REU Sam Rhodes, Summer 2013

- Orientation – CEBAF, injector, beam polarization, Mott scattering polarimeter
- Mott Experiment – Broad issues, the "team", goals, background issues
- Sam's Project – reduce dump background, impact of NP 499MHz vs. special 31MHz operation

Tasks

Electron Beam

- ✓ Learn about beam lines, RF acceleration, beam optics
- ✓ Learn how to setup/run Elegant
- ✓ Augment existing beam line to include Mott an spectrometer beam lines
- ✓ Use design Twiss parameters to calculate beam envelope to Mott target and dump plate
- ✓ Use two quadrupole to optimize beam size to specification

Mott /Target Scattering

- ✓ Learn about electron scattering and bremsstrahlung
- ✓ Learn about cross-section, single, plural (<5) and multiple scattering; Moliere distributions
- ✓ Install G4Beamline and (Histo)Root
- ✓ Learn how to setup a simple case of electron beam impinging a target
- ✓ Compare Moliere w/ G4Beamline distributions for different atomic number, foil thickness and momenta

Dump Plate Studies

- ✓ Learn about beam interacting w/ thick material, energy deposition, radiation length
- ✓ Learn about air and forced cooling of materials/dumps
- ✓ Use G4Beamline to investigate electron beam interacting with dump plate material
- ✓ Evaluate significance of lost/dumped beam vs. backscattered/background events
- ✓ Implement "dump dipole", compare w/ experimental data

Dump Plate Design

- ✓ Evolve existing 1" aluminum plate to new design (likely composite low-Z / high-Z material)
- ✓ Evaluate designs for backscattering and beam power deposition
- ✓ Interact with engineering staff re: new dump design
- ✓ Complete simulations of new dump design 2-10 MeV up to 100uA

Dump Plate Installation

- ✓ Work with engineering and operations staff re: fabrication or installation of dump plate
- ✓ Install dump plate, perform technical testing of water flow, vacuum integrity