Minutes of the 12th Meeting of the SBN Oversight Board
(Fermilab, March 12, 2021)

Committee Attendees:

S. Bertolucci (INFN, Italy)
S. Brice (Chair)
J. Evans (UK)
A. Ereditato (Switzerland)
A. Guglielmi (ICARUS Deputy Spokesperson)
O. Palamara (SBND Co-spokesperson)
C. Rubbia (ICARUS Spokesperson)
M. Shaevitz (US NSF)
D. Schmitz (SBND Co-spokesperson)
R. Wilson (ICARUS Deputy Spokesperson)

Committee Absentees:
M. Nessi (CERN)

Non-Committee Attendees:
M. Del Tutto (Speaker), A. Fava (ICARUS Commissioning Coordinator), E. Johnson (Secretariat), K. McFarland (IB Chair), P. Wilson (SBN Program Head)

Action Items

No Action Items

Introduction and Review of Last Meeting

S. Brice, SBN Oversight Board Chair, welcomed the members and participants to the Twelfth Meeting of the SBN Oversight Board, there were no actions item up for discussion.

SBN Project Update, Peter Wilson

P. Wilson, SBN Program Head, presented slides and update on SBN Project.

Work continues on-site with the same access restrictions and safety protocols of the past six months. For planning purposes, we are assuming that access restrictions and work rules will remain in place at least through the summer of 2021. There has been progress in many areas of SBND. On the Light Systems, all PMTs were mounted in the photon detector system boxes at LANL and delivered to Fermilab, cold testing continues with an improved light injection system. DAQ and Electrical Installation interface are fully implemented, functional and ready for reception test on power supply. The PMT electronics rack is being prepared for installation. The White Rabbit timing system is being integrated into the DAQ readout. Final preparation for the TPC Assembly is in progress and expect to be ready by early April. There is activity on Installation, expected to be completed in April. The first two (of three) shipments of membrane cryostat materials were delivered from South Korea to Fermilab. CERN shipment of ICARUS Top CRT modules are due

at Fermilab within a few days. Leak check of welds on warm vessels are just about complete, arranging for touchup welding in a few areas. Cryostat Top Cap fabrication has been completed at CERN, schedule for delivery to Fermilab is under discussion. Progress on Cryogenics piping assemblies for the LAr and LN2 dewar system are being fabricated and installation will start soon.

ICARUS Commissioning Angela Fava

A. Fava, ICARUS Commissioning Coordinator, presented slides and update on the Commissioning of the ICARUS Detector.

Detector filled with liquid argon and in stable operations at nominal drift field 500 V/cm since the end of August. Cosmic-ray interaction events collected with random 5 Hz trigger, data being analyzed for calibration purposes and measurements of electron lifetime. Also, collecting additional runs for specific commissioning tasks. Initial trigger setup on the Booster neutrino beamline which allowed to observe first neutrino interactions. Cryogenics system overall is stable and fully operational. South-East condenser started in February is performing strong and steady. All GAr filter regenerated. Venting procedure continues twice daily, LAr level to be re-topped later this month. Electron lifetime has improved up to almost 2.5/3 ms in West/East cryostat. There are plans to improve the electron lifetime. External warm filters are being constructed at CERN and will be added to the gas collection system sometime in May. Studies on the TPC electronic noise have demonstrated that the imperfections were due to the baseline. There has been slight movement; however, further investigation remains. Improvement on the PMT equalization is being developed. The last CRT wall was installed, electronic installation and cabling in progress. Plans for the installation of vertical support structures to start in April. Due to the use of the artdaq configuration database and upgraded online software, the DAQ and online systems are performing much better. The updated online monitoring suite includes live measurements of the LAr electron lifetime in the detector. Studies show stable operations, processing ~100 tracks every 15-20 minutes and provides immediate feedback. The integration of purity monitoring into the online monitoring system is a significant milestone. An initial simplified trigger system was setup aimed at verifying the correctness of the trigger chain is functioning, as well as exercising the synchronization of the DAQ components.

SBN Working Groups, Ornella Palamara

O. Palamara, SBND Co-spokesperson, presented slides and update on the Joint Working Groups.

The results and success based on Angela's presentation has shown a lot of the work going on with the involvement of the SBN Working Groups. Reiterated the common efforts critical for ICARUS success. Provided an update on all the working groups. The DAQ and Data Pre-Processing WG developments on TPC readout tests were completed. Delivery of PMTs, integrating White Rabbit Timing system into DAQ and the designing of detector top cable trays. Slow Controls WG developments on web-based displays expanded, first pass for PMT and TPC web displays, beam monitoring, controller and monitoring for power supply are ready for reception tests. Cosmic Ray Tagger WG sides of the ICARUS detector have been covered with the CRT modules, all modules of the Top CRT in transit to FNAL, bottom layer of CRT installed and commissioning of the side CRT in progress. Analysis Infrastructure WG - subgroups are being setup within to ensure high

quality data management and infrastructure. Other recent activities being develop are common analysis files modeled after files used by NOvA and DUNE, database production for accurate tracking and reducing file size. Analysis WG presented the SBN status at the Physics Advisory Committee (PAC) Meeting on December 8, 2020. The topics presented were event simulation, selection and reconstruction, update on oscillation sensitivity studies, detector systematics and highlighted the First ICARUS data/Monte Carlo comparison. The groups continue to make progress on all these topics. Plans for SBN Analysis Workshop sometime around mid-April. Shared "thank you" letter from Nigel on the presentation from the Analysis WG at the PAC meeting. Included notes from the PAC that the development of the common analysis framework is essential for reaching the core science goals of the SBN program and reaffirms its strong support for this effort. They also commend on the SBN analysis effort for incorporating the inputs from ProtoDUNE-SP and the first ICARUS data into simulations.

The excerpts from the December 2020 PAC report acknowledged an array of recent progress in simulation, selection and reconstruction. Also, significant improvements in detector description and event reconstruction. Despite the limitation imposed by the pandemic the SBN Analysis WG was able to maintain regular meetings, organized two workshops, and present tutorials on software tools. More importantly, the Analysis WG presented the first pass of muon neutrino event selection from the efforts of combining the three systems. The PAC strongly encourages SBN to develop a scheme for incorporating the latest understanding of detector effects into modeling of projected oscillation sensitivity. They also encourage the collaboration to quantify the impact of cross section uncertainties of the SBN physics program, particularly on the sterile neutrino search. The recommendation for the Analysis WG was to support the ICARUS collaboration in using the common tools developed in SBN to quantify the sensitivity of running ICARUS in the single-detector mode and assess computing needs. The PAC would like the joint SBN Analysis WG to develop a study of effectiveness of the overburden for both the ICARUS and SBND detectors. Comparisons are in progress and plans for a PAC meeting is scheduled for Spring 2021 to review these findings.

Comment on Overburden Studies:
Concerns on how it would be done and that it should be discussed within the collaborations prior to a joint discussion.

SBND and ICARUS Overburden Studies, Marco Del Tutto

M. Del Tutto, Speaker, presented slides that covered overburden studies.

The purpose of a concrete overburden would be to reduce this activity in the detector. Plans to install a 3-meter thick layer of concrete above the SBND and ICARUS detector for cosmic-ray shielding. SBND studies started in January 2020; ICARUS studies based on the same analysis code started in October 2020. First pass of comparisons done before the December 2020 PAC. Studies of three configuration were performed. For each configuration the studies were on the cosmic primaries entering the detectors and the electromagnetic activity produced inside the detectors. Detailed comparison of numbers for all configurations between SBND and ICARUS in progress but not completed. Studies showed how important it is to have a proper description of SBND and ICARUS geometries simulations. Some issues occurred with the geometry

implementation in both SBND and ICARUS. When adding the overburden, more primaries enter the SBND then in ICARUS. More work is needed with the help of experts who know the geometry details of the detectors.

Report SBN IB, Kevin McFarland

K. McFarland, IB Chair, presented update that covered the Institution Board.

The possibility of Kevin stepping down has not materialized. The committee is writing By-Laws for SBN IB that includes election of a deputy. Expect to vote on the By-Laws at the April IB meeting. The important business for SBN IB are the rules-writing committees. Drafts from three of the writing committees were presented at the February IB meeting. A fourth committee (D3C) responsible for coordinating the joint computing work between the experiments will be presenting at the April meeting. Discussions from the last meeting focused on determining if results will use SBN or collaboration process based on the data sharing agreement, coordination between the different functions and involvement of the SBN Analysis organization for joint analyses. The next steps for the committees are to respond to feedback, continue soliciting feedback from SBND, ICARUS, IBs and leadership. Other business includes possible formation of SBN Young Scientist group, propose adding representatives to SBN IB. The IB webpage has been released that includes public summaries of IB minutes. Next meeting in April.

More Discussions/Comments on Overburden

As mentioned earlier, studies have been completed but more work still needs to be done. Propose a meeting with the experts to improve the geometry. Would be able to compare the results and start writing the document with what we have now, then update. Need about two months to update the geometry, review the results of the analysis and look at the neutrino in ICARUS. It would be wise not to have a special (PAC) meeting but prepare for the regular PAC meeting on June 7th. This request should be taken up with the collaboration. The collaboration will be holding a two-day meeting (March 16 – 17) can introduce this proposal. Because of travel restrictions, more communication is needed, propose to put out a subjective agenda earlier than usual for the next meeting.

The SBN-OB meeting was adjourned.

Next meeting 3 months from now June 11, 2021