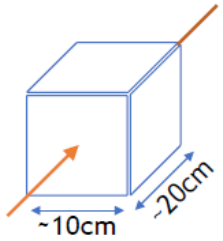
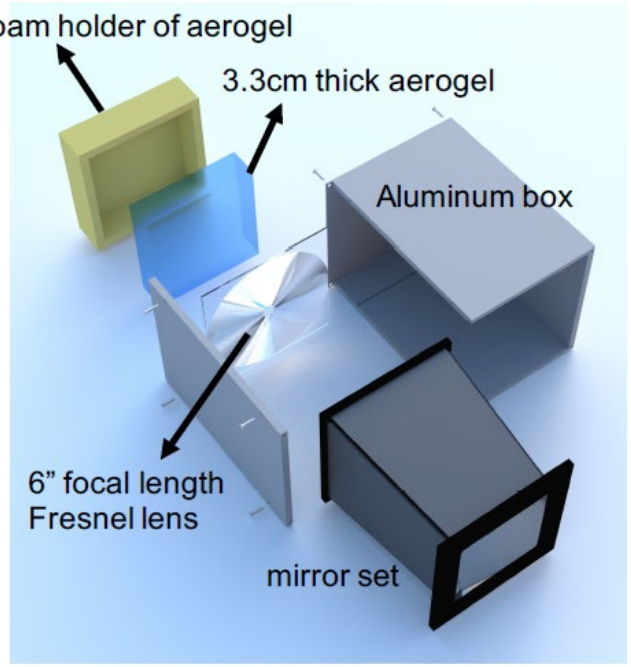
Description of Detector and Parameters

- Geometrical acceptance





- Cherenkov radiator (Aerogel)
  - refractive index, n = 1.03
  - length of the radiator, L = 3 cm
  - lens with focal length, f = 6"

- Angular resolution
  - With the average angular resolution for the angle measurement for the single photoelectron , the total resolution becomes

$$\sigma_{\theta_c}^2 = \left(\frac{\sigma_{\theta_i}}{\sqrt{N_\gamma}}\right)^2 + \sigma_{Glob}^2$$

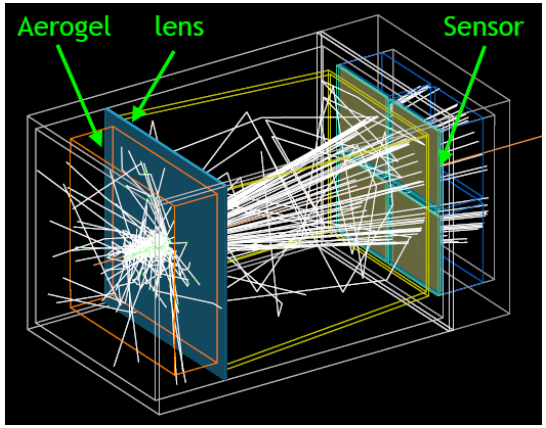
$$\sigma_{\theta_i}^2 = \sigma_{EP}^2 + \sigma_{Chro}^2 + \sigma_{Pix}^2$$

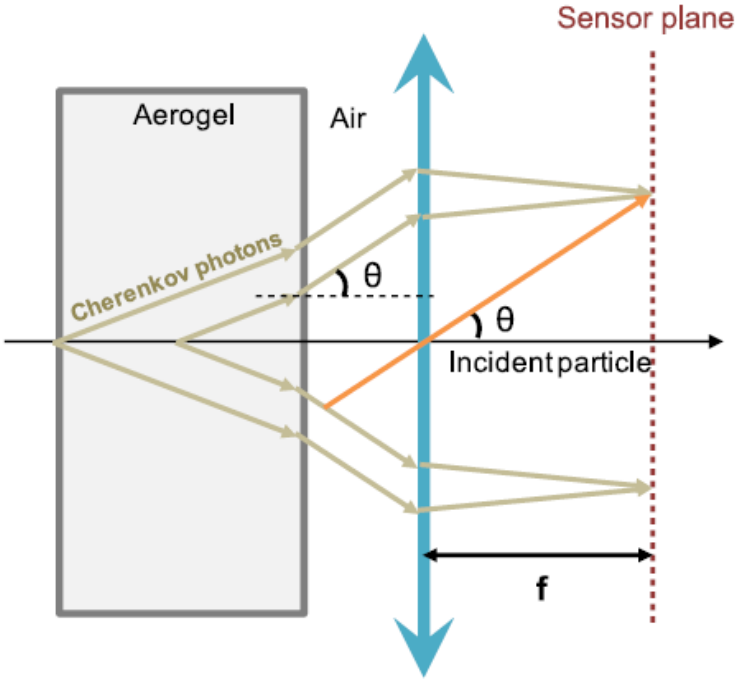
- Emission point error: minimized at the lens focal plane
- Chromatic dispersion error: reduced by selecting the lens transmittance in the near-UV region.
- Pixel size error: the uncertainty raised by pixel size, a, error

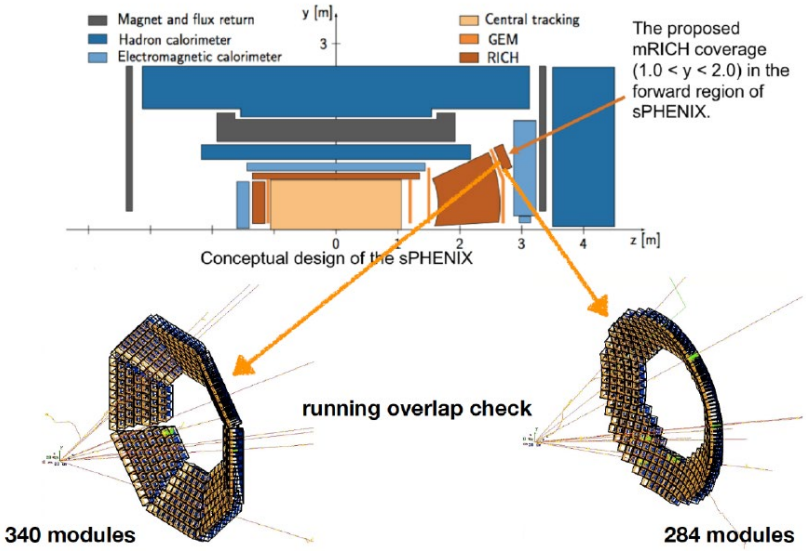
$$\sigma_{Pix} = \frac{a}{f\sqrt{12}} cos^2\theta$$

*Nuclear Inst. And Methods in Physics Research A **666**, 148 (2012)*
*Nuclear Inst. and Methods in Physics Research A **871,** 13 (2017)*

GEANT4 Simulation and Analytical Description



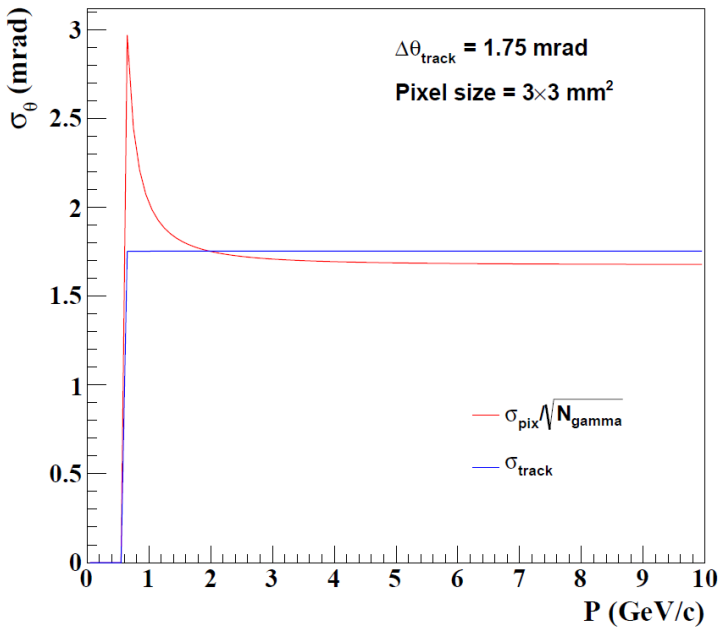


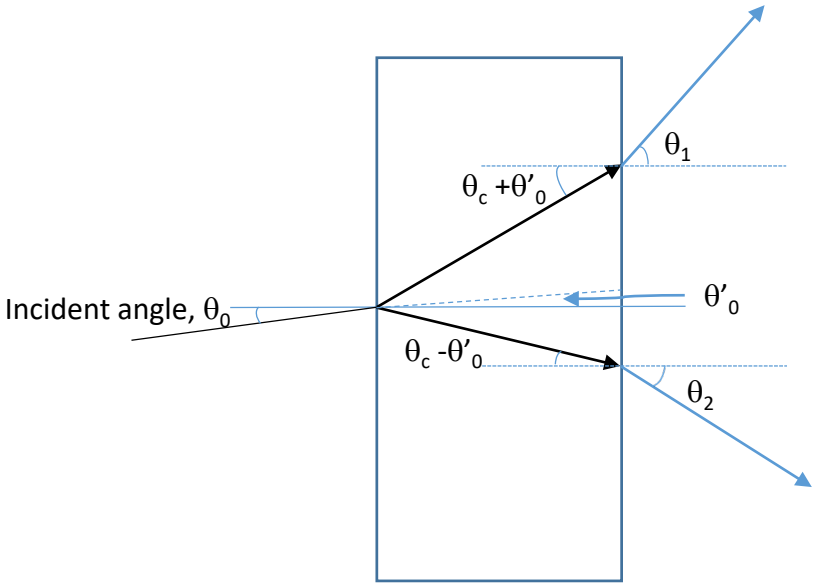


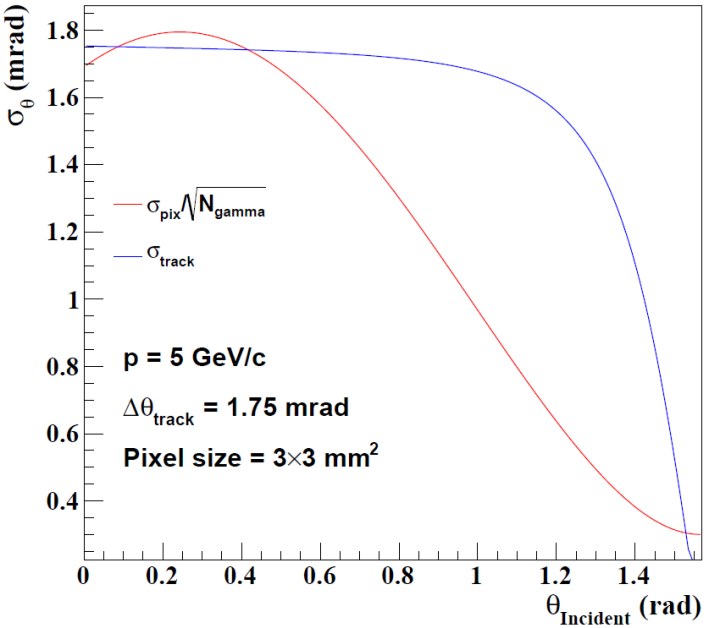
$$\theta_c = cos^{-1}\frac{1}{n\beta}$$

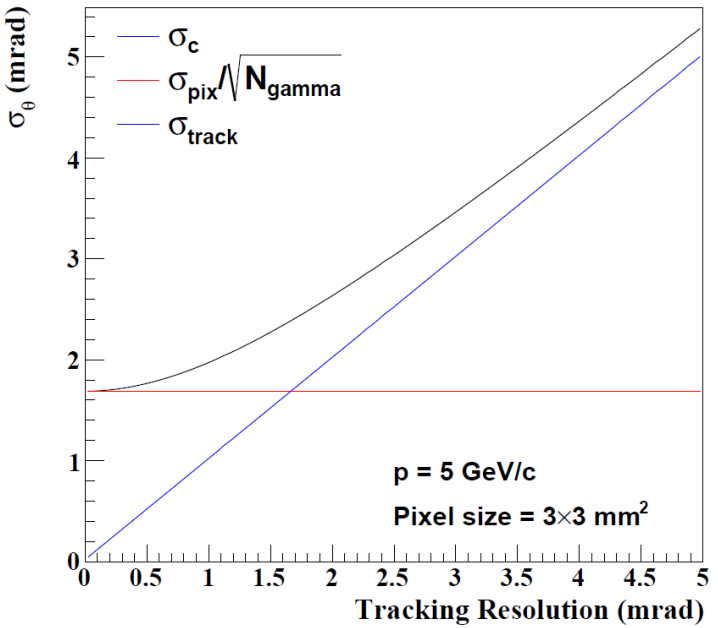
$$N_\gamma = 2\pi\alpha L\left(1-\frac{1}{\beta^2 n^2}\right) \times \int_{\lambda_1}^{\lambda_2} QE(\lambda)\cdot T_{aerogel}(\lambda)\cdot T_{lens}(\lambda)\cdot T_{glass\ window}(\lambda)\frac{d\lambda}{\lambda^2}$$

Cherenkov Angle Resolution



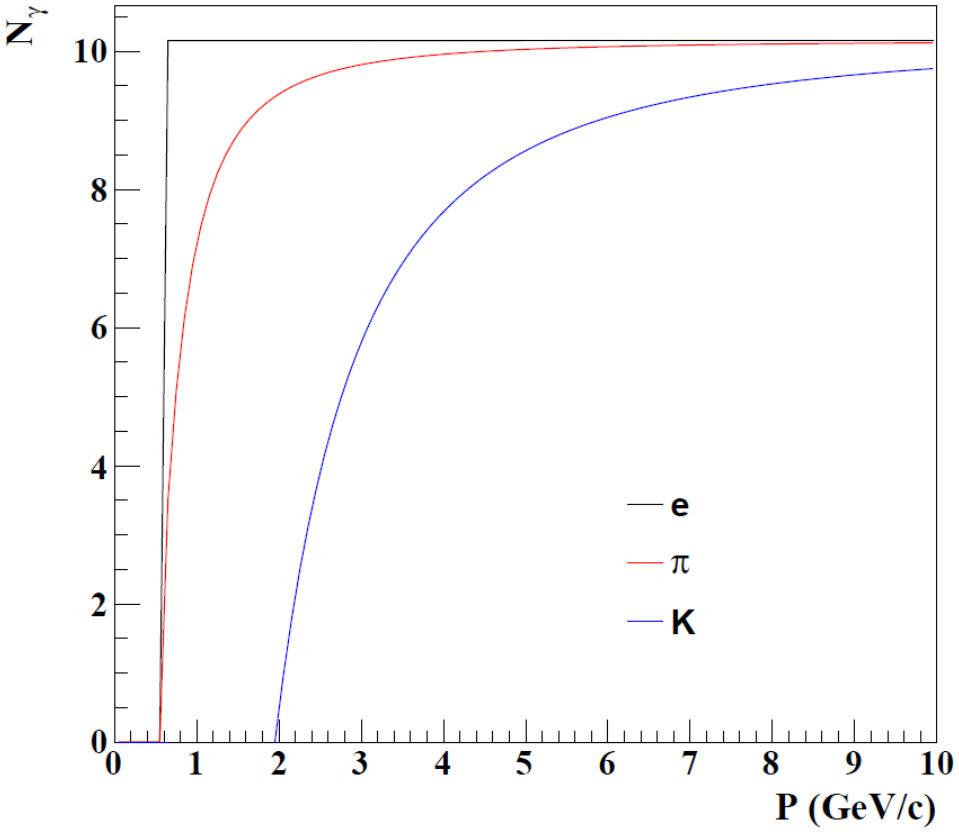




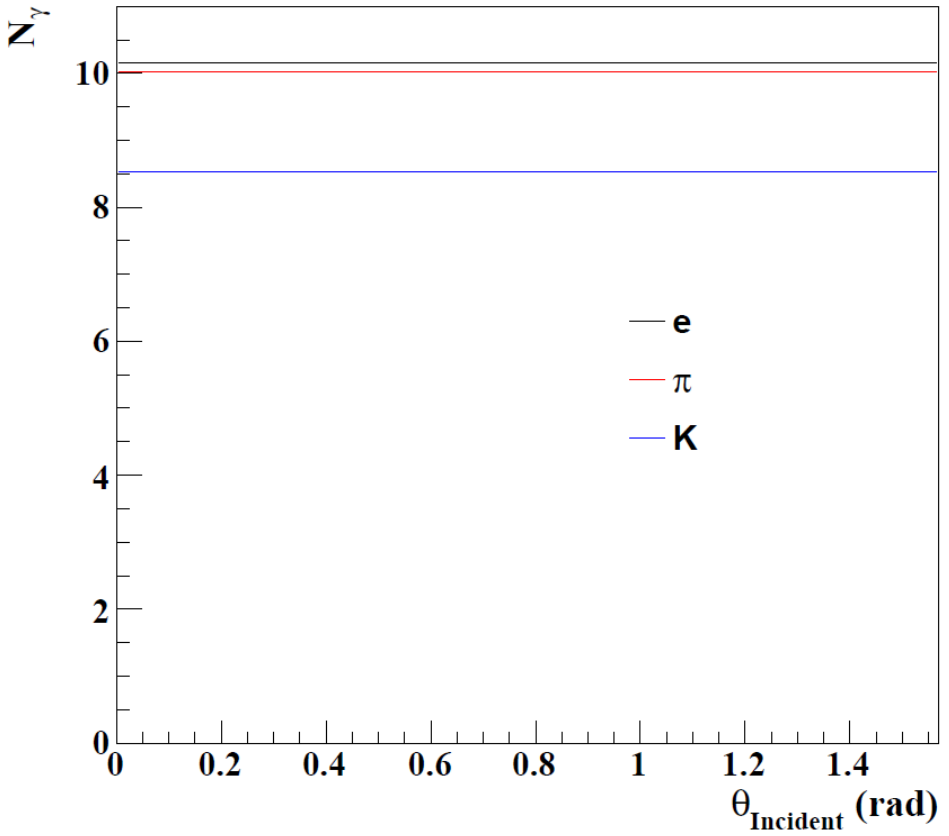


Number of Cherenkov Photons

As function of momentum

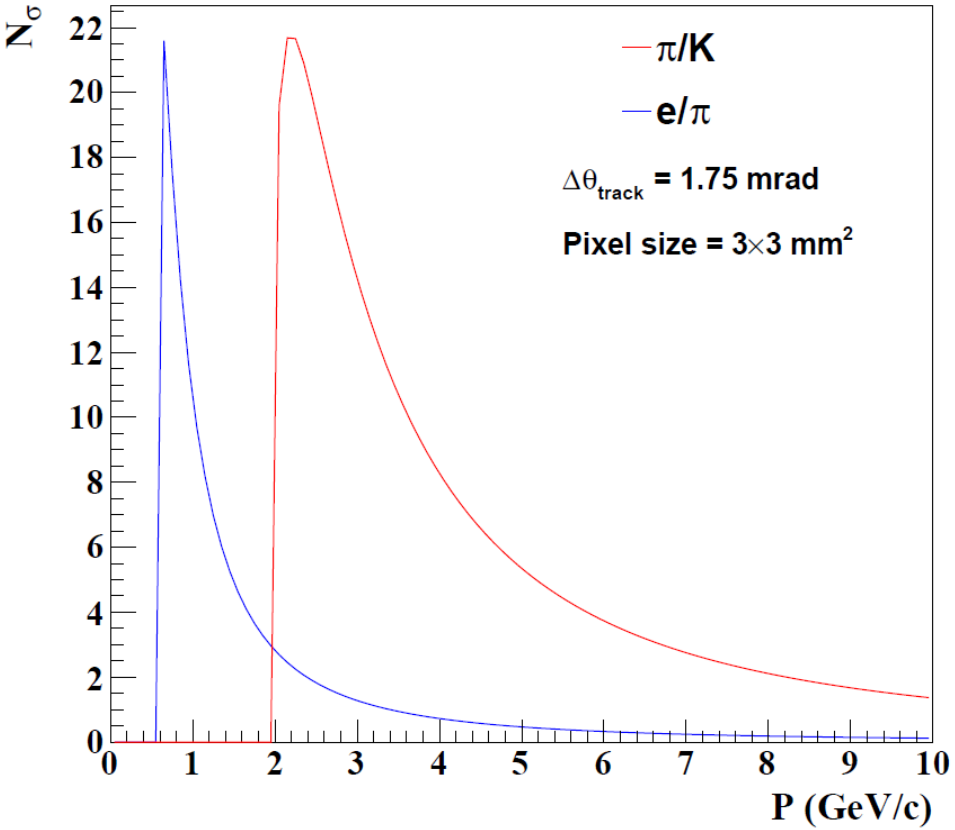


As function of the track polar angle

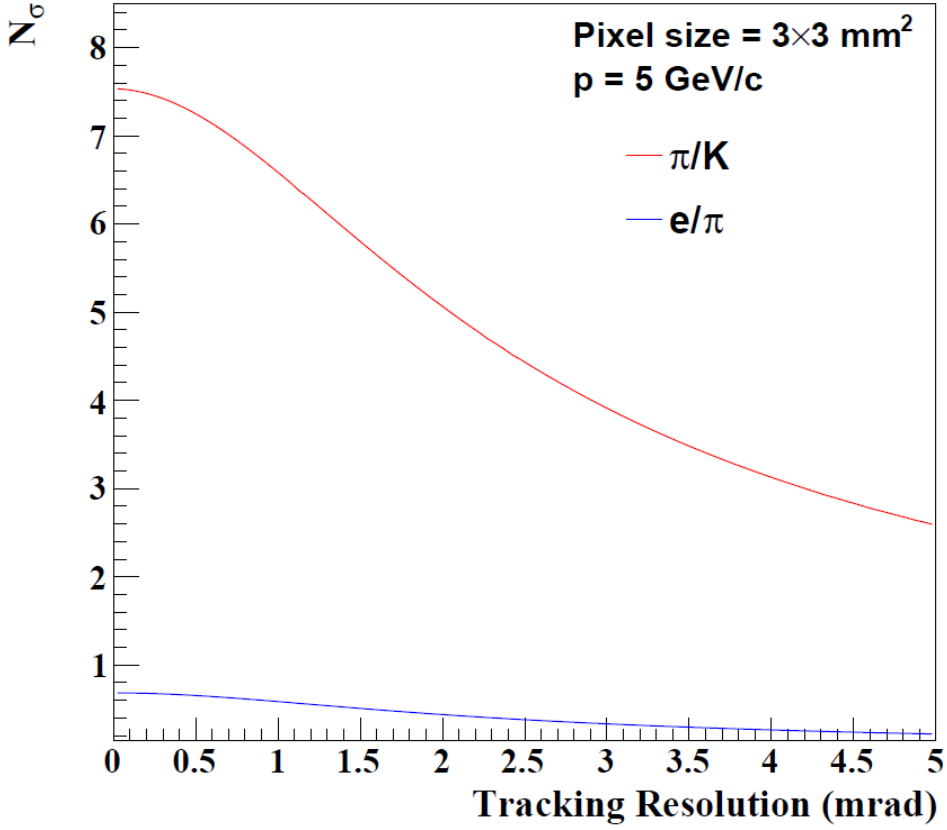


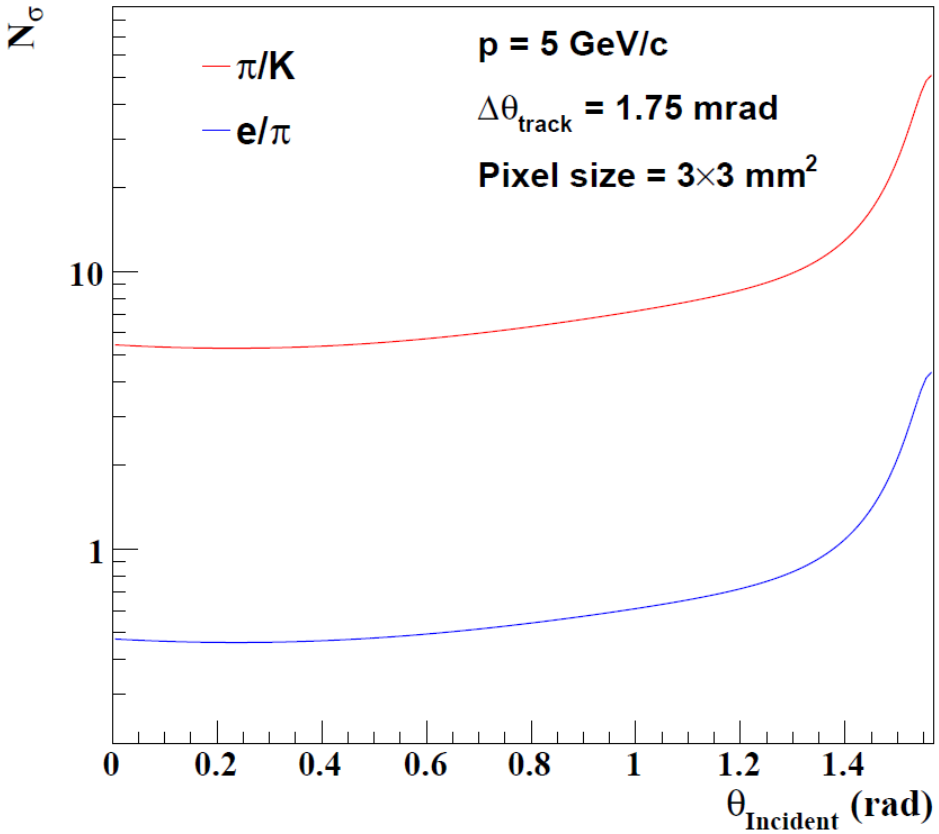
K/π and e/π Separation

As function of momentum



As function of the tracking resolution




N_σ
π/K
e/π
p = 5 GeV/c
$\Delta\theta_{track}$ = 1.75 mrad
Pixel size = 3×3 mm^2
10
1
0
0.2
0.4
0.6
0.8
1
1.2
1.4
$\theta_{Incident}$ (rad)