Contribution ID: **6** Type: **not specified**

Mechanical Integration of the Micro Vertex Detector of the CBM Experiment

Wednesday, 31 May 2023 11:00 (20 minutes)

The four planar detector stations of the CBM-MVD will operate between 5 and 20 cm downstream of the target in the moderate vacuum of the target chamber, which is placed in the center of the CBM dipole magnet with a maximum 1 T. The harsh radiation environment of up to 7×10^{13} n_{eq}/cm^2 and 5 Mrad per CBM running year poses challenging constraints not only on the dedicated CMOS pixel sensors MIMOSIS, but also on the choice of all other materials. The sensor technology requests stable sub-0 ℃ operation during run time to maintain high detection efficiency and low fake rate. The MVD will serve as a high-precision tracking device in direct proximity of the target, allowing for low-momentum tracking, primary and secondary vertexing with a precision of below 70 µm along the beam axis, background suppression in dieletron spectroscopy and, together with the following tracking detector STS, the identification of hyperons by decay topology. Hence, minimizing the material budget down to $x/X_0 \approx$ 0.3-0.5 % per station inside the acceptance is of primary interest.

The baseline detector concept relies on integrating large-area (31.15×17.25 mm^2) thinned (50 µm) silicon sensors on both sides of highly heat-conductive carrier sheets of Thermal Pyrolytic Graphite (TPG, 380 µm thick, $\lambda > 1500$ W/mK), to provide full acceptance and efficiently conduct the dissipated power to an actively cooled aluminum heat sink outside the acceptance, respectively. pCVD diamond (150 µm thick) might serve as carrier material for the first station to minimize the material budget even further for enhanced secondary vertex reconstruction precision. The heat sinks are cooled with Novec-649 and host the first stage of readout electronics, which is connected via thin flex cables ($x/X_0 \approx$ 0.06 %) to the sensors. Each of the four detector stations comprises four independent quadrants (sensors - TPG carrier - heat sink - R/O).

This contribution will present the overall detector concept, elaborating on the selection of materials and assembly procedures, based on the Technical Design Report that has been approved in 2021. In preparation of the pre-production of the detector quadrants, compiling robust and sound procedures of high-yield sensor integration and quality assessment & assurance is of primary interest in this phase of the project and first ideas will be discussed. Insights on the selection of glues and ideas to further reduce the material budget will be touched.

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Session Classification: Plenary