MVD prepairing

Dilepton meeting
Frankfurt, Germany
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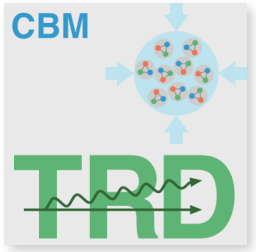
Etienne Bechtel
University of Frankfurt



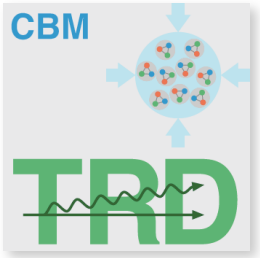
What is checked?

12 A GeV Au+Au UrQMD collisions 0-10% centrality

Standard sis100 electron setup as in APR20

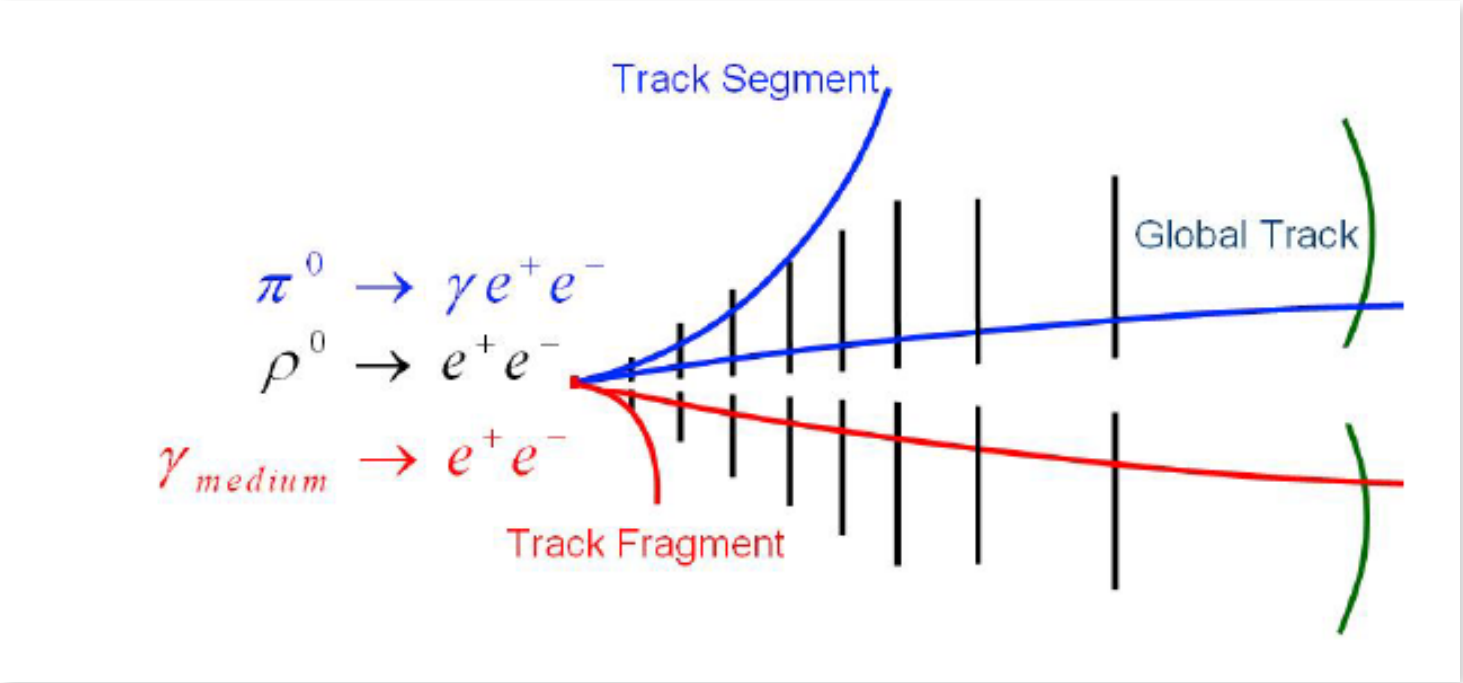
	Events	Location
In-medium	2.5 M	/lustre/cbm/pwg/common/mc/cbmsim/apr20_fr_18.2.1_fs_jun19p1/ urqmd_pluto_inmed_had_epem/auau/12agev/centr_0_10/sis100_electron_target_25_mkm/ TGeant4/
In-medium (no MVD)	2.5 M	/lustre/cbm/users/isegal/mc/cbmsim/apr20_fr_18.2.1_fs_jun19p1/ urqmd_pluto_inmed_had_epem/auau/12agev/centr_0_10/ sis100_electron_target_25_mkm_no_mvd/TGeant4/

Track selection



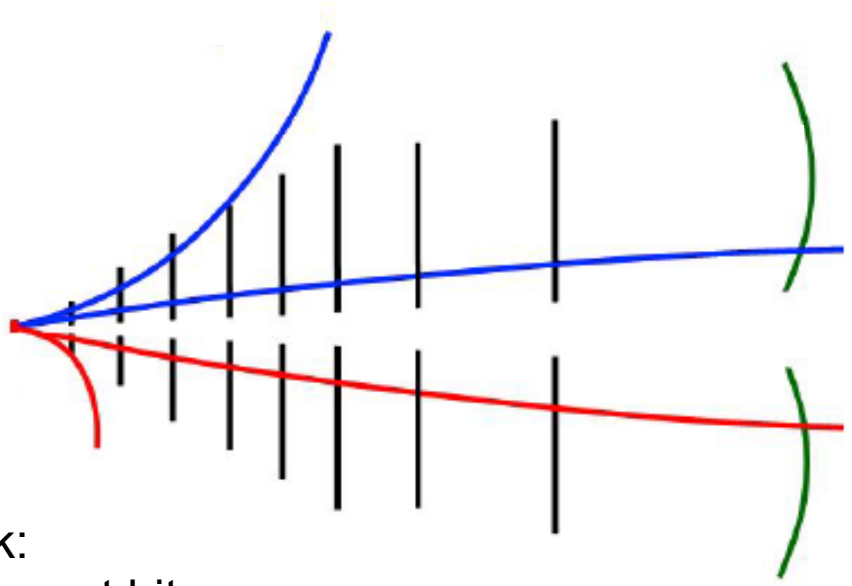
Reconstructed in STS	Sts hits > 2
Fit to primary vertex	χ^2/NDF < 3
Transverse momentum	p_T > 50 MeV/c
Pre-pairing mass cut	A full pairing procedure is done and both tracks are rejected if the invariant mass is < 25 MeV/c^2
Closest hit	Point of interest for this analysis
Reconstructed in RICH	Rich hits > 5
PID in RICH	ANN output (at 90% for all momenta)
Reconstructed in TRD	Trd hits > 2
PID in TRD	Electron-Likelihood (at 80% for all momenta)

Basic idea



Use proximity of hits in the MVD/STS to reject physical background pairs

Basic idea



I can define per track:

- Distance to closest hit
- Number of reconstructed daughter hits

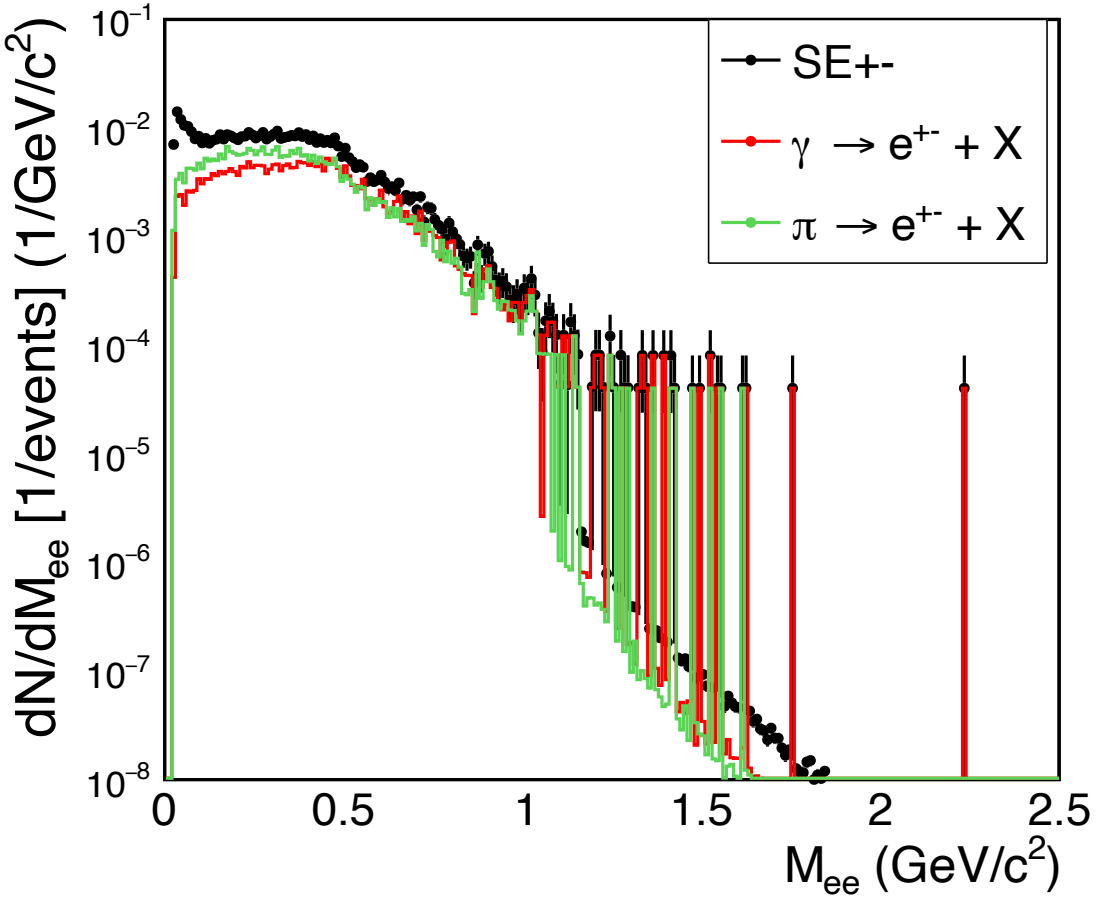
Per pair:

- Distance between + and - in the first station

(something I am still checking if it could be useful)

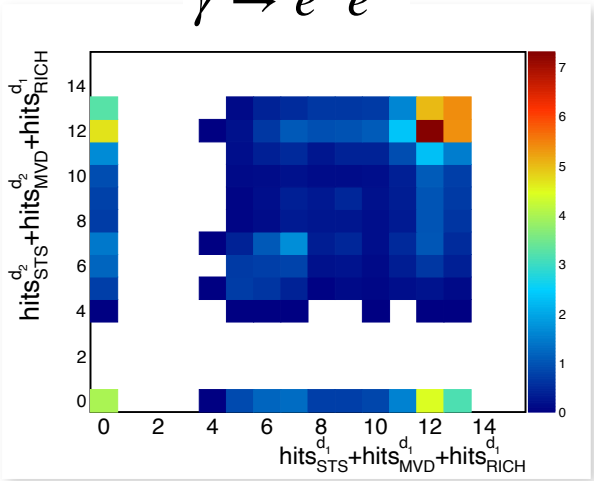
Physical background

Most of our combinatorial electron contributions come from gamma conversions and pions

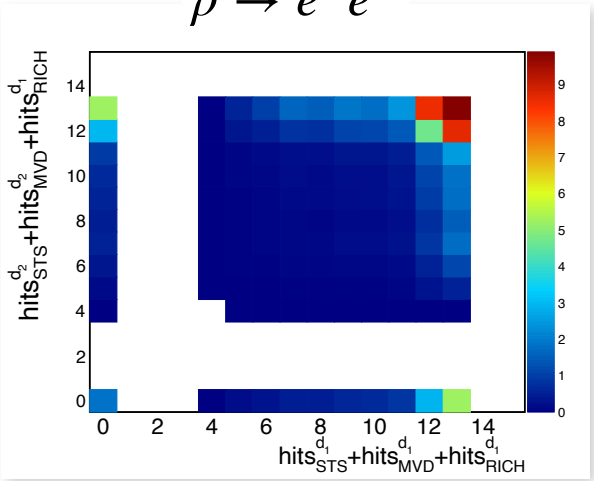


Daughter track hits

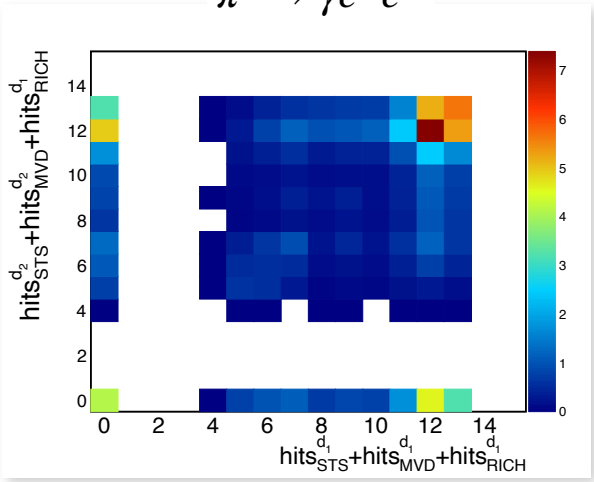
$\gamma \rightarrow e^+e^-$



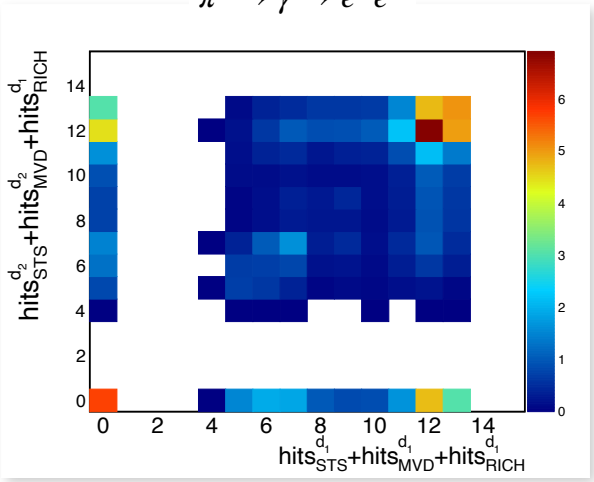
$\rho \rightarrow e^+e^-$



$\pi^0 \rightarrow \gamma e^+e^-$

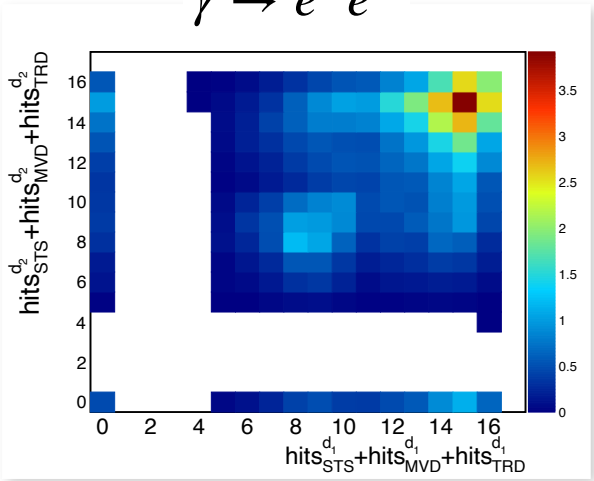


$\pi^0 \rightarrow \gamma \rightarrow e^+e^-$

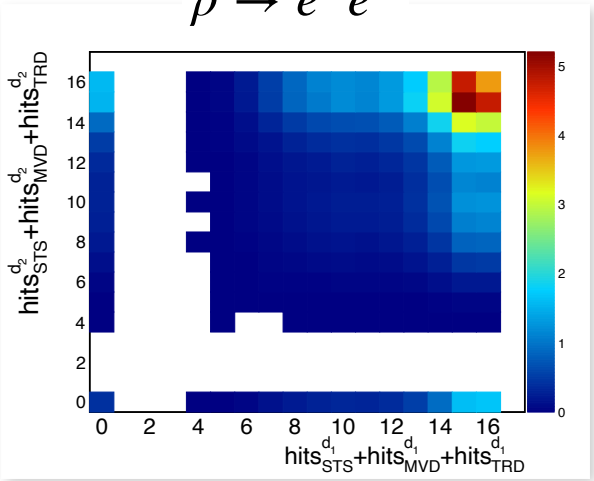


Daughter track hits

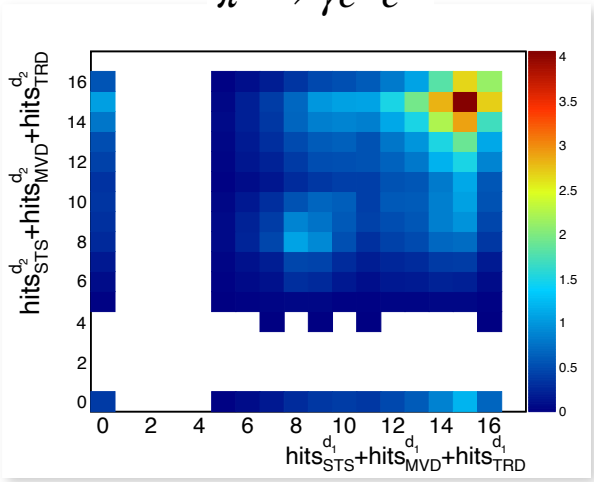
$\gamma \to e^+e^-$



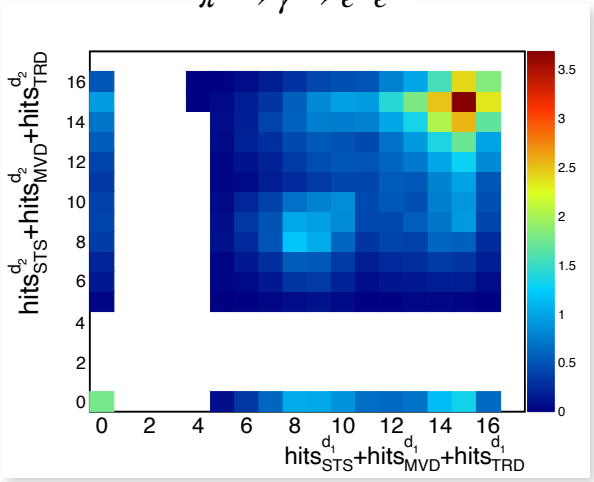
$\rho \to e^+e^-$



$\pi^0 \to \gamma e^+e^-$

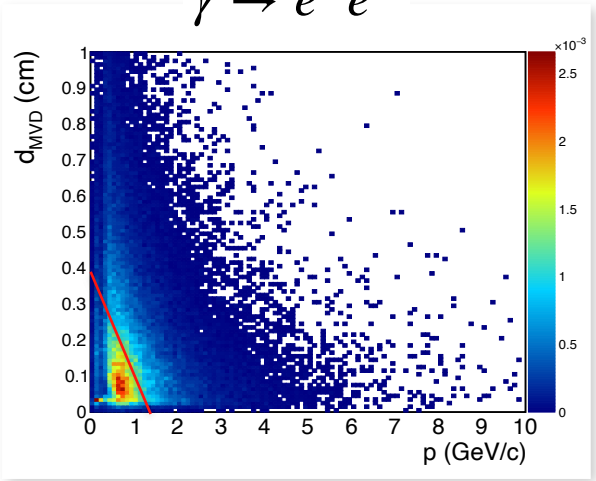


$\pi^0 \to \gamma \to e^+e^-$

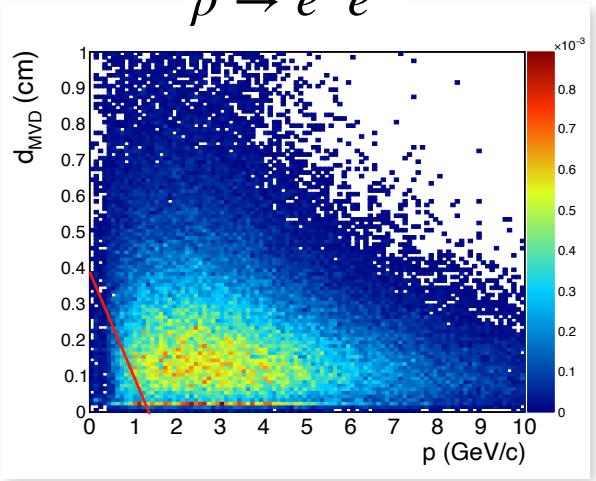


Acceptance - MVD closest hit rejection

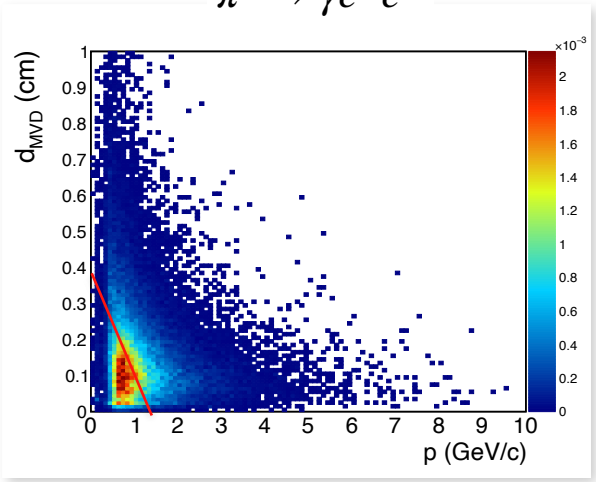
$\gamma \rightarrow e^+e^-$



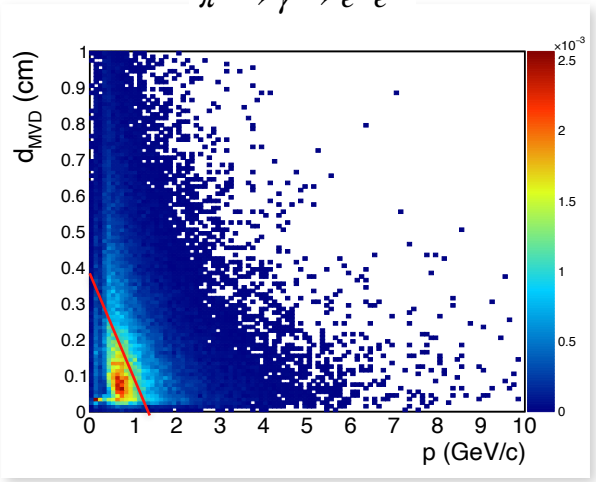
$\rho \rightarrow e^+e^-$



$\pi^0 \rightarrow \gamma e^+e^-$

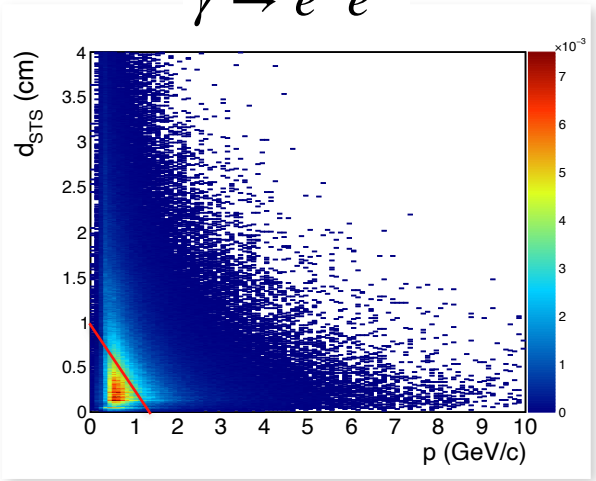


$\pi^0 \rightarrow \gamma \rightarrow e^+e^-$

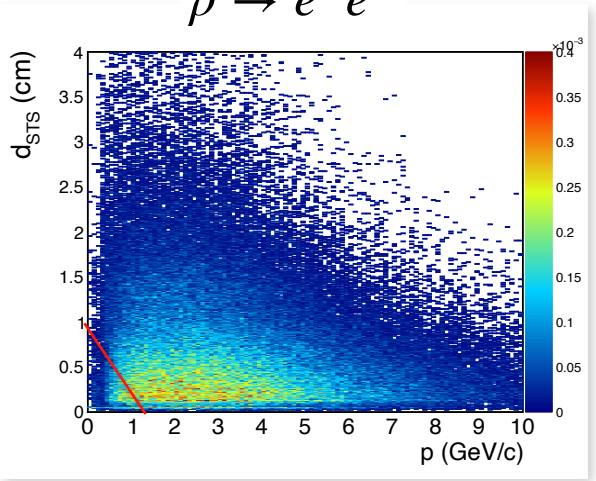


Acceptance - STS closest hit rejection

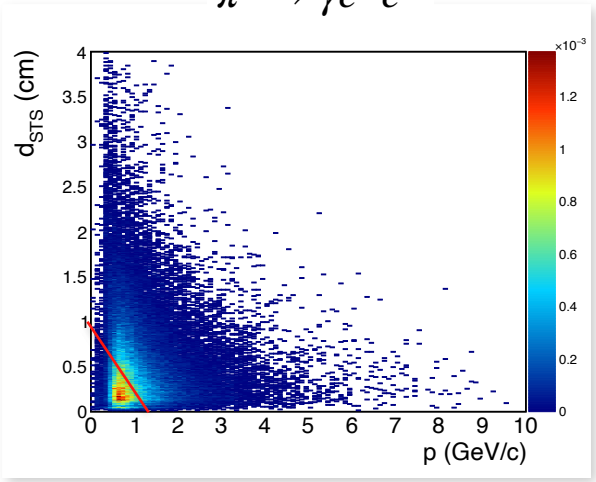
$\gamma \rightarrow e^+e^-$



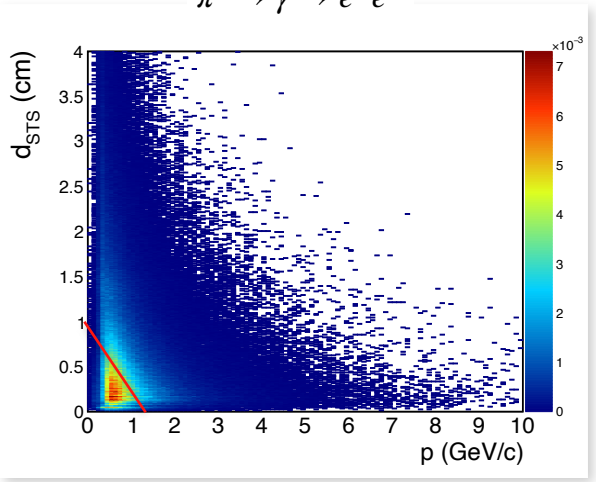
$\rho \rightarrow e^+e^-$



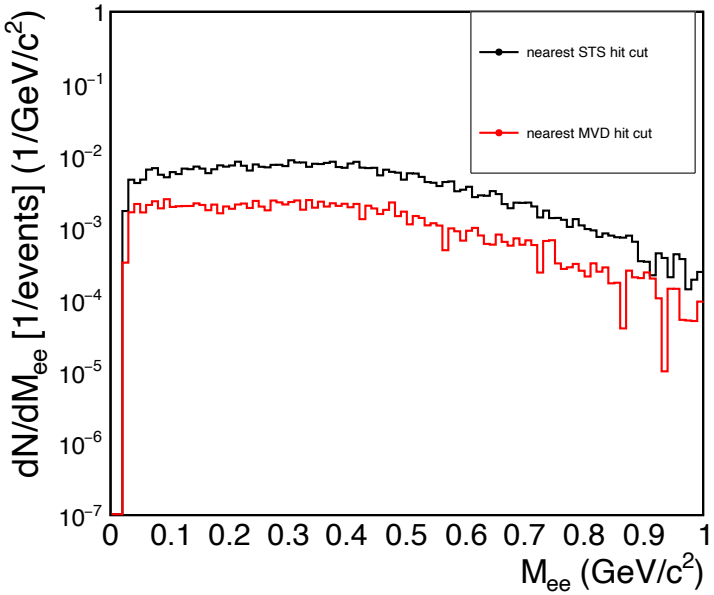
$\pi^0 \rightarrow \gamma e^+e^-$

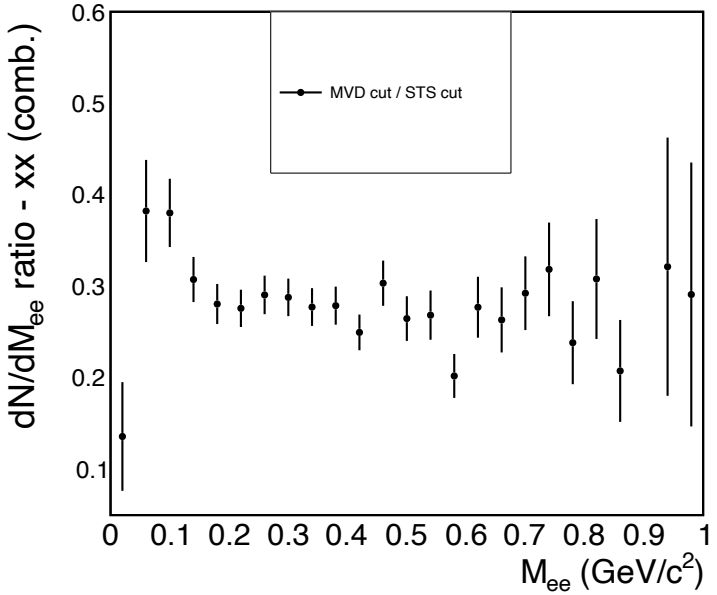


$\pi^0 \rightarrow \gamma \rightarrow e^+e^-$



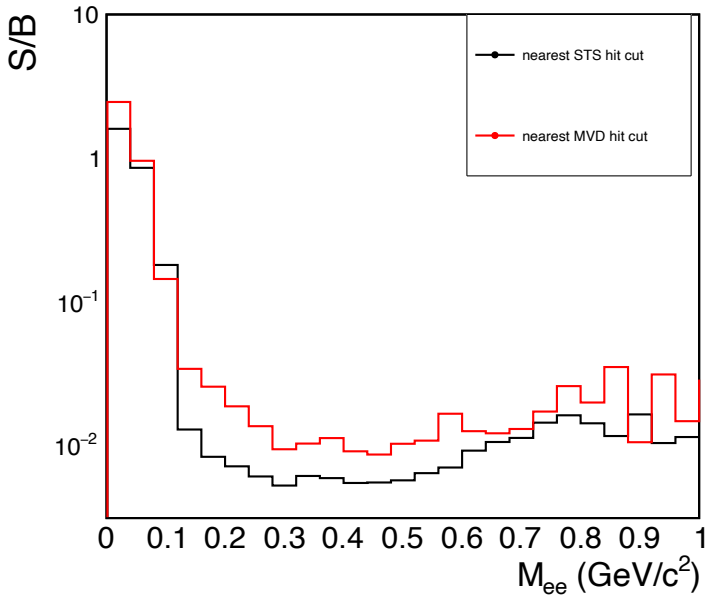
Reduction of of the total combinatorial background

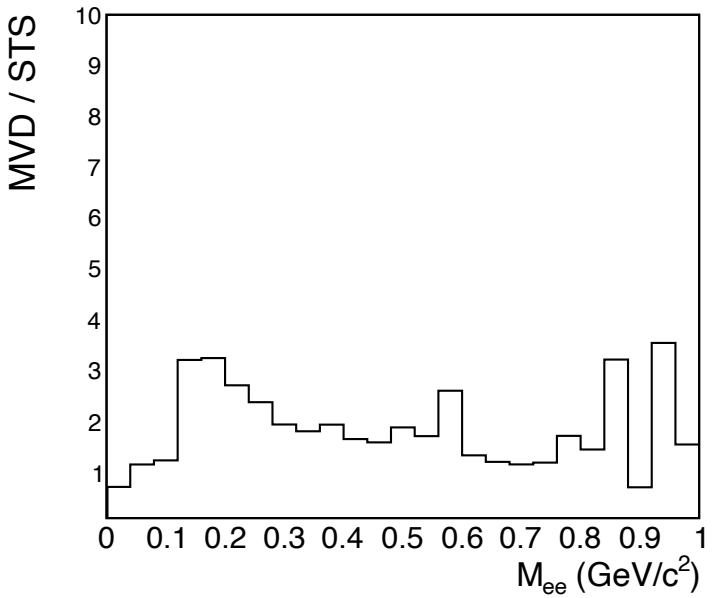




Overall, there is a significant subtraction of background

Signal-to-background

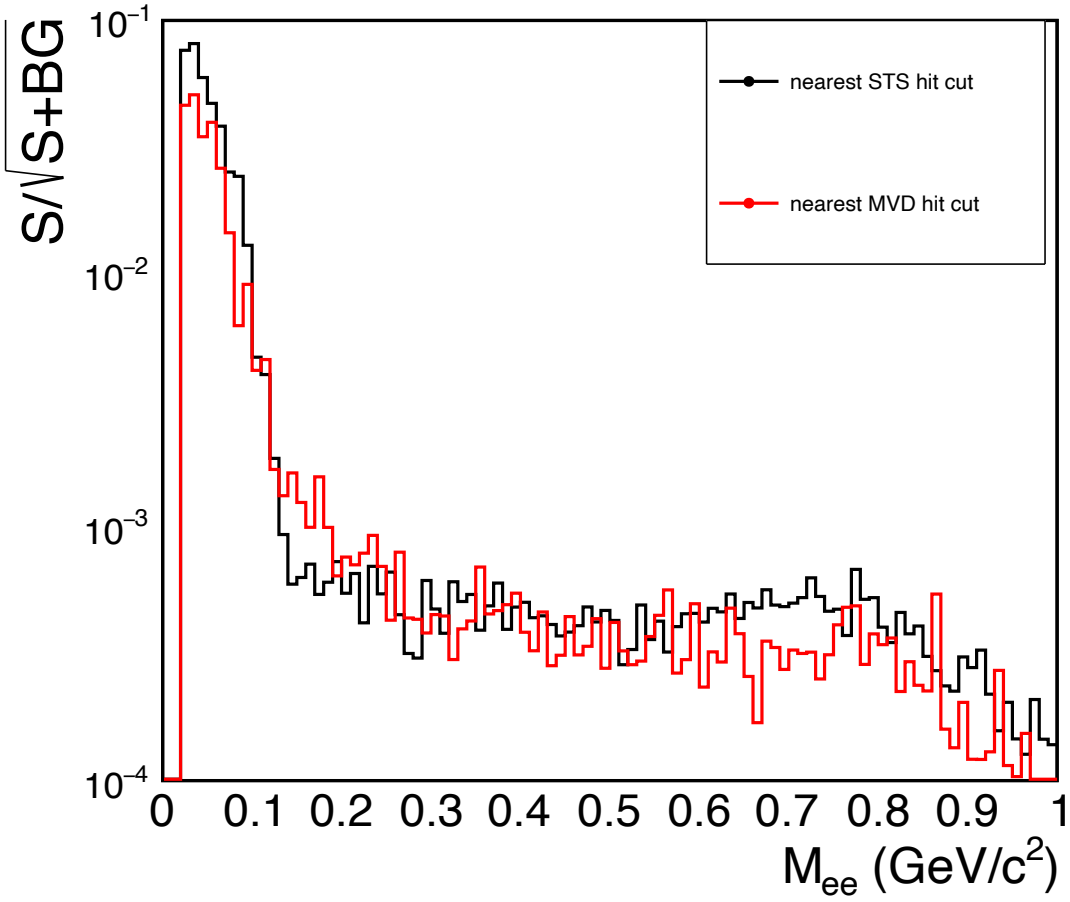




The signal-to-background increases up to a factor 3

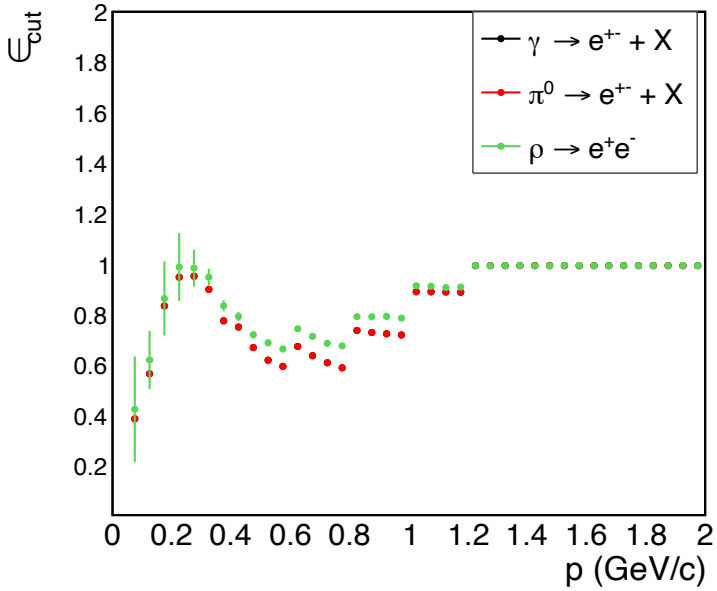
Significance

Significance does not change in the process

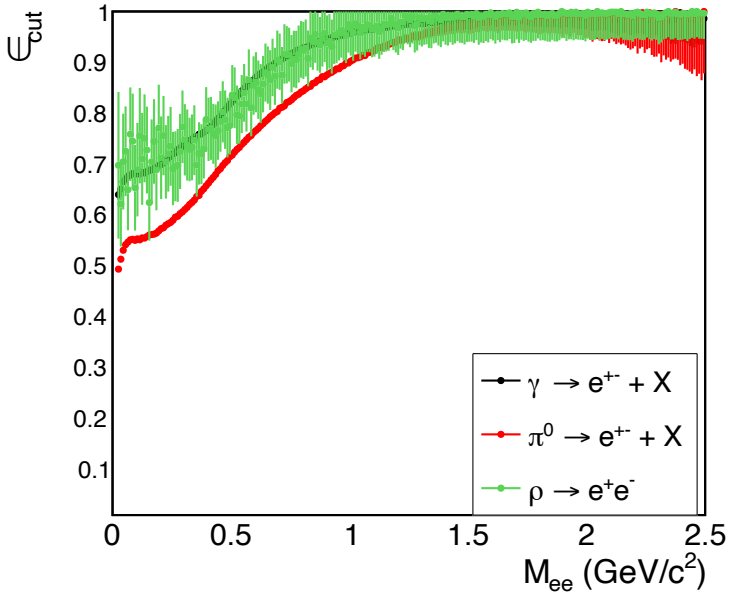


Cut efficiency

Single tracks



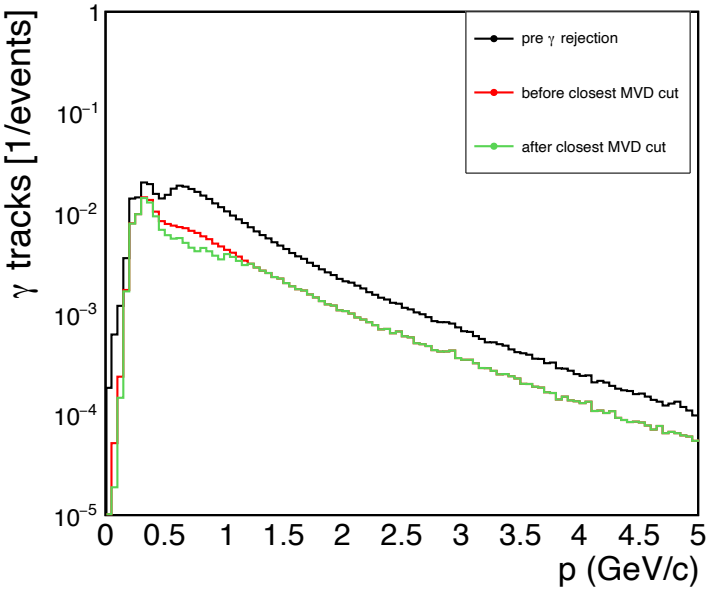
Pairs



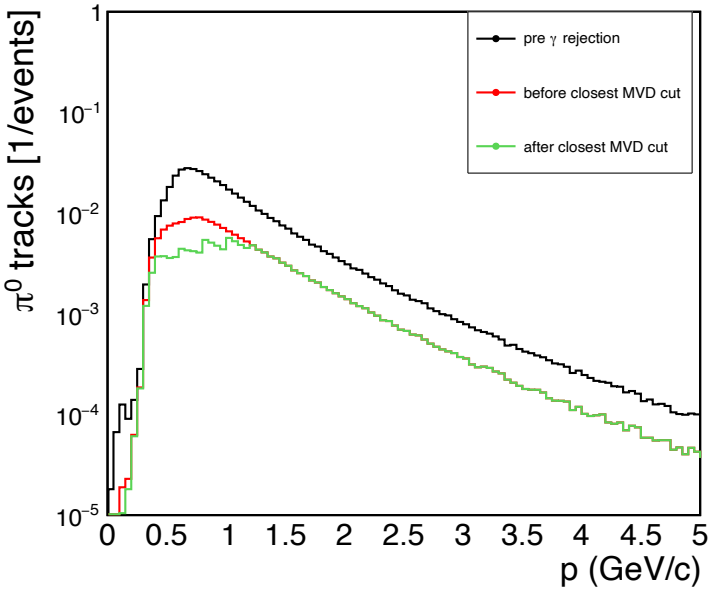
However, there is also a significant signal loss included

Cutsteps

$\gamma \rightarrow e^+e^-$



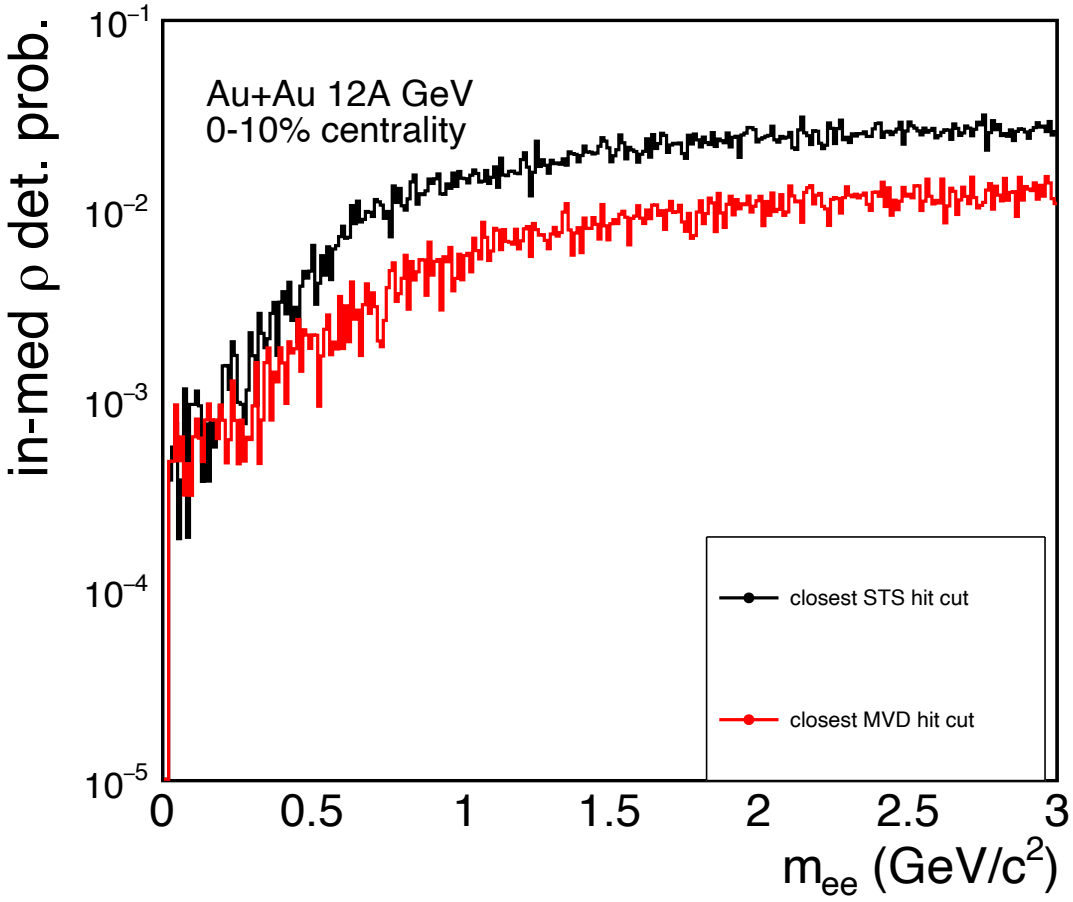
$\pi^0 \rightarrow \gamma e^+e^-$



The total reduction is lower than on slide 9/10 suggested due to the previous pair rejection

Detection probability

The signal loss causes a decrease at larger invariant masses



Invariant mass spectra

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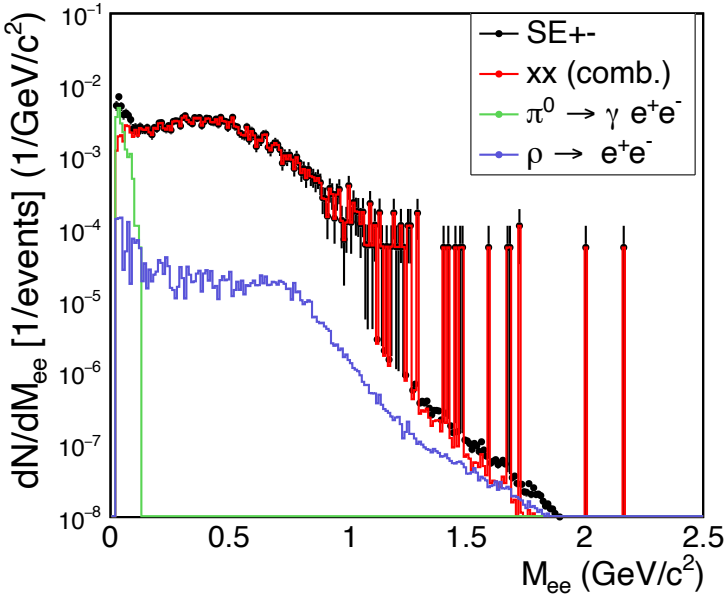
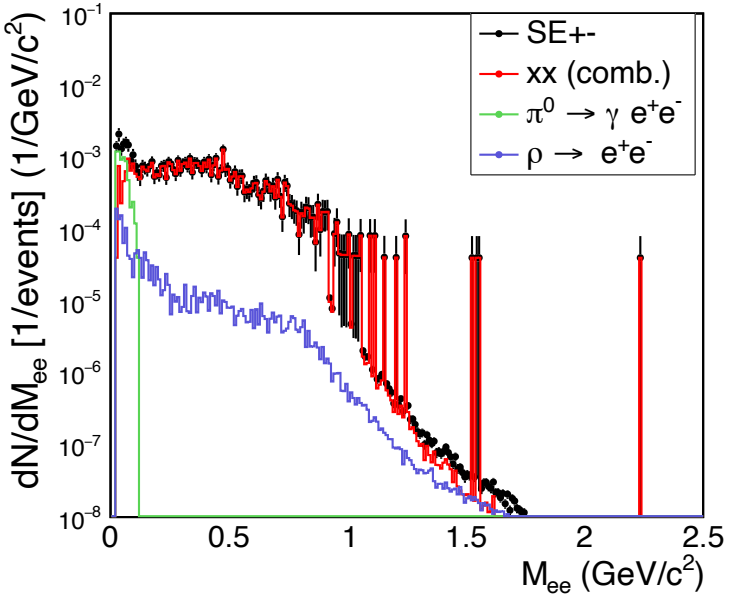
Closest STS cut



Closest MVD cut



The invariant mass spectra look comparable

Conclusion

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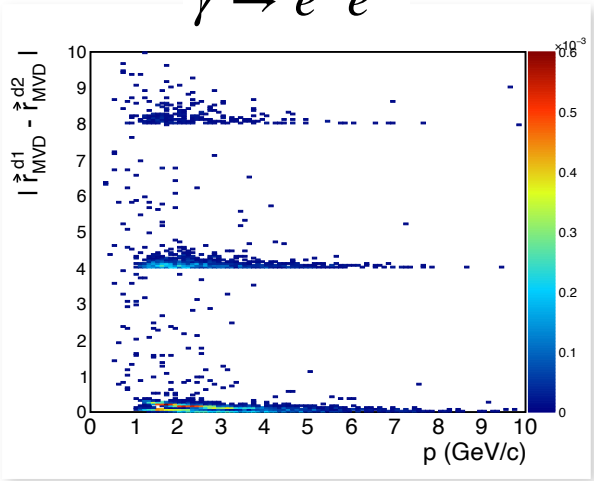
MVD usage

- A rudimentary implementation of a “closest hit” cut was compared between STS and MVD
- The background contributions from gamma conversion and pi0-dalitz decays were suppressed substantially
- The signal-to-background ratio increased significantly

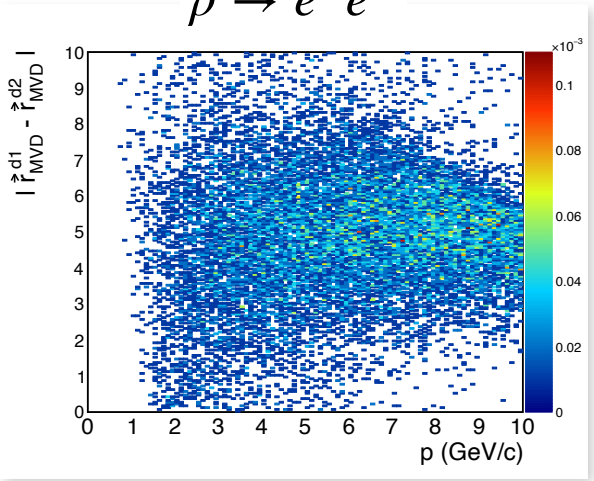
Backup

MVD pair hit distance

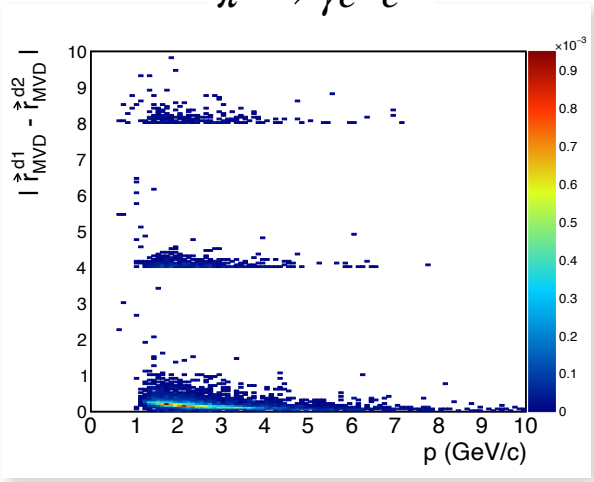
$\gamma \rightarrow e^+e^-$



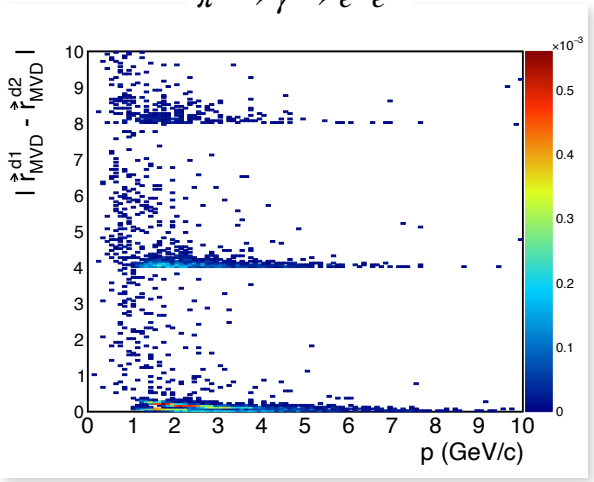
$\rho \rightarrow e^+e^-$



$\pi^0 \rightarrow \gamma e^+e^-$

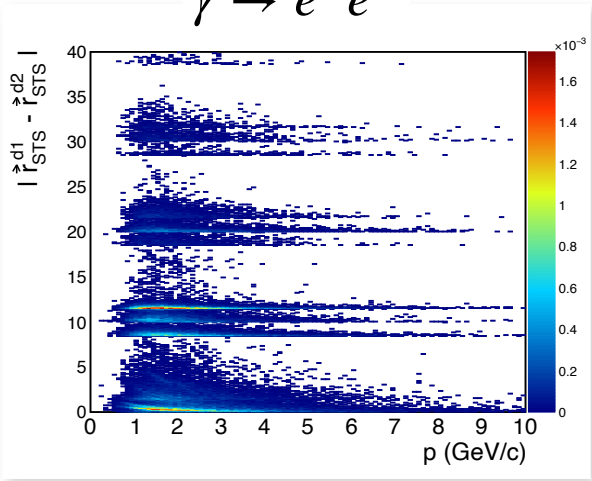


$\pi^0 \rightarrow \gamma \rightarrow e^+e^-$

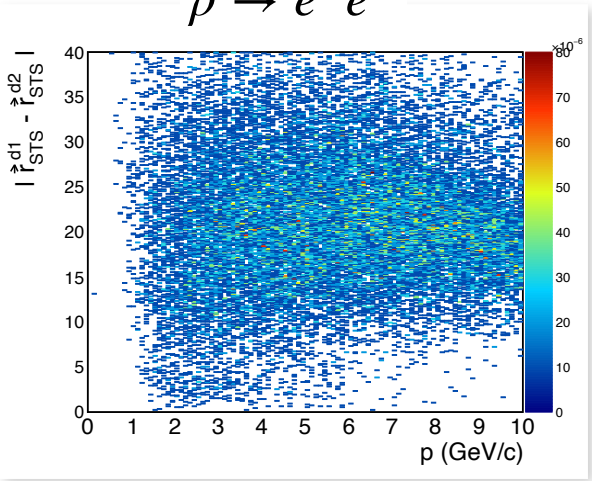


STS pair hit distance

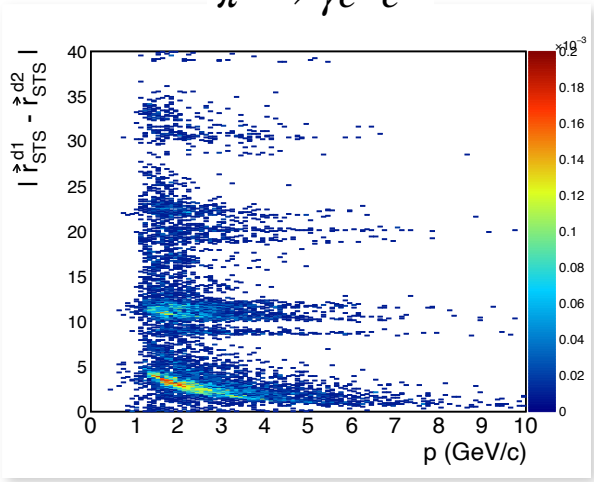
$\gamma \rightarrow e^+e^-$



$\rho \rightarrow e^+e^-$



$\pi^0 \rightarrow \gamma e^+e^-$



$\pi^0 \rightarrow \gamma \rightarrow e^+e^-$