

ACCELERATOR SEMINAR

“MEIC Design Studies: Chromaticity Correction and Spin Rotators”

Hisham Sayed

The proposed medium energy electron ion collider at JLAB introduces an ambitious high luminosity and highly polarized beams collider. Those unique features represent a challenging task requiring self-consistent optimized design. Two of the most important problems that to be solved are the chromaticity correction and spin manipulation.

As for the first, since electron lattice exhibits low β - functions at the Interaction Point (IP) ($\beta_x^* \sim 100$ mm - $\beta_y^* \sim 20$ mm) and rather large equilibrium momentum spread of the collider ring ($\delta p/p = 0.00158$). Both features make the chromatic corrections of paramount importance. Here the chromatic effects of the final focus quadruples are corrected both locally and globally. Local correction features symmetric sextupole families around the IP. Global interleaved families of sextupoles are placed in the figure-8 arc sections, and non-interleaved families at straight section making use of the freely propagated dispersion wave from the arcs. This strategy minimizes the required sextupole strength and eventually leads to larger dynamic aperture of the collider.

While in the later case, a unique design feature of a polarized Medium Energy Electron-Ion Collider (MEIC) based on CEBAF is its 'Figure-8' storage rings for both electrons and ions, which significantly simplifies beam polarization maintenance and manipulation. While electron (positron) polarization is maintained vertical in arcs of the ring, a stable longitudinal spin at four collision points is achieved through solenoid based spin rotators and horizontal orbit bends. The proposed MEIC lattice was developed in order to preserve a very high polarization (more than 70%) of the electron beams injected from the CEBAF machine. The otherwise coupled beam trajectory due to solenoids used in the spin rotators was decoupled by an optimized set of a doublet and singlet.

In the presentation both problems will be introduced along with a systematic approach to the solution.

Monday, June 7, 2010

3:30 p.m. – 4:30 p.m.

CEBAF Center, Room L102/104