Self consistency

Efficiency and acceptance matrices were produced using 100 real files, in which white electrons or positrons were embedded (1 per sector). For generating efficiency matrices single cuts (no close neighbour and χ^2 cut) and pair cuts (opening angle) were applied. Furthermore only tracks were used with $4 < \phi < 56$). NO momentum cut was used here. There are 4 options to produce the matrices:

- IDEAL: use ideal (GEANT) variables for filling the matrices.
- IDEAL(weight): use ideal (GEANT) variables for filling the matrices, momenta a weighted with exponential distribution of leptons.
  positrons: weight = 2.47786e-04* (exp(-7.77766e-03*p)+(3.25607e-05)*exp(-4.28148e-03*p))
  electrons: weight = 7.98584e-05* (exp(-4.38105e-03*p)+(6.56046e-04)*exp(-8.76580e-03*p));
- REAL: use reconstructed (DST) variables for filling the matrices.
- REAL(weight): use reconstructed (DST) variables for filling the matrices, momenta a weighted with exponential distribution of leptons.

To check the acceptance filtering and efficiency correction a self consitency check was performed with physical dilepton sources from Pluto. For 10 real files 6 sources (π^0 - Dalitz, η - Dalitz, Δ - Dalitz, ρ - direct, ω - direct and ω - Dalitz) were produced in Pluto. This yields in roughly 2 Mio generated events for each source. In one case thiese events were filtered and smeared, in the other case processed through GEANT, embedded in real events and DST production including pairing was performed.
For comparison it is important to use also the single cuts (see above) for the case of full analysis chain. Momentum (80 MeV/c < p < 2000 MeV/c) and pair cuts (if there are pairs) are used for both, filtered AND full analysis chain. In which step this is applied depends on the stage of self consistency check. Additionally legs with efficiencies lower than 5% were skipped.

Self consistency check for physical singles

First the variables of the single legs of physical pairs are checked. Therefore the electrons and positrons of one event were splitted into two subevents and processed separately.

For filtering and smearing the steps are:

- get efficiency and acceptance from IDEAL matrix
- smear momentum and angles
- single cuts (ϕ and momentum)
- filling histograms for efficiency > 5% weighted with efficency*acceptance

For the full analysis chain the steps are:

- get efficiency from IDEAL matrix
- single cuts (ϕ, momentum, χ^2, close neighbour)
- filling histograms for efficiency > 5% w/o weighting

Afterwards a ratio between the single variables can be built and are shown for θ, ϕ and p for electrons and positrons from the η-Dalitz decay respectively in figs. 1 to 6. Inside the error bars this is 1 for all distributions.

Self consistency check for pairs - stage1

The same now can be done for the pairs. The same files were now processed in the same manner but without splitting into electrons and positrons.
For filtering and smearing the steps are:

- get efficiency and acceptance from IDEAL matrix
- smear momentum and angles
- single cuts (ϕ and momentum)
- opening angle cut
- correction of eff1*eff2 due to opening angle (retrieved from η - Dalitz: eff1*eff2 *= (6.26790e+01/(TMath::Power(OA,-2.19297e+00)+1)-6.17033e+01))
- filling histograms for efficiency of both legs > 5% weighted with eff1*acc1*eff2*acc2

For the full analysis chain the steps are:

- single cuts (ϕ, momentum, χ^2, close neighbour)
- recursive opening angle cut
- filling histograms with true pairs w/o weighting

The comparison of invariant mass (fig7), opening angle (fig8), p_T (fig9) and rapidity (fig10) is done for all sources separatly.

Self consistency check for pairs - stage2

In a second stage the method for efficiency correction, which is applied for experimental data, is fully reproduced. In this case the Pluto cocktail is only smeared and filtered through acceptance and the GEANT-DST output is corrected for efficiency.
For filtering and smearing the steps are:

- get acceptance
- smear momentum and angles
- get efficiency from REAL weighted matrix
- single cuts (ϕ and momentum)
- opening angle cut
- filling histograms for efficiency of both legs $> 5\%$ weighted with acc1*acc2

For the full analysis chain the steps are:

- single cuts (ϕ, momentum, χ^2, close neighbour)
- recursive opening angle cut
- opening angle correction: 1./(6.26790e+01/(TMath::Power(opang,-2.19297e+00)+1)-6.17033e+01);
- filling histograms for efficiency of both legs $> 5\%$ with true pairs weighted with (1/eff1*eff2)

The comparison of invariant mass (fig11), opening angle (fig12), p_T (fig13) and rapidity (fig14) is done for all sources separatly.
In addition the effect of using different types of efficieny matrices was investigated (only for η - Dalitz events). In fig. 15 the ratios are shown for REAL and IDEAL matrices, with and without weighting with experimental lepton momentum distributions.

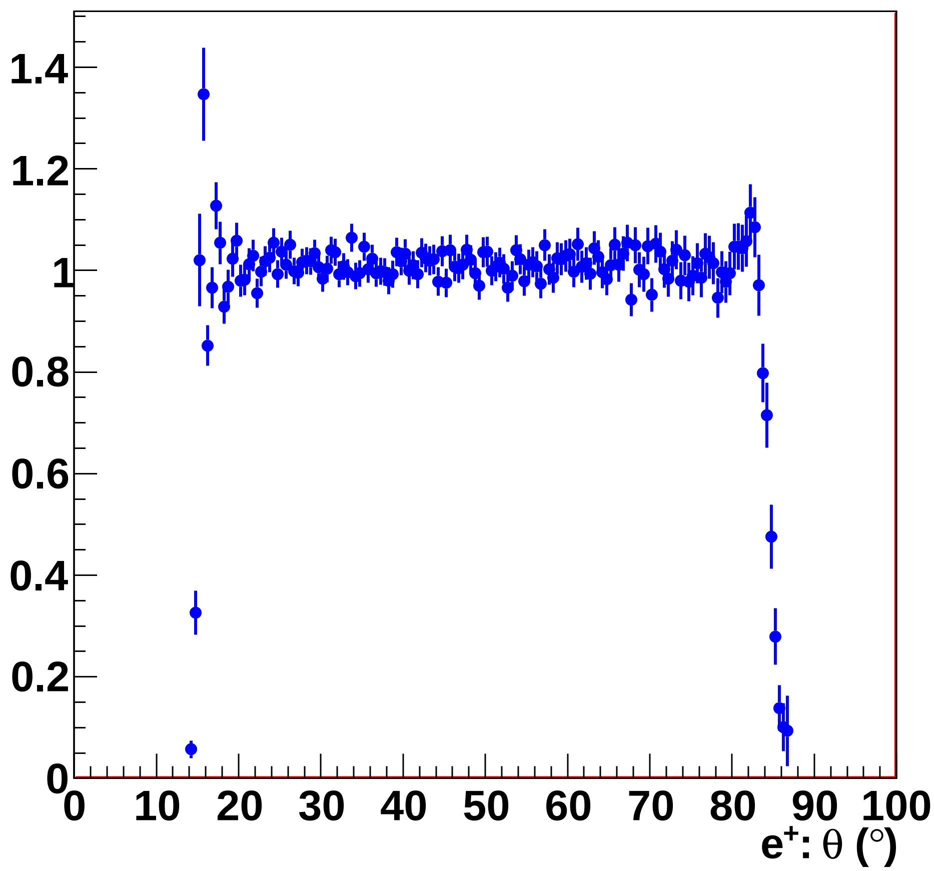

Figure 1: Ratio (GEANT-DST/Filter-Smear) for θ of positrons from η - Daliz events.

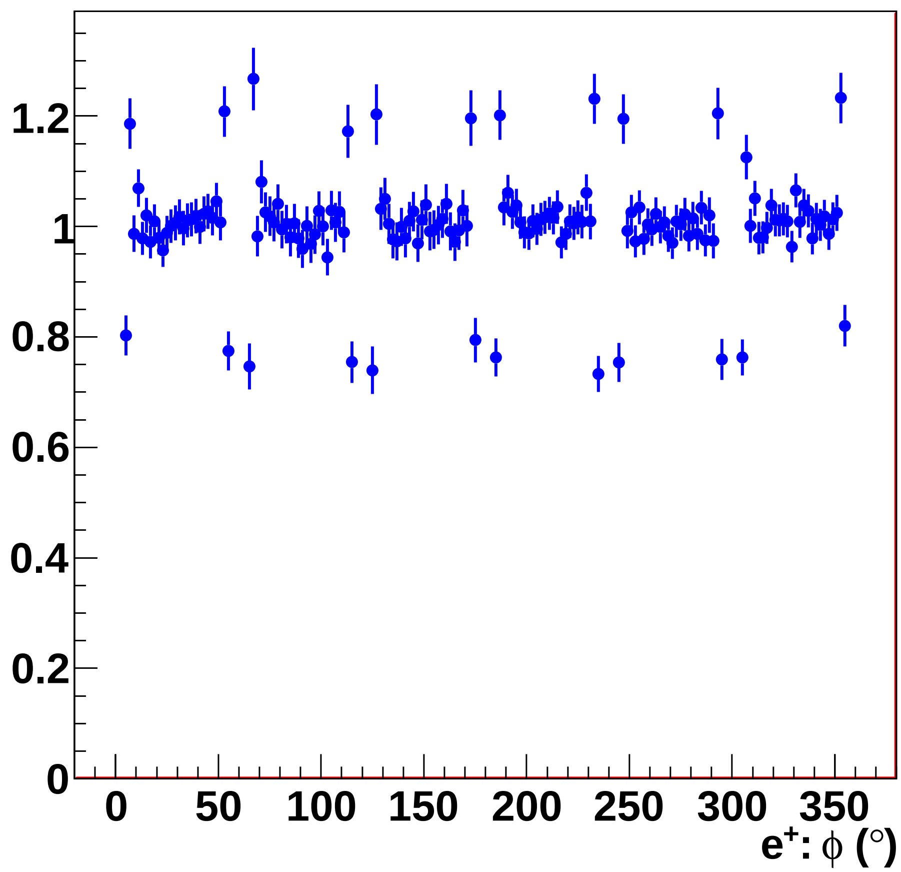

Figure 2: Ratio (GEANT-DST/Filter-Smear) for ϕ of positrons from η - Daliz events.

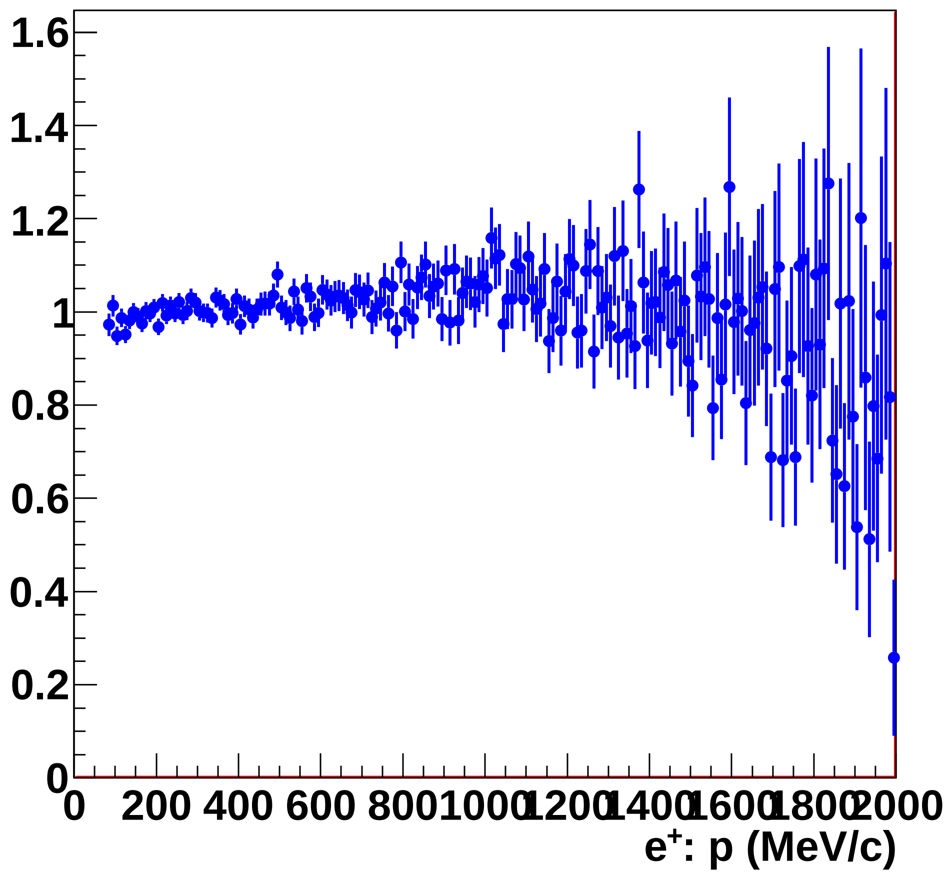

Figure 3: Ratio (GEANT-DST/Filter-Smear) for momentum of positrons from η - Daliz events.

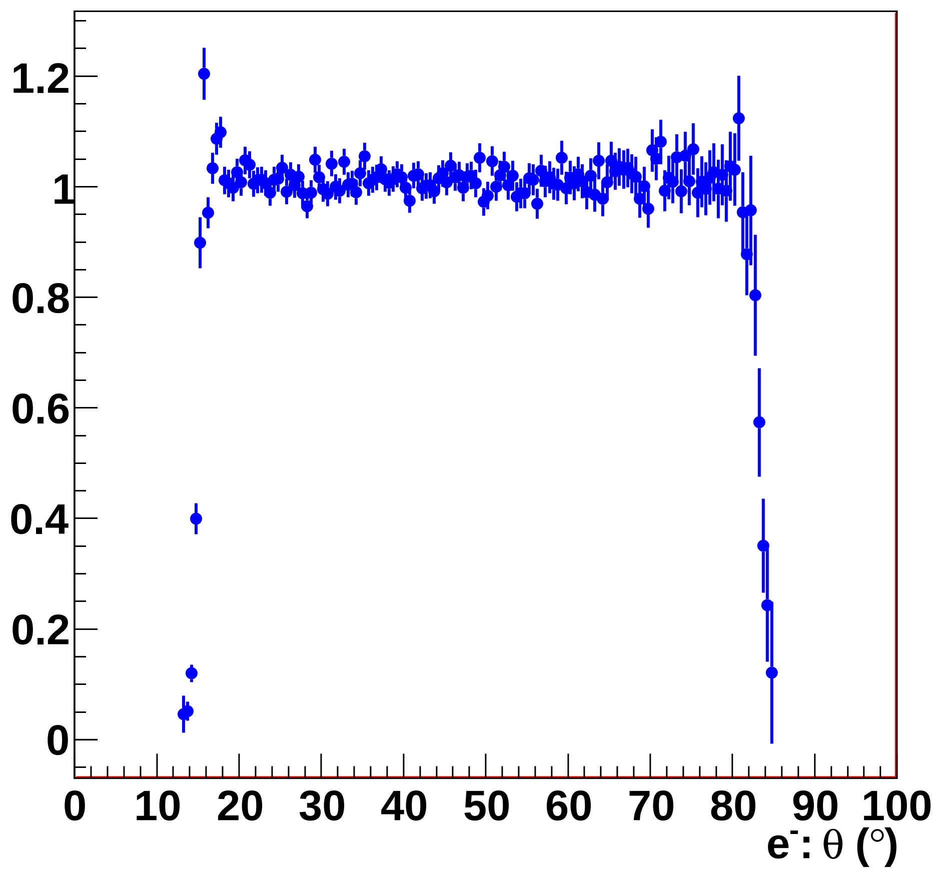

Figure 4: Ratio (GEANT-DST/Filter-Smear) for θ of electrons from η - Daliz events.

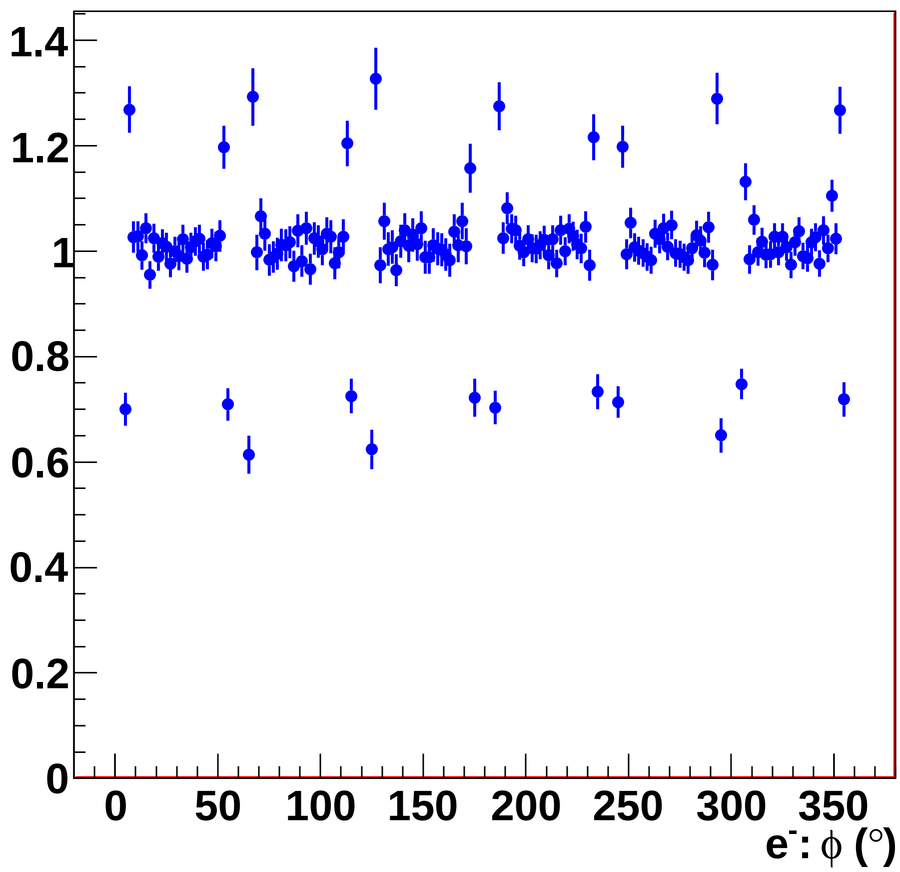

Figure 5: Ratio (GEANT-DST/Filter-Smear) for ϕ of electrons from η - Daliz events.

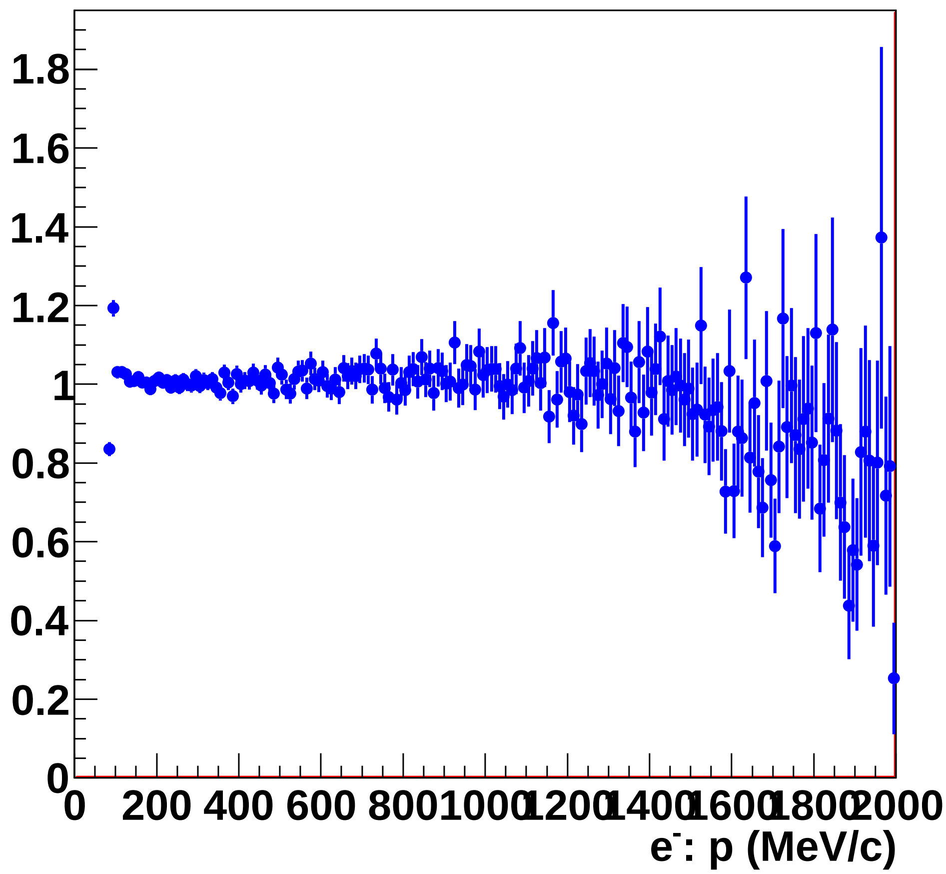

Figure 6: Ratio (GEANT-DST/Filter-Smear) for momentum of electrons from η - Daliz events.

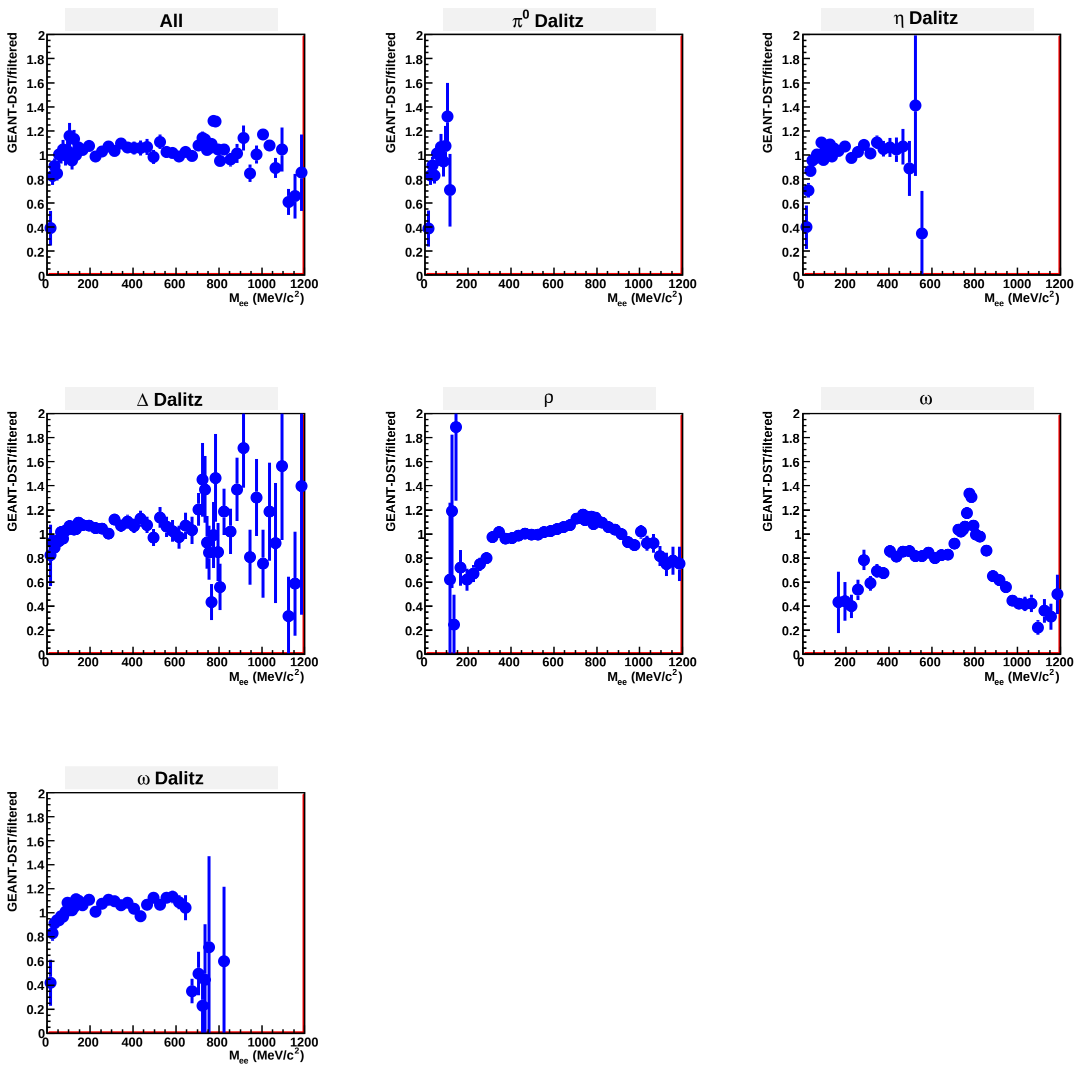

Figure 7: Ratio (GEANT-DST/Filter-Smear) for invariant mass of different dielectron sources.

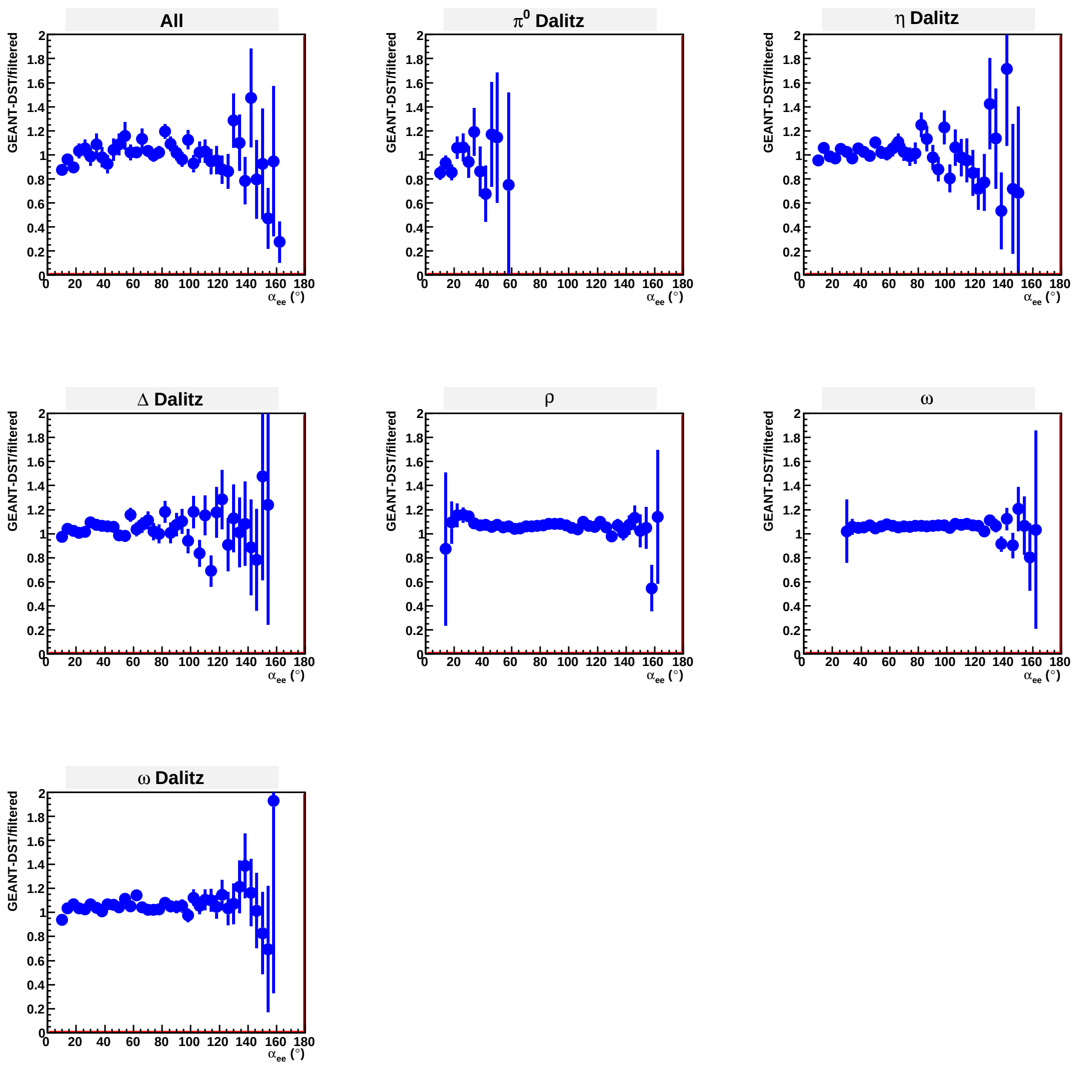

Figure 8: Ratio (GEANT-DST/Filter-Smear) for opening angle of different dielectron sources.

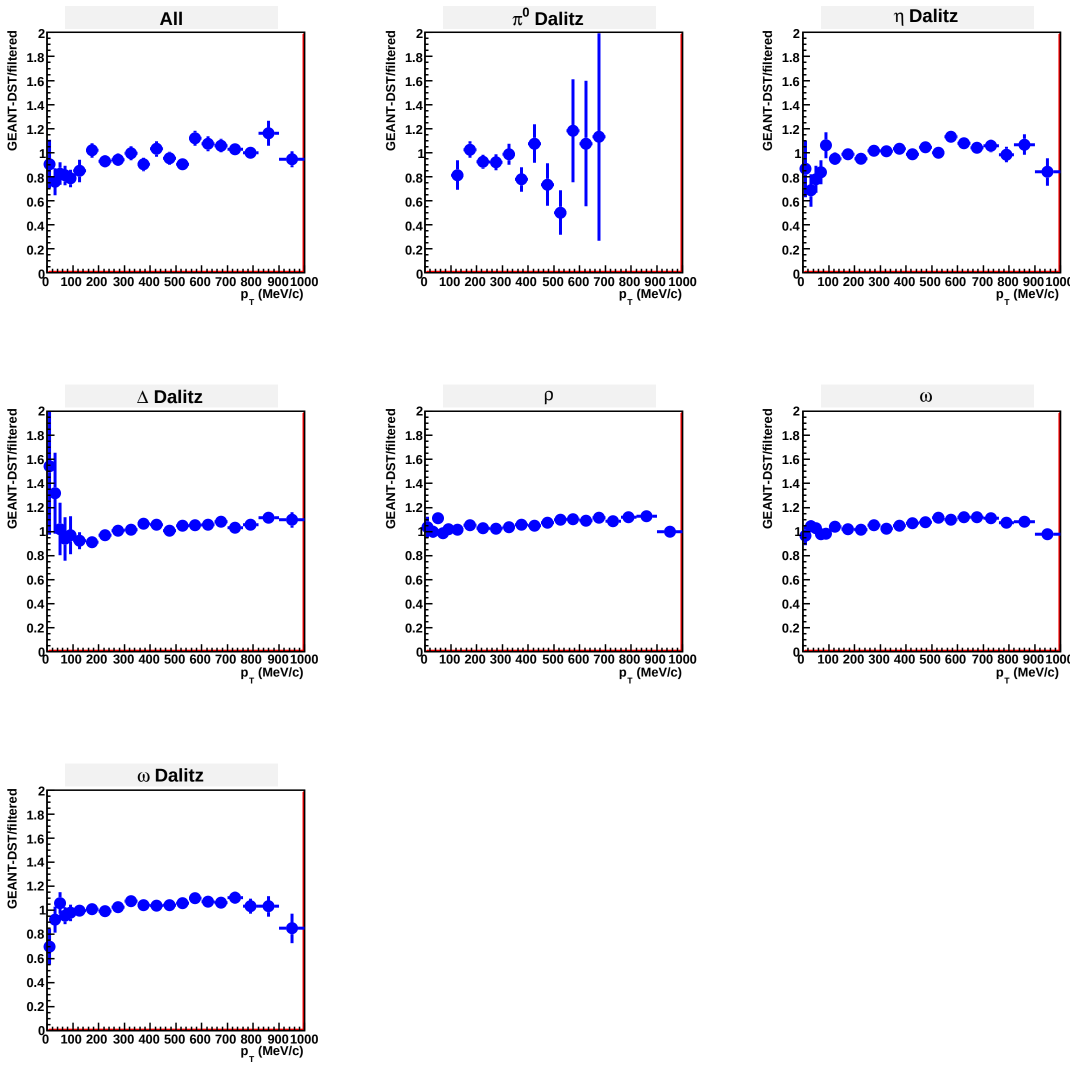

Figure 9: Ratio (GEANT-DST/Filter-Smear) for p_T of different dielectron sources.

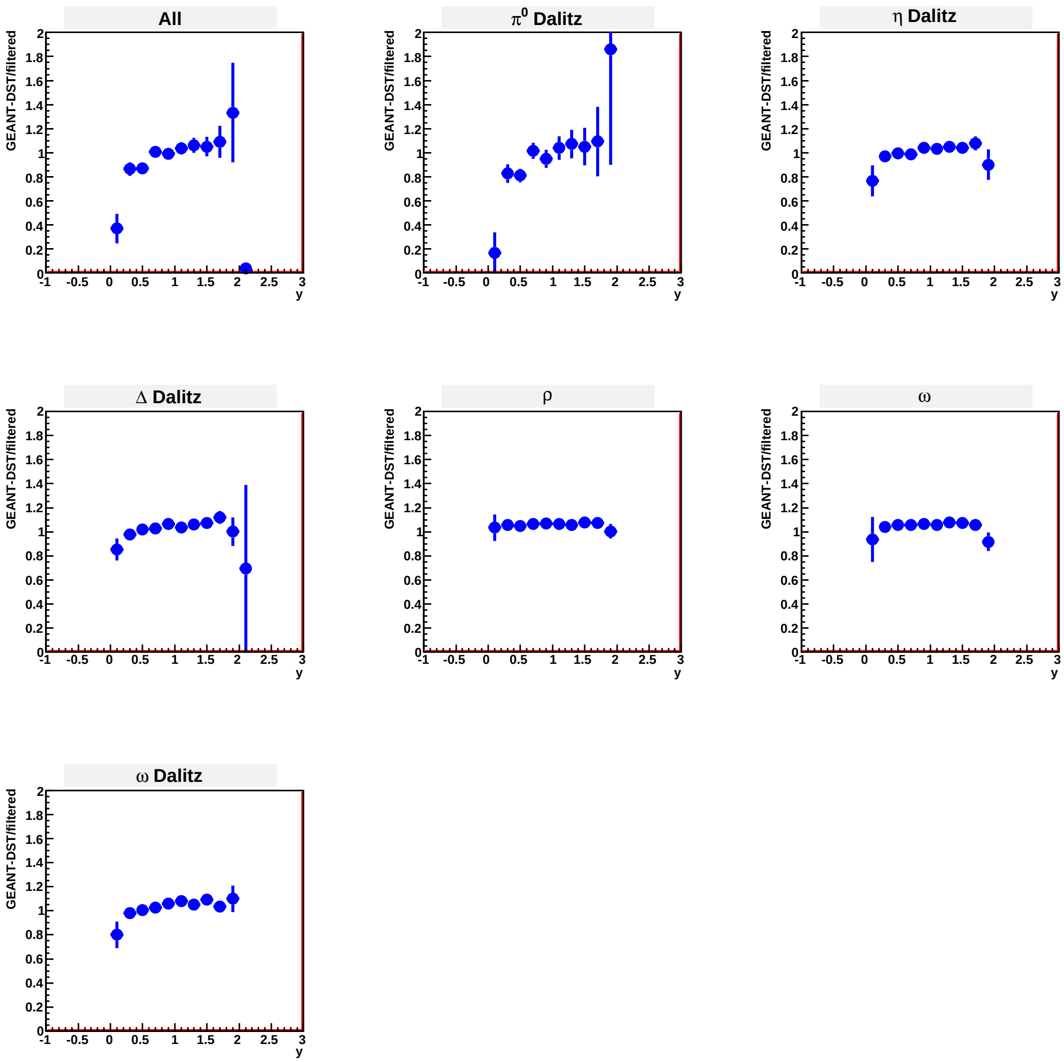

Figure 10: Ratio (GEANT-DST/Filter-Smear) for rapidity of different dielectron sources.

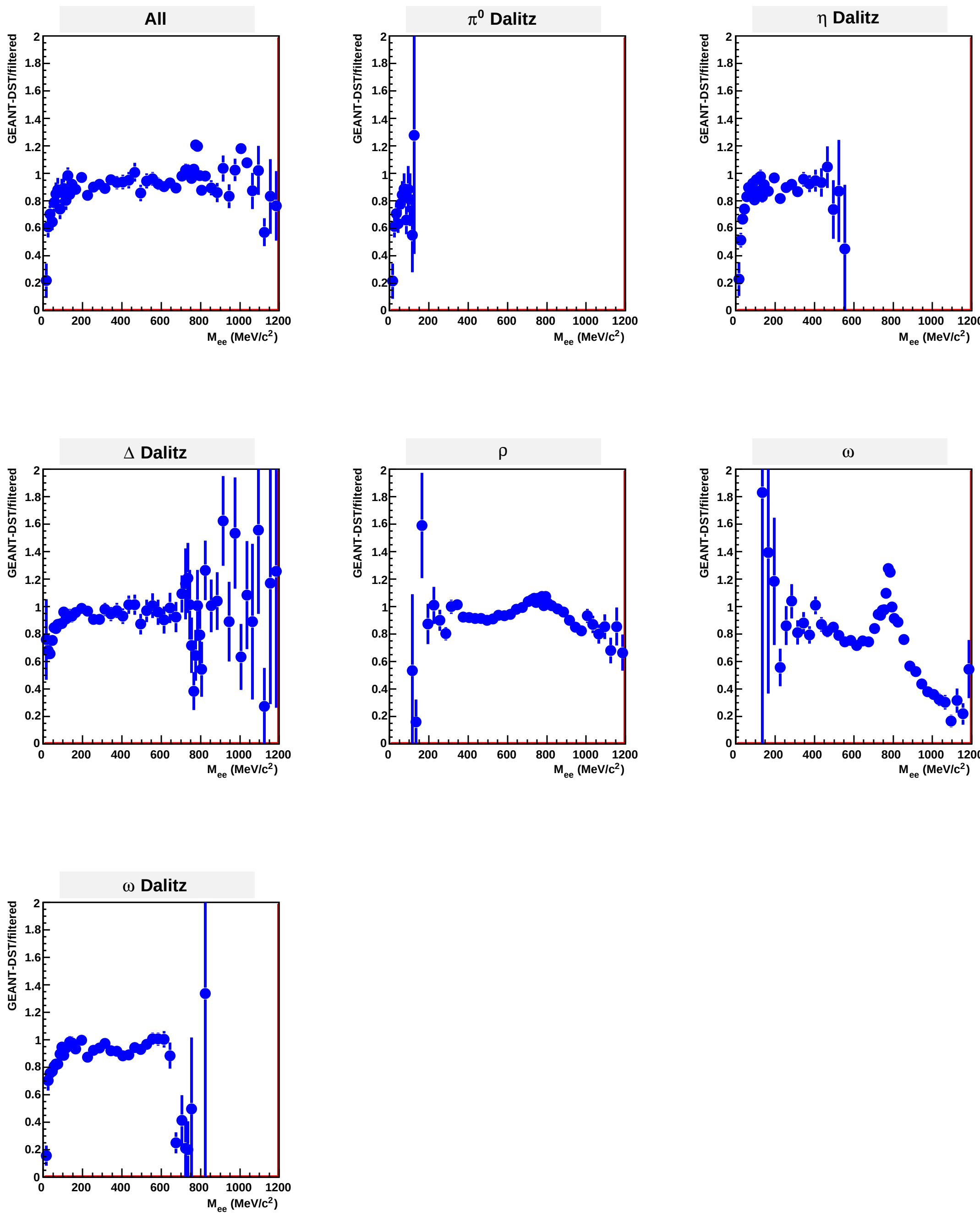

Figure 11: Ratio (GEANT-DST-effiency corrected/Filter-Smear) for invariant mass of different dielectron sources.

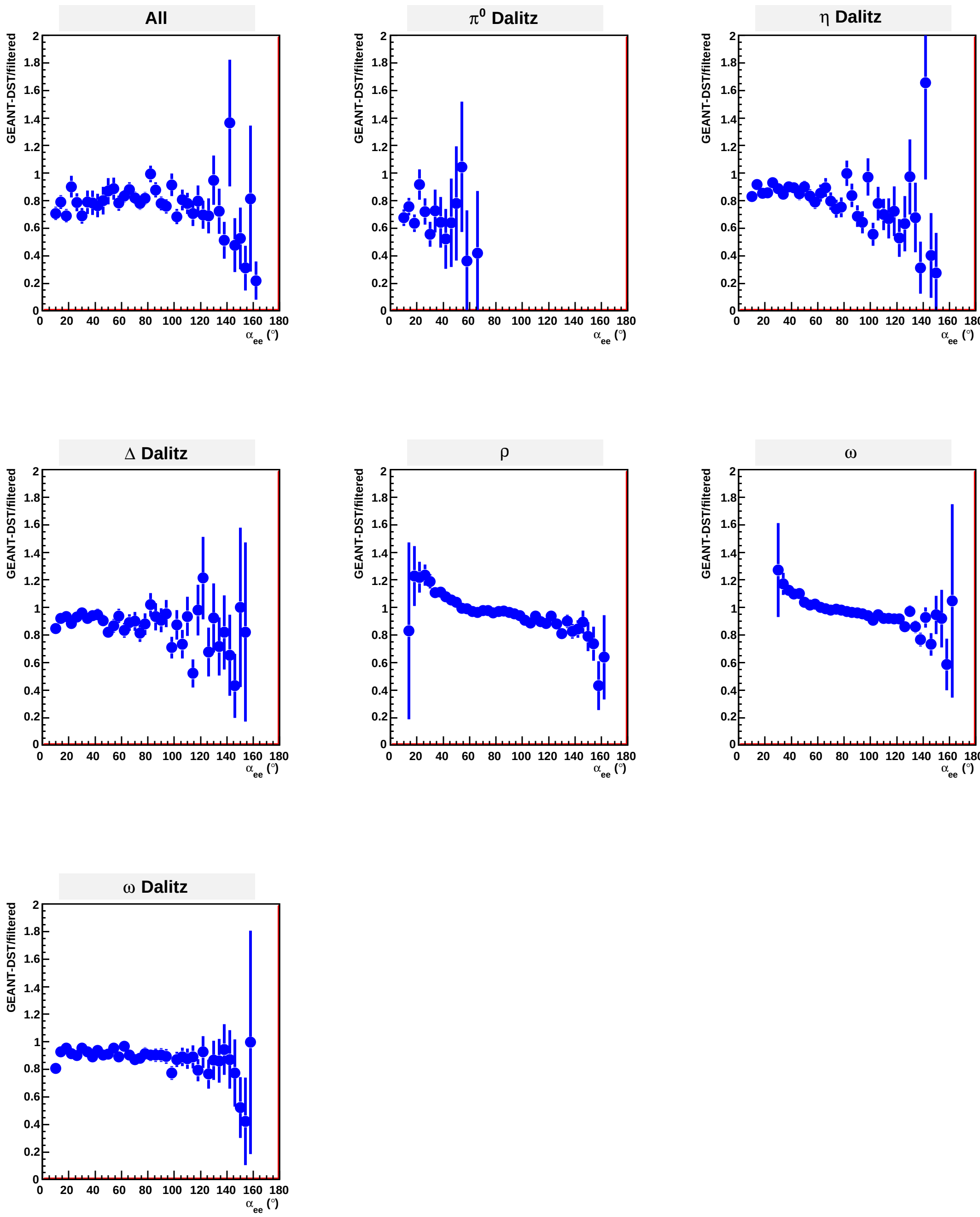

Figure 12: Ratio (GEANT-DST-effiency corrected/Filter-Smear) for opening angle of different dielectron sources.

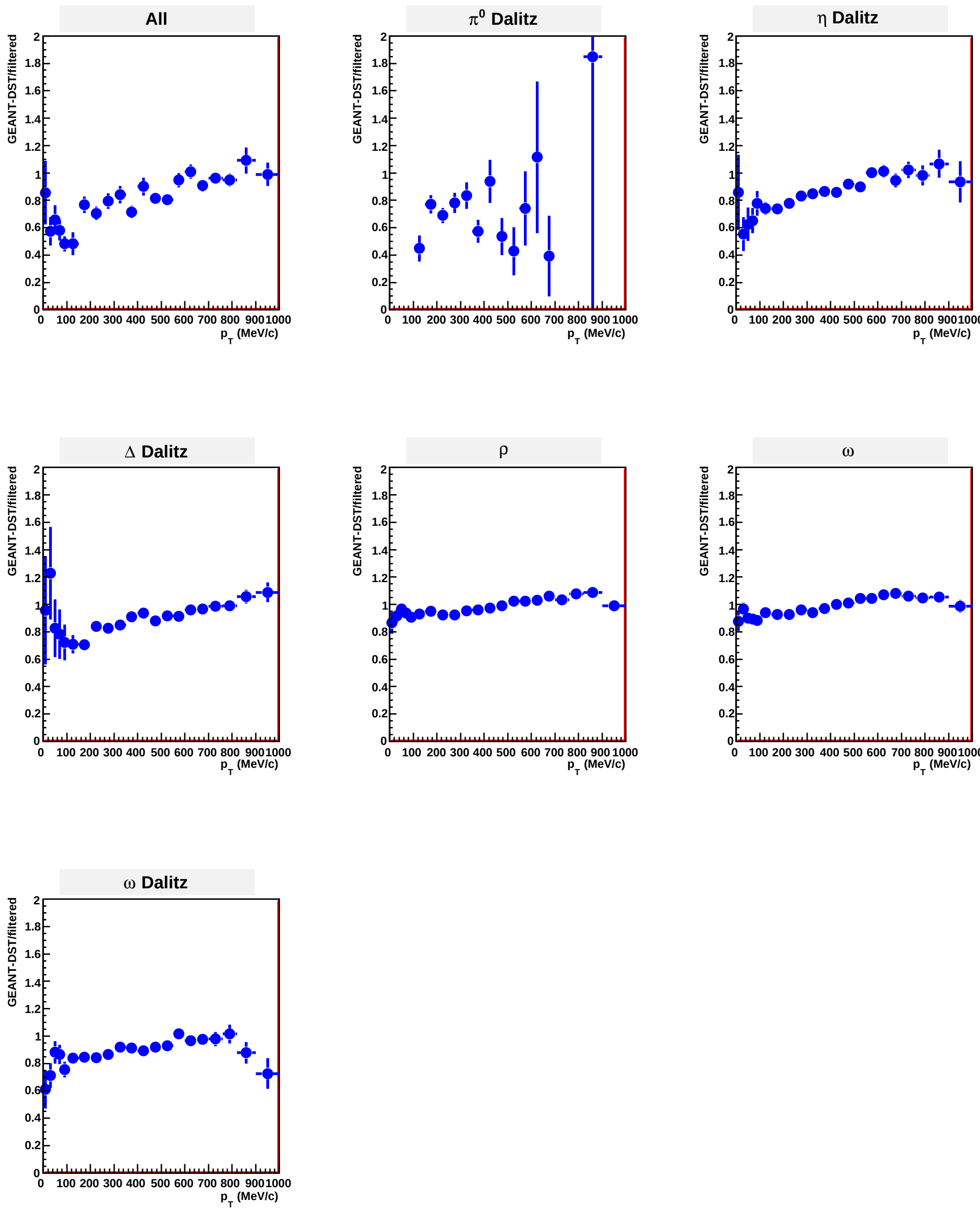

Figure 13: Ratio (GEANT-DST-effiency corrected/Filter-Smear) for p_T of different di-electron sources.

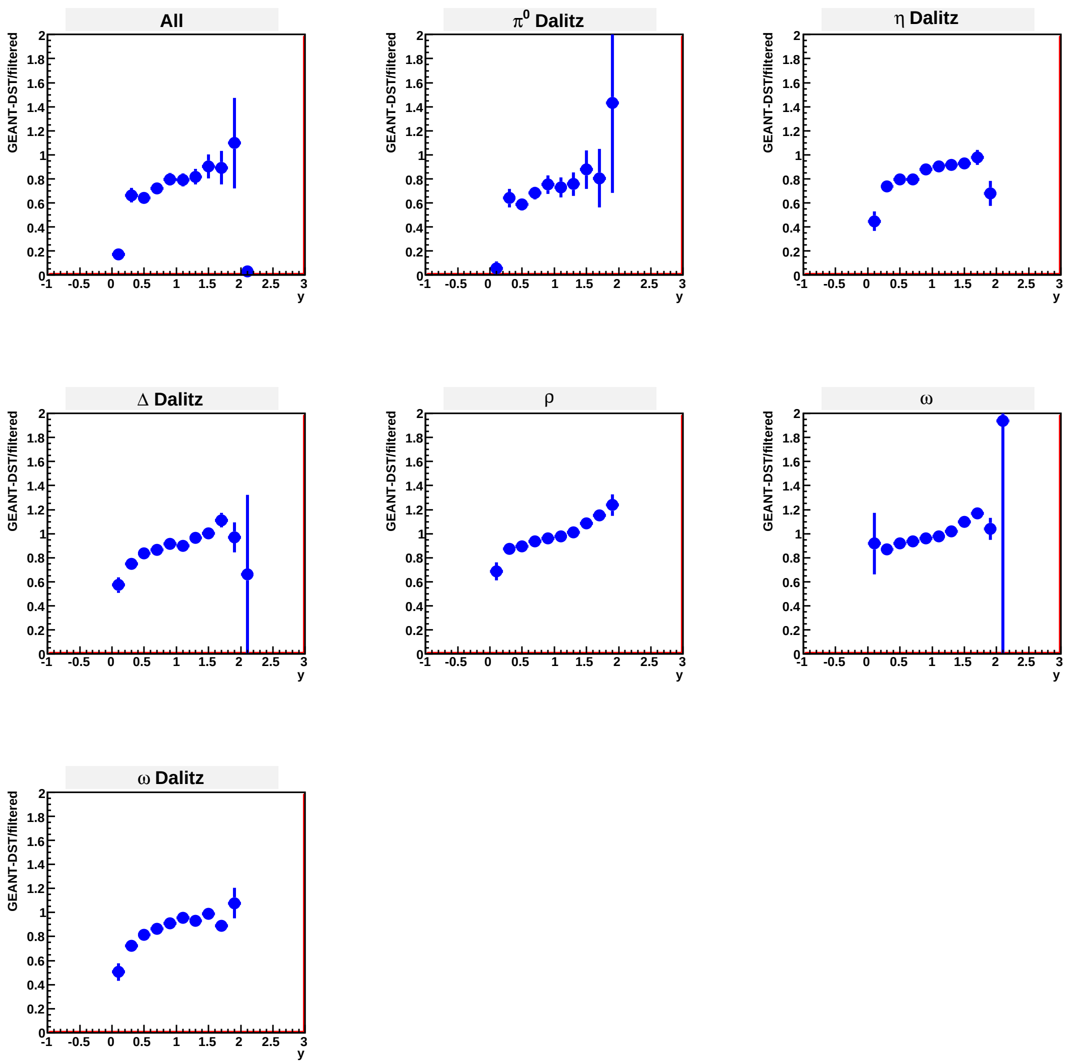

Figure 14: Ratio (GEANT-DST-effiency corrected/Filter-Smear) for invariant mass of different dielectron sources.

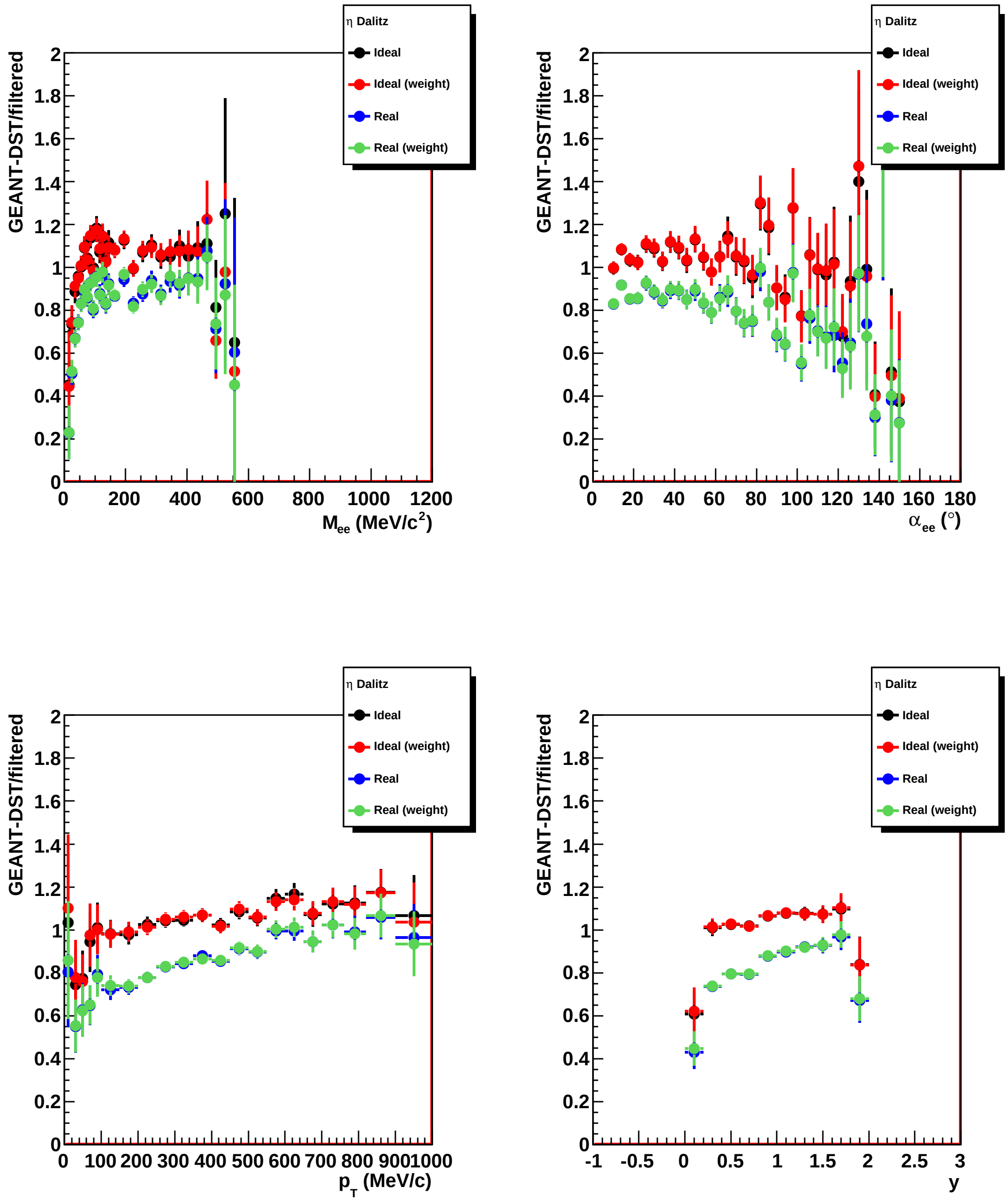

Figure 15: Ratios (GEANT-DST-effiency corrected/Filter-Smear) for invariant mass, opening angle, p_T and rapidity of η - Dalitz events for different efficiency matrices. Black: IDEAL, Red: IDEAL(weighted), Blue: REAL, Green: REAL(weighted).