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# CMS-DP-2015/057

# 2015 ECAL detector performance plots

**Abstract:** Collection of plots summarizing the ECAL performance on 2015 data. General update of 2012 performance plots available in CMS-DP-2013/007.

CDS entry

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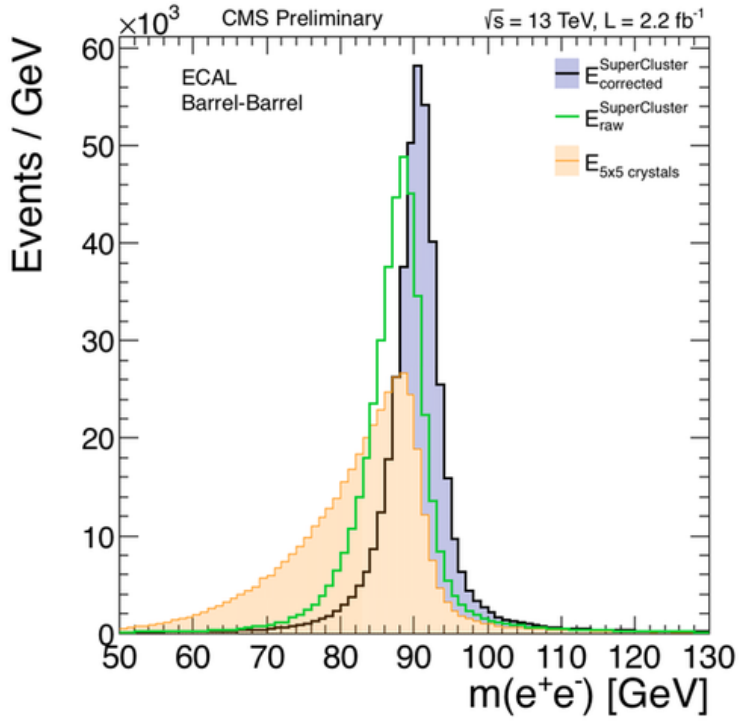
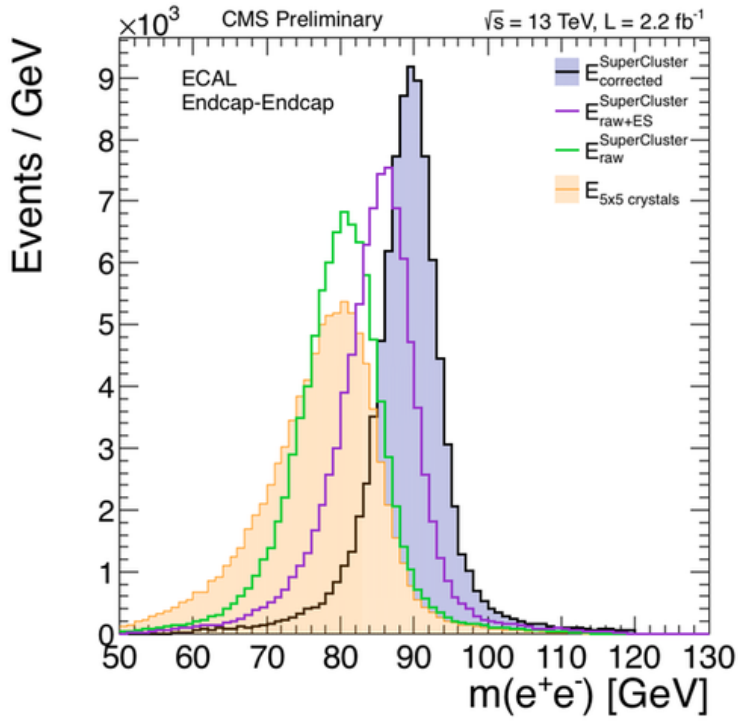
| Figure | Caption |
| --- | --- |
| pdf version<br>  <br><br>pdf version | ***ECAL supercluster energy*** The two plots show the improvements to the Z e+e− energy scale and resolution from the incorporation of more sophisticated clustering and cluster correction algorithms (energy sum over the seed 5x5 crystal matrix, bremsstrahlung recovery using supercluster, inclusion of preshower (ES) energy, energy correction using a multivariate algorithm). The invariant mass of the two electrons is reconstructed using all of the 2015 Run 2 ECAL data at B=3.8 T. The energy sum over the seed 5x5 crystal matrix is shown. In general not all of the energy from showering electrons is collected within this region, particularly where there is significant dead material in front of the ECAL. In the barrel, the long tail to lower values of the E5x5 is due to the high fraction of showering electrons in the high-material region at abs( )>1. The resolution is improved by using the supercluster algorithm, that dynamically includes cluster spread, especially in the 𝜙 direction, for showering electrons. For the endcaps, the energy scale is improved by adding the energy deposited in the preshower to the energy deposited in the crystals. The supercluster estimate is finally corrected by applying a multivariate algorithm which makes use of many ECAL variables, such as the cluster shape of the seed cluster and the characteristics of the most energetic sub-clusters of the supercluster. |

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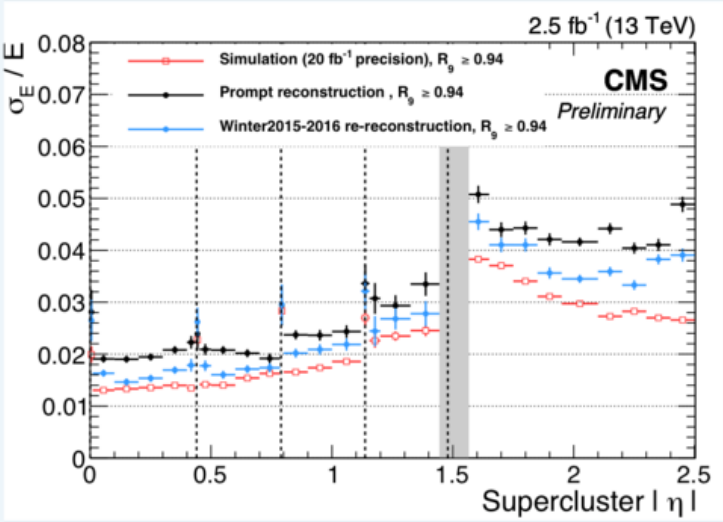


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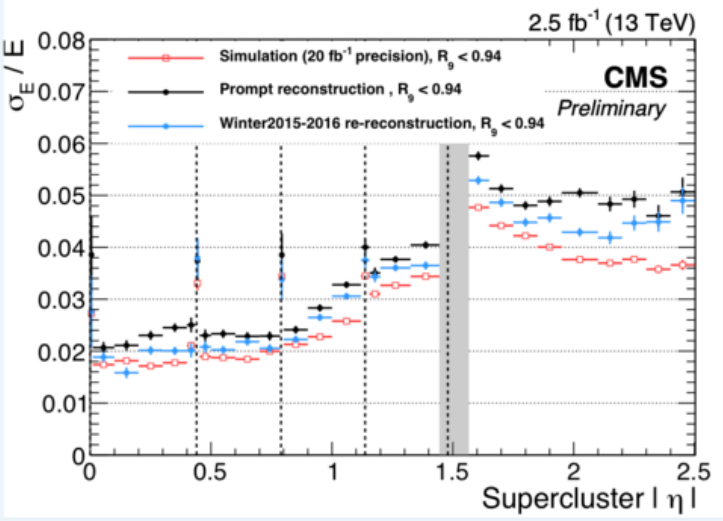


***ECAL energy resolution with Z e+e-***

Relative electron (ECAL) energy resolution unfolded in bins of pseudo-rapidity for the barrel and the endcaps. Electrons from Z e+e- decays are used. The resolution is shown for low (top plot) and high (bottom plot) bremsstrahlung electrons (R9>0.94 and R9<0.94 respectively, with R9=E3x3/ESupercluster).The resolution E/E is extracted from an unbinned likelihood fit to Z ee events, using a Breit-Wigner function convoluted with a Gaussian as the signal model. The resolution is plotted separately for data and MC events. The MC is generated assuming the calibration precision that was achieved with the amount of data collected in Run1 (~20_-1). The resolution is affected by the amount of material in front of the ECAL and is degraded in the vicinity of the eta cracks between ECAL modules (indicated by the vertical lines in the plot) The resolution, especially in the barrel, improves significantly after a dedicated calibration by using the transported calibrations derived in 2012 and combining them with the calibrations obtained from the 2015 CMS dataset (blue points), compared to the prompt reconstruction using only the unmodified 2012 calibrations (black points). The resolution in the central barrel reaches the level achieved in Run1, while int the endcaps the resolution is still significantly affected by the statistical precision of the calibration (2.4

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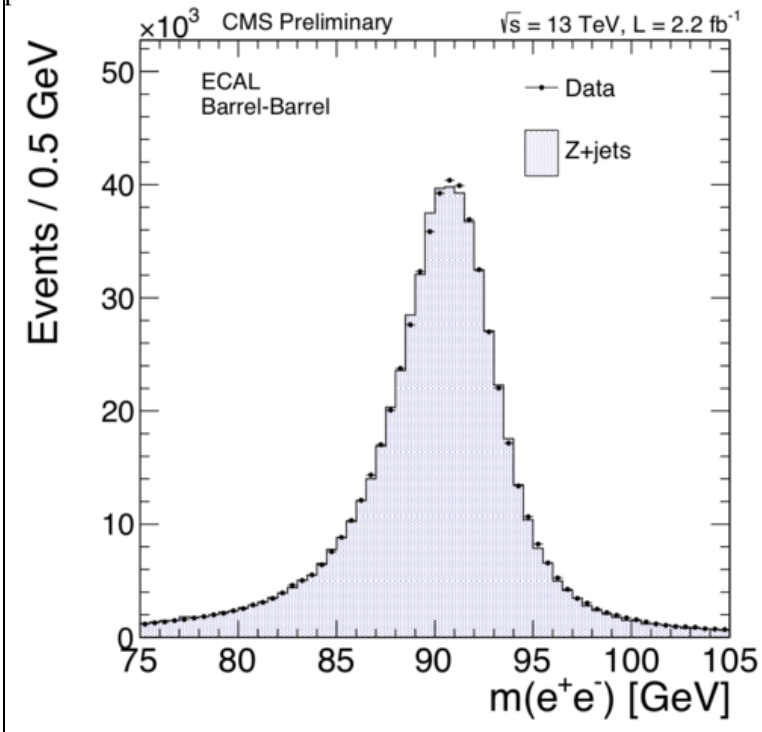
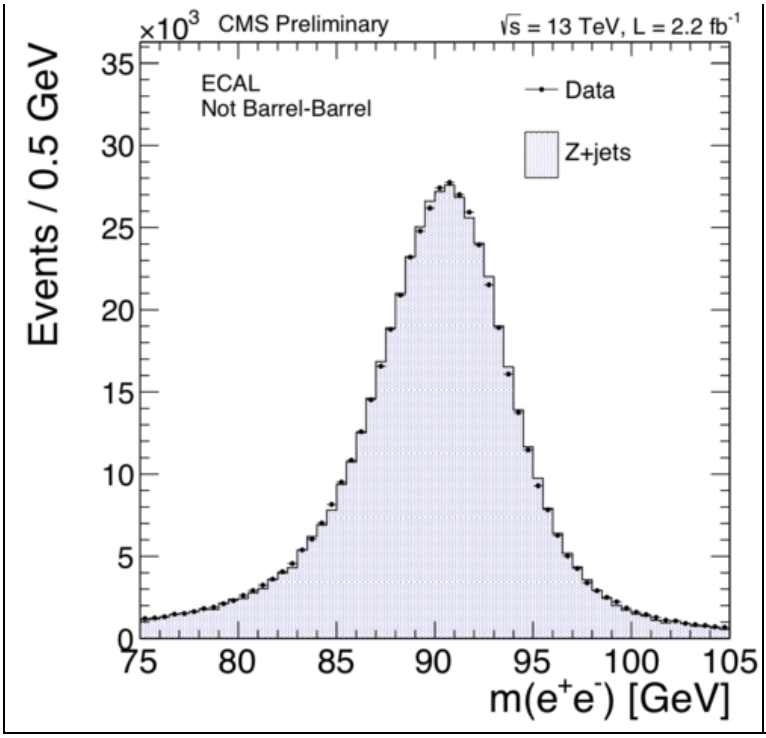
| | fb-1 used) The simulation is shown with red points. The MC used the calibration precision expected from Run 1, from ~20fb-1 of data. The residual differences are due to the Run2 statistical uncertainties and other systematic effects described in the CMS paper link to the Run1 legacy paper The single electron energy resolution is estimated in bins of that are chosen to match the geometry of the ECAL modules. The resolution is estimated with the approximation of a Gaussian distribution convoluted to the natural width of the Z boson. The vertical dashed lines show the barrel module boundaries, where the resolution is somewhat degraded. The grey band at abs( ) 1.5 marks the barrel-endcap transition region excluded from the photon fiducial region used in the H analysis. No ad-hoc corrections of the resolution is applied here on top of the full-simulation. Those are then derived as corrections in coarse bins of and R9 and are used at analysis level. |
| pdf version   pdf version | ***Z e+e- invariant mass in data and simulation*** Reconstructed invariant mass distribution of electron pairs in Z e+e− events from data (points) and from simulation (histogram). The electron energy is estimated using ECAL-only information. Dedicated supercluster corrections and smearings are applied. These are calculated from the prompt-reconstruction data in 2015. The corrections are calculated separately for golden and showering electrons, and in four bins. The comparison between data and simulation is shown for events with both showers in the barrel (left) and for events with one of the two showers in the endcaps (right). The residual data-MC discrepancy in the scale and resolution is mainly due to the different fraction of golden/showering electrons in data and simulation. |




-- EmanueleDiMarco - 2015-12-14

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