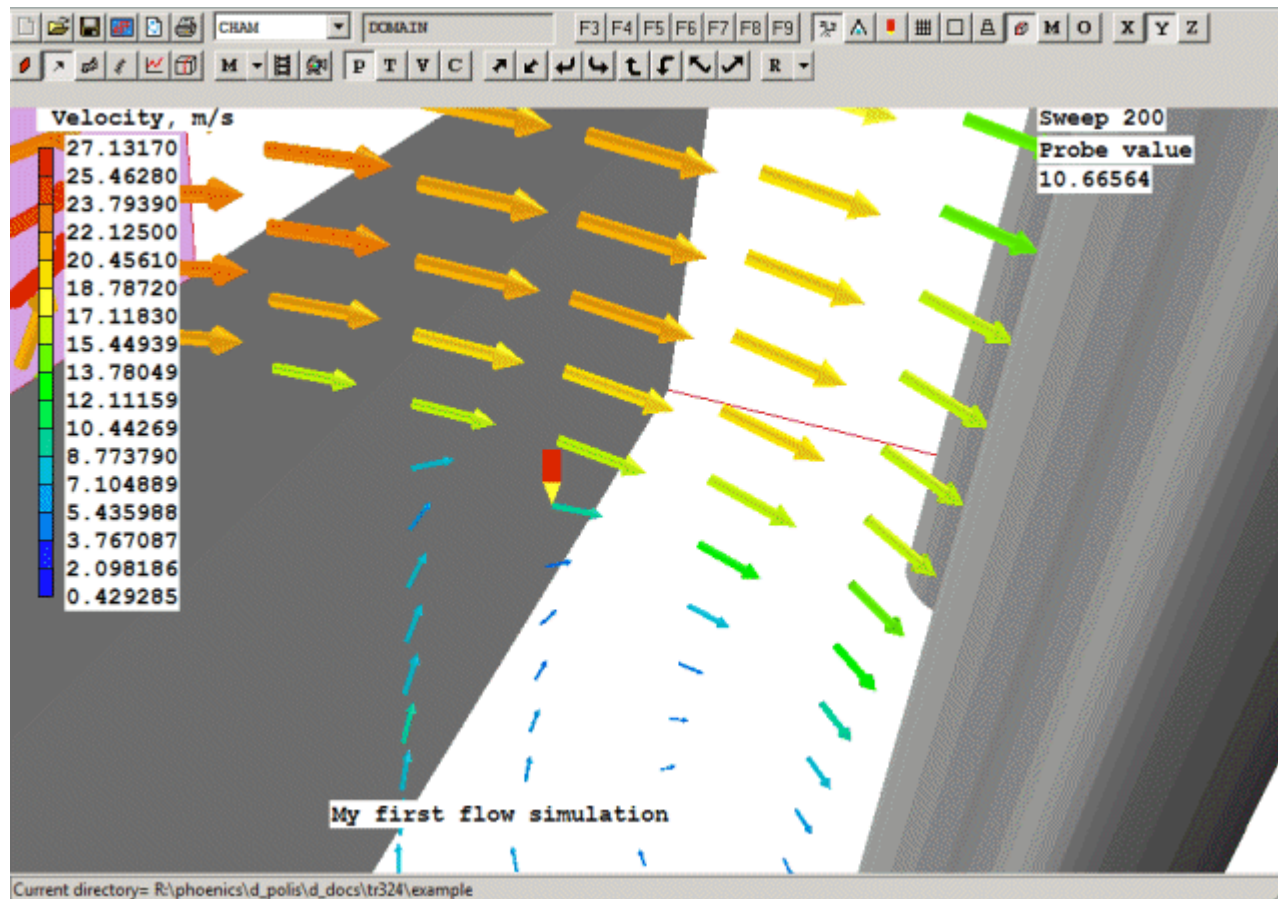
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# VR Viewer Improvements

PHOENICS  
Today

- Vectors can be drawn as 3D arrows



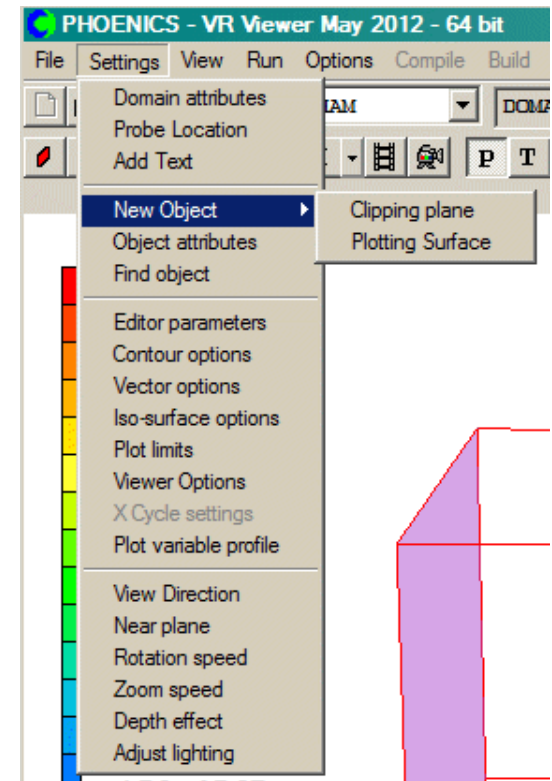
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# VR Viewer Improvements

PHOENICS  
Today

- Contours and vectors can be plotted on an arbitrary surface of any shape – the 'Plotting Surface' object.

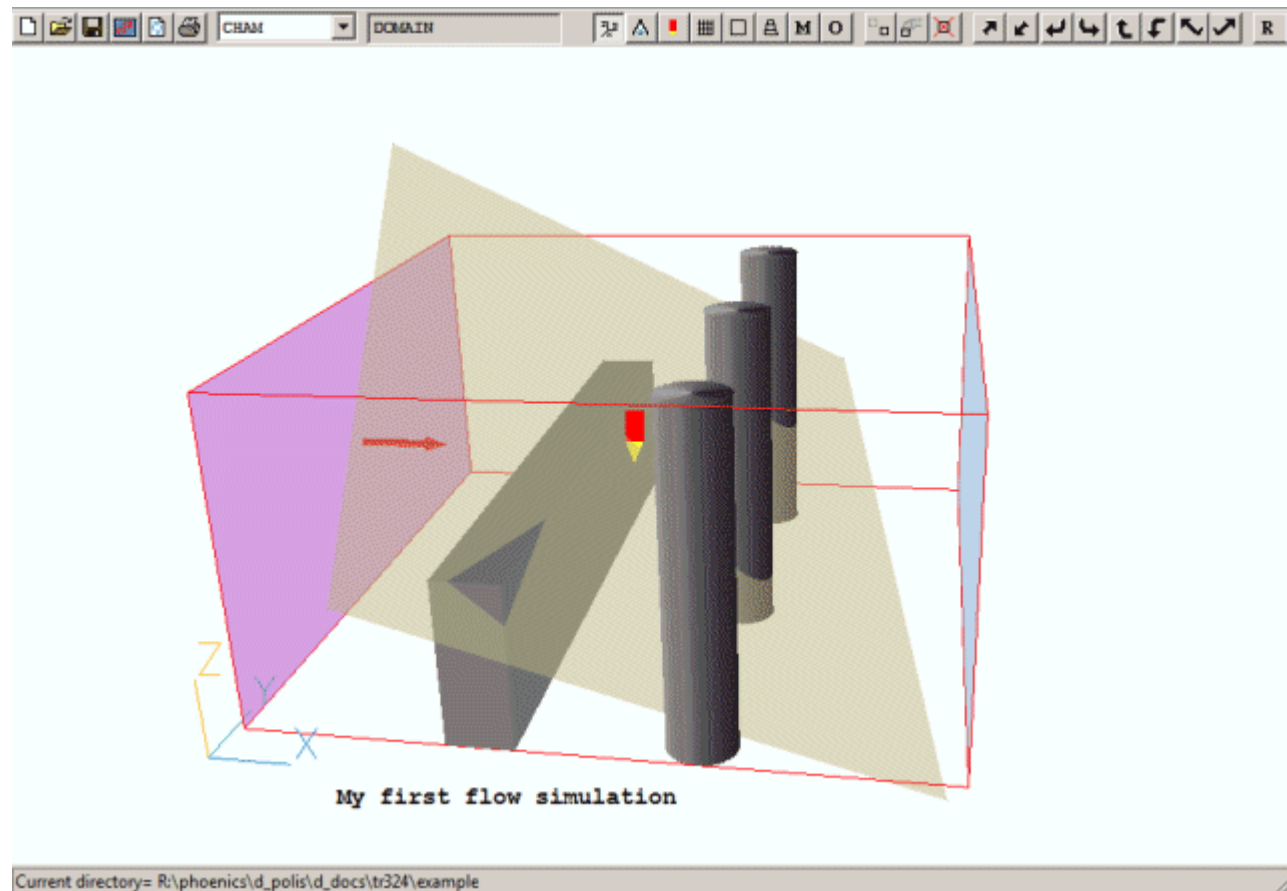




# VR Viewer Improvements

PHOENICS  
Today

- Rotate to any position:



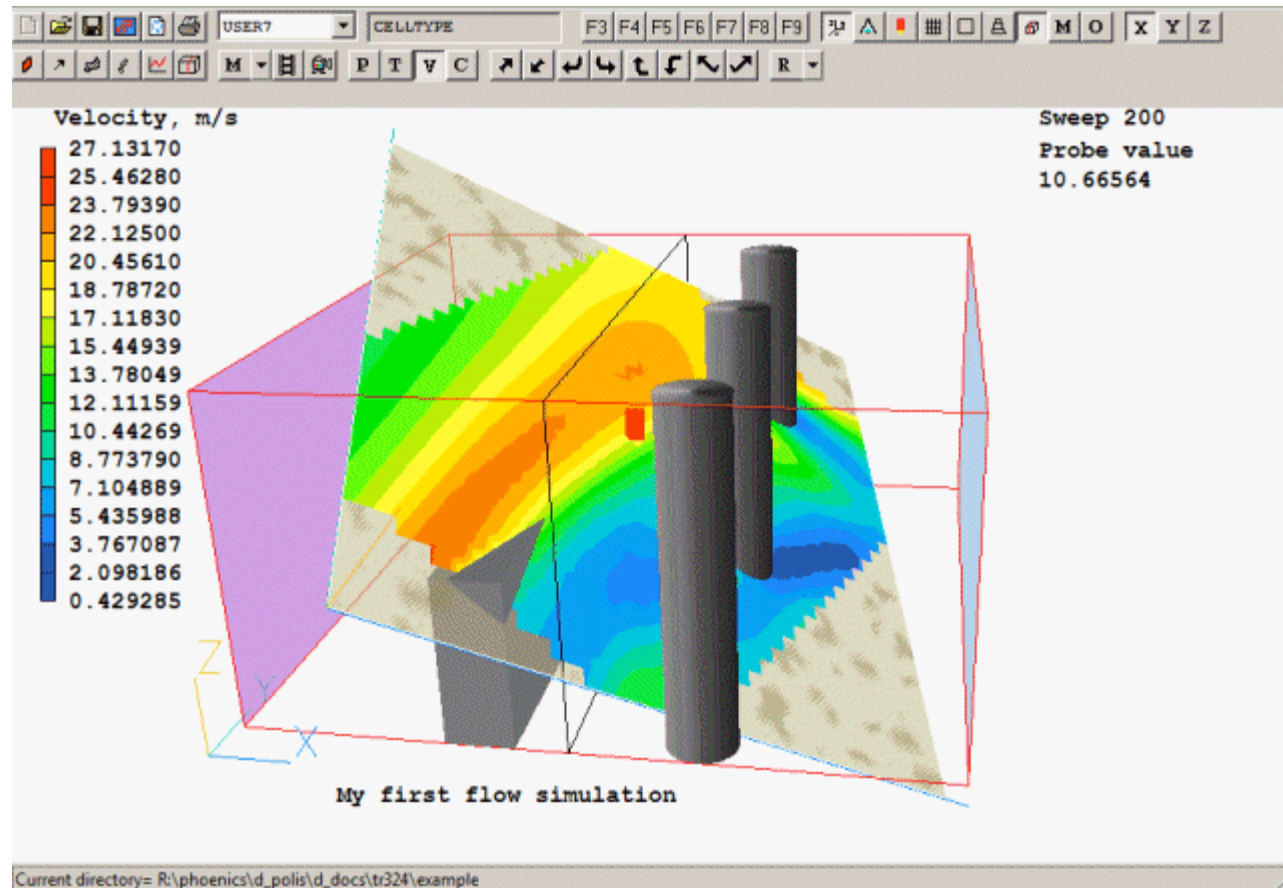
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# VR Viewer Improvements

PHOENICS  
Today

- Select the new object, right-click and select 'Surface contours'

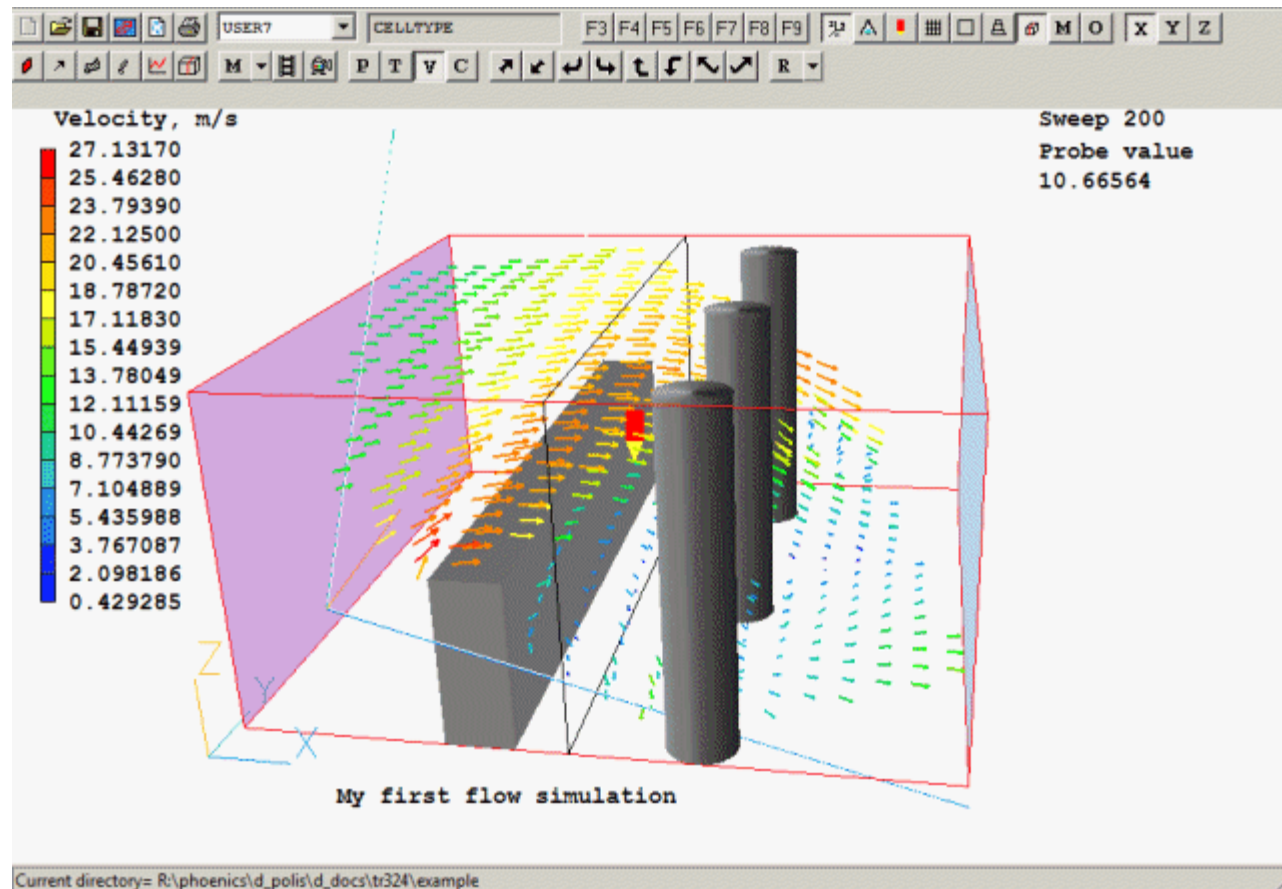




# VR Viewer Improvements

PHOENICS  
Today

- Now select 'Surface vectors'



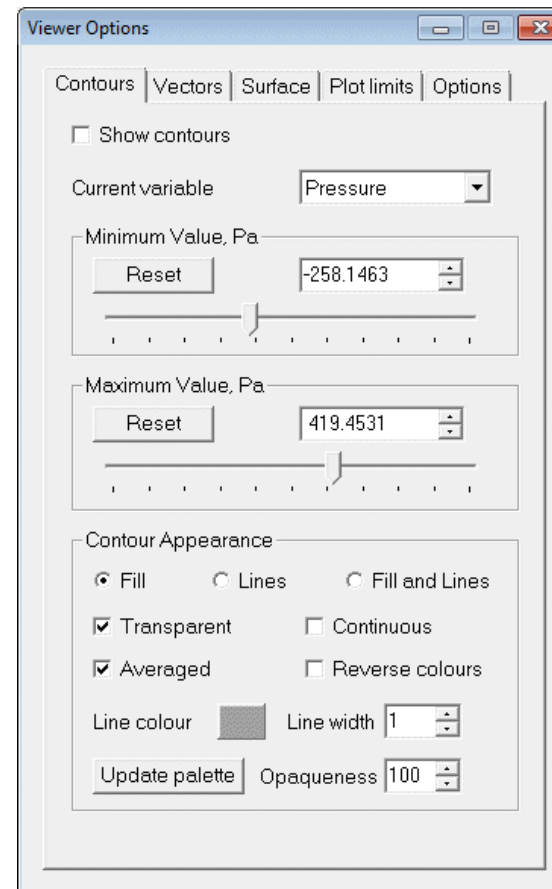
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# VR Viewer Improvements

PHOENICS  
Today

- Contours have new options:
  - Fill
  - Lines
  - Lines and fill





# VR Viewer Improvements

PHOENICS  
Today

PHOENICS December 2012

- Contours have new options:
  - Fill
  - Lines
  - Lines and fill
- These can be applied to contour planes, contours on surfaces of objects and contours on Plotting Surface objects



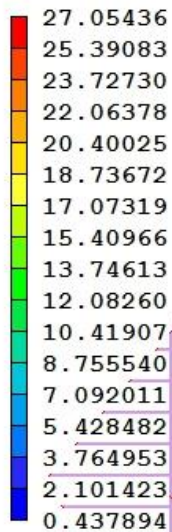


# VR Viewer Improvements

PHOENICS  
Today

## ● Fill

Velocity, m/s



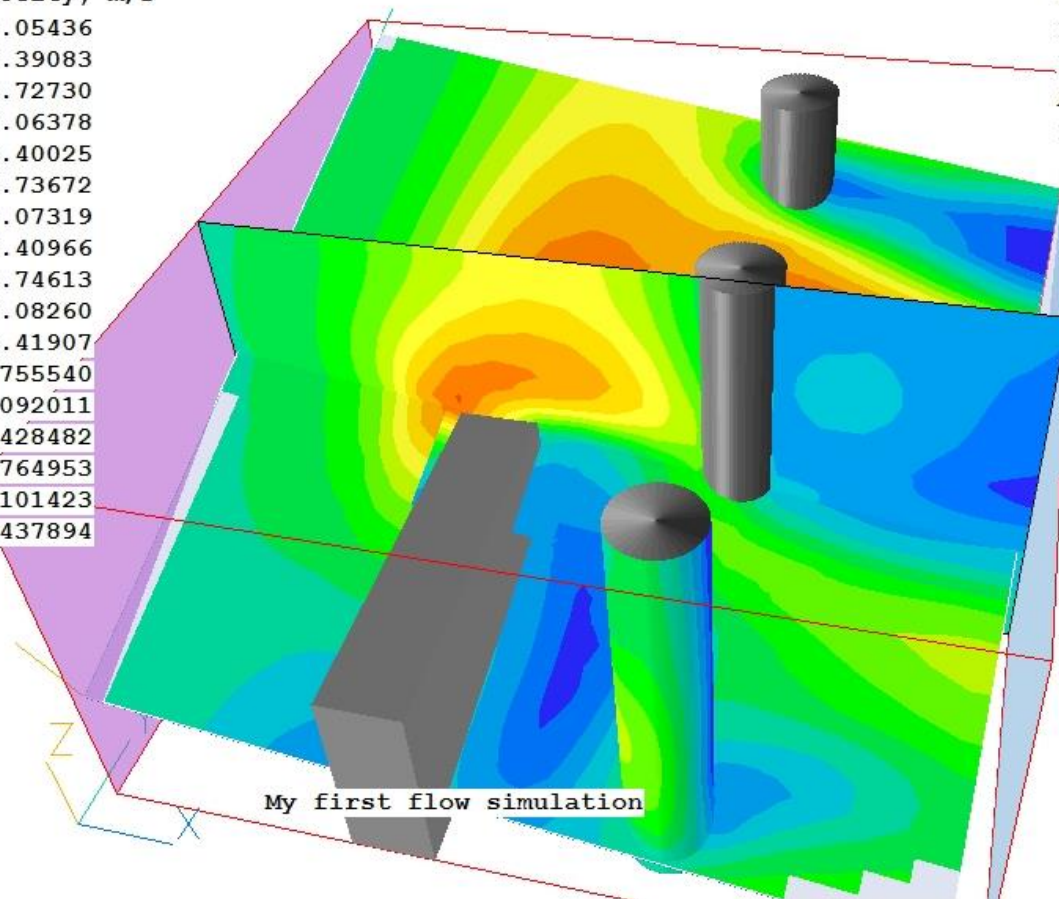
Sweep 200

Probe value

11.08617

Average value

10.26845





# VR Viewer Improvements

PHOENICS  
Today

- Lines

Velocity, m/s



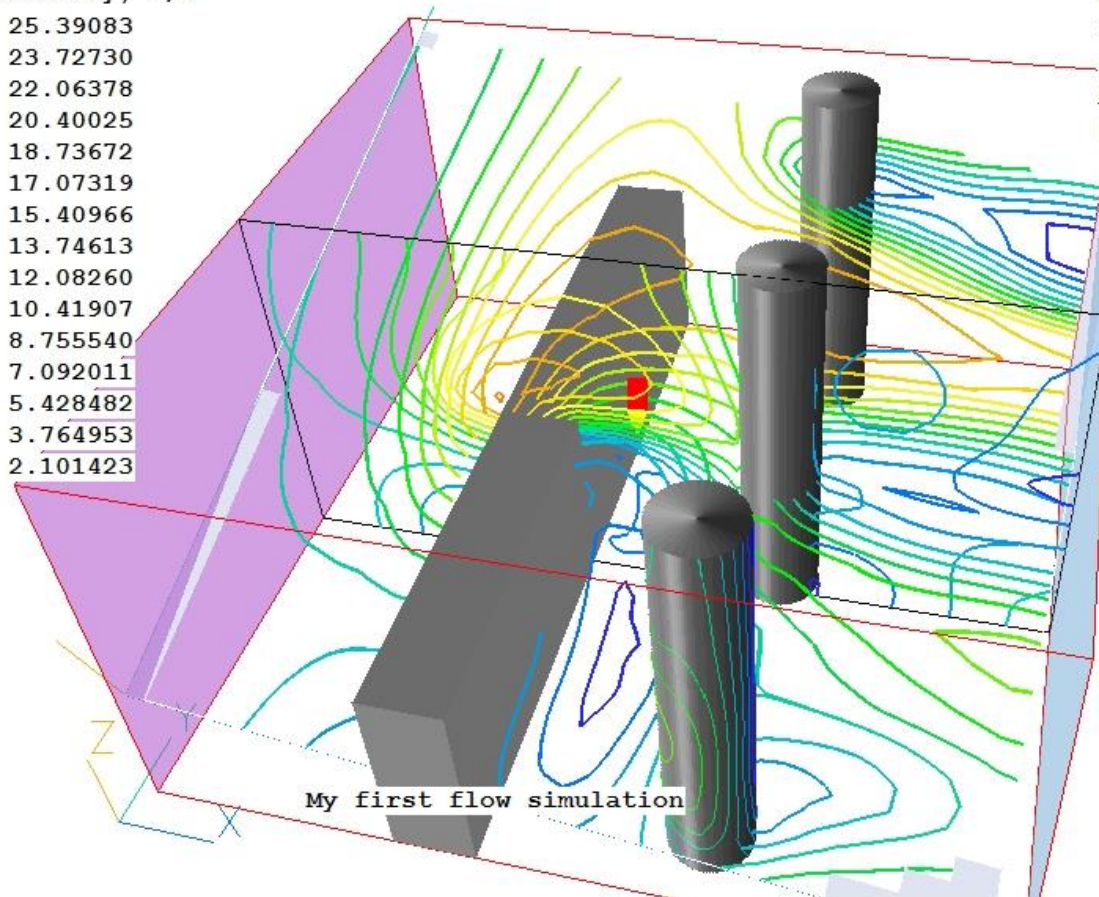
Sweep 200

Probe value

11.08617

Average value

0.000000



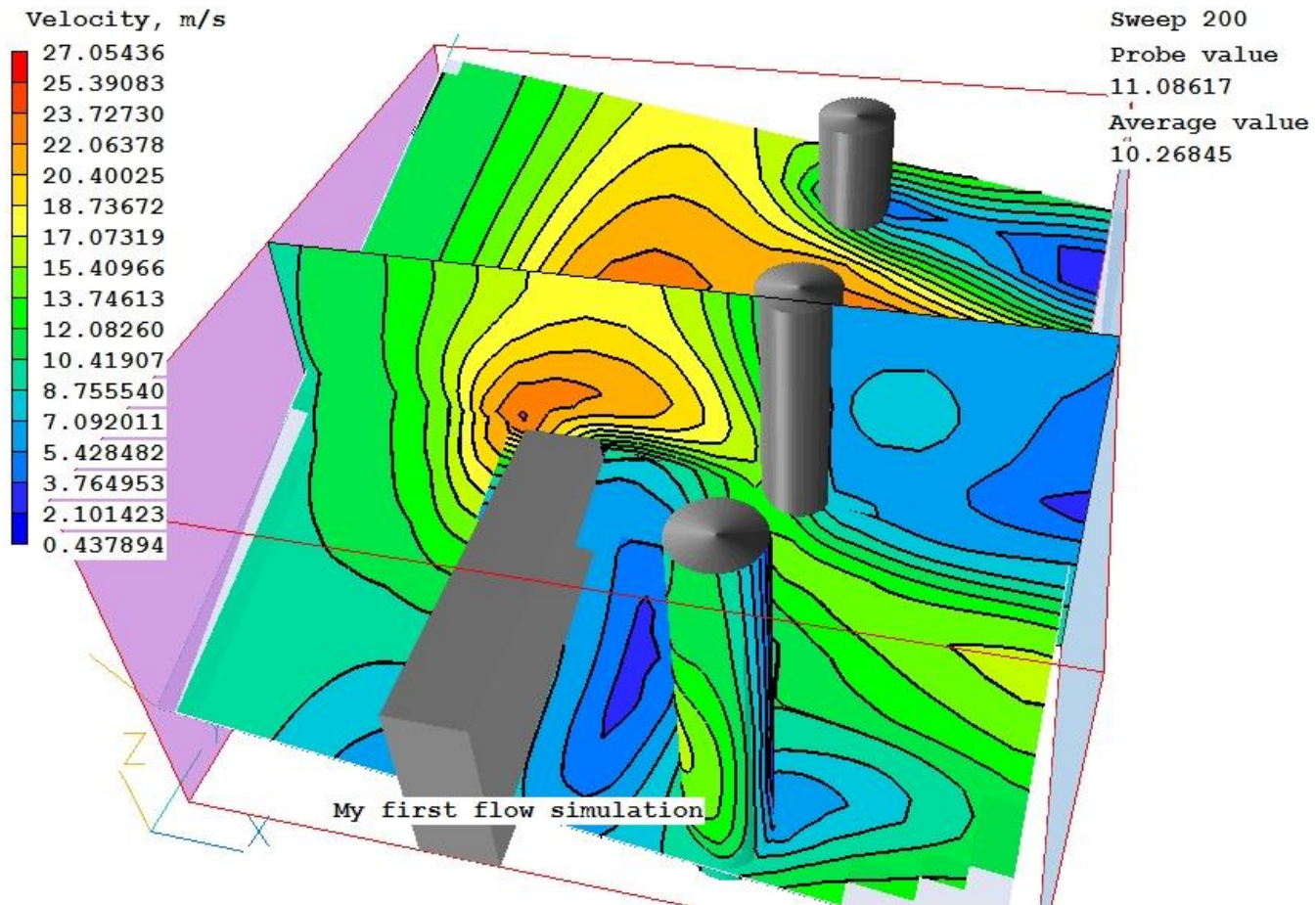
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# VR Viewer Improvements

PHOENICS  
Today

- Lines and Fill





# VR Editor / Viewer Improvements

PHOENICS  
Today

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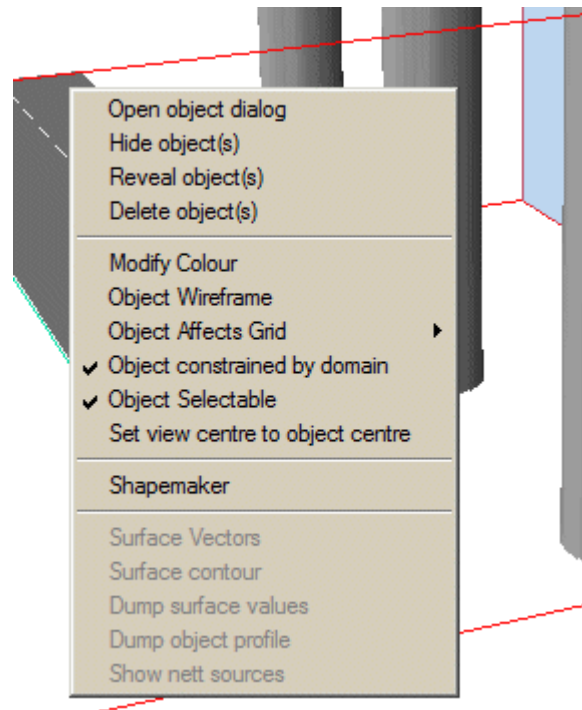
- An extra selection mode has been added.
- Holding shift + cntrl when selecting an object on the screen selects all objects under the cursor, not just the nearest.
- Objects have a 'Selectability' flag. Those which are in the way can be made unselectable (from the screen) so that those behind can be selected.



# VR Editor / Viewer Improvements

PHOENICS  
Today

- The view centre can be set to the middle of a selected object





# VR Editor / Viewer Improvements

PHOENICS  
Today

- The working directory is displayed in the status bar at the bottom of the window.

```
Current directory= W:\phoenics\d_polis\d_docs\tr324\example
```



# Earth Improvements

PHOENICS  
Today

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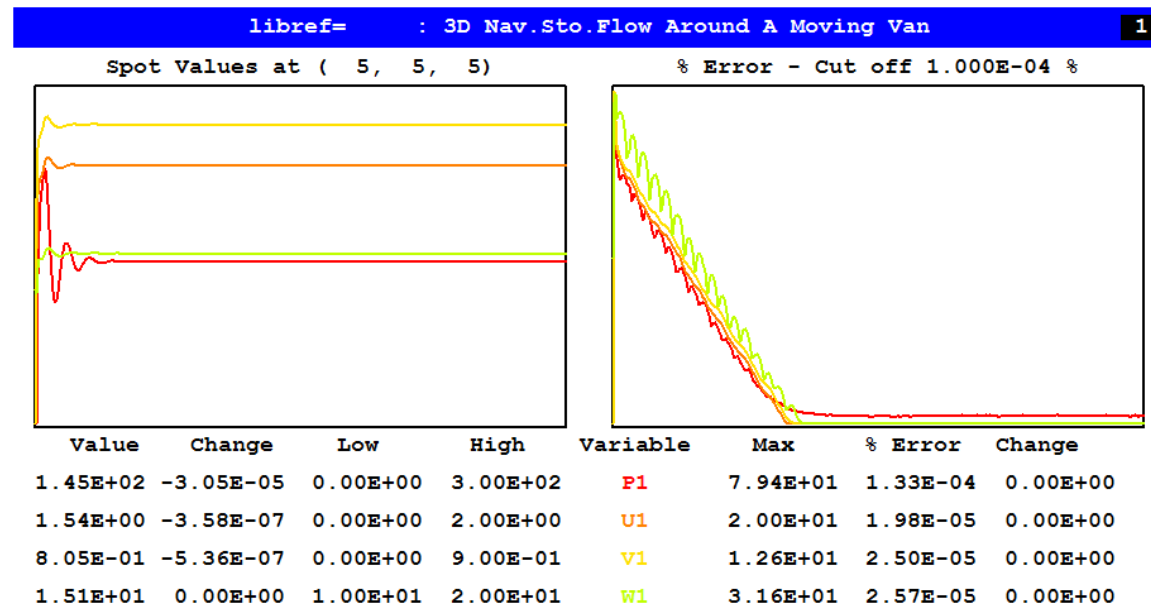
- A full double-precision version of the Earth solver will be available.
- In some cases this converges much better than the standard single-precision version.
- This is especially true for transient cases where the domain is huge and not much is happening.
- The price is doubling the memory requirement.



# Earth Improvements

PHOENICS Today

- Convergence of single-precision version



NX NY NZ ISWEEP 400 TIME  
8 12 20 IZSTEP OFF Working

Press a character key  
to interrupt.



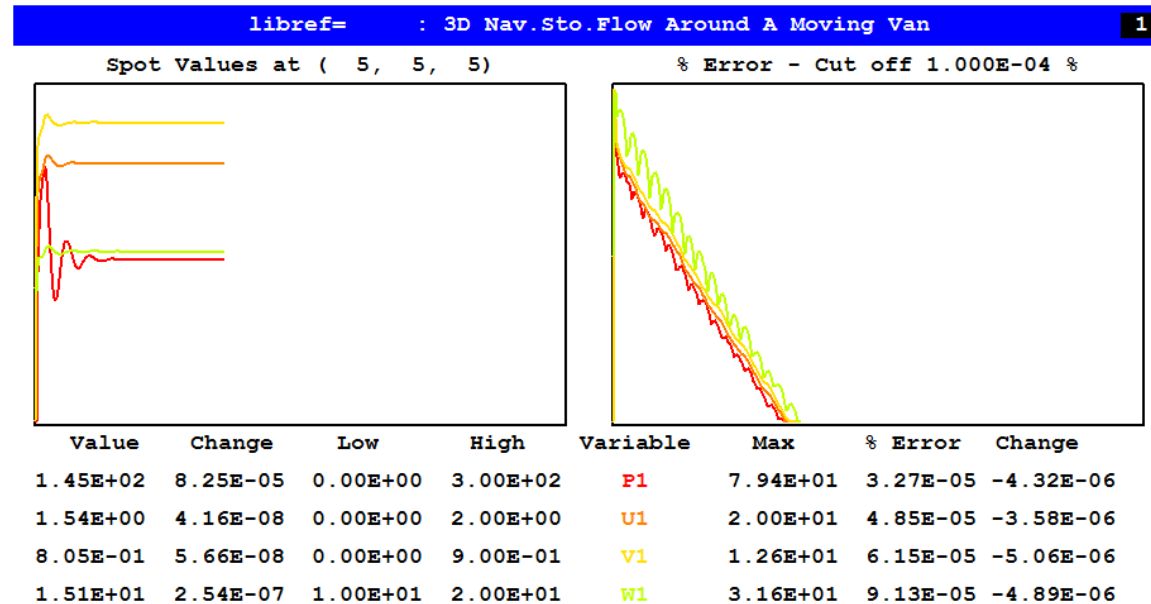




# Earth Improvements

PHOENICS Today

- Convergence of double-precision version



NX NY NZ ISWEEP 142 TIME  
8 12 20 IZSTEP OFF Working

Press a character key  
to interrupt.





# Earth Improvements

PHOENICS  
Today

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- For many years the normalised residuals displayed on the monitor screen have been a cause of wonder and amazement.
- The idea – to normalise the errors by the sums of sources and fluxes – was good, but the implementation was faulty.
- Residual values of many thousand % were common, and in fact the normalised error increased as the number of cells increased.
- For some years Flair users have had the CONV\_TABLE.CSV file which contains the errors normalised by the inflow fluxes.



# Earth Improvements

PHOENICS  
Today

PHOENICS December 2012

- The problem with the internal normalisation has at last been found and fixed, so that the normalised residuals are now a true reflection of the level of convergence.
- The old normalisation produced:

Whole-field residuals before solution at sweep 400  
with resref values determined by EARTH  
& resfac=1.0E-06

variable	resref	(res sum)/resref	(res sum)
P1	4.781E-06	2.584E+02	1.236E-03
U1	3.045E-06	1.262E+03	3.844E-03
V1	2.239E-06	2.129E+03	4.767E-03
W1	6.775E-05	7.379E+01	4.999E-03



# Earth Improvements

PHOENICS Today

PHOENICS December 2012

- The problem with the internal normalisation has at last been found and fixed, so that the normalised residuals are now a true reflection of the level of convergence.

- The new normalisation produces:

Whole-field residuals before solution at sweep 400  
 with resref values determined by EARTH  
 & resfac=1.0E-06

variable	resref	(res sum)/resref	(res sum)
P1	9.297E+02	1.333E-06	1.240E-03
U1	1.957E+04	1.982E-07	3.879E-03
V1	1.957E+04	2.496E-07	4.885E-03
W1	1.957E+04	2.574E-07	5.038E-03

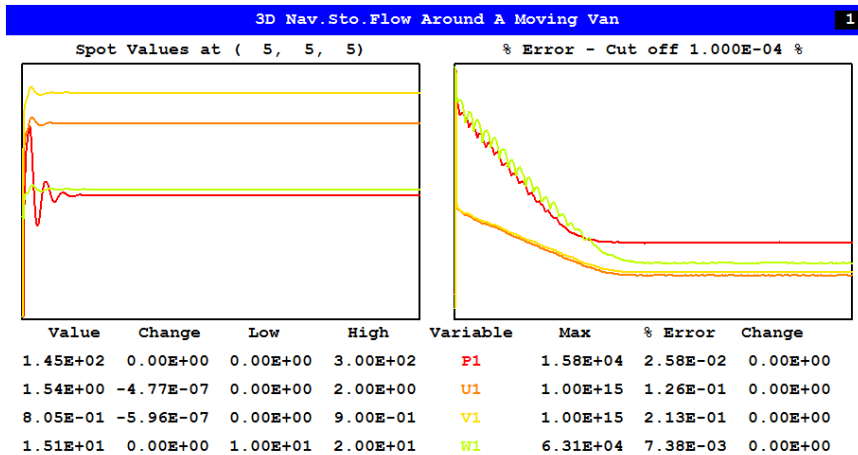
- The actual residual is almost the same, but the normalised value is very small and more like that in CONV\_TABLE.CSV.



# Earth Improvements

PHOENICS Today

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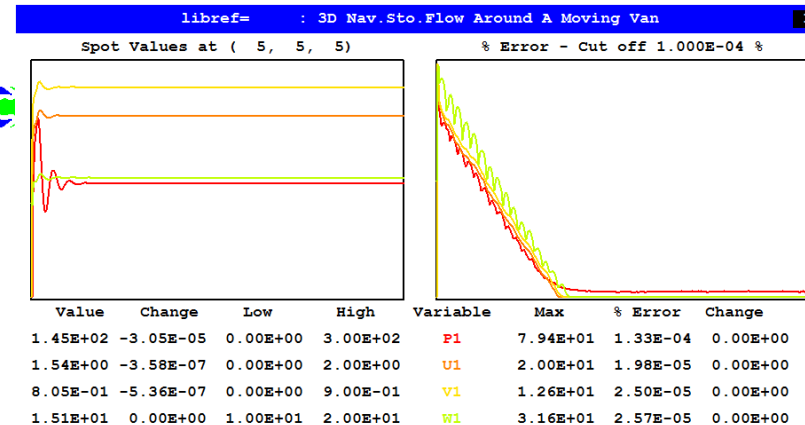
- Old normalisation

```
NX NY NZ ISWEEP 400 TIME
8 12 20 IZSTEP OFF Working
```

Press a character key to interrupt.



- New normalisation



```
NX NY NZ ISWEEP 400 TIME
8 12 20 IZSTEP OFF Working
```

Press a character key to interrupt.





# Earth Improvements

PHOENICS  
Today

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- For several years now there have been three modes of operation for the graphical convergence monitor:
  - Spot value and residual;
  - Maximum correction and sum of nett sources; or
  - Maximum and minimum value in the field.
- It has always been possible to switch mode during the run, but the graph only switched at the moment of changing, so the previous values were not displayed.



# Earth Improvements

PHOENICS  
Today

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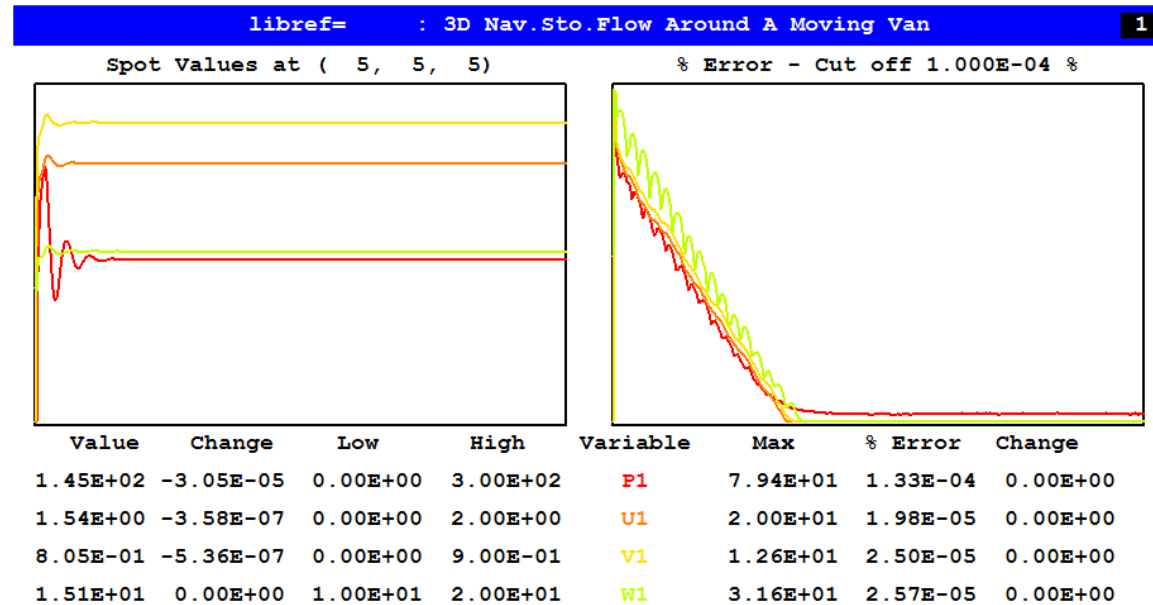
- All monitoring values for all three modes are now held, and when the mode is changed the entire graph is redrawn in the new mode.
- It is possible to set a flag (Options, Solver Monitor Options) to have images of all three modes saved at the end of a run.



# Earth Improvements

PHOENICS Today

- Spot value and residual



NX NY NZ ISWEEP 400 TIME  
 8 12 20 IZSTEP OFF Working

Press a character key  
 to interrupt.



PHOENICS December 2012

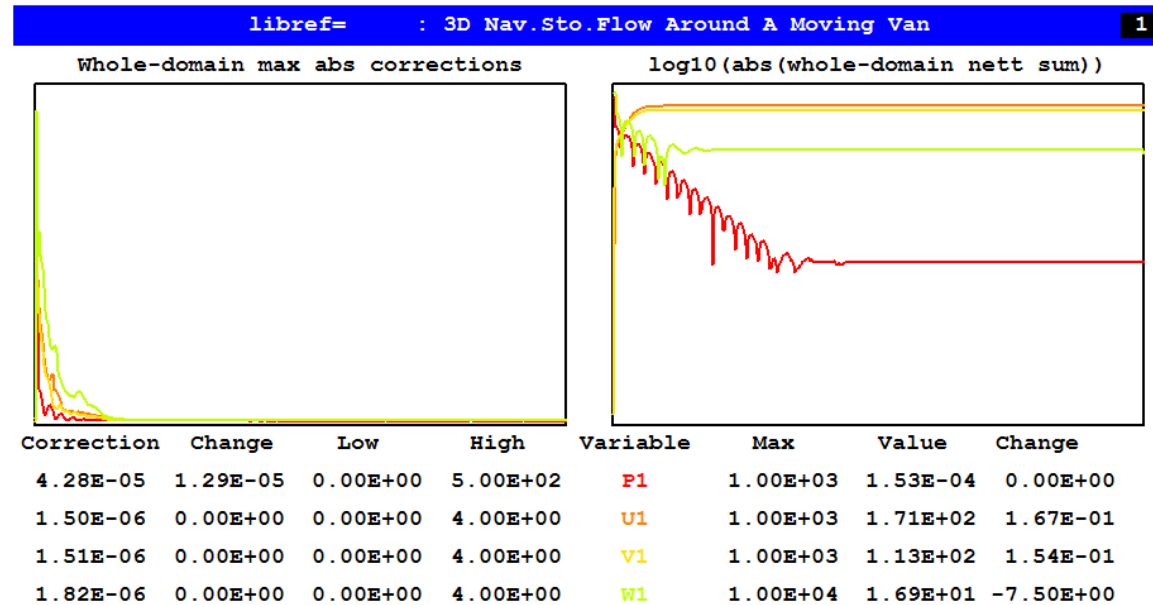




# Earth Improvements

PHOENICS Today

- Maximum correction and sum of nett sources



PHOENICS December 2012

```

NX  NY  NZ  ISWEEP  400  TIME
8   12  20  IZSTEP OFF  Working

```

Press a character key  
to interrupt.

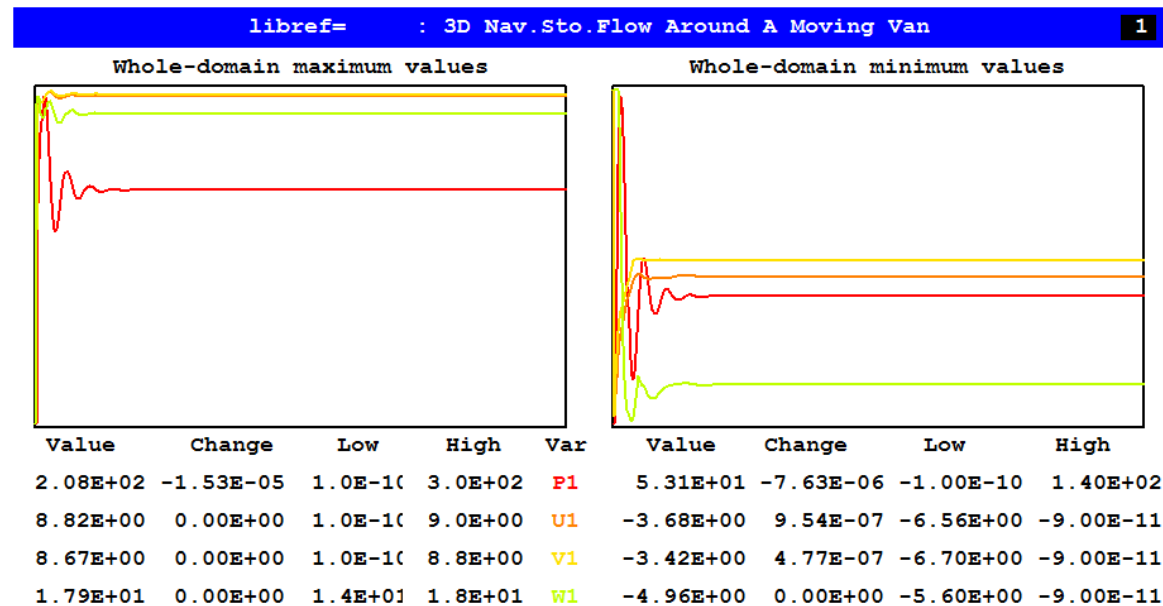




# Earth Improvements

PHOENICS Today

- Maximum and minimum field values



NX NY NZ ISWEEP 400 TIME  
8 12 20 IZSTEP OFF Working

Press a character key  
to interrupt.





# Earth Improvements

PHOENICS  
Today

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- There is a new 'rolling' mode for the convergence monitor where only the last, say, 100 sweeps values are shown.
- This can help show the detailed behaviour of long runs, where the normal display crushes everything together.



# Earth Improvements

PHOENICS  
Today

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- The wall function coding has been updated so that the same code sequences are used for cut-cells and fully blocked cell faces.
- This should result in better heat transfer calculations when cut cells are present.



# Earth Improvements

PHOENICS  
Today

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- There was a problem with fully-rough wall functions when the roughness height was set  $\leq$  the near-wall cell half-height. The run would fail.
- This has been fixed.



# Earth Improvements

PHOENICS  
Today

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- As a by-product of this work, the boundary conditions required by the various low-Reynolds Number turbulence models have been made available for cut cells and the so-called Earth-Generated wall functions.
- Previously the low-Re models only worked properly with plates and with  $EGWF = F$ .



# Earth Improvements

PHOENICS  
Today

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- New InForm command  
`NETS (var, place)`  
where `var` is the name of a variable  
and `place` is the name of an object or  
patch.
- It returns the net source of the  
variable. Very useful for linking two  
or more objects.



# Earth Improvements

PHOENICS  
Today

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- Calculation of the average outlet temperature for printing in RESULT made more accurate and robust.
- The net friction force on a BLOCKAGE object is now printed to RESULT.
- Diffusive/conductive heat fluxes can be stored by adding `STORE(QDX,QDY,QDZ)` to Q1.





# Earth Improvements

PHOENICS  
Today

- In parallel PHOENICS, the occasional but long-standing 'Neighbour has other number of pbc-bound cells' error has been removed.

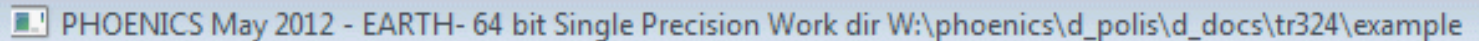


# Earth Improvements

PHOENICS  
Today

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- The working directory, 32-bit or 64-bit and single or double precision status are echoed to the title bar of the Earth solver window

A screenshot of a window title bar from the Phoenix software. The title bar is light blue with a dark blue border. It contains the text: "PHOENICS May 2012 - EARTH- 64 bit Single Precision Work dir W:\phoenics\d\_polis\d\_docs\tr324\example".

PHOENICS May 2012 - EARTH- 64 bit Single Precision Work dir W:\phoenics\d\_polis\d\_docs\tr324\example

and to the RESULT file.

---

```
Running with 64-bit Single Precision executable  
Working directory:  
W:\phoenics\d_polis\d_docs\tr324\example
```



# Earth Improvements

PHOENICS  
Today

PHOENICS December 2012

- If a table file is open (in Excel for example) when Earth wants to write to it, the Earth run would crash as the file was locked. This could lose many hours of computations.
- Now, the Earth run will pause and a dialog will open advising that the file should be closed before continuing.



# Earth Improvements

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- Similarly, if the hard drive becomes full when writing the solution file, the Earth run will pause allowing an opportunity to delete files and create more space.



# SUNLIGHT Object Update

PHOENICS December 2012

- In 2010 the SUNLIGHT feature was created. This preliminary version was accessed through the WIND object dialog, and had several limitations:
  - The latitude was a user-input
  - The direct solar radiation was a user-input
  - There was no allowance for diffuse solar radiation
  - Transient operation was very limited, with multiple WINDs being required.
- An updated version is now ready for release.



# SUNLIGHT Object Update

PHOENICS December 2012

- The main improvements made are:
  - No longer accessed through WIND, there is a separate SUN object.
  - The required inputs can be read from a standard EPW Weather Data File. The fields read include:
    - Latitude
    - Direct and diffuse solar radiation
    - Air and ground temperature
    - Humidity
- A link to the EPW site is provided for easy download of weather data files.
- The WIND object can take the wind speed and direction from the same weather file.
- Transient operation improved



# SUNLIGHT Object Update

PHOENICS December 2012

- The amount of incident solar radiation absorbed by each object in the scene can be set by the user.
- BLOCKAGE and PLATE objects have an extra 'Solar absorption' input box which allows the absorption factor for that object to be set. For most substances the absorption will be 0.5 or greater. Bricks, weathered steel or marble can be up to 0.9. Polished metal surfaces can be 0.1 – 0.2.
- The user no longer has to ensure that objects are faceted in order for them to be picked up by the illumination algorithm.
- The illumination algorithm will detect PLATE objects as well as BLOCKAGES



# SUNLIGHT Object Update

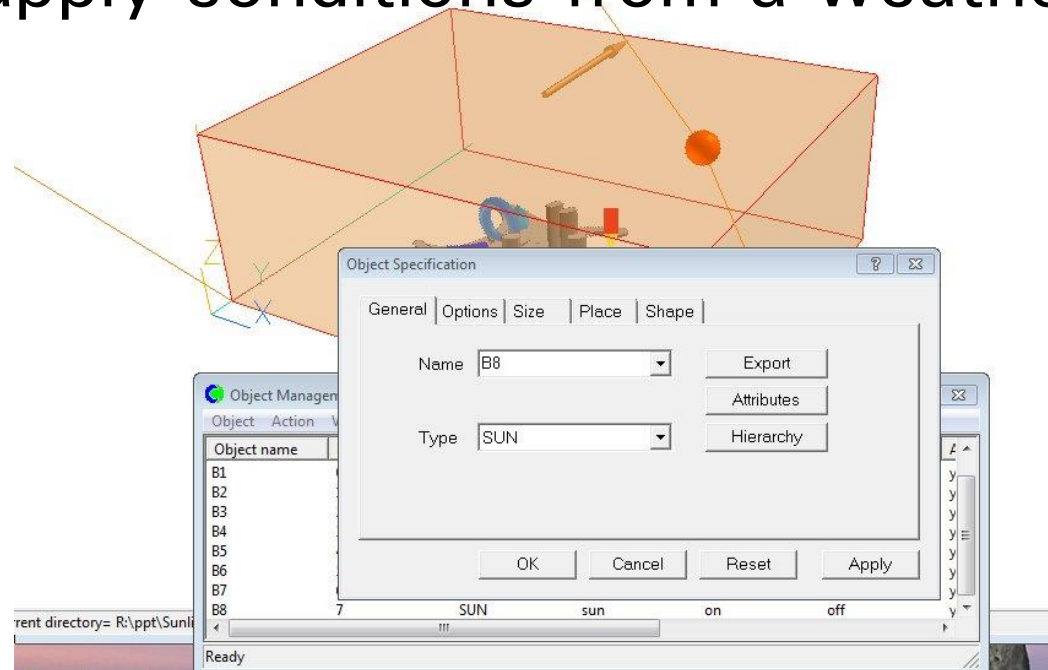
- The following additional output variables can be activated directly from the SUN object dialog:
  - The illumination flag LIT
  - The potentially illuminated surface flag #SRF
  - The TEM1 heat source per cell #QS1
  - The total heat source per unit area #QS2
  - The T3 heat source per cell (for IMMERSOL) #Q3
  - The solar absorption factor #SOL
- These can be used to check the correct functioning of the illumination model.





# SUNLIGHT Object Update

- The next sequence of images shows how to apply conditions from a weather file.



- We create a SUN object and open its attribute dialog



# SUNLIGHT Object Update

- Click on 'Use weather data file'

Sun Attributes

Get North and Up from WIND

Angle between North and Y  °

Use weather data file

Latitude  °

Direct Solar radiation   W/m<sup>2</sup>

Diffuse Solar radiation   W/m<sup>2</sup>

Date (dd/mm/yy)

Time (24hr)  h  m  s



# SUNLIGHT Object Update

- Then select 'configure file'

A screenshot of the 'Sun Attributes' dialog box. The dialog has a title bar with a question mark and a close button. The main area contains several input fields and buttons. The 'Use weather data file' option is set to 'Yes', and the 'Configure file' button is highlighted. Other fields include 'Get North and Up from WIND' (No), 'Angle between North and Y' (0.000000), 'Latitude' (51.000000), 'Direct Solar radiation' (File, 1000.000 W/m^2), 'Diffuse Solar radiation' (File, 100.0000 W/m^2), 'Date (dd/mm/yy)' (1 Jun 2011), and 'Time (24hr)' (12 h 0 m 0 s). There is also an 'Optional extra output' checkbox and 'Cancel' and 'OK' buttons at the bottom.

Sun Attributes

Get North and Up from WIND

Angle between North and Y  °

Use weather data file

Location: NOTSET

Latitude  °

Direct Solar radiation   W/m<sup>2</sup>

Diffuse Solar radiation   W/m<sup>2</sup>

Date (dd/mm/yy)

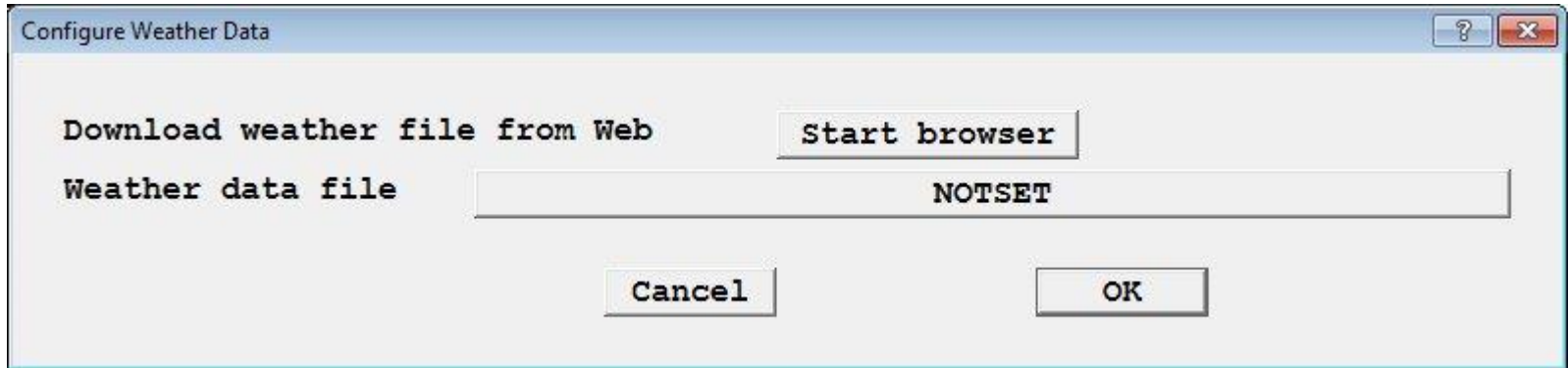
Time (24hr)  h  m  s

Optional extra output



# SUNLIGHT Object Update

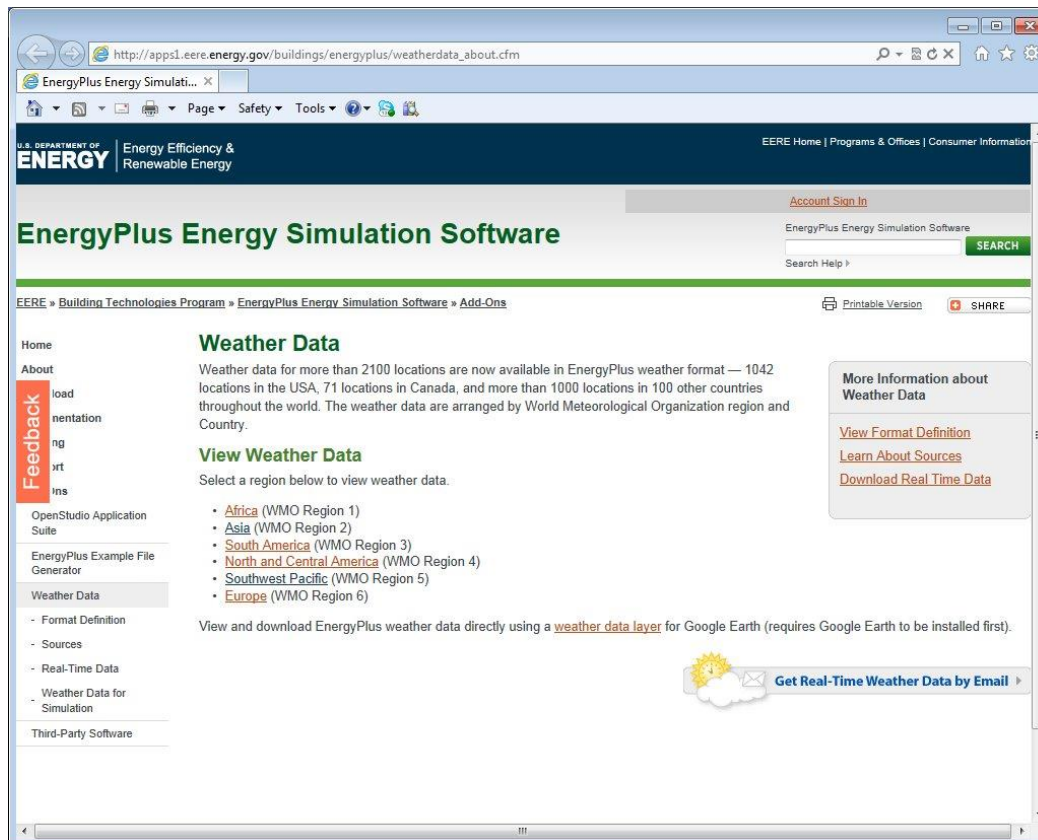
- We don't have a weather file, so click 'Start browser' to download one





# SUNLIGHT Object Update

- The default browser will open the Energy Plus site from where the weather data file can be selected and downloaded





# SUNLIGHT Object Update

- Once the weather file has downloaded, select it



- Then click 'Load data file' to read it into VR Editor.



# SUNLIGHT Object Update

- The dialog will update to show the data read from the file.

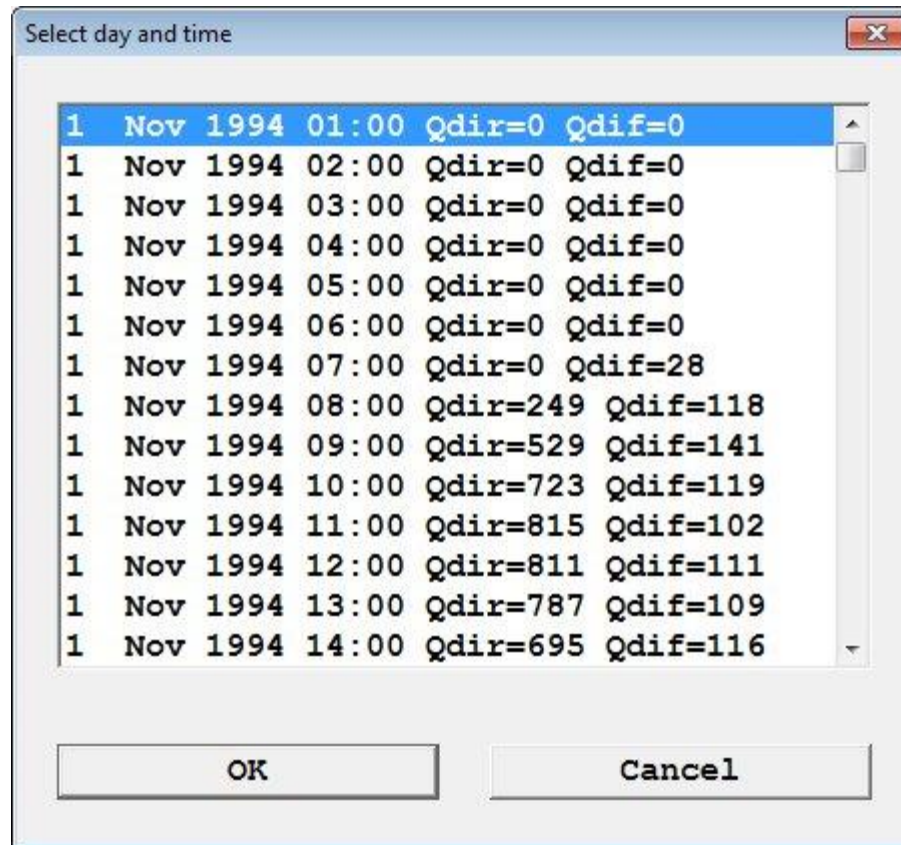
The screenshot shows a 'Configure Weather Data' dialog box with the following fields and controls:

- Download weather file from Web**: A button labeled 'Start browser' is positioned to the right.
- Weather data file**: A text box containing the file path 'JPN\_Tokyo.Hyakuri.477150\_IWEC.epw'.
- Load data file**: A button located below the file path.
- Location**: A text box containing 'TOKYO HYAKURI - JPN'. To its right, the label 'Latitude' is followed by a text box containing '36.18000' and the unit 'deg'.
- Select month**: A dropdown menu showing 'Jan'.
- Using data for**: A text box containing '1 Jan 1983 01:00'.
- Direct normal radiation**: A text box containing '0.000000' with the unit 'W/m2' to its right.
- Diffuse radiation**: A text box containing '0.000000' with the unit 'W/m2' to its right.
- Buttons**: 'Cancel' and 'OK' buttons are located at the bottom of the dialog.



# SUNLIGHT Object Update

- We can now select the month, day and time we are interested in:







# SUNLIGHT Object Update

- The dialog updates again to show the new data

Configure Weather Data

Download weather file from Web

Weather data file

Location TOKYO HYAKURI - JPN Latitude  deg

Select month

Using data for

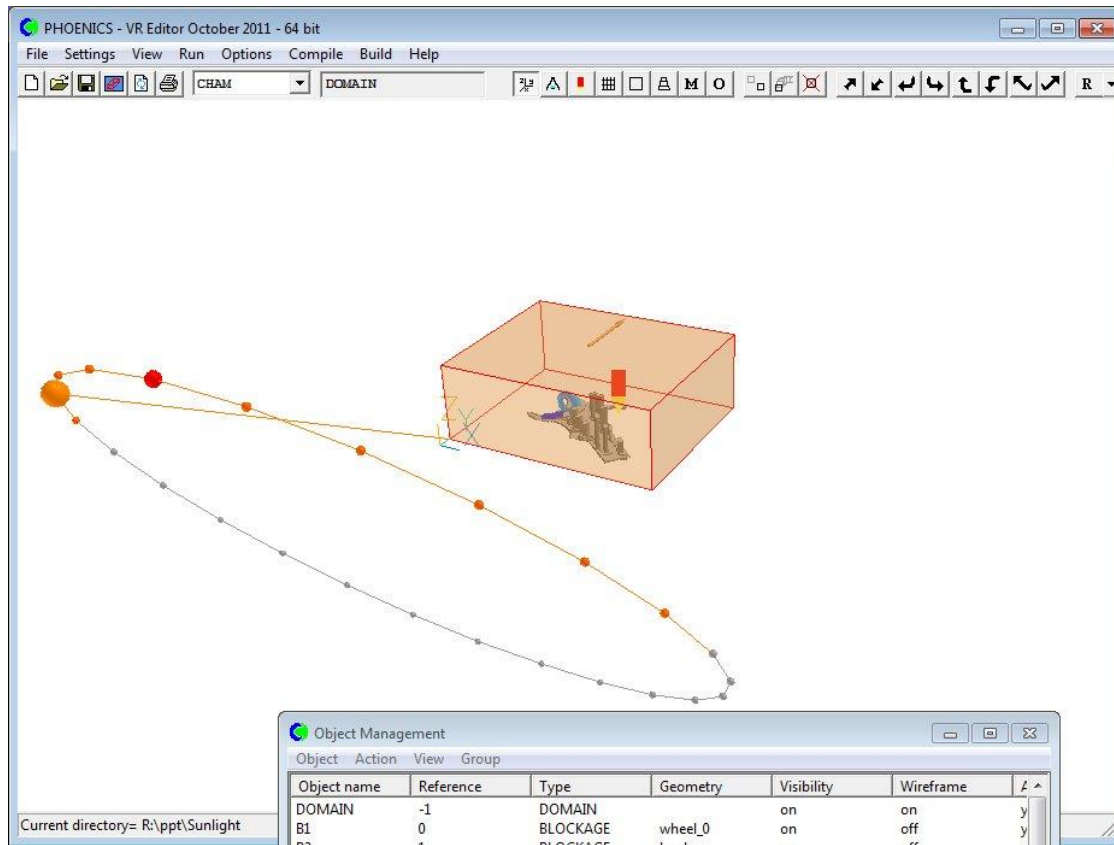
Direct normal radiation  W/m2

Diffuse radiation  W/m2



# SUNLIGHT Object Update

- The sun position is shown on the main VR Editor screen





# SUNLIGHT Object Update

- The WIND object can also use the weather data file

A screenshot of the 'Wind Attributes' dialog box in a software application. The dialog box contains various settings for wind simulation. The 'Use weather data file' option is currently set to 'No'. Other settings include: External density is: Domain fluid; External pressure: 101325.0 Pa; Coefficient: 1000.000, Linear; External Temperature: 20.00000 °C; Wind speed: 10.00000 m/s; Wind direction: North, 0.000000 °; Reference height: 10.00000 m; Angle between North and Y: 0.000000 °; Profile Type: Logarithmic; Vertical direction: Z; Effective roughness height: Open sea, 2.000E-4 m; Include open sky: Yes; Include ground plane: Yes; Ground temperature: Adiabatic; Solar absorption: 1.000000; Store Wind Amplification Factor (WAMP): No. At the bottom are 'Cancel' and 'OK' buttons.

Use weather data file	No
External density is:	Domain fluid
External pressure	101325.0 Pa
Coefficient	1000.000 Linear
External Temperature	20.00000 °C
Wind speed	10.00000 m/s
Wind direction	North 0.000000 °
Reference height	10.00000 m
Angle between North and Y	0.000000 °
Profile Type	Logarithmic
Vertical direction	Z
Effective roughness height	Open sea 2.000E-4 m
Include open sky	Yes
Include ground plane	Yes
Ground temperature	Adiabatic
Solar absorption	1.000000
Store Wind Amplification Factor (WAMP)	No

- Toggle 'Use weather data file' to Yes



# SUNLIGHT Object Update

- The pre-attached data file is used, and the current data are shown

A screenshot of the 'Wind Attributes' dialog box in a software application. The dialog box has a title bar with a question mark and a close button. It contains various input fields and buttons for configuring wind-related parameters. The parameters are listed on the left, and their values or selected options are shown in the corresponding input fields on the right. The values are: Use weather data file: Yes; Location: TOKYO HYAKURI - JPN; Date: 1 Jan 1983 01:00; External density is: Domain fluid; External pressure: 100905.0 Pa; Coefficient: 1000.000 Linear; External Temperature: -1.100000 °C; Wind speed: 0.000000 m/s; Wind direction: File 0.000000 °; Reference height: 10.00000 m; Angle between North and Y: 0.000000 °; Profile Type: Logarithmic; Vertical direction: Z; Effective roughness height: Open sea 2.000E-4 m; Include open sky: Yes; Include ground plane: Yes; Ground temperature: File 3.790000 °C; Solar absorption: 1.000000; Store Wind Amplification Factor (WAMP): No. At the bottom are 'Cancel' and 'OK' buttons.

Wind Attributes

Use weather data file

Location: TOKYO HYAKURI - JPN

Date: 1 Jan 1983 01:00

External density is:

External pressure  Pa

Coefficient

External Temperature  °C

Wind speed  m/s

Wind direction   °

Reference height  m

Angle between North and Y  °

Profile Type

Vertical direction

Effective roughness height

m

Include open sky

Include ground plane

Ground temperature   °C

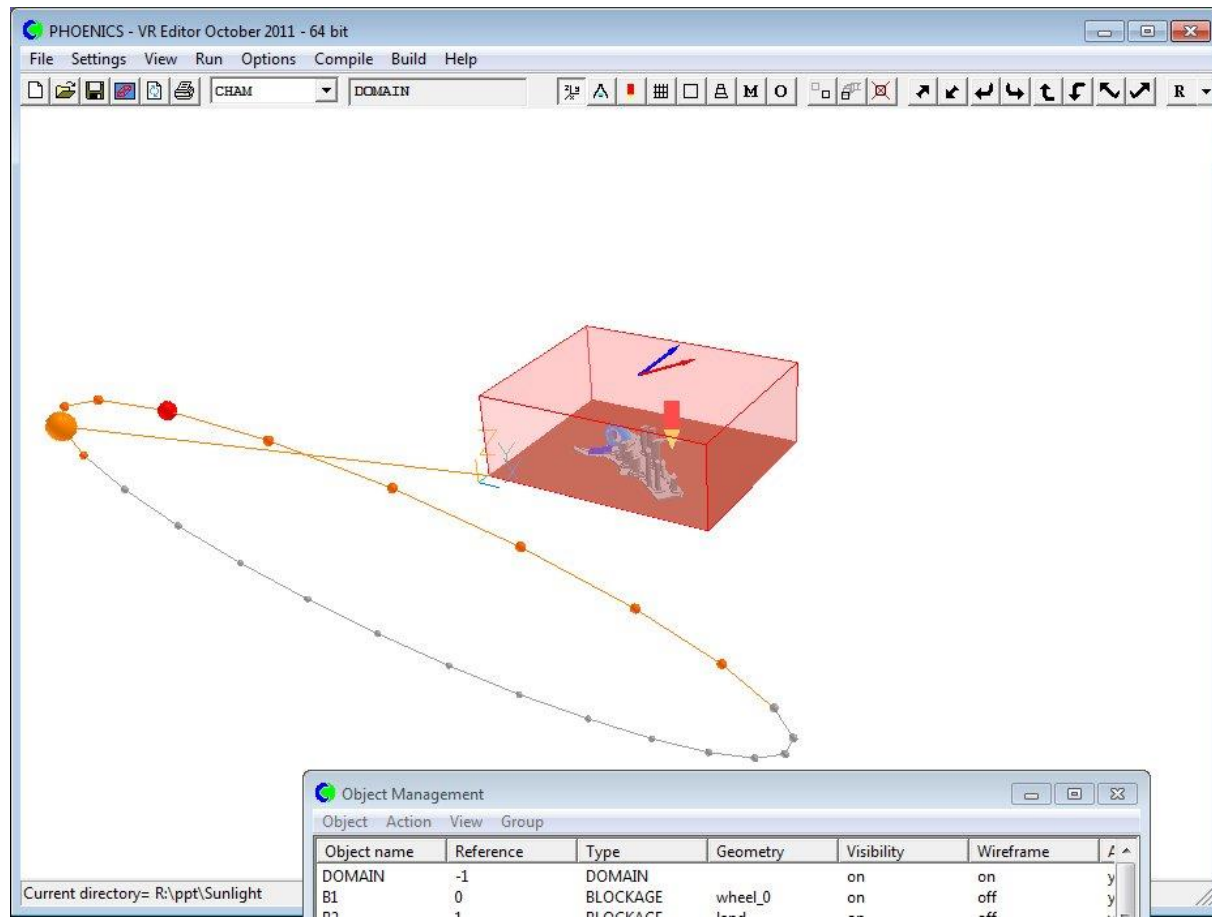
Solar absorption

Store Wind Amplification Factor (WAMP)



# SUNLIGHT Object Update

- The WIND object graphic shows the current North (blue) and wind (red) direction.





# SUNLIGHT Object Update

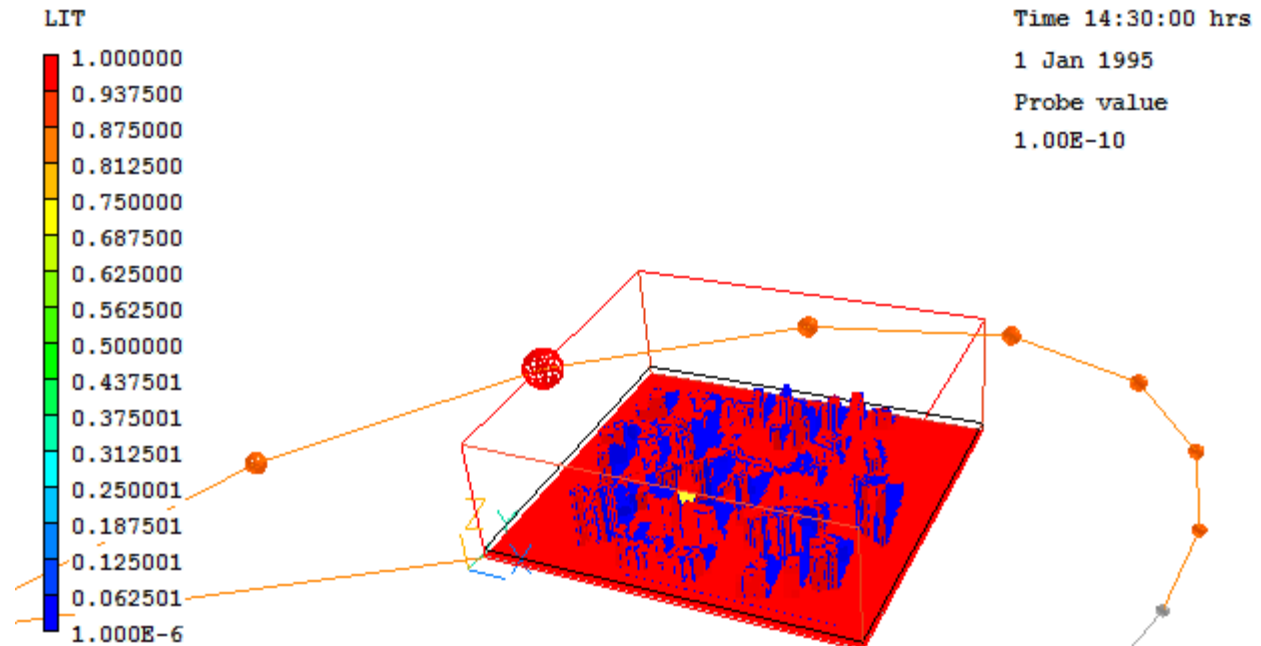
PHOENICS December 2012

- In a transient case, the time-step setting dialog controls the time step size and number of steps to run.
- The time of day at the start of the run is the time chosen from the weather data file.
- The data values from the file are transmitted to Earth, and at each time step the solver interpolates between the data-file values to get the current inlet values.
- The solar shading is updated at the start of each time step, and the current direct and diffuse solar radiation values are interpolated from the weather data file.



# SUNLIGHT Object Update

- The animation shows a 24-hour sequence



Heat Island example-1



# WIND Object Update

PHOENICS  
Today

PHOENICS December 2012

- When a weather file is in use for a transient case, the external pressure and temperature are updated at each time step from the weather file.
- This was done by updating the external pressure at outflow boundaries.
- In practise, it turned out that changing the external pressure can have unexpected consequences, for example creating inflows when the external pressure rises.





# WIND Object Update

PHOENICS  
Today

PHOENICS December 2012

- This has been addressed by keeping the external pressure at zero relative to the reference pressure, `PRESS0`, and updating `PRESS0` each time step.
- In addition, the reference density for buoyancy, `BUOYD`, is also updated each time step to match the new external pressure and temperature.
- The transient behaviour is much improved by these two measures.



# WIND Object Update

PHOENICS  
Today

PHOENICS December 2012

- When a SUN object is active, the 'Solar absorption' factor of the WIND ground plane can also be set.
- The 'Wind Amplification Factor' (local absolute velocity divided by reference velocity) can be STORED by a button-click on the WIND object attributes dialog.

A screenshot of a software dialog box for the WIND object attributes. It contains three rows of settings: 'Ground temperature' with a dropdown menu set to 'Adiabatic', 'Solar absorption' with a text input field containing '1.000000', and 'Store Wind Amplification Factor (WAMP)' with a dropdown menu set to 'No'. At the bottom, there are 'Cancel' and 'OK' buttons.

Ground temperature

Solar absorption

Store Wind Amplification Factor (WAMP)



# Previous highlights

PHOENICS  
Today

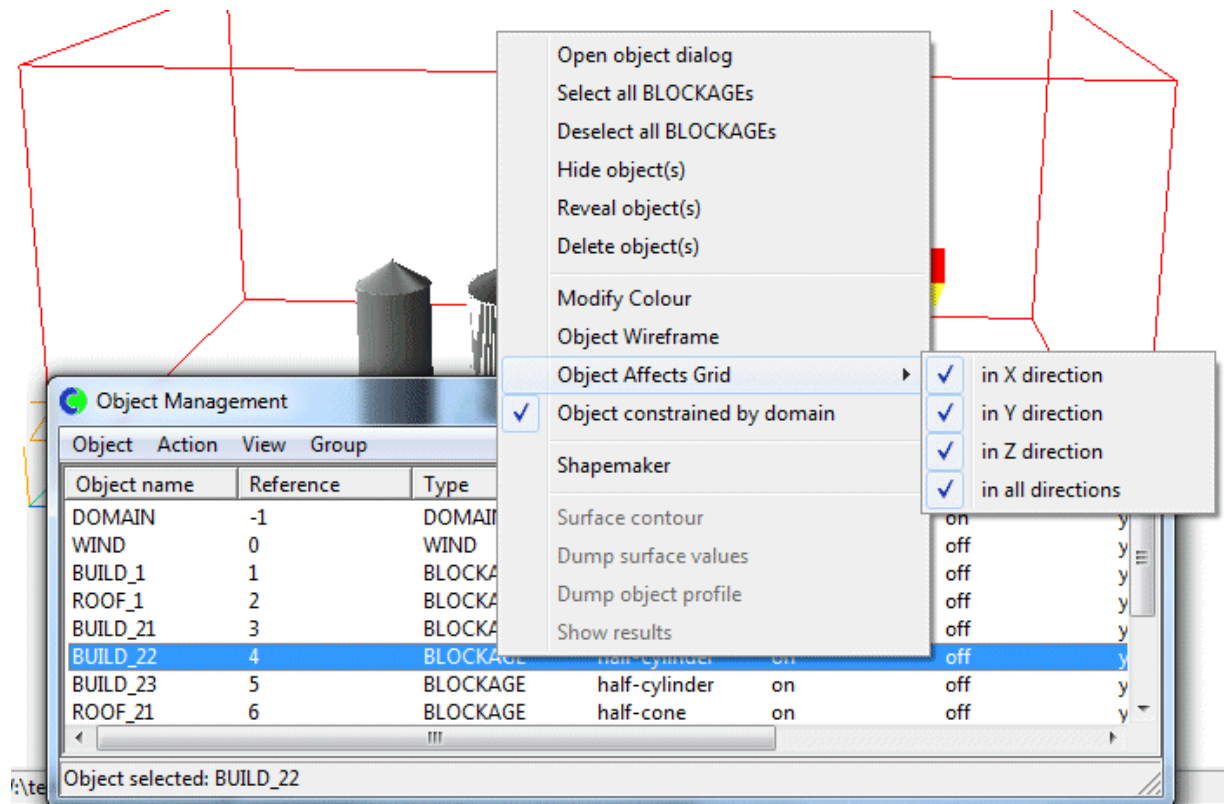
- Here follow some improvements made in the previous release which are worth mentioning again, in case they have been missed.



# VR Editor Improvements

PHOENICS  
Today

- The 'Object affects grid' attribute has been split into the three coordinate directions.





# VR Editor Improvements

PHOENICS  
Today

PHOENICS December 2012

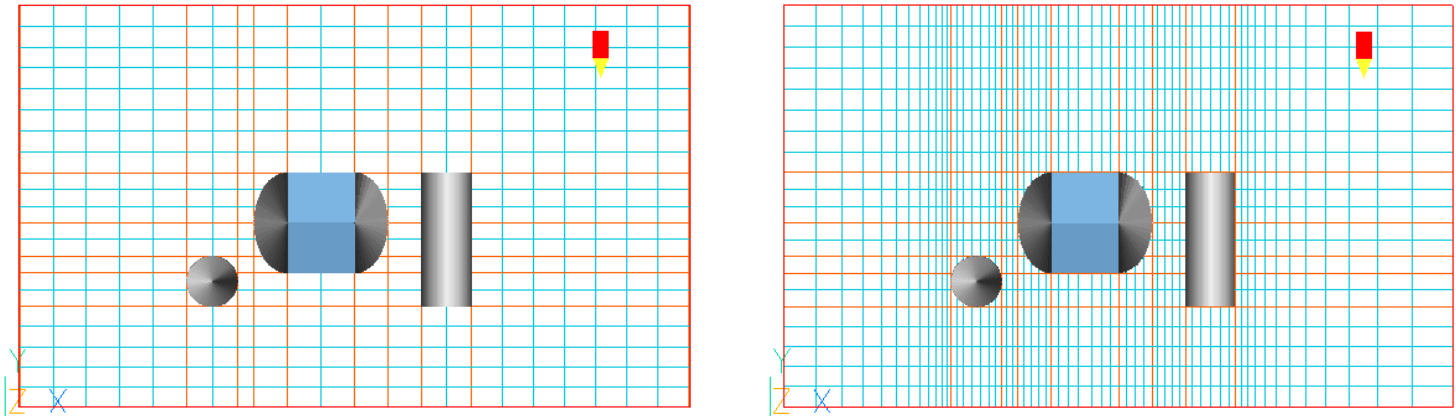
- A long-standing error in the Auto-mesher has been corrected.
- The grid refinement stops when the ratio between the size of the last cell in one region and the first in the next region falls below a set criterion.
- On the auto-mesh dialog, this was set as a fraction of the domain size, but was then treated as an actual physical dimension when being compared to the cell sizes.
- This means that for large domains, the refinement process terminated earlier than expected.



# VR Editor Improvements

PHOENICS  
Today

- The image on the left shows the original auto-mesh, that on the right the new corrected version.



- There is also a new option to set the minimum and initial cell sizes as physical dimensions rather than fractions of the domain size.



# Earth Improvements

PHOENICS  
Today

PHOENICS December 2012

- In Flair the 'Calculate link temperature' and 'Activation temperature' settings for a SPRAY\_HEAD object really activate the spray when the activation temperature is reached.
- In previous versions, a message was written to RESULT when the criterion was met, but the spray was not automatically activated.
- A table file containing the calculated link temperatures at the end of each step is also produced.



# VR Editor Improvements

PHOENICS  
Today

- Ambient pressure and ambient temperature settings.

The screenshot shows the 'Domain Settings' dialog box with the following settings:

- Navigation tabs: Geometry, Models, Properties (selected), Initialisation, Help, Top menu, Sources, Numerics, Output.
- Domain material: The current domain material is 2 Air using Ideal Gas Law, STP.
- Edit properties of current material.
- Reference pres (Pa): 101325.0
- Ambient pressure: 0
- Initialise from ambient: ON
- Temperature units: Centigrade
- Ambient temperature: 20 C
- Set buoyancy from ambient: ON
- Property storage.
- Prandtl/Schmidt Nos: settings
- InForm - Group 9: Edit InForm 9





# VR Editor Improvements

PHOENICS  
Today

PHOENICS December 2012

- The ambient settings represent the pressure and temperature outside the domain.
- They can be used as the initial value, and are the default values at all inlets and openings.
- The reference density used for buoyancy is also derived from the ambient values.
- This should ensure that the buoyancy settings are always self consistent.
- It also makes it easy to change the external temperature at all openings or inlets.



# Earth Improvements

PHOENICS  
Today

PHOENICS December 2012

- Often there is a need to link the flow rate and temperature at one boundary condition to the flow and temperature at another.
- Typical examples are
  - Ducting that is not explicitly modelled that joins one part of the domain to another
  - The intake and exhaust from an Induction Fan
  - Active chilled beams
- This can now be achieved by a pair of linked ANGLED-IN objects.



# Earth Improvements

PHOENICS  
Today

PHOENICS December 2012

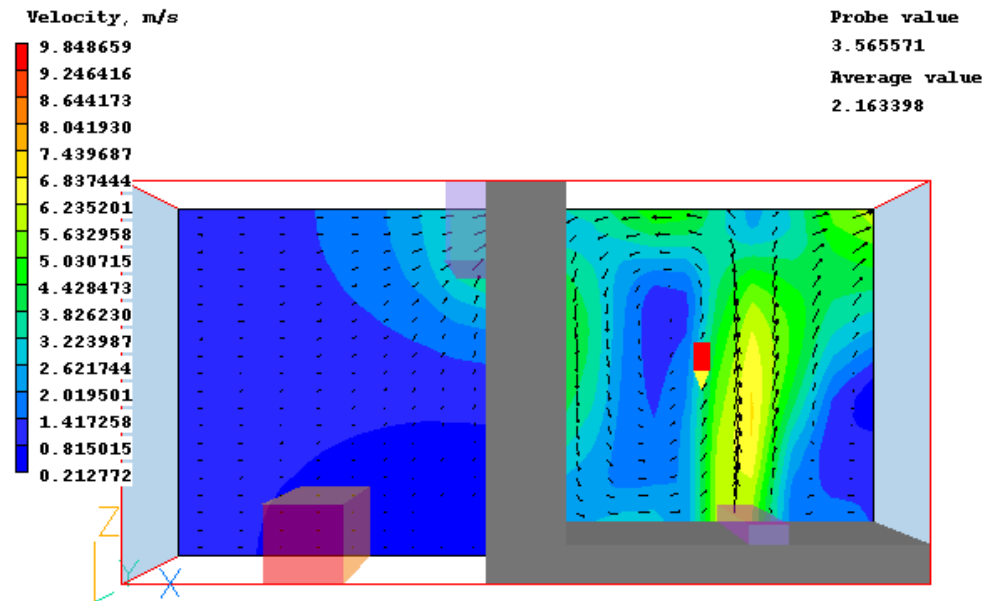
- One ANGLED-IN, set to extract flow, acts as a 'donor'.
- The immediately-preceding or immediately-following ANGLED-IN takes the flow rate from the 'donor' and uses it as the inflow:
  - The temperature, smoke and other scalars are taken as the mass-averaged average values at the 'donor' object.
  - The density is evaluated at the average temperature and ambient pressure.
  - The velocity is deduced from the mass flow rate (taken from the 'donor'), the flow area and the deduced density.
  - The turbulence values are computed from the turbulence intensity, velocity and hydraulic diameter.
- The linking happens in pairs, so that a linked pair can be copied or arrayed. The correct objects will stay linked.



# Earth Improvements

PHOENICS Today

- Here a pair of linked ANGLED-Ins are used to represent a duct joining the left and right-hand sides of the domain.



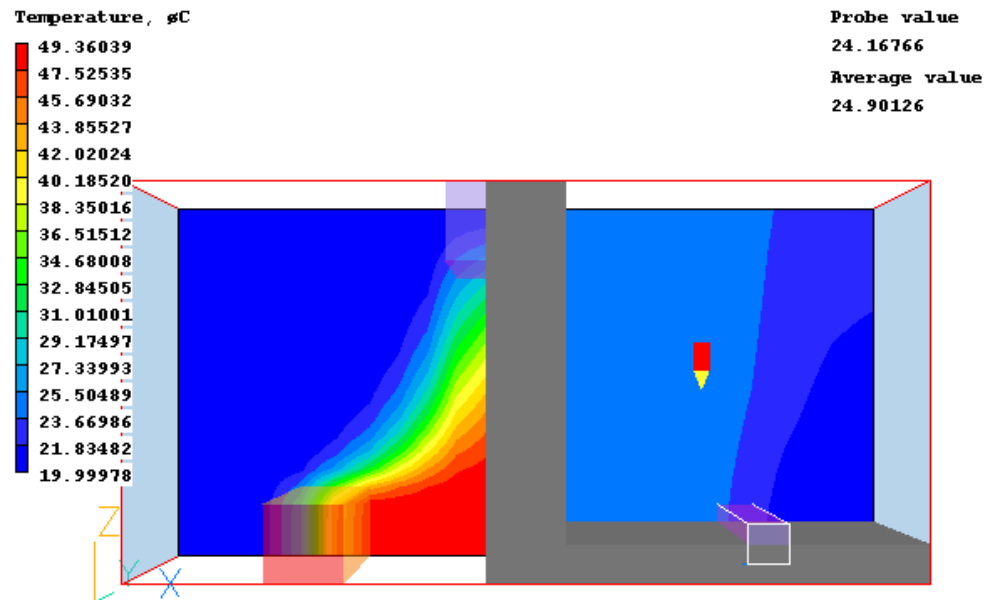
Linked Angled-in objects



# Earth Improvements

PHOENICS Today

- Here a pair of linked ANGLED-Ins are used to represent a duct joining the left and right-hand sides of the domain.



Linked Angled-in objects



# Earth Improvements

PHOENICS  
Today

- Here a pair of linked ANGLED-Ins are used to represent an induction fan.

