Jefferson Lab 12 GeV Upgrade Accelerator Readiness Review Phase 3

Roger Erickson
SLAC National Accelerator Laboratory
ARR Team Chairman

August 26-28, 2014

The ARR Team

Roger Erickson, SLAC – Chair
John Anderson Jr., FNAL
Roger Carlini, JLab
Ian Evans, SLAC
Harry Fanning, JLab
Jim Floyd, LBNL
Dennis Parzyck, Consultant
Karen White, ORNL
Peter Wilson, FNAL

Facilitator:
Robert May, JLab

DOE Observers:
Mike Epps, JLab Site Office
Patty Hunt, JLab Site Office
Steve Neilson, JLab Site Office

Accelerator Readiness Review Plan
Accelerator Commissioning Plan
Accelerator Hardware and Beam Transport Readiness

Dennis C. Parzyck, Consultant

Accelerator Readiness Review Plan

Observation:

- JLab has done accelerator readiness review planning that supports commissioning and operation of Hall D and Hall B and the HPS experiment. The JLab ARR program provides an effective approach for determining that hardware, personnel, administrative systems and technical programs are adequate to support commissioning and operations.

Findings: None

Accelerator Commissioning Plan

Observation:

- The Integrated Commissioning Plan addresses Hall D and Hall B commissioning and operations activities. The Commissioning plan describes the staff, equipment, procedures and the organization necessary to safely commission and operate. The Plan has been developed and implemented with the Commissioning Advisory Board participation.

Findings: None

Noteworthy:

- Internal JLab communication and external communication and information exchange with user groups has been excellent.

Accelerator Hardware and Beam Transport Readiness

Observation:

- Accelerator hardware and beam transport systems were determined to be functional and ready to deliver beam to Hall D and Hall B. The JLab Hot Checkout Process has been effectively utilized to verify readiness. The Credited Controls and related safety systems and hardware have been completed.

Post-Start Finding:

- JLab has determined that the higher energy 12 GeV operations will result in elevated arc magnet temperatures. Current tests measure 135 F both on the magnet iron and in ambient air.

Accelerator Hardware and Beam Transport Readiness

Post-start Finding (con't):

- JLab has developed a technical basis for mitigating burn hazards from direct contact with hot objects. This should be implemented through an OSP with staff training to follow.

Noteworthy:

- The JLab Hot Check Out process is a notable approach for verifying readiness.

Experimental Facility/Infrastructure

John Anderson, Jr.
Fermi National Laboratory

Experimental Facility/Infrastructure

- Objective
  - Experimental facility/ infrastructure systems for Hall B and Hall D are sufficient to support beam commissioning and operations
- Criteria
  - Verify the following systems are in place and operable
    - Basic services including process water, instrument air, electrical supply, and cryogens;
    - Fire protection systems including fire detection and fire suppression; and
    - Personnel safety systems (PSS) including access controls, protection against beam transport to occupied spaces, and oxygen deficiency hazard mitigations.

Experimental Facility/Infrastructure

- Approach
  - Document reviews
  - Staff Interviews
  - Field visits to verify hardware
    - Hall B beamline, Hall B,
      Hall D beamline, Hall D Tagger and Hall D

- Observations
  - Hot Checkout process is being used to monitor and track installation and commissioning activities
  - Robust configuration management systems are in place for safety critical systems, fire protection, MPS, and PSS
  - Fire protection systems use a combination of early detection and suppression
  - Flammable gas detection is installed near the Hall D Target Gas Cart

Experimental Facility/Infrastructure

- Hall B
  - Electrical infrastructure work is nearing completion
  - Fire protection systems are in place and operable
  - Radiation shielding is all in place
  - MPS, PSS and ODH systems for the most part are in place, some components need to be installed and systems need to be re-commissioned and certified
  - System certification process expected in October

Experimental Facility/Infrastructure

- Hall D
  - Fire protection and flammable gas detection systems are installed and operational
  - ODH systems operational
  - Cryogens are being used in the hall for solenoid commissioning activities
  - Some radiation shielding needs to be installed
  - MPS and PSS systems are 95% complete and certified
  - Certification tests expected to be complete by mid-September

- Pre-Start Findings
  - ODH system for Hall B needs to be certified
  - PSS for Halls B & D need to be certified
  - Radiation shielding for Hall D needs to be installed and verified in-place

Experimental Facility/Infrastructure

- The Team recommends that document management processes, including version control, be formalized for the Hall B procedures and other related operational and commissioning documents to ensure that users always have the most recent information.

- Process and procedures exist to adequately manage the systems to completion in conformance with the ASE.

Experiment Commissioning Plans for HPS, GlueX Experimental Readiness (Equipment. Procedures, Training) Hall B, Hall D

Ian Evans, SLAC

August, 2014

Experimental Physics Work Planning and Controls (WPC)

Observation:

- Reviewed documentation pertinent to Hall B &D Experiment Readiness Review process and Operations.
- Conducted interviews with staff and observed limited activities.
  - Roles, responsibilities and reporting structure are well defined
  - Communication paths via routine collaboration meetings, video conferences and integration into plan of day meetings has been established
  - Institutional (for Physics) process in place to review scheduled experiments via Program Advisory Committee (PAC) and readiness review process flowchart
  - New and ongoing activities are reviewed frequently with all involved

Experimental Physics Work Planning and Controls (WPC)

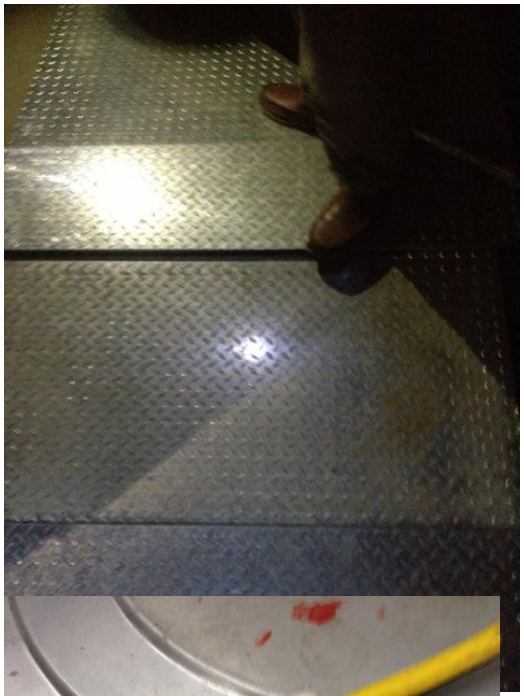
Observation:

- WPC processes are also responsible for identifying requirements for final status/configuration for safety significant equipment.
- Beam authorization checklist are executed by MCC prior to beam, verifying status and configuration for most safety significant equipment.
  - systems that are part of this checklist; PSS, Fire suppression, Radcon and the Operations pre-beam sweep.
- Process is robust and relies on competent and dedicated staff

Finding:

- Hazard Abatement/Program Compliance – awareness not where it needs to be, especially Administrative Control LOTO program

Small stuff matters



Conclusion

Pre-Start:

- Complete items stemming from Experiment Readiness Reviews; including assurance that credited shielding is all in place.
- Complete and sign-off commissioning plans
- Evaluate and update sweep procedures for all configurations (Hall D, Maintenance & Operation Modes)

Post Start:

- Walkthrough Halls B & D and look for OSHA type issues and address them.
- Implement recommendations from Electrical Safety Committee on magnet terminal covers in the accelerator enclosure.

Conclusion

Post-start issue from Phase 2 ARR:

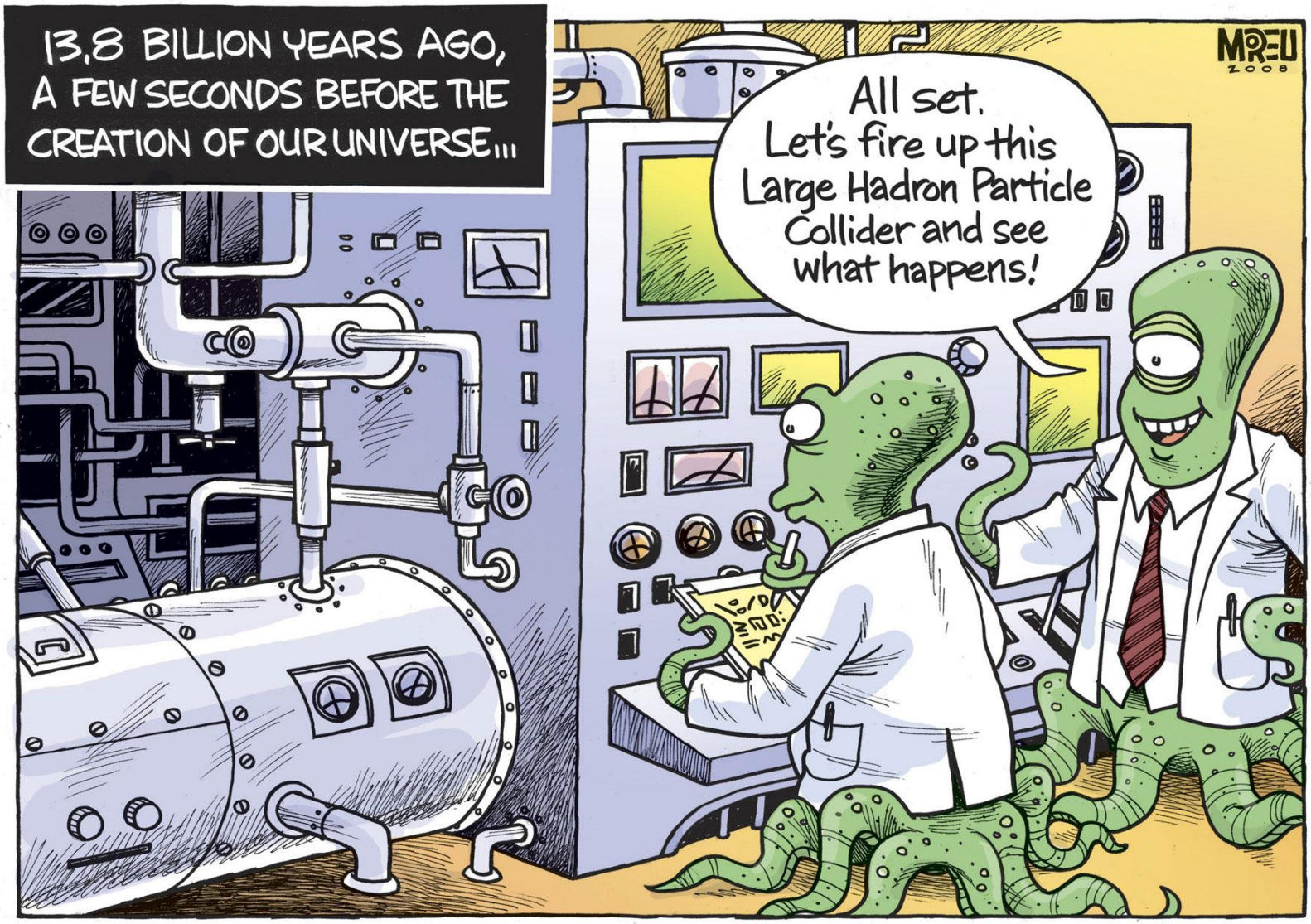
"As a post start concern, the lab should evaluate the use of electronic record management for experiment readiness and operations documentation (COO, ESAD, RSAD, ERG)."

- A framework for managing readiness documentation is now being employed for Hall A. The same system should be considered to accommodate the needs of the other halls and experiments.

"Ensure that activities at other Halls integrate, implement and execute program with same rigor."

- Readiness Review Process provides a framework, consider self-assessing program elements after first commissioning run

Moving Forward



Accelerator/Physics Experiment Integration

Peter Wilson
Fermi National Laboratory

January 28-30, 2014

Accelerator/Physics Experiment Integration

Observations:

- Commissioning plans were presented for accelerator, beam lines and experiments in Hall B and Hall D. There is a coherence of plans between accelerator and experiments for both halls. Priorities are clear for the experiments and the beam lines.

- Communication between the accelerator and experiment teams is very good. Regularly scheduled meetings (eg Daily 7:45/8:00 and Weekly Wednesday) are used for communication on tactical and strategic plans. There are additional meetings on specific topics such as the Hall D photon beam.

- Roles are clear for both the experiments (eg Run Coordinators, Physics Division Liaisons, Spokespeople) and accelerator (eg Accelerator Operations Hall Liaison). The responsibilities are detailed in Conduct Of Operations documents.

- The interfaces between Accelerator and Hall D are defined in a draft Interface Control Document. Agreement on the final components of the ICD and signoff is expected in September.

Accelerator/Physics Experiment Integration

Observations

- Both the Glue-X and HPS experiments have undergone Experiment Readiness Reviews with no major findings. Effective plans to address the findings are in place.

- Presentations were made by Glue-X (Hall D) and HPS (Hall B) spokespeople. There is clearly demonstrated strong participation by collaboration members (users) that has already taken place in testing and installation of experiment equipment. These efforts are well integrated with and complimentary to work by lab staff for commissioning and operation of the experiments.

- Overall integration of Accelerator and Experiment planning for commissioning and operations for both Hall B and Hall D is very good.

Findings:

- None

Experiment Controls/Software with Safety Significance

Karen White
Oak Ridge National Laboratory

Cyber Security/SW QA for Exp. Halls

- Observations Hall D Software
  - Appropriate controls are in place for system access consistent with JLab cyber security guidance
  - Interlocks used for equipment protection are hardwired with no software controls, only status readbacks
  - Control system tools (OPI, alarms, striptool and archiver) are in place, displays developed and tested
  - Some necessary device control software is not complete, but expected by October

Cyber Security/SW QA CF Controls

- Observations
  - Following ARR1, a separate review evaluated cyber security for the CF controls and a plan was developed to address issues, but the initial timeline stretched over several years
  - Segmentation of the various vendor supplied CF control systems on private networks is now expected to be complete in October 2014
  - The unsupportable/unpatchable Windows XP machines used in the vendor systems will also be gone by October 2014
  - The CF staff now coordinates the controls work that supports accelerator systems through ATLis

Radiological Protection (RP) for 12 GeV Commissioning and Operations

Jim Floyd
LBNL

Radiation Protection

Observations:

- (From Phases I and 2), Radiation Protection Program is effective and its Commissioning Plan is well integrated into the 12 GeV Project

- Comprehensive surveillance, including:
  - C-100 activation follow-up
  - Hall D
  - Installation of continuous monitors
  - Verification of Rad Physics models

Radiation Protection

Observations (cont.):

- Shielding
  - Effectiveness verified for Hall D
  - Developing a database

- Experiment Reviews:
  - RSADs completed for Halls B (HPS) and D

- Dump Upgrade
  - Nearing completion for Hall A

Radiation Protection

Noteworthy:

- Noteworthy effort to upgrade the Hall A and C dumps
- Noteworthy effort to develop a movable shielding database and integrate with shielding reviews

Findings:

- (Post start) Continue high power dump integration efforts

Charge to the Committee: Six Issues

1. "Consistent with the Experiment Readiness Review, **commissioning and operational procedures** necessary for the safe and effective commissioning and for the operation of **Hall D** by laboratory staff and experimental physics users have been developed, reviewed, and approved, and an appropriate process for the development, review, and approval of new and revised procedures is in place."

- JLab has processes in place for the development and review of new and revised procedures that are well organized and matched to the needs of the lab.

- The JLab ERR process is well developed to ensure a safe and effective operating environment for users.

- Hall D procedures are ready or scheduled to be completed by October 1

Charge to the Committee: Six Issues

2. "Consistent with the Experiment Readiness Review, commissioning and operational **procedures** necessary **for the safe and effective** delivery of **multi-pass CW electron beam** from the upgraded accelerator **to Hall B** and the HPS experiment have been developed, reviewed, and approved."

- Procedures necessary to start commissioning with **multi-pass CW electron beam** to the Hall B Tagger Dump are ready.

- Not all procedures are ready for safe and effective delivery of beam to the HPS Experiment. Many safety and operational documents have been written but should be formally released and subject to document control (including version control and approval).

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Charge to the Committee: Six Issues

3. "**Hall D infrastructure**, support equipment, and associated experimental apparatus necessary for the safe and effective commissioning and operation of Hall D are properly **installed**, functionally **tested**, and appropriately documented. Similarly, **user supplied experimental apparatus** necessary **for HPS experiment in Hall B is properly installed**, functionally tested, and appropriately documented."

- Basic infrastructure and support equipment are ready for beam operation, or nearly so, in both Halls D and B, and unfinished items are being tracked to completion.
- Experimental apparatus in Hall D is nearly ready, and is expected to be complete for the fall run.
- Much of the user supplied apparatus for the full HPS experiment has not yet been installed. However commissioning of many subsystems could proceed this fall.

Charge to the Committee

4. "Equipment and **systems having safety significance** for beam delivery for both **Hall D and Hall B** meet the criteria established in the FSAD, are fully operational, and are managed as part of the laboratory's configuration management process and all requirements for the intended activities, as specified in the ASE, are met."

- Safety systems have been installed. Some functions are awaiting final testing and certification before beam delivery may commence.

- The Personnel Safety System and the Oxygen Deficiency Monitoring System need to be operationally checked/certified prior to beam delivery.

- Configuration management of safety systems is effective. The incomplete items are identified in the HCO system and are being tracked to completion.

Charge to the Committee

5. "Consistent with the Experiment Readiness Review, there are sufficient **staff and users** appropriately **trained** on procedures for commissioning activities, normal operations, and for abnormal or emergency situations for beam delivery to both Hall D and Hall B."

- Systems for managing training activities are well developed, and training activities have taken place where possible.
- It appears there will be sufficient trained individuals to commence commissioning this fall.
- Training of users can only be effectively done on a time scale close to their involvement in their on-site activities.

Charge to the Committee

6. "**Records** important for pre-operational, operational, and post-operational (and post-experiment) activities are adequately managed and controlled."

- Processes for managing and controlling critical records are in place.

Conclusions of Phase 3

Hall D

- The 12 GeV Upgrade Project is nearly ready for beam operation to Hall D, pending close-out of a few remaining items.
- The processes for managing the open items are well developed and on track for successful completion within a few weeks.
- Preparations for the experimental program are progressing well.

Conclusions of Phase 3

Hall B

- Credited safety systems for multi-pass operation are nearly ready.
- The Hall B facility is nearly ready to accept experiments pending completion of a few remaining items.
- Preparations for the HPS experiment are progressing well and are being managed by the Experiment Readiness Review Process.

Conclusions of Phase 3

A Closing Observation

- The ARR Team has determined that rigorous application of the internally managed Experiment Readiness Review and other configuration management programs will enable safe and effective commissioning and operation of beam lines and experiments at Jefferson Lab.