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Development of Lightweight Forward Discs for the ePIC SVT at the EIC: Mechanical and Thermal Design, Prototyping, and Testing

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Experiments at the future Electron-Ion Collider (EIC) pose stringent requirements on the tracking system for the measurement of the scattered electron and charged particles produced in the collision, as well as the position of the collision point and any decay vertices of hadrons containing heavy quarks. Monolithic Active Pixel Sensors (MAPS) offer the possibility of high granularity in combination with low power consumption and low mass, making them ideally suited for the inner tracker of the EIC detector(s). The forward discs are critical to the measurement of the scattered electron, and thus minimizing the mass is crucial.
To that end, we have developed a disc design for the ePIC Silicon Vertex Tracker (SVT) that incorporates a corrugated carbon fiber core to add strength while providing a channel for air cooling. Recent efforts have focused on prototyping discs using updated carbon composite structures and more realistic module geometries to better reflect the final detector configuration. New thermal tests incorporating updated power dissipation estimates have been conducted, and detailed finite element analysis (FEA) has been performed to model thermal behavior, with results compared directly to lab measurements. In addition, new tooling is being designed to enable precise and repeatable construction of the complex disc geometry. We have also begun mechanical stress testing to evaluate structural performance under simulated operational loads. In this talk, we will present the current disc design, our latest R&D progress, and the roadmap toward final integration.

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