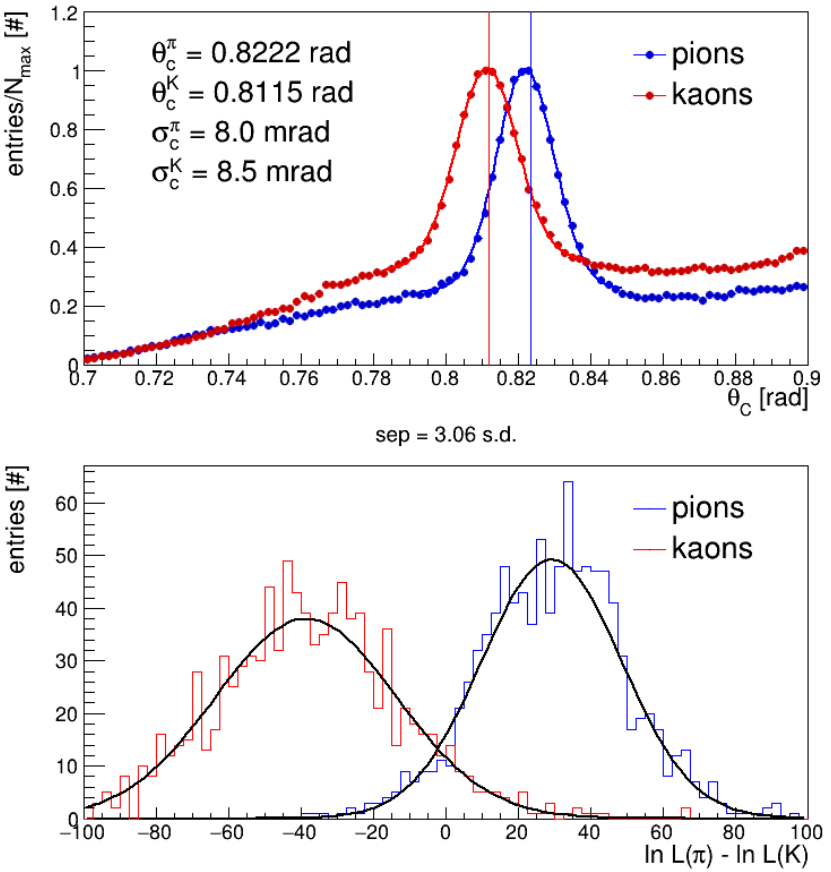
Geometrical Reconstruction

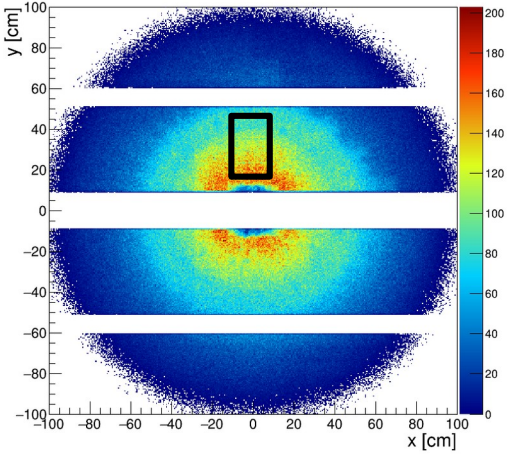
GlueX DIRC workfest
20 Apr 2020

Roman Dzhygadlo

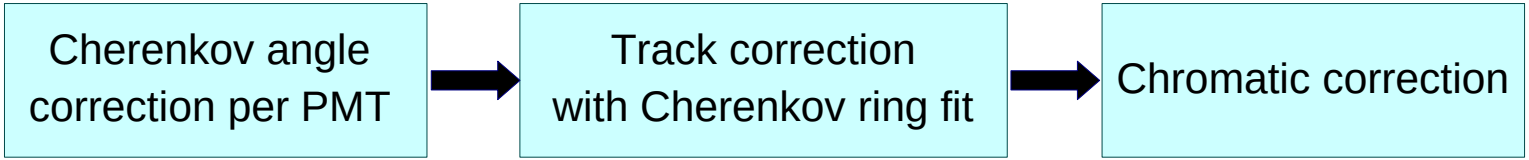
Default Performance



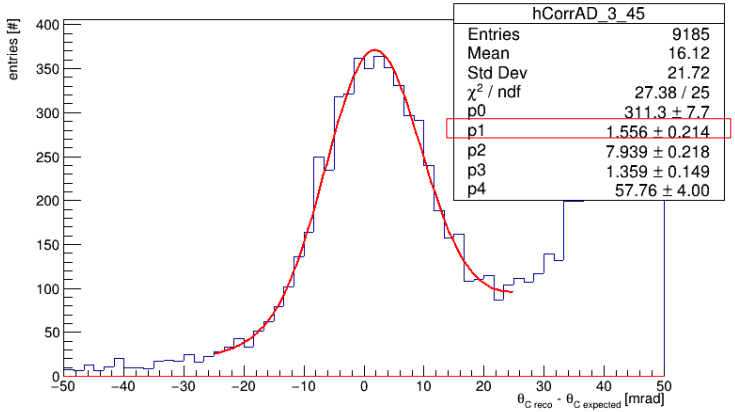
p = [2.9,3.1] GeV/c

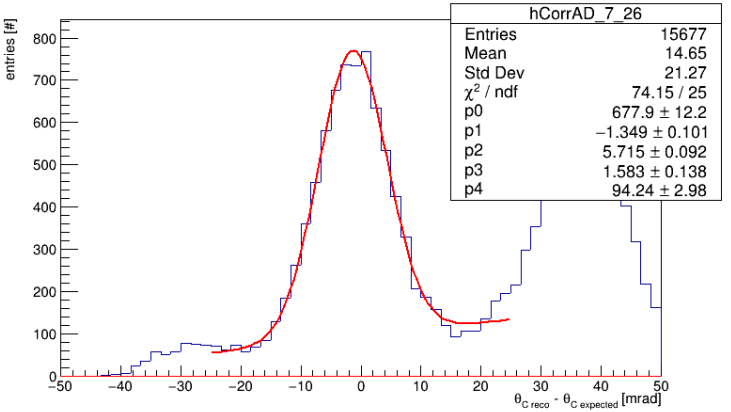


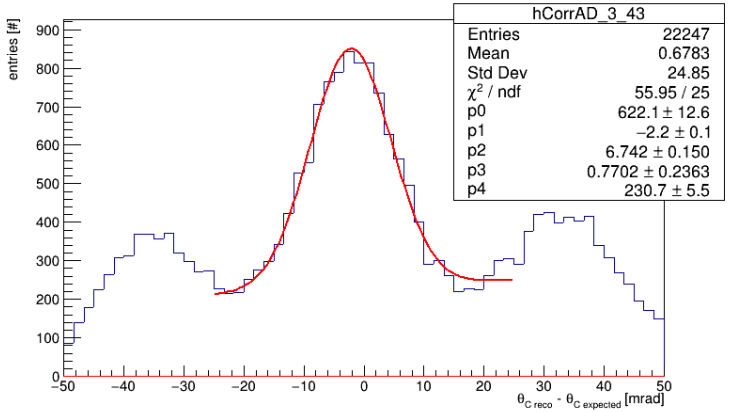
Corrections

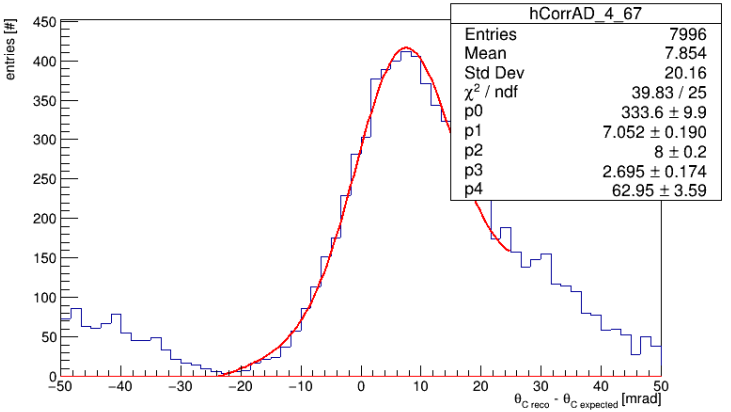


Per PMT Cherenkov Angle Correction



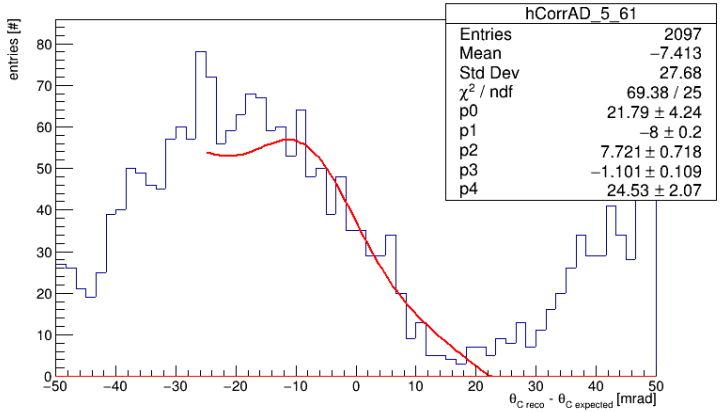


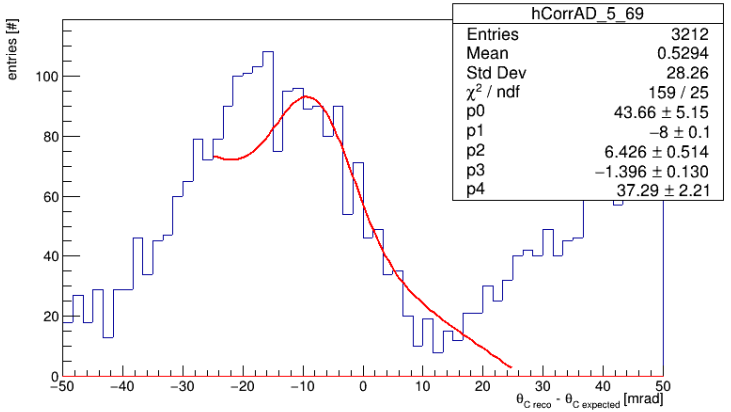


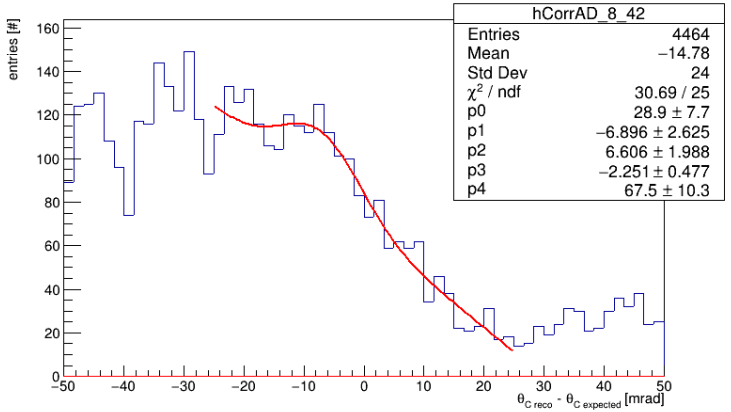


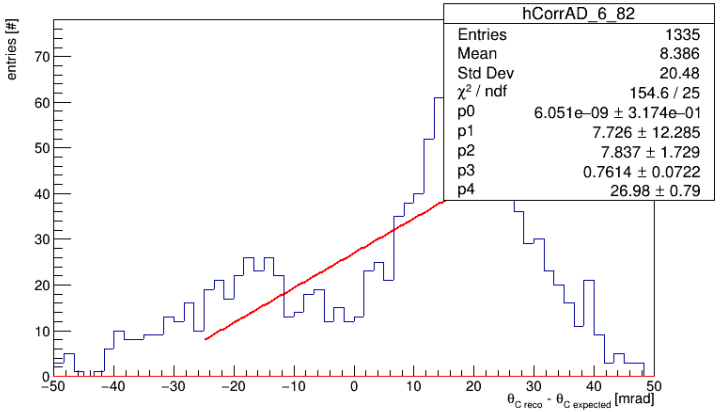
- p > 2 GeV/c
- pi + K
- per bar
- per PMT

Per PMT Cherenkov Angle Correction





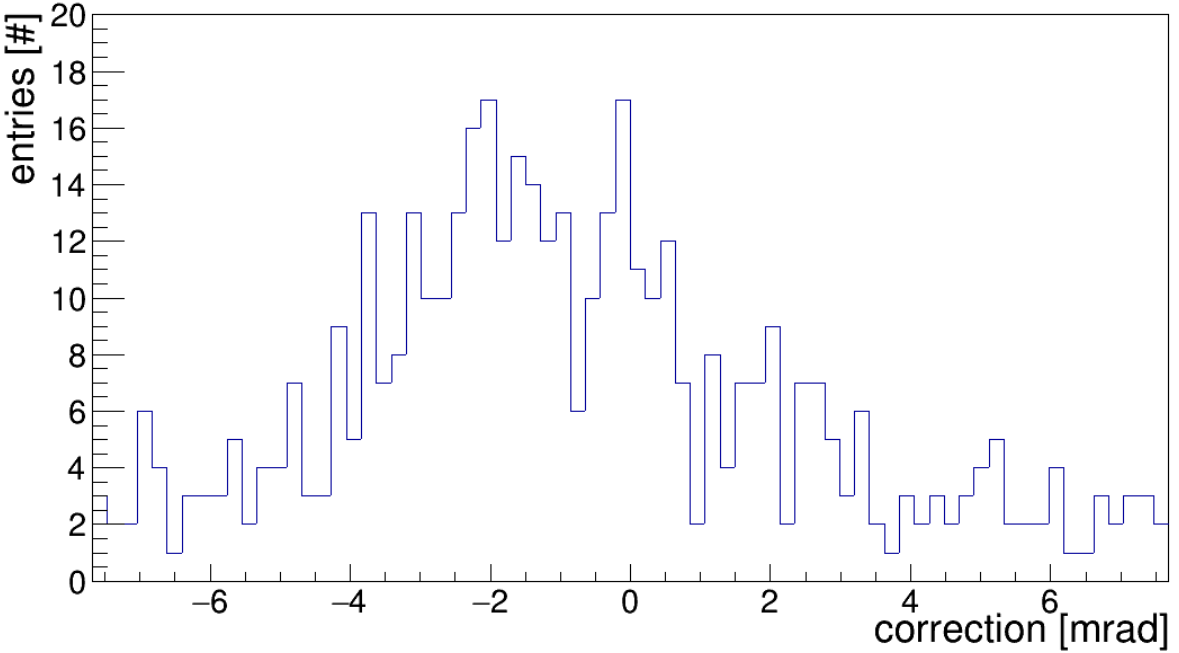




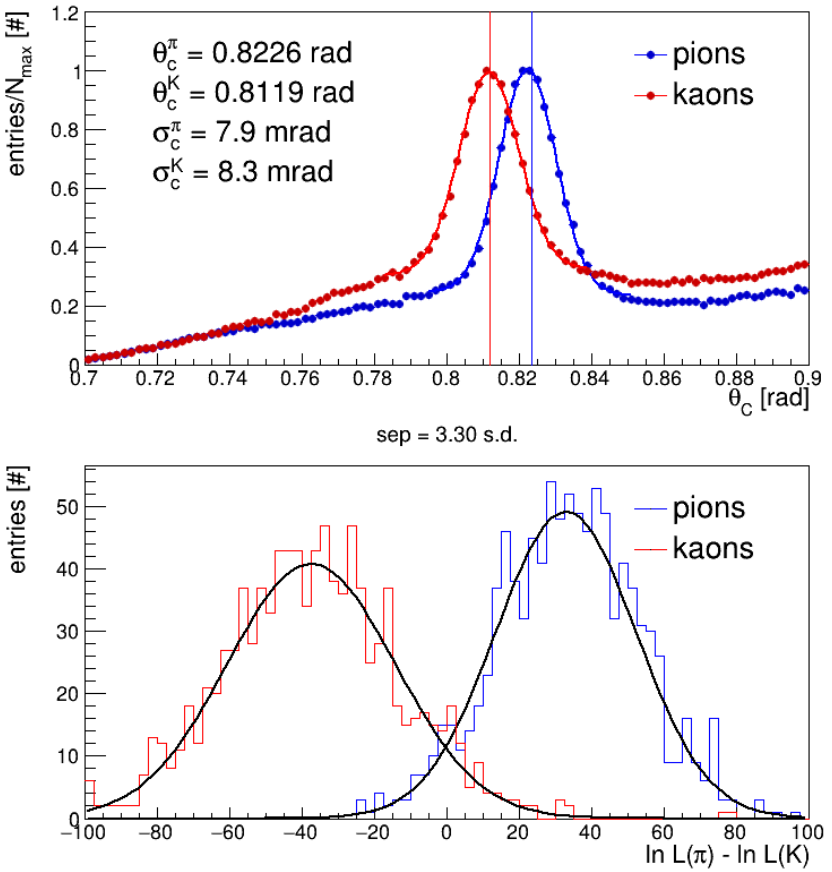
bad fits/distributions

Per PMT Cherenkov Angle Correction

distribution of the correction for all PMTs and selected bars:



Per PMT Cherenkov Angle Correction



Cherenkov Ring Fit

$$\sigma_{\theta_C}^{\text{track}} = \sqrt{\left(\frac{\sigma_{\theta_C}^{\text{photon}}}{\sqrt{N_{\text{photons}}}}\right)^2 + \left(\sigma^{\text{correlated}}\right)^2}$$

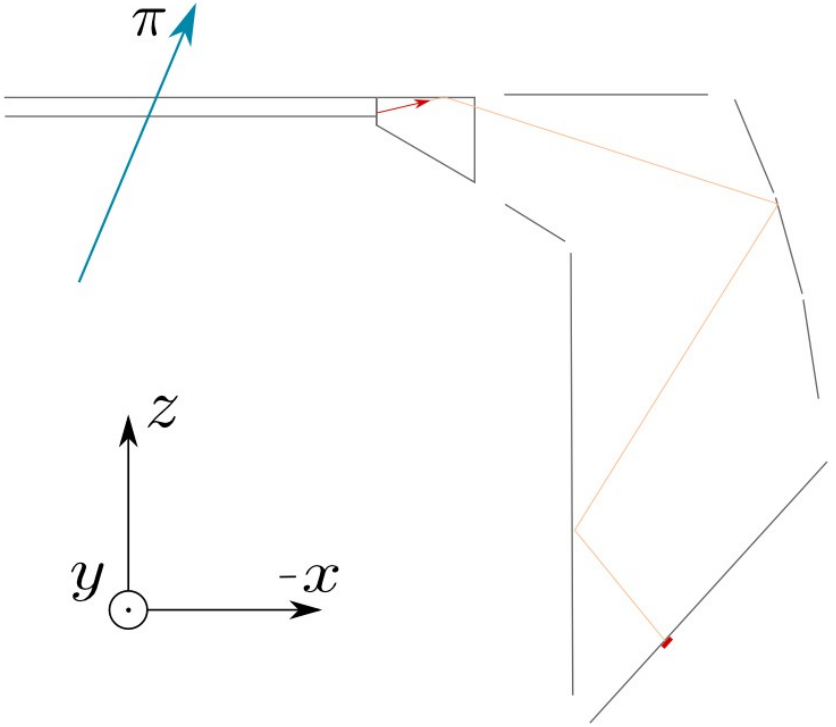
$\sigma^{\text{correlated}}$ - track resolution, multiple scattering, etc. bar misalignment

With Cherenkov ring fit we can:

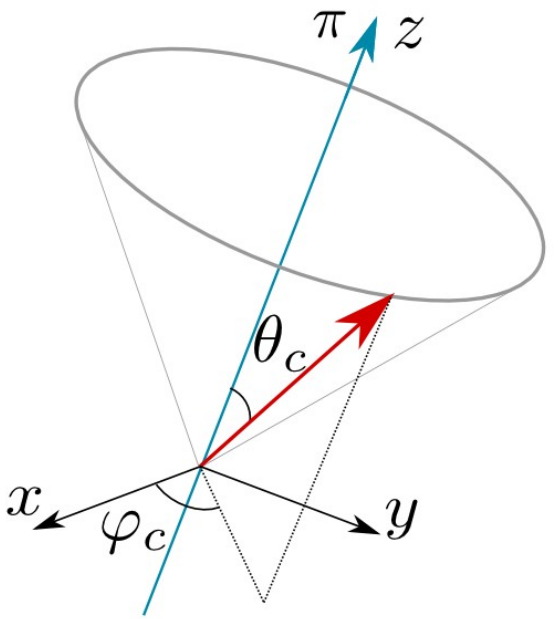
- correction of the bar rotation
- correction of the individual track direction

Cherenkov Ring Fit

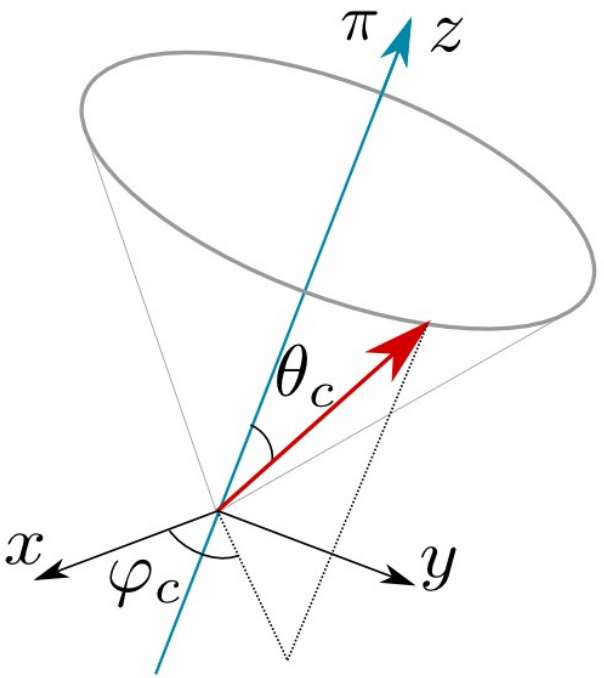
detector CS



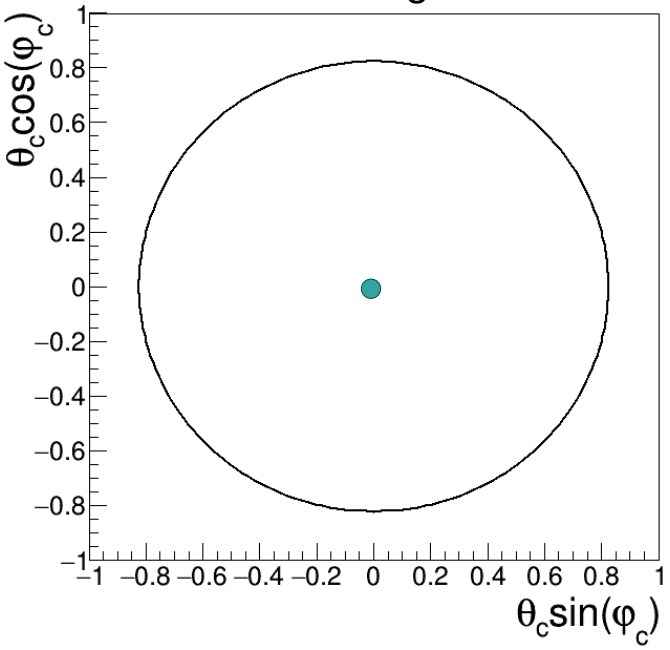
charged particle CS



Cherenkov Ring Fit

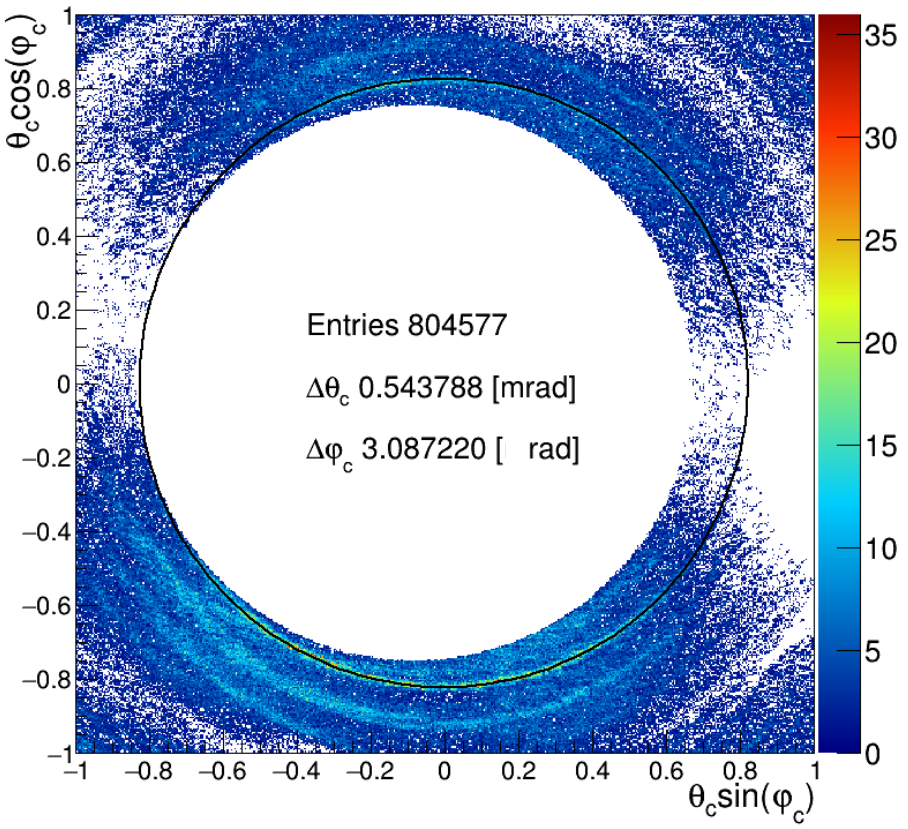


Cherenkov photons are distributed on ring:

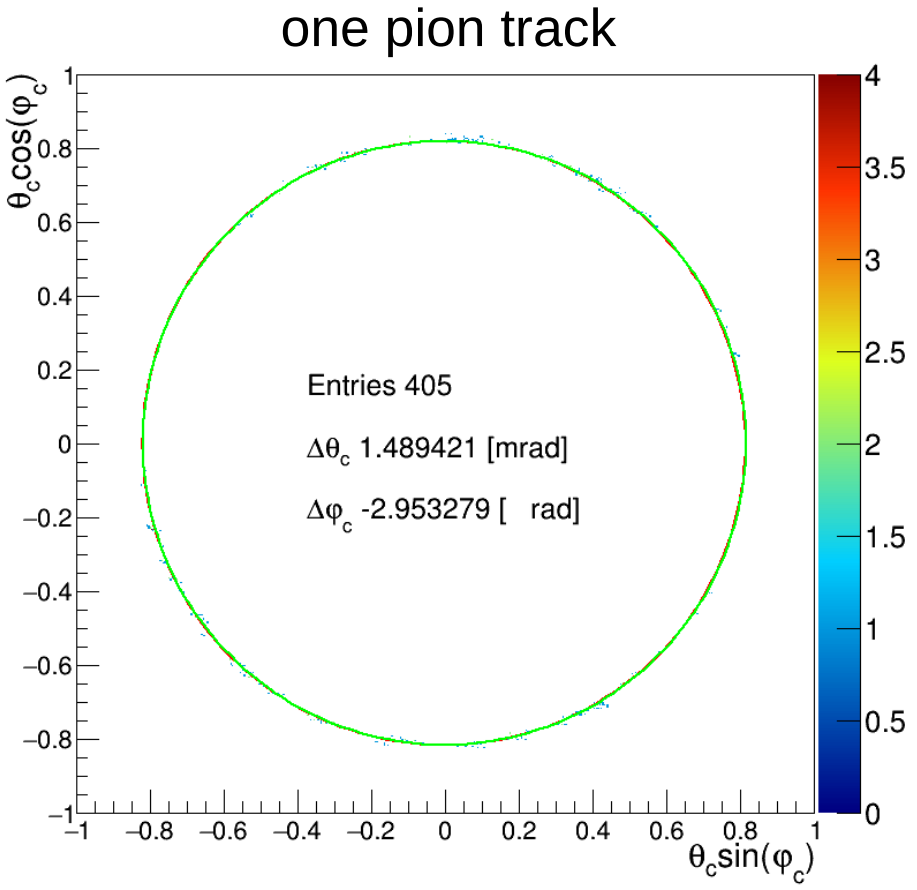


Cherenkov Ring Fit

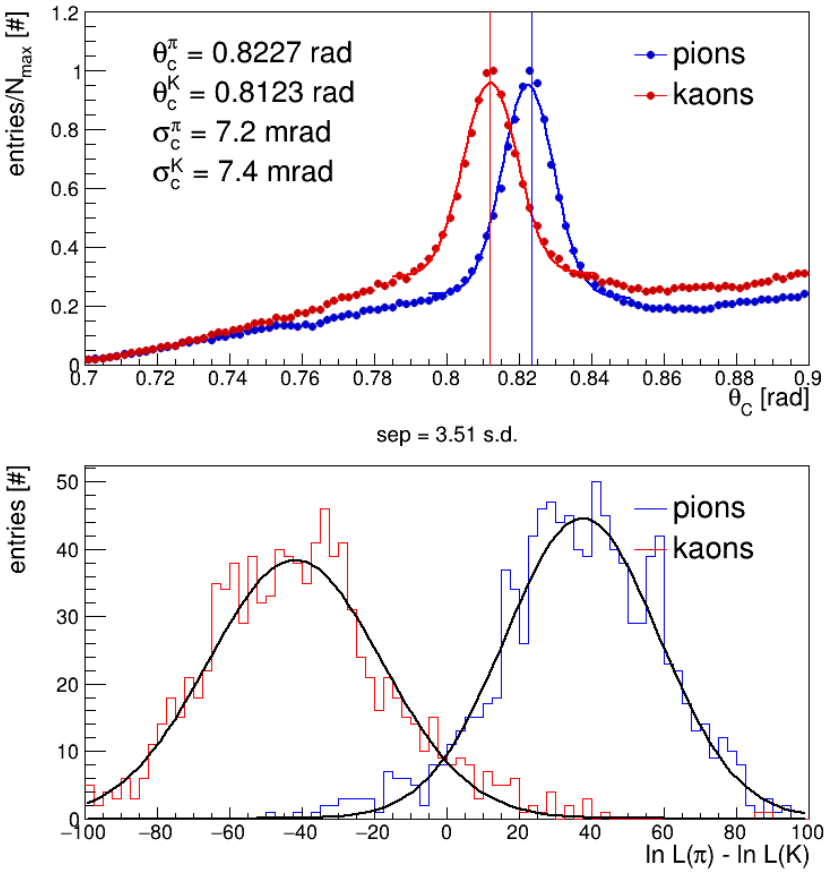
all tracks from bar #9



Cherenkov Ring Fit

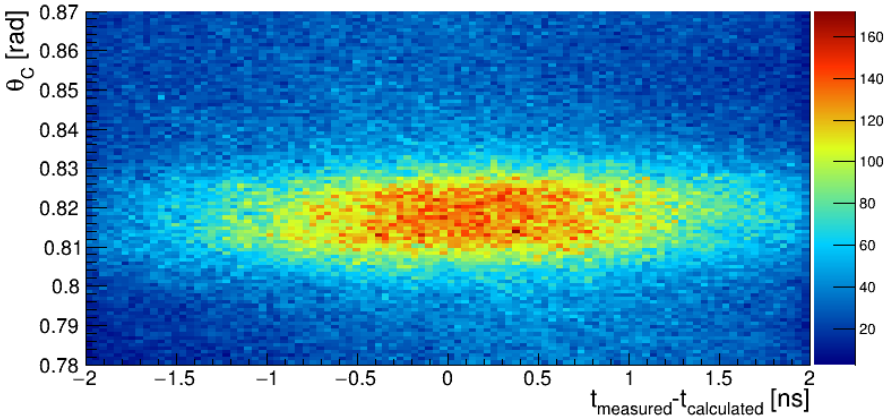


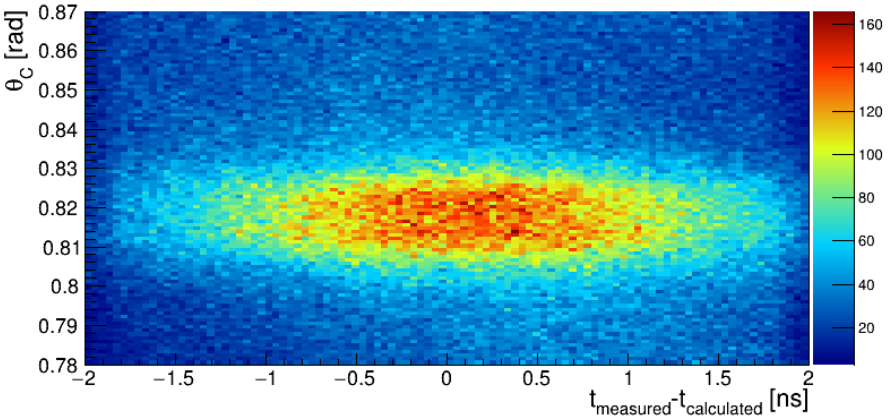
Cherenkov Ring Fit

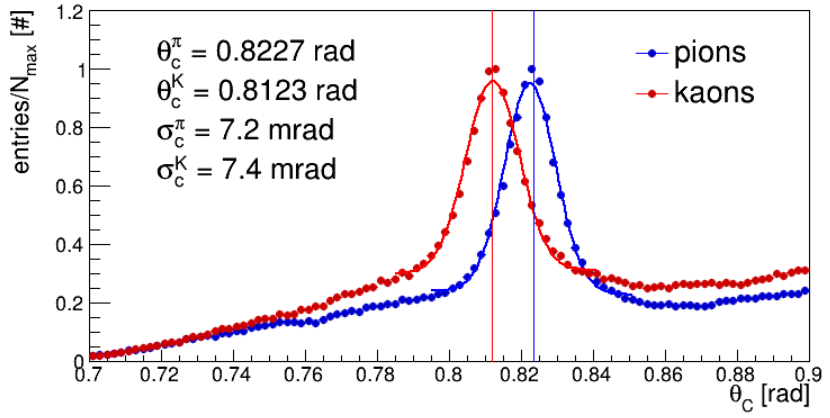


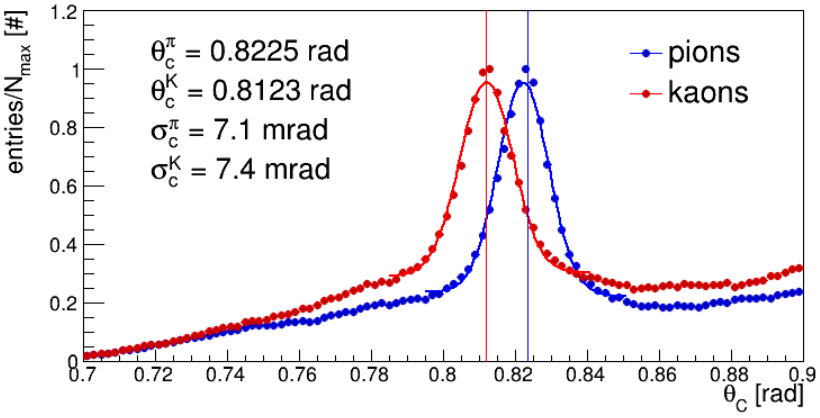
Chromatic Correction

cangle -= 0.0015*diff_time

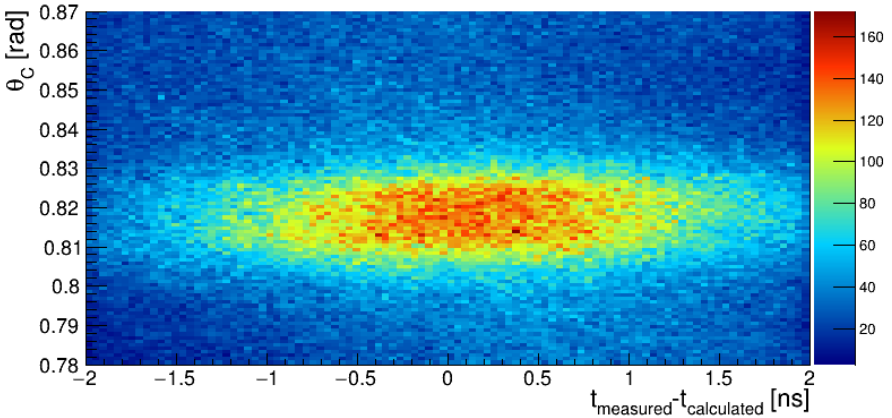


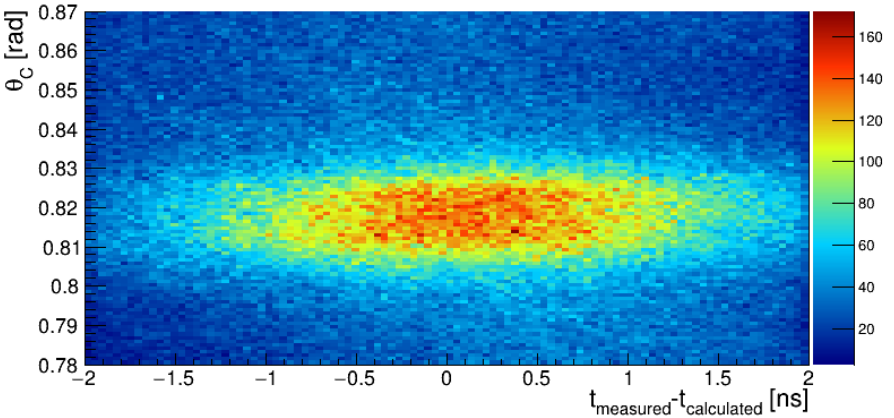


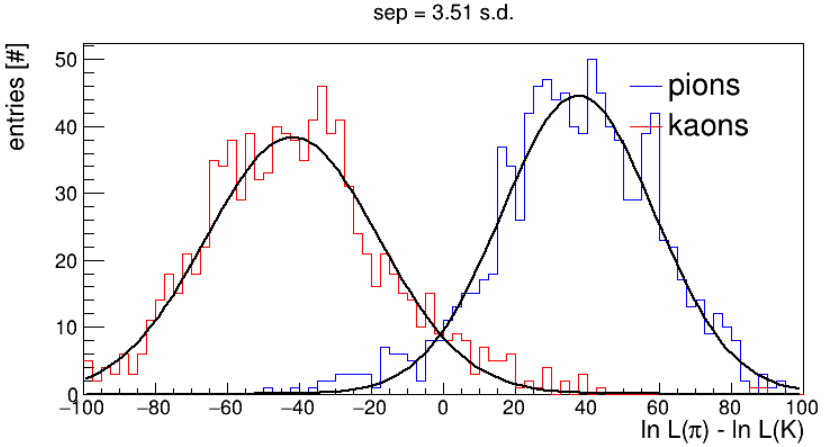


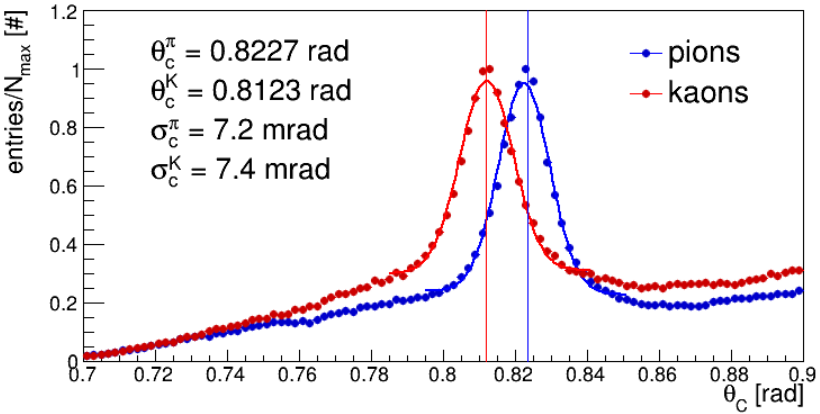


Chromatic Correction



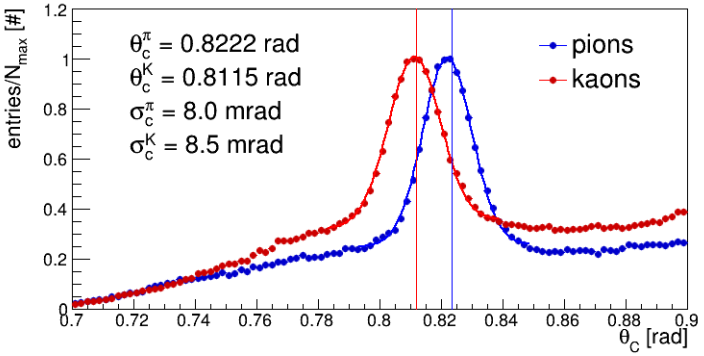




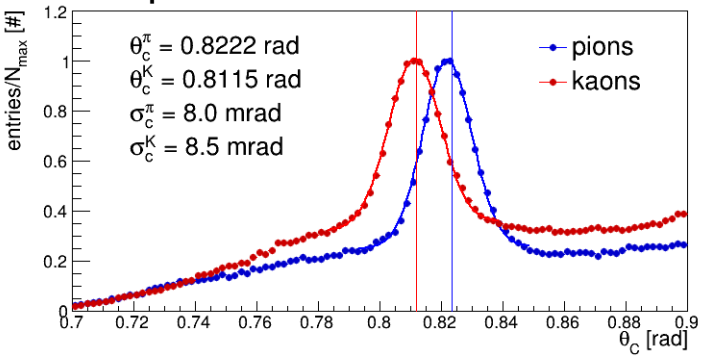


Comparisons

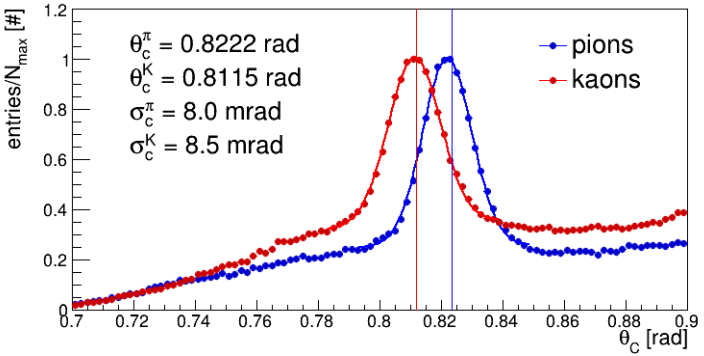
no correction



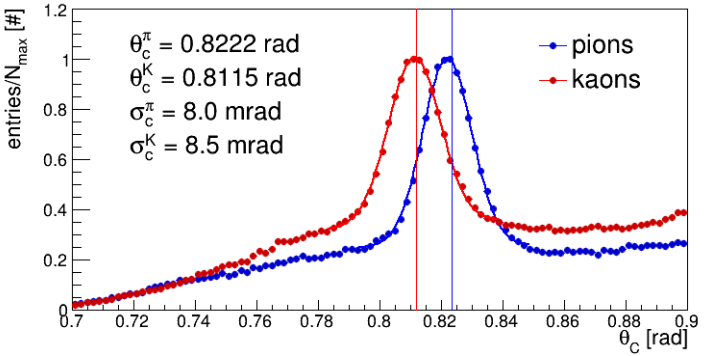
+ per PMT correction



+ track correction

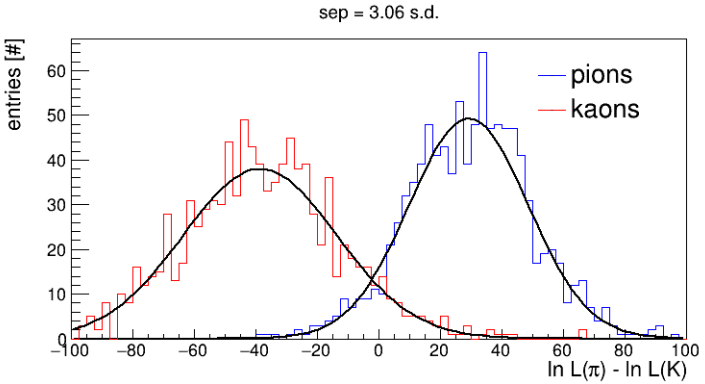


+ chromatic correction

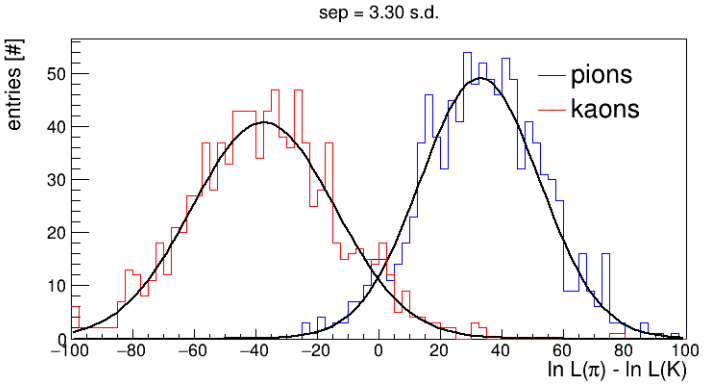


Comparisons

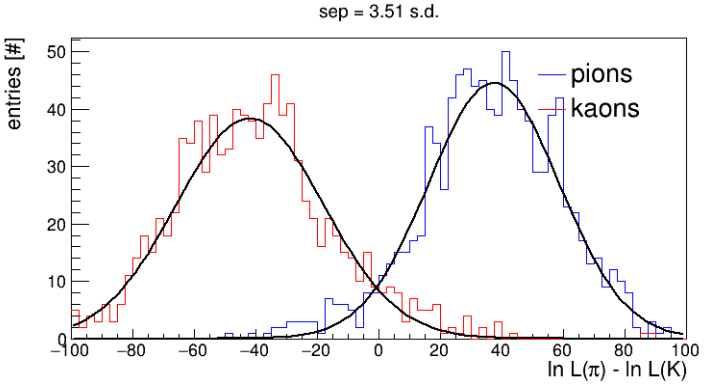
no correction



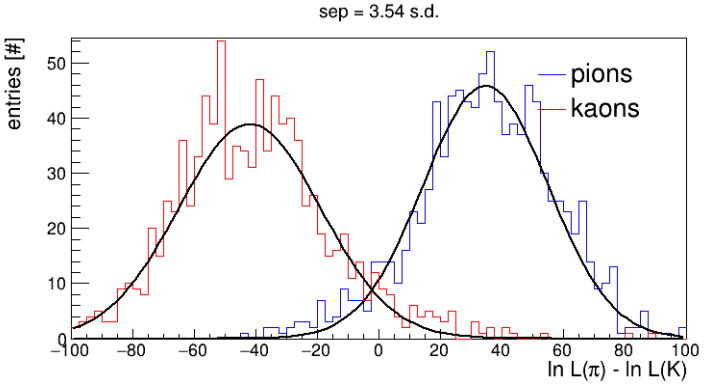
+ per PMT correction



+ track correction



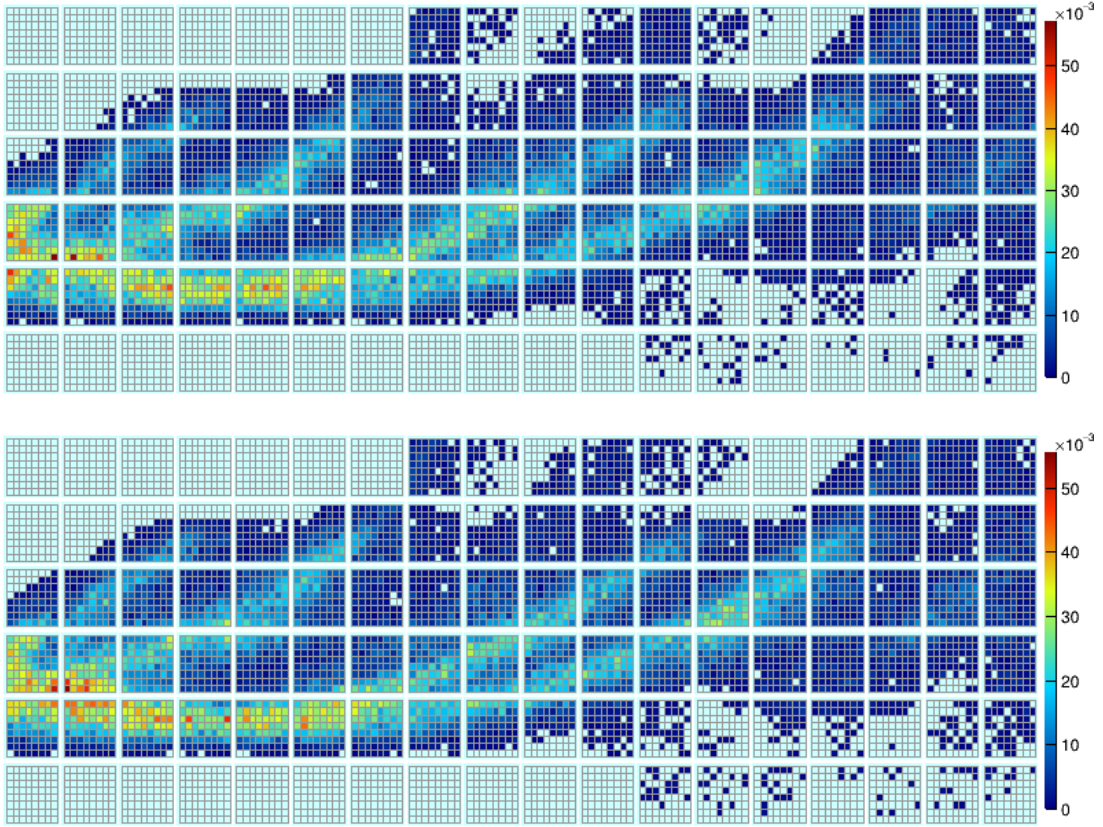
+ chromatic correction



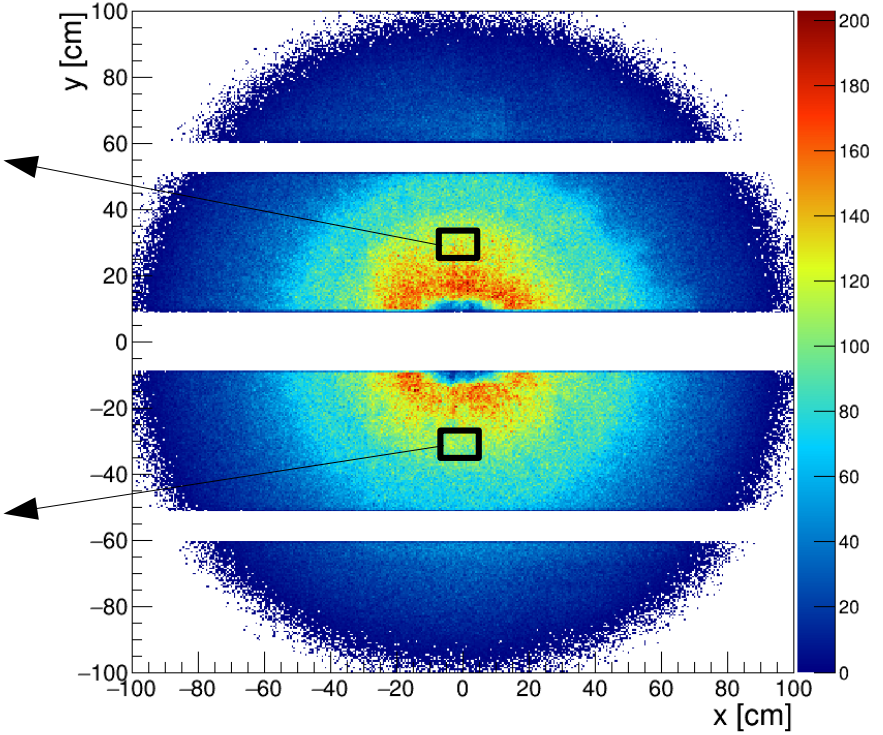
Performance Overview

Hit Pattern

>4 GeV/c pions from beam

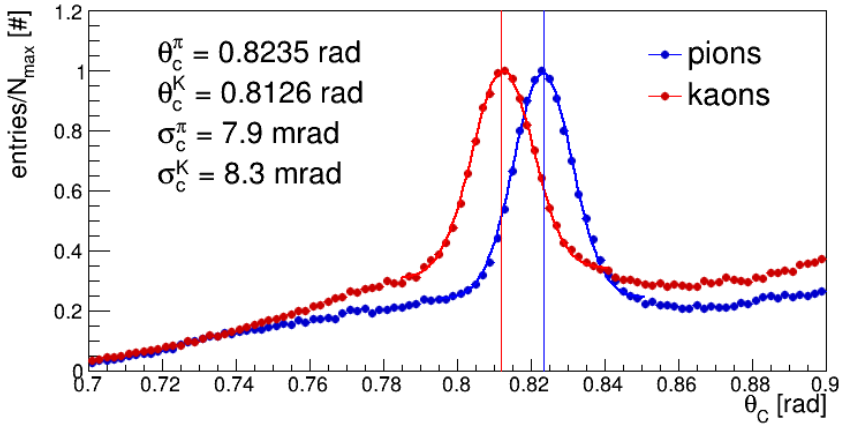


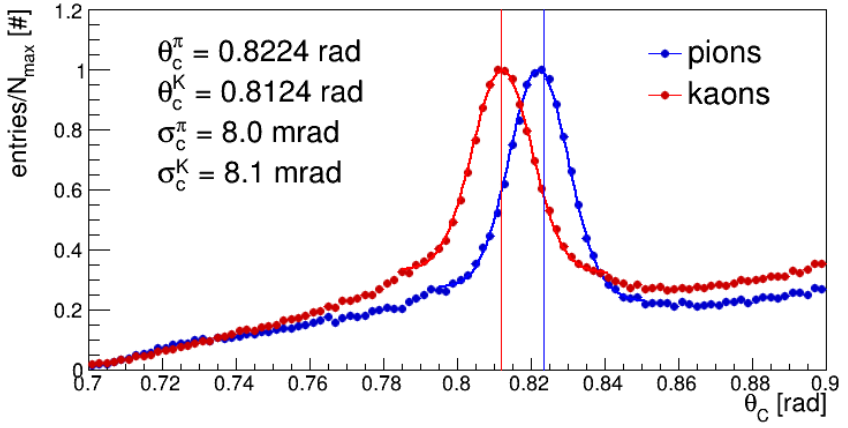
Hit position of the charge tracks on the radiator wall:



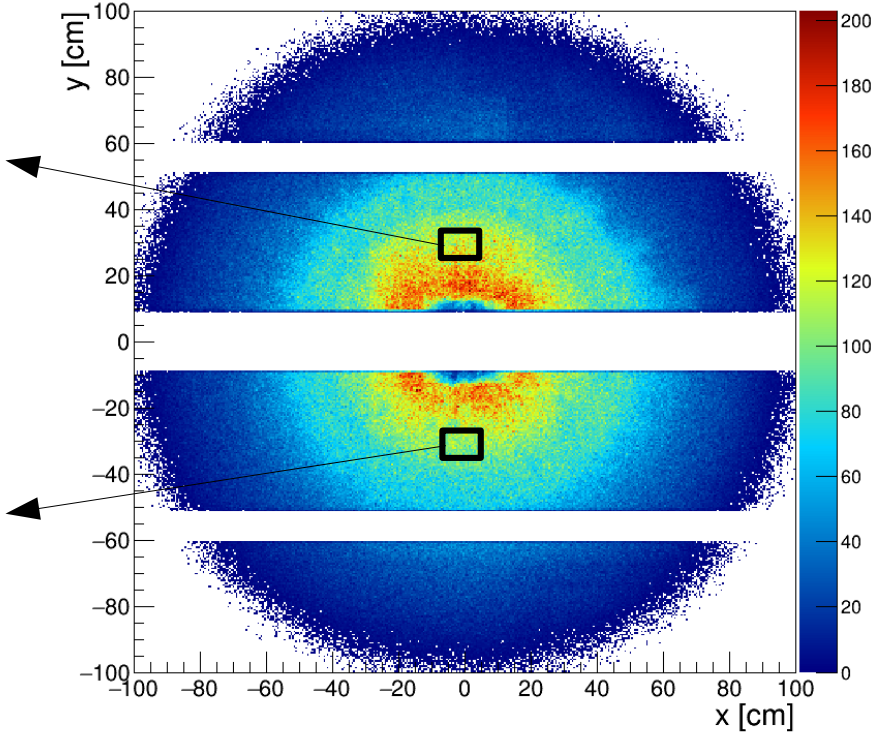
Single Photon Resolution

pions / kaons @ 3 GeV/c beam



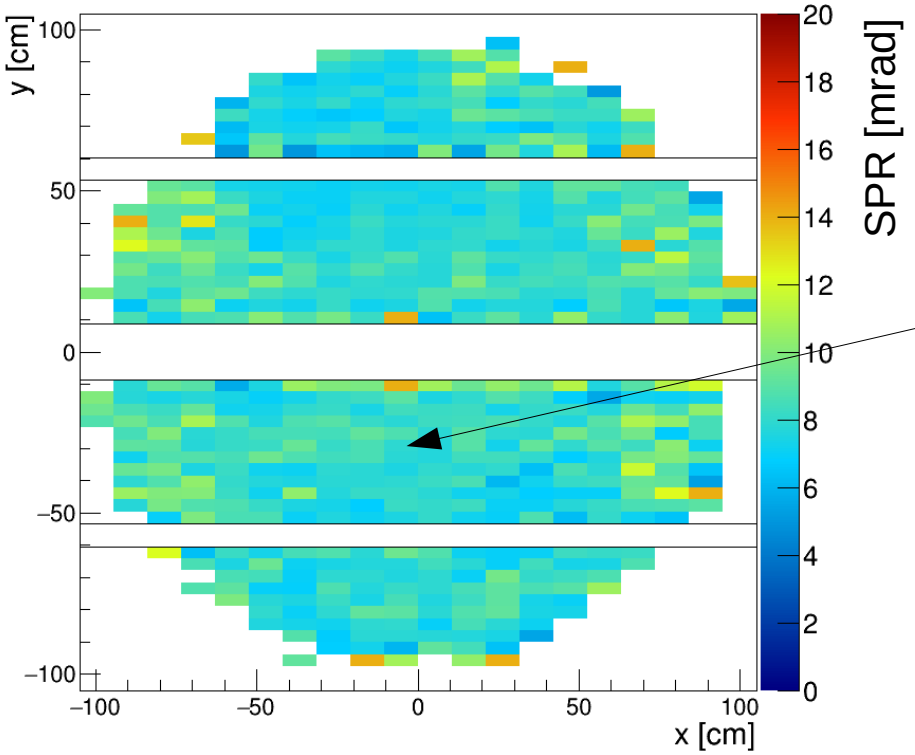


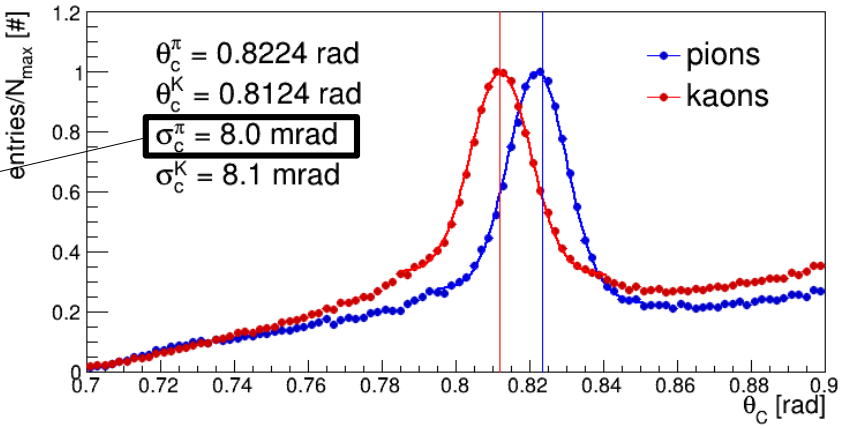
Hit position of the charge tracks on the radiator wall:



Single Photon Resolution

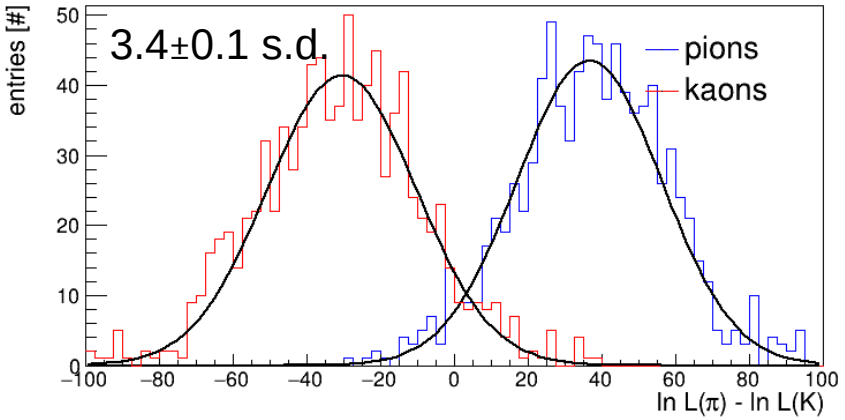
SPR for pions @ 3 GeV/c beam momentum:



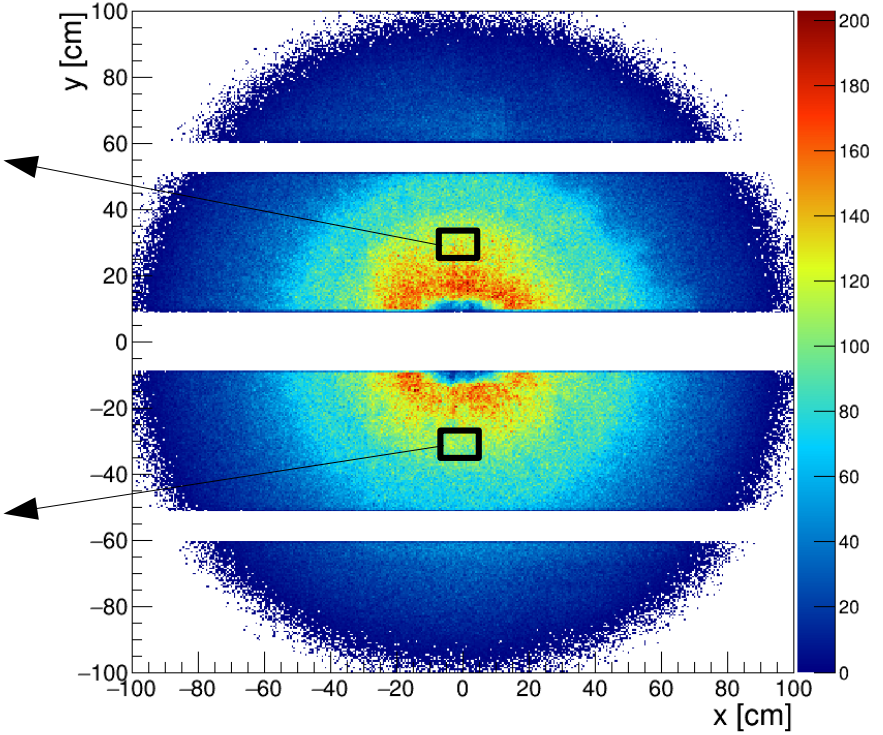


Separation Power

pions / kaons @ 3 GeV/c beam

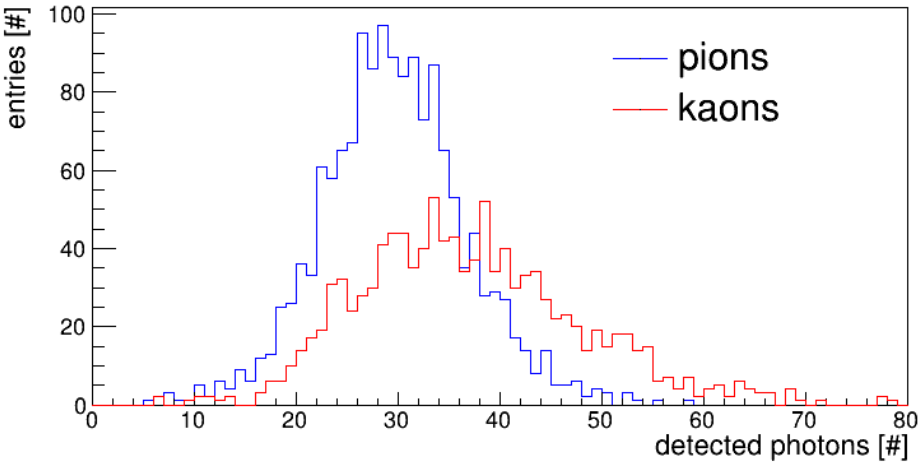


Hit position of the charge tracks on the radiator wall:

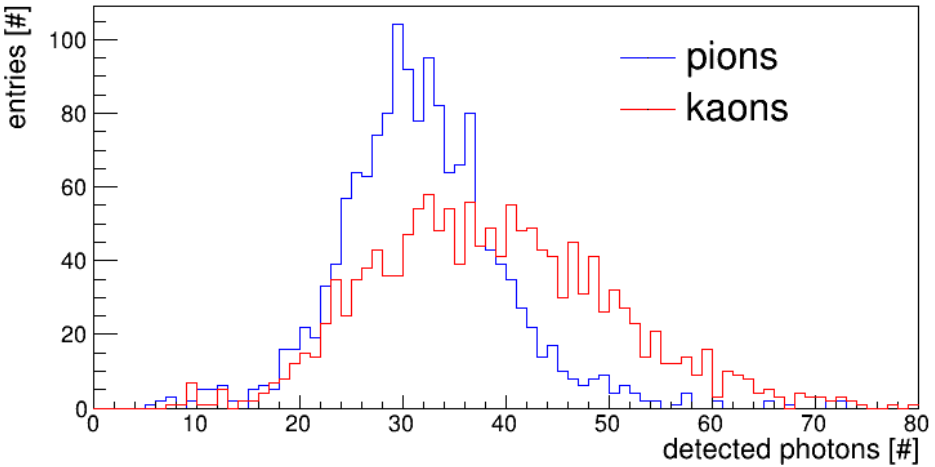


Photon yield

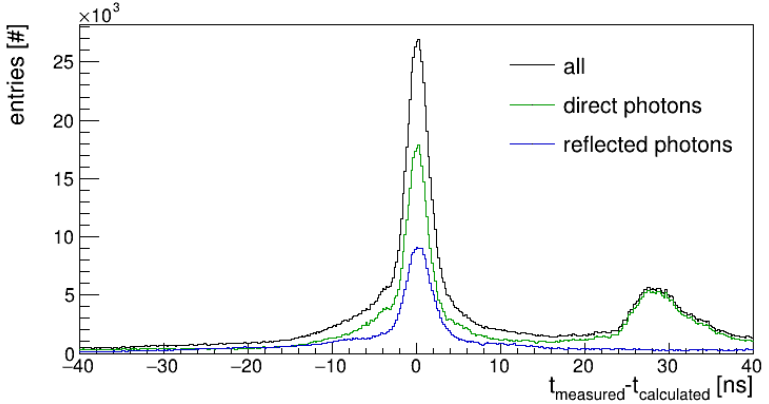
bottom OB

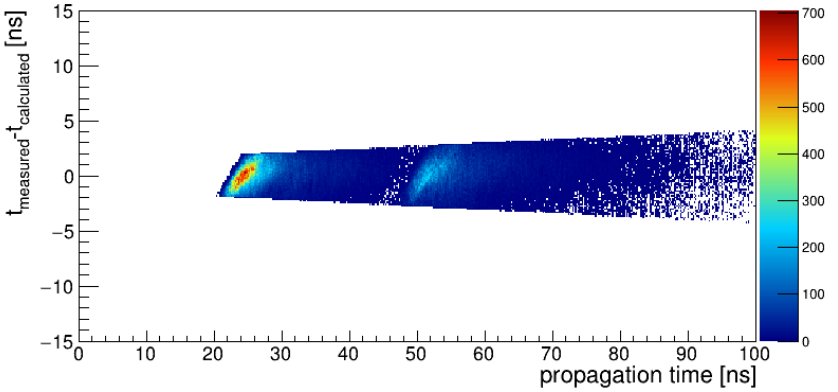


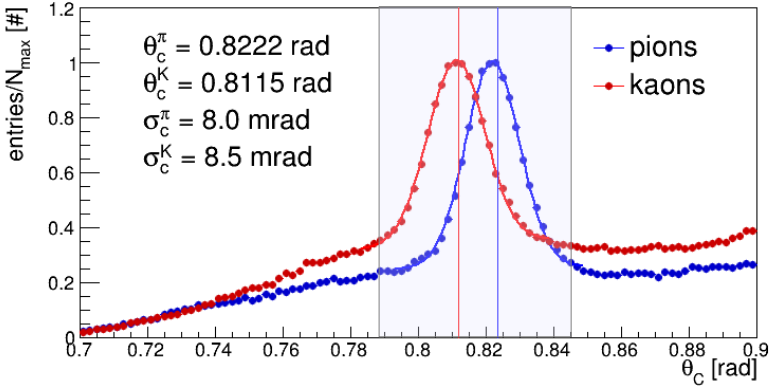
top OB



Photon yield: Cuts

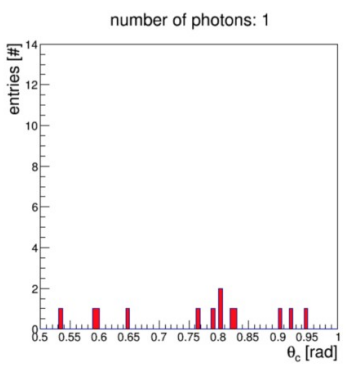


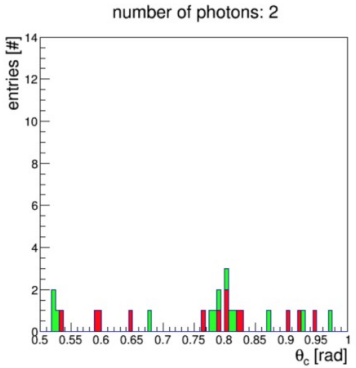




Backup: Geometrical Reconstruction

- Adapted from the PANDA Barrel DIRC reconstruction
- Geometrical algorithm determine θ_c using Look Up Tables





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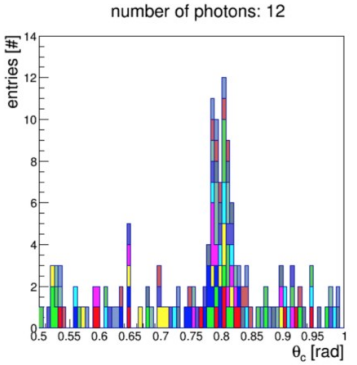


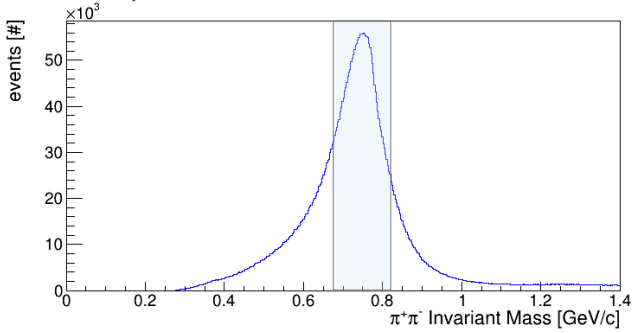
- PID performed by unbind likelihood fit of the determined θ_c using different mass hypothesis

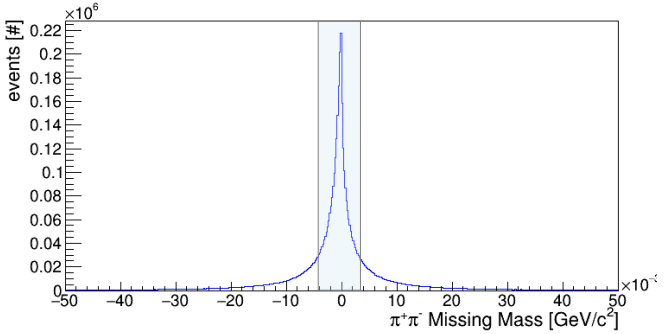
Backup: Event Selection

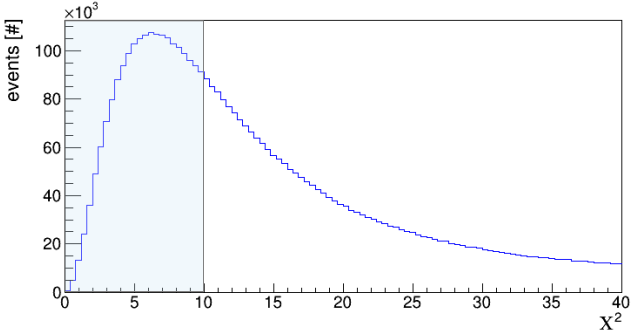
beam data

after kinematic fit

$\rho \to \pi^+\pi^-$







$\phi \to K^+K^-$