Contribution ID: **113** Type: **Recorded Presentation**

Development of the space-time self-triggering Silicon Tracking System for the CBM Experiment at FAIR

The Silicone Tracking System (STS) of the future CBM experiment is a unique detector aiming to cope with charged particle tracks and momentum measurement at unprecedented heavy-ion beam-target interaction rates up to 10 MHz. The detector design combines features low material budget down to 2% of radiation length, radiation hardness up to 10^14 n_eq/cm^2, and single-point resolution of ~30 μm which results in the momentum resolution of about 1.5%. The essential property of STS is a free-streaming triggerless read-out which allows to independently obtain data from about 1.8 million silicon microstrip channels with timing better than 5 ns along with charge measurement. The online reconstruction algorithms provide the real-time event building and selection. Such challenging requirements to the detector are dictated by the physics program of CBM: to study strongly interacting matter at high net-baryon densities with multi-strange particle yields and other rare observables.

The CBM-STS team has produced the mSTS detector, consisting of 11 prototype STS detector modules. It was operated in high-intensity heavy-ion beam from the GSI-SIS18 accelerator as a part of the mCBM demonstrator experiment.
From early 2022 the STS assembly centers start the pre-series production of the final-shape detector components. The detector construction is expected to be finished until the end of 2024.

In the presentation, the current prototypes and the detector under preparation will be overviewed.

Primary experiment

CBM

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Track Classification: Semiconductor Detectors