Director's Review of Long Shutdown Planning

EXPERIMENTAL HALLS

1. Hall A

1.1. Scope of Work

Experimental Hall A will stop operation on Friday, May 18, 2012 to upgrade to 12 GeV operations. The scope of work for Hall A includes:

- Removal of the existing experiment
- Upgrades and modifications to the basic Hall infrastructure
- Reinstallation of optional Hall infrastructure
- Installation of the first 12 GeV experiment
- Checkout, Calibration and Commissioning
- Some deferred maintenance

The Hall is scheduled to be ready to receive beam by September, 2013 and is expected to receive beam to an experimental target in February 2014.

1.2. Major Tasks

a. 12 GeV Upgrade to Compton Polarimeter *May 18, 2012 to Mar 5, 2013*

The Compton Polarimeter is a permanent part of the Hall A infrastructure. This upgrade is required to operate at 12 GeV.

b. Remove Elements of G2P *May 29, 2012 to July 31, 2012*

G2P is the last 6GeV experiment and parts of it must be removed to make room for the supporting infrastructure required for 12 GeV installation.

c. Install upstream beam girder and upside down girder *Completed by Nov 16, 2012*

These are basic hall equipment that was removed to accommodate G2P. They must be reinstalled to support the next experiment.

d. 12 GeV Upgrade to Moeller Polarimeter *May 21, 2012 to October 18, 2012*

The Moeller Polarimeter is a permanent part of the Hall A infrastructure and this upgrade is required to operate at 12 GeV.

Begin Installation of Experiment Specific Components

Note: The project plan has been designed assuming that either the APEX or PREX experiment will be installed. Other experiments that may be selected for implementation will require less time to implement and will not adversely impact the schedule.

e. Moeller Target *Jan 18, 2013 to Mar 29, 2013*

Installation of existing target for use by APEX/PREX experiment.

f. Experiment Specific Target *Completed by Feb 2, 2013*

This target is developed and installed specifically for the selected experiment.

g. Modify Septum for APEX/PREX *Feb 12, 2013 to Mar 19, 2013*

Both APEX and PREX use different configurations of the Septum magnet and modifications will have to be made to accommodate the selected experiment. Coils which were damaged during operations must be replaced regardless of the selected experiment.

h. Install APEX/PREX *Mar 20, 2013 to July 19, 2013*

Because APEX/PREX installation is more complicated than the other experiment candidates, a change in experiment selection would not delay the schedule, but may shorten it.

i. Radiation Hardening of Bogies *July 22, 2013 to July 29, 2013*

These are electronically controlled casters that are part of the basic hall infrastructure. They are worn from years of use and must be replaced and the electronics must be hardened.

j. CRYO System Upgrade *Sep 4, 2012 to Aug 19, 2013*

This upgrade is necessary because the existing WEKA system valves are obsolete and the new controls are not radiation hardened. Hall A will switch to the standard Jefferson Lab valve, improving maintainability and compatibility with future systems.

k. Standard Maintenance of Power Supplies *Jul 8, 2013 to Aug 30, 2013*

This is standard maintenance work that is conducted during a shutdown.

l. Detector Installation *Apr 15, 2013 to Aug 7, 2013*

Installation of experiment specific detectors and upgrade to support structure. Change in experiment selection should not alter this schedule.

m. Final Checkout and Calibration *8/19/2013 to 9/16/2013*

These are the final steps necessary to make Hall A ready for lock-up and receipt of beam when ready.

n. Optional Deferred Maintenance *Jan 14, 2013 to Aug 13, 2013*

This work is should be performed if possible, but is not required to begin operation. Tasks include greasing components and modifying the vacuum systems.

1.3. Milestones

- Arrival and acceptance of quadrupole magnet *8/15/2012*
- Operations check for new quadrupole magnet *10/1/2012*
- Hot Checkout *8/22/2013*
- Restore Beam *Jan 2014*
- Begin Commissioning *Feb 2014*
- Detector Checkout *Feb 2014*

1.4. Critical Path

Because Hall A will be ready for beam as early as September, 2013 it should not be on the critical path for any 12 GeV or Long Shutdown project deliverables. External critical factors that may impact delivery of beam to Hall A as scheduled include:

- Moeller quadrupole delivery
- Removal of G2P
- ARC magnet remapping project
- Hall A ARC power supply upgrade

1.5. Internal Risks

a. Moeller Quadrupole

This quadrupole is due to arrive in August and must be installed and operational by October 1. If procurement is delayed then the schedule will slip correspondingly. Additionally, if the quadrupole does not meet specification, the time required to bring it into compliance may also impact the schedule. The likelihood of these risks is considered low.

b. Manpower Availability

Peaks and valleys in manpower requirements must be accommodated throughout the shutdown. These concerns are being mitigated through cooperative labor exchange between the halls.

c. Funding

Funding for 6GeV work (which includes removal of the G2P experiment, some beamline elements and cryogenic systems) will be tight throughout FY12 and cannot tolerate unexpected costs.

2. Hall B

2.1. Scope of Work

Experimental Hall B will stop operation on Friday, May 18, 2012 to upgrade to 12 GeV operations. The scope of work for Hall B includes:

- Removal of existing experiment
- Removal of CLAS6 components and infrastructure

- Installation of CLAS12 magnets and stuff
- Alignment, calibration and commissioning

The Hall is scheduled to be ready to receive beam by when and is expected to receive beam to an experimental target in April, 2015.

2.2. Major Tasks

a. Remove HDIce Experiment *Jun 4, 2012 to Jun 6, 2012*

b. Remove CLAS Delay Cables *Jun 8, 2012 to Sep 14, 2012*

The delay cables attached to the forward carriage will be removed by 6 technicians provided by the Engineering group.

c. Remove Time of Flight *Jul 7, 2012 to Oct 9, 2012*

Forward TOF and Panels 2, 3 and 4 TOF will be removed and stored.

d. Cerenkov Counter Removal *Jul 9, 2012 to Jul 24, 2012*

Cerenkov counters will be removed and stored.

e. South Clamshell Removal *Aug 27, 2012 to Sep 18, 2012*

The south clamshell will be removed from Hall B by a contractor.

f. Remove CLAS Drift Chambers *Sep 18, 2012 to Nov 6, 2012*

The region 1, 2 and 3 drift chambers will be removed from the Hall and transported to storage

g. Torus Removal *Sep 18, 2012 to Dec 17, 2012*

The torus will be disassembled in the experimental hall and its components will be shipped to storage.

h. North Clamshell Removal *Jan 2, 2013 to Jan 22, 2013*

The north clamshell will be removed from the experimental hall, marketing the completion of work associated with 6GeV deinstallation.

Begin CLAS12 Installation

i. Modify Space Frame and Upgrade Beamline *Feb 6, 2013 to Apr 2,2013*

The space frame, forward carriage and beamline in Hall B will be modified to accommodate the new experimental configuration.

j. Install Forward Carriage Detector Packages *Mar 26, 2013 to Jul 1, 2013*

Installation of pre-shower calorimeter *(PCAL)*, forward time-of-flight *(FTOF)* and low threshold Cerenkov counters *(LTCC)*.

k. Install Torus *Feb 6, 2013 to Sep 19, 2014*

Includes power supply, torus coil, control system and adjustments stands

l. Install Drift Chambers *Feb 6, 2013 to Jan 15, 2014*

Installation of regions one, two and three drift chambers.

m. Install High Threshold Cerenkov Counters *Nov 5, 2013 to Nov 17, 2014*

n. Install New Cryogenic Distribution System *Sep 30, 2013 to Nov 8, 2013*

o. Install Central Detector Package *Jul 17, 2014 to Jan 22, 2015*

Installation of solenoid, neutron detector, central time of flight *(CTOF)*, and silicon detector.

2.3. Milestones

- HDIce Experiment Ends *May 18, 2012*
- Begin CLAS6 Deinstallation *Jun 4, 2012*
- End CLAS6 Deinstallation *Jan 23, 2013*
- Begin CLAS12 Installation *Feb 12, 2013*
- Completion of Torus and Solenoid Fabrication *Jan 15, 2014*
- Complete Installation of Torus *Sep 19, 2014*
- Complete Installation of Solenoid and Detectors *Jan 22, 2015*

2.4. Critical Path

Work to be performed during the CLAS6 deinstallation is well-structured and understood. The critical path in Hall B emerges as we move into the CLAS12 domain, and is dominated by the fabrication of the torus and solenoid. The extended project schedule is currently being structured to allow the maximum amount of flexibility to accommodate delayed delivery of key components. More specific data will be available once the processes and vendors are finalized for magnet fabrication.

2.5. Internal Risks

a. Magnet Fabrication

It is expected that the CLAS12 magnets will be significantly delayed. The work flow is being restructured to accommodate these delays and to accomplish other project objectives outside of the expected sequence.

b. Manpower Availability

Manpower requirements during CLAS6 deinstallation require more technical staff than Hall B currently has available. To accommodate this personnel have been reassigned from experimental Hall A to support their activities until January 2013.

3. Hall C

3.1. Scope of Work

Experimental Hall C will stop operation on Friday, May 18, 2012 to upgrade to 12 GeV operations. The scope of work for Hall C includes:

- Decommission and removal of QWeak
- Removal of SOS apparatus
- Installation of SHMS
- Testing and commissioning

The hall is scheduled to receive beam on target in April, 2015.

3.2. Major Tasks

a. Decommission and Remove QWeak *May 25, 2012 to Aug 15, 2012*

b. Remove SOS Dipole *Aug 16, 2012 to Aug 21, 2012*

QWeak must be removed to provide space for a large crane to be brought into the hall to remove the SOS dipole. SOS dipole weighs 100 tons.

c. Remove HKS Concrete Floor Pad *Aug 22, 2012 to Sep 4, 2012*

This floor was originally installed to support the movement of the HKS magnets, and must be removed to accommodate the installation of the Super HMS rails and assembly.

d. Remove SOS Concrete Shield Hut *Aug 22, 2012 to Oct 30, 2012*

The shield will be cut into sections that are less than 18 tons. The work will begin with the roof and then proceed down the wall. The 18 ton limit is driven by the maximum capacity of the Hall C material handling equipment.

e. Remove SOS Steel Chassis *Oct 8, 2012 to Oct 30, 2012*

This includes the steel base, pivot section and rails.

Begin 12 GeV Installation

f. SHMS Rail Installation *Oct 8, 2012 to Oct 22, 2012*

The SHMS rail will be installed and aligned by a third-party contractor.

g. Installation of Moeller/Compton Beamline *Oct 4, 2012 to Dec 14, 2012*

Actual schedule for this is soft as it requires very little interaction with other work in the hall. It is likely to be delayed to allow incorporation of lessons learned during QWeak running.

h. Assemble SHMS Support Structure *Nov 29, 2012 to May 17, 2013*

This is rigging, alignment, and welding of pre-assembled steel structures, to be accomplished by a steel erection contractor.

i. Shield House Construction *Mar 8, 2013 to Jul 19, 2013*

The shield house will be formed of concrete cast in place on the support structure. Fabrication will be performed by an outside contractor. Interior surfaces will be faced with boron-carbide-loaded materials, lead, and an aluminum skin. The house has separate rooms for the detectors and for the electronics, with additional shielding for the latter.

j. Utility Installation *Jul 15, 2013 to Oct 7, 2013*

Electrical power will be installed by licensed contractor electricians. HVAC for the shield house will be installed by a contractor under the direction of JLab Facilities. LCW, cableways, lighting, communication, fire protection and other safety systems will be installed on the support structure and the shield house by responsible JLab groups, with the assistance of contractors where appropriate.

k. Installation of Detectors and Cables *Jul 29, 2013 to May 30, 2014*

When the shield house fabrication is complete and the needed utilities are in place, detector installation can start with stacking of the lead-glass calorimeter blocks. Once the dipole magnet is installed, other detector systems and cables can be installed. With support of the Hall-C technicians, these installations will be performed by the various user groups responsible for the individual detector systems.

l. Electronics Installation *Nov 5, 2013 to Apr 17, 2014*

When utility systems are in place, installation of the data-acquisition electronics for the detector systems will take place in the electronics room of the shield house.

m. Magnet Installation *Dec 10, 2013 to Mar 18, 2015*

The first magnet to be installed will be the dipole. Q1 and HB will follow. The Q2 and Q3 magnets will arrive near the end of the installation period, and lie on the critical path for SHMS completion. All of the magnets except HB will be cooled and tested for the first time after they are assembled and installed on the support carriage. Magnet installation and testing will be performed by Hall-C technicians and engineering staff, with support from JLab Alignment and the relevant magnet vendor. Critical and heavy lifts will require the involvement of a rigging contractor.

n. Spectrometer and Beamline Vacuum Installation *Jan 22, 2014 to Mar 6, 2015*

The beam-pipe for the un-deflected electron beam must mate to the SHMS structure when it is rotated for minimum scattering angles. Because of the tight mating tolerances required, this pipe must be fabricated after the SHMS support and shield house are in place. After the spectrometer magnets are tested and accepted, their bores will be connected together with spool pieces to provide a continuous vacuum from the entrance window near the target to the exit window near the first detector. The sieve-slit assemblies will be installed as part of this vacuum system.

o. Cosmic Tests *Jun 6, 2014 to Mar 9, 2015*

Cosmic rays will be used to test the detectors and the data-acquisition system until beam is available.

p. Commission with Beam *Apr 21, 2015 to Apr 27, 2015*

3.3. Milestones

- LH2 Target at room temperature *May 25, 2012*
- Last day of End Station Refrigeration *Jul 13, 2012*
  Note: ESR is required to power the SHMS magnets to test the new SHMS power supplies.
- QWeak is removed *Aug 15, 2012*
- Concrete pad is removed *Sep 10, 2012*
- SOS is removed *Nov 20, 2012*
- End 6 GeV Deinstallation *Dec 19, 2012*
- Start 12 GeV Installation *Oct 8, 2012*
- Completion of SHMS Shield House *Jul 19, 2013*
- Completion of Magnet Installation *Mar 18, 2015*
- Completion of Spectrometer and Beamline Vacuum Installation *Mar 6, 2015*
- Beam on Target *April 2015*

3.4. Critical Path

Many of the tasks being conducted in Hall C can be performed concurrently, reducing the likelihood that any one task would significantly delay the project. This work is facilitated through the use of multiple external contractors in conjunction with Hall staff.

Delivery of the SHMS magnets has been delayed by as much as 18 months, however. The arrival of these magnets dominates the critical path and is a non-negligible risk to delay.

3.5. Internal Risks

a. Testing of SHMS Power Supplies

Because the SHMS power supplies can only be tested if end station refrigeration is available, these power supplies must arrive before July 13, 2012. After this the ESR will be powered down and testing will not be possible.

b. SOS Shield Hut Removal

Because of the reinforcing materials used in the shield hut walls, their cutting and removal may require more time than originally expected.

c. Lead Risk

Hall C Engineering staff involved in the design and fabrication of the SOS walls have indicated that no lead was used in their construction.

d. Mildly Activated Debris

The concrete removed from the hall floor and the SOS shield hut are likely to be mildly activated. These materials will be surveyed and stored in the CMSA until ready for disposal.

e. Airborne Silica

Because of the high volume of concrete cutting, Industrial Hygiene is scheduled to continuously monitor the level of airborne silica. Engineering controls will be implemented to reduce the amount of airborne silica and minimize the risk.

f. Delivery of SHMS Magnets

Magnet vendors are running later than expected. As a result, the schedule for the completion of the project is likely to be governed by the delivery date of the last of the magnets.

4. Hall D

4.1. Scope of Work

Experimental Hall D will continue installation activities associated with 12 GeV operations. The scope of work for Hall D includes:

- Ongoing installation of Hall D infrastructure
- Solenoid Installation
- Beamline and Cryogenic Installation
- Detectors, Magnet and Target Installation
- Alignment and Commissioning

The Hall is scheduled to receive beam to an experimental target in April, 2014.

4.2. Major Tasks

a. Install Solenoid/Cryo Can *Oct 29, 2012 to Apr 17, 2013*

Once the Cryo Can is received, it will be craned into position and then interconnects will be made between the device and the solenoid magnet.

b. Refurbish and Install Pair Spectrometer Magnet *May 1, 2012 to Jan 14, 2013*

This magnet was provided by BNL and is being refurbished prior to installation in Hall D.

c. Collimator Beamline Installation *May 1, 2012 to Jul 15, 2013*

The beamline, active collimators, sweep magnets and harp will be installed in the collimator cave.

d. Detector Installation *Jun 4, 2012 to Sep 27, 2013*

This installation includes the forward calorimeter, time of flight, barrel calorimeter, central drift chamber, forward drift chamber and liquid hydrogen target assembly.

e. Assemble Tagger Magnet and Install Hodoscope *May 1, 2012 to May 16, 2013*

Four major components of the Tagger will be assembled, and the power supply will be installed and connected. A 30 ft long thin window will be installed prior to the Hodoscope assemblies along with the Microscope assembly.

f. Electronics Installation *Aug 6, 2012 to Apr 17, 2014*

When utility systems are in place, installation of the data-acquisition electronics for the detector systems will take place in the Tagger Hall, Hall D proper, and the electronics room of the Counting House. This includes installation of electronic equipment, Detector and Magnet control cabling, and fiber optic runs between the Hall and Counting House.

g. Install Goniometer *Oct 1, 2012 to Nov 26, 2012*

The vacuum chamber will be fabricated, and then the Goniometer will be installed and tested.

h. Install Quadrupole and Permanent Magnets *Oct 23, 2012 to Nov 6, 2012*

The quadrupole must be installed in conjunction with its power supply and wired to the control system. The permanent sweep magnet is installed and aligned independently.

i. Solenoid Cool Down and Commissioning *Nov 26, 2012 to Jan 31, 2013*

j. Install Hall Infrastructure *May 1, 2012 to Mar 25, 2014*

Infrastructure to include the gas shed, LCW, electrical power, compressed air, grounding, chilled water, equipment racks, cable trays and platforms will be installed and aligned.

k. Install and Align Target *Jan 6, 2014 to Mar 21, 2014*

Once the target is received from the target group, it will be installed on the beamline, aligned, and connected to gas, cryogens and instrumentation.

l. Commissioning with Beam *April 2014*

4.3. Milestones

- Receive Cryo Can *Oct 29, 2012*
- Receive BCAL Light Guides and Components *Jul 5, 2012*
- Receive Tagger Magnet *Oct 1, 2012*
- Receive Goniometer *Oct 1, 2012*
- Solenoid Commissioning Complete *Jan 31, 2013*
- Receive TOF Panels *Aug 2, 2013*
- Receive Target *Jan 6, 2014*
- Beam on Experimental Target *Apr 2014*

4.4. Critical Path

The installation and testing of the solenoid is the predominant element on the critical path. In addition to this, components that are being fabricated and acquired and the construction and installation of the cryogenic system are also significant factor on the critical path. Finally, the ongoing modifications and installation of the Hall infrastructure must be timed to provide capabilities in support of all other activities.

4.5. Internal Risks

a. Component Delivery

All detector packages and magnets must be delivered on time in order to maintain the schedule. Because there are dependencies in the installation order, a late delivery early in the process will have repercussions throughout the schedule.

b. Cooling Capacity

The refrigeration system that was reused from the Test Lab minimally meets the projected cooling requirements for the Solenoid. This demands very close tolerances on the cryo can and transfer line construction, as well as their interconnects, to minimize heat load.