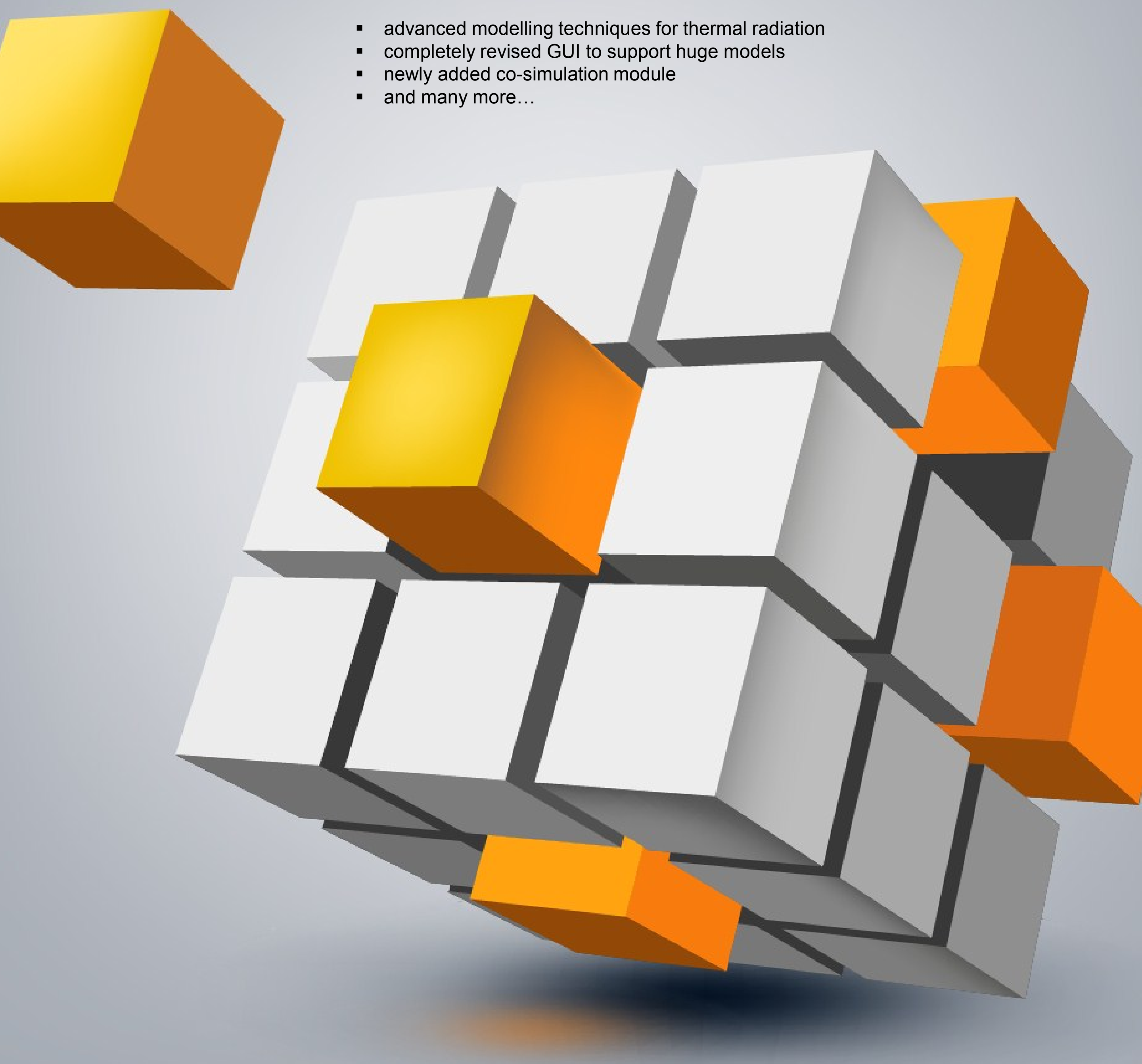
THESEUS-FE 4.4

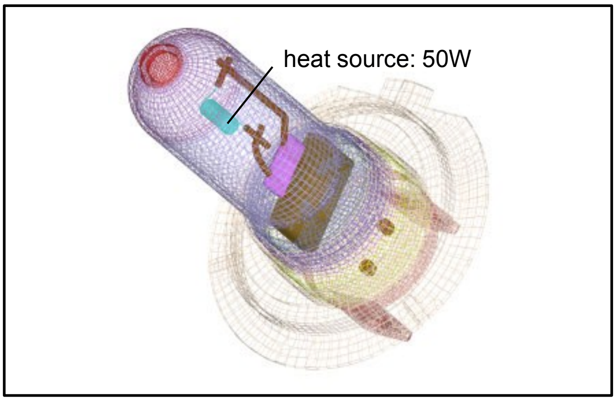
new release 4.4 with numerous improvements

- advanced modelling techniques for thermal radiation
- completely revised GUI to support huge models
- newly added co-simulation module
- and many more…



P+Z Engineering

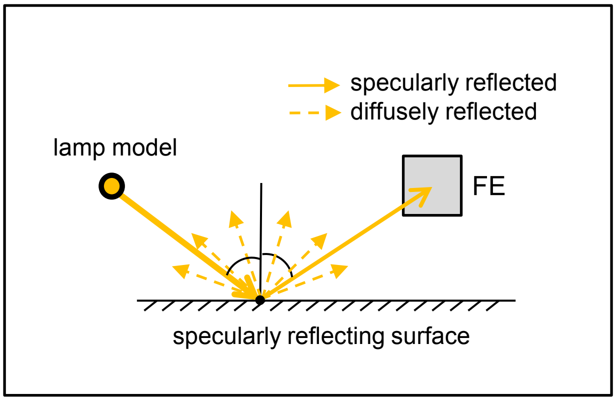
New models for shortwave radiation sources



Two new shortwave radiation sources are now available for modelling the thermal emission of objects emitting predominantly in the visibile range of the radiation spectrum. The first one (**DEFSUNR**) is fed with data from so-called Rayfiles provided by manufacturers of high-power LEDs. Such files contain a vast number of rays (100k-50M) each carrying an individual fraction of the total source power.
The second new model (**DEFSUNS**) uses FE shell surfaces to distribute a specific radiative power into the model. This can be used for example to model the filament of a conventional light bulb either by directly using the wire or approximating it by a cylindrical analogous model.

Specularly reflecting surfaces

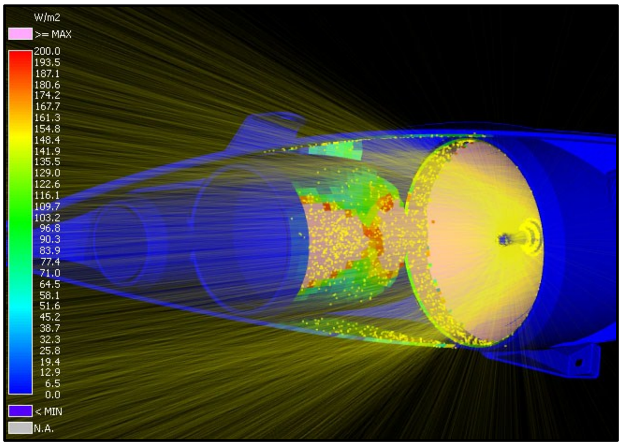
Surface properties for thermal radiation now include a specularity factor used to define specularly reflecting surfaces like polished metal or highly-reflecting surface coatings.
Surfaces may either be completely diffuse, completely specular or a combination of both (as most real-world surfaces are).
This may be used to model the highly specularly reflecting reflectors in automotive headlights.
As before, the reflection can depend on the wavelength of the incident radiation and the angle of incidence.
With the new model the reflected energy will be distributed in form of an diffuse part that is uniformly distributed into the surrounding space and a directed component depending on the angle of incidence.



Thermal simulation and analysis of automotive headlights

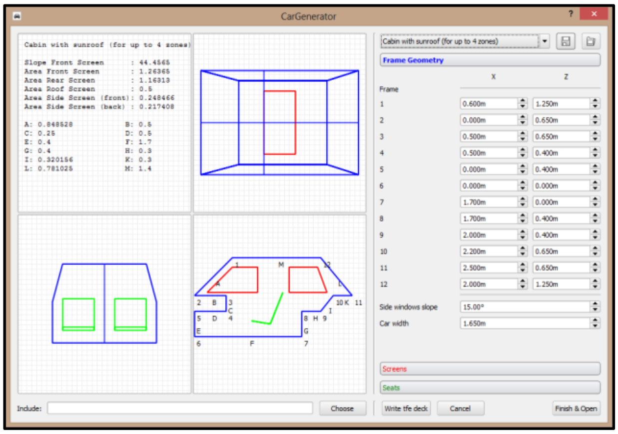
With the aforementioned new shortwave radiation sources and the ability to define specularly reflecting surfaces it is now possible to use THESEUS-FE for entirely new applications like the thermal simulation and analysis of automotive headlights.
Transmission, reflection and absorption of any surface can be prescribed as a function of wavelength.
The new release 4.4 is accompanied by a tutorial case especially made to demonstrate these new features on a simplified automotive headlight model.
To improve the simulation results the thermal simulation may be coupled with a CFD solver to include the fluid flow inside the headlight. Such kind of coupled multiphysics simulation can easily be done using the new co-simulation module also presented in this newsletter.
The graphical user interface of THESEUS-FE has also been enriched by possibilities to visualize the ray data generated by distributing the power of the new radiation sources in combination with specularly reflecting surfaces.

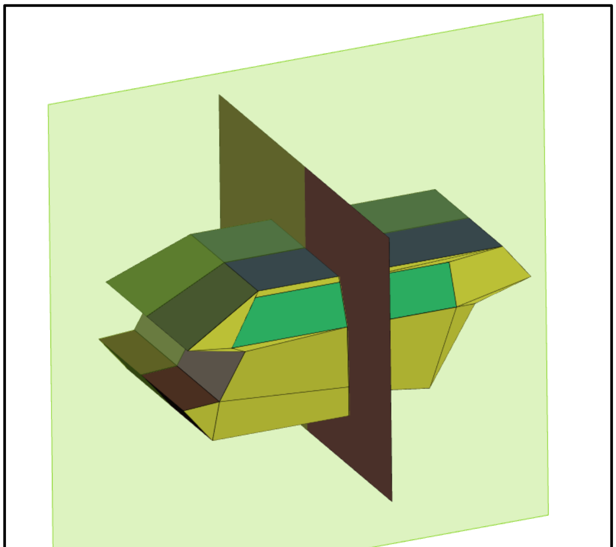
This may be used to analyze individual ray paths and to optimize the light distribution while simultaneously optimizing the component temperatures at any time. Simulation can quickly be run to check the effectiveness of changes in reflector geometry or lamp positioning.



New types for the CarGenerator

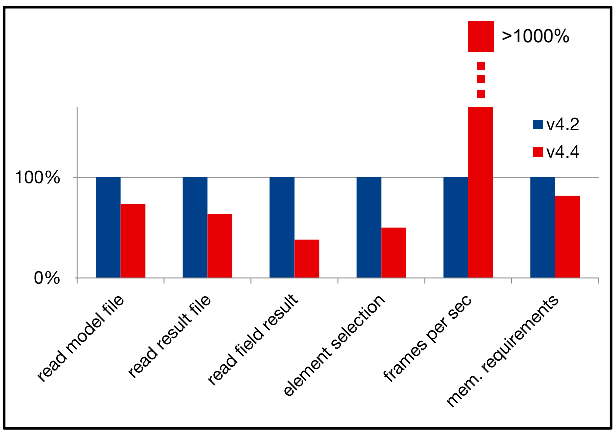
The CarGenerator model setup dialog now includes new types that allow multi-zonal modelling to get more detailled results for the local cabin air temperatures.
The figure below shows a new type with sunroof.





4-zone model
CarGenerator model

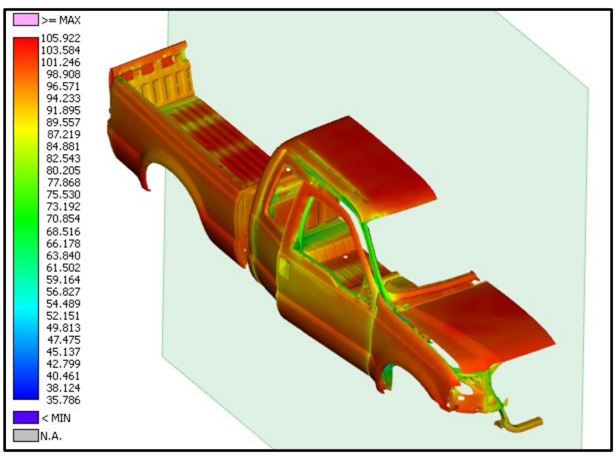
Completely revised graphical user interface



The graphical user interface (GUI) has undergone a major revision process. The 3D visualization now makes use of the latest features of modern graphic cards. Together with speed improvements for reading and writing of model and result files the handling of huge models with several million shell and solid elements is now comfortably possible.
The benchmark results show the relative changes since version 4.2 shown for a recent battery-powered VW Golf model consisting of approximately 3 million elements.
Especially noticable is the performance boost in the visualization module by several magnitudes which leads to smooth handling of huge models when rotating, selecting individual objects or visualizing results.

Utilizing model symmetries

Simulation times and memory needs can greatly be reduced for models with symmetrical geometry and boundary conditions by defining up to three perpendicular symmetry planes (keyword **SYMMETRY**).
Each symmetry condition leads to a reduction in computation costs and memory needs by approximately one half.
This is especially useful for simulations with the THESEUS-FE OVEN module where the typically used models and boundary conditions (radiation walls, nozzles and body-in-white) exhibit a clear symmetry with respect to the central plane.

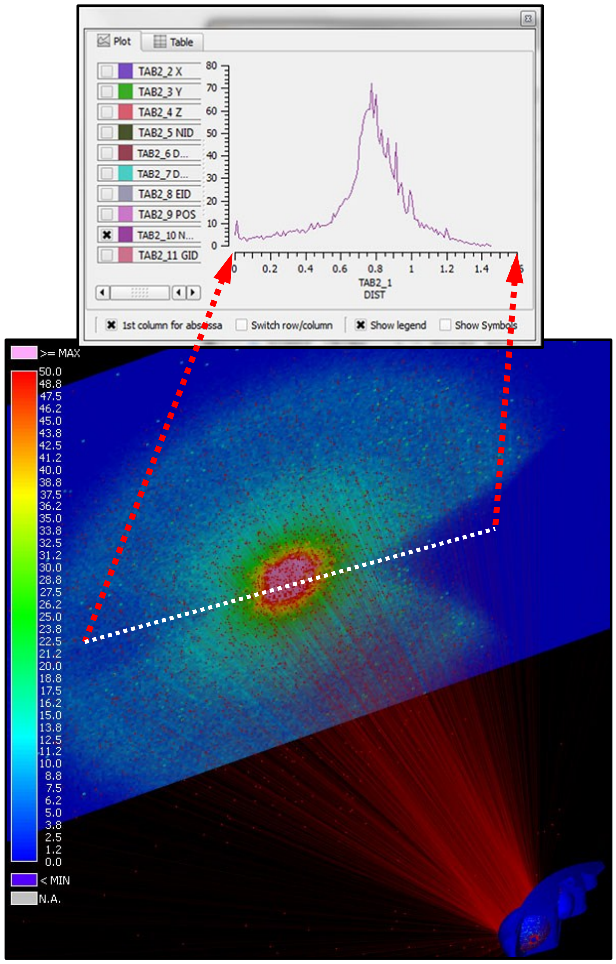


Plenty of new convenient features in the GUI

This release 4.4 of THESEUS-FE includes many new features in the graphical user interface.

To name just a few that will definitely make the work with the GUI a lot more comfortable:

- 3D visualization of element sets corresponding to warning and error messages of the solver
- 3D visualization of contact heat fluxes & residuals
- progress bars to provide feedback when reading models or doing time-consuming operations
- improved visualization of the sector timeline for oven models
- plotting of field results along a curve projected onto the shell geometry (shown in the figure to the right)
- user-adjustable toolbars
- opening of input decks and result files per drag-and-drop
- tabular editor for most keywords to quickly get an overview over the properties of all keywords of a certain type and to easily change values of multiple selected objects at once
- six user-definable views (save: <Ctrl>+1-6, use: 1-6)
- logarithmic result scaling mode
- improved screenshot tool
- function to add neighbouring elements to the current visible elements
- highlighting feature for many types including a descriptive legend in the 3D visualization window



Progress bars for most time-consuming tasks during the pre-processing stage

Most computation tasks during the pre-processing stage will now display a progress bar on the screen in the interactive mode to provide the user with better feedback about the estimated time they will take.

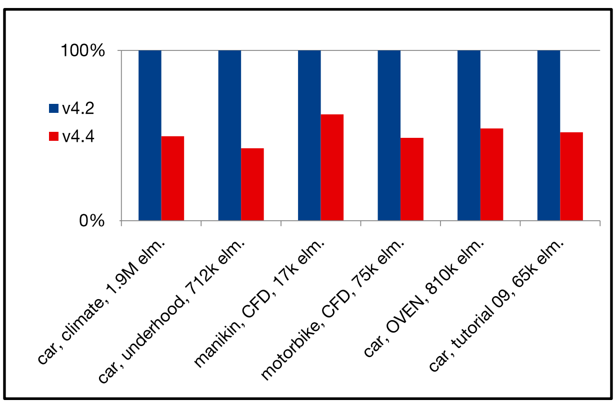
Besides that, more detailed information about the model is given both on the screen and in the report file as for example the model extends and minimum/maximum shell layer thickness to quickly identify erroneous model parameters as soon as possible.

```
GENERATING ACCELERATION DATA STRUCTURE FOR SHADING
   |========================| done, elapsed:   00:00:29

 WRITING VF-MATRIX TO FILE
 ============================================================
    # cavities          :            1

    CALCULATION FOR CAVITY:          1
    ------------------------------------------------------------
      # facets          :       567737
      |=========...............|  38%, remaining: 00:02:08
```

Reduced pre-processing time for large models

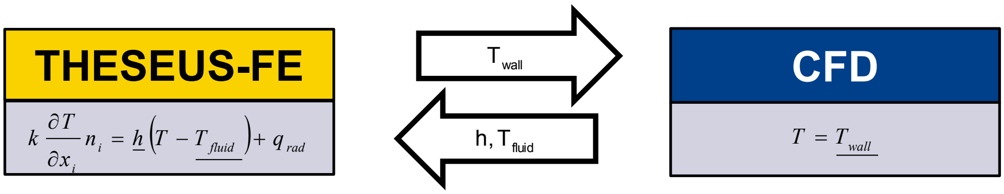


Pre-processing time especially for large models has been greatly reduced. This is especially noticable for models with more than 10k elements.

The chart above shows a comparion of pre-processing times for a selection of models of different types and sizes.

Better results through robust co-simulation using the new module THESEUS-FE Coupler

Many simulation tasks require knowledge of local convection parameters to precisely simulate the overall physics of the problem. For applications which demand for highly-accurate assessment of the fluid flow through the model it is advisable to obtain these through an external sophisticated CFD solver and feed these results as boundary condition parameters to THESEUS-FE. While THESEUS-FE will be responsible for the accurate solution of all wall temperatures the CFD solver will provide the local convection parameters for each boundary element.



The THESEUS-FE Coupler provides the infrastructure for controlling co-simulation tasks in a user-friendly and transparent way. It takes charge of data communication and synchronization between two or more solvers, typically THESEUS-FE and a CFD solver. We currently support OpenFOAM, Star-CCM+ and Flowmaster as exchange partners.

THESEUS-FE

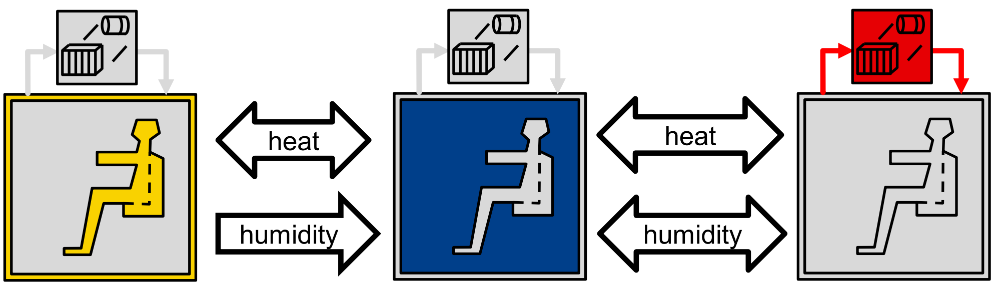
Models:
- conduction in solids
- radiation
- manikin physiology
- manikin comfort

STAR-CCM+

Models:
- air velocity
- air pressure
- turbulence
- heat transport
- steam transport

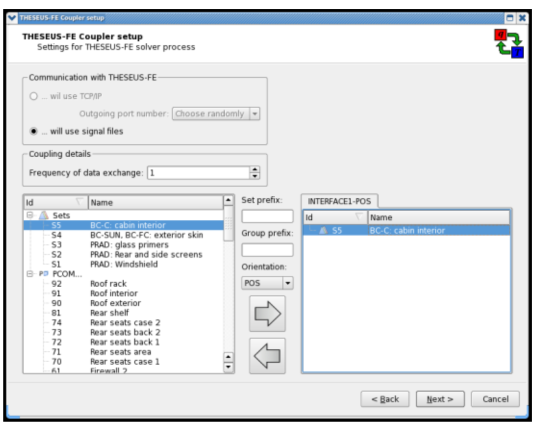
FLOWMASTER

Models:
- AC system controls
- compressor power
- refrigerant quality
- outlet humidity



User-friendly co-simulation setup dialog

The Coupler Setup Dialog is integrated into the graphical user interface. It provides a user-friendly wizard interface that unifies the foreign solver case settings and allows you to set up co-simulation scenarios in a matter of minutes.
Besides setting up the exchange data it can be used to monitor and control the coupling process during simulation.



We‘re moving!

From January 2014 onwards we will have a new address. We are moving within Munich just a stone’s throw away from our current location into a new building since our old one is already bursting at the seams.

Our new address will be:

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Frankfurter Ring 160
D-80807 Munich

Imprint

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