Low-energy RHIC electron Cooler (LEReC) progress updates

July 12, 2016:

Physics Support:

- Study and optimization of beam dynamics in simulation with electron beam produced off center of the cathode.
- Study and optimization of beam parameters based on laser shaping
- Development of e-beam alignment strategies in cooling sections, setting the proper e-beam focusing in cooling sections.
- Beam modes (for MPS) for 2016-17 and 2018 runs defined.
- MPS conceptual design is being finalized.
- Procured and received the magnetic probe for measuring the CS shielding. Procuring the shields for the CS test-bench measurements.
- Optics and location of all magnet elements for DC gun test beamline was finalized. DC gun test beamline layout document written.

DC gun and cathode system:

- DC gun conditioning at Cornell is scheduled for the week of August 1. A scratch on the cathode and an update to the survey fiducials have resulted in 2-3 weeks delay. After conditioning, the DC gun will be bled-up and prepared for shipping to BNL in mid August.
- Drawings of the major components for the cathode puck insertion system and puck suitcase transportation vacuum chamber are checked and signed off. Design work on the transporter cart continues.

Cathodes:

- Recipe development for Na2KSb cathode has started, first run was promising. Parts for the prototype deposition system have been welded, cleaned and are being assembled.

Laser:

- Design of laser transport continues. The laser path location has been finalized.
- Vibration measurements have been taken in both the 02:00 laser trailer and at ERL for comparison, the ERL concrete floor is much more stable with less deflection than the laser trailer floor. Various approaches to stabilize trailer floor are being explored.

RF cavities:

- **2.1 GHz Warm RF Cavity:**
  Pre-braze RF measurement of the 2.1 GHz warm RF cavity was completed. The test was very successful. RI is proceeding with the final brazing of the cavity and will redo the RF test before shipment to BNL in July. BNL has received the 4 JLab RF windows for the 2.1 GHz. The plan is to retest the RF windows at 2.1 GHz and 20KW during the summer. Most of the waveguide system for 2.1 GHz is ordered.

- **704 MHz Warm RF Cavity:**
  The final design review of 704 MHz warm RF cavity was done at RI in June. A few design improvements were suggested and BNL needs to approve the final drawings when RI completes the modifications. Design of the tuner is done. Drawings are being checked. Estimated delivery is October 2016.

Magnets:

- Contract for DC gun solenoids was awarded.
- ERL solenoids measured.
- DC gun test beamline correctors under construction.

Power Supplies:

- PO for 12V 1A power supplies for Correctors 25, 25 and 26. Power supplies should be here end of July. PO for a Sorenson 1kV 10mA ps for the anode high voltage bias was written on 6/21/16. Should be here 8/23/16.
- Started making a current monitor board for the MPS system for Correctors 24 and 25.
- Starting to make a current monitor board for the MPS for ComD1 which is the 45 degree dipole in the gun injection section.
- The 180 degree ps rack wiring is complete except for the temperature controller ps wiring. Planning to start testing the 180 degree power supply system with the temperature controller together as one system.

Beam Instrumentation:

- All gun test beam line instruments are in progress with the emittance slit design beginning this month.
- Gun Profile Monitor design complete, drawing being released.
- Anode bias power & current monitoring components have been chosen.
- Large cable orders are being prepared from detailed estimates.
- BPM time of flight energy measurement algorithm is being developed with encouraging preliminary results.

- Differential FCTs were added for MPS in 4 locations: Injection, Gun Dump, RF Diagnostic, HP Dump.
- Preliminary test results of our efforts to develop BPM phase based Time of Flight energy measurements are encouraging.
- A low-field NMR magnetic probe has been chosen to regulate the energy spectrometer dipole in the cooling section.

Controls:

- Established minimum MPS response time 20us.
- Conceptual MPS design is being finalized. It was presented and reviewed by JLAB collaborators.
- Various controls systems are now under development and progress is being documented on Controls Wiki page.

Cryogenics:

- IP2 Cryogenics transfer lines drawings were completed and are ready for procurement. SOW/Specs are being finalized. 2K/4K Recovery heat exchanger released for procurement. External Review of the internal cryogenics lines routing for 704MHz SRF Cryostat and beamline/Choke joint modifications was held June 17.

Commissioning:

- Commissioning plans and steps are under development

Installation and other Design work summary:

- The fabrication drawings for the transport line between the DC gun and booster cavity are complete and being checked. Mounting components for the solenoids and correctors have been approved and requisitions are being prepared. A design review of the special profile monitor for that area was completed and the drawings have been updated with the suggested changes.

- Fabrication drawings for the halo monitor vacuum chamber and main beam line profile monitor are being completed and some are in checking. The DC gun dump line profile monitor has been assembled, leak checked, and is being pre-surveyed to prep it for installation. Final decisions were made on the quadrupole and dipole apertures for the dump lines so the beam line vacuum chamber drawings have been completed and submitted for checking. The transport line bellows drawings are complete and are out to vendors for final quote. The vacuum pumping systems have also been defined and the requisition's prepared. The emittance slit drive system design will begin in July. The

beamline design is being updated to add a fast current transformer as part of the MPS system.

- The design of the DC gun and SCRF gun work platform was completed. Stress analysis of the support beam elements has been completed. A purchase order for the platform frame and flooring is being prepared. The cleanroom design was updated to include a gowning area and larger area for the cathode change cart.