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Scott Larsen,
R&D Program Manager,
NYSERDA,
17 Columbia Circle
Albany, NY 12203-6399

Dear Mr. Larsen:

This letter summarizes the activities performed at BNL and at Cornell University in the period August 1 through August 31, 2018, in support of the Cornell BNL ERL Test Accelerator project, CBETA.

SIGNIFICANT EVENTS AND ISSUES

Milestone 7 "Girder Production Run Complete" is the primary focus at BNL, while both teams are jointly working on milestone 8 "Final Assembly and Pre-Beam Commissioning". The current period, through February 2019, is the core fabrication and construction phase of the project, during which we work to complete the entire CBETA loop and prepare for spring 2019 beam operations.

Cost and schedule: The "Estimate to Complete" cost and schedule exercise was completed. The new baseline version v2, which was approved by the CBETA Oversight Board, indicates that the project is on cost and on schedule.

Lessons learned: The results and lessons of the Fractional Arc Test continue to be better understood and mitigated. Survey data confirm that the Main Linac Cryomodule is indeed vertically misaligned, as indicated by beam-based measurements. The RF isolators that were damaged during early testing (due to a manufacturing defect) are being repaired. A summary technical report document is in preparation, for completion by the end of September.

Halbach magnets and girders: Magnet tuning and girder production are going well at BNL, despite some delays in Halbach corrector production. Some magnet halves will need to be clamped together during assembly, to fully seat them together.

Splitter magnets and system integration: Elytt will shift their time-critical magnet production focus to the "common" magnets that are required for early beam running in the 1-pass Energy Recovery configuration. Electrical, water cooling and HVAC utilities in the L0E hall are being upgraded. The schedule may admit the (as yet uncertain) **possibility** of beam operations even in early 2019.

ACTIVITIES

1. **Project Management** (BNL & CU)
    - The "Estimate to Complete" cost and schedule exercise was completed, and baseline version V2 was approved by the CBETA Oversight Board.
    - The next review meeting of the Advisory Committee, which reports to the Oversight Board, will take place on October 8 by video conference.

2. **Accelerator Physics** (CU & BNL)
    - Kirsten Deitrick accepted an accelerator physics position at Cornell, starting work on October 15.
    - Colwyn Gulliford et al are writing a Fractional Arc Test (FAT) summary report document. Dejan Trbojevic et al are writing additional documentation, to be made available to the Advisory Committee for their meeting on October 8.
    - Computer simulations using the GPT code are being used to model the emittance penalty that would be incurred by running the Injector CryoModule with the second cavity turned off.
    - Lattice design work continues, in order to finish a short to-do list. Work currently is focused on the beam dump line.

3. **DC Electron Source** (CU)
    - Laser work is ongoing, redesigning the oscillator and synchronization system.

4. **RF Systems** (CU)
    - Meetings have been held at Cornell to discuss the apparent vertical misalignment of the Main Linac Cryomodule (MLC). The RF group analysis of survey data suggests that the entire cryomodule is displaced by about 2.5 mm, while beam measurements taken during the FAT suggest that the error may be as large as 4 or 5 mm. The analysis of survey data continues. A plan is being developed to reposition the MLC.
    - A teleconference with the vendor SigmaPhi discussed the isolator damage that occurred during early testing (due to a manufacturing defect), and a plan for repair was defined. The timing of the repair is still under discussion.

5. **Halbach Magnets and Girders** (BNL)
    - The last two air shipments of Halbach magnets from the vendor (Kyma) have experienced delays, but enough magnets are on hand at BNL for work to proceed uninterrupted. 27 QF magnets arrived in the last week of August, and Kyma will ship another batch of magnets in the second week of September.
    - Magnet measurements and tuning are going well at BNL. Girder production is progressing well. The plan for the delivery of girder plates from BNL to Cornell is being optimized.
    - Halbach corrector magnet production has been delayed but material will soon be on hand at the vendor (Sag Harbor) to re-start production. Enough correctors are on hand to continue magnet and girder assembly at BNL.
    - Some magnet halves will need to be clamped together during assembly, to fully seat them together. A few magnets will need to be squeezed after assembly around the beampipe. Cornell is checking magnets that have already been delivered.

6. **Splitters** (CU)
    - A teleconference was held with engineers at the vendor (Elytt) to discuss status and delivery. All vertical corrector magnets have been completed and are crated. Most of the short dipoles have been completed, and while testing is slow, a delivery is anticipated at the end of September. Many air-cooled quadrupoles are also complete.
    - Elytt will next shift their focus to "common" magnets, which are required for early beam running. Common magnets will be shipped in December 2018. The delivery of water-cooled quads may slip into early 2019.
    - Almost all vacuum chamber pieces are on hand for the SX and RX splitter lines, with the exception of chambers for the common magnets. The design of these relatively complex chambers is complete. Splitter beam pipe welding begins in October.
    - There is a vendor delay on the stainless-steel extrusions that are needed for the sliding joints.
    - Splitter viewscreens are currently being designed but are not yet being manufactured.

7. **Power Supplies** (CU)
    - All splitter dipole power supplies have now been ordered, and delivery is imminent, enabling mounting in racks that are all complete and ready.
    - Quadrupole supplies will also be supplied by the vendor TDK-Lambda, using a low power / low current version for air-cooled quads. That order will soon be placed.
    - A brief teleconference was held with vendor SigmaPhi. Their first prototype multichannel Fixed Field Arc (FFA) corrector power supply had a failure on the power board that feeds power to all channels. The board is back at an outside vendor for diagnosis and repair. The first unit is expected to ship to Cornell in October.

8. **Controls** (CU & BNL)
    - Outdated computers continue to be replaced.

9. **Instrumentation** (BNL & CU)
    - A prototype 2.6 GHz mixer is under test.
    - Parts are being procured.
    - A large fraction of V301 Beam Position Monitor (BPM) electronics boards have now been received. The yield is poor, with more than 50% failing out-of-the-box tests. Fault diagnosis is on-going, working with the vendor to repair bad boards.

10. **Vacuum System** (CU).
    - Work proceeds on finishing the FFA beampipes. All chambers will be finished by early October. FB-04, which uses a special welding jig, will be the last chamber produced.
    - Six out of the 12 beampipes of type TA/TB are complete, with the rest making their way through the cleanroom.
    - Welding a chamber takes roughly a day. Cleanroom processing is slow and the number of staff available is limited. Cleanroom activities are being co-ordinated with the SRF group.
    - The scheme that allows surveying in the welding jig delivers chambers that are within an unusually small angular error of 0.05 degrees. Post welding corrections are minimal – sub-millimeter.
    - Many NEG vacuum pumps are used throughout CBETA, and so turn on will be tough. A rolling rack system is being built for activation of all the pumps.
    - A clean pumping station is being finished for the cleanroom in Wilson Lab.

11. Systems Integration (CU)

- The design of the 800 A / 480 VAC electrical service is complete, and the job is going to the Cornell contracts office in preparation for contractor installation. A platform will be required to mount the electrical equipment.
- The design of the 150 gpm water cooling system, using de-ionized water from the Cornell campus chilled water system, is still in progress.
- It has been discovered that the south wall of the L0E building is 6 inches closer to the north wall than previously stated. CAD models are being updated, based on true survey data.
- Life safety code design items (smoke, alarms, exit, egress) are proving to be more complex than expected.
- The planned HVAC upgrade will be simple, adding ductwork to distribute cool air, mostly to areas with racks and heat-producing equipment.
- No CHESS-U girders will remain in L0E at the end of the second week of September. L0E space clearance has already begun, in preparation for CBETA installation.
- Design work is required to replace the two structural columns that need to be removed from an existing platform.
- Plans to repair and replace trench covers are in progress, in parallel with progress on the shielding wall plan.
- The 110/208 VAC electrical distribution system is being finalized for building permits.
- The finished design of the distributed 85 F water stabilization system for the Halbach magnets will soon be implemented.
- The schedule admits the (as yet uncertain) **possibility** of beam operations even in early 2019.

12. Beam Commissioning (CU)

- Wiki documentation that will play a key training role is progressing well.
- A commissioning retreat was held in late August to work on overall planning.

13. Safety (CU)

- The development of an operations safety plan has been started. A list of items to be included in the plan will be sent to the safety committee by mid-October. The committee will vote on final approval in November.
- Daytime operations are a critical aspect of any safety plan. A staged review process will be used to progressively increase the allowable daytime operational performance envelope.

Table 1: Technical milestones in the NYSERDA contract. **Boldface** milestones are go/no-go.

#	Technical milestone	Contract	Actual	Forecast
	NYSERDA funding start date		31-Oct-16	
1	Engineering design documentation complete	31-Jan-17	31-Jan-17	31-Jan-17
2	Prototype girder assembled	30-Apr-17	30-Apr-17	30-Apr-17
3	Magnet production approved	30-Jun-17	23-Jun-17	30-Jun-17
4	**Beam through Main Linac Cryomodule**	**31-Aug-17**	**16-Jun-17**	**31-Aug-17**
5	First production hybrid magnet tested	31-Dec-17	21-Dec-17	31-Dec-17
6	**Fractional Arc Test: beam through MLC & girder**	**30-Apr-18**	**20-Apr-18**	**30-Apr-18**
7	Girder production run complete	30-Nov-18		30-Nov-18
8	Final assembly & pre-beam commissioning complete	28-Feb-19		28-Feb-19
9	Single pass beam energy scan	30-Jun-19		30-Jun-19
10	Single pass beam with energy recovery	31-Oct-19		31-Oct-19
11	Four pass beam with energy recovery (low current)	31-Dec-19		31-Dec-19
12	Project complete	30-Apr-20		30-Apr-20

Kind regards,

Karl Smolenski & Stephen Peggs

Cc: H. Biedenkapp, D. Hatton, G. Hoffstaetter, K. Jackson, S. LaMontagne, S. McKeon, R. Michnoff, J. Misewich, S. Pankowski, R. Patterson, T. Roser, K. Smolenski, J. Thom, M. Torpey, D. Trbojevic.