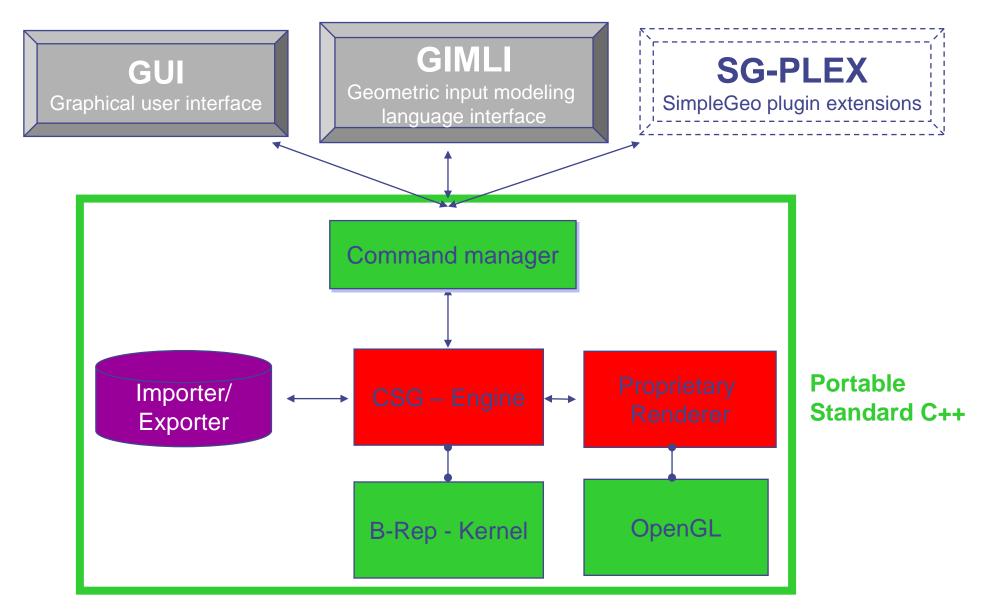
SimpleGeo render plugins

**Chris Theis** 

## SimpleGeo architecture



## Plugins

# 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> pary import/export filter
- ...

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

## **Available plugins**

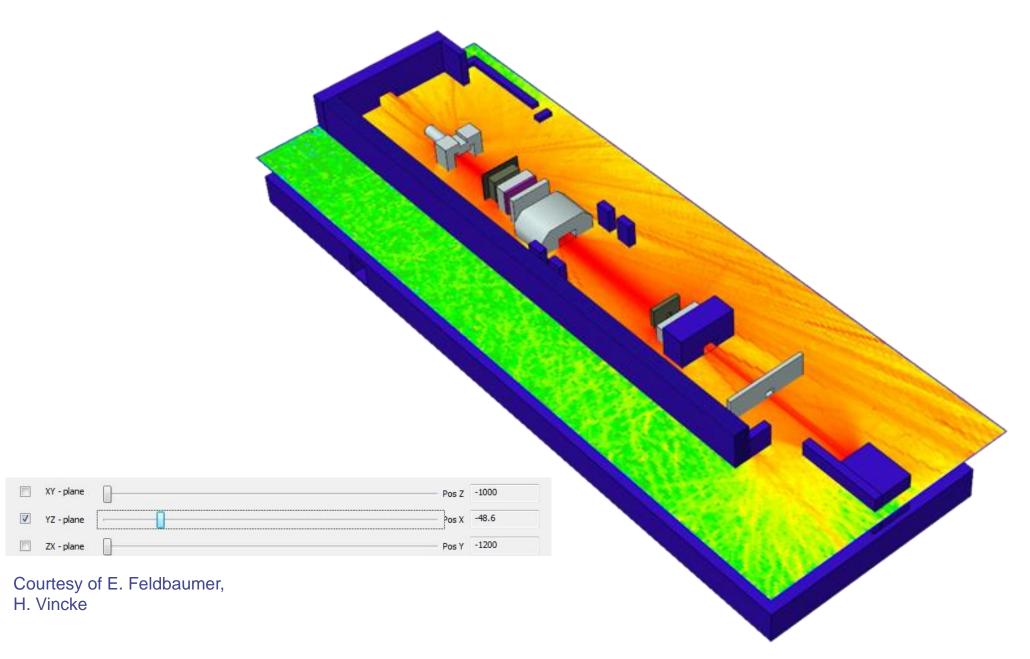
DaVis 3D (see the demo in the videos directory)

- 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

XY - plane		Pos Z	0
YZ - plane		Pos X	0
ZX - plane		Pos Y	0
Transparent	0 % Enforce overlay	Palette	20 💌

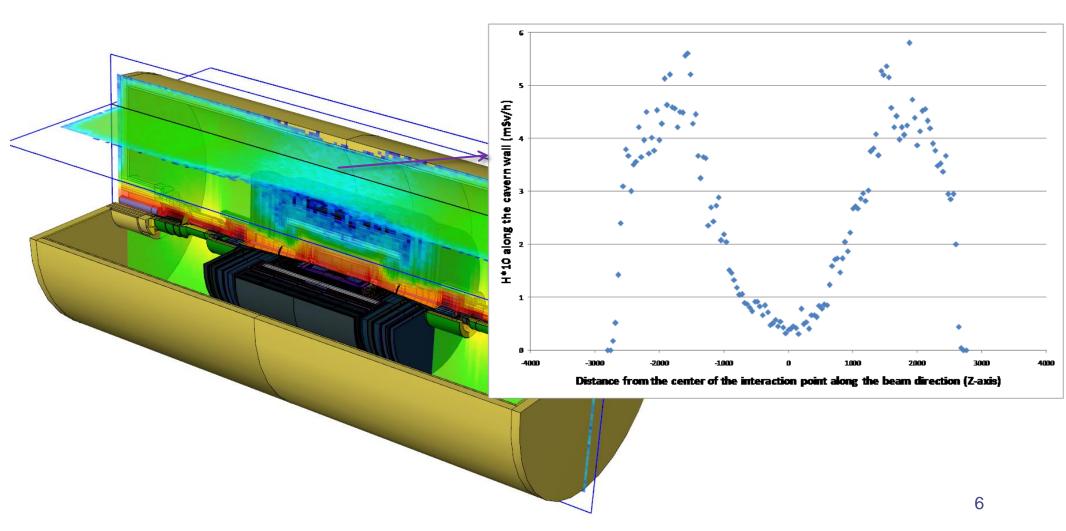
- data can be superimposed on top of geometry
- the color tables are user configurable and interpolate if requested

## SimpleGeo/DaVis3D

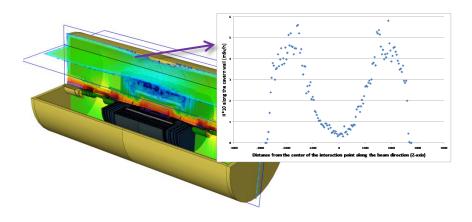


## Data extraction

### • 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 >=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

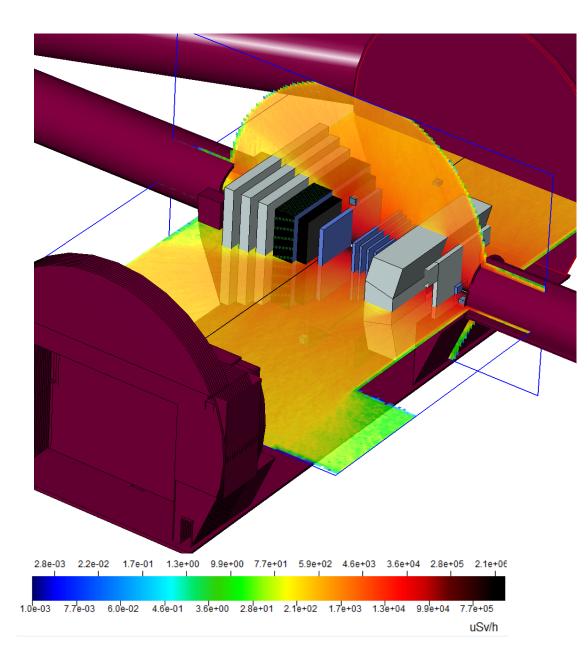
- Define arbitrary volume interactively while browsing the data.
- Calculate averages on-the-fly while moving the volume through the data set

## 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**

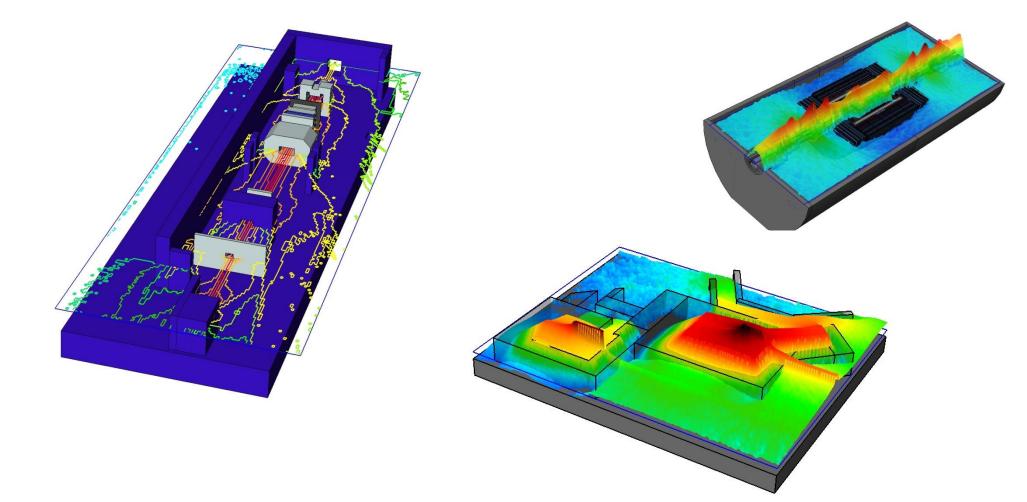


### Typical question:

Where is the dose >1 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

Select Plu	g Ins		
S. No	Plug-In Name	Plug-In Path	
0	PCloud 3D V 1.0 (c) 2006 C. Theis	C:\temp\plugintest\PCloud3D.plx	
1	PipsiCAD 3D V 2.2 (c) 2005, 2006 C. Theis,	C:\temp\plugintest\PipsiCAD3D.plx	
2	DaVis 3D Version 1.3 (c) 2005, 2006 C. Thei	C:\temp\plugintest\VDaVis3D.plx	
<	- 1007		>
Set plugin	path Load selected Plug-Ins		ОК
Last plager			

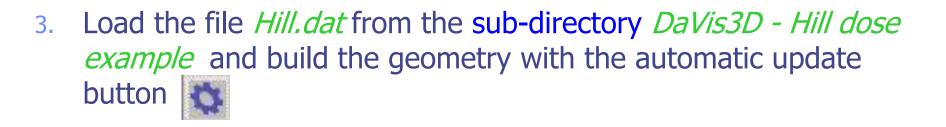
- 2. The path which is searched for the plugins can be set by the Set plugin path button.
- 3. Tick the check box next to the "DaVis 3D" plugin and click on Load selected plugins!
- 4. Click on OK.

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 USRBINs in parallel.

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



2. Activate the Space ball from the toolbar



4. Activate the plugin-dialog by pressing the plugin button DaVis3D

Load data Clear data Post-process data   XY - plane Pos Z   YZ - plane Pos X   ZX - plane Pos Y   Color plot Emphasize thresholds   Y Transparent 0   %     Pos Y     Pos Y   O     Nr of Y - bins   O   Origin X   Bin - size X   Value   Pror %     Pate extraction   Source-format     Plane     Extract	Wis3D	-		-	Sec. and	and a	il an	-		×
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YZ - plane Pos X   ZX - plane Pos Y   Color plot Emphasize thresholds   W Transparent 0   %     Qave legend     Legend settings   Palette   21   Emphasize thresholds     Pos Y   0   %     Qave legend     Legend settings   Palette   21   Emphasize thresholds     Pos Y   0   %     Qave legend     Legend settings   Palette   21   Emphasize thresholds   W rof X - bins   Origin X   O   Bin - size X   Cell   1   Value   Error %     Data extraction   Source-format   Plane   Extract     Message   Pinitializing DaVis20     III     III     Value   Version 3.6 (c) 2005 - 2009   C. Theis & K. H. Buchegger		.oad data	Clear	data	Post-process dat	a				
ZX - plane Pos Y   Color plot Emphasize thresholds   Z Transparent 0   Save legend Legend settings   Palette 21   Color plot Emphasize thresholds     Nr of X - bins O   Origin X Bin - size X   Source - format Plane     Plane Extract     Message   Plane     With italizing DaVis 3D     III     III     III     Pos Y   0   %     Pos Y   0   %     Image: State straction     Source-format     Plane     Image: State straction     Source-format     Plane     Image: Straction     Version 3.6 (c) 2005 - 2009   Color Straction     Image: Straction   Image: Straction   Image: Straction     Image: Straction     Image: Straction     Image: Straction <t< td=""><td>XY - plane</td><td></td><td></td><td></td><td></td><td></td><td></td><td>Pos Z</td><td>0</td><td></td></t<>	XY - plane							Pos Z	0	
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C. meis ara n. buchegger		s3D						Version 3.6	(c) 2005 - 20	09
							•	C. Theis & I	K. H. Buchegg	jer

## Screenshot of the main dialog

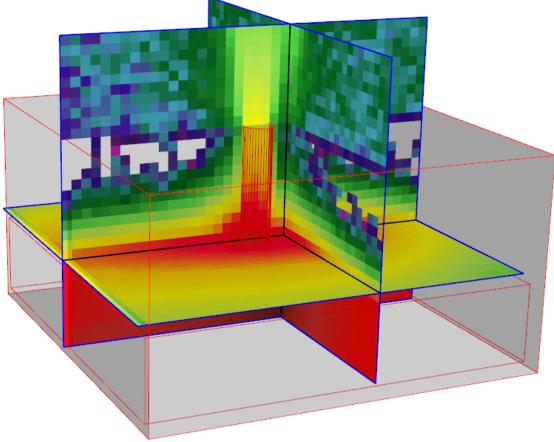
- Click on the \_\_\_\_\_ button to select the data file *Hill.amb74\_001.usrbin* in the sub-directory *DaVis3D - Hill dose example*. (This is an example of protons hitting a target in an underground area with a shaft to the surface).
- 2. Press the load button to load the data.
- 3. Tick one or more 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.

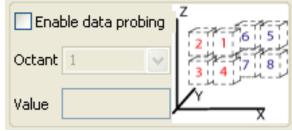
Save legend Legend settings Palette 21

• 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



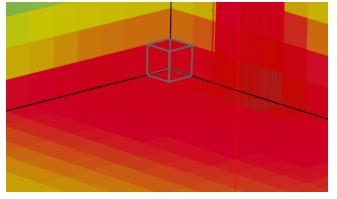
### Getting the results of one single bin:

 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.



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.

Data extraction —			
Source-format	Plane	~	Extract

\*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.

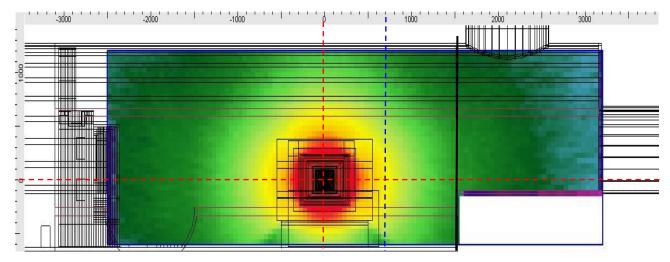
Getting the results of the values at the intersection of 2 planes = profile function.

- 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.

-Data extraction		
Source-format	Profile	Extract
	-	

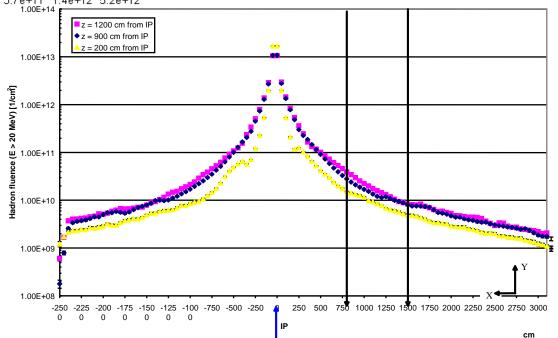
\* Version >= 3.5 also averaged profiles are available.

- 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.



1.9e+07 7.2e+07 2.7e+08 1.0e+09 3.7e+09 1.4e+10 5.2e+10 1.9e+11 7.2e+11 2.7e+12 1.0e+13

1.0e+07 3.7e+07 1.4e+08 5.2e+08 1.9e+09 7.2e+09 2.7e+10 1.0e+11 3.7e+11 1.4e+12 5.2e+12



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.

Average data	
Average FLUKA outputs	
Data files	
	Calculate
	Close
Add Remove all	
Result file	
Consider individual weights	
Message	
< >	
	,

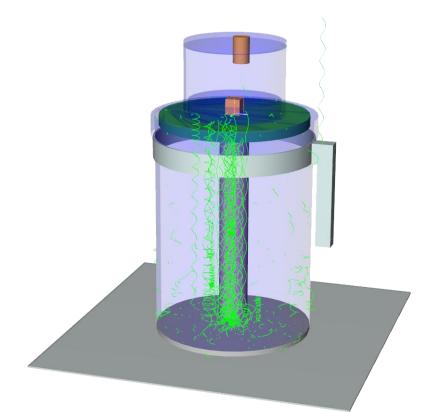
## **Available plugins**

## PipsiCAD 3D

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

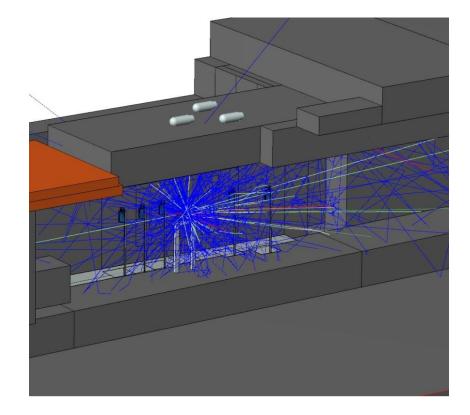
- reads ASCII files produced by available user routines
- superimposes color encoded particle tracks on top of geometry
- color encoding and transparency is user configurable
- interactive application of filters with respect to particle energy and particle type
- Animate particle tracks as a function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

- 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
- Optionally, you might select track evolution display and animate the resulting tracks. (see <u>www.cern.ch/theis/simplegeo/download/CERF\_tracks.avi</u> for an example)

Please refer to the manual for a more detailed description.

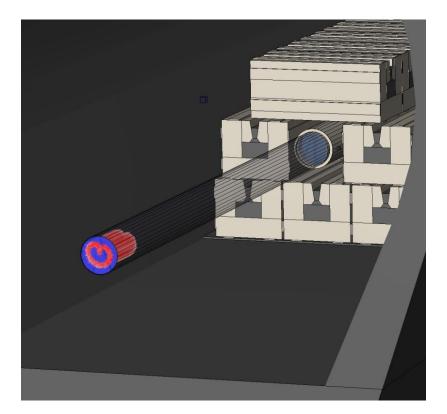
## **Available plugins**

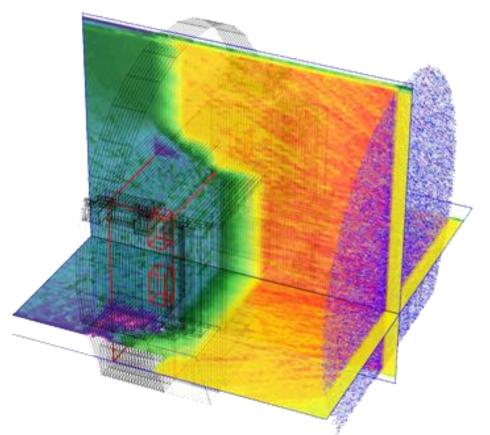
### PCloud 3D

- 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



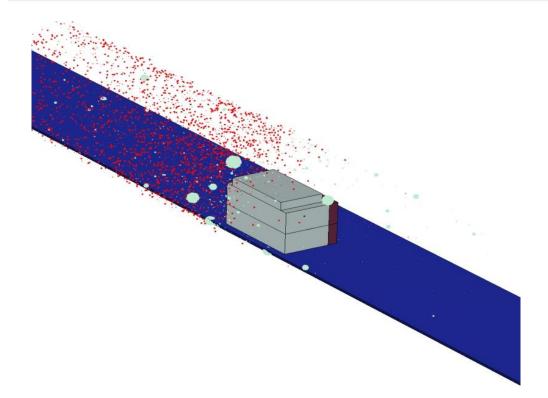


Verification of a special beam particle distribution

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

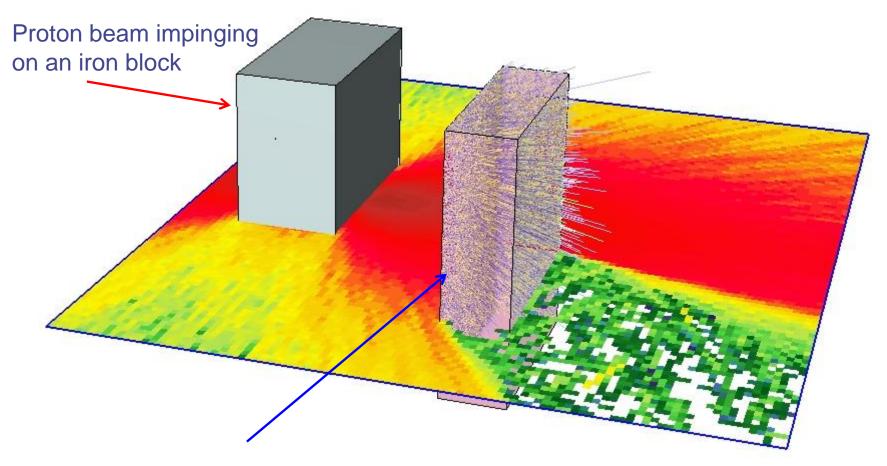
Courtesy of J. Vollaire

## IsoVis3D



- 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



Secondary particles entering a second iron block