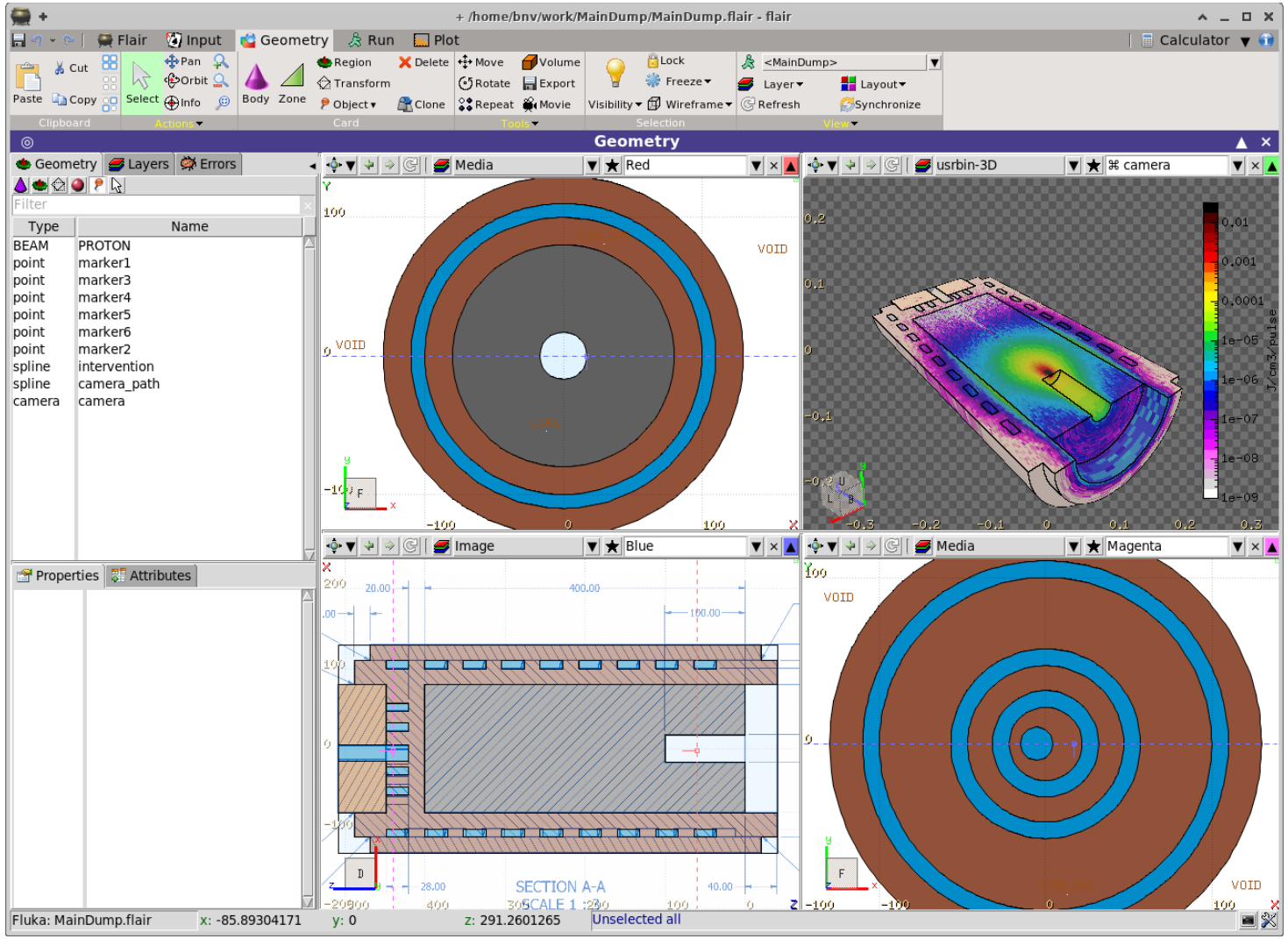
Flair advanced exercise

Discovering some advance features in flair

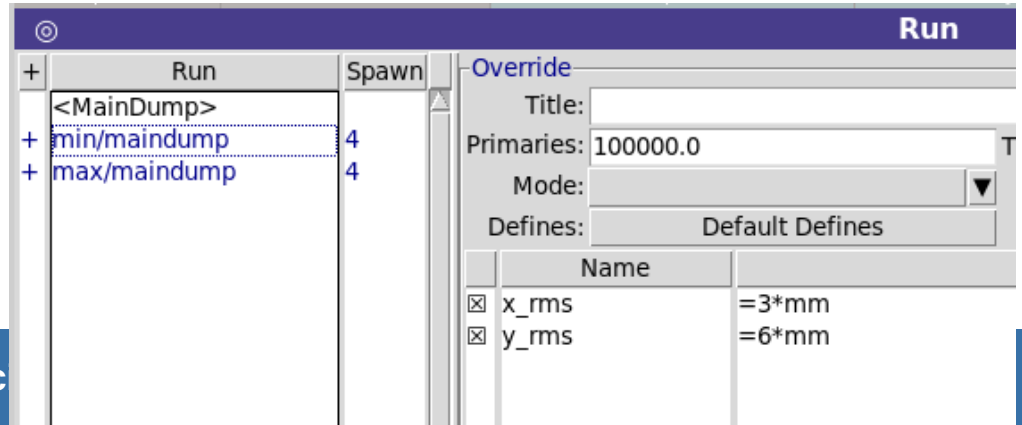
Flair advance exercise - Aim

- Compare the energy deposition and adiabatic temperature rise for two run scenarios with the LINAC4 main dump
- Geometry editor
  - Learn the use of Layers
  - Discover the 3D capabilities
  - Use a technical drawing in the geometry editor
  - Usrbin layer mapping 2D & 3D with multiple detectors
- Multiple plots with proper normalization
- Create an intervention planning scenario
- Create a short movie of the target



Flair advance exercise – 2 beam size scenarios

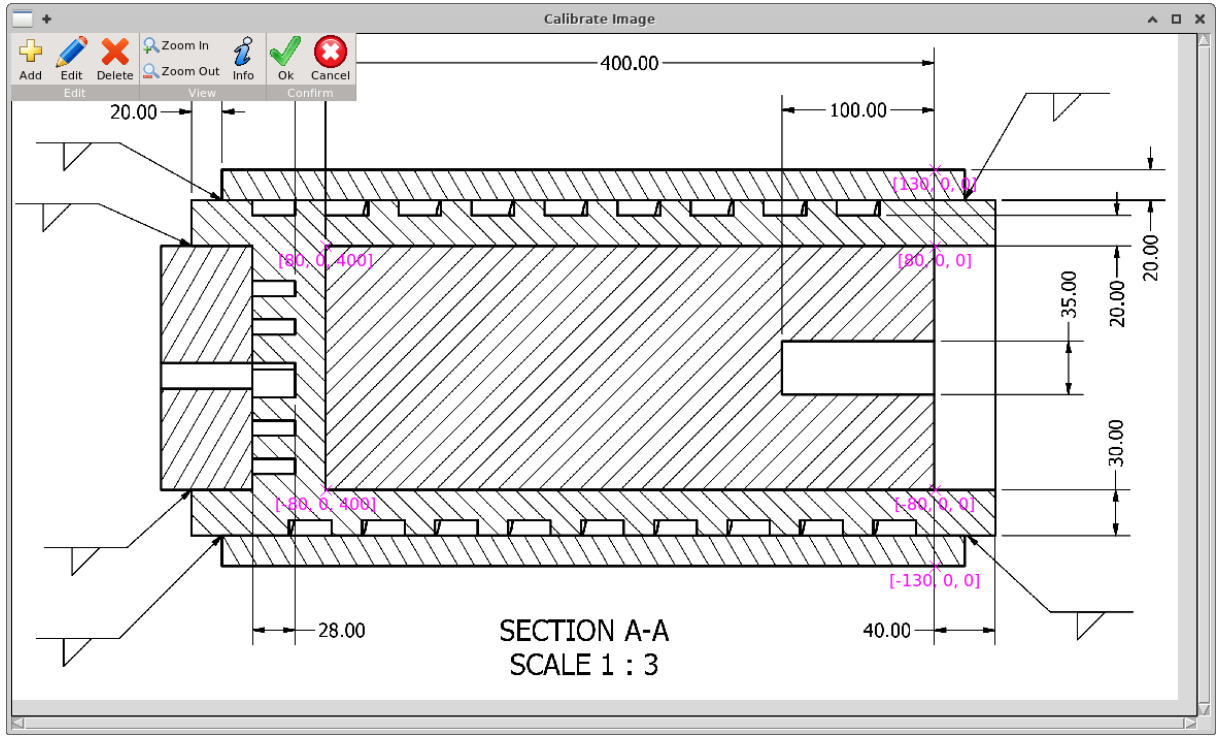
1. Download the MainDump.flair project as well the auxiliary files (Main_Dump.png, Blue-Image.png, Green-usrbin-3D.png and optionally the pdf document)
2. Inspect the input, it describes the LINAC4 main dump.
   - In the project notes you have the beam description
   - the graphite core material
   - The dump is made from a graphite core inside an iron jacket with a spiral water coil
   - There are a few predefined USRBIN detectors:
     - 21 energy deposition coarse and fine mesh
     - 22 dose equivalent everywhere
3. Create two #define variables in the input to hold the x&y beam rms (e.g. x_rms and y_rms)
   - modify the BEAM card to Gaussian with a FWHM as a function of the x&y beam rms variables
4. In the Run→Run tab create two runs
   i. min/maindump and set the x&y rms to correspond to the small beam size 3 x 6 mm RMS
   ii. max/maindump and set the x&y rms to the big beam size 6 x 8 mm RMS
5. Override the number of primaries to 100’000
6. Spawn both runs to 4 cpus for 5 cycles
7. Perform the runs



Flair advance exercise – Image calibration

while the run is going on profit to create a new layer with the technical drawing

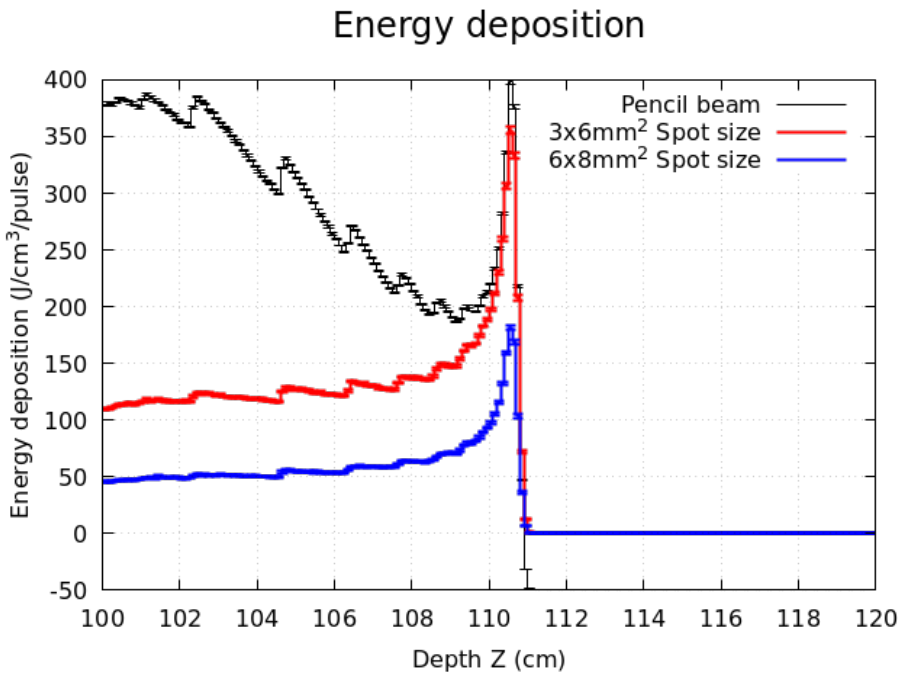
1. Go to the Geometry editor
2. Select the layers tab
3. Add a new layer name it as “Image”
4. Insert the “Image” option in the new layer
5. Load the “Main_Dump.png” file
6. Calibrate the image with the coordinates of at least 4 points
7. Adjust the transparency and the background color
8. Tick the “prompt draw”
9. Go in one of the viewports e.g. Blue and select the Image layer
10. Check if everything looks ok

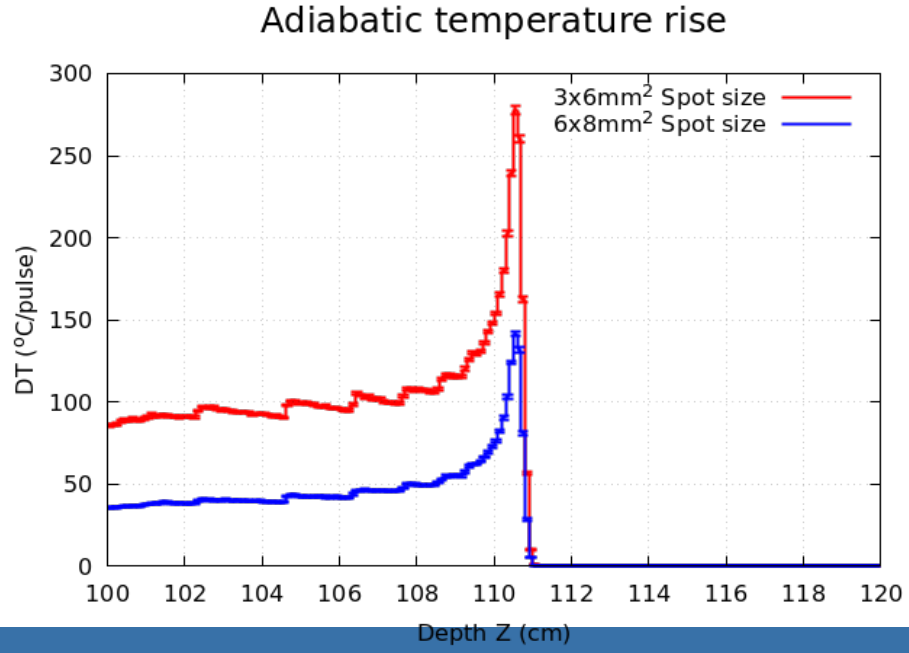


Flair advance exercise – Plots

when the runs have finished

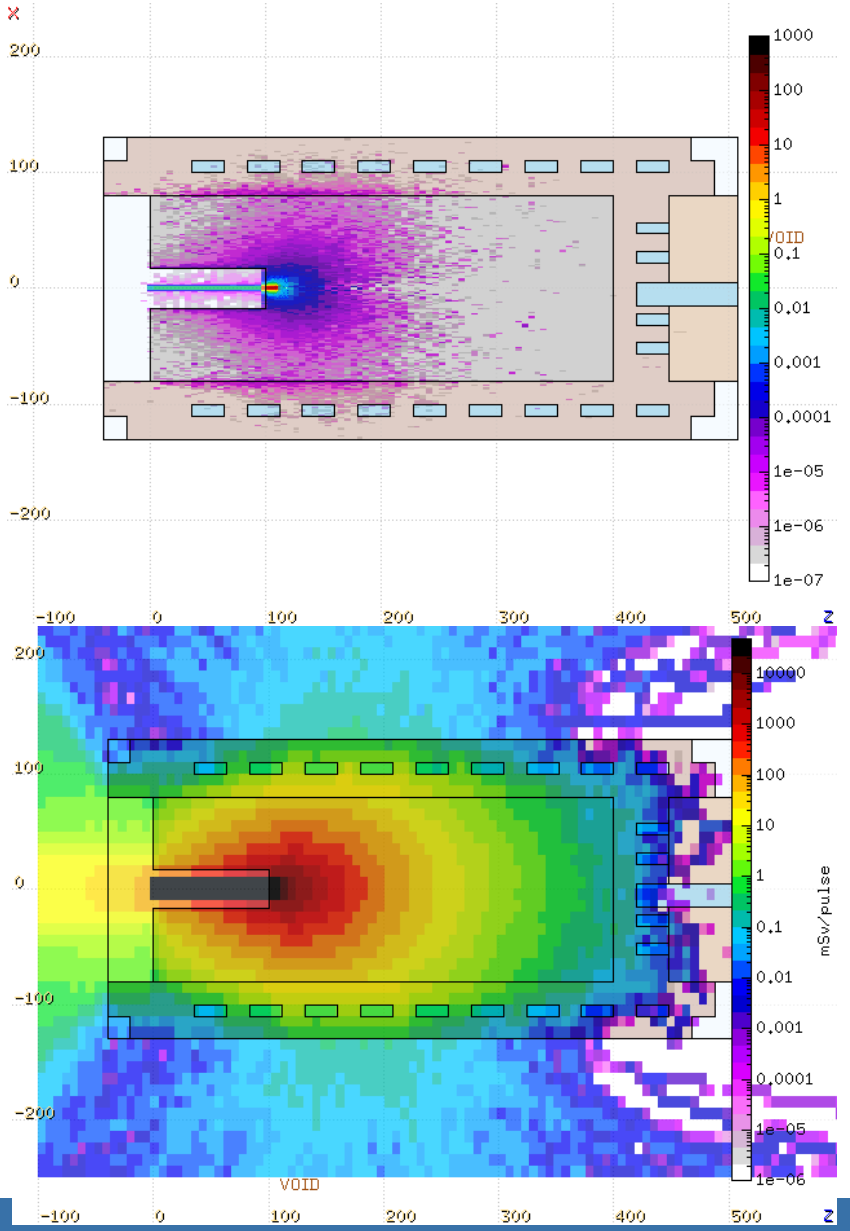
- process the detectors in the Run→Data
- In the Plot tab create a few plots
  1. min_1dmax: USRBIN 1D Maximum trace plot of the energy deposition with the energyFine mesh detector 21 energy for the minimum beam run
  2. max_1dmax: same as above for the maximum beam run
  3. energy: Usr-1D plot where you load the min_1dmax and max_1dmax as detectors
     Use the proper normalization to convert the simulated result from GeV/cm^3/p → J/cm^3/pulse
     Remember: 1 pulse is 40mA for 400us (us=micro second)
  4. temperature: Usr-1D plot with the adiabatic temperature rise in the graphite core for both scenarios. Specific heat of graphite C_p=699 J/kg/C





Flair advance exercise – Geometry Layers

- Create two additional layers in the geometry editor
  1. 3D with the usrbin of the energy deposition using both 21(energy) meshes for the min-scenario (Coarse and Fine)
     You need to add the following options:
     i. 3D – clip by the clipping plane to see half of the target
     ii. Usrbin with the minimum beam 21 energyC
     iii. Usrbin2 with the minimum beam scenario 21 energyF
     iv. Use the proper normalization to convert from GeV/cm^3/primary → J/cm^3/pulse
  2. 2D usrbin with the 22 (eq.dose) mesh for the min-scenario
     Normalize from pSv/p → mSv/pulse

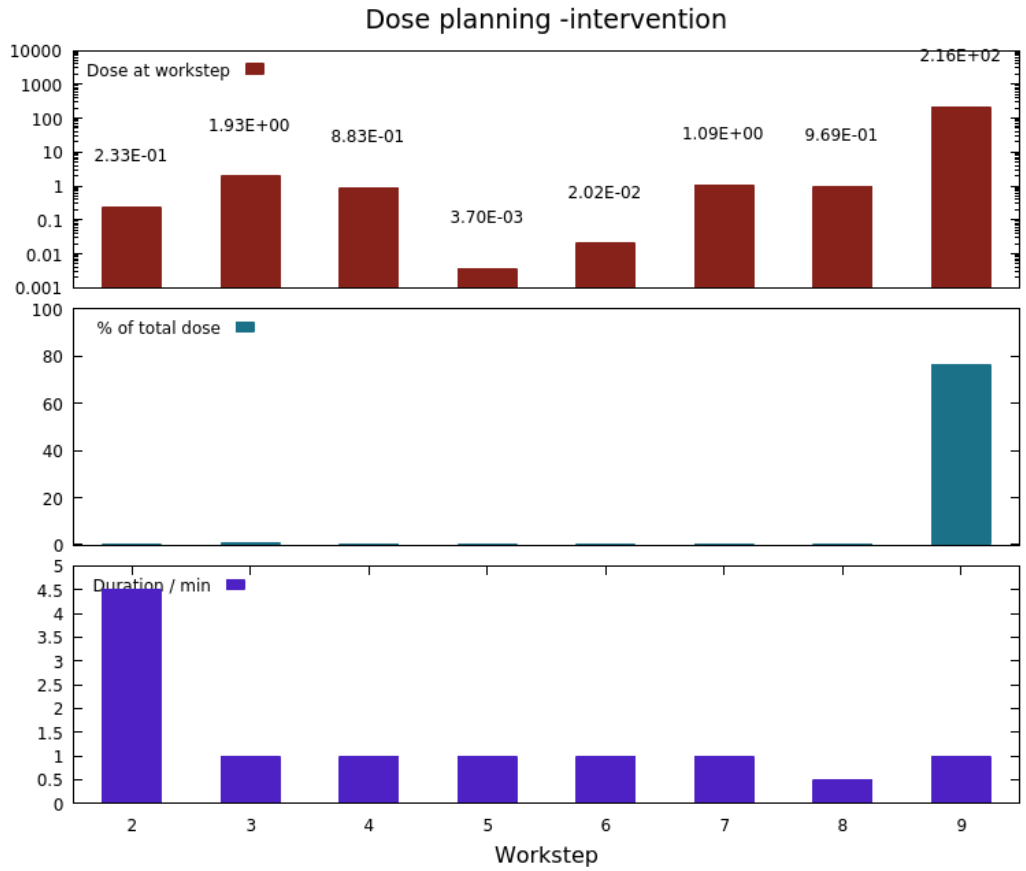


Flair advance exercise – Planner (optionally)

Using the 2D eq dose layer perform an intervention planning scenario

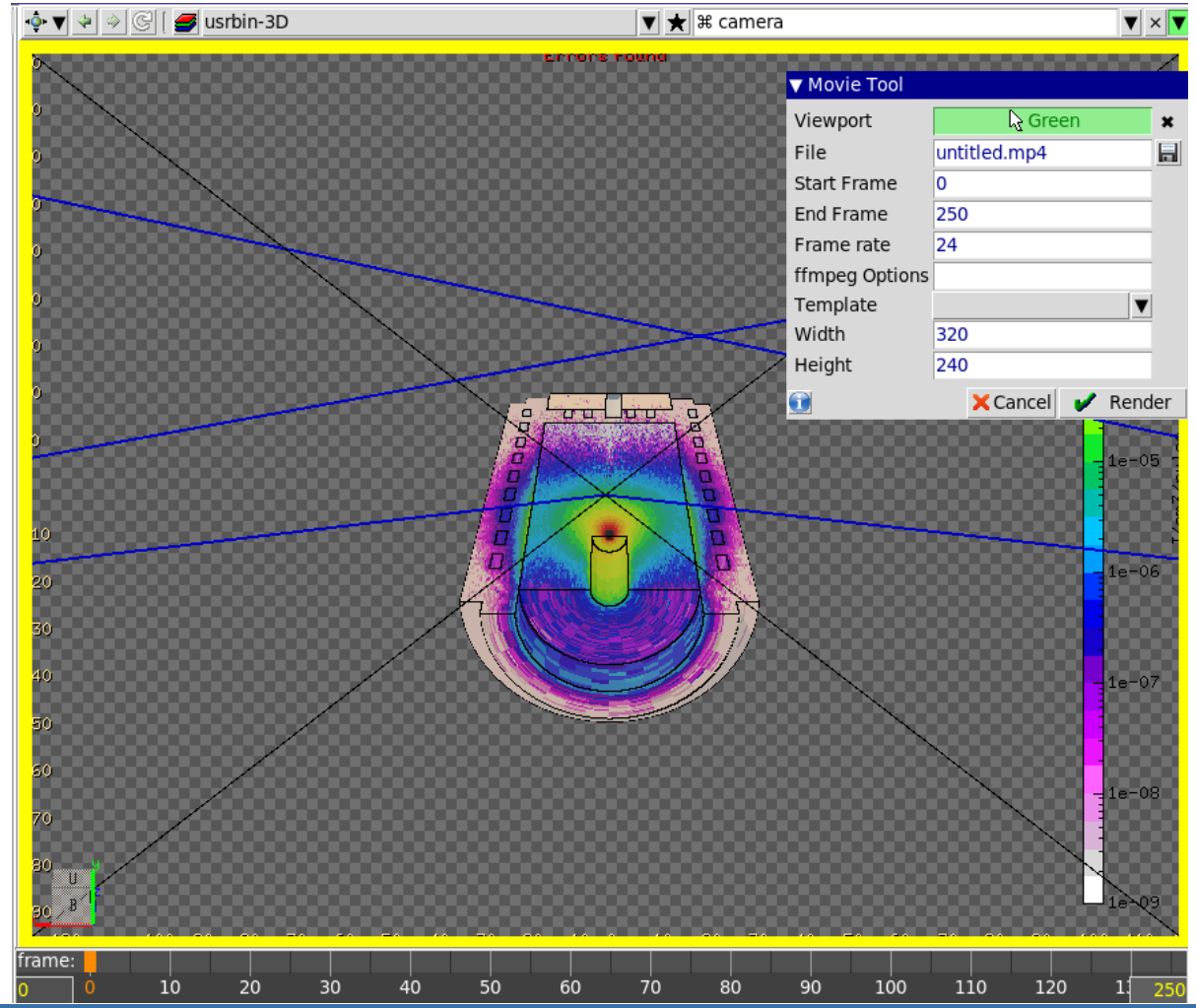
1. Create a spline path along the Z-X projection around the target
2. Use at least 6 nodes
3. The path can be either closed or open
4. In the Input editor adjust the node time.
   Default value is seconds but you can use minutes,
   if you provide 60 as scaling factor
5. In the geometry editor open the planner tool
   i. Select the viewport with the 2D usrbin
   ii. Select the spline path
   iii. Set time scaling to 60 if you have used minutes in the time nodes
   iv. Provide a file name e.g. “planner.dat”
6. Calculate

7. In a terminal open gnuplot and type
   - $ gnuplot
   - gnuplot> load “planner.dat”



Flair advance exercise – Movie (optionally)

Using the 3D energy deposition layer perform a movie around the target
… follow the lectures slides for instructions…

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