Flair intermediate hands on

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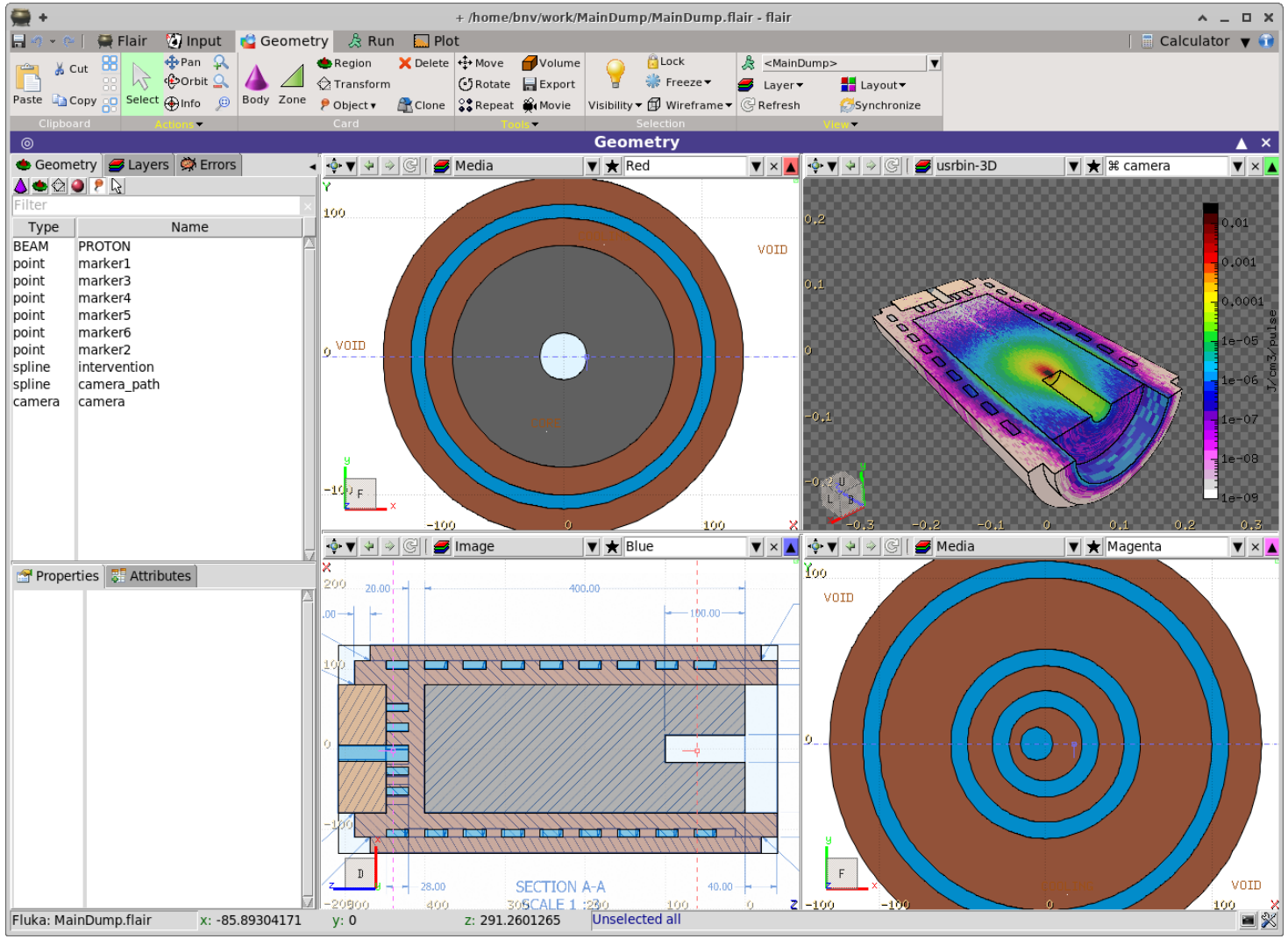
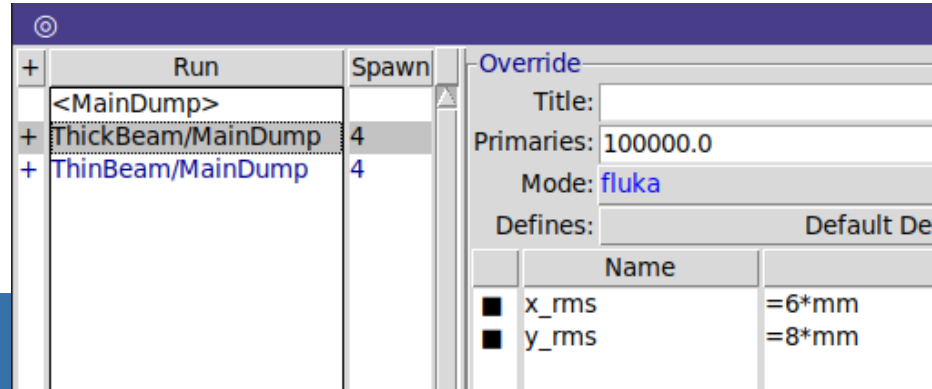
Flair intermediate hands on - aims

- Compare the energy deposition and adiabatic temperature rise for two run scenarios with the CERN 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



Flair intermediate hands on– 2 beam size scenarios

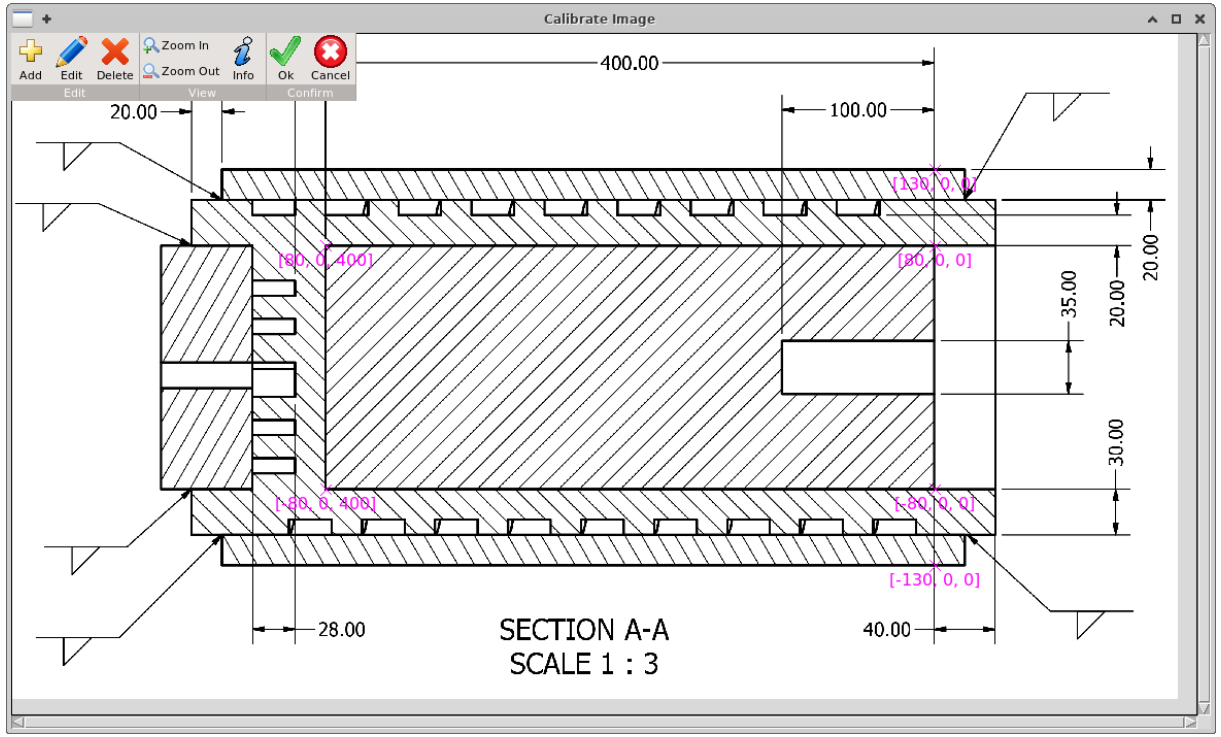
1. Download the MainDump.flair project as well the auxiliary file Main_Dump.png (and optionally the pdf document)
2. Inspect the input, it describes the CERN LINAC4 main dump.
   - In the project notes you have the beam description
   - The dump is made from a graphite core inside an iron jacket with 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. ThickBeam/MainDump and set the x&y rms to correspond to the small beam size 3 x 6 mm RMS
   ii. ThinBeam/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 intermediate hands on – Image calibration

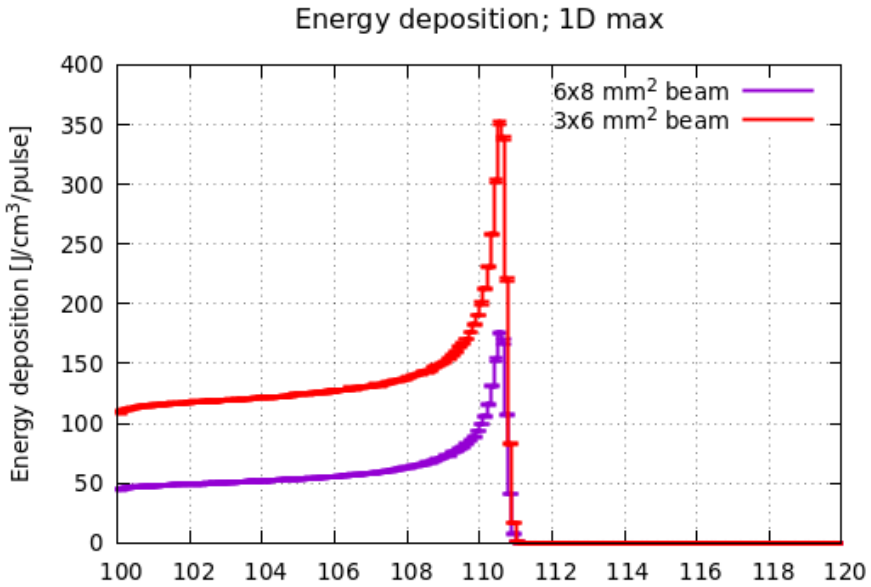
- While the run is going on profit to create a new layer with the technical drawing

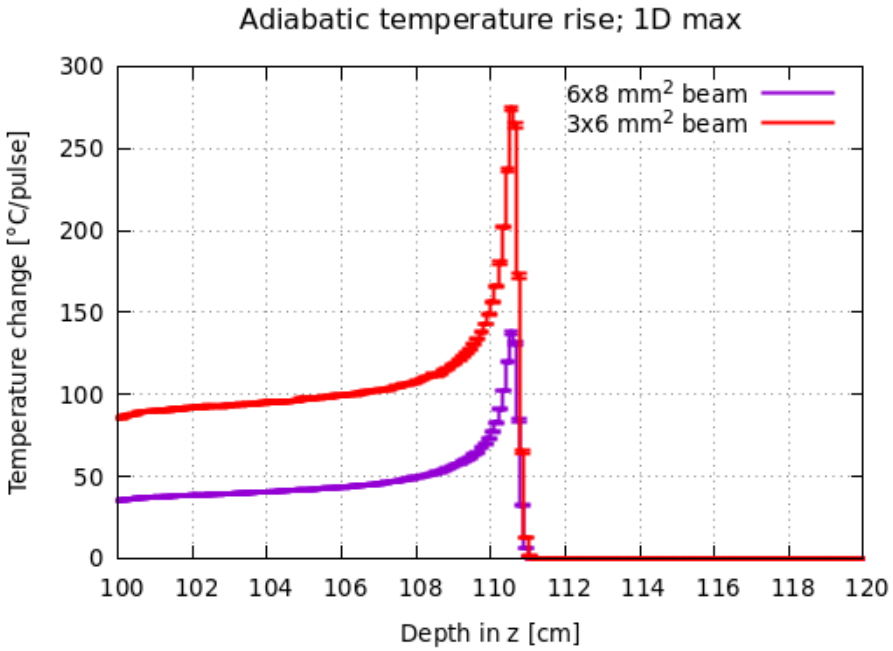
1. Go to the Geometry editor
2. Select the layers tab
3. Add a new layer name it as “Image”
4. Insert the “Image” option in the new layer
5. Load the “Main_Dump.png” file
6. Calibrate the image with the coordinates of at least 4 points (objects: points may be of help)
7. Adjust the transparency and the 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 intermediate hands on– Plots

- When the runs have finished
- process the detectors in the Run→Data
- In the Plot tab create few plots
  1. ThinBeam_1Dmax_fine : USRBIN 1D Maximum trace plot of the energy deposition with the energy fine mesh detector 21 for the thin beam run. Take a look to the gnuplot commands used by clicking the output symbol (black terminal).
  2. ThickBeam_1Dmax_fine : same as above for the thick beam run.
  3. Energy: Usr-1D plot where you load the ThinBeam_1Dmax_fin and ThickBeam_1Dmax_fine as detectors.
     Use the proper normalization to convert the simulated result from GeV/cm^3/p → J/cm^3/pulse (the calculator tab may be of help)
  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

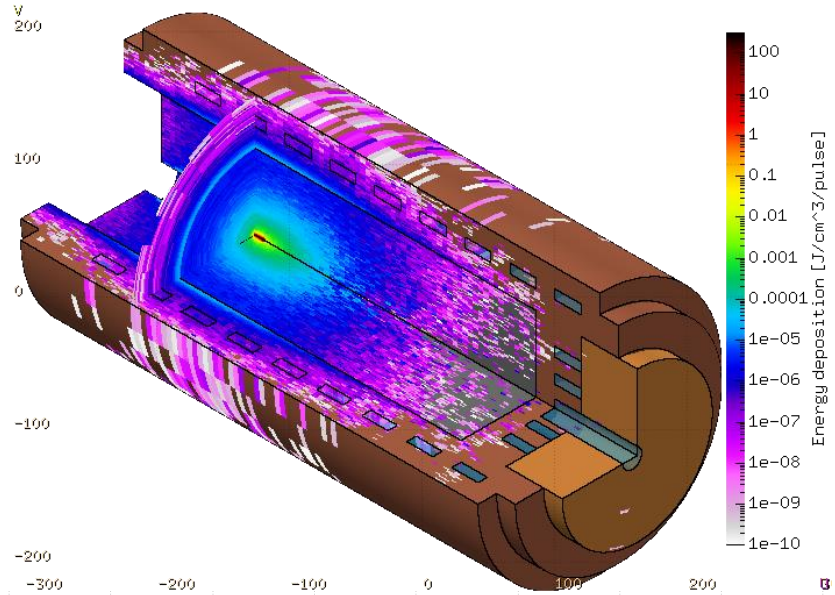


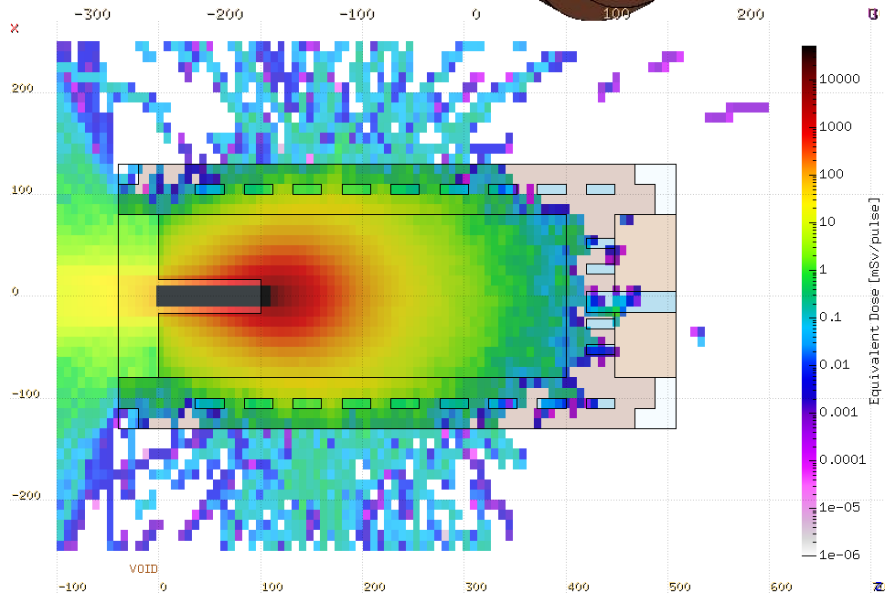


Flair intermediate hands on – Geometry Layers

- Create two additional layers in the geometry editor
  1. 3D with the usrbin of the energy deposition using both 21(energy) meshes for the thin-scenario (Coarse and Fine)
     You need to add the following options:
     i. 3D – clip by the clipping plane (or RCC) to see inside the target. Try also to project a body (option below clipping)
     ii. Usrbin with the thin beam 21 energyC
     iii. Usrbin2 with the thin 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

- Create some nice pictures to be exported from the geometry tab to the project notes.





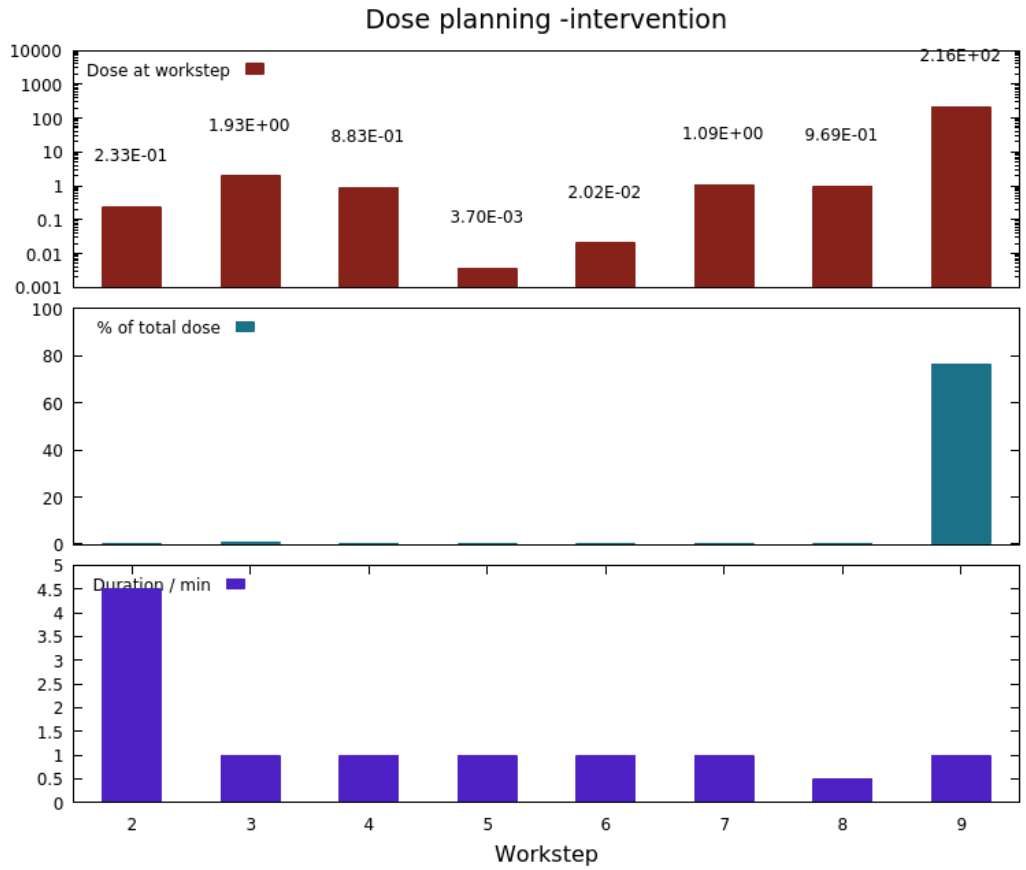

FLUKA

Flair intermediate hands on – Planner (optional)

- 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 intermediate hands on – Movie (optional)

- Using the 3D energy deposition layer perform a movie around the target
  - … follow the lecture's backup slides for instructions…