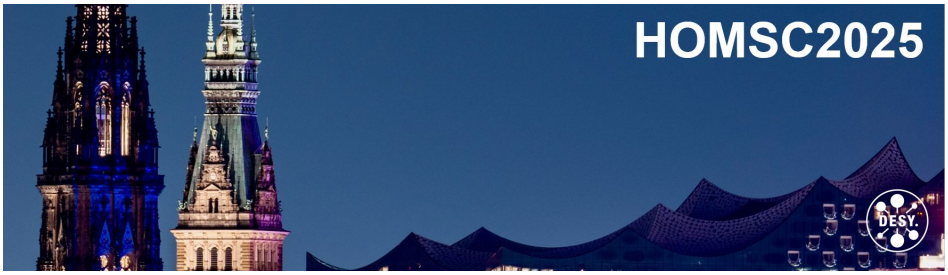

Contribution ID: **31** Type: **Oral contribution**

Beam Stability in the EIC ESR: Contribution of the 591 MHz RF Cavities

Monday 6 October 2025 17:00 (30 minutes)

The Electron-Ion Collider (EIC) Electron Storage Ring (ESR) will circulate high-intensity electron beams, making beam–cavity interactions and higher order mode (HOM) effects a central concern for stability. This work presents wakefield and impedance simulations of the ESR cryomodule containing two back-to-back 591 MHz single-cell RF cavities and associated beamline components. The contribution of the cavities to the overall impedance budget is quantified through detailed wakefield calculations and pseudo–Green function analysis. Multi-particle tracking with ELEGANT was employed to evaluate microwave instability thresholds, while coupled-bunch instability growth rates were estimated using the HOM spectra of the cavities. The results demonstrate that while the cryomodule impedance remains within design requirements, HOM-driven longitudinal instabilities require a bunch-by-bunch feedback system. The analysis highlights the critical role of the 591 MHz RF cavities in ESR beam stability and provides guidance for HOM damping and feedback strategies necessary for reliable collider operation.

Primary author: BLEDNYKH, Alexei (BNL/EIC)

Presenter: BLEDNYKH, Alexei (BNL/EIC)

Session Classification: HOM Damping Requirements for Future Facilities

Track Classification: HOM Damping Requirements for Future Facilities