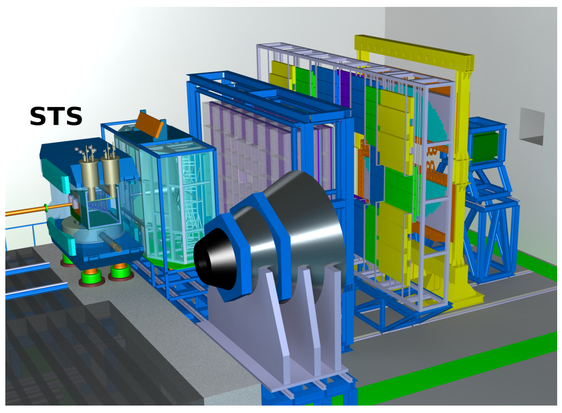
Ladder Assembly for the Silicon Tracking System of the CBM Experiment at FAIR

Shaifali Mehta for the CBM Collaboration

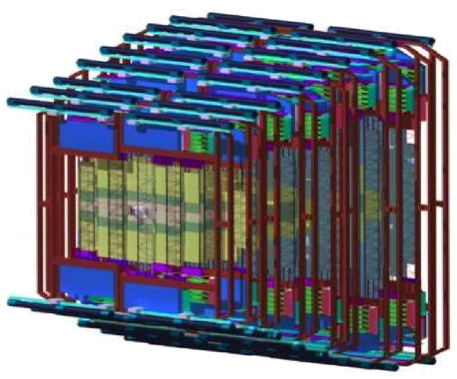
Physikalisches Institut der Universität Tübingen and GSI Darmstadt

The STS for the CBM experiment at FAIR



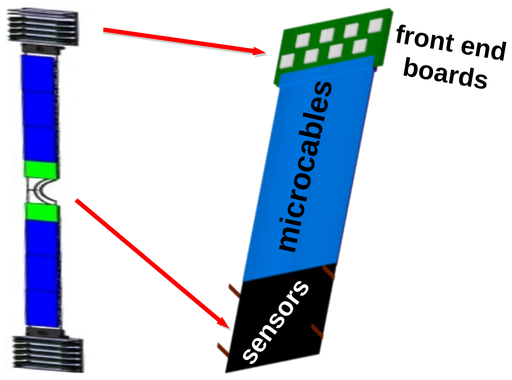
- STS is core detector of CBM
- Located inside of dipole magnet
- Track reconstruction, momentum measurement low material budget

STS with 8 tracking stations

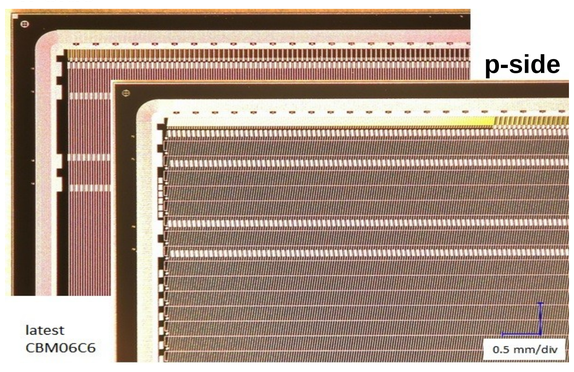


- Consists of 8 tracking stations
- 896 detector modules mounted on 106 Carbon Fiber (CF) ladders
- 8-10 modules on each CF ladder
- Requirement: Precision of sensors in 3-D better than 100 µm

106 ladders 896 modules



n-side sensors p-side

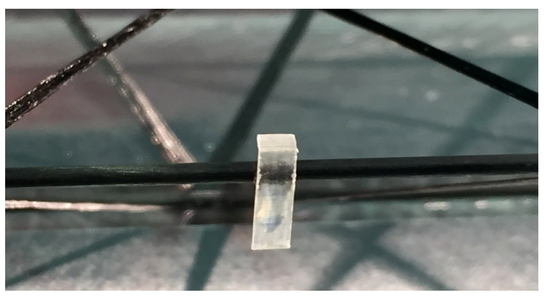


- Double-sided silicon micro-strip sensors
- 1024 strips on each side
- Stereo angle between front /back strips 7.5º
- 4 sensors sizes- 6.2 x 2.2, 4.2, 6.2, 12.4 cm²

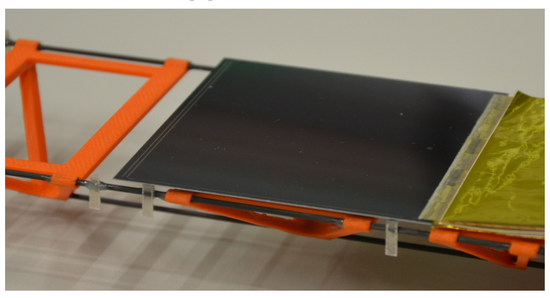
STS ladder

sensor module

CF support structures

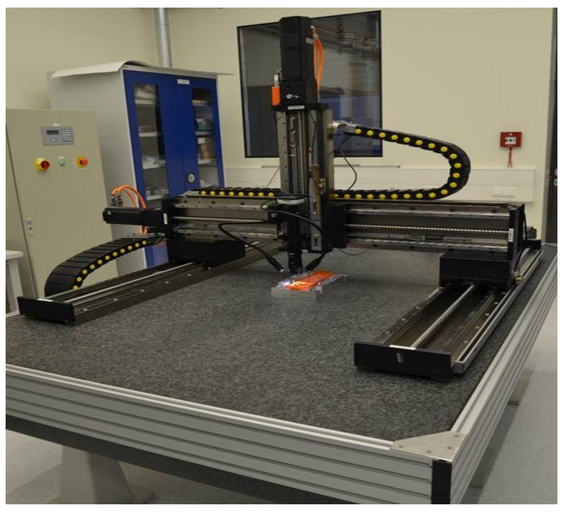


sensor holding structures, L-legs

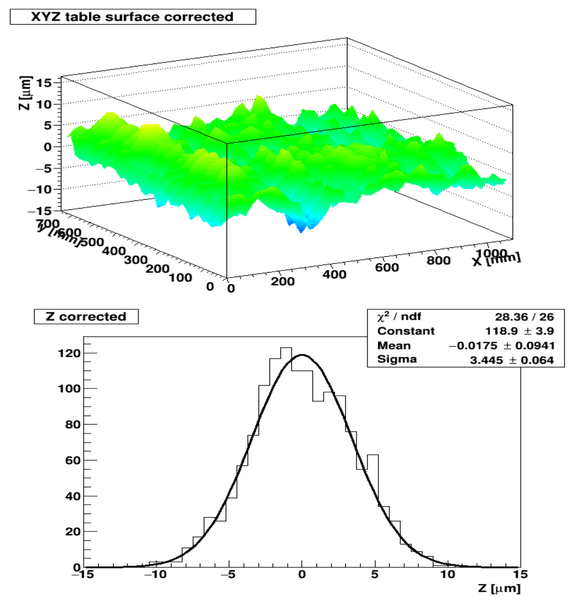


sensors glued on space frame using L-legs

Instrument for geometrical survey

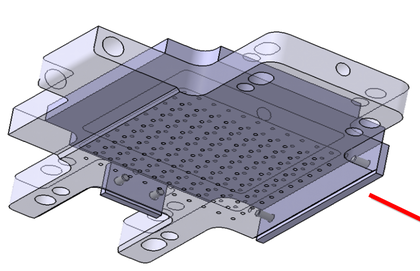


- Three-axis measurement instrument (1100 x 800 x 170 mm)
- Equipped with camera
- Suitable for measuring ladder ~1000 mm
- Non-rectangularity of X & Y axis is 17 µm

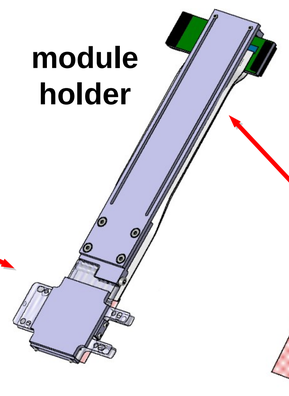


Precision in the height measurement after correction: better than 10 µm

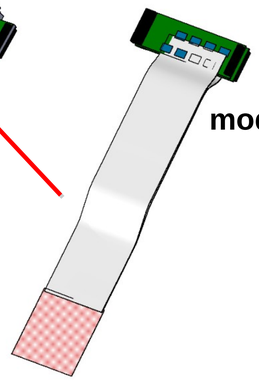
Assembly tools



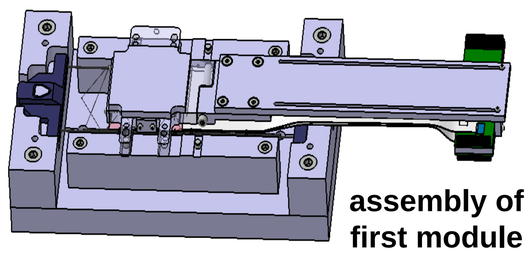
sensor holder



module holder

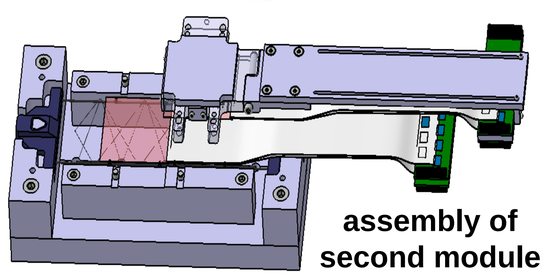


module

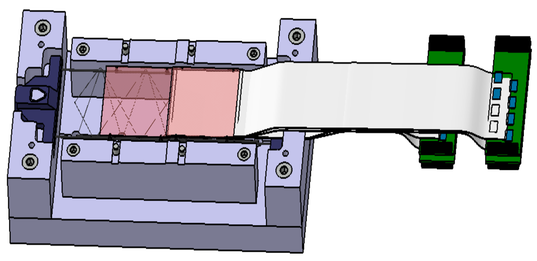


concept tool

assembly of first module

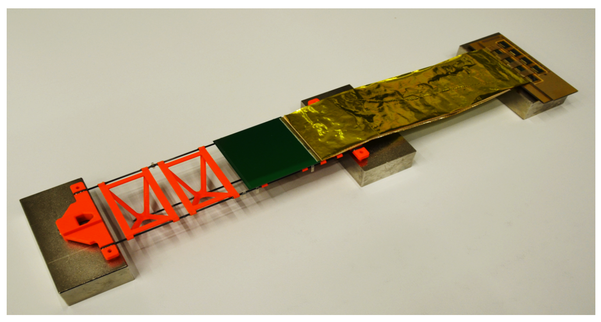


assembly of second module



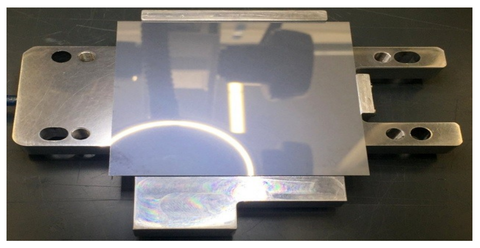
two modules assembled on the CF ladder

- The concept tool has been designed to mount the sensors on the CF ladders.
- Sensors are positioned by ledges on the sensor holder.
- Sensor holder is positioned to the tool with dowel pins.

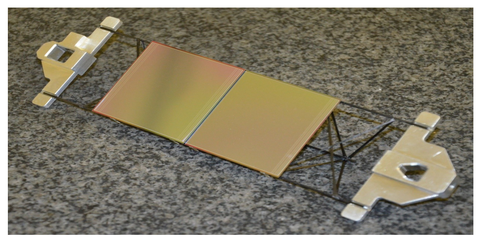


- Assembly of a CF ladder with single non-functional module mounted on it.
- Ensures the feasibility to mount the module on the tool.

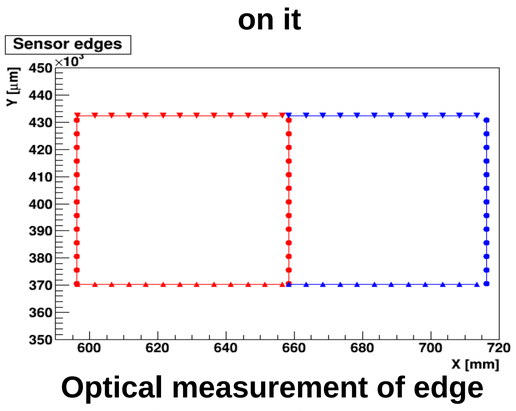
Positioning accuracy of sensors



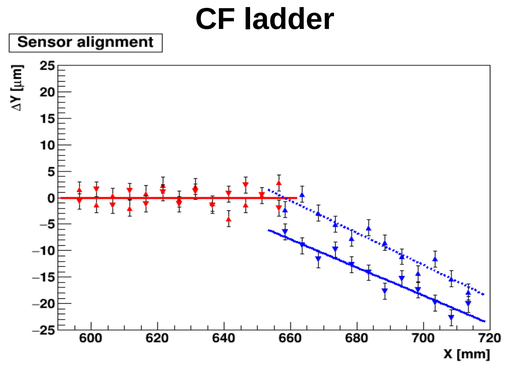
Sensor holder with sensor placed on it



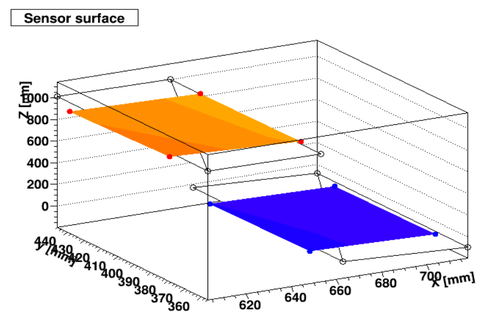
Positioning of sensors on CF ladder



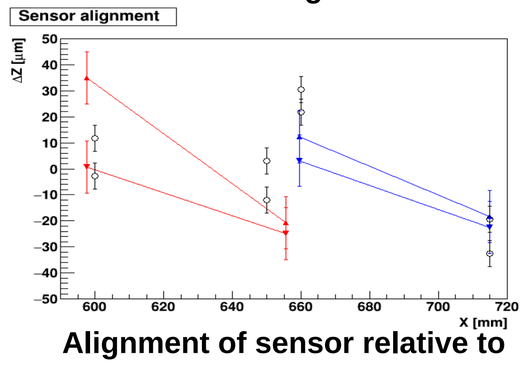
Optical measurement of edge position of two overlapping sensors



Alignment of two sensors after fitting



Optical measurement of surface positioning of sensors in 3-D



Alignment of sensor relative to mounting tool giving precision of ~ 40 µm

Conclusion & Outlook

- Positioning of sensors achieved within the target range (100 µm).
- Improved second generation of the mounting tool is under construction to assemble the functional ladders for the mSTS in 2018.