

Long Shutdown Scope of Work for the Experimental Halls

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- **Scope of Work for Halls A, B, C and D**
- **Major Tasks**
- **Internal Risks**
- **Critical Path Considerations**

Experimental Hall A

- **Scope of Work:**
 - **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**
- **Scheduled to Receive Beam February 2014**

Major Tasks in Experimental Hall A

- **12 GeV Upgrade to Compton Polarimeter** *May 18, 2012 to Mar 5, 2013*
- **Remove Elements of G2P** *May 29, 2012 to July 31, 2012*
- **Install upstream beam girder and upside down girder** *Completed by Nov 16, 2012*
- **12 GeV Upgrade to Moller Polarimeter** *May 21, 2012 to October 18, 2012*
- **Moller Target** *Jan 18, 2013 to Mar 29, 2013*
- **Experiment Specific Target** *Completed by Feb 2, 2013*
- **Modify Septum for APEX/PREX** *Feb 12, 2013 to Mar 19, 2013*
- **Install APEX/PREX** *Mar 20, 2013 to July 19, 2013*
- **Radiation Hardening of Bogies** *July 22, 2013 to July 29, 2013*
- **CRYO System Upgrade** *Sep 4, 2012 to Aug 19, 2013*
- **Standard Maintenance of Power Supplies** *Jul 8, 2013 to Aug 30, 2013*
- **Detector Installation** *Apr 15, 2013 to Aug 7, 2013*
- **Final Checkout and Calibration** *Aug 19, 2013 to Sep 19, 2013*
- **Optional Deferred Maintenance** *Jan 14, 2013 to Aug 13, 2013*

Internal Risks for Experimental Hall A

- **Moller 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.

- **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.

- **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.

Critical Path Elements for Experimental Hall A

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**

- **Scope of Work:**
 - **Removal of existing experiment**
 - **Removal of CLAS6 components and infrastructure**
 - **Installation of CLAS12 magnets and stuff**
 - **Alignment, calibration and commissioning**
- **Scheduled to Receive Beam April 2015**

Major Tasks in Experimental Hall B

- **Remove HDIce Experiment** *Jun 4, 2012 to Jun 6, 2012*
- **Remove CLAS Delay Cables** *Jun 8, 2012 to Sep 14, 2012*
- **Remove Time of Flight** *Jul 7, 2012 to Oct 9, 2012*
- **Cerenkov Counter Removal** *Jul 9, 2012 to Jul 24, 2012*
- **South Clamshell Removal** *Aug 27, 2012 to Sep 18, 2012*
- **Remove CLAS Drift Chambers** *Sep 18, 2012 to Nov 6, 2012*
- **Torus Removal** *Sep 18, 2012 to Dec 17, 2012*
- **North Clamshell Removal** *Jan 2, 2013 to Jan 22, 2013*
- **Modify Space Frame and Upgrade Beamline** *Feb 6, 2013 to Apr 2, 2013*
- **Install Forward Carriage Detector Packages** *Mar 26, 2013 to Jul 1, 2013*
- **Install Torus** *Feb 6, 2013 to Sep 19, 2014*
- **Install Drift Chambers** *Feb 6, 2013 to Jan 15, 2014*
- **Install High Threshold Cerenkov Counters** *Nov 5, 2013 to Nov 17, 2014*
- **Install New Cryogenic Distribution System** *Sep 30, 2013 to Nov 8, 2013*
- **Install Central Detector Package** *Jul 17, 2014 to Jan 22, 2015*

Internal Risks for Experimental Hall B

- **Magnet Fabrication**

It is expected that the CLAS12 torus and solenoid 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.

- **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.

Critical Path Elements for Experimental Hall B

- **Torus and Solenoid Fabrication**

*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.***

- **Emerging Work Flow**

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.

- **Scope of Work:**
 - **Decommission and removal of QWeak**
 - **Removal of SOS apparatus**
 - **Installation of SHMS**
 - **Testing and commissioning**
- **Scheduled to Receive Beam April 2015**

Major Tasks in Experimental Hall C

- **Decommission and Remove QWeak** *May 25, 2012 to Aug 15, 2012*
- **Remove SOS Dipole** *Aug 16, 2012 to Aug 21, 2012*
- **Remove HKS Concrete Floor Pad** *Aug 22, 2012 to Sep 4, 2012*
- **Remove SOS Infrastructure** *Aug 22, 2012 to Oct 30, 2012*
- **SHMS Rail Installation** *Oct 8, 2012 to Oct 22, 2012*
- **Installation of Moeller/Compton Beamline** *Oct 4, 2012 to Dec 14, 2012*
- **Assemble SHMS Support Structure** *Nov 29, 2012 to May 17, 2013*
- **Shield House Construction** *Mar 8, 2013 to Jul 19, 2013*
- **Utility Installation** *Jul 15, 2013 to Oct 7, 2013*
- **Installation of Detectors and Cables** *Jul 29, 2013 to May 30, 2014*
- **Electronics Installation** *Nov 5, 2013 to Apr 17, 2014*
- **Magnet Installation** *Dec 10, 2013 to Mar 18, 2015*
- **Spectrometer and Beamline Vacuum Installation** *Jan 22, 2014 to Mar 6, 2015*
- **Cosmic Tests** *Jun 6, 2014 to Mar 9, 2015*
- **Commission with Beam** *Apr 21, 2015 to Apr 27, 2015*

Internal Risks for Experimental Hall C

- **Testing of SHMS Power Supplies**

SHMS power supplies are scheduled to be tested using end station refrigeration. Since the ESR will be power down after July 13, 2012, the power supplies must arrive and be tested before then.

- **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.

- **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.

- **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.

- **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.

- **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.

Critical Path Elements for Experimental Hall C

- **Deinstallation**

Removal of the SOS shield hut and floor are essential to clearing the Hall for the SHMS installation.

- **SHMS Installation**

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.

- **SHMS Magnets**

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.

- **Scope of Work:**
 - **Ongoing installation of Hall D infrastructure**
 - **Complete Solenoid Installation**
 - **Beamline and Cryogenic Installation**
 - **Detectors, Magnet and Target Installation**
 - **Alignment and Commissioning**
- **Scheduled to Receive Beam April 2014**

Major Tasks in Experimental Hall D

- **Install Solenoid/Cryo Can** *Oct 29, 2012 to Apr 17, 2013*
- **Refurbish and Install Pair Spectrometer Magnet** *May 1, 2012 to Jan 14, 2013*
- **Collimator Beamline Installation** *May 1, 2012 to Jul 15, 2013*
- **Detector Installation** *Jun 4, 2012 to Sep 27, 2013*
- **Assemble Tagger Magnet and Install Hodoscope** *May 1, 2012 to May 16, 2013*
- **Electronics Installation** *Aug 6, 2012 to Apr 17, 2014*
- **Install Goniometer** *Oct 1, 2012 to Nov 26, 2012*
- **Install Quadrupole and Permanent Magnets** *Oct 23, 2012 to Nov 6, 2012*
- **Solenoid Cool Down and Commissioning** *Nov 26, 2012 to Jan 31, 2013*
- **Install Hall Infrastructure** *May 1, 2012 to Mar 25, 2014*
- **Install and Align Target** *Jan 6, 2014 to Mar 21, 2014*
- **Commissioning with Beam** *April 2014*

Internal Risks for Experimental Hall D

- **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.

- **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.

Critical Path Elements for Experimental Hall D

- **Solenoid**

The installation and testing of the solenoid is the predominant element on the critical path.

- **Component Deliveries**

The schedule is tightly coupled to the receipt of components that are being fabricated either internally or offsite.

- **Cryogenic System Construction**

- **Hall Infrastructure**

The ongoing modification and installation of the Hall infrastructure must be timed to provide capabilities in support of all other activities.

Summary

- **Component Fabrication and Delivery is a Common Concern**

Each Hall is either building or acquiring components, and if they are delayed it will have an immediate impact on the schedule.

- **Demolition and De-installation Should be Monitored for Variance**

Depending on the complexity of the demolition, risks ranging from lead to silica may impact the schedule and must be monitored diligently.

- **Success Depends on Flexible Deployment of Technicians Across Halls**

Technicians will be deployed dynamically between Halls to ensure that work is completed in according to organizational priorities.

- **The Experimental Hall's Projects Extend Beyond the LSD**

Although the Long Shutdown ends in September 2013, the upgrade of the experimental Halls continues until mid-2015.