Top of Instrument Interactions and material inhomogenities

N. Tomassetti, INFN Perugia
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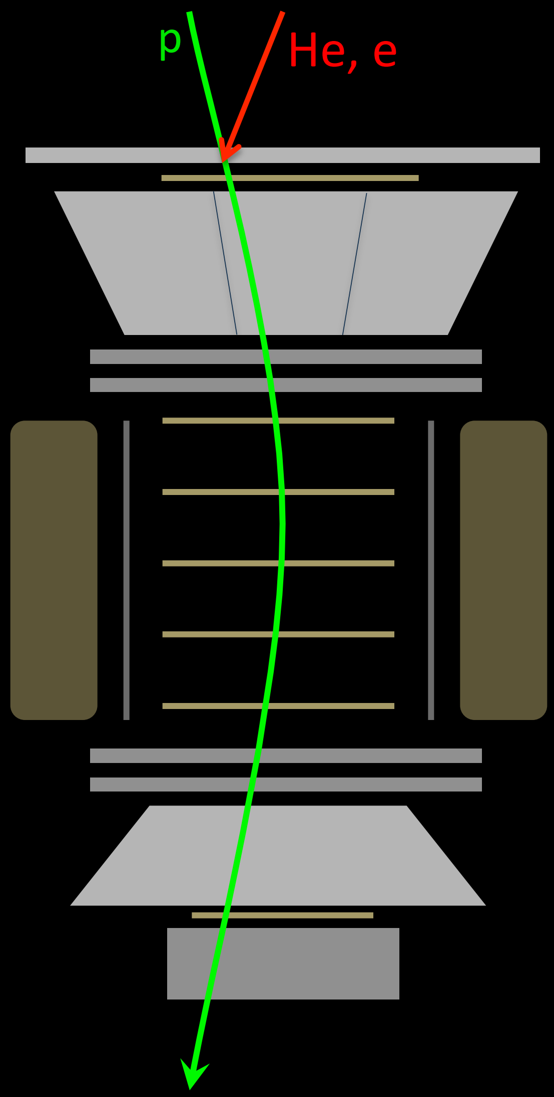
TOI Interactions



Protons, He and e+- interact in TOI material elements, but interaction probabilities are different

He/p ratio can be used to trace the TOP material

$$N_{He} \sim \phi_{He} e^{-x/\lambda_{He}} \qquad N_{H} \sim \phi_{H} e^{-x/\lambda_{H}}$$

$$\Rightarrow He/H \sim \left(\phi_{He}/\phi_{H}\right)\left[1 - X/X_0\right]$$

$$\begin{cases} \sigma_{He}/\sigma_{H} \sim 1.2 \\ \lambda_{He} \sim 50\,g/cm^2 \end{cases} \qquad X_0 \sim 250\,g/cm^2$$

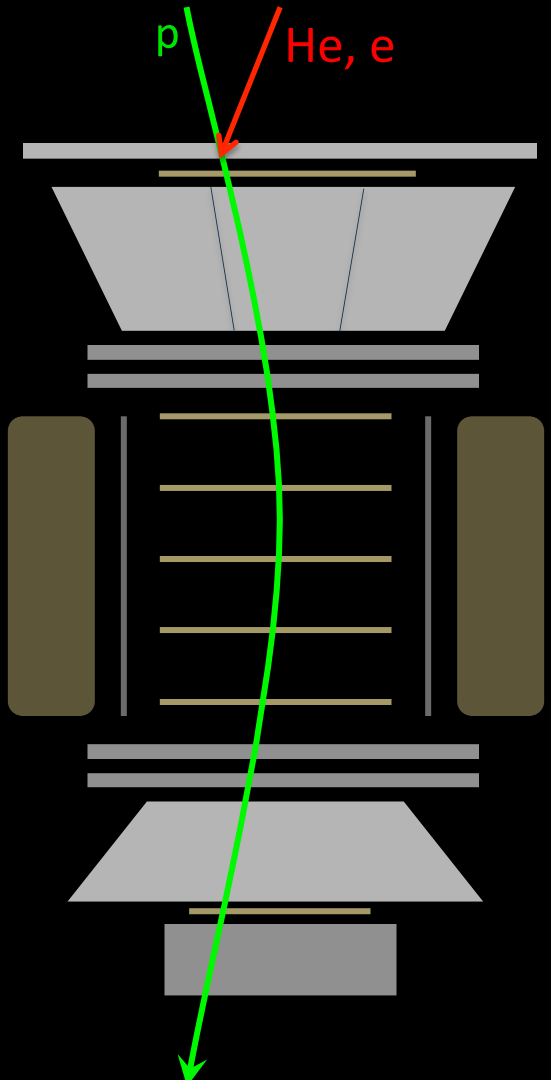
B584/pass3 data | June-2011 to Nov 2011

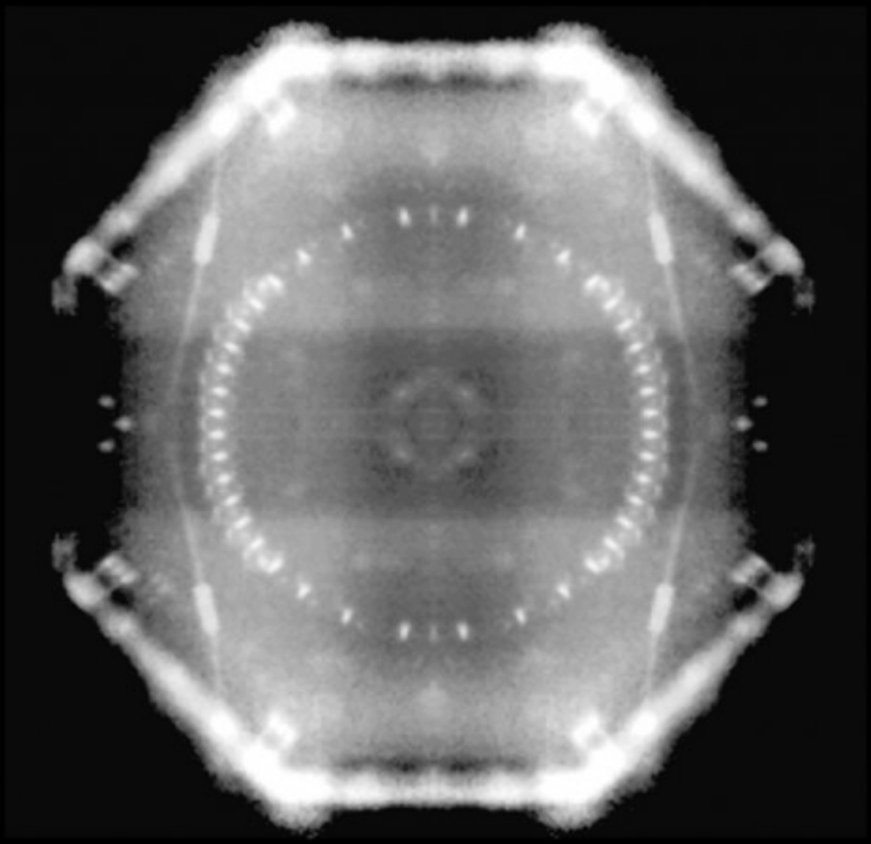
1/1 TrTrack | TOF 4/4 | Chi<50 | R > 1.5 GV

Z=1 : ~3.6 billion events

Z=2 : ~670 million events

Hadronic Tomography /w He/p Ratio



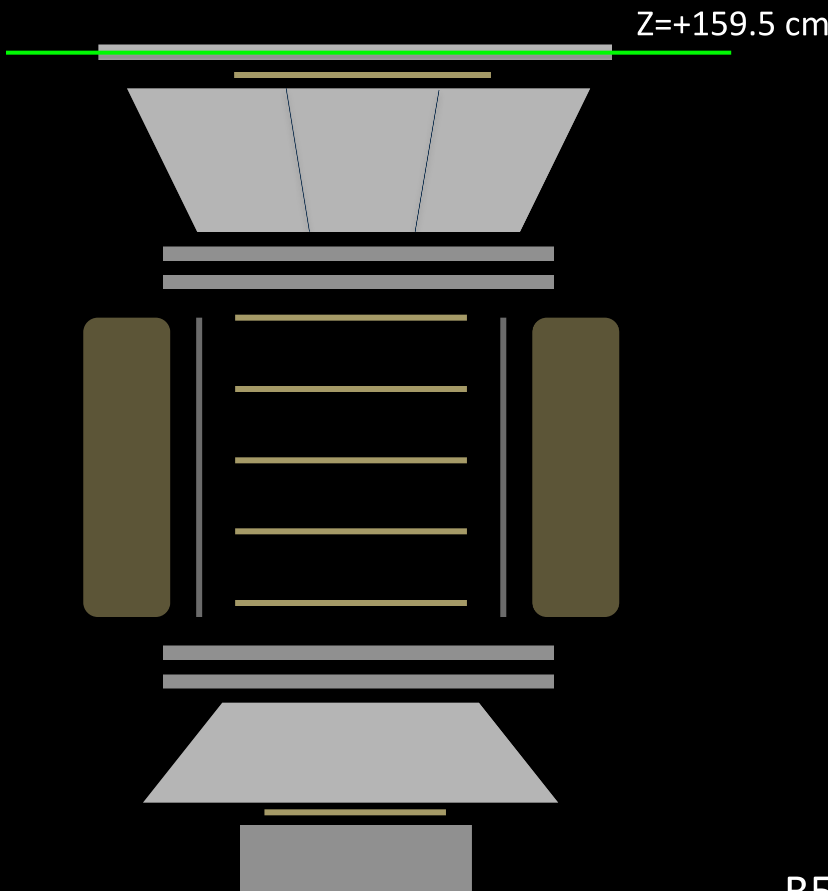


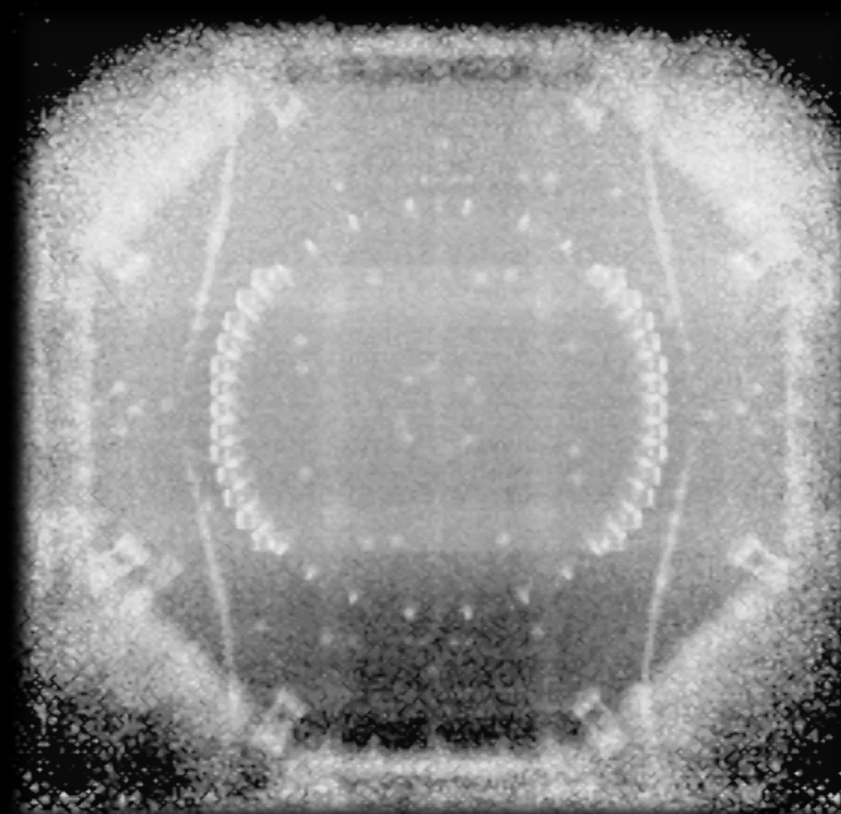
Credit: AMS Collaboration

He/p~ 0.13 – 0.16 ⟹ ΔX ~ 6 g/cm2

Leptonic Tomography – e-/p Ratio

36 159.5 cm

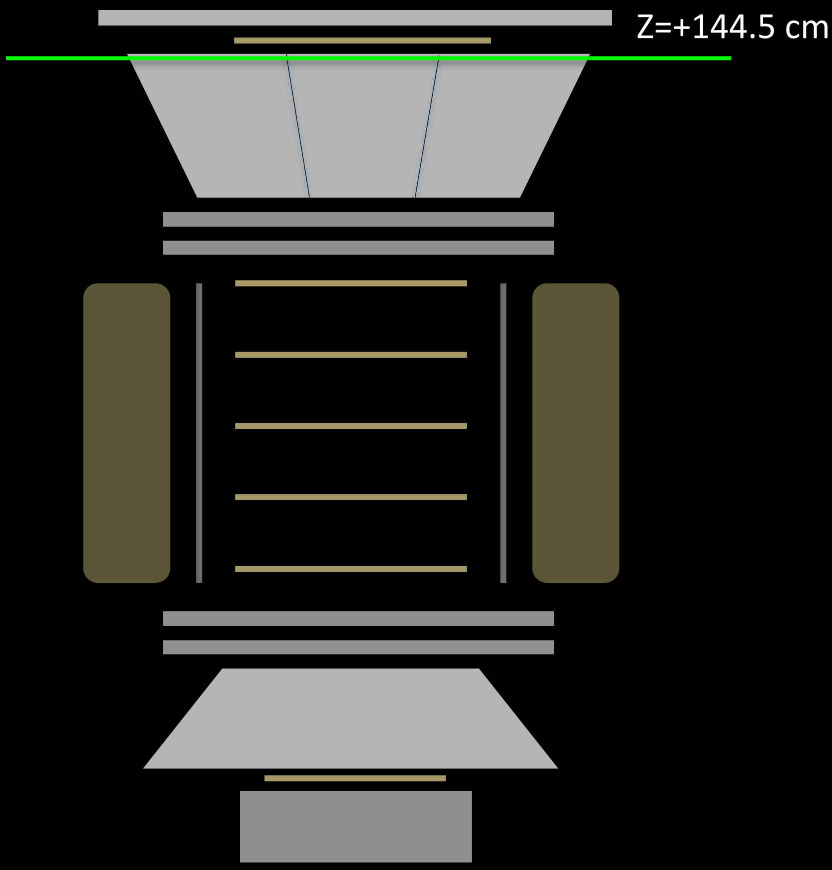


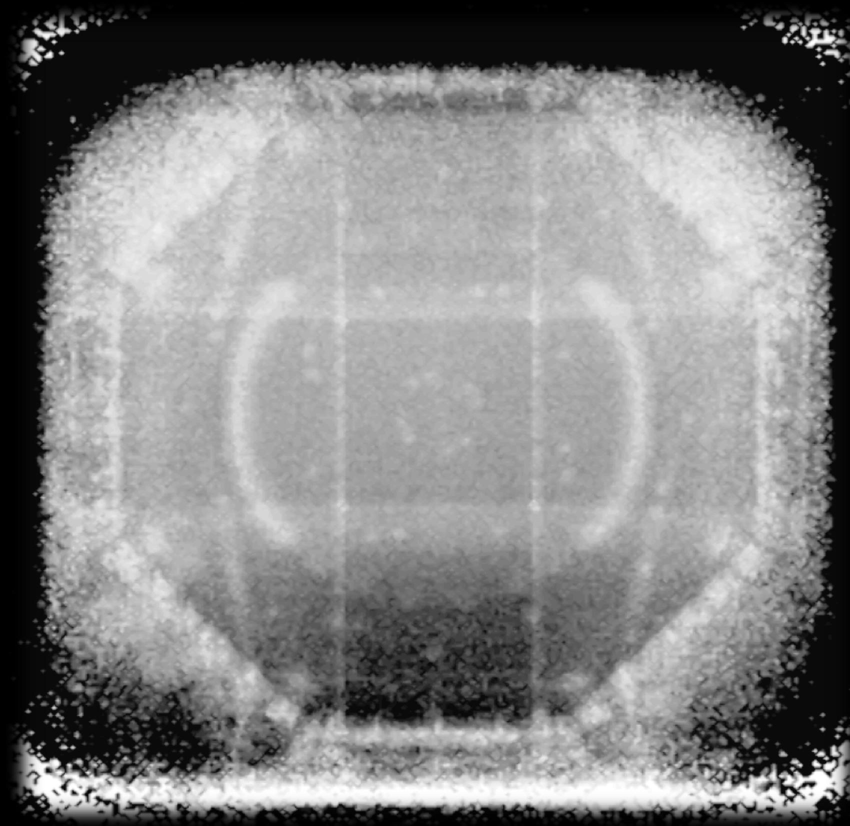


B584/2ecal2 data | June-2011 to June 2012
1/1 TrTrack; TOF 4/4; Chi<50 ; |R| > 1.5 GV
Z= 1 : ~3.6 billion events
Z=-1 : ~48 million events

Leptonic Tomography – e-/p Ratio

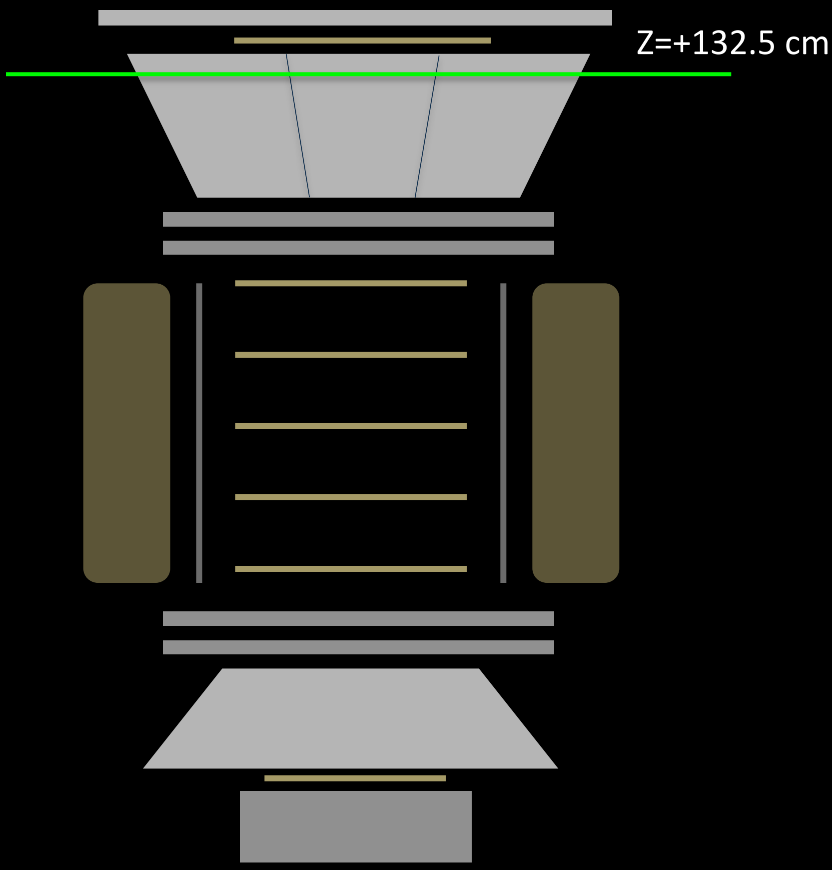
31 144.5 cm

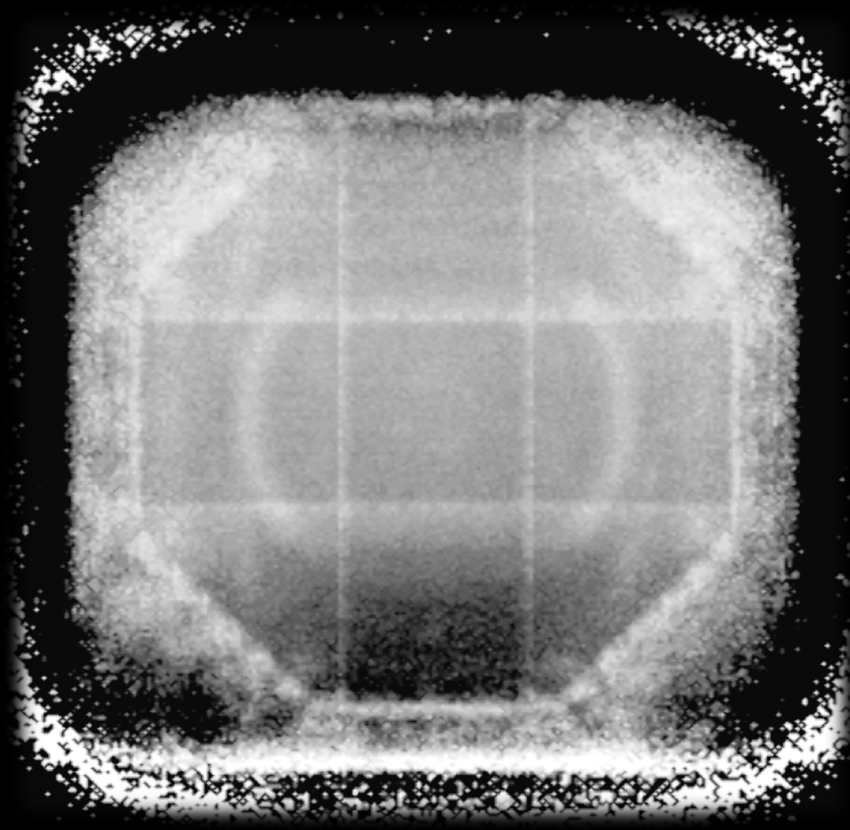




Leptonic Tomography – e-/p Ratio

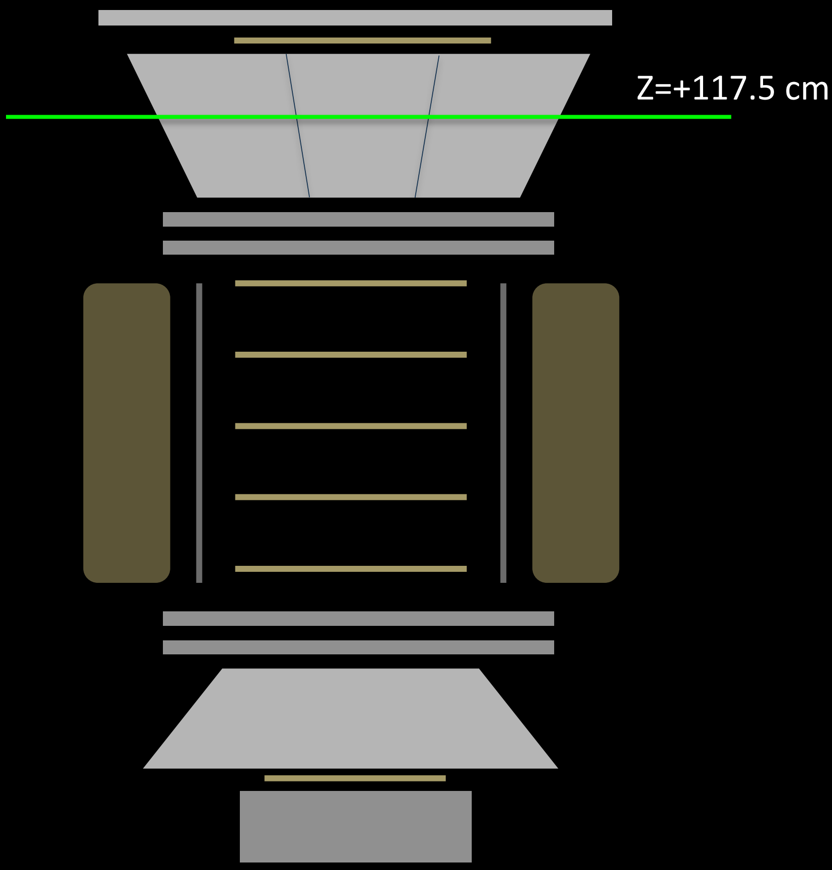
27 132.5 cm

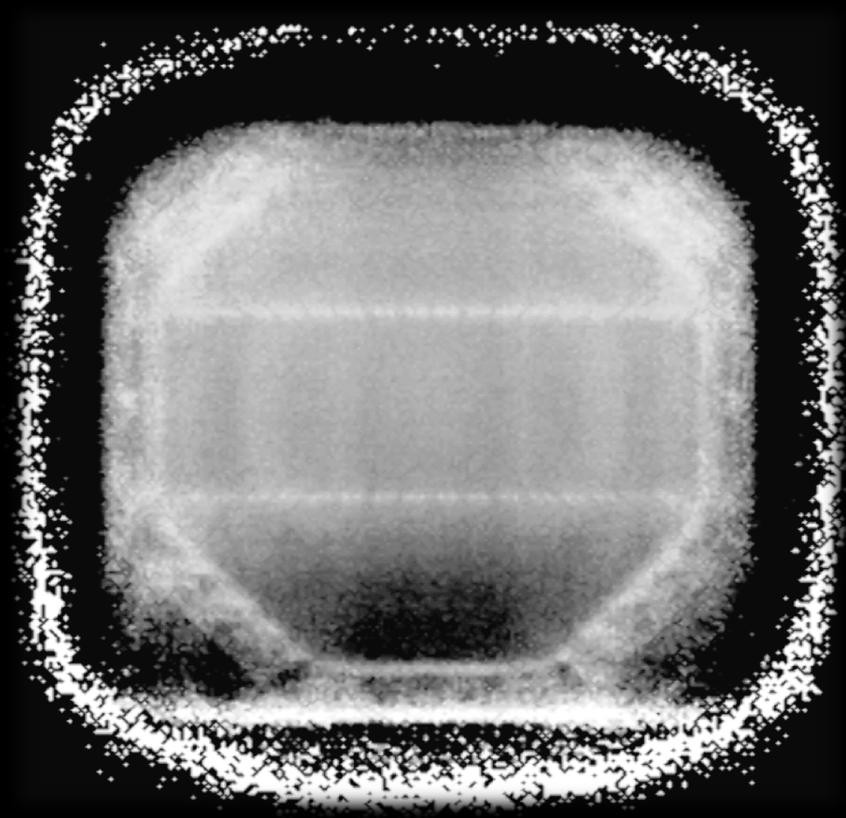




Leptonic Tomography – e-/p Ratio

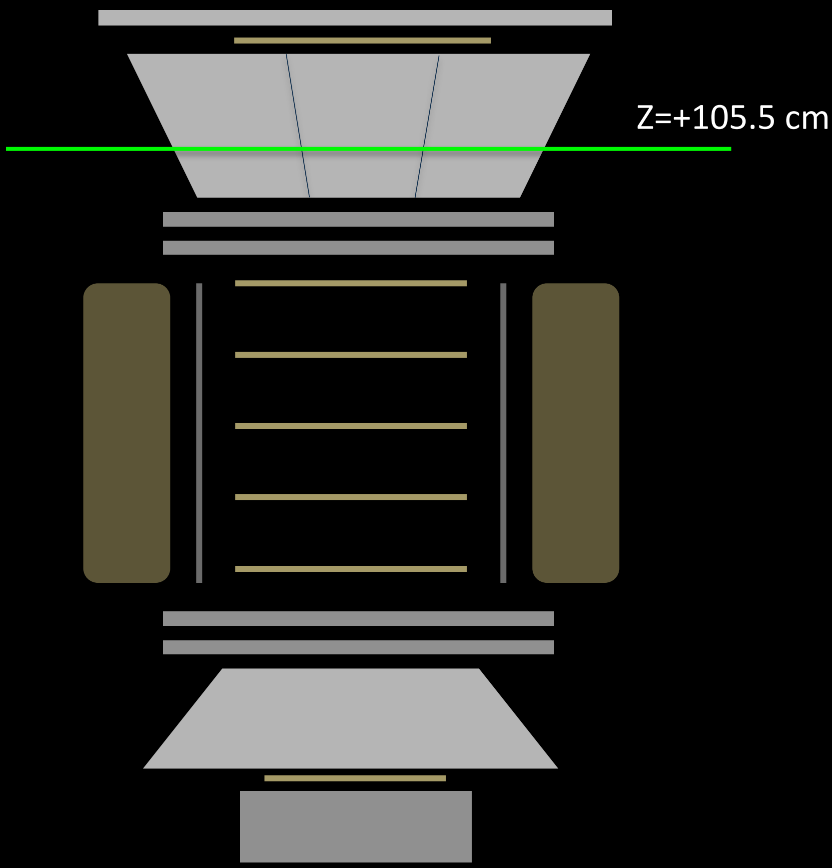
22 117.5 cm

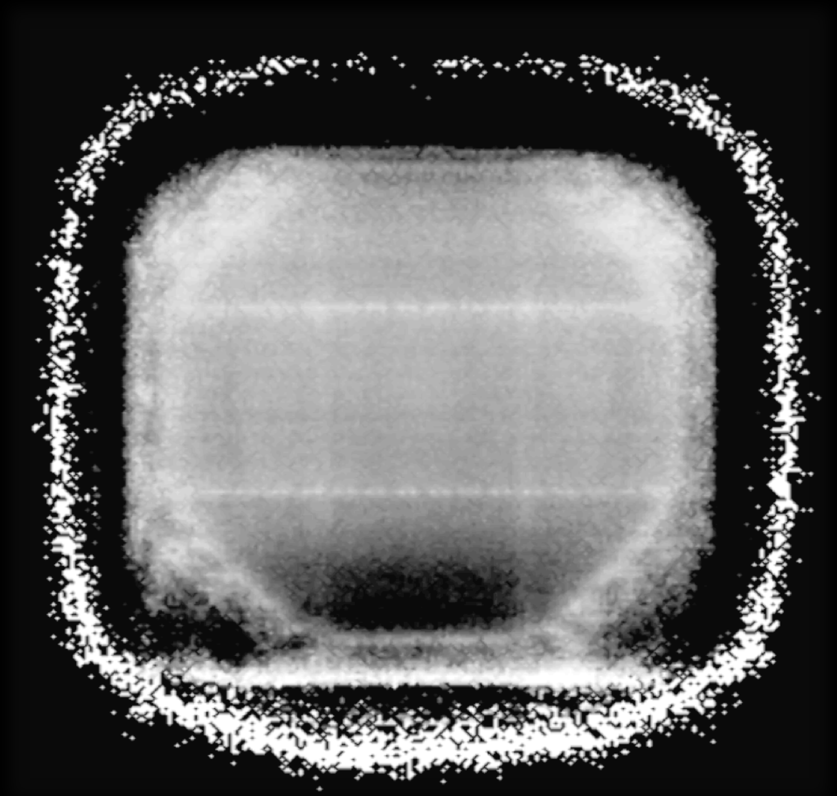




Leptonic Tomography – e-/p Ratio

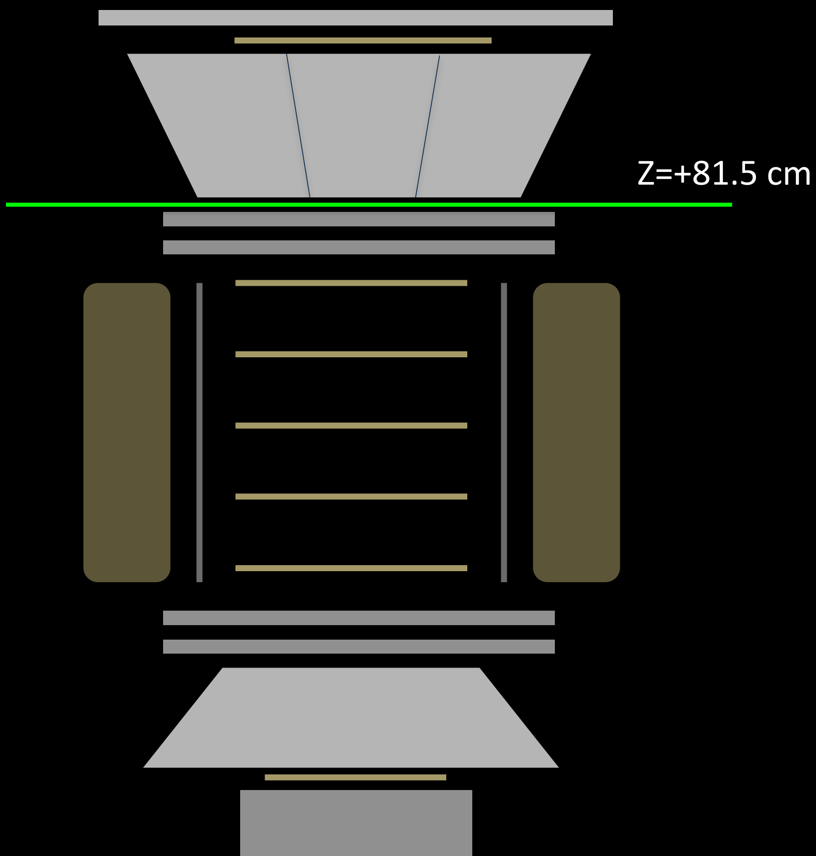
18 105.5 cm

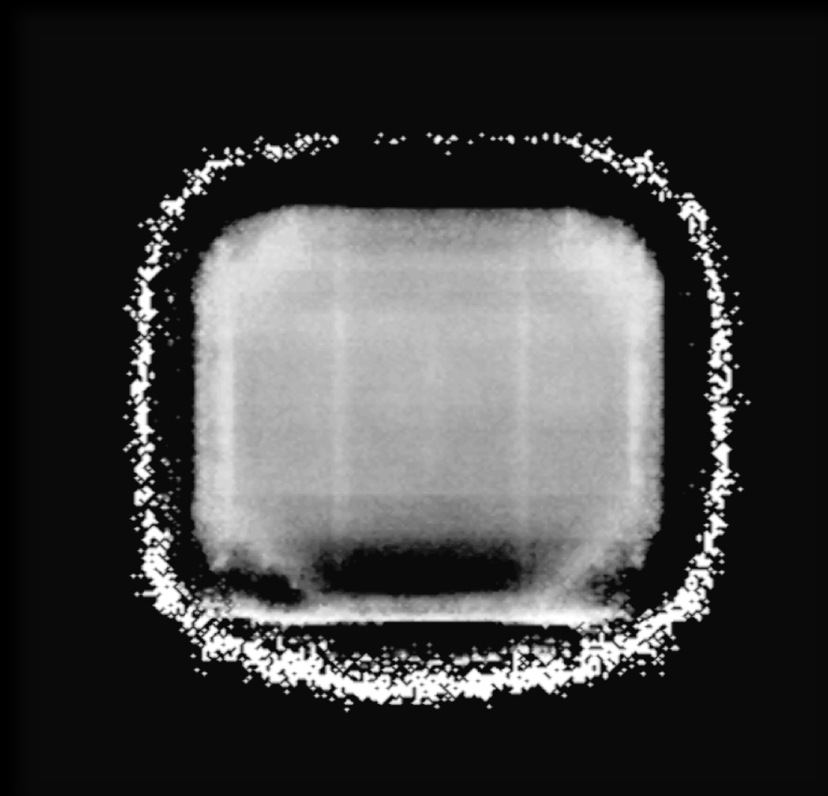




Leptonic Tomography – e-/p Ratio

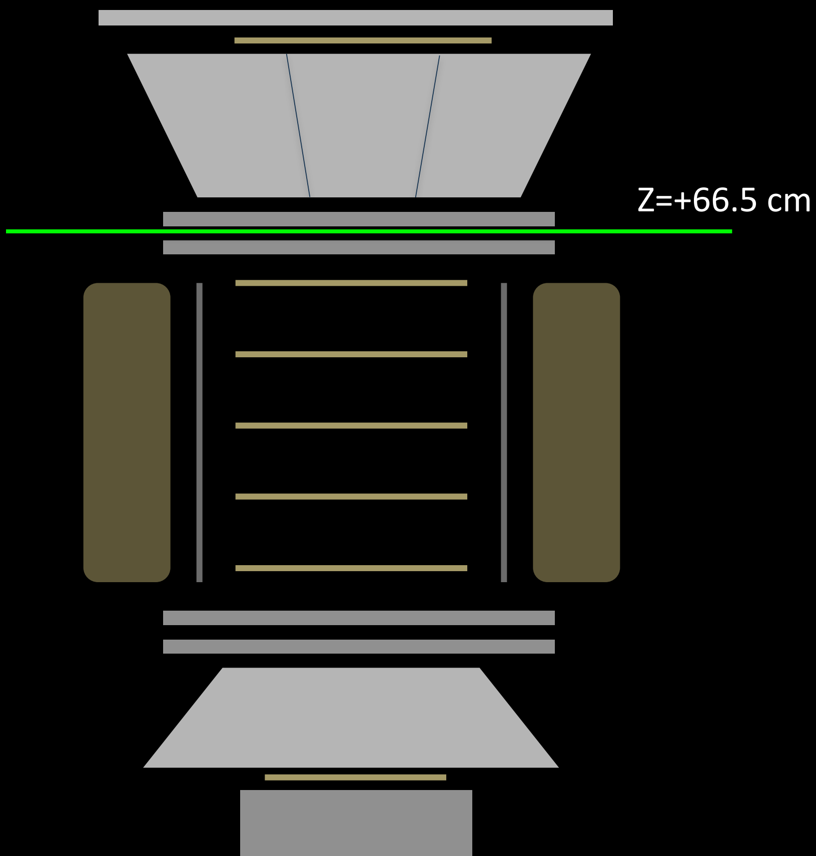
10 81.5 cm

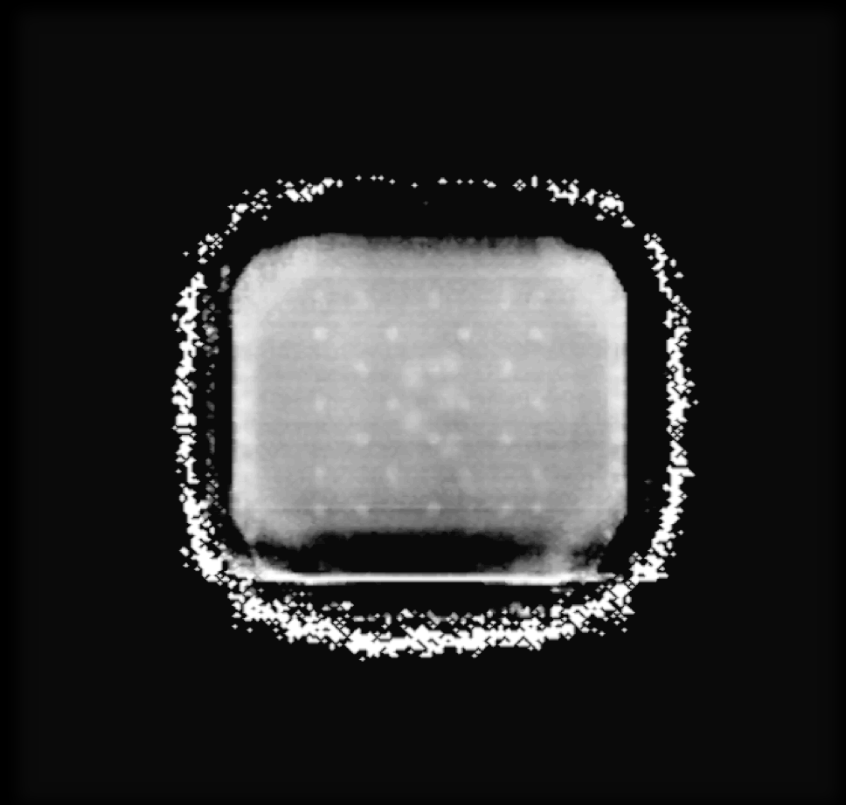




Leptonic Tomography – e-/p Ratio

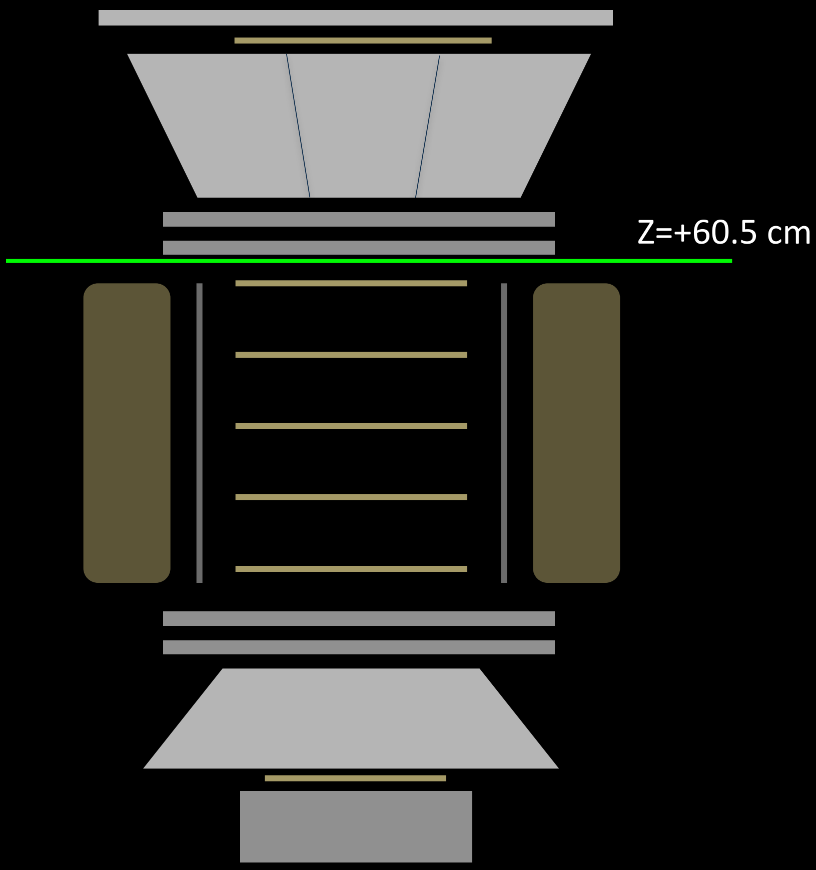
5 66.5 cm

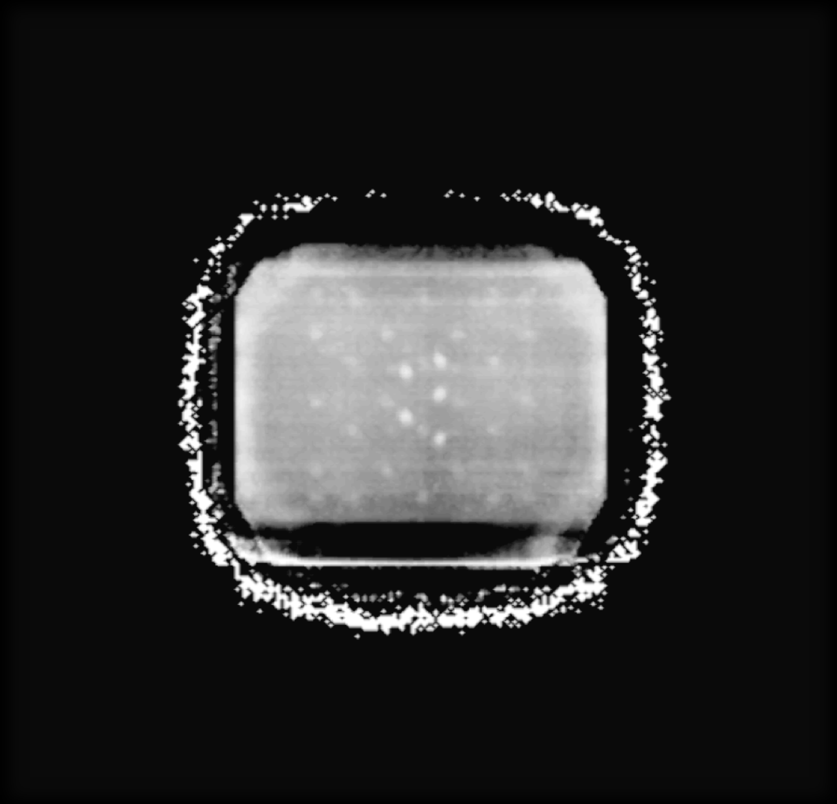




Leptonic Tomography – e-/p Ratio

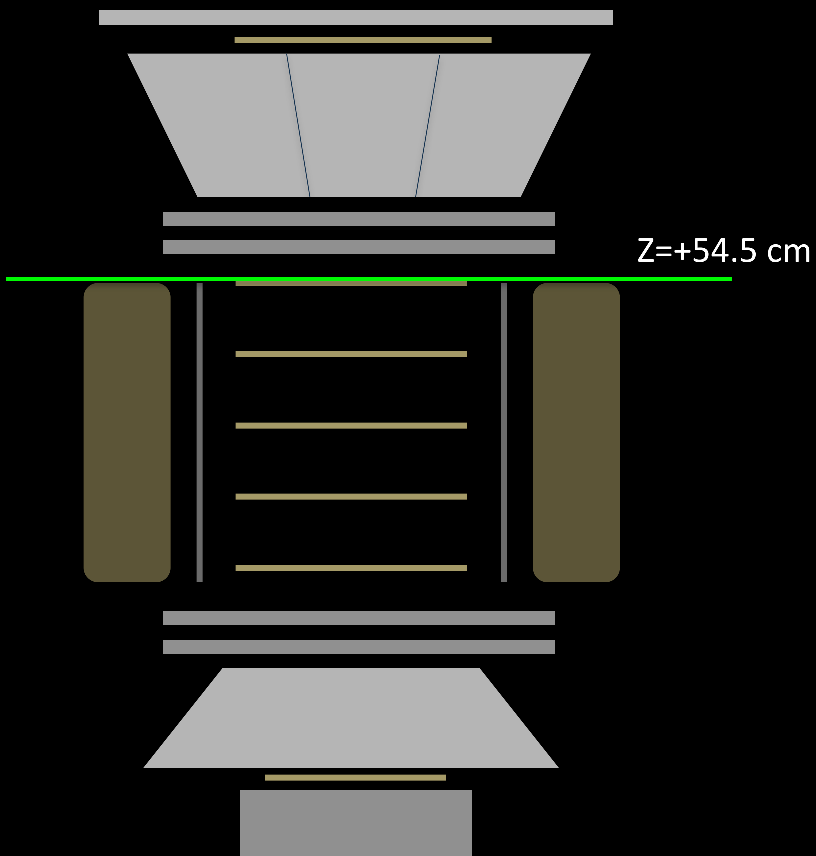
3 60.5 cm

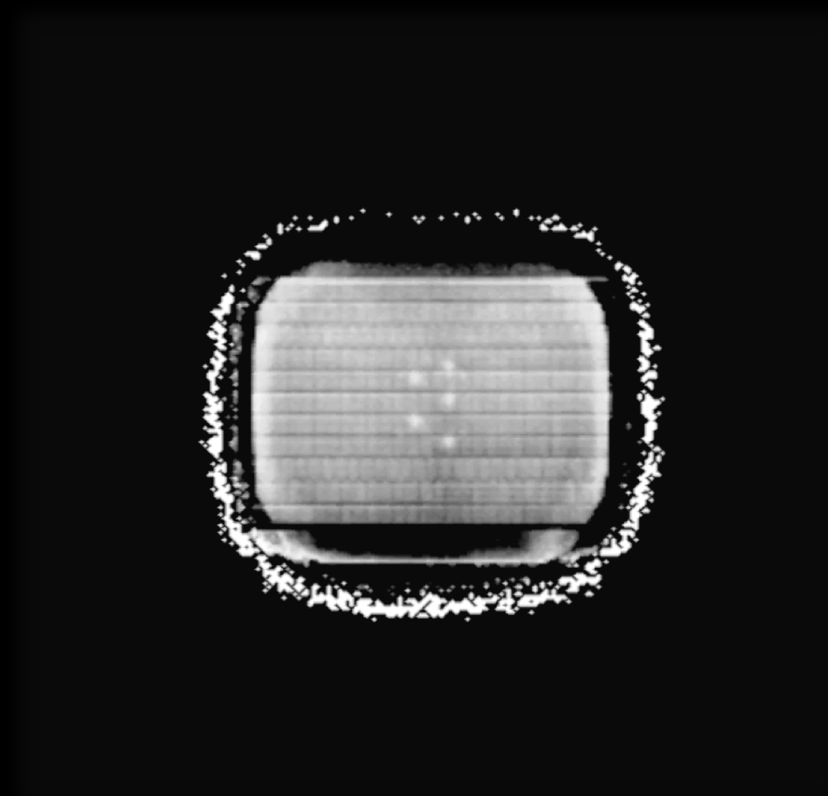




Leptonic Tomography – e-/p Ratio

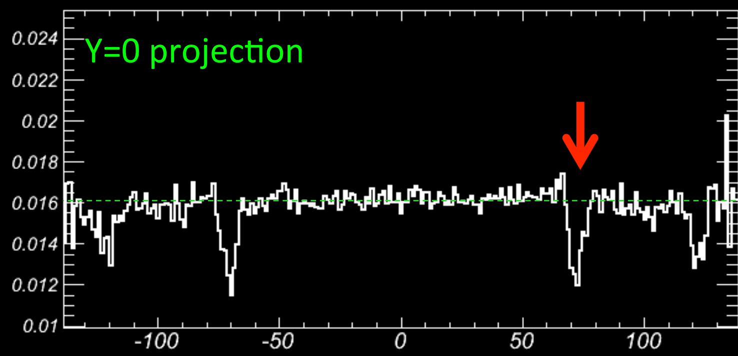
1 54.5 cm





TOI : screws [w/ e-/p ratio]

36 159.5 cm



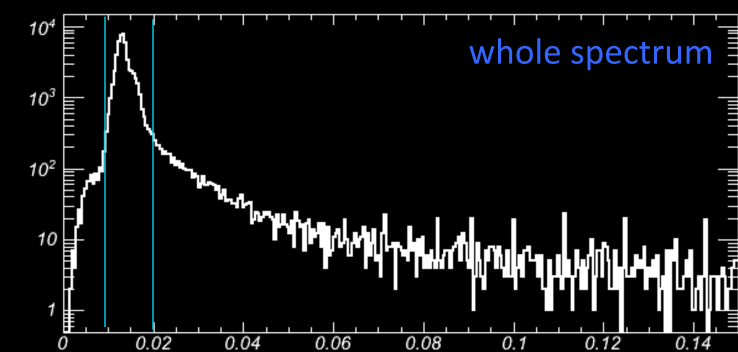


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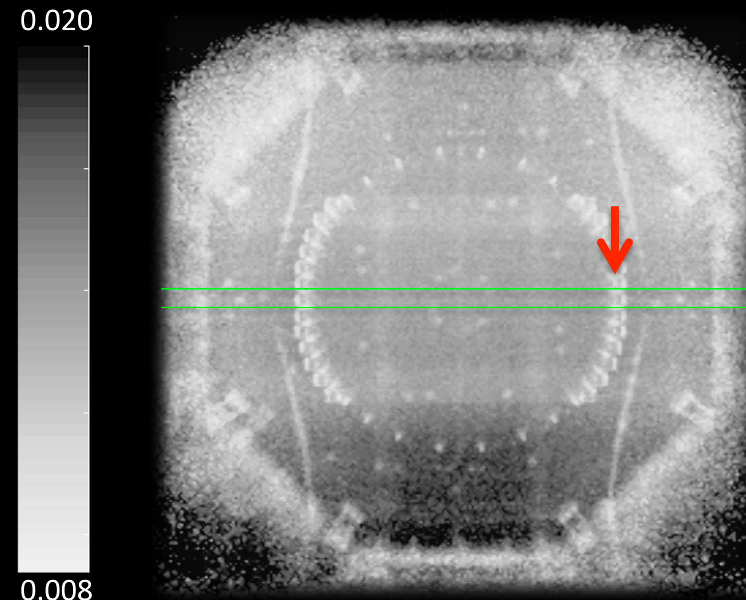
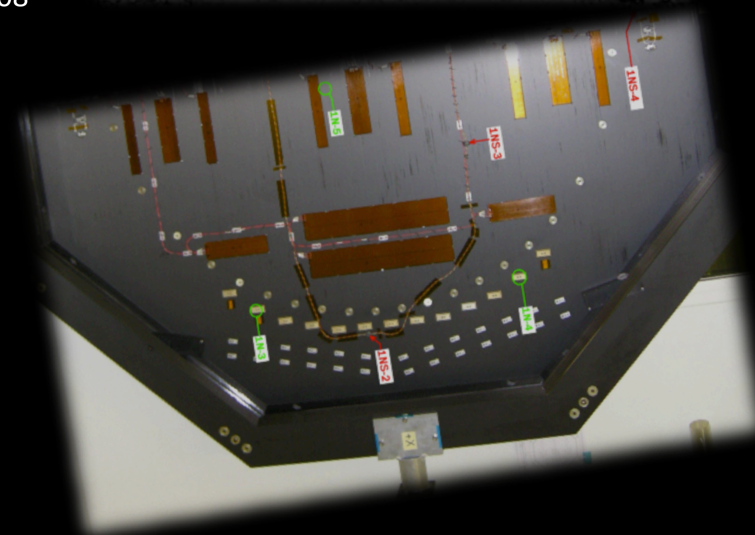
IMAGE

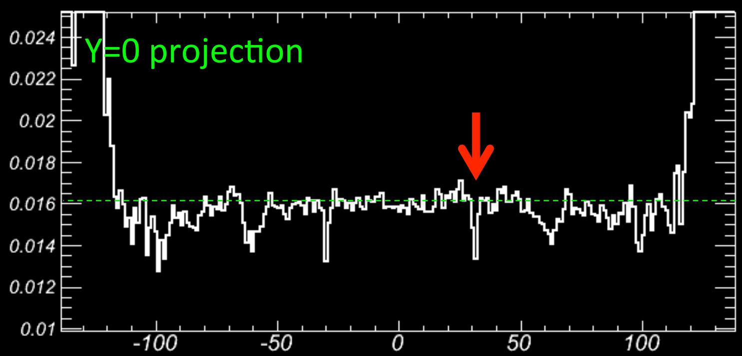




The screws on Layer-1 support plane produce a e-/p ratio deficit of > 30%.
If Layer-1 is requested by the analysis cuts, the screws do not enter in the acceptance.

Inside TRD: bulkheads [w/ e-/p ratio]

27 132.5 cm



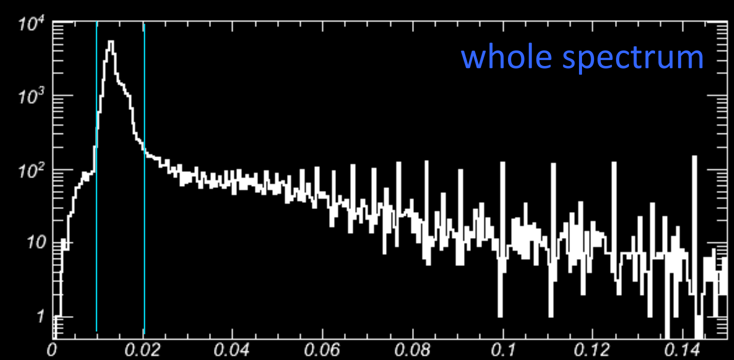


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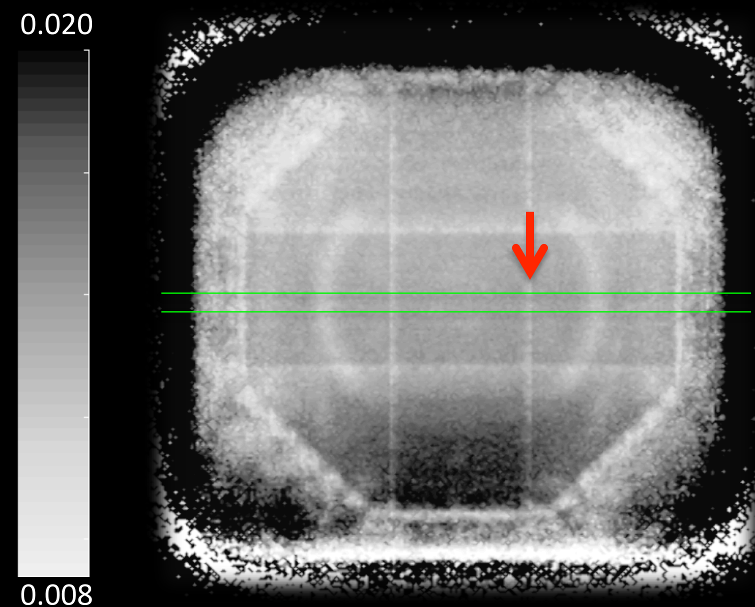
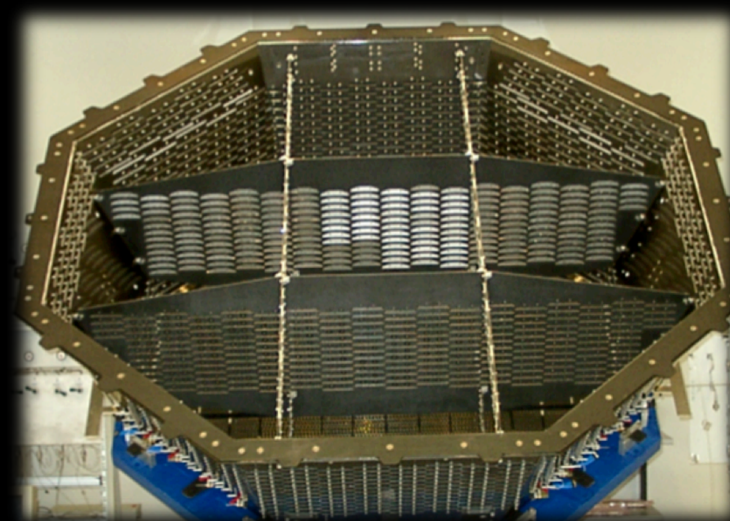
IMAGE

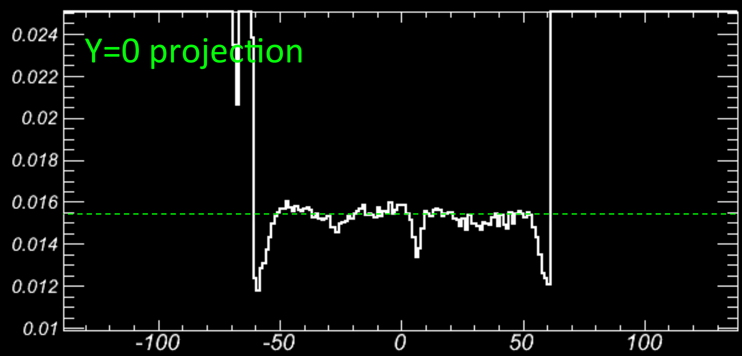




The TRD support structure has an effect of a ~17%. Can be removed/ studied with a dedicated cut (cut efficiency to be quantified).

Inside upper TOF: screws [w/ e-/p ratio]

5 66.5 cm



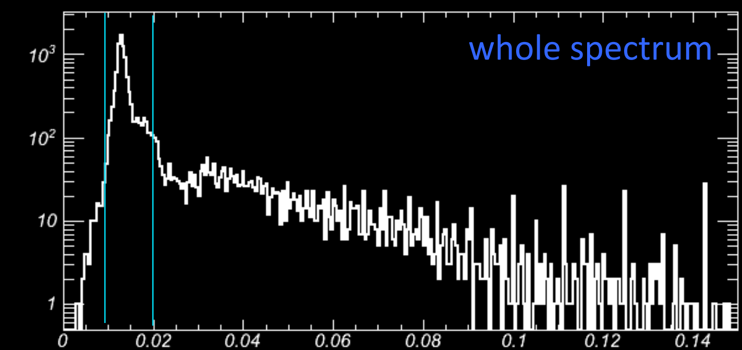


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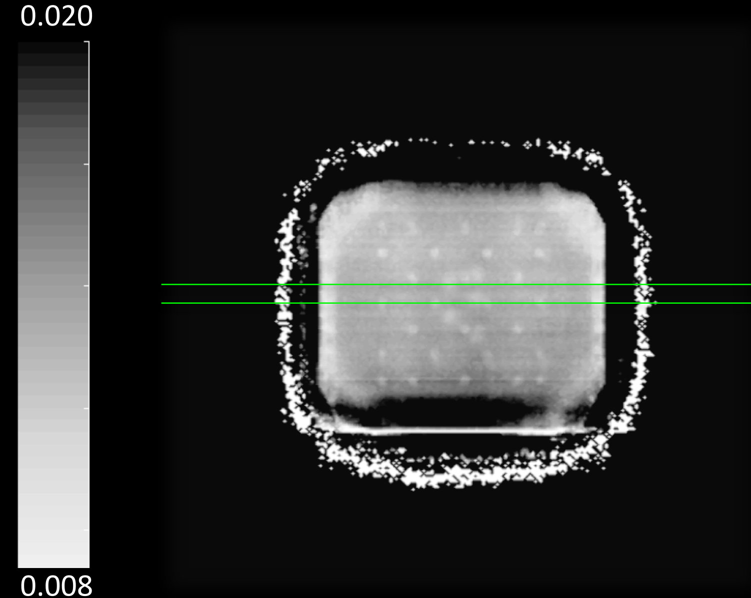
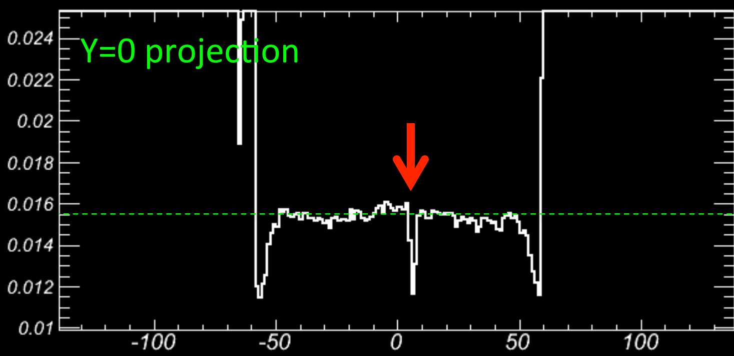
IMAGE



TOF paddles are connected by small mechanical elements. They affect the e/p ratio by 10% dips. (the peack in the middle is due to TAS … next slide)

Below Layer-2: TAS [w/ e-/p ratio]

1 54.5 cm



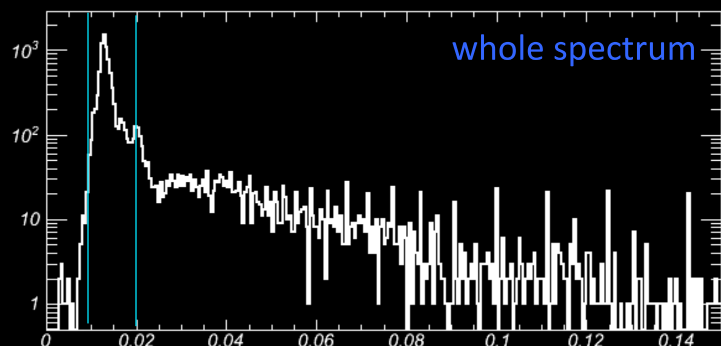


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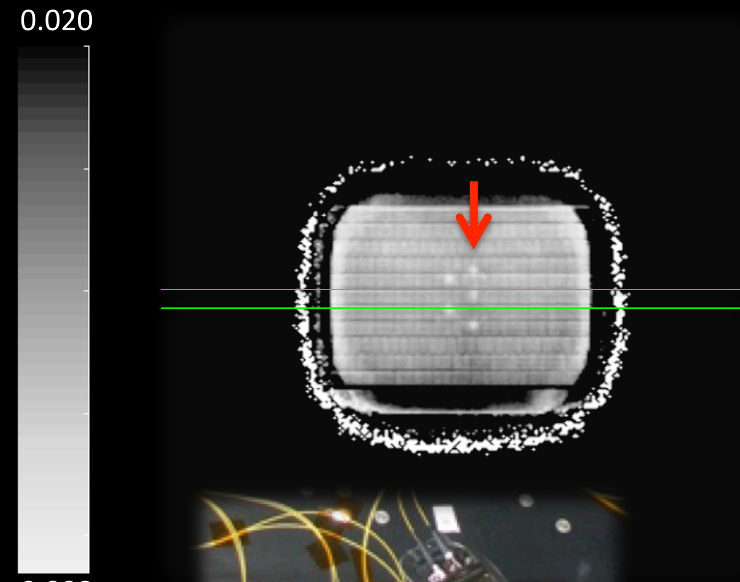
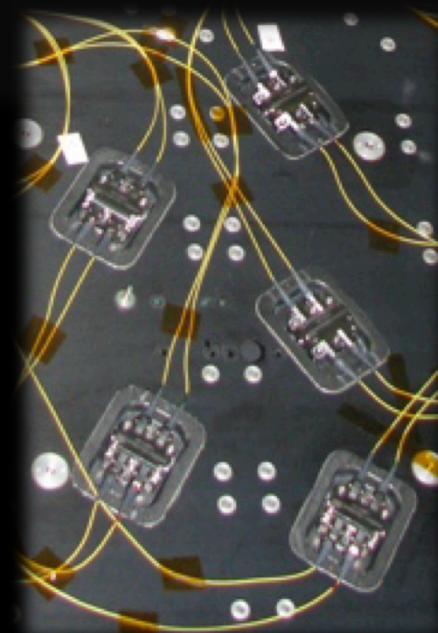
IMAGE

TAS system suppresses the e/p ratio by ~30%. Can be easily removed by a geometric cut.





Summary

Material inhomogenities are of the order or ~5 g/cm2 or more,
These inhomogenities are localized: small elements of ~few cm2.

Appreciable (local) deficit in e/p ratio: up to ~ 30% → 30% in e- or e+ fluxes.

MC geometry: many elements are missing. Some parts are wrongly implemented.

The overall effect in data analysis has to be quantitied (for a TRD/Ecal based selection).
I expect a small influence (%?) in e- flux measurements. Hopefully smaller in e+/e- ratio.

These elements are source of secondary emission and can be removed by geometric (high-efficiency) cuts. Knowledge of AMS geometry is important to define these cuts.