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Multipurpose Beam Instrument for EIC

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A large part of the physics program being envisioned for future facilities such as the Electron Ion Collider (EIC) requires novel precision beam instrumentation. Here, we present a novel technique which uses the spacial asymmetry of synchrotron radiation (SR) produced by an electron beam passing through a wiggler magnet to trace the changes in beam polarization. Such a relative polarimeter could be vital if the goal of $< 0.5\%$ polarimetry is to be achieved at EIC In this paper, we update the discussion on the development of this technique supported by a Geant4 simulation. The polarimeter apparatus along with the underlying basic ideas are briefly introduced. As a part of the simulation, the effects of electron beam current and beam energy were studied which were found to be manageable over a wide range of electron beam energies and beam currents. It was found that such a relative polarimeter works best in the $4 - 20$ GeV regime. When coupled with a CCD camera, the SR can be used to further monitor the beam profile as demonstrated at the Swiss Free Electron Laser (FEL). Furthermore, the SR can also be used to monitor the beam current and thus be effectively implemented as a beam current monitor. In the following chapter the extent of applicability of such a device is explored.

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