Update on TOF performance at SPD

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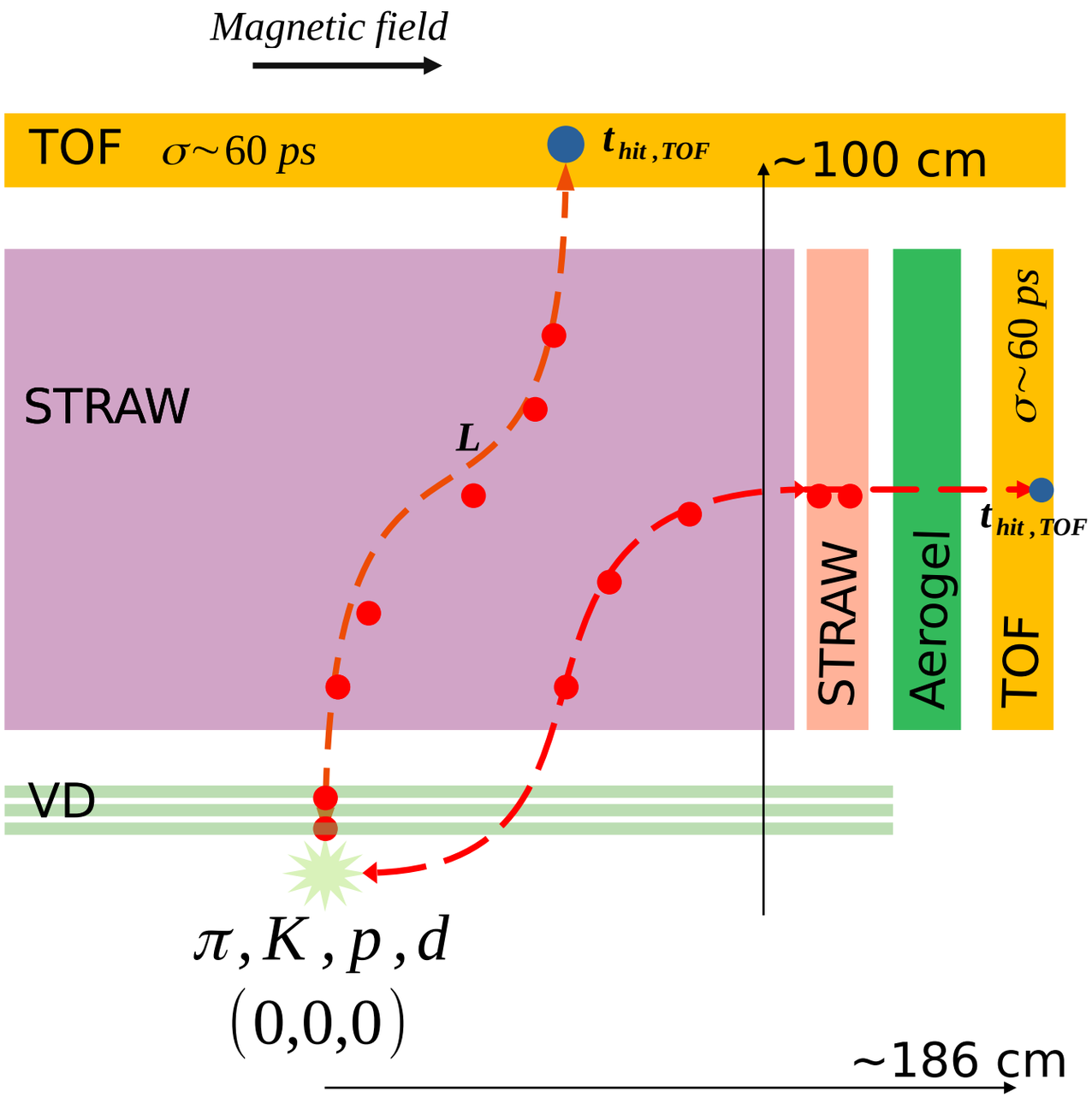
Time of Flight system



$$m^2 = \frac{p^2}{c^2}\left[\frac{t_{TOF}^2 c^2}{L^2} - 1\right]$$

$$\sigma_{m^2}^2 = 4m^4\left(\frac{\sigma_p}{p}\right)^2 + 4E^4\left(\frac{\sigma_t}{t}\right)^2 + 4E^4\left(\frac{\sigma_L}{L}\right)^2$$

$\sigma\sim 150\ \mu m$ — $\sigma_{TOF} = 60\ ps$ — from fit

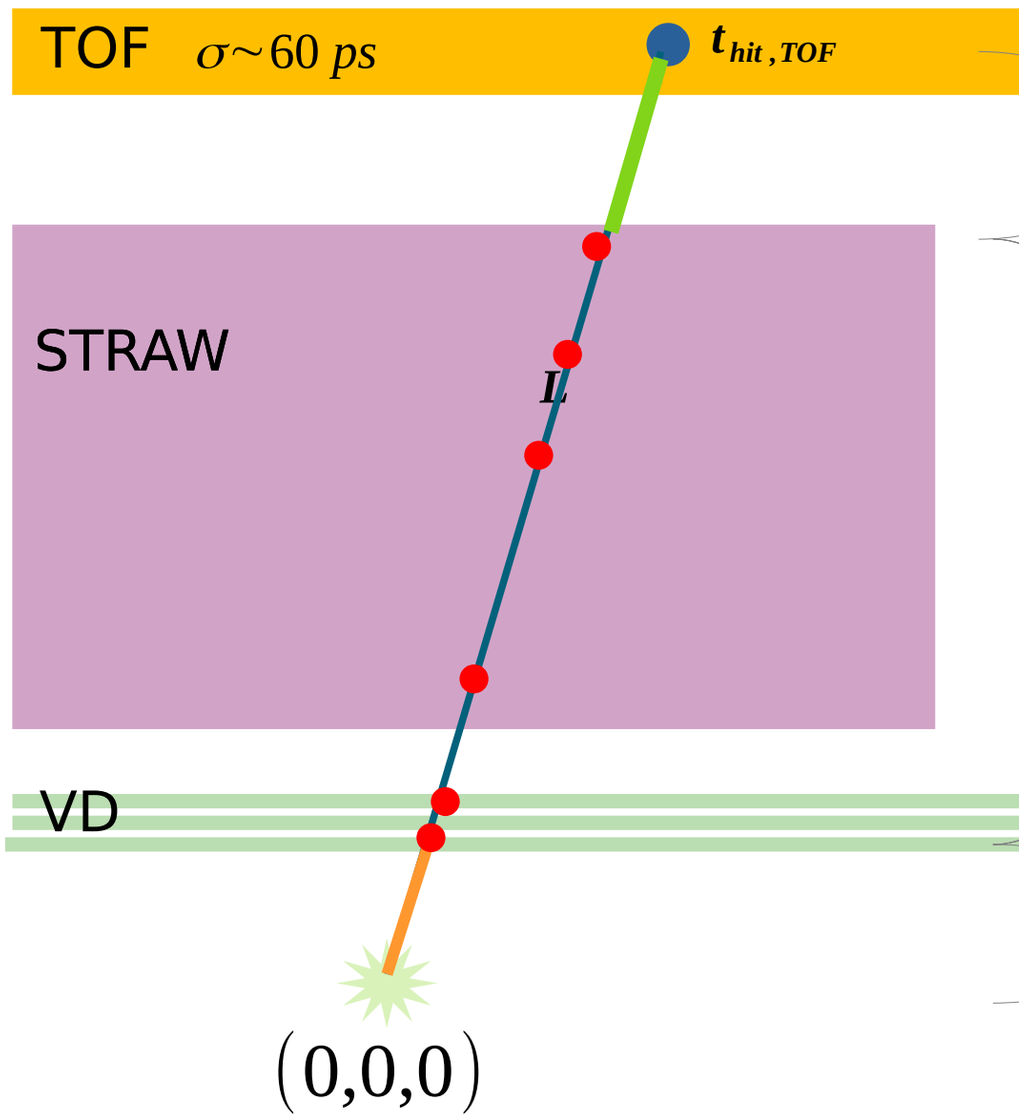
Artificial samples

$p \in [0.2; 6.0, step = 0.01\ GeV]$

Calculation L_{rc}

$L_{rc} = L_1 + L_2 + L_3$

$$m^2 = \frac{p^2}{c^2}\left[\frac{t_{TOF}^2 c^2}{L_{rc}^2} - 1\right]$$



L : extrapolation from *last state* to TOF hit

ExtrapolateToPlane(tofHit, plane_norm, *trklaststate, trkextstateLtoToF_plane)

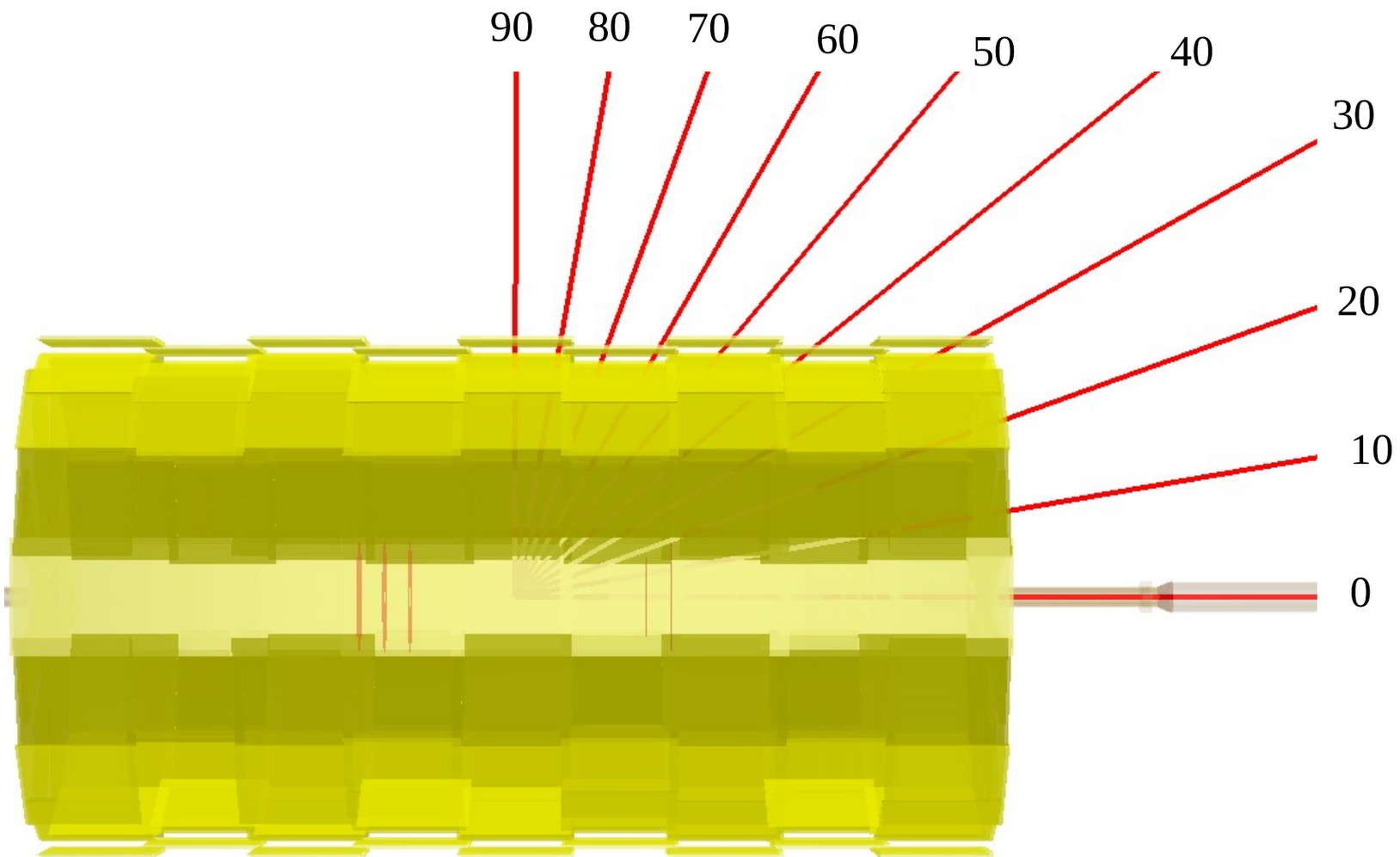
L: from *first state* to *last state*

fitpars->GetTrackLength()

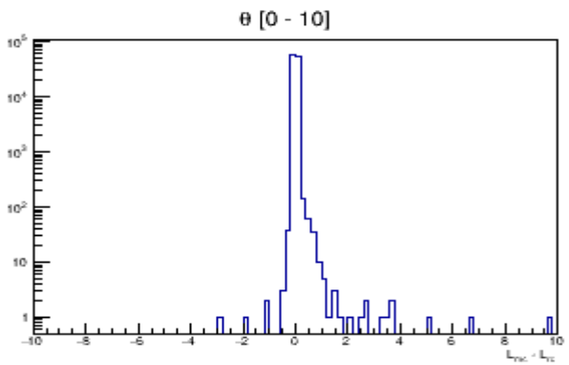
L: extrapolation from *first state* to PV

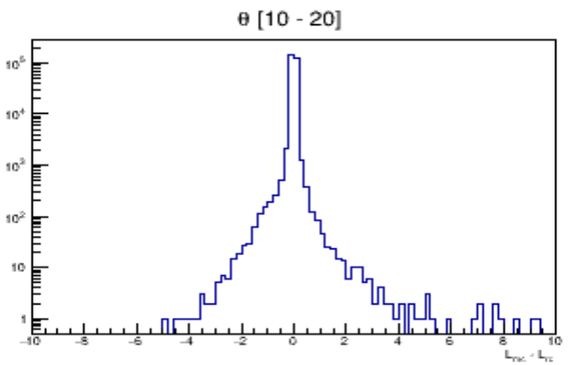
ExtrapolateToPoint(vtxPos, *trkfirststate, trkextstateFirstToPV)

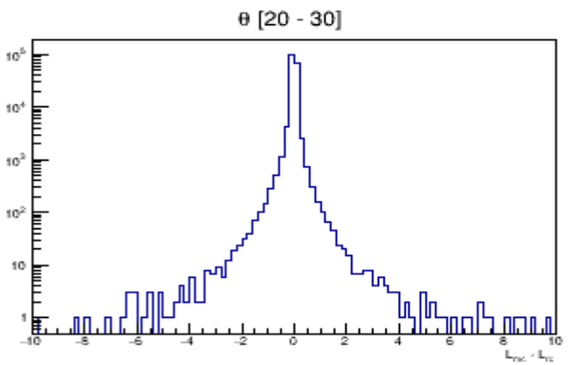
Theta bins

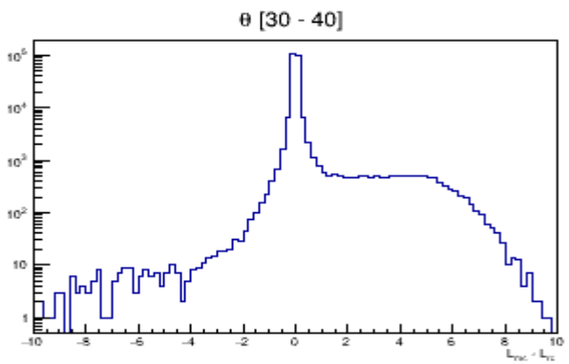


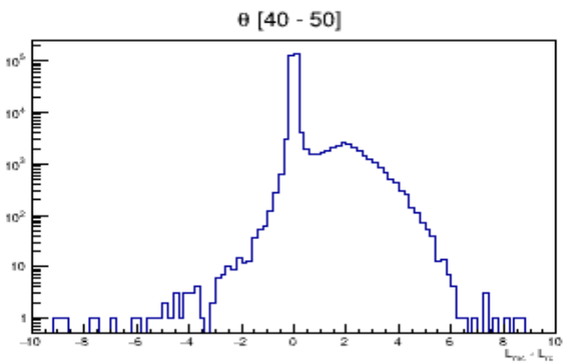
L_{mc}-L_{rc} in theta bins (cm)

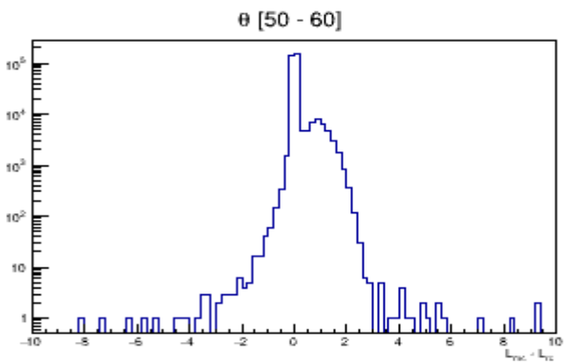


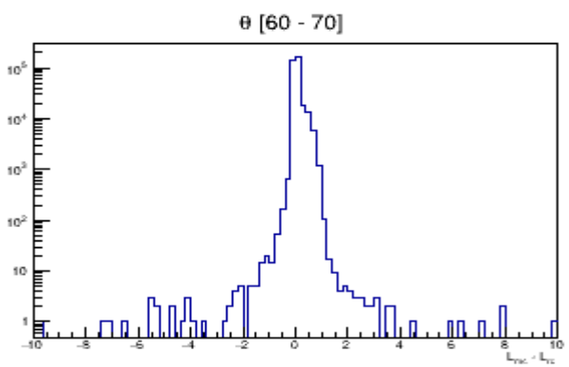


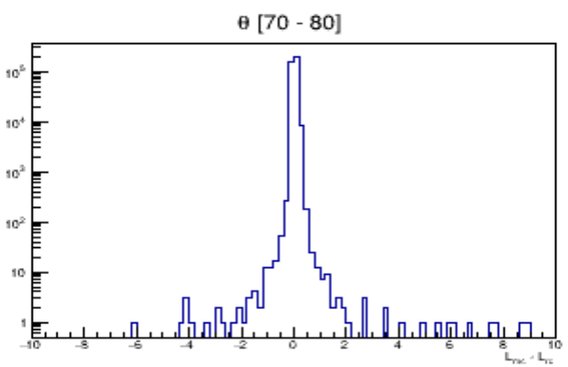


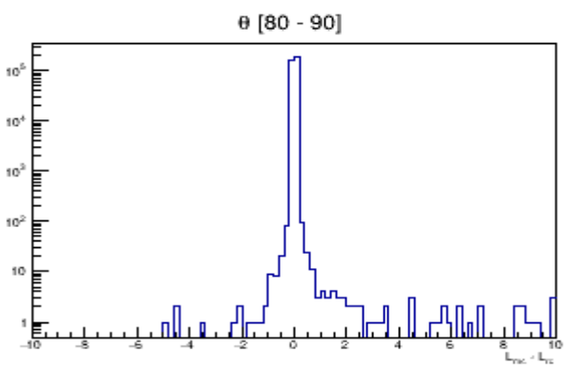






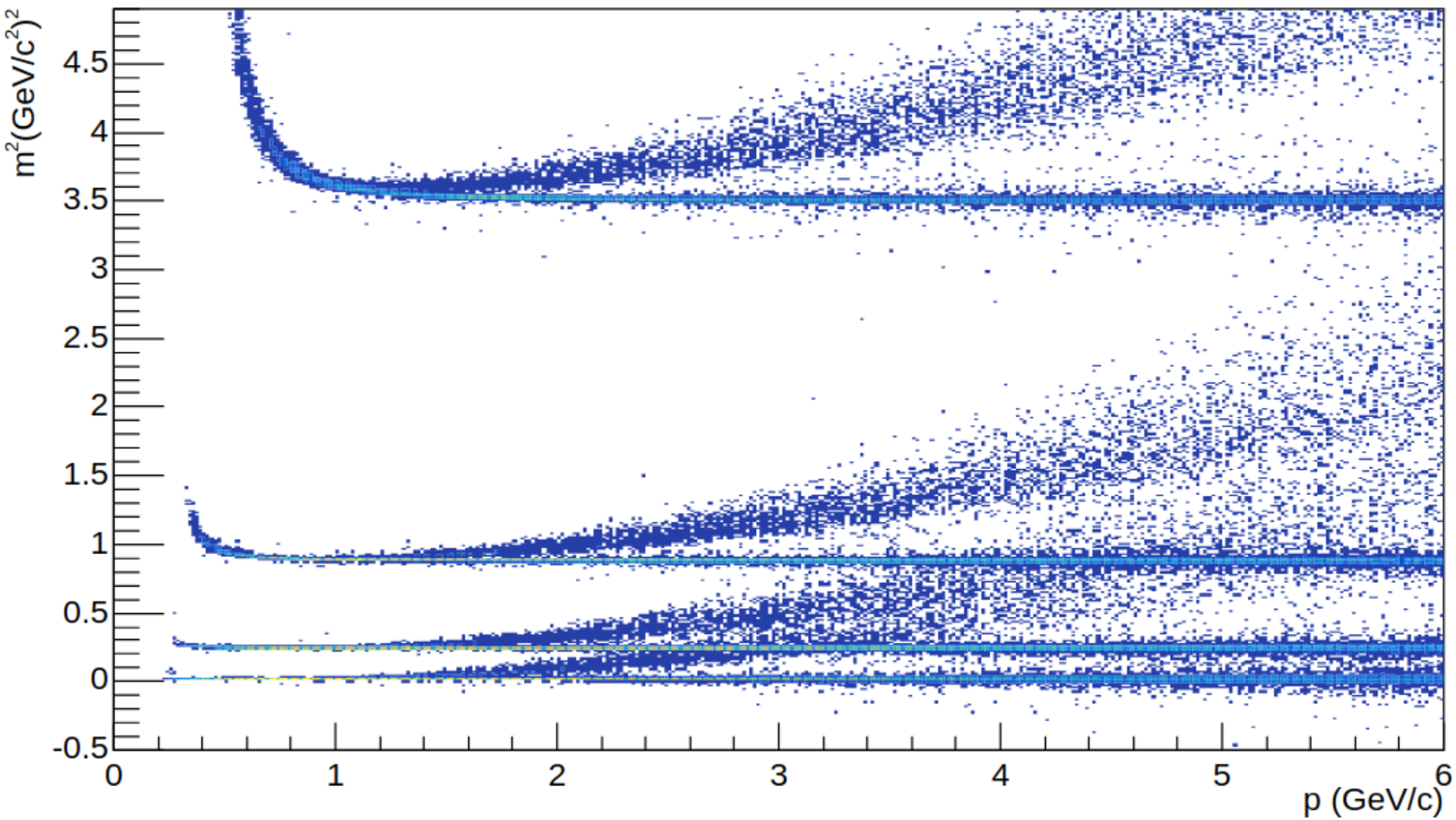






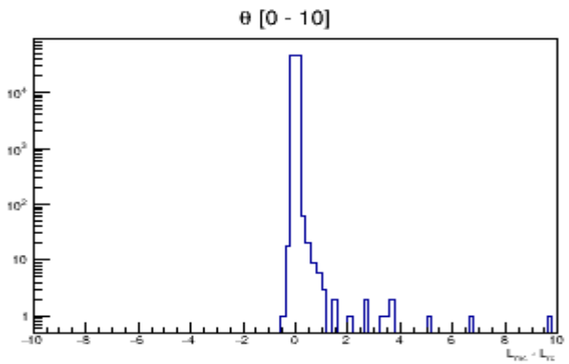
m² vs p, bin [40-50]

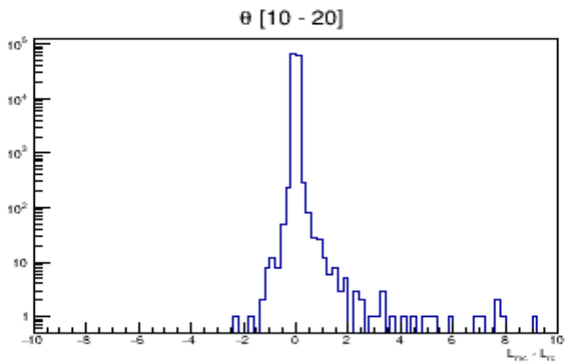
$$m^2 = \frac{p^2_{mc,pv}}{c^2}\left[\frac{t^2_{mc,TOF}\,c^2}{L^2_{rc}} - 1\right]$$

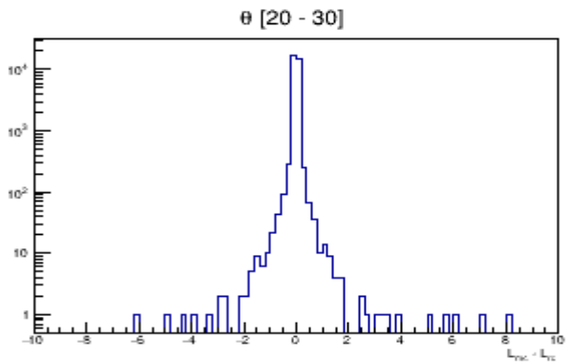


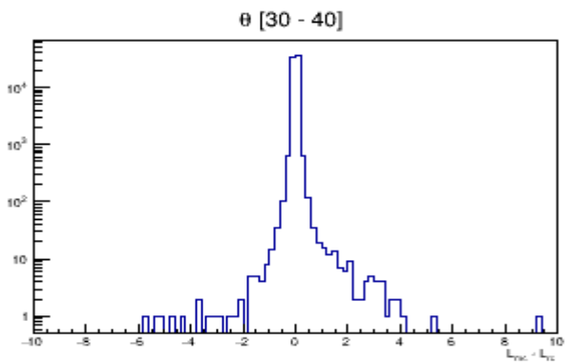
L_{mc}-L_{rc} in theta bins (cm)

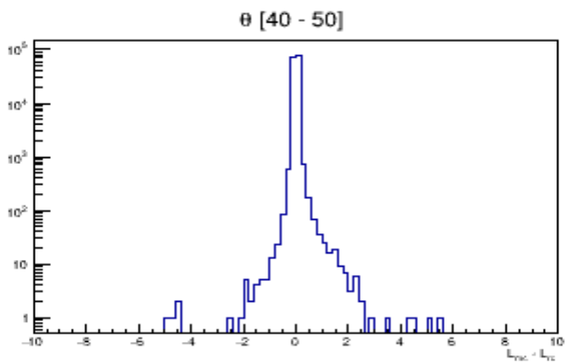
Chi2overNDF<1.0

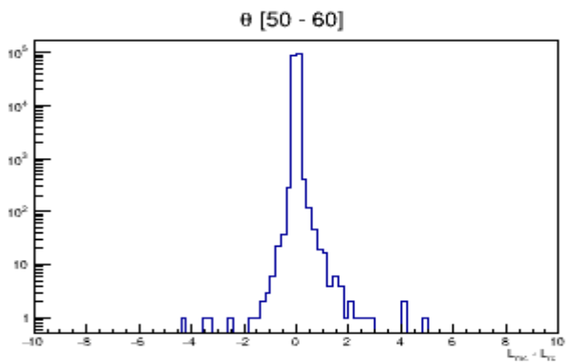


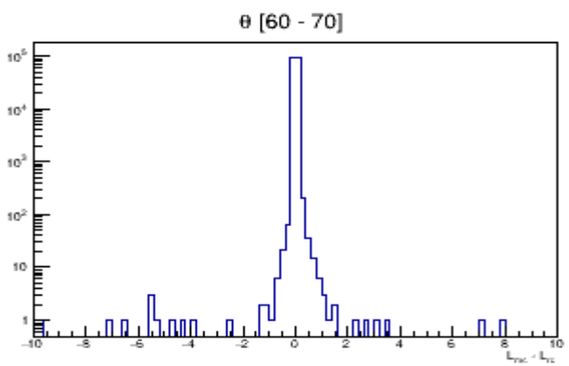


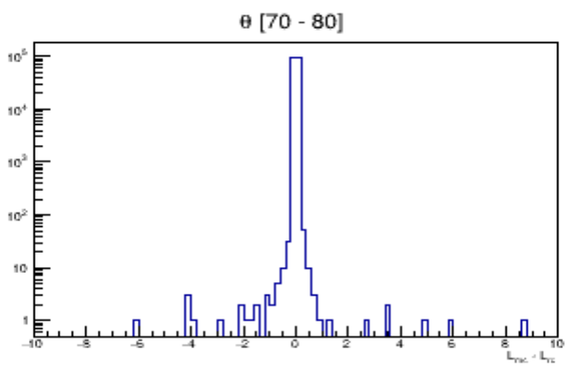


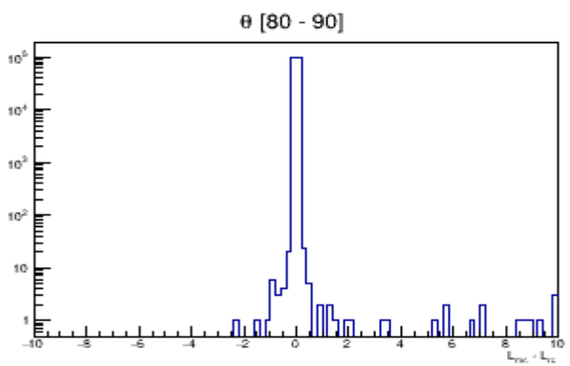












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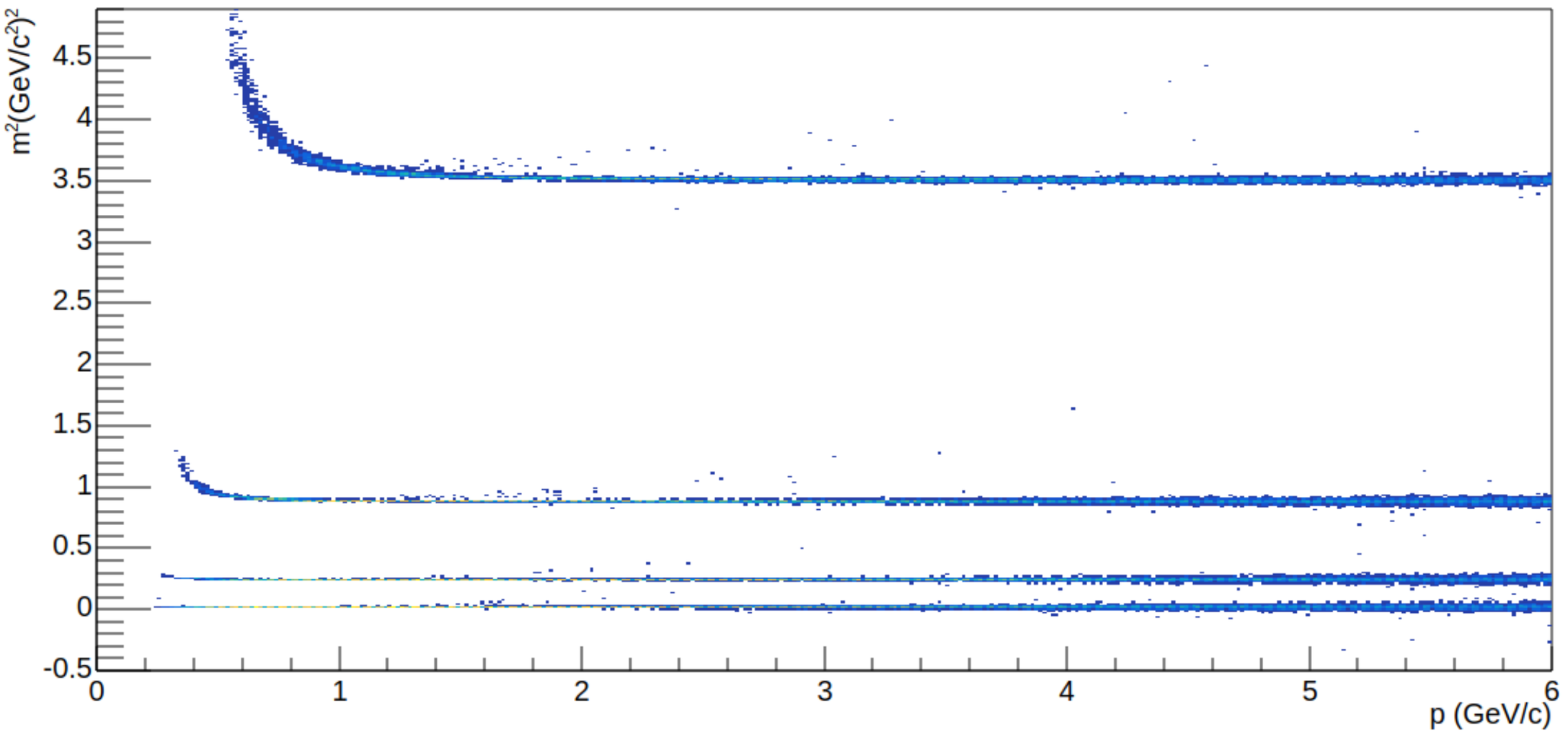

Conclusion

- Uncertainty of the track length was included to PID TOF study.
- Unclear behaviors of L_{rc} is required further investigation. Need to cross-check of method calculation L_{rc}