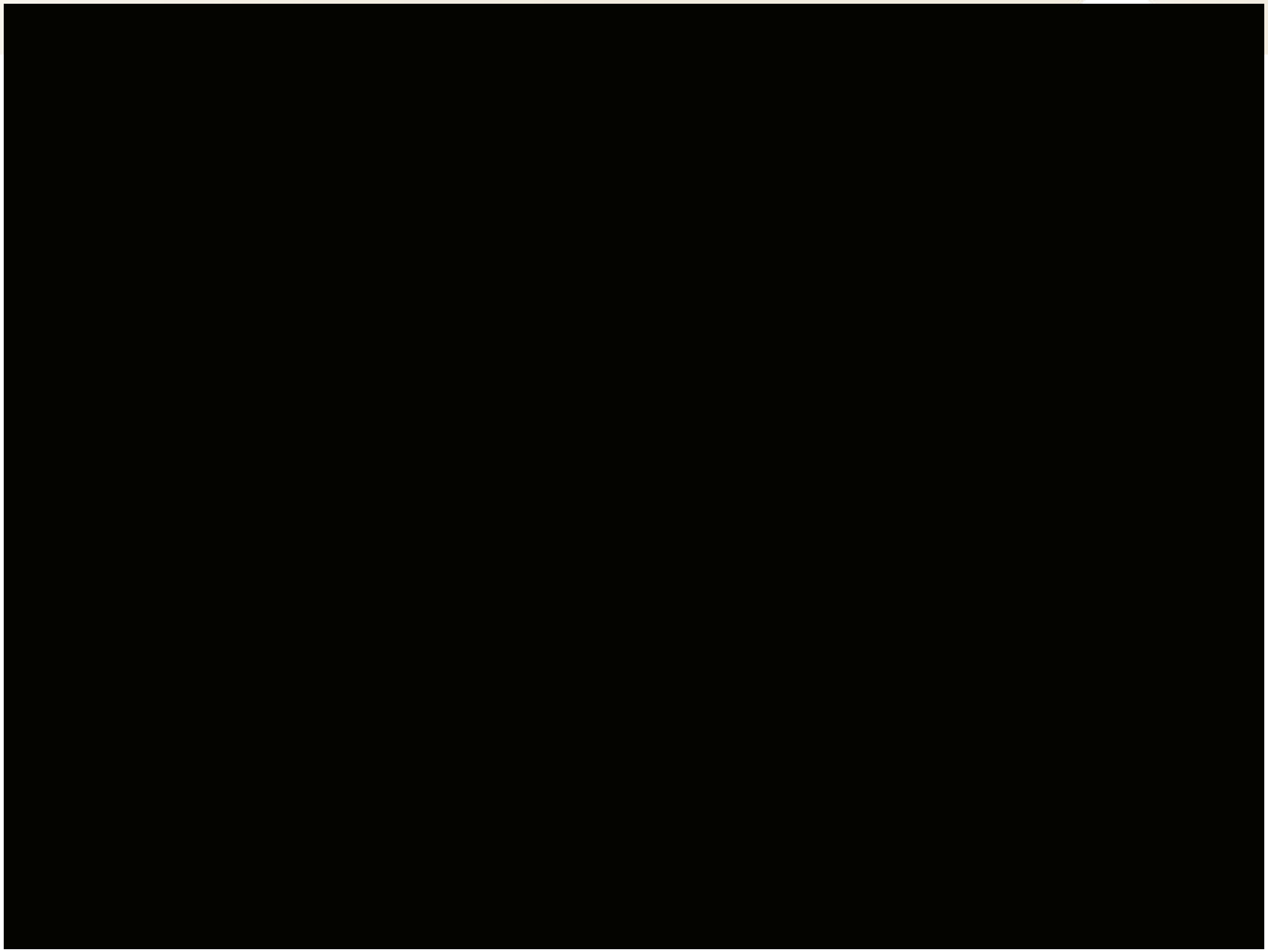
Pre-CD-1 Director's Review of the Proton Power Upgrade Project

ORNL
Feb. 14-16, 2017

Ian Evans (SLAC)
John Haines (ESS)
Norbert Holtkamp (SLAC)
Curt Hovater (JLab)
Jeff Hoy (SLAC)
Patrick Hurh (FNAL)
Chris Jensen, (FNAL)
Cathy Lavelle (BNL)
Olivier Napoly (CEA)
Les Price (retired)
Deepak Raparia (BNL)
Marc Ross (SLAC)
Larry Rybarcyk (LANL)
Wayne Steffey (US - ITER)
Jack Stellern (SLAC)

Why are we really here?



We provide assurance to the against things that can go wrong ! Especially in a review where the expectations are high!!!

The Charge

1. Does the conceptual design provide increased research capabilities envisioned in the mission need?
2. Do the conceptual design report and supporting documentation adequately justify the stated cost range and project duration?
3. Does the proposed project team and staffing plan offer adequate management experience, technical expertise, and Laboratory support to produce a credible technical, cost and schedule baseline required for CD-2?
4. Are ES&H aspects being properly addressed and are future ES&H plans sufficient given the project's current stage of development?
5. Have significant risks and potential mitigations been identified?
6. Are the system conceptual design review recommendations being adequately addressed?
7. Have all prerequisite requirements for CD-1 approval been satisfied?

Executive Summary

- Thanks for the opportunity to be here. Thanks for the hospitality. Thanks for the good preparation that made our job easy. And congratulations: You have come a long way to make PPU a reality.
- It's a competent team, but so far it's a small team. It needs to be augmented with experienced project support staff to be ready for the ICR/IPR.

- Reliable target operation at 1.4MW and a solid Target Development Program showing meaningful steps towards a reliable 2.0MW design remain the highest risk for timely implementation of PPU.
- Conflicting design guidance makes the implementation of the design a challenge. The MNS, the PPU KPP's and the design implementation represent a mix of parameters and boundary conditions.- There needs to be clear agreement with BES on what PPU provides and what not.
- PPU, while ultimately providing enough power to feed the STS, should stand on its own, scientifically and technically. Communicate clearly with BES what is required for 2MW@FTS and what is part of PPU that is relevant for STS only.
- The project is not quite ready for CD-1, but it is possible to get there with SC/BES/OPA/SNS support.

Review Committee

SRF

Marc Ross (SLAC)

Olivier Napoly (CEA)

RF / Power Systems

Curt Hovater (JLab)

Chris Jensen (FNAL)

Ring-Accelerator

Larry Rybarcyk (LANL)

Deepak Raparia (BNL)

Target

John Haines (ESS)

P. Hurh (FNAL)

Conventional

Jack Stellern (SLAC)

ES&H

Ian Evans (SLAC)

Cost Schedule

Cathy Lavelle (BNL)

Wayne Steffey (US - ITER)

Management

Les Price (retired)

Jeff Hoy (SLAC)

SRF

Marc Ross (SLAC)
Olivier Napoly (CEA)

Findings – SRF

- Seven PPU CM will fill empty slots in existing SNS tunnel
- Key CM components will be procured from industry
- CM will be assembled at another DoE-supported facility. SNS infrastructure is adequate for testing and (possible) repairs
- SNS SC linac performance is limited by cavity field emission and end-group heating
- PPU cavities are to have high RRR end-groups to correct the heating (through improved conduction)
- PPU CM will be fully 10CFR851 compliant
- SNS Cryoplant can support primary LHe system. The cryoplant CM shield circuit capacity is marginal but this can be mitigated by increasing T1 size

SRF Comments

- The PPU SCL plan is very good and reflects very high design-maturity.
- Consider reducing the number of CM from seven to six and raising the PPU CM gradient to ~18.7 MV/m. This is within the modulator / klystron capability and the FPC capability and would reduce project cost by almost 10M. The seventh CM would then be held as risk-mitigation to be applied following assessment of CM performance. (ESS expects to achieve 20 MV/m CM gradient).
- The existing reactor-grade cavity end-group thermal performance limits the SCL. Even with encouraging modelling results for the proposed new end-groups, this should be verified experimentally. The HB spare CM cavity end groups are similar to the existing CM. A testing program should be considered.

SRF Comments

- There will be one spare MB and one spare HB CM. The HB CM performance is expected to be limited to 13.3 MV/m if it is installed in the ‘worst-case’ location. Consider preparing a fully compatible HB spare CM.
- Partner-lab assembly procedures and practices may affect CM performance, design, testing, and safety aspects. SNS PPU should anticipate the impact this may have on the project plan. Prepare outreach and engagement plans that go beyond a simple procurement process.
- Risks associated with cavity fabrication (He vessel bellows), CM assembly (tuner delivery), and CM transport (leak creation) should be revisited. The emphasis should reinforce the full-risk associated with the component / system.
-

SRF Comments

- We support two Strategic Decisions:
  - Procure fresh cavities. Rework of existing on-the-shelf spares is risky and has (so far) proven unsuccessful
  - Use US DoE-supported CM assembly facilities. These facilities are proven and have capability beyond that available at SNS.

- CM cost-development (SNS →PPU) notes were provided.
  - Understandable when compared to similar projects

SRF Recommendations

- Consider the cost-saving and risk of reducing the number of cryomodules from seven to six.

SRF response to the Charge Questions

1. Does the conceptual design provide increased research capabilities envisioned in the mission need? N/A
2. Do the conceptual design report and supporting documentation adequately justify the stated cost range and project duration? YES
3. Does the proposed project team and staffing plan offer adequate management experience, technical expertise, and Laboratory support to produce a credible technical, cost and schedule baseline required for CD-2? YES. The SNS project team and staffing plan fill those conditions, with some areas covered by only one individual (cryogenics, utilities). The partner lab(s) project team and staffing plan, in charge of cavity tests and CM fabrication, cannot be assessed at this point.
4. Are ES&H aspects being properly addressed and are future ES&H plans sufficient given the project's current stage of development? NO, the interrelationship with partner labs is not defined in terms of coordination, responsibilities and applicable rules.
5. Have significant risks and potential mitigations been identified? No, see comments on risk
6. Are the conceptual design review recommendations being adequately addressed? YES
7. Have all prerequisite requirements for CD-1 approval been satisfied? YES

RF / Power Systems

Curt Hovater (JLab)

Chris Jensen, (FNAL)

Findings

- Team works well together, has many years of experience and is very familiar with all the SNS RF systems.
- RF System Conceptual Design Review was in November 2016, there were 5 recommendations and all are in progress.
- A RF Margin Task Force has been formed to investigate/analyze if the installed RF can support PPU requirement of 38 mA.
- The 28 new SC cavities will use new 700 kW klystrons, new modulators and new LLRF
- 700 kW Klystrons are backward compatible to the old SC cavities.
- These new klystrons can be operated to >900 kW
- RF system spares are included in the build out for the new SC cavities
- A prototype modulator to drive the 700 kW klystrons has been built and design work has begun on modulator changes to drive the 2 x 3 MW klystrons
- LLRF system is designed around uTCA
- The 2 MW FTS requirements can be met with the existing NCL RF system.

Comments

- The team worked with us to help us understand the material they presented.
- The RF System BOEs seem reasonable (based on vendor quotes, ORNL labor rates and previous work).
- A drill down on the modulator BOE showed that the cost of the modulator has escalated at a rate much more than inflation. This is validated by a cost comparison with a different modulator of similar power.
- The cost estimate for the transmitter and klystrons are based on a recent vendor quotes. Klystron costs have increased at a rate closer to inflation.
- RF Controls and LLRF costs should be re-examined to eliminate double counting and duplication with on going operation funded projects.
- Investigate LLRF systems at other labs (LCLSII, LANCE) that are compatible for the project.
- The RF project contingency seems high at 35%. Given the risk, design progress, and project experience the contingency should be lower.

Comments

- It is not clear that Controls, RF and SRF schedules are aligned (dependencies) with the 6 week down periods.
- RF Staffing, beginning in FY18, could be a potential schedule drag if not addressed. There is a significant step in engineering which requires reallocating resources. Strongly consider increasing project priority over operations after CD2, otherwise new manpower may be required.
- Klystron spares should be moved off project or to scope contingency. There are enough 700 kW spares (40) to cover the linac after the upgrade (81 sockets now + 28 added sockets)
- Examine the economic aspects of using a single spare HVCM tank for both original and alternative topology modulators.
- Investigate cost of building modulators in house with contract labor instead of a build to print contract.

Recommendations

- The RF Margin task force needs clear and defined deliverables and should be completed by CD2. There are long lead time items currently in the schedule that are impacted by these findings.

RF Systems Response to the Charge

Does the Conceptual Design provide increased research capabilities envisioned in the mission need? **NA**

Does the Conceptual Design Report and Supporting Documentation adequately justify the stated cost range and project duration? **Yes**

Does the proposed Project Team and Staffing Plan offer adequate management experience, technical expertise, and Laboratory support to produce a credible technical, cost and schedule baseline required for CD-2? **Yes**

Are ES&H aspects being properly addressed and are future ES&H plans sufficient given the Project's current stage of development? **Yes**

Have significant risks and potential mitigations been identified? **Yes. They have formed a team to look at the RF margin in the linac.**

Are the Conceptual Design Review recommendations being adequately addressed? **Yes**

Have all prerequisite requirements for CD-1 approval been satisfied? **Yes**

Ring - Accelerator Subcommittee

Larry Rybarcyk (LANL)

Deepak Raparia (BNL)

Ring – Accelerator Findings

- The ring scope includes injection region magnet replacements, additional extraction region kicker magnets and ancillary equipment, modification of extraction septum magnet, additional cooling system for the ring magnet power supplies, cooling upgrades to substation power transformer and new beam view screen and analysis of power rating for the injection dump
- The escalated total cost for the ring scope is $10.8M and is well documented and supported. Contingency is 34%
- The people have proven and relevant expertise, many of whom have been here since the original SNS design and construction. Staff will need to be augmented.
- A potential savings of ~$2M, operational simplicity and better beam performance may be realized through outcome of CDR recommendation of operating existing extraction kickers at higher voltage as a substitute for addition of two new kickers needed for 1.3 GeV.
- Although foil performance is acceptable up to 2 MW, a concern is that ring injection stripper foil will not survive 2.8 MW operation for FTS and STS. Mitigation strategies in PPU include in-situ foil temperature measurements and stripping efficiency monitoring, and foil testing with electron beam at equivalent deposited power.

Ring – Accelerator Findings

- Beam losses due to Lorentz field stripping of H- ions in the High-energy beam transport constrain the linac final energy to 1.3 GeV
- The e-p instability has been observed in the ring, but is very weak under present operating conditions. Several measures are in place to mitigate this instability should it appear at PPU parameters.

Comments

- Operationally funded upgrades to ring RF power supplies and LLRF control should improve performance and reliability at present and PPU beam conditions.
- Contingency for P.04.08 (Accel Physics Management) & P.04.03.02 (Inj Dump Imaging Sys) are in excess of 70% and credibility is questionable.
- Additional contingency may be needed to cover the cost of upgrades to any magnet power supply that would be operated too close to nameplate rating and suffer reliability issues.
- Ring-injection waste-beam dump window change out should be considered when installation of view screen is performed to maximize efficiency
- Credibility of technical baseline, associated cost and schedule for CD-2 may be negatively impacted when actual people are assigned to replace known expert currently assigned to multiple WBS slots.
- Evidence from work-to-date performed in the ring injection region suggests potential ES&H concern associated with movable contamination is likely a non-issue
- Effort should be made to ensure project success and mutually beneficial interactions with partner labs

Recommendations

- To ensure no operational surprises with the ring RF system, it should be tested at anticipated RF power levels needed to overcome e-p instability prior to completion of PPU

Ring-Accelerator: response to Charge Questions

1. Does the conceptual design provide increased research capabilities envisioned in the mission need? **N/A**
2. Do the conceptual design report and supporting documentation adequately justify the stated cost range and project duration? **YES**
3. Does the proposed project team and staffing plan offer adequate management experience, technical expertise, and Laboratory support to produce a credible technical, cost and schedule baseline required for CD-2? **YES (see comment)**
4. Are ES&H aspects being properly addressed and are future plans sufficient given the project's current stage of development? **YES**
5. Have significant risks and potential mitigations been identified? **YES**
6. Are the Conceptual Design Review recommendations being adequately addressed? **YES**
7. Have all prerequisite requirements for CD-1 approval been satisfied? **YES**

Target Subcommittee

John Haines (ESS)

Pat Hurh (FNAL)

Target : Findings

- Target R&D plans including He bubble injection, He gas layer formation, Hg flow, and Hg vessel structural enhancements are being developed to meet target module lifetime goals for PPU
- Off-project initiatives (operations funded) needed to meet the PPU Target Station goals were identified as key project assumptions and are defined in the SNS Target Management Plan
- Cost estimate, including contingency assessment, and resource loaded schedule have been established:
  - First Target Station base estimate = $15.7 M; contingency = 37%
    - 2 MW Target Module base estimate = $6.5 M; contingency = 30%
  - Gas Injection R&D base estimate = $3.3 M, contingency = 17%
- Project risks as well as opportunities for the Target Station were identified, evaluated, and mitigation measures defined where needed
- Injection of He into the Hg flow circuit will affect the safety case of the Hg loop, requiring a USI
- Current engineering staffing level devoted to target development (both operations and PPU) is about 4 FTEs

Target: Comments

- A highly capable core PPU Target Team is in place, focused on the key issues, and working closely with SNS operations and ES&H counterparts to improve target performance to the level needed for PPU
- To more clearly convey the case for a 2 MW FTS, the team should re-package the presentation of the Hg target into a reference conceptual design, incorporating all the features currently envisioned
- The project team also needs to emphasize that successful completion of the target R&D program will support the presented conceptual design, satisfying PPU target lifetime goals; not with certainty, but with a reasonable extrapolation from current understanding
- Clearly defined goals and deliverables should be incorporated into the PPU Target R&D schedule and documented in the PPU Target Development Plan
- Base cost estimates appear credible for this stage, but the contingency for the 2 MW target and R&D activities seems low and should be reconsidered
- Establishing high flow gas bubble injection is required for the 2 MW Target and therefore, communication and cooperation with the ES&H team will continue to be critical to the overall success of this work

Target: Comments (continued)

- The currently planned operational initiatives dedicated to improving the performance of Target Station components, e.g. 1.4 MW Hg Target module development and IRP, are critical to the success of the PPU Project, and should be tracked in the project plan
- Major risks associated with PPU Target efforts were properly captured and analyzed within the project's risk registry, but risks associated with off-project efforts needed to support PPU were not included
- The current staffing level of four FTEs for Hg target design and development is inconsistent with the criticality of these activities; management has plans to add some staff using external and laboratory resources to minimally support project needs, but they should seriously consider further augmenting this team soon to increase the probability of meeting the operational and PPU project plans
- The Target Management Plan is already helping to establish the proper framework for well-controlled beam exposure of new targets, enabling evaluation of design changes and making steady progress towards higher power target capability

Target: Recommendations

- Accelerate production of the PPU Target Development Plan and conduct review (including external reviewers) prior to CD-1 Review
- Identify critical off-project activities needed for PPU success, reflect associated risks in the risk registry, and create milestones or other place-holders in the PPU P6 project schedule enabling tracking and development of mitigation strategies

Target: Response to Charge

1. Does the conceptual design provide increased research capabilities envisioned in the mission need? N/A
2. Do the conceptual design report and supporting documentation adequately justify the stated cost range and project duration? No, but this can be remedied by reviewing and issuing the PPU Target Development Plan and clearly defining the reference target conceptual design used for cost estimating in the Conceptual Design Report
3. Does the proposed project team and staffing plan offer adequate management experience, technical expertise, and Laboratory support to produce a credible technical, cost and schedule baseline required for CD-2? Yes, but adding engineering and R&D staff could accelerate efforts and result in a better, i.e. more robust and longer lifetime, design
4. Are ES&H aspects being properly addressed and are future ES&H plans sufficient given the project's current stage of development? Yes
5. Have significant risks and potential mitigations been identified? Yes. Completion of off-project activities critical to the PPU project should be added
6. Are the conceptual design review recommendations being adequately addressed? Yes
7. Have all prerequisite requirements for CD-1 approval been satisfied? Yes, if the above mentioned items are properly addressed

Conventional Facilities

Jack Stellern (SLAC)

Conventional Facilities - Comments

- CF team has responded adequately to the comments and recommendations from the November 2016 conceptual review.
- The CF team has done a good job completing a lot of work in a short time to redesign the tunnel stub and revise the construction schedule and estimate based on review comments.
- The tunnel stub is not needed to meet the PPU project KPPs. There is no clear justification for including the tunnel stub out in the PPU instead of the STS.
- It is advantageous to include the tunnel stub out scope in the contract for the larger STS construction scope. A large construction company would get the contract for STS and will have the staff, equipment and processes in place to cost effectively complete the stub out with the rest of the STS tunnel. Constructing the stub out separately would result in small companies bidding on a heavy construction job which would result in large mobilization costs and most likely a limited number of bidders.

Conventional Facilities - Comments

- Cost estimates for the AE design and construction contracted tasks are credible. However, the CF staffing hours are not adequate to support the project.
- The cost contingencies are not valid and could not be explained.

Conventional Facilities - Recommendations

- The proposed CF staffing is too low based on the current scope and the CF cost contingencies are not valid, both should be reassessed.
- Project should consider moving the scope for the tunnel stub out into the STS project.

CF Response to Charge Questions

1. Does the conceptual design provide increased research capabilities envisioned in the mission need? **N/A**
2. Do the conceptual design report and supporting documentation adequately justify the stated cost range and project duration? **CF base cost estimates appear credible for the design and construction tasks but the CF staffing is low and contingencies are not valid.**
3. Does the proposed project team and staffing plan offer adequate management experience, technical expertise, and Laboratory support to produce a credible technical, cost and schedule baseline required for CD-2? **The proposed CF team is experienced and qualified. However, the current staffing man hours proposed in the estimate are inadequate.**
4. Are ES&H aspects being properly addressed and are future ES&H plans sufficient given the project's current stage of development? **Yes.**
5. Have significant risks and potential mitigations been identified? **Yes.**
6. Are the conceptual design review recommendations being adequately addressed? **Yes**
7. Have all prerequisite requirements for CD-1 approval been satisfied? **No, the CDR needs to be updated for the CF scope.**

ES&H and Q

Ian Evans (SLAC)

Findings

Documentation supporting this stage of the Project is in place;

- Preliminary Hazards Analysis Report (PHAR)
- Quality Assurance (QA) Plan
- Security Vulnerability Assessment Report (SVAR)
- NEPA compliance through original SNS Environmental Impact Statement (EIS) and 4MW analysis.
- Worker Safety and Health program that describes ORNL's approach to the *development, management, and implementation* of the worker safety and health program at ORNL.
- Integrated Safety Management Plan that describes ORNL's approach to *integrating environment, safety, health, and quality* (ESH&Q) requirements into the processes for planning and conducting work at the Laboratory.
- Chestnut Ridge ESH Plan Company defines how the principles and functions of ISMS are *implemented for PPU*.

Findings

- A Preliminary Hazards Analysis Report (PHAR) consistent with the DOE Order 420.2.c and its guide has been developed, using the Unreviewed Safety Issue (USI) process to evaluate new hazards. Five positive USI's have been identified. These will take considerable analysis to complete, after which time the FSAD should be updated to incorporate proposed changes. There are some soft statements in the PHAR that should be replaced with firm facts.
- The Project ESH staff are knowledgeable and competent, and fully embedded in the Project organization. The Project has access to capable institutional ESH resources as needed, both at SNS and ORNL. ESH staff remain highly visible to the Project team, attending design reviews, group meetings etc.
- The Project Management Plan (PMP) suitably defines the ESH&Q roles, responsibilities, authorities and accountabilities for staff on the Project team.
- Throughout the plenary and breakout sessions, time was devoted to system and sub-system ESH and risk considerations in a consistent manner.
- ESH&Q for all facets of the Project are adequately addressed for this status of the Project.

Findings

- ODM system coverage was confirmed to be adequate for the new installation.
- Fire/Life Safety Hazards are being reviewed and implemented through designs.
- Environmental considerations; waste, isotope production, limits, air permits etc. are being actively analyzed.
- Shielding is being reevaluated to ensure 1.3GeV operations won’t change boundary conditions, however the change in energy may alter the source term for instruments in the forward direction. Neutronics Group is analyzing and performing dose model calculations and are closely tied into Project. Most of the work will be performed in first year to ensure any new shielding can be accommodated. There are forecasted high losses in the ring injection area (as expected), however the source term won’t change much and may incrementally increase the dose in ring injection dump. A strong Radiological Work Planning process, coupled with the effective implementation of ALARA principles during maintenance and access activities will help maintain low dose levels to personnel.

Comments

- The Project needs to consider how it will integrate ESH at partner labs. The present ISMS plan is dedicated to ORNL based activities, but when you have a partner lab, the Project will need to assure that ESH is covered to the same degree at that facility too.
- Most Project ESH staff come from Operations and there may be limitations on their time for Project work. This is a risk to ensuring Project based activities receive priority, as User Operations is the focus.
- CD-1 requirements are met.

Recommendations

- Develop a written Environmental Compliance Strategy
- Develop a timeline for completion of safety analyses required in the PHAR, including updating the FSAD for Proton Facilities to incorporate proposed changes. (What needs to be done and by when?)
- Include in the risk registry ESH construction & installation risks and shielding upgrade cost risks that may come from the shielding re-assessment.
- Develop an FTE count and timeline for completion for USI safety analyses as they may alter the design requirements. Keep a careful eye on resources to ensure analyses are completed in a timely manner.

ESH Response to Charge Questions

1. Does the conceptual design provide increased research capabilities envisioned in the mission need? **N/A**
2. Do the conceptual design report and supporting documentation adequately justify the stated cost range and project duration? **N/A**
3. Does the proposed project team and staffing plan offer adequate management experience, technical expertise, and Laboratory support to produce a credible technical, cost and schedule baseline required for CD-2? **Yes**
4. Are ES&H aspects being properly addressed and are future ES&H plans sufficient given the project's current stage of development? **Yes**
5. Have significant risks and potential mitigations been identified? **Yes**
6. Are the conceptual design review recommendations being adequately addressed? **N/A**
7. Have all prerequisite requirements for CD-1 approval been satisfied? **Yes**

Cost & Schedule

Cathy Lavelle (BNL)
Wayne Steffey (US - ITER)

Findings

- The project cost range is $191.4M to $237.2M, with a point estimate of $212M .
- The project cost estimate is comprised of 42% labor and 58% non-labor.
- There are 156 Control Accounts, 41 CAMs.
- Long Lead procurements were identified totaling $978K without contingency.
- Project has a detailed WBS to Level 5 that is used to integrate scope, schedule, and cost.
- A Funding profile has not been provided by DOE, the project has proposed one based on cost/obligations plan.
- The schedule is resource loaded and logically linked with approx. 2800 activities and over 5000 logic ties.
- The critical path is defined and runs through RF cavities, cryomodules, installation, ARR and commissioning.
- Milestones have been identified to L1, L2 approval levels.

Findings

- Cost contingency was estimated at 35% (work to go) based on estimate uncertainty and two risks (schedule slip/escalation).
- Estimate uncertainty was calculated by resource (based on BOE factors/weights applied) and was the basis for determining cost contingency.
- The Project Schedule has 18 months of schedule contingency.
- Limited Scope contingency was identified approx. $2M
- A total of 74 risks have been identified in the risk registry, with 6 high and 16 medium risks post mitigation.
- The project is estimated based on FY17 rates with special project overhead rate. LDRD burden is applied. Escalation rates are based on FY16 values.
- Draft Preliminary PEP, Assumptions document and PMP have been prepared.

Comments

- The schedule and cost estimate detail is significant for CD-1. The time phasing of cost is based on projected shutdown schedule, and a schedule developed based on the sequence of work without influence from a DOE funding profile.
- The cost estimate is traceable based on a CAM drill downs conducted on Target and Cryomodules.
- The committee was pleased with the level of back-up detail, traceability, and knowledge of the team.
- The risk registry is a preliminary risk event assessment by the CAMs without management review. The cost contingency does not include costs for event risks impact.
- While the cost contingency of $53.8M seems plausible (35%), the process to develop it lacks consistency and completeness.
- The Estimate uncertainty is inconsistently applied and is the primary basis used for developing the cost contingency.

Comments

- The cost contingency should be based on the estimate uncertainty **and** the risk assessment.
- Identify additional scope contingency up to $20M..
- Limit optimizaton of the schedule until the funding profile is provided to the project. Focus on correcting errors and improving the quality of the schedule.
- Currently, only two interfaces with SNS Operations funded work are included in the schedule.
- The ICR/ICE per the DOE Order: “requires validation of the basis of the preliminary cost range for reasonableness and executability”. Preparation required to be ready for the ICR in mid April includes the management review of risks and development of accurate cost contingency to support the cost range. This will be a challenging task due to limited preparation time and additional experienced personnel will be needed.

Recommendations

- Review Risk Events and estimate uncertainty for each control account and quantify High/Med Risks (probability and impact) to develop cost contingency and revise the cost range as necessary.
- Review mitigation strategies and ensure the costs and mitigation plans are included in the schedule.
- Acquire additional project controls staff to meet the requirements necessary for the ICR scheduled in mid-April. Preparation includes: 1-Finalize risk assessment, 2-define and incorporate mitigation plans, 3-review estimate uncertainty for inconsistencies, 4-conduct management review, 5-revise cost contingency and 6-re-assess cost range.
- Constraints representing the external Operations funded work need to be added to the schedule.

Charge Questions - Cost /Schedule Response

1. Does the conceptual design provide increased research capabilities envisioned in the mission need? **N/A**
2. Do the conceptual design report and supporting documentation adequately justify the stated cost range and project duration? **No**
3. Does the proposed project team and staffing plan offer adequate management experience, technical expertise, and Laboratory support to produce a credible technical, cost and schedule baseline required for CD-2? **Yes**
4. Are ES&H aspects being properly addressed and are future ES&H plans sufficient given the project's current stage of development? **N/A**
5. Have significant risks and potential mitigations been identified? **Yes, but additional review and assessment is required.**
6. Are the conceptual design review recommendations being adequately addressed? **N/A**
7. Have all prerequisite requirements for CD-1 approval been satisfied? **No**

Management Subcommittee

Les Price (retired)

Jeff Hoy (SLAC)

Critical Decision Strategy

Findings

The Project presented a CD strategy that divided CD-2 into two stages, and CD-3 into three stages. CD-3a is for an initial set of long-lead procurement items totaling a bit under $1M. CD-2b is scheduled for 2QFY20 to permit the completion of critical Target R&D milestones prior to final PMB approval.

Comments

The CD strategy appears to be overly conservative and unnecessarily extends the period leading up to a full CD-2/Performance Management Baseline approval. This extension creates a longer period of funding uncertainty in the early years of the project.

Recommendation

Before the IPR, re-evaluate the CD strategy with the aim of maximizing the scope of long-lead procurements at CD-3a and consolidating CD-2 into one decision at the appropriate time. Incorporate the resulting CD strategy into the PPEP.

PPU Scope

Findings

As currently scoped, PPU includes scope for upgrading SNS FTS to 2MW capability and in addition, provides scope for up to 2.8MW in anticipation of a future STS project. The Project is assuming that SNS will perform the necessary prerequisite work to lay the groundwork for the PPU Project to proceed. These are described in a draft Project Assumptions document.

Comments

The PPU project needs to be defensible on its own merits (i.e., 2.0MW FTS capability). This enables significant scientific capacity and capability beyond that provided by the current FTS facility. Scope related to STS capability should only be included in PPU if there are compelling cost/schedule savings in doing so. The PPEP should identify the major activities that SNS will conduct to set the stage for PPU execution.

Recommendation

Before the IPR, re-evaluate PPU scope with respect to STS related items.

Project Budgeting Approach

Findings

The draft PPEP identified the approach to funding PPU to be an MIE, but review discussions revealed that the approach is shifting toward making the project a Line Item. In fact, the FPD has submitted a draft Project Data Sheet for a Line Item to DOE HQ.

Comments

The project understands the pro's and con's associated with the MIE and Line Item funding approaches, and the Committee agrees with their preference for a Line Item approach (especially if the complications of PED funding can be avoided).

Recommendation

Before the IPR, reach agreement with BES on the best approach to budget for PPU and incorporate this into the PPEP and other key documents.

Organization and Staffing

Findings

The PPU organization is set up in a logical project oriented structure. The second-level management staff are highly experienced, having spent many years working on SNS (and in most cases, having participated in its construction).

Comments

The heavy reliance on matrixing staff will be a new management challenge. Discussions with senior managers within the Neutron Sciences Directorate indicated that they are well aware of what must be done and have begun to make preparations. Establishing a fully functioning PPU project staff will require close Directorate management attention to ensure that the Project receives appropriate consideration among the Lab's competing priorities.

Recommendation

None

Partner Laboratories

Findings

The Project intends to procure cryomodules (CMs) and some other components (magnets) via partnering arrangements with other SC Labs. For the CMs, the approach is to copy the existing spare CM that has been developed at SNS/ORNL. In order to take advantage of existing CM production capacity, the Project sought and received "bids" from FNAL, JLab, and FRIB. These Labs may have other demands on their production capacity. An acquisition decision to select one of these Labs' bids is expected to occur in FY19-20 based on cost and ability to deliver on schedule.

Comments

The Project does not need the CM partner lab to perform substantial design and development work, and hence intends to deal with the CM partner lab essentially as a vendor. Based on lessons learned from previous multilab projects, the Committee noted that this relationship may not get the desired result of having quality deliverables arrive at SNS on time. The possibility of a negative outcome would be increased if the Lab does not assign its best staff to the job and does not allocate other resources in a high priority basis.

Recommendation

Before the IPR, the Project should develop a description of a constructive and effective management relationship between PPU and the partner lab.

Science Case for PPU

Findings

There is not yet any evidence that the scientific user community advocates the need for the PPU on its own.

Comments

The active support of the scientific user community is absolutely essential to obtain funding for the PPU Project, and documented evidence of this is presently lacking.

Recommendation

Before the IPR, seek a strong endorsement from the scientific user community.

PPU Contribution to SNS Annual Operating Cost

Findings

The present estimate for the incremental increase in annual SNS operating cost is ~$5M.

Comments

The Project's estimate for its contribution to the annual SNS operating cost may not cover all activities (e.g., instruments).

Recommendation

Before the IPR, re-evaluate the incremental SNS annual operations cost increase attributable to PPU, and incorporate into the life cycle cost estimate contained in the AS and PPEP.

Risk Management and Contingency

Findings

The Project presented the results of an initial risk analysis and the contingency assigned to each Level 2 WBS element. The contingency percentages for the various WBS elements varied significantly. The Project intends to conduct a risk management workshop in the near future to enhance the quality of the analysis and contingency estimates.

Comments

The contingency was developed through a mechanistic process based on cost uncertainties. It did not account for event risks, programmatic risks, and management judgment. A risk workshop involving certain US ITER Project staff would take advantage of their considerable experience in risk analysis and contingency development.

Recommendation

Before the IPR, proceed with the risk management workshop incorporating US ITER Project experience.

Funding Profile

Findings

The Project has developed an unconstrained funding profile and a corresponding project schedule that leads to CD-4 in the fastest technically achievable way.

Comments

BES has yet to agree to the unconstrained funding profile on which the present project schedule is based. Significant replanning may need to be quickly done if BES program funding guidance is provided at some point that imposes annual limitations on the Budget Authority profile.

Recommendation

As soon as possible, reach agreement with BES on the assumed project funding profile on which to base the project schedule.

Acquisition Strategy/Preliminary PEP

Findings

The Project has developed drafts of the AS and PPEP documents and iterated with the FPD and BES. These are works in progress (i.e., there are still some missing information, such as the project funding profile and possibly some key assumptions).

Comments

The Project is uncertain about whether the AS and PPEP documents are to be ready for signature and signed before the CD-1 IPR, before the CD-1 ESAAB, or in conjunction with the latter. There are certain key assumptions that should be included.

Recommendation

Before the IPR, complete the reviews and finalization of the AS and PPEP documents. Include key assumptions that should have DOE concurrence. Reach agreement with BES on when they will be signed for approval.

Management Response to Charge Questions

1. Does the conceptual design provide increased research capabilities envisioned in the mission need? Yes, to the extent that the existing MNS addresses the PPU portion of the overall STS mission need.
2. Do the conceptual design report and supporting documentation adequately justify the stated cost range and project duration? No
3. Does the proposed project team and staffing plan offer adequate management experience, technical expertise, and Laboratory support to produce a credible technical, cost and schedule baseline required for CD-2? This is a work in progress
4. Are ES&H aspects being properly addressed and are future ES&H plans sufficient given the project's current stage of development? N/A
5. Have significant risks and potential mitigations been identified? Not yet
6. Are the conceptual design review recommendations being adequately addressed? N/A
7. Have all prerequisite requirements for CD-1 approval been satisfied? Not entirely yet