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Development and characterization of high-density interconnection technologies for the CBM Silicon Tracking System at FAIR

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The Compressed Baryonic Matter (CBM) experiment at the future Facility for Antiproton and Ion Research (FAIR) in Darmstadt, Germany, aims to explore the quantum chromodynamics phase diagram for highest baryon densities.
One of the core detectors of CBM is the Silicon Tracking System (STS). The STS is the key detector for measuring the momentum and tracks of up to 1000 charged particles produced in Au+Au collisions which happen at interaction rates up to 10 MHz on a fixed target. Due to the required momentum resolution for the STS of $\Delta p/p \tilde{} 1.5\%$, the material budget of STS has to be minimized as much as possible. In order to keep the read-out electronics, cooling and mechanical infrastructure out of the detector acceptance, the sensors are connected to the self-triggering front-end electronics by means of low-mass flexible microcables with a length up to 50 cm. In combination with the large double-sided sensors with a size up to 124 mm x 62 mm, the detector module becomes a highly complex structure, which in turn leads to a challenging module assembly procedure.
To mitigate risk, two high-density interconnection technologies have been developed for the STS modules, based on ultra-thin aluminium and copper mircocables, respectively. Capacitance simulations and measurements of the microcables and full detector material budget simulations have been performed. Next to the individual steps involved in the respective interconnection technologies, the electrical performance of the assembled modules, including a thorough noise analysis, will be presented.

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