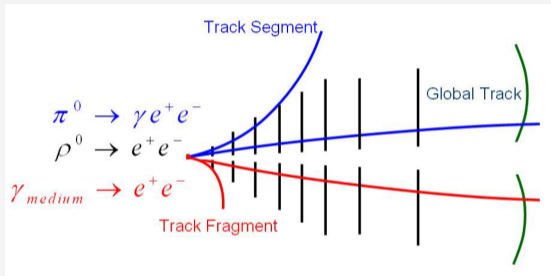




## Rejecting Electrons from $\gamma$ Conversion and $\pi^0$



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How to reject  $e^+e^-$  from  $\gamma$  conversion:

- ▶ If both decay partners are fully identified:  
⇒ Use pair cut
- ▶ If not:  
⇒ Use topology i.e. small opening angle

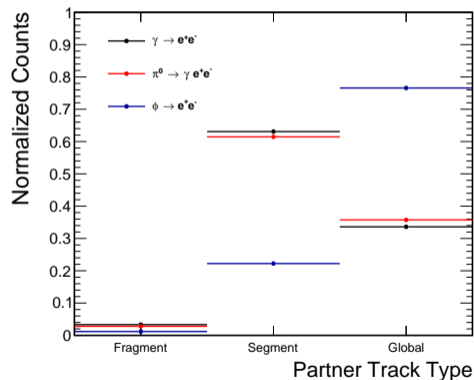
Track Fragment: Not tracked

Track Segment: Tracked, but not identified

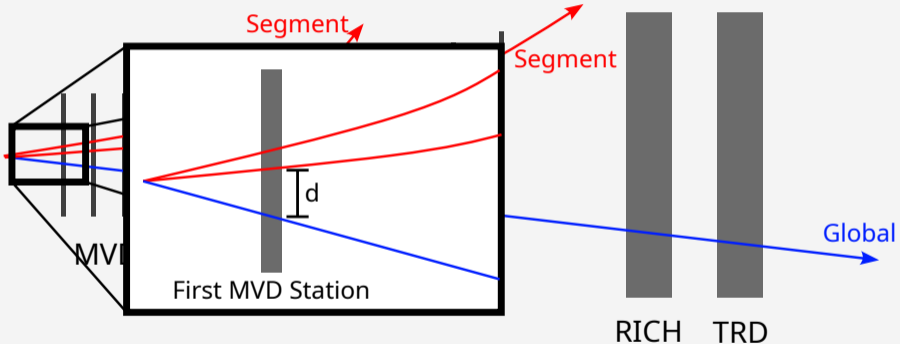
Global Track: Fully identified

## Track Topology with Reconstructed Tracks

- ▶ Similar behaviour with seen in reconstructed tracks
- ▶ Note: Fragments by definition cannot be a reconstructed track  
⇒ True amount not seen here
- ▶ Partners found here with MC info
- ▶ How should partners be found using only data from reconstructed tracks?

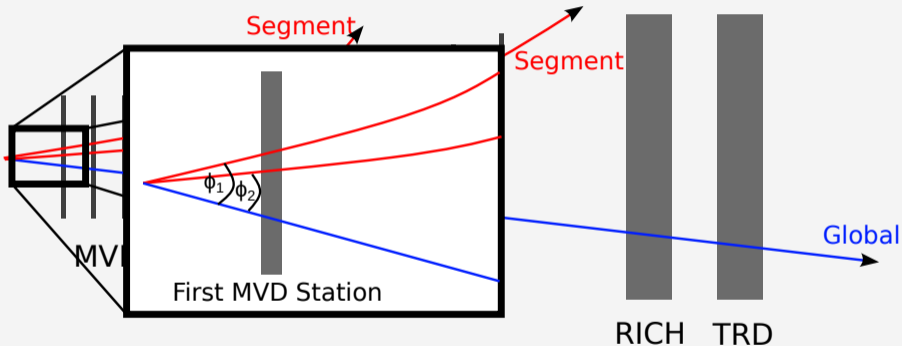


## Previous Matching in PAPA



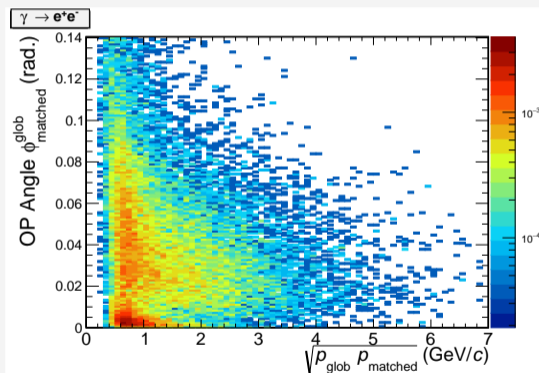
Matching via closest hit in first MVD station  $\Rightarrow$  Reliance on hit in first MVD station

## New Matching

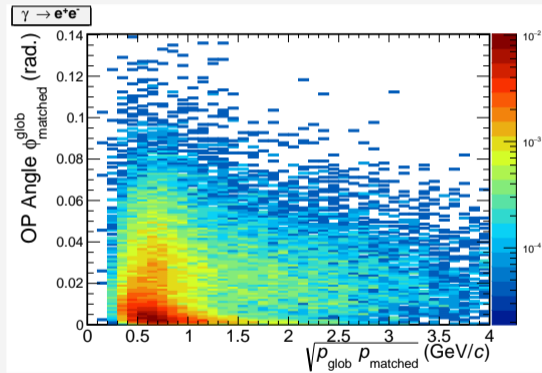


Matching via smallest opening angle  $\phi \Rightarrow$  **No** reliance on hit in first MVD station

## Previous vs New Matching



Closest hit in 1st MVD

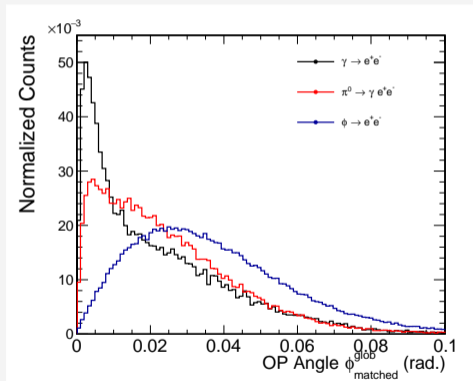


Smallest op. angle

## Different Decays

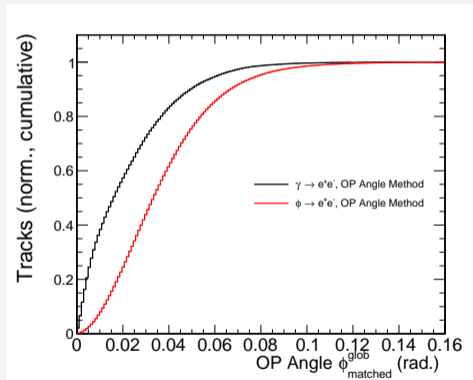
- ▶ Clear difference between  $\gamma/\pi^0$  and  $\phi$

Now find a good cut value!



## Find Cut Value

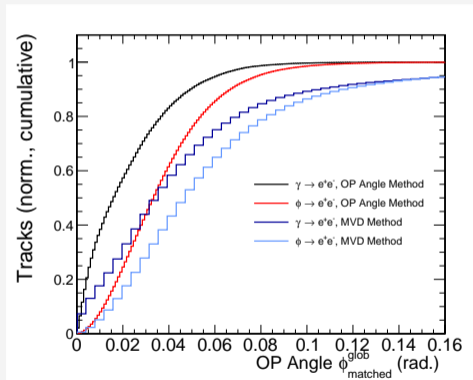
- **Cumulative** angle distribution





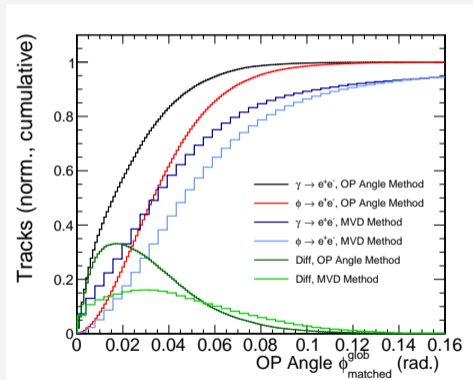
## Find Cut Value

- ▶ **Cumulative** angle distribution
- ▶ Separation better than with previous method

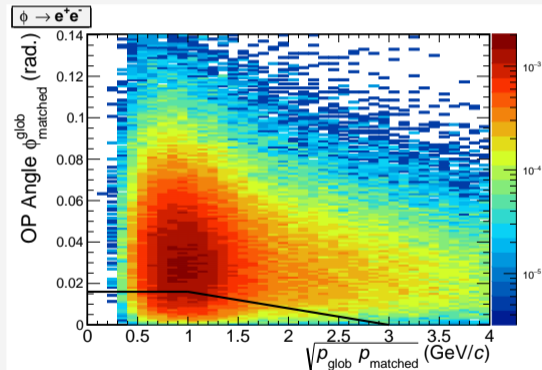
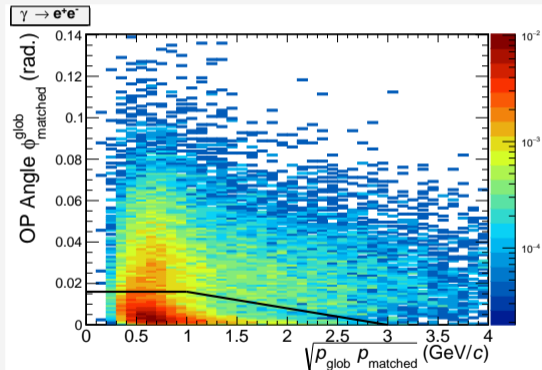


## Find Cut Value

- ▶ **Cumulative** angle distribution
- ▶ Separation better than with previous method
- ▶ Largest diff at  $\phi \approx 0.016$  rad

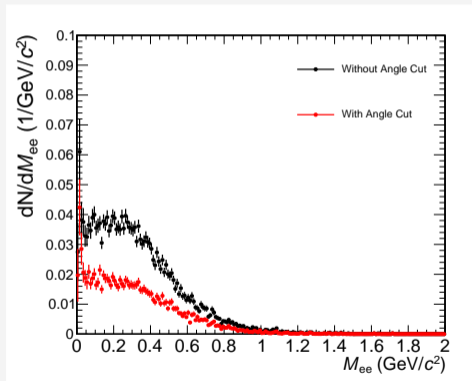


## 2 Dimensional Cut



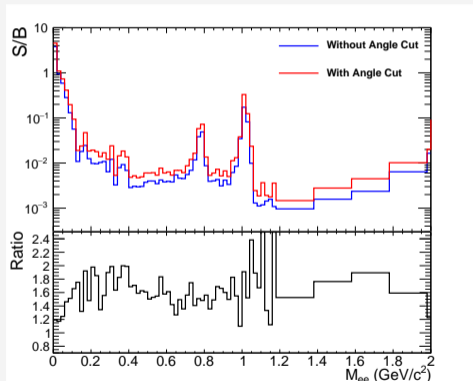
## Combinatorial Background

- ▶ Track rejection:
  - ▶  $\gamma$ :  $\sim 44\%$
  - ▶  $\pi^0$ :  $\sim 34\%$
  - ▶  $\phi$ :  $\sim 10\%$  (i.e. 90% efficiency)
- ▶ Reduction of combinatorial background by  $\sim 50\%$



## Signal to Background Ratio

- ▶ Track rejection:
  - ▶  $\gamma$ :  $\sim 44\%$
  - ▶  $\pi^0$ :  $\sim 34\%$
  - ▶  $\phi$ :  $\sim 10\%$  (i.e. 90% efficiency)
- ▶ Reduction of combinatorial background by  $\sim 50\%$

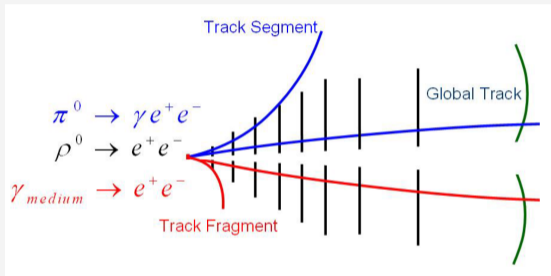


## Other things going on : Machine Learning

### PID with Machine Learning

- ▶ Modified Henriks machine learning framework to use more training data
- ▶ Created more training data
- ▶ Trained different models
- ▶ Testing still ongoing

## Other things going on: Cut on Fragments



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Track Fragment: Not tracked

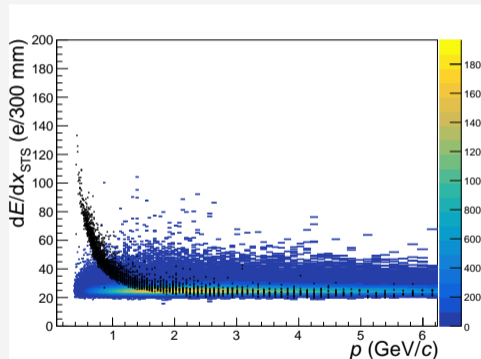
Track Segment: Tracked, but not identified

Global Track: Fully identified

- ▶ Up to now: Only cut tracks with segment as partner  
⇒ Momentum info needed
- ▶ Next step: Cut tracks with fragment as partner  
⇒ No global track, use distance in first mvd station

## Other things going on: ELoss in STS

- ▶ Protons account for  $\sim 25\%$  of had. BG (after cuts)
- ▶ Use  $dE/dx$  info from STS to reject protons  $\Rightarrow$  not affected by wrong matches with RICH rings, TOF hits etc.
- ▶ Cut not implemented yet



Color: Electrons, Boxes: Protons (both after PID cuts)