Hard Muon Reconstruction in CMS/LHC and Cosmic Muons Data Handling

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Studies with TeV energy muons at the Compact Muon Solenoid (CMS) experiment on LHC at CERN can lead to new physical phenomena discoveries and also be a tool for testing muon reconstruction algorithms on their efficiency and precision of measurements.

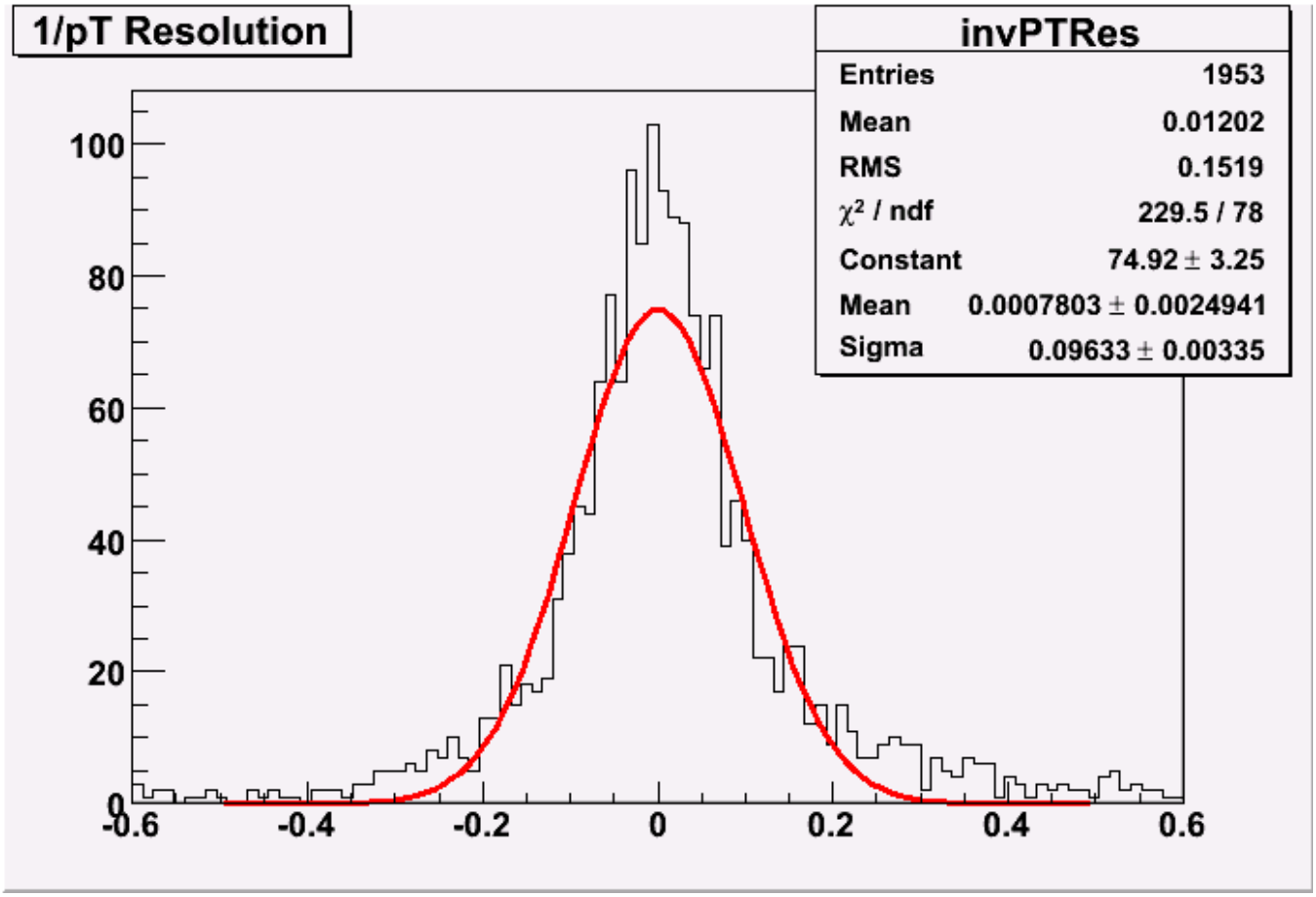

Fig. 1: Inverse transverse momentum residuals [1/Pt(reconstructed)-1/Pt(generated)]*Pt(generated) for 1 TeV single muons in endcap pseudorapidity $1.2 < \eta < 2.1$ region (2000 events; standard CMS software): efficiency for reconstruction is 97.6%, transverse momentum resolution - 9.6%

A significant progress in efficiency and transverse momentum Pt reconstruction is achieved for single hard muons in the recent CMS software: for Pt = 1 TeV the efficiency of reconstruction in the endcap region is 97.6% and Pt-resolution became less than 10% (see Fig.1). It is obtained substantially by improving the trajectory seed generator algorithm in Cathode Strip Chambers (CSC) for standalone muon reconstruction based on transverse momentum estimation by the difference of azimuth angles between CSC track-segments of pair with similar (η,ϕ)-parameters.

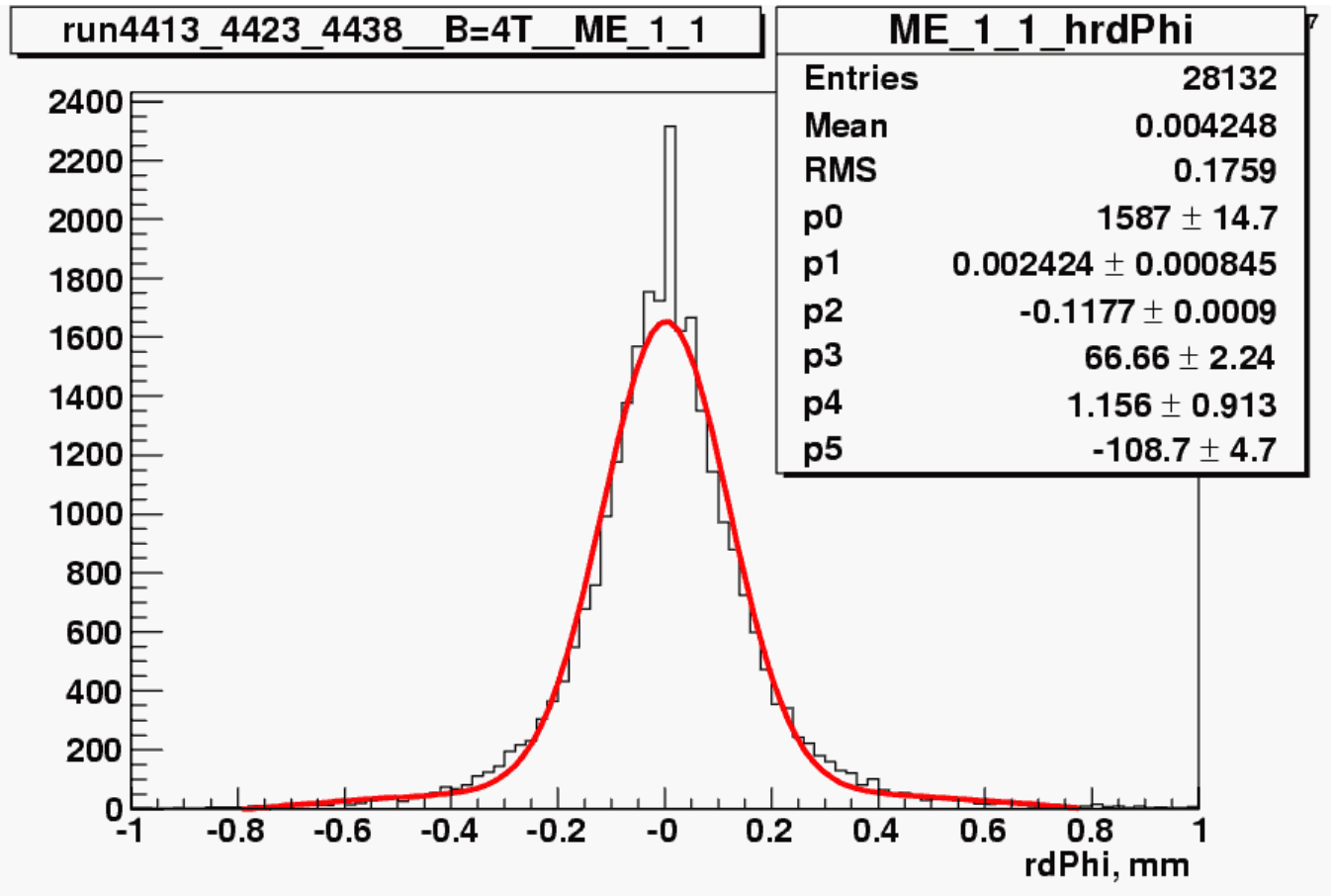

Fig. 2: R*dϕ resolution for top parts of ME1/1 chambers on MTCC2 (Magnetic Test& Cosmic Challenge-2) data. Distribution for R*[ϕ (measured)- ϕ (fitted)]-residuals is fitted by Gaussian and parabola, the P2 parameter is a standard deviation (sigma) of Gaussian

The Dubna group is fully responsible for ME1/1 CSC stations. Using CMS software on experimental data with cosmic muons in CMS magnetic field, a good ME1/1 space resolution has been obtained (see Fig.2). The resolution (118 microns) fully satisfies the designed requirements (150 microns).

The results were presented at CMS Collaboration Meetings in February-March, 2007 and the NEC'2007 Conference in Varna (September, 2007).