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To: Norbert Holtkamp

From: Tom Shea

Subject: **First report of the LLRF Advisory Board**

Introduction

The LLRF Advisory Board (LAB) consists of the following members:
Tom Shea (ORNL, Chairman)
Curt Hovater (JLab)
Coles Sibley (ORNL)
Craig Swanson (ORNL/AlphaCad)
Mike Thuot (LANL)
All members contributed to this report.

In our discussions, we have adopted the following terminology:
Initial System: The complete LLRF system that will be used for Front End commissioning, initial cyromodule tests, and DTL commissioning.
Ultimate System: The complete LLRF system that will replace the initial system and be used through CD4.
Field Control Module (FCM): In the ultimate system, the FCM replaces the existing Berkeley-developed electronics (RF front end, analog section, digital section).

Comments on the plan and the proposed funding

The LAB has been actively involved in the development of the plan and supports it. Multi-laboratory teams like the one proposed have worked successfully in SNS Diagnostics. For this team to succeed, LBNL, LANL, and ORNL must each contribute to both the initial system and the ultimate system. This is reflected in the list of responsibilities assigned to each laboratory. The proposed schedule is driven by the SNS integrated project schedule and as a result, it is very compressed and has high schedule risk. The schedule for development of the ultimate platform is particularly tight. If the scope of new development is restricted to the absolute minimum necessary to meet requirements, then schedule risk and exposure to cost overrun will be reduced to acceptable level. The LBNL, LANL, and ORNL resources identified in the plan possess all of the skills required to succeed. Next month, when a detailed plan is available, concurrent activities might be identified and addition of resources might provide schedule float. The proposed funding is adequate.

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Recommendations

For FY03, provide similar funding to the three participating labs
The strength of this team will be enhanced by equal sharing of responsibility.

For FY04, provide reduced, but still significant funding for LANL and LBNL
Development and integration support will be essential to the success of the effort, so in no case should LANL and LBNL budgets be reduced to very low levels in FY04. Key design engineers from LBNL and LANL should assist in the migration from the initial system to the final system.

ORNL should take on responsibility for production of the ultimate FCM
ORNL personnel have significant experience in managing production of similar electronic systems. They will be ready to take on this responsibility in FY04. This allows partner lab engineers to concentrate on the critical activities described above.

Restrict new development to the absolute minimum necessary to meet requirements
Over the next year, the initial system will be used to support Front End commissioning, cryomodule tests, and DTL commissioning. It will be integrated and well proven by the time an ultimate system is available. Because of the tight schedule, design of the ultimate system should be based on the architecture of this initial system. Changes to a system that is already integrated and commissioned can cause significant impact. During development of the ultimate system, design engineers must be very conservative and propose only essential revisions.

Produce the detailed system development plan
The current plan provides a high level view that is adequate to assess the new strategy and the funding profile. To track FCM and ultimate system development, we require the next level of detail that explicitly documents concurrent engineering tasks. The plan must be loaded with named resources and be made available before the December design review. This is an action item for Mark Champion, Alex Ratti, and Hamid Shoaee.

Hold a design review during the week of December 2, 2002
The LAB expects that this design review will demonstrate strong collaboration between the labs and the establishment of effective teams. As evidence of this, we expect that the team will produce the following documents in time for the review:

1. LLRF system block diagrams
2. FCM design description and block diagram
3. System dataflow diagrams
4. A flow-down from the amplitude and phase error budget into FCM component selection
5. A detailed system development plan
6. A test plan

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7. An initial Interface Control Document (ICD)
8. Latest test results from the initial system
9. Documentation of decisions on development tools
10. Latest simulation and modeling results

Items 1 and 2 should be made available during the week of November 4, 2002. Throughout November, the board will participate in the development process. This interaction, combined with the availability of all 10 documents will allow the team to avoid preparation of formal presentations.

The LAB should deliver its next report on December 6, 2002