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LHC REFERENCE VOLUME

Performance of CMS muon reconstruction in pp collision events at $\sqrt{s} = 7$ TeV

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ABSTRACT: The performance of muon reconstruction, identification, and triggering in CMS has been studied using 40 pb^{-1} of data collected in pp collisions at $\sqrt{s}$ = 7 TeV at the LHC in 2010. A few benchmark sets of selection criteria covering a wide range of physics analysis needs have been examined. For all considered selections, the efficiency to reconstruct and identify a muon with a transverse momentum p_{T} larger than a few GeV/c is above 95% over the whole region of pseudorapidity covered by the CMS muon system, $|\eta| < 2.4$, while the probability to misidentify a hadron as a muon is well below 1%. The efficiency to trigger on single muons with p_{T} above a few GeV/c is higher than 90% over the full η range, and typically substantially better. The overall momentum scale is measured to a precision of 0.2% with muons from Z decays. The transverse momentum resolution varies from 1% to 6% depending on pseudorapidity for muons with p_{T} below 100 GeV/c and, using cosmic rays, it is shown to be better than 10% in the central region up to $p_{\mathrm{T}} =$ 1 TeV/c. Observed distributions of all quantities are well reproduced by the Monte Carlo simulation.

KEYWORDS: Performance of High Energy Physics Detectors; Large detector-systems performance; Simulation methods and programs; Particle identification methods; Muon spectrometers; Particle tracking detectors; Particle tracking detectors (Gaseous detectors)

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2012 JINST 7 P10002

Algorithms to identify cosmic and beam-halo backgrounds among collision events were developed and successfully used in physics analyses of 2010 data. The performance of various muon isolation algorithms was shown to be reasonably well modelled by the simulation.

The muon trigger efficiency for isolated muons is better than 90% over the full η range, and is typically substantially better.

In this document we have shown that the performance specifications set out for the measurement of muons in CMS have largely been met. The good performance and detailed understanding of the muon reconstruction, identification, and triggering provides the necessary confidence in all elements of the chain from muon detection to muon analysis, which is essential for searches for physics beyond the Standard Model as well as accurate Standard Model measurements.

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2012 JINST 7 P10002

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2012 JINST 7 P10002