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

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The proposed Electron-Ion Collider (EIC) will operate high-luminosity high-energy electron+proton and electron+nucleus collisions at the collision energies from 20 to 141 GeV to solve several fundamental questions in the high energy and nuclear physics fields. Its instant luminosity can reach $10^{33-34} \text{ cm}^{-2} \text{ s}^{-1}$ and the bunching crossing rate is around 10 ns. The EIC project has received CD1 approval from US DOE in 2021 and moves towards the machine design and construction. To realize the proposed high precision particle measurements at the future EIC, a low material budget and high granularity silicon vertex/tracking detector with fine spatial and momentum resolutions and nearly 4π solid angle coverage is desired. The Monolithic Active Pixel Sensor (MAPS) and AC Coupled Low Gain Avalanche Diode (AC-LGAD) stand out of several advanced silicon technologies as the top candidates for the EIC silicon detector subsystems. Latest studies and results for the EIC silicon vertex/tracking detector, which includes the conceptual detector design, performance validations in simulation and ongoing MAPS and AC-LGAD detector R&D will be presented. The EIC detector development plan and schedule will be discussed as well.

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