



CBM Silicon Tracking System integration: from module production to ladder assembly

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Compressed Baryonic Matter experiment at FAIR

CBM Silicon Tracking System

Detector module construction

- DSDM silicon sensors
- SMX 2.2 ASICs
- micro cables
- aluminium cooling fin
- module

Ladder assembly and integration

- ladder
- Tracker mechanics and services
- assembled unit
- STS mainframe

- The **Compressed Baryonic Matter at Facility for Antiproton and Ion Research (FAIR)** is a fixed target experiment which aims to explore the QCD phase diagram at high baryonic densities
- Silicon Tracking System**
 - Inside 1 Tm dipole magnet
 - Radiation tolerant up to $10^{14} \text{ n}_{\text{eq}}\text{cm}^{-2}$
 - Momentum resolution $\Delta p/p \approx 1.5\%$
 - Material budget per station: $0.3\% - 2\% X_0$
 - 876 detector modules produced in GSI and KIT
 - 106 carbon fiber support structures
 - 199 module variants, 38 ladder types
 - Self triggered Front End Electronics

All sensors have been delivered and quality inspection has been performed

Assembly procedure of a STS module (Sensors + Micro-cables + Front End Boards (FEBs))

Step I: TAB-bonding of the micro-cables to the STS-XYTER-ASICs

Step II: TAB-bonding of the micro-cables to Silicon sensor

Step III: Bonding of the STS-XYTER-ASICs to the PCB-rows

Step IV: FEBs glued to T-shelves using thermally conducting interface

- Well defined assembly procedures have been developed
- QA tests are performed at each step during assembly
- To dissipate heat from the front end electronics, it is imperative to optimise the Thermal Interface Materials (TIMs)
- Each module is tested after assembly before mounting on to the ladder

Pre series production to start in spring 2022

Precise mounting of modules on ultra thin support structures: Ladder

Carbon Fiber ladders

Gluing of L-legs on ladder

Precise mounting of modules on ladder

Sensor glued onto the L-legs + CF Ladder

- Ladder assembly technique has been exercised
- Optical inspection is done with focus based metrology
- Deviation of markers from nominal position is within $100 \mu\text{m}$
- Ladders assembled with modules have been tested under the beam during the m-CBM campaign

Ladder assembly procedure has been developed such that sensors position do not deviate from their nominal position by more than $100 \mu\text{m}$

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