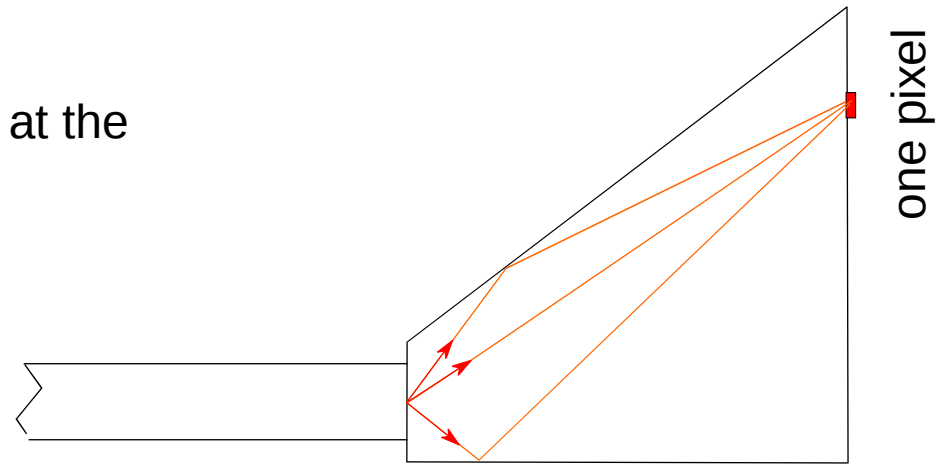# Reconstruction methods of PANDA Barrel DIRC

- ■ Geometrical reconstruction
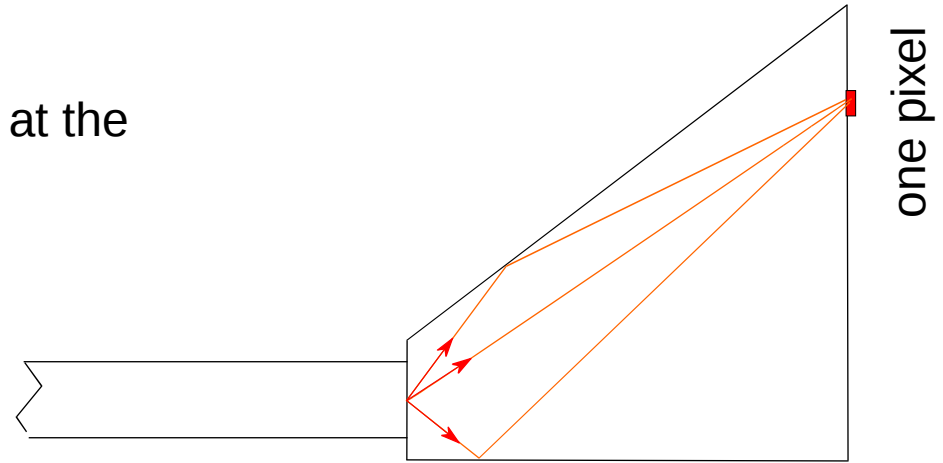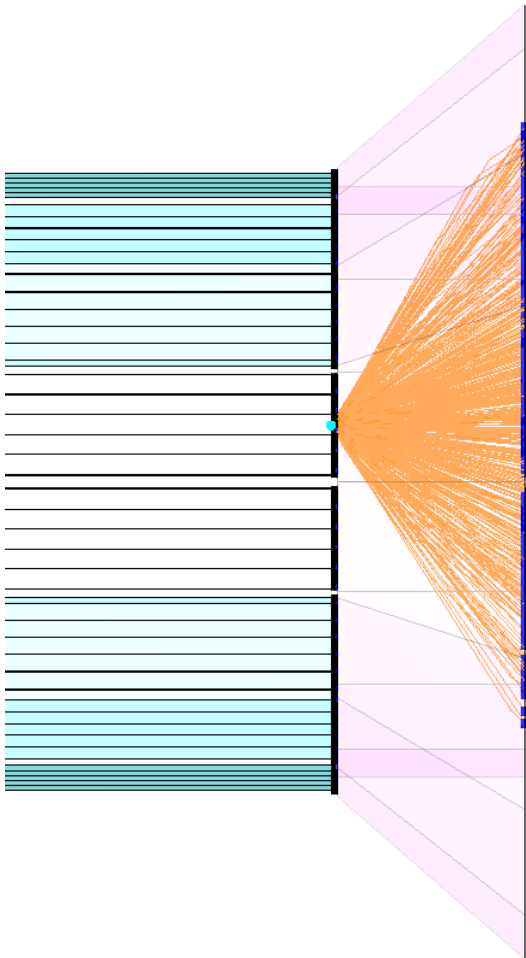
- ■ Time Likelihood imaging

for GlueX DIRC

GSI

Geometrical Reconstruction

- BABAR-like reconstruction

- Look-Up Table creation: store direction at the end of the radiators for each hit pixel

one pixel

Geometrical Reconstruction

- BABAR-like reconstruction

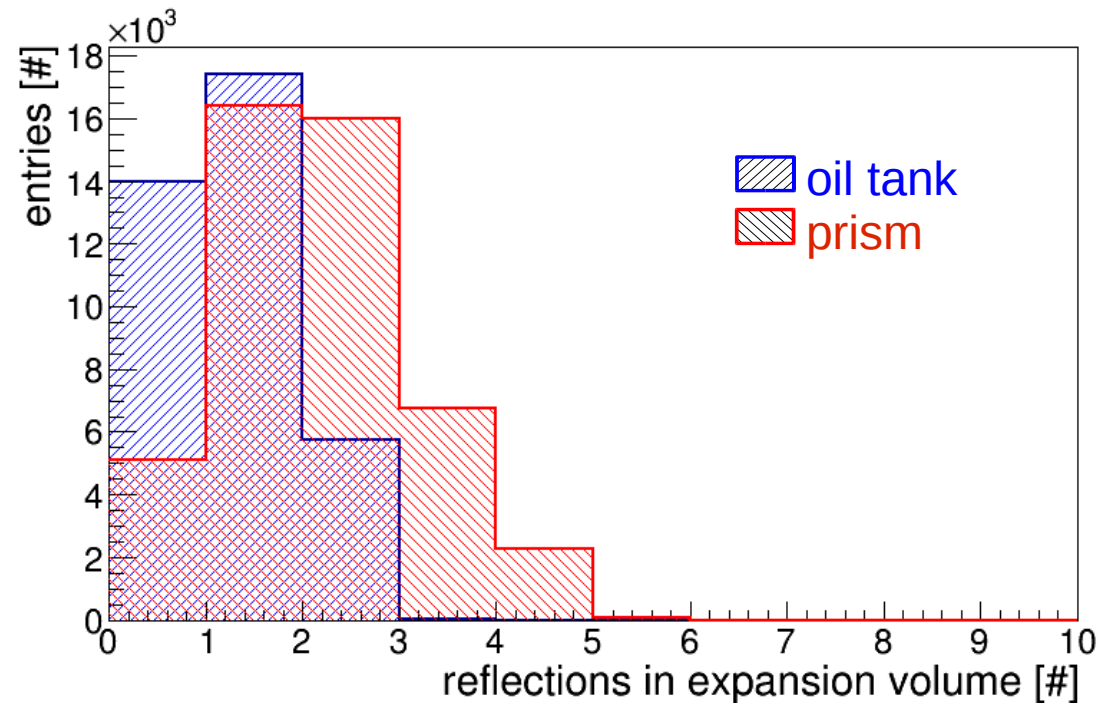- Look-Up Table creation: store direction at the end of the radiators for each hit pixel

one pixel

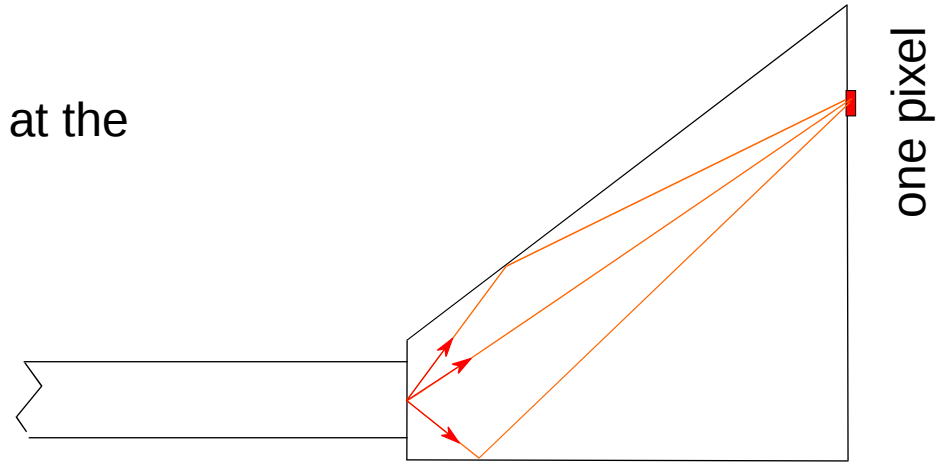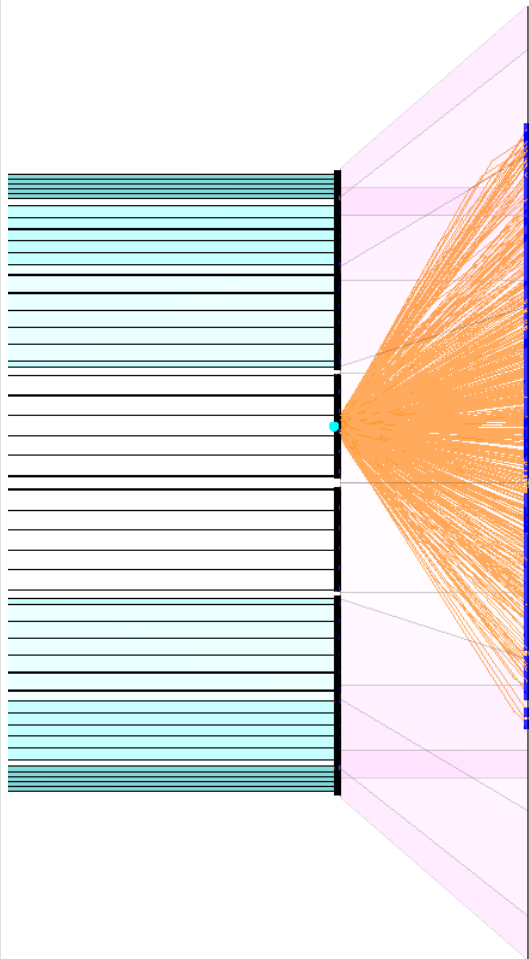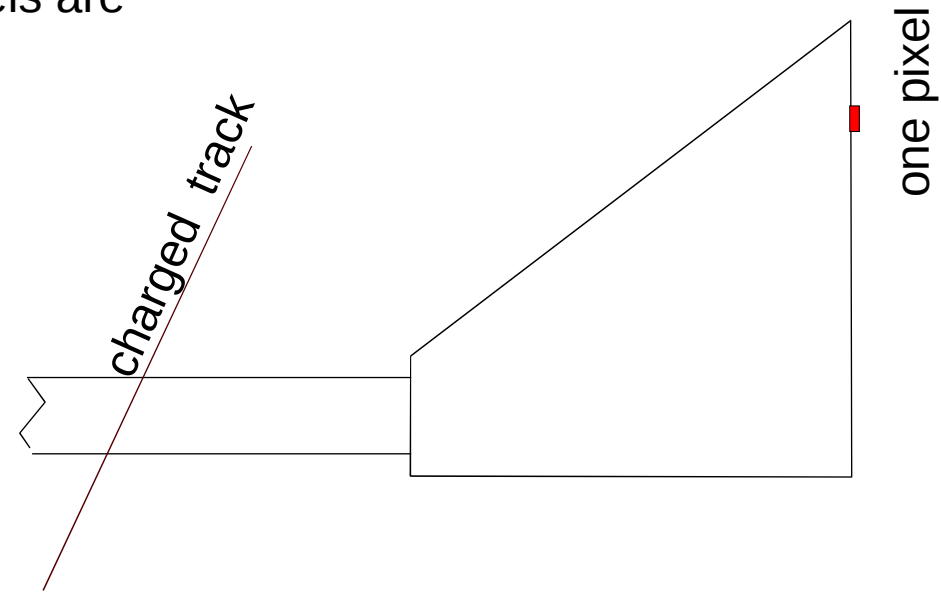# Geometrical Reconstruction

- BABAR-like reconstruction

- Look-Up Table creation: store direction at the end of the radiators for each hit pixel

one pixel

Geometrical Reconstruction

- Reconstruction: direction from LUT for hit pixels are combined with charge track direction
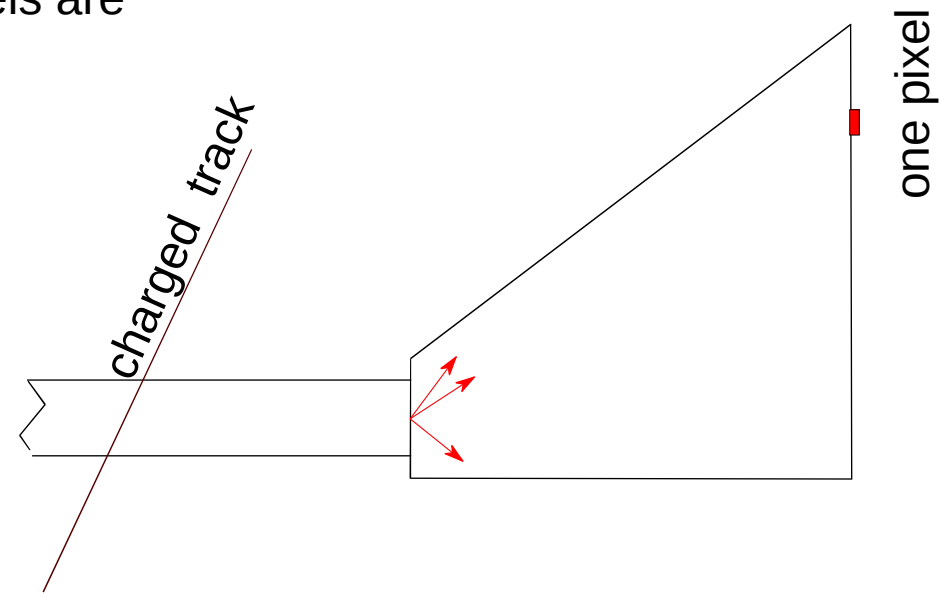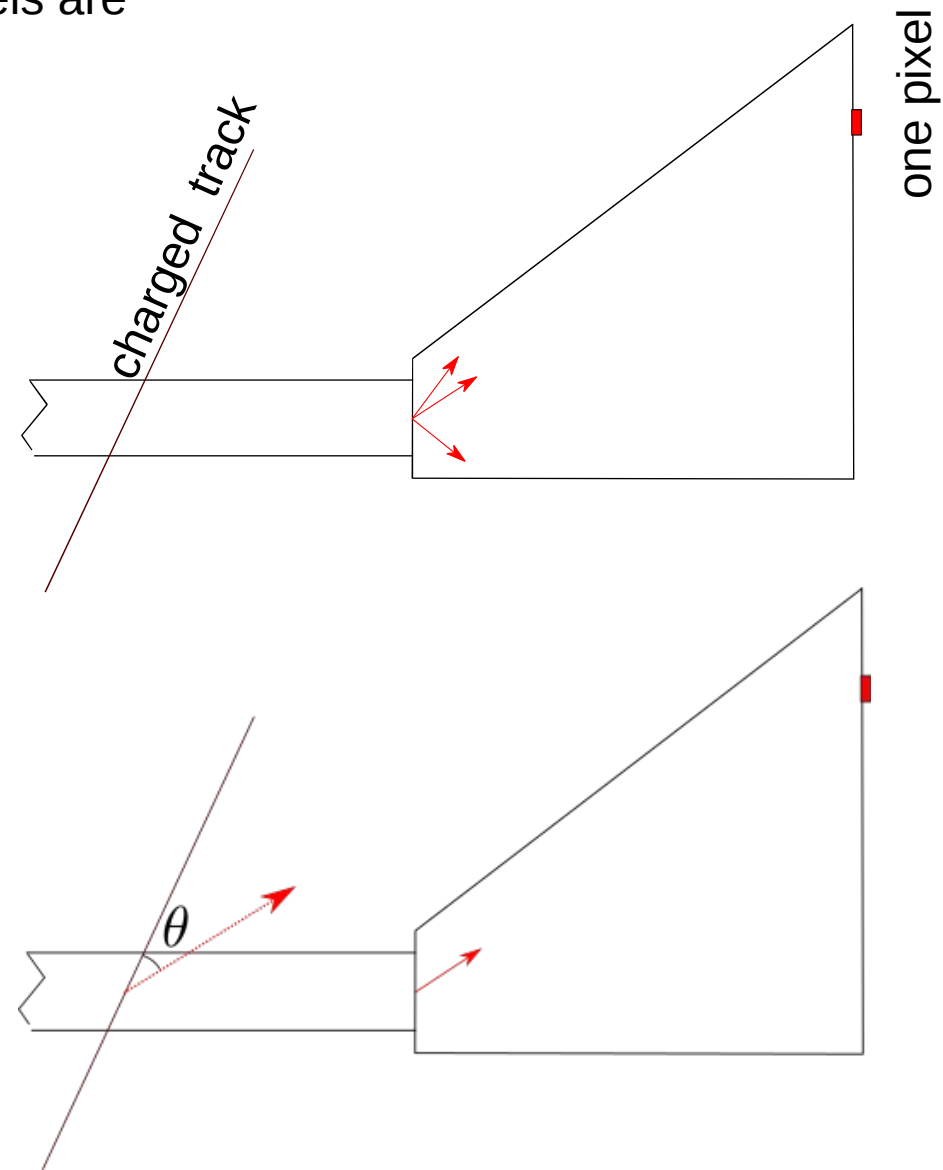
charged track

one pixel

Geometrical Reconstruction

- Reconstruction: direction from LUT for hit pixels are combined with charge track direction

Geometrical Reconstruction

- Reconstruction: direction from LUT for hit pixels are combined with charge track direction

Geometrical Reconstruction

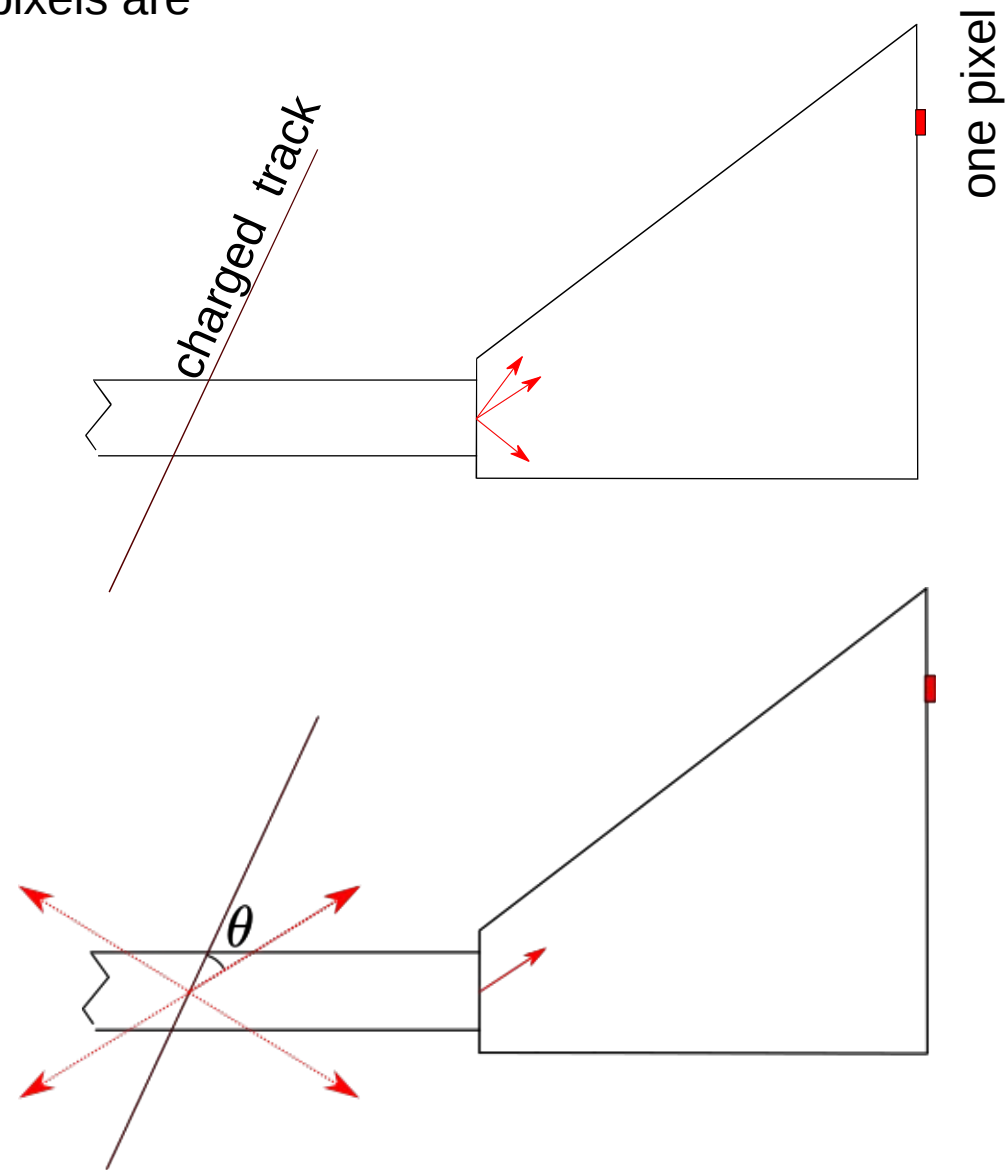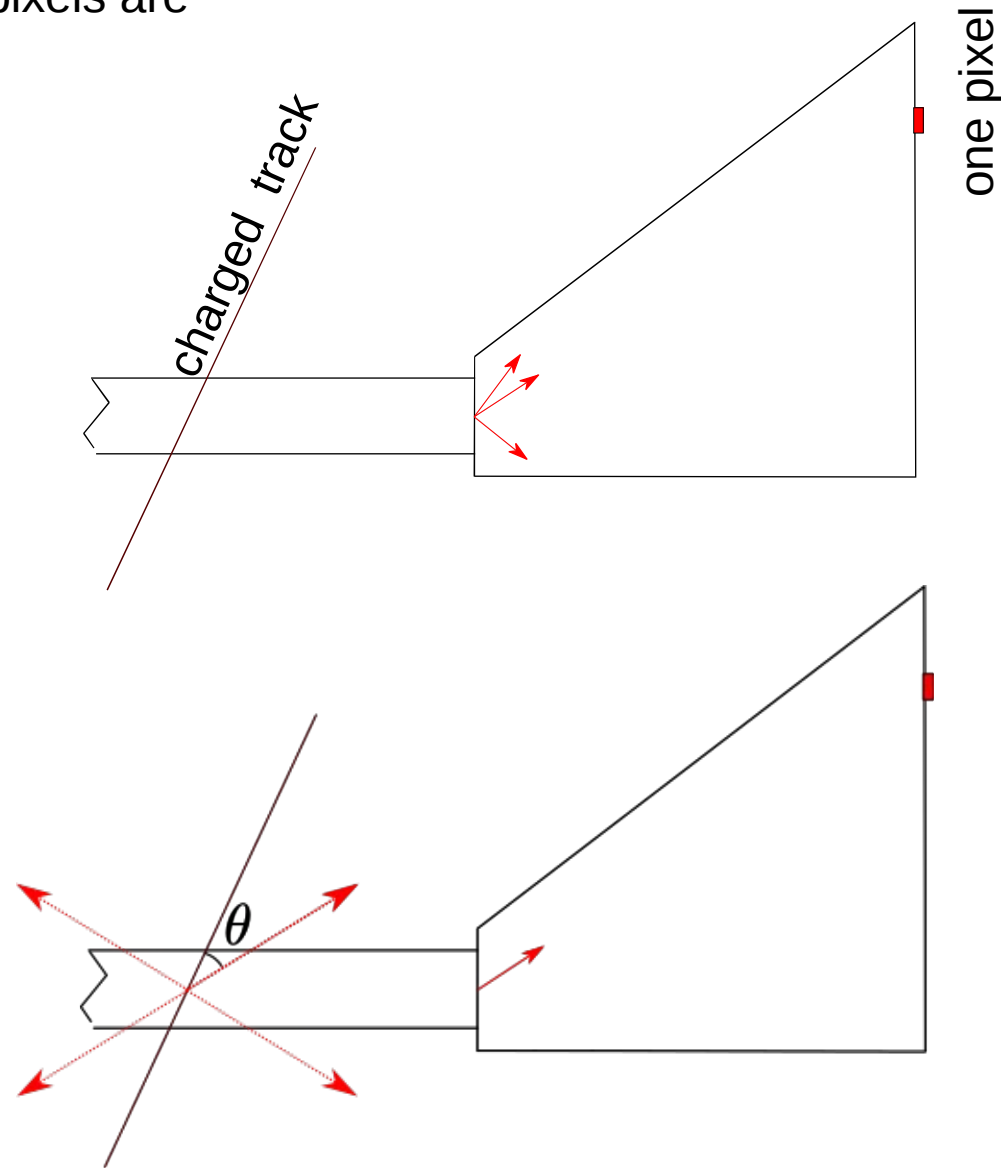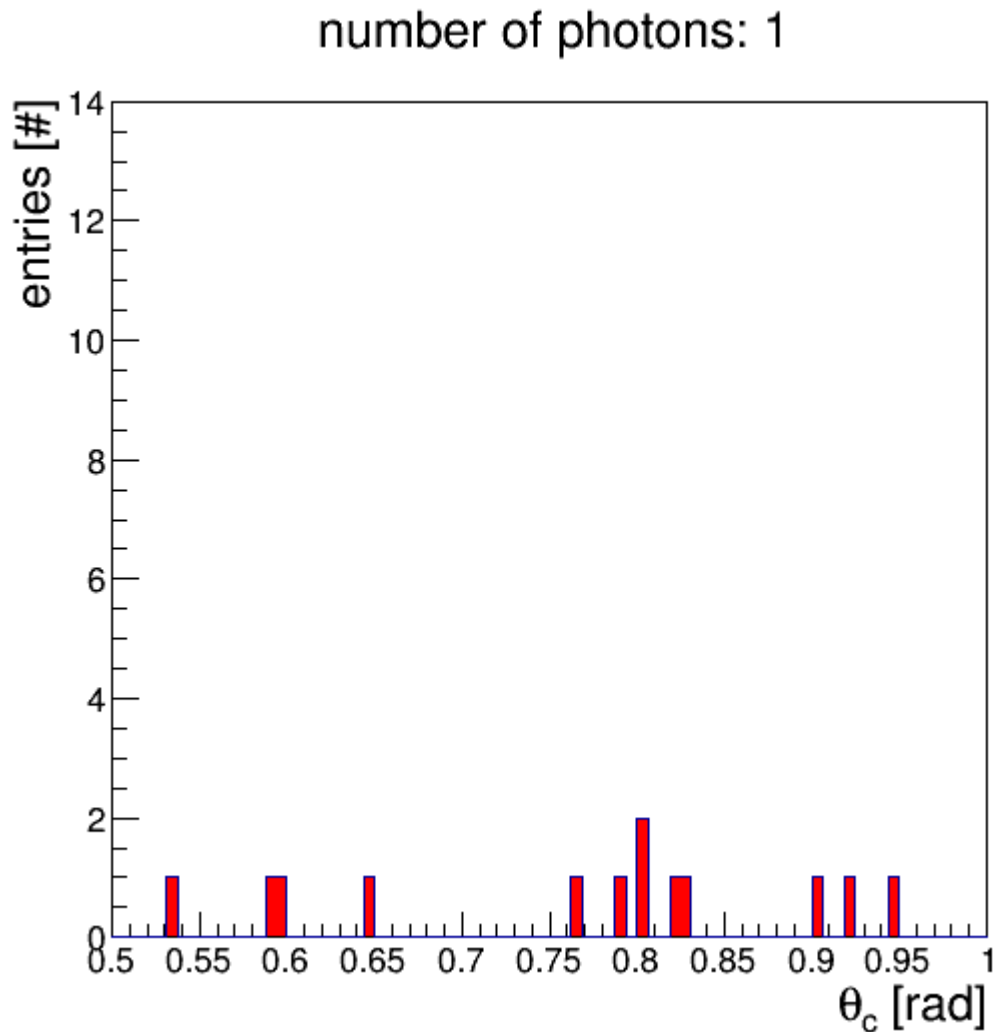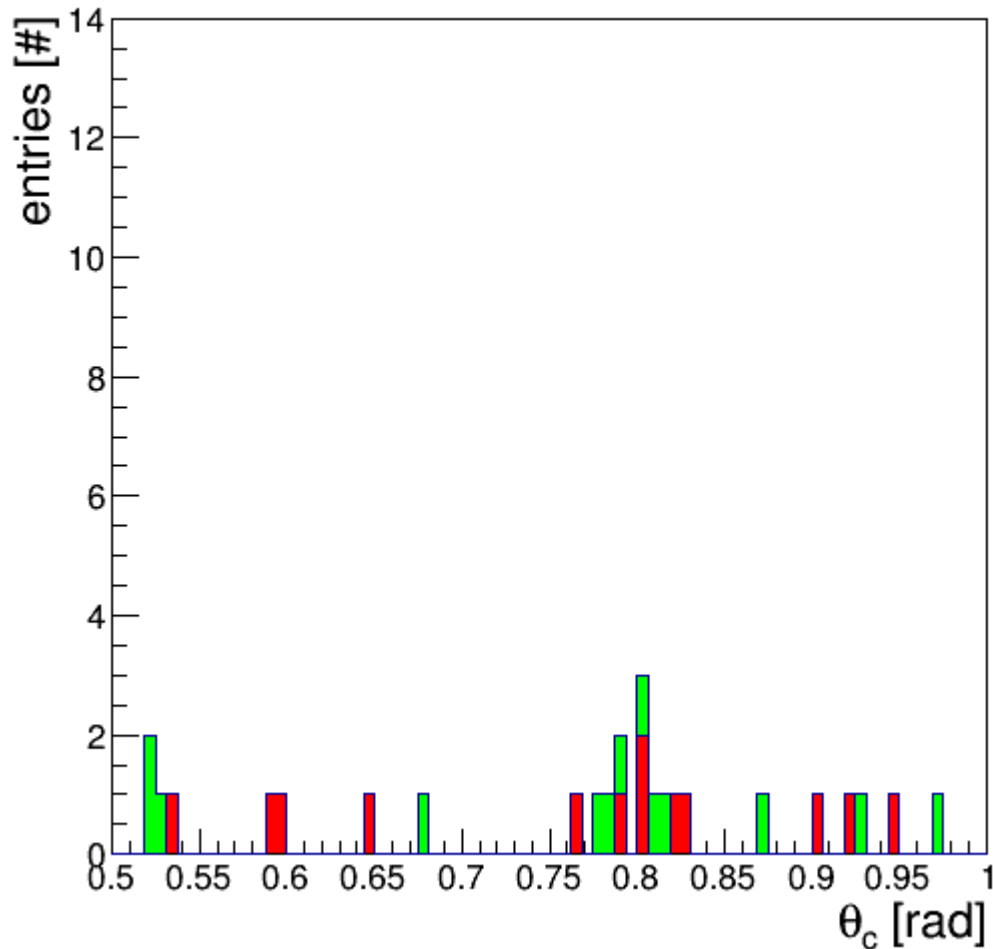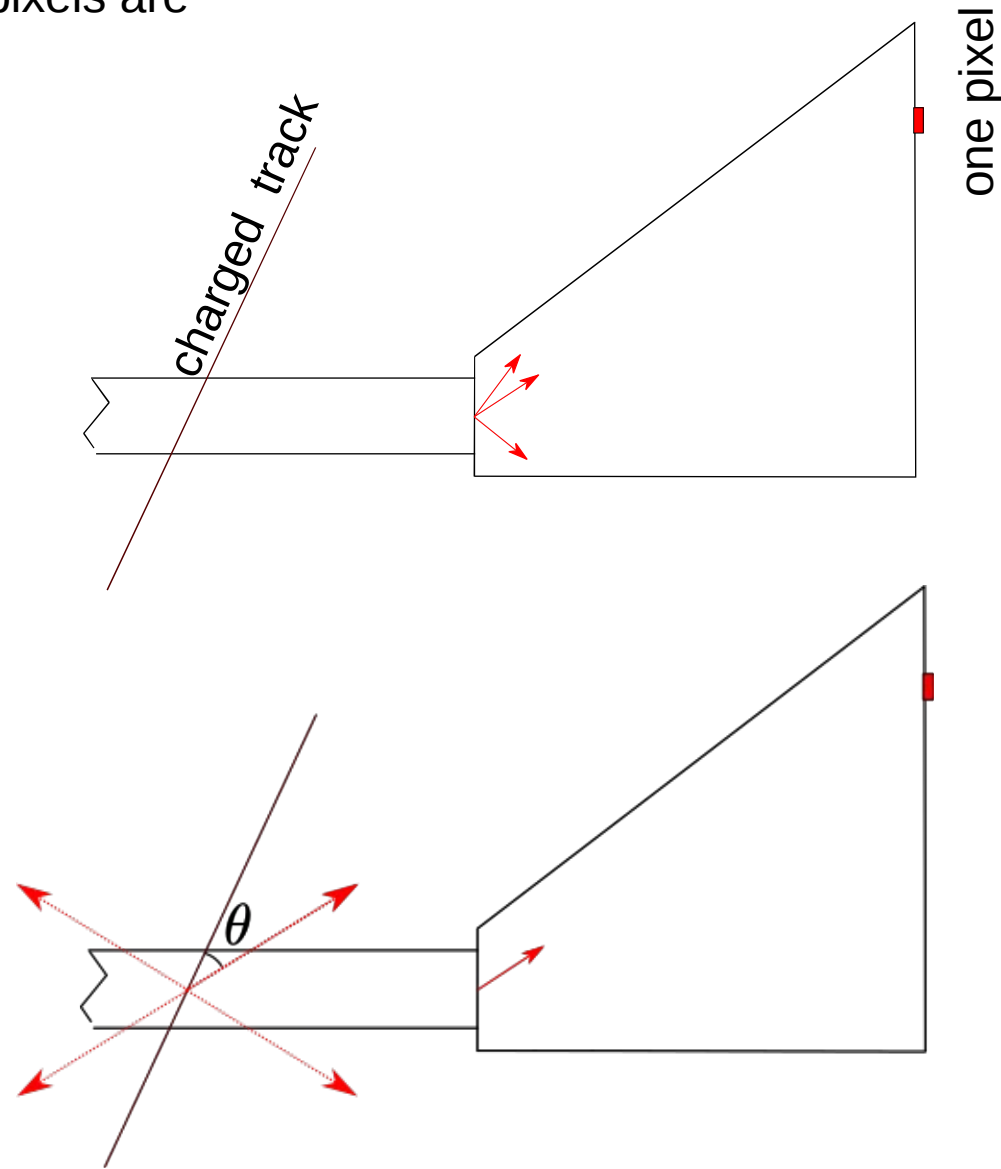- **Reconstruction:** direction from LUT for hit pixels are combined with charge track direction
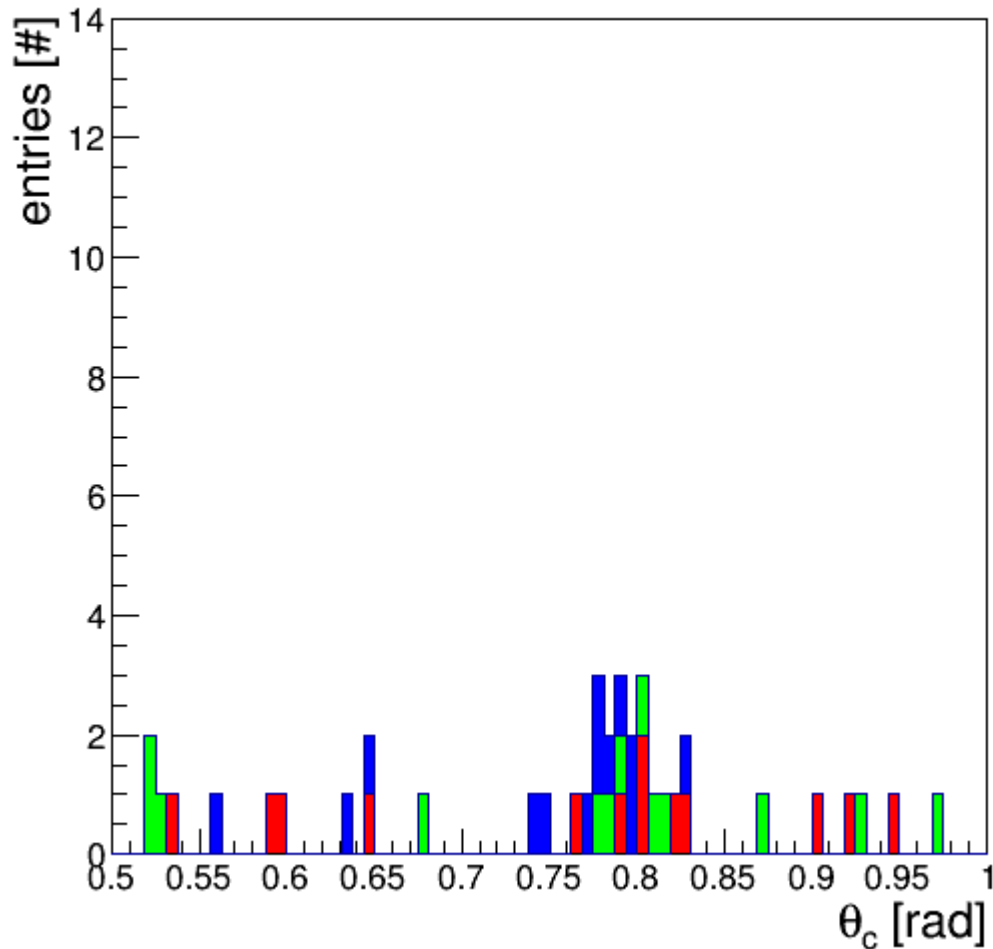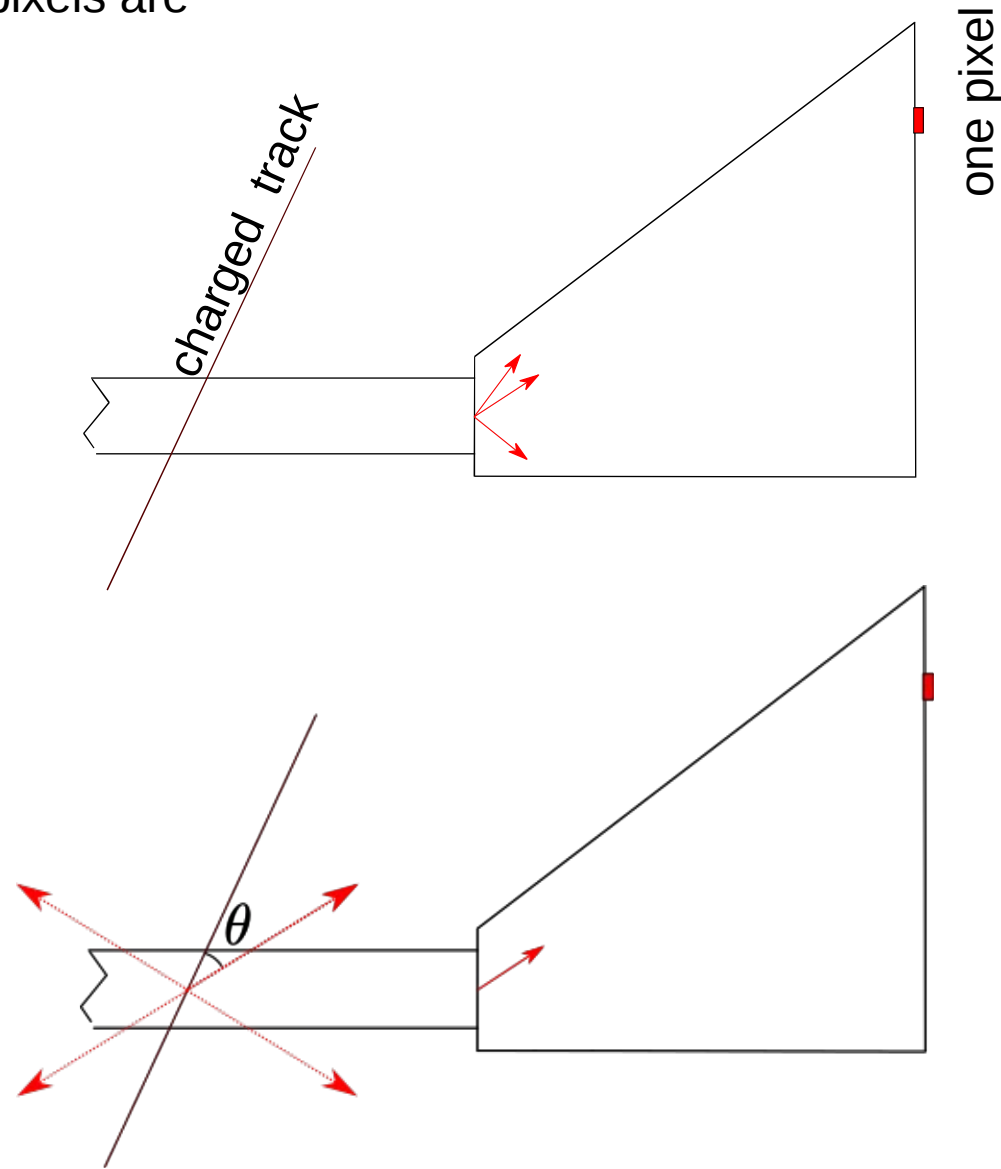
charged track

one pixel

θ

GSI

Geometrical Reconstruction

- Reconstruction: direction from LUT for hit pixels are combined with charge track direction

number of photons: 1

Geometrical Reconstruction

- Reconstruction: direction from LUT for hit pixels are combined with charge track direction

number of photons: 2

Geometrical Reconstruction

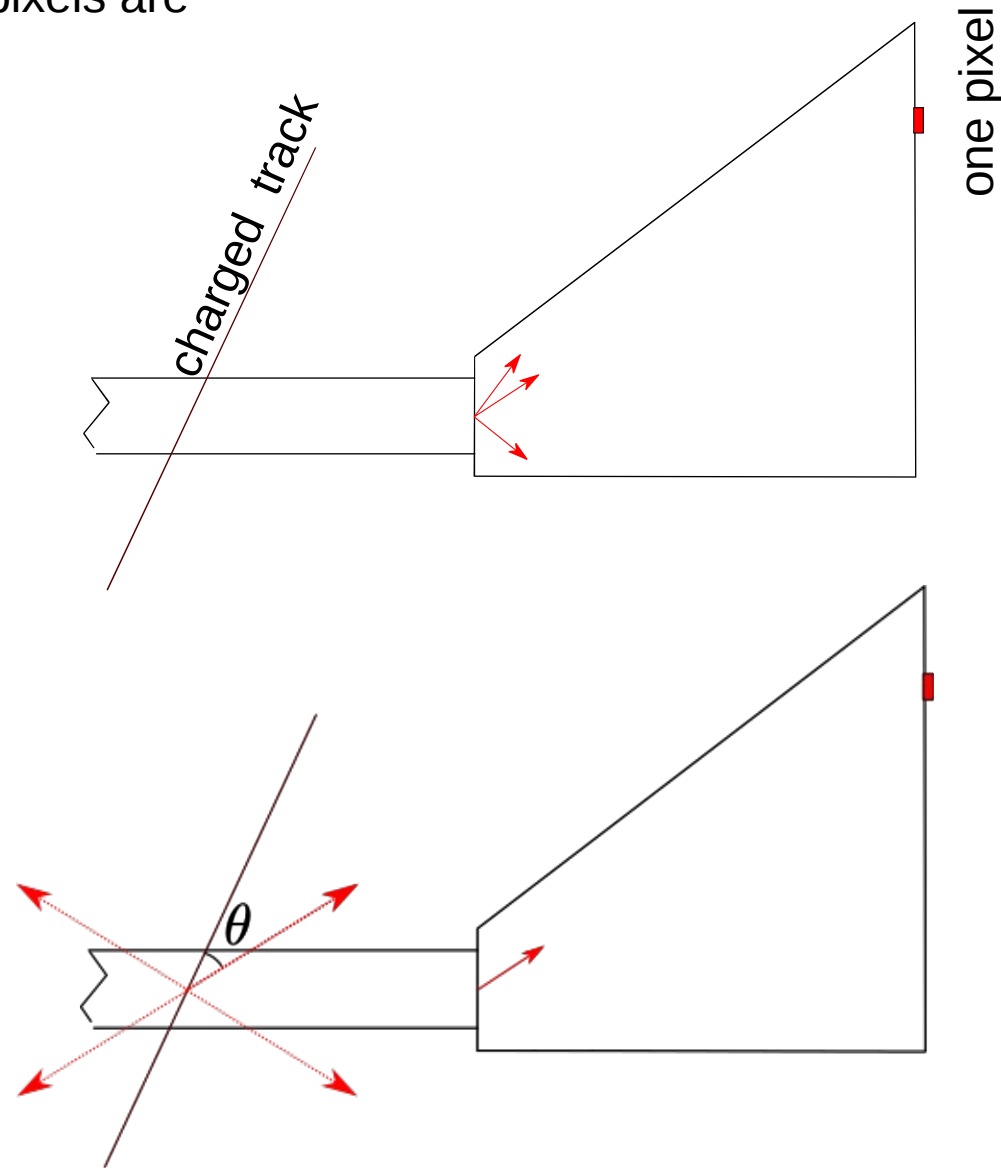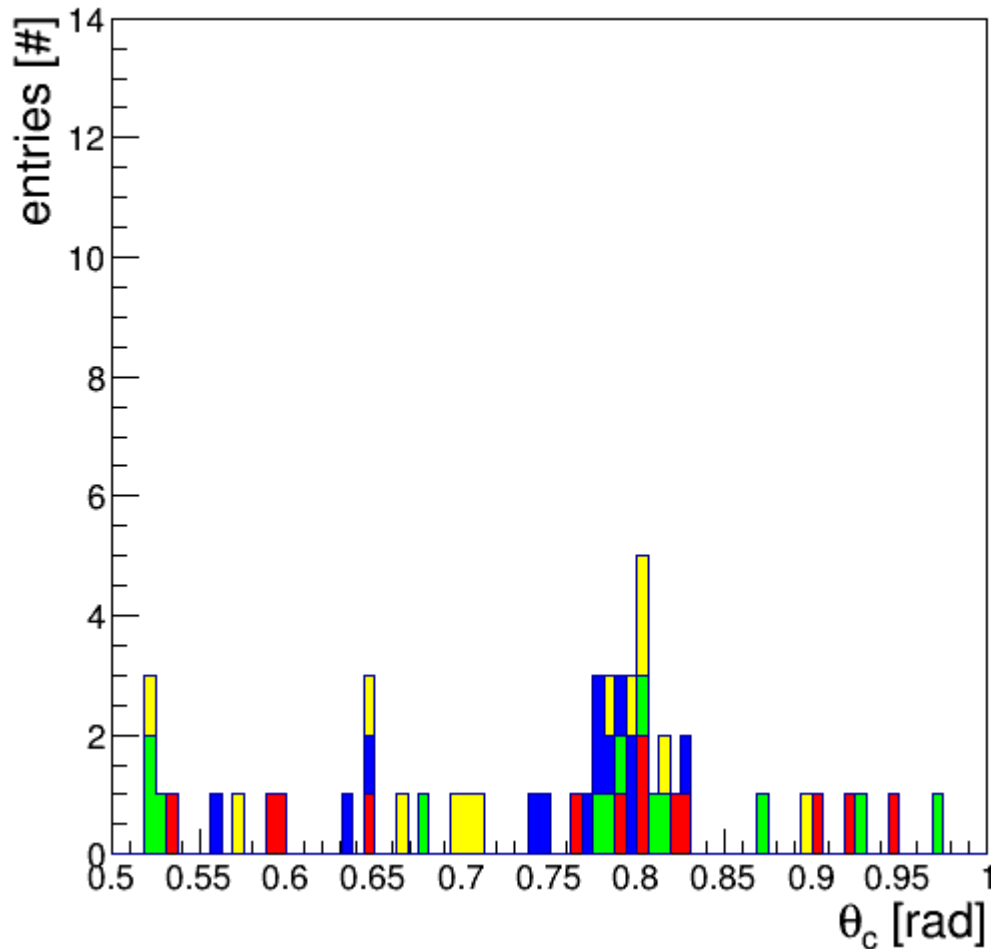- Reconstruction: direction from LUT for hit pixels are combined with charge track direction

number of photons: 3

Geometrical Reconstruction

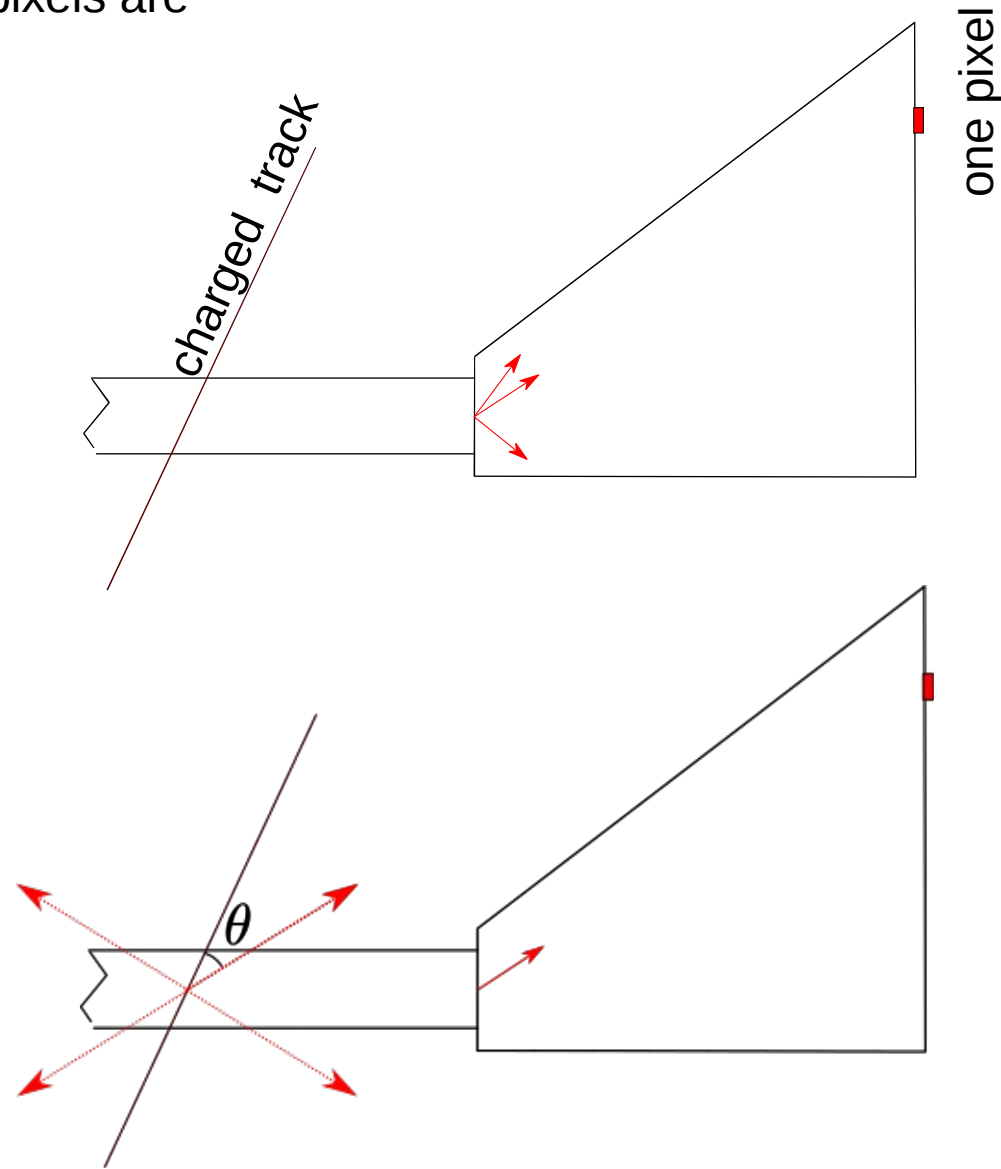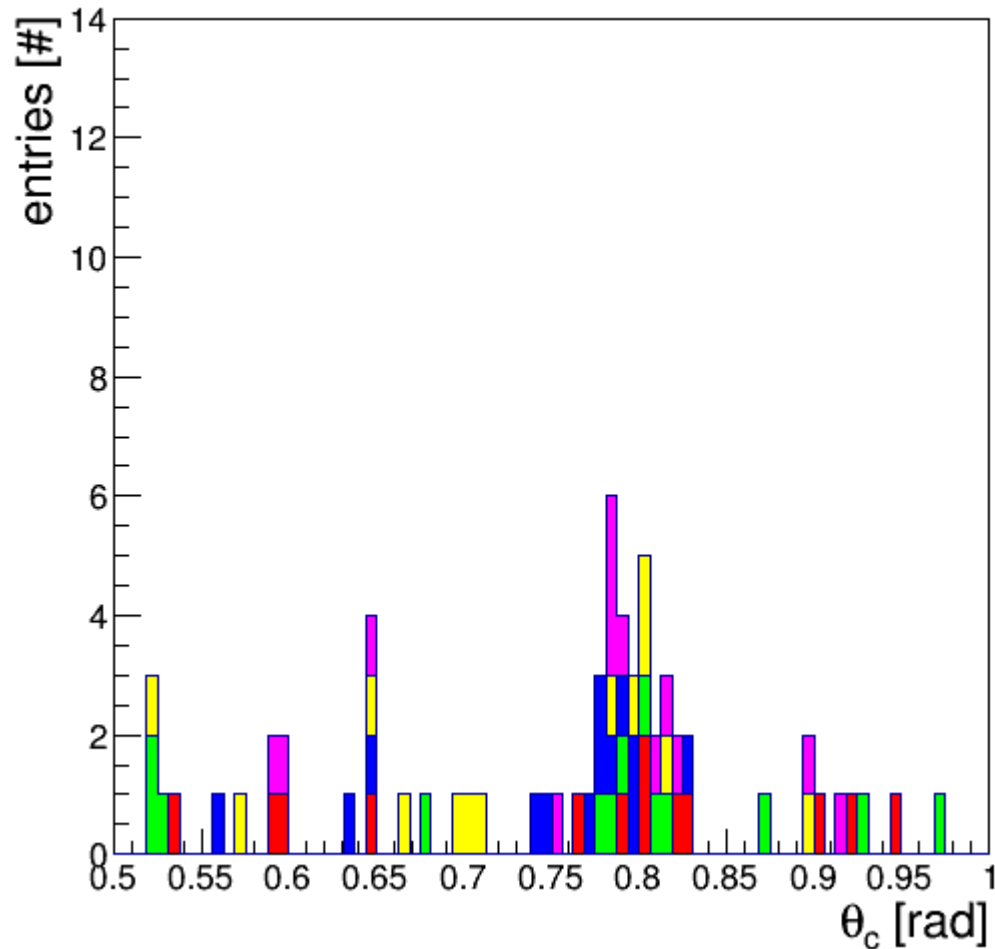- Reconstruction: direction from LUT for hit pixels are combined with charge track direction

number of photons: 4

Geometrical Reconstruction

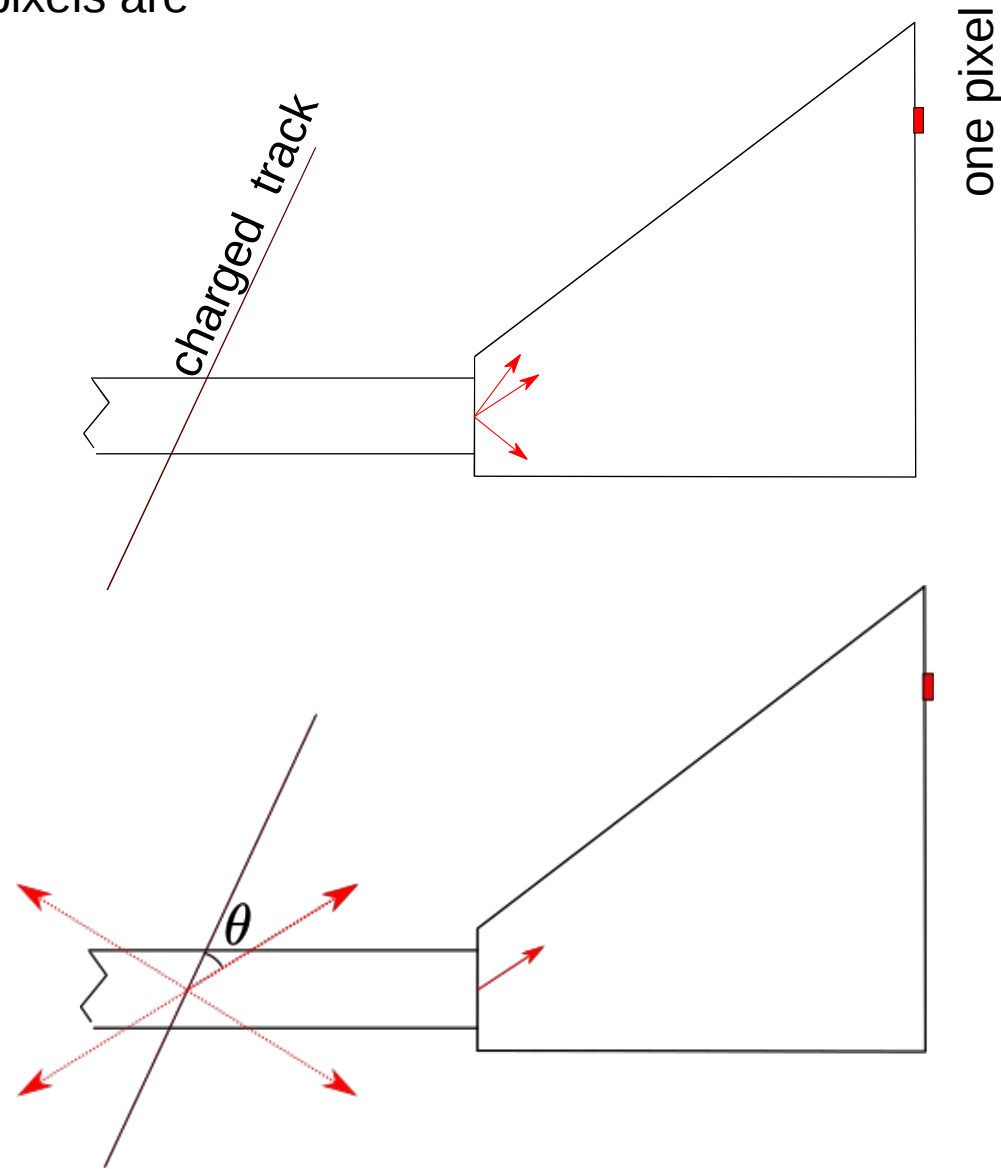- Reconstruction: direction from LUT for hit pixels are combined with charge track direction

number of photons: 5

Geometrical Reconstruction

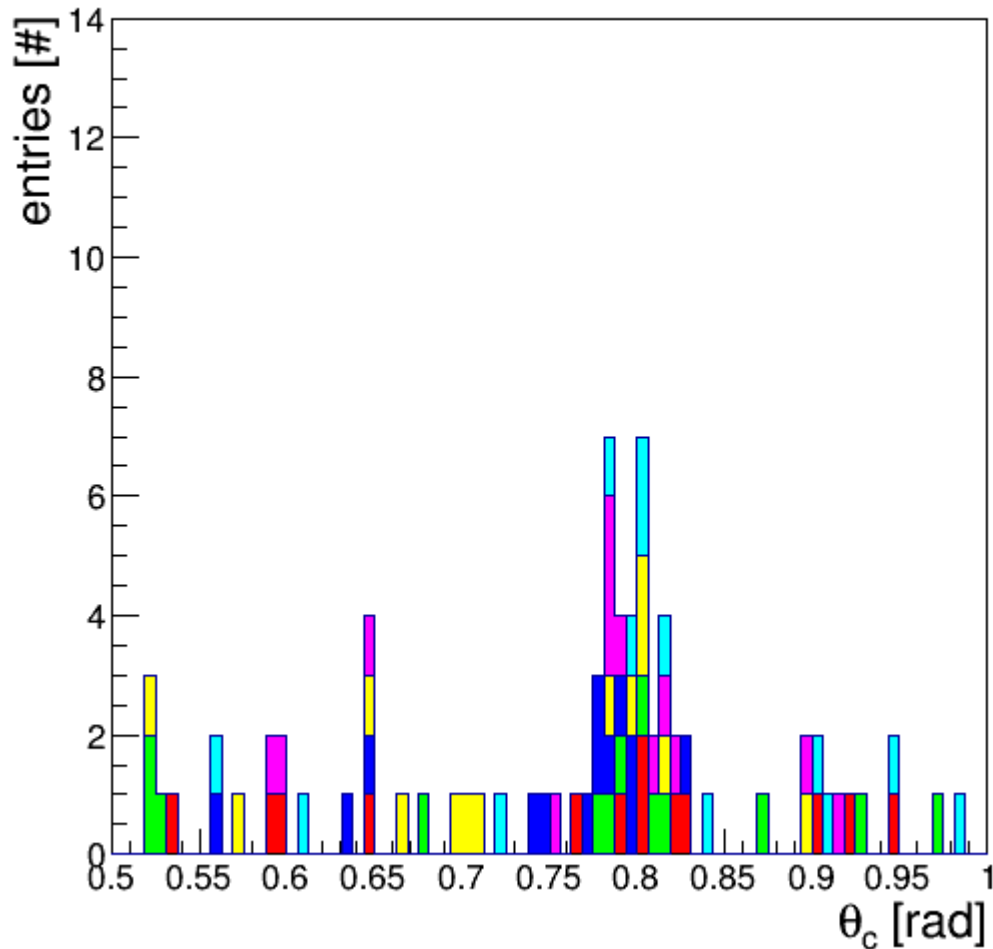■ Reconstruction: direction from LUT for hit pixels are combined with charge track direction

number of photons: 6

Geometrical Reconstruction

- Reconstruction: direction from LUT for hit pixels are combined with charge track direction

number of photons: 7

Geometrical Reconstruction

- **Reconstruction:** direction from LUT for hit pixels are combined with charge track direction
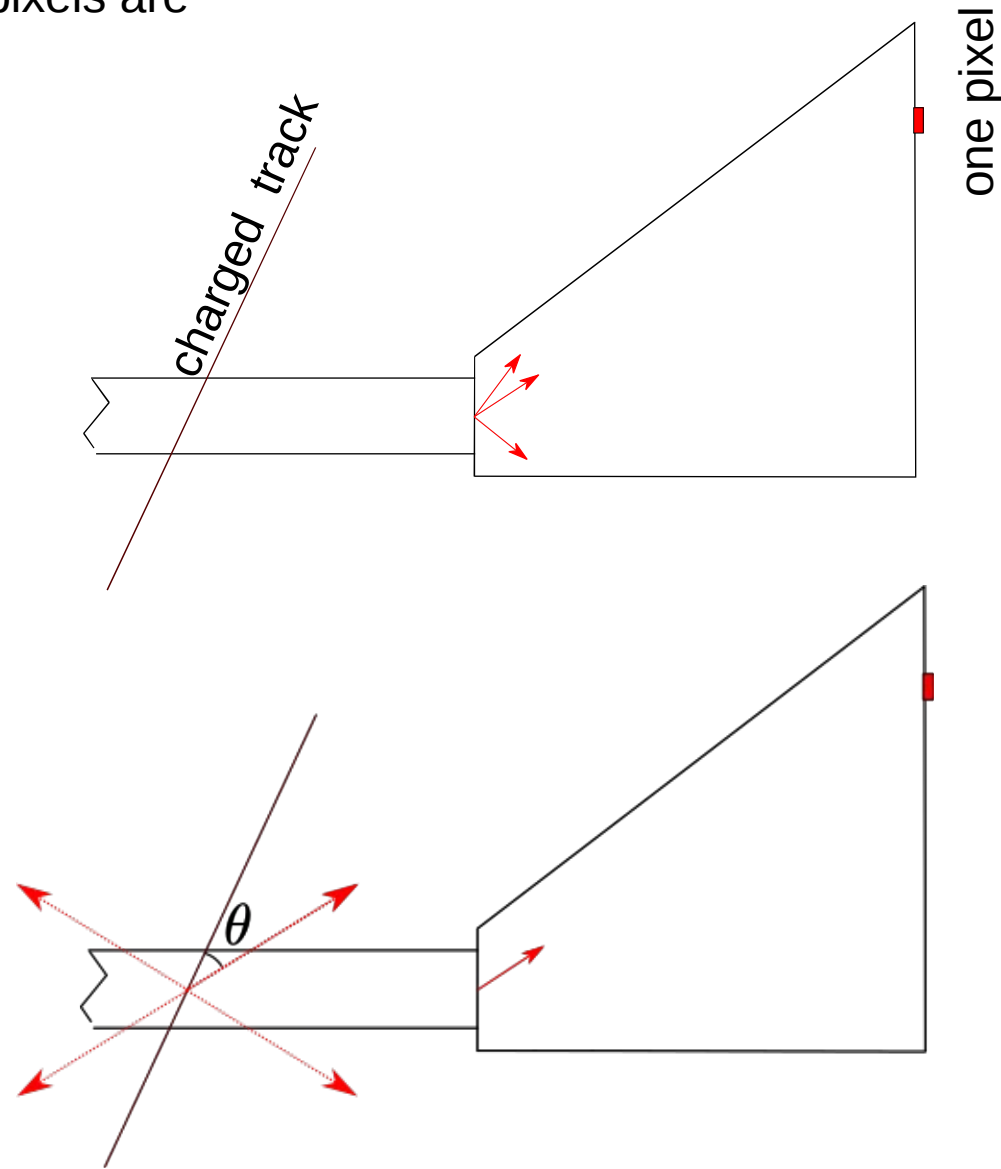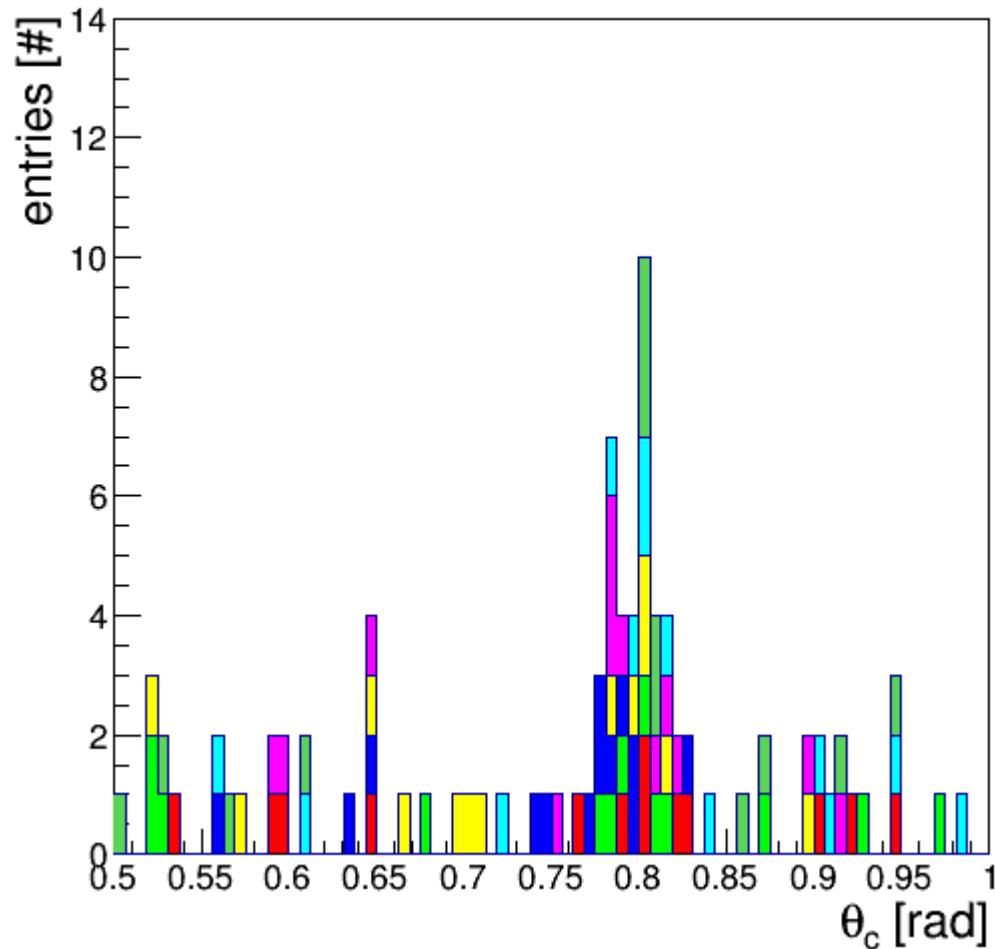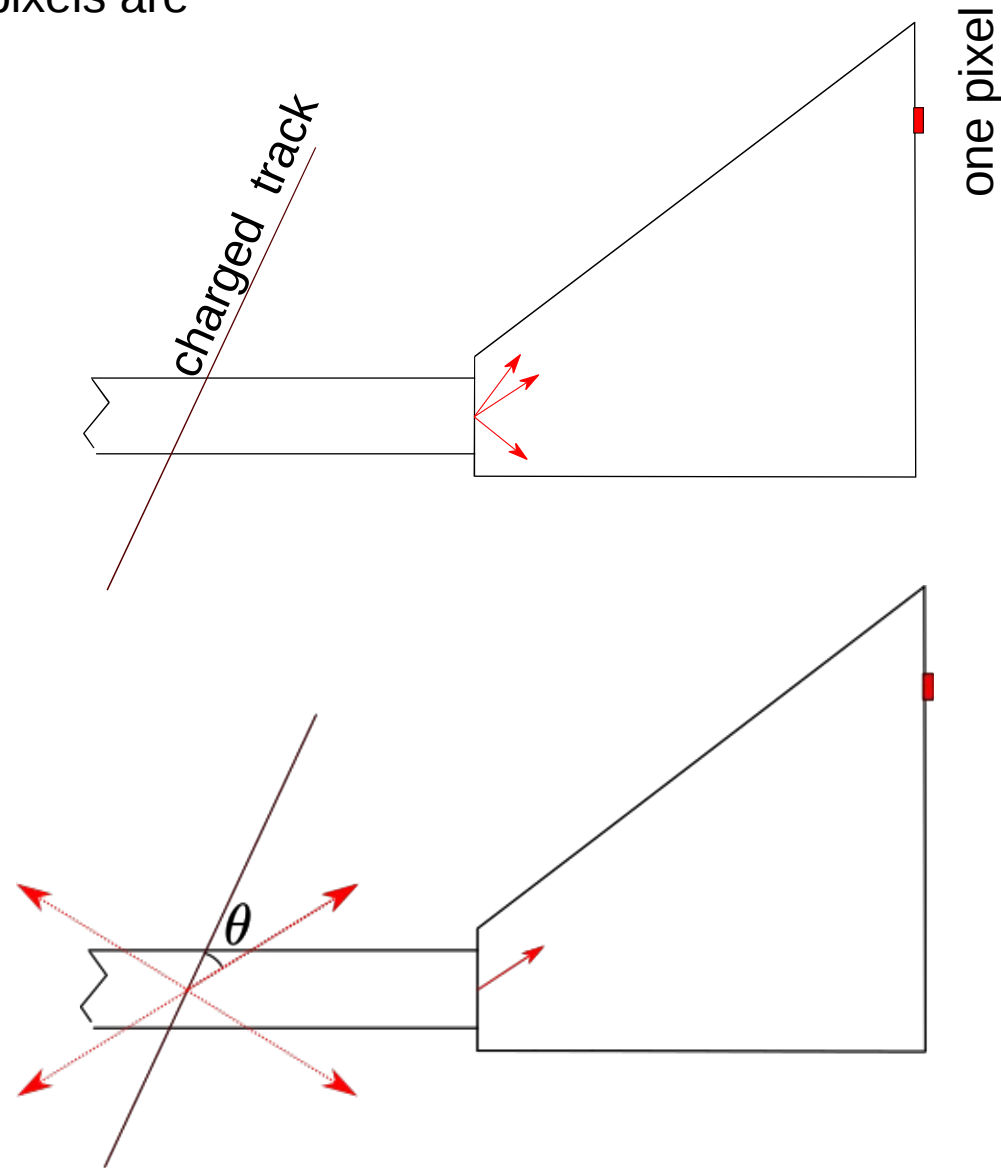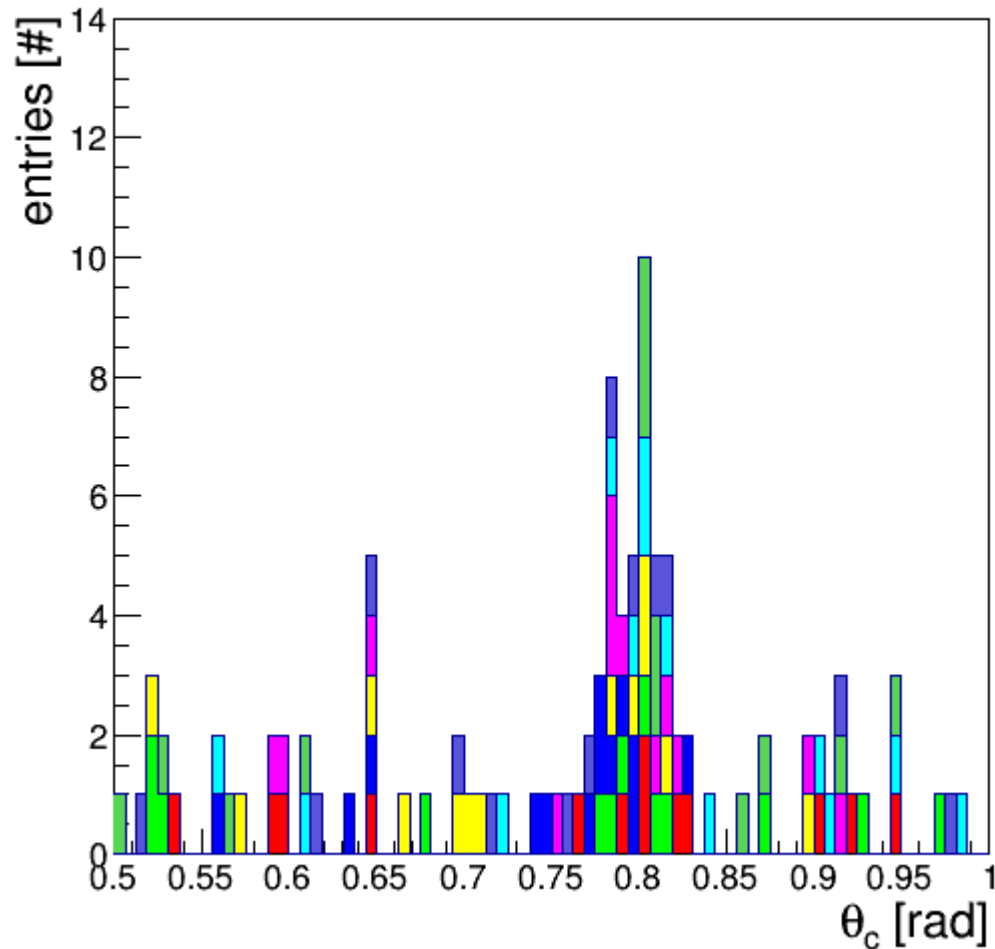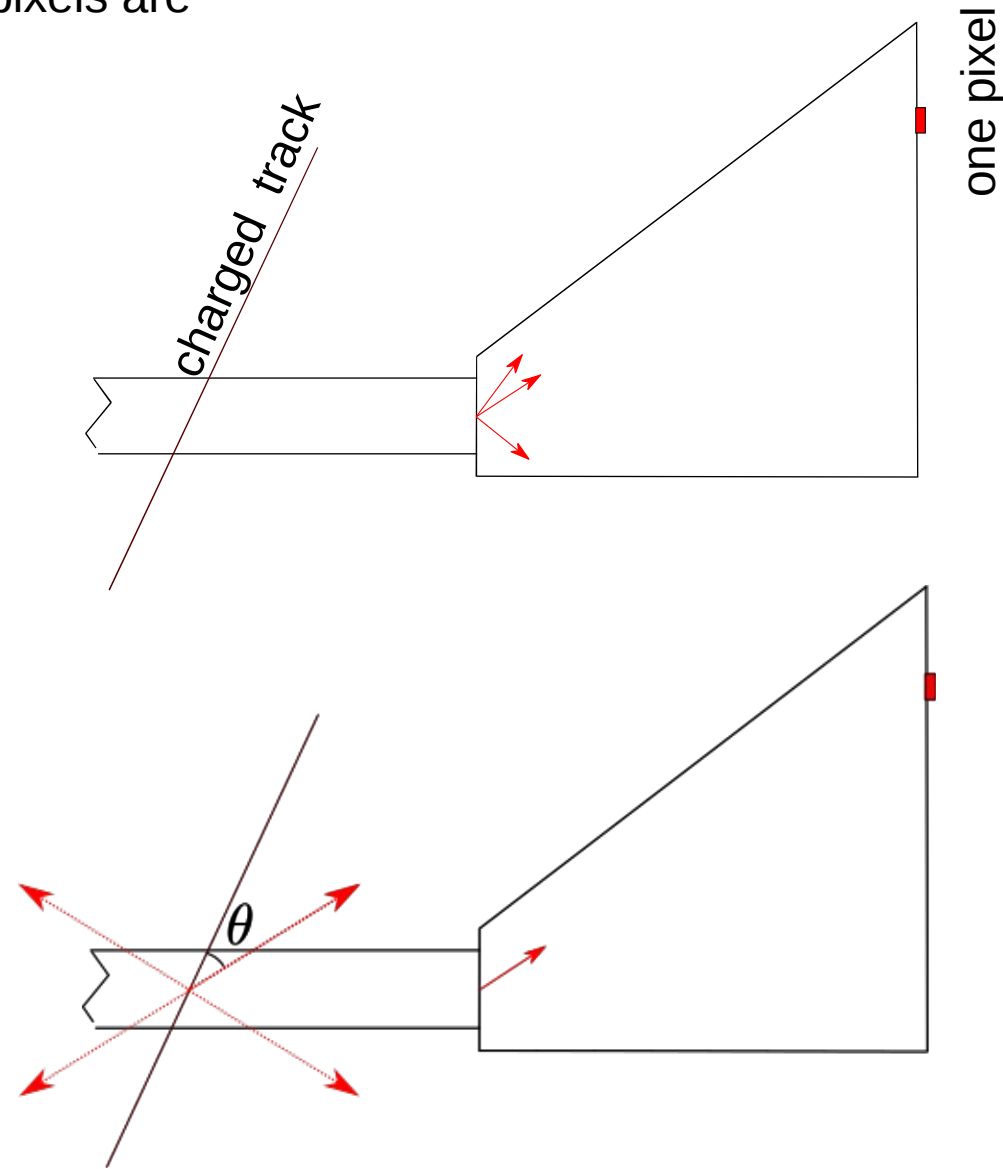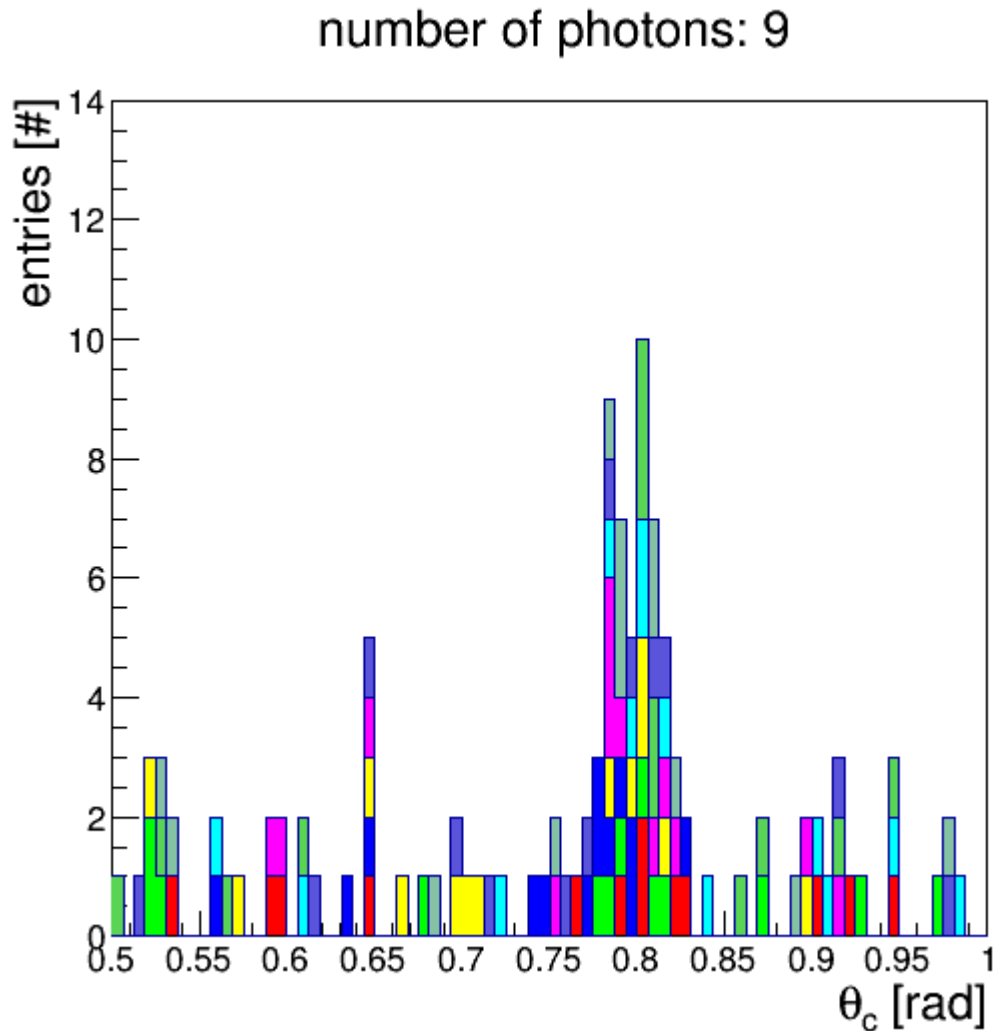
Geometrical Reconstruction

■ **Reconstruction:** direction from LUT for hit pixels are combined with charge track direction

Geometrical Reconstruction

- Reconstruction: direction from LUT for hit pixels are combined with charge track direction

Geometrical Reconstruction

- Reconstruction: direction from LUT for hit pixels are combined with charge track direction

Geometrical Reconstruction

- Reconstruction: direction from LUT for hit pixels are combined with charge track direction
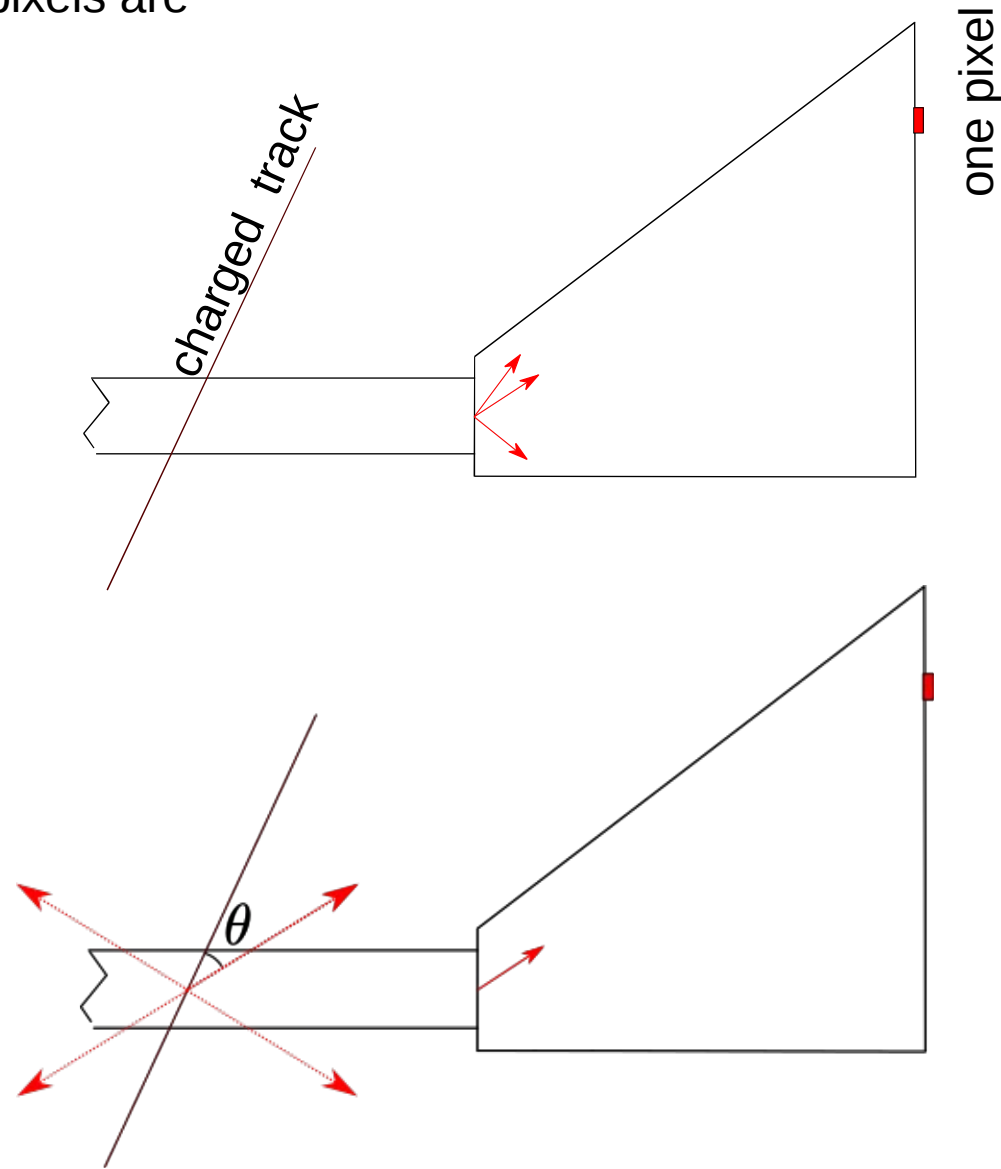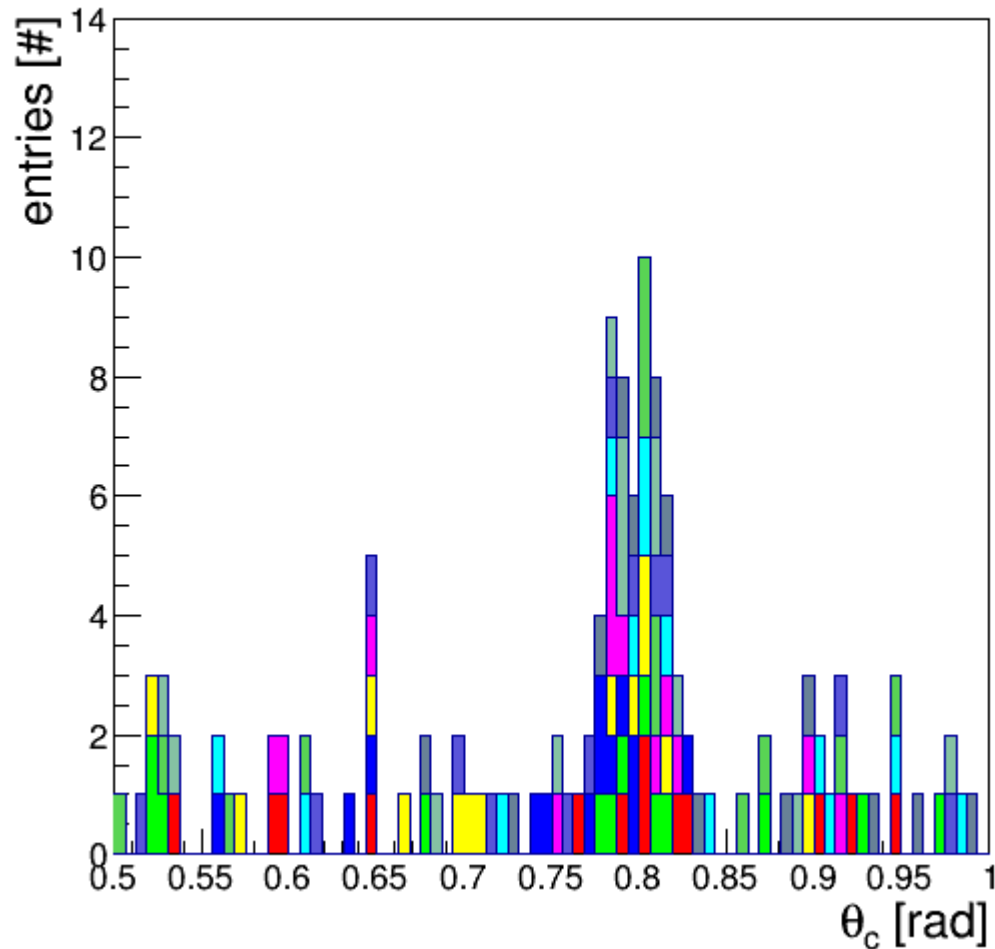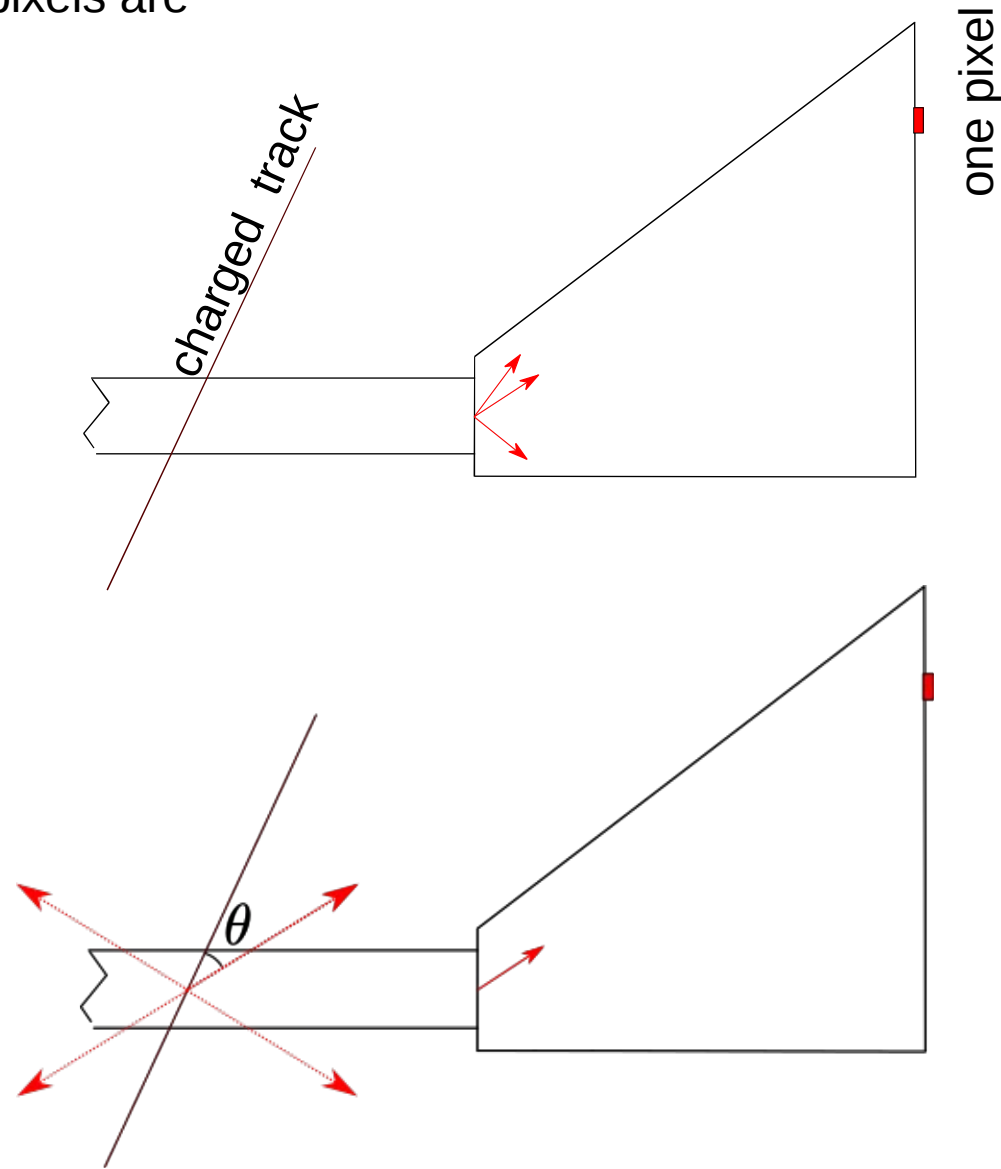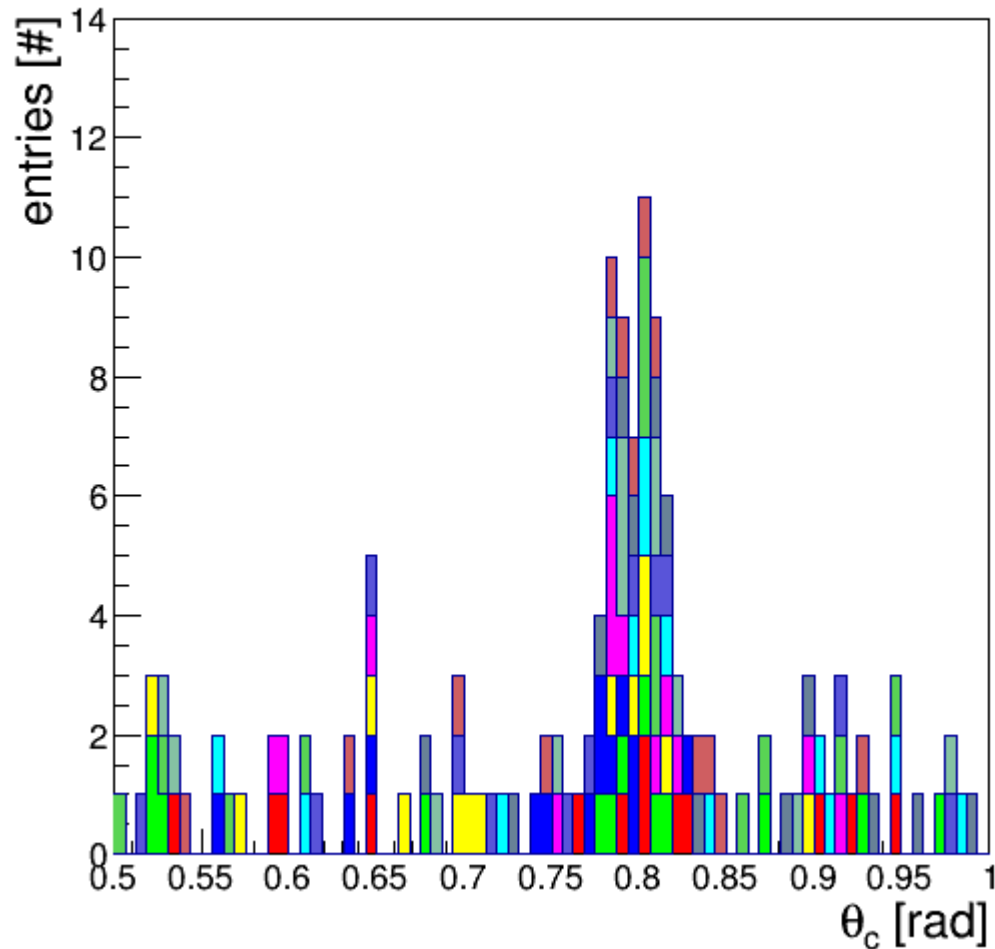

number of photons: 12

Geometrical Reconstruction

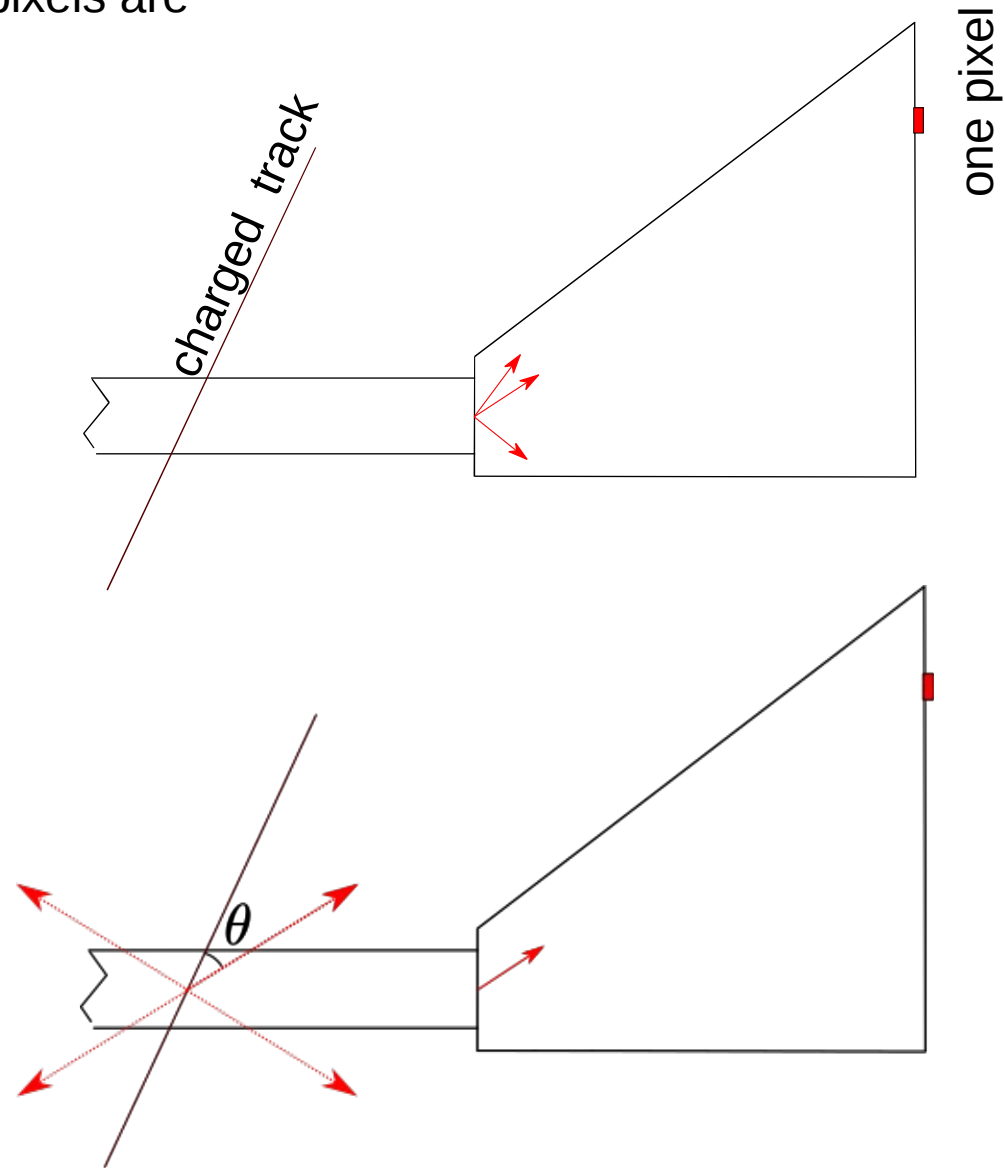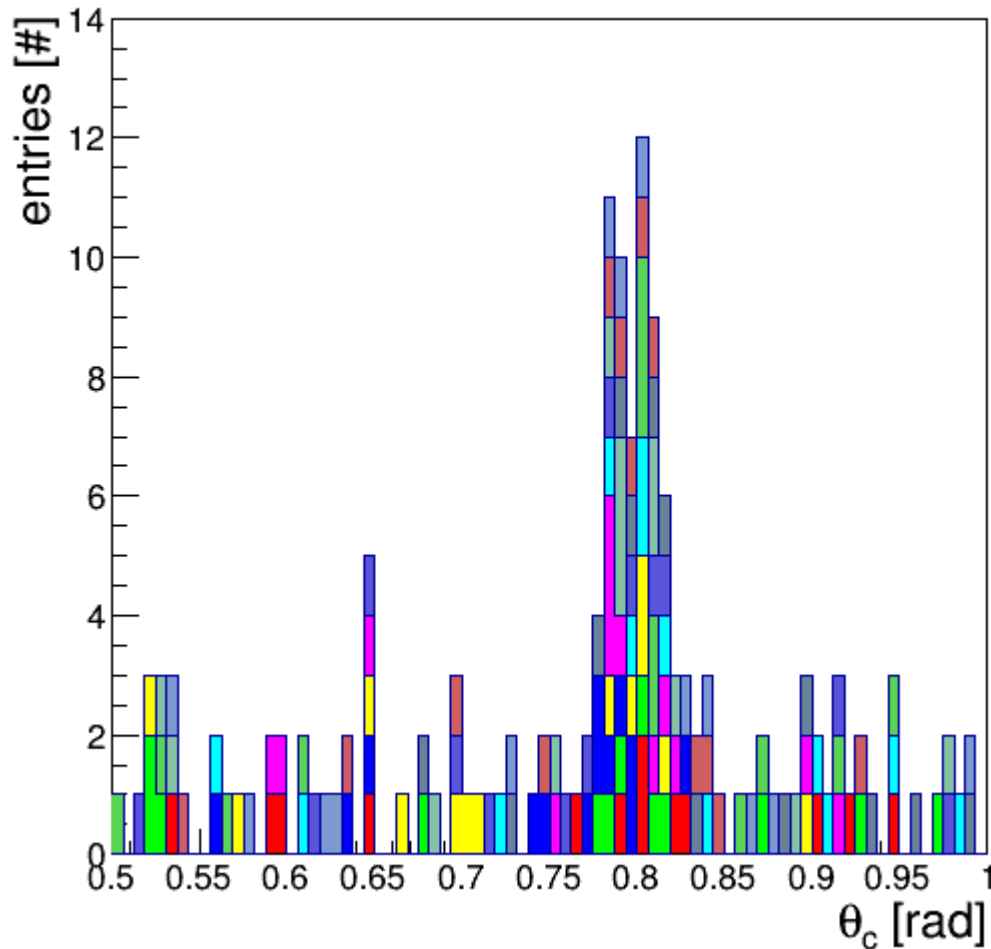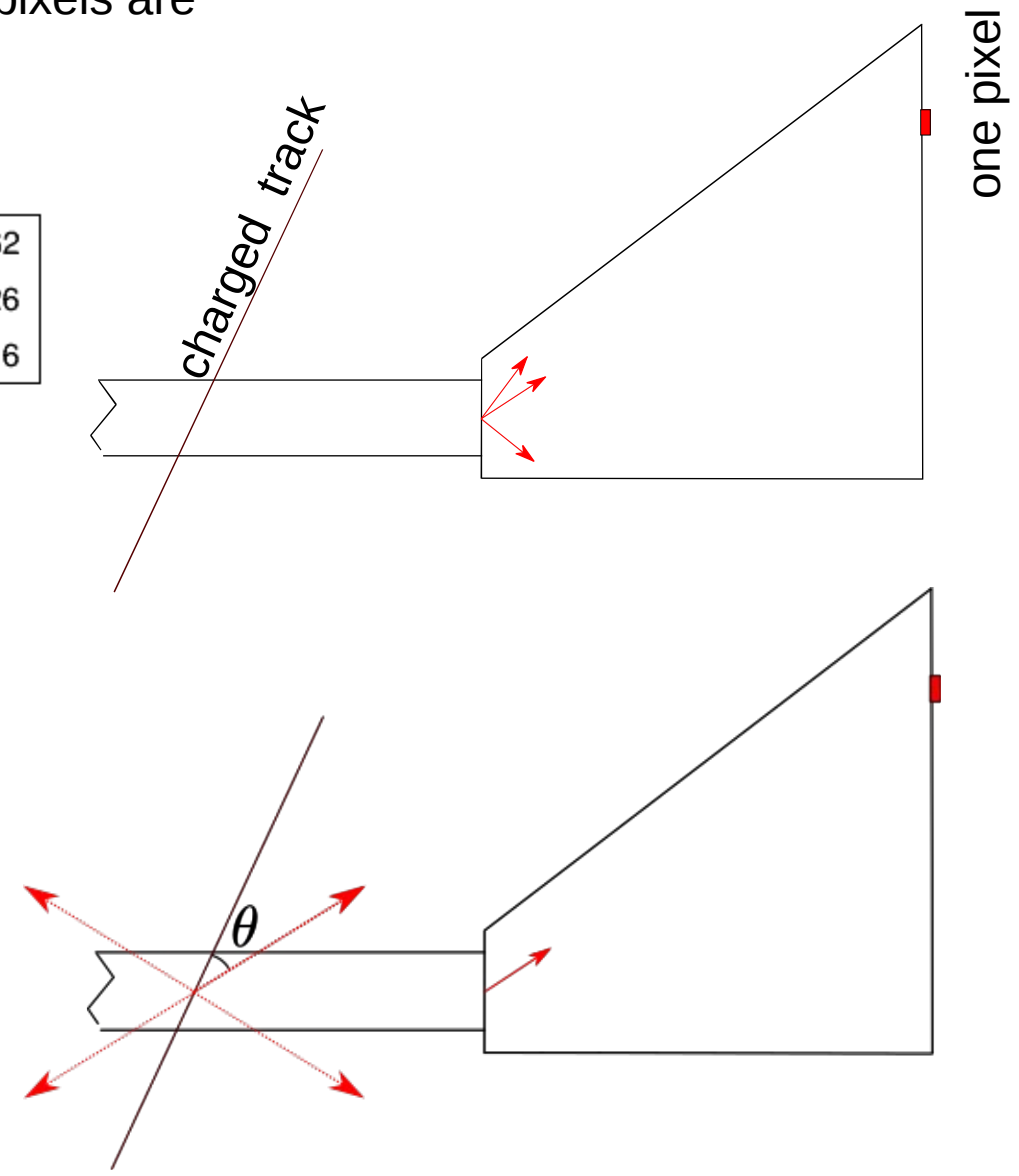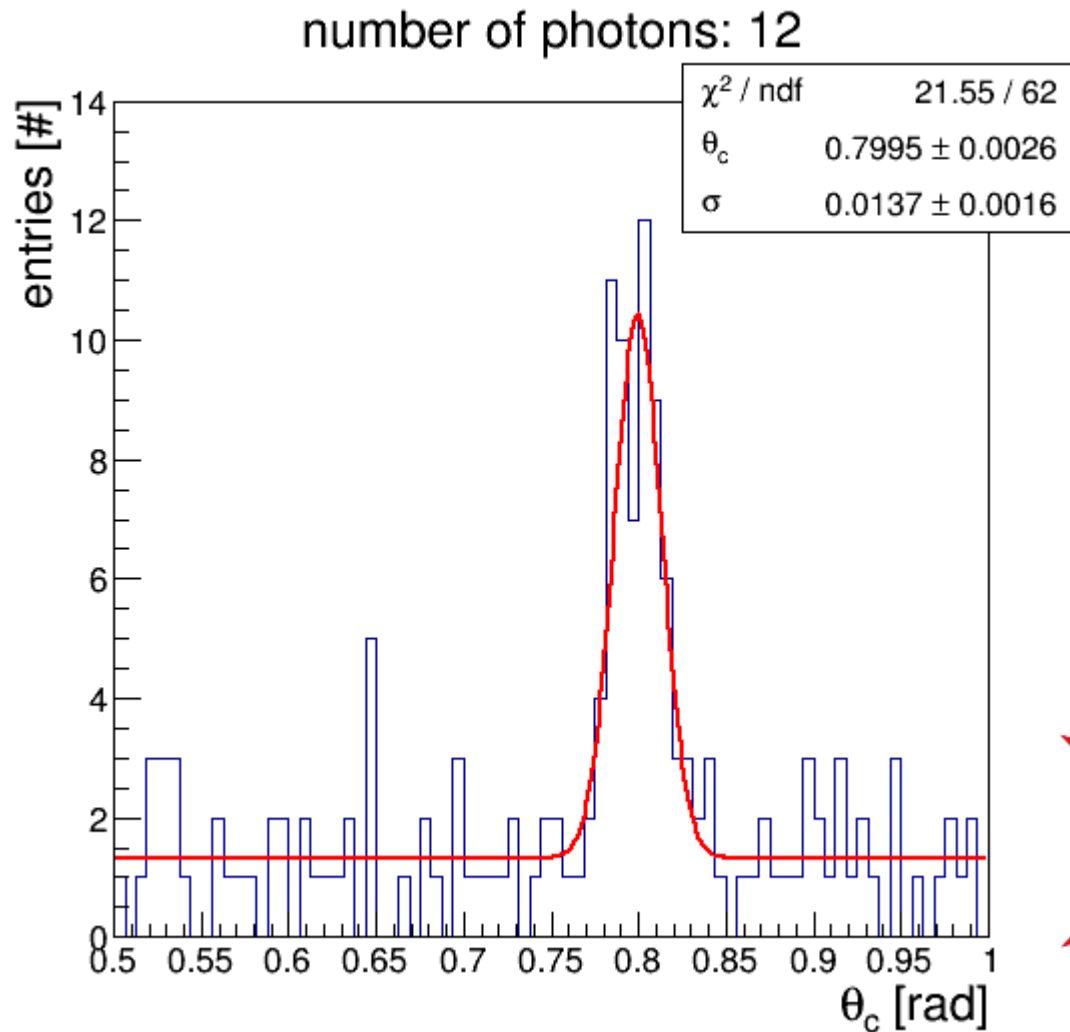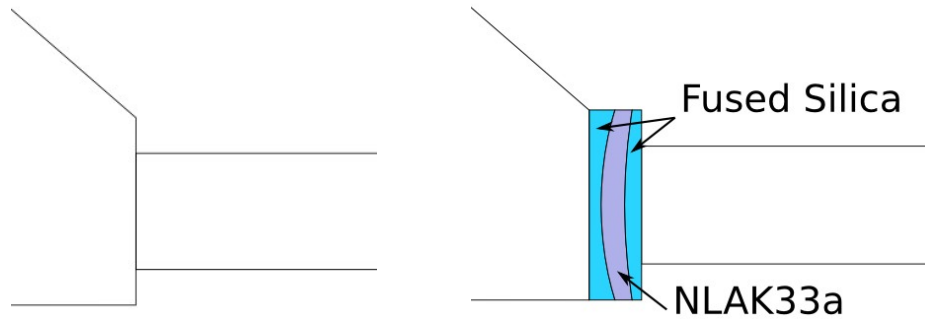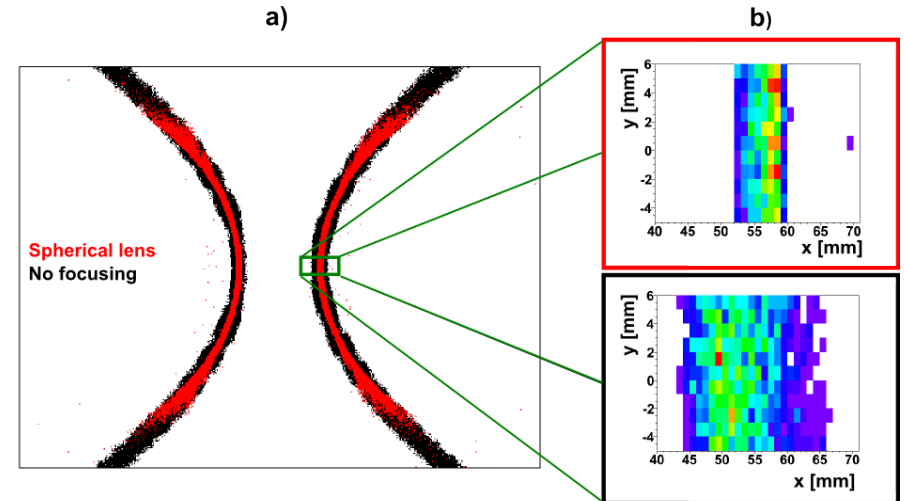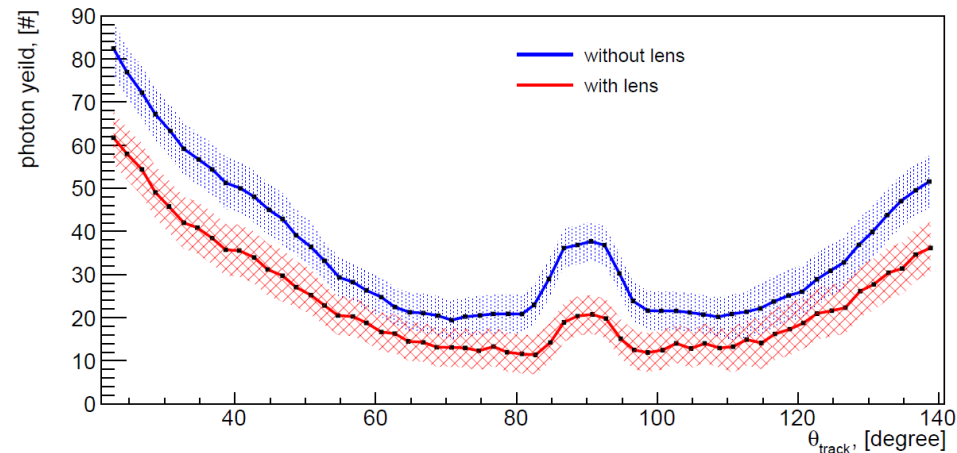- Reconstruction: direction from LUT for hit pixels are combined with charge track direction

Example of reconstruction

Fused Silica

NLAK33a

3-layer lens with high-refractive index materials (NLAK33)

a)

b)

Spherical lens
No focusing
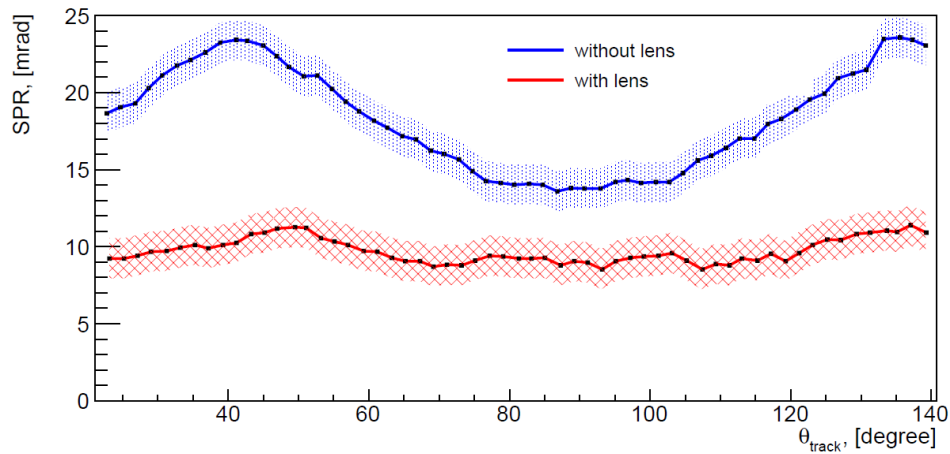
more in the next presentation
by Lee Allison

➔ Design with lens satisfies the PANDA PID requirements

Geometrical Reconstruction

Works with narrow bars

Not so well with plates (Width of radiator not negligible anymore)

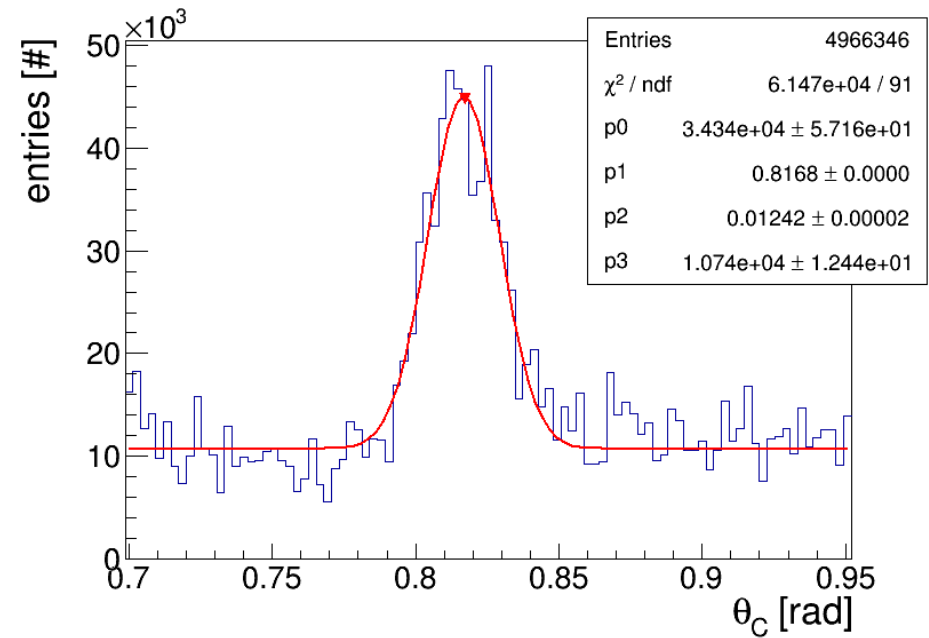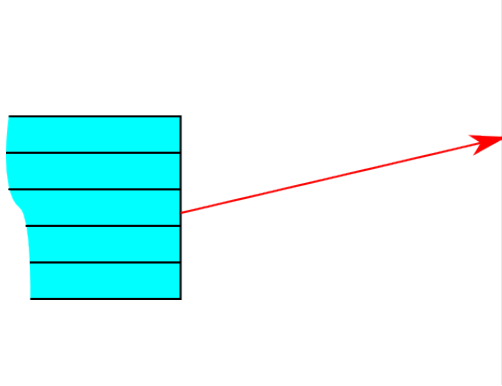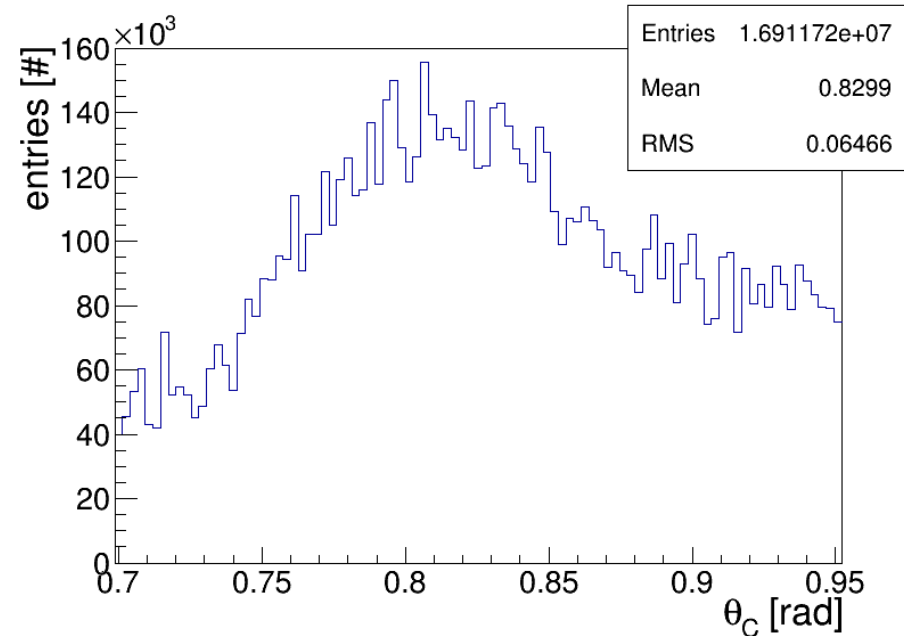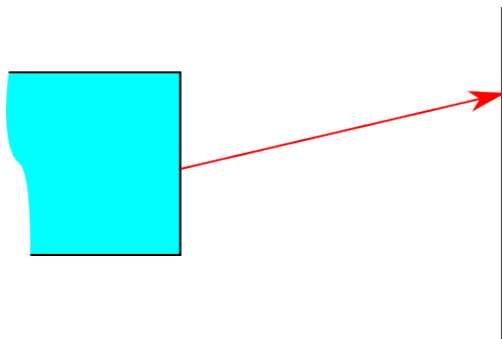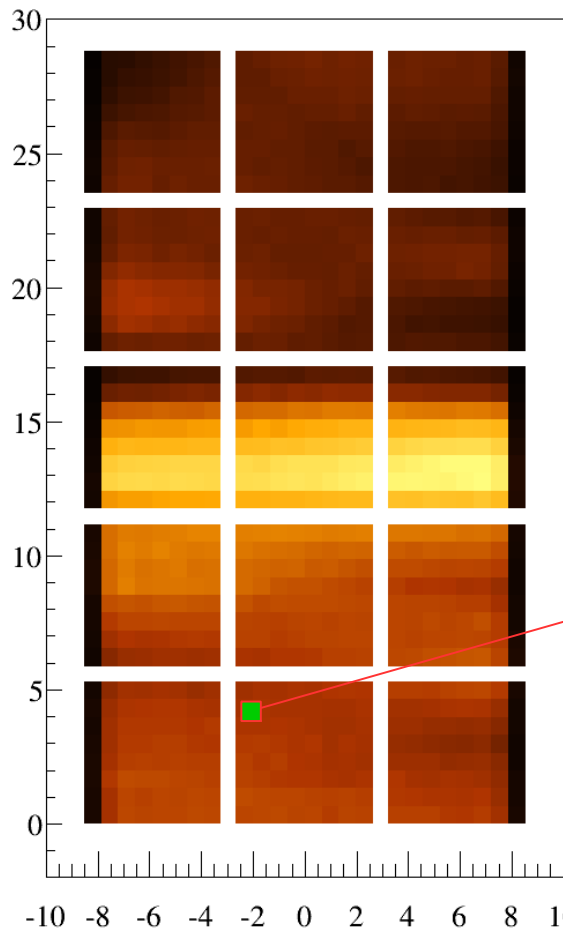# Time Likelihood Imaging

Belle II-like reconstruction.

pions

kaons
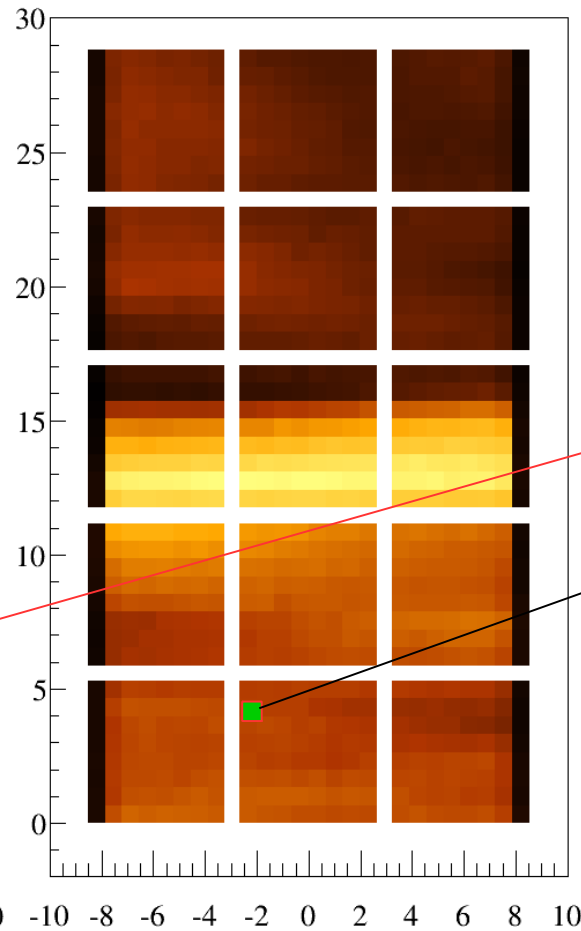
Pdf for pixel 2330

one pixel

pions

kaons

Photon arrival time [ns]
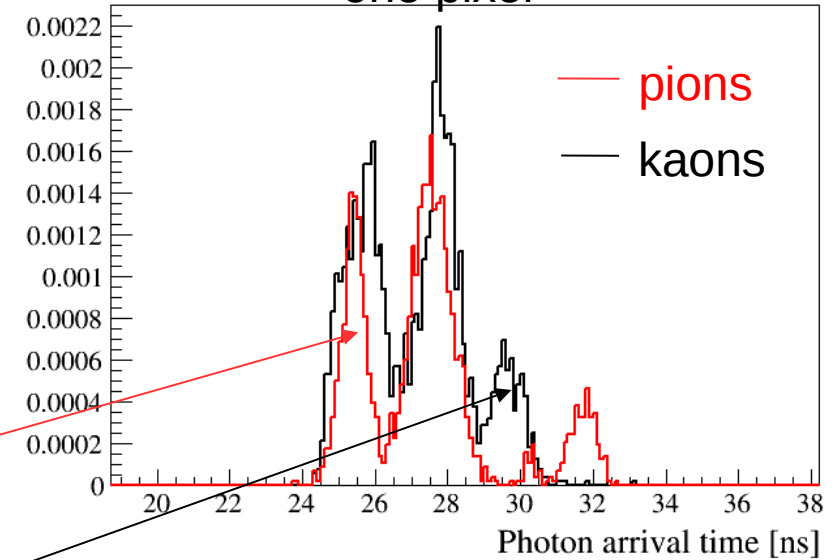
y

x

Time Likelihood Imaging

- Reconstruction: arrival time of each photon from given track is compared with PDF to calculate time-based likelihood for the photon to originate from a given particle

Time Likelihood Imaging

- Reconstruction: arrival time of each photon from given track is compared with PDF to calculate time-based likelihood for the photon to originate from a given particle

- Full likelihood:
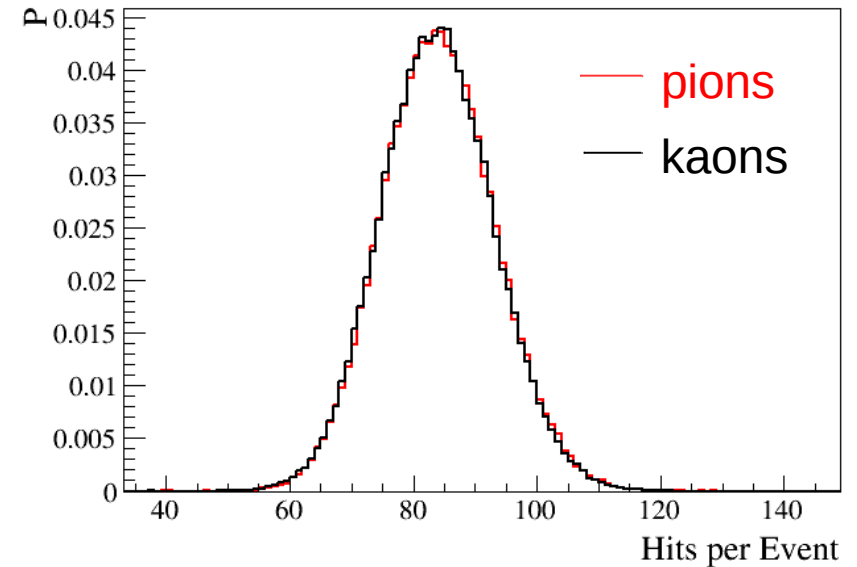
$$L_H = \prod_N pdf(x_i, y_i, t_i; H) \times P_{N_0}(N)$$

Time Likelihood Imaging

- Reconstruction: arrival time of each photon from given track is compared with PDF to calculate time-based likelihood for the photon to originate from a given particle
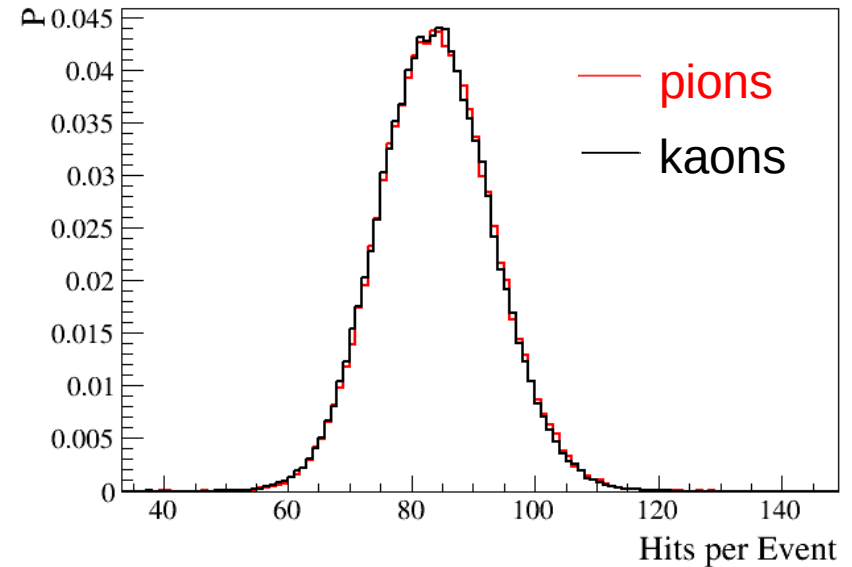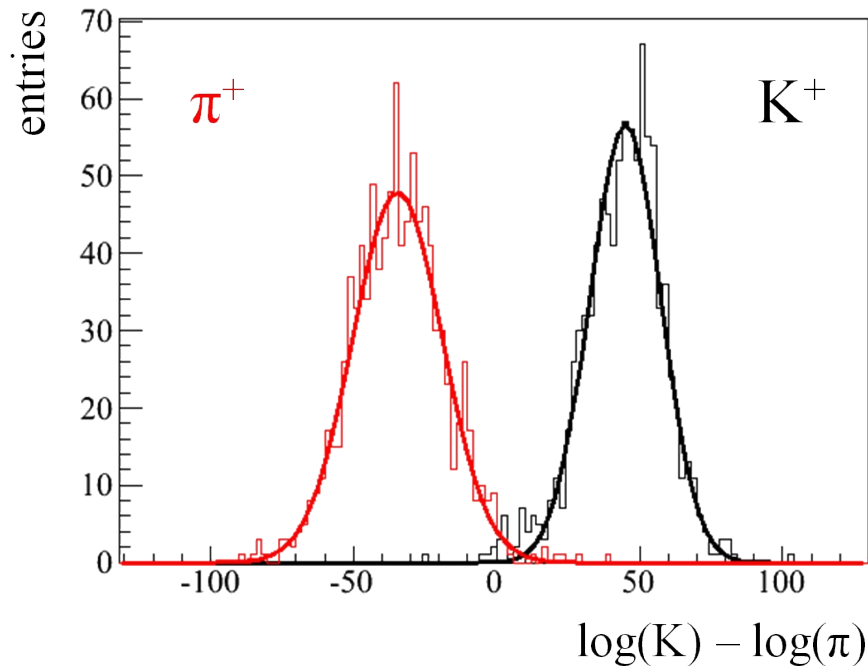

pions
kaons

Hits per Event

Example: momentum = 3 GeV/c
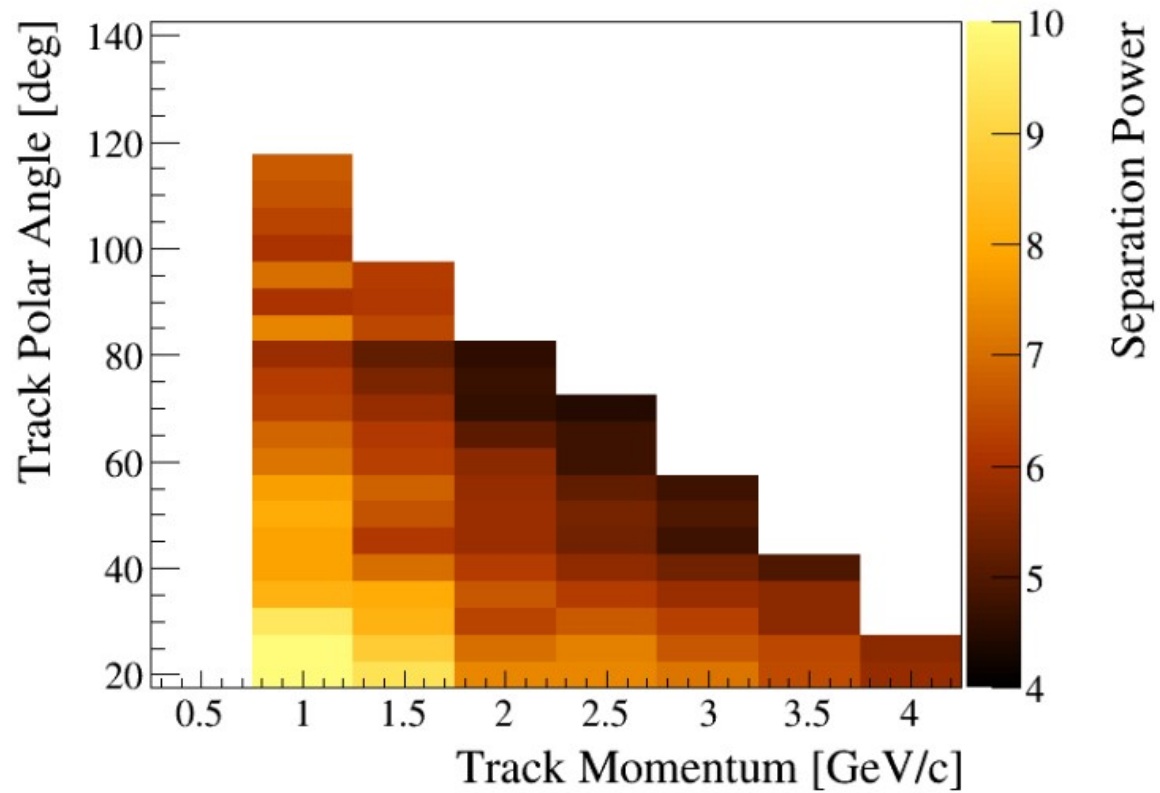angle = 22°

π^+　　K^+

$\log(K) - \log(\pi)$

- Full likelihood:

$$L_H = \prod_N pdf(x_i, y_i, t_i; H) \times P_{N_0}(N)$$
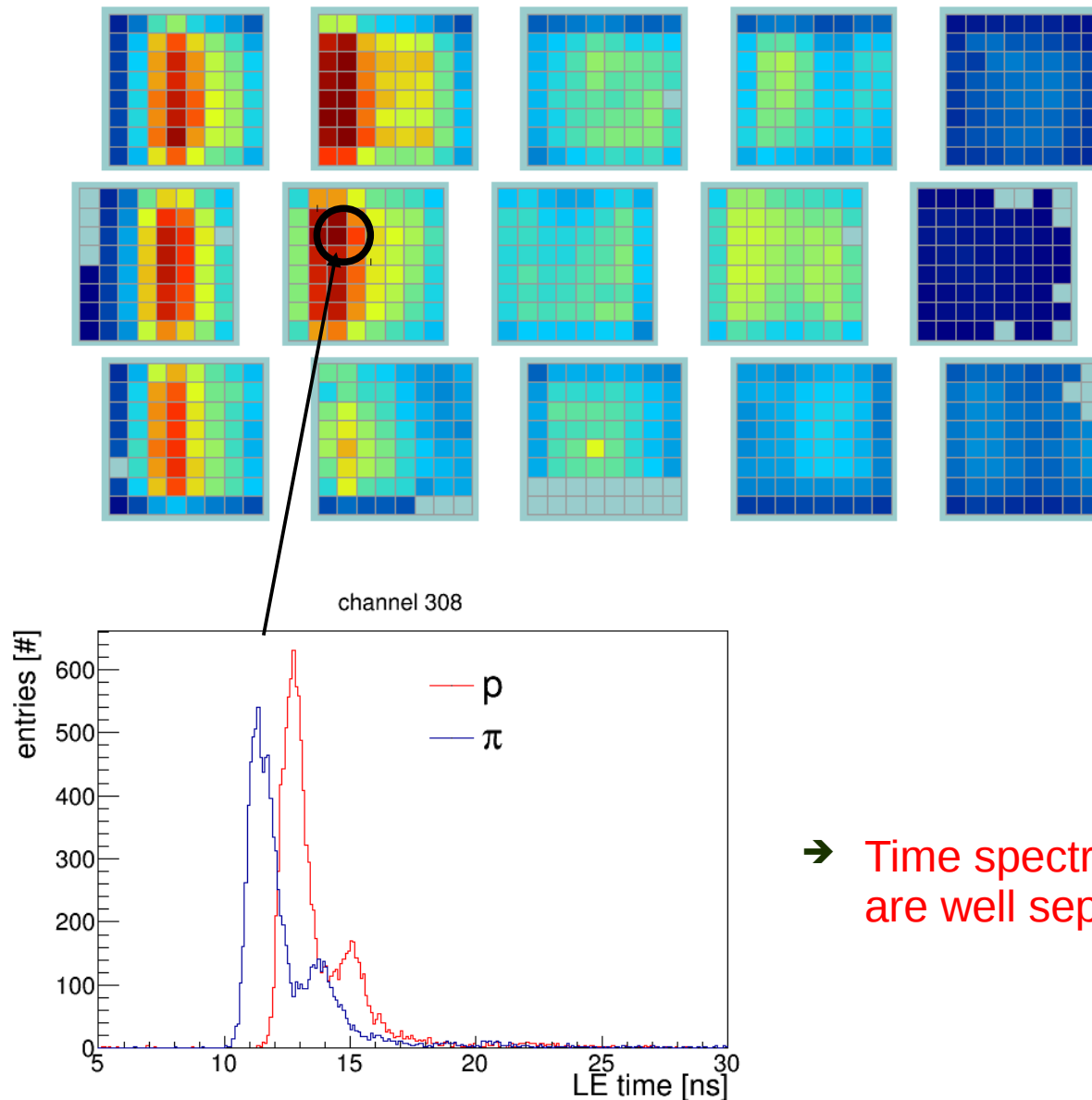
➔ Clean π/K separation at 3.5 GeV/c even without optics

Time Likelihood Imaging

➔ Satisfies the PANDA PID requirements
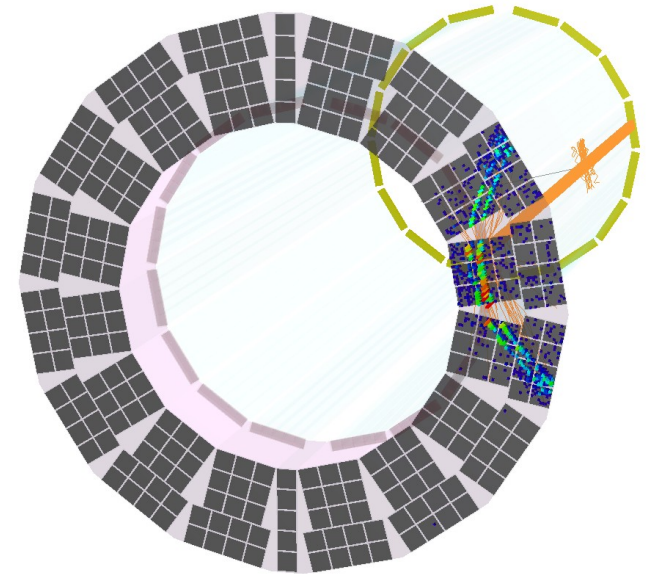
CERN beam time example

channel 308

➔ Time spectra of pions and protons are well separated

Reconstruction Methods: Summary

Geometrical reconstruction:

- works for narrow bars
- fails with wide plates
- SPR – is measured quantity

Time Likelihood Imaging:

- works for narrow bars
- works for wide plates
- no SPR