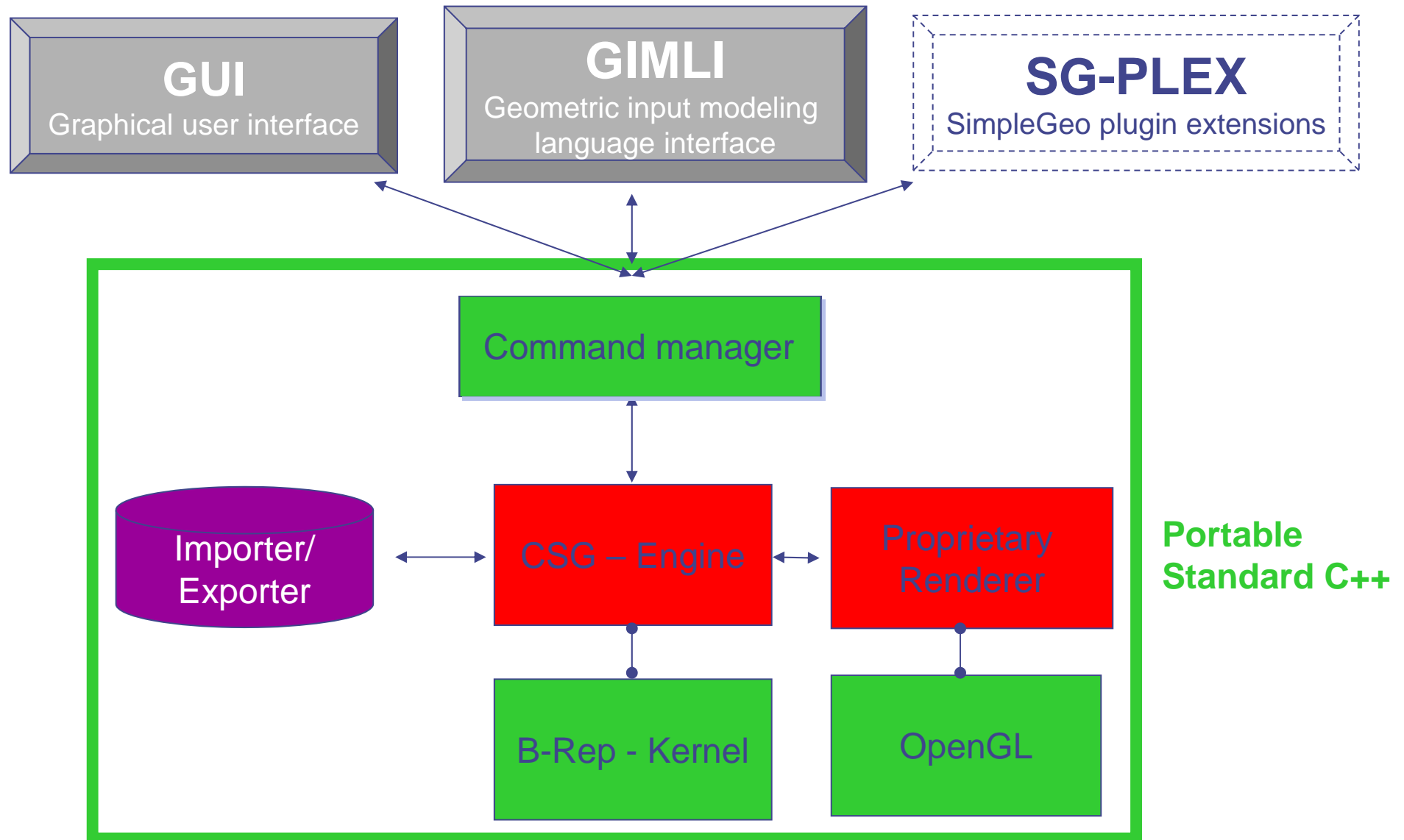




# SimpleGeo render plugins

Chris Theis

# SimpleGeo architecture



# Plugins

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Plugins are extensions that can be **loaded at runtime**

They can be used to

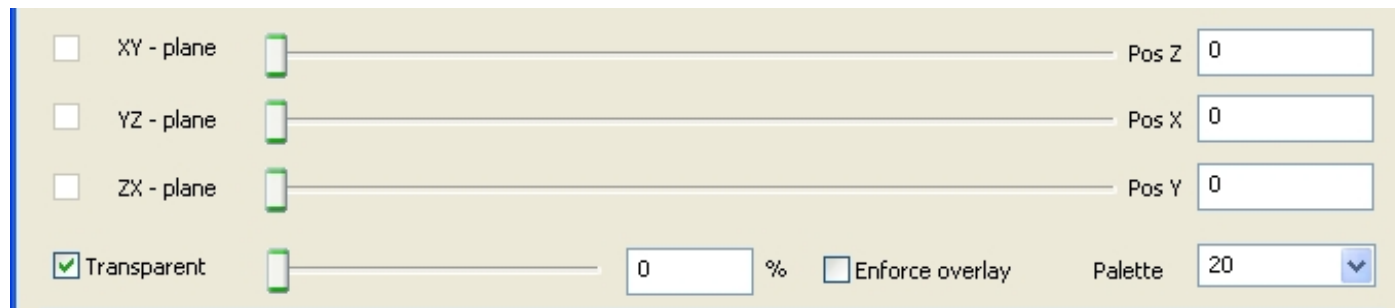
- extend SimpleGeo's proprietary renderer
- act as 3<sup>rd</sup> party import/export filter
- ...

They are contained in the file **SGPluginsX.X.zip** which should be unpacked into the SimpleGeo installation directory (recommended).

# Available plugins

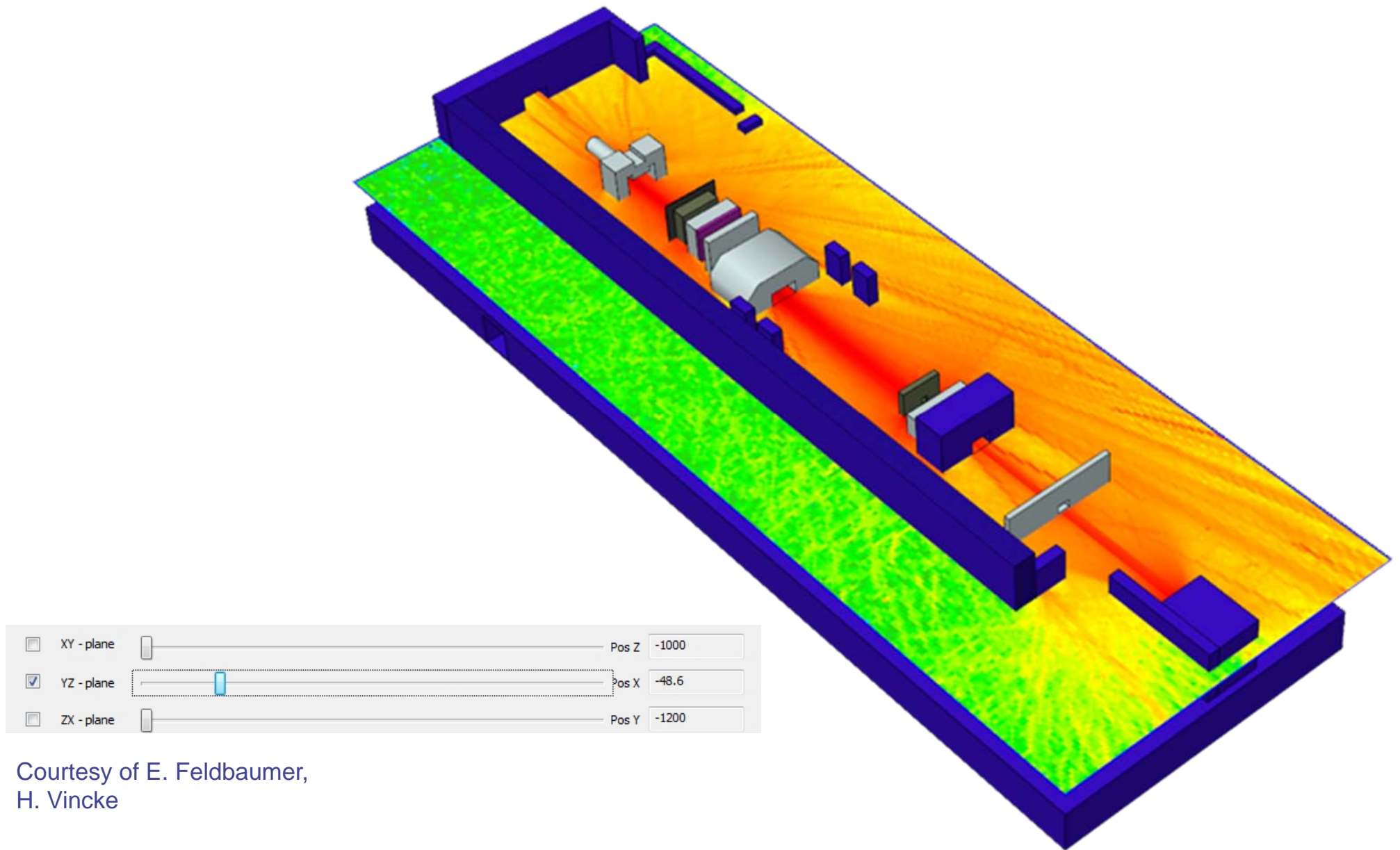
## DaVis 3D (see the demo in the videos directory)

- reads FLUKA USRBIN, XYZ and GRIDCONV files
- displays the binned data of up to 3 planes (XY,YZ,ZX) than can be interactively moved through the data set



- data can be superimposed on top of geometry
- the color tables are user configurable and interpolate if requested

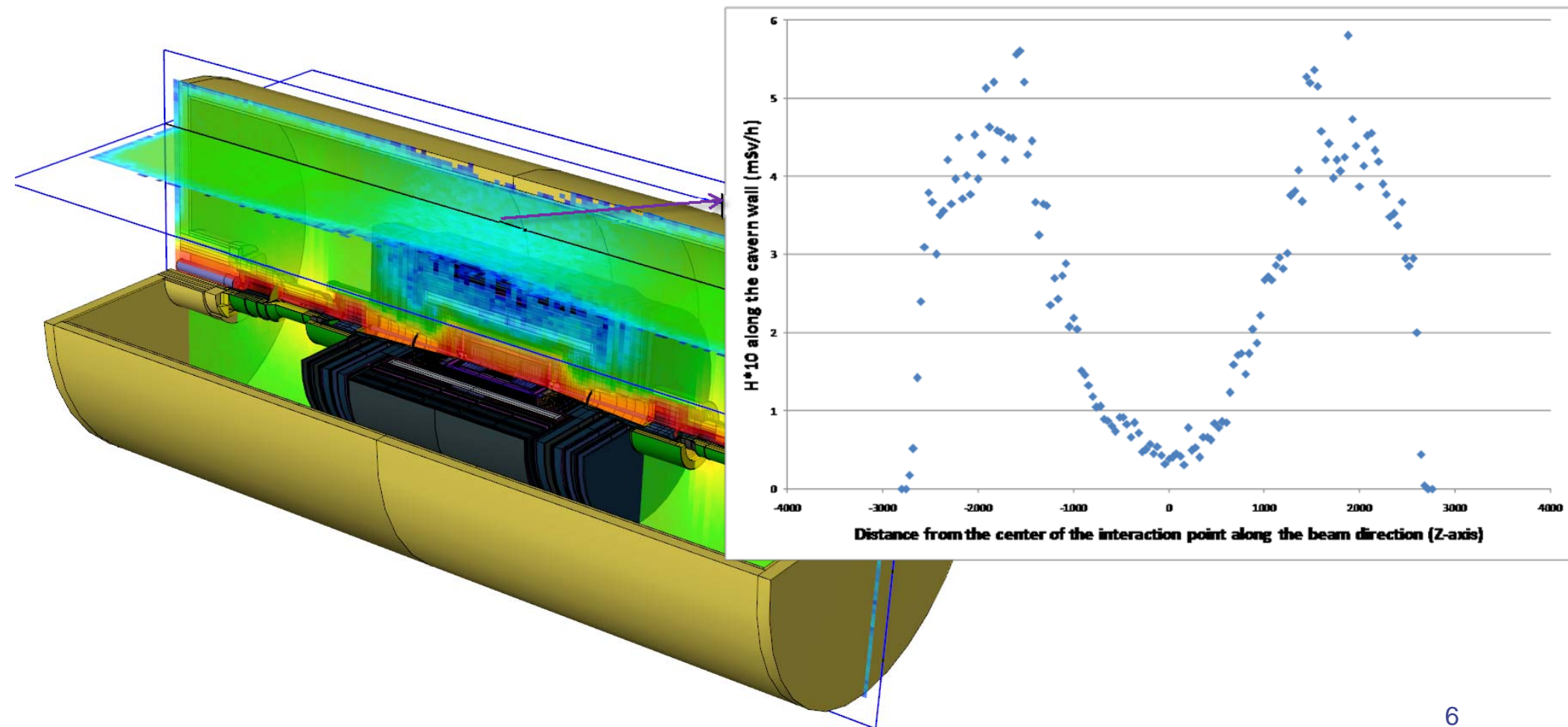
# SimpleGeo/DaVis3D



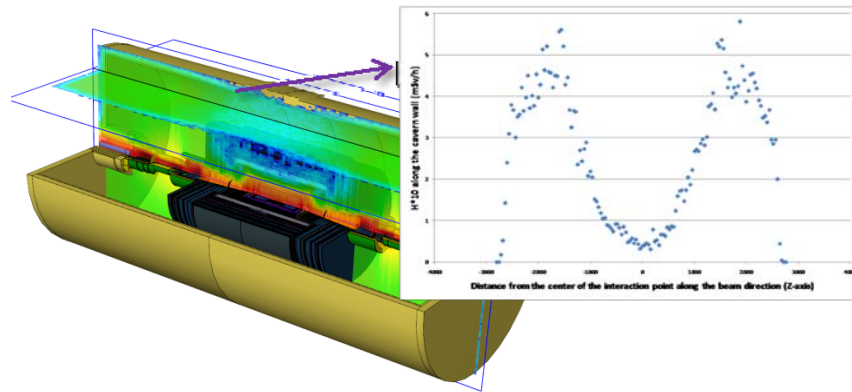
Courtesy of E. Feldbaumer,  
H. Vincke

# Data extraction

- Extraction of values  
(planes, profile functions or single bins)



# Data extraction



- Profiles can be extracted taking 1 bin into account along the intersection of 2 planes → statistical fluctuations
- Solution: “**Averaged profiles**”: (DaVis3D version  $\geq 3.5$ )  
an arbitrary averaging volume can be defined which is moved along the intersection and the resulting profile is extracted



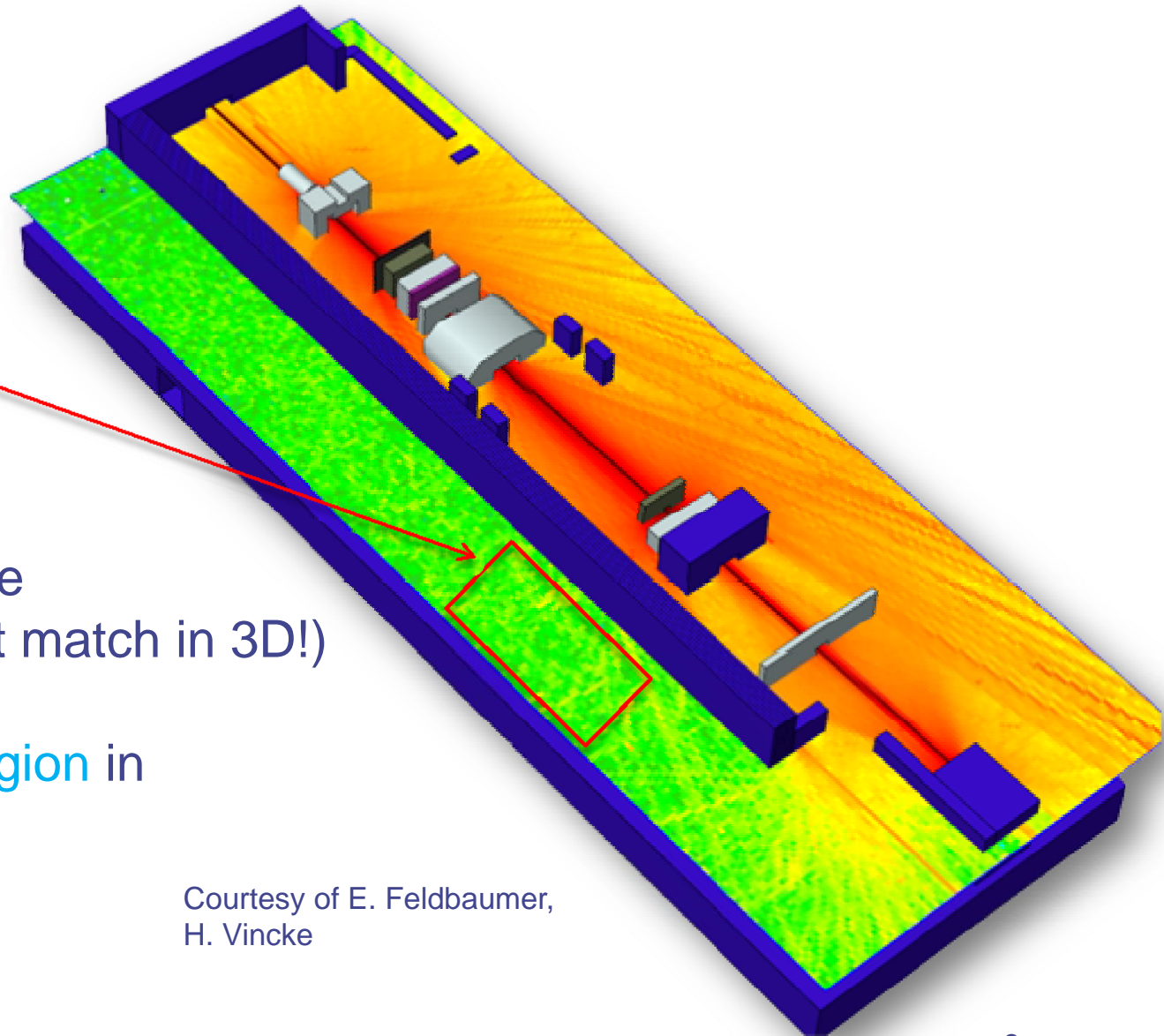
# Data post-processing

## Question:

What's the average dose at a workplace?

## Solution:

- Rough estimate from the 2D dose map (might not match in 3D!)
- Foresee a geometric region in the input



Courtesy of E. Feldbaumer,  
H. Vincke

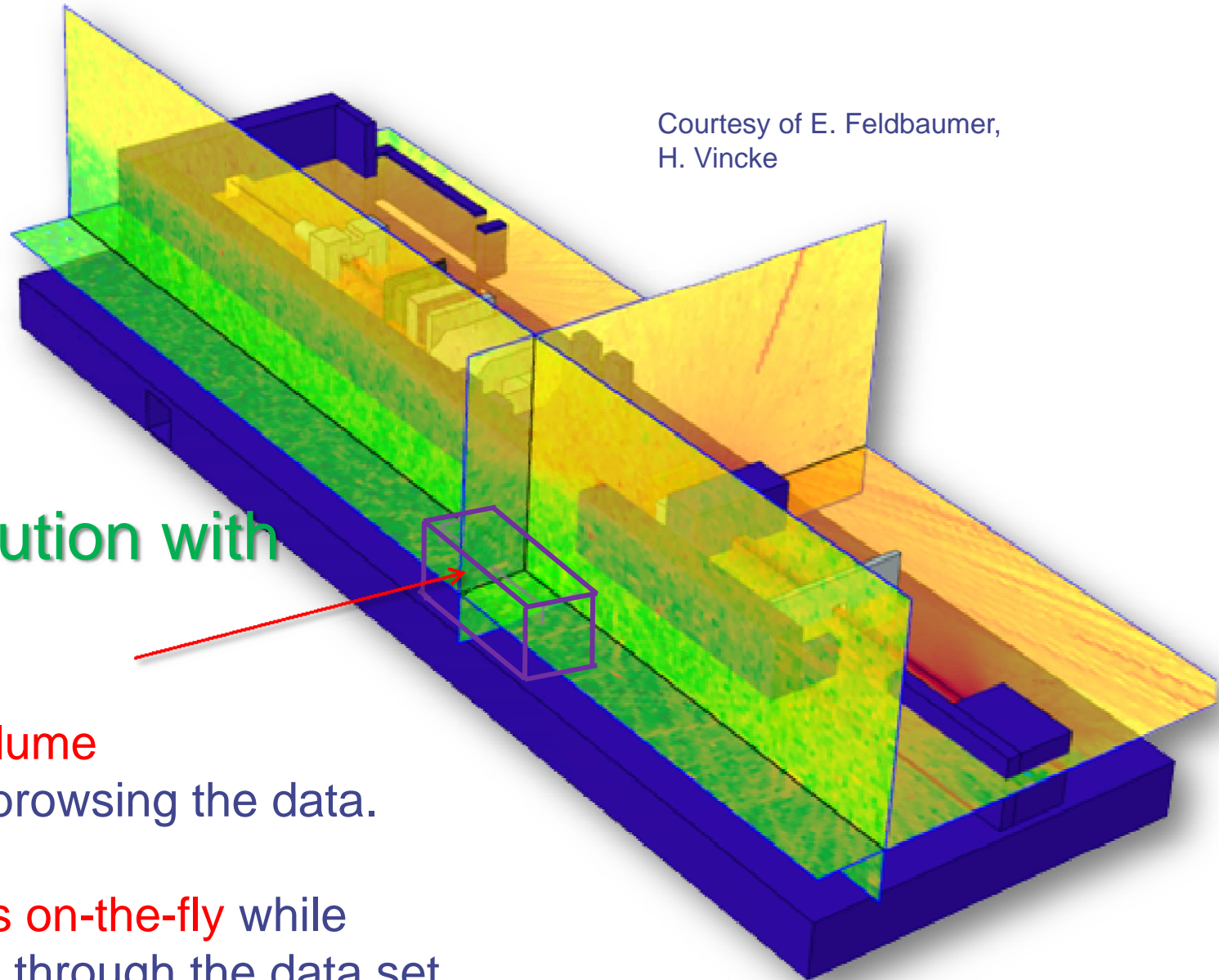


# Data post-processing

Courtesy of E. Feldbaumer,  
H. Vincke

## Alternative solution with DaVis3D

- Define arbitrary volume interactively while browsing the data.
- Calculate averages on-the-fly while moving the volume through the data set

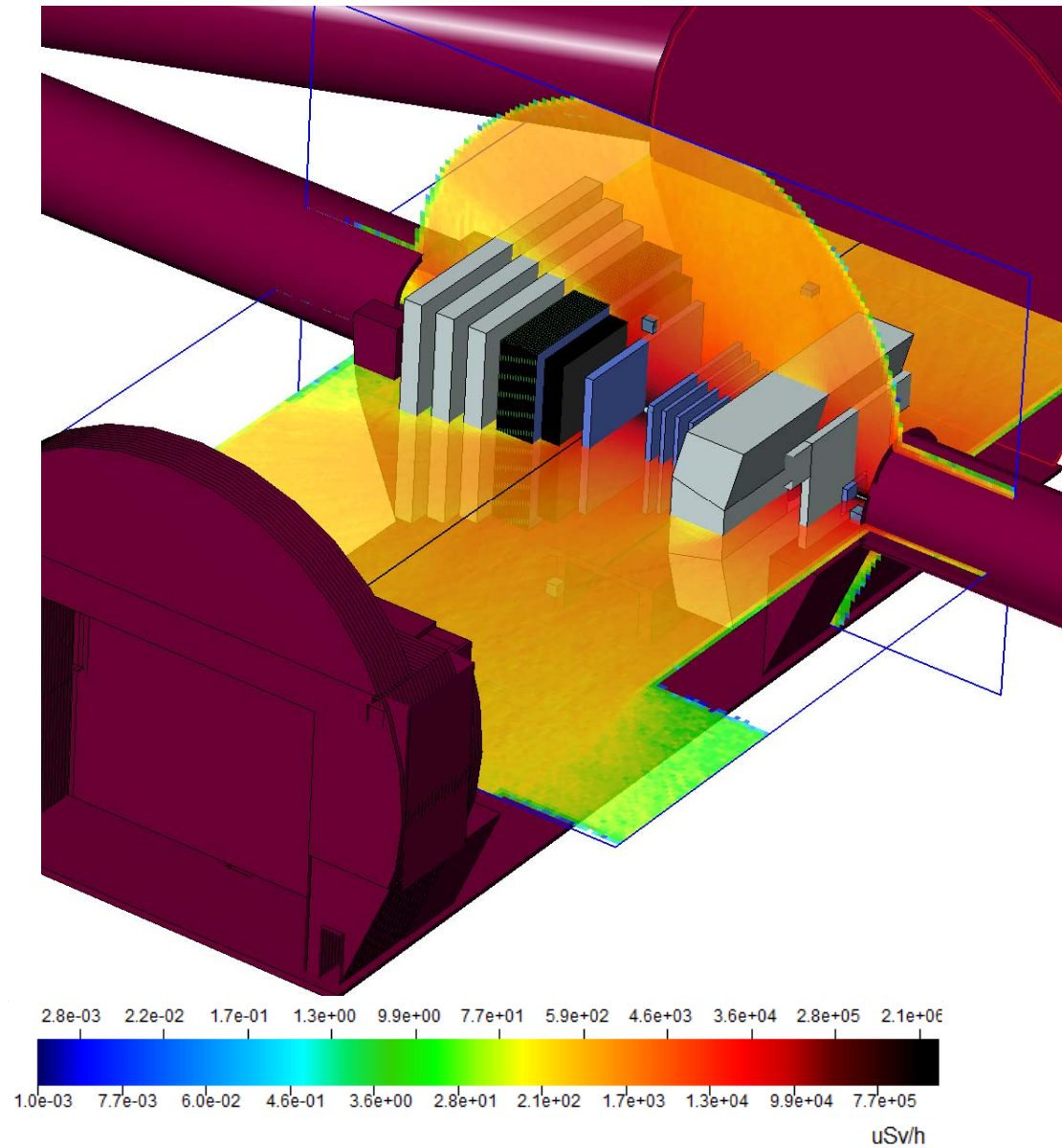


# More post processing options

The following post – processing options are available for FLUKA USRBIN files (ASCII format):

- **Averaging** over several USRBIN results including error calculation  
(inconsistent weights are treated accordingly)
- **Sum** of several USRBIN results
- **Difference** of 2 USRBIN results
- **Ratio** of 2 USRBIN results

# Threshold detection



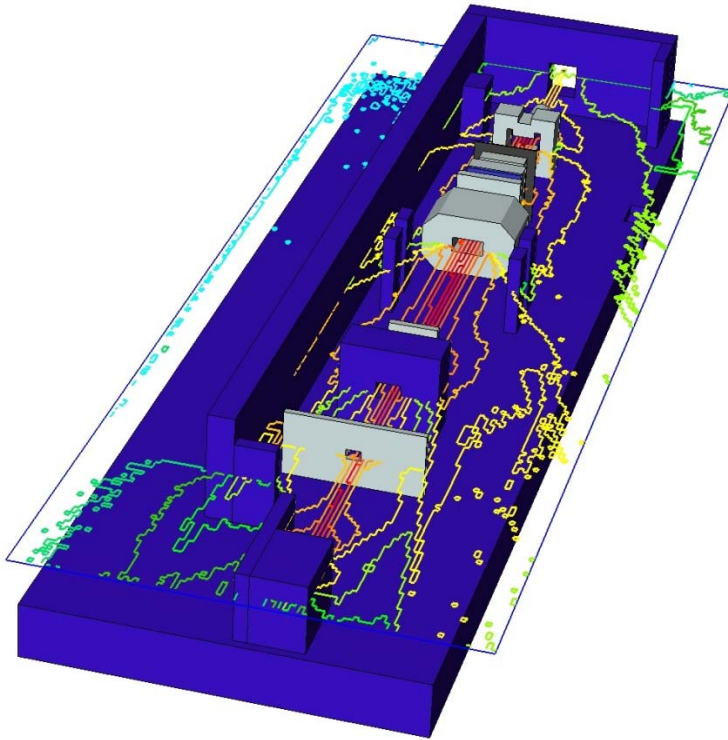
Typical question:

Where is the dose  $> 1 \text{ mSv/h}$ ?

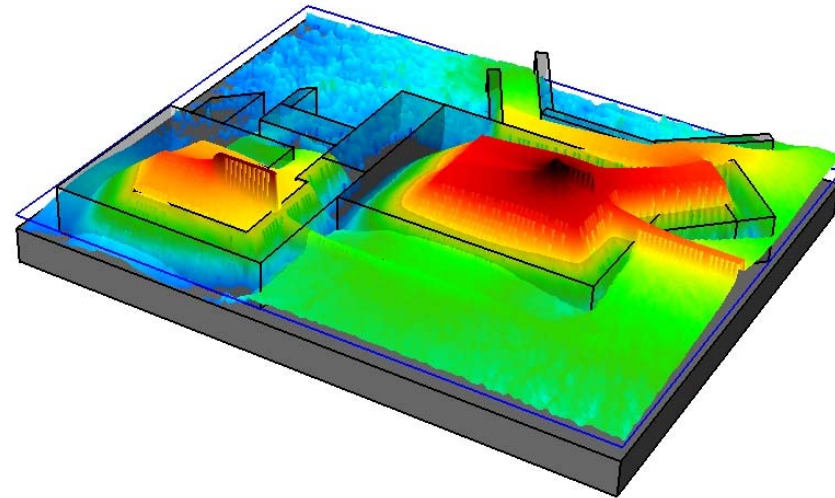
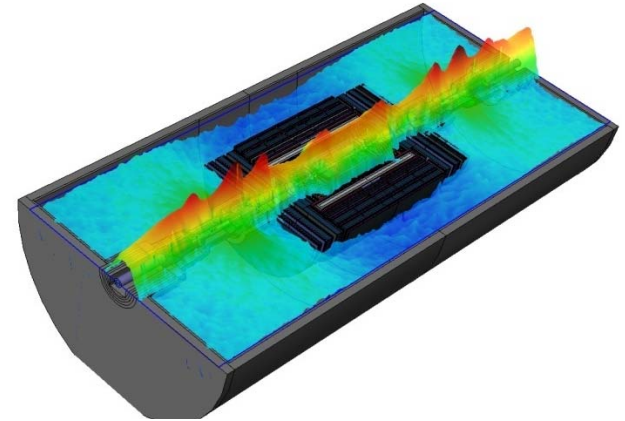


Development of an automatic threshold contouring algorithm

# Additional visualization modes



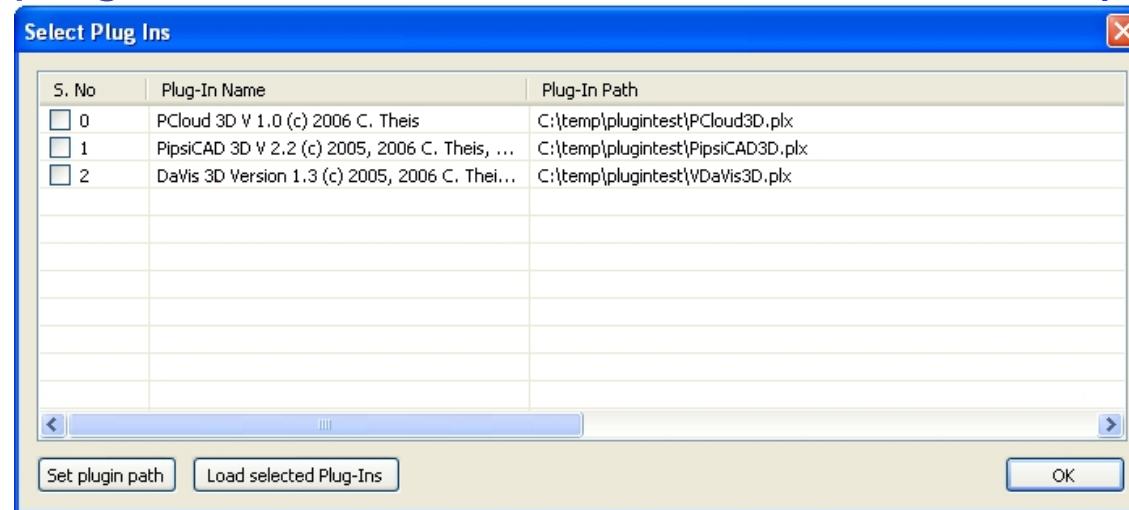
Contour rendering



Smoothed extrusion rendering

# "Hands-on" example of DaVis 3D

1. Load the plugin via the menu item **Macros -> Load plugins**



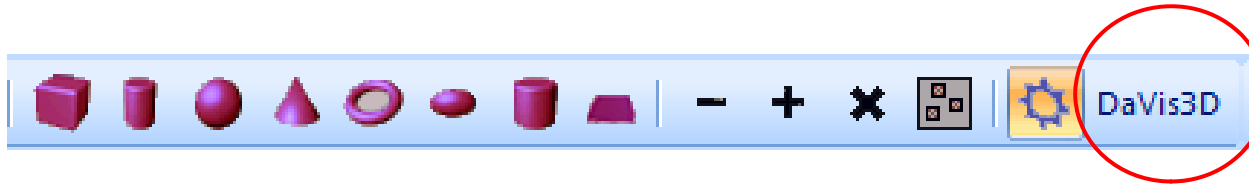
2. The path which is searched for the plugins can be set by the **Set plugin path** button.
3. Tick the check box next to the "DaVis 3D" plugin and click on **Load selected plugins!**



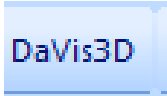
4. Click on **OK**.

Hint: Creating copies of the \*.plx files allows for loading Multiple instances of the same plugin. Thus, DaVis3D can be loaded several times to display different USBINs in parallel.

# DaVis 3D example

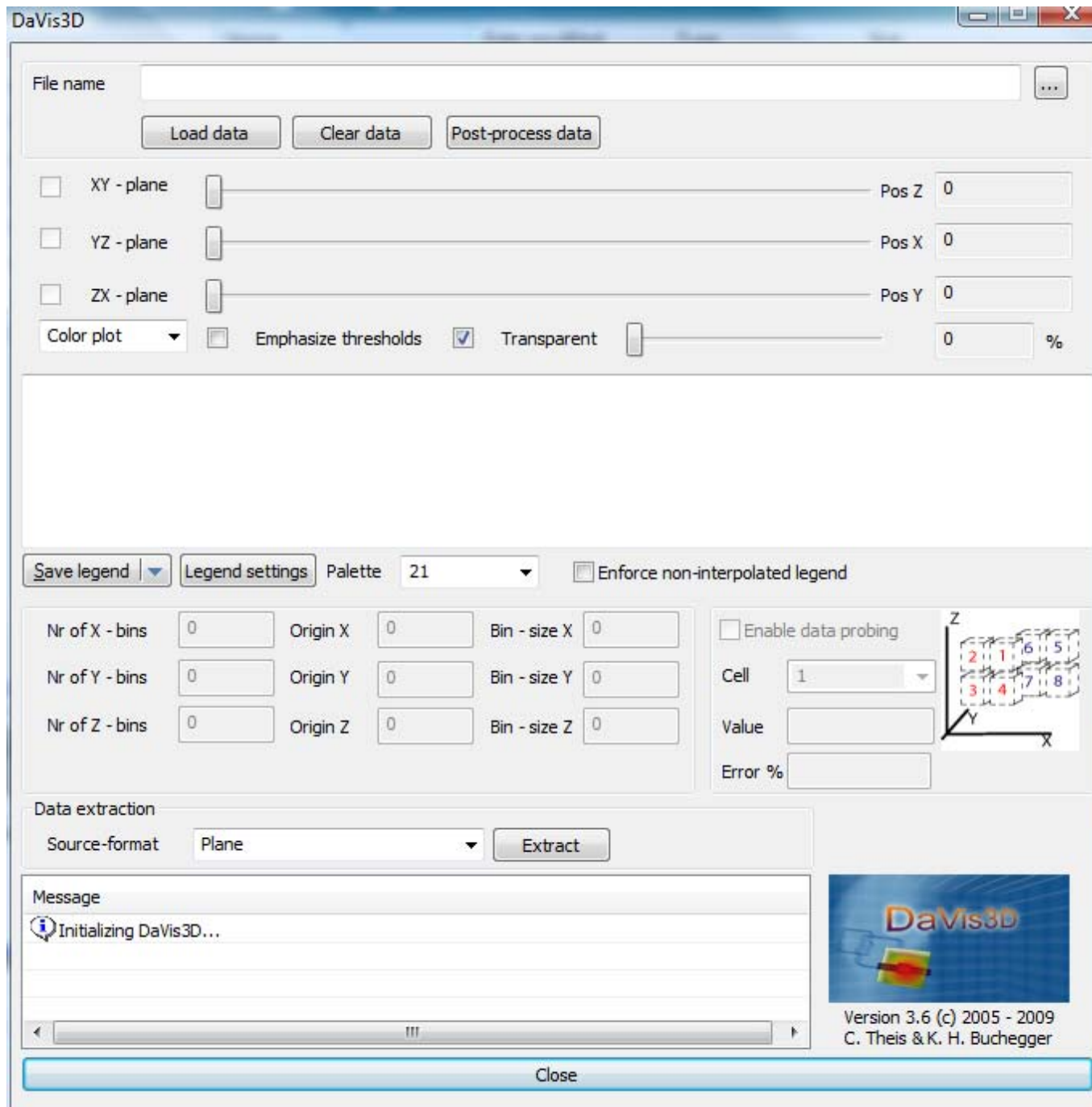
1. New icons should appear in the tool bar which activate the respective plugin



2. Activate the Space ball from the toolbar 
3. Load the file *Hill.dat* from the sub-directory *DaVis3D - Hill dose example* and build the geometry with the automatic update button 
4. Activate the plugin-dialog by pressing the plugin button 




# DaVis 3D example

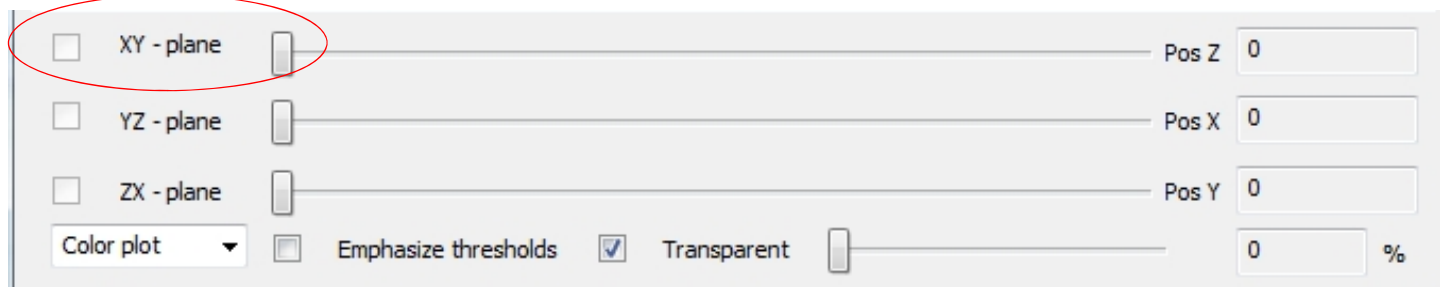


Screenshot of the  
main dialog

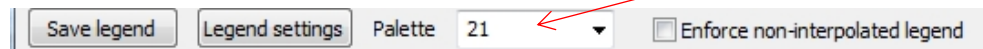


# DaVis 3D example

1. Click on the  button to select the data file *Hill.amb74\_001.usrbin* in the sub-directory *DaVis3D - Hill dose example*. (This is an example of protons hitting a target in an underground area with a shaft to the surface).
2. Press the **load button** to load the data.
3. Tick one or more of the **checkboxes** to active the respective planes for visualization of the data. They can be moved using the slider next to the check box.

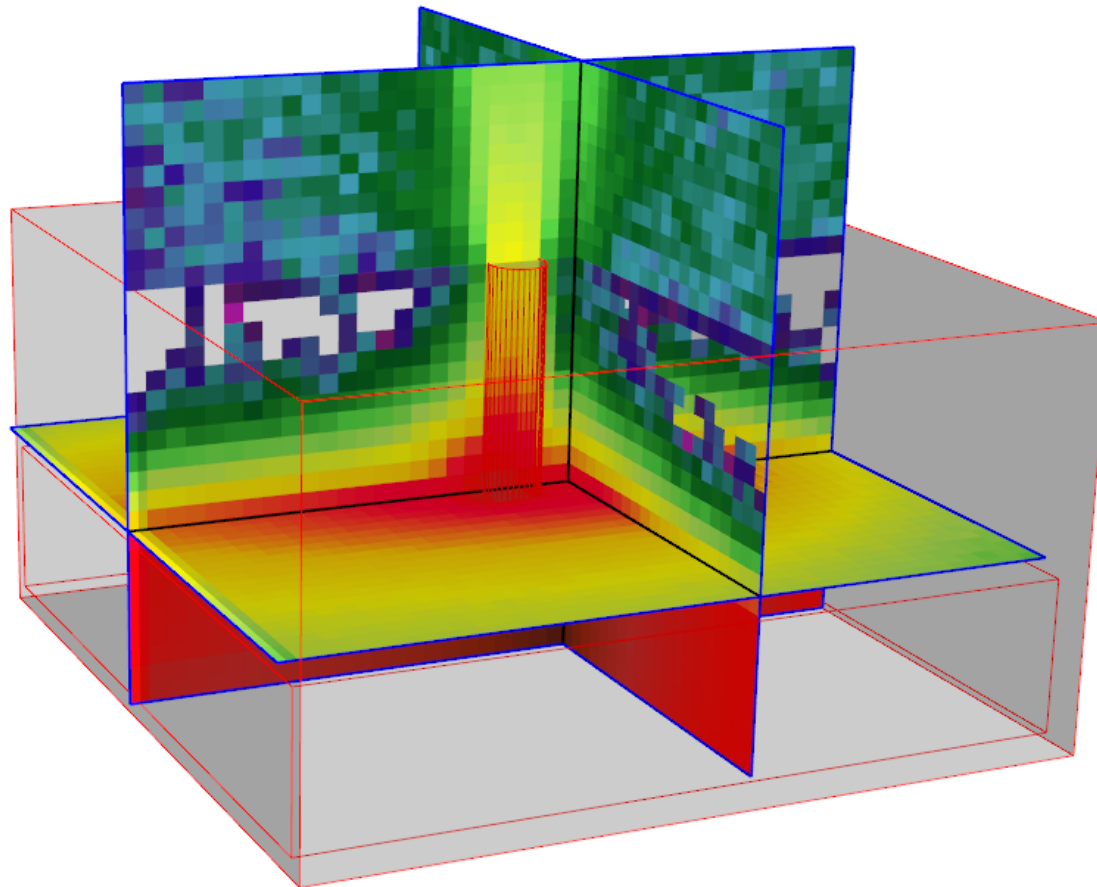


4. The number of colors used can be selected from the **Palette drop-down box**.



# DaVis 3D example

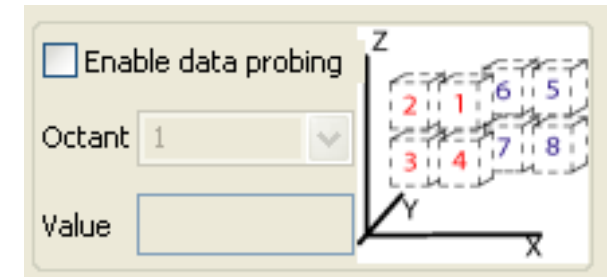
- If you want to look into what is happening inside the hill, then select the node **Hill** in the CSG tree and set the visualization attribute **X-Ray mode** to **On**. Consequently, the material will be transparent and you should get something like the following picture



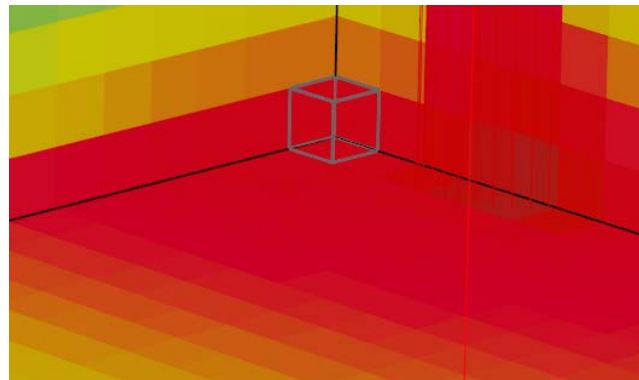
# Advanced DaVis 3D example

## Getting the results of one single bin:

- All three planes must be selected and the bin values of the 8 voxels adjacent to their intersection point can be obtained via ticking the **Enable data probing** check box.



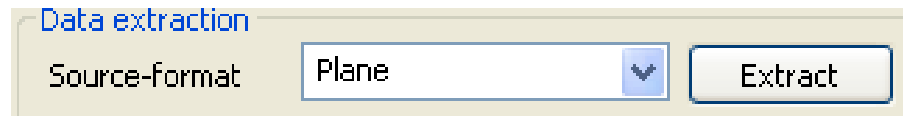
- Select one of the eight octant bins or the average over all 8 bins. The currently selected bin is outlined as a grey box in the rendering.



# Advanced DaVis 3D example

Getting the results of all values on a 2D plane:

1. Move the respective plane to the appropriate position.
2. Select **Plane** as the source of the data extraction and press the **Extract** button.



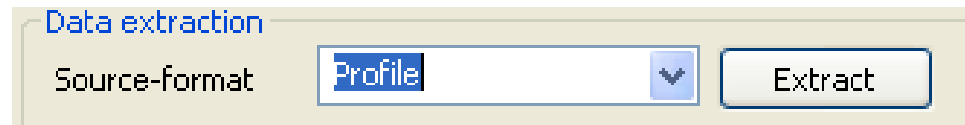
*\* In version 1.5 this functionality is obtained by the **extract data** button.*

3. Select the respective plane and the data will be exported in a 2D matrix.

# Advanced DaVis 3D example

Getting the results of the values at the intersection of 2 planes  
= profile function.

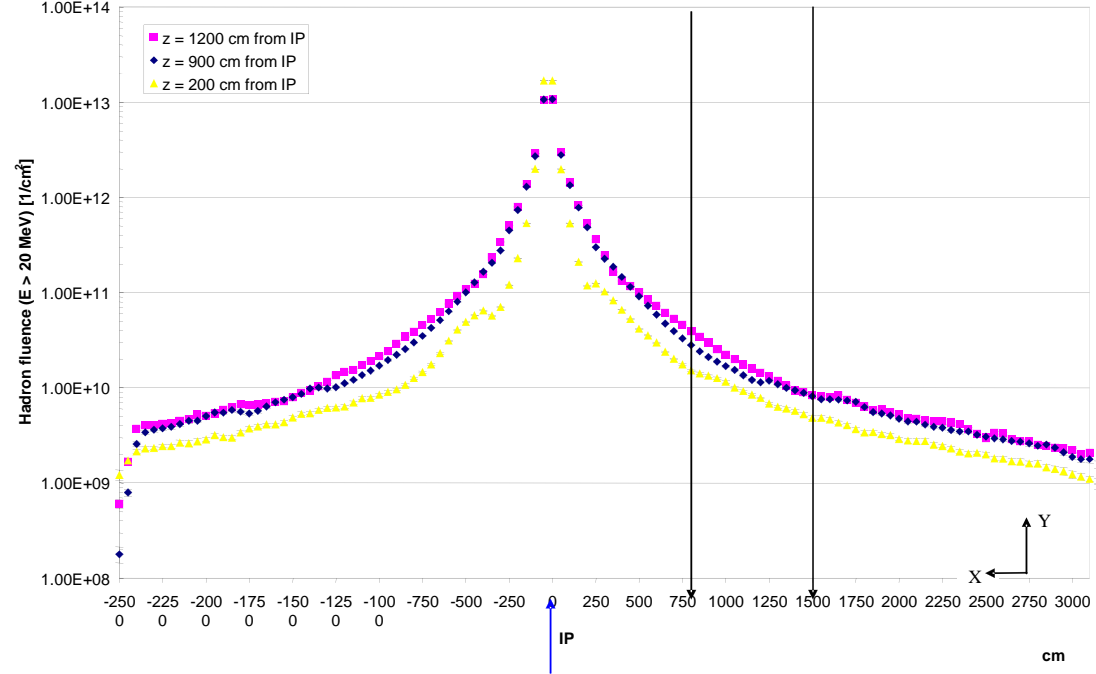
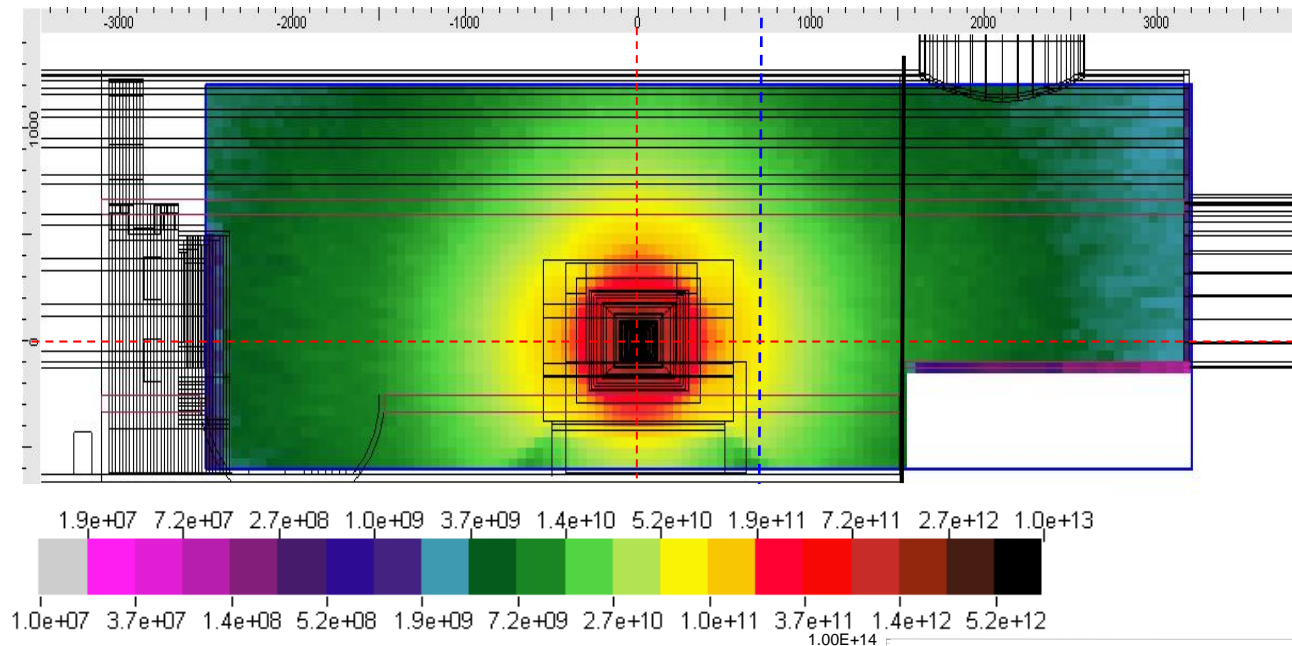
1. Move the respective 2 planes to the appropriate position.
2. Select **Profile** as the source of the data extraction and press the **Extract** button.



\* *Version  $\geq 3.5$  also averaged profiles are available.*

3. Select the respective planes and the data will be exported as a 1D function.
4. See next page for an example for hadron fluence as a function of distance to the particle interaction point.

# Advanced DaVis 3D example

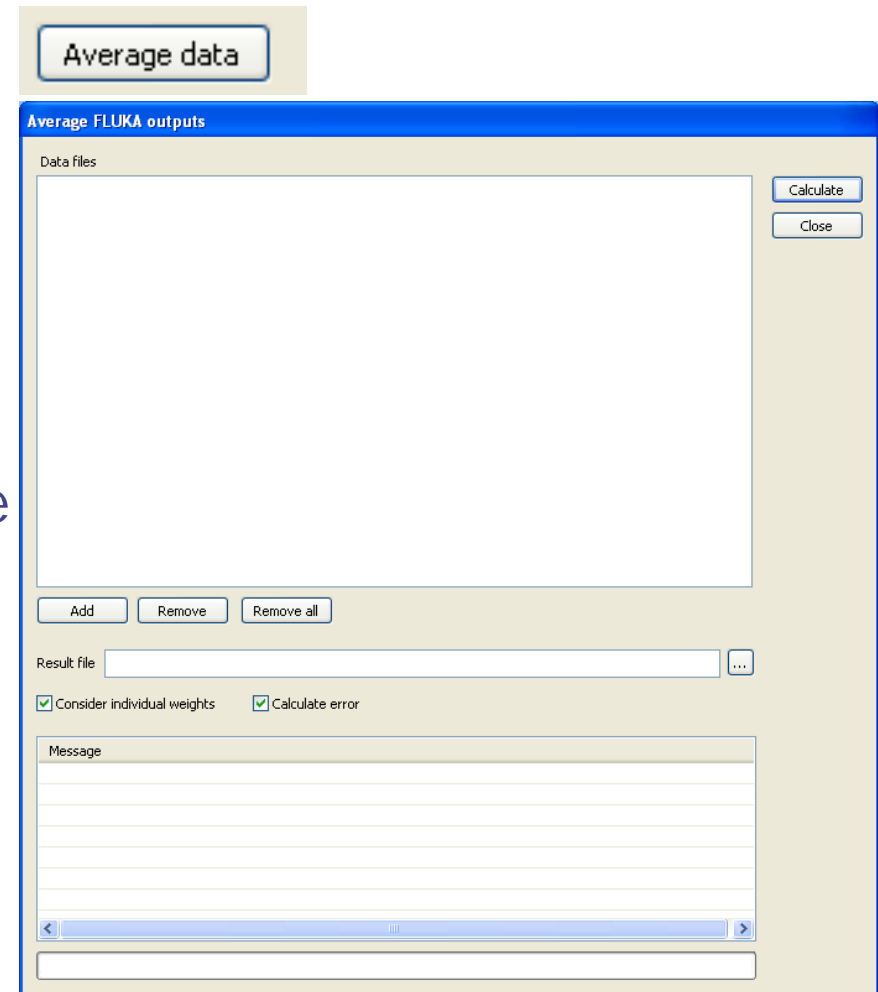


# Advanced DaVis 3D example

Calculating the average & error of several FLUKA USRBIN files:  
(requires version 2.4.3 or above)

1. Click on the **Average data** button.
2. In the new dialog use the **Add** button to add all files that should be averaged. (ASCII files only!!!, but XYZ, R-Z, R-Z-Phi does not matter). In the file dialog multiple files can be selected at once!
3. Set the resulting file name or use the suggested one.
4. Press the **calculate** button

\*Files with different weights are taken into account accordingly.





# Available plugins

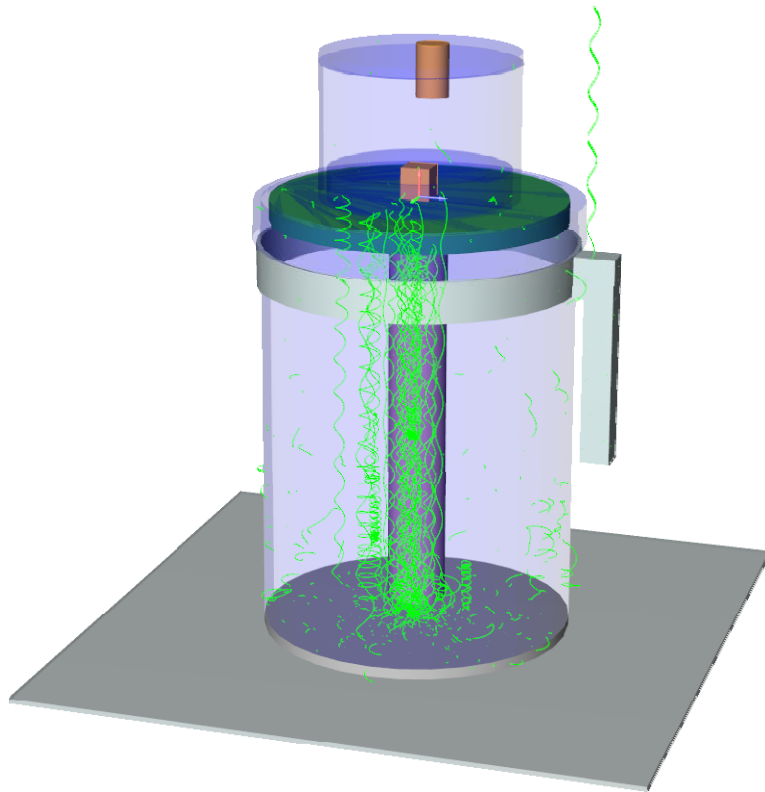
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## PipsiCAD 3D

(co-author: Helmut Vincke, who implemented the first generation of PipsiCAD)

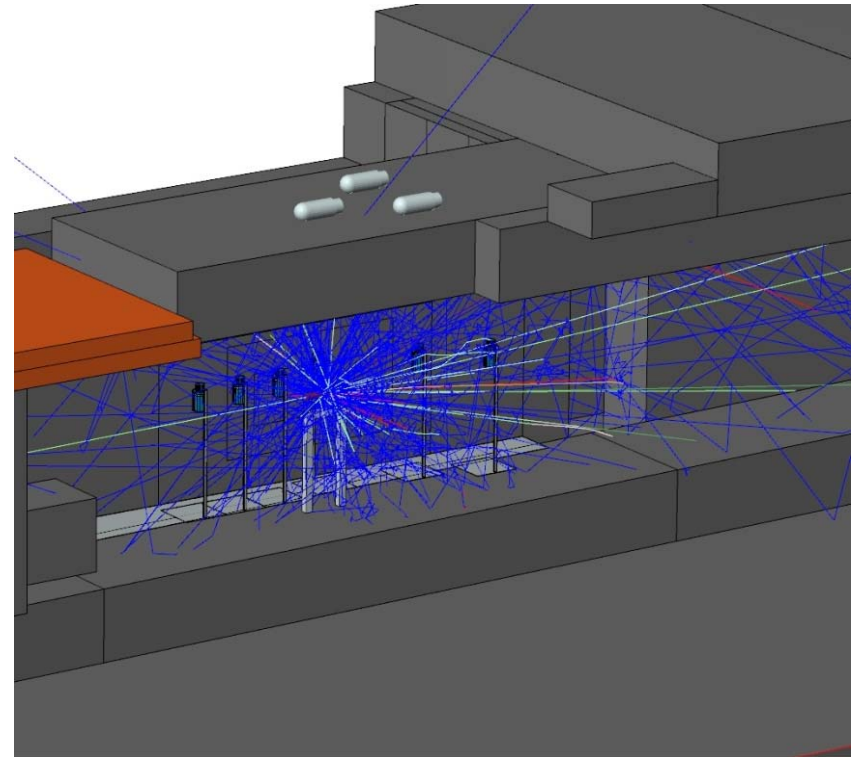
- reads ASCII files produced by available user routines for DPMJET 3
- superimposes color encoded particle tracks on top of geometry
- color encoding and transparency is user configurable
- interactive application of filters with respect to particle energy and particle type
- Animate particle tracks as a function of time

# PipsiCAD3D



Ionization chamber with  $e^-$  tracks in a magnetic field.

Courtesy of Helmut Vincke



Neutron tracks due to 1 proton hitting the CERF target.

# Steps to run PipsiCAD3D

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1. Compile and link the proprietary **mgdraw.f** to **FLUKA**
2. Add a **USERDUMP** statement to your input to produce a collision tape
3. Run your simulation to create a collision tape
4. Run the linux interface **PipsiCAD\_SimpleGeo.linux** to select the energy range & binning of the particles that will be extracted
5. Load your geometry and the PipsiCAD3D plugin in **SimpleGeo**
6. Load the created data file with the plugin and press the "**Visualize**" button
7. Optionally, you might select track evolution display and animate the resulting tracks.  
(see [www.cern.ch/theis/simplegeo/download/CERF\\_tracks.avi](http://www.cern.ch/theis/simplegeo/download/CERF_tracks.avi) for an example)

*Please refer to the manual for a more detailed description.*

# Available plugins

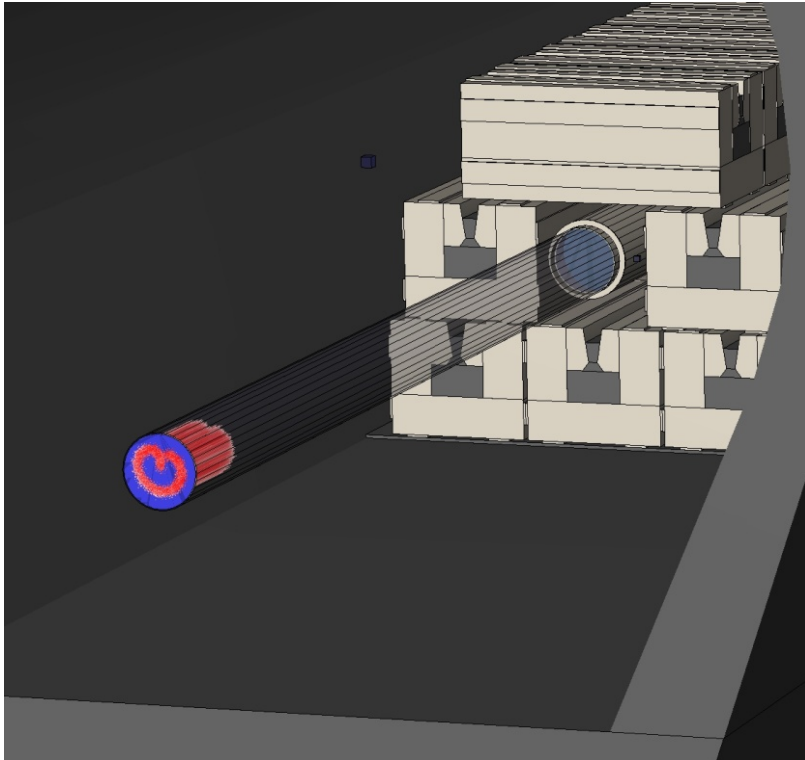
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## PCLoud 3D

- reads ASCII files produced by FLUKA 2Step routines (open format and very simple)
- various display modes for particles (position, direction, energy scaled direction)
- color encoding and transparency are user configurable
- interactive application of filter with respect to particle types
- statistical information with respect to particle type or particle type and energy

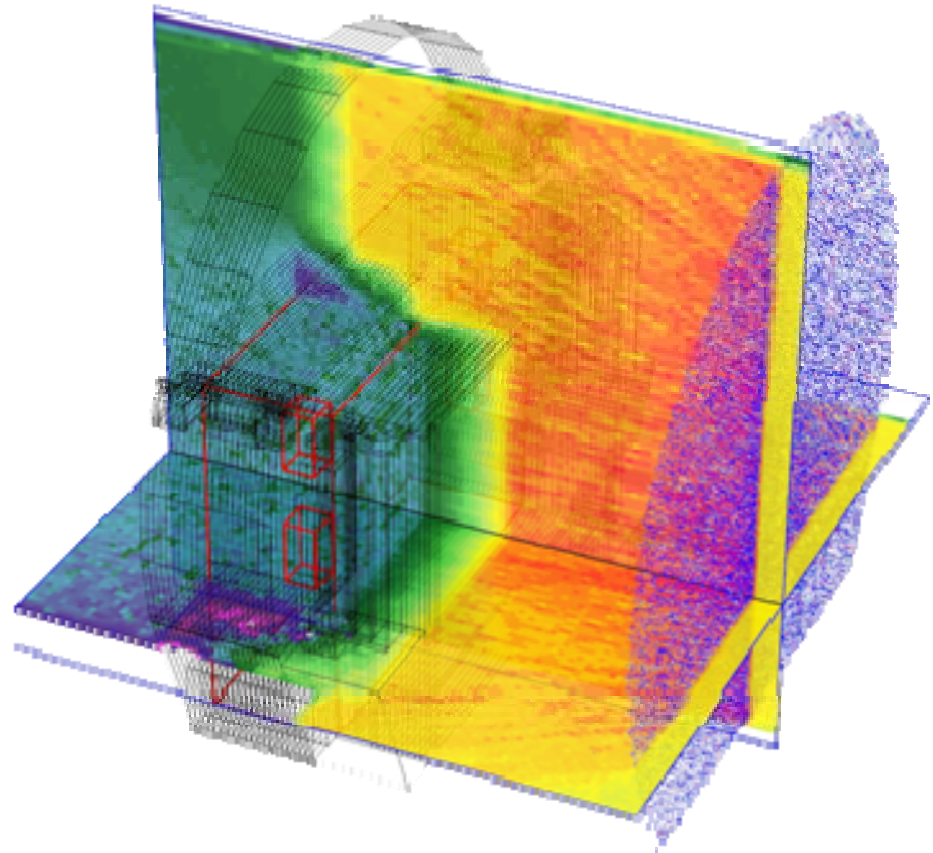
# PCloud3D

## particle position & direction visualization



Verification of a special beam particle distribution

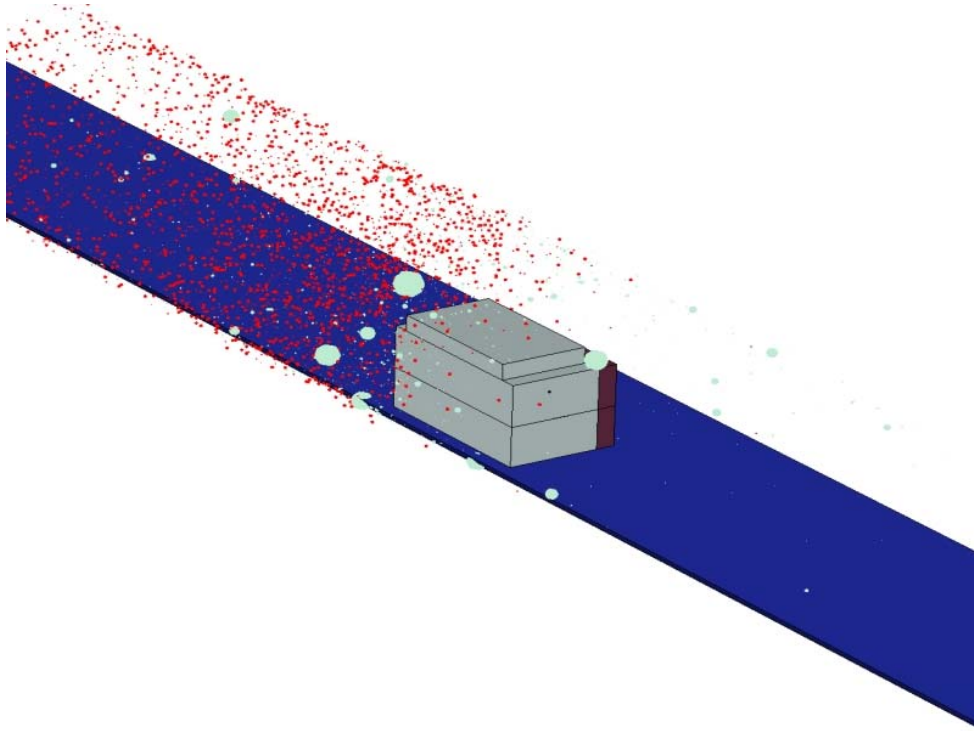
Courtesy of J. Voltaire



Hadrons directed towards the LHCb shielding, combined with fluence visualization by DaVis3D

# IsoVis3D

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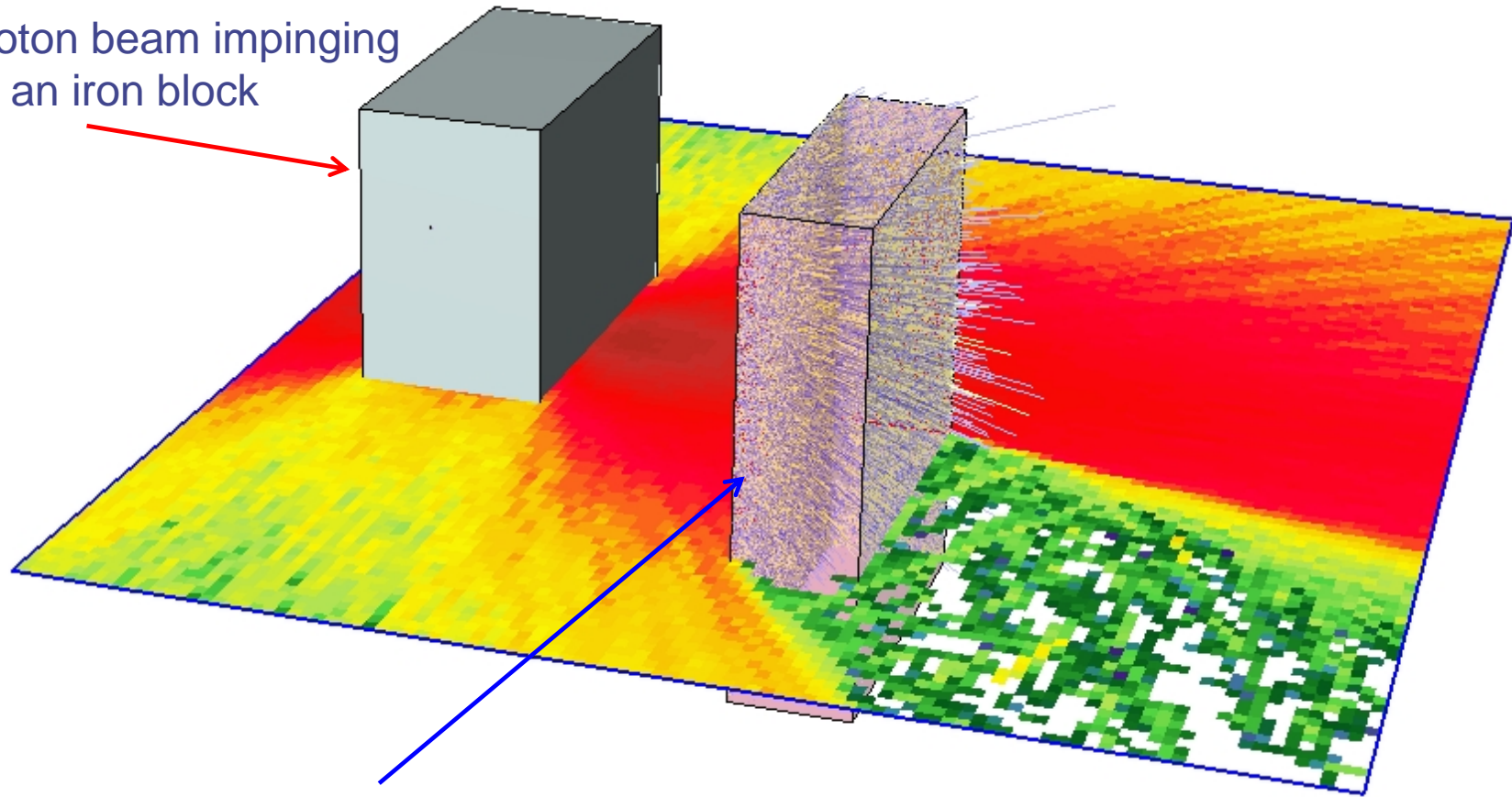


- Reads FLUKA - **ISODUMP files** created by the 2-step activation routines developed by S. Roesler
- Visualizes the **spatial + weight distribution of isotopes**
- **Filters** can be applied for either the isotope types and/or weight
- **Relative abundance of each isotope** can be analyzed with weights taken into account



# Combining DaVis3D + PCloud3D

Proton beam impinging  
on an iron block



Secondary particles entering a second iron block