First FLUKA Simulation of TOFpRad

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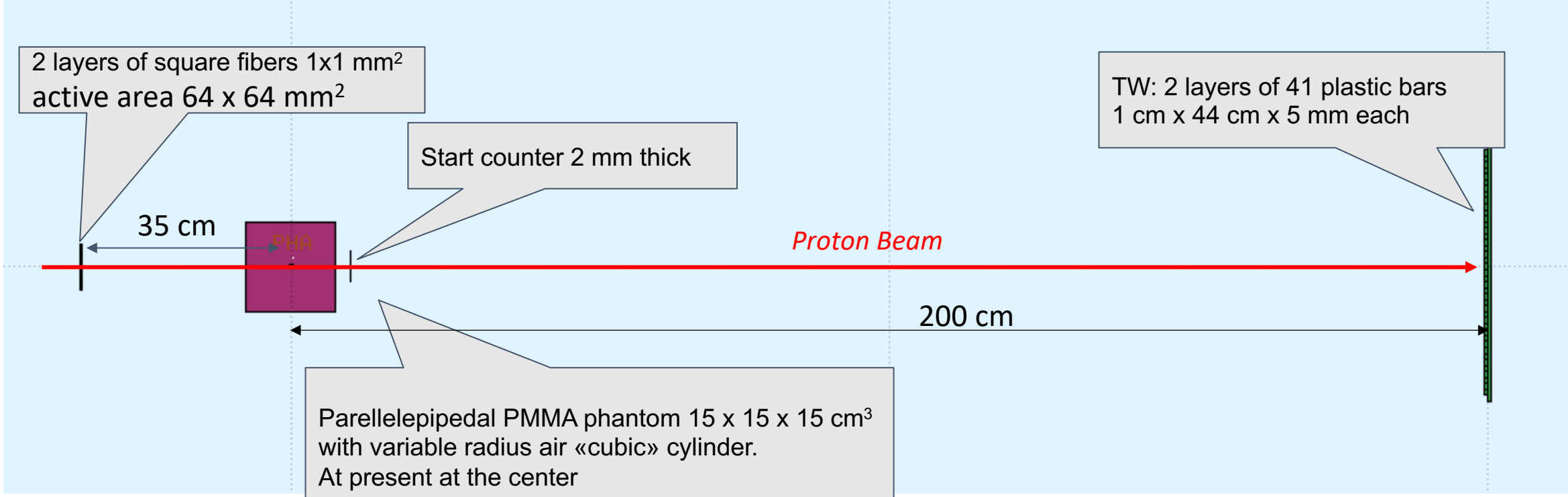
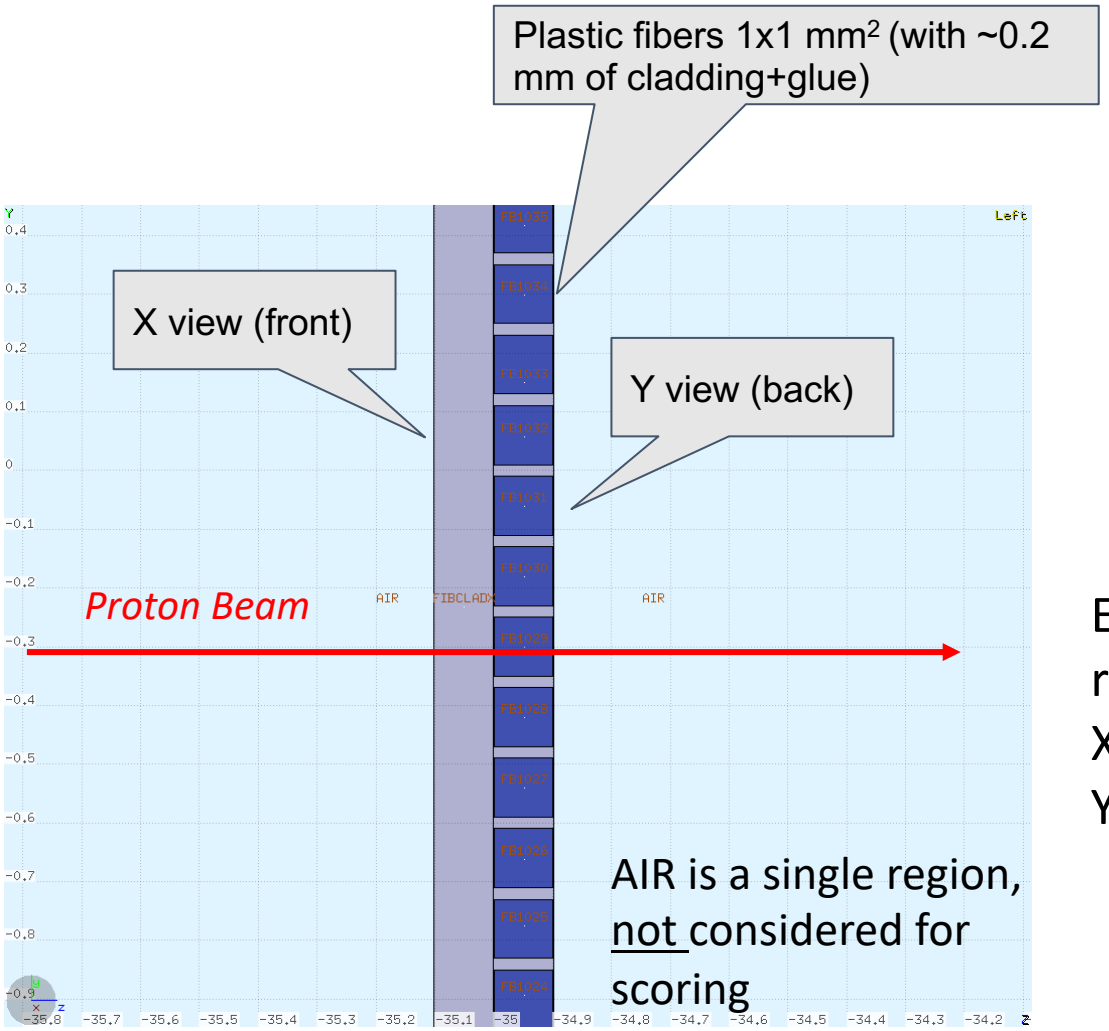
The geometry

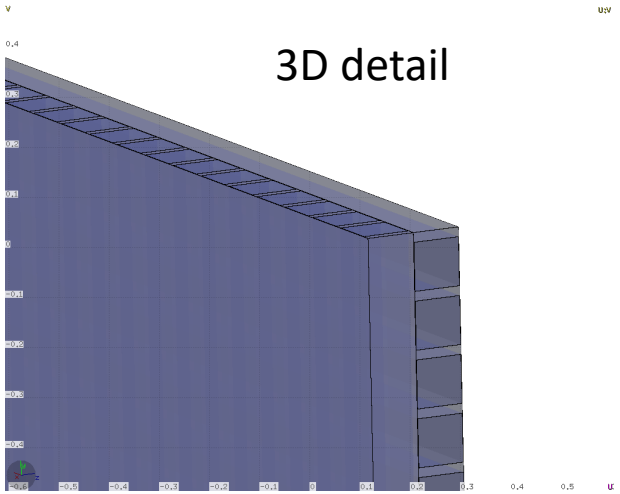


Origin of coordinates set at the center of the phantom

Proton beam: E = 228.57 MeV, FWHM (x,y) = 0.737 cm at isocenter
[from A. Mirandola et al., Med. Phys. 42 (9) p. 5287, 2015]

The geometry details: the fiber Beam Monitor





Each individual 1x1 mm² fiber is a separate region considered for hit scoring:

X view: from FB0000 to FB0063

Y view: from FB1000 to FB1063

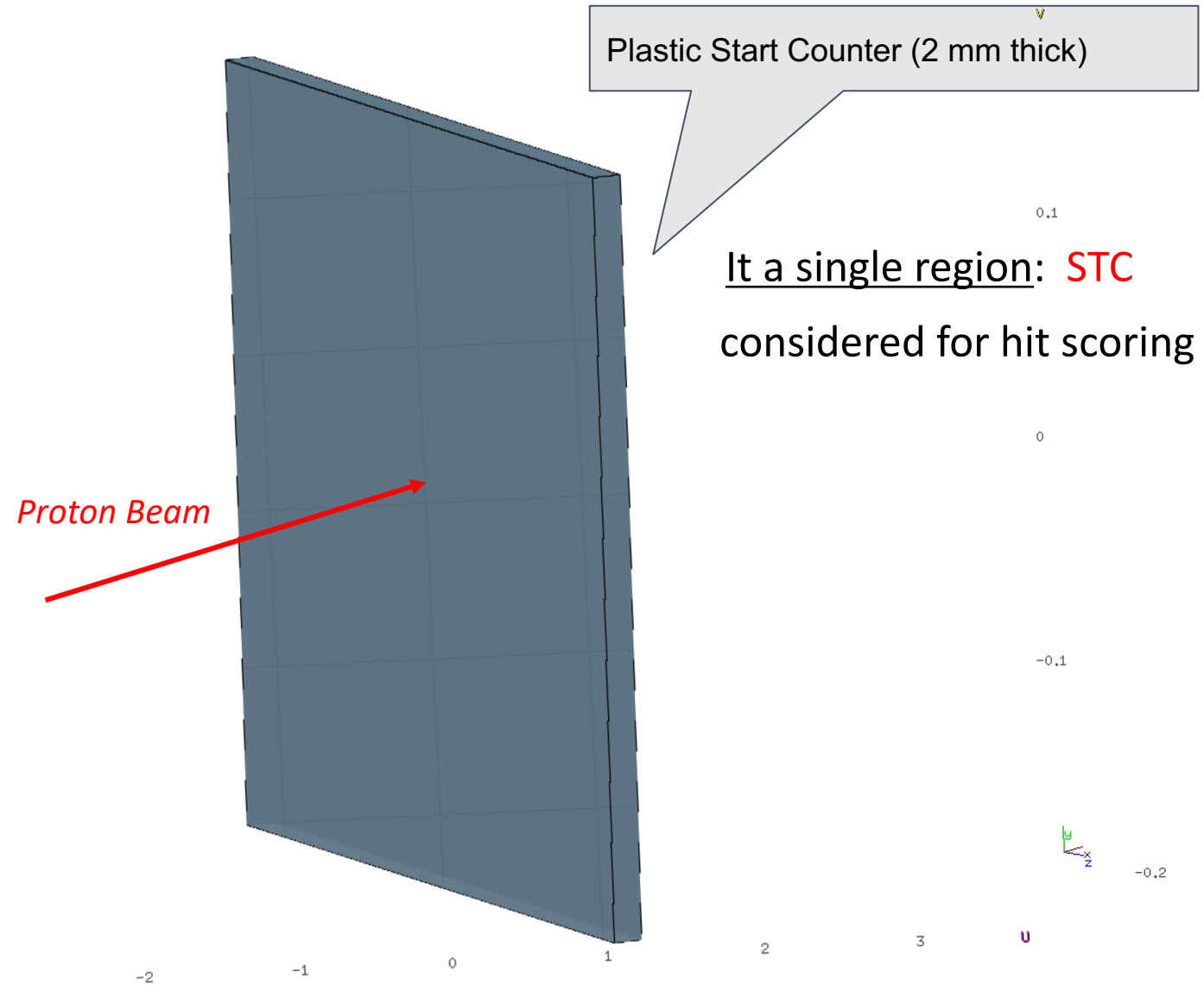
Layer index

Fiber index

The cladding is another region, not considered for scoring

The geometry details: the Start Counter

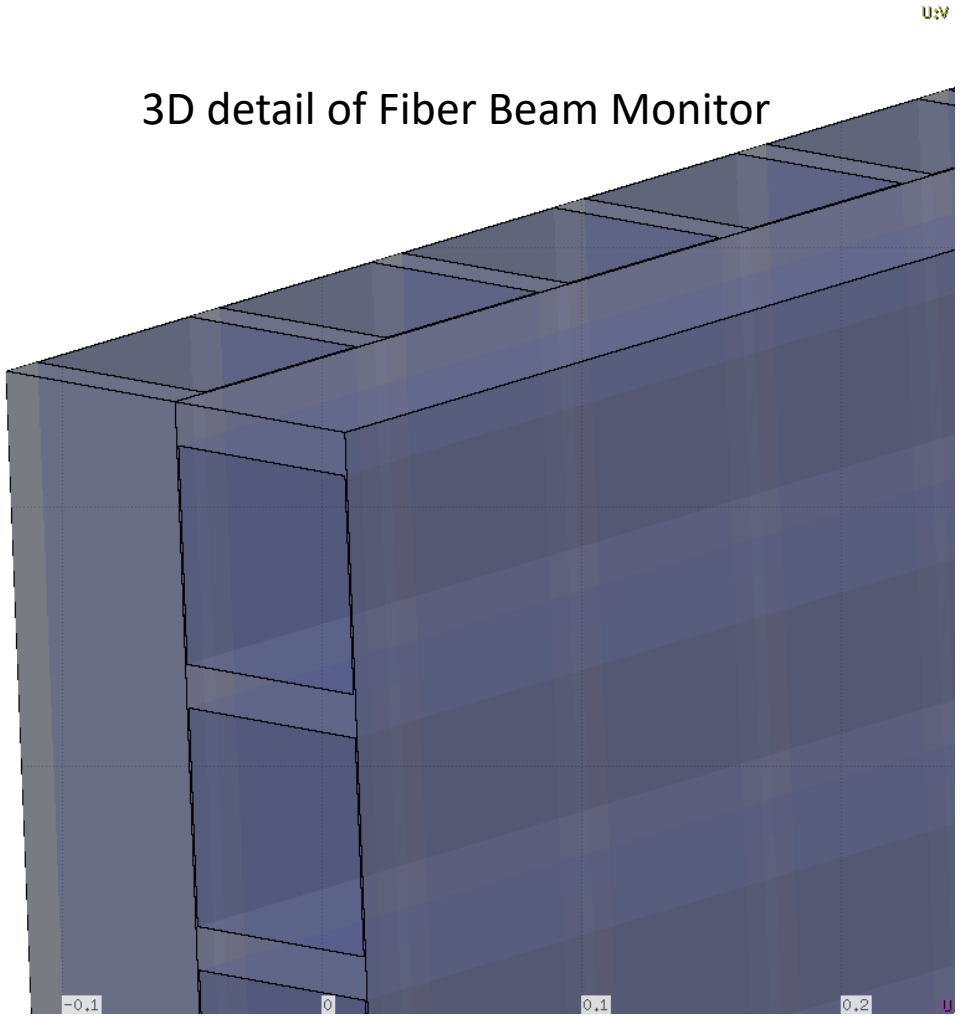
Plastic Start Counter (2 mm thick)



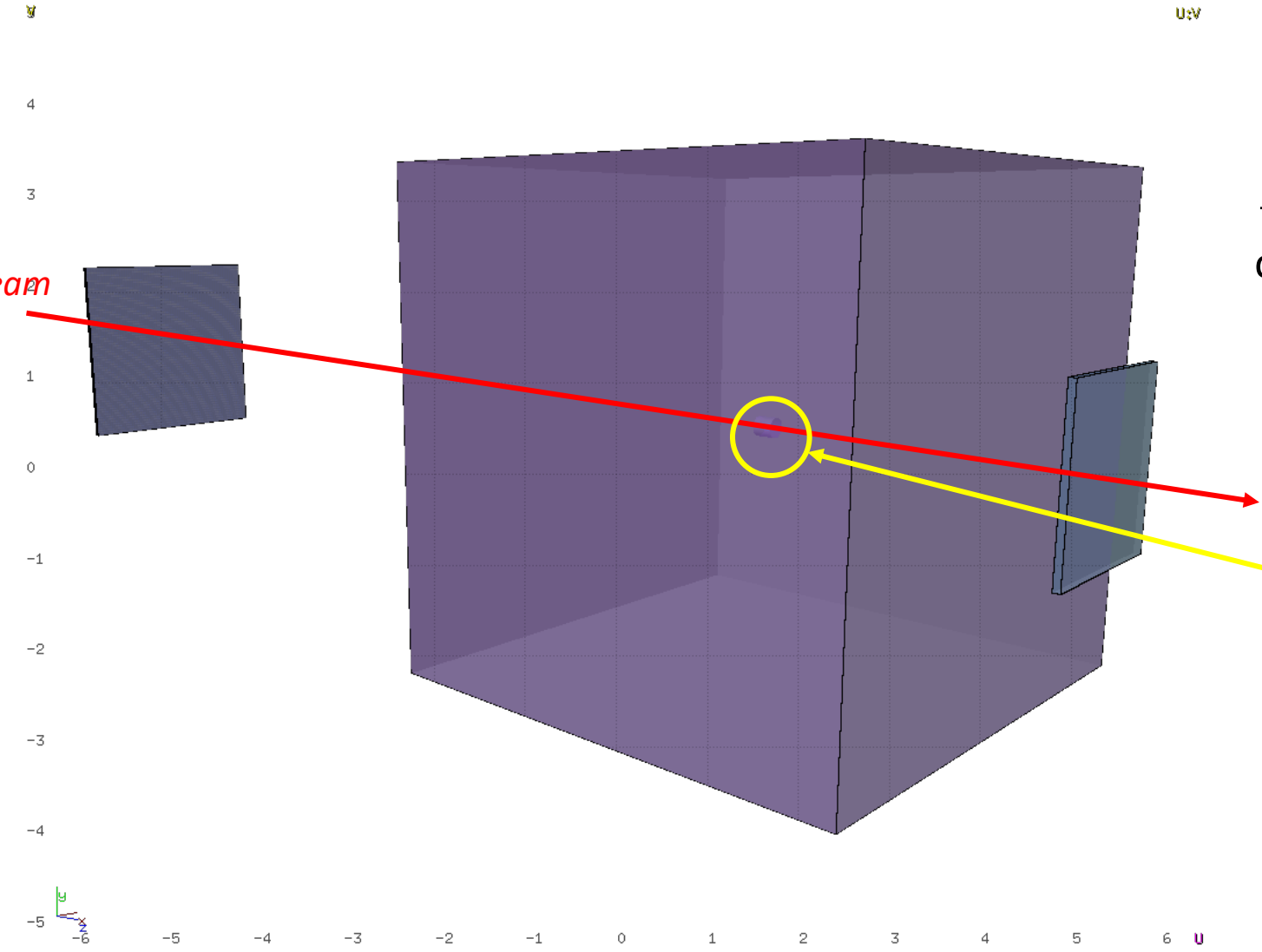
It a single region: STC

considered for hit scoring

3D detail of Fiber Beam Monitor



The geometry details: the Phantom and the Air Insert



It a single region: PHA

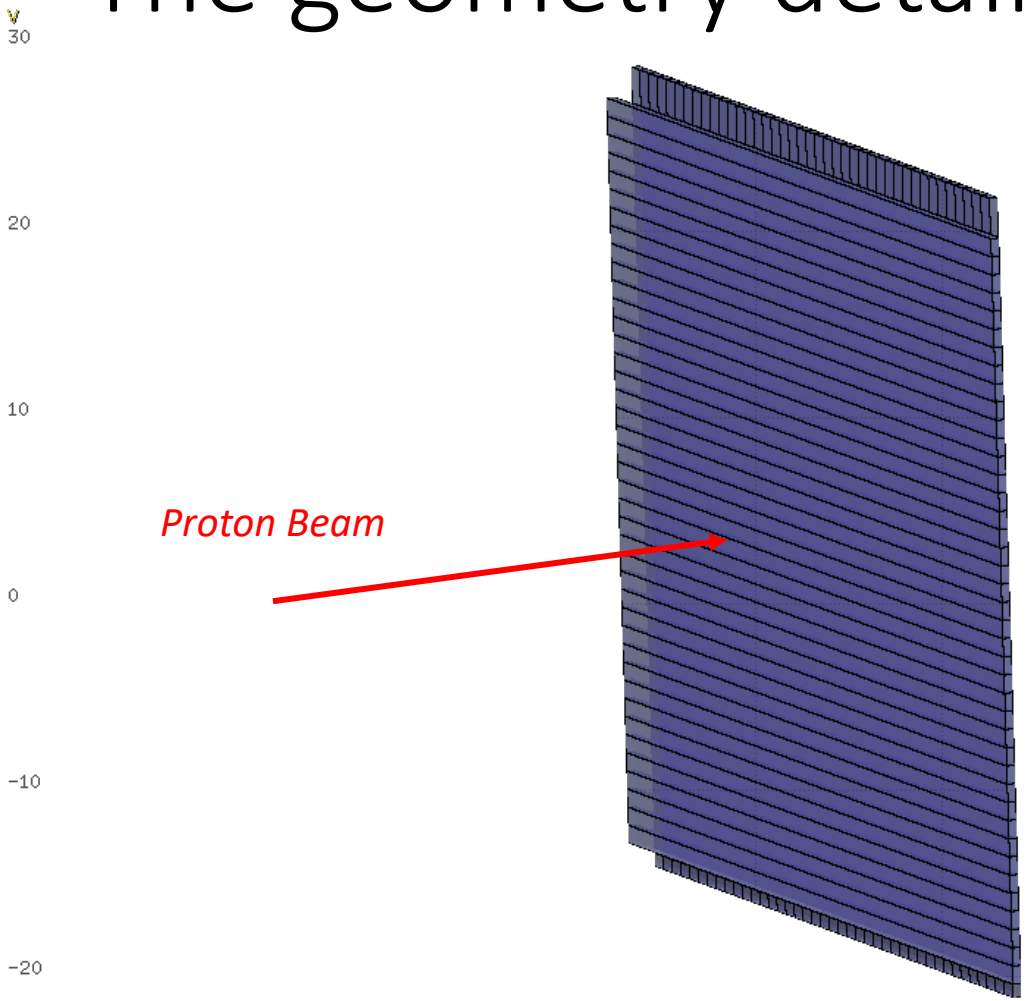
considered for hit scoring

AIR cyliner insert.

It a single region: INS

considered for hit scoring

The geometry details: the Tof Wall



Each individual scintillator bar is a separate region considered for hit scoring:

X view (horiz. bars, front layer): from SCN100 to SCN140

Y view (vert. bars, rear layer): from SCN040 to SCN040

Layer index

Bar index

We have maintained the anti-intuitive convention of marking the front layer with 1 and the back layer with 0, as in FOOT

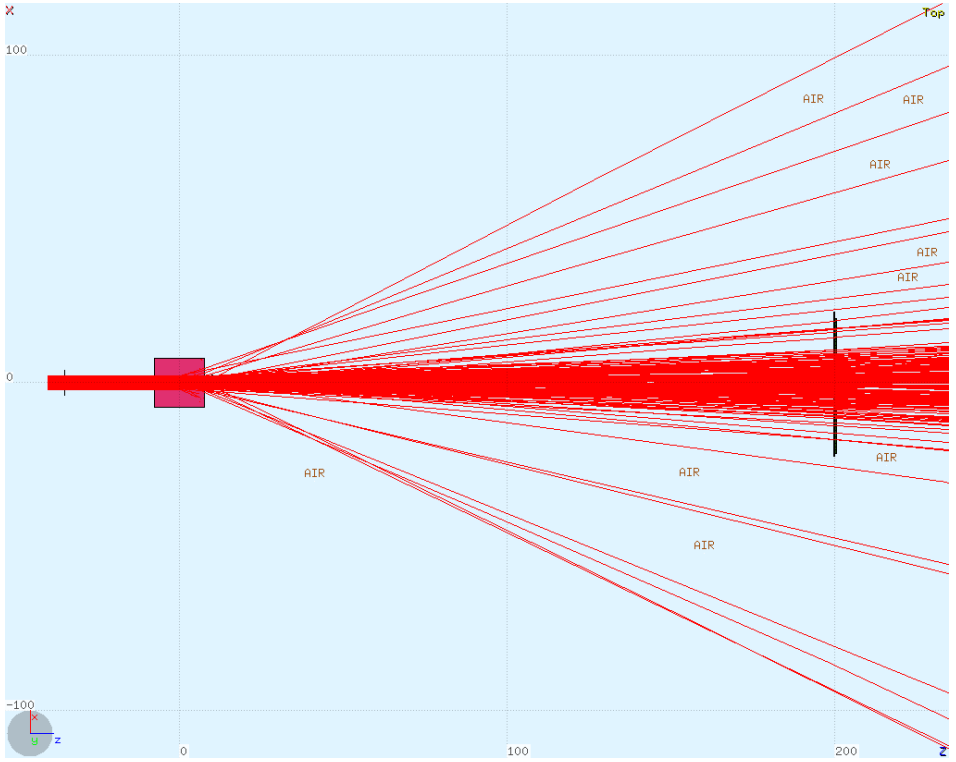
Details and event by event output

- We consider the following regions: AIR, Start Counter (SC), Fiber Beam Monitor (FB), Fiber Cladding (FIBCLADX, FIBCLADY), Phantom (PHA), Air Insert (INS) and TofWall (TW)
- Of these regions all are considered detectors with the exception of AIR, FIBCLADX and FIBCLADY
- Txt2Root to get the root output from the TXT.dat is ready
- A working template of AnaFluka to read the root output, capable of reading the hit variables of all detector regions is ready

First exercise

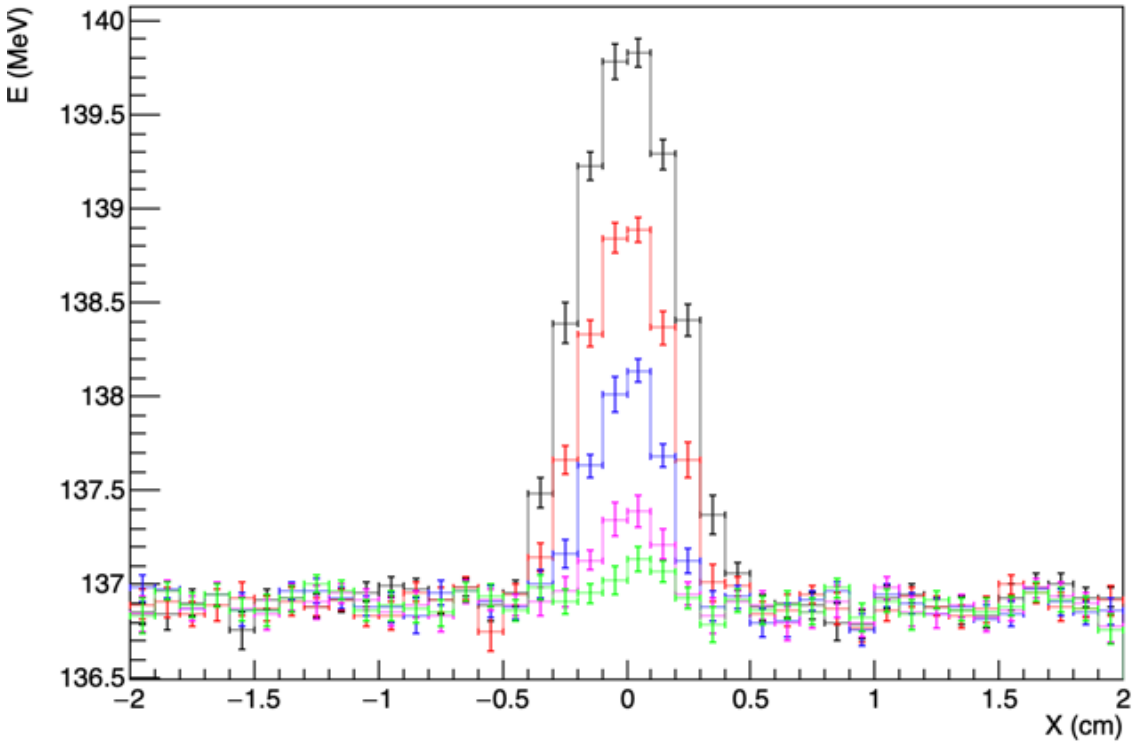
- 10^6 primaries shot on a “screen-saver” regione of 2x2 cm^2 varying the size of the air insert at the center of the phantom (r = 1.0, 1.5, 2.0, 2.5, 3.0 mm)

- Analysis: energy and TOF measured as a function of X in (-2 cm, 2 cm), as read in fiber tracker, for a band in Y of 5 mm wide
- A TOF resolution of 50 ps has been considered

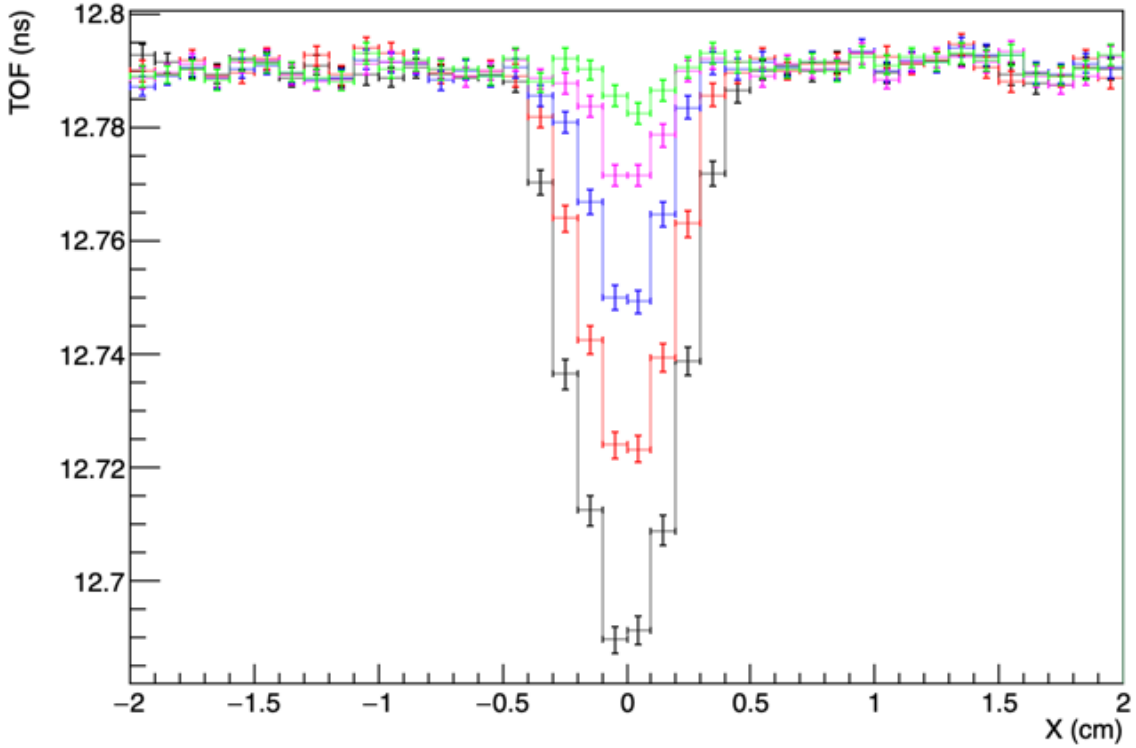


r = 1.0 mm
r = 1.5 mm
r = 2.0 mm
r = 2.5 mm
r = 3.0 mm

Energy at TW

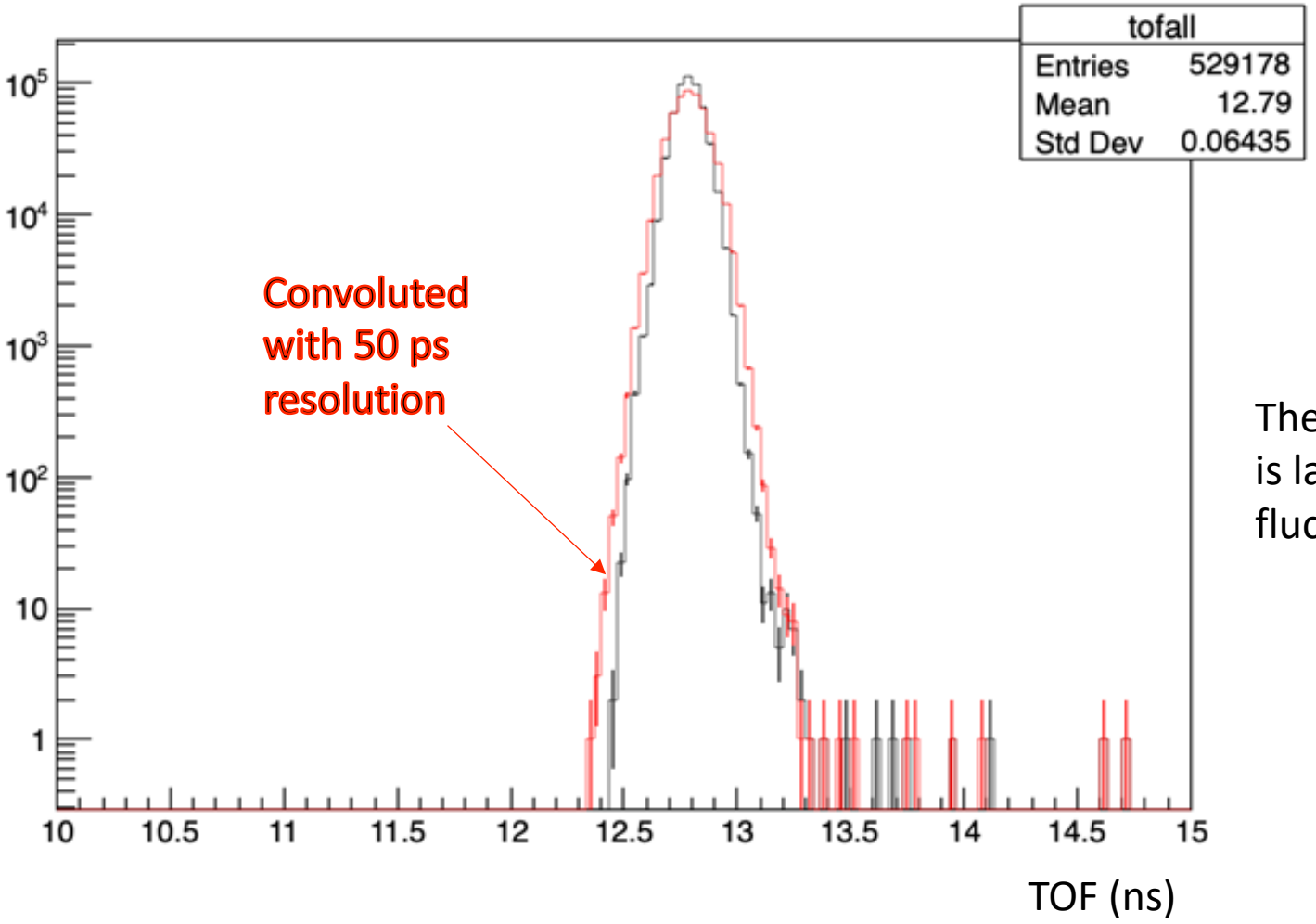


TOF



~12500 protons contribute to each bin (1x5 mm^2)

TOF distribution for all tracks reaching the TW



The width of TOF distribution is largely dominated by E loss fluctuations or path length