ME1/1 CSC Spatial Resolution with CRAFT08 and CRAFT09 Data of the CMS Experiment

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Abstract. The spatial resolution of the outer part of the ME1/1 muon station (for which JINR has full responsibility) has been studied with CRAFT08 and CRAFT09 (cosmic ray runs during 2008 and 2009 years) data of the CMS experiment at CERN. The Cathode Strip Chamber (CSC) layer spatial resolution as a function of the CMS magnetic field is presented. Finally the 6-layer CSC spatial resolution was calculated and the ME1/1 outer part spatial resolution was estimated.

1. Introduction

ME1/1 is the innermost muon station of the CMS endcap muon system [1]. It is composed of 36 six-layer Cathode-Strip Chambers (CSC) [2] in each endcap. The CMS detector operated at a magnetic field of B = 0–3.8 T with cosmic muons. This paper presents the results of a study of ME1/1 CSC spatial resolution on CRAFT08 and CRAFT09 data.

2. ME1/1 spatial resolution

For the layer spatial resolution calculation we adopted the following event requirements:

- A track requires 6 hits (in the 6 CSC layers);
- Large angle muons are excluded by the following cut: $|dx/dz| < 0.15$ and $|dy/dz| < 1.5$.

The Gatti function [3] is used to determine the precise (strip) coordinate for each layer. A track segment is composed of six strip coordinates and is fitted by a straight line. The residuals are the differences between the measured and fitted track strip coordinates in each layer. The residuals for each layer are adjusted by correction factors [4]. Figure 1 shows the residuals for ME1/1 layers at B = 3.8 T on CRAFT08 data.

Taking into account that the histogram x-axis is in strip width units, the layer spatial resolution is calculated to be $\sigma = 0.0189 \times 6$ mm = 113 μm. The same result has been obtained on CRATF09 data.

We also studied the influence of the solenoid magnetic field on the layer spatial resolution (Fig. 2). The points at B = 1.95 and 2.85 T correspond to data collected when the magnetic field was rising or lowering during a run. One can see that the spatial resolution clearly depends on the magnetic field.

The layer spatial resolution as a function of the radial coordinate R is presented in Fig. 3. Radial cuts were made to separate ME1/1 into four regions, labeled R1–R4. The strip width increases with the
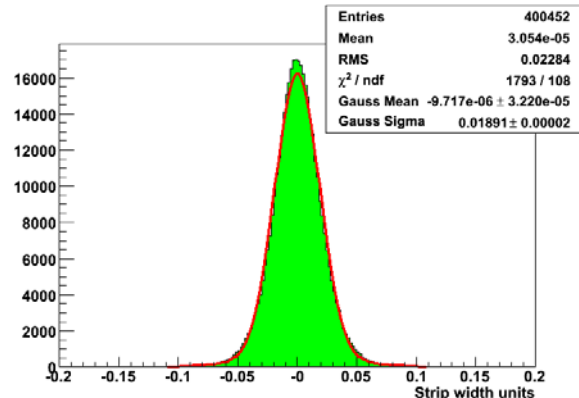

Figure 1: Residuals with correction factors for ME1/1 layers on CRAFT08 data. The fitting curve is the sum of a Gaussian and a parabola
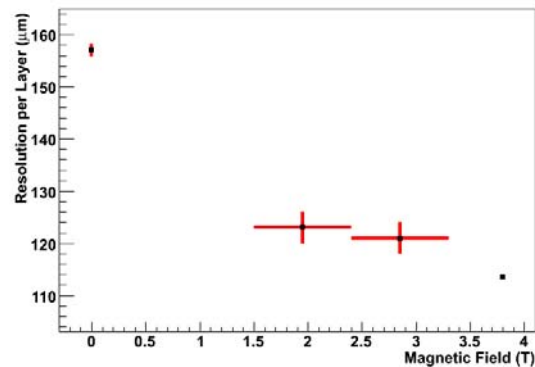

Figure 2: Layer spatial resolution vs CMS magnetic field

global radius. With the present chamber geometry this leads to degradation in the resolution [5].

Mean value of ME1/1 CSC spatial resolution for both endcaps is about 50 μm (Fig.4).

3. Conclusions

A study of the ME1/1 outer part spatial resolution was made using CRAFT08 and CRAFT09 data of the CMS experiment at CERN. The CSCs operated at the nominal anode-cathode voltage of 3.0 kV. For data processing, only 6-hit tracks were used. At the solenoid field of B=3.8 T, the layer spatial resolution is 113 μm. It was shown that without the field the spatial resolution degrades to 157 μm. In addition, a study of the layer spatial resolution across the CSC sensitive area was
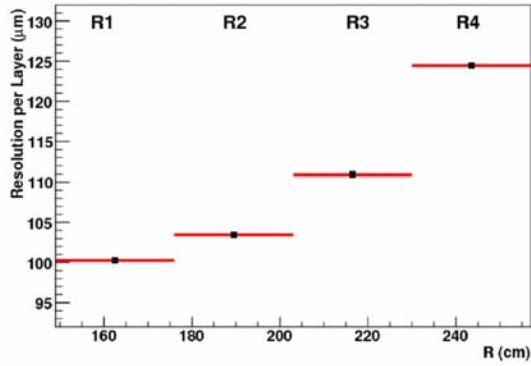
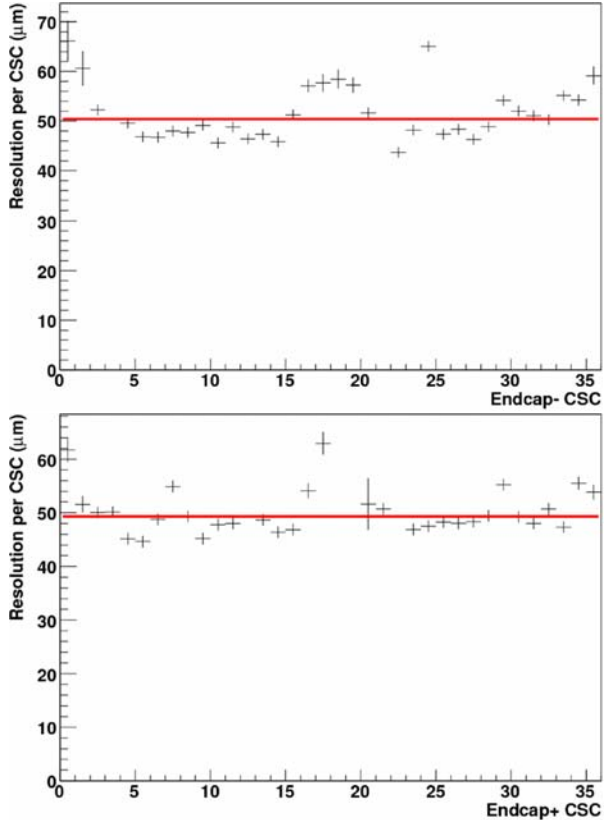Figure 3: Layer spatial resolution vs radial coordinate

Figure 4: ME1/1 outer part spatial resolution (per CSC) for both endcaps

made. The 6-layer spatial resolution for the CSCs in both endcaps was calculated. From these data the ME1/1 outer part spatial resolution (per CSC) is estimated to be 50 μm. This is better than the Muon TDR requirement [1] for the ME1/1 spatial resolution (75 μm).

References

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