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Calibration of the ATLAS hadronic barrel calorimeter TileCal using 2008, 2009 and 2010 cosmic rays data

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The ATLAS iron-scintillator hadronic calorimeter (TileCal) provides precision measurements of jets and missing transverse energy produced in the LHC proton-proton collisions. Results assessing the calorimeter calibration obtained using cosmic ray muons collected in 2008, 2009 and 2010 are presented. The analysis was based on the comparison between experimental and simulated data, and addresses three issues. First the average non-uniformity of the response of the cells within a layer was estimated to be about ±2%. Second, the average response of different layers is found to be not inter-calibrated, considering the sources of error. The largest difference between the responses of two layers is 4%. Finally, the differences between the energy scales of each layer obtained in this analysis and the value set at test beams using electrons was found to range between -3% and +1%. The sources of uncertainties in the response measurements are strongly correlated, and include the uncertainty in the simulation of the muon response. The total error of each layer determinations is 2%. A value of the ratio between the actual value of the energy scale in ATLAS and the value set at test beams was determined to be 0.99±0.03 using all layers measurements and assuming that the mis-calibration is due to some unknown systematic uncertainty.

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