Impact of SPD barrel on track reconstruction

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Event reconstruction

- Pattern recognition

- Track fitting and estimation of track parameters

- Vertexing

Parametrization in solenoidal magnetic field:

ϕ_0 the azimuth angle where the trajectory intersects the reference radius

z_0 the z value where the trajectory intersects the reference radius

ψ_0 the phase angle of the helix at the reference radius intersection, which corresponds to the angle of the tangent at this point
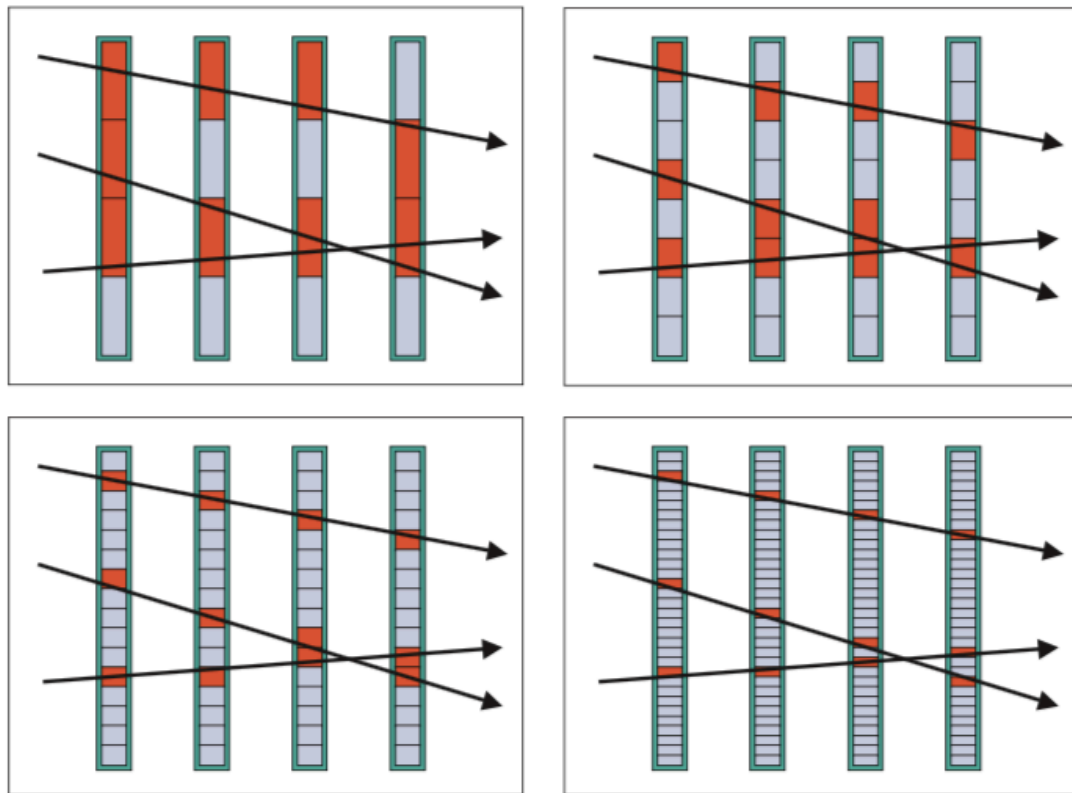
Q/R the signed inverse curvature radius of the helix

$\tan \lambda$ where $\lambda = \arctan p_z/p_\perp$ is the dip angle of the helix
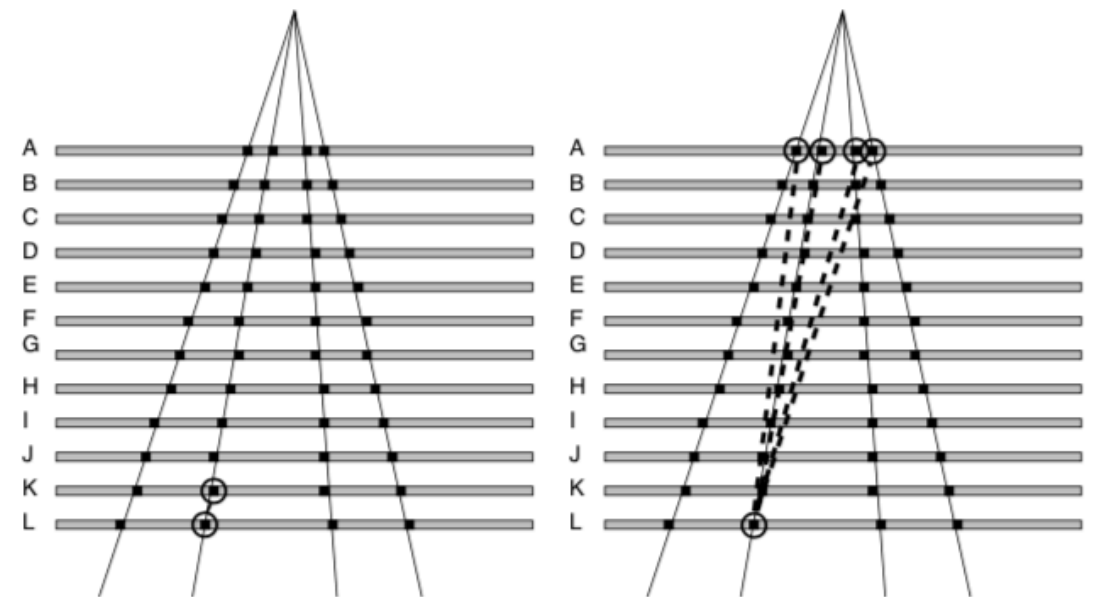
Pattern recognition

Global:

- Template matching

- Neural Network Techniques
- Combinatorics

Local:

- Seeds - initial track candidates formed by just a minimal set of hits which serve as starting point for the track following procedure.

- Track following - the selected part of a track is extrapolated to the detector part where the next hit is expected.

Kalman filter

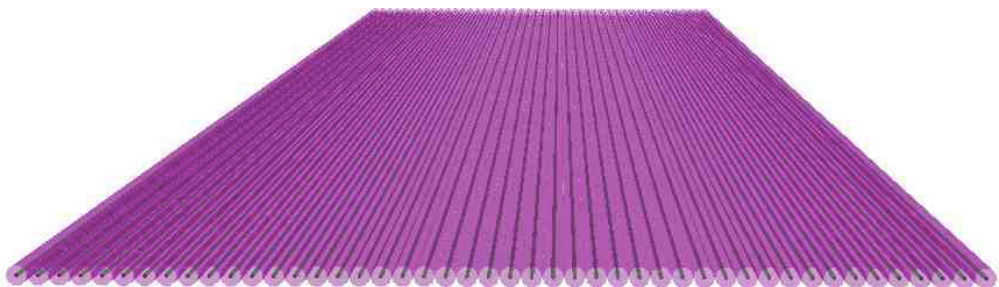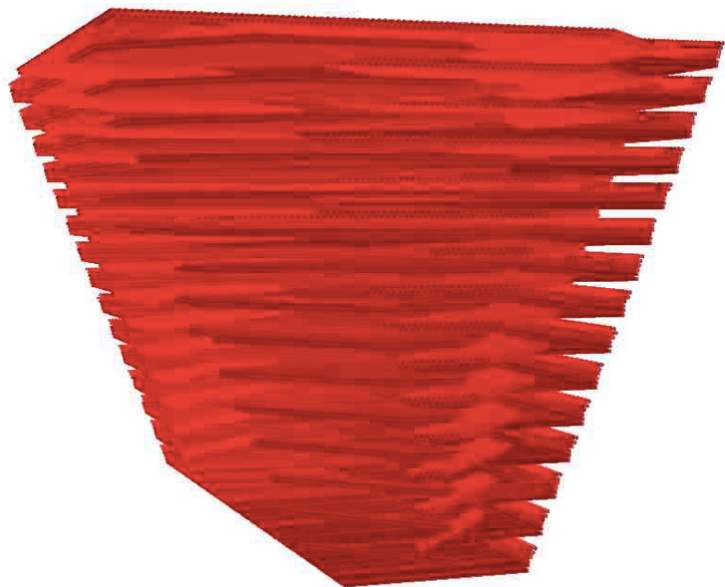- Takes into account both pattern recognition and track fitting:
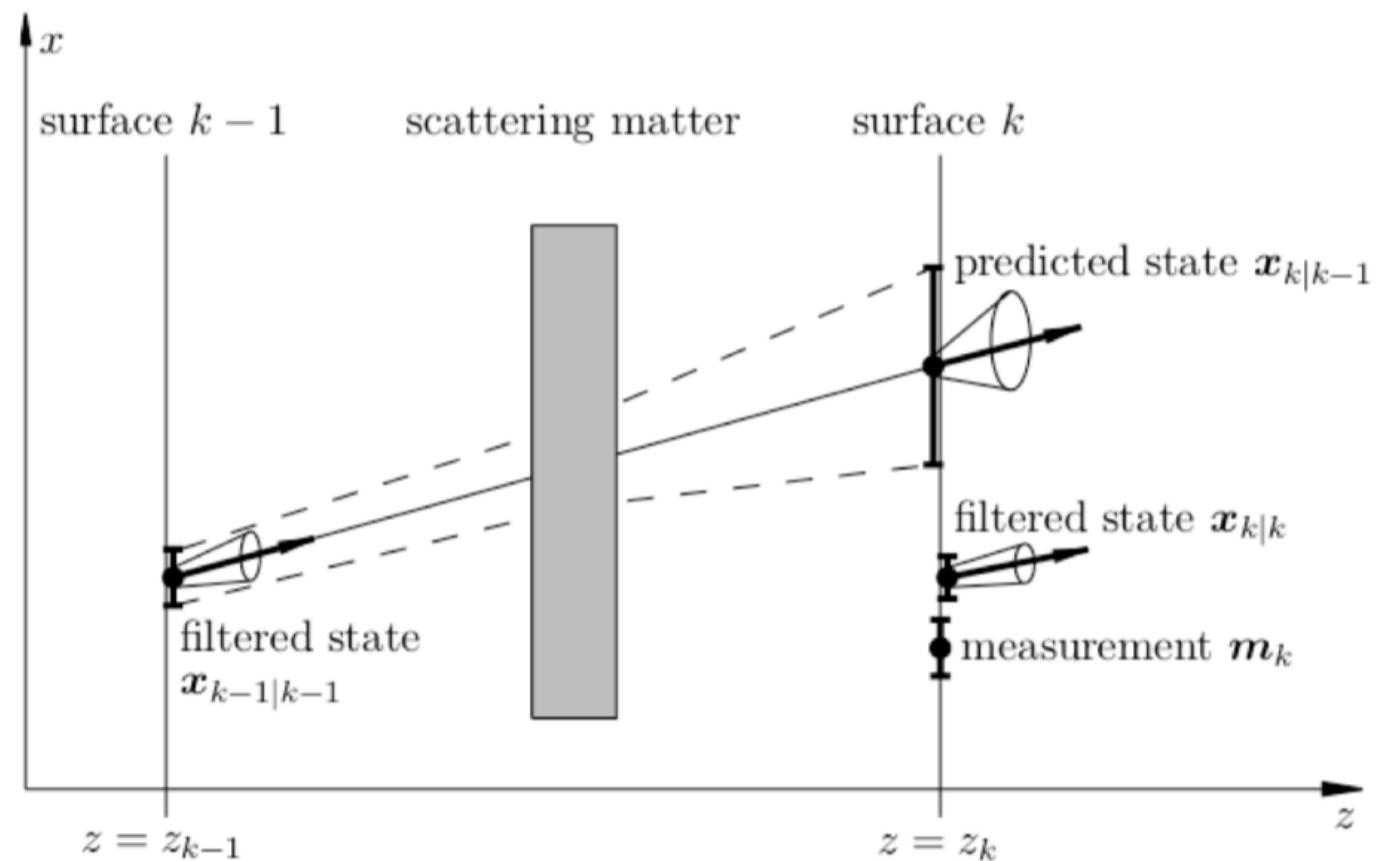
- Recursive procedure:

  1. **Prediction** — trajectories are extrapolated from a layer to next layer accounting multiple scattering and energy loss;

  2. **Filtering** – new trajectories are constructed with updated parameters (and errors) for each compatible hit in the layer;

  3. **Smoothing** – Final fit of trajectories to obtain optimal estimates at every measurement point along the track;
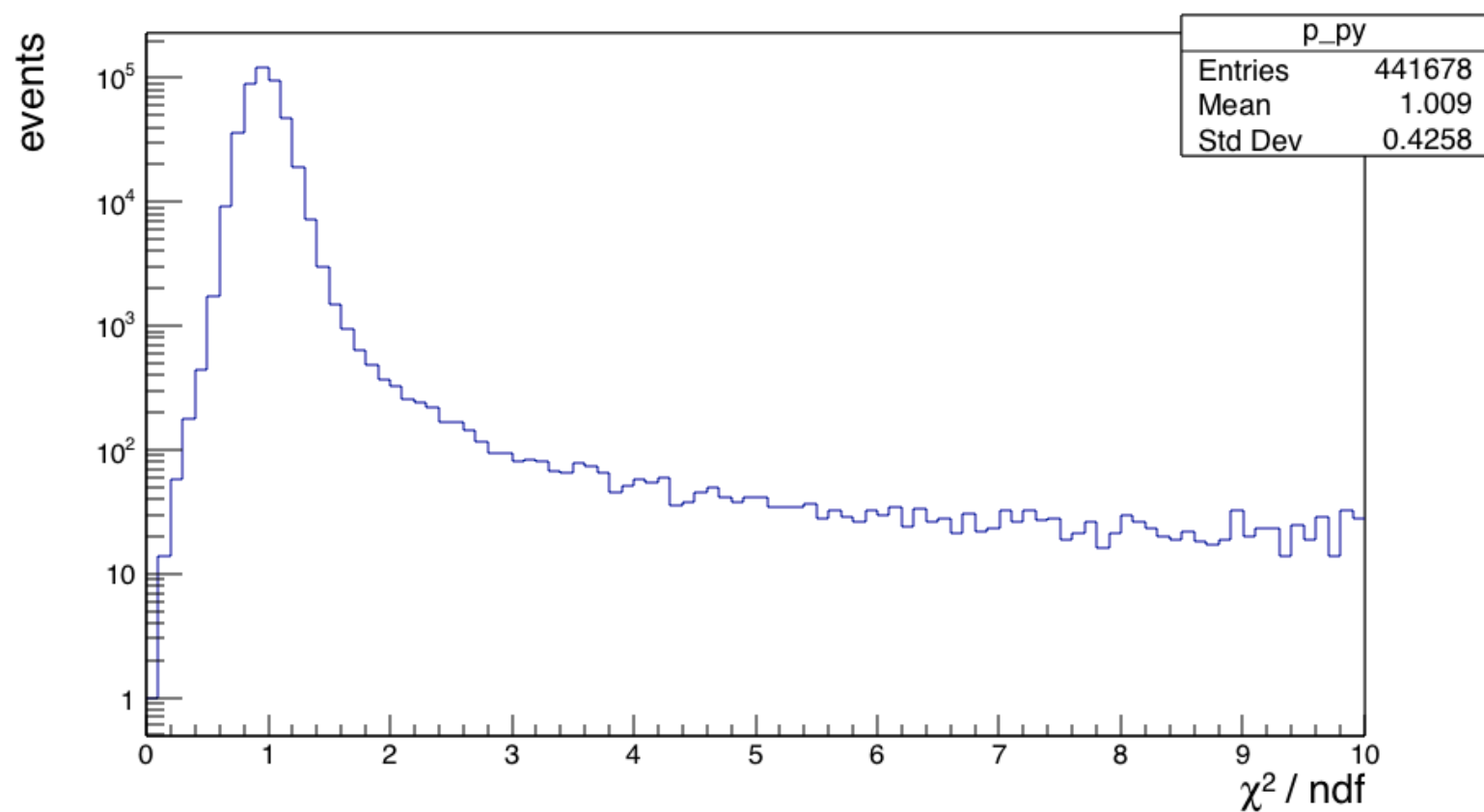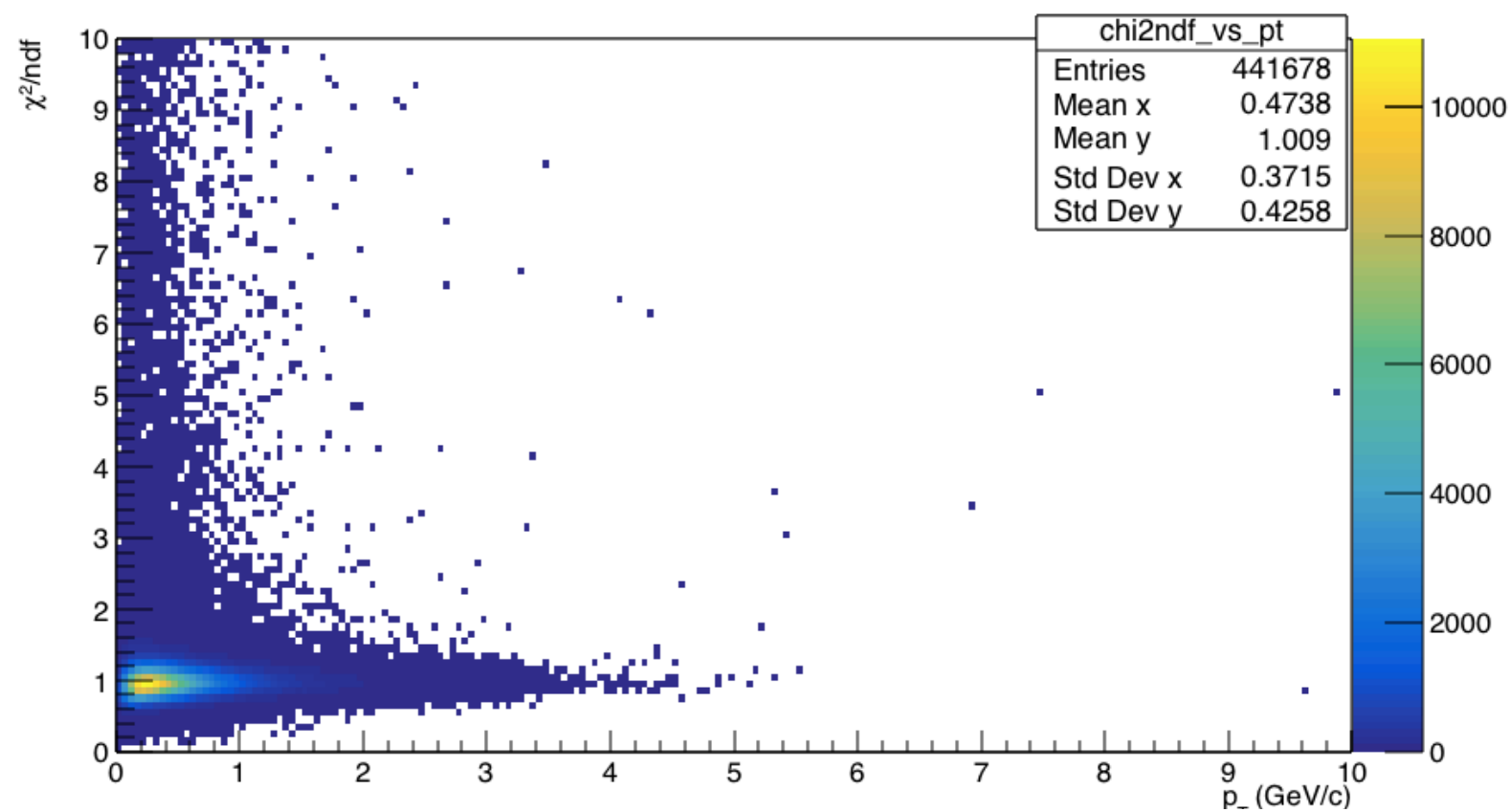
SPD barrel
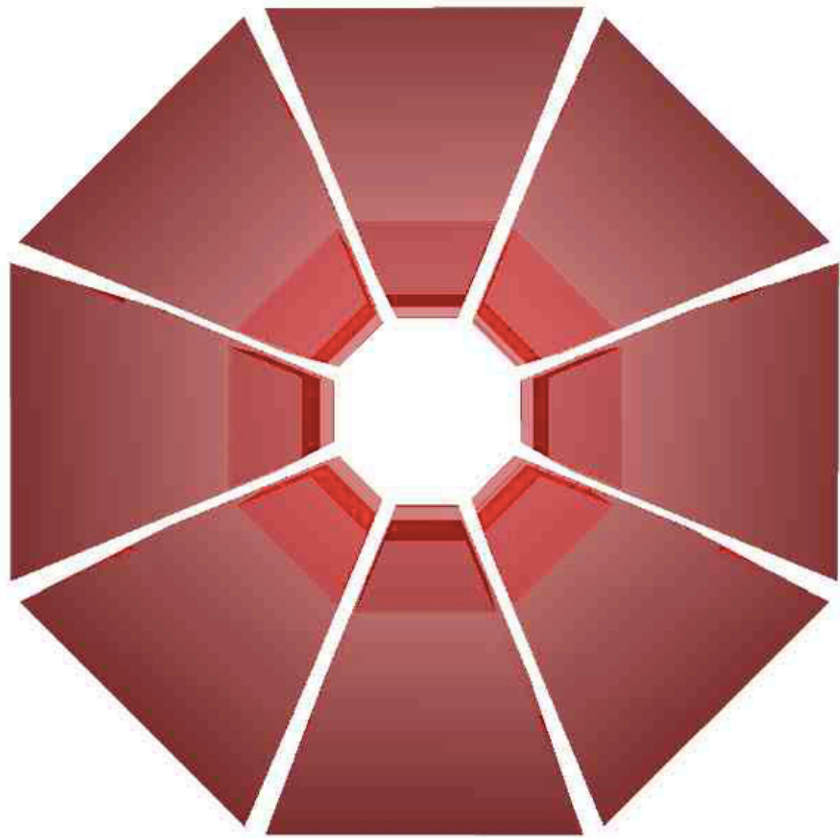
- The SPD barrel consists of 8 modules;

- Each module is a set of packs of straw tubes;

- Each pack has 8 layers of straw tubes, which put under different angles ($0°$, $45°$, $90°$);

- The number of straw tubes is calculated automatically taking into account: *tube width, distance between tubes, barrel size;*
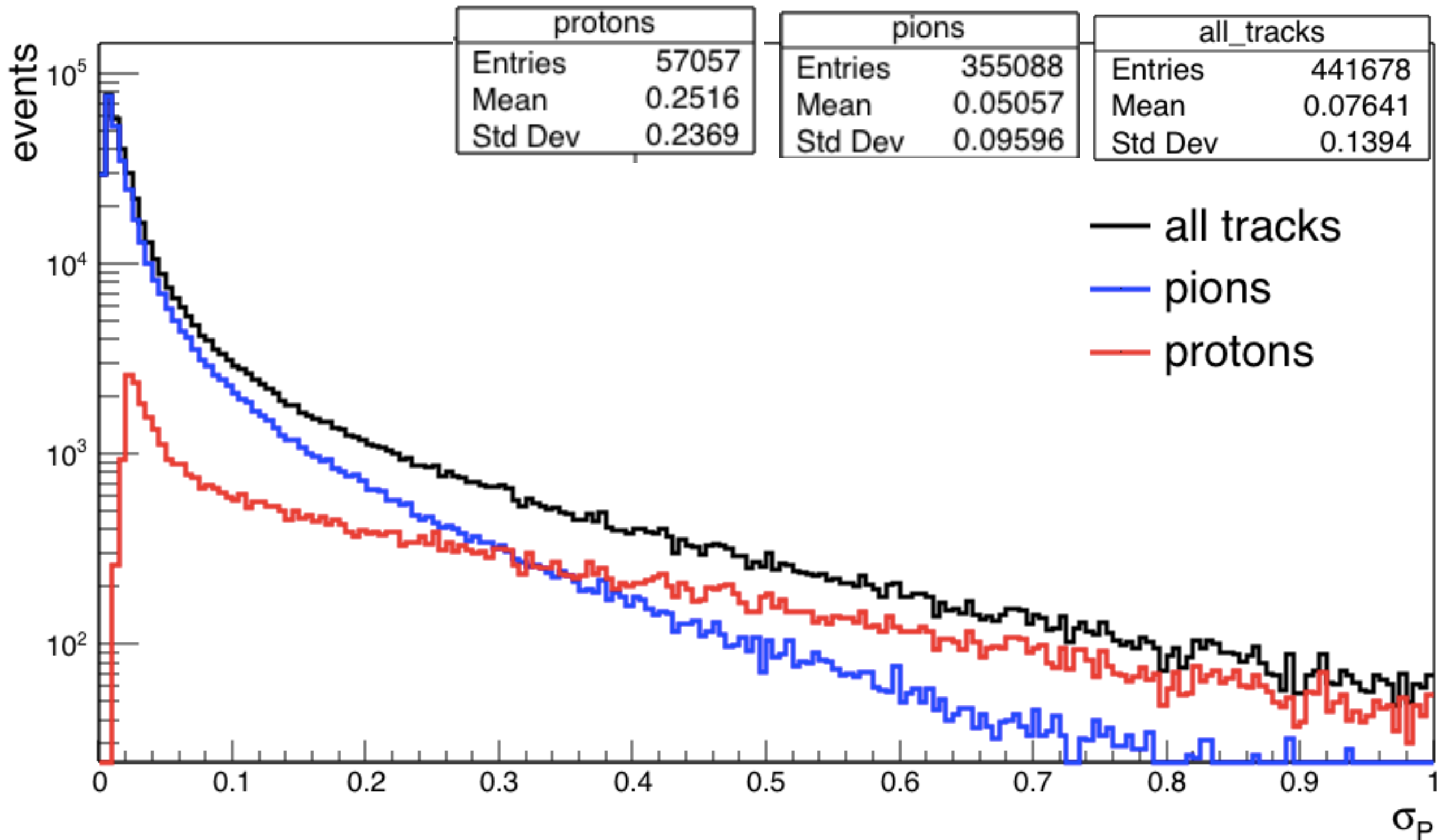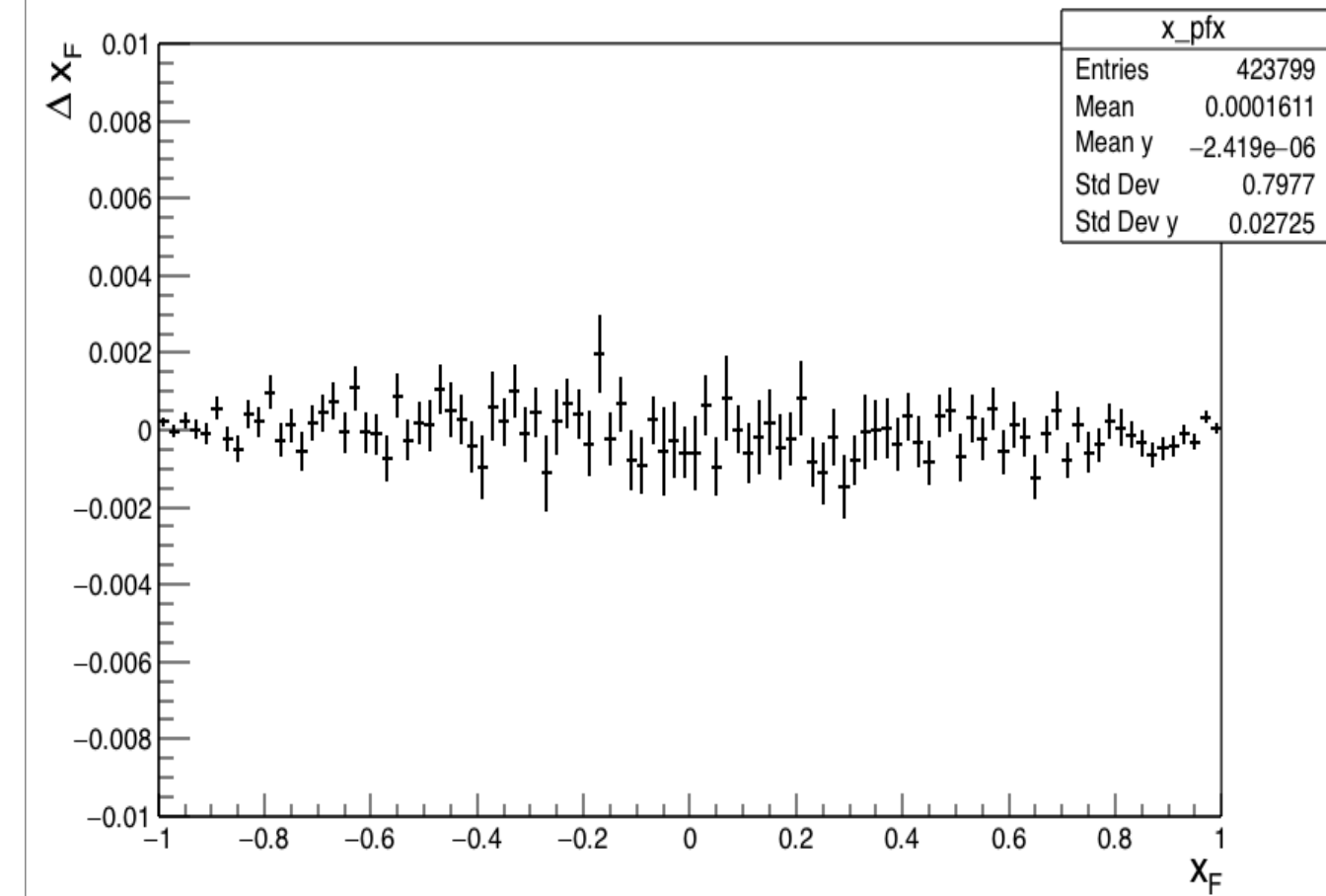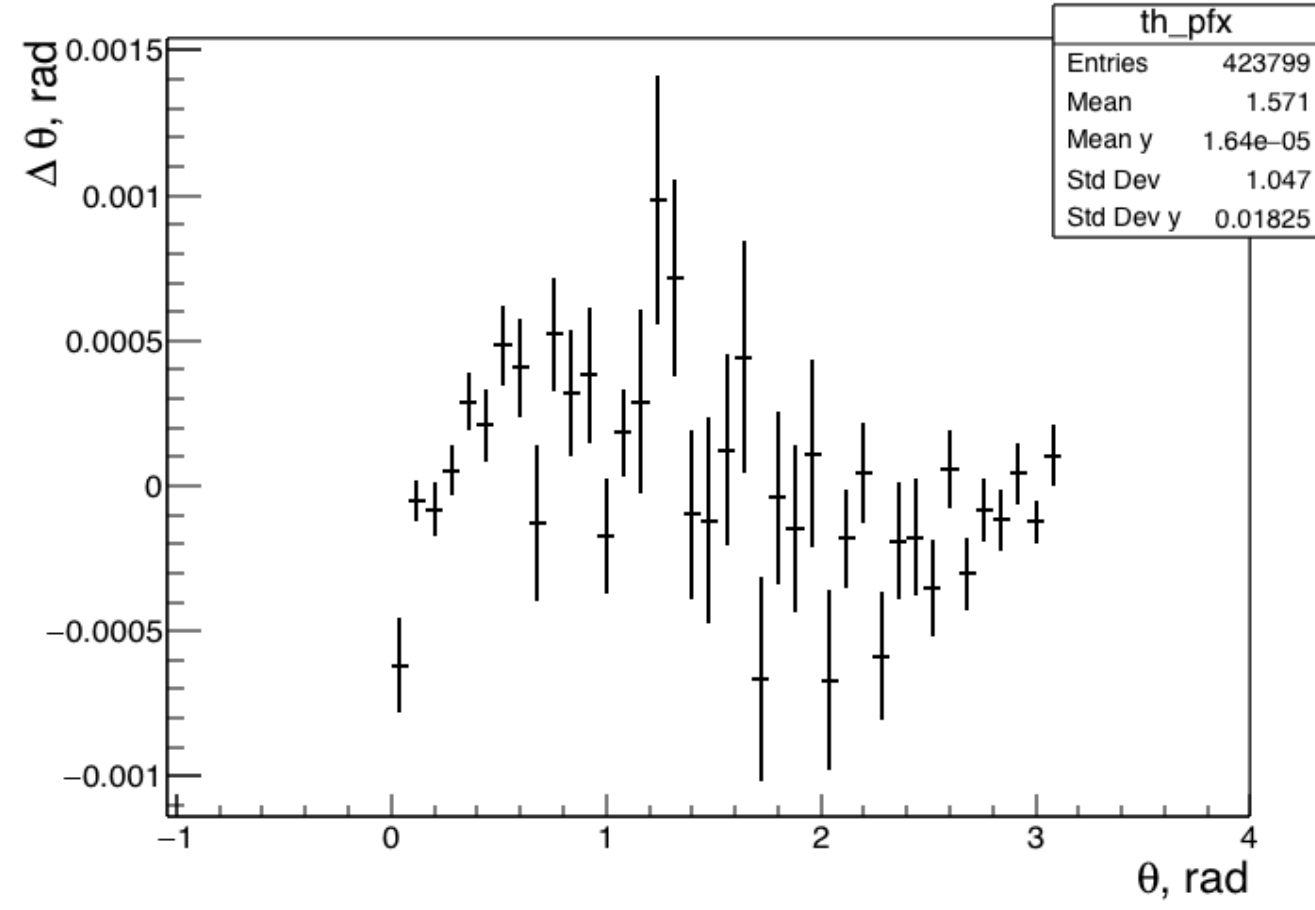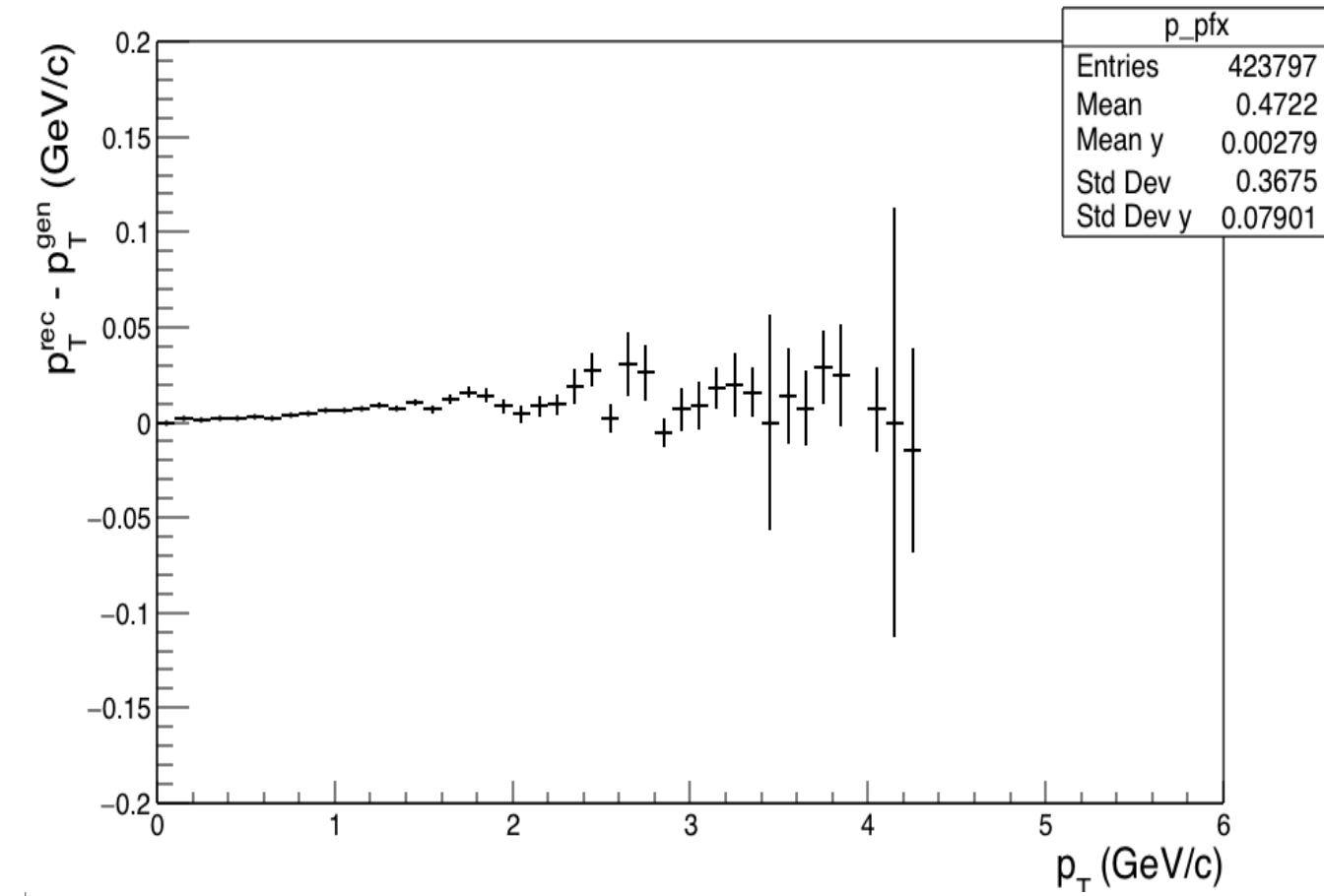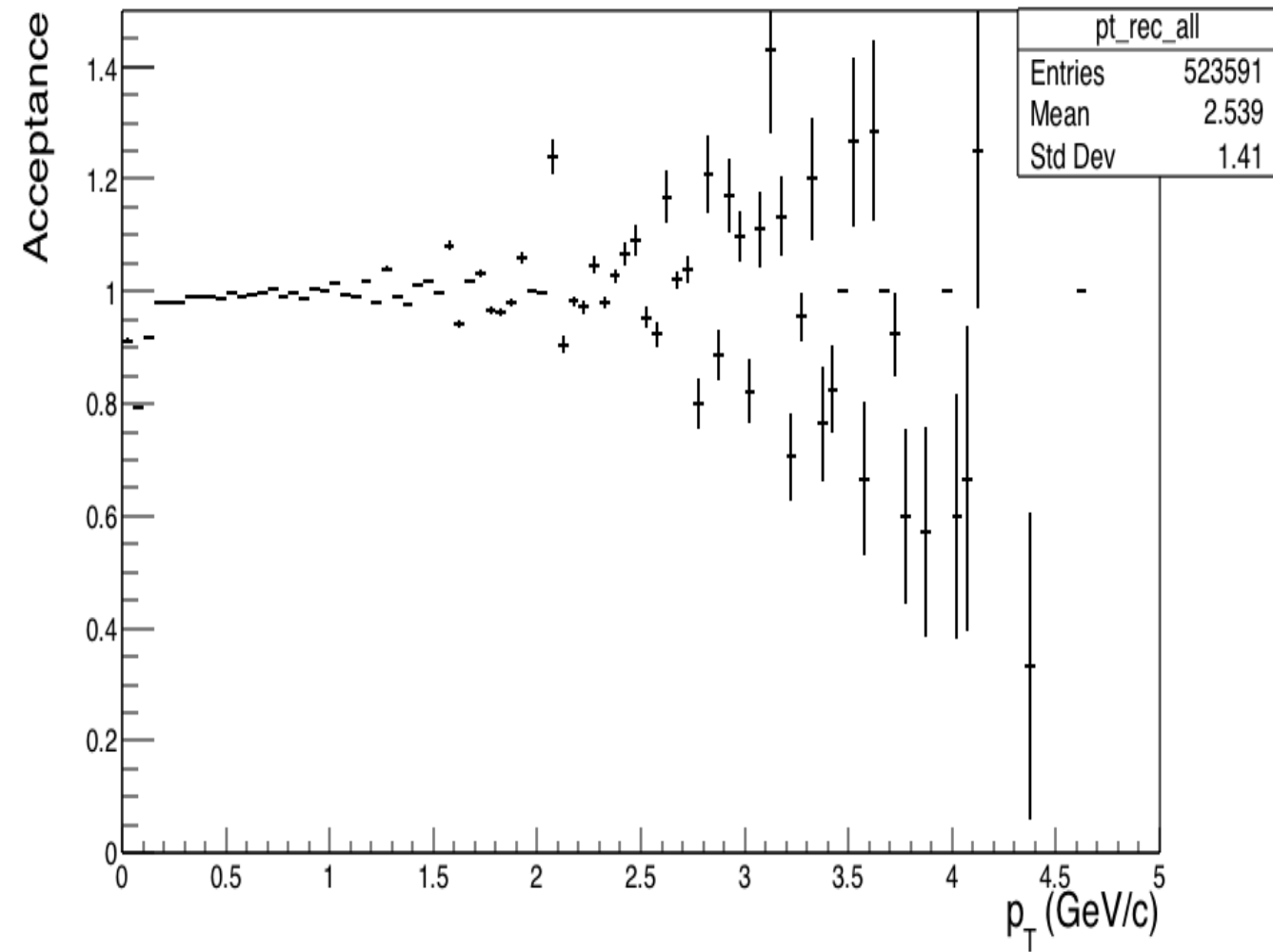
Default geometry: width = 1.0 cm, gap = 0;

Track chi2/ndf

Error of momentum reconstruction

protons	
Entries	57057
Mean	0.2516
Std Dev	0.2369

pions	
Entries	355088
Mean	0.05057
Std Dev	0.09596

all_tracks	
Entries	441678
Mean	0.07641
Std Dev	0.1394

— all tracks
— pions
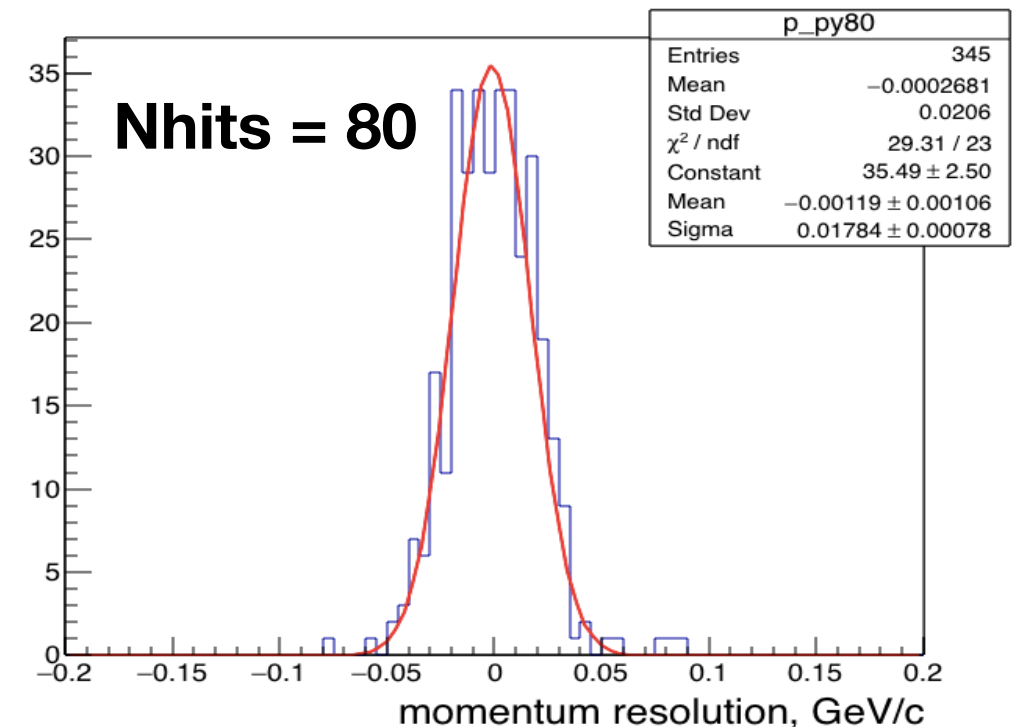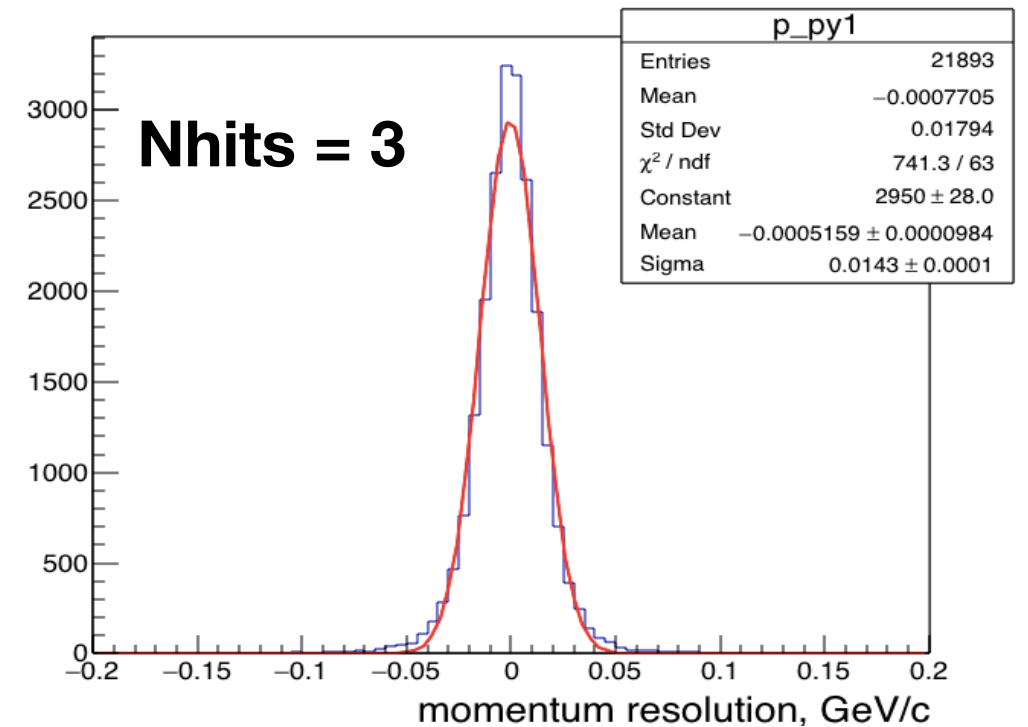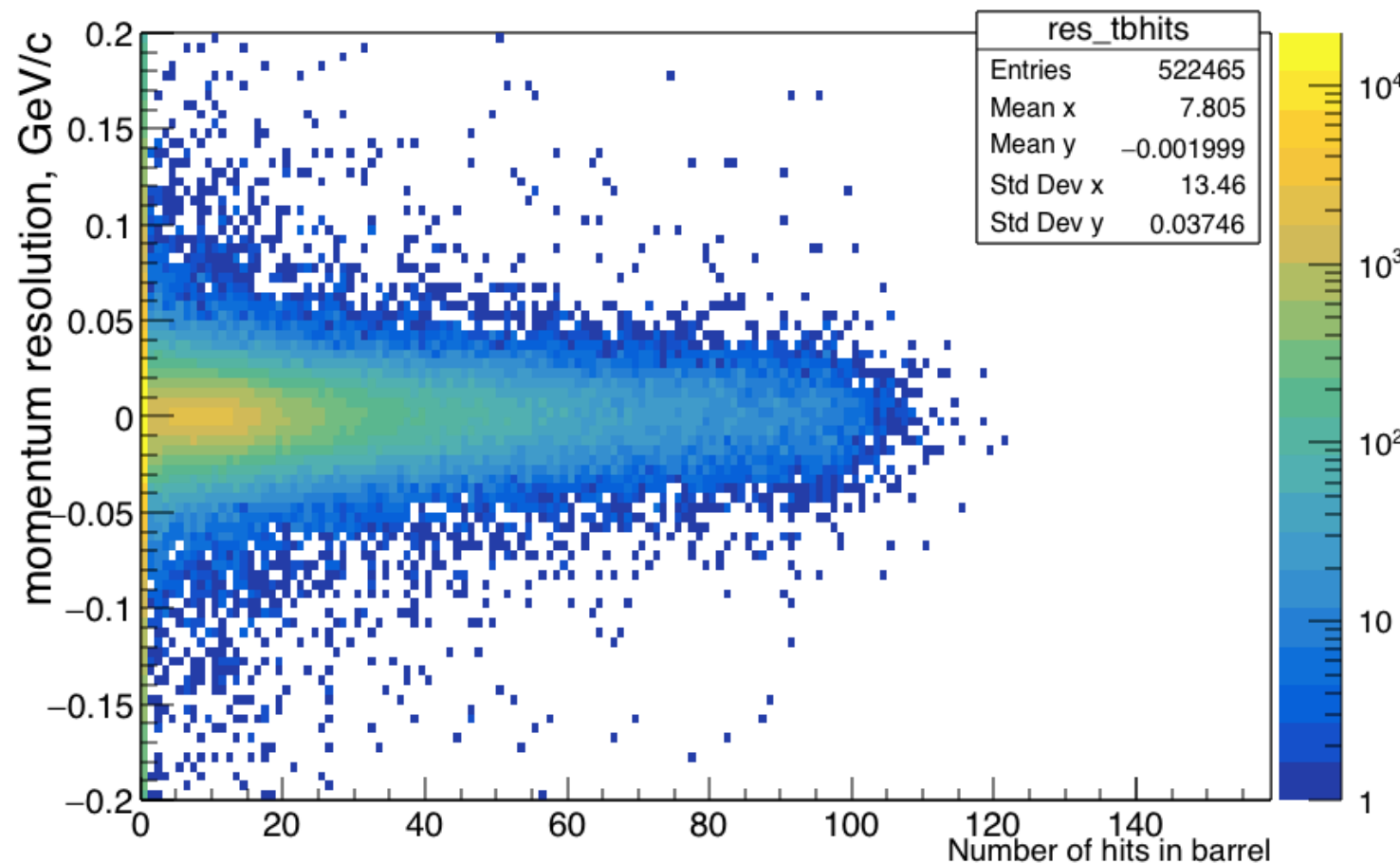— protons
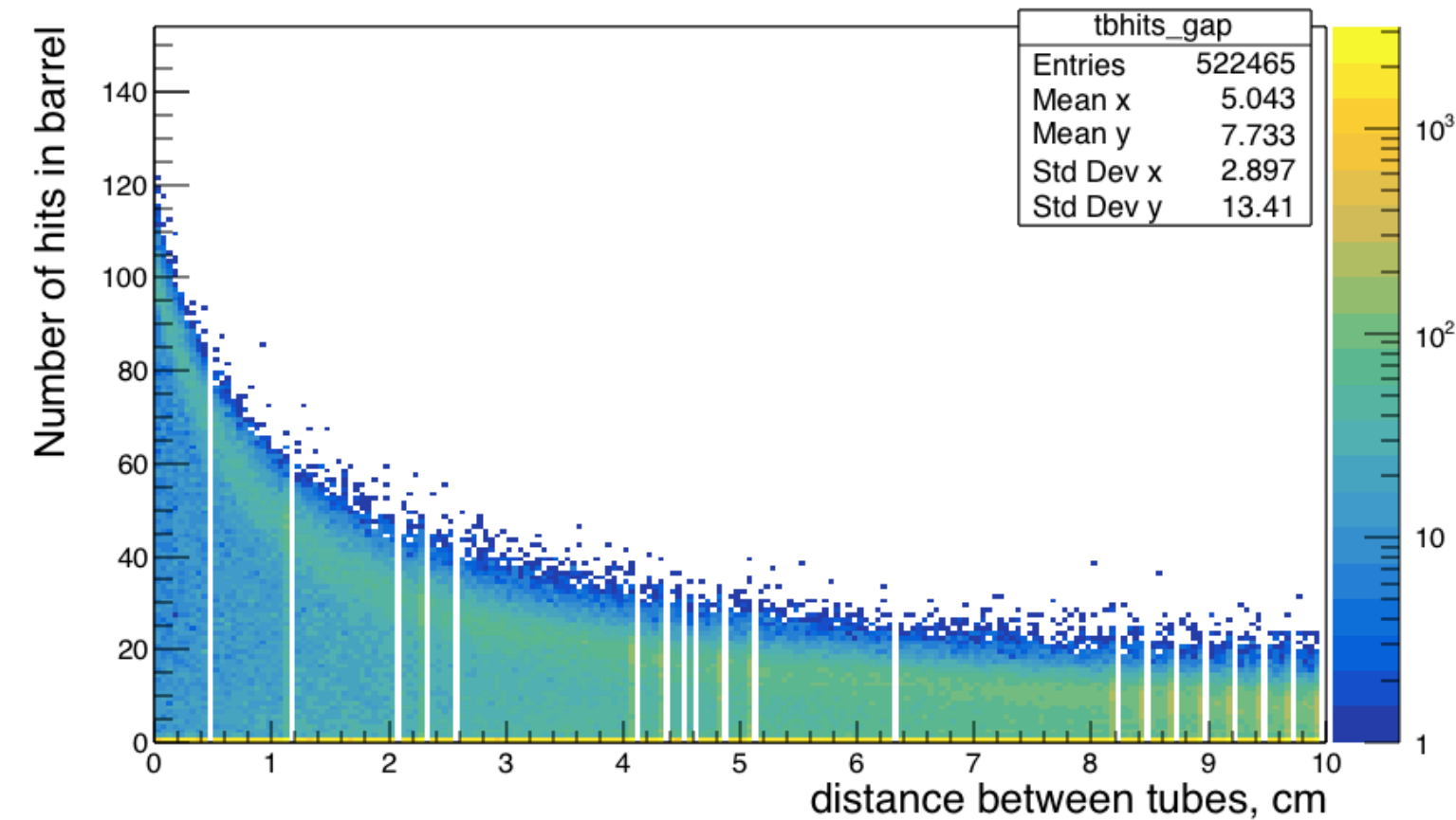
Resolution

Acceptance
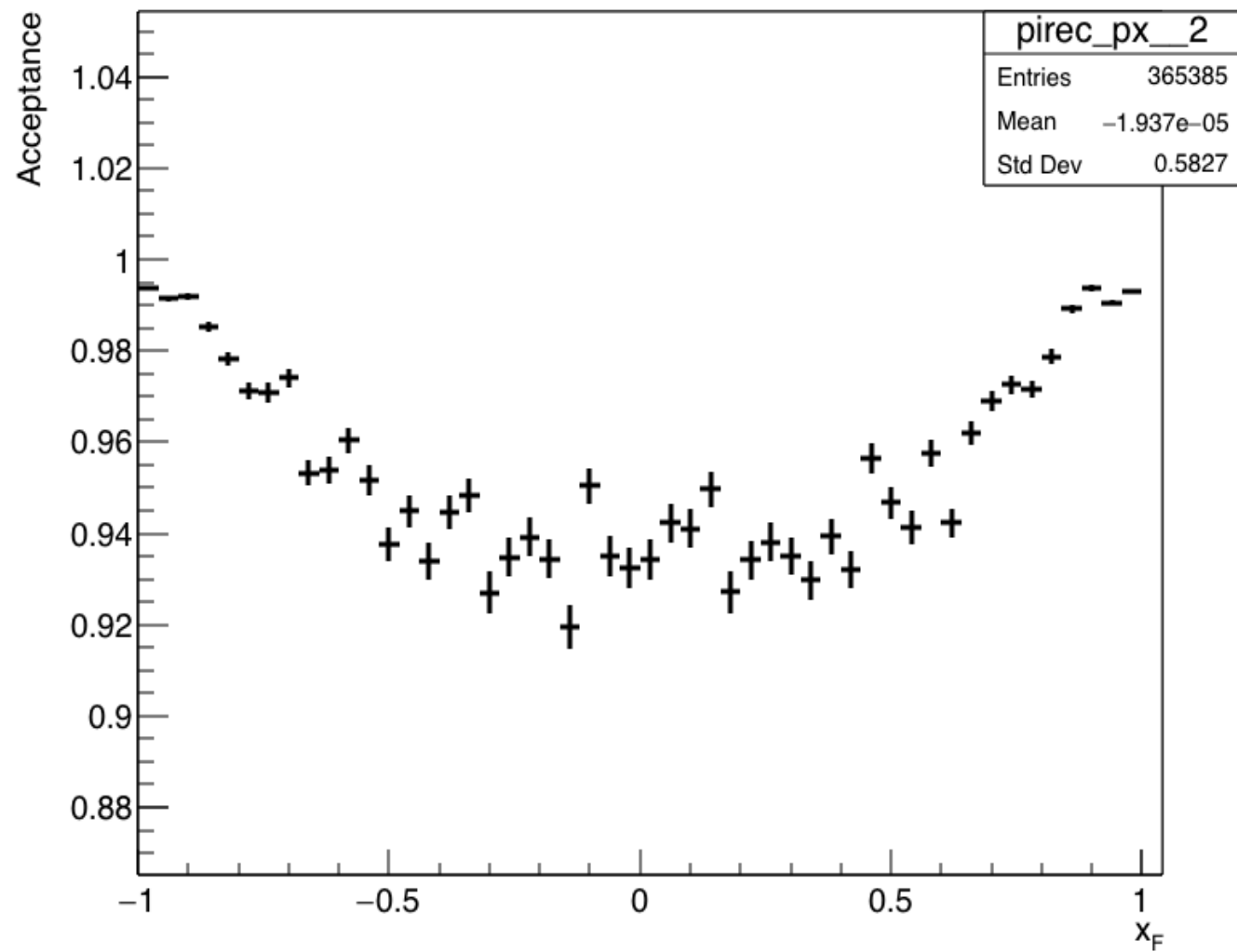
Separation criteria for p and pi
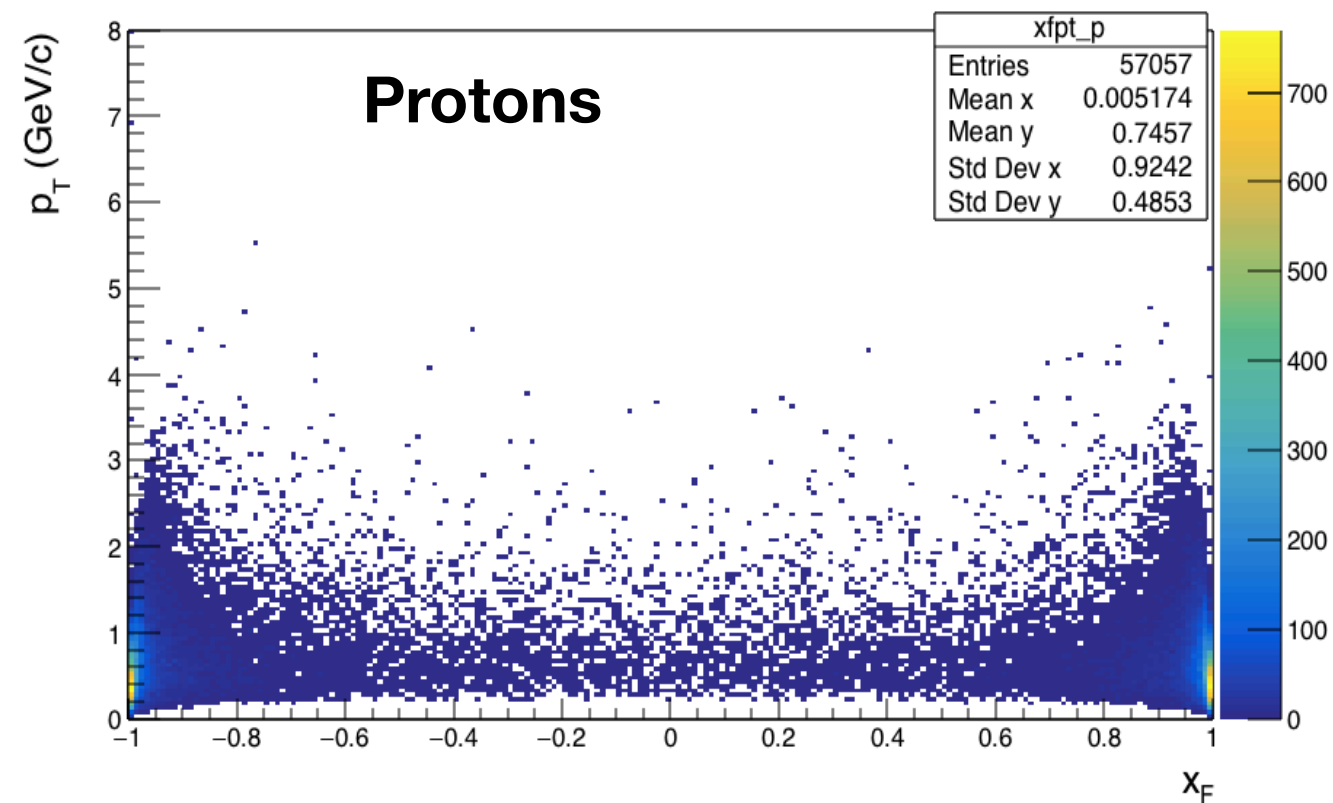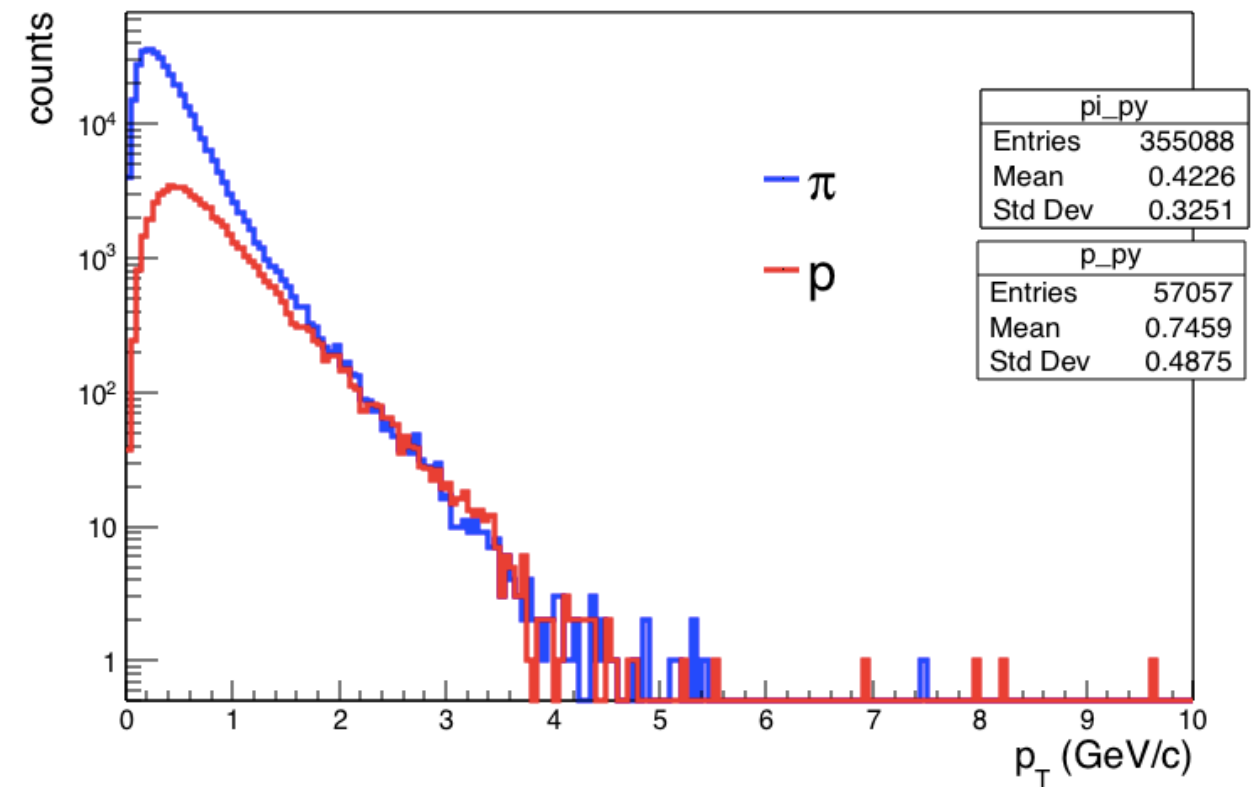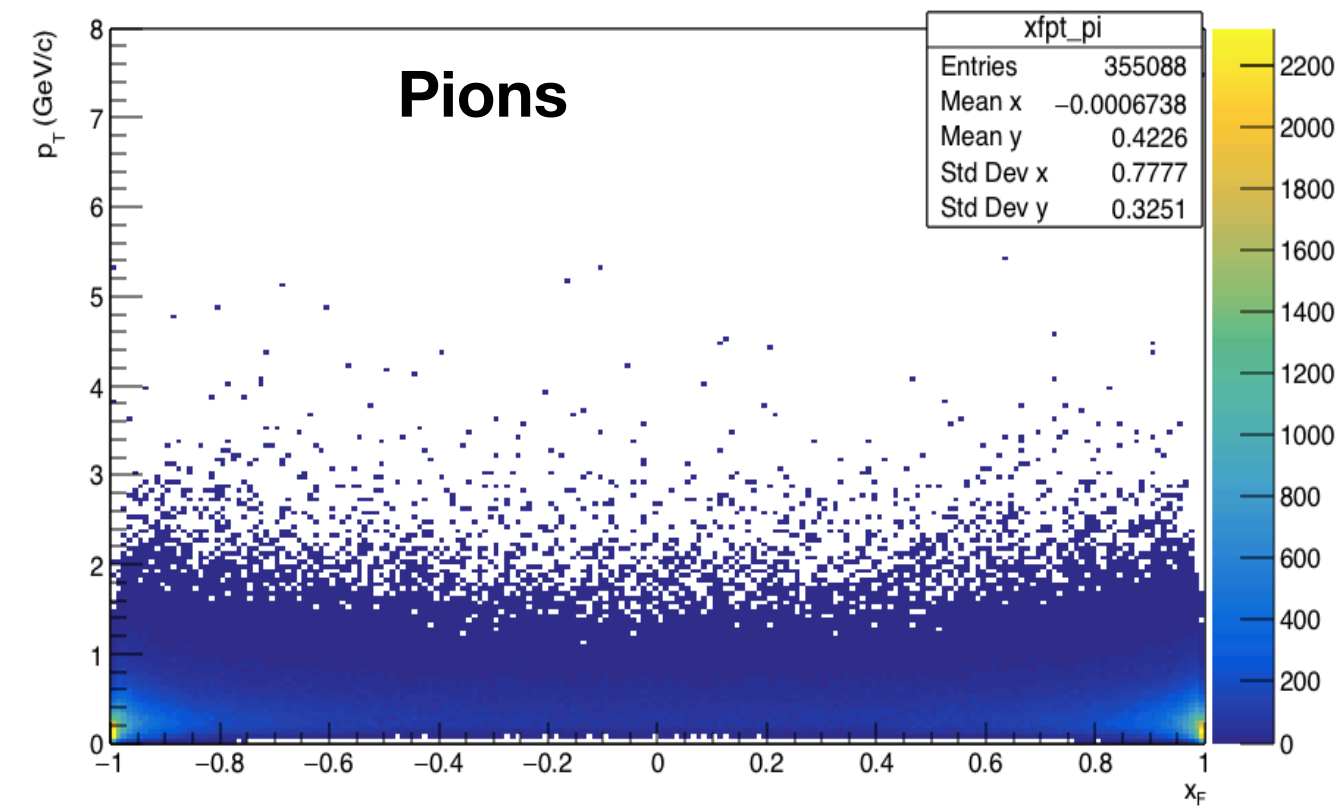
Not default geometry

- Varied distance between tubes with fixed tubes size (width = 1cm);

Conclusions

- No problems with track fitting;

- Different momentum reconstruction error for protons and pions;

- The momentum resolution doesn't depend on the number of hits in barrel.