Backtracking approach to remove conversion electrons

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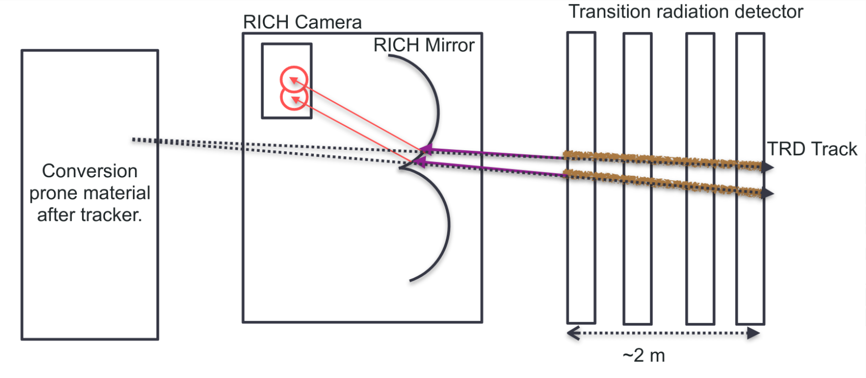
Bundesministerium
für Bildung
und Forschung



- The schematic shows **untracked electrons** which forms rings in the RICH.
- The idea is to **remove** the rings before matching other tracks.

Procedure :

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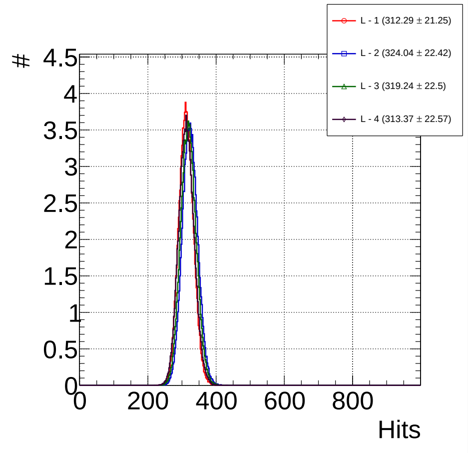
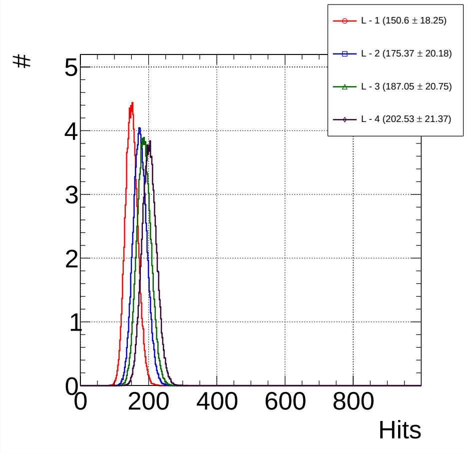
- STS track matched TRD hits are filtered.
- With remaining TRD hits, the standalone tracks are reconstructed and fitted using linear model, assuming the TRD2D resolution ($\sigma_x \simeq 100\mu m$, $\sigma_y \simeq 800\mu m$).
- These tracks are extrapolated to RICH and matched to nearest ring.
- Once matching conditions are satisfied, the rings are removed before matching STS tracks.
- **System** : 10^5 events of 8 AGeV UrQMD Au-Au central collisions + 1 Pluto $\omega \rightarrow e^+e^-$ per event.

TRD Hits :



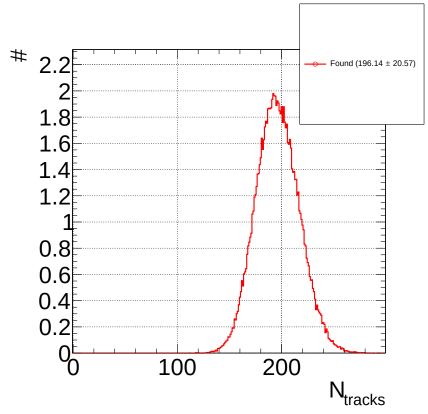
Layerwise hits in TRD



Layerwise hits in TRD after removing STS matched hits

Ideal track finder :

Tracks with *Hits* $>= 2$.

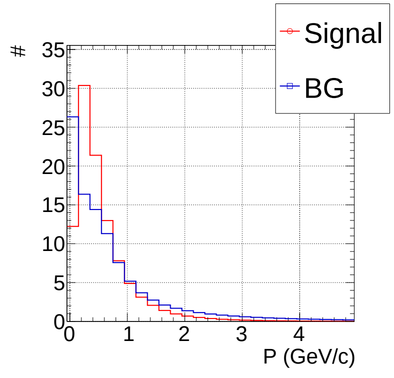


Track multiplicity (Normalised to integral)

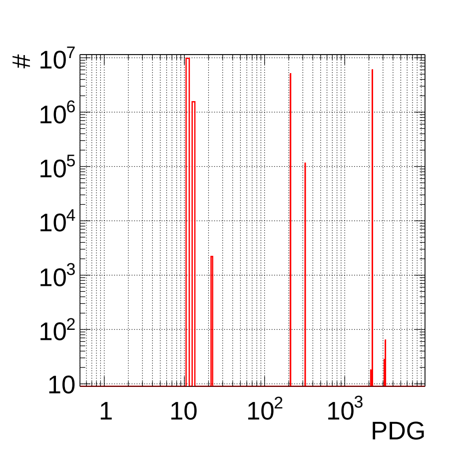
Number of rings in RICH / event $\sim 20 \rightarrow$ Large track background.

Signal : The conversion electrons having ring in RICH and TRD hits >= 2.

Background : Others.

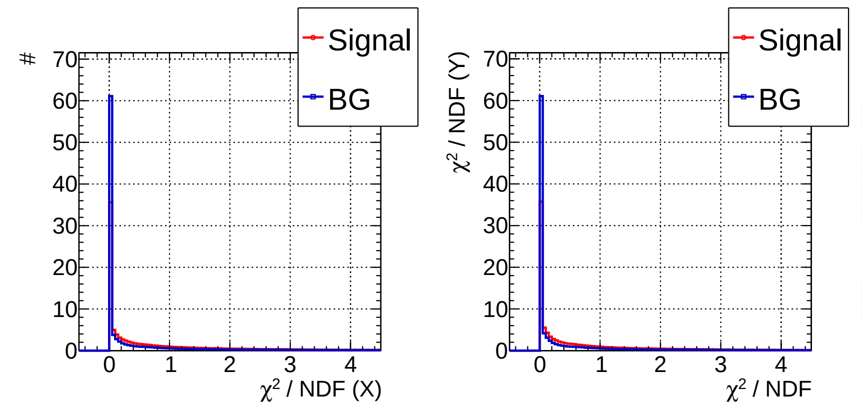


MC Momentum distribution (Normalised to integral)



PDG codes of all found tracks

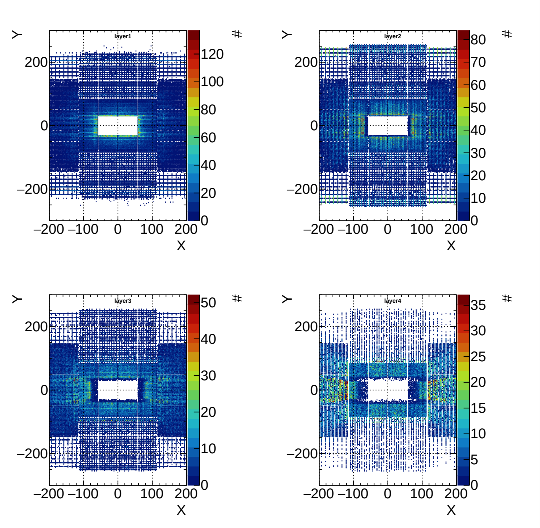
Tracks with $Hits >= 2$.



χ^2/NDF for the found tracks (Normalised to integral).

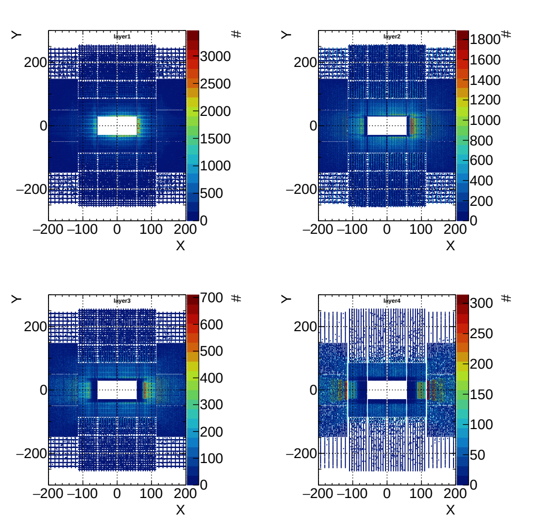
Selected tracks : $\chi^2/NDF(x) < 1.0$ and $\chi^2/NDF(y) < 1.0$

Positions on the TRD : Signal



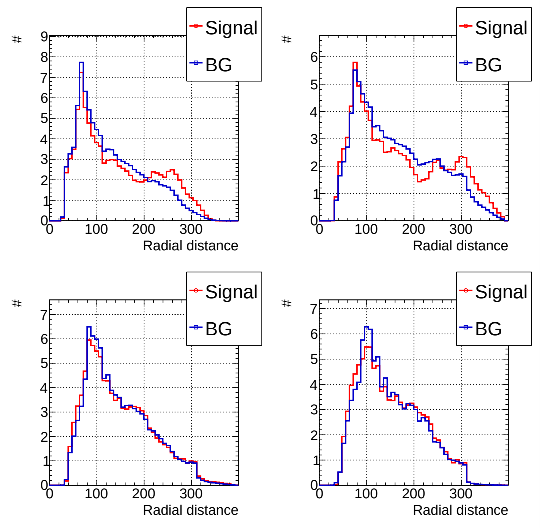
Signal hits in each layer

Positions on the TRD : Background



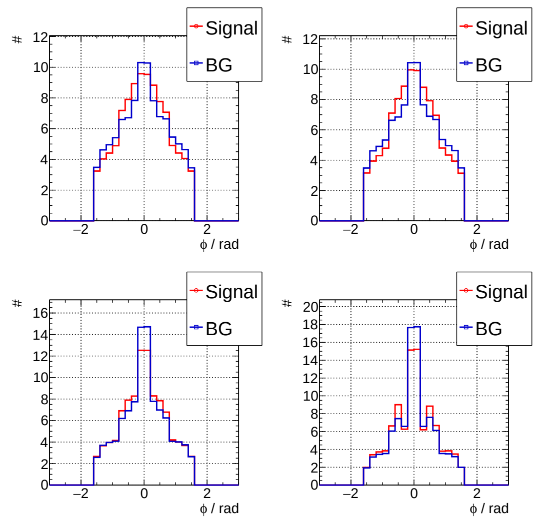
BG hits in each layer

Positions on the TRD : Radial distribution



In polar coordinates (R) (Normalised to integral)

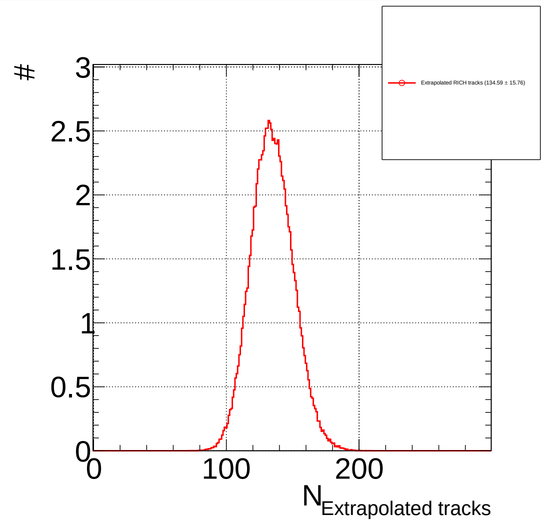
Positions on the TRD : Angle distribution



In polar coordinates (ϕ)(Normalised to integral)

Extrapolated tracks :

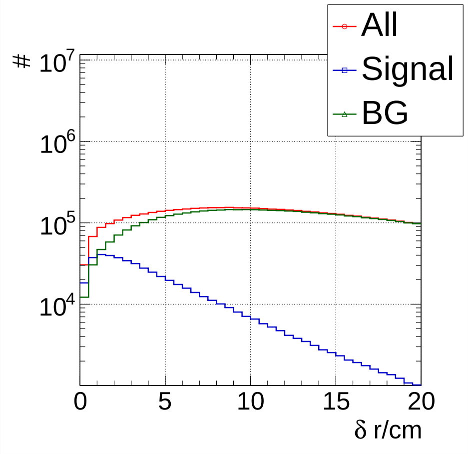
Tracks which has projections into the RICH camera. ($\sim 0.66\times$ found tracks)



Extrapolated tracks (Normalised to integral)

Distance to nearest ring :

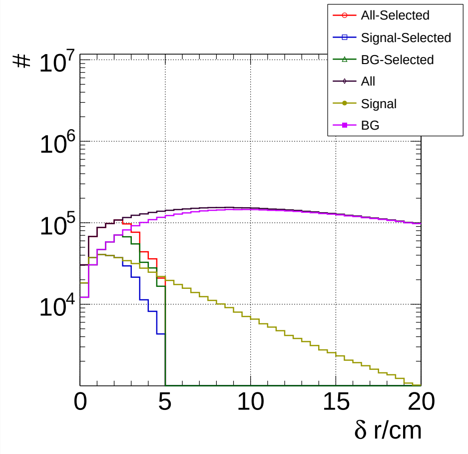
Distance to the nearest ring for all the extrapolated tracks. Since the background tracks does not have any ring reference has broad distribution.



Distance distribution

Track matching selection :

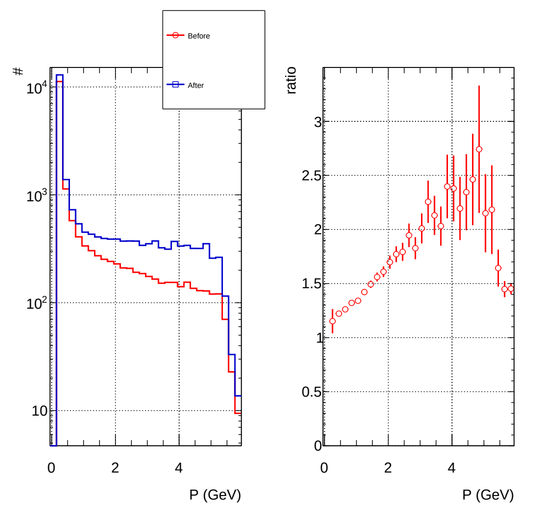
Applying cut on dx,dy,dr to ring-track matching distance.



Distance distribution after the track selection

Pion suppression :

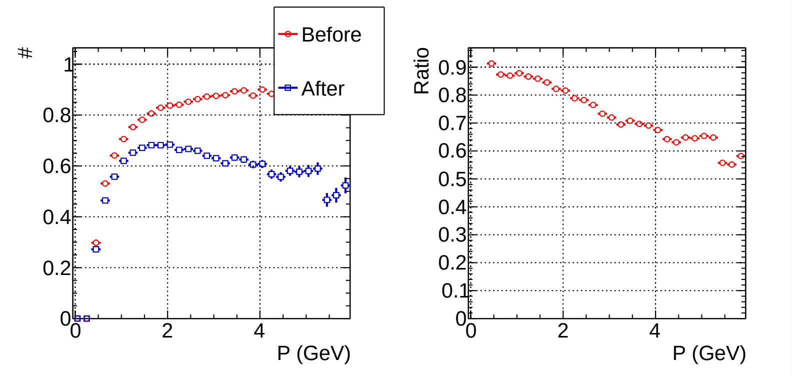
Applying cut on dx,dy,dr to ring-track matching distance.



Pion suppression. Red - Status quo, Blue : after removing untracked ring

Efficiency :

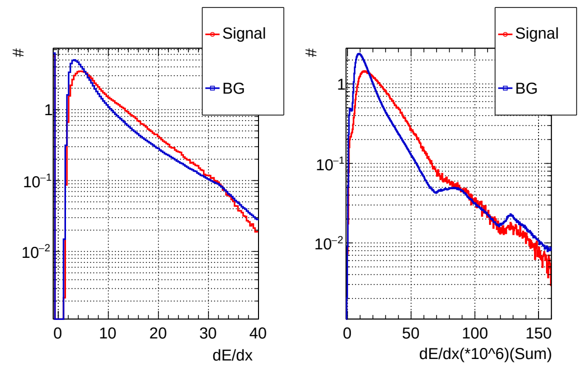
Applying cut on dx,dy,dr to ring-track.



Efficiency for primary electrons. Red - Status quo, Blue : after removing untracked ring

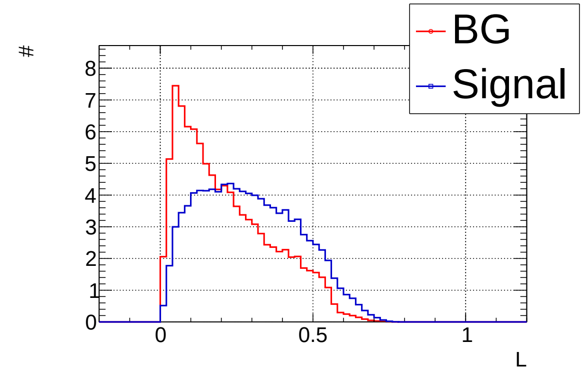
This is not the final result, still the parameter optimisation to be performed.

Energy loss in TRD :



Energy loss in TRD. Left :Individual hits Right - Sum of dE/Dx

Electron Likelihood from TRD :



Electron likelihood assuming tracks to be 0.6 GeV/c momentum

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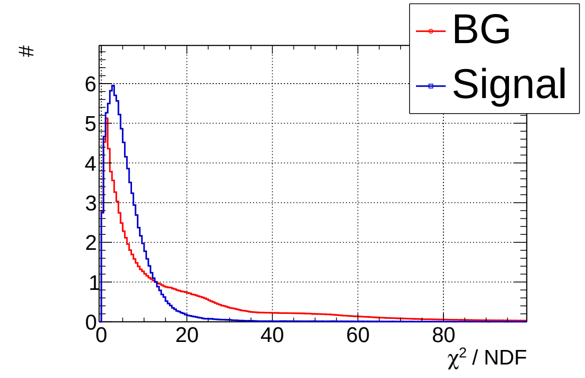
χ^2 for the primary vertex :



χ^2_{vertex} assuming tracks to be 0.3 GeV/c momentum Proton

Summary :

- The Backtracking approach to reduce the secondary electron contribution is discussed.
- Fine tuning the parameters still to be performed.
- Maybe not remove the rings altogether but tag each ring with conversion probability.
- Testing the procedure for the day 1 TRD geometry to be planned.

Appendix :

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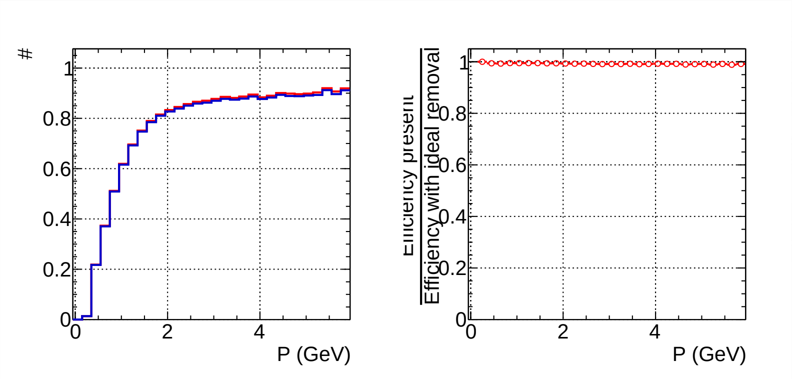
Target response : Efficiency

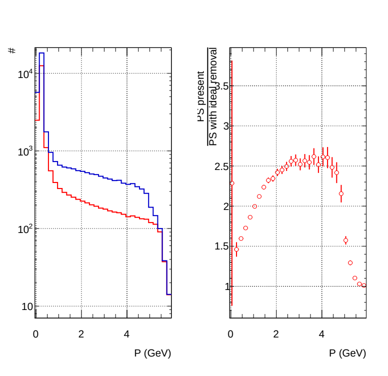
TRD hits $>=2$, Ring-backtrack Distance cut : $\delta_x, \delta_y, \delta_d < 5.0cm$



Efficiency for primary electrons. Red - Status quo, Blue : after removing untracked rings

Target response : Pion suppression

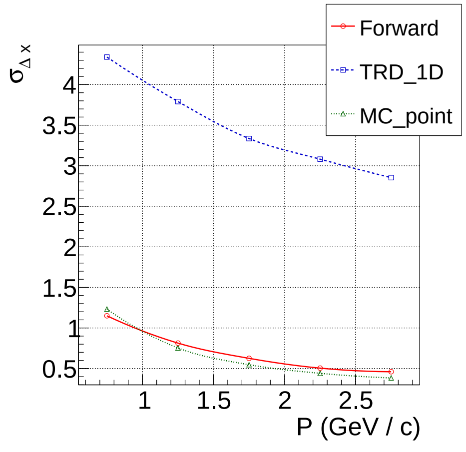
TRD hits >= 2, Ring-backtrack Distance cut : $\delta_x, \delta_y, \delta_d < 5.0cm$



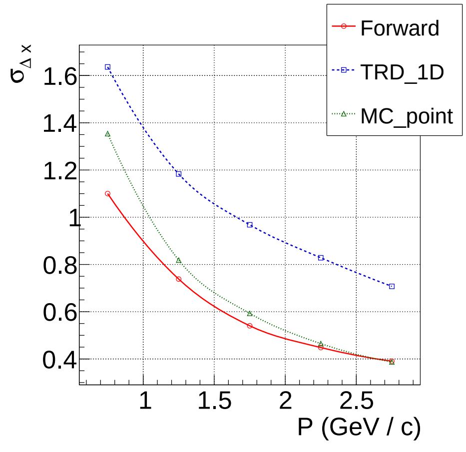
Pion suppression. Red - Status quo, Blue : after removing untracked rings

TRD-2D track fit performance :

Assuming the TRD2D position resolution we have a better track fit as compared to TRD1D.



Ring-track match resolution for 2 TRD Hits for Δx



Ring-track match resolution for 3 TRD Hits for Δx