Study of a MAPS detector prototype for the upgrade of the BESIII inner tracker

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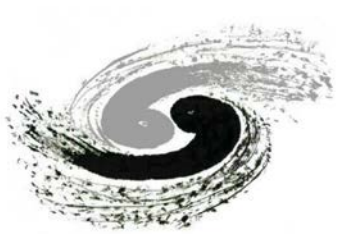

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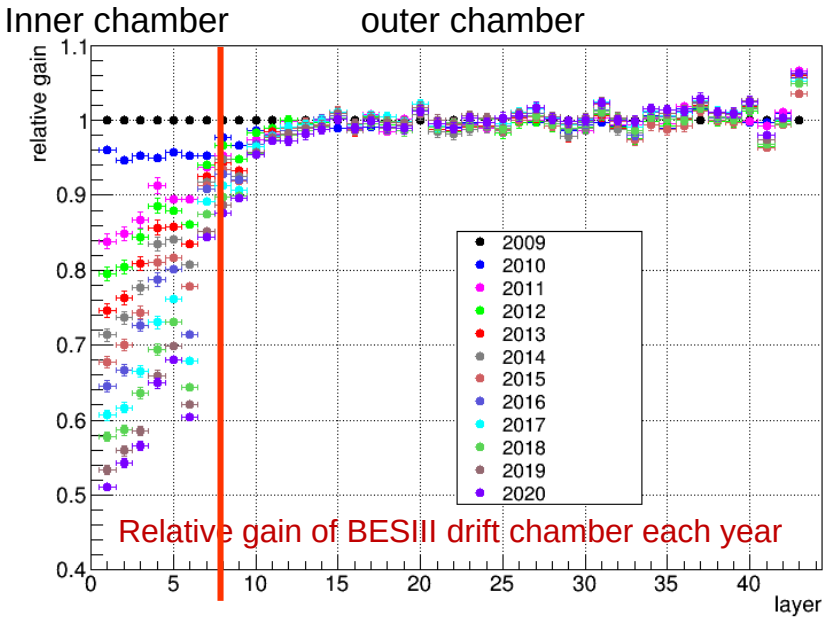
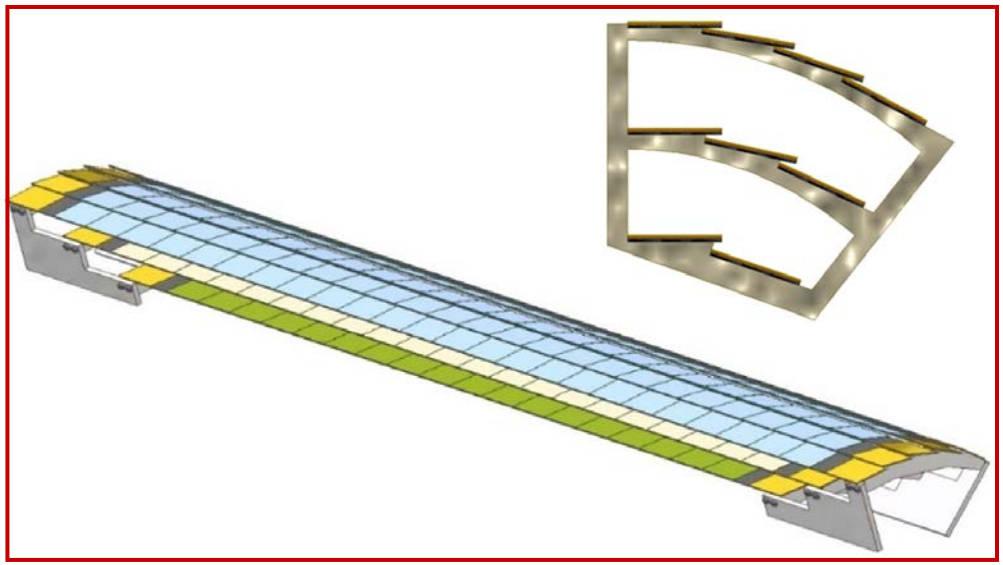
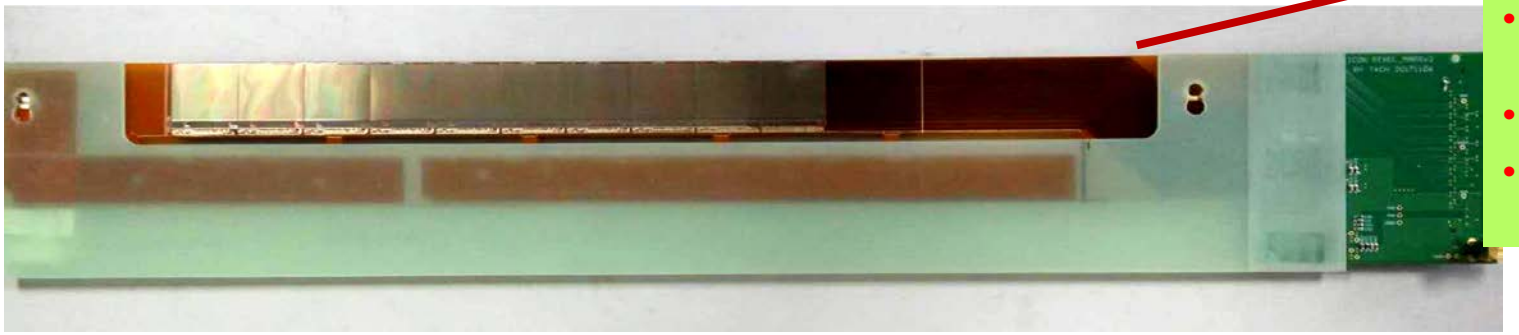
MAPS Detector Prototype





- Three layers CPS detector prototype designed for BESIII inner tracker upgrade
- 1/10 coverage of the inner tracker (~ 720cm^2 ⟶ 180 chips)
- In ϕ direction: 2 , 3 and 4 ladders for layer1-layer3 respectively
- In Z direction: 2 sets of ladders each layer



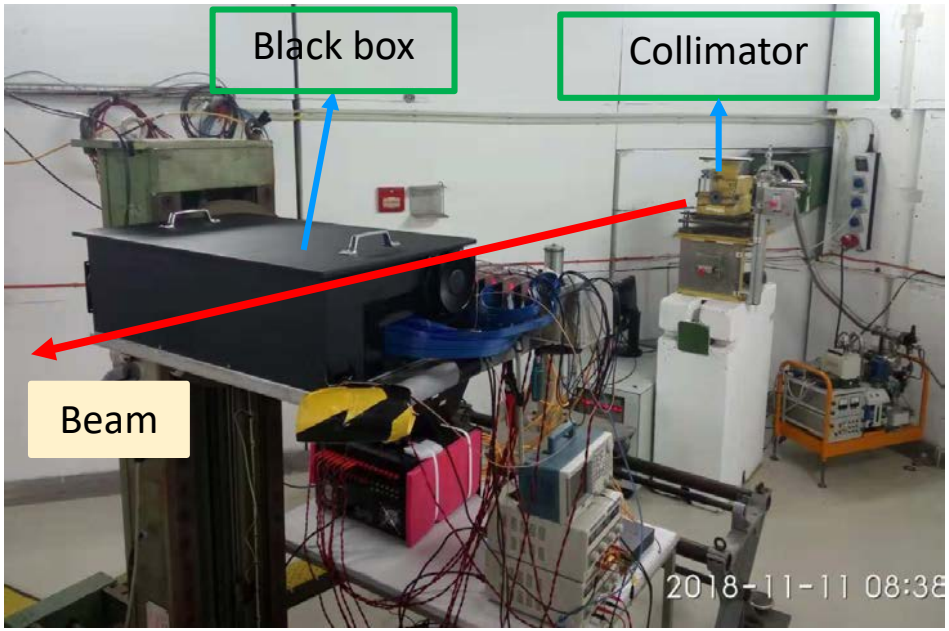
Ladder:

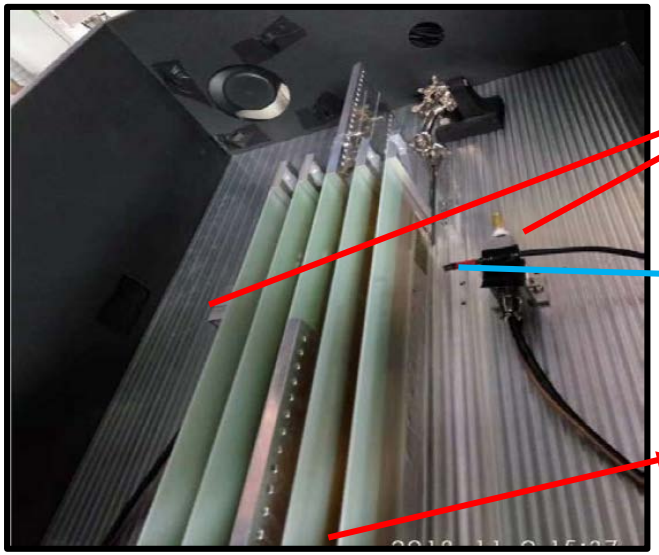
- 10 Mimosa28 chips (thinned to 50 μm)
- Flex cable
- Carbon fiber mechanical support

Test Beam in DESY

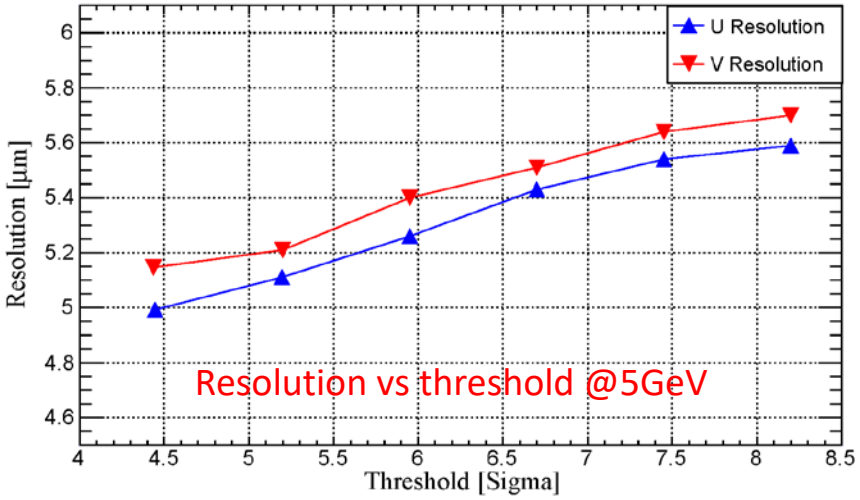
Setup of the test (T24 test beam in DESY)

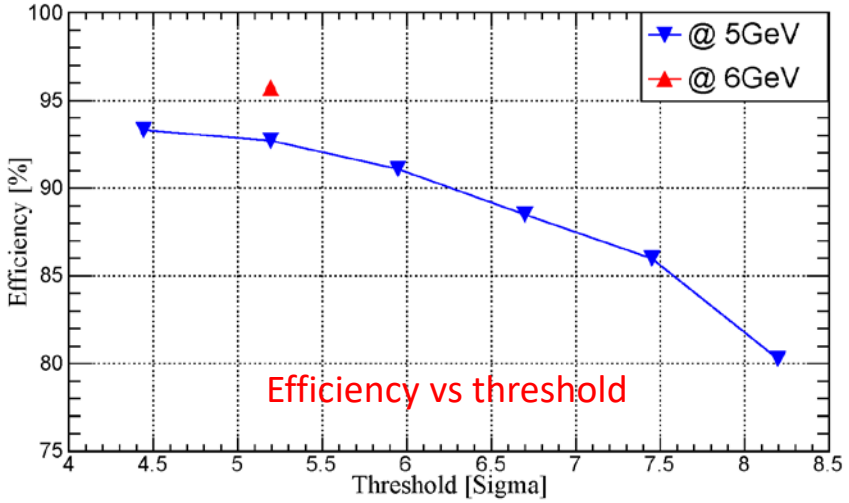
- Five detector ladders arranged in parallel
  - Telescope system, DUT plane
  - Spacing: 20mm
- Two scintillators provide trigger signals
  - Size: 15mm×15mm
- Fans for air cooling
- A temperature sensor monitors the environment temperature



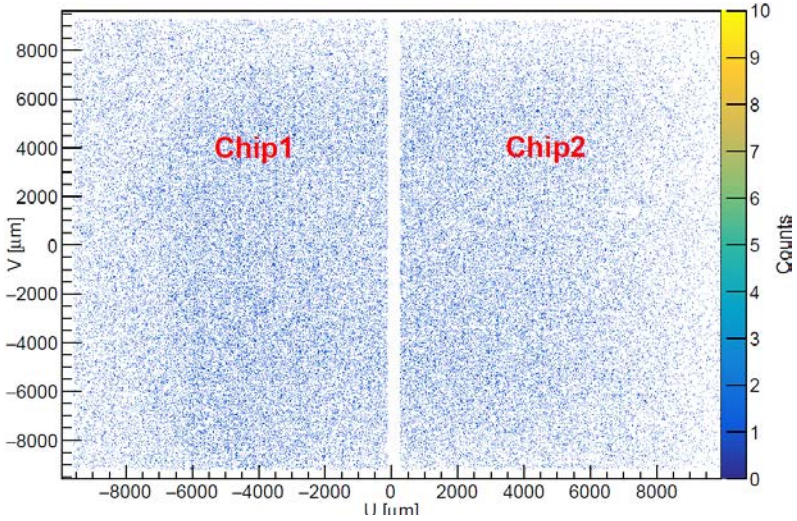


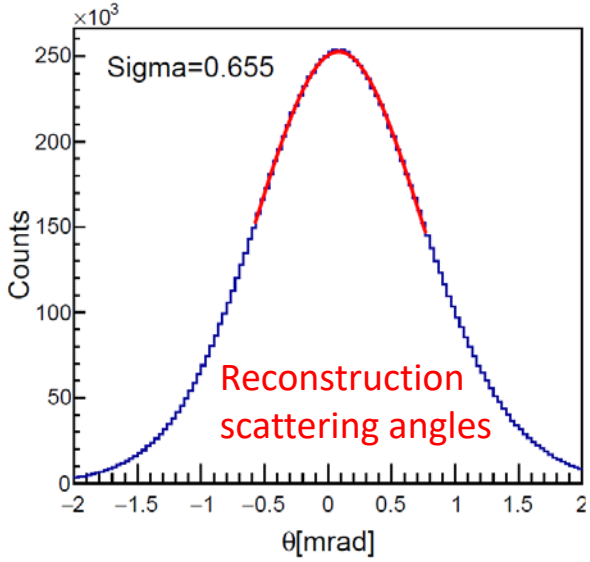
Test Results





- Spatial resolution: about 5 μm. Maximum of tracking efficiency: 96%
- loss of ~4% of the efficiency is due to the readout and DAQ system. Already updated for next test





- The average gap between neighboring chips is better than 10 μm.
- The material budget is about 0.37% X_0 / ladder (based on Highland formula)