PID status

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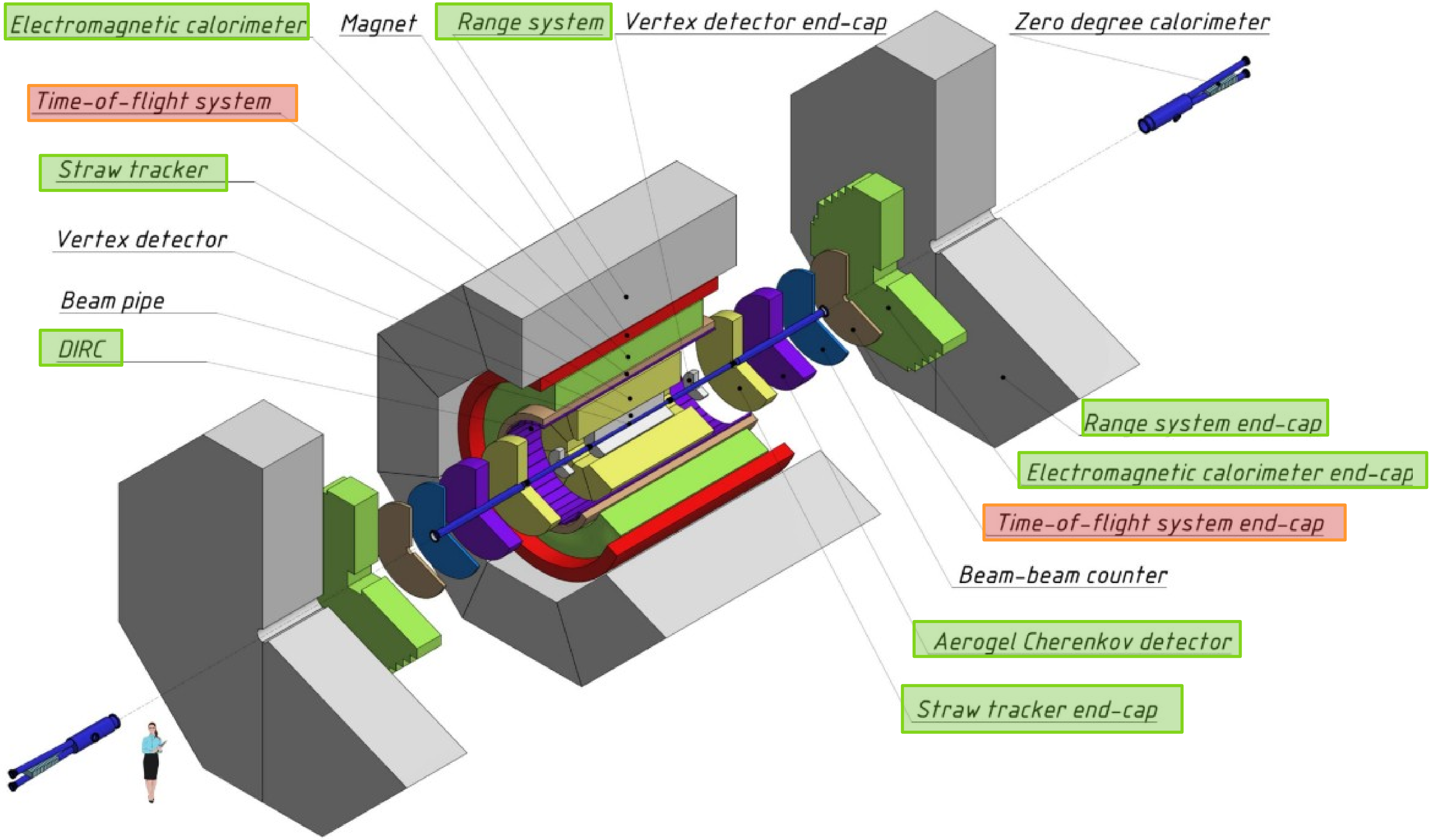
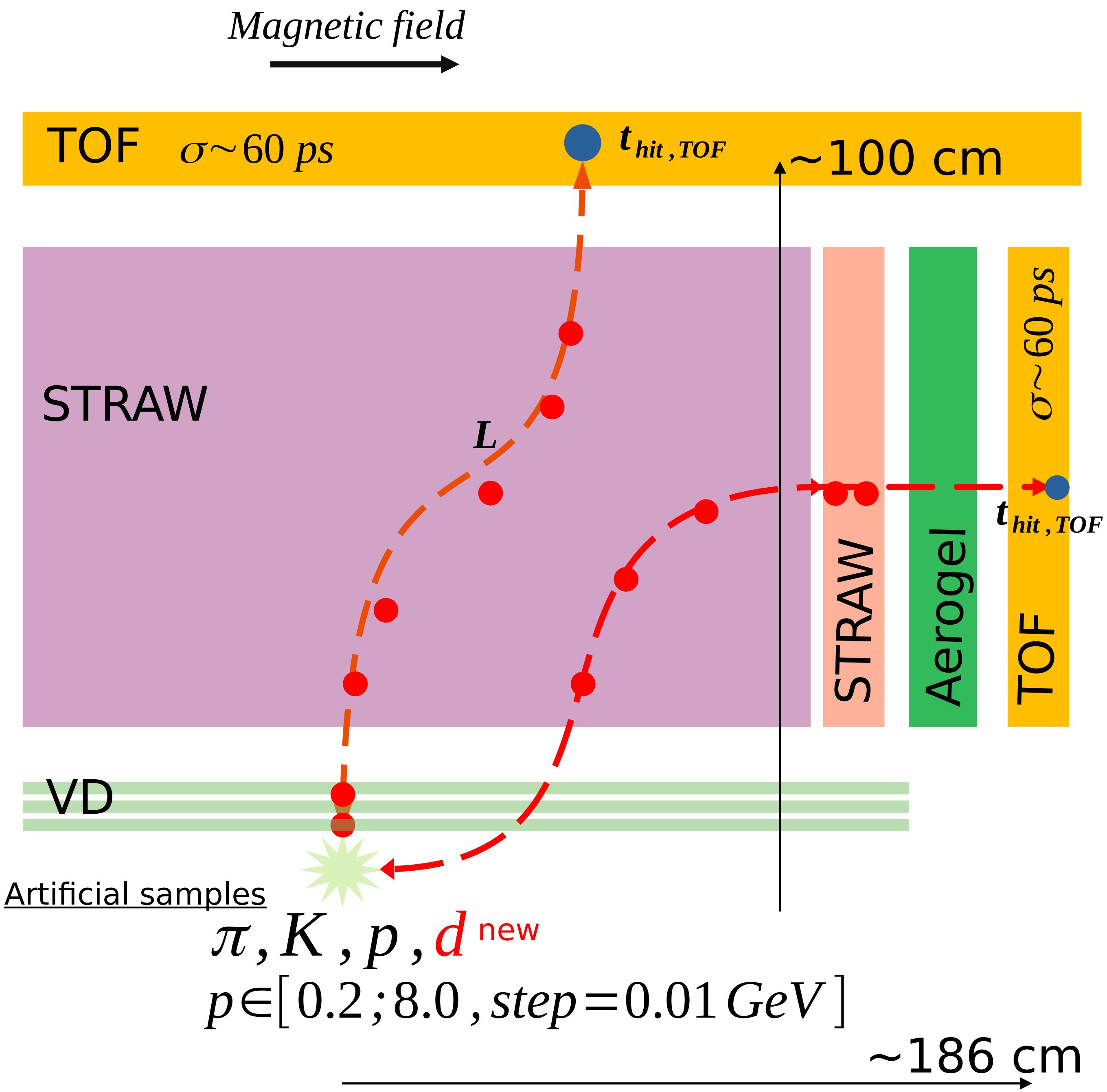
Particle identification in SPD



Discussed in this talk: particle identification via Time-of-flight system

Time of Flight system



Artificial samples

π, K, p, d new

$p \in [0.2; 8.0, step = 0.01\,GeV]$

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

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

$\sigma \sim 150\,\mu m$

$\sigma_{TOF} = 60\ ps$

from fitting

Selection criteria

cuts on the quality of the tracks

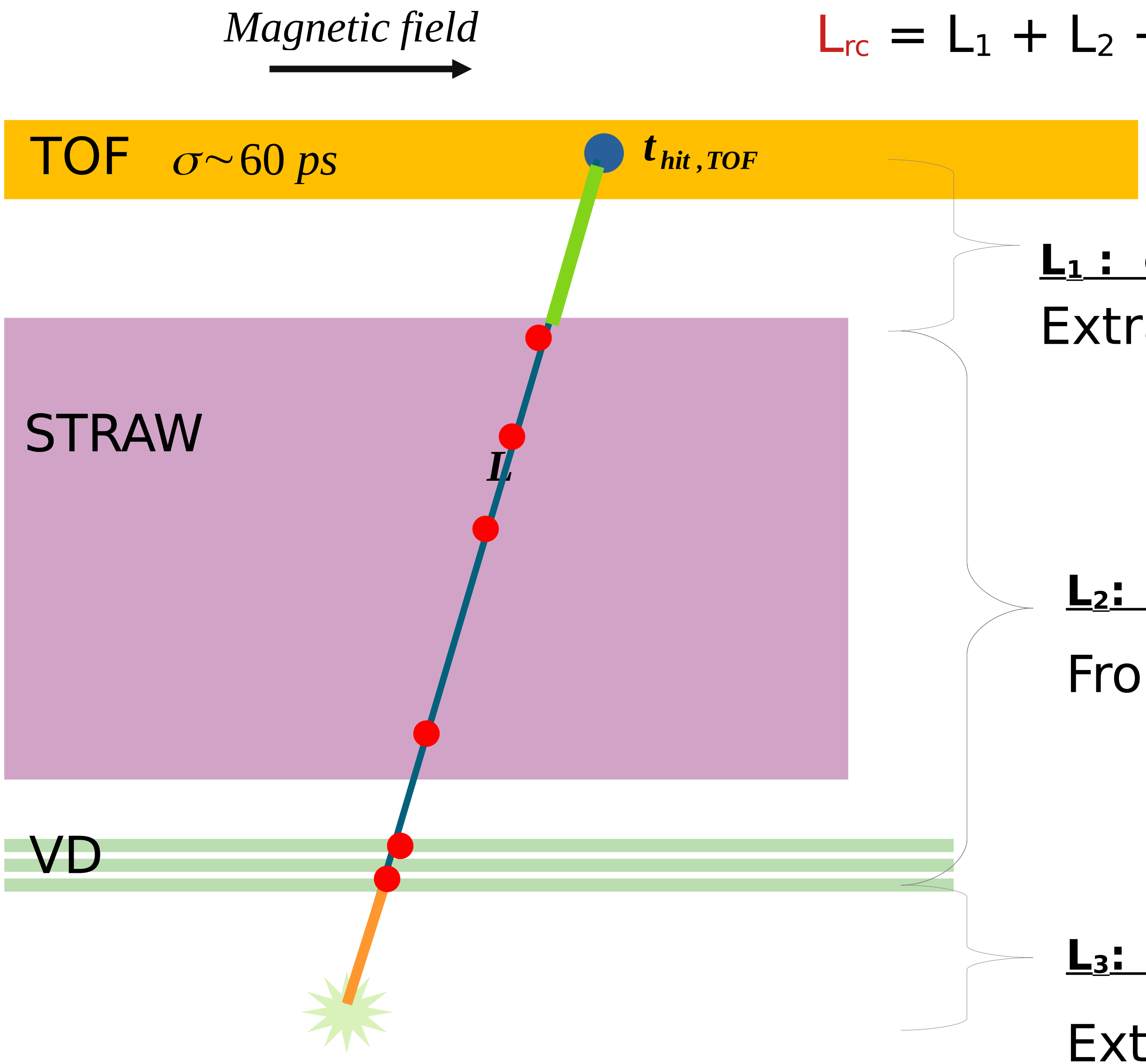
(status of fit from GenFit and chi2/ndf<5)

detailed explanation of cuts in talk of Ruslan Akhunzyanov

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_1 : extraction from *last state* to TOF hit

ExtrapolateToPlane

L_2: from *first state* to *last state*

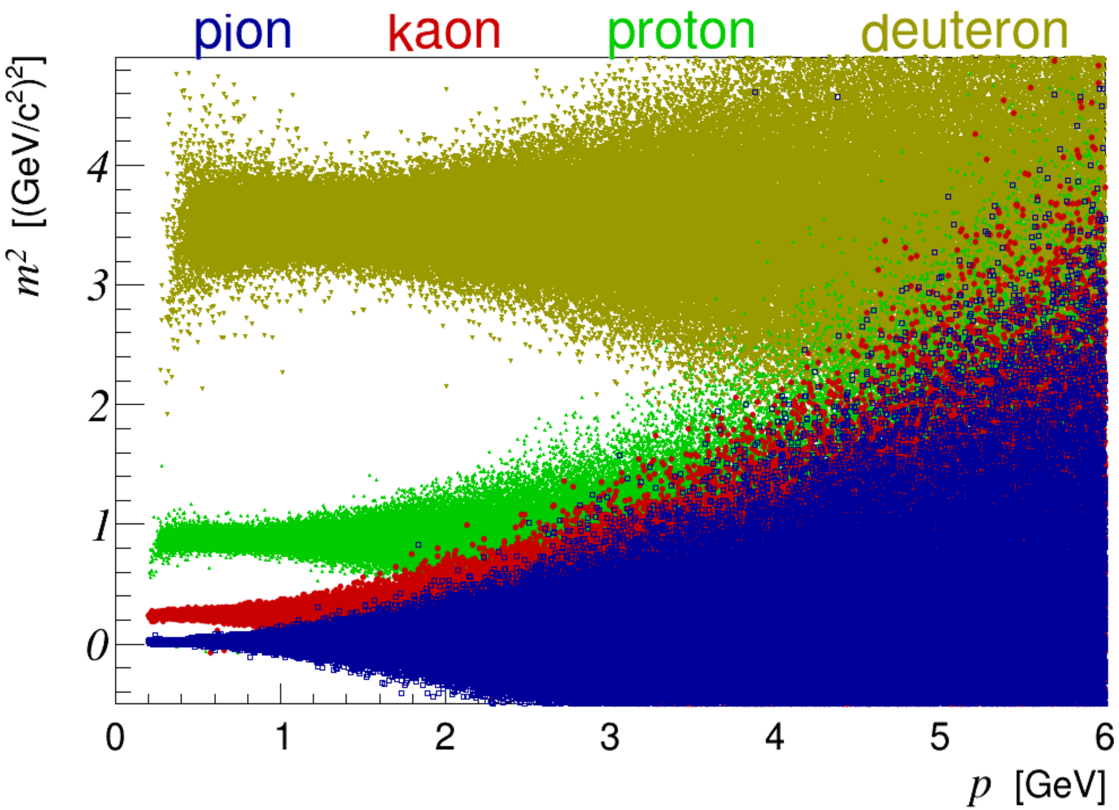
From fit

L_3: extrapolation from *first state* to PV

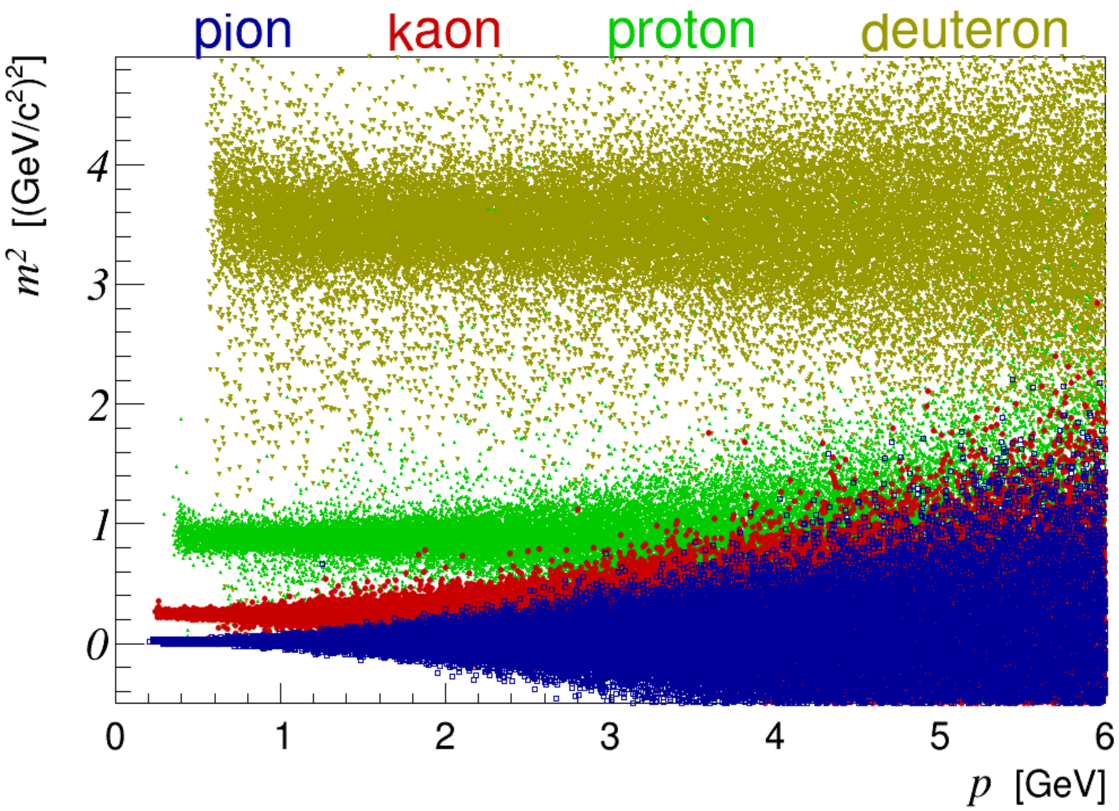
ExtrapolateToPoint

m^2 vs p

Barrel



End-Cap

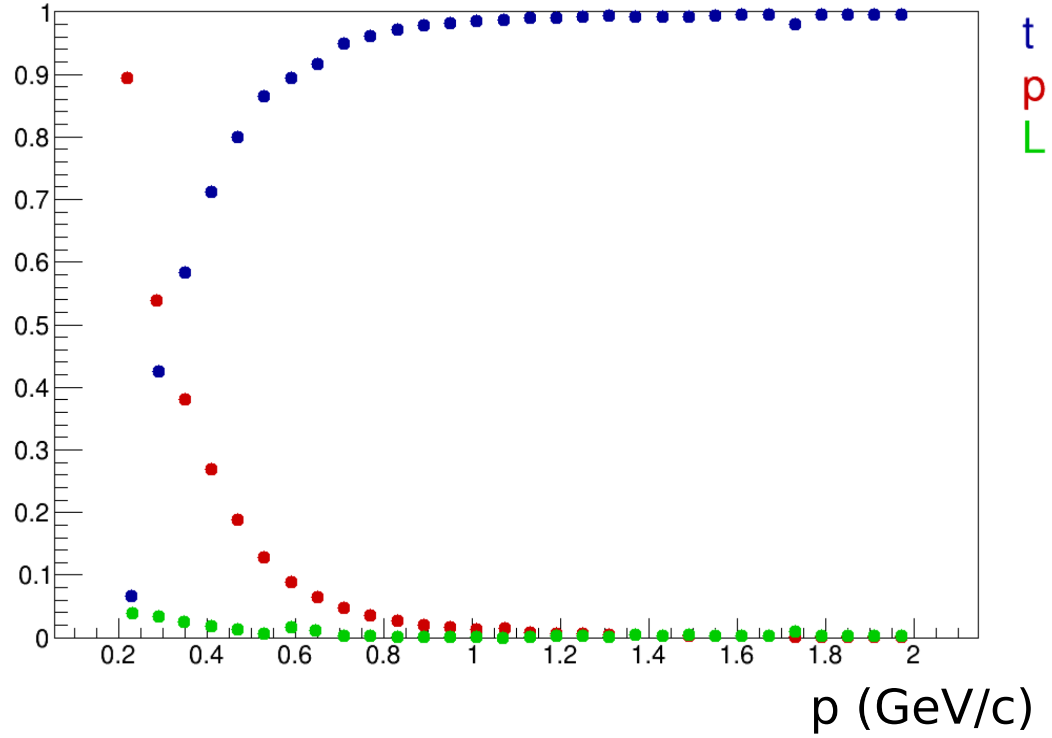


The mass squared resolution

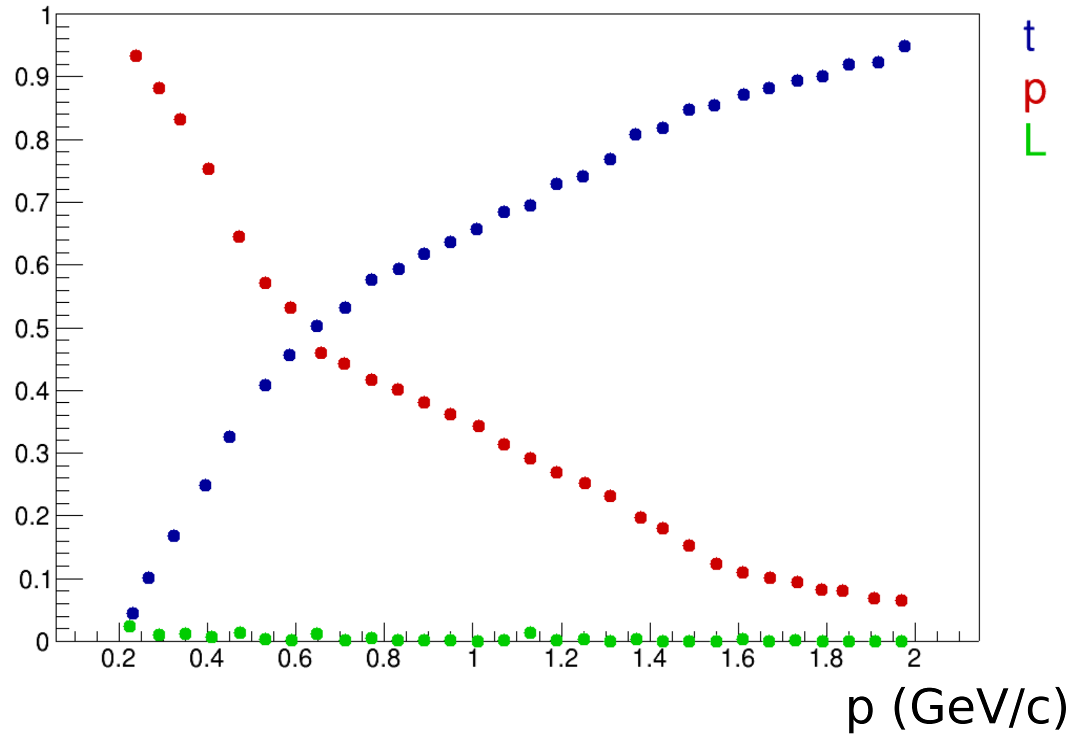
$$\sigma_{m^2}^2 = 4m^4\left(\frac{\sigma_p}{p}\right)^2 + 4E^4\left(\frac{\sigma_t}{t}\right)^2 + 4E^4\left(\frac{\sigma_L}{L}\right)^2$$

kaon

Barrel



End-Cap

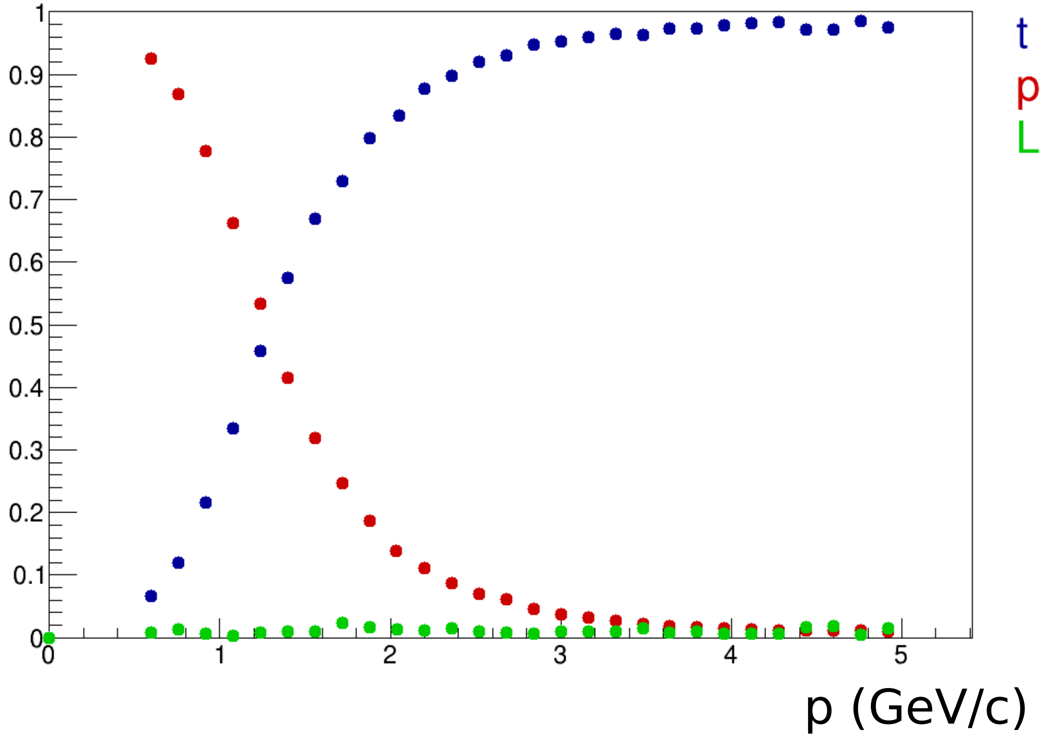


The mass squared resolution

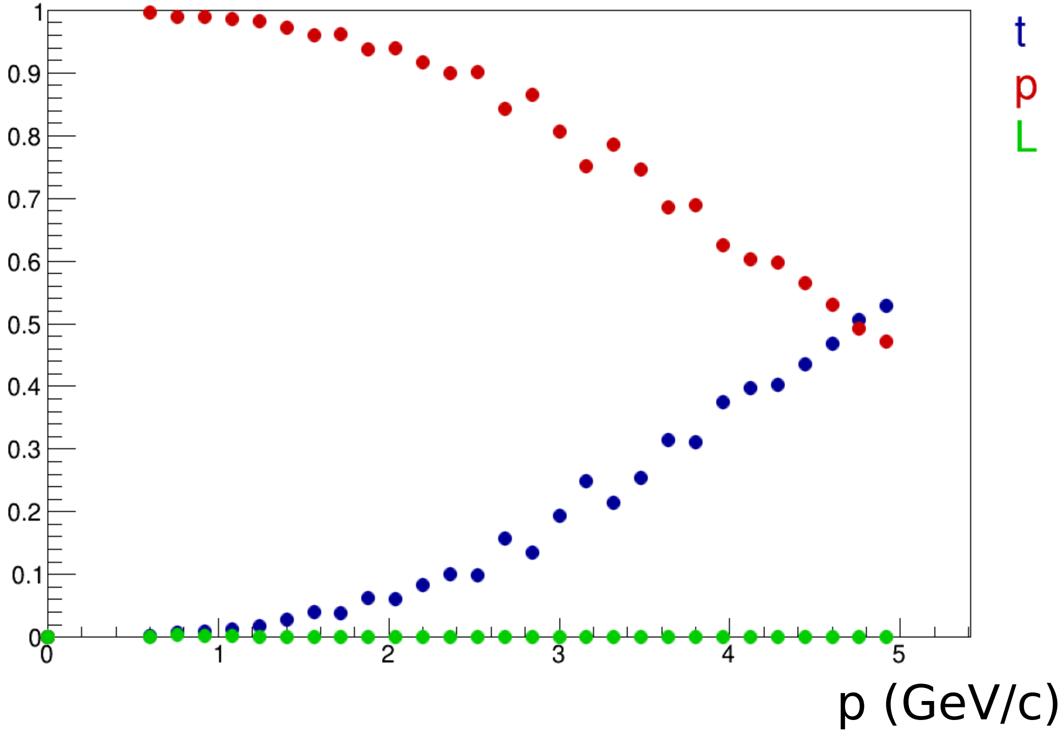
$$\sigma_{m^2}^2 = 4m^4\left(\frac{\sigma_p}{p}\right)^2 + 4E^4\left(\frac{\sigma_t}{t}\right)^2 + 4E^4\left(\frac{\sigma_L}{L}\right)^2$$

deutron

Barrel



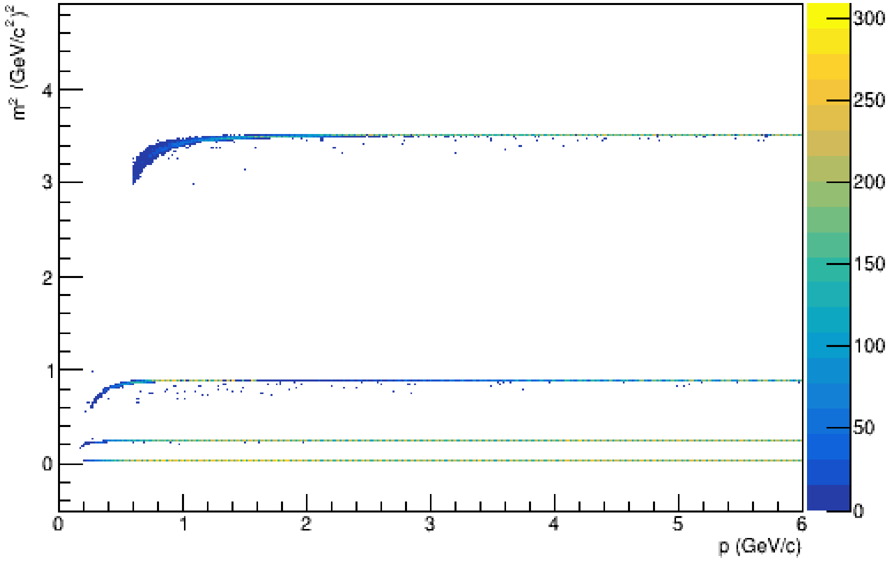
End-Cap



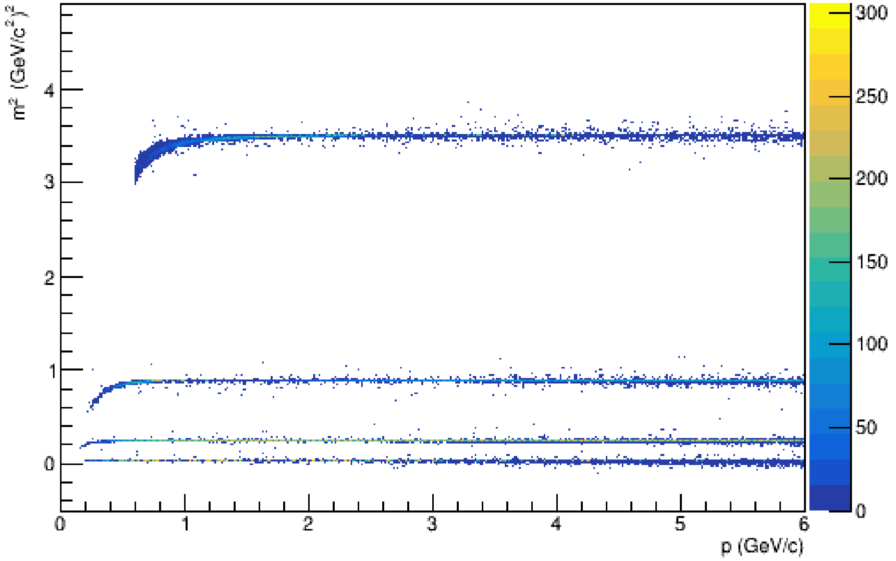
m² vs p: End-Cap

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

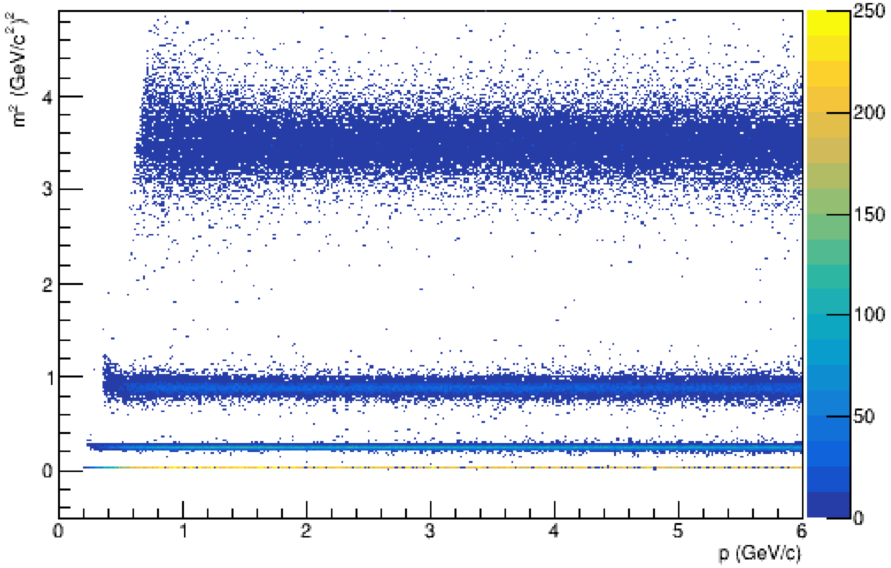
p_{mc}, L_{mc}, t_{mc}



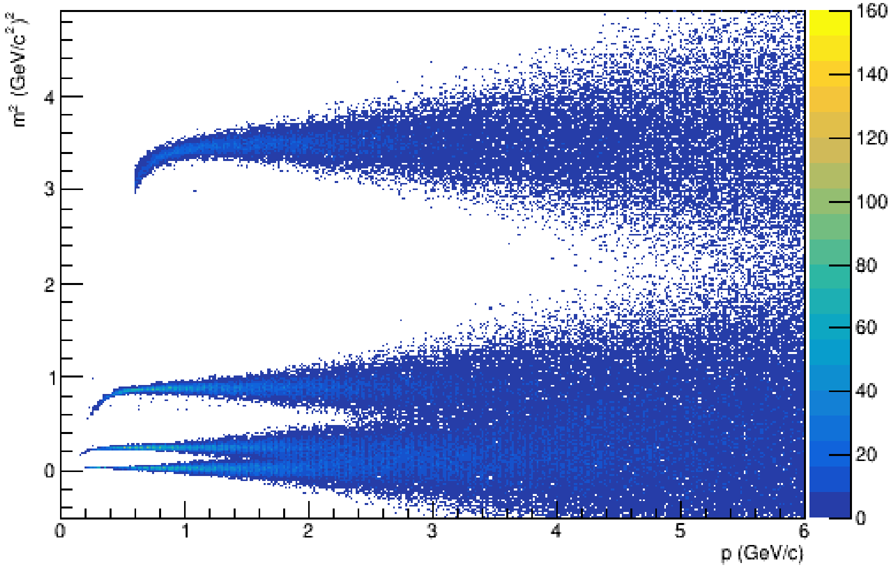
p_{mc}, L_{rc}, t_{mc}



p_{rc}, L_{mc}, t_{mc}

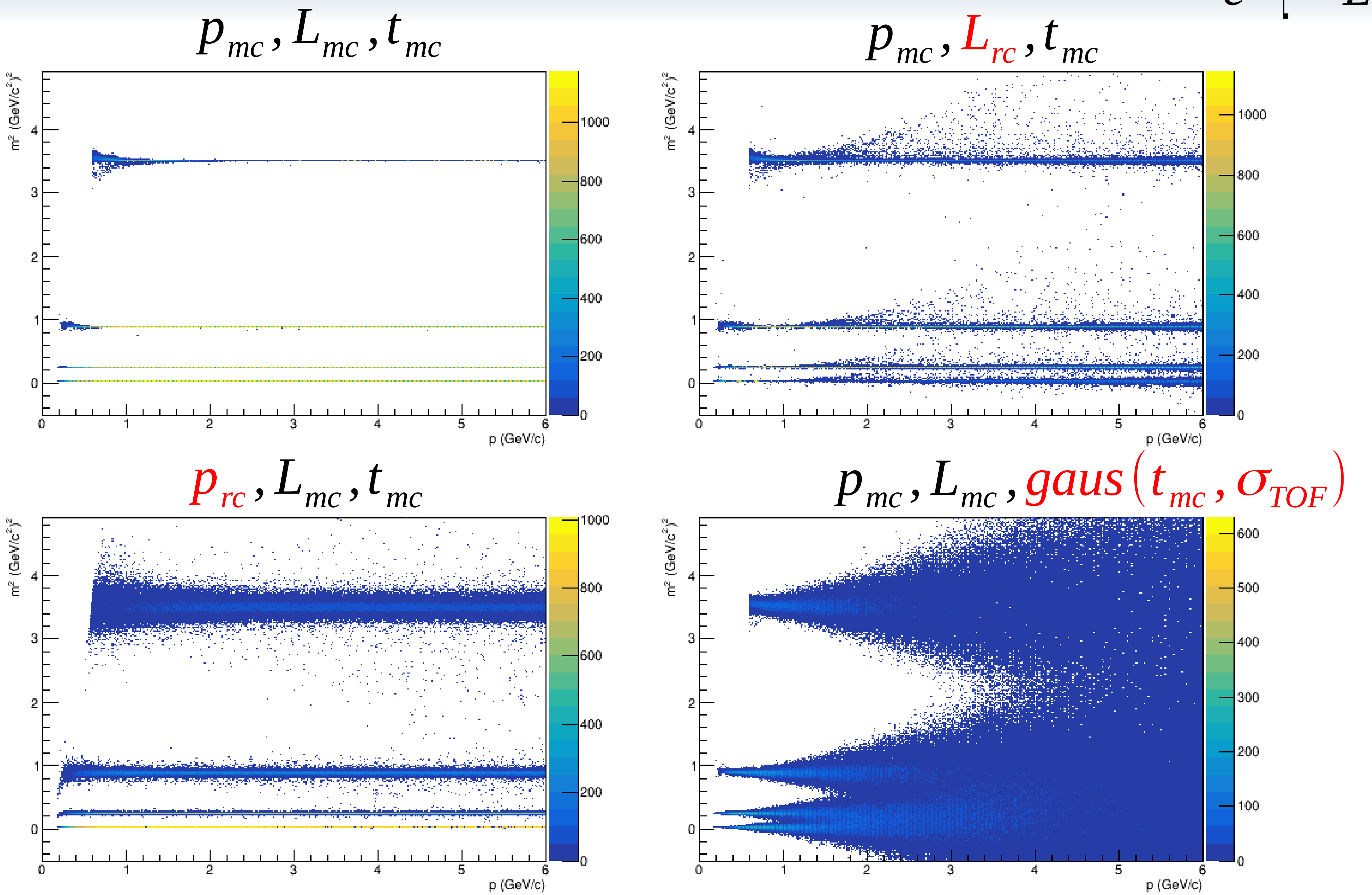


$p_{mc}, L_{mc}, gaus(t_{mc}, \sigma_{TOF})$



m² vs p: Barrel

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



$$p_{mc},L_{mc},t_{mc}$$

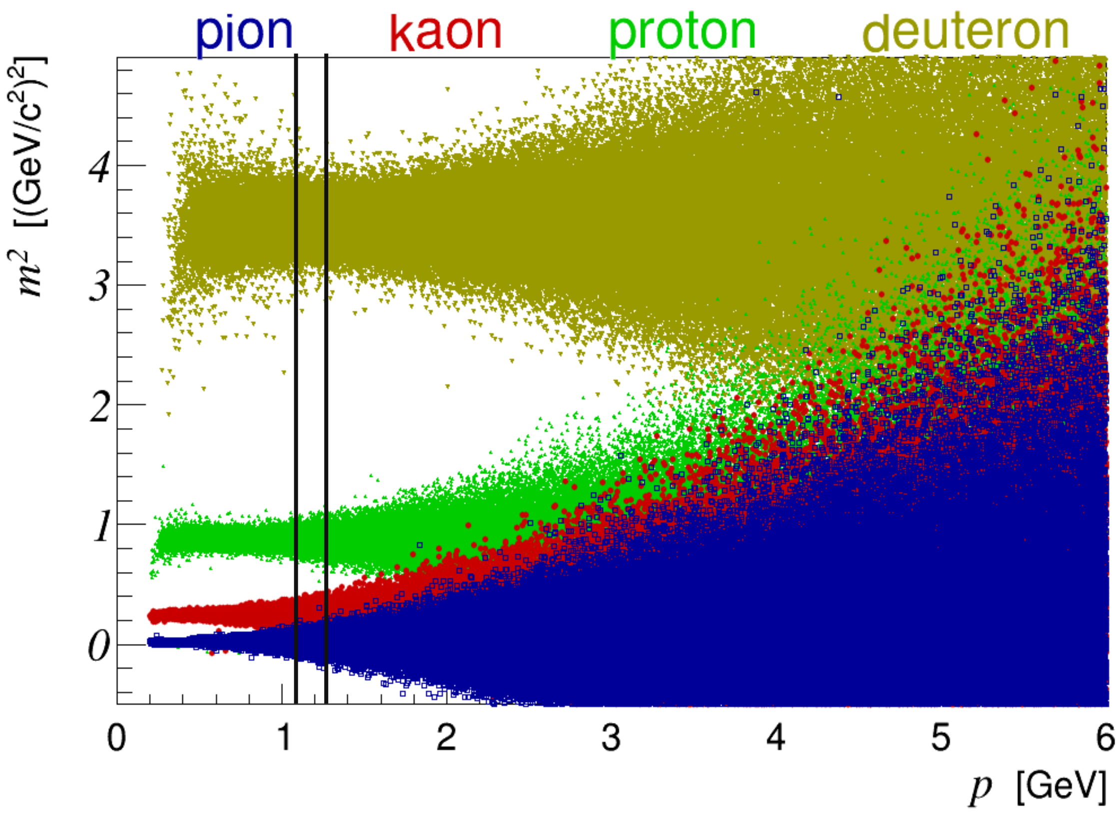
$$p_{mc},L_{rc},t_{mc}$$

$$p_{rc},L_{mc},t_{mc}$$

$$p_{mc},L_{mc},gaus\left(t_{mc},\sigma_{TOF}\right)$$

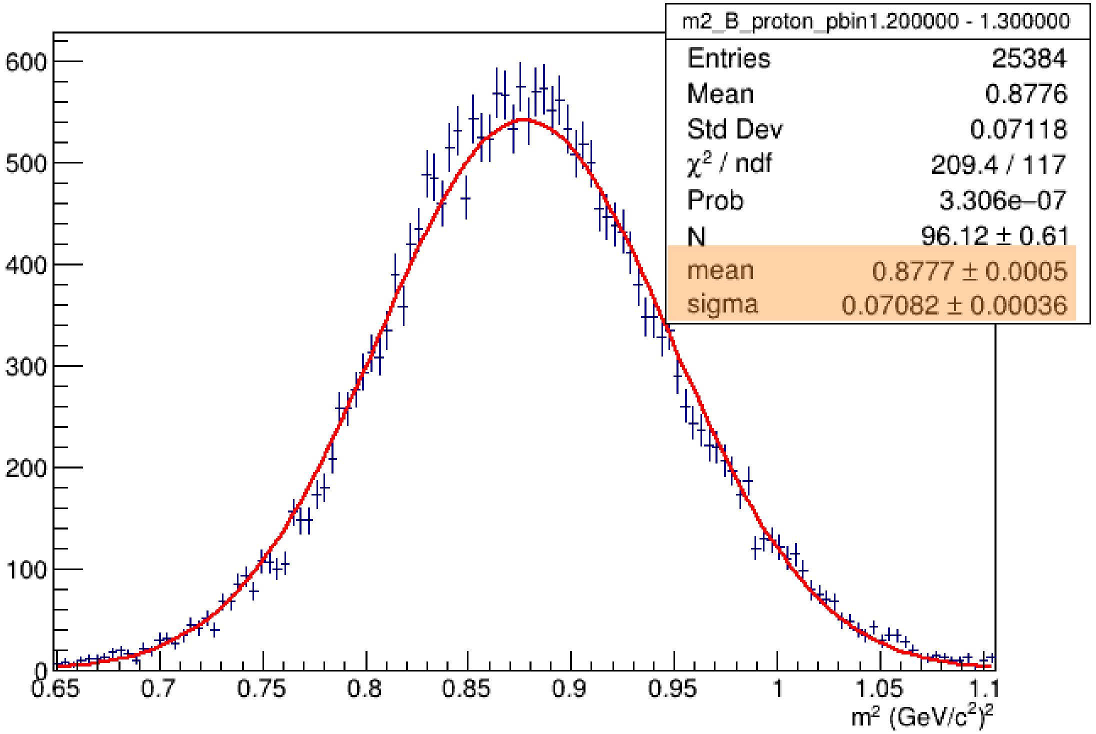
Parametrization

Fit m² distribution in 40 bins of momentum



proton

P_{bin}= 1.2 – 1.3 GeV

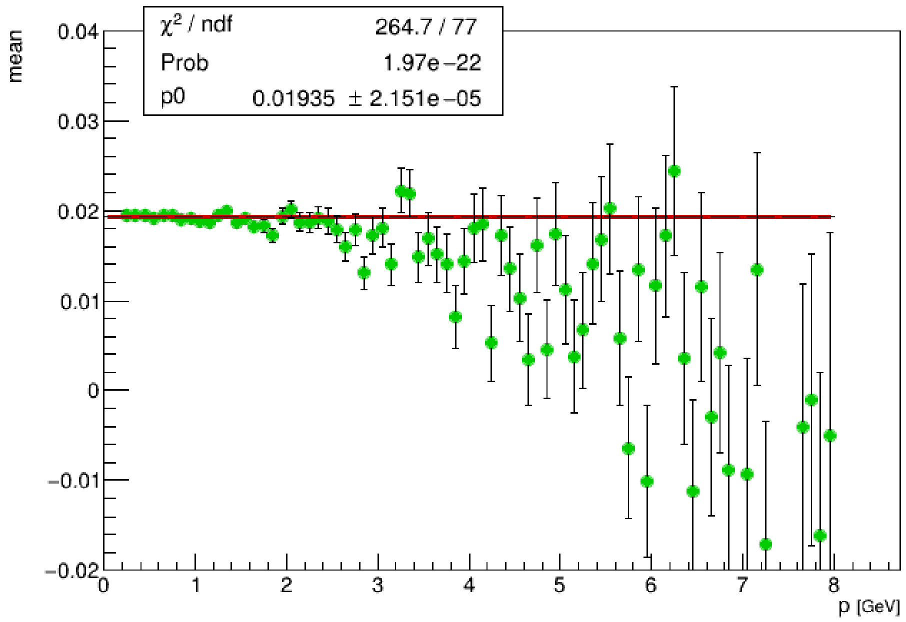


Pion parametrization

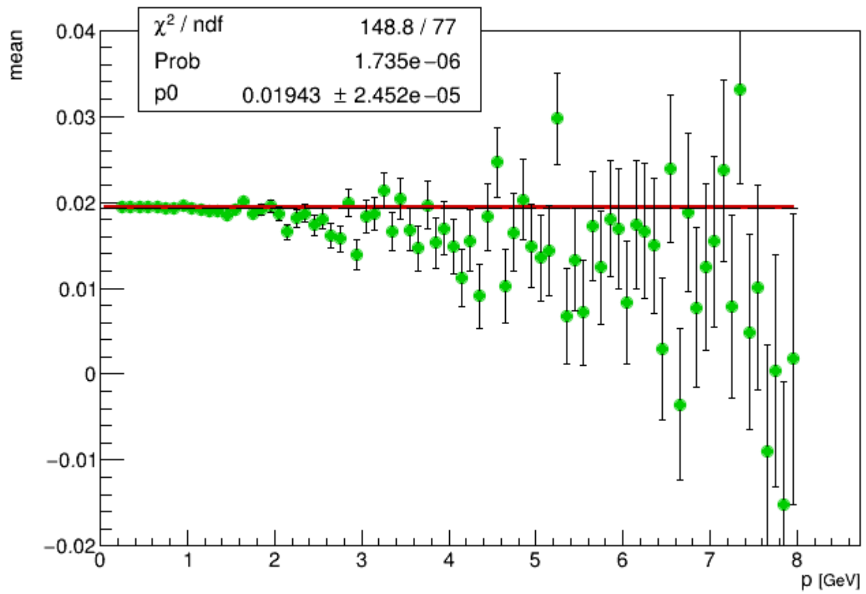
m^2_{pdg} = 0,019321 GeV

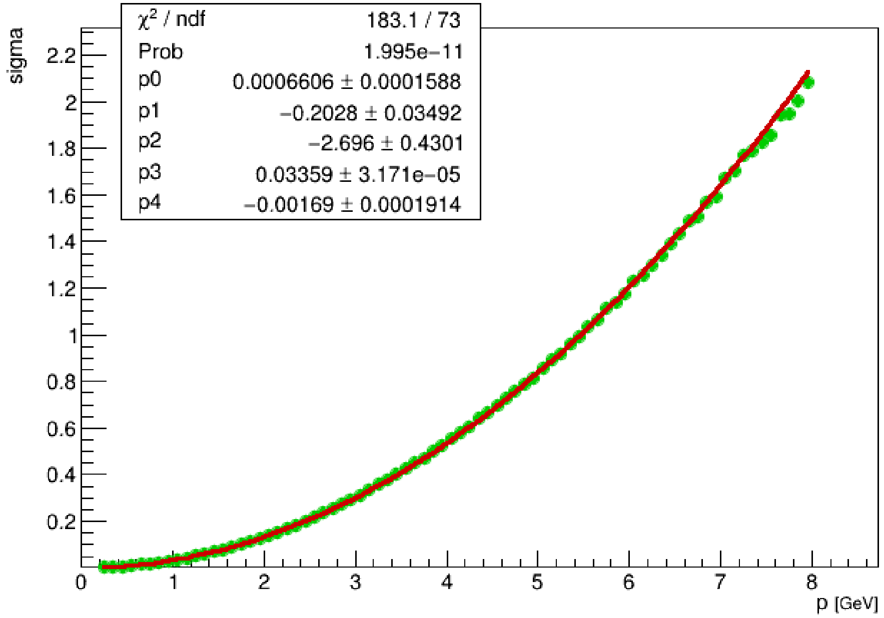
Barrel

End-Cap

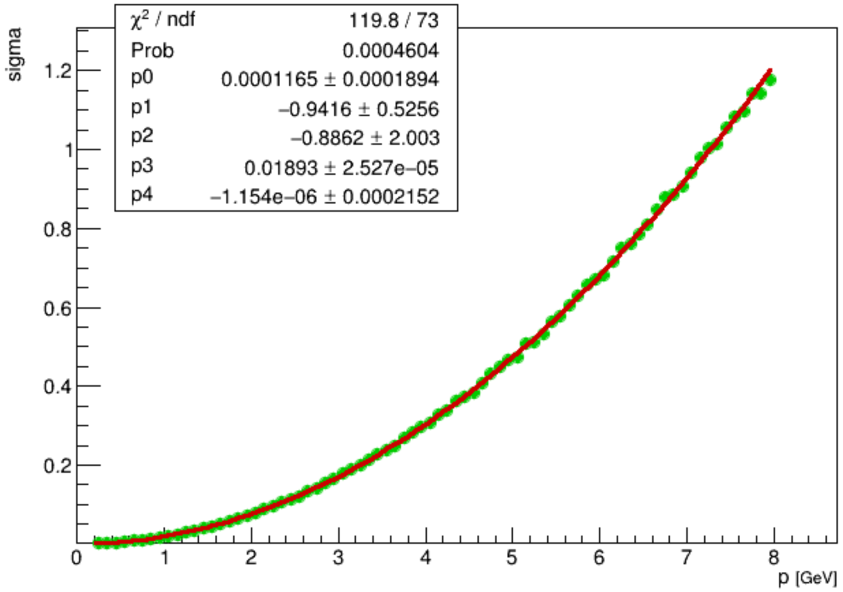


mean





sigma

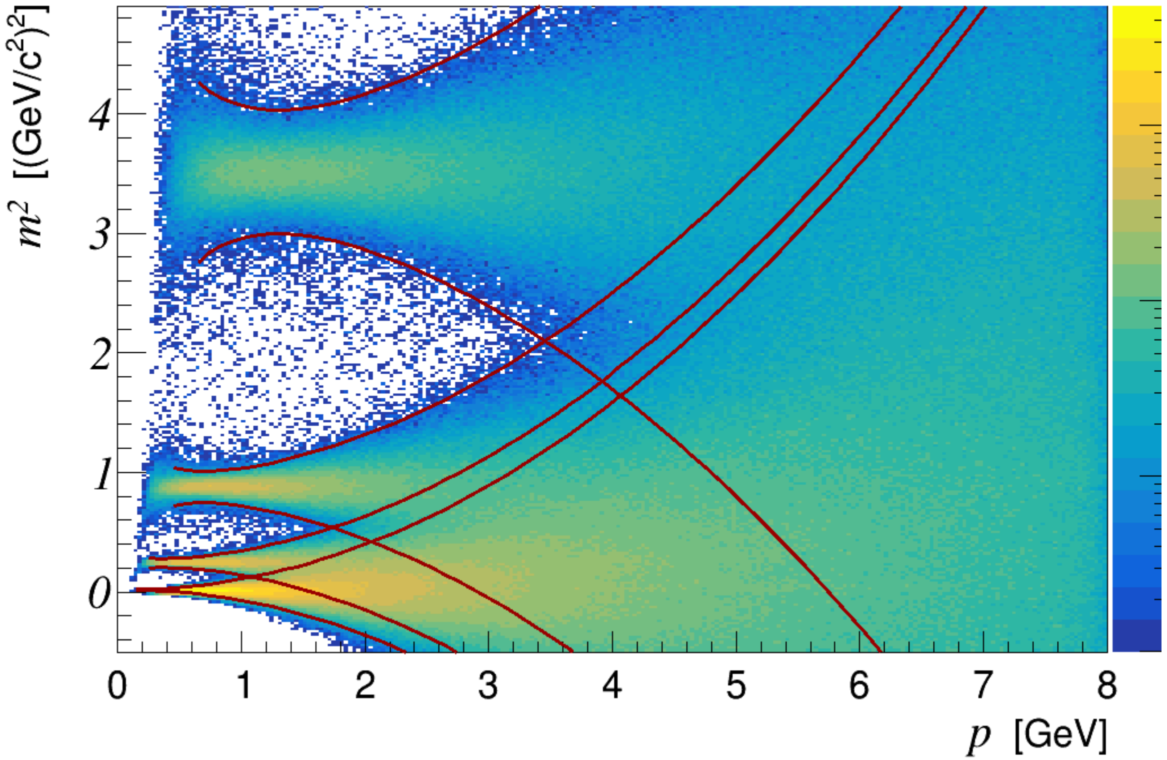


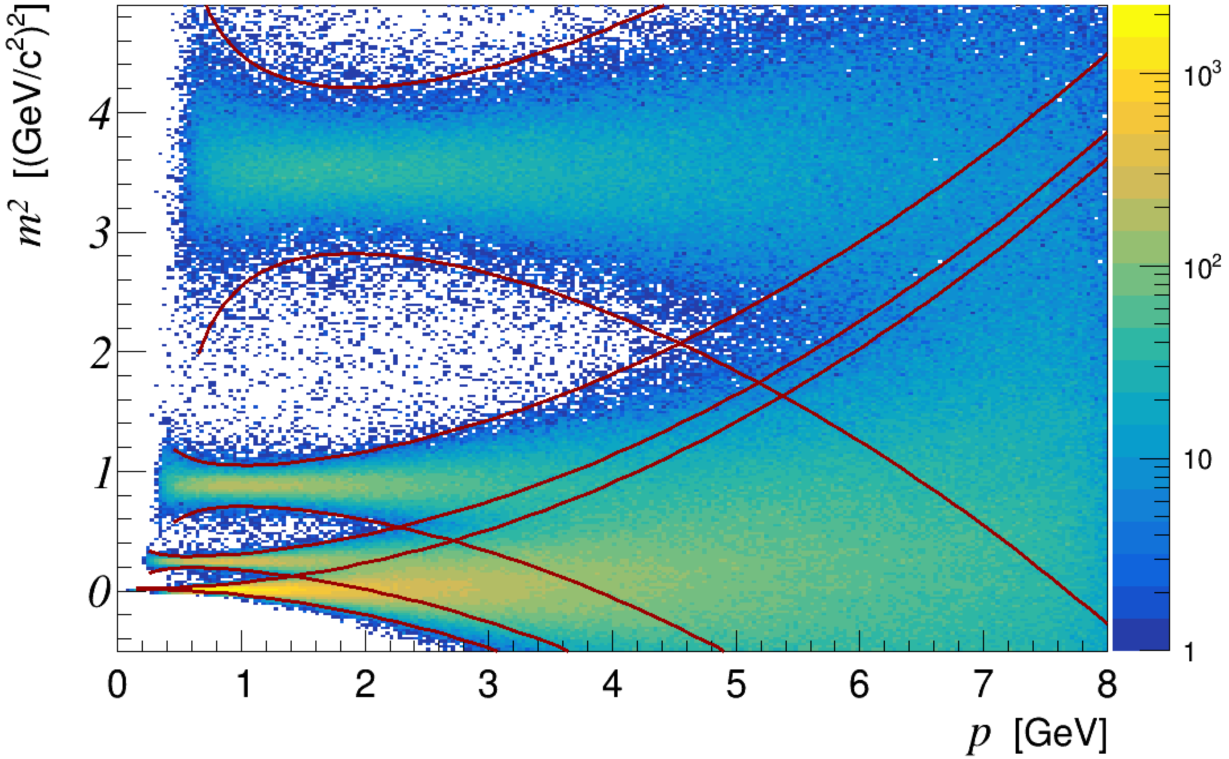
m^2 vs p

Barrel

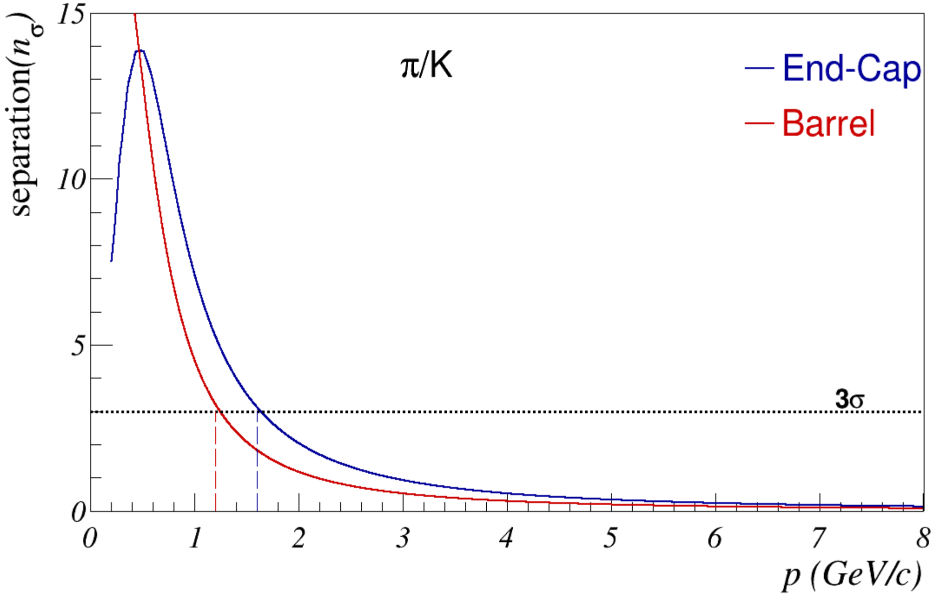
End-Cap

curves with 3 σ



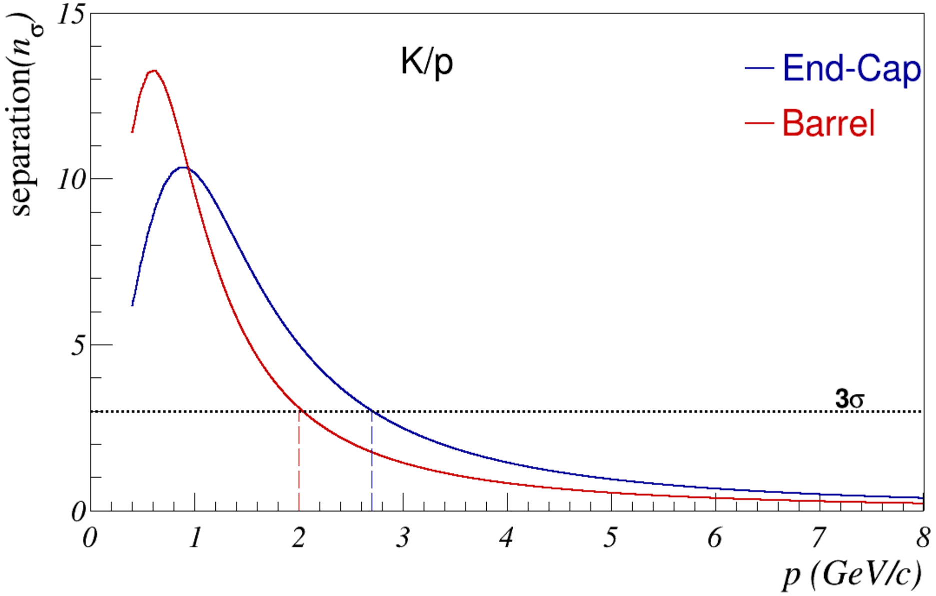


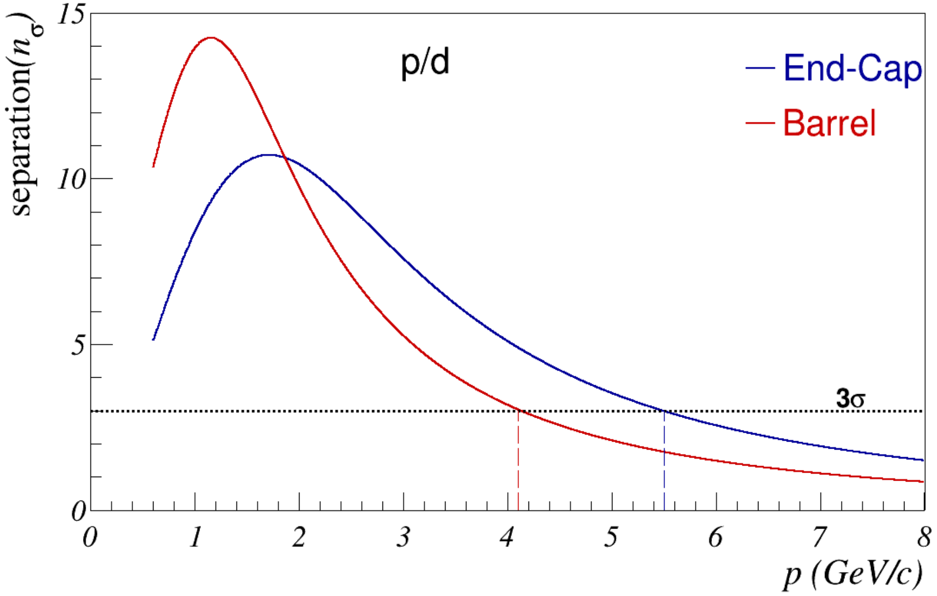
Separation power



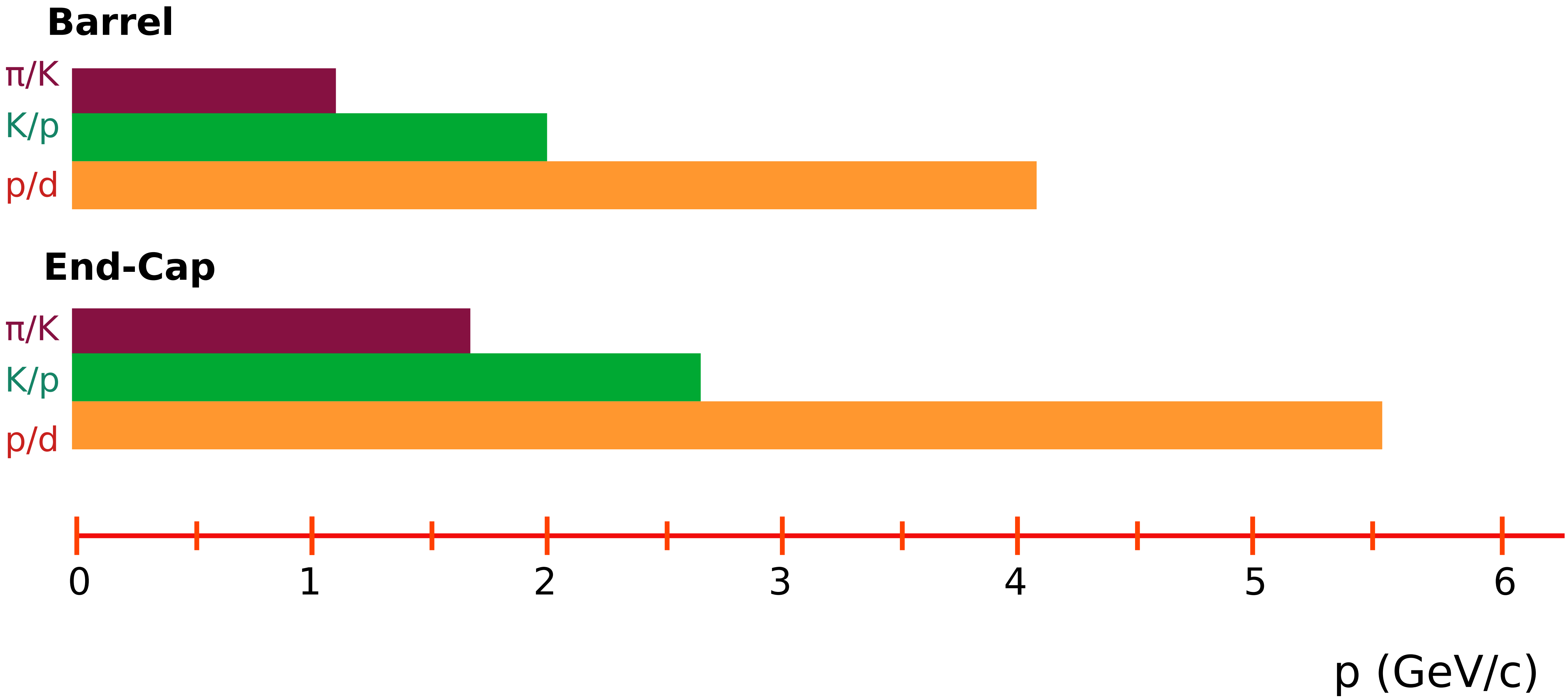
$$n_{sigma}=\frac{\mu_i-\mu_j}{\sqrt{\sigma_i^2+\sigma_j^2}}$$

$$i=\pi,K,p;j=K,p,d$$

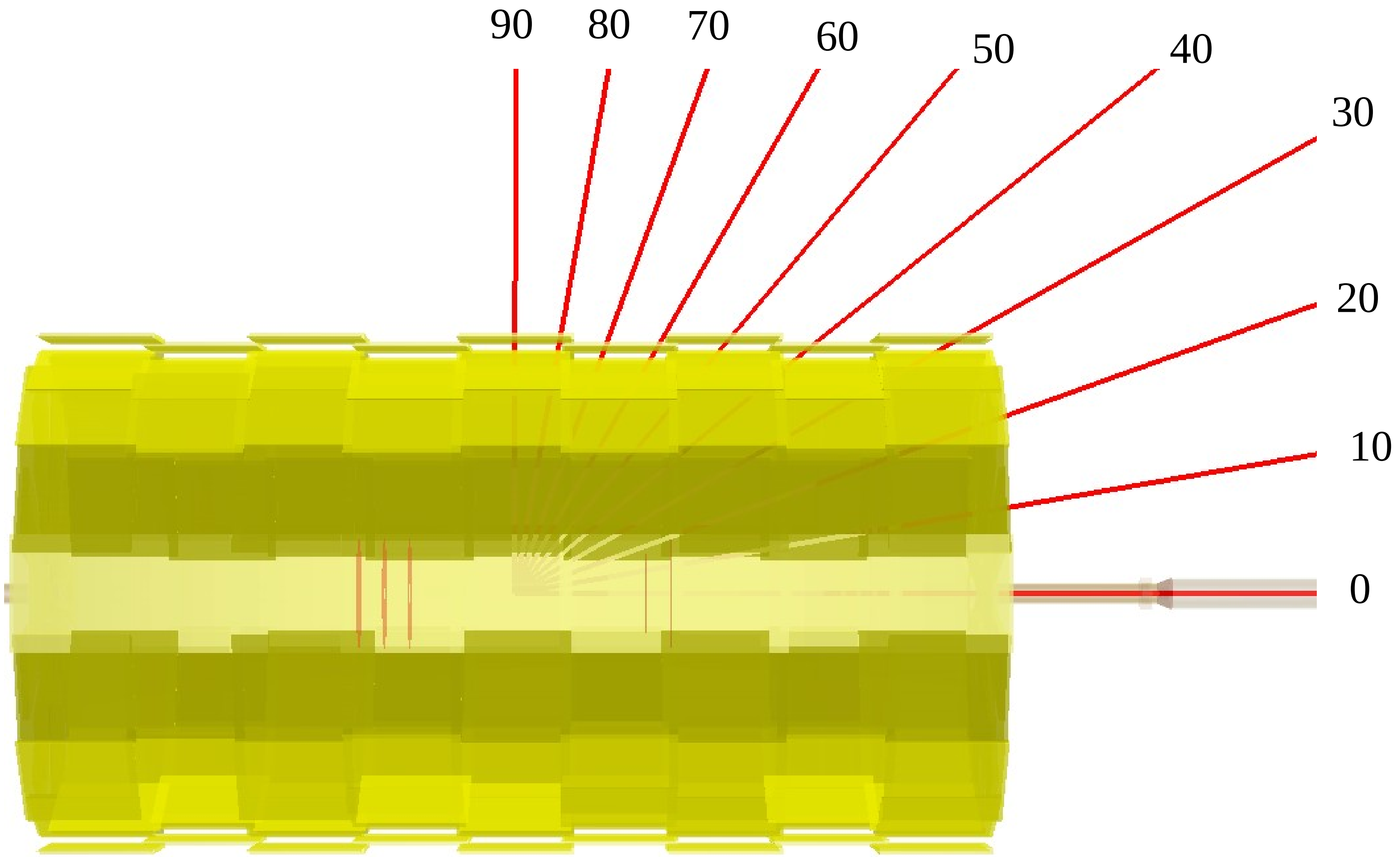




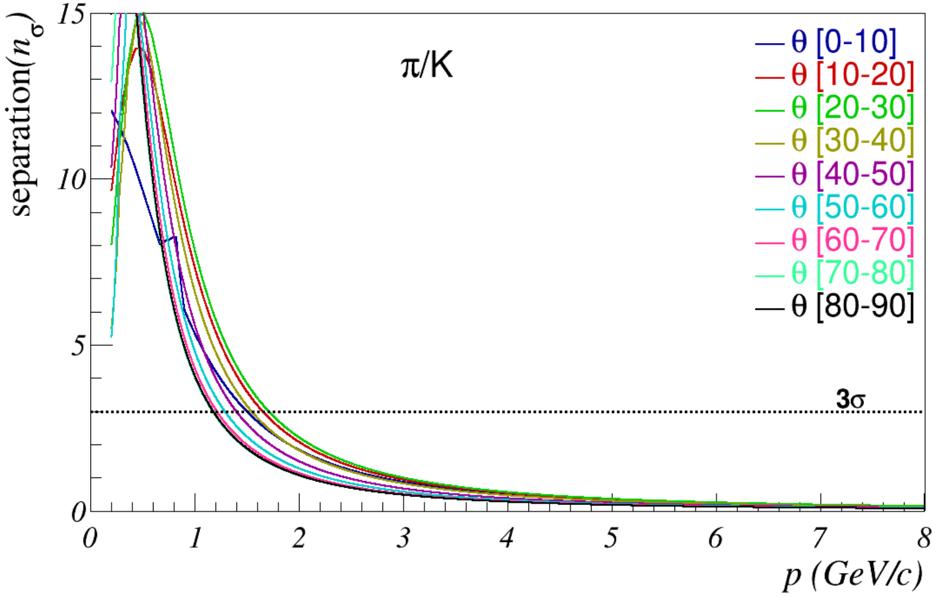
PID in SPD with TOF (3 sigma)

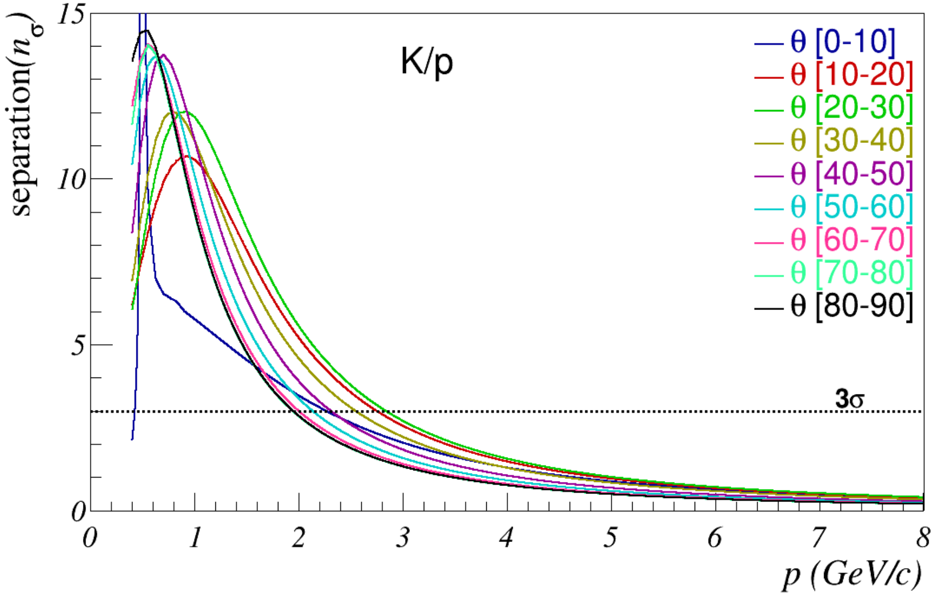


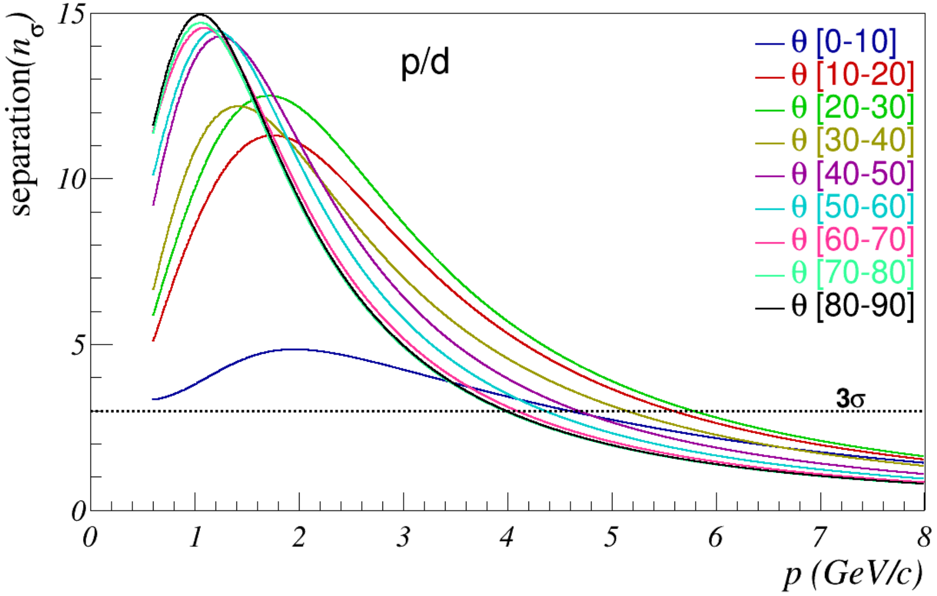
Theta bins



Separation power in theta bins







Conclusion

- Investigation of PID system is ongoing.

  1) Deuteron was added

  2) Uncertainty on the track length was included to PID TOF study.

$n_{sigma}=3$	p_{max}(pion/kaon), GeV	p_{max}(kaon/proton), GeV	p_{max}(deuteron/proton),GeV
Barrel	1.2	2.0	4.1
End-Cap	1.6	2.7	5.5