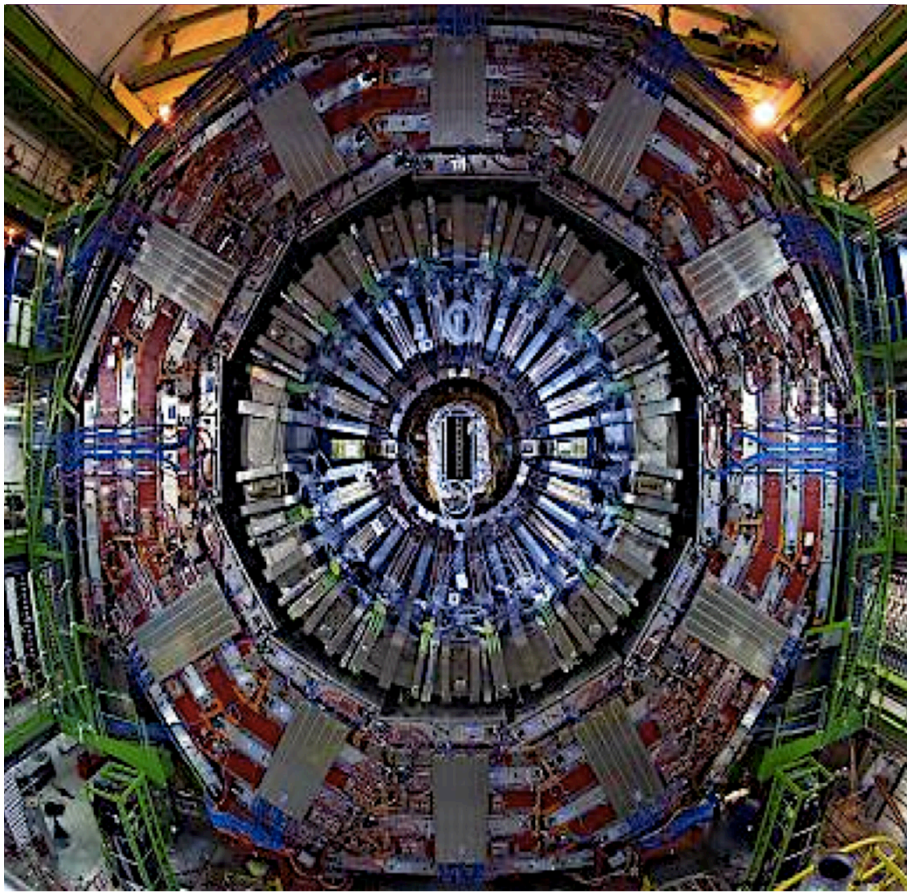
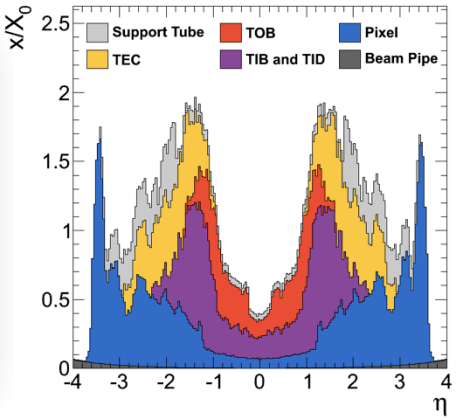
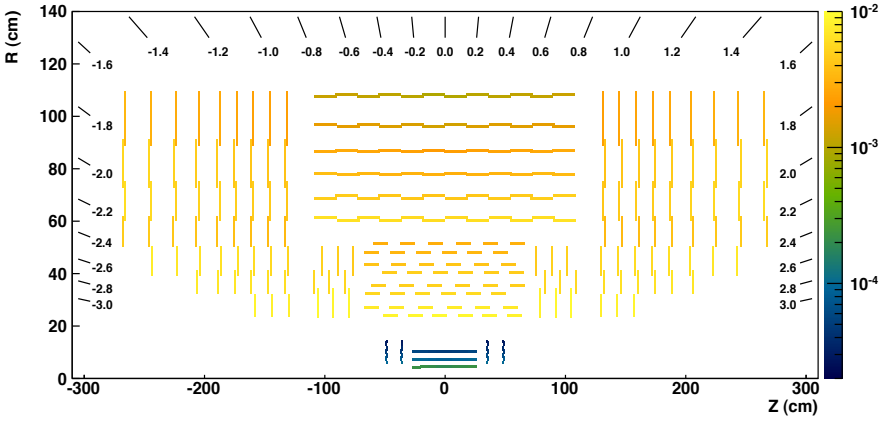


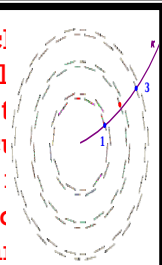

# CMS Silicon Pixel and Strip Tracker Performance

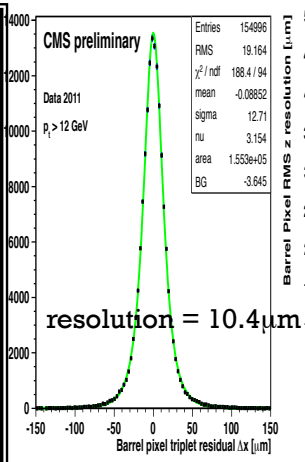
Petra Merkel – Purdue University

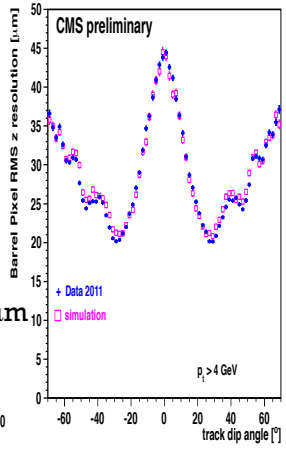
# Pixel and Strip Detector Performance

## Pixel Hit Resolution

We select trac
hits in 3 pixel l
then redefine t
by using the cu
measurement
full tracker and
position and a
from pixel hits 1 and 3.
The residual of the 2.
pixel hit to the track is
a measure of the pixel
hit resolution.

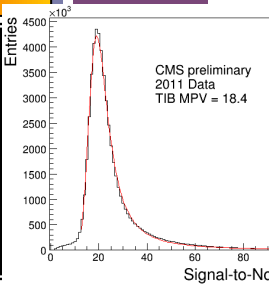




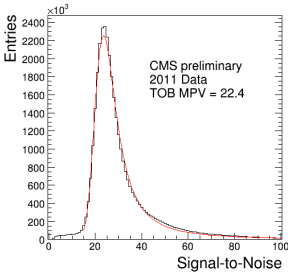




## Strip Hit Resolution & S/N

We measure the strip detector resolution by using hits on tracks passing overlapping modules. We compare the difference in the hit position to the expected hit position (from the track) between the two hits. The width of this difference is a measure of the hit resolution.



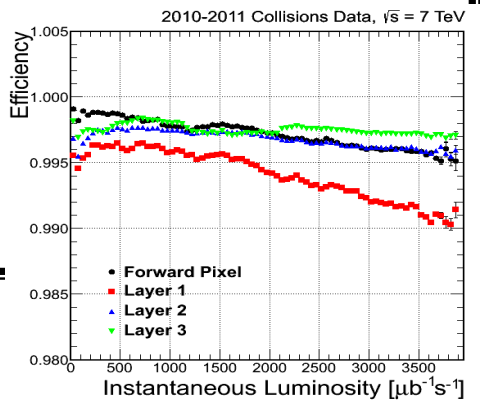

| Sensor / Layer | Pitch [μm] | Resolution [μm] vs. cluster size 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| TIB 1-2 | 80 | 15.0±4.6 | 14.0±3.6 | 13.7±4.2 | |
| TIB 3-4 | 120 | 24.1±5.2 | 24.7±4.1 | 22.1±7.0 | |
| TOB 1-4 | 183 | | 29.2±9.2 | 36.1±5.1 | 24.5±10.3 |
| TOB 5-6 | 122 | | 12.6±8.3 | 22.0±4.6 | 16.3±4.6 |




## Pixel Hit Finding Efficiency

We use well reconstructed, isolated tracks with a pt>1GeV, which originate from the primary vertex. Trajectories passing near the edges of sensors are excluded. Known bad modules are excluded as well. The hit efficiency is calculated from the present and the missing hits on and near the track (within 0.5mm of the predicted position).

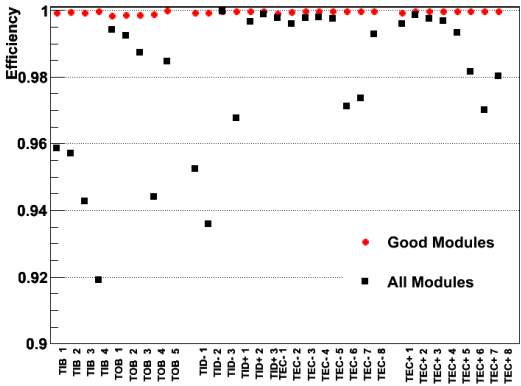
- **The average hit efficiency is measured to be 99%**
- It depends on the instantaneous luminosity, the trigger rate and the presence of beam background
- Sources of inefficiency are readout errors in the frontend electronics and a limited internal buffer size of the readout chips




## Strip Hit Finding Efficiency

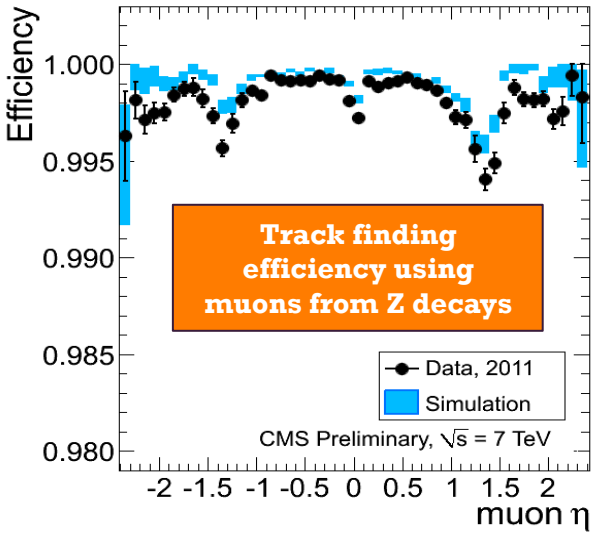
We measure the hit efficiency with tracks with at least 8 hits and not passing near the edges of sensors. The efficiency is calculated from the present and missing hits in the traversed modules. In order to avoid multiple scattering a hit in the subsequent layer is required. Known bad modules are excluded.

- **The average hit efficiency is measured to be 99.8%**

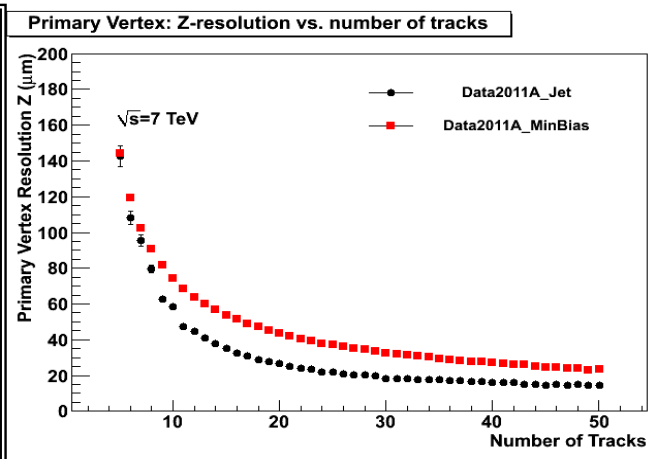


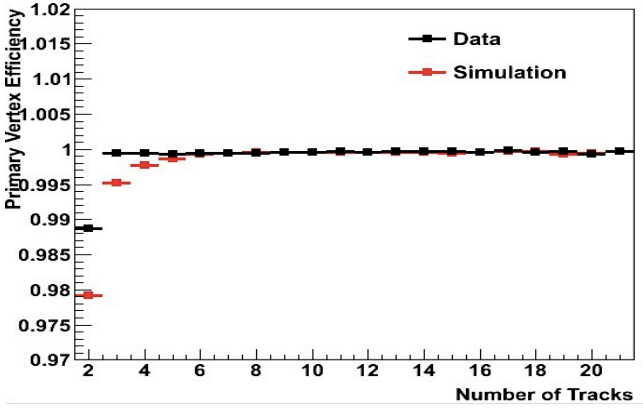
# Tracking and Vertexing Performance

CMS uses an iterative tracking algorithm with subsequent steps picking up inefficiencies from previous steps. Subsequent iterations are based on a different, and typically looser seeding, which could be affected by larger combinatorics, and therefore have to be applied only after other iterations. The main tracking algorithm is based on pixel seeds and uses a Kalman filter.




Good primary vertex finding efficiency and resolution are essential to physics using the busy LHC collisions. The luminous region in CMS is ~5cm in z, containing an average of 8 (15) pp interactions for 2011 (2012) data taking conditions.




**Concluding Remarks**

**The CMS Silicon Tracker is performing according to design specifications**

**Its excellent performance is key to the successful physics programme of CMS**