The desire to increase the luminosity in a collider motivates the search for highly efficient cooler design. Application of electron cooling at ion energies above a few GeV has been limited due to the reduction of electron cooling efficiency with energy and difficulty in producing and accelerating a high-current high-quality electron beam. A high-current storage-ring electron cooler offers a solution to both of these problems by maintaining high cooling beam quality through naturally-occurring synchrotron radiation damping of the electron beam. An appropriate design of the two-energy storage ring cooler may be useful to cool the ion beams resulting in a significant reduction of six-dimensional beam emittance, which is crucial to deliver high luminosities over a broad center of mass energy range in a collider. This presentation reports the development of a storage-ring based cooling design, which may provide the best possible solution to the emittance degradation due to the heating effects in ion storage rings in Electron-Ion Collider.

**ABSTRACT**

The total length is 343.4 m, each ring 171.7 m.
- Machine elements (Dipoles, Quadrupoles and Sextuples).

**SUMMARY AND FUTURE WORK**

- Full energy injection
- Heat transfers from ion beam to electron beam through scattering.
- Single particle tracking with and without synchrotron radiation has been performed which verifies the stability.
- Damped equilibrium emittance and energy spread are estimated.

**APPLICATION OF TWO-ENERGY STORAGE RING**

- Test of cryomodules, HOM couplers, and crab cavities at high currents.
- Dark matter search, low energy electron physics, and figure-8 test.
- Positron production tests and low-energy positron physics applications.
- High intensity CEBAF detector and target tests.
- Isotope production tests.
- Test for CEBAF luminosity increase, CEBAF energy increase.
- Ultra-short bunches for light source applications.
- Radiation effects study for NASA applications.

**REFERENCES**