First results on dilepton analysis in HADES.

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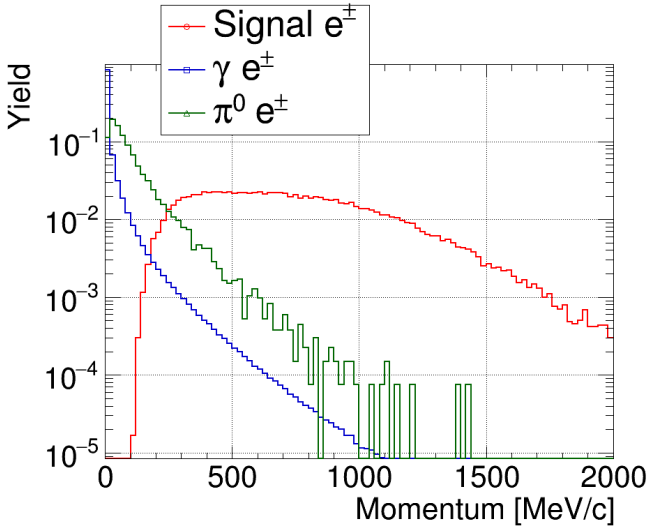
Simulation

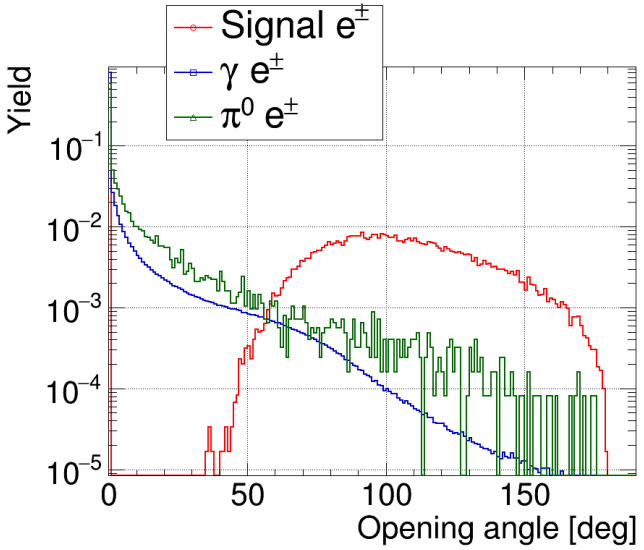
- Preliminary results will be shown, set up simulation framework, the work is ongoing.
- Bechelor thesis of Marten Becker
- **Main goal: investigate how to make best use of the upgraded RICH, improve dilepton reconstruction and reduce BG.**
- New simulation for Ag-Ag at 1650 MeV beam energy.
- Pluto signal: **φ→e+ e-** embedded in each event.
- Analysis is in the HADES repository:
  - https://subversion.gsi.de/hades/analysis
- Only 30k events due to the technical problems.

Electron Identification and analysis cuts

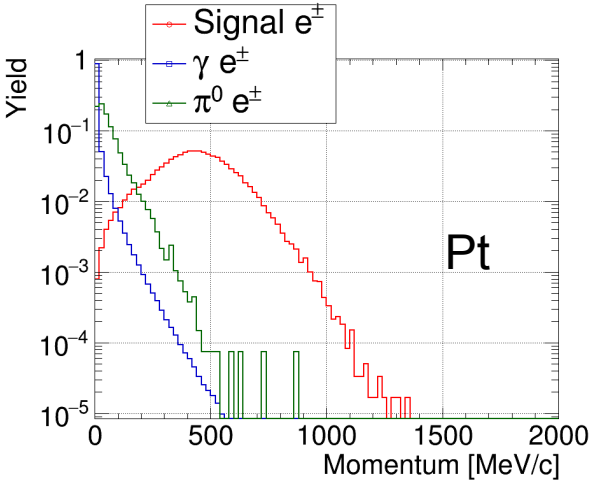
- MDC sharing is switched on (Improve reconstruction of close pairs).
- Standard Lepton Id (beta > 0.9, **RICH matching < 4°**)
  - For the current analysis beta >= 0.94
- Momentum Cut (100 MeV/c < P < 1400 MeV/c)
- Opening Angle cut (OA < 9°), both track candidates are removed from combinatorics.

GEANT data input

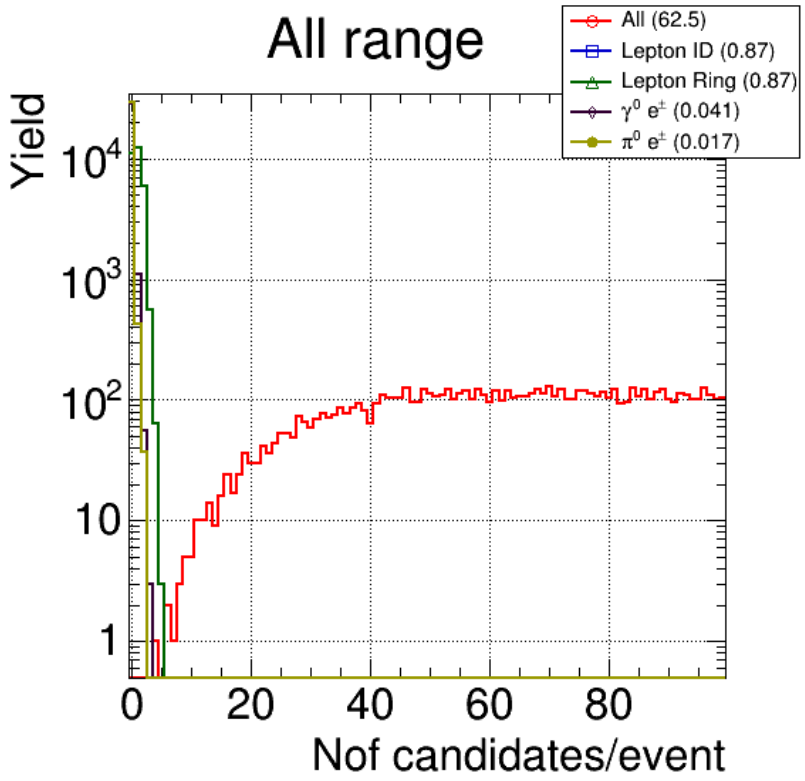


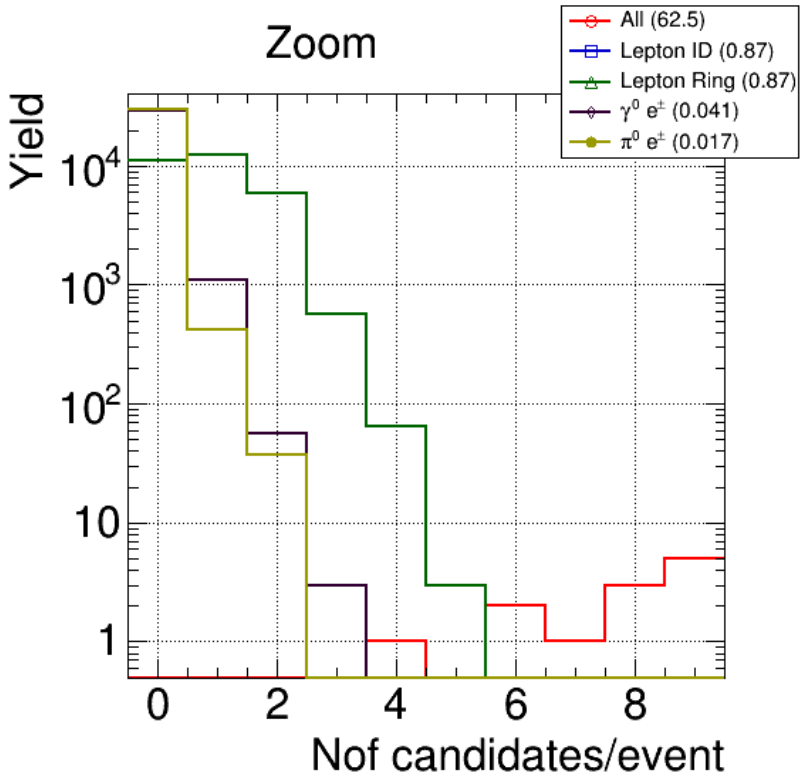


- Kine objects
- Expected main sources of BG are ϒ conversions and π^0 Dalitz decays



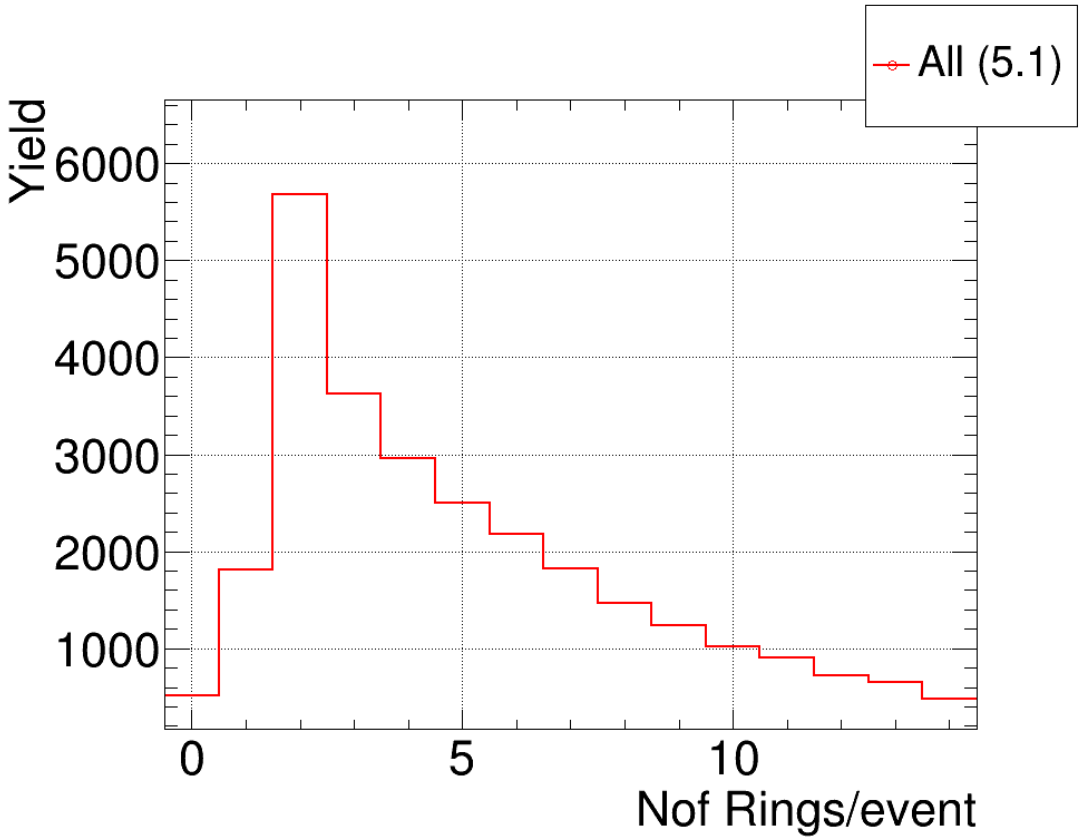
Reconstruction
Number of track candidates per event





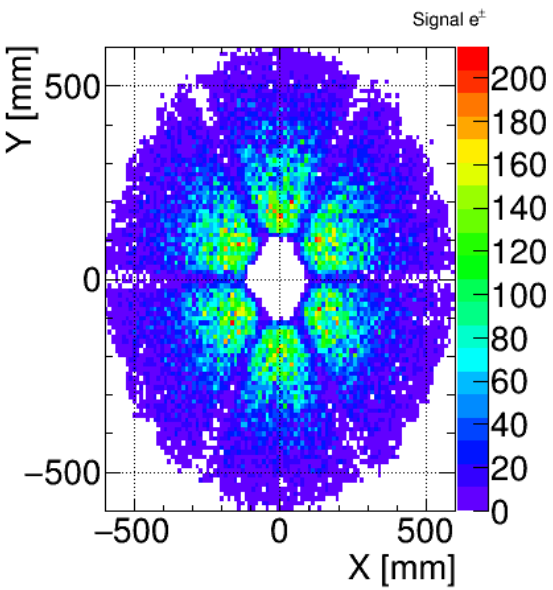
- Most of the tracks are rejected by Lepton Id

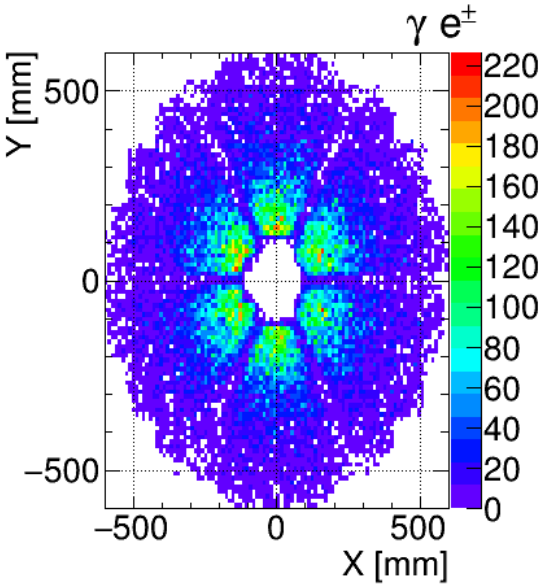
Number of reconstructed rings per event

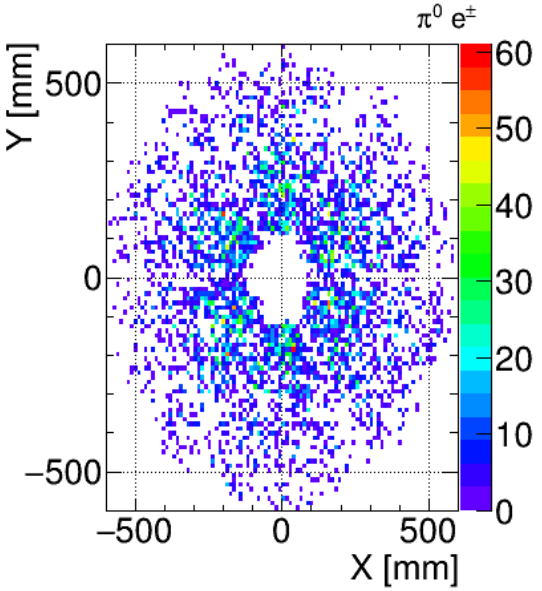


- Mean number of reconstructed rings per event is 5.1

Ring XY positions

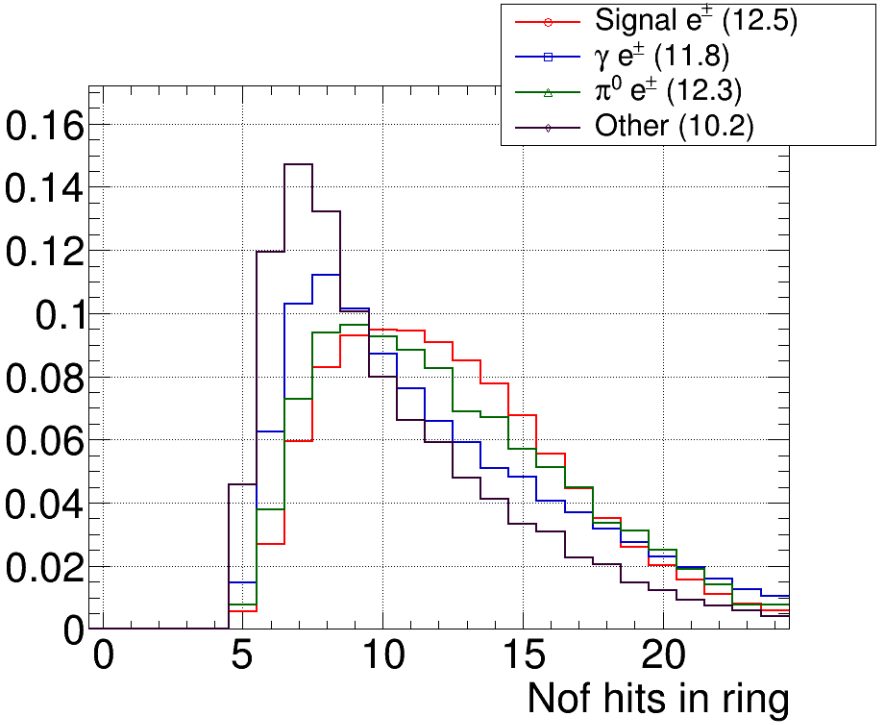


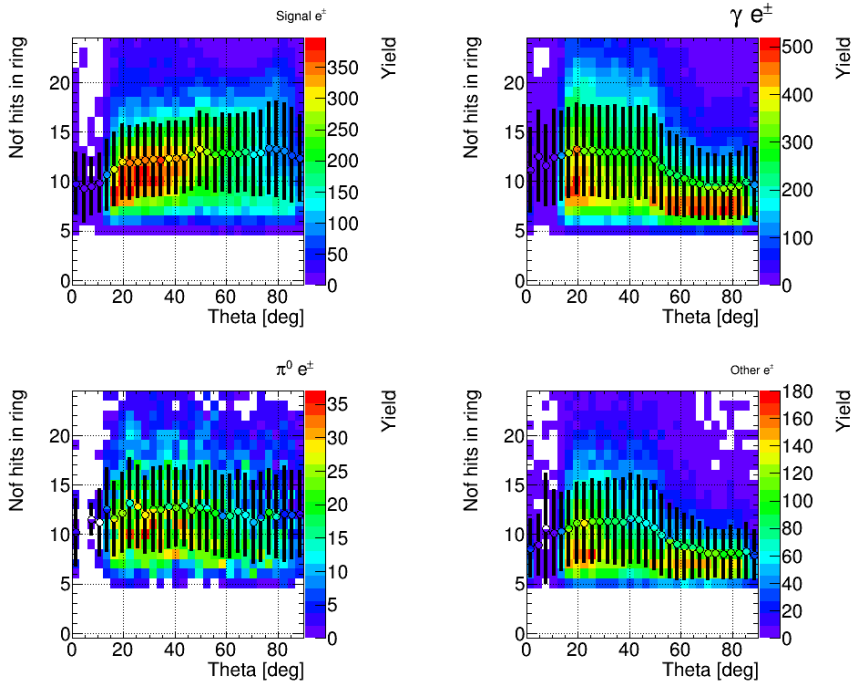




- Signal rings and BG rings are located in the same PMT area.

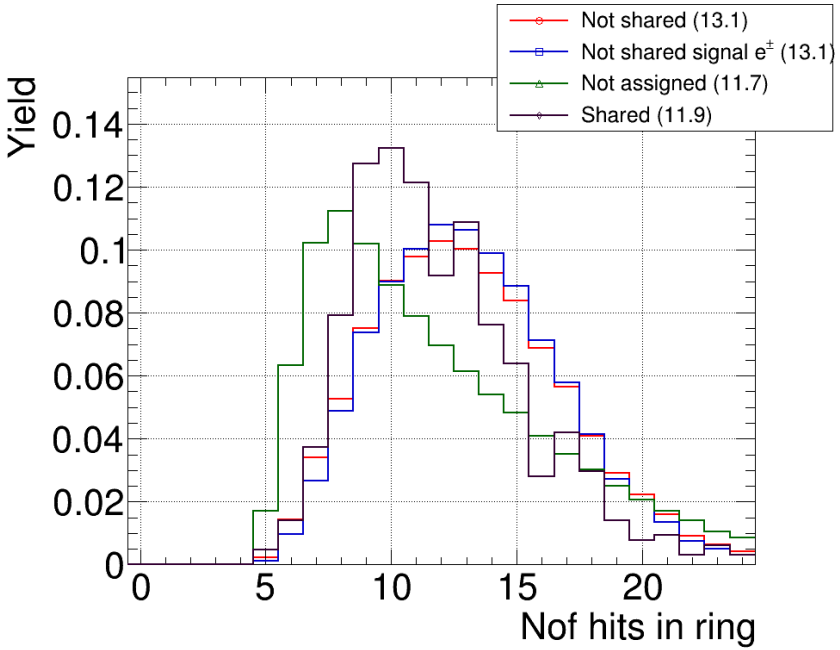
Number of hits per ring
Different sources

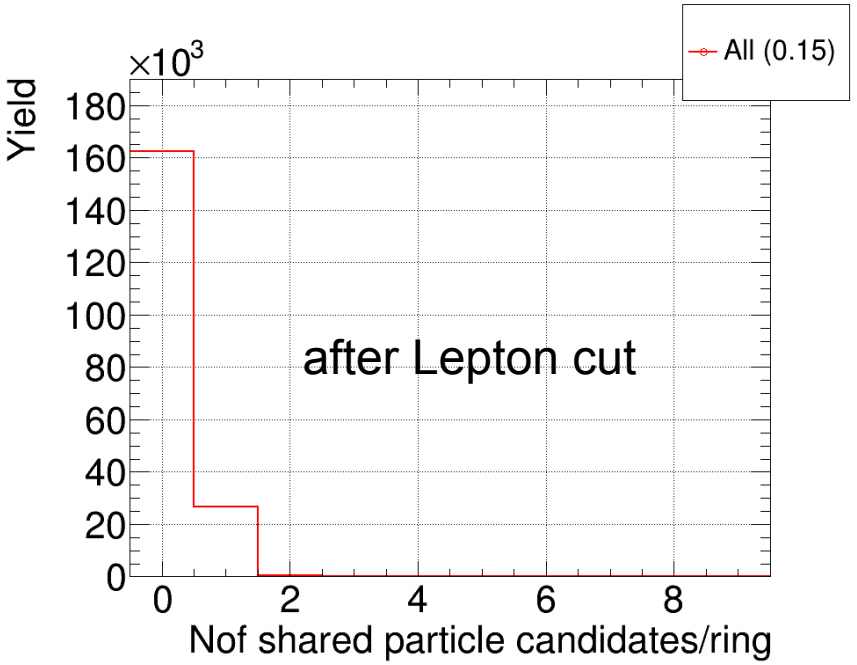




- Drop for the high theta angle for gamma e+/-
- GEANT PID is taken from ring

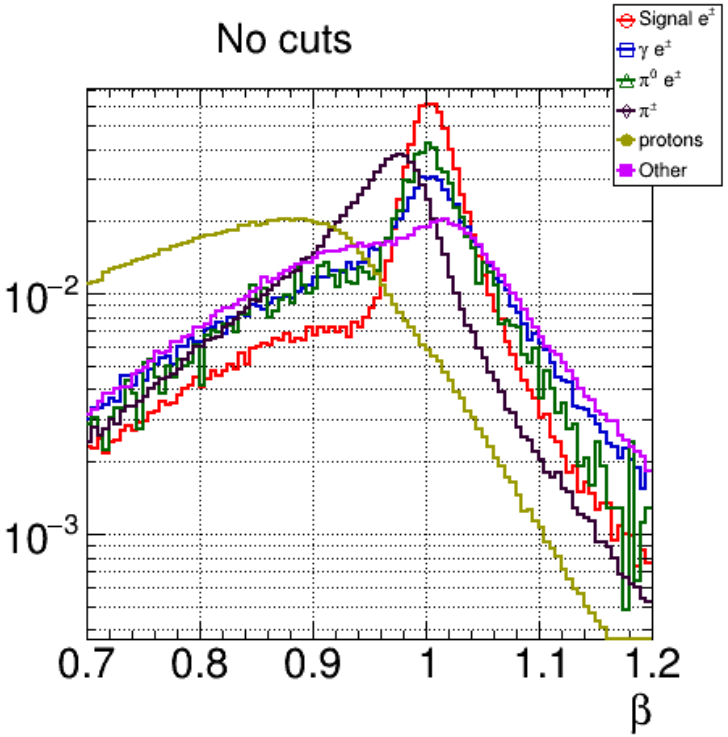
Number of hits per ring
Shared/Not shared rings

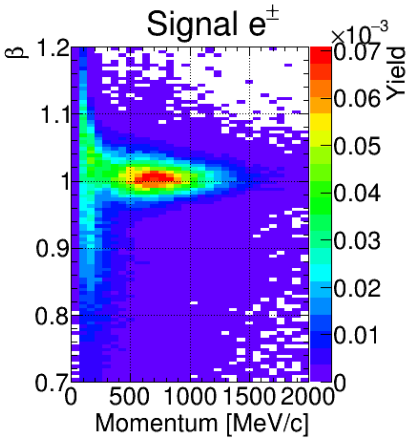


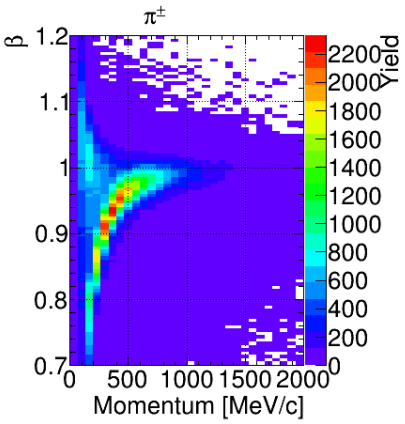


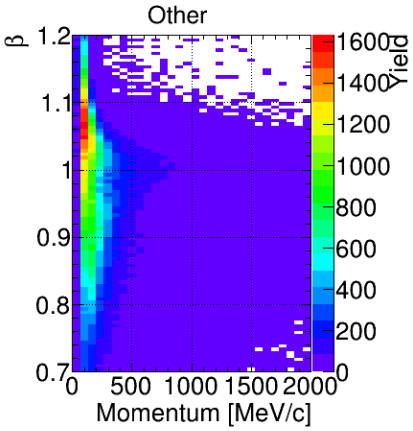
- Use better reconstruction efficiency of the upgraded RICH
- Is it possible to detect double rings from γ conversion?
  - So far number of hits is no good criteria to reject those

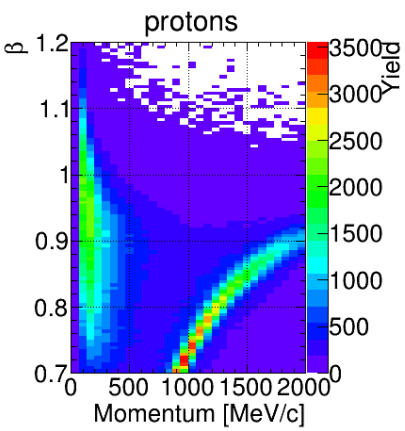
Beta distribution





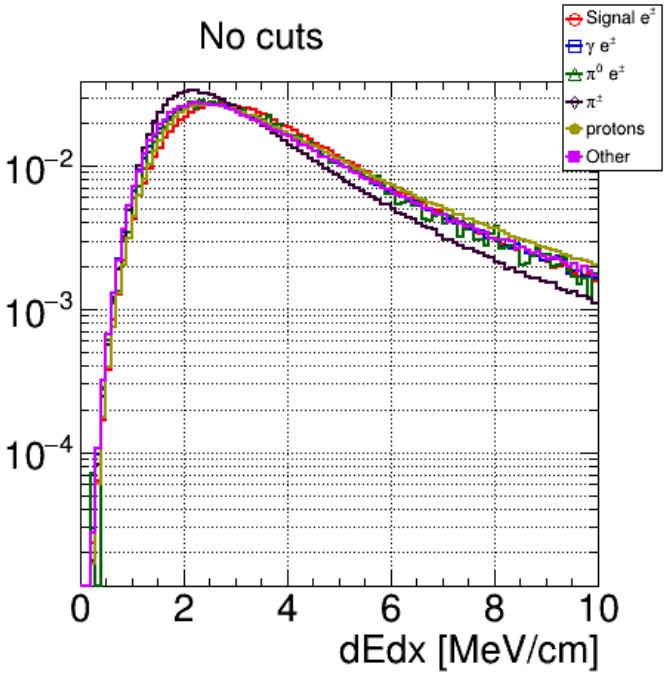


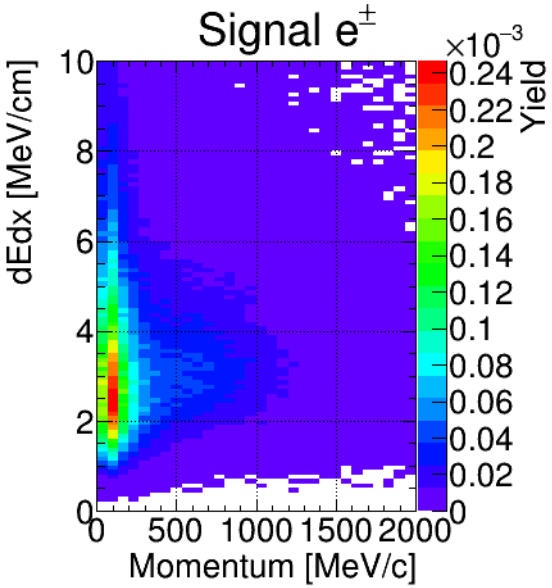


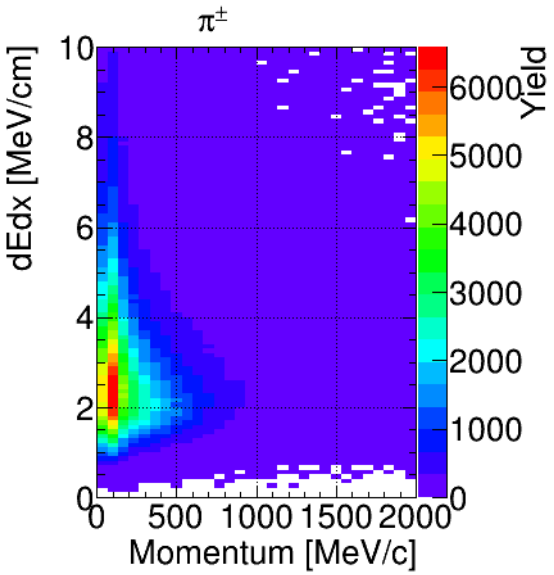


- Improve standard Lepton Id: $\beta > 0.94$

dEdX distribution

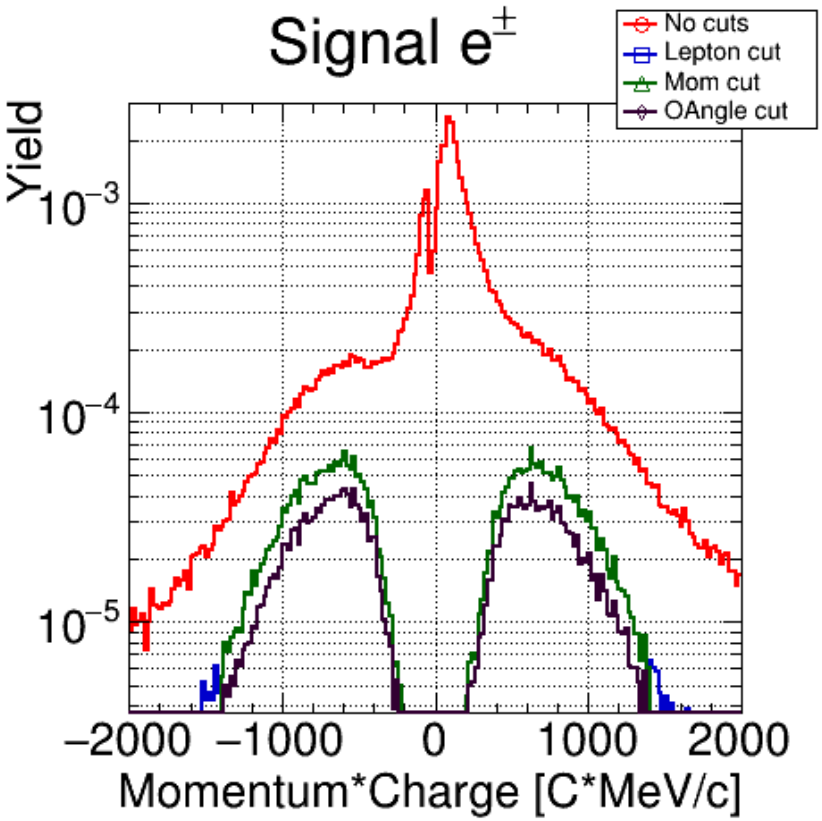


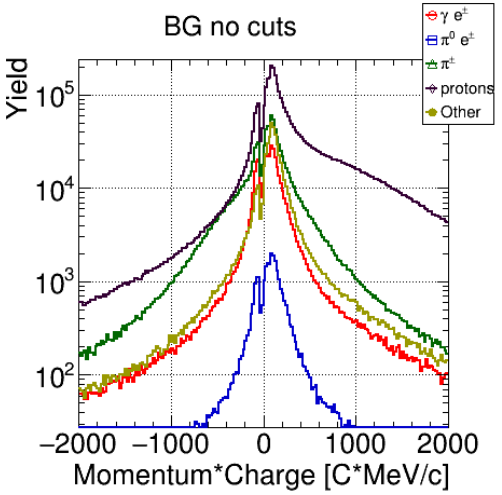


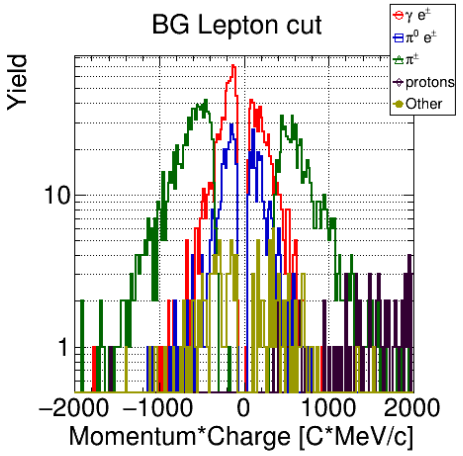


- Is it possible to use dEdX form MDC for improvement of Lepton Id?

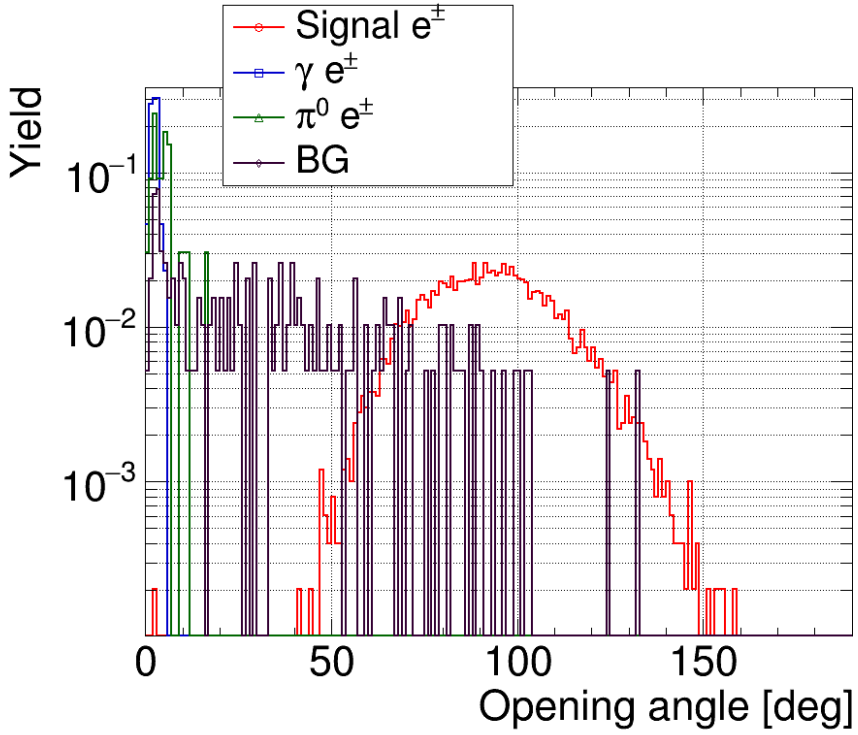
Momentum * charge

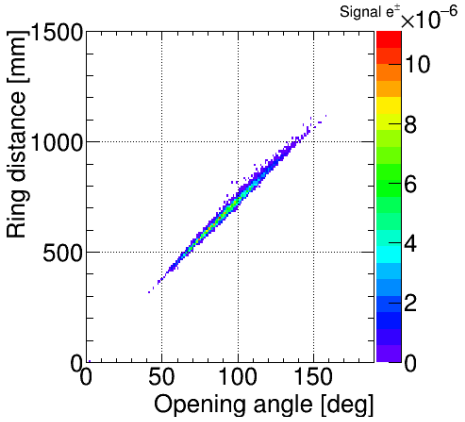


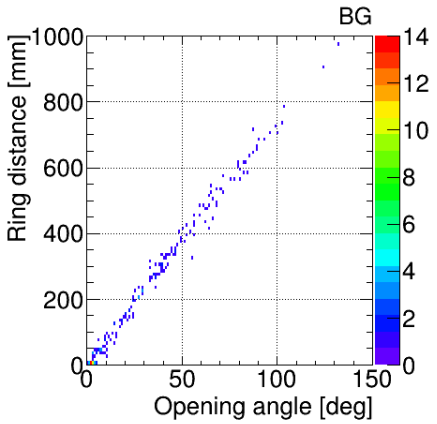




Opening angle
Track candidates

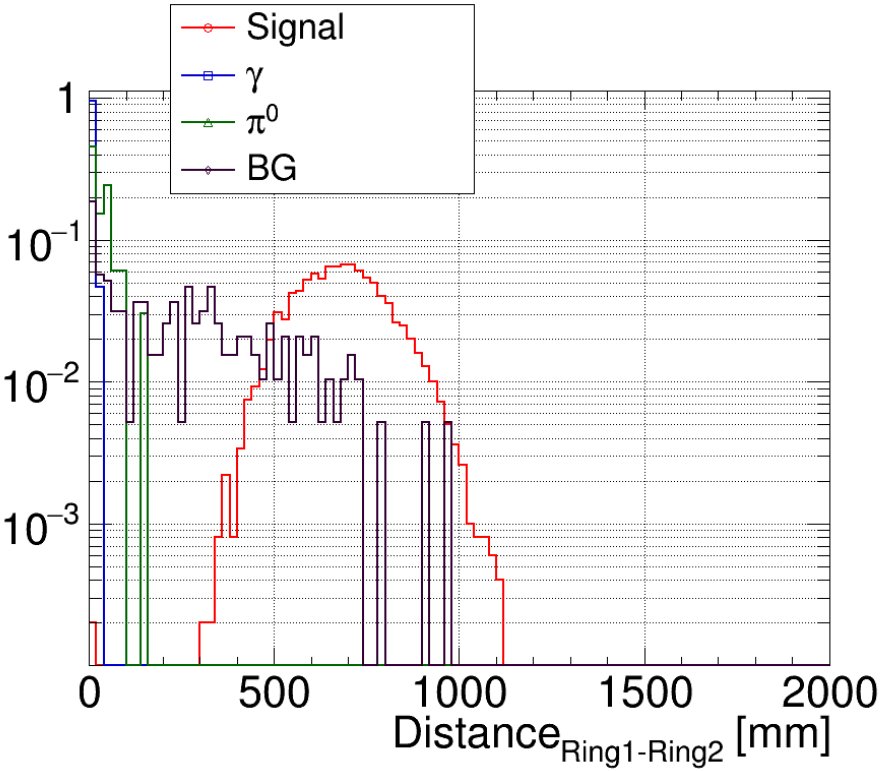


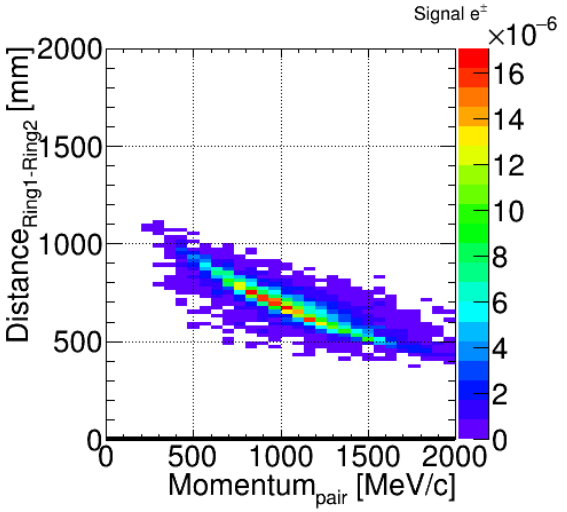


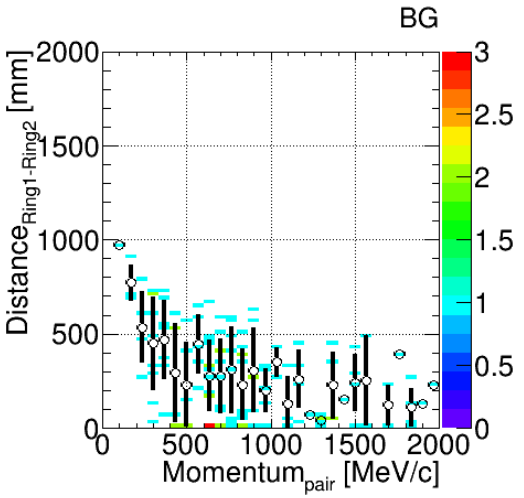


- After Lepton cut
- Almost linear correlation with XY distance

Pair momentum vs. Ring distance

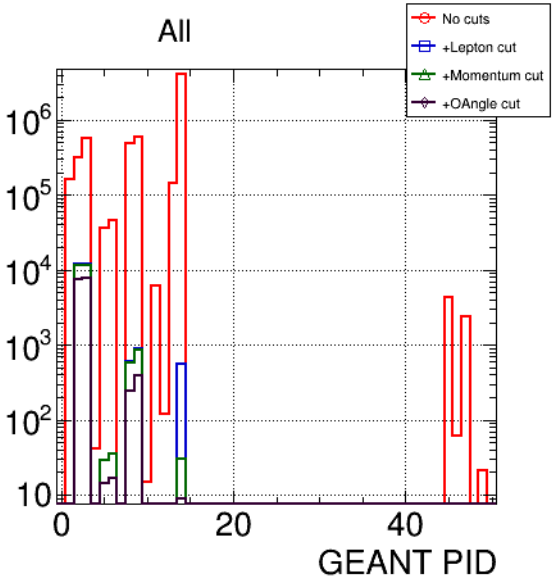


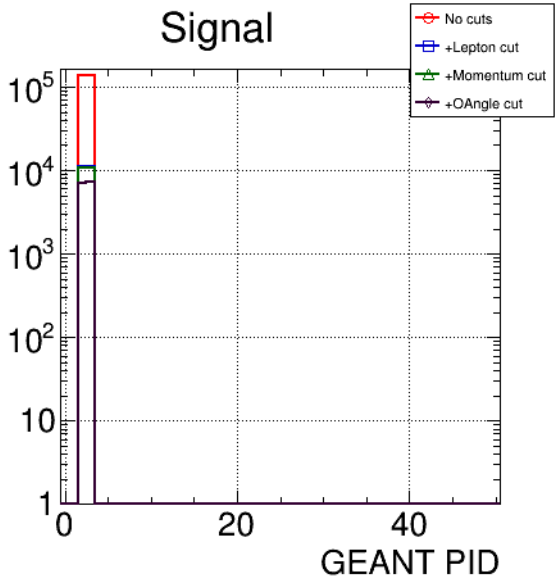


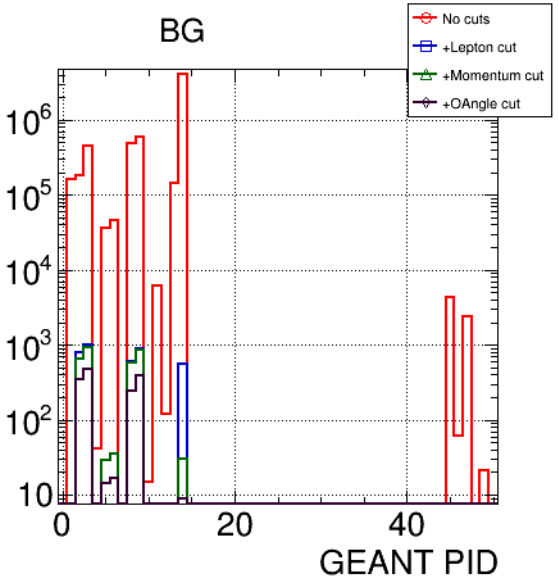


- After Lepton cut

Number of track candidates after cuts

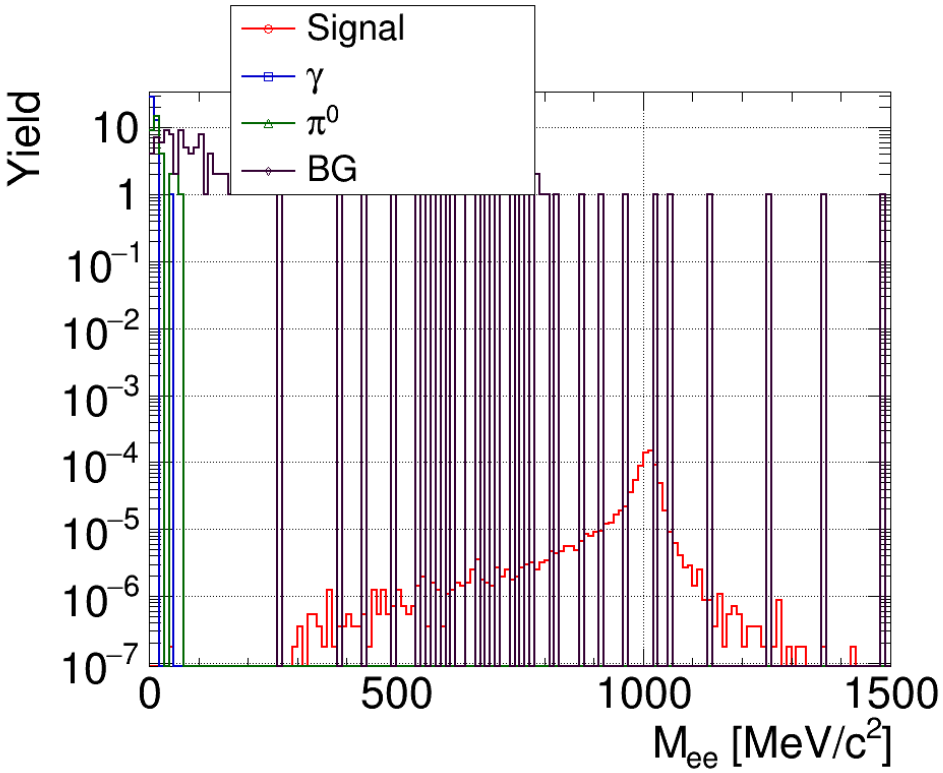


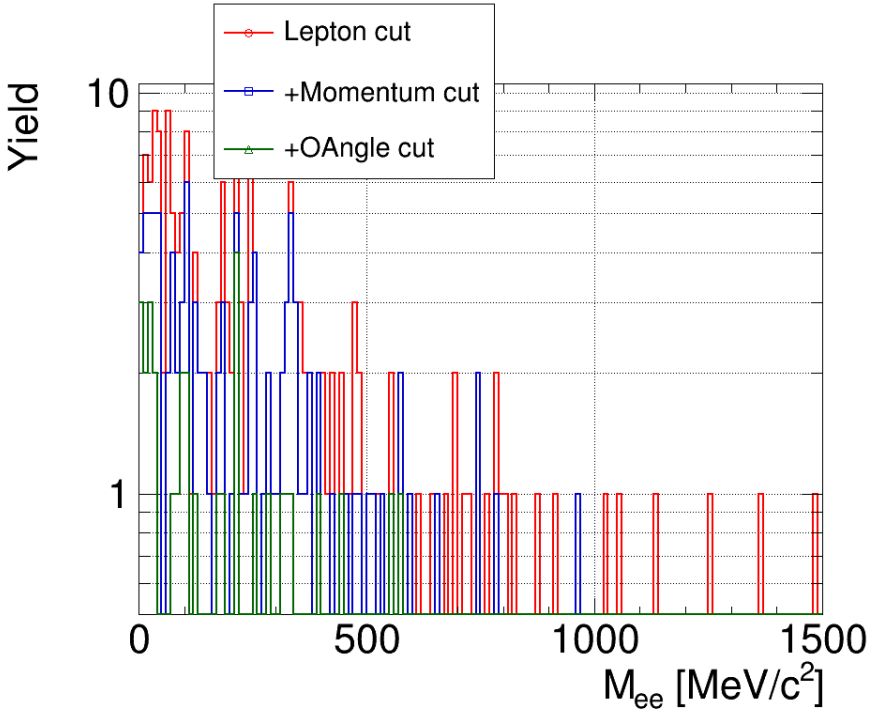




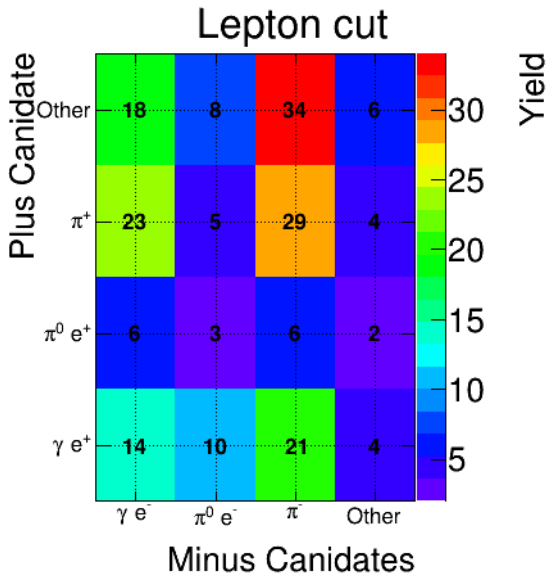
- **2,3**: $e^{\pm}$ **5,6**: $\mu^{\pm}$ **7, 8**:$\pi^{\pm}$ **14**: p
- Almost **no protons** after all cuts but still **many pions**
  - To do: Improve electron ID

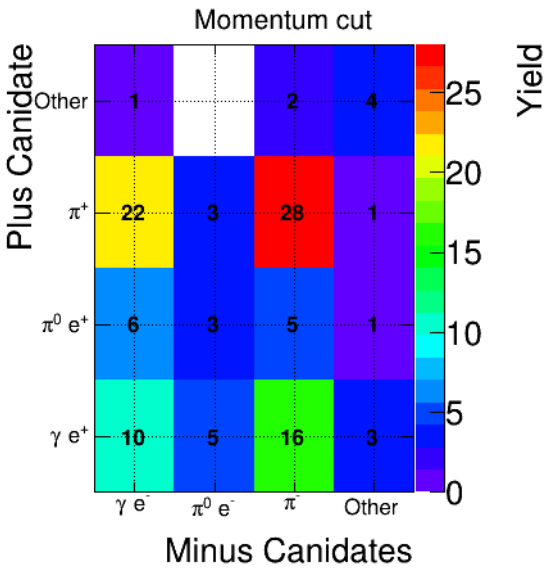
Invariant mass

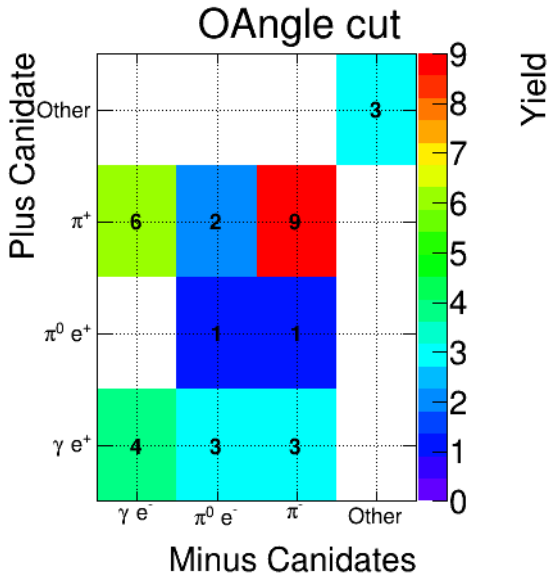




BG pair sources

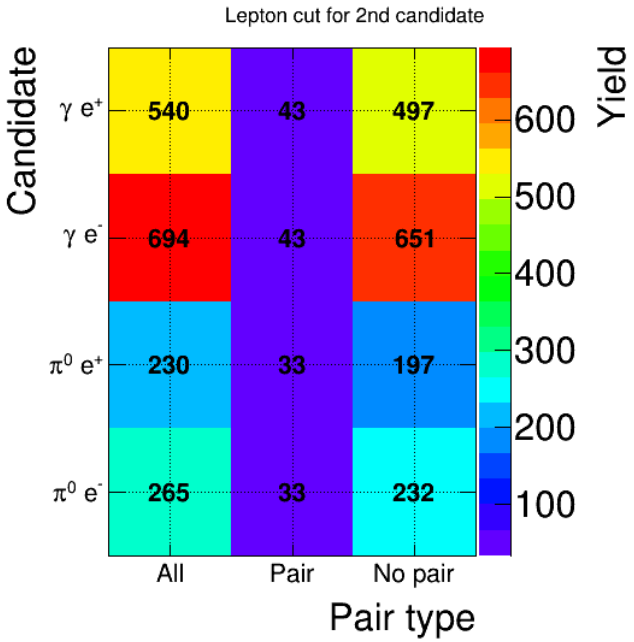


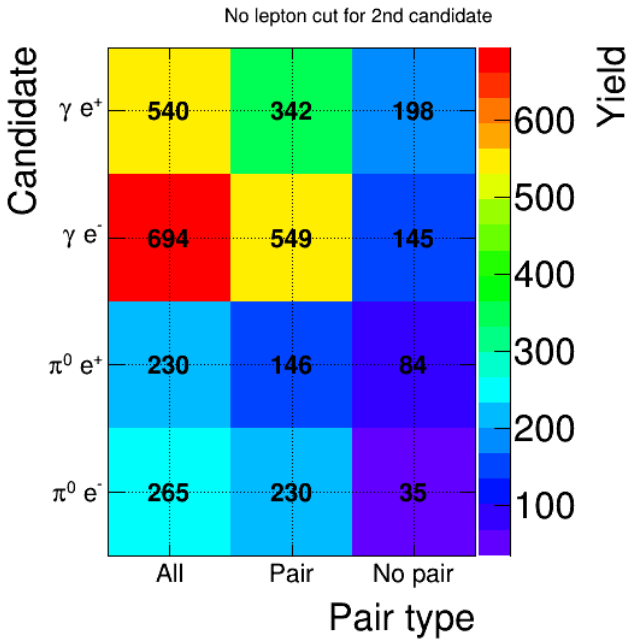




- The biggest contribution comes from misidentified pions.

Opening angle cut discussion





If OA < 9° remove both tracks from combinatorics

- Is opening angle cut helpful?
  - Only in 10% of all pairs both tracks are identified as electron
- Do we need to use isLepton for the second candidate?

Summary

- On the basis of this work/results Marten writes his bachelor thesis!
- The initial version of the dielectron analysis was implemented. Many new developments/studies are ongoing.
- The first analysis in the HADES repository:
  - https://subversion.gsi.de/hades/analysis