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Module and ladder characterization and burn-in tests of the Silicon Tracking System for the CBM experiment

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The Silicon Tracking System (STS) in the upcoming heavy-ion CBM experiment is tailored for an unprecedented 10 MHz beam-target interaction rate. A unique integration strategy was employed to maintain a material budget within 2 - 8\% X_0 while ensuring ample granularity, spatial precision, and timing accuracy. The read-out electronics sit external to the sensitive volume, connected to double-sided double-metal silicon sensors through ultra-thin micro cables. Each double-sided silicon strip sensor is connected to two Front-End Boards (FEBs), featuring eight custom-designed STS-XYTER ASICs (SMX) per FEB.

Post-assembly, rigorous quality control tests, including time and amplitude calibration of all module ASICs, ensure reliable performance, operational refinement, and accurate data interpretation. Operating at room temperature to -20 ℃ (coolant) and -10 ℃ (effective), FEBs undergo mechanical stress due to temperature fluctuations. The burn-in test exposes modules to varying temperatures and power cycles, identifying weaknesses and evaluating electronics robustness and module functionality.

Post-testing, modules are affixed to carbon fiber ladders, hosting up to 10 modules each, and undergo further assessments to verify sustained functionality and performance. This study outlines the status and outcomes of tests on the first modules and ladders of the STS detector's series production, providing valuable insights into its development and performance capabilities.

Hauptautor: COLLAZO SÁNCHEZ, Lady Maryann (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI))

Co-Autoren: RODRIGUEZ RODRIGUEZ, Adrian (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI)); RODRÍGUEZ GARCÉS, Dairon (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI)); TEKLISHYN, Maksym (GSI)

Vortragende(r): COLLAZO SÁNCHEZ, Lady Maryann (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI))

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