

Committee Report - 4/4/16
Tritium Experiment(s) Interim Readiness Review
(The review was held on March 16th 2016)

Committee Members:

Roger Carlini (chair), Mark Dalton, Ed Douberly, Carroll Jones, Dave Kausch,
Henry Robertson, Vashek Vylet, Timothy Whitlatch, Bob May

Observers:

Rolf Ent, Ed Folks, Patricia Hunt

Summary

The committee was impressed by the scientific collaboration, the excellent presentations, the details on critical documentation and the very professional level of technical work demonstrated. The collaboration and laboratory staff have done an excellent job to date in preparing to conduct the set of four experiments covered under this review. Below are the charges to the committee with our responses in the categories of findings, comments and recommendations (if any).

It should be noted that this readiness review committee was not charged with any aspect of reviewing the technical concept, engineering design, safety or operational limits of the Tritium target cell assembly as these issues have been previously reviewed by a separate specialized committee. Our tritium related charges are limited to an interim evaluation as to whether that the previous specialized tritium target review's recommendations are being acted upon.

The remaining charges to this committee relate to standard issues covered under a typical readiness review for a medium scale experiment at Jefferson Laboratory. These traditional issues concerning developing, staging and running this scale experiment in Hall A are well under control with only modest modifications required to the existing spectrometer configuration. The collaboration is scientifically strong and has sufficient manpower to execute the proposed set of four measurements.

Charges and Committee Responses

1. Is all the equipment installed and operational? If not, what is their completion/commissioning schedule and procedure?

- Findings:
 - Not all equipment required is presently installed. Hall A is currently running a different experimental program. However, all four experiments covered under this review do employ the “base equipment” which is already installed in the hall, with the addition of several additional new/replacement sub-systems. Additional items required include a new resistive Q1 magnet plus its power supply for one of the high resolution spectrometer (HRS) arms and more significantly a new tritium target cell assembly including its associated control hardware and safety systems.
 - Procurement and installation schedules have been presented. The schedules are tight but no slippage has been observed to date. These schedules did not explicitly indicate the float at the sub-system level so how well they will hold is hard to tell. The 2016 summer down work will include HRS modifications consisting of Q1 magnet replacement (old superconducting magnet to be replaced by a new resistive magnet) and new installations such as the exhaust safety system for the tritium target cell. The tritium target installation will occur during the brief winter down (Dec 2016 - Jan 2017). The basic plan calls for the operational checkouts of sub-systems to be conducted as items are installed/modified.
 - The collaboration and laboratory management have decided that the labor intensive configuration originally proposed requiring the Big Bite spectrometer is not essential for the series of four experiments planned. Instead employing the two “twin” HRS configuration significantly simplifies installation and mitigates technical and schedule risk without serious degradation to the proposed physics goals.
 - There are general plans for testing the new Q1 power supply when it arrives. A test procedure will be written as required. The Hall A technical staff has experience with similar power supplies.
 - Procedures for the target installation are well underway and should be complete before the September 2016 ERR.

- Comments:
 - The new Q1 “resistive” magnet is scheduled for delivered to JLab by June 15, 2016 and the associated power supply is due around July 1, 2016. Since the plan is to install and test the magnet systems this summer, the laboratory/collaboration needs to keep a close eye on long-lead time items (especially the Dan Fysik power supply and the new Q1 resistive magnet). If these items are late and not able to be installed and tested this summer, a heavier burden will be put on the already very tight winter installation schedule.
 - Being that the accelerator schedule is subject to some level of uncertainty, the laboratory/collaboration should be prepared for a potential two week earlier start in January 2017.
- Recommendations:
 - None.

2. Have the recommendations addressed during the September 15, 2015 ERR concerning the conceptual design of the Tritium Target from an operational safety, been followed? In particular:

- a. Has the final target ladder configuration been finalized?**
- b. Has the schematics of vacuum systems and exhaust systems been checked/certified for functionality?**
- c. Have all pressure system analyses been reviewed and approved?**
- d. What is the status of passive and active control and safety systems?**
- e. Status of the radiological recommendations (e.g. atmospheric dispersion check, transport/storage container definition,)?**

- Findings:
 - All recommendations from the September 15, 2015 ERR were addressed in an adequate manner for this interim review. Specifically, that previous review generated:
 - 6 administrative Tasks of which 3 are complete, 3 are in-process and scheduled to complete in appropriate time frame.
 - 4 EHS Tasks of which 3 are complete, 1 is in-process and scheduled to complete in appropriate time frame.
 - 10 Equipment Tasks - 6 are complete, 4 are in-process and scheduled to complete in appropriate time frame,

- 5 Shipping - 1 is complete, 3 are in-process and scheduled to complete in appropriate time frame, 1 is incomplete (just-in-time target delivery unreasonable),
 - 4 Procedural - 4 are in-process and scheduled to complete in appropriate time frame.
 - Target ladder item (a) is finalized and the stakeholders are satisfied. The ladder cell order was done in an intelligent manner with respect to maximizing scientific output and safety.
 - Schematics exist for item (b) but checking/certification is still required.
 - The pressure system item (c) analyses are in progress and scheduled to complete in an appropriate timeframe.
 - Concerning item (d) we commend the use of the fence as an administrative control of access to the target.
 - In reference to item (e): The atmospheric dispersion estimates have been verified. A related RadCon technical basis document was developed in February: “Technical Basis for Stack Height to Meet Design Goals For Public Doses in the Event of a Release from a Proposed Tritium Target” (see JLAB-TN-16-003). A type DOT B package for shipping (and for on-site storage) of the Tritium Target has been identified. It should be noted that this package provides much more protection than is actually required: the tritium target is a much lower (Type A) quantity.
- Comments:
 - In reference to item (d): We note that the simplified diagram shows a single signal to the FSD for the target system. Consider including redundancy here!
 - Recommendations:
 - In reference to item (d): Finalize the exhaust fan controls needed to satisfy the requirements of the Tritium target and the fire protection smoke exhaust. Finalize the CANS access control configuration for truck ramp roll-up door and exhaust fan operation.
 - In reference to item (e): The type B container is certified for storage and transport of experimental apparatus, and when used by trained

personnel, eliminates the requirement for triple confinement of the target. As the committee understands the situation there were two issues here, one for shipping and one for storage. We therefore assume that there is no need for a third layer of confinement in either case other than the already required radiation signs for storage in the Hall. Also, during the first meeting with the SRS group George Kharashvili estimated activation of the cell using FLUKA and summarized it in TN-14-013. Dose rate after 1 day should drop to around 1 mrem at 1 foot, i.e. much less at the surface of the container. In the following 10 days this would further drop by more than a factor of 5. There should be no issue with shipping the container back to SRNL.

- In reference to item (e): We see no benefit to a downstream window (just downstream of the scattering chamber), except in the case of a scattering chamber contained catastrophic tritium target cell failure. Even under this scenario such a window would provide isolation of the large downstream vacuum pipe from internal tritium contamination at the expense of additional background for the experimental measurements. We recommend that Hall A management do its own cost-benefit analysis and make the decision as to whether this configuration should be employed.
- In reference to item (e): Review the target cell installation and removal procedure to insure that the steps required for using the new shipping container are included.

Note: The committee has combined its responses to charges 3 and 4.

- 3. Have all the jobs that need to be done to mount the experiment/s been identified and defined adequately?**
- 4. Are the responsibilities for carrying out each job identified, and are the manpower and other resources necessary to complete them on time in place? (both Jefferson Lab and the collaboration must be included). This should include a clear definition of the target system ownership and responsibilities. i.e., for the target system the installation plan, including safety checkout plans both prior to installation (specifically including the transportation of the target to JLab), during installation, and after installation, should be presented.**

- Findings:
 - The experiments all use the base equipment in Hall A with the Tritium target and associated infrastructure and the spectrometer magnet reconfiguration being the only major changes.
 - The tritium target system ownership is clearly defined with roles and responsibilities clearly understood. The roles and responsibilities for developing the target system installation plan, including safety checkout plans throughout the installation process, are well understood. As presented, the target system installation procedures, are at the appropriate stage of development – for this interim review. Specifically, the JLab target Group (especially Dave Meekins) has taken full responsibility for the entire target system aspect of the experiment(s) readiness.
 - We see no unidentified tasks.
 - The collaborations are adequately staffed, trained (or will be before the run) and enthusiastic.
- Comments:
 - Dave Meekins has coordinated with Dave Kausch, Tom Renzo, and Carol Jones regarding various aspects of the Tritium Exhaust System. Required additional support from Facilities will be provided to Dave Meekins regarding design review, installation support, system testing, and system start-up.
- Recommendations:
 - We recommend that the external exhaust gas stack work be started and preferably completed during the 2016 summer down, if possible.
 - We recommend that preventative maintenance tasks be identified so that “JLab Facilities” can complete these during the summer down.
 - We recommend that JLab service providers be briefed on the schedule and kept up to date on changes, so that they can better plan their resources to cover the tight installation and checkout schedules associated with these experiments.
 - We note that the winter installation is very tight. We recommend that careful planning and adequate manpower be made available ahead of time.

5. Has the sequence of the experiments in the run group been optimized? Is there a backup plan in case the requirements of an experiment are not fulfilled?

- Findings:
 - To the extent the accelerator operation schedule remains firm, the execution plan of these four “tritium target” based experiments has been optimized. Some backup planning has already been undertaken for possible schedule variations. Caveat Emptor!
- Recommendations:
 - None.

6. Are the radiation levels expected to be generated in the hall acceptable? Is any local shielding required to minimize the effects of radiation in the hall equipment?

- Findings:
 - After considering the contributions from the 20 μ A beam, a thin Be upstream scattering chamber isolation window, the two thin Al target cell windows plus the tritium and the other target materials to be used during these measurements, the radiation levels in the hall and expected contribution to the JLab boundary dose, should be modest. This conclusion is for a no abnormal conditions scenario with respect to the tritium target cell. However, a formal RSAD still needs to be preaped.
 - The various scenarios for mitigating an undesired “tritium event” have been evaluated (as noted elsewhere in this report) by a previous specialized review committee for the tritium target cell and its associated safety systems. This committee does not address these issues.
- Recommendations:
 - None.

7. Are the formal documentation requirements and reporting (run coordinator → shift leaders) procedures for running the experiment adequate, appropriate and complete (COO, ESAD, RSAD, ERG, OSP's, general equipment operation manuals, etc.)?

- Findings:
 - These documents have not been completed to date. However, drafts for many documents listed above do already exist. JLab and the collaborations have experience generating the required set of documents. Therefore, it is anticipated by the committee that they will be completed in sufficient time prior to the formal deadlines such as to prevent any delay in approval for beam-on-target.

- Comments:
 - None.

- Recommendations:
 - The collaboration and JLab should assign each experiment's documentation to a single individual as the responsible point-of-contact.
 - Ensure documents are reviewed by the various subject matter experts in advance, particularly RadCon calculations for the RSAD.
 - The NEPA supplement must be modified for the DOT container usage.