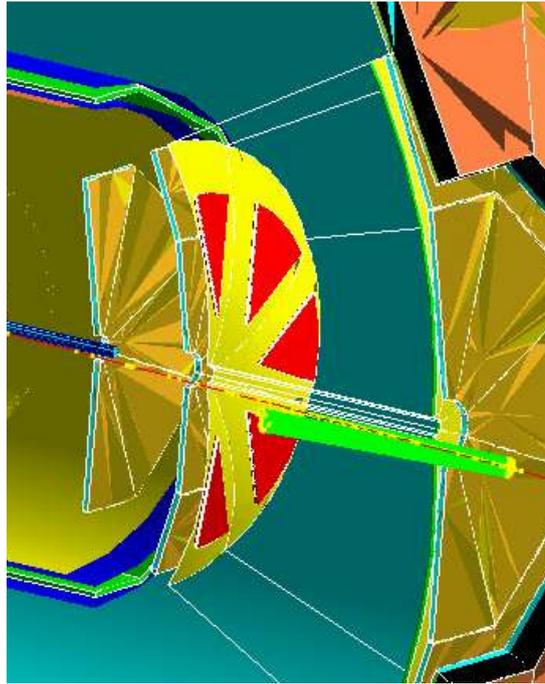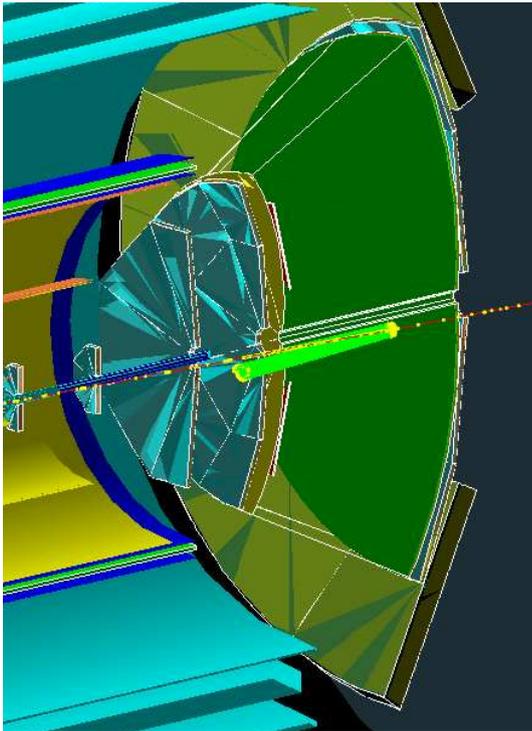# EIC Particle ID with Gas RICH update

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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 <u>reconstruction code(s)</u> 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.
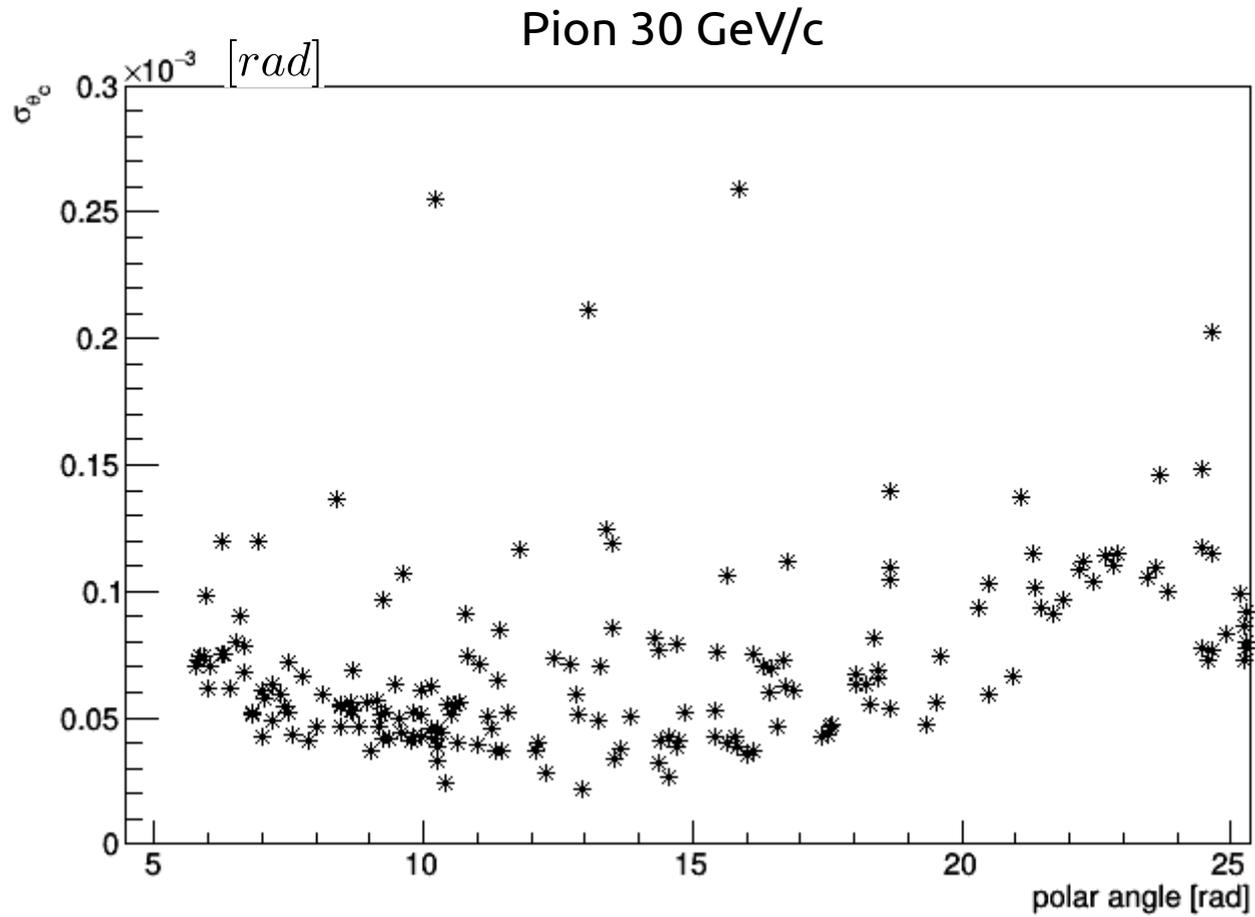Big chromatic dispersion!
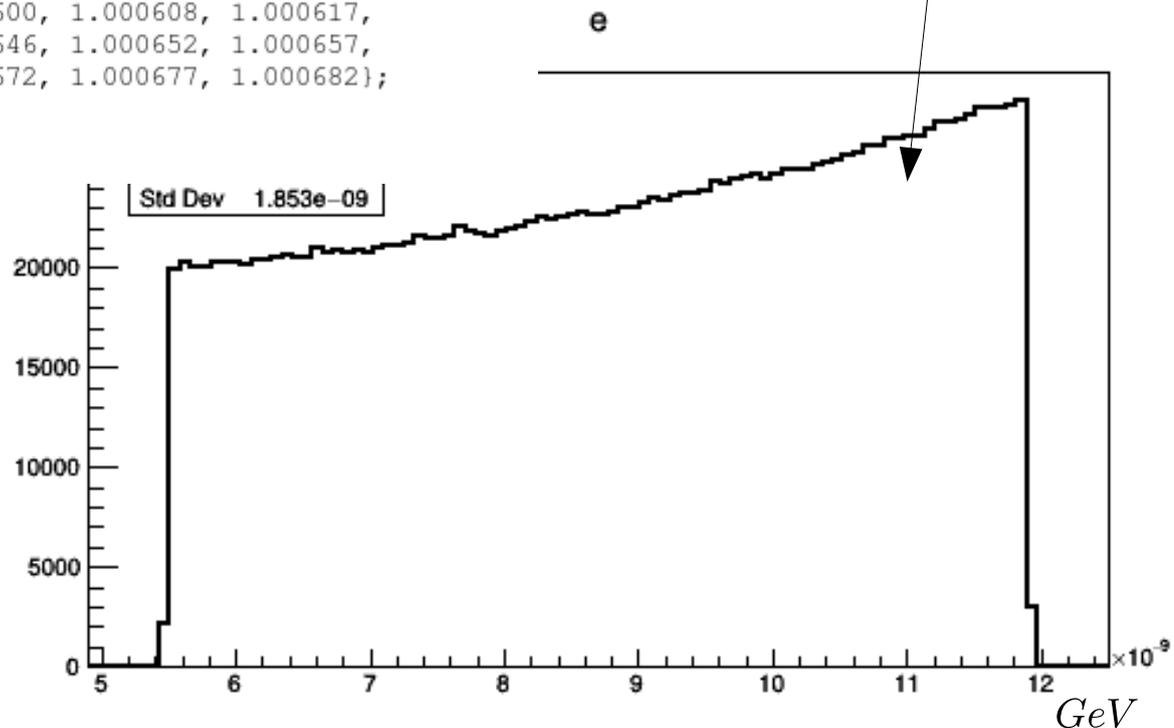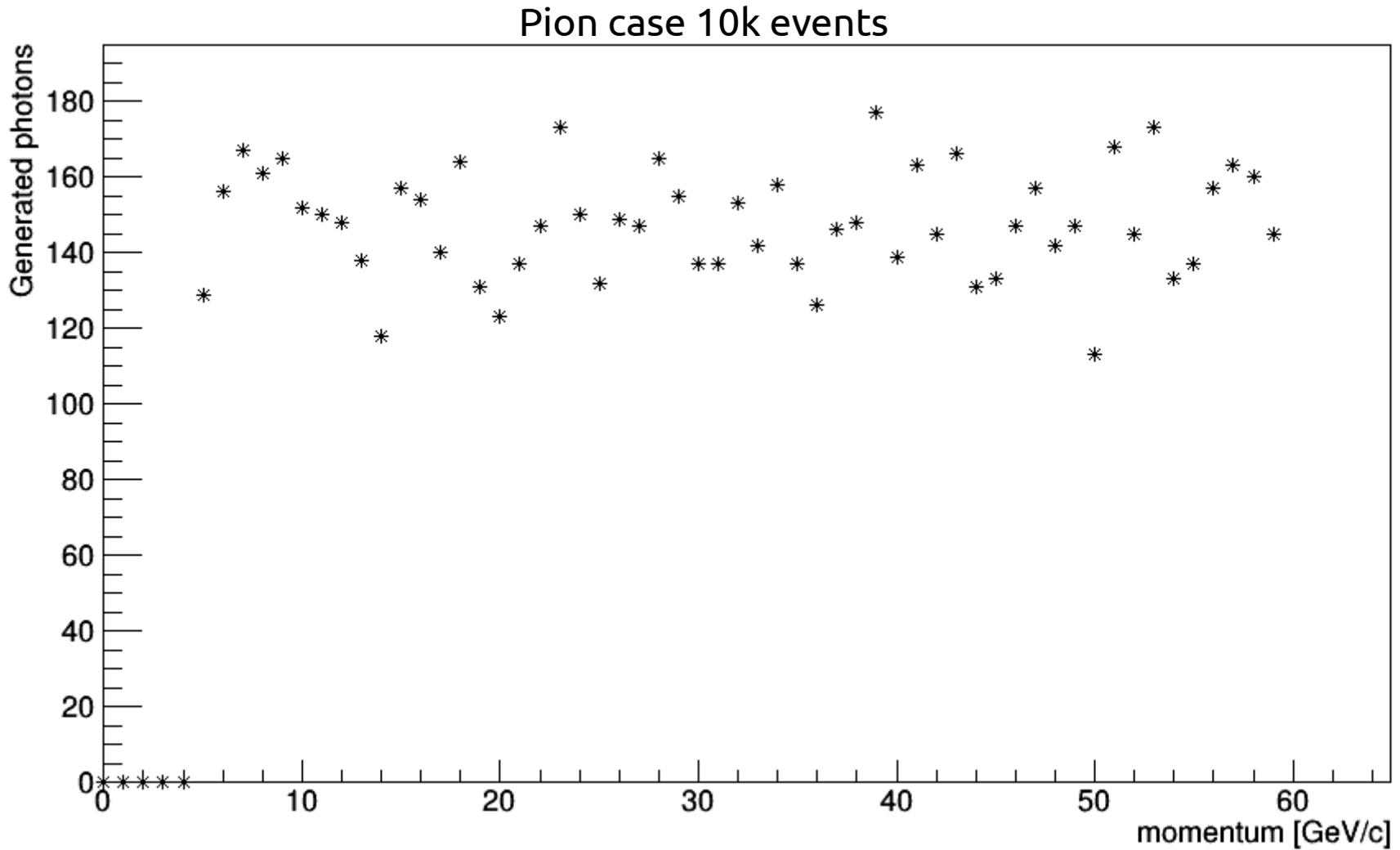
Cherekov angle dispersion

Chromatic dispersion (big) dominat error on sigma tot
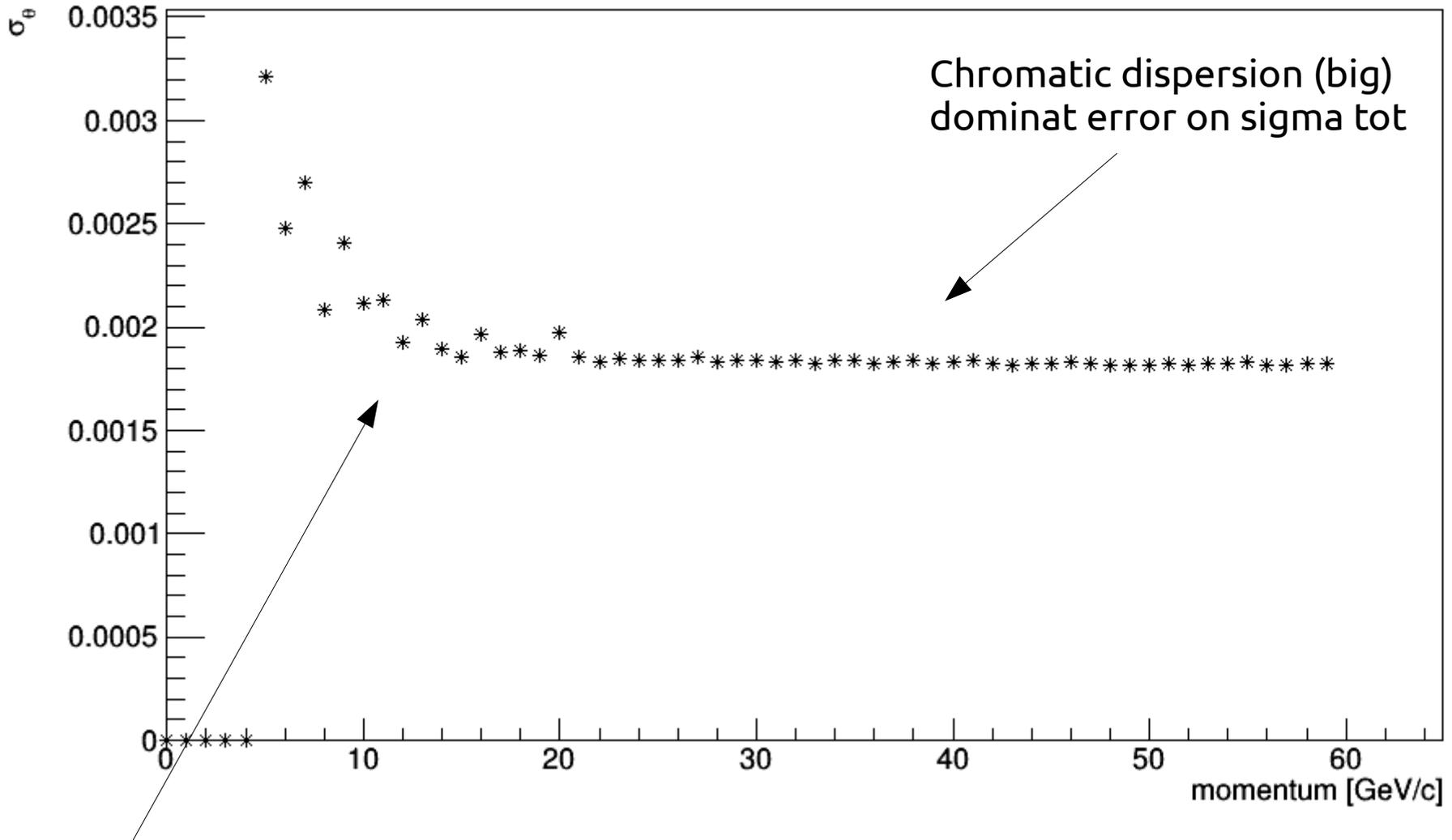
Variable pattern due to poor statistics and binning!

Emission error

Pion 30 GeV/c

Generated (and detected) photons

Pion case 10k events
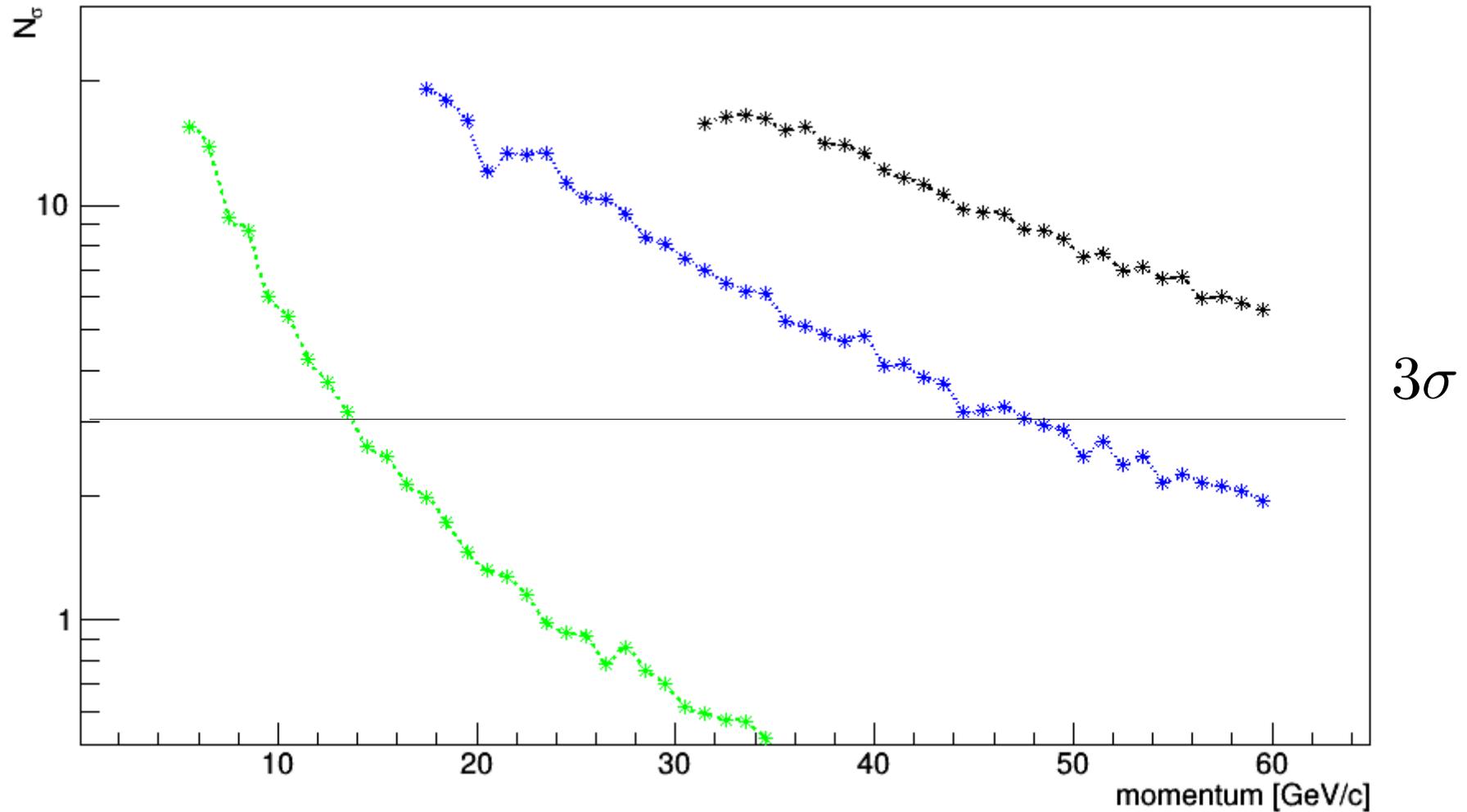
Number of p.e. - scaled value

Pion case 10k events
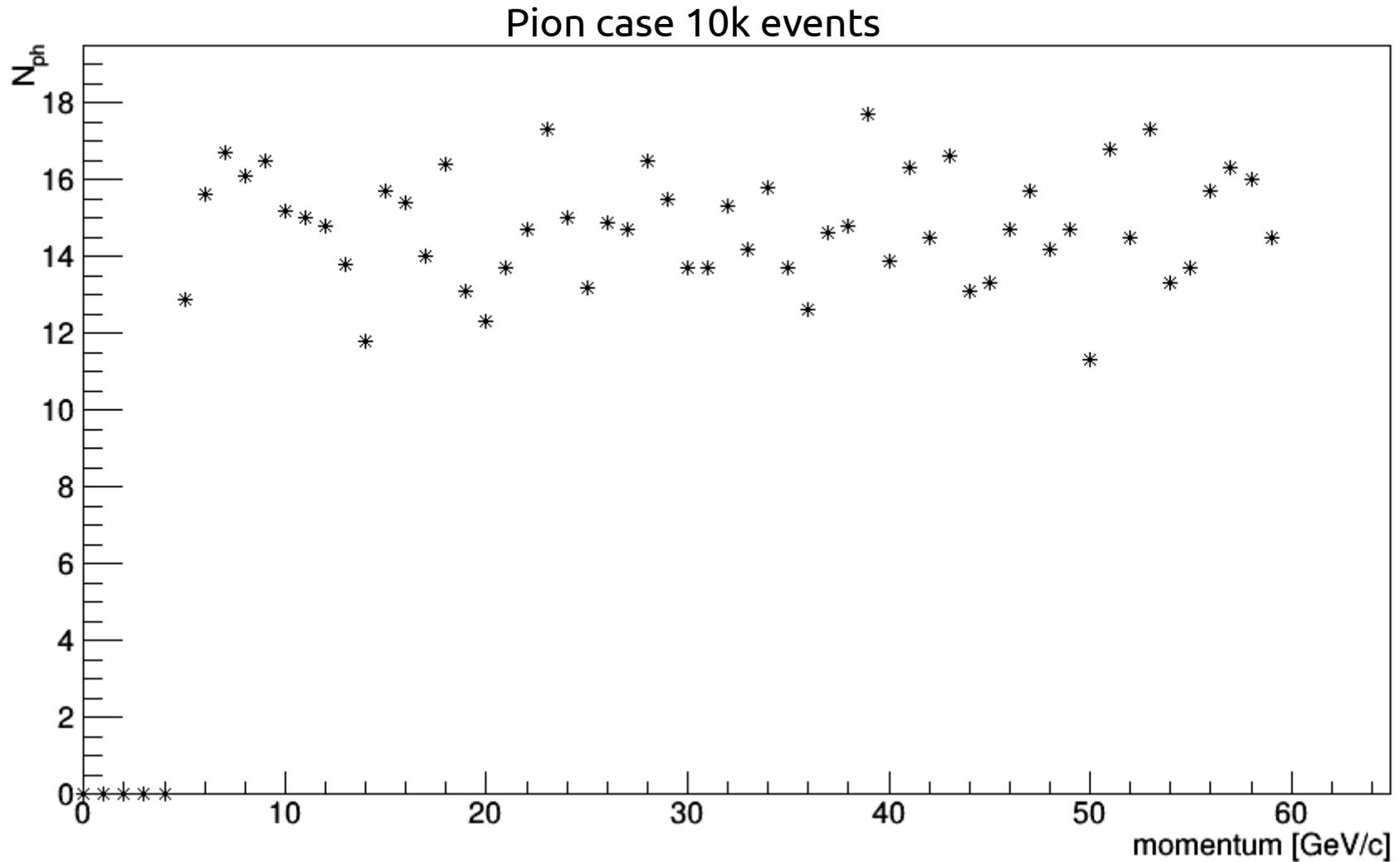
After considering pixel superposition and using a additional scale factor!
No real GEMs QE used!

PID capability (preliminary)

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

3σ

- Pixel sixe 3 mm
- Magnetic field on

8

To do next

- Optimize the chromatic range of the photons
- Add realistic Quantum Efficency curve
- Better to have more statistics, at least at low momenta
- ...

- Estimate PID for a dRICH