

Single Cell, HIGH Gain, Timing Resolution vs Energy in the LAr EM Barrel Calorimeter

Using electrons from $W \rightarrow e\nu$ candidate events recorded in ATLAS during the 2011 pp data taking period, various corrections (as a function of the data taking period, front-end board, channel within the front-end board, cell energy and primary vertex position) were studied and applied to calibrate the LAr EM Barrel Calorimeter time measurement and gauge its timing resolution. A timing resolution of ≈ 300 ps is achieved for a large energy deposit in a cell of the EM Barrel.

The plot shows the single cell timing resolution energy dependence, for cells reconstructed in HIGH gain, in the Middle layer of the LAr EM Barrel Calorimeter ($|\eta| < 1.4$). A fit with the expected energy dependence, comprising a so-called "noise term" and a "constant term", added in quadrature, is shown superimposed.

By comparing the corrected time of the two electrons in $Z \rightarrow ee$ events from the same period, this resolution is understood to include a correlated contribution of ≈ 200 ps, expected to be dominated by the spread of the proton bunches along the LHC beamline, and an uncorrelated contribution of ≈ 200 ps. The latter component includes the intrinsic timing resolution of the LAr EM Barrel Calorimeter and its readout, as well as residual nonuniformities and imperfections in the calibration procedure.

