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Forward silicon tracking detector developments for the future Electron-Ion Collider

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The proposed high-luminosity high-energy Electron-Ion Collider (EIC) will provide a clean environment to precisely study several fundamental questions in the high energy and nuclear physics fields. A low material budget silicon vertex/tracking detector with fine spatial resolution (hit spatial resolution < 10 μm) is critical to carry out heavy flavor hadron and jet measurements at the future EIC. Fast timing capability (< 10 ns) helps suppressing backgrounds from neighboring collisions. We will present the design of a proposed Forward Silicon Tracking (FST) detector with the pseudorapidity coverage from 1.2 to 3.5, which can provide both fine spatial and temporal resolutions for the EIC. This detector geometry has been implemented in the GEANT4 simulation in integration with the selected EIC detector: ECCE. The integrated ECCE tracking performance meets the EIC physics requirements and enables a series of high precision heavy flavor measurements especially in the forward pseudorapidity region. Simulation studies for both the FST detector and heavy flavor physics developments will be presented. The Low Gain Avalanche Diode (LGAD), AC coupled LGAD (AC-LGAD) and Depleted Monolithic Active Pixel Sensor (MALTA), which are the EIC silicon detector technology candidates, are under detector R&D. A series of bench tests have been performed for both single prototype sensor and a telescope setup. Progresses and results from the ongoing detector R&D for LGAD, AC-LGAD and MALTA will be presented as well.

In-person participation

Yes

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