dRICH and gas RICH update

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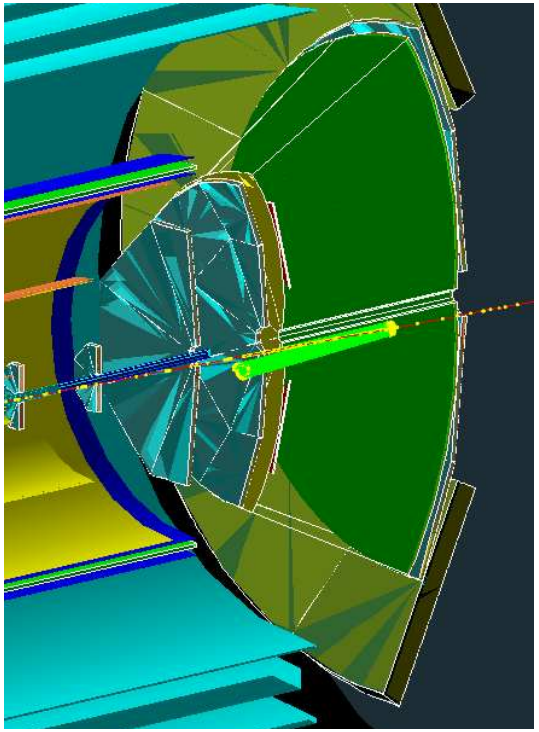
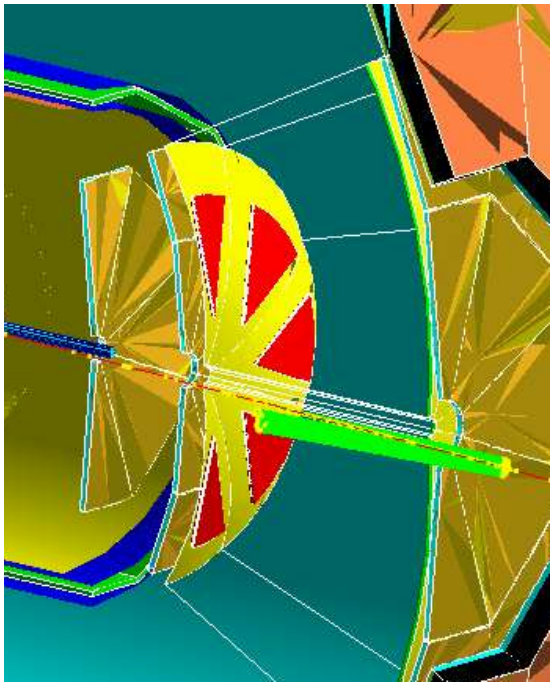
ePHENIX gas RICH simulation





PHENIX GEANT MC based simulation:

- Gas RICH, CF_4
- inward reflecting mirrors, eight sectors in azimuthal angle
- eight detector planes
- The RICH is in sizable magnetic field

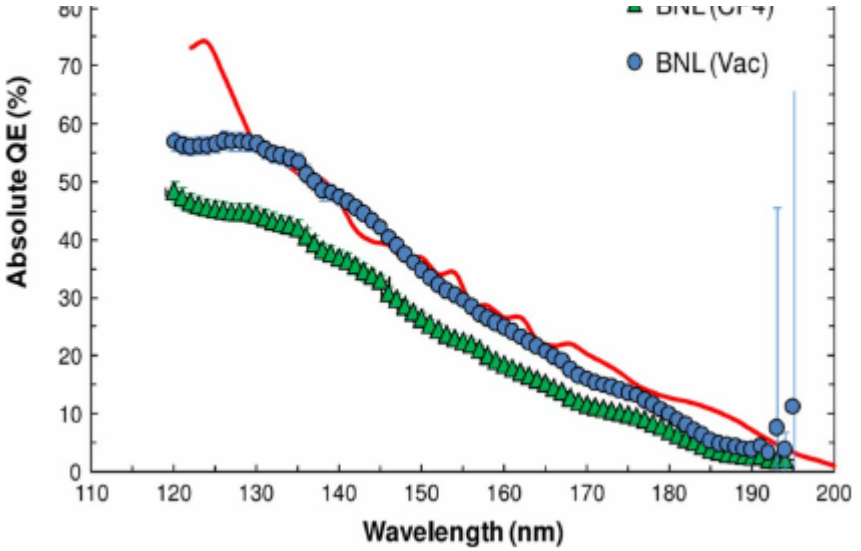
Our goals:

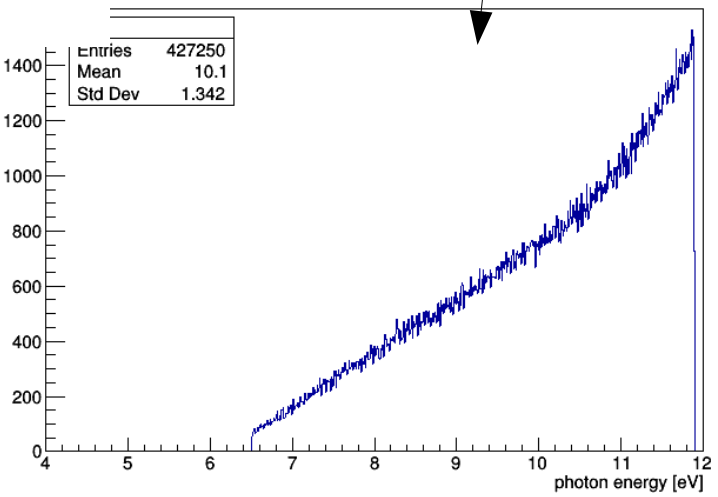
- Set up a reconstruction code(s) usable to characterize the system (PID capability)
- Do a comparison, in the same framework, with a dual-radiator RICH arranged in the ePHENIX geometrical constraints

Simulated sperctrum

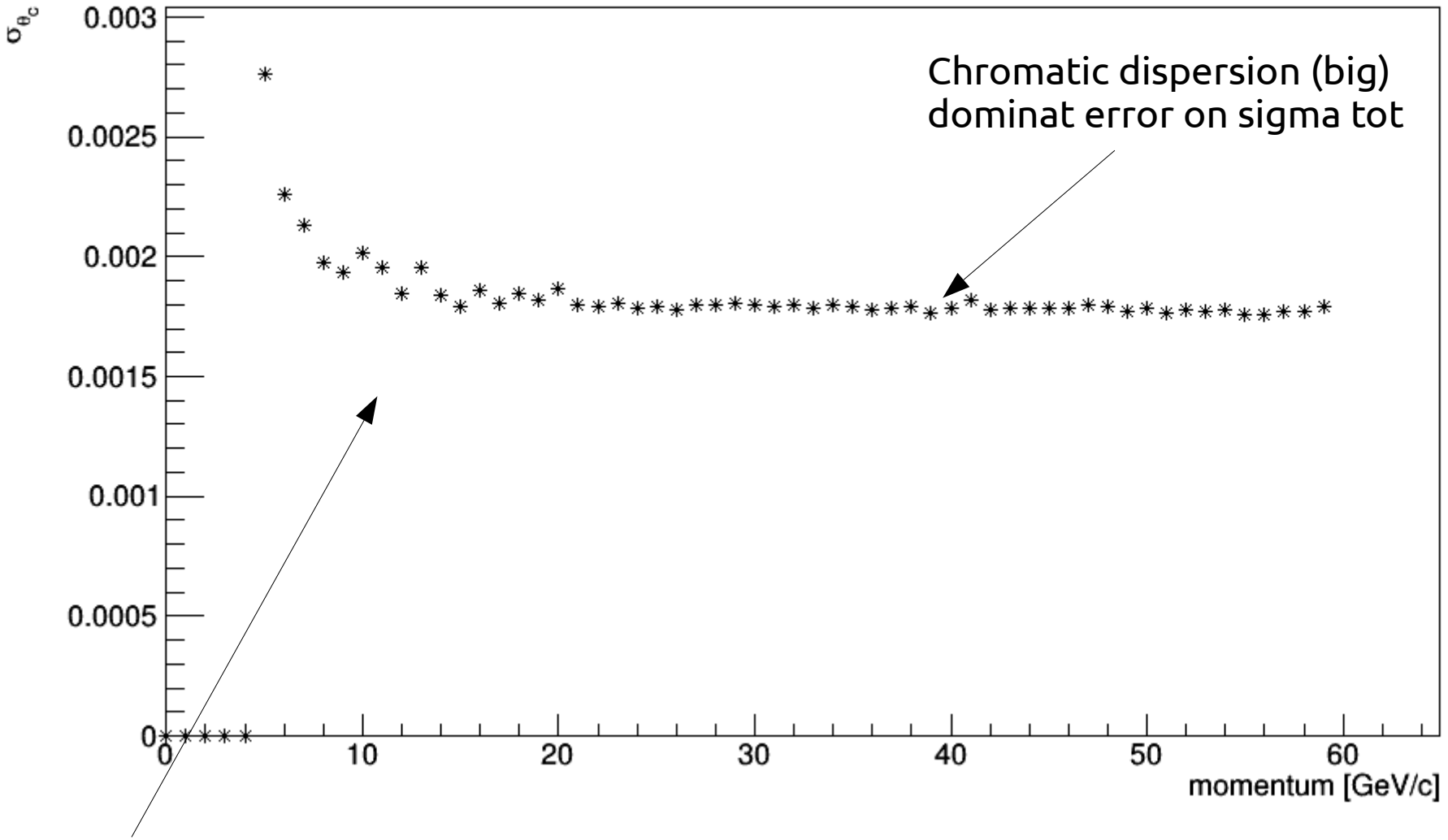
```
G4double PhotonEnergy_CF4[nEntries_CF4] =
    {5.5 * eV, 5.6 * eV, 5.7 * eV, 5.8 * eV, 5.9 * eV,
     6.0 * eV, 6.1 * eV, 6.2 * eV, 6.3 * eV, 6.4 * eV,
     6.5 * eV, 6.6 * eV, 6.7 * eV, 6.8 * eV, 6.9 * eV,
     7.0 * eV, 7.1 * eV, 7.2 * eV, 7.3 * eV, 7.4 * eV,
     7.5 * eV, 7.6 * eV, 7.7 * eV, 7.8 * eV, 7.9 * eV,
     8.0 * eV, 8.1 * eV, 8.2 * eV, 8.4 * eV, 8.6 * eV,
     8.8 * eV, 9.0 * eV, 9.2 * eV, 9.4 * eV, 9.6 * eV,
     9.8 * eV, 10.0 * eV, 10.2 * eV, 10.4 * eV, 10.6 * eV,
     10.8 * eV, 11.0 * eV, 11.2 * eV, 11.3 * eV, 11.4 * eV,
     11.5 * eV, 11.6 * eV, 11.7 * eV, 11.8 * eV, 11.9 * eV};

G4double RefractiveIndex_CF4[nEntries_CF4] =
    {1.000480, 1.000482, 1.000483, 1.000485, 1.000486,
     1.000488, 1.000490, 1.000491, 1.000493, 1.000495,
     1.000497, 1.000498, 1.000500, 1.000502, 1.000504,
     1.000506, 1.000508, 1.000510, 1.000512, 1.000514,
     1.000517, 1.000519, 1.000521, 1.000524, 1.000526,
     1.000529, 1.000531, 1.000534, 1.000539, 1.000545,
     1.000550, 1.000557, 1.000563, 1.000570, 1.000577,
     1.000584, 1.000592, 1.000600, 1.000608, 1.000617,
     1.000626, 1.000636, 1.000646, 1.000652, 1.000657,
     1.000662, 1.000667, 1.000672, 1.000677, 1.000682};
```

Large number of photons at high Energy where the index of refraction varies considerably.
Big chromatic dispersion!



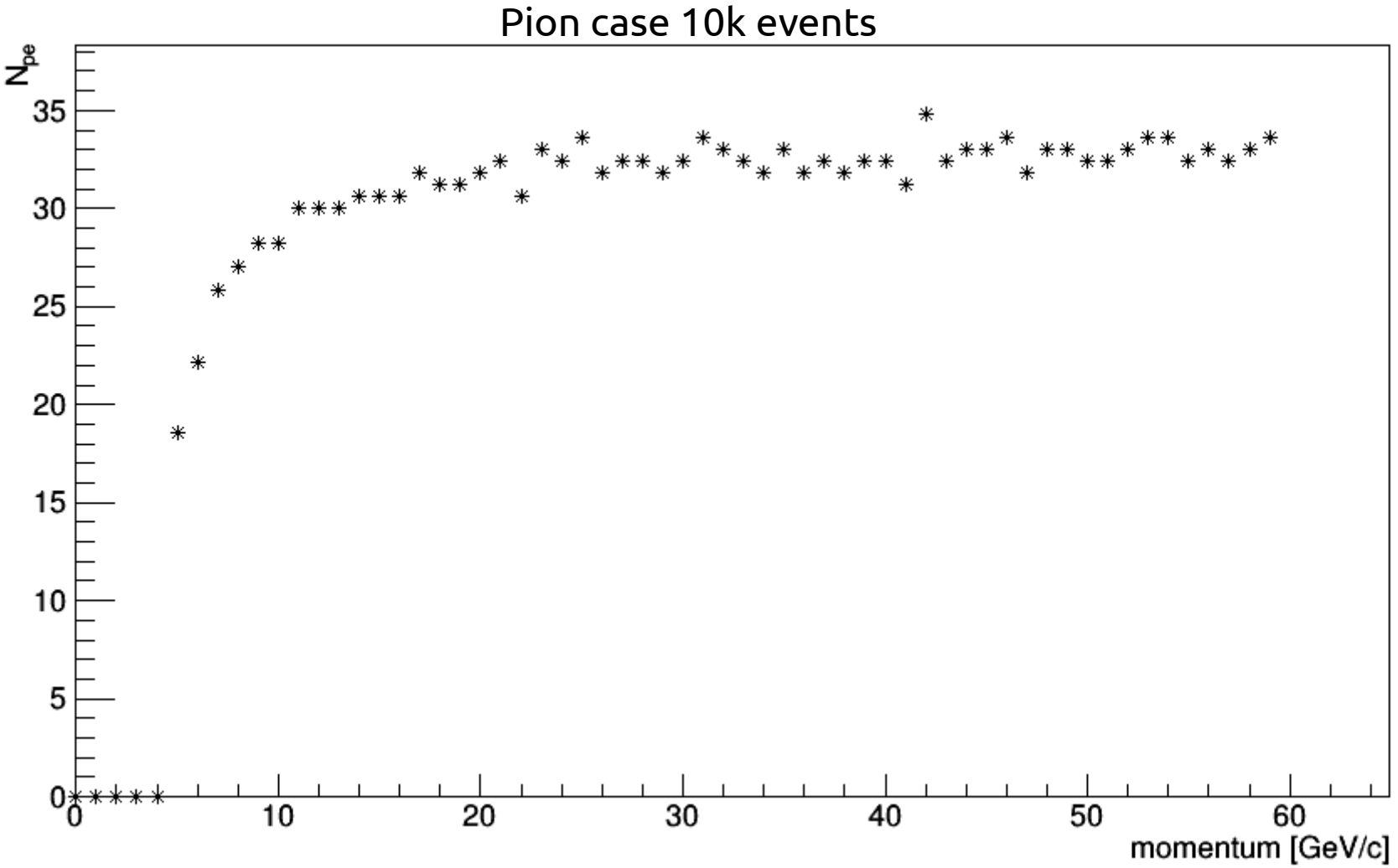


Cherekov angle dispersion



Variable pattern due to poor statistics and binning (momentum binning 1 GeV/c)!

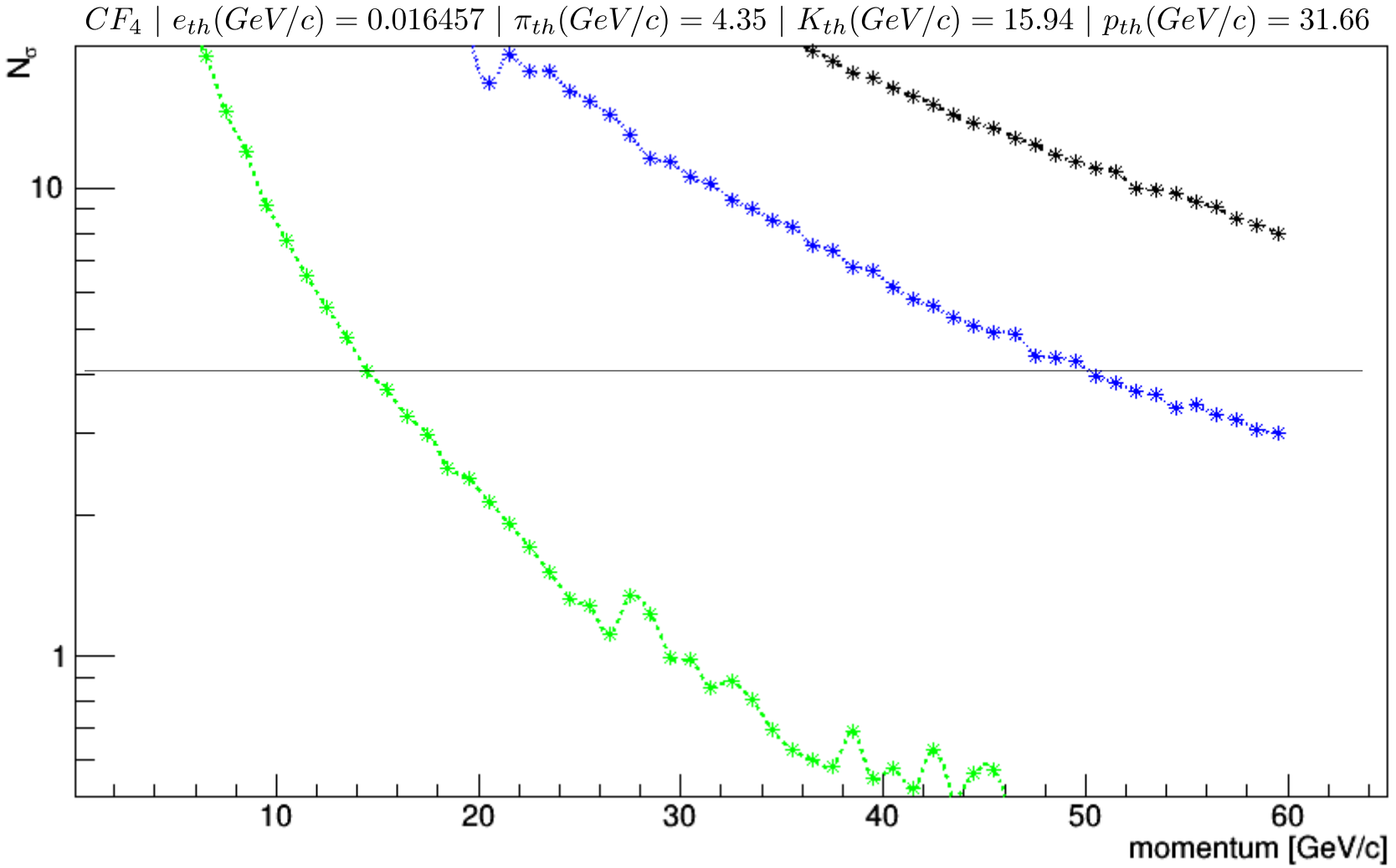
Number of p.e. - scaled value



Scaled with a factor 0.6, already too big numbers. Usual in GEANT4.

PID capability (preliminary)

e/pi
pi/K
K/p

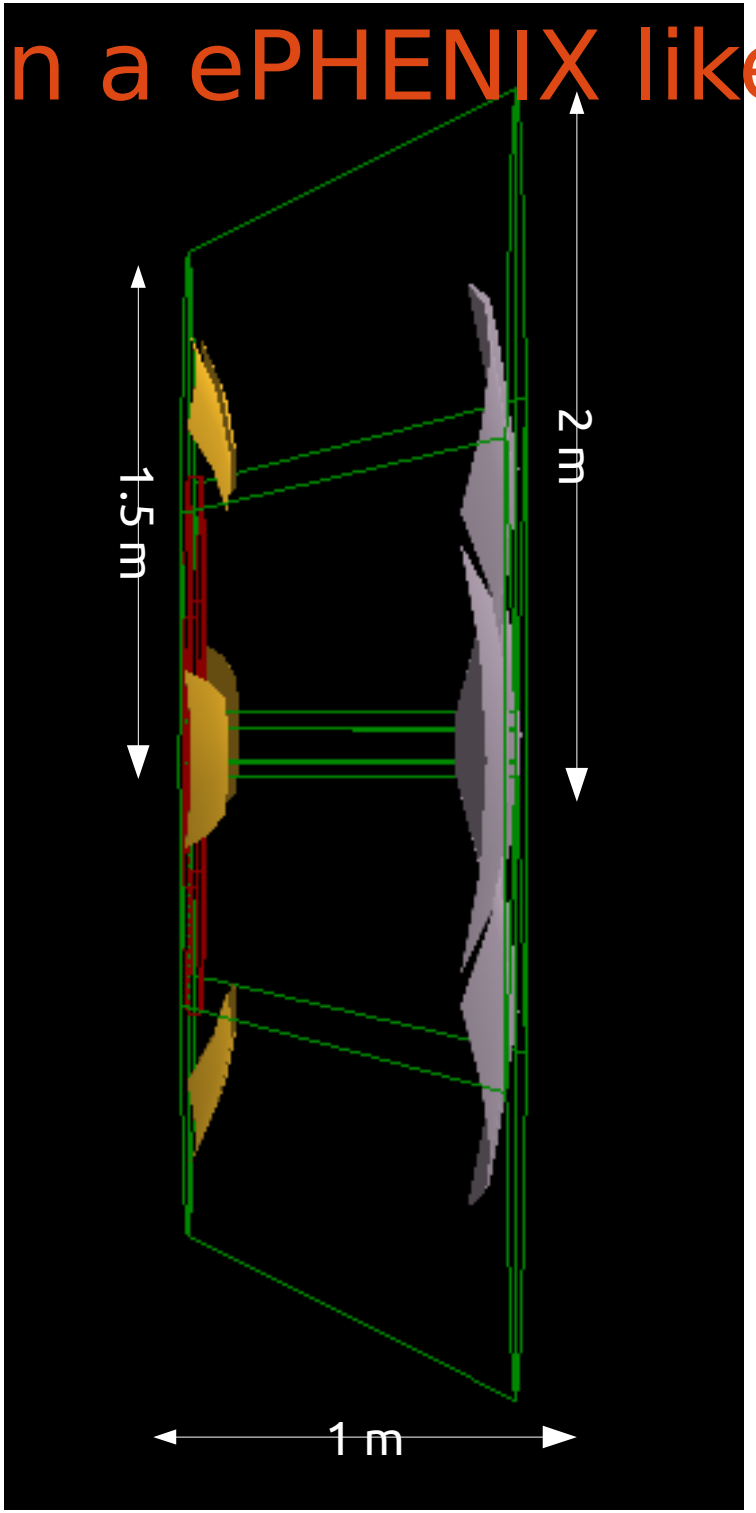


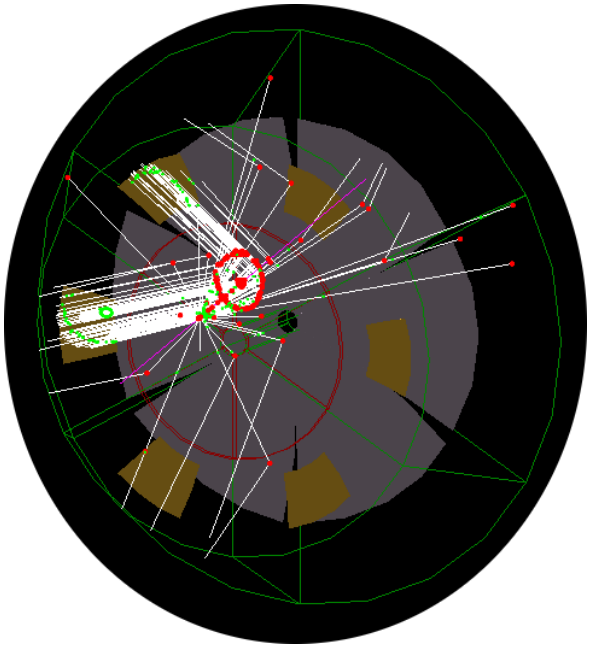
3σ

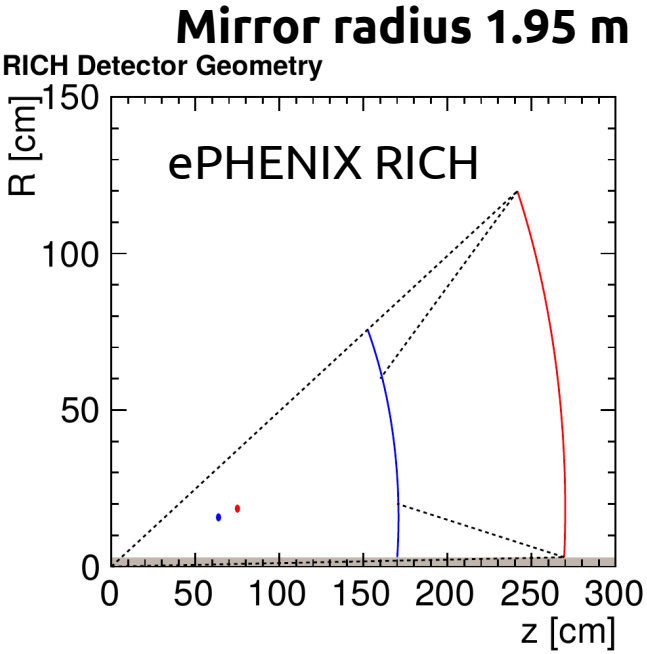
- Pixel sixe 3 mm
- Magnetic field on

dRICH in a ePHENIX like contex

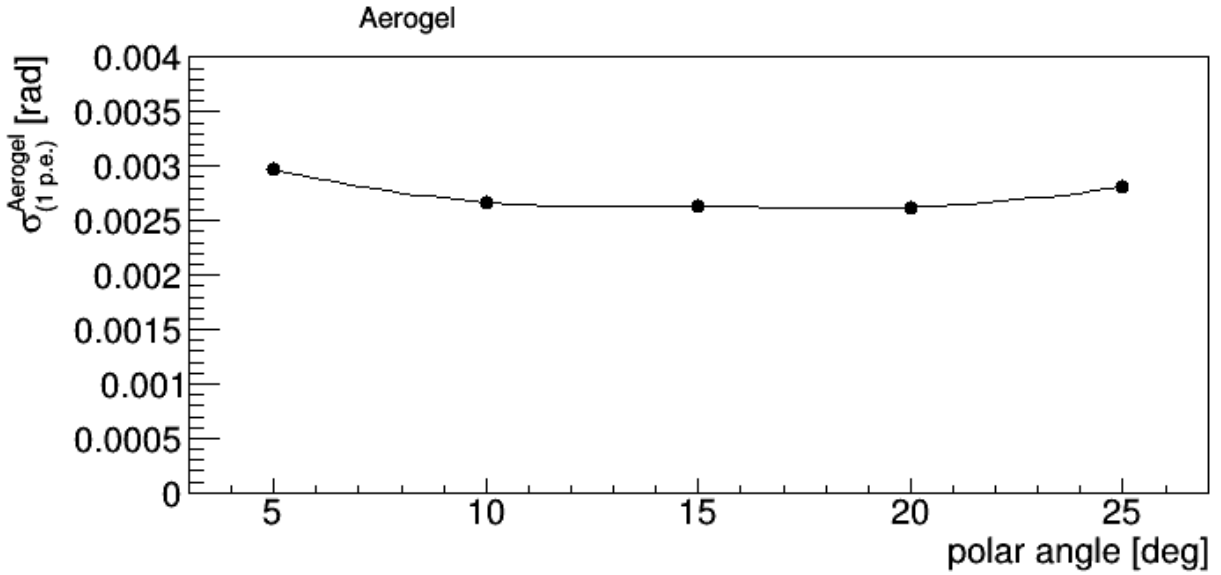
Do we have this space?

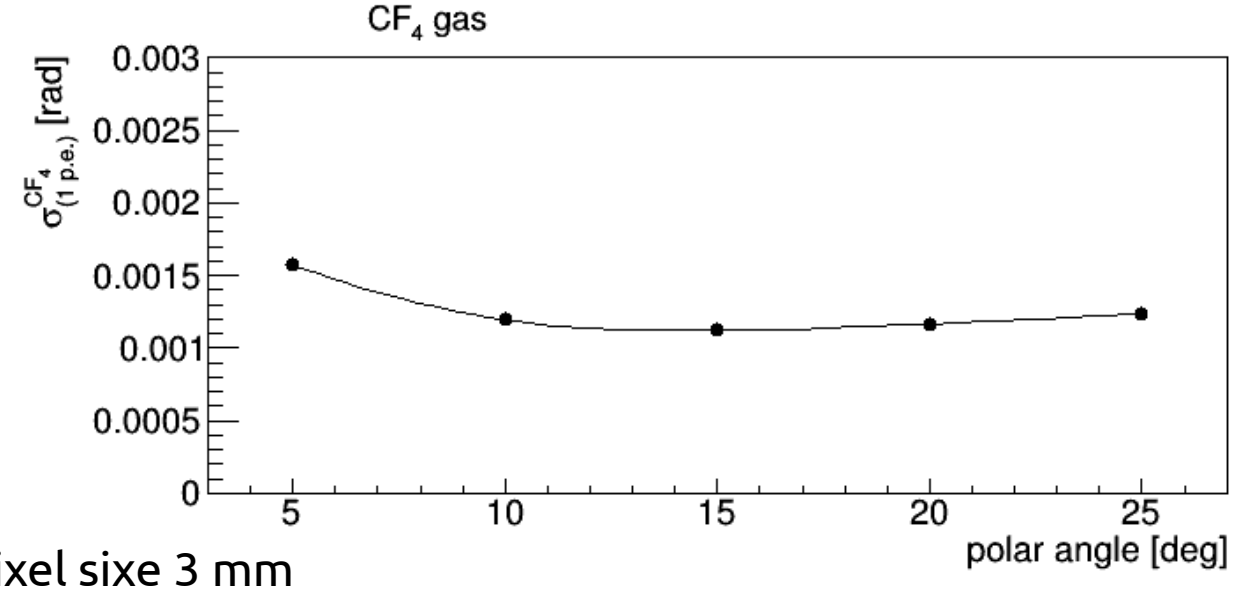






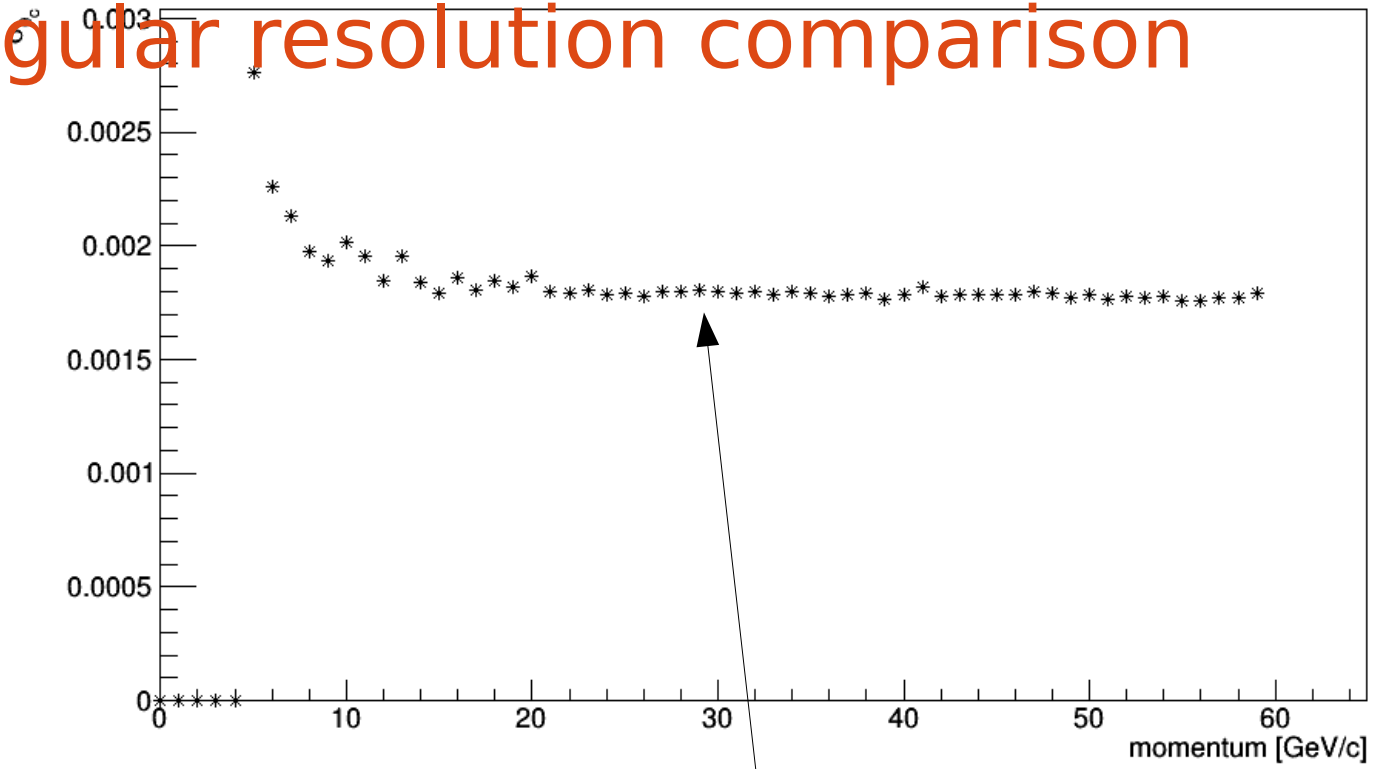
Angular resolution (pion at 30 GeV/c)



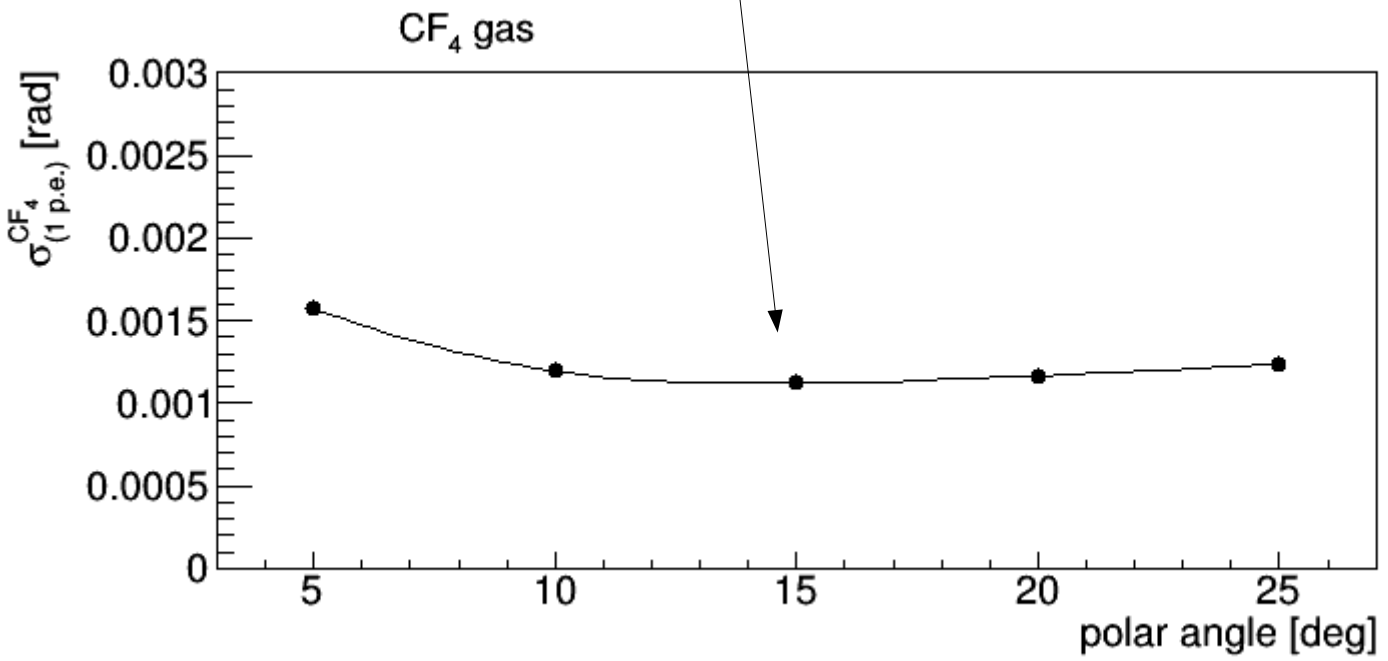


- Pixel sixe 3 mm
- Magnetic field off

Angular resolution comparison



Gas RICH

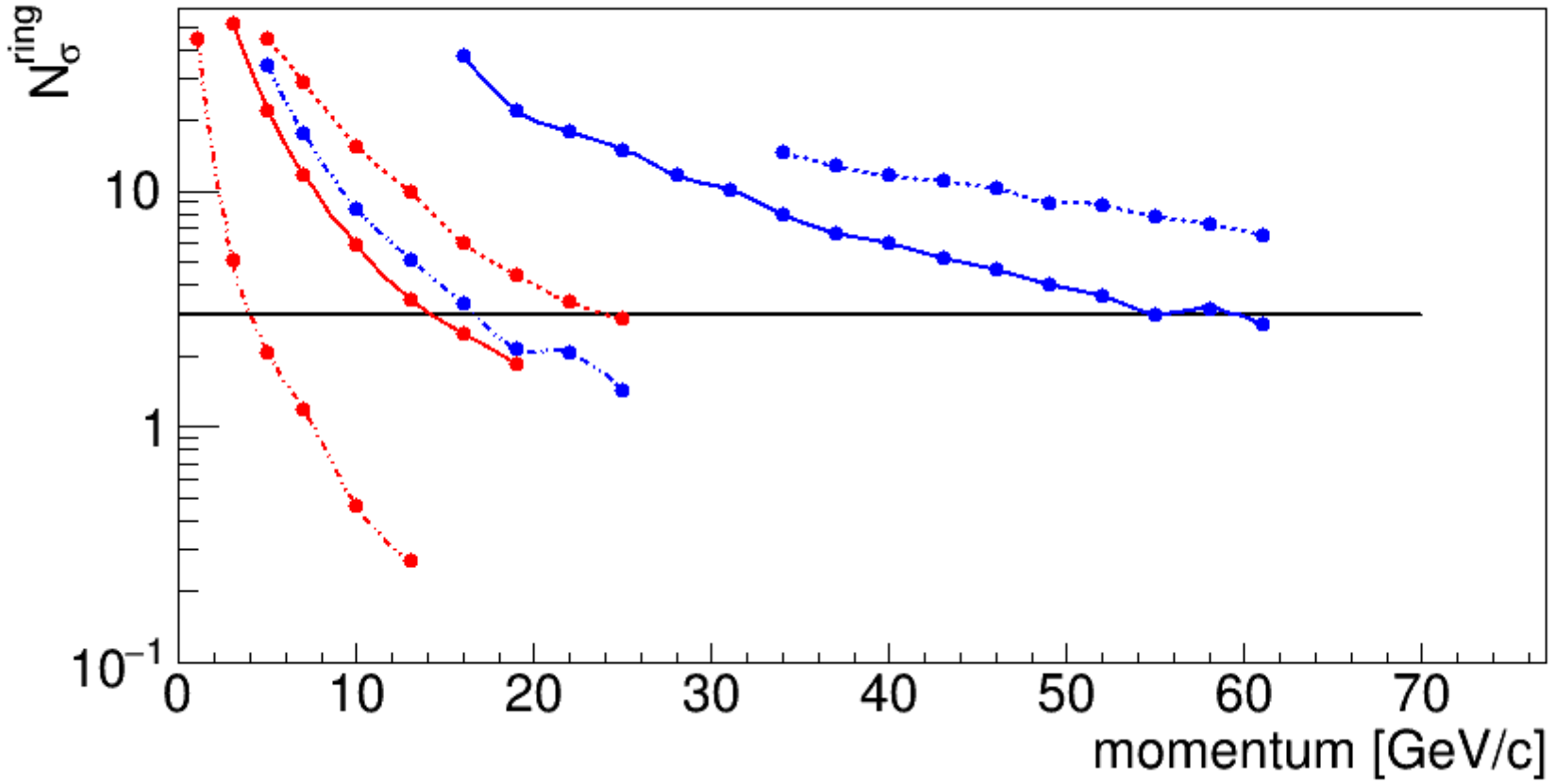


dRICH RICH

PID capability at 10° (preliminary)

$Aerogerl \mid e_{th}(GeV/c) = 0.002542 \mid \pi_{th}(GeV/c) = 0.67 \mid K_{th}(GeV/c) = 2.46 \mid p_{th}(GeV/c) = 4.89$

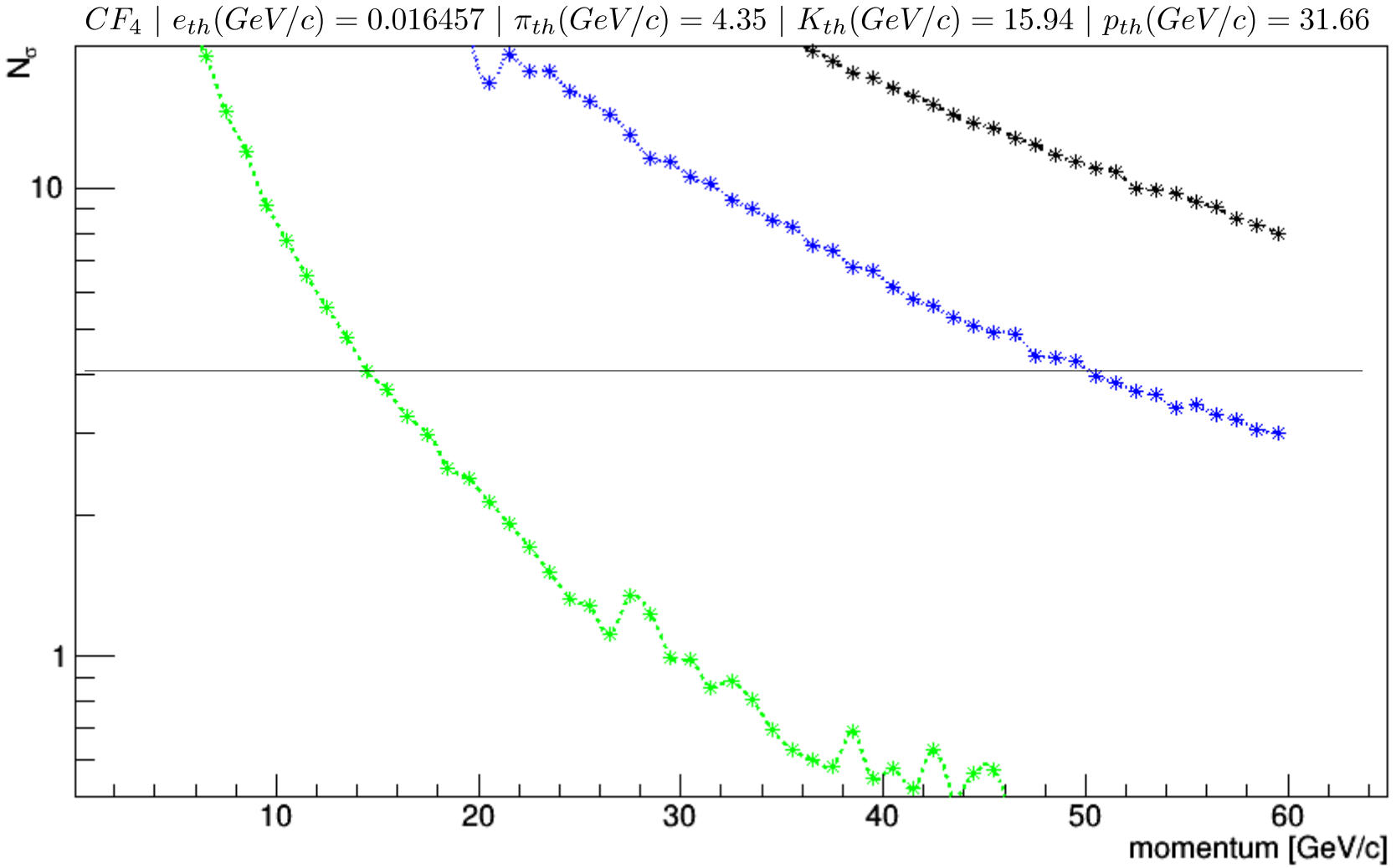
$CF_4 \mid e_{th}(GeV/c) = 0.016457 \mid \pi_{th}(GeV/c) = 4.35 \mid K_{th}(GeV/c) = 15.94 \mid p_{th}(GeV/c) = 31.66$



- Pixel sixe 3 mm
- Magnetic field off

PID capability gas RICH

e/pi
pi/K
K/p



3σ

- Pixel sixe 3 mm
- Magnetic field on

To do next

- Consolidation of the results
- Discussion on the realistic space at disposal
- ...