Importance of the HADES RICH for di-electron analysis in pion induced reactions*

F. Scozzi[1,2] *and the HADES Collaboration*[1]
[1]TU Darmstadt, Germany; [2]IPNO, Orsay, France

In summer 2014 the High Acceptance Di-Electron Spectrometer (HADES) experiment at GSI took data from pion-induced reactions using three targets: tungsten, carbon and polyethylene, at several pion beam momenta. These data permit to investigate hadron and di-electron production. The main objective for di-electron studies is the understanding of the coupling of virtual photons to baryonic resonances by analyzing the process $\pi N \rightarrow e^+e^-N$, a process for which neither experimental data nor reliable theoretical predictions exist. A clear understanding of the elementary reactions is also important for the interpretation of di-electron production in heavy-ion collisions. The main challenge of this type of analysis is to distinguish di-electrons, that are very rare probes, from the hadronic background. The identification of e^+e^- is usually performed in HADES through appropriate cuts on time-of-flight, energy loss, shower signal and RICH observables. Especially the HADES RICH detector is essential to achieve a required purity in the electron selection. On the other side, it reduces the efficiency to detect an electron/positron.

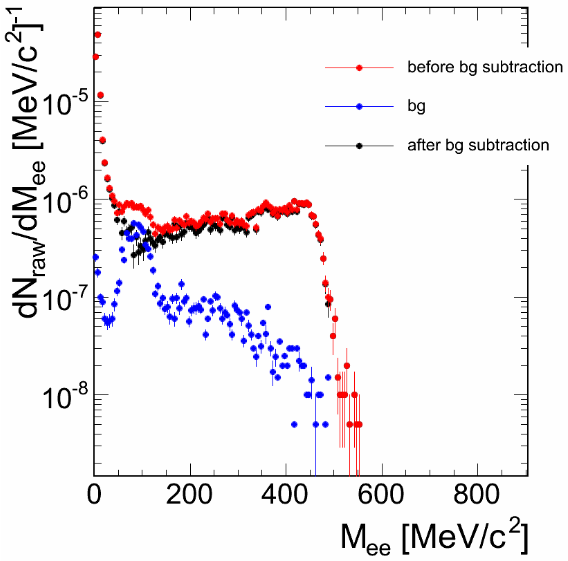

Figure 1: Di-electron invariant mass reconstructed from π^- + polyethylene target reactions at 0.69 $\frac{GeV}{c}$

In order to get a larger statistics, one may hope that the RICH detector is not necessary for electron identification being at low energy and in an environment with low multiplicity. In Fig. 1 the di-electron spectrum from data coming from the interaction of a pion beam witm momentum equal to 0.69 $\frac{GeV}{c}$ with a polyethylene target is shown before and after background subtraction (background is calculated using the geometrical average). In order to understand the slope at 200 $\frac{MeV}{c^2}$ the same identification conditions were applied to data coming from the interaction of pions beam with a momentum equal to 1.7 $\frac{GeV}{c}$ with a tungsten target.

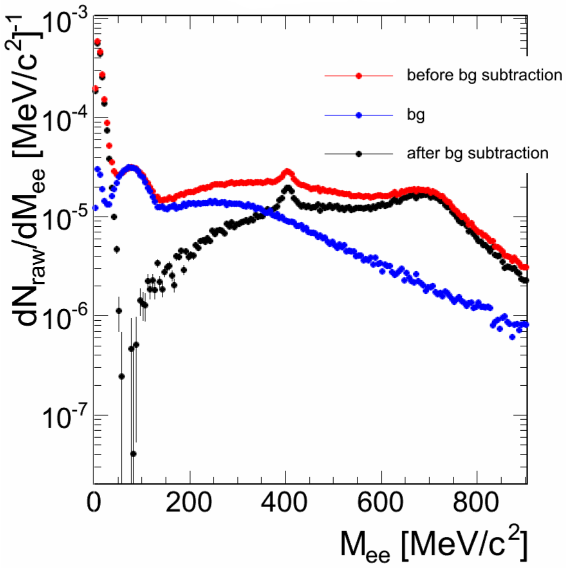

Figure 2: Di-electron invariant mass reconstructed from π^- + tungsten target at 1.7 $\frac{GeV}{c}$

In Fig. 2, at around 400 $\frac{MeV}{c^2}$ it is now possible to observe clearly the peak due to K_{0s}, obtained from misidentified pions (the shift of the peak from the nominal position is due to the fact that the mass of electrons is assigned also to these particles), that also create the structure at higher masses. From this spectrum it is possible to infer that also the structure in the PE spectrum is due to misidentified pions.

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