Detector desing report

Team 2

November 21, 2014

Introduction

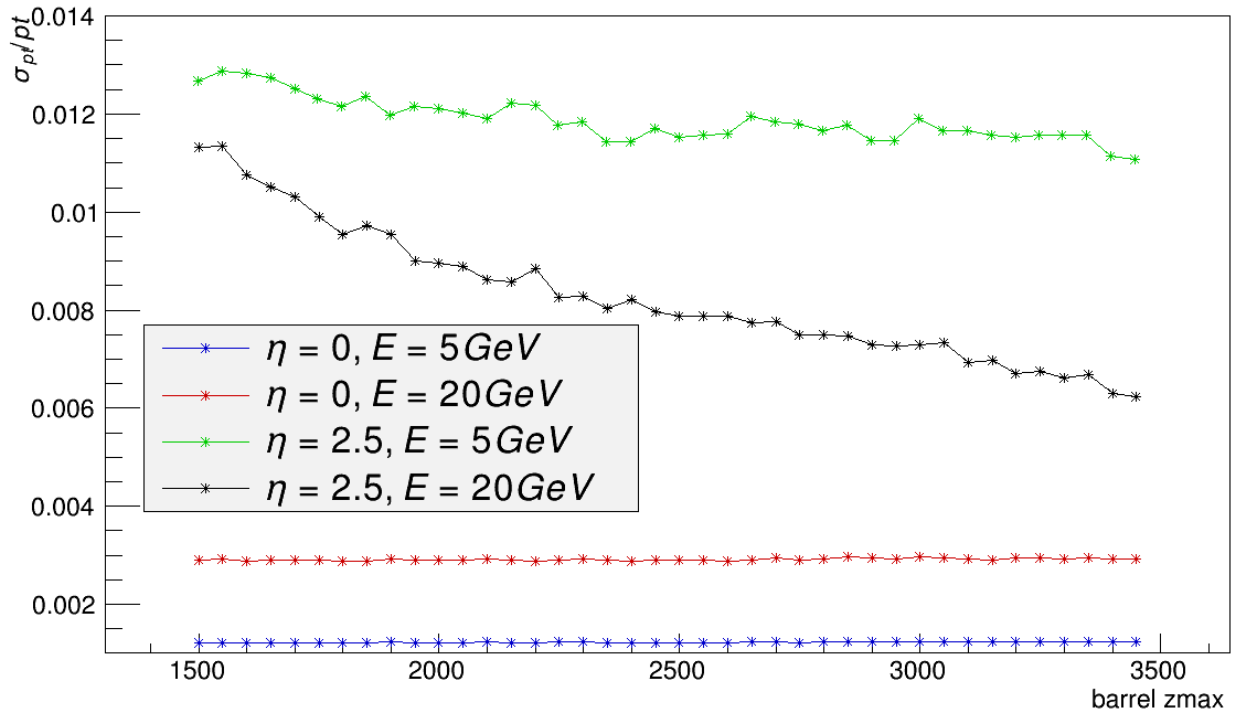
- Task was to design a detector for detecting low p_T muons
- $B_s \to \mu\mu$ and $B^0 \to \mu\mu$ decays were used as a benchmark channels
- The mass resolution of the B^0 and B_s mass peaks were required to be less than 60 MeV

Detector design

- Magnetic field of 3.8 T was lowered to 3 T to enhance the rate of low-p_T muons in the muon chambers
- In order to improve p_T resolution for low-p_T muons, tracker was redesigned
- Other sub-detectors of CMS were not changed

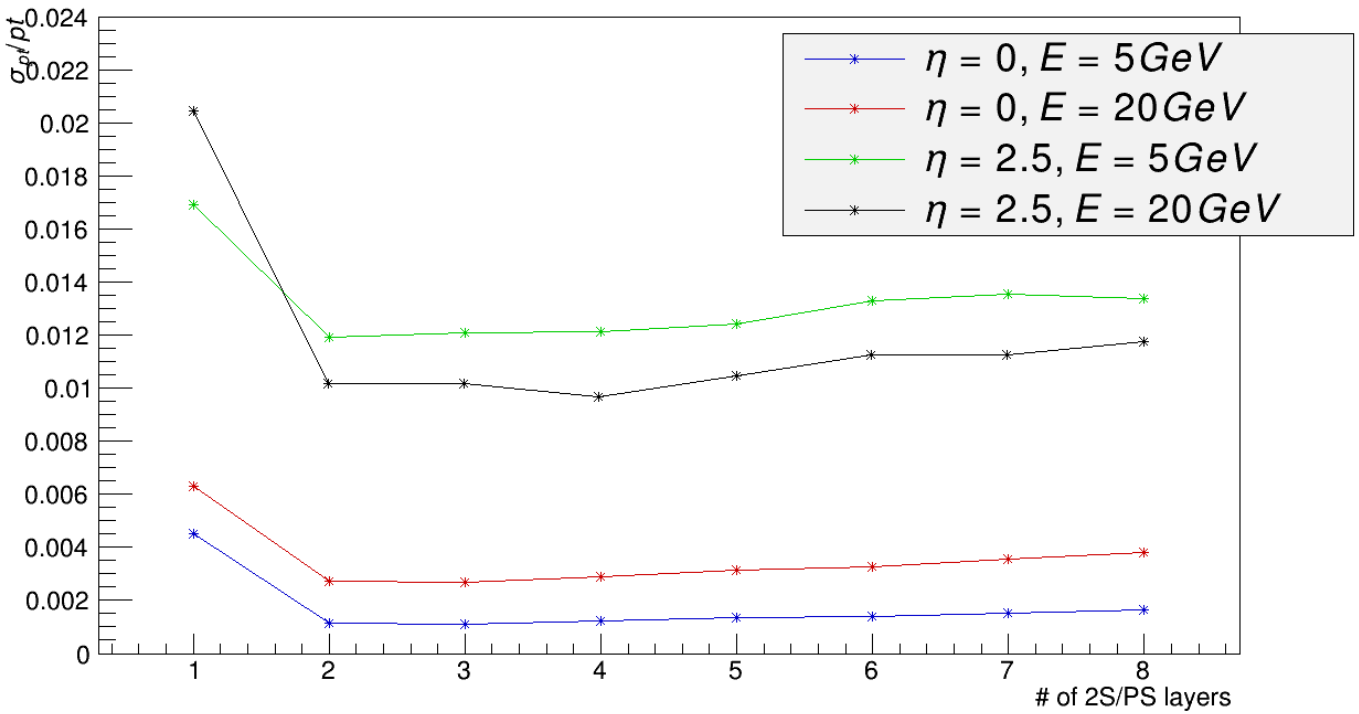
Tracker optimisation

- Tracker p_T resolution as a function of zmax

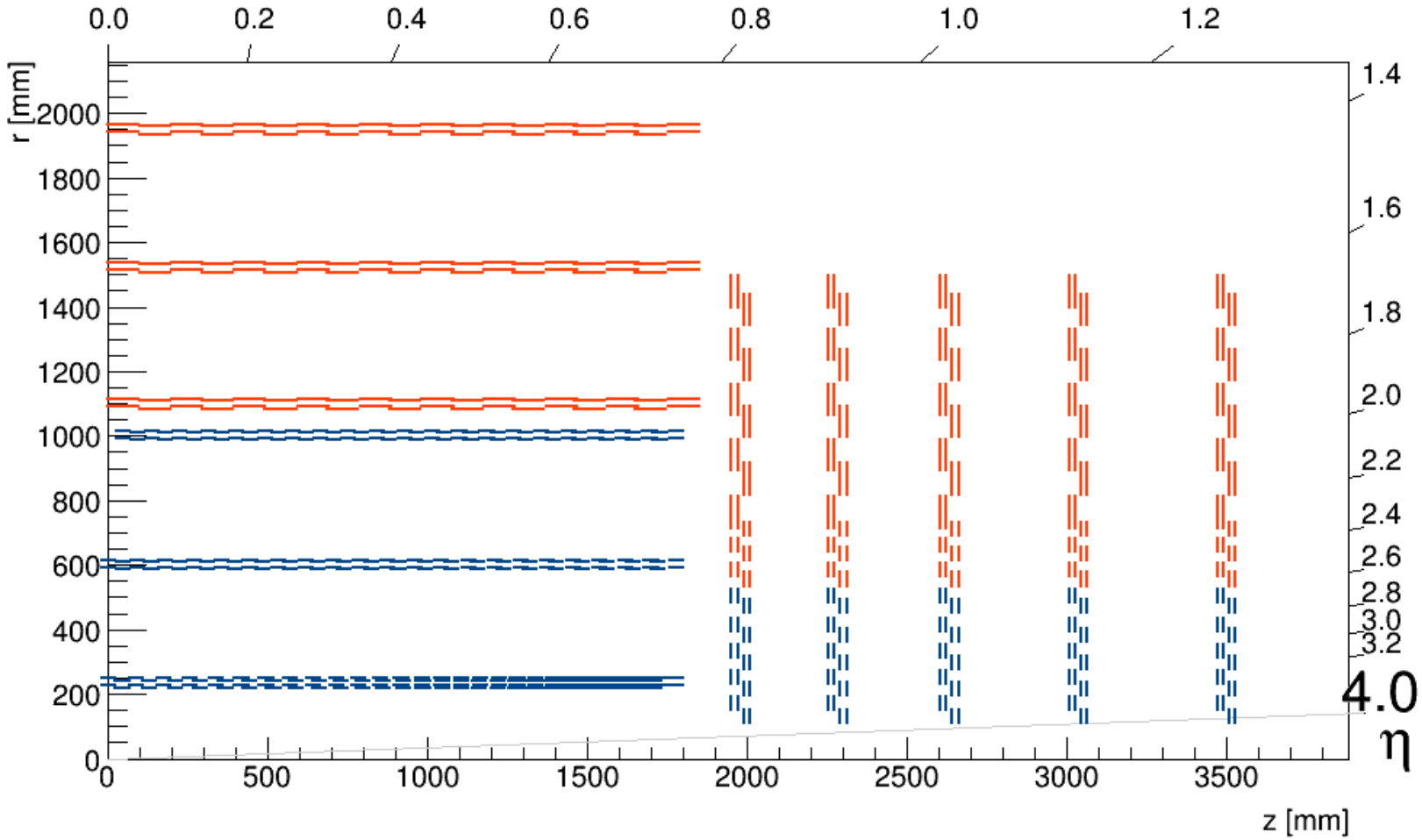


Tracker optimisation

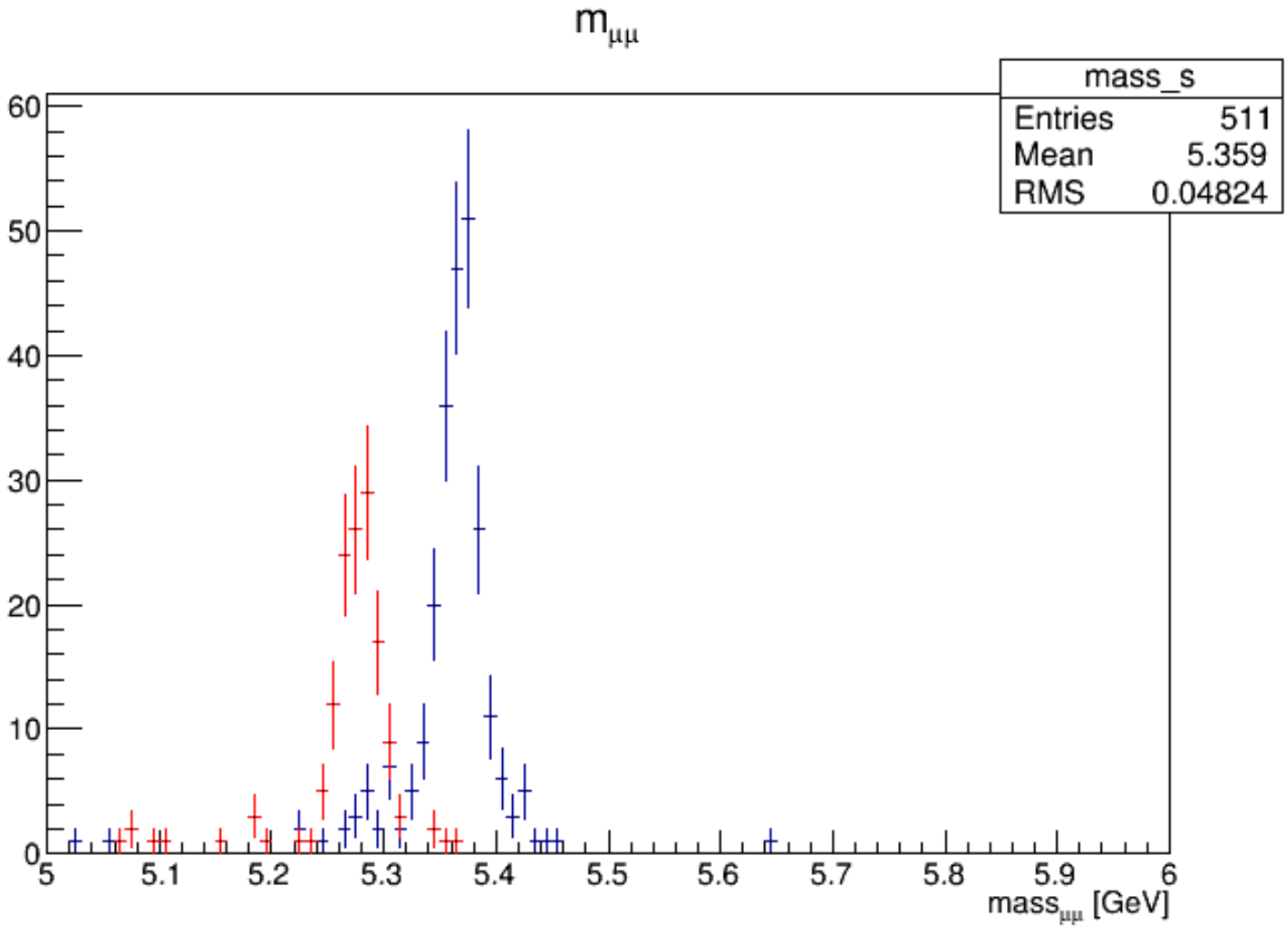
- Tracker p_T resolution as a function of number of barrel layers for each module type



Tracker design



Mass plots


$m_{\mu\mu}$
mass_s
Entries 511
Mean 5.359
RMS 0.04824
60
50
40
30
20
10
0
5
5.1
5.2
5.3
5.4
5.5
5.6
5.7
5.8
5.9
6
$mass_{\mu\mu}$ [GeV]

Conclusions

- The new tracker consisted of
  - 3 layers of pixel (PS) and strip (2S) modules in the barrel
  - 5 layers of disks in the endcaps
  - length along the beam axis was extended to 1.8 m
- The p_T resolution of tracker was improved, at $\eta = 2.5$ and $p_T = 5$GeV, from 1.64% to 1.21%
  - 30.2% increase in resolution !