Minutes of the 5th Meeting of the LBNF/DUNE Resources Review Board (Fermilab, November 2-3, 2017)

Attendees:

I. Allekote (CNEA, Argentina; remote)
R. Marcondes César (FAPESP, Brazil)
E. Elsen (CERN; remote)
M. Nessi (CERN)
G. Hamel De Monchenault (CEA/IRFU, France; remote)
P. Verdier (IN2P3, France; remote)
A. Caldwell (Max Planck Institute, Germany; remote)
F. Simon (Max Planck Institute, Germany; remote)
S. Bertolucci (Università di Bologna, INFN, Italy)
A. Masiero (INFN, Italy)
Y. Okada (KEK, Japan)
A. Aranda (Universidad de Colima, Mexico)
S. Bentvelsen (NIKHEF, Netherlands)
M. Martinez (IFAE, Spain)
A. Ereditato (Universität Bern, SNSF/SERI, Switzerland)
T. Medland (STFC, United Kingdom)
M. Procario (DOE, United States)
J. Shank (NSF, United States)

Fermilab: S. Holmes, C. Keaty (*Secretariat*), N. Lockyer (*Director*), A. Markovitz (*Chair*), E. McCluskey, T. Meyer, C. Mossey, H. Ramamoorthi

DUNE: E. Blucher (University of Chicago), A. Dave (Fermilab), E. James (Fermilab), M. Thomson (University of Cambridge)

LBNC: D. MacFarlane (SLAC)

Apologies Received: A. Etienvre (CEA/IRFU, France), J. Tagüeña (Conacyt, Mexico), M. Losada (UAN, Colombia)

Action Items

1. Resources Review Board (RRB) participants were asked to provide comments on proposed meeting dates by November 10 - no comments were received. The schedule for future RRB meetings at Fermilab is as follows:
    a. April 10-11, 2018
    b. September 13-14, 2018
    c. March 14-15, 2019
    d. September 19-20, 2019
2. RRB participants to provide comments on the draft charter by December 1, 2017; RRB charter to be finalized by January.
    a. Following discussion at the RRB, the charter will include an expectation of in person attendance at meetings.
3. RRB concurred with the recommendation to establish a Neutrino Cost Group (NCG), reporting to the Fermilab Directorate.
4. The Fermilab Director will issue a formal charge to both the Long-Baseline Neutrino Group (LBNC) and the NCG. The NCG charge will include a focus on conducting cost/schedule reviews of the Technical Design Reports for DUNE, but also will include applying a common methodology to value international contributions to LBNF, PIP-II, and SBN.
5. Each RRB participant will review the Collaboration Resources Board membership list to ensure the appropriate collaboration member connected to their funding agency/institution is identified.
6. The next RRB meeting will be on April 10-11, 2018 at Fermilab. Fermilab will notify participants whether an INC meeting will be held on April 12. At the next meeting of the RRB, the DUNE Collaboration will present:
    a. Updated DUNE management structure, as discussed with Fermilab as host lab
    b. Technical Proposal and TDR requirements and timeline, as discussed with the LBNC and NCG
    c. Common funds/common projects proposal for construction
    d. Timeline and process for agreements with international funding agencies/institutions contributing to DUNE
7. Also at the next RRB in April 2018, the RRB will receive updates from the Projects and funding agencies/institutions on the status of international contributions and opportunities. The LBNC and NCG also will provide reports.

Introduction

A. Markovitz, RRB Chair, welcomed the members and participants to the Fifth Meeting of the RRB, expressed the goals of the meeting, and provided a summary of recent milestones for LBNF and DUNE. These include:

- July 21, 2017: LBNF/DUNE groundbreaking in South Dakota, attended by representatives from the White House, members of Congress, and international funding agencies
- August 9, 2017: Contract awarded to Kiewit/Alberici Joint Venture (KAJV) to begin laying the groundwork for the excavation for LBNF
- August 15, 2017: DUNE collaboration welcomes 1,000th member- Vitor Prestes Luzio from Brazil
- August 28, 2017: As the two protoDUNE cryostats are nearing completion, the first APA module arrived at CERN and will be installed in November, after testing.
- September 20, 2017: UK announces $88M in contributions for LBNF/DUNE

In addition, Fermilab continues to enter into agreements to facilitate contributions from international funding agencies.

Director's Report, N. Lockyer

N. Lockyer, Fermilab Director, detailed the significant support for the LBNF/DUNE project as expressed by international partners (including commitments by CERN and the United Kingdom), the White House, the Department of Energy, the U.S. State Department, and members of Congress.

- White House Deputy Assistant to the President Michael Kratsios, OSTP, attended the LBNF/DUNE groundbreaking in South Dakota and stated at the time: "Today's groundbreaking for the Long-Baseline Neutrino Facility . . . serves as a model for what the future of mega-science research looks like: an intensely collaborative effort between state, local and federal governments, international partners, and enterprising corporate and philanthropic pioneers whose combined efforts will significantly increase our understanding of the universe."
- Energy Secretary Rick Perry stated at the time of the LBNF/DUNE groundbreaking: "The start of construction on this world-leading science experiment is cause for celebration, not just because of its positive impacts on the economy and on America's strong relationships with our international partners, but also because of the fantastic discoveries that await us beyond the next horizon. I'm proud to support the efforts by Fermilab, Sanford Underground Research Facility and CERN, and we're pleased to see it moving forward."
- Members of U.S. Congress have expressed their support for the project, including statements at the time of the groundbreaking and letters of support.

N. Lockyer provided an update on the U.S. budget process. A Continuing Resolution is in effect through December 8, and the budget discussions reflect support from Congress for LBNF/DUNE. N. Lockyer also provided an update on other activities at Fermilab, including celebrations this year of the lab's 50th Anniversary, future construction planned at the lab, and progress on SBN and PIP-II.

Role of the RRB, A. Markovitz

A. Markovitz discussed the RRB role, scope, and objectives. The primary review by the RRB is of the DUNE collaboration, as an international collaboration managed by co-spokespersons elected by the collaboration. In addition, as LBNF, PIP-II, and SBN are related to the overall efforts to develop the world's flagship neutrino project, and as they include international contributions, the RRB will receive updates on those projects as well.

A draft charter for the RRB was proposed and discussed. A copy of the charter was provided on the RRB Indico site for review and comments by December 1. Approval of the RRB charter is expected by January 2018.
With respect to the charter, a few items were discussed:

- RRB membership includes the funding agencies that have committed to support LBNF/DUNE/SBN/PIP-II. However, during this period of project development, other funding agencies/institutions are permitted to attend as observers upon approval of the RRB Chair. The RRB may revisit this policy at some point in the future.
- The charter will add a provision that the expectation is for in person attendance at RRB meetings; substitutes/additions for RRB participants are permitted upon approval of the Chair.
- The managements of the DUNE Collaboration and the LBNF Project participate in the RRB meetings and make regular reports to the RRB on technical, managerial, financial and administrative matters. In addition, the RRB receives regular reports on the progress of PIP II and SBN, as well as the status of international contributions to those projects.
- The LBNC and NCG provide updates to the RRB, including whether to endorse the Technical Design Reports for DUNE.
- The charter articulates the roles of the RRB.

The process for RRB meeting minutes was discussed. Minutes will identify specific action items and other deliverables, reflect Board resolutions, and provide a summary of the discussion topics. Generally, detailed agency-specific discussions will not be included in the minutes. Participants will be provided with an opportunity to review draft minutes before they are finalized. Minutes will be finalized before the next RRB meeting and made publicly available.

Dates were proposed for upcoming RRB meetings through September 2019, occurring twice a year. Feedback on the proposed schedule was requested by November 10; no comments were received. The RRB schedule is as follows:

- April 10-11, 2018
- September 13-14, 2018
- March 14-15, 2019
- September 19-20, 2019

In addition, the RRB discussed the objectives for its upcoming meetings. Those objectives were identified as follows:

April 10-11, 2018

- Reports from DUNE on:
  - Updated DUNE management structure
  - Technical Proposal and Technical Design Report requirements and timeline
  - Common funds proposal for construction
  - Timeline and process for agreements with international funding agencies contributing to DUNE
- Updates from LBNC and NCG
- Updates from Fermilab, projects, and funding agencies on international contributions status

September 13-14, 2018

- Reports from LBNC and NCG on their evaluation of the DUNE Technical Proposals
- DUNE and LBNF provide updates on status of international contributions and timeline for agencies to enter into agreements
- DUNE provides updates on allocation of common funds and expectations for funding agencies
- DUNE report on Computing consortia

March 14-15, 2019

- Funding agencies confirm commitments identified on DUNE funding matrix, to be formalized following TDR approval
- DUNE presents common funds proposal and agreement language, to be finalized following TDR approval
- DUNE Computing consortia discussion, including expectations for funding agencies

September 19-20, 2019

- Reports from LBNC and NCG on their analysis of the TDRs for DUNE and their associated conclusions
- Presentation from LBNF on CD 2/3b elements for the far site, to be presented to DOE in October 2019
- RRB considers and, if appropriate, approves Technical Design Reports for DUNE consortia for the far site

- DUNE collaboration confirms deadline and expectations for funding agencies to enter into agreements to reflect scope of commitments as reflected in the TDRs; agreements would also include appendix on common funds

Status of LBNF, C. Mossey

C. Mossey, Deputy Director for LBNF, provided information on the LBNF project, including updates on progress since the May 2017 RRB meeting. This progress includes the July 21 groundbreaking, the award of the Construction Manager/General Contractor (CM/GC) contract to Kiewit/Alberici JV and the subsequent issuance of the notice to proceed, and progress on other contracts. In addition, the cryostat design is progressing, including an improved design that better defines the penetrations needed for the Far Detector (FD) and cryogenics. In addition, CERN is initiating the start of the GTT membrane design this fall.

With respect to the beamline, the Experiment Facility Interface Group (EFIG) recommended implementation of an optimized design that will have the equivalent of increasing the mass of the Far Detector by 70%.

In addition, the international project milestones were communicated to the RRB. These milestones were developed with the DUNE collaboration, LBNF, CERN NP, DOE, and Fermilab leadership. They reflect coordination between the facility, experiment, and across the consortia, as well as the coordination of international deliverables. These milestones are as follows:

- 2019: Start Main Cavern Excavation
- 2022: Start Detector #1 Installation
- 2026: Beam on with two detectors

C. Mossey discussed the status of international in-kind contributions to LBNF, including CERN which is designing and building the first membrane cryostat, contributions from the U.K./RAL, as well as participation and ongoing discussions with other international partners. Additional possibilities for international contributions to LBNF were also described.

Finally, upcoming key events were identified, including completion of the final design for excavation. The project is on track to initiate pre-excavation work in 2018.

DUNE Status and Milestones, E. Blucher

E. Blucher, DUNE co-spokesperson, discussed the status and milestones for DUNE. The collaboration continues to grow. At the time of the meeting, it had 1,041 collaborators from 176 institutions in 31 nations. Sixty percent of the institutions are non-U.S. Eleven new institutions joined at the August 2017 collaboration meeting.

Since the last RRB meeting, the collaboration completed a major reorganization, moving from Far Detector working groups to consortia of institutions that will take responsibility for detector sub-systems. This organization, which is similar to the LHC experiments, will allow institutions to take responsibility for concrete deliverables. The consortia will be responsible for preparing technical proposals (TPs), TDRs, and will help to establish the required funding matrix.

As discussed at the last RRB meeting, the collaboration has agreed to transition to a new Executive Committee (EC) in May 2018, as its role changes from planning to execution. The plan for this transition will be presented at a January Institutional Board meeting. The RRB discussed the technical coordination roles and consideration by DUNE of a potential consolidation. The RRB will be updated on this new structure at its April 2018 meeting.

E. Blucher described DUNE's strategic goals through 2019, including:

- Construction and operation of large-scale prototypes at CERN
- Preparation of DUNE TDRs for LBNC review
- Enlarging the collaboration, and defining the responsibilities of the near and far detectors
- Establishing a resource matrix for construction of DUNE, and ensuring that funding for the TDR scope is in place by 2019

Progress on the detector technologies was discussed. Two liquid argon Far Detector technologies, single-phase (SP) and dual-phase (DP), are being prototyped at CERN. Both protoDUNEs aim to begin taking data in mid-2018.

The goal is to settle on a Near Detector (ND) concept by May 2018, with a TDR review for the ND in the summer of 2020. The collaboration has a detailed plan, including interim workshops, to reach a decision in May 2018 approved by the collaboration EC. Following a decision on the detector concept, the collaboration will form ND construction consortia.

Upcoming DUNE milestones were reviewed, sequenced to correspond with the international project milestones, including the start of detector #1 installation in 2022. In general, DUNE has made substantial progress in the past few months, including with the protoDUNEs and the formation of the far detector consortia. Challenges in the year ahead include completing, commissioning, and running the protoDUNEs, completing the TPs for the Far Detector, and deciding on and developing the Near Detector concept.

DUNE Detector Construction: towards a funding matrix, M. Thomson

M. Thomson, DUNE co-spokesperson, discussed progress by the DUNE collaboration to develop a funding matrix to support construction of the Far Detector. The goal is to develop the funding matrix for the Far Detector TDRs by mid-2019, including scope for at least two of the four Far Detector modules. Ultimately the goal is to develop a funding matrix for the full experiment.

The collaboration approach is to build consortia of institutions responsible for a particular system, analogous to the detector-system collaborations within the LHC experiments. This approach begins by identifying interests within the collaboration; the institutions identify the Work Breakdown Structure (WBS) elements where they wish to take responsibility. Then, the collaboration and its members will iterate with the funding agencies with the goal of a final funding matrix for the far detector TDRs, agreed to by the RRB, in 2019.

DUNE is pursuing two liquid argon TPC technologies, a single phase and a dual phase. DUNE intends to deploy both technologies. Of the nine consortia defined to date, three are SP, three are DP, and three are joint (SP/DP). Details of the consortia structure are defined in the DUNE Management Plan. Leaders have been elected for the consortia, as well as a technical lead who acts as a project manager. The consortia each have a board with a representative from each institution. There also is an internal project management board with representatives from each contributing national project. The consortia leadership reflects the international nature of the collaboration. Leaders are from countries including the U.K., Brazil, U.S., France, CERN, and Spain. The leadership of the CRP consortia for the dual phase detector has not yet been identified, and as a result the areas of interest for that consortia are not yet defined.

In October 2017, the consortia mapped institutional interests of the consortia members on to the WBS. This serves as a first iteration of a responsibility matrix. While it is not yet linked to funding, it identifies the areas of interest expressed, and was used to communicate those interests of the collaboration members to RRB members who represent the funding agencies/institutions. In some cases, funding agencies have committed to the interests expressed by collaboration members (e.g. U.S. DOE and U.K) and in other cases, the charts were used to communicate the interests of collaboration members to their country's funding agencies/institutions.

Based on expressions of interest, for presentational purposes the model was proposed as a 2+1+1 model – including two Single-Phase FD modules; 1 Dual-Phase FD module; and 1 uncovered FD model (TBD). The areas of interest also were used to identify opportunities for additional participation by existing or new collaboration members—this includes areas of opportunities with all of the consortia plus a fourth detector module.

For the Near Detector, the design remains more open; an agreed upon-collaboration concept is planned in May 2018, followed by a conceptual design report (CDR) in 2019. Initial interests have been expressed by various countries in this area as well. There are outstanding questions, and the collaboration has agreed upon a process and milestones to address them.

At the next RRB, an updated allocation of interests will be presented, as well as identification of available opportunities.

With respect to computing, this model is being developed by a DUNE computing coordinator with the intent to have a conceptual design report by 2019. The RRB will hear from DUNE on computing at the September 2018 RRB meeting.

Plans for Review of the Far Detector, E. James

E. James, DUNE Technical Coordinator, spoke about the planned path forward for reviewing the technical readiness, cost, and schedule of the Far Detector.

The consortia were established this past summer, and initially have been focused on three areas: further refining the subsystem technical designs, defining the consortia scope as documented in the global DUNE WBS, and developing a mapping between the interests of the consortia institutions and the deliverables associated with the WBS elements. This initial mapping has been completed, and the interested institutes are pursing funding support for the required activities; in addition, unassigned areas represent opportunities for additional institutions or assignment of some items to a common fund.

The Collaboration has defined a plan for the development and review of Technical Design Reports on an aggressive timescale consistent with collaboration requirements. DUNE management will work closely with the Long-Baseline Neutrino Committee (LBNC) and the Neutrino Cost Group (NCG) to define the documentation requirements and ensure a smooth review process. The next steps include the following:

- The initial step will be to be to prepare a Technical Proposal, to be completed in the spring of 2018. The TP will include: a compressed technical description of the proposed detector subsystems broadly following the proposed TDR report structure; preliminary subsystem cost estimates; and a preliminary assignment of institutional responsibilities for the subsystem deliverables.
- The LBNC and NCG will review the TP, with a report expected by July 2018
- The Collaboration expects to complete full Technical Design Reports for the Far Detector modules by the spring of 2019. The TDRs will include: a full technical description of proposed detector subsystems; validation that the proposed subsystems meet the DUNE physics requirements; complete subsystem cost estimates; and a final assignment of institutional responsibilities for the subsystem deliverables.
- The LBNC and NCG will review the TDRs, with a final report expected in August 2019

The current experience with the full-scale module production of the protoDUNE will substantially assist in preparing the cost estimates. The collaboration will work with the NCG to define what is needed in terms of deliverables for those estimates. The collaboration is seeking to capture both M&S costs and the required number of labor hours.

Resource Coordination Report, A. Dave

A. Dave, DUNE Resource Coordinator, spoke about the Collaboration Resources Board (CRB) and plans for establishing common funds for the collaboration.

The CRB member is the contact person from the collaboration representing the proposed interest/responsibility of individual institutions, and serves as the connection with the funding agencies of that institution at the national level. RRB members were asked to review the list of CRB members connected with a country/funding agency to ensure the appropriate designation, and the active engagement of that representative in the CRB process. CRB members will work with their respective funding agencies/institutions to ensure timely signatures on agreements to assure funding commitments aligned with the collaboration's responsibility matrix. CRB members also will review the collaboration's recommendations for a common fund and common projects prior to the request for RRB approval. During construction, the CRB will validate and review distribution of common funds for approved expenses.

The collaboration is developing a proposal for a common fund to address activities not assigned to a specific institution/agency. Currently the collaboration is developing a detailed list of items that may be included in a common fund, and also is developing a methodology for assigning common fund contributions to institutions/funding agencies. Common funds/common projects initially would focus on the completion of the detectors, and could include in-kind contributions. The model used for the LHC experiments is being reviewed.

The collaboration also will develop agreements to (1) document the scope and schedule of deliverables from each funding agency/institution to DUNE; and (2) detail the commitment to contribute to a common fund for DUNE, as well as the method of allocation. CRB members will be asked to work with their respective RRB members to keep them informed and to understand the processes for agreements in their nation's funding agency/institution.

Deliverables for the next RRB meeting include: (1) a recommended list of expenditures categorized by cost type, (2) a recommended cost and cost profile associated with construction and operation common costs, (3) a recommended methodology for contributing to common funds, and (4) a recommendation on an agreement structure.

Around the Table Discussion

RRB participants conveyed the status of activities and involvement in the Projects by their respective funding agencies/institutions.

LBNC Update, D. MacFarlane

D. MacFarlane, LBNC Chair, spoke regarding the progress, status, and plans for the group. The LBNC provides an independent review of the scientific, technical, and managerial decisions of the DUNE collaboration, including a review of the TDRs.

In terms of organization and process, the LBNC met three times in 2017. In between meetings, it has established ten referee subgroups which maintain regular contact with identified LBNF/DUNE points of contact. The LBNC prepares reports following each meeting, including recommendations to LBNF and DUNE.

In the view of the LBNC, this effort has come very far in a short time – including a vigorous, truly international science collaboration in DUNE; a further-strengthened LBNF organization; suitable management structures and oversight for the projects; a science strategy satisfying P5 requirements; successful completion of a DOE CD-3a review for LBNF far site construction; and an established protoDUNE organization to validate the DUNE engineering design.

The LBNC met most recently at Sanford Lab in South Dakota at the end of October. The LBNC recognized the significant progress since the previous LBNC review in June – both with respect to LBNF developments at the far site and progress with the protoDUNE at CERN. D. MacFarlane detailed how the projects had responded to the previous recommendations from the LBNC in the June-October timeframe.

New recommendations from the LBNC for DUNE include – hearing a proposed mechanism for documenting the flow down from physics to technical requirements in DUNE; developing a list of questions and factors that will influence the computing model, with a prioritization of those factors in terms of likely cost and schedule impact. For LBNF, the LBNC noted that the project is well-placed to execute the far site project once funding becomes available, and will need additional attention to address procurement, legal, tax, liability, and real estate matters.

Going forward, the LBNC will turn to reviewing the Technical Proposal and TDRs. This review will take place in close coordination with the NCG.

Plans for a Neutrino Cost Group, A. Markovitz

At the last RRB meeting, members proposed the formation of a cost group to provide assurance of the cost and schedule for the DUNE collaboration. A. Markovitz presented a recommendation to establish a Neutrino Cost Group (NCG) to review the cost, schedule, and associated risks for the DUNE experiment, as reflected in the Technical Design Reports. The group's name reflects that it would also value the international contributions to LBNF, SBN, and PIP-II. Cost/schedule reviews for those projects would proceed separately.

The overall goals of the LBNC and NCG were shared, and will be reflected in a charge from the Fermilab Director to those two groups. The new NCG will be modeled after the Upgrade Cost Group established to review the cost and schedule for the CERN LHC experiment upgrades. The NCG will report to the Fermilab Directorate, provide progress reports to the RRB, coordinate with the LBNC, review the cost, schedule, and associated risks for the DUNE TDRs, provide a recommendation to the Fermilab Directorate following its review, and establish a uniform process for determining the value of international contributions to LBNF, PIP-II, and SBN, following the same valuation model developed for DUNE. Subgroups may be established to evaluate specific TDRs.

The NCG and LBNC will provide instructions to the DUNE collaboration regarding the requirements for submission of the TP and TDRs. The NCG will work with the LBNC to determine the sequence of reviews. Certain elements of cost for the NCG review will be submitted via a confidential cost matrix. Upon a positive TDR review, the LBNC and NCG will recommend to the Fermilab Directorate the acceptance of the technical design, cost estimate, and schedule as firm baselines for the DUNE project. The LBNC and NCG then will provide reports to the RRB summarizing their respective review and recommendation, for endorsement by the RRB.

The group discussed that the reviews by the LBNC and NCG would be an international review, rather than a U.S. review. The RRB agreed that a cost group should be formed.

Status of the Neutrino Platform at CERN, M. Nessi

M. Nessi, CERN and University of Geneva, discussed the status of the neutrino platform at CERN. This effort originated with the 2013 European strategy, which concluded that CERN should develop a neutrino program to pave the way for a substantial European role in future long-baseline experiments. The initial mandate was developed in 2015, and led to a MOU framework to define the interactions for a CERN neutrino platform. As of November 2017, CERN has reached agreements relating to the neutrino platform with 106 institutions (64 from the E.U.).

Relating to the CERN involvement in this area, six major projects have been approved, and a few additional projects are in the pipeline. These activities include ICARUS as a far detector for the SBN program at Fermilab; two protoDUNEs constructed at CERN as prototypes for the DUNE single phase and dual phase detectors; participation in the LBNF cryostat activities (including a commitment to deliver the first cryostat); and active participation in the DUNE program (including hardware, physics).

The RRB received updates on the following activities of the CERN neutrino program:

- NP05 collaboration (Baby MIND) and NP03 (Wagasci/Baby-MIND)
- NP01 collaboration (WA104-ICARUS) which included the transportation of ICARUS from CERN to Fermilab this past summer. M. Nessi articulated CERN's commitment to a comprehensive SBN physics program at Fermilab, and its importance to allow verification of all technology aspects before large-scale application in LBNF/DUNE.
- NP02 and NP04 (protoDUNEs). M. Nessi detailed the substantial progress in developing the protoDUNEs. Developments include: cryostats for both protoDUNEs are nearly complete; the internal cryogenics are being assembled; the first Anode Plane Assembly (APA) for the single-phase detector has arrived and is undergoing testing; the online computing farm is active; and installation of beam lines has begun. The critical remaining installations include the five APAs for single-phase, and the four Charge Readout Planes (CRPs) for the dual-phase, both of which are driving the

schedule. As protoDUNE is verifying the construction and operational concept of LBNF/DUNE, it constitutes a fundamental milestone for the project.

- Near Detectors Forum. M. Nessi provided an update on the ongoing near detector discussions.
- LBNF Cryostat. CERN is building the first cryostat for LBNF. A final design review took place at SURF in August 2017. The design was discussed as well as requirements for installation. The overall cryostat schedule is compatible with the start of installation at SURF in 2021.

Going forward, CERN will continue to discuss formal agreements relating to the delivery of the cryostats and future activities.

Discussion with Mike Procario, U.S. DOE

M. Procario, U.S. Department of Energy, provided his perspective on LBNF/DUNE. He indicated that the project has strong support from both DOE and the U.S. Congress. The group discussed the International Project Office (IPO) for DUNE. Participation in the IPO is welcomed from all partners, including international, and particularly those with expertise managing a large project. Suggestions on how the office should be run and staffed are welcome. Certain host lab responsibilities would be outside of the project. The collaboration leadership indicated that they welcome international participation in the IPO, and would prefer to locate a core group at Fermilab.

With respect to the Cost Group, there is a desire to value and recognize international contributions to all aspects of the neutrino efforts hosted by Fermilab – this would include DUNE, LBNF, PIP-II, and SBN. The RRB will continue to discuss this topic at subsequent meetings.

The group also discussed matters relating to international travel, including potentially discussing this matter when setting up agreements. Feedback was requested from NSF based on its experience.

Status of PIP-II and SBN, N. Lockyer

N. Lockyer discussed the status of PIP-II and SBN. The goals of PIP-II include delivering world-leading beam power to the neutrino program and providing a platform for the future. Specifically, the design includes delivery of >1 MW of proton beam power over the energy range of 60-120 GeV, at the start of LBNF operations. R&D has been underway for several years, including superconducting radio-frequency (SRF) technologies. A mission need statement (CD-0) was approved by DOE in November 2015, and a CD-1 review is scheduled for December 2017.

With respect to international contributions to PIP-II, discussions are underway with several countries, including India/DAE, Italy/INFN, UK/STFC, and France/CEA/IN2P3. Additional opportunities remain.

For SBN, ICARUS arrived at Fermilab from CERN (and originally INFN) in July 2017, with installation to take place next year, and liquid argon fill in late 2018. Also, for SBND, TPC fabrication is progressing well, with UK and US involvement. Both ICARUS and SBND involve substantial international contributions. SBN is technically well advanced, with management challenges undergoing review.

Discussion of the Roadmap to Fall 2019 and Closeout, A. Markovitz

A. Markovitz reviewed the timeline and expectations for the RRB to meet the current objective of reviewing and, if appropriate, approving the TDRs for the DUNE Far Detector in September 2019. Topics and deliverables for each RRB meeting from now through that date were outlined, as detailed above. The RRB also discussed the need to concurrently develop and execute agreements reflecting the commitments from funding agencies/institutions supporting DUNE. It was noted that some agreements may be with funding agencies and others may be with institutions, depending on the structure and processes within each country.

In addition, C. Mossey conveyed that Fermilab is addressing issues relating to its responsibilities as a host laboratory and relevant developments will be communicated to the RRB.

The action items from the meeting, as reflected above, were communicated to the group. In addition, the RRB will receive a document outlining the path forward to 2019, incorporating changes suggested by participants. It also was suggested that a common document describing the projects for use by different agencies/institutions may be useful to develop. Any input for this document should be provided to the RRB Chair.

There being no other business, A. Markovitz thanked the attendees and closed the meeting. The next RRB will be held on April 10-11, 2018 at Fermilab.

The RRB meeting was adjourned.