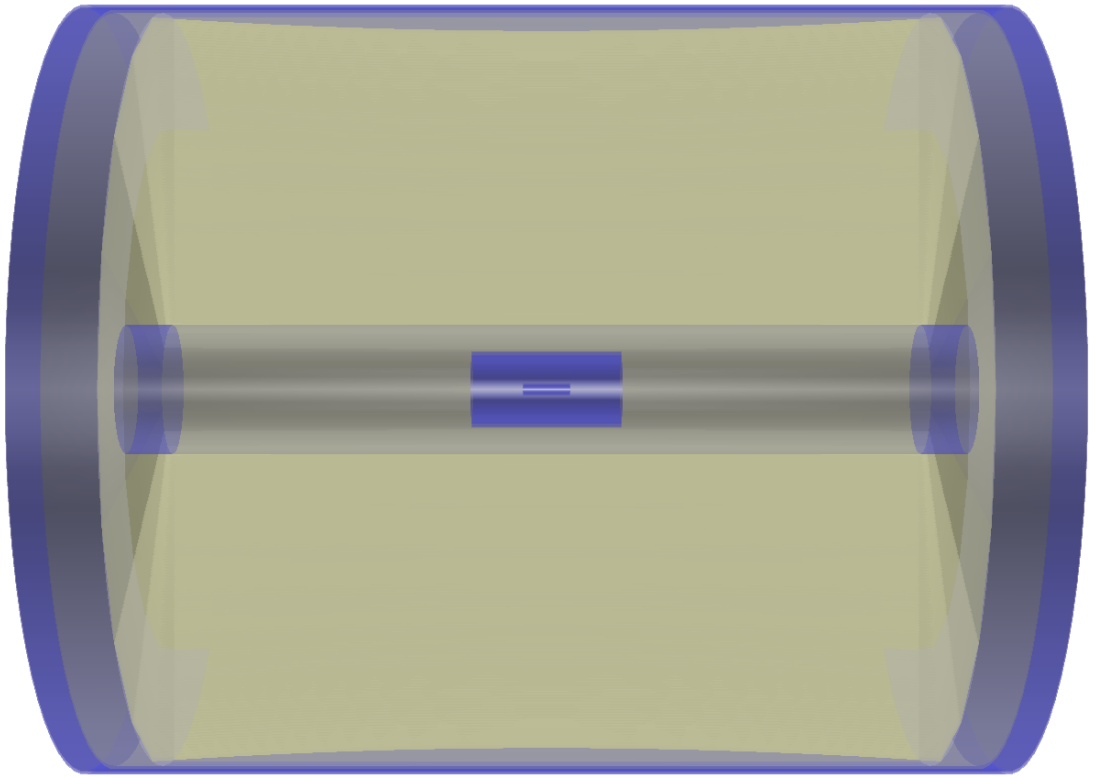
IDEA Detector Simulation Status



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IDEA (baseline) tracking geometry simulation

Following dimensions reported by Mogens talks at FCC-Berlin

- **Pipe**: equivalent to 0.48% X_0 at radius of 15.6 mm (170 µm of Ti, *to avoid overlaps*)
- **SVX:** (for this study) 7 layers of Si:
  - radii: 17.0, 23.0, 31.0, 180.0, 200.0, 330.0, 340.0 mm;
  - lengths: 250, 250, 250, 800, 800, 1500, 1500 mm (coverage not checked);
  - thickness 0.28, 0.28, 0.28, 0.94, 0.94, 0.94, 0.94 mm
  - pixel 20 µm;
- **DCH**: (gas He 90% i-C_4H_{10} 10%)
  - radii: 345, 2000 mm:
  - length: 4000 mm;
  - Cell: 56448;
  - Layers: 112;
  - Cell size: 11.85 – 14.7 mm;
  - Stereo angle: 48 - 250 mrad.
- **PSHW**: 2 active layers (+ 2 Lead radiator layers):
  - radii: 2012, 2027 mm (2004, 2014);
  - Lengths: 4800, 4800 mm (4800, 4800);
  - thickness 0.94, 0.94 mm (6, 11)
  - pixel 70 µm;

Working in a 2T magnetic field

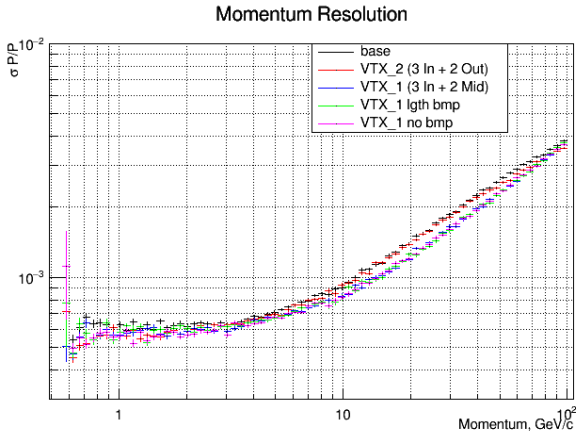
IDEA single track fitting (additional tests)

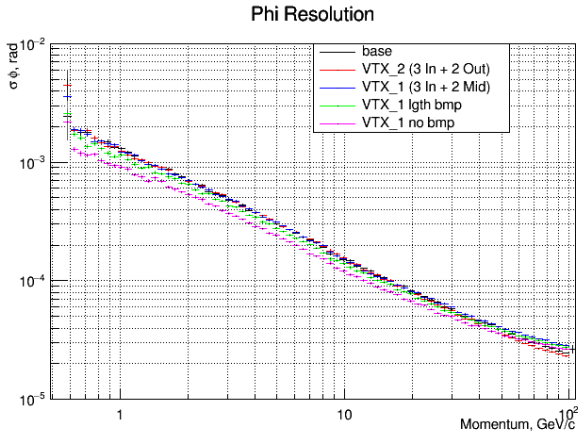
We perform a comparison of the following configuration:

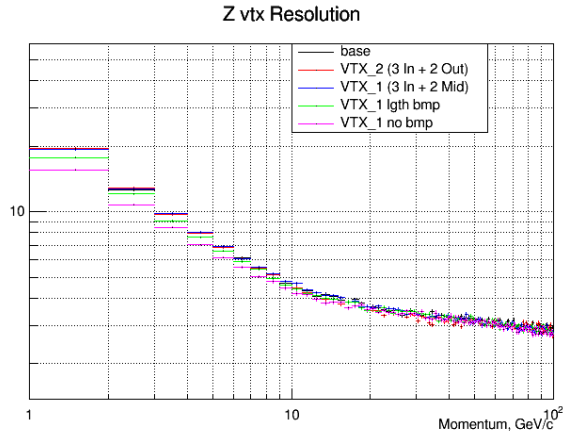
- Using a VTX made of the 3 inner layers and the 2 outers ones (VTX_2).
- Using a VTX made of the 3 inner layers and the 2 central ones (VTX_1).
- With VTX_1 use a thinner Beam Pipe (made of 1mm of Beryllium).
- With VTX_1 without Beam Pipe wall

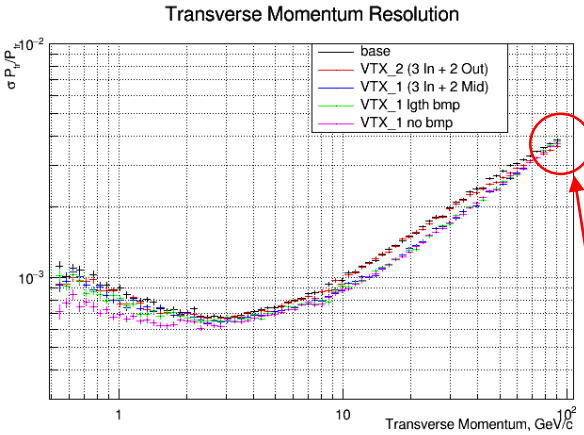
Moreover we performed a scan of the resolutions as a function of the theta angle for tracks of fixed momenta (1, 5, 10, 30, 100 GeV).

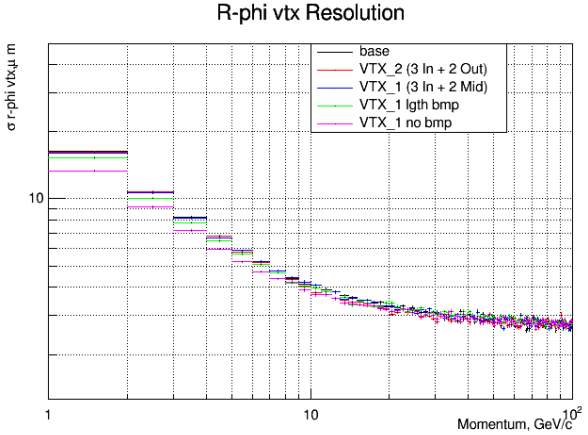
Resolutions (μ^- at fixed θ=65deg)





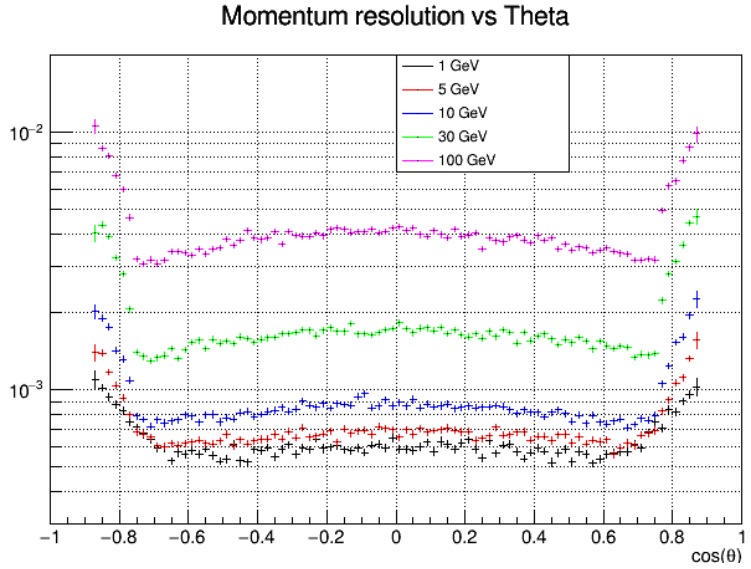


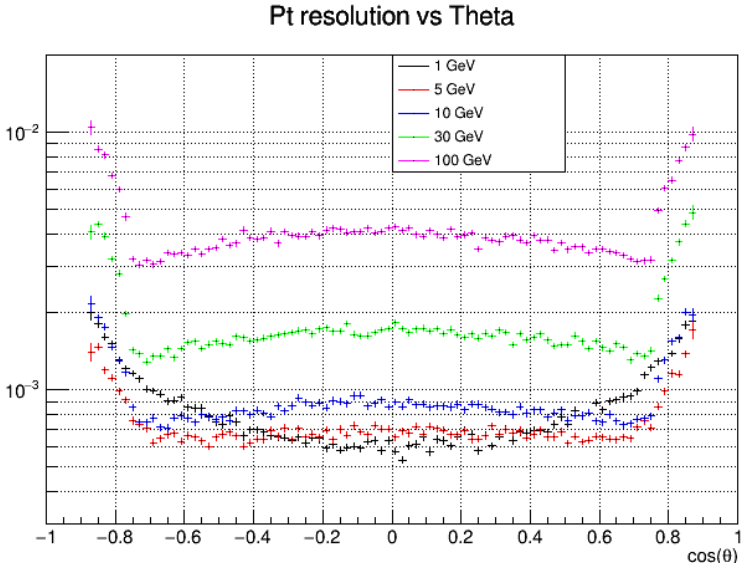


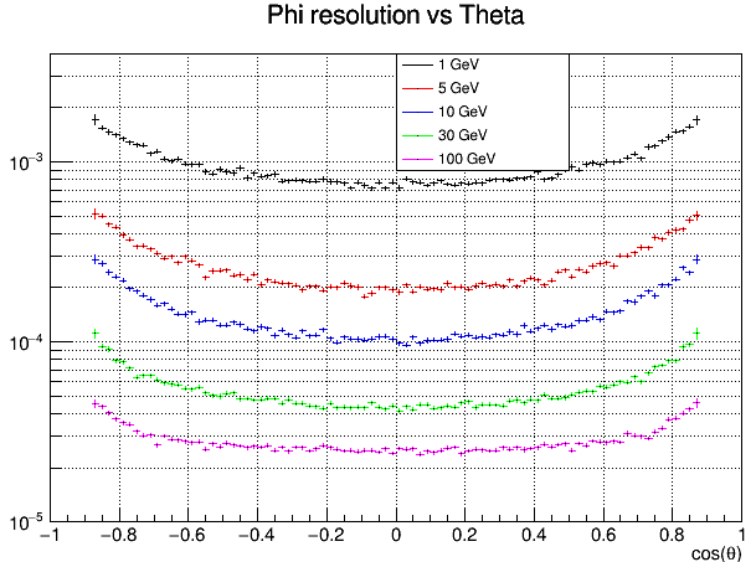


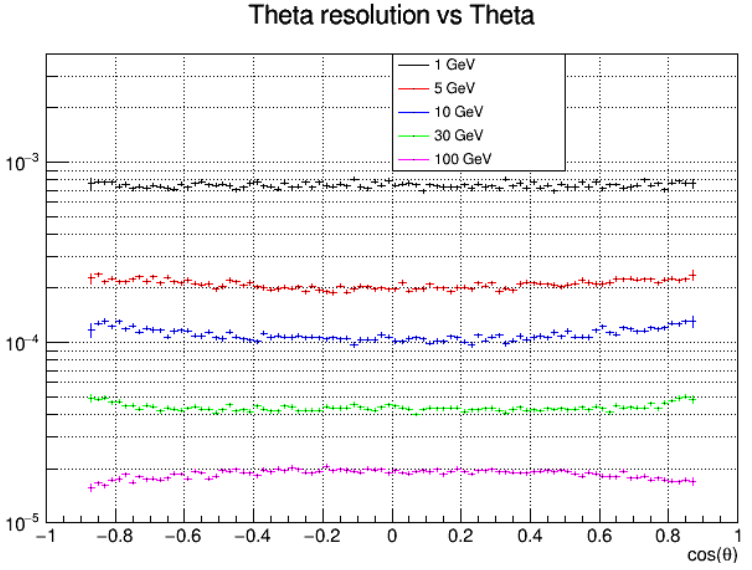
$\sigma pt/pt^2(100GeV) = 3\text{-}4 \times 10^{-5}$

Resolutions (μ^- as function of θ)

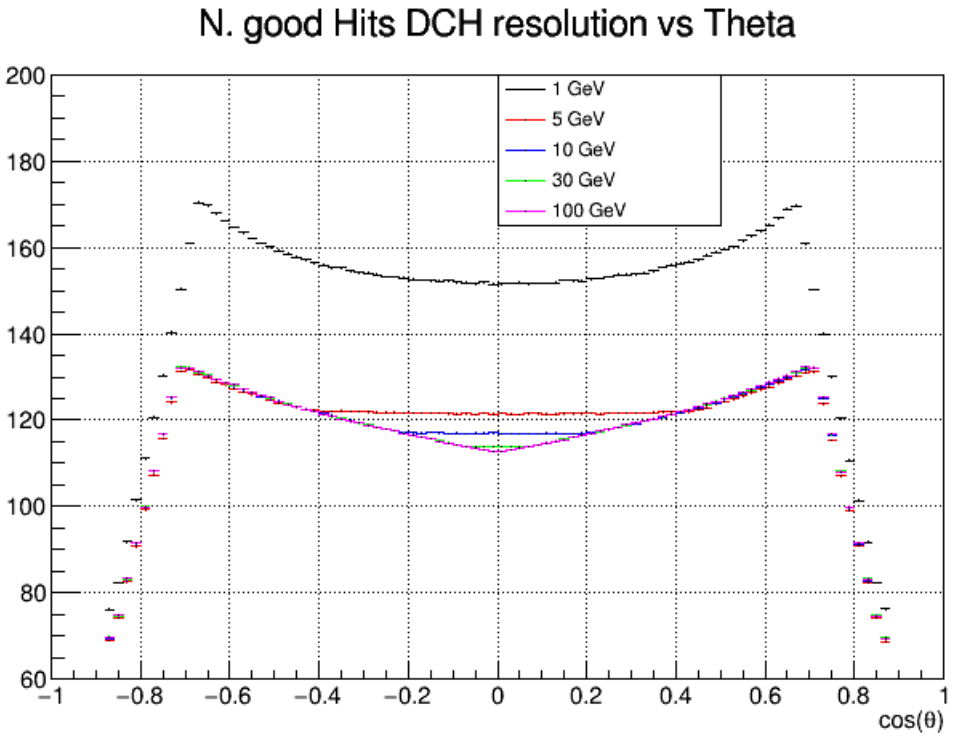


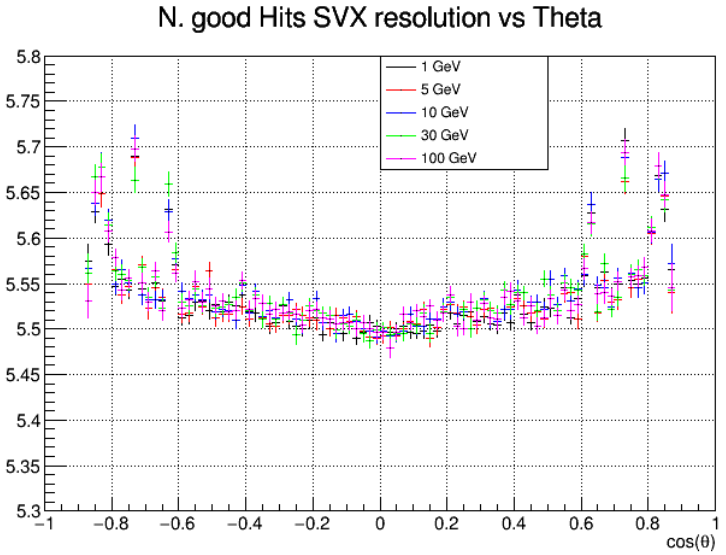


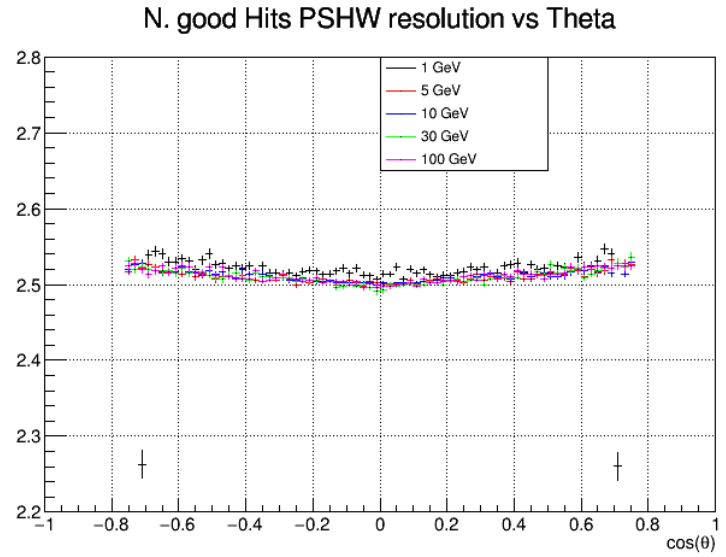




Resolutions (μ^- as function of θ)







Works in progress

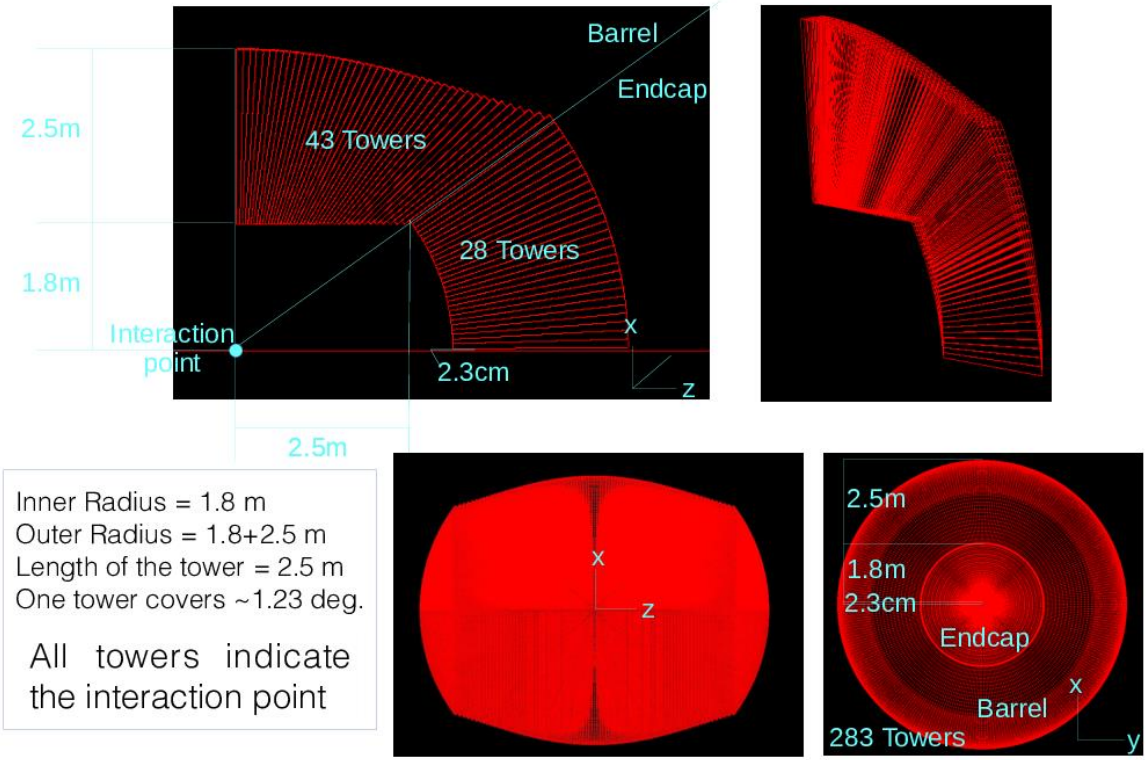
- Integration of the DR calorimeter inside the actual IDEA full simulation tools:
  - The 4pi DR calorimeter geometry, taken from CEPC collaboration, is integrated;
  - We are merging the hit simulation of the Pavia group on a DR calorimeter prototype with the 4pi one got from CEPC.
- The integration of the CDCH (and SVX) simulation inside their framework (ILCSoft + Mokka)
  - Xu Yin is performing the integration;
  - He succeeded to import the CDCH and SVX geometry in Mokka;
  - Currently we are finalizing the validation of the CDCH simulation in Mokka.
  - Hit production, track fitting and track reconstruction integration is not started yet.

Integration of the DR calorimeter inside the actual IDEA full simulation tools

Mokka DR calo geometry:
autor FU ChengDong

The porting of the DR 4pi geometry inside the IDEA sim tool is completed.

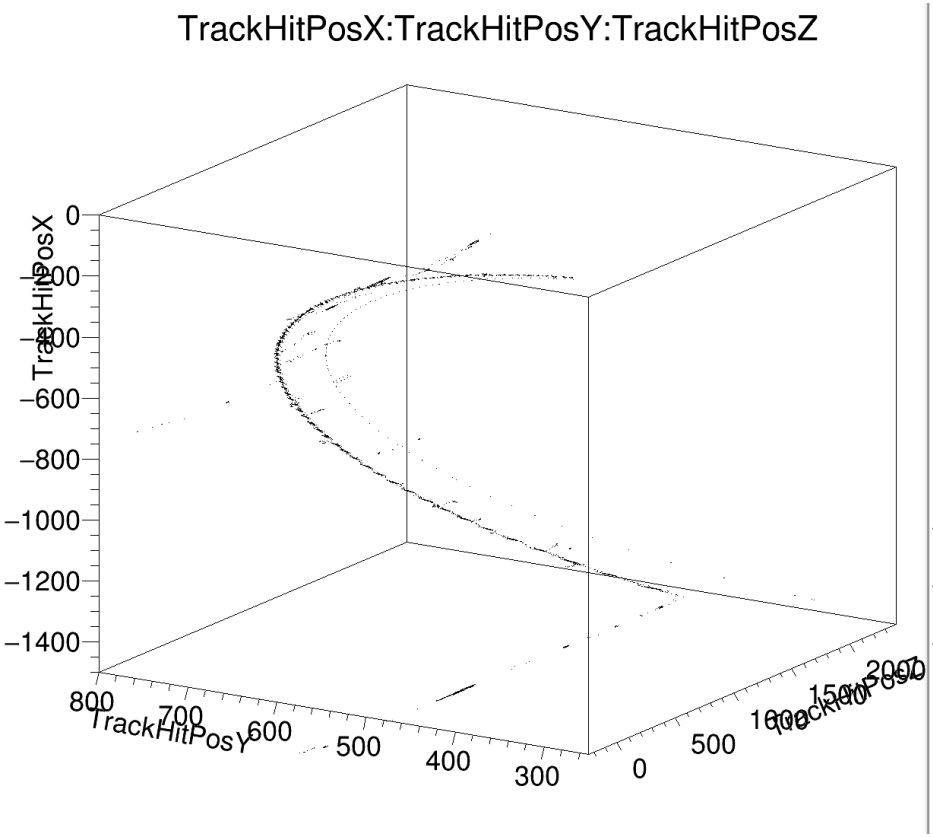
With the help of Lorenzo Pezzotti (INFN Pavia) we are working on the merging of the Sensitive Detector of the prototype simulation and of the Mokka DR code.



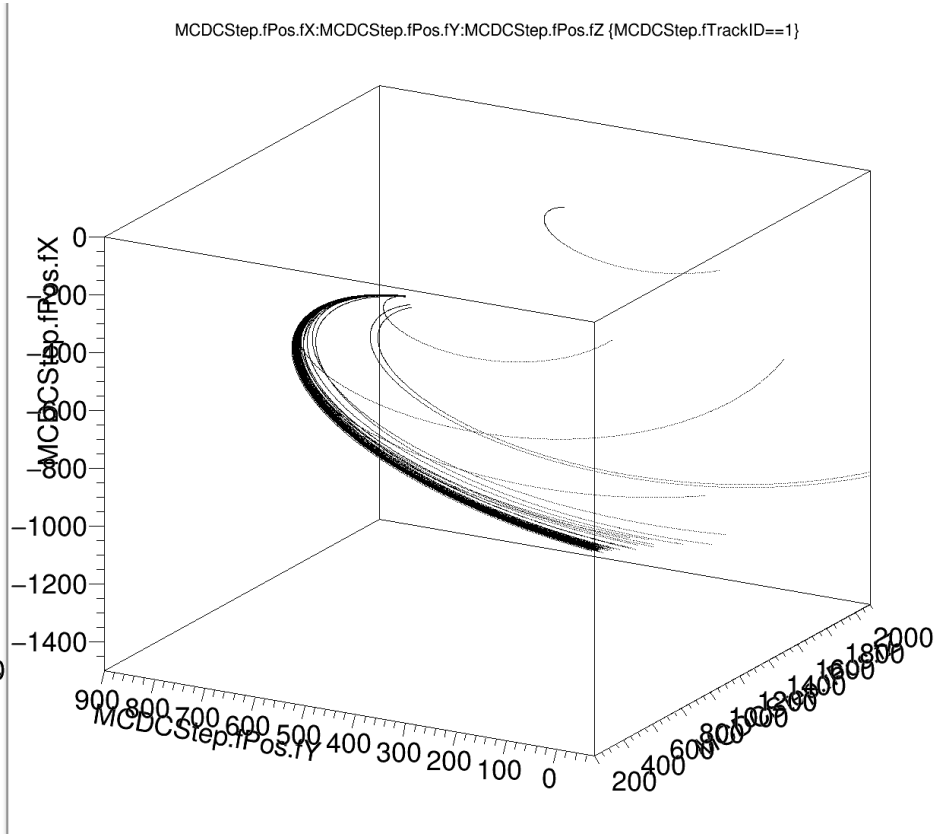
CDCH Mokka simulation validation status

First test at almost 1 month ago, (Yin should have new results)

Mokka

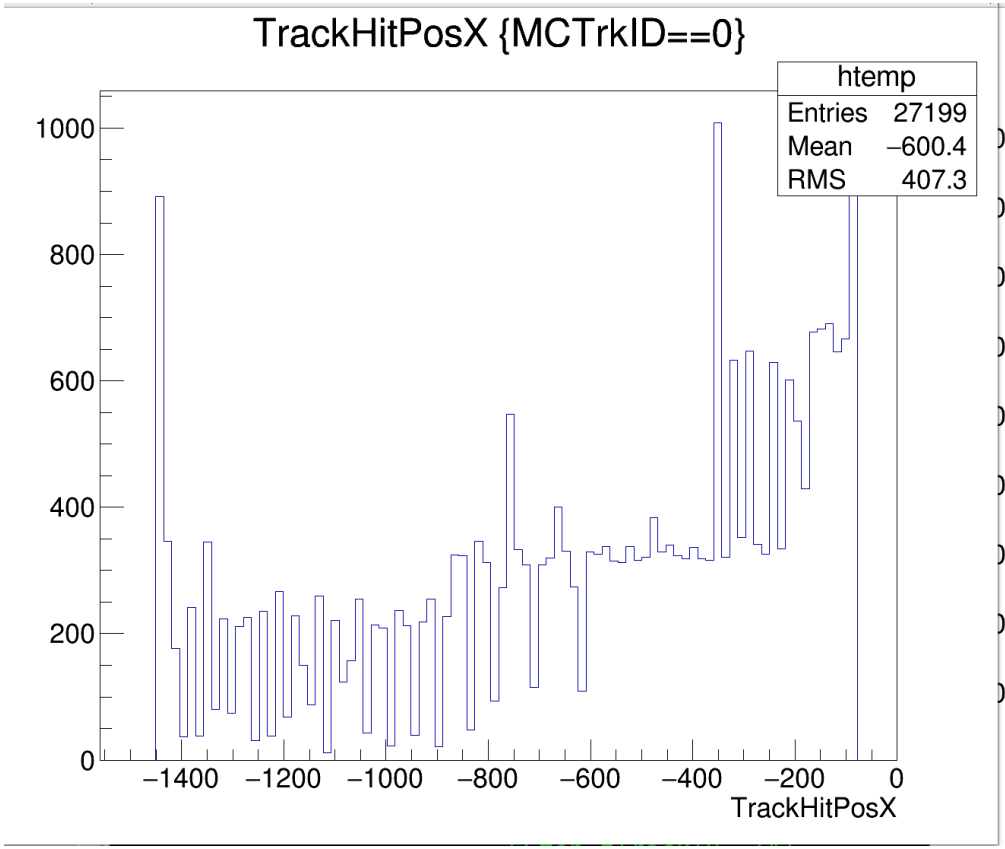


IDEA sim tool
(delta ray removed)

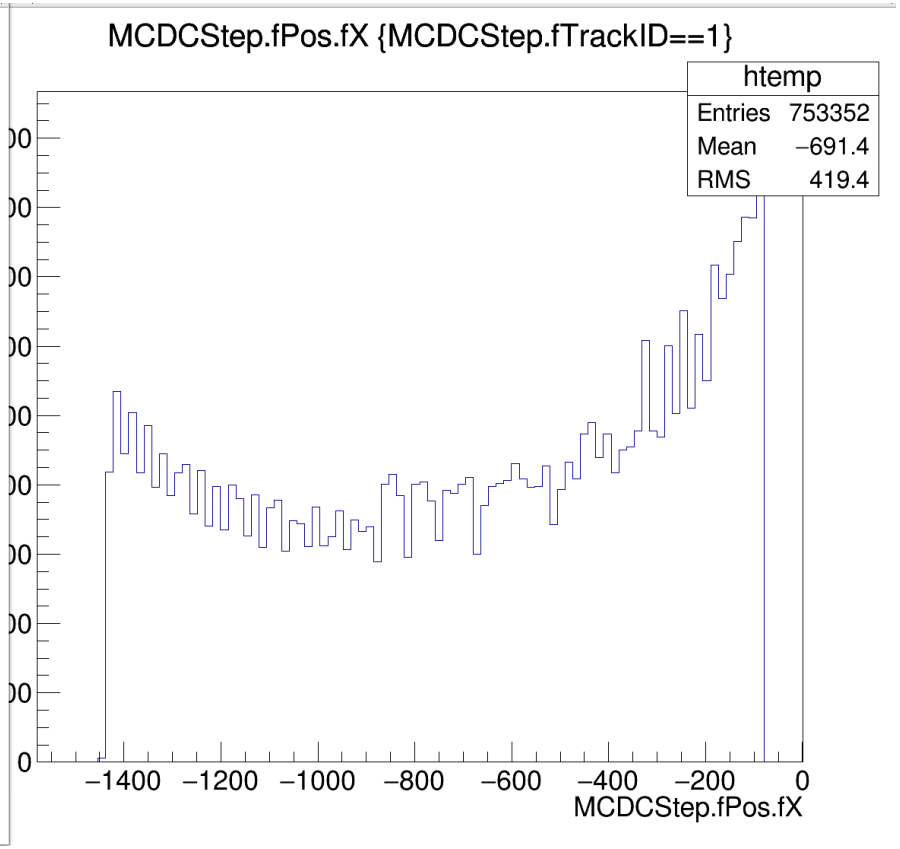


CDCH Mokka simulation validation status

Mokka

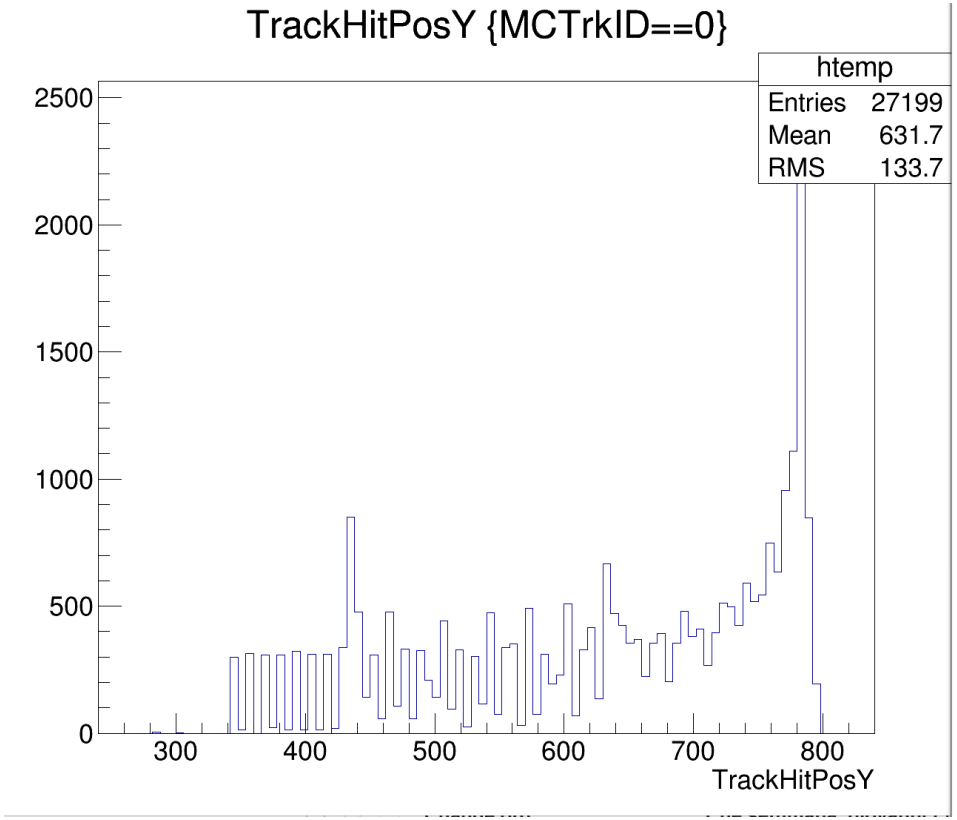


IDEA sim tool
(delta ray removed)



CDCH Mokka simulation validation status

Mokka



IDEA sim tool
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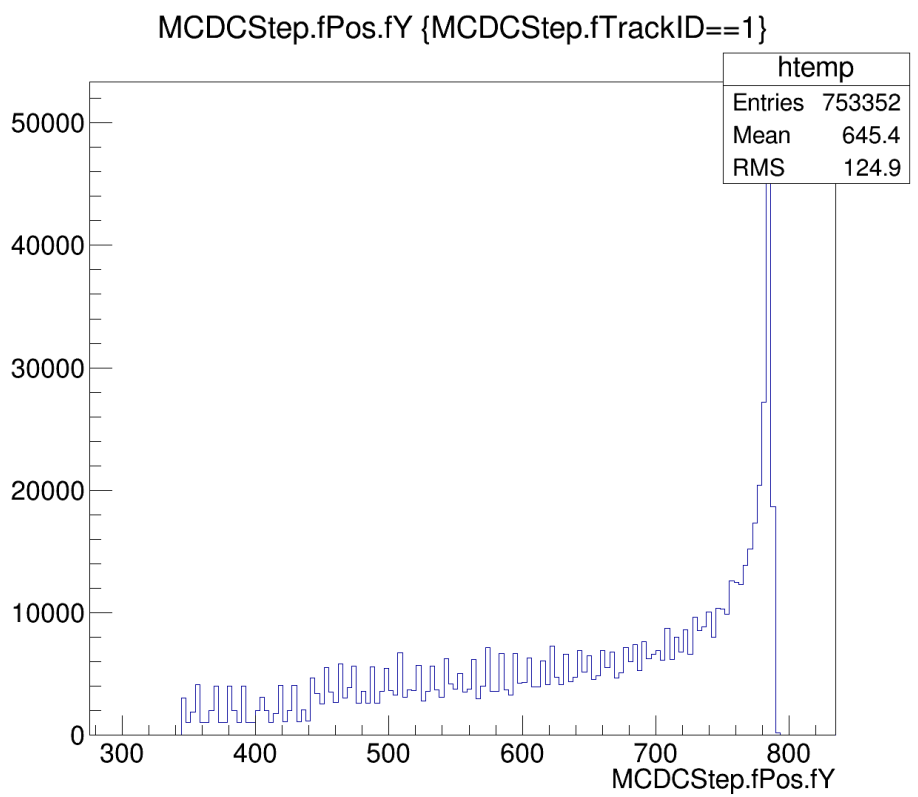
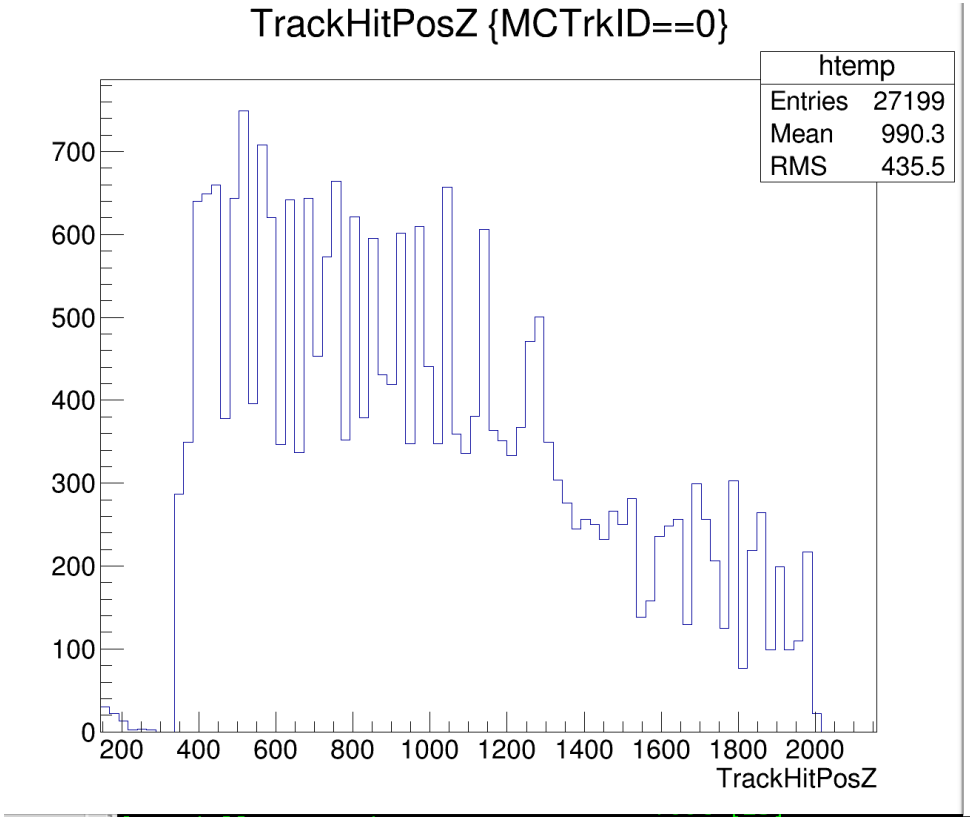


CDCH Mokka simulation validation status

Mokka



IDEA sim tool
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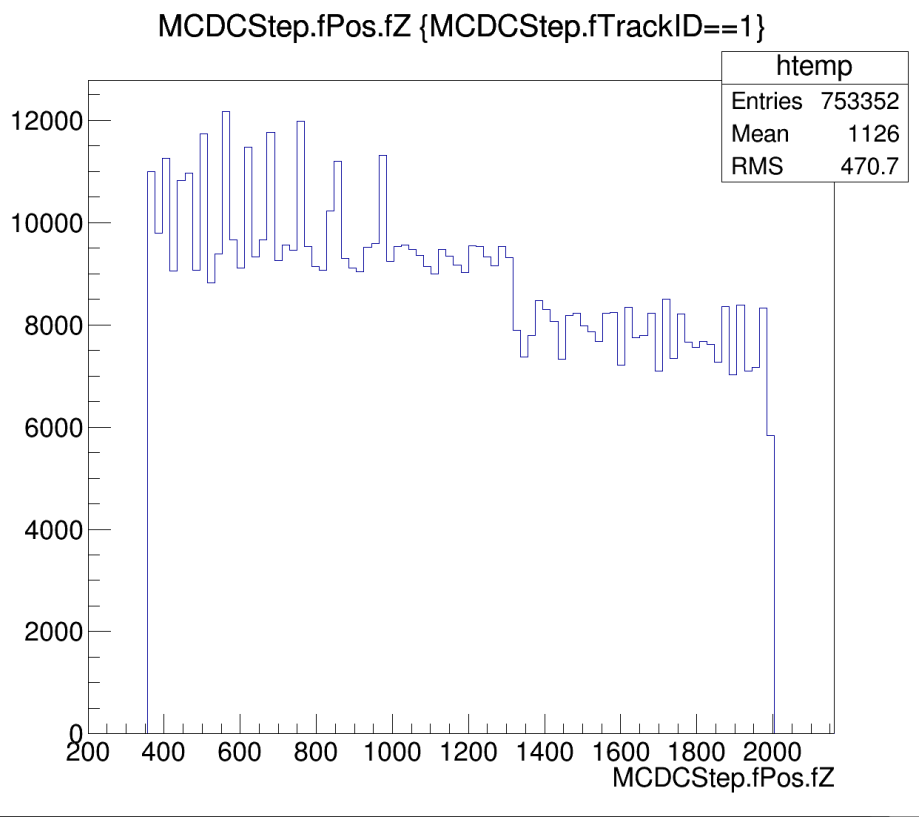
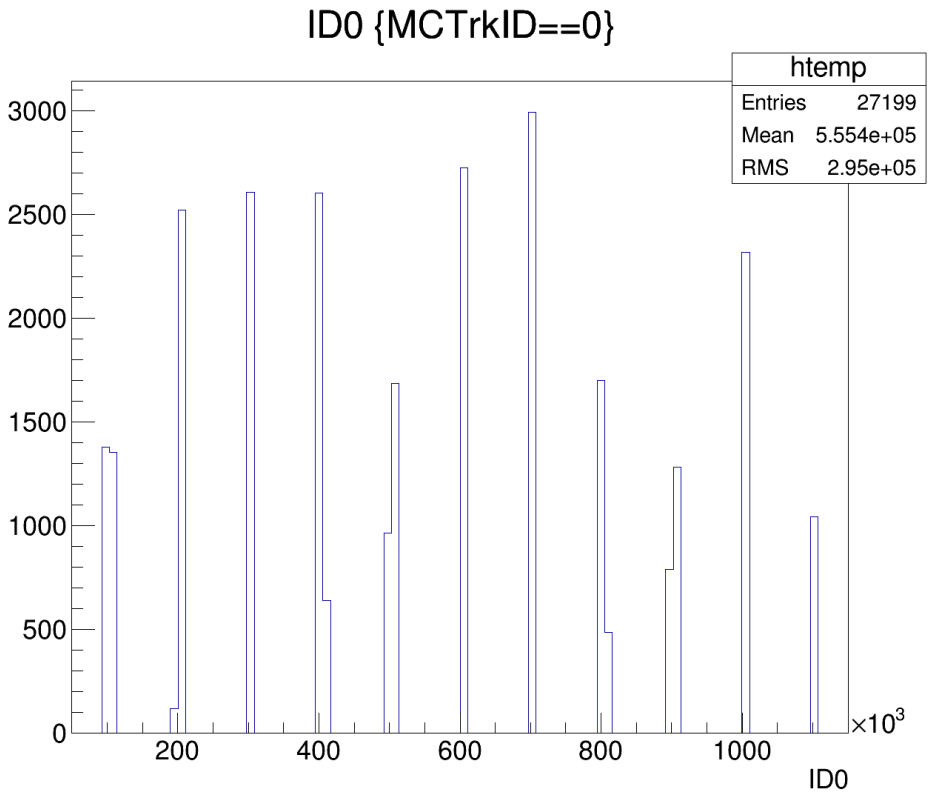
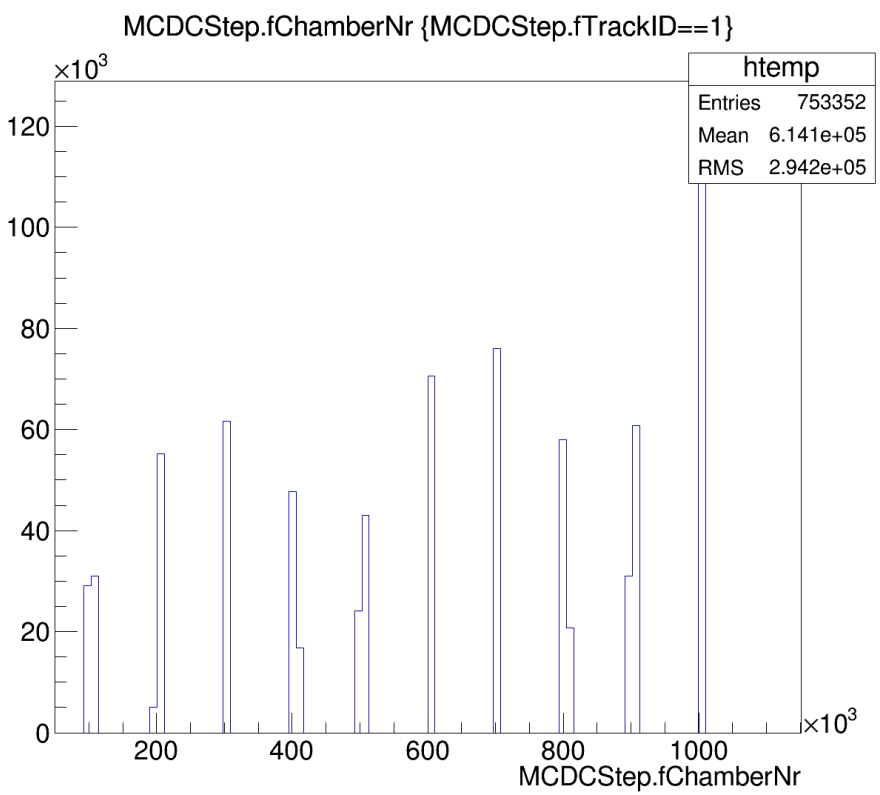


CDCH Mokka simulation validation status

Mokka



IDEA sim tool
(delta ray removed)



CDCH Mokka simulation validation status

First test at almost 1 month ago, (Yin should have new results)

The validation of the two CDCH simulation is on going:

- Points coordinates distributions are statistically compatible;
- Cell Ids distributions are statistically compatible;
- Some differences occur on the number of Points and on the number of secondary particles produced;
- Some differences are visible in the shapes of the tracks, in Mokka seems equal event by event, there are smaller fluctuation.

Possible reasons could be:

- Physics list used;
- Step point limiters;
- Random number generators.

Summary

- We have a working standalone full simulation tools for the IDEA detector:
  - The CDCH is at good level of details;
  - The SVX and PSHW, at current stage, are simulated only in the barrel region;
  - We have reasonable track finding and track fitting working tools;
  - The 4pi DR calorimeter geometry, taken from CEPC collaboration, is integrated, work is still on going on the hit creation and Calorimeter data object manipulation.
- The IDEA detector simulation inside CEPC framework (ILCSoft + Mokka) is in progress:
  - Xu Yin is performing the integration of the CDCH and SVX geometry in Mokka;
  - the validation of the two simulations should finish soon.
  - Hit production, track fitting and track reconstruction integration is not started and need some more work.

We want to continue to use the IDEA standalone simulation to produce some preliminary physics results soon.