Status about the dE/dx on a MDC

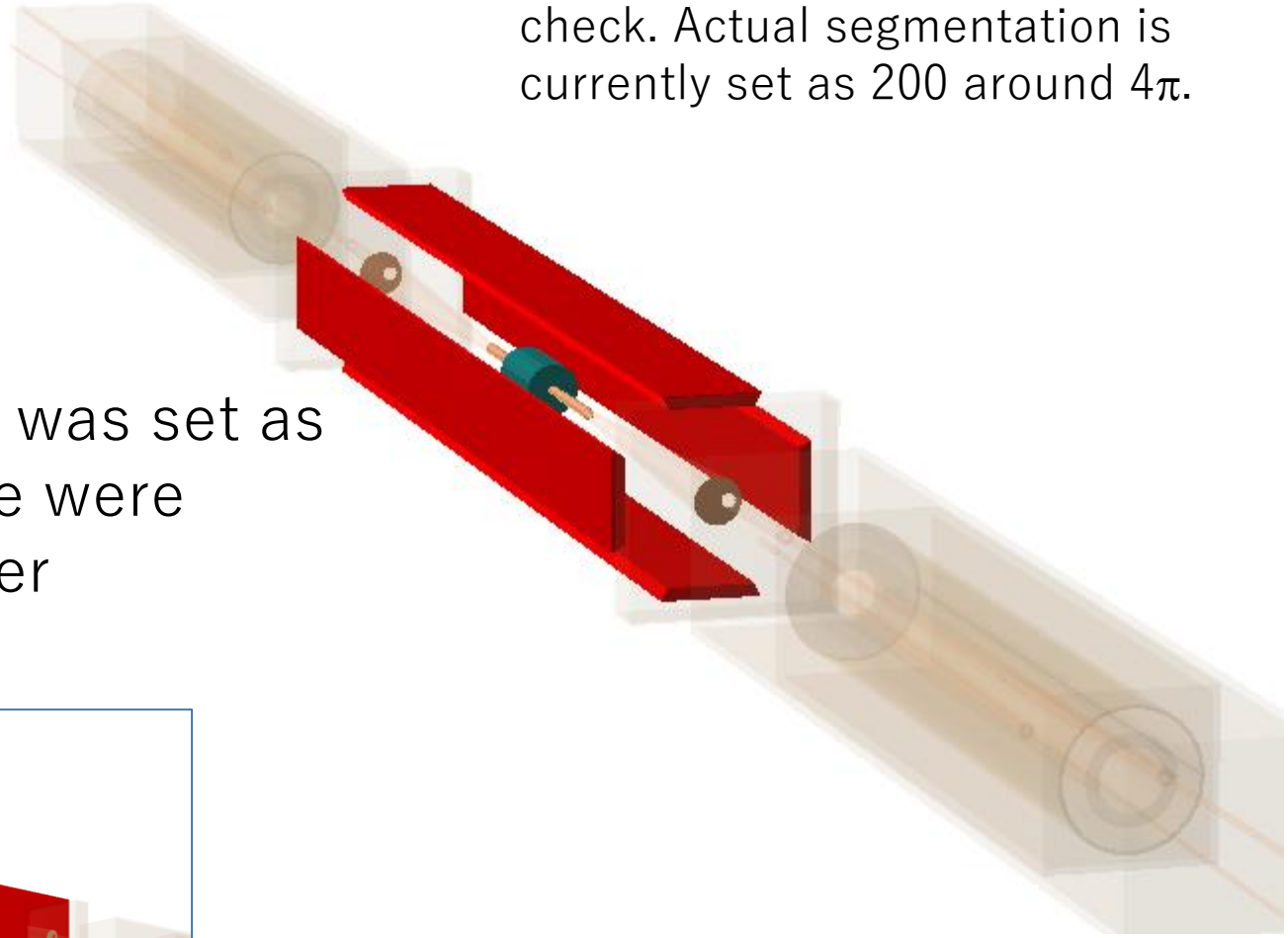
Ryuta

09/07/2020

Bug fix in Detector configuration

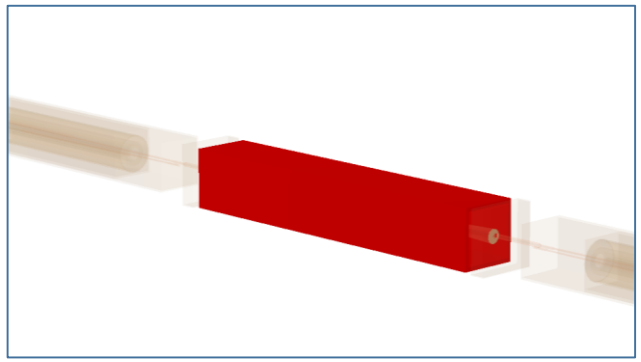
・ Segments, defined by square (trapezoid) , are covering 4π around the beam axis.

this layout is for a eye-check. Actual segmentation is currently set as 200 around 4π.



→ because the length parameter was set as half of necessary length, there were regions, where no drift chamber segments are covering

→ fixed.



Next steps

- Check the “energy deposit/path length”
- the cluster counting method

- Detector configuration

  -- currently, no stereo angle. (and no superlayers)

  -- the cell size (in ϕ direction) is not adjusted, but just increasing by the radius (=r)

  -- gas mixture, etc.

Status about the dE/dx on a MDC

Ryuta

09/04/2020

Change to the particle gun injection

- Particle injection method

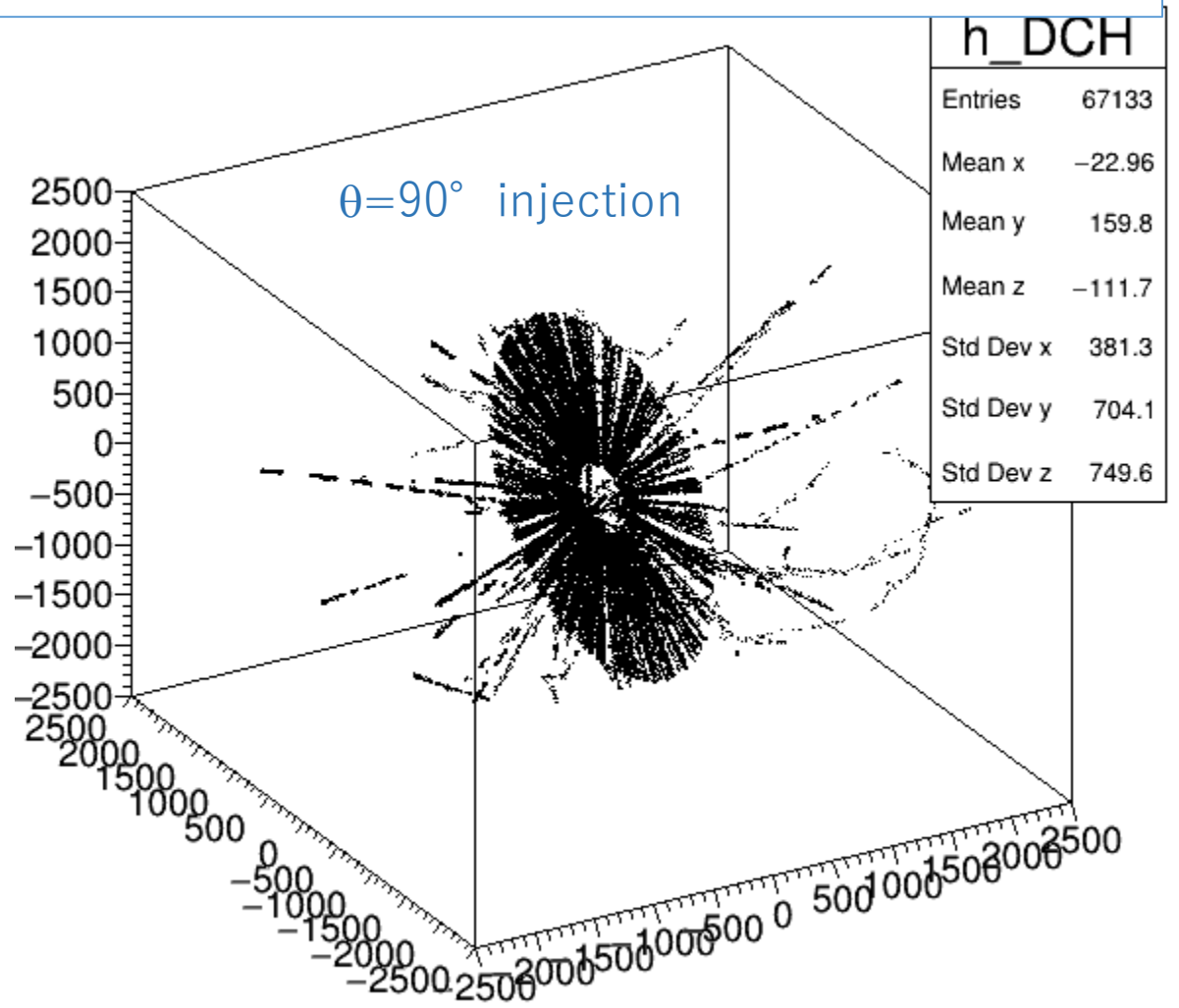
-- stdhep → particle gun

-- turns out that it is already prepared in current CEPCSW

-- can specify,
particle type, energy (momentum), direction etc.

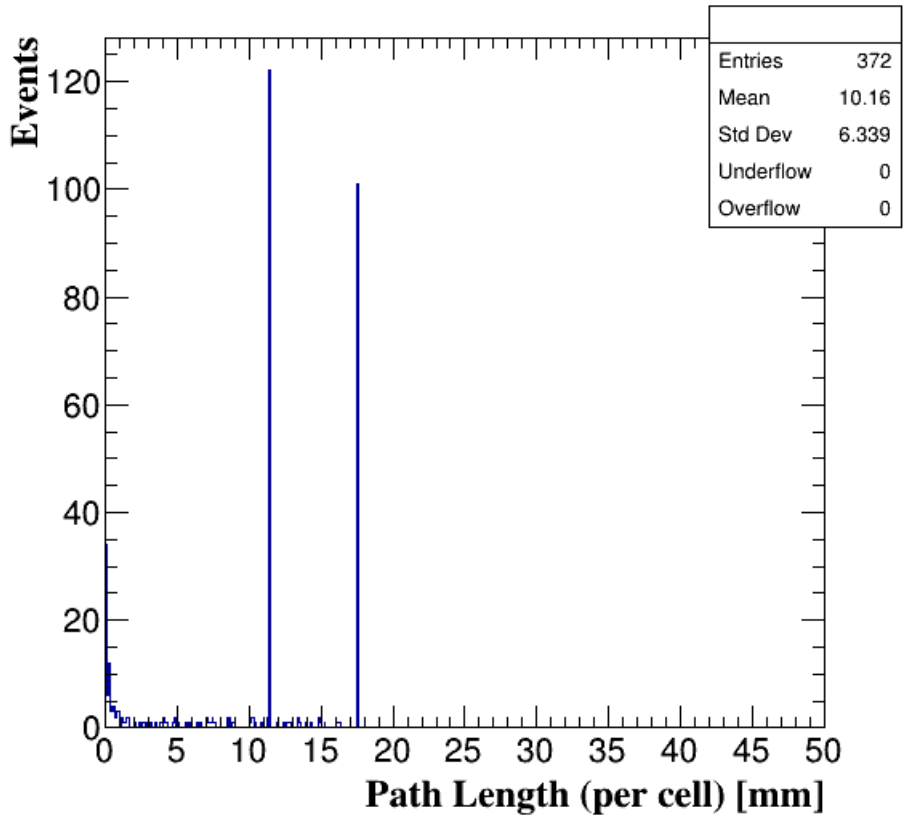
-- For now, using pion/kaon (muon for checks) with momentum 0.5GeV~100GeV, with θ=90°

Hit map (of Drift Chamber part)

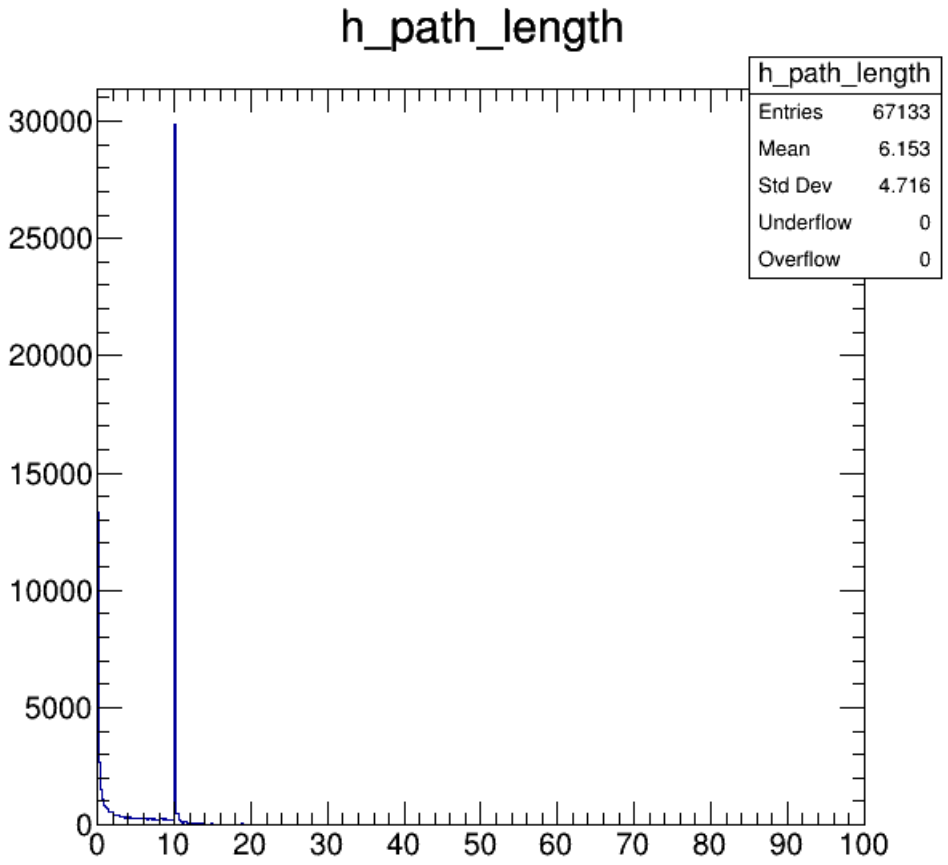


Path length

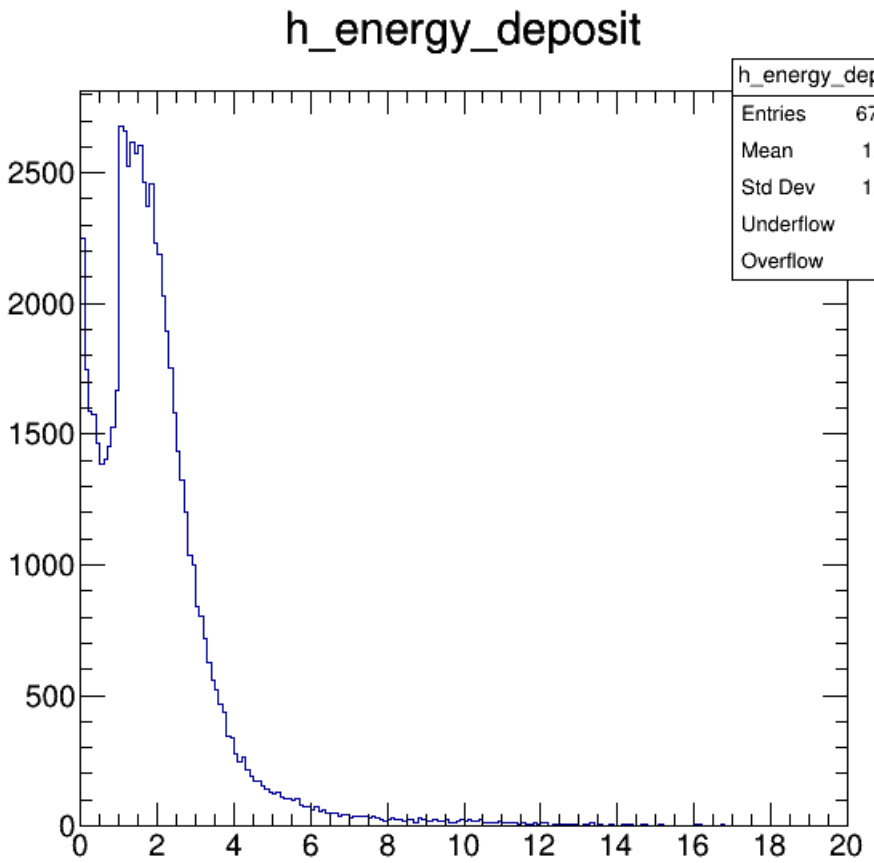
previous distribution (input: stdhep, particle direction was not controlled)



peak at 10mm (== cell size) is clearly seen, but tails in lower region are also there.

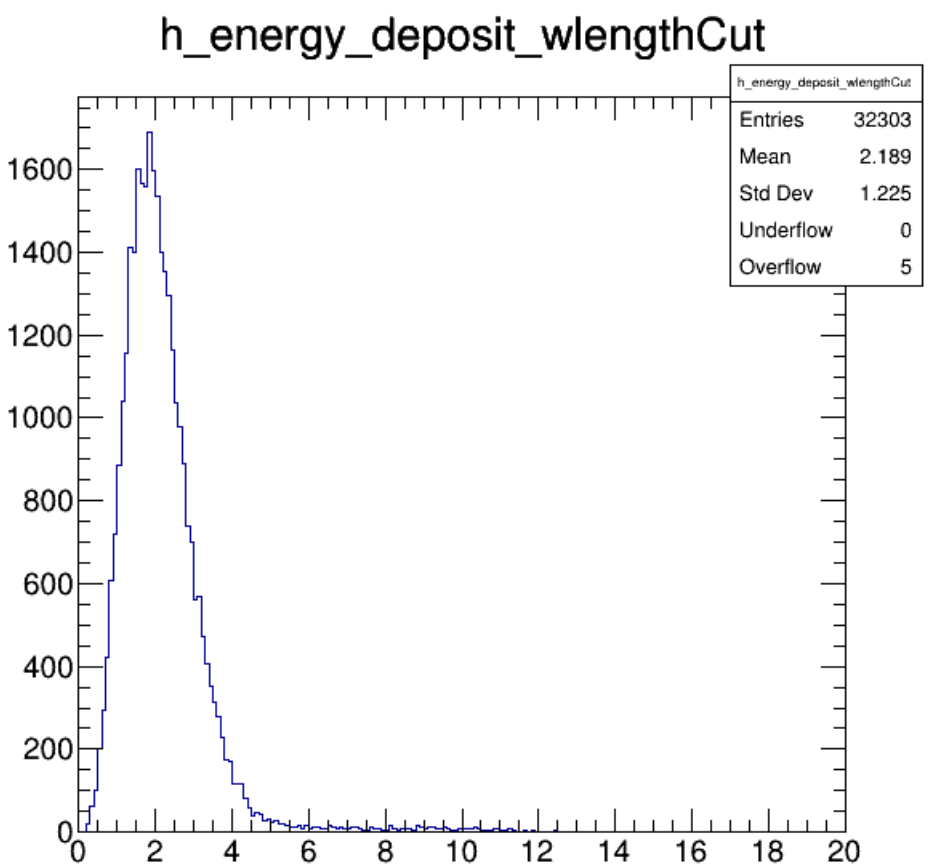


Energy deposit distribution



for the moment,
applying cut on
the path length

$| \text{pathL} - 10\text{mm} | < 1\text{mm}$

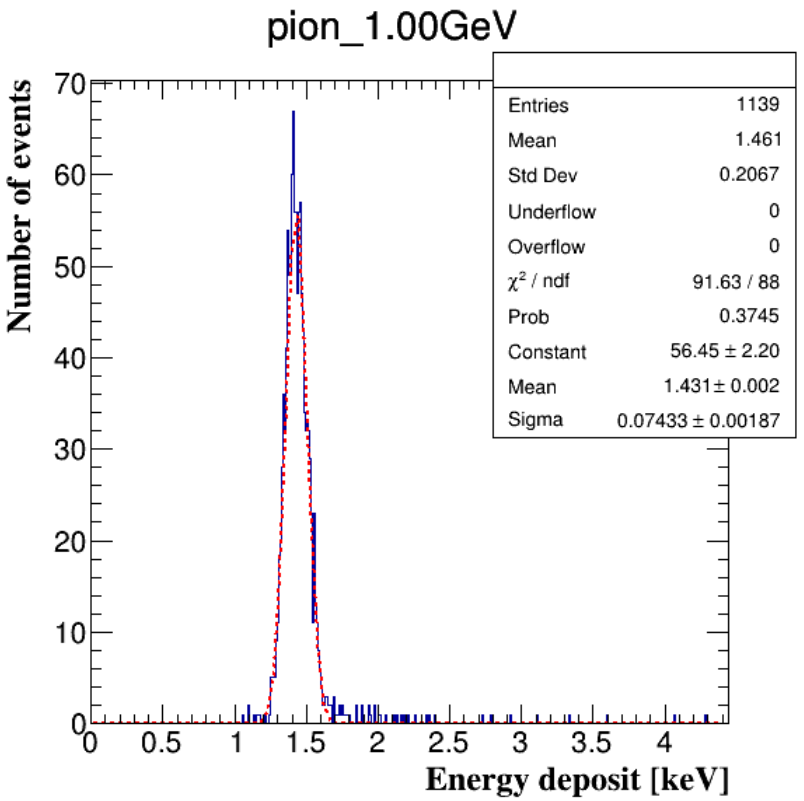


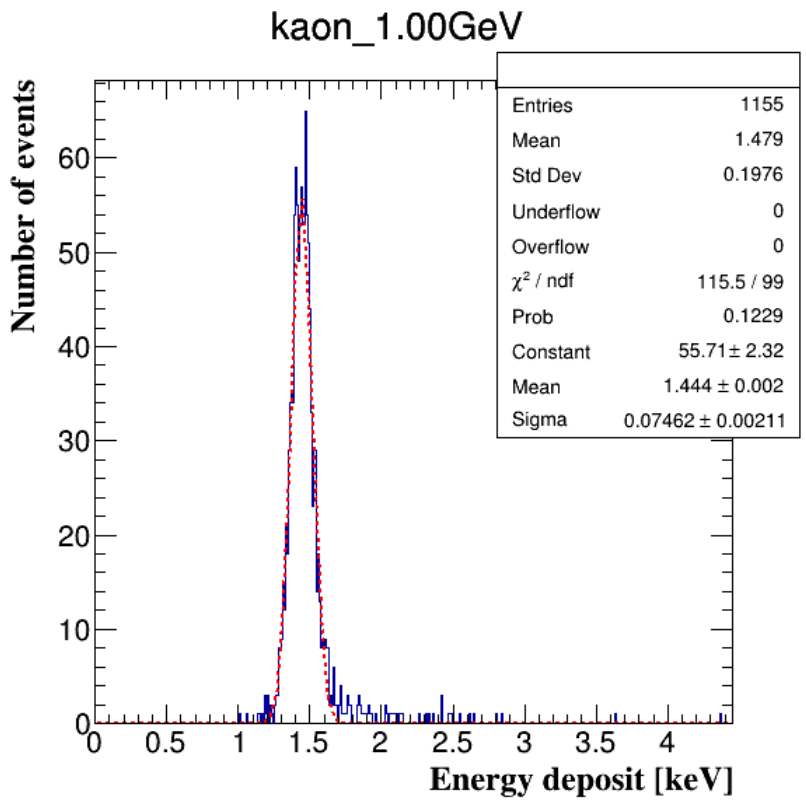
Fitting to truncated-mean

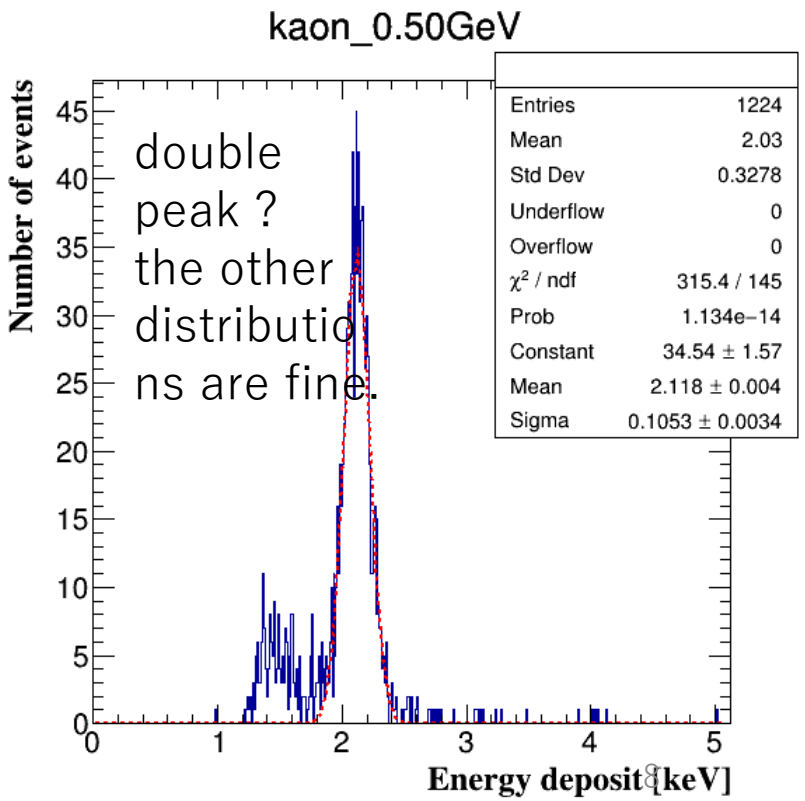
1) per event, ~100 hits from the MDC (after path-length cut), using 90% of hits == truncation

2) taking simple average from the hits collection, and then , put it into distribution which is shown in bellow .

3) fitting with Gaussian. Regarding the mean and sigma as de/dx and its resolution for the particle with that momentum/direction

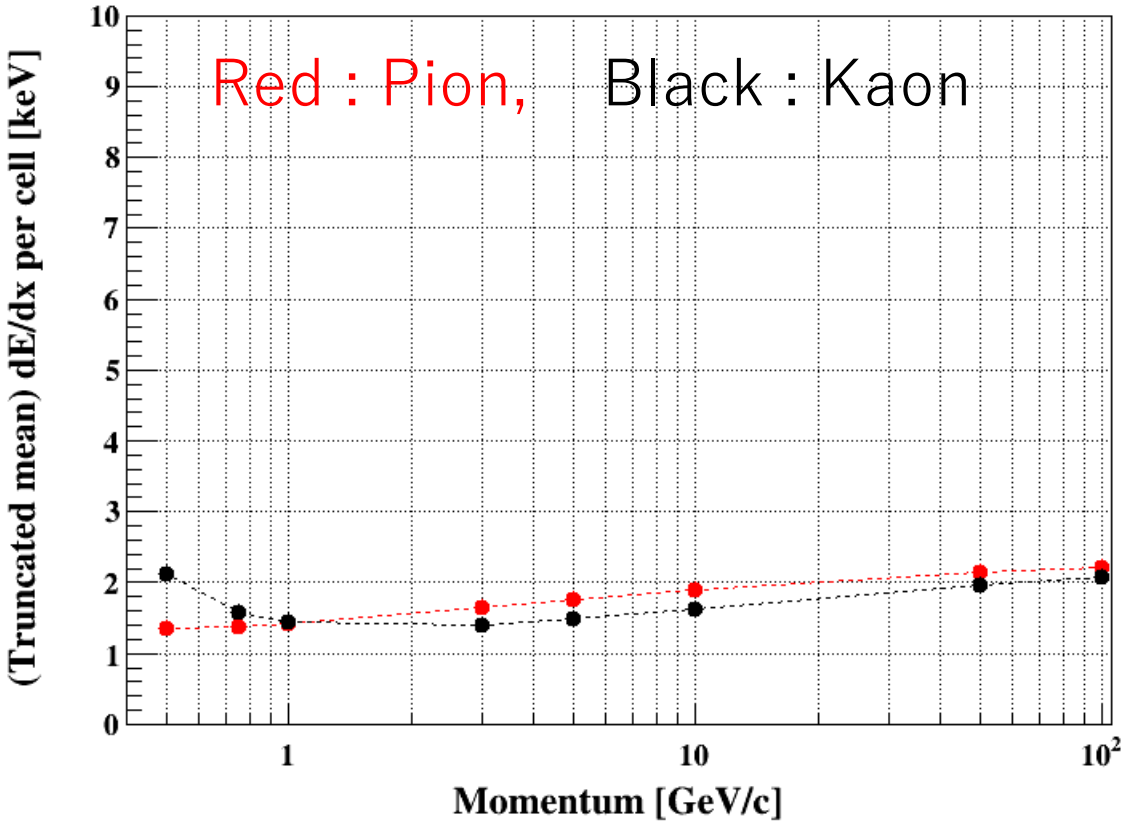






Energy deposit per cell (==10mm)

somehow similar to a distribution from the reference . . .



Reference :

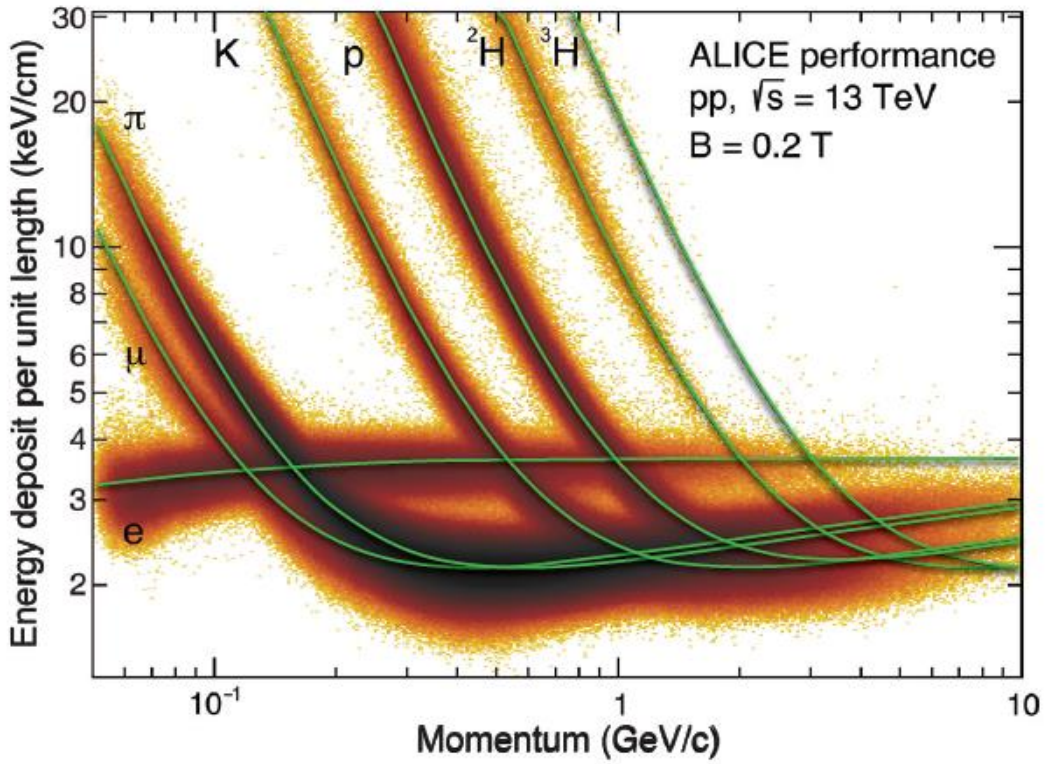
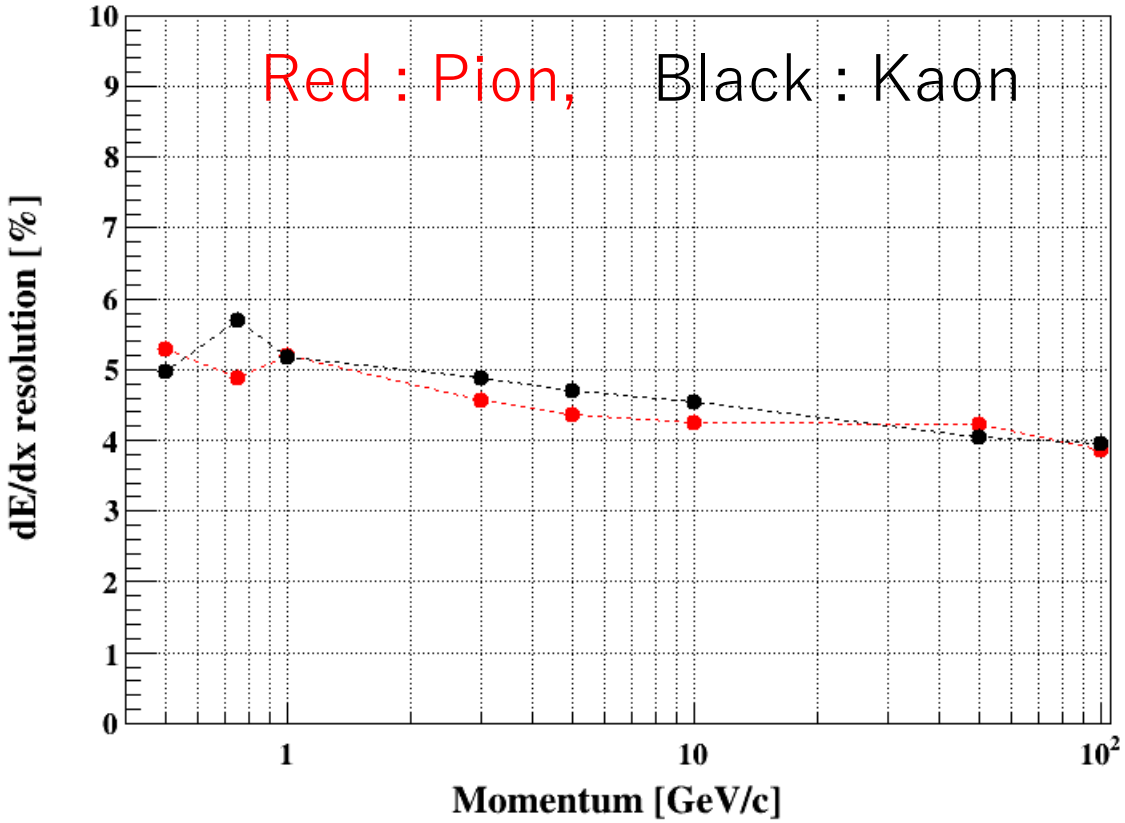


Figure 35.15: Energy deposit versus momentum measured in the ALICE TPC.

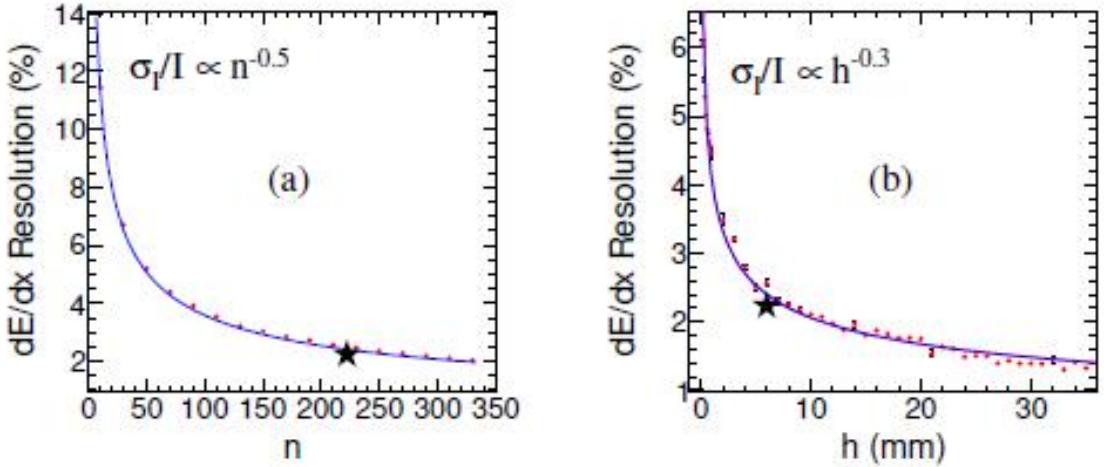
Energy deposit per cell (==10mm)

Resolution defined by (Gaussian)sigma/Mean looks a bit worse ?, but surely need certain investigations



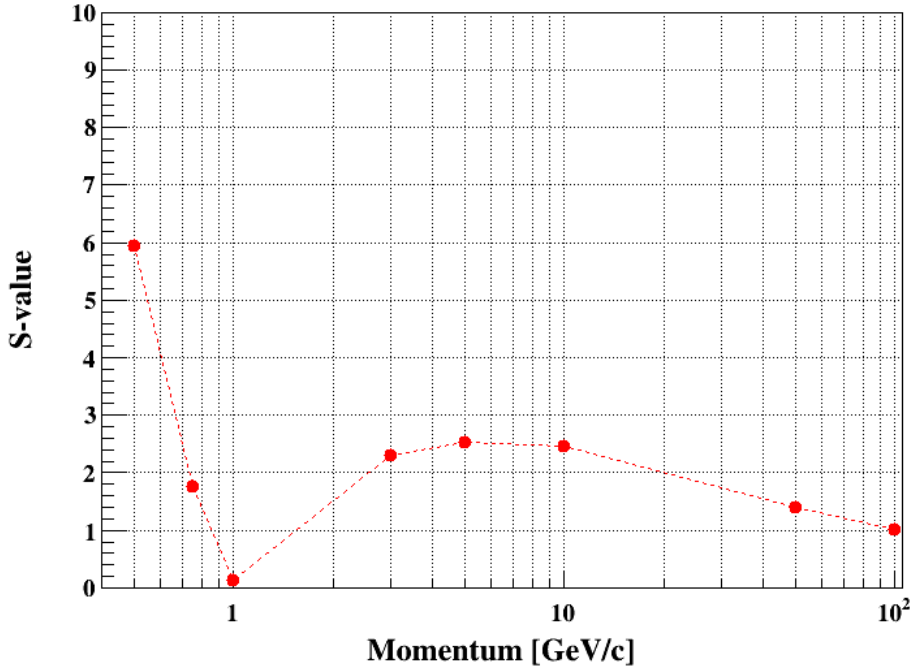
Reference :

from the TPC paper



S-value

obtained for kaon-pion case



A common figure of merit for the PID performance is the separation power S. Between particle types A and B we define

$$S_{AB} = \frac{|I_A - I_B|}{\sqrt{\sigma_{I_A}^2 + \sigma_{I_B}^2}}, \quad (2)$$

where I_A (I_B) and σ_{I_A} (σ_{I_B}) are the average dE/dx measurement of particle type A (B) and the corresponding resolution. In the ideal case assuming no degradation and σ_I follows Eq. (1), we estimate $S_{K\pi}$ at the CEPC as a function of p and $\cos\theta$ (see Fig. 4).

from TPC paper