

R&D Coordination (so far) for a future LAr long-baseline neutrino experiment at LBNF

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Talk Content

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R&D Coordination

- The R&D Coordination Committee has been tasked with evaluating all R&D projects, internal or external, that will contribute towards three areas: far detector and underground physics, neutrino beam design, and precision near detector measurements.
- RDCC charge (as defined in R&D briefing to DOE, May 2014): “LBNE RDCC identifies, categorizes, prioritizes and documents the R&D needs of LBNE for the beam, near, and far detectors. It maintains an R&D plan that will be carried out either within LBNE or in separately proposed external efforts. It provides its evaluations on impacts of independent specific programs or proposals for their relevance to LBNE R&D priorities upon request from the spokespersons.”



R&D Coordination

- LBNE established mechanism, through RDCC, to
 - Coordinate R&D activities within collaboration and with external projects to meet the LBNE goals.
 - Incorporate domestic and international collaborators within LBNE R&D framework.
 - Make recommendations to the management upon requests.
- RDCC identified categories of critical R&D efforts that could directly contribute to the construction project as well as efforts that are needed to ensure and enhance the scientific performance of the experiment.



R&D Coordination Committee Membership

From LBNE:

- RDCC Coordinators, (Zelimir Djurcic, Jaehoon Yu)
- Physics Analysis Working Group convener, (Jon Urheim)
- Physics Tools Working Group Convener, (Thomas Junk)
- Software and Computing coordinator, (Thomas Junk, Maxim Potekhin)
- 35-ton prototype technical coordinators, (Mark Convery, Michelle Stancari)
- 35-ton prototype hardware coordinator, (Alan Hahn)
- Collaboration spokespersons, (Milind Diwan, Robert Wilson, Maury Goodman)
- LBNE project director, (Jim Strait)
- Far detector manager, (James Stewart)
- Beam technical coordinator, (Alberto Marchionni)
- Beam manager, (Vaia Papadimitrou)
- Near detector manager. (Christopher Mauger)

From FNAL:

- the head of PPD or designated representative (Mike Lindgren)



R&D Coordination Committee Membership

Representative from each of the following efforts is invited to participate in RDCC meetings as a member:

- Coordinating Panel for Advanced Detectors (Craig Thorn)
- Materials Test Stand (Stephen Pordes)
- Photon Detection System (Norm Buchanan)
- LArIAT (Brian Rebel, Jen Raaf)
- CAPTAIN (Christopher Mauger)
- MicroBooNE (Regina Remeika)
- NA61 (Geoff Mills)
- WA-105 (Greg Pawloski, Thomas Kutter)
- Short-baseline Neutrino Experiments Coordinator (Peter Wilson)

-What we have established was an evolving R&D organization.



Summary of work we have completed so far

- Discussed R&D areas with Project/Collaboration Management
=> identified holes to be filled.
- Performed R&D survey to place/position new collaboration members within open R&D tasks
=> Collected information on expertise/interests of the collaboration members.
- Collaboration with “external” (non-LBNE) R&D efforts and experiments
=> used these as R&D platforms for R&D;
 - Established a process to evaluate impacts of independent specific programs or proposals, and their relevance to the LBNE R&D priorities.
 - Established task forces (so-called EPAGs to identify areas of R&D collaboration and produce review reports.
 - Example: EPAGs on CAPTAIN, LArIAT.



Summary of work we have completed so far

- Organized internal workshops to review R&D progress and identify on-going R&D issues
 - => LBNE R&D Workshop held at ANL March 22-24, 2014.
- Report at DOE Reviews/Briefings
 - => RDCC produced the summary document on R&D status and needs (please see LBNE docdb-8885) for the R&D briefing at DOE held May 12, 2014;
 - provided answers to questions raised at the review.
- Write reports to DOE and to the collaboration
 - => EPAG evaluations provided to spokespersons to inform DOE (examples: reports on CAPTAIN, LArIAT).
 - viewed as an important input to DOE funding planning process.



Summary of Current Critical R&D Tasks

(as presented in the document to DOE R&D Briefing May 15, 2014).

List of critical tasks and dates when these tasks need to be completed to have maximum impact on the design, construction and operation of the experiment.

- Detector design validation studies with 35-ton prototype 2017
- Demonstration of cold digital electronics 2017
- Design of the beam-line hadron monitor 2017
- Improved response of target materials to 1.2 MW proton beam 2017
- Beam muon measurement systems prototyping, simulations 2017
- Near Detector prototyping, verification of requirements, simulation 2018
- Investigation of LArTPC integrated with FGT Near Neutrino Det. 2018
 - Each major task consists of many sub-tasks.
- This list would need to be modified with evolution in the timescale, and with addition of dual-phase R&D to the single phase LAr readout R&D.



R&D items may further improve physics performance

(as presented in the document to DOE R&D Briefing May 15, 2014).

-Important but less critical in near term

-Conceptual work on these items should be pursued now

⇒ they could significantly affect the integration of the rest of the components in time for the experiment to capitalize.

- More efficient light collection systems 2018
- Improved argon purification 2018
- Improved cryogenic liquid processing (microphonics, maintenance) 2018
- Improved understanding of HV breakdown in LAr 2018
- Detector calibration test beam measurements 2021
- Development of target and horns for improved flux spectrum as soon as available
- Development of target and horns for 2.3 MW > 2025
- This list would need to be modified with evolution in the timescale, and with addition of dual-phase R&D to the single phase LAr readout R&D.



Evaluation of R&D Priorities

- Recently started an effort to further evolve the R&D prioritization process
 - initially R&D activities were oriented to placing new collaborators into existing R&D tasks, and by addressing some R&D tasks to External Projects.
- In addition we needed to define an R&D prioritization process for internal projects.
- Started discussions on
 - What kind of prioritization process we need?
 - What is useful for the project and collaboration?
 - What is useful for DOE and other funding agencies?
- Planned to have priorities ready for the full LBNE R&D Review.



Evaluation of R&D Priorities

- One example how it may work (to be further discussed) is given:
 - Categorize R&D needs as crucial/essential, beneficial, or secondary.
 - Derive scores to be used to order R&D needs.

	Crucial/Essential	Beneficial	Secondary	Score	Weight	Final Score
Can this R&D reduce construction time scale?	Sizeable Construction time reduction	Some Construction time reduction	No Construction time reduction			
Can this R&D reduce construction cost?	Sizeable Construction Cost reduction	Some Construction Cost reduction	No Construction Cost reduction			
Can this R&D improve physics performance?	Sizeable improvement	Some improvement	No improvement			
Can this R&D be completed in time to be capitalized?	Close but partial output can be within the time line	Too close to call within the time line	No way this can complete in the time for capitalization			
What are the time scale and cost of this R&D?	Can be completed within or close to the relevant time scale and medium cost	Can be completed very close to the relevant time scale and relatively high cost	Cannot be completed within the time scale on any budget			
Is this R&D within the scope of the experiment?	Reasonably within the scope of LBNE and will strengthen its case	Marginally within the scope of LBNE and may or may not strength its case	Not within the scope of LBNE			



Status Summary

- R&D Coordination Committee was established to coordinate R&D within collaboration, and in a relation to external experiments that may benefit the LBNF.
- 1st internal R&D review completed in March 2014
 - Assessed current status and schedule risks
 - Identified critical R&D tasks
 - Established plans
 - A snapshot document written and submitted to DOE as a supplementary material for the briefing panel
- 2nd review was planned in an appropriate time scale to track progress new structure
 - => the mechanism for this should be established within the new ELBNF Collaboration.



Status Summary

- Established Scheme to leverage expertise – both domestic and international
 - Two EPAG's established and completed their work, more was planned to come.
- Started developing ideas to establish CTAG: Internal Critical Task Assessment Group
 - To advise and evaluate focused critical R&D issues
- LBNE had a one day R&D briefing at the DOE S&C review in May
 - The panel reviewers and DOE managers seemed to be satisfied with our progress and organization.
 - Additional questions were raised, and the answers have been submitted to the leadership, and forwarded to DOE.
- Scheme for Prioritization being discussed
 - A draft prioritization rubric and procedure in place
- Need to understand how the E-LBNF will be structured and what RDCC's role would be in this new structure, if it still exists



Conclusions

- The LBNE Project has produced a well understood and reviewed design sufficient to baseline and construct the project without further extensive R&D
=> this is now evolving with the ELBNF.
- At the same time the LBNE Project is well positioned to take advantage of R&D in the US or internationally that may reduce cost or risks, or improve performance.
- R&D Organization effort was viewed as a very beneficial to both Collaboration and funding agencies (mostly DOE).
- We strongly recommend the new collaboration to establish an RDCC-like mechanism ASAP for efficient R&D coordination.

