LARP Luminosity Monitor Cost and Technical Review Committee Report –FINAL CANDIDATE

May 9, 2006

Review held April 24, 2006 at LBNL

Reviewers:
Enrico Bravin (CERN)
Angelika Drees (BNL - by phone)
Clive Field (SLAC)
Alan Fisher (SLAC)
Tom Shea (ORNL, Chair)

Introduction and Executive Summary

Organization of the Report

The report mirrors the organization of the committee's charge. For reference, the charge letter is included as Appendix 1. Each section refers to a particular question from the charge, and contains both observations and recommendations.

Executive Summary

The overall impression of the reviewers was positive. We appreciated the open and honest discussions, particularly when problems (technical or otherwise) were brought up. Significant progress has been made since last year's review and the LARP team responsible for this progress clearly possesses the experience and expertise to deploy a successful system at the LHC.

The report can be summarized by area of risk:
1. Technical Risk: Low (commissioning) to Medium (operational device for life of facility). The engineering analysis is generally high quality but a few loose ends remain before final fabrication can begin.
2. Schedule Risk: Medium high (assuming the current plan to commission beginning in of Fall '07). Effort must increase as planned and the focus must transition now to final fabrication and final detailed documentation. Tighter coordination with CERN staff is planned and will be critical in reducing schedule risk.
3. Cost Risk: We did not have time to assess this in detail. The estimate presented by Alex Ratti is consistent with past development programs of similar scope. It appears possible to accomplish the proposed work within this estimate if the focus now moves to final construction and if the tighter coordination with CERN does not uncover significant omissions in the estimate.

Response to the Charge

Are the presented results from R&D adequate to indicate a good chance of success in the LHC?

- In general, the R&D has confirmed the viability of the approach.
- Some questions arose regarding the dynamic range of luminosity:
    - It is not clear if there is sufficient amplitude and signal-to-noise for low-luminosity measurements.
    - Extra gain before the digitizer might be helpful.
    - The RHIC test will be helpful to study low-luminosity conditions.
- The ALS 40 MHz tests are very encouraging. It would be useful to complete the deconvolution exercise on the data in order to unmask any hidden effects, and perhaps to sharpen technical ideas for implementation at LHC.

Is the proposed radiation hardness approach adequate? Can it be improved?

- Radiation hardness approach (equipment layout and materials selection) is consistent with best practices at accelerator facilities.
- The proposed tests should give useful information. Information from the highest doses may come late, but it will still be in time to react before the highest LHC doses are encountered.
- The passive filter components are probably the most radiation sensitive parts on the detector. Now that the distance from the preamp to the detector has been shortened, is there an advantage to moving the passive filter on the HV line up out of the TAN? Consider this only if the schedule allows.
- Consider whether there is available effort to test detector parts at a reactor, and whether this would be beneficial.
- Testing the effect of a 1kGy dose on a preamplifier, or its components, would reduce risk.

Is the proposed final mechanical design solid and ready for production?

- Design appears well engineered and detailed. Manufacturability considerations have been addressed. The engineering analysis appears thorough and of high quality.
- The mechanical design of the detector is solid. As long as radiation testing does not lead to required changes, the detector is nearly ready for production.
- Some system integration details remain.

- Consider if the pressure in the detector would be affected by a gas leak there (at the tin seal, for example). Pressure and flow are monitored only at the gas control panel. Since thermal cycling is expected, it is conceivable that a gas leak would develop. If so, it could be helpful in diagnosis and operation to have a pressure measurement at, or close to, the chamber body.
- Additional analysis is planned to address bakeout.
    - If the luminosity monitor has to be lifted up during bakeout, a shield and/or remote handling equipment may be needed to reduce radiation exposure. Consistent with ALARA, assure that the procedure to lift the monitor assembly is simple (cable/gas line flex, screw or bail accessibility, etc…)
    - If the monitor can survive the bake-out in place, its temperature should be monitored. Thermocouples were mentioned, but there is no wiring in the plan so far, and it's not clear if there is space for glass-fiber insulated wire pairs.

Is the proposed approach to electronics processing likely to succeed?

- Yes, the approach appears very likely to succeed. There are still some details that should be considered.
- As already agreed, remove the voltage regulators from the preamp board.
- As discussed during the review, rotating the preamp to be on the aisle side with the cables going upward would ease maintenance.
    - Consider making a quick disconnect mount for the box, so that it can easily be replaced.
    - If the connectors are all moved to one side, blind-mate connections could be used to allow rapid module replacement.
- As mentioned above, testing a preamplifier or its components at ~1kGy would remove some risk exposure.
- Relays have been added to provide hot spares. Assure that this additional complexity actually increases reliability.
- Arc protection has been added to address failures that occurred during testing. The new circuitry has not yet been tested. Test this on the bench.

How can the design be improved? Where are the main obstacles likely to come from? Assess Project Planning/Risk.

- One frequently observed obstacle is an incompatibility encountered at installation time. This risk is best handled up front by careful planning and frequent information exchange, followed by on-site coordination and test fitting, and lastly by float built into the schedule.

Is the planning adequate and likely to lead to success? Is there a risk of delays or of missing key milestones? Is adequate and appropriate LARP manpower committed to the task?

- Adequate manpower is planned.
- The plan and schedule appears realistic.
- Funding profile:
  - Money was insufficient in FY2005.
  - Future funding needs to be provided as presented in the plan.
  - Some provision for contingency should be made.
- We endorse the plan to increase the presence of LARP personnel at CERN.
  - This is essential for a successful outcome.

Does communication and co-ordination with CERN seem adequate? Is the integration plan adequate?

- Coordination of installation and integration is off to an excellent start. In particular, good coordination has begun in the area of installation planning with TS at CERN.
- An interface control document including the division of responsibilities and important dates should be agreed to and put into the EDMS before the DOE review in June. This would also be a good place to document who pays for what.
- These plans should be set down beyond installation and well into the commissioning period. This may involve other portions of the LARP organization.
- Complete travelers and as built documentation are planned. The detectors are designed to be identical. This will ease system integration at CERN.
- The gas system is designed to LBNL pressure vessel requirements, and planned to be reviewed according to CERN requirements.
- Since CERN will deploy CdTe monitors at other IPs, any commonality between these and the LARP ion chamber systems might ease integration. This is especially true in the areas of data acquisition and software.

Are there any measures that can be taken to reduce either cost or schedule risk?

- Remote access to the newly installed system from LBNL could accelerate system integration and commissioning at a time when schedule float is typically gone.

Appendix: Charge to the Committee

LARP

Steve Peggs
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April 24, 2006

Tom Shea
ORNL

Dear Tom,

thanks for agreeing to chair the LARP "Lunimosity Monitor Cost and Technical Review" one more time. The review will take place on Berkeley on Monday April 24 and the Lawrence Berkeley National Laboratory.

The LBL group is preparing a site for the review, which will be updated regularly and contain the presentations for the review, as well as this charge.

http://uslarp.lbl.gov/workshops/060424/

For your reference, and as a reminder, you can find all materials from last year's review at:

http://uslarp.lbl.gov/workshops/050411/

The committee is asked to review all materials presented, including those for the previous review and critically comment on the following objectives in your written report:

Technical design assessment:
1 - Are the presented results from R&D adequate to indicate good chance of success in the LHC?

2 - is the proposed rad hardness approach adequate? Can it be improved?

3 - Is the proposed final mechanical design solid and ready for production?

4 - Is the proposed approach to electronics processing likely to succeed?

5 - How can the design be improved? Where are the main obstacles likely

to come from?

Assess Project Planning/Risk
6 - Is the planning adequate and likely to lead to success? Is there risk of delays or key milstones not to be met? Is adequate and appropriate LARP manpower committed to the task?

7 - Does communication and co-ordination with CERN seem adequate? Is the integration plan adequate?

8 - Are there any measures that can be taken to reduce either cost or schedule risk?

Sincerely

Steve Peggs
LARP Program Leader

Co-Reviewers:

Enrico Bravin	CERN
Angelika Drees	BNL
Clive Field	SLAC
Alan Fisher	SLAC
Tom Shea (Chair)	ORNL