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Minimal material, maximum coverage: Silicon Tracking System for high-occupancy conditions

Silicon strip sensors have long been a reliable technology for particle detection. Here, we push the limits of silicon tracking detectors by targeting an unprecedentedly low material budget of **2%–7% X_0** in an 8-layer 4m² detector designed for high-occupancy environments (**≤ 10 MHz/cm²**).

To achieve this, we employ **Double-Sided Double Metal (DSDM) silicon microstrip sensors**, coupled with readout electronics capable of precise **timing and energy measurements**. These 300 µm thick sensors, featuring 2×1024 channels with a **58 µm pitch**, are connected via ultra-lightweight aluminium-polyimide microcables for signal transmission and integrated with a custom **SMX readout ASIC**, operating in **free-streaming mode**. This system enables the simultaneous measurement of **time (Δt ⊠ 5 ns)** and **charge deposition (0.1–100 fC)**, significantly enhancing the detector's capacity for high-precision track reconstruction in high-occupancy and harsh radiation field environments.

The primary application of this technology is the **Silicon Tracking System (STS) for the CBM experiment**, with additional potential in projects like the **J-PARC E16 experiment** and future uses in medical physics, such as advanced imaging telescopes. In this contribution, we present the current status of CBM STS construction, with almost one-third of the modules produced and tested. We also discuss immediate applications and explore promising **prospects in both scientific and medical fields**.

Primary experiment

CBM

Primary authors: RODRÍGUEZ RODRÍGUEZ, Adrian; TOIA, Alberica (Goethe University Frankfurt (DE)); Ms SHARMA, Anju (Aligarh Muslim University); SCHMIDT, Christian Joachim (GSI - Helmholtzzentrum fur Schwerionenforschung GmbH (DE)); RODRÍGUEZ GARCÉS, Dairon; RAMIREZ ZALDIVAR, Dario Alberto; LEHNERT, Joerg (GSI Darmtadt, Gernany); HEUSER, Johann (GSI); COLLAZO SÁNCHEZ, Lady Maryann; SHIROYA, MEHULKUMAR (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI)); TEKLISHYN, Maksym; VASYLYEV, Oleg; KSHYVANSKYI, Oleksandr (National Academy of Sciences of Ukraine (UA)); FRANKENFELD, Uli (GSI - Helmholtzzentrum fur Schwerionenforschung GmbH (DE))

Presenter: TEKLISHYN, Maksym

Track Classification: Semiconductor Detectors