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Design of the cryogenic BPM pick-ups for the EIC Hadron Storage Ring

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Designing cryogenic BPM pick-ups for the Hadron Storage Ring (HSR) of the Electron-Ion Collider is challenging due to the need for reliable beam position measurements across diverse beam species, operating modes, and with various energies. The existing RHIC BPM stripline pick-ups are incompatible with the planned EIC HSR beam parameters, as it will have a 10-times shorter bunch length (6 cm rms, shortest hadron bunch anywhere), a factor of 3 more currents, compared to RHIC, and will have a large radial offset (± 20 mm) to adjust the path length for different beam energies. The BPM pick-up design takes into consideration the potential elevated heating concerns caused by resistive wall loss due to radial beam offset and heat conduction through cryogenic BPM signal cables from room temperature feedthrough to the cryogenic temperature BPM housing. Minimizing geometric impedance in the button configuration and housing transition to the adjacent HSR beam screen is crucial. This paper focuses on the evolution of the button BPM design and describes simulation results of the position-related voltage signals, and beam-induced losses on the metallic BPM buttons due to the radial offsets.

Footnotes

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