



# Testbeam August 2010 TRD Analysis



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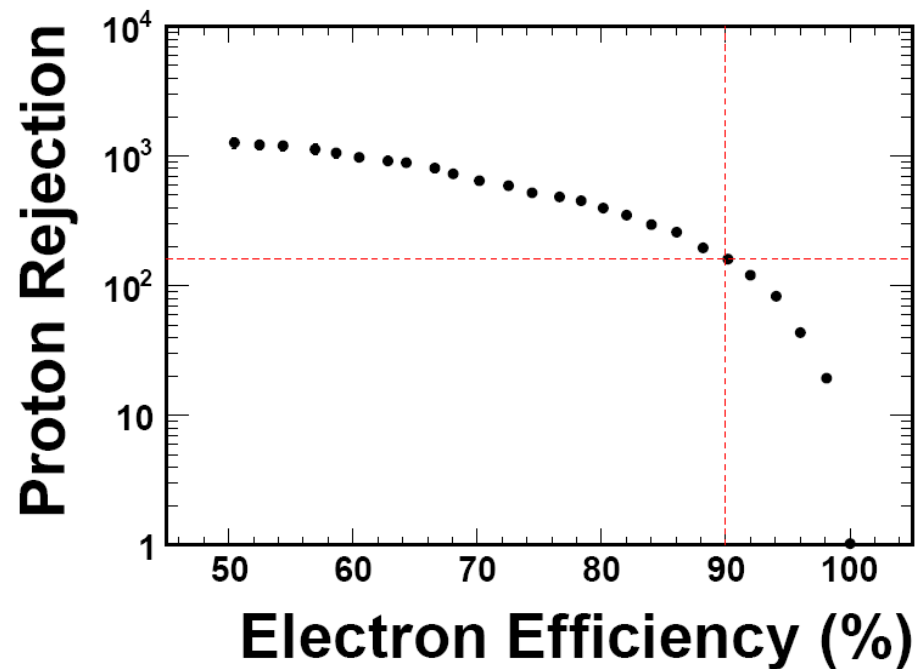
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- Event selection
- Particle identification
  - Electrons/Positrons
  - Pions
- “Rejection” (inverse efficiency)
  - Likelihood



# Proton Results

- 400 GeV Protons have been analyzed for February and August Beam Tests



- Simulate higher Proton energies using Pions from August Test Beam → lower proton rejections expected



# Event Selection

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- Samples:
  - ECAL7 180 GeV Electrons & Positrons
  - ECAL7 60-120 GeV Pions/Protons
- Single track events:
  - Only one TRD track
  - One Tracker track (at least 5 hits on track)
  - One ECal shower
  - Selection Efficiency:  $\sim 10\%$



# TRD Track Selection

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- A good track is defined by:
  - At least 17 layers with energy deposition  $>0.5$  keV
  - At least 2 hits in each layers 0-3 and layers 16-19
  - At least 8 hits in layers 4-15
  - “hits on track” / “total number of hits in trd”  $> 0.5$
- Matching of TRD track to beam settings
- Matching of TRD track to Tracker track
- Selection Efficiency:  $\sim 60\%$



# Particle Identification (Electrons/Positrons)

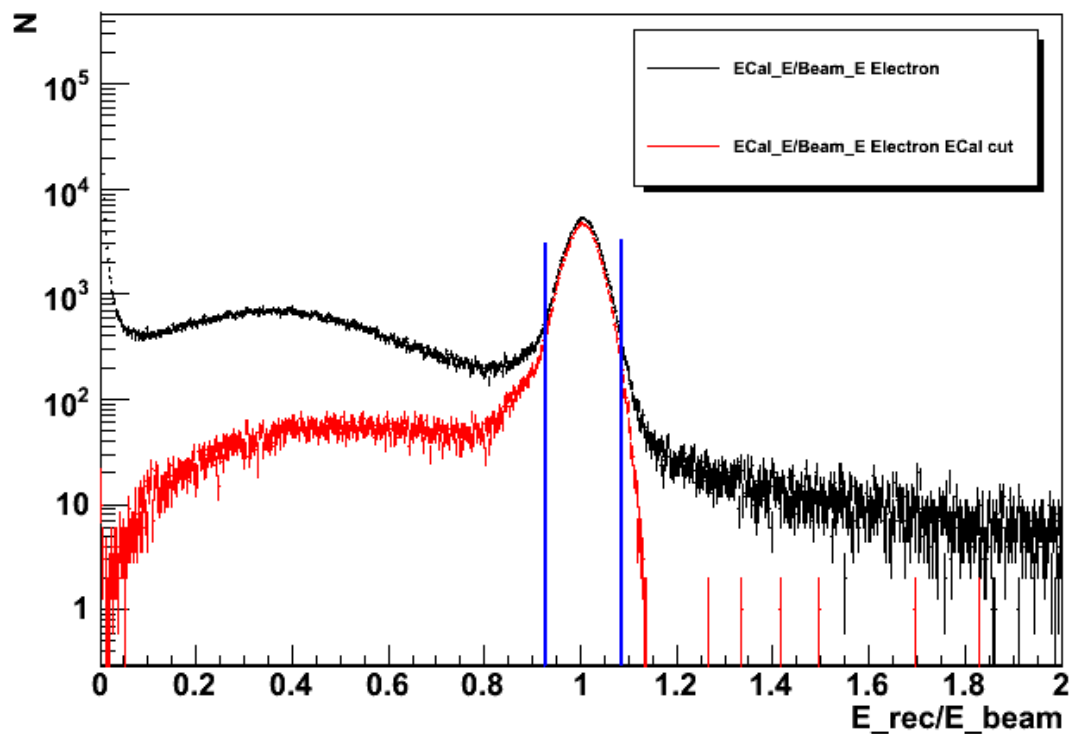
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- ECal shower requirements:
  - Shower maximum between 6 cm and 11cm
  - Energy deposition “2cm range”/ total : 94.5 % - 97.5 %
  - Rear leak between 0.05 and 0.2
  - Chi2 between 0.1 and 2
  - $E_{\text{reconstructed}}/E_{\text{Beam}} - \text{mpv} < 2\sigma$
- External trigger bits:
  - Ext1 ==1 && Ext2 == 1 (signal in both Cerenkov-counters)



# ECAL Selection Efficiency

ECal\_E/Beam\_E Electron



- $MPV = 1.024$  ,  $\sigma = 0.044$
- Selection Efficiency:  $\sim 20\%$



# Particle Identification (Pions)

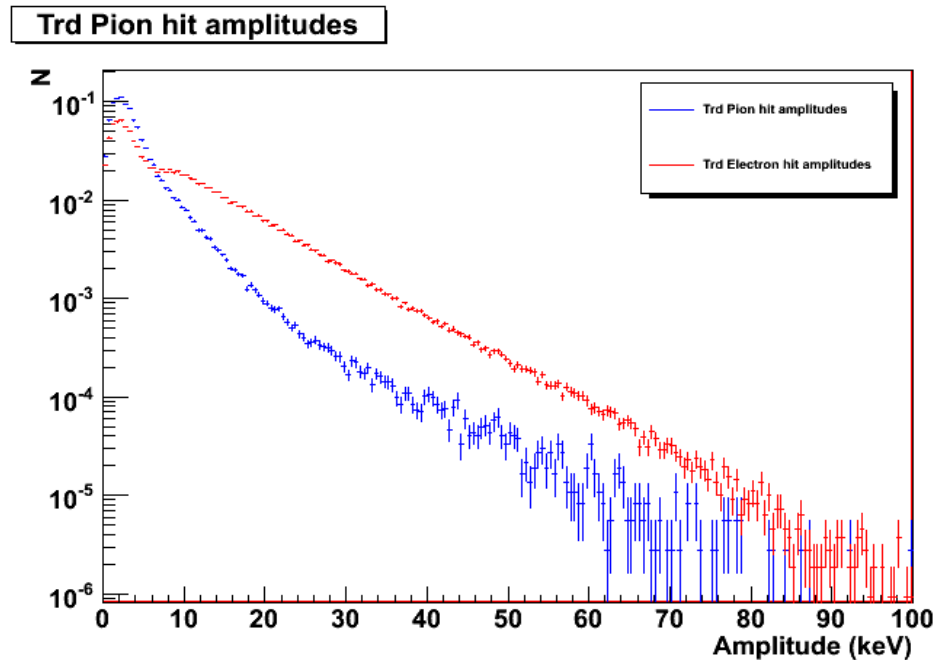
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- ECal shower requirements (MIP):
  - $E_{\text{dep}}/E_{\text{beam}} < 0.035$
- External trigger bits:
  - For 60-120 GeV beam: Ext1 == 1 && Ext2 == 1  
Cerenkov pressures set between thresholds of Pions and Kaons/Protons
- Selection Efficiency: ~ 15%





# Energy Spectra



- Fixed factor used to convert all ADC channels to energy
- Spectra not corrected yet (e.g. temperature, voltage) – tbd



# Likelihood

- Get particle probability for each layer:

$P_e, P_p$  : compare energy deposition to energy spektra

- Build geometric mean of layers for event probability:

$$P_k = \sqrt[n]{\prod_{i=1}^n P_k^i}$$

- Calculate Likelihood of event:

$$L = P_e / (P_e + P_p)$$

- Use logarithmic value for better sensuality :  $Loglike = -\log(L)$

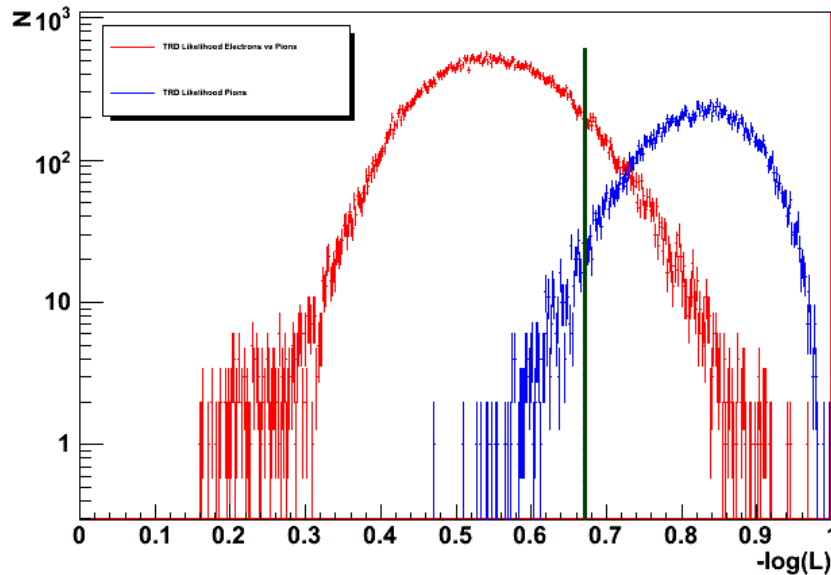
- Set cut for selected Electron efficiency (90%)  $\rightarrow 0.67$

- “Rejection”:  $\#Protons_{total} / \#Protons_{loglike < cut} \rightarrow \sim 50$



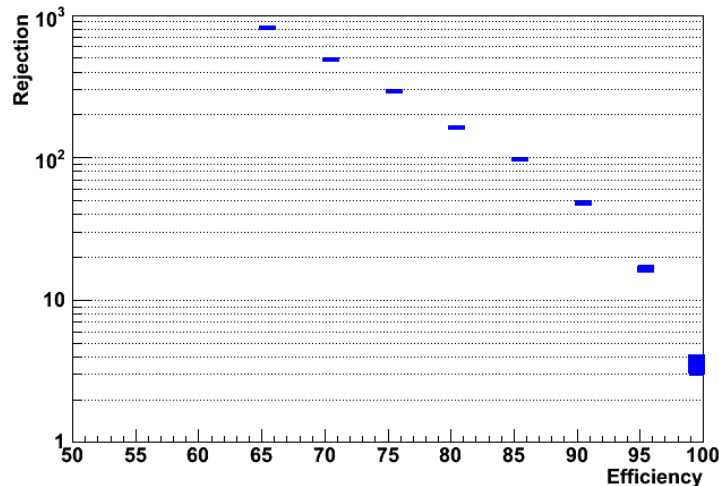
# Test Beam Results

TRD Likelihood Electrons vs Pions

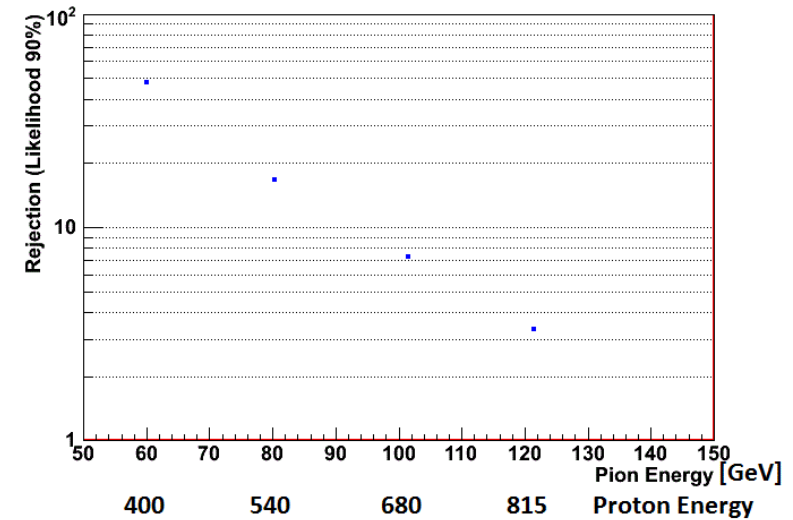


Electron efficiency: 90%  
 → Cut @  $-\log(L)=0.67$   
 → “Rejection” ~ 50

TRD Electron/Pion Rejection/Efficiency



Rejection/Beam Energy





# Summary

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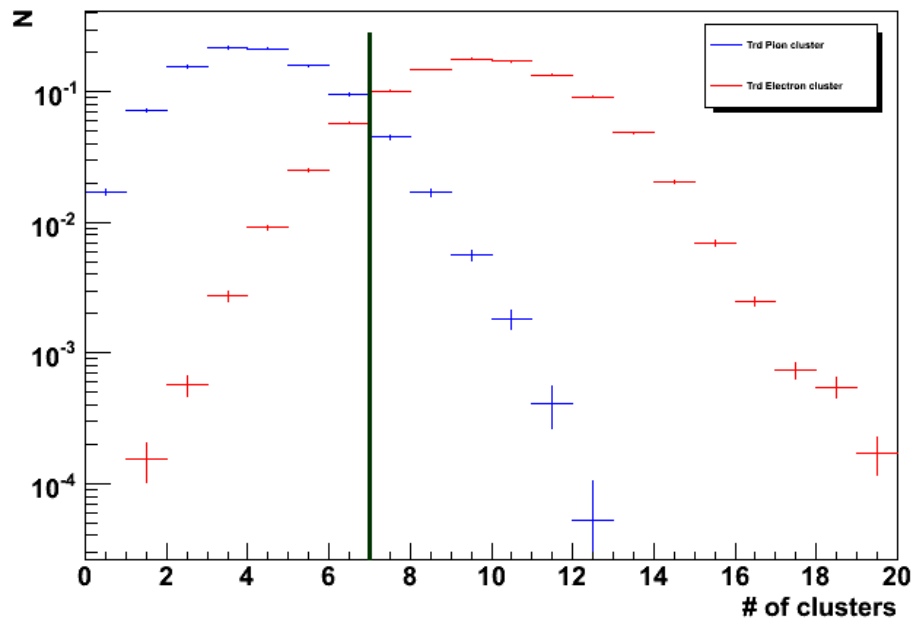
- Current/preliminary status:
  - Proton Rejection with 90% Electron Efficiency using external Trigger bits:
    - “Rejection” ~ 50
  
- Tbd:
  - Cross-check of Cerenkov counter trigger bits
  - TRD single channel calibration



# Cluster counting

- Cluster: hit on track with energy deposition > 6 keV
- Calculate cut for selected electron efficiency (~90%) -> 7
- “Rejection”:  $\frac{\#Protons_{total}}{\#Protons_{\#clusters > cut}} \rightarrow 15$

Trd Pion cluster



Rejection/Beam Energy

