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Electron energy resolution corrections for calibration of the ATLAS Liquid Argon Calorimeter

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The calibration of the Liquid Argon Electromagnetic Calorimeter at the ATLAS experiment is done with $Z \to ee$ Data and MC. While the continuous efforts of the collaboration have improved the agreement between both samples, there is a remaining non-negligible discrepancy between the Data and MC dilepton invariant mass lineshape that has not been accounted for by existent corrections. As measurements coming from the tracker (and their simulation) are highly precise, the energy measurement at the calorimeter seems to be the most likely culprit.

This study aims to better understand the mass lineshape discrepancy by performing energy resolution corrections on MC. These are performed on an event-by-event basis with scalings of $\Delta = E_{\mathrm{reco}} - E_{\mathrm{truth}}$ via some parametrization $\Delta' = f_\eta(\Delta, E^{\mathrm{T}}_{\mathrm{truth}})$, where the explicit dependence on $E^{\mathrm{T}}_{\mathrm{truth}}$ seeks to account for the changing kinematics of the electron-pair across different regions of the calorimeter. As the Δ' correction translates into a shape deformation of the energy resolution distribution, it allows to account for specific effects, such as tails and negative smearing corrections, which have an important effect on the lineshape agreement.

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