

EM scale in forward calorimeters.

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- Electron identification in the forward calorimeters
- Insitu Calibration with $Z \rightarrow ee$ and $J/\psi \rightarrow ee$



GEFÖRDERT VOM

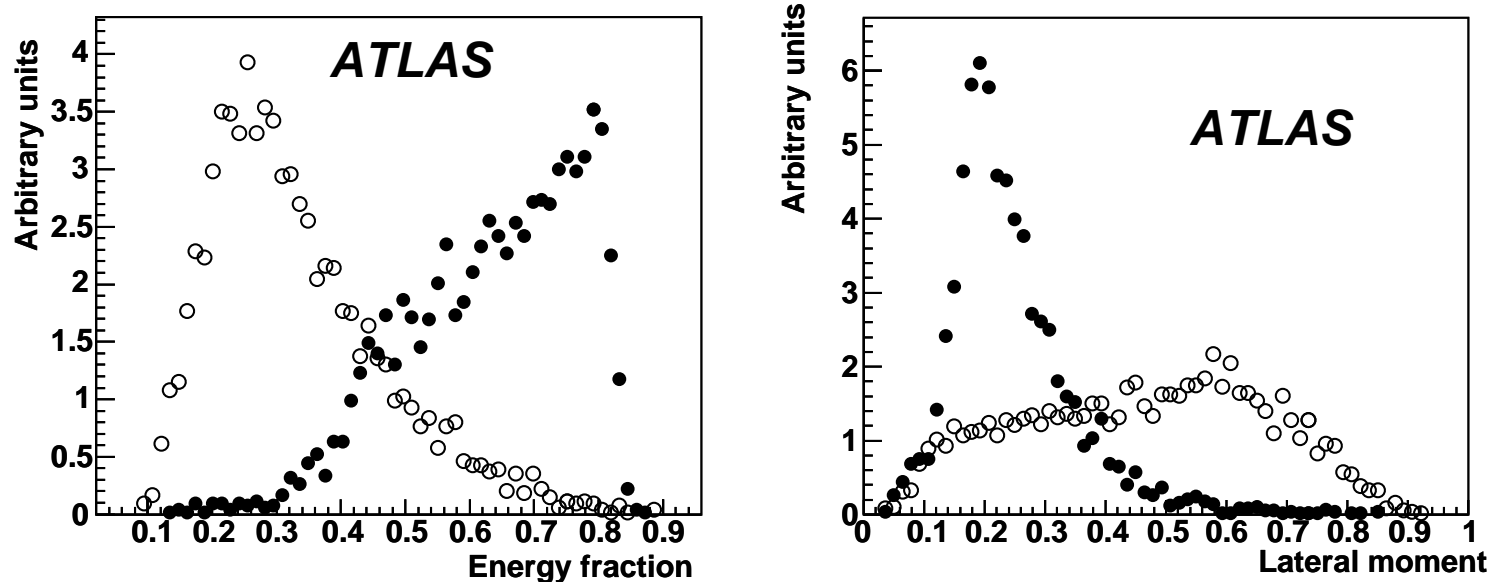


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Forward Electrons

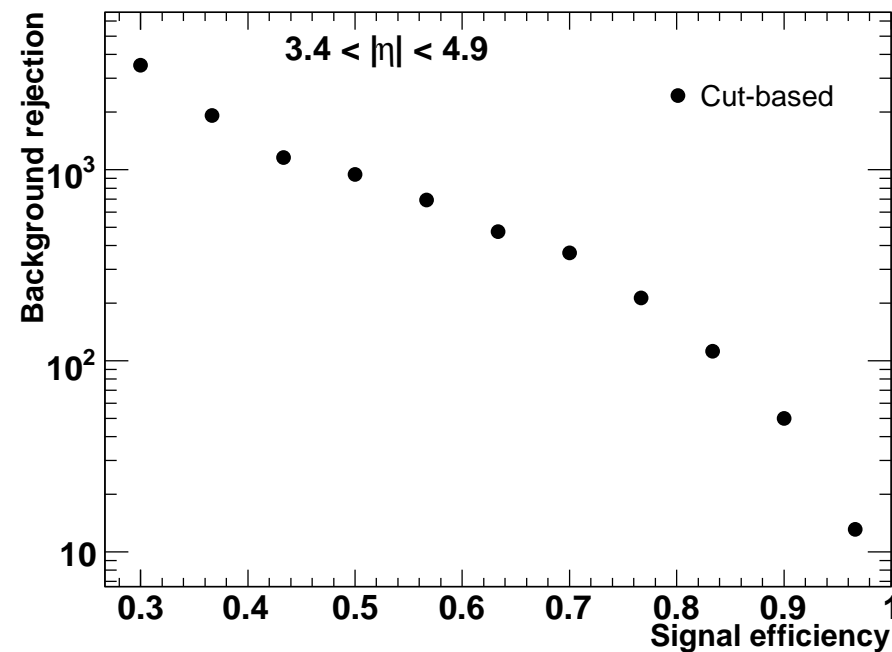
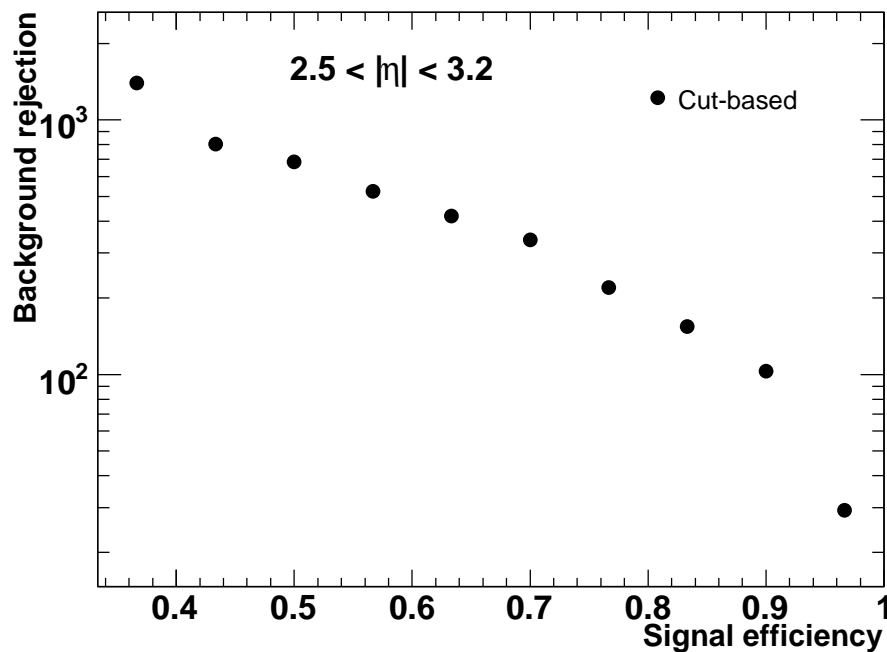
- What are differences with fiducial electrons
 - You do not have charge
 - * We cannot distinguish between photon, electron and positron
 - The clustering
 - * We are using the topological clustering algorithm (in principle we can also use SW but does not cover that region)
 - We cannot trigger on (there is possibility to use the jet trigger for these electrons if they are energetic), you have to look for one reference: for $Z \rightarrow ee$ you should trigger for at least one electron in the central region.

Forward ID



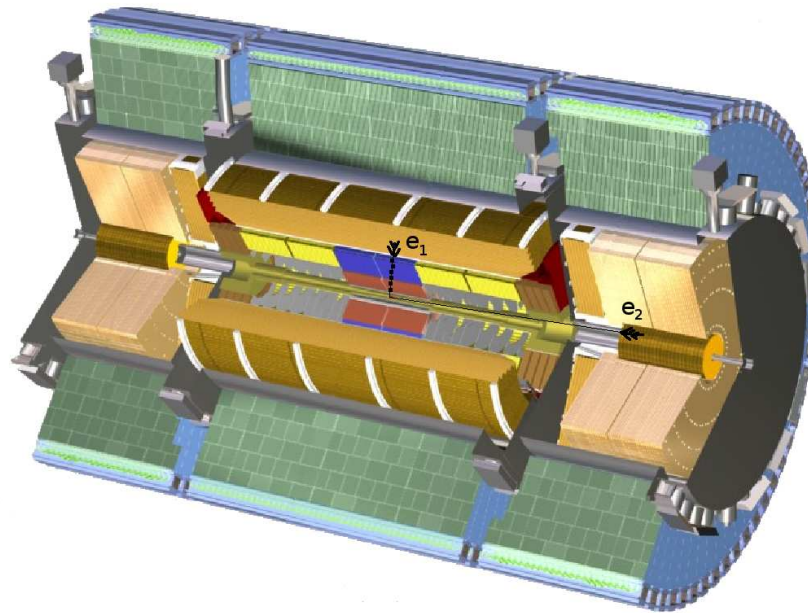
- 7 variables are used for the electron ID. Most of the variables are the topological cluster moments
 - Energy fraction in the most energetic cell
 - Longitudinal and lateral moments
 - Energy density
 - Distance of each cell to the Shower center
- Two eta bins: EMEC IW and FCal
- Plots show two cluster moments for the signal electrons (full circles) and the QCD di-jet background (open circles) in the FCal.

Efficiency vs Rejection



- plots show jet background rejection versus signal electron (from Z) efficiency using the cut-based methods in the inner wheel of the EMEC (left) and in the FCal (right).

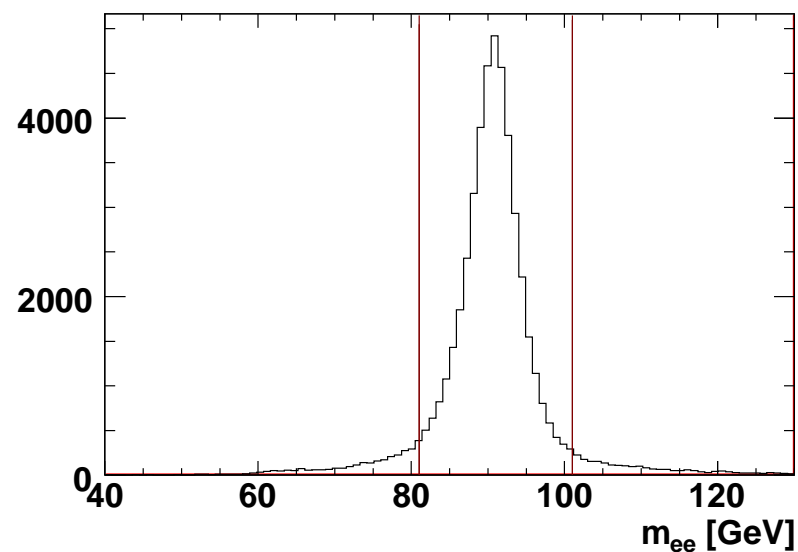
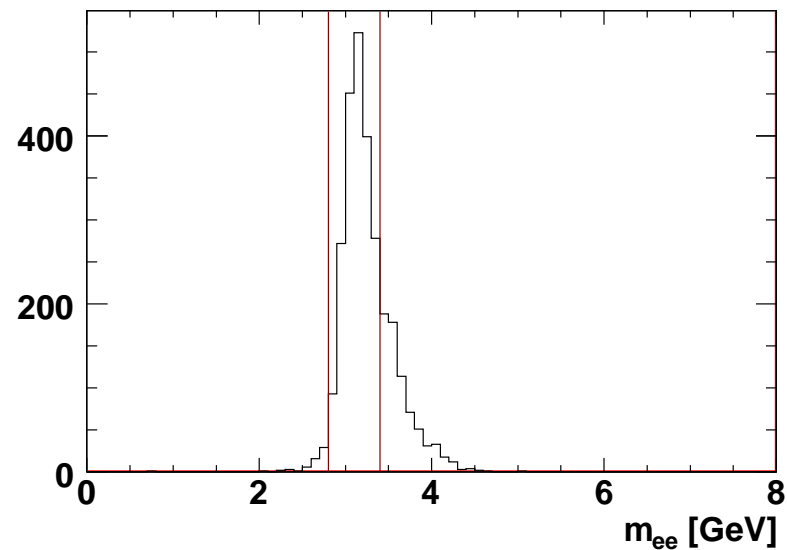
Calibration - Calculation



- Calculate energy of cluster $E_2 = E_{alg}$ starting with $m_{Res}^2 = (p_1^2 + p_2^2)^2$, $Res = J/\psi$ or Z
- Determination of E_2 yields $E_2 = \frac{-b}{2 \cdot a} + \sqrt{\frac{b^2}{4 \cdot a^2} - \frac{c}{a}}$ with
 - $a = E_1^2 + (m_e^2 - E_1^2) \cdot \cos^2(\sphericalangle(\tilde{p}_1, \tilde{p}_2))$
 - $b = -2 \cdot M^2 \cdot E_1$
 - $c = M^4 + m_e^2 \cdot (E_1^2 - m_e^2) \cdot \cos^2(\sphericalangle(\tilde{p}_1, \tilde{p}_2))$
 - $M^2 = \frac{m_{Res}^2}{2} - m_e^2$

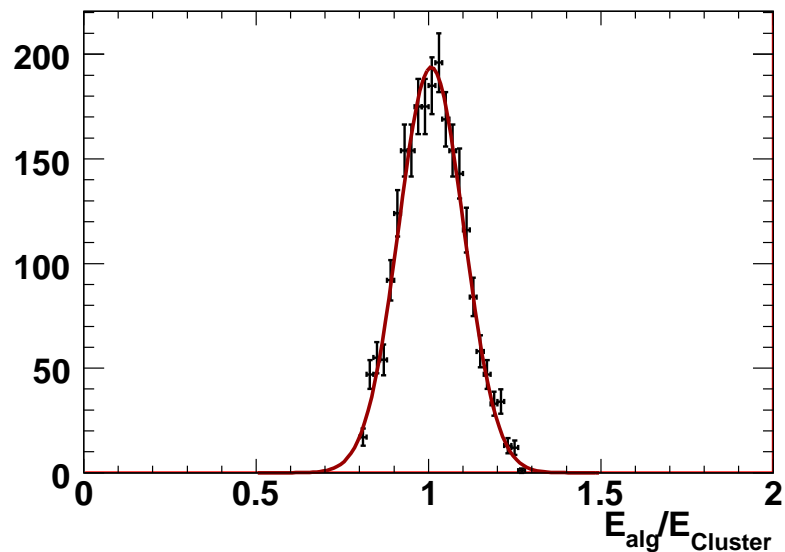
Tag'n'Probe

- Tag
 - *Good* electron in the central region ($|\eta| < 2.5$)
- Probe
 - One forward electron
- Tag and probe electron around $m_{J/\psi}$ or m_Z

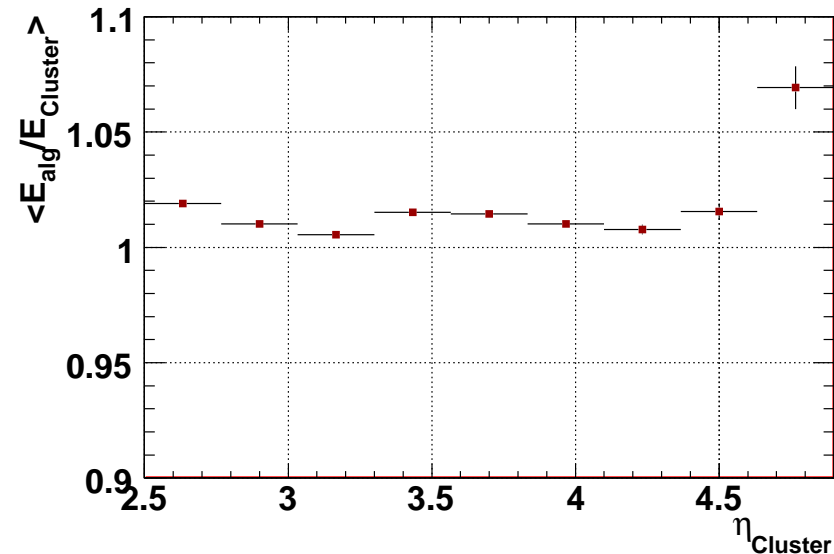


Energy scale with $Z \rightarrow ee$

4.1 η 4.35



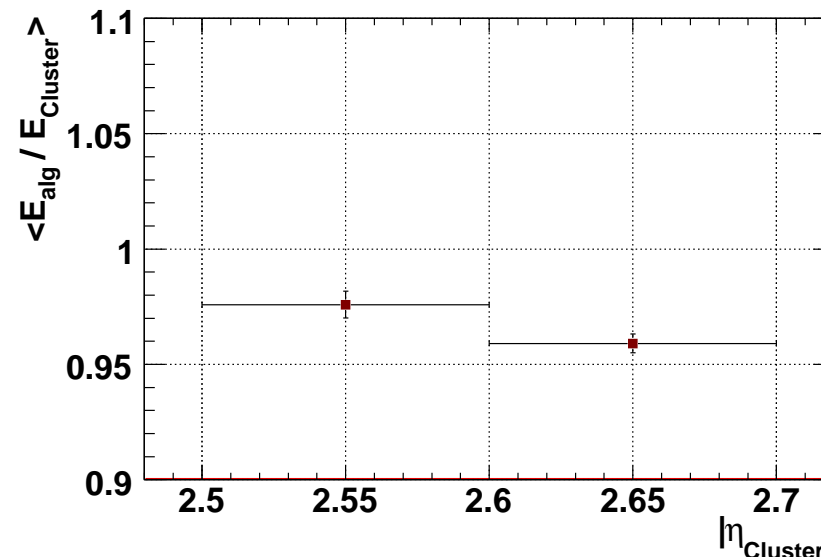
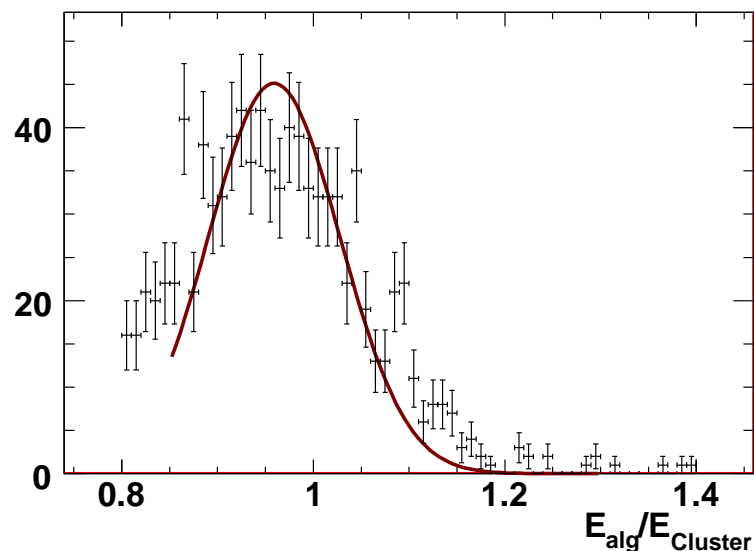
Z \rightarrow ee



- right plot shows the scale factor calculated for different eta bins in the forward calorimeters. We fit a gaussian to the distribution of the scale in each bin.

Energy scale with $J/\psi \rightarrow ee$

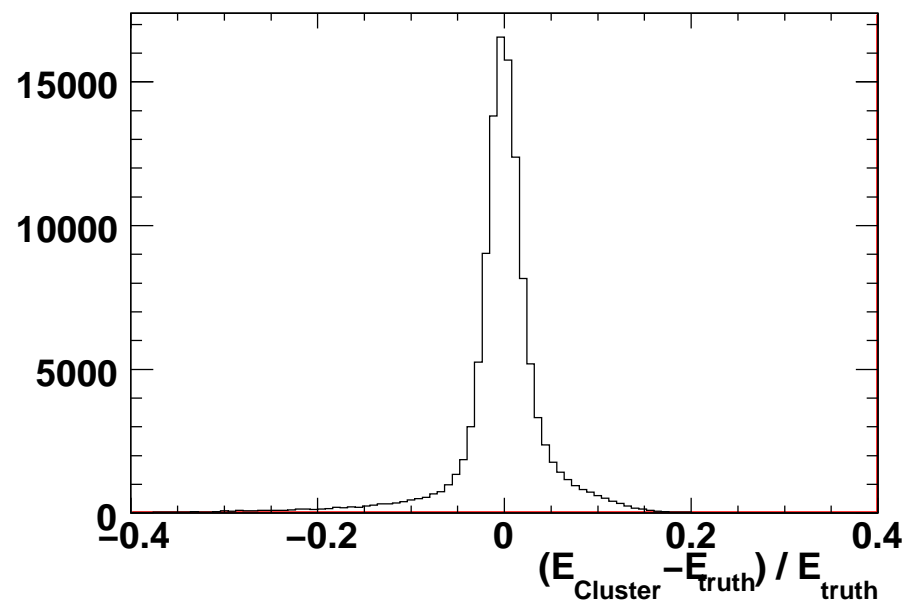
2.6 < η < 2.7



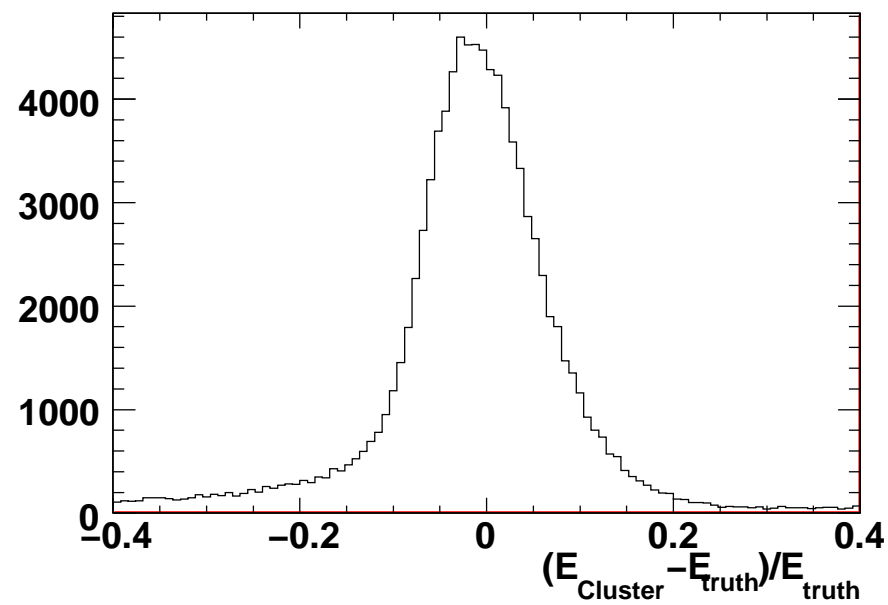
- Here we fit Crystal Ball function to the distribution of the scale in each bin.
- we are limited in statistics (we will have more stats by the workshop time). Also since the opening angle of the two electrons is too small compared to Zee events, most of the forward electrons are concentrated in EMEC IW (With the first 200 pb-1 the calibration with $J/\psi \rightarrow ee$ will be feasible only for the EMEC)

Backup

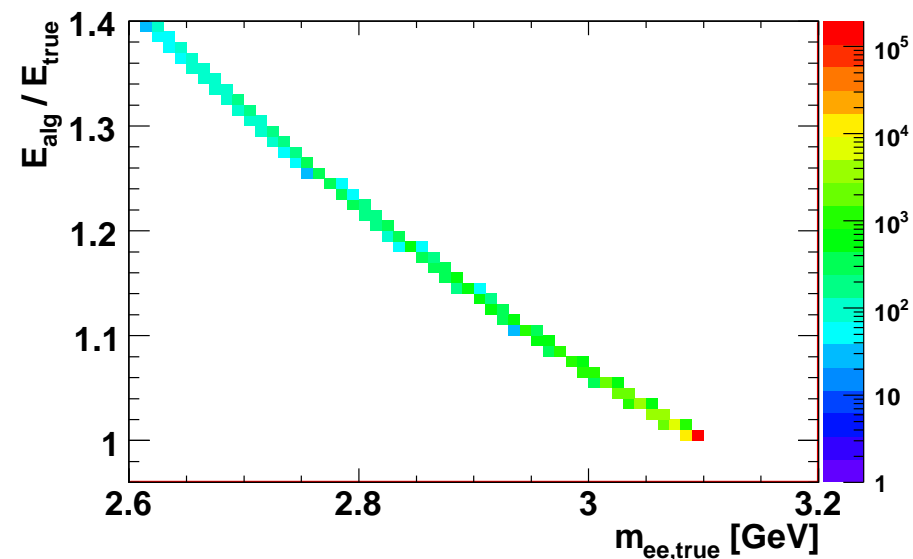
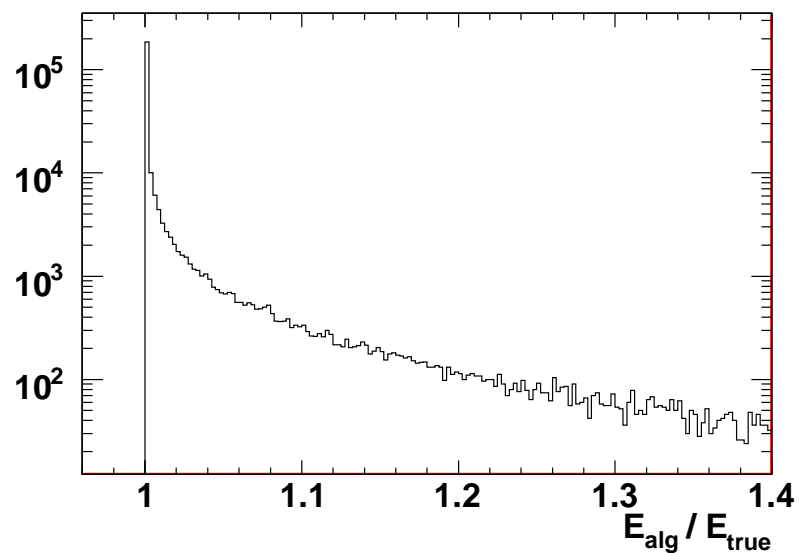
EMEC IW



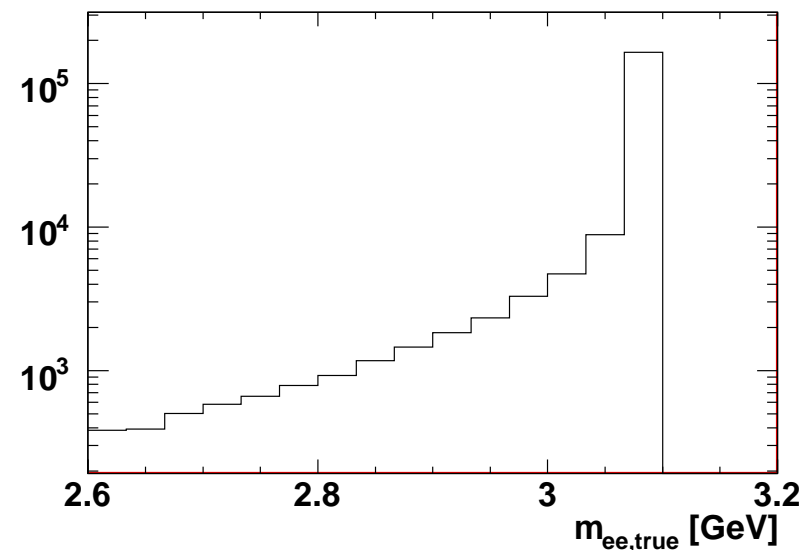
FCAL



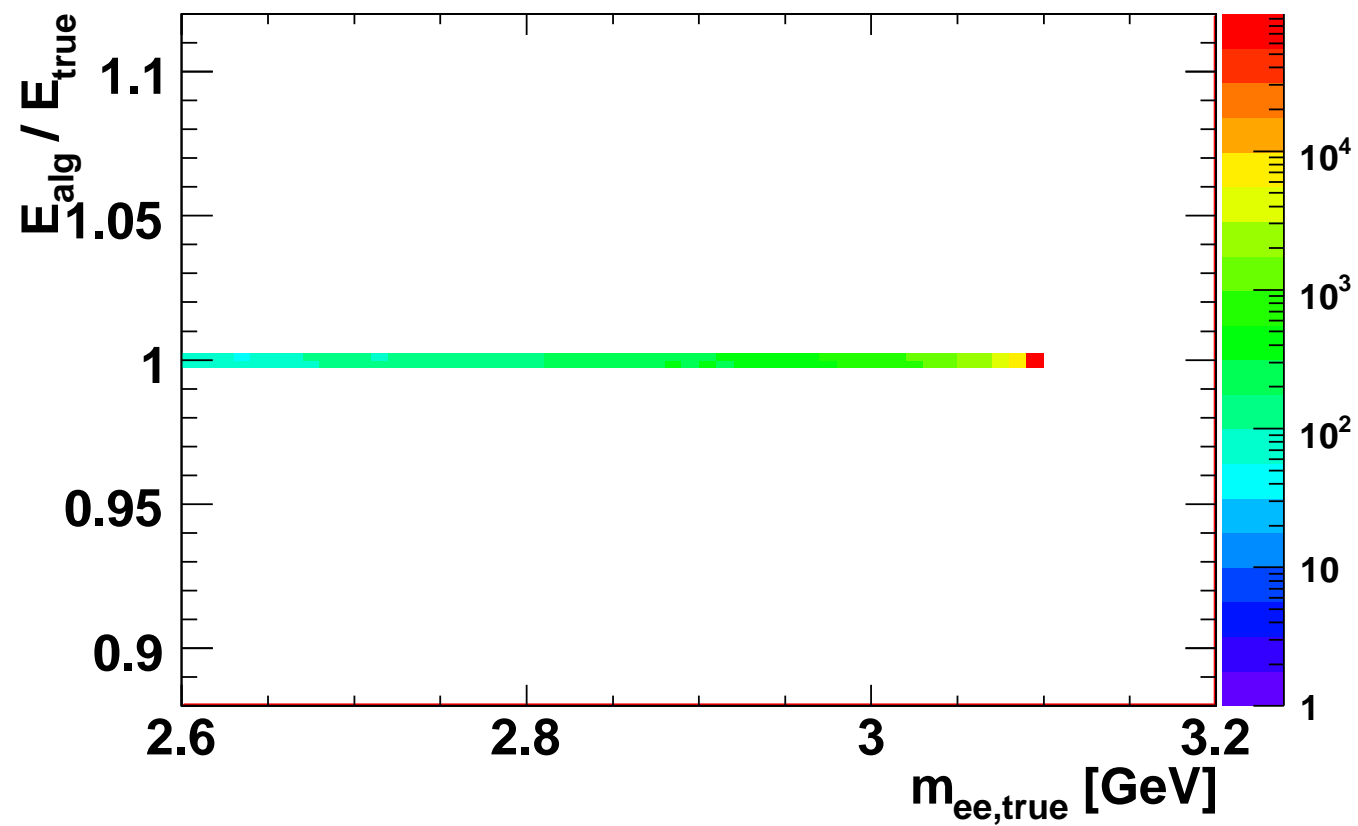
Test for Fraction of Energies vs m_{ee}



- Normally $m_{J/\psi} \neq m_{ee}$ as seed
- Look at correlation between E_{alg}/E_{true} and m_{ee}



Test with m_{ee} as Seed



- Cross-check: use m_{ee} as seed
- Algorithm provides correct energy