

NOTE: The following was an interim response to the three November 2013 S&T review recommendations submitted by Fermilab about a year ago in March 2014. These responses were accepted by the Office of High Energy Physics. The Institutional Review plenary presentation will include current status.

1. The review panel recommended that the lab formulate a coherent plan for its small and mid-scale neutrino experiments, which should include a timeline for physics and technical milestones. The reviewers did not find the suite of neutrino experiments to be adequately coordinated into a program that had decisive physics goals that lend support to the lab's flagship experiment, the Long Baseline Neutrino Experiment (LBNE).

Significant progress has been made since the S&T review. Two proposals were obtained for the near term program and they have been reviewed by the Fermilab PAC.

A roadmap for an integrated and globally neutrino program hosted at Fermilab that includes the small, mid-scale, and flagship program is emerging.

The goals of the small and mid-term experiments are:

- Address anomalies in the neutrino sector
- R&D on LAr detector technology that mitigates risk to LBNE
- Development of analysis techniques and the needed physic engineering measurements with a large (1E6) sample of neutrino-Argon interactions
- Community development: assembling the teams and training the generation of scientists needed to execute the flagship program

A broad consensus is emerging among the U. S. and European partners on the need for an integrated global partnership, not only for the flagship program, but for the nearer term program as well—an 'umbrella-like' approach for assuring an optimal coordinated program is a key piece of the roadmap.

Discussions among CERN, Fermilab, Europe and America are ongoing.

2. The review panel recommended that the lab should develop a systematic comparison of the two or more linac upgrade options to reach the MW power goal. The plan should address what R&D is needed and when, the cost, the role of international contributions, any necessary infrastructure additions or upgrades, and the upgrade potential of the design. They should determine the implications for the ongoing PXIE and SRF work.

Following the S&T review a design study for upgrading the Fermilab proton accelerator complex to a beam power capability of at least 1 MW delivered to the neutrino production target at the initiation of LBNE (Long Baseline Neutrino Experiment) operations was undertaken. The design is responsive to the vision articulated in the Snowmass report which highlights the opportunity for the U.S. to host a world-leading long baseline neutrino research program that would anchor a broader program of intensity frontier research. The plan is structured to deliver, in a cost effective manner, more than 1 MW of beam power to LBNE while creating a flexible platform for longer-term development of the Fermilab complex to multi-MW capabilities in support of a broader research program, as future resources become available.

Two options were considered:

1. 800 MeV superconducting pulsed linac
2. 400 MeV “afterburner” to the existing 400 MeV linac

Option 1 was preferred for reasons detailed in the report, which also speaks to the recommendation for a description of the needed R&D efforts, the international partnerships, other infrastructure needs, and the implications to the R&D efforts currently underway.

The results of the design study were presented to P5 in December and are publicly posted at :

<http://projectx-docdb.fnal.gov/cgi-bin/ShowDocument?docid=1232>

3. The reviewers requested the Scientific Computing Division to develop a plan for supporting software and computing needs for the neutrino experiments, which will fully engage and leverage other DOE national labs' expertise and resources. The plan must enable distributed simulations, data management, and analysis and should include a set of metrics to gauge the success of the plan based on user experiences, both on and off site. The plan should call out any re-prioritization and re-allocation of resources in the Scientific Computing Division needed to align the computing support manpower with Fermilab priorities, as is being done in the accelerator, detector, and research areas.

Fermilab is implementing a plan to provide the proper infrastructure, build systems, underpinning framework, and hardware resources that will provide environment from which experiments can develop the software that is unique to their detector situation. The table below summarizes the current state of use of the common computing tools across eight intensity frontier efforts

To further support the needs, a key person, with a track record for leading development efforts for CMS, has now taken charge of Software+Computing for LBNE. A team that leverages the underpinning ART/LArSoft framework to develop the reconstruction and simulation code necessary for LBNE to be successful is being assembled.

Below is a series of steps that being taken to further foster improved collaboration from both other Laboratories as well as Universities.

- Established the FIFE project -Fabric for Intensity Frontier Experiments. This effort provides a broad array of tools to experiments to help them carry out their mission, from author data bases, to bulletin board style chats, to build management systems, to document data bases etc. Experiments should just be able to just pick what they want and need. This is a broad effort – Argonne has just joined this effort and some Universities are helping as well.
- Writing a C++ course and will give it this summer. Hired a Professor to develop a C++ course for HEP experimenters -- we will give it this summer and video tape the classes so that others can benefit. After this summer, the plan will be to teach it again perhaps twice/year -- one in the summer and one in the winter. This should help develop a broad base of university students and post doc's who can write effective software.
- Improved Documentation -- putting together a workbook to teach graduate students and post doc's how to use the tools to do analysis. The workbook has lots of examples with answers that students walk through and learn how to work with the code. We have an initial version that is being beta tested now by 5 or 6 students... The next step in this workbook is to broaden it so that it not only covers ART/LArSoft but also job submission, SAM Data Handling etc. The idea

is that this book should shorten the learning curve for students and post doc's to do effective analysis – particularly remote ones that have less access to mentors.

- Established a development effort on GENIE – the IF event generator of choice. Hired Gabe Purdue as an associate scientist to lead this. This generator as it stands now does not do a sufficient job of modeling the data. With Gabe, Steve Mrenna and others, we hope to improve this and give the IF experiments the software modeling they need to be successful.
- Once these various initiatives are rolled out, SCD will take some customer satisfaction surveys and use that as a guide for where to improve moving forward.

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