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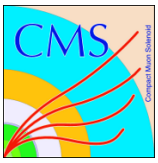
Jet energy scale and resolution in the CMS experiment in pp collisions at 8 TeV



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Abstract: Improved jet energy scale corrections, based on a data sample corresponding to an integrated luminosity of 19.7 fb^{-1} collected by the CMS experiment in proton-proton collisions at a center-of-mass energy of 8 TeV, are presented. The corrections as a function of pseudorapidity η and transverse momentum p_{T} are extracted from data and simulated events combining several channels and methods. They account successively for the effects of pileup, uniformity of the detector response, and residual data-simulation jet energy scale differences. Further corrections, depending on the jet flavor and distance parameter (jet size) R, are also presented. The jet energy resolution is measured in data and simulated events and is studied as a function of pileup, jet size, and jet flavor. Typical jet energy resolutions at the central rapidities are 15–20% at 30 GeV, about 10% at 100 GeV, and 5% at 1 TeV. The studies exploit events with dijet topology, as well as photon+jet, Z+jet and multijet events. Several new techniques are used to account for the various sources of jet energy scale corrections, and a full set of uncertainties, and their correlations, are provided.The final uncertainties on the jet energy scale are below 3% across the phase space considered by most analyses ($p_{\text{T}} > 30$ GeV and $|\eta| < 5.0$). In the barrel region ($|\eta| < 1.3$) an uncertainty below 1% for $p_{\text{T}} > 30$ GeV is reached, when excluding the jet flavor uncertainties, which are provided separately for different jet flavors. A new benchmark for jet energy scale determination at hadron colliders is achieved with 0.32% uncertainty for jets with p_{T} of the order of 165–330 GeV, and $|\eta| < 0.8$.

Keywords: Large detector-systems performance; Performance of High Energy Physics Detectors

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[48] CMS collaboration, *Energy calibration and resolution of the CMS electromagnetic calorimeter in pp collisions at* $\sqrt{s} = 7$ *TeV*, 2013 *JINST* **8** P09009 [arXiv:1306.2016].

[49] CMS collaboration, *Performance of quark/gluon discrimination in* 8 *TeV pp data*, CMS-PAS-JME-13-002, CERN, Geneva Switzerland, (2013).

[50] CMS collaboration, *Calculation of residual energy correction for b jets using* $Z + b$ *events in* 8 *TeV pp collisions*, CMS-PAS-JME-13-001, CERN, Geneva Switzerland, (2013).

[51] M.J. Oreglia, *A study of the reactions* $\psi' \to \gamma\gamma\psi$, see appendix D, SLAC report SLAC-R-236, Ph.D. thesis, Stanford University, U.S.A., (1980).

[52] H.L. Lai et al., *Global QCD analysis and the CTEQ parton distributions*, *Phys. Rev.* **D 51** (1995) 4763 [hep-ph/9410404].

[53] D.E. Groom, *A simplistic view of hadron calorimetry*, *AIP Conf. Proc.* **896** (2007) 137.

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