

# **TRD PID study using cosmic muons**

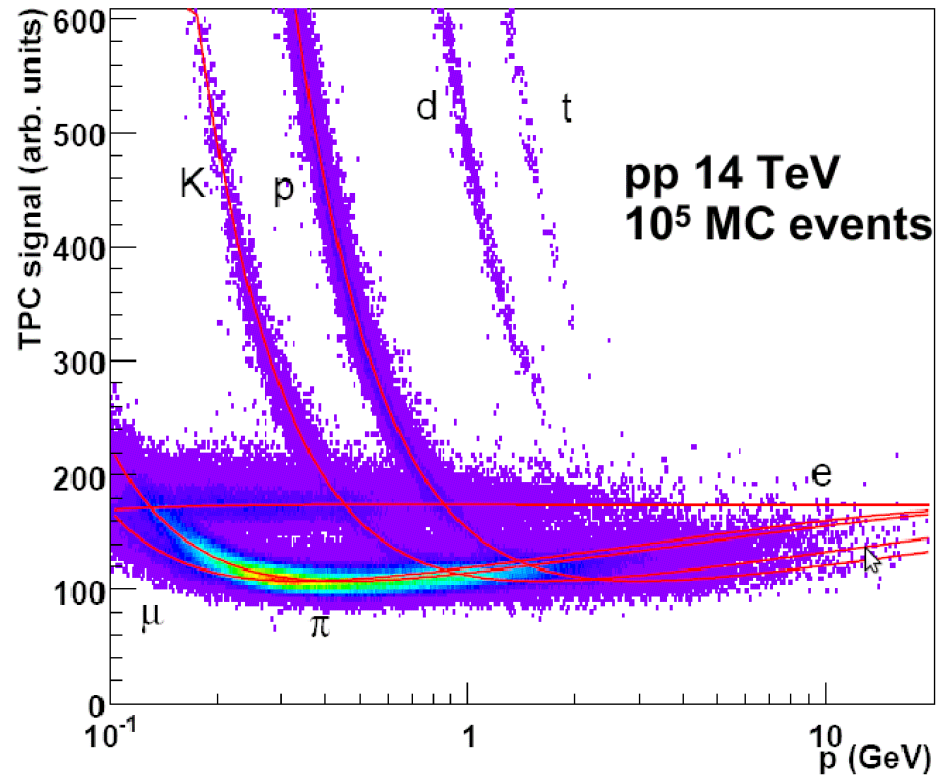
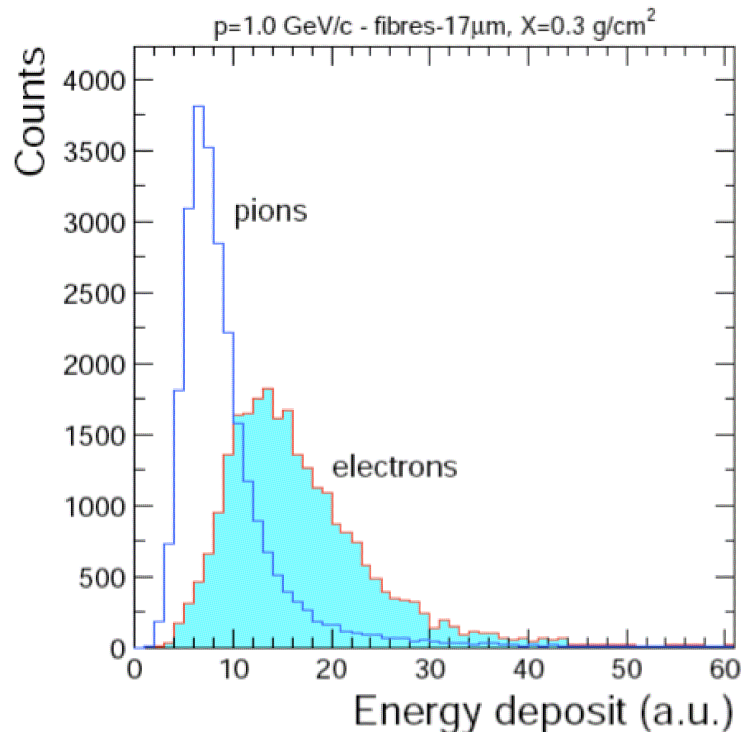
TRD meeting  
08.03.10

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MinJung Kweon

# Motivation

- **Chief goal of TRD:**  
Electron identification for momenta in excess of 1 GeV where pion rejection by TPC energy loss is not sufficient
- **Our goal:**  
Pion PID reference distribution based on cosmic data and comparison with test beam data

Integrated energy deposit for pions and electrons (test beam data; TRD TDR)



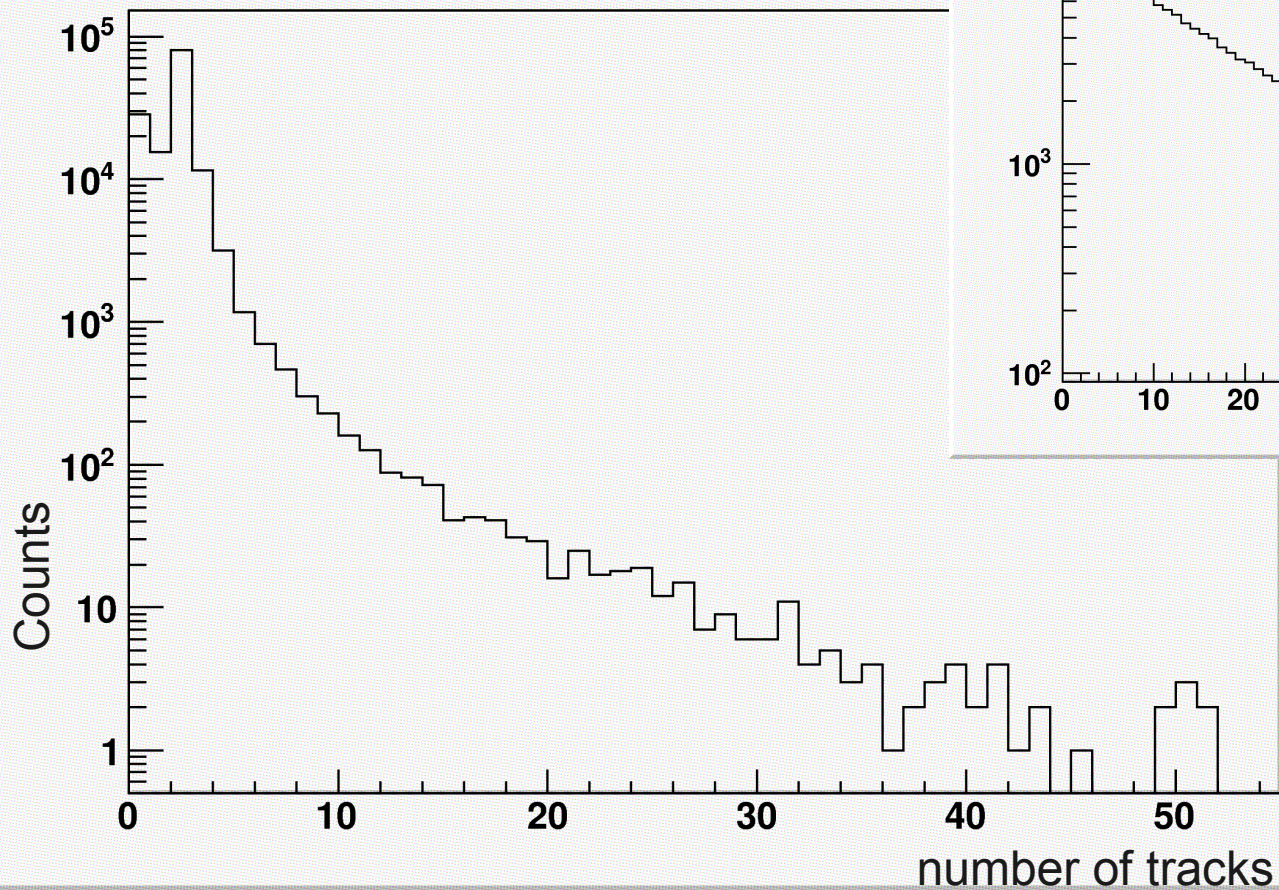
# Selected runs

- Xe,CO<sub>2</sub>(15%) runs
- Reconstruction done at GSI; data located at  
/lustre/alice/local/alice/data/2009/LHC09c/0000{run number}/  
ESDs/trd/pass1/
- Run numbers: 95741, 96287, 97873, 98371, 99031, 99152, 99248
- Total number of events: 142571

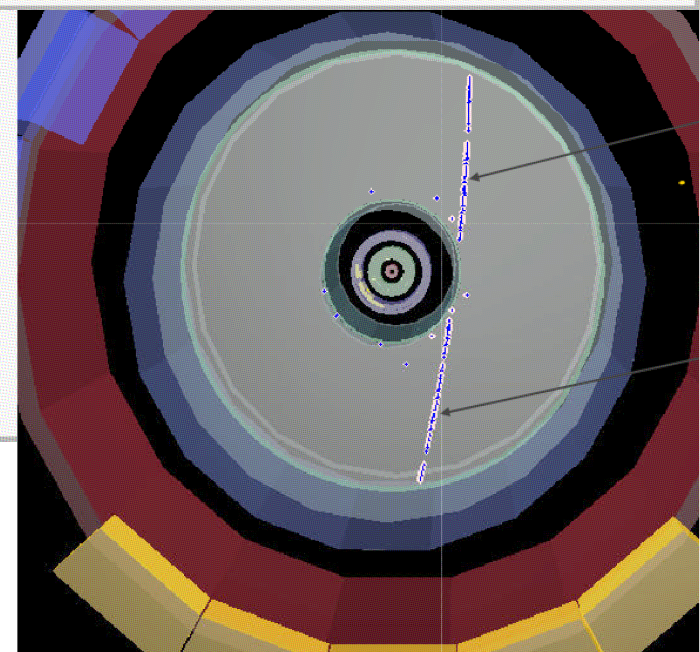
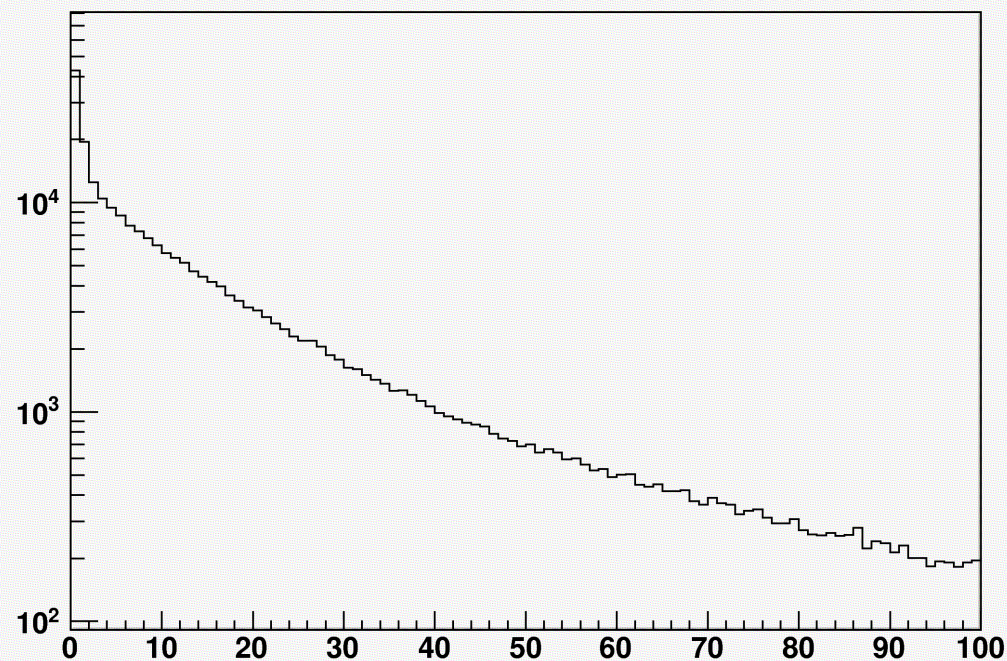


# TPC track qualities

number of tracks with TPCclusters>0



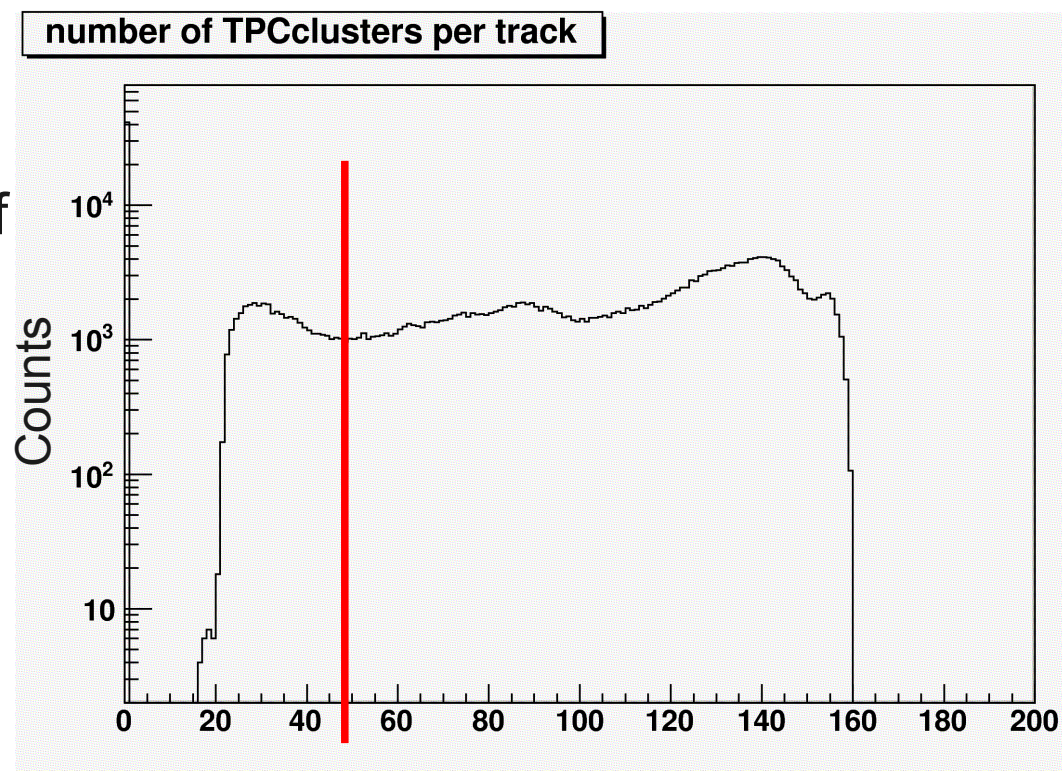
p of tracks





# TPC and TRD cuts

- To get rid of shower events:  
Remove events with number of tracks  $> 4$  (multiplicity cut)
- Recommended cuts on number of TPC clusters per track and TPCchi<sup>2</sup>/clusters
- For TRD: Tracks with no TRD clusters removed

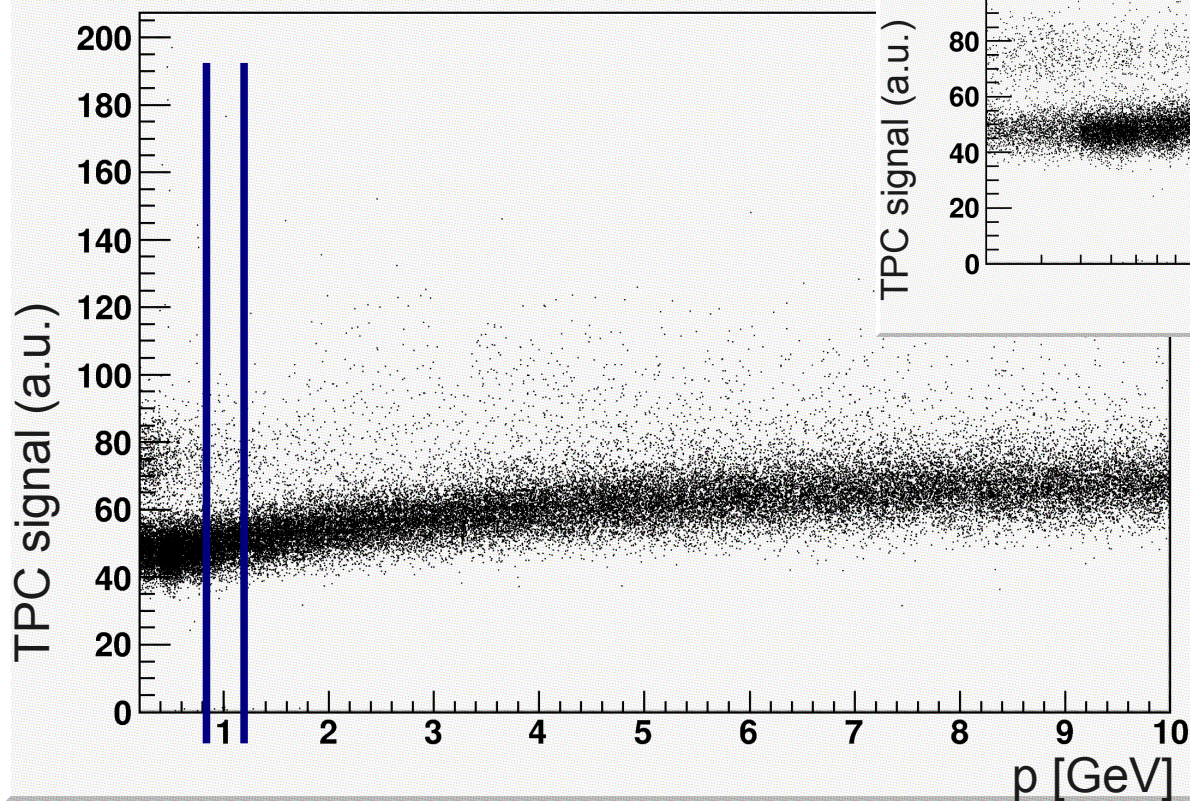




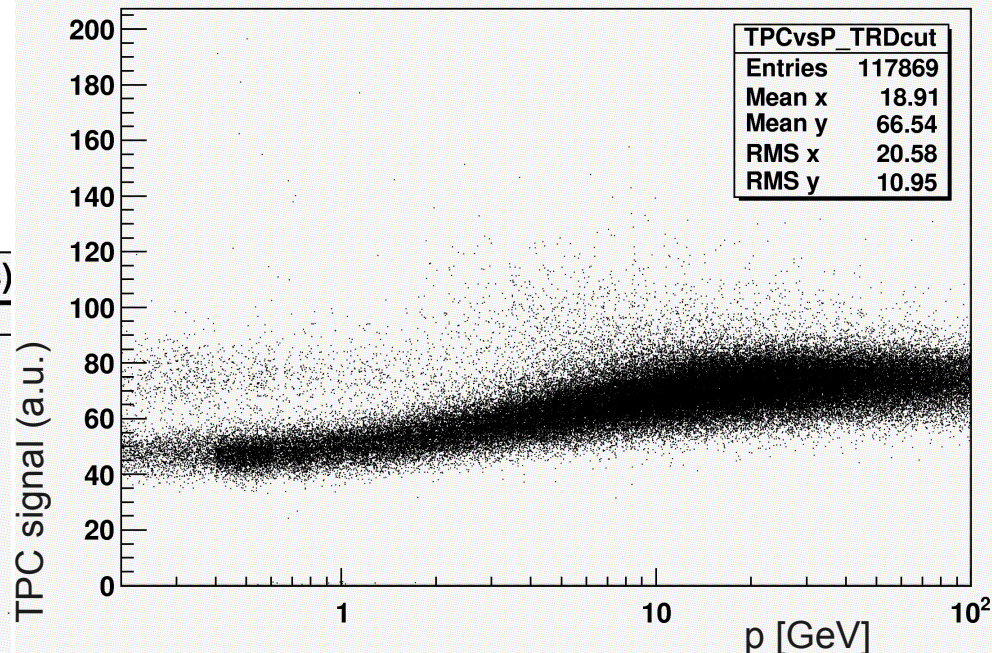
# TPC energy deposit

TPC dE/dx after multiplicity,  
TPC and TRD cuts

TPC signal vs. momentum (after TPC and TRD cuts)



TPC signal vs. momentum (after TPC and TRD cuts)

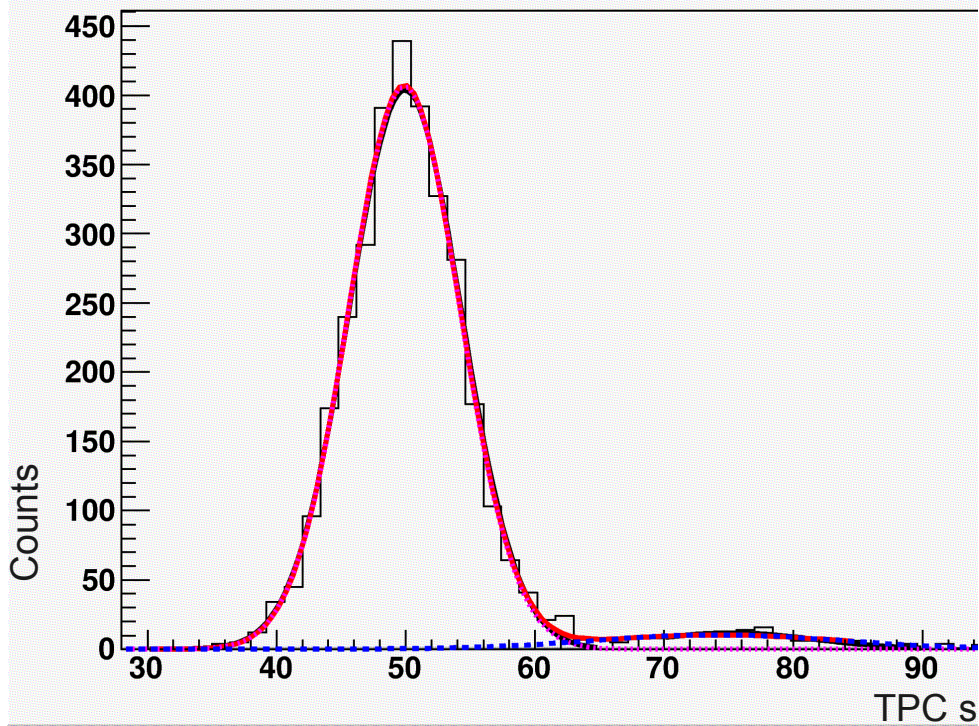


Still electron contamination  
=> dE/dx cuts  
=> Projection of dE/dx  
values for given  
momentum range

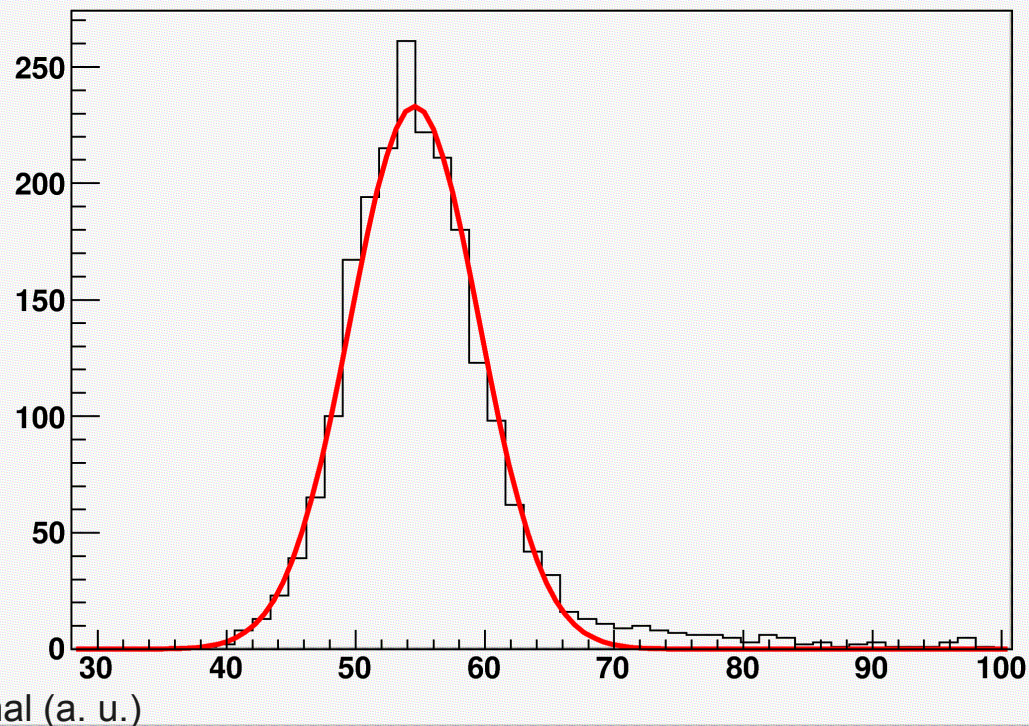


# TPC Projections and dE/dx cuts

TPC dE/dx for  $0.8\text{GeV} < p < 1.2\text{GeV}$



TPC dE/dx for  $1.8\text{GeV} < p < 2.2\text{GeV}$



## dE/dx cuts:

for lowest p and  $p = 1 \text{ GeV}$ : 
$$\frac{dE_{\text{mean muon}}}{dx} - 3\sigma_{\text{muon}} < \frac{dE_{\text{mean muon}}}{dx} < \frac{dE_{\text{mean elec}}}{dx} - 2\sigma_{\text{elec}}$$

for  $p = 1.5$  and  $2 - 10 \text{ GeV}$ : 
$$\frac{dE_{\text{mean muon}}}{dx} - 3\sigma_{\text{muon}} < \frac{dE_{\text{mean muon}}}{dx} < \frac{dE_{\text{mean muon}}}{dx} + 1\sigma_{\text{muon}}$$

# Calculation of TRD $dE/dx$

Two steps:

1. Method `cookdEdx` in `AliTRDseedV1`

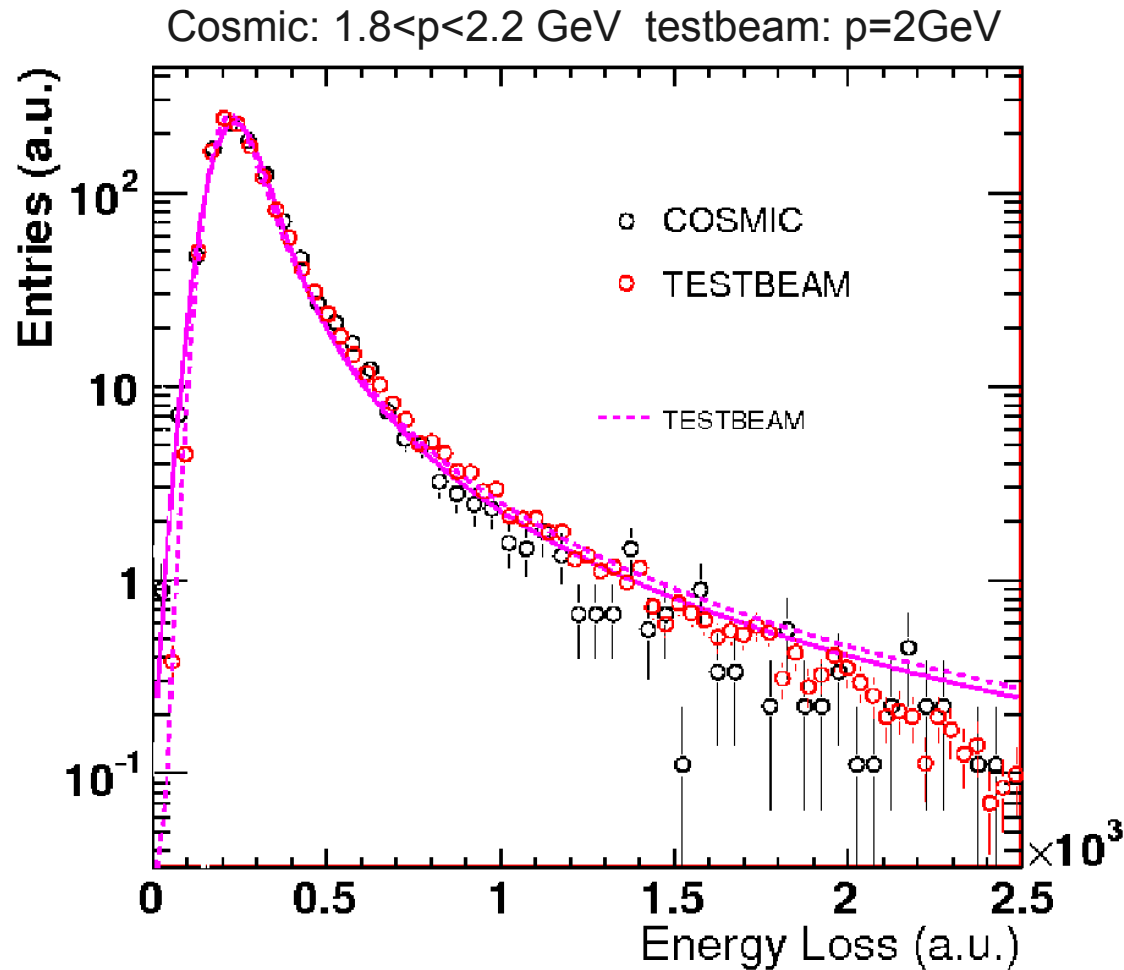
$$\frac{dE_j}{dx} = \sum_{i = \frac{nTimebins}{nSlices} \times j}^{i = \frac{nTimebins}{nSlices} \times (j+1)} \frac{dQ_i}{dl} \times \frac{1}{nClusters}$$

2. Method `PlotdEdx` in `AliTRDcheckPID`

$$\frac{dE}{dx} = \frac{\sum_{j=0}^{j=nSlices} \frac{dE_j}{dx}}{nSlices}$$



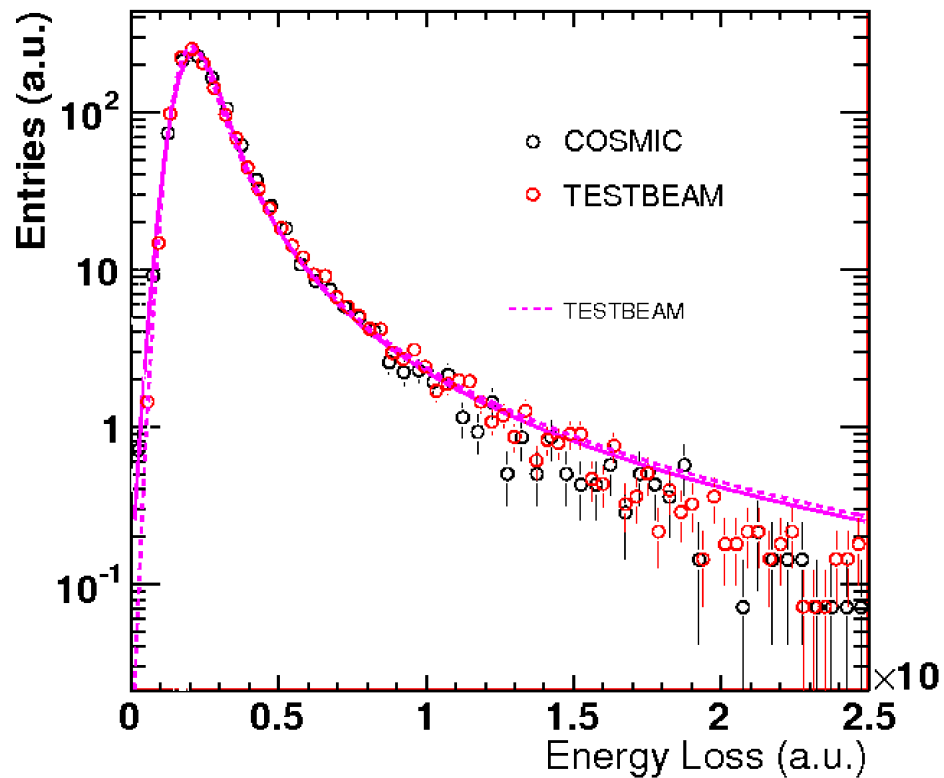
# Cosmic and testbeam TRD $dE/dx$



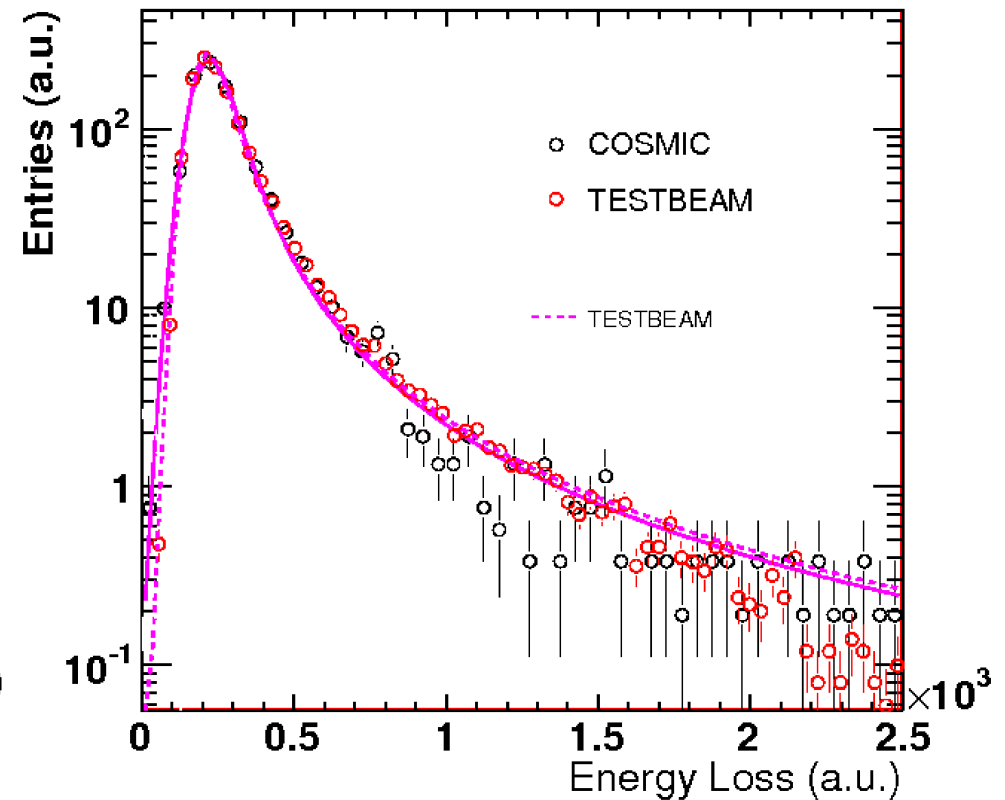
- Fit: Landau convoluted with Gaussian
- Scaling is done based on MPVs for 2 GeV

# Comparison cosmic and testbeam data

Cosmic:  $0.8 < p < 1.2$  GeV testbeam:  $p = 1$  GeV

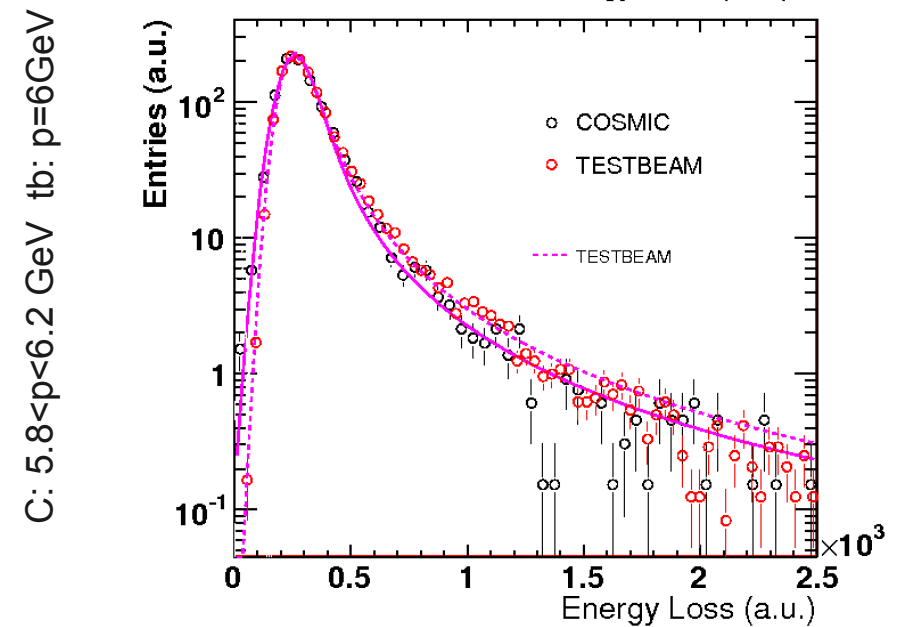
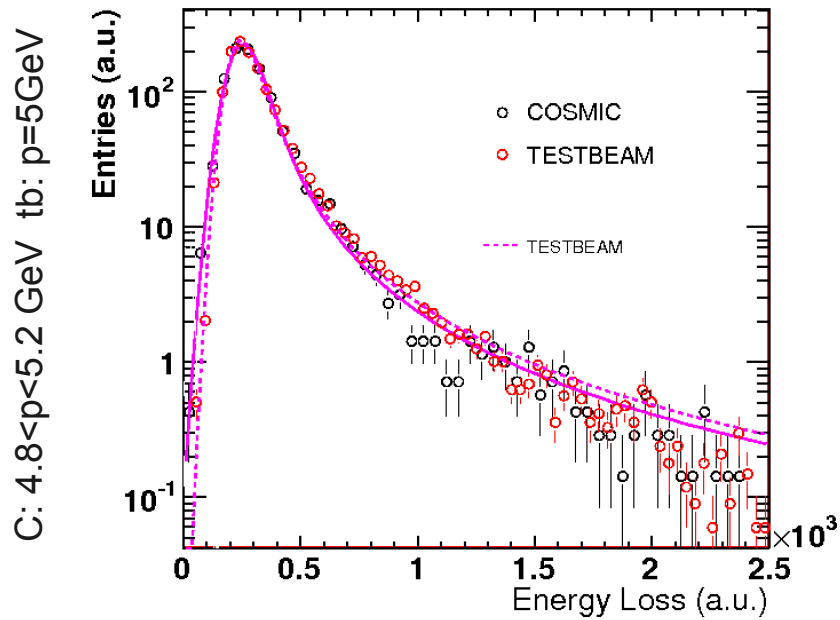
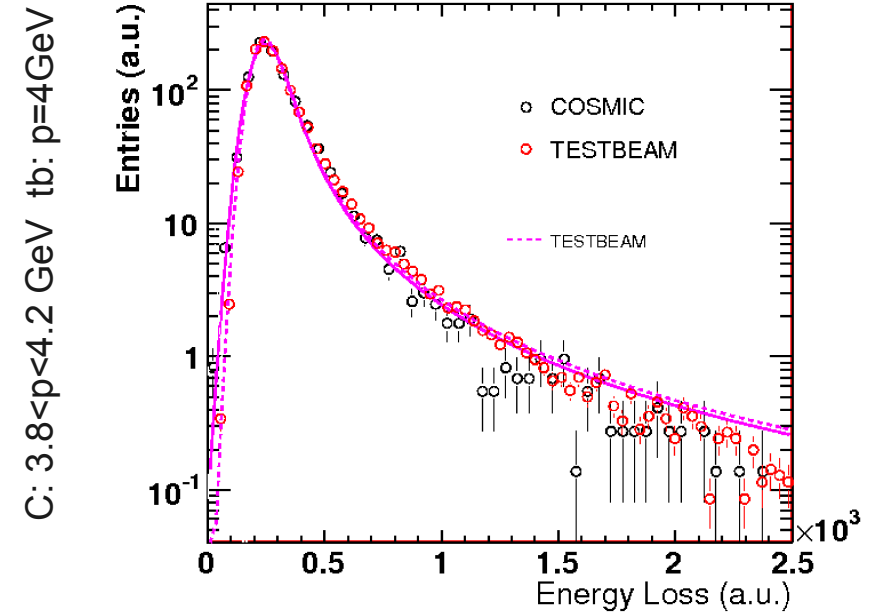
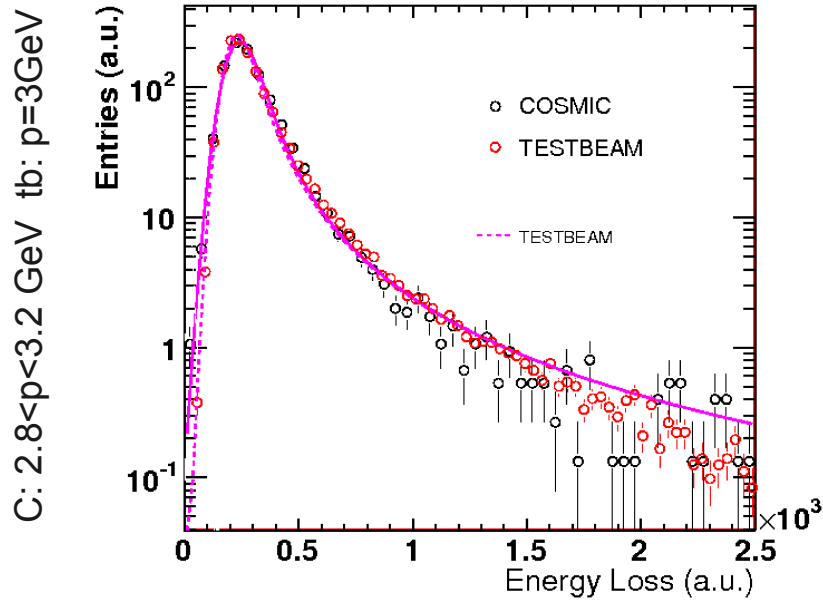


Cosmic:  $1.4 < p < 1.6$  GeV testbeam:  $p = 1.5$  GeV

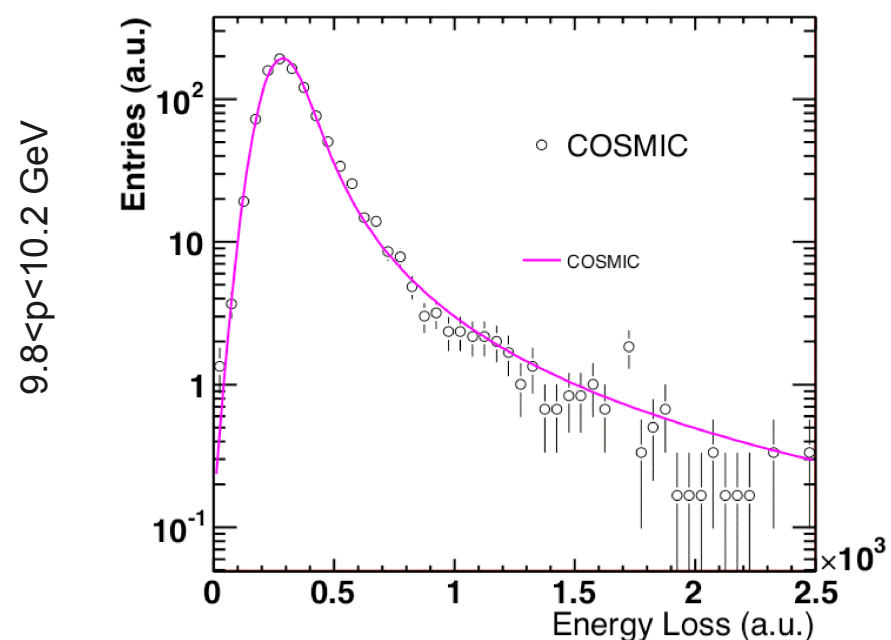
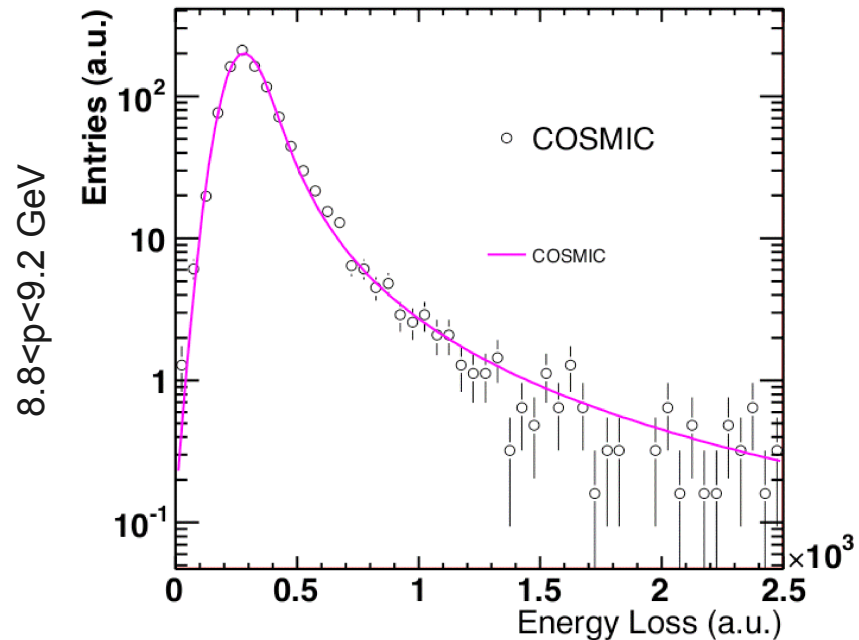
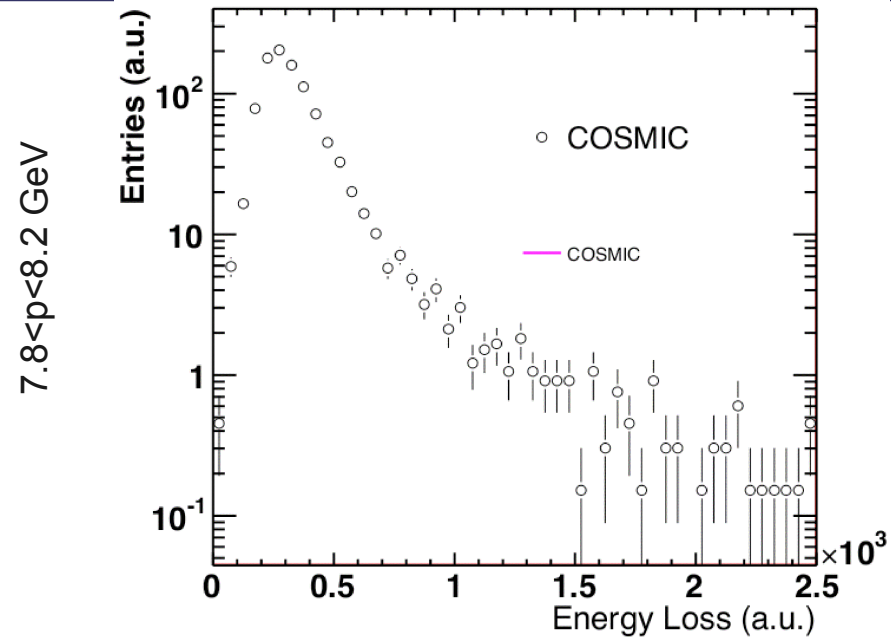
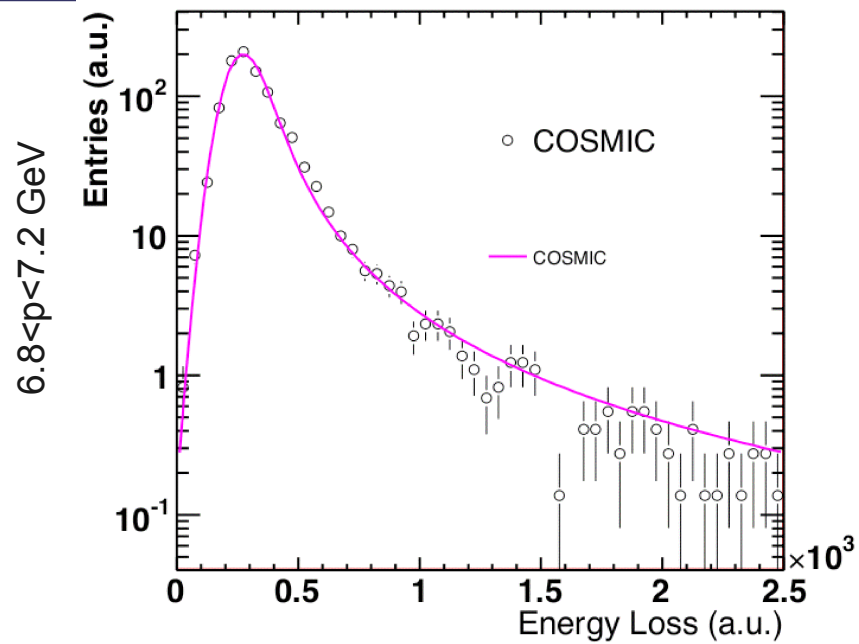




# Comparison cosmic and testbeam data

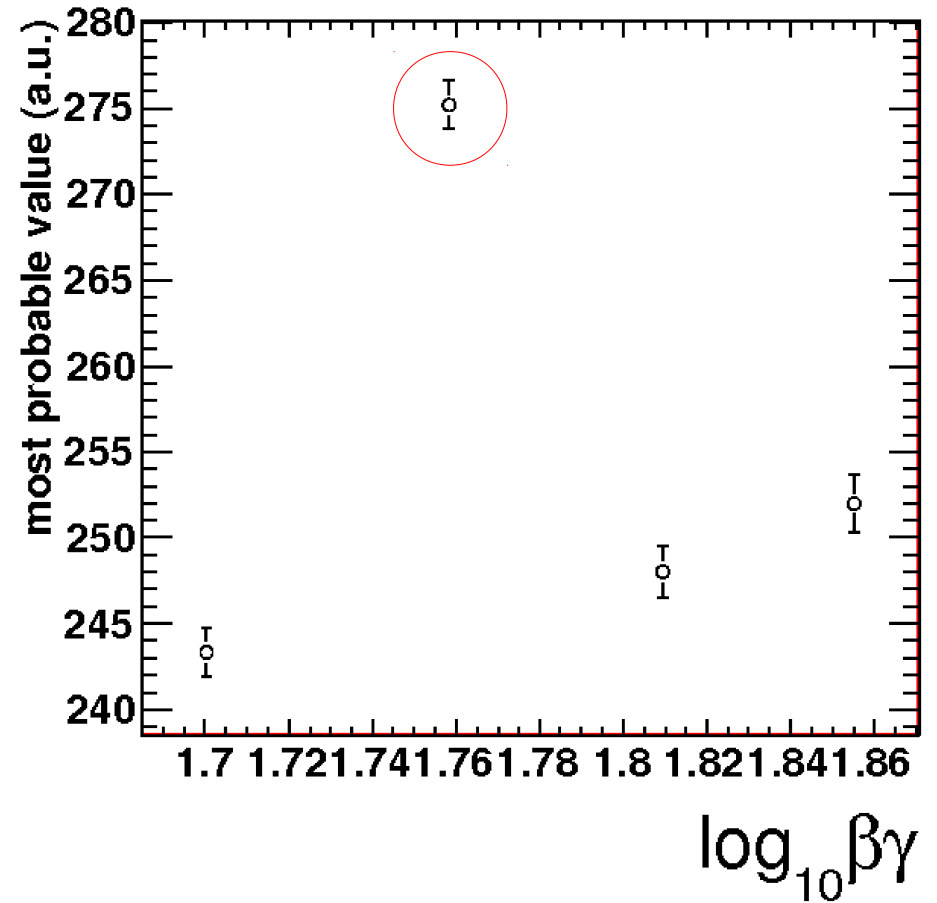
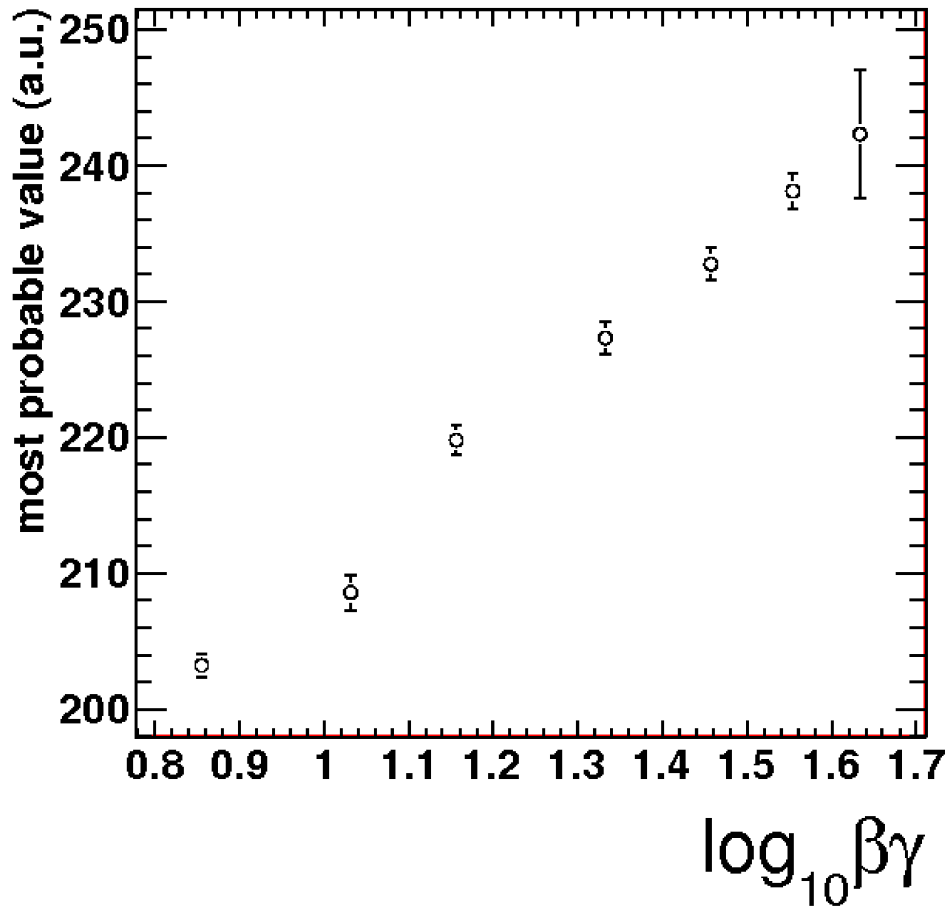


# Cosmic data for 7-10 GeV





# Beta gamma dependence of MPV(1-10 GeV)

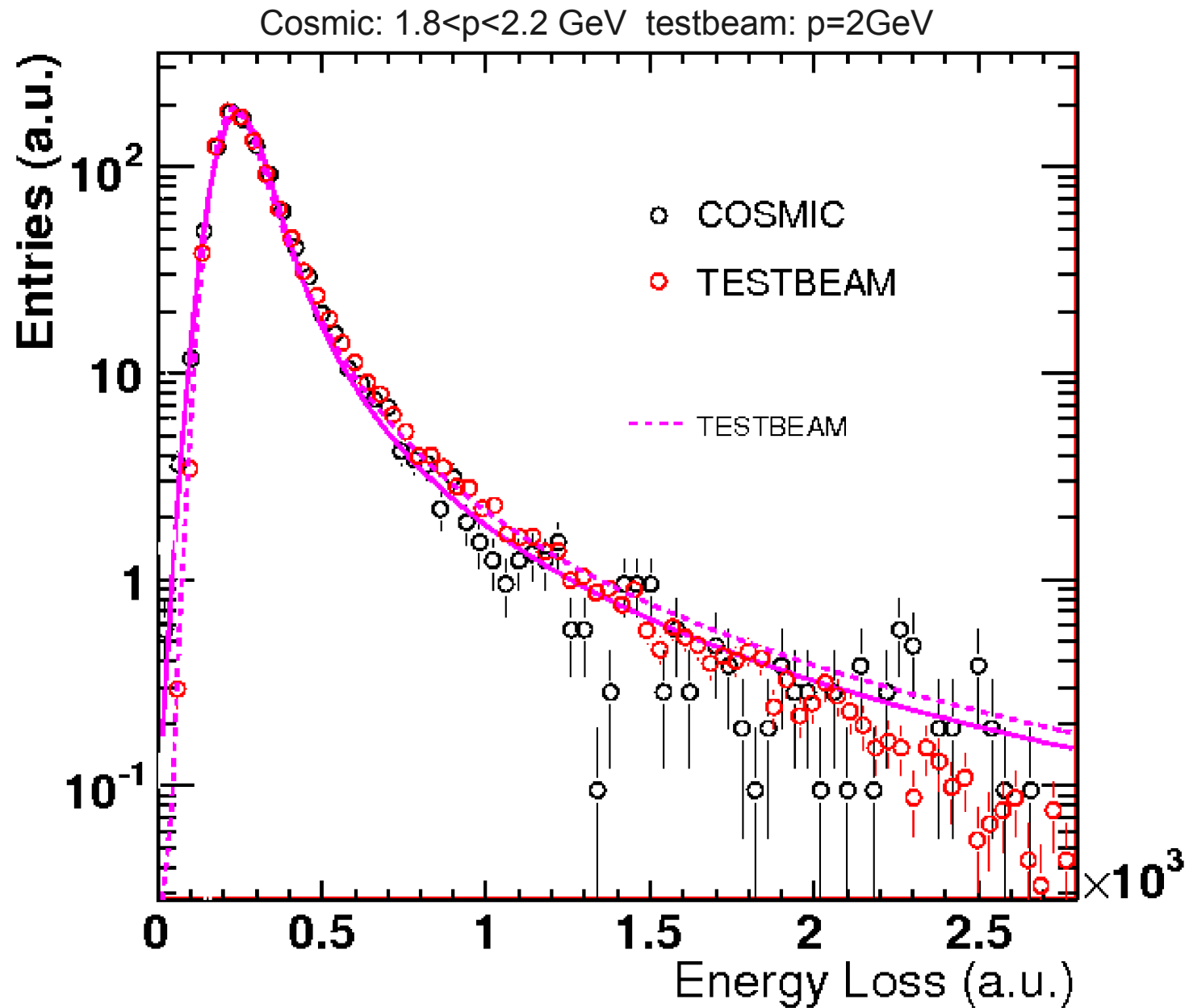


# Recalibrated data

Reconstructed data (cosmic pass 2): TRD has been recalibrated.



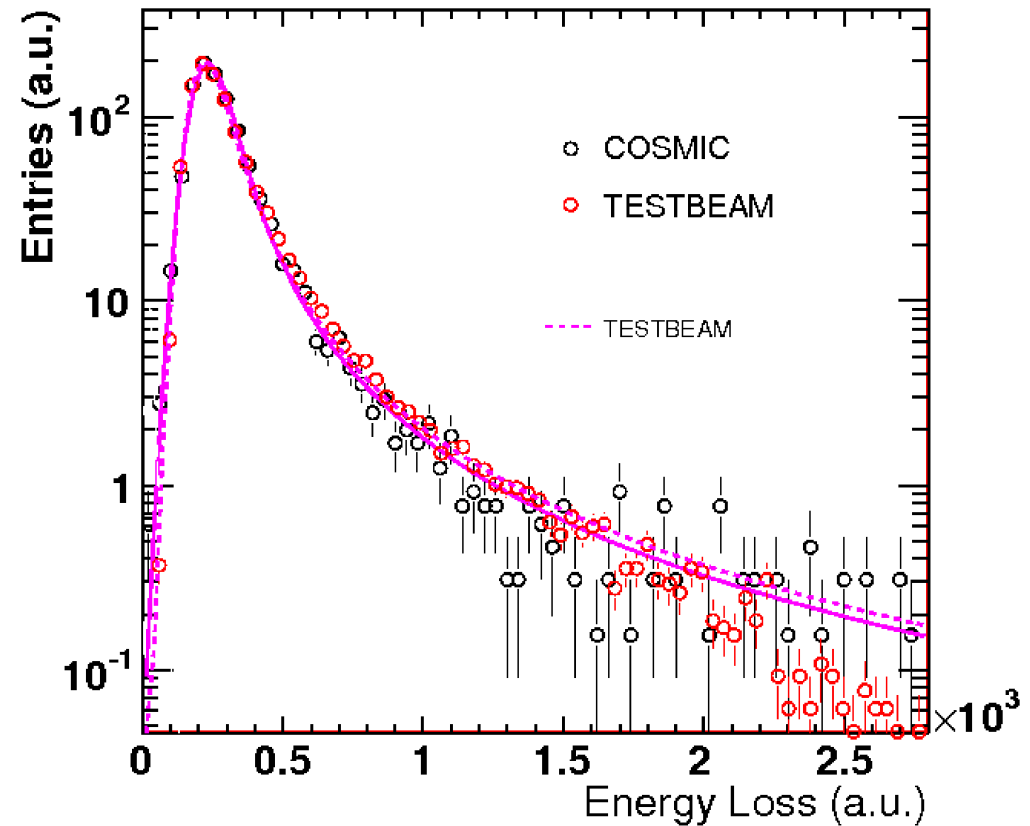
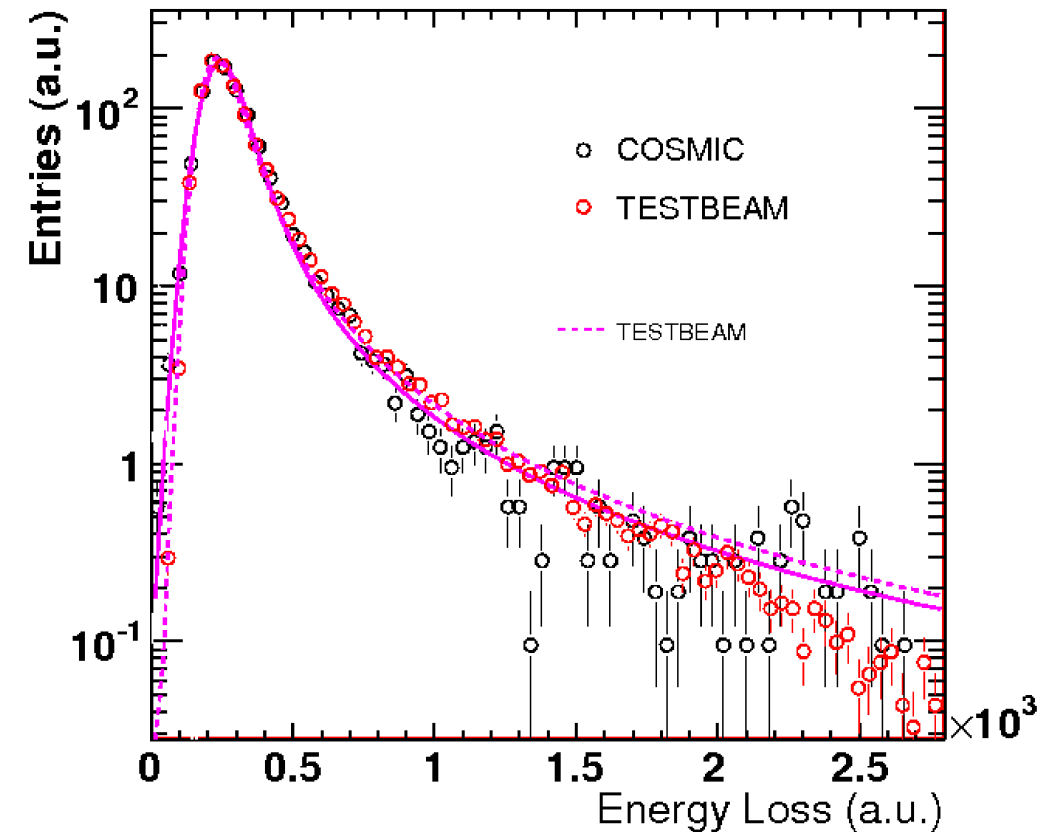
# Cosmic and testbeam TRD $dE/dx$



# Comparison cosmic and testbeam data

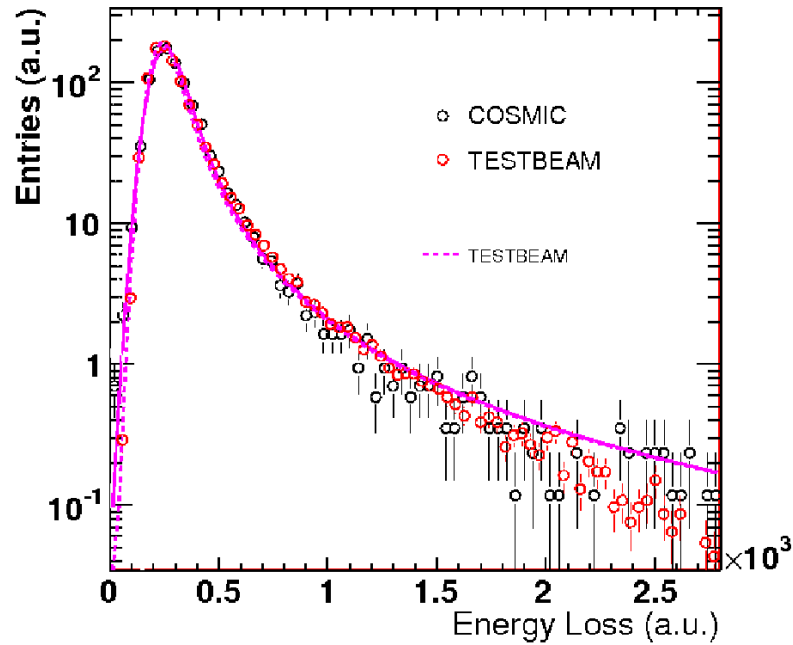
Cosmic:  $0.8 < p < 1.2$  GeV testbeam:  $p = 1$  GeV

Cosmic:  $1.4 < p < 1.6$  GeV testbeam:  $p = 1.5$  GeV

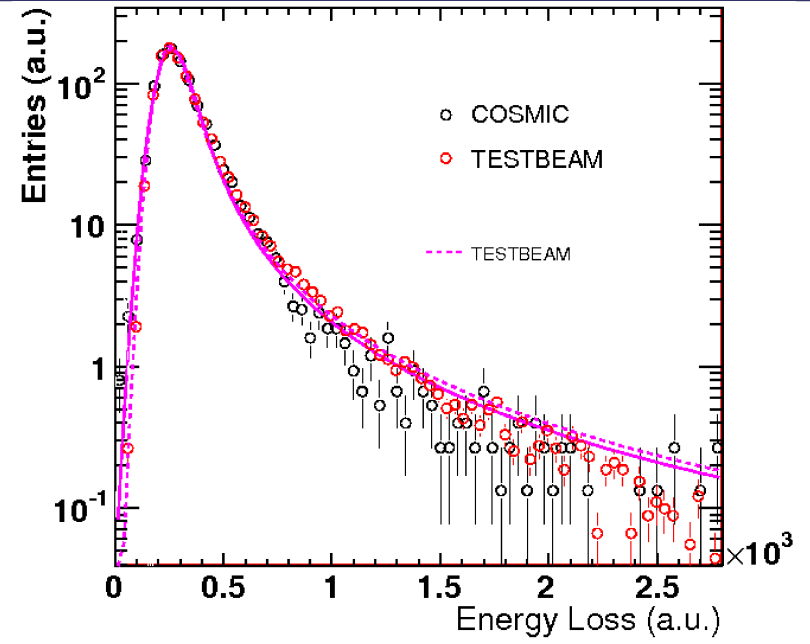


# Comparison cosmic and testbeam data

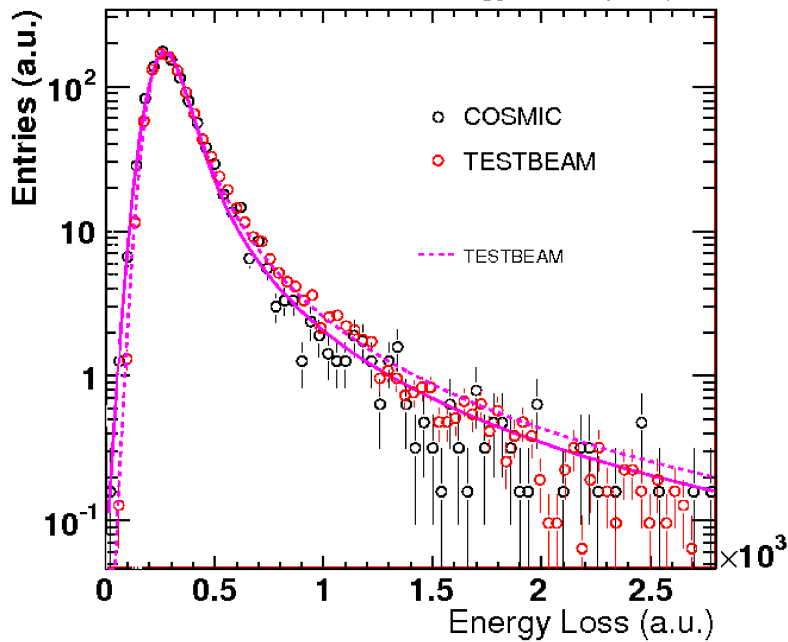
C:  $2.8 < p < 3.2$  GeV tb:  $p = 3$  GeV



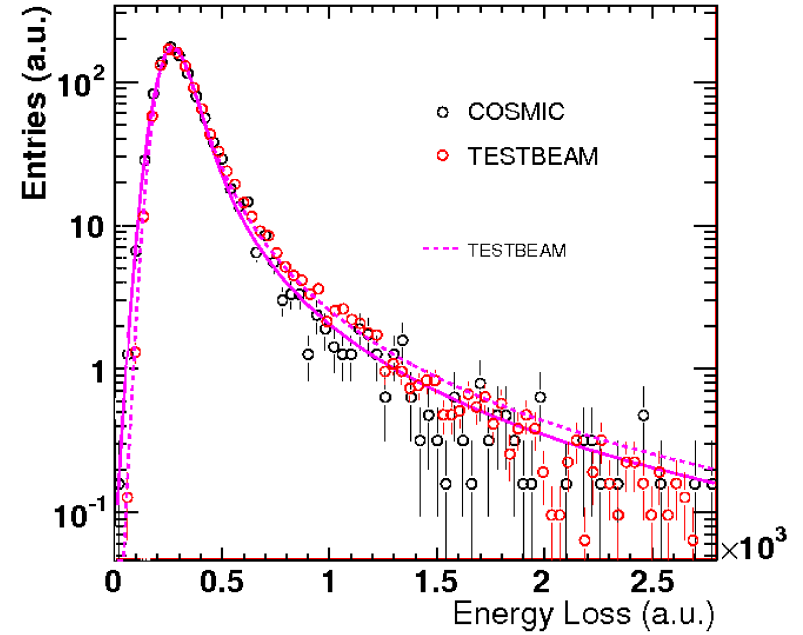
C:  $3.8 < p < 4.2$  GeV tb:  $p = 4$  GeV



C:  $4.8 < p < 5.2$  GeV tb:  $p = 5$  GeV

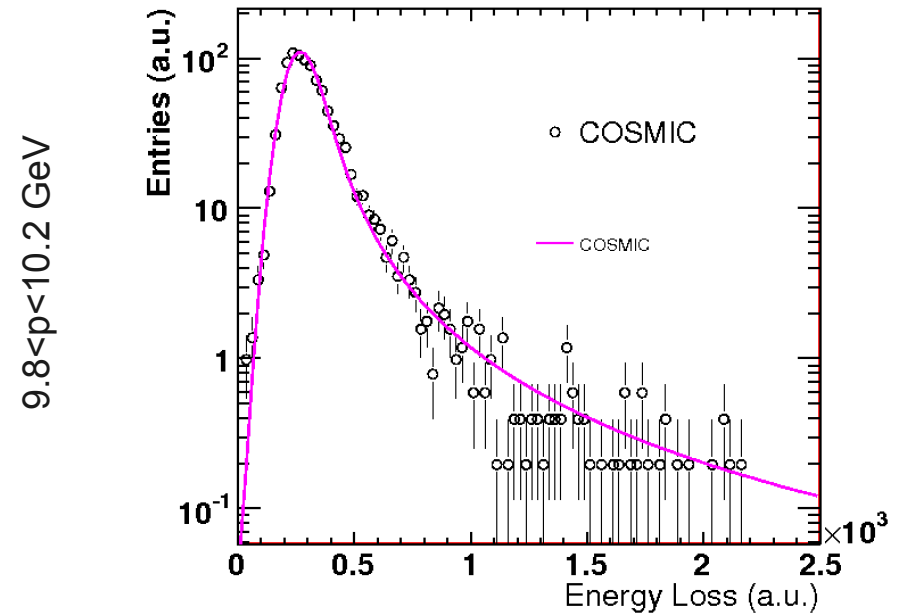
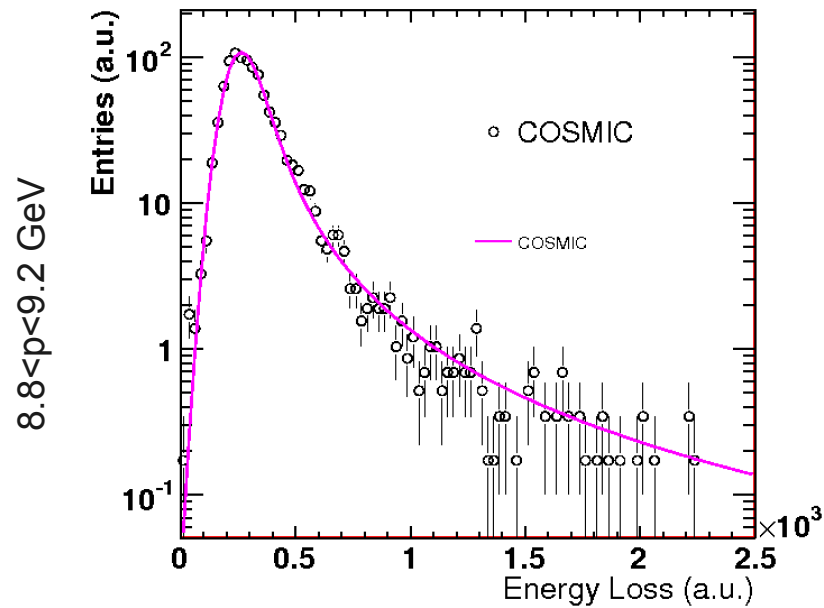
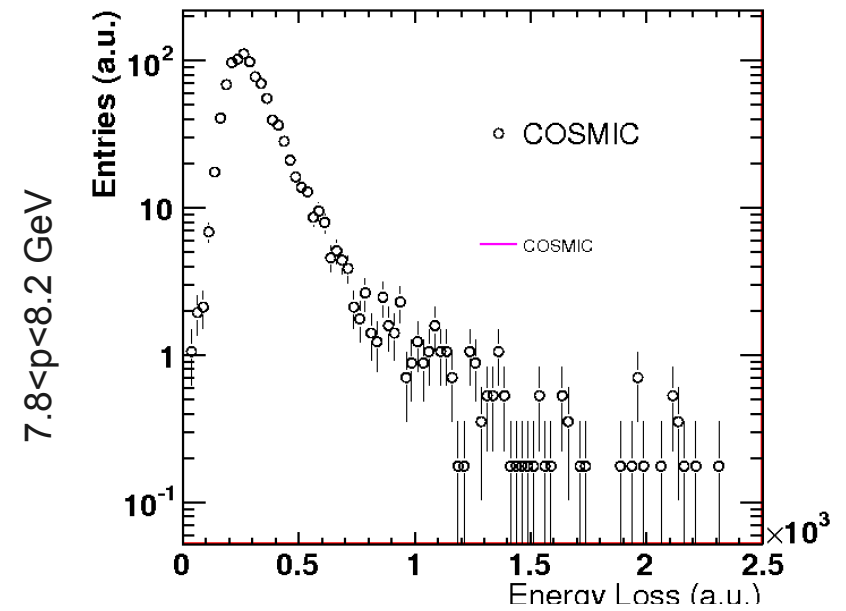
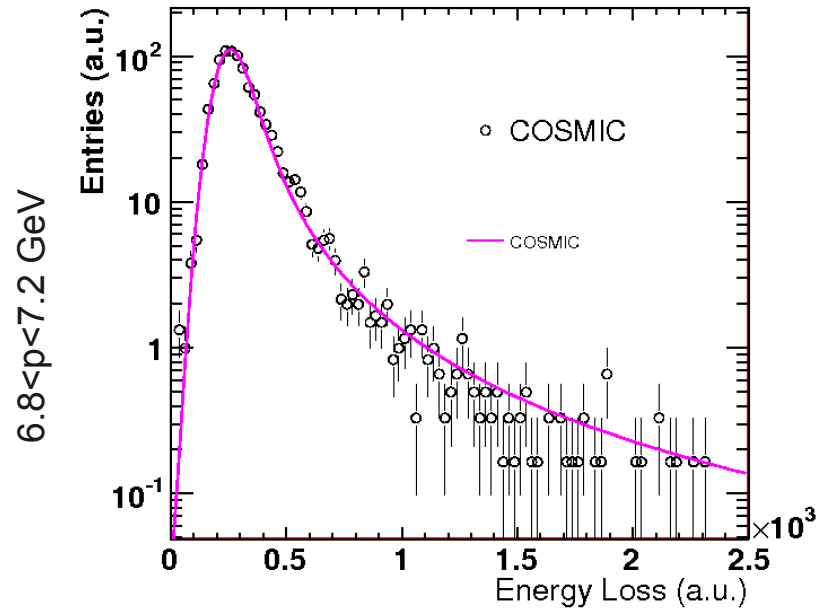


C:  $5.8 < p < 6.2$  GeV tb:  $p = 6$  GeV



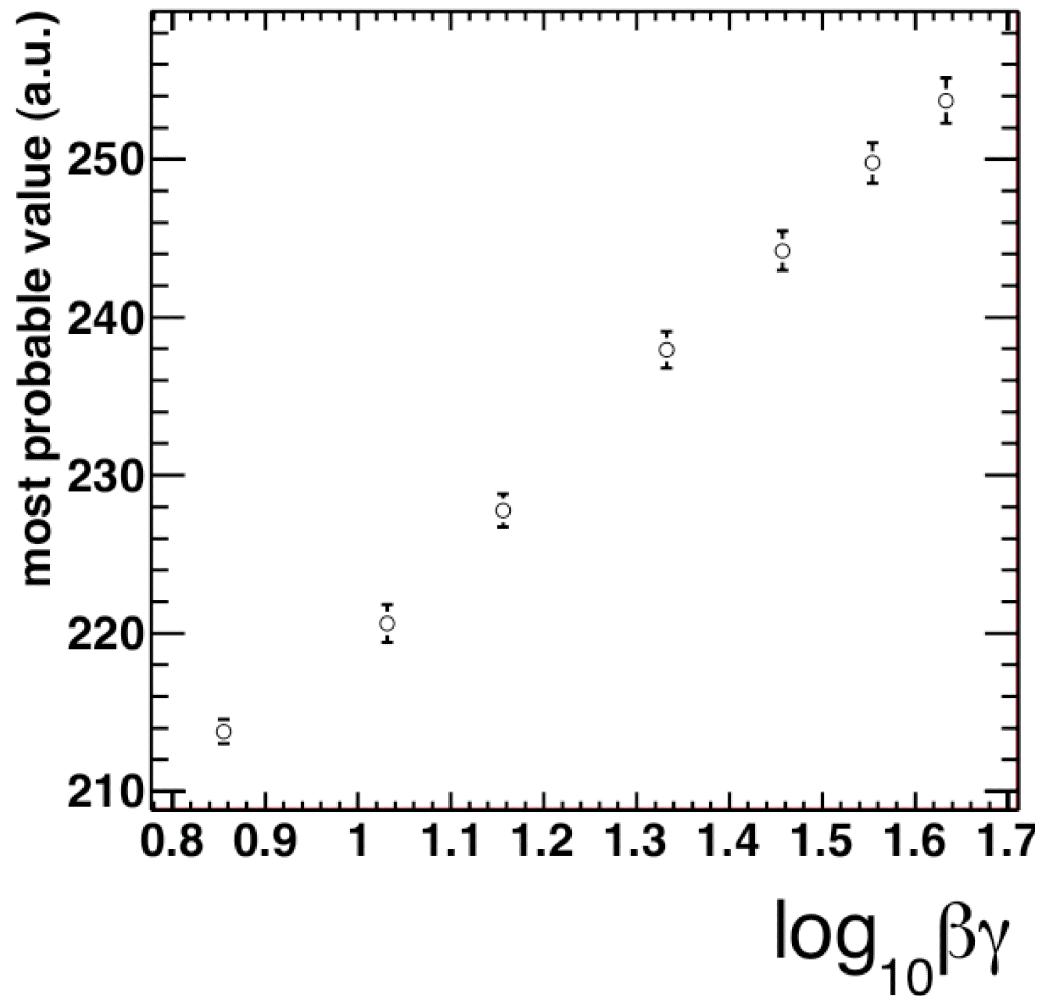


# Cosmic data for 7-10 GeV

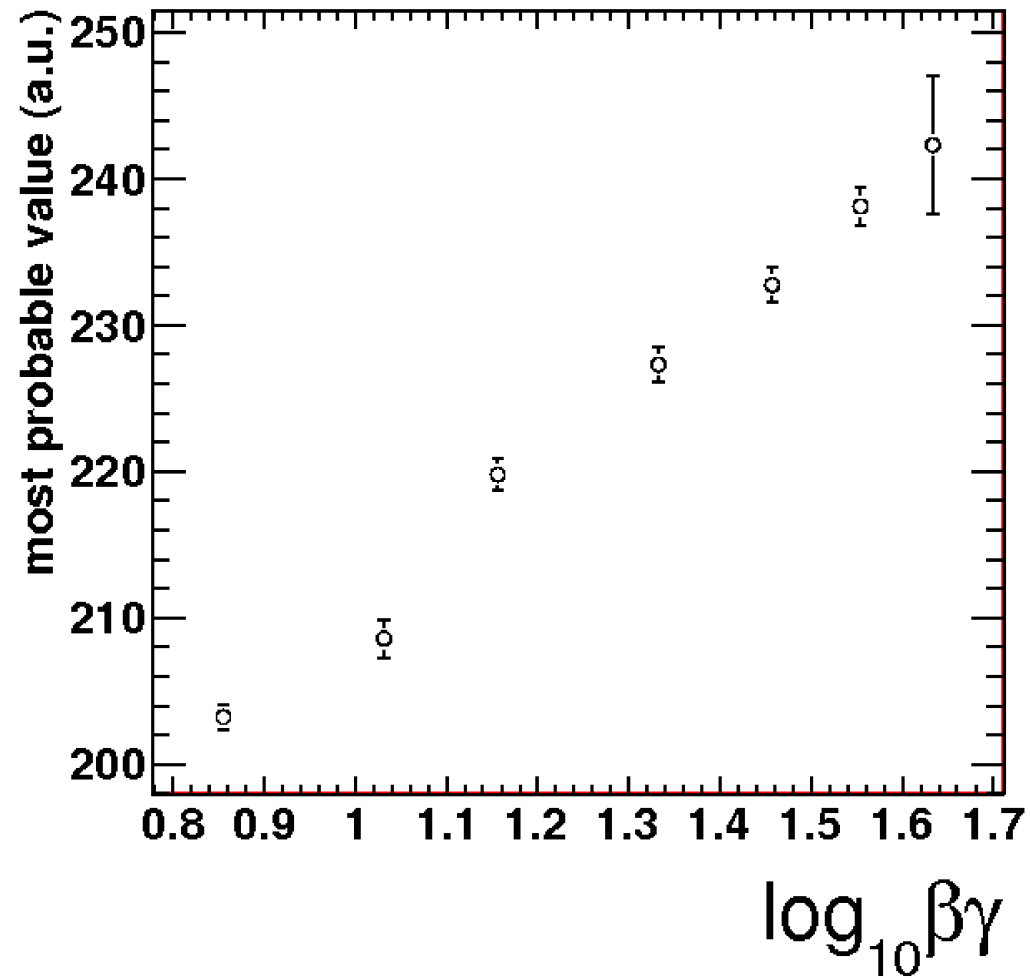


# Beta gamma dependence of MPV (1-6 GeV)

Recalibrated data (cosmic pass 2)



Old data (cosmic pass 1)



=> correlation looks much smoother for recalibrated data  
(no fit and examination of  $\chi^2$  done yet)

# Summary

- Results with cosmic data seems to fit with testbeam data
- It is doable to generate pion reference plot using cosmic muon data
- Although it is hard to tell from the individual  $dE/dx$  plots if the TRD recalibration gives better results, we observe that the  $dE/dx$  MPV vs.  $\log(\beta \cdot \gamma)$  gives a better systematic trend for the new calibration

Next steps: We want to make data points also for intermediate momentum values and extend the investigations to higher momentum ranges.