

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 (close neighbour and χ^2 cut) were applied. Furthermore only tracks were used with $4 < \phi < 56$ (ϕ border cut)). NO momentum cut was used here.

There are 3 options to produce the matrices:

- IDEAL: use ideal (GEANT) variables for filling the matrices.
- REAL: use reconstructed (DST) variables for filling the matrices.
- SMEAR: like REAL but instead of using the ideal values in the denominator momentum smeared values were used here (Witek style).

In addition one could also use momentum weighting, which was shown already to have no impact on the self consistency in this case (see previous report). The matrices had 90 bins in ϕ , 45 bins in θ and 100 bins in p . Additionally smoothing is also investigated in this report.

To check the acceptance filtering and efficiency correction a self consistency check was performed with physical Dilepton sources from Pluto. For 100 real files 6 sources (π^0 - Dalitz, η - Dalitz, Δ - Dalitz, ρ - direct, ω - direct and ω - Dalitz) were produced in Pluto. In one case these 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 ($80 \text{ MeV}/c < p < 2000 \text{ MeV}/c$) and pair cuts (opening angle) are used for both, filtered AND full analysis chain. Additionally legs with efficiencies lower than 5% were skipped.

For all pictures the ratio of $\frac{\text{GEANT-DST-efficiency corrected}}{\text{ACC filtered-momentum smeared}}$ is shown.

Self consistency check for physical singles

First the variables of the single legs of physical pairs (η - Dalitz) are checked. Therefore the electrons and positrons of one event were split into two sub-events and processed separately.

In fig. 0.1 it is clearly visible that the best solution is to use SMEAR matrices, the ratio is fairly flat in all observables (except high θ for positrons) and centered around 1.

Using then in addition smoothing the situation becomes worse (green in fig. 0.2). The edges of each sector are bent upwards (compare fig. 0.3(a) and fig. 0.3(b)) and this causes quite some structures in the self consistency. If then the cut on ϕ is switched off, this structures are still visible (fig. 0.3(c)), but do not cause a difference in the self consistency to not smoothed matrices (pink in fig. 0.2).

Self consistency check for pairs

The first step is to look at pairs with both legs in different sectors (there no opening angle correction will be applied), again this was done without smoothing the matrices. On the left hand side of figures 0.4 - 0.6 the opening angle distribution for this pairs is shown. On the right hand side the same sector distributions are shown together with a fit to the η data. This fit is then used to correct for the opening angle deficiencies. It is:

$$\text{IDEAL: } 9.54635e - 01 * (1 - \exp(-8.13397e - 01 * TMath :: Power(opang - 8.48966e + 00, 4.48948e - 01))) \quad (0.1)$$

$$\text{REAL: } 7.21634e - 01 * (1 - \exp(-5.87552e - 01 * TMath :: Power(opang - 7.80897e + 00, 7.41832e - 01))) \quad (0.2)$$

$$\text{SMEAR: } 8.35898e - 01 * (1 - \exp(-7.25235e - 01 * TMath :: Power(opang - 8.15106e + 00, 6.01941e - 01))) \quad (0.3)$$

The trend already seen in singles is also visible here, IDEAL bigger than 1, REAL smaller and SMEAR just around 1. IDEAL seems to be the flattest one.

In the end one applies this opening angle correction and compares all pair observables for all

matrices. It seems that the SMEAR matrices give stable result around 1 (10% differences), nevertheless IDEAL matrices are also fine (less structures, but at higher values (≈ 1.1)).

Smoothing again produces more structures (the opening angle correction was also adjusted like described above for the smoothed case - not shown here), which can be avoided if one DOES NOT use the ϕ border cut.

Resume: SMEAR with smoothing but without the ϕ border cut seems to give the best results. This will be used for correcting the SEP08 data.

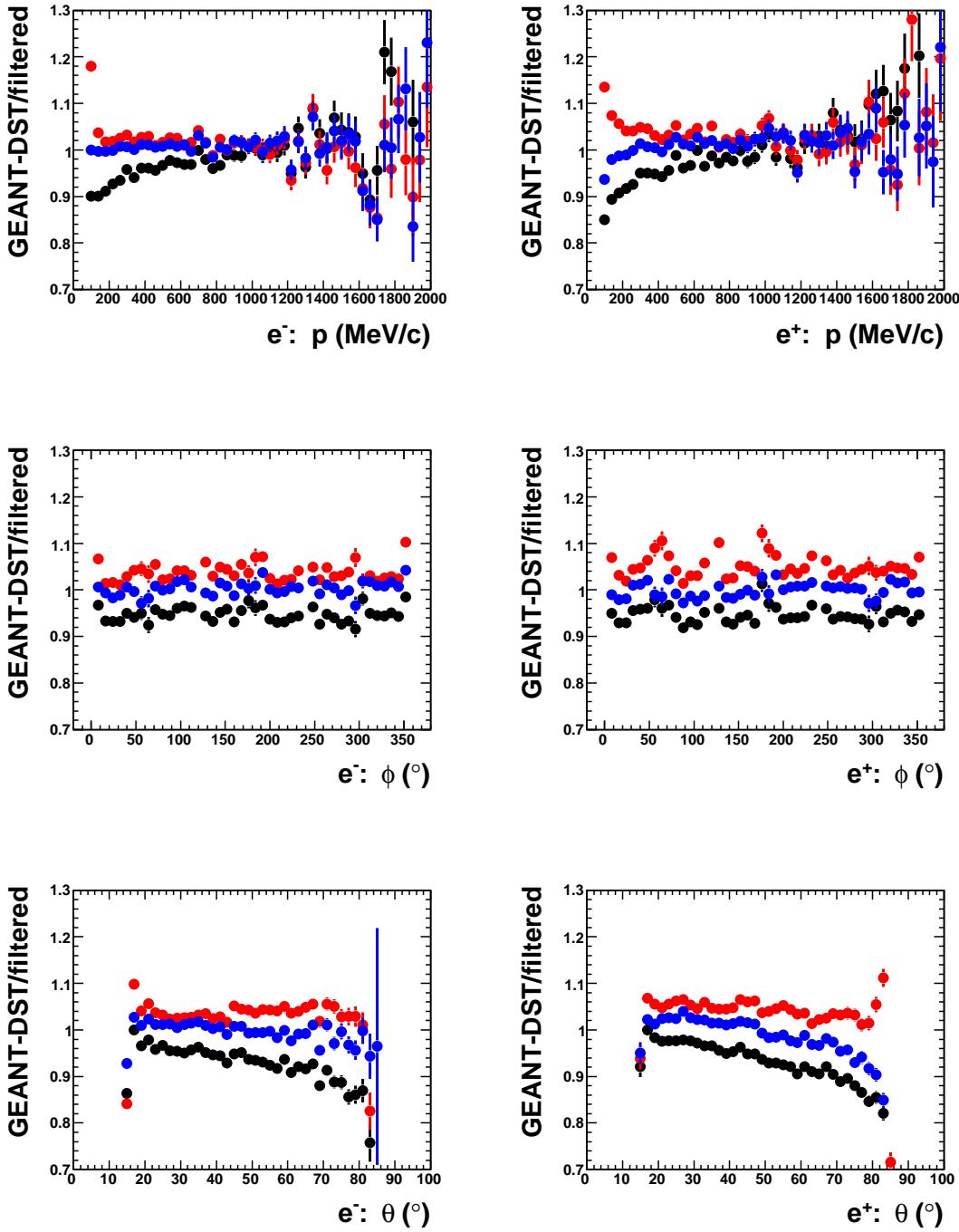


Figure 0.1: Comparison of IDEAL(red), REAL (black) and SMEAR (BLUE).

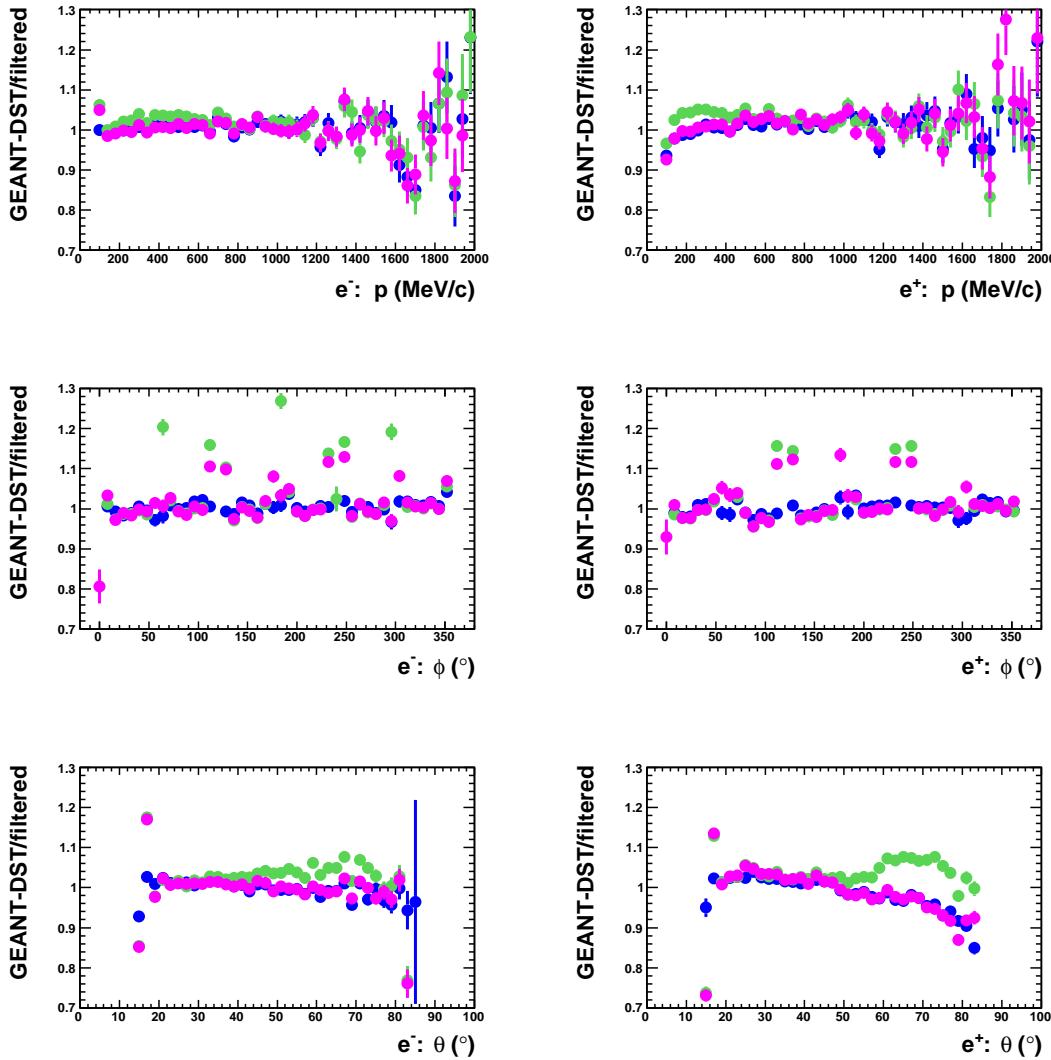


Figure 0.2: Comparison of SMEAR (BLUE), smoothed SMEAR (GREEN) and smoothed SMEAR without the phi border cut (pink).

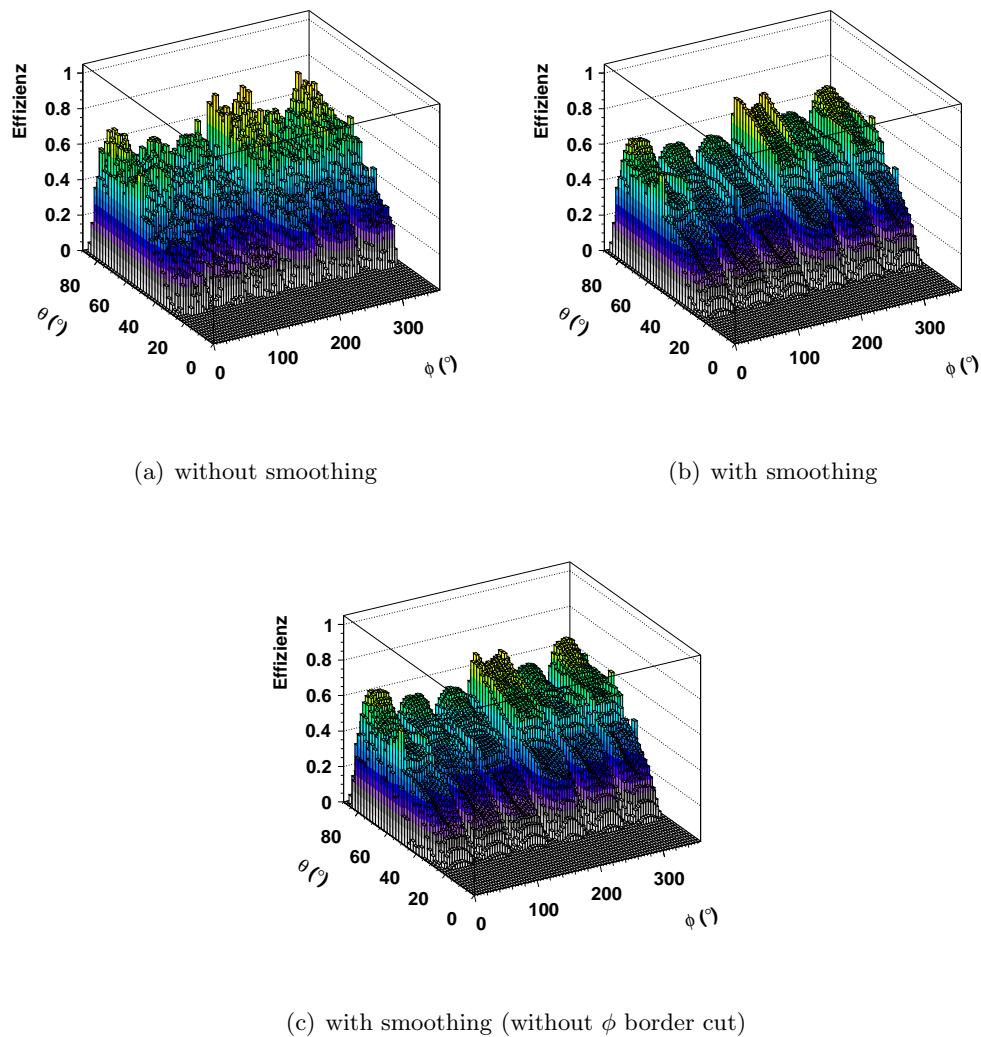


Figure 0.3: efficiency matrices for e^+ at $p = 200 \text{ MeV}/c^2$.

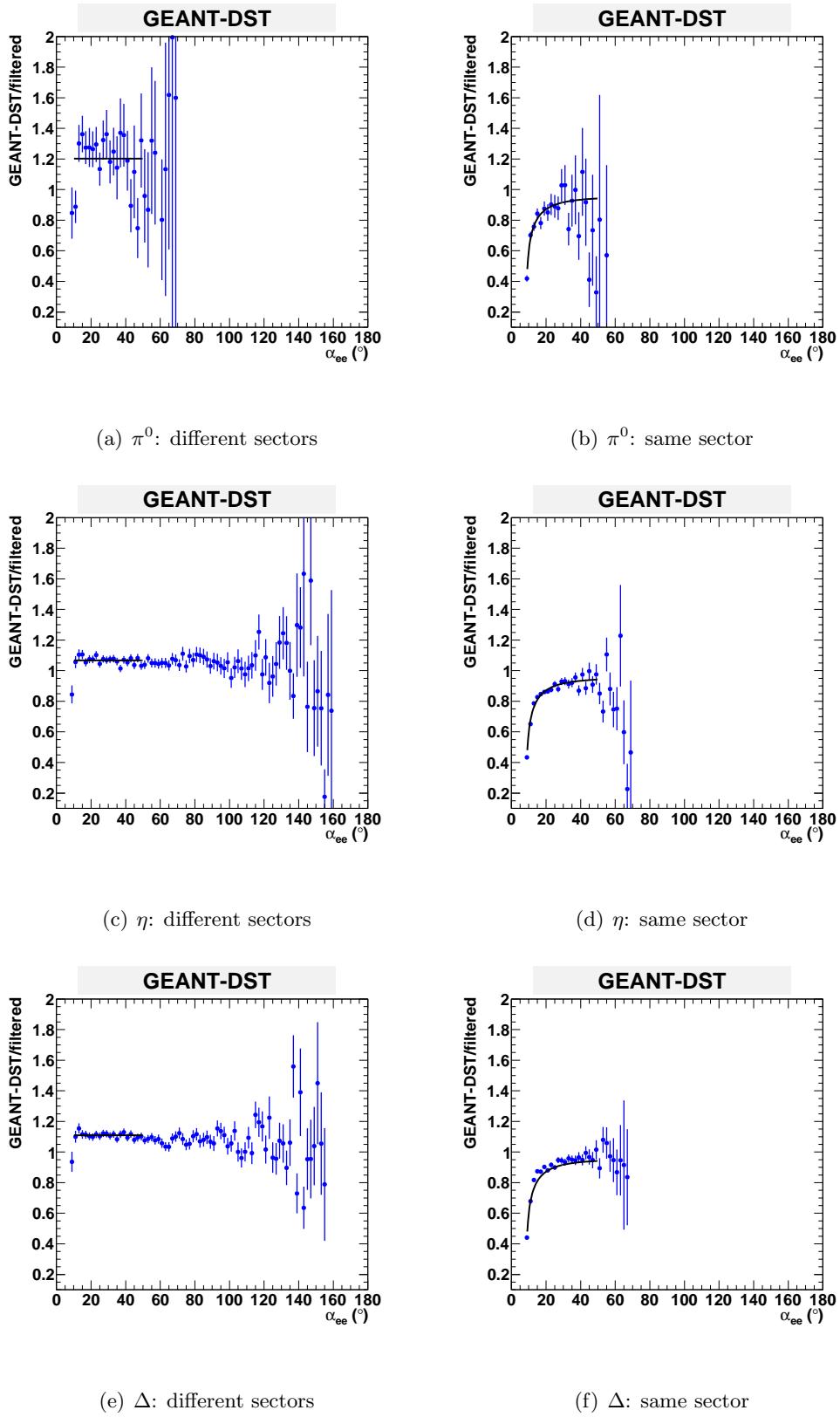


Figure 0.4: IDEAL matrices w/o opening angle correction, black solid line shows the fitted on η in same sector.

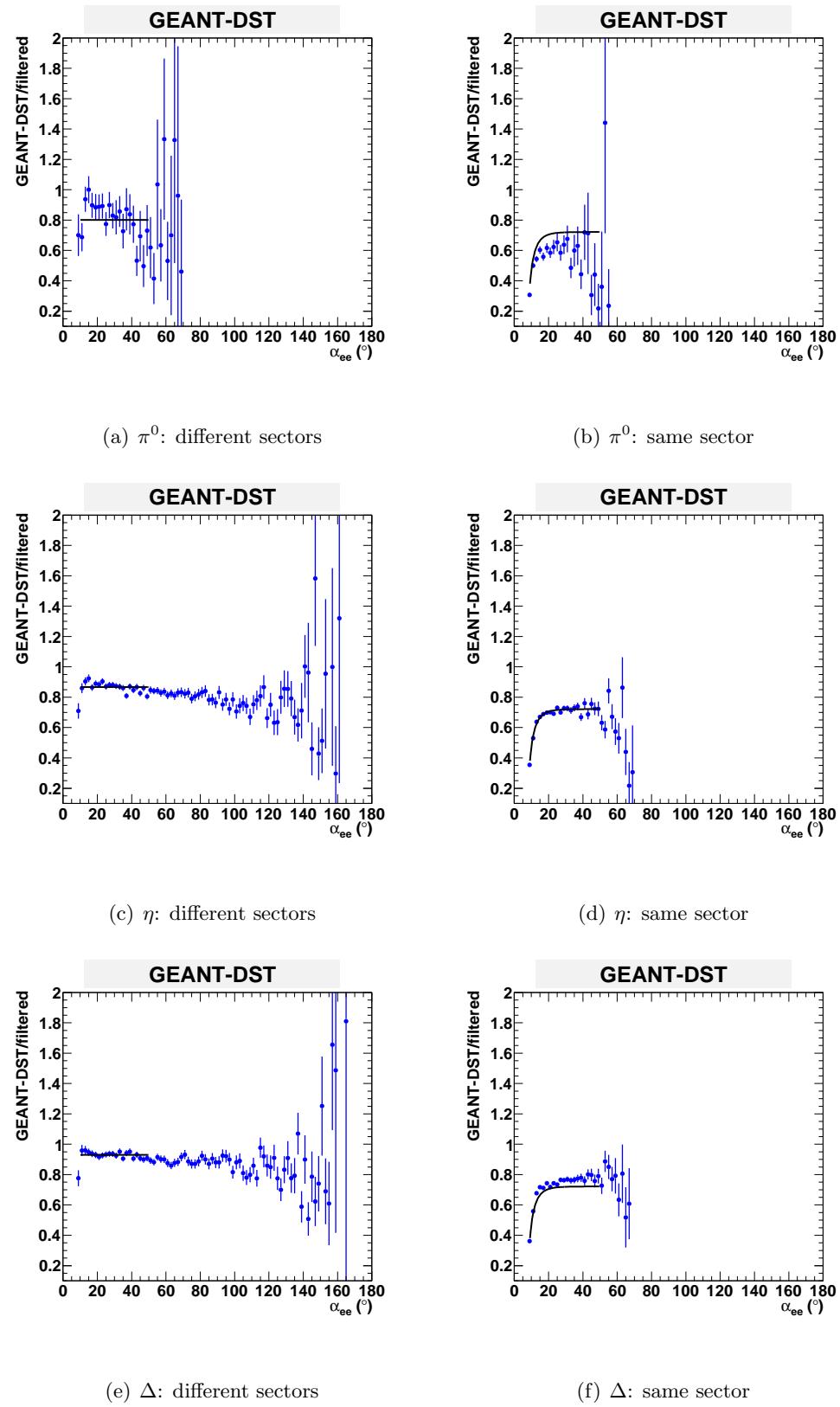


Figure 0.5: REAL matrices w/o opening angle correction, black solid line shows the fitted on η in same sector.

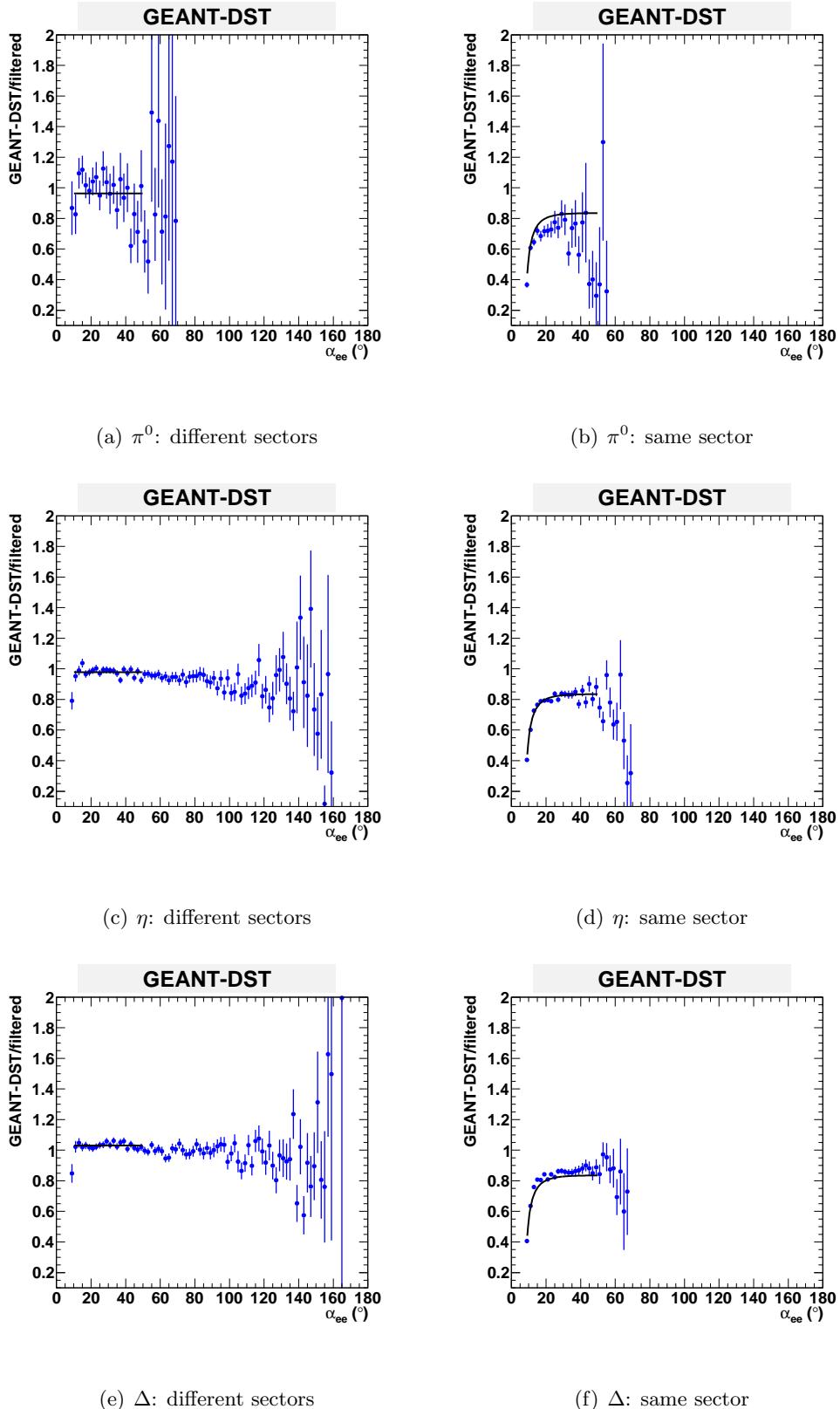


Figure 0.6: SMEAR matrices w/o opening angle correction, black solid line shows the fitted on η in same sector.

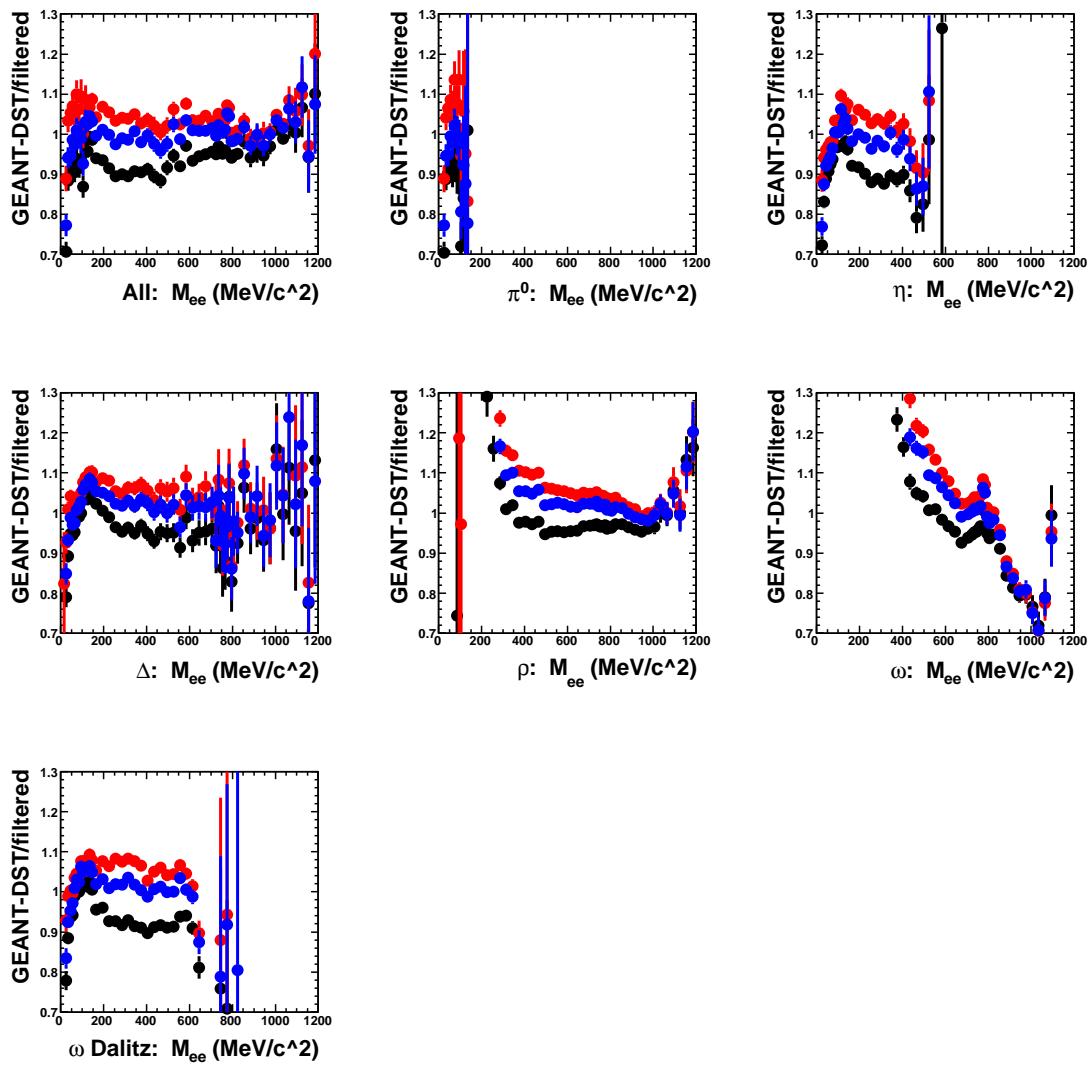


Figure 0.7: Invariant mass: Comparison of IDEAL(red), REAL (black) and SMEAR (BLUE).

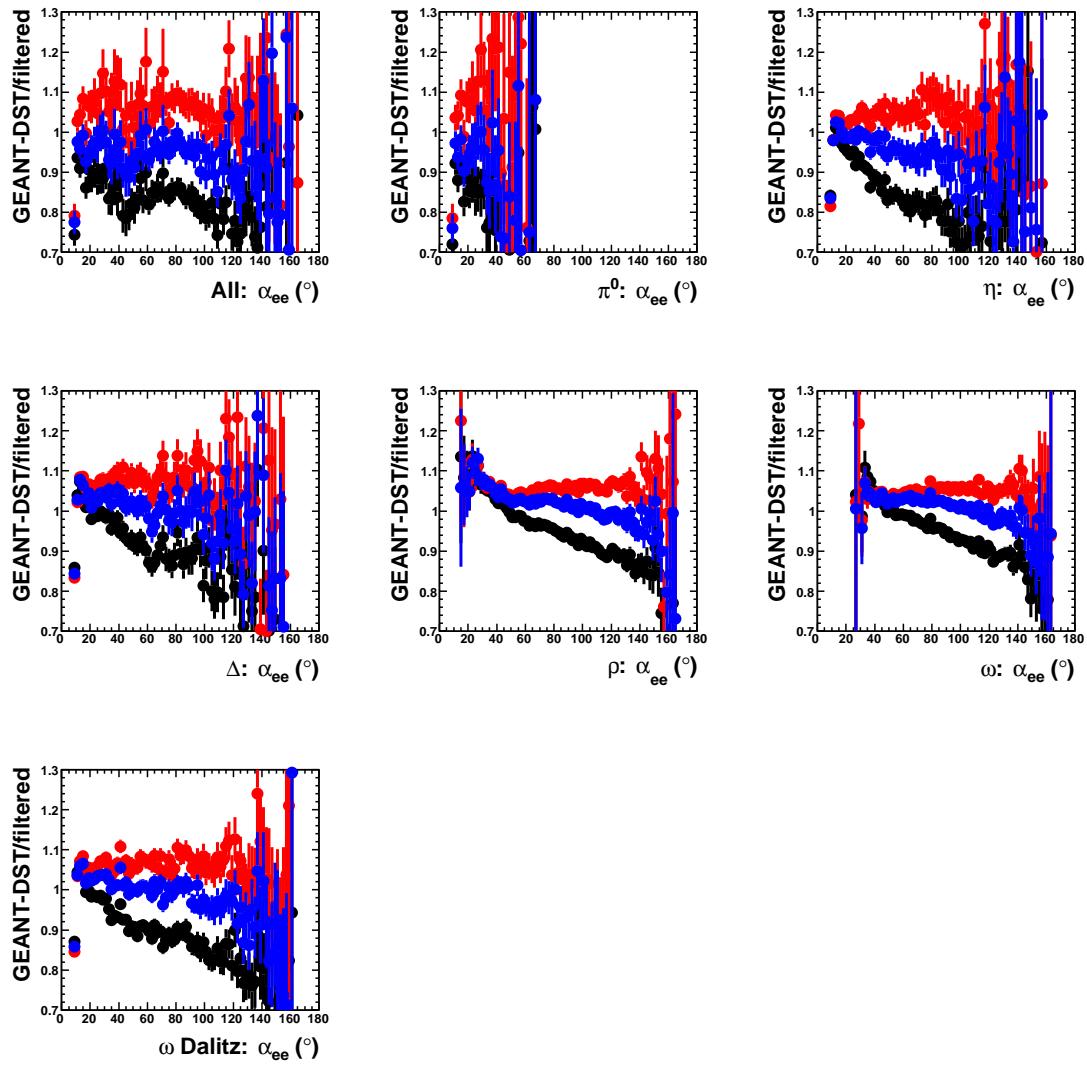


Figure 0.8: Opening angle: Comparison of IDEAL(red), REAL (black) and SMEAR (BLUE).

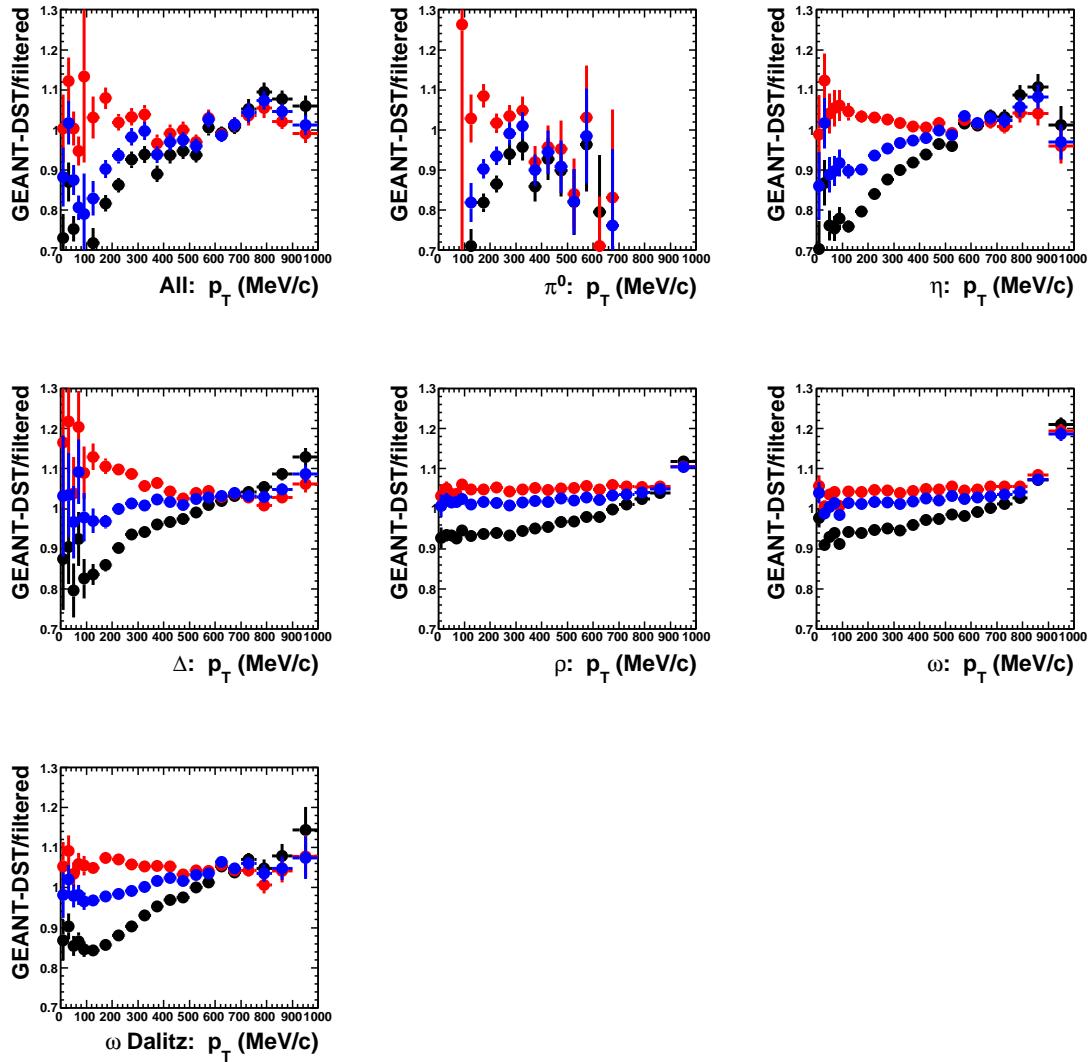


Figure 0.9: Transverse momentum: Comparison of IDEAL(red), REAL (black) and SMEAR (BLUE).

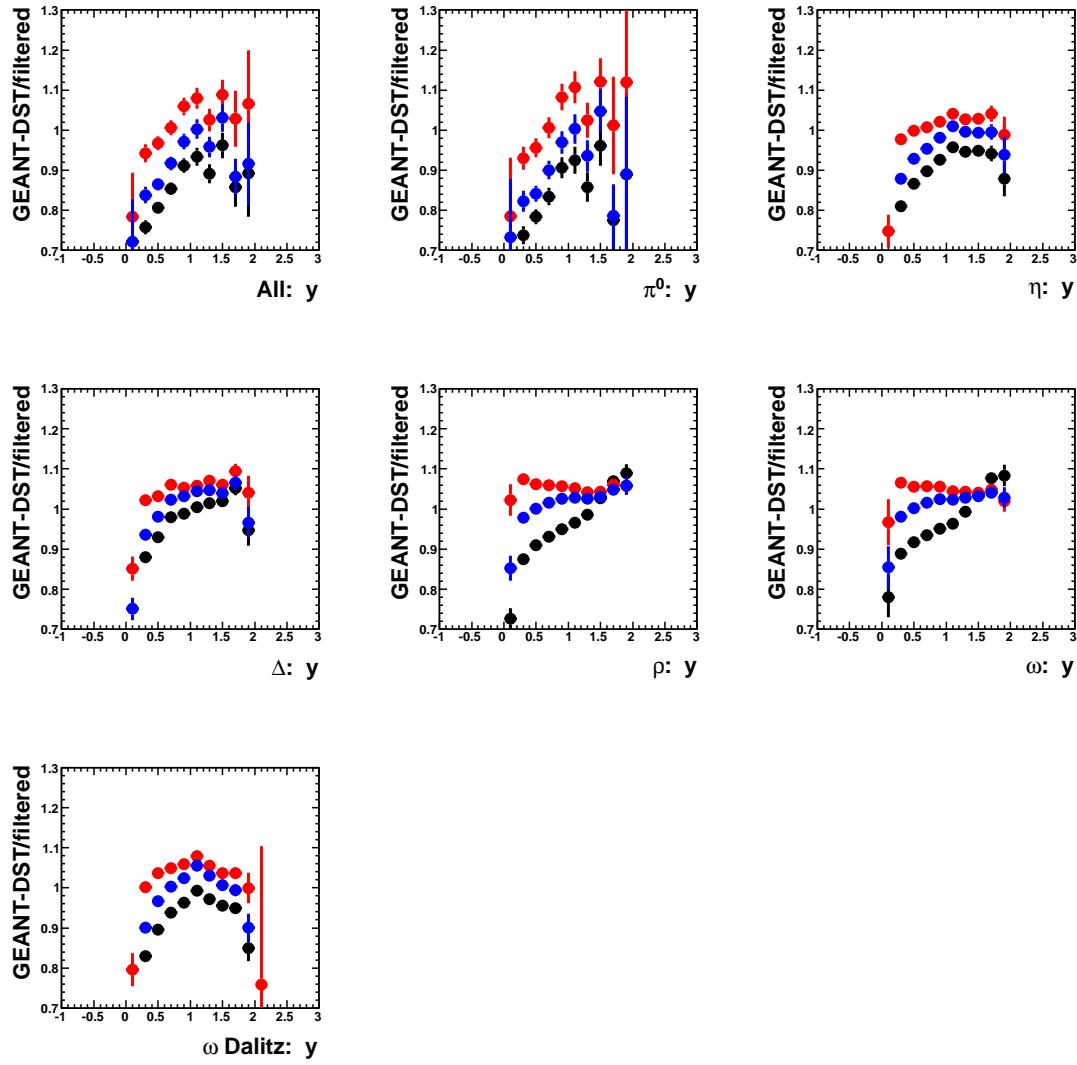


Figure 0.10: Rapidity: Comparison of IDEAL(red), REAL (black) and SMEAR (BLUE).

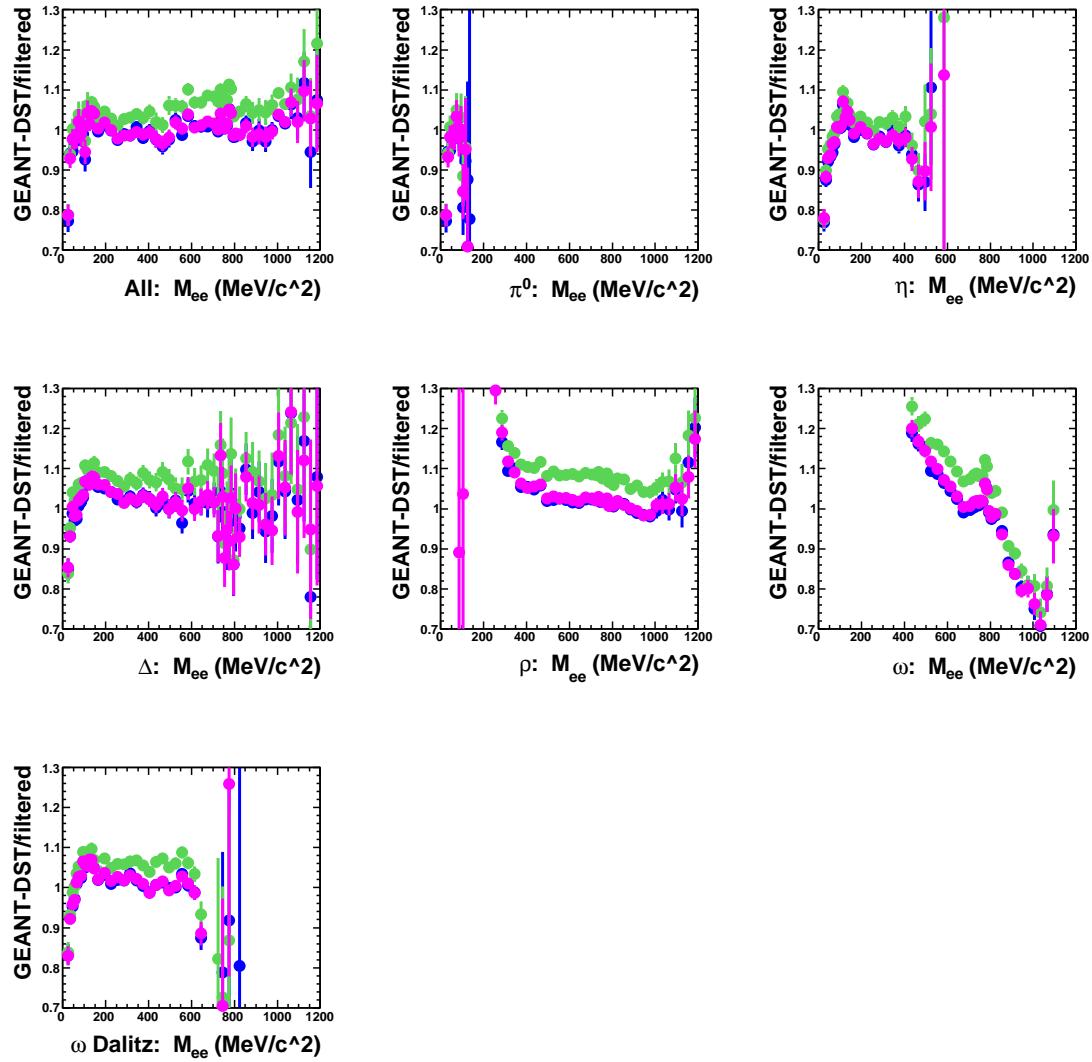


Figure 0.11: Invariant mass: Comparison of SMEAR (BLUE), smoothed SMEAR (GREEN) and smoothed SMEAR without the phi border cut (pink).

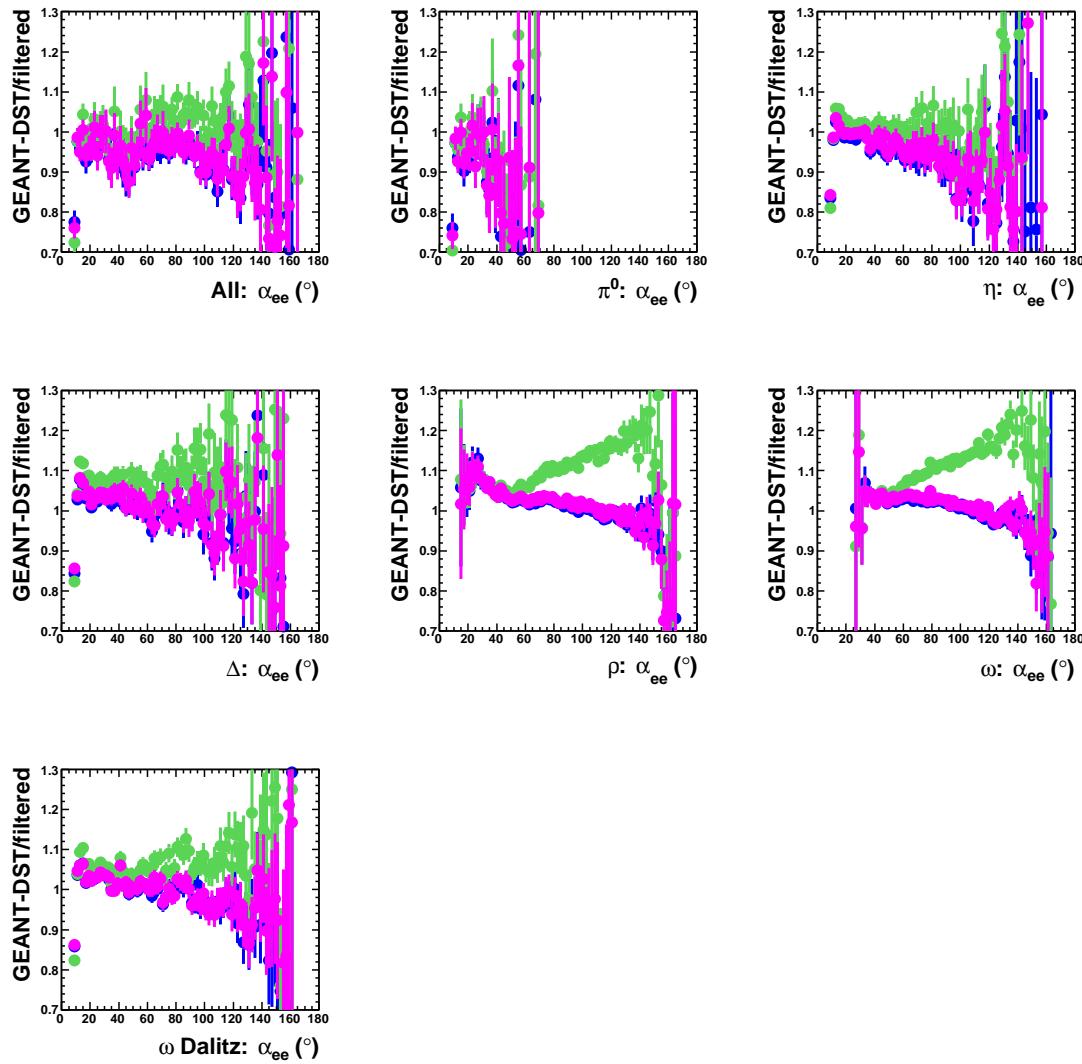


Figure 0.12: Opening angle: Comparison of SMEAR (BLUE), smoothed SMEAR (GREEN) and smoothed SMEAR without the phi border cut (pink).

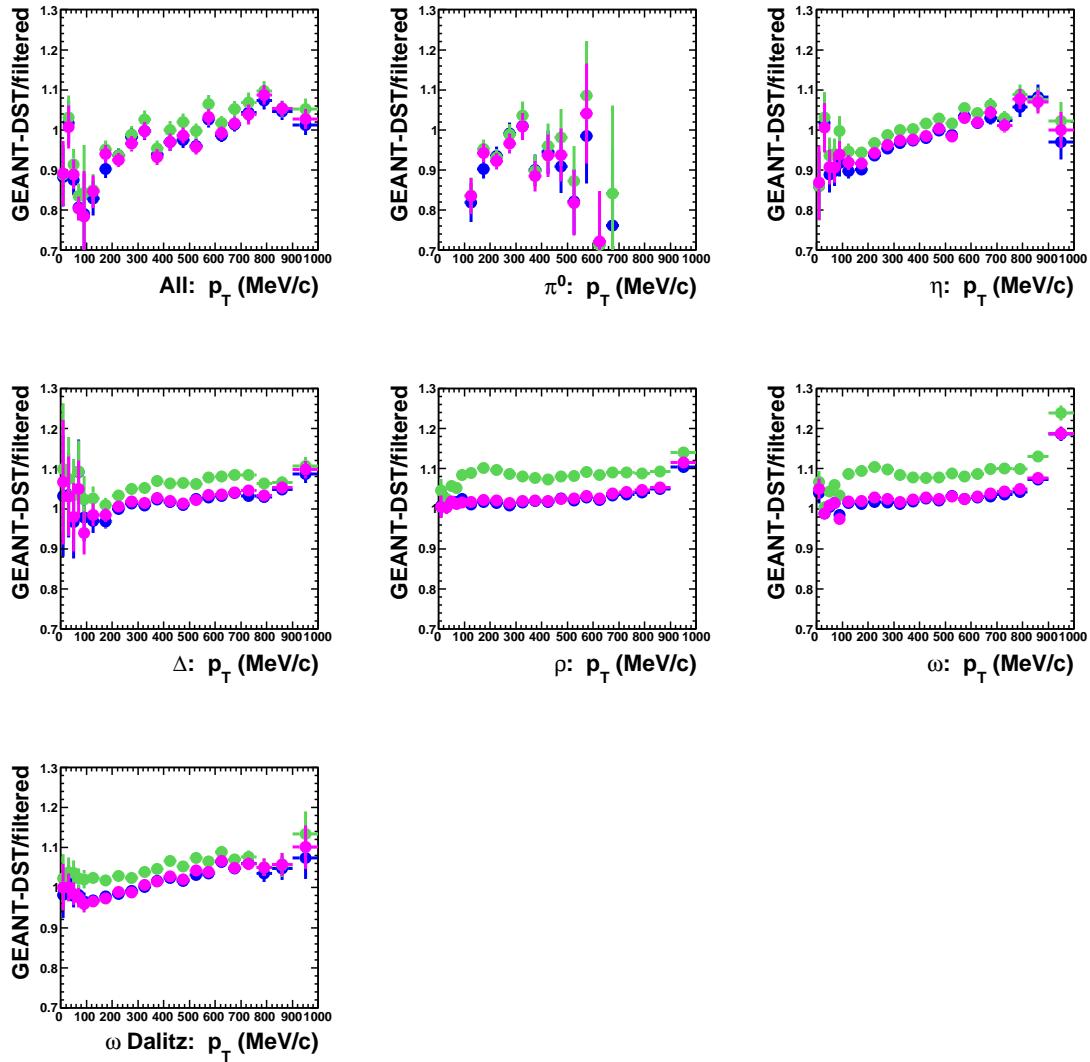


Figure 0.13: Transverse momentum: Comparison of SMEAR (BLUE), smoothed SMEAR (GREEN) and smoothed SMEAR without the phi border cut (pink).

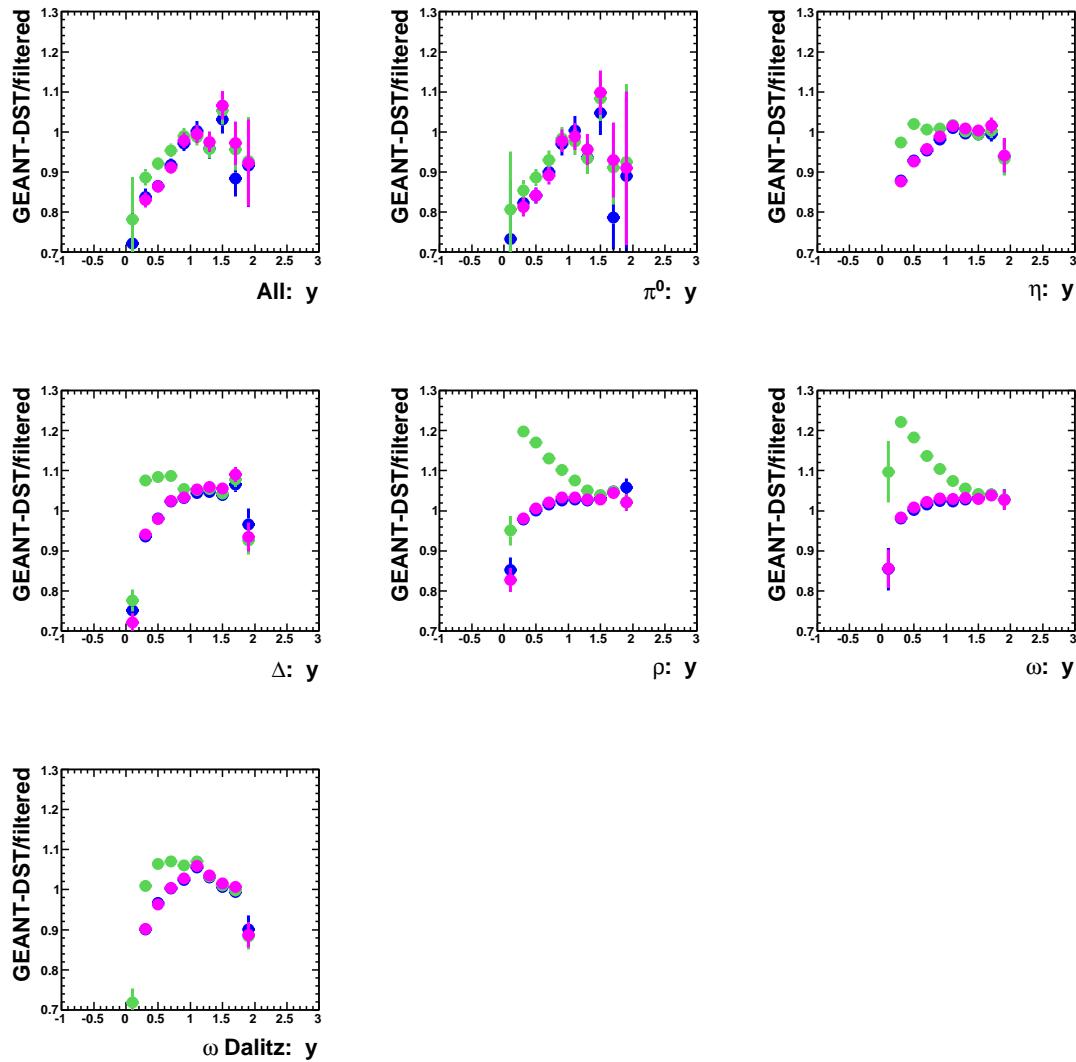


Figure 0.14: Rapidity: Comparison of SMEAR (BLUE), smoothed SMEAR (GREEN) and smoothed SMEAR without the phi border cut (pink).