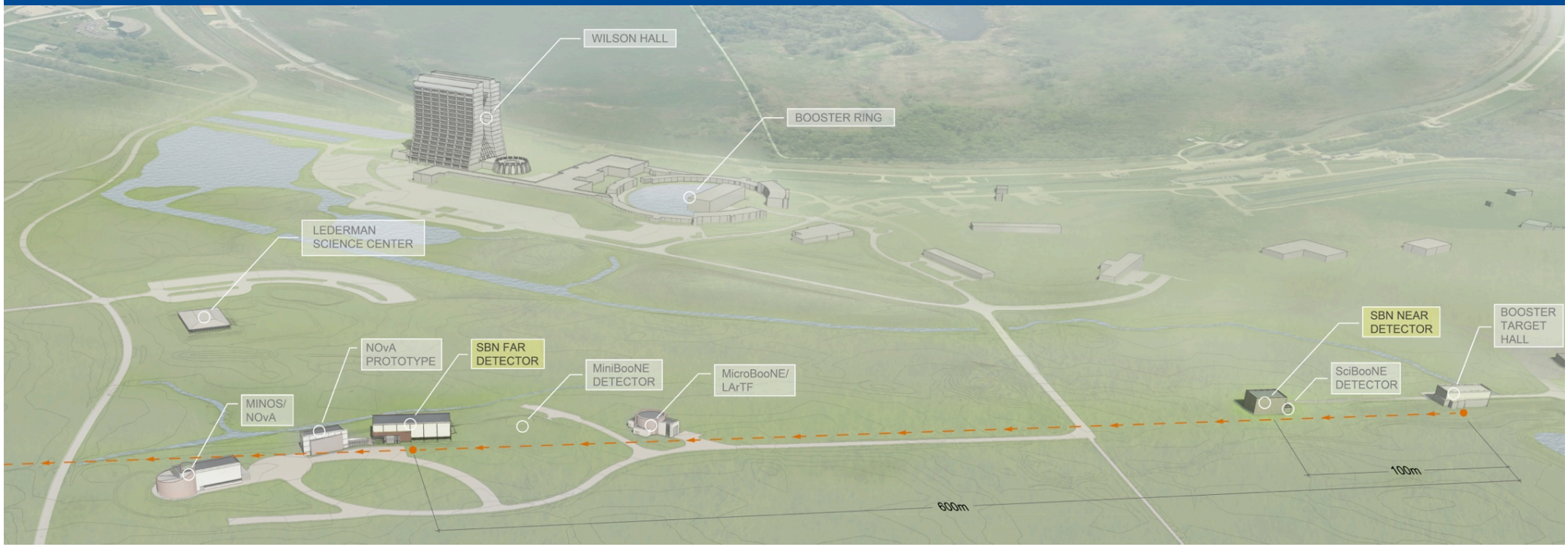


SBN Working Groups

SBN Oversight Board Meeting

December 11th, 2020

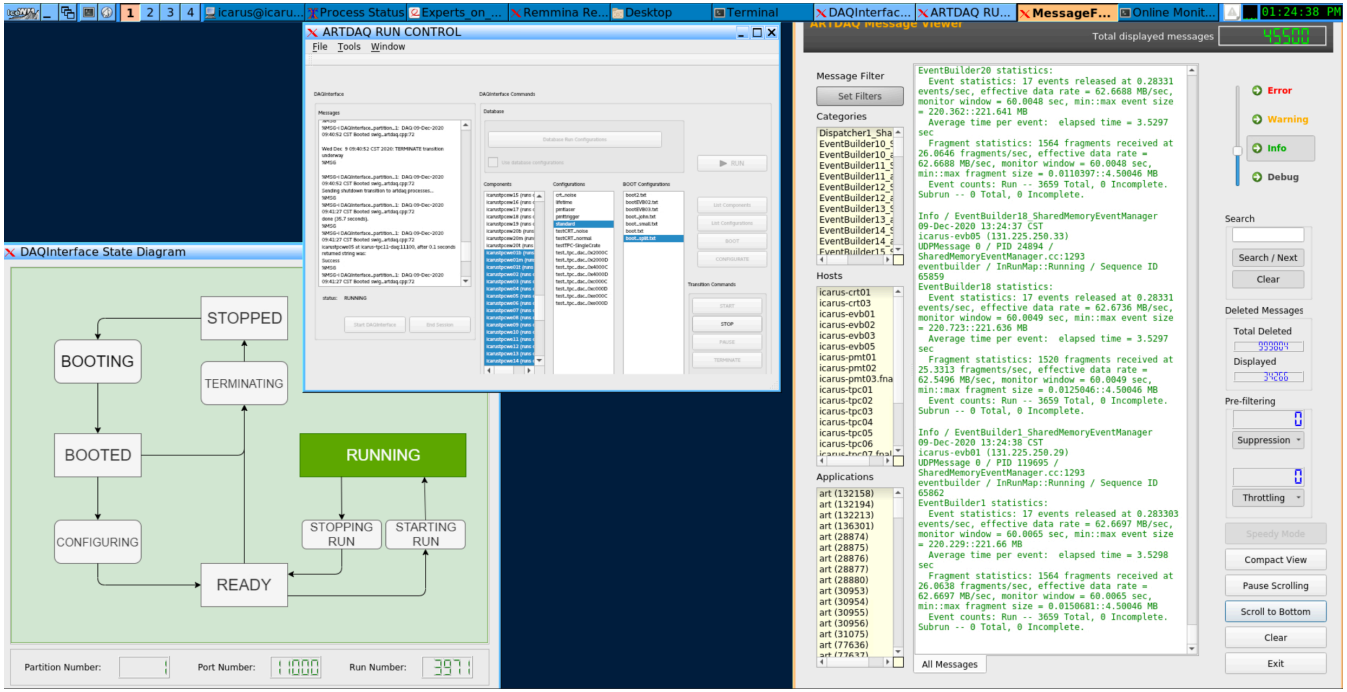
Ornella Palamara

SBN Working Groups

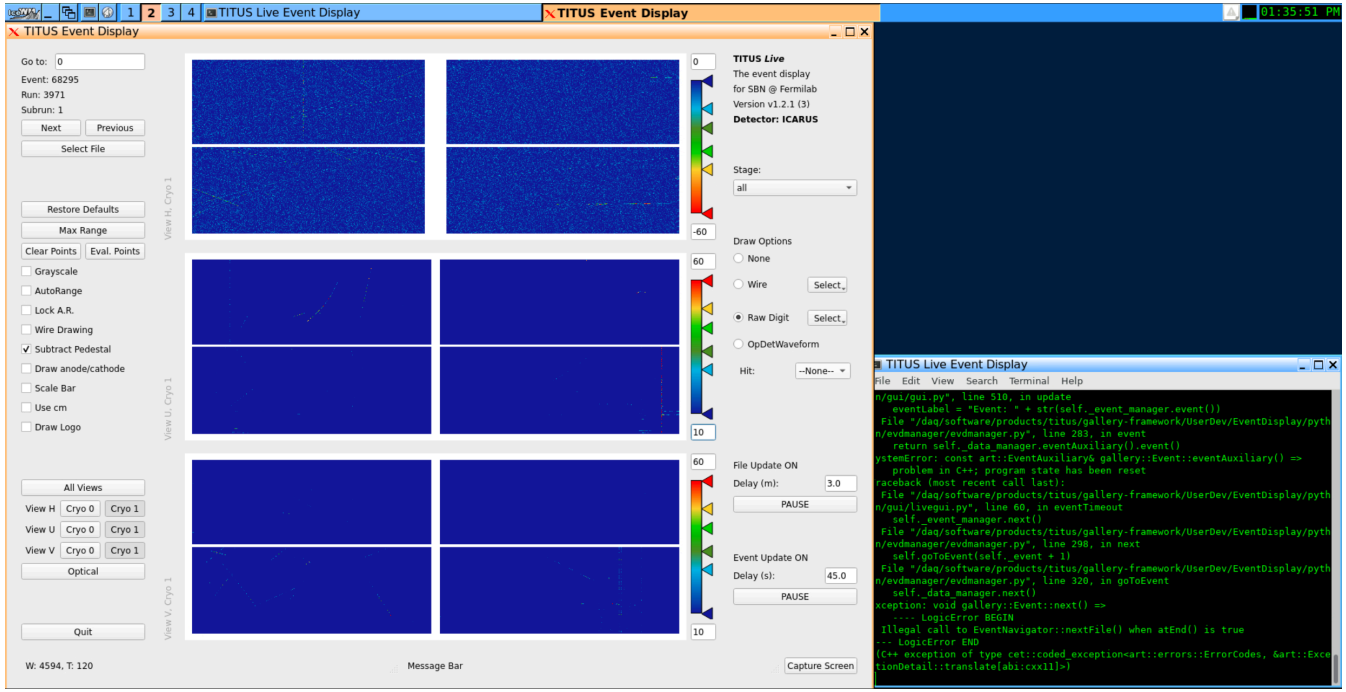
- SBN DAQ and Data Pre-Processing *[conveners: Bill Badgett, Angela Fava, Wes Ketchum, Yun-Tse Tsai]*
  - *Goal*: Develop common tools for **trigger, data acquisition and data pre-processing**, and coordinate activities in those areas.
- SBN Slow Controls *[conveners: Geoff Savage, no convener for SBND]*
  - *Goal*: Develop **control systems** based on **hardware and software interfaces** as much as possible identical for the two detectors.
- SBN Cosmic Ray Tagger *[conveners: Umut Kose, Igor Kreslo, Minerba Betacourt]*
  - *Goal*: Review the **CRT production status and the installation plans** for the two detectors, develop common **CRT DAQ** and **monitoring.**
- SBN Analysis Infrastructure *[conveners: Wes Ketchum, Joseph Zennamo]*
  - *Goal: C*oordinate and address **data and software infrastructure** and **computing resource needs** across the SBN
- SBN Analysis *[conveners: Daniele Gibin, Ornella Palamara]*
  - *Goal:* Take care of all the aspects of the **multi-detector** physics analysis for **SBN sterile neutrino oscillation searches**

SBN DAQ and Data Pre-processing WG

- ICARUS Detector Commissioning
  - **DAQ and monitoring** supporting detector commissioning efforts
  - **ICARUS specific updates** in trigger readout, PMT-trigger integration, and event-building configuration
  - **Updates necessary** for ICARUS (and eventually SBND) **in key common efforts** include:
    - Updates to **SBN Run Control GUI** for configuration database integration
    - Updates to **SBN Data quality monitoring** website for extended access to 'slow controls' monitoring, channel mapping, and offline analysis updates
    - Critical **CRT readout firmware fix** for common CRT electronics
    - **White Rabbit timing** data extraction updates
    - Further development and testing of **online data management transfer tools**
    - Updates to *artdaq* software to fix data flow inefficiencies and errors
  - SBN common efforts critical for ICARUS success, and are integral part of operational readiness



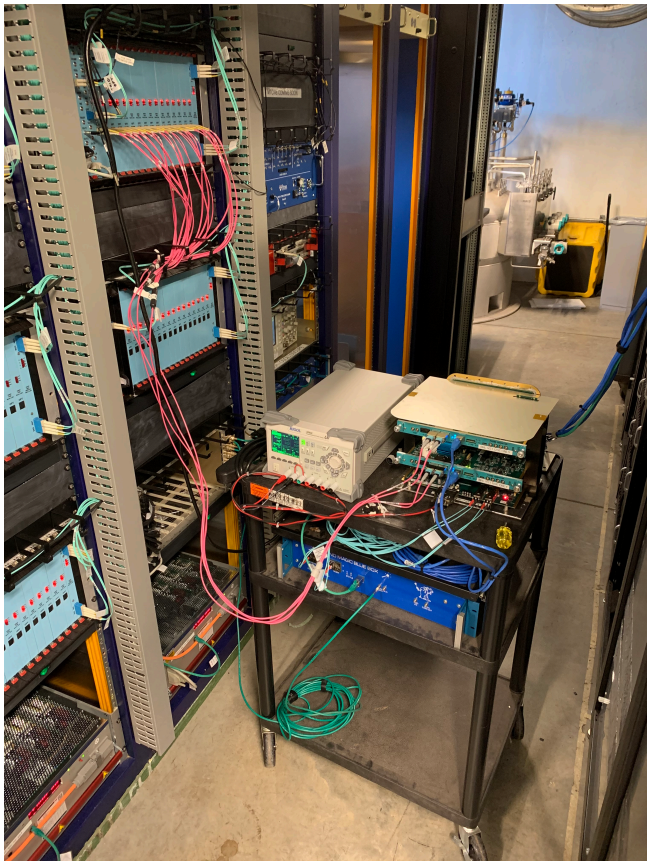
~live from ICARUS run!
(Dec. 9)



SBN DAQ and Data Pre-processing WG

SBND developments

- Readout reception tests at SBN-ND complete and 100%. Successful!
- Warm Interface Board (WIB) data output issue resolved with a new brand of QSFP fiber transmitters



Test Stand
(ND building)

SBN Slow Controls WG

- ICARUS
  - **Cathode High Voltage** remote **monitoring** has been implemented
  - **TPC readout crate** power supply remote **monitoring** has been implemented
  - **Testing station** has been setup at SBN-FD for slow controls developments

- SBND
  - EPICS controller has been written for Heinzinger **drift High Voltage** power supply

SBN Slow Controls WG

ICARUS specific:

- Inside cryostat
  - Liquid argon temperatures
  - Liquid argon levels
- TPC
  - Wire bias power supply
  - Readout crate power supply - new
- PMT
  - HV power supply
  - HV distribution
  - VME crate power supply
  - Calibration system
- Drift (cathode) HV - new
- CRT
  - Readout power supplies
  - HV power supplies

Comments:

- Underscore indicates tested with a user interface
- Other items are in progress

SBN Common:

- GPS
- Impedance monitor
- Cryogenics
- Beam
- Computer status
- DAQ status
- Environment

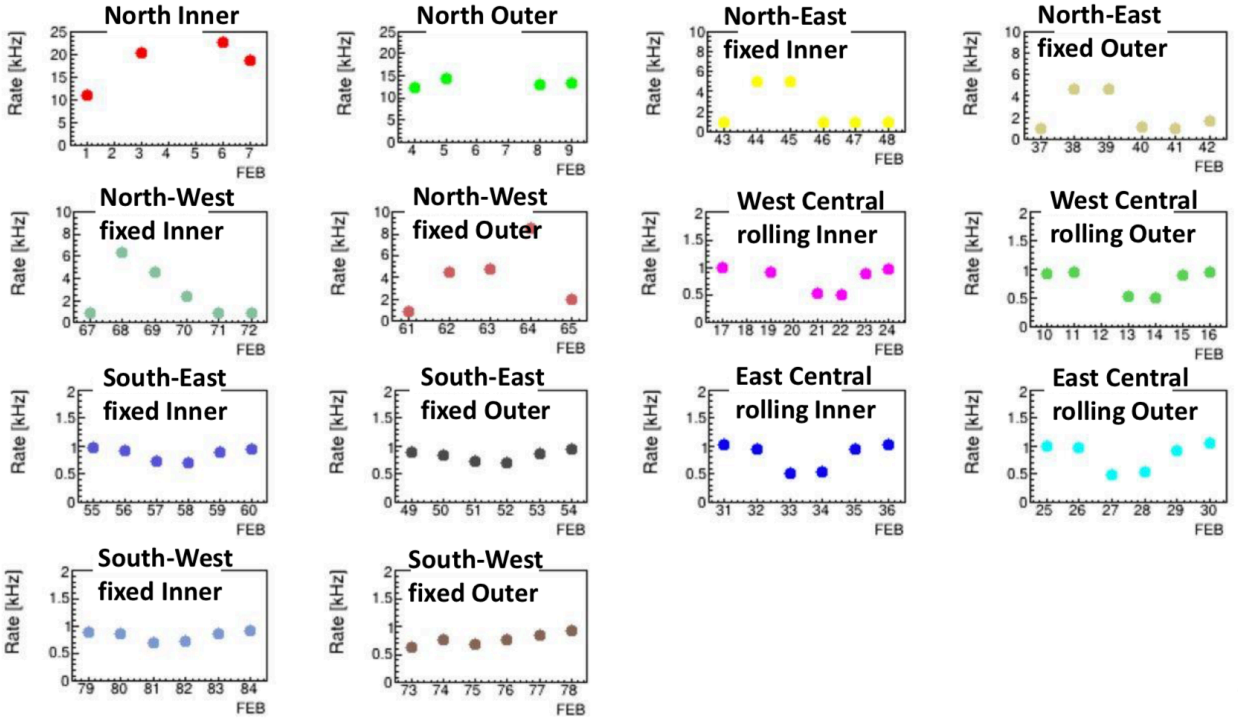
SBN Cosmic Ray tagger WG

- ICARUS
  - The CRT modules have been installed on three sides of the ICARUS detector (North, East and West)
    - Five walls installed during the pandemic!
  - Installation of the last side CRT (South) wall is scheduled for January 2021
  - Top CRT:
    - All modules of the top CRT are at CERN, ready for shipment
    - Vertical support structures are planned to be installed in February 2021
    - The work for the horizontal plane installation will begin once the supports are in place, currently expected in July 2021

West and East side CRT

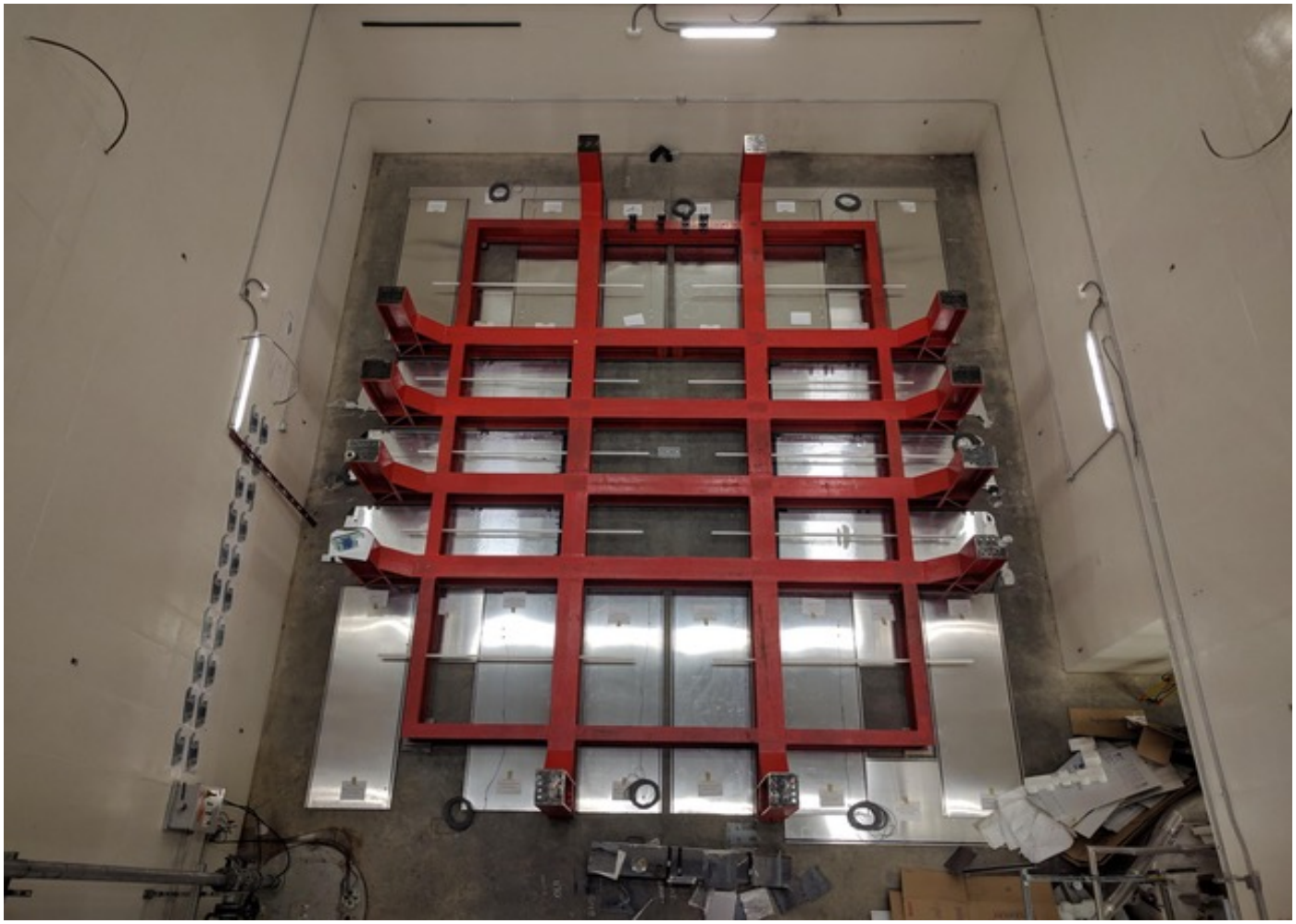
SBN Cosmic Ray tagger WG

- **Commissioning** of the five new walls is starting
  - CRT wall sections being integrated in the readout
  - Implemented into standard DAQ for some shifter-piloted runs, in a noise study configuration
  - Moving toward a standard inclusion in the DAQ
  - High rates in some CRT components (generally near the cryo). Investigations ongoing



SBN Cosmic Ray Tagger WG

SBND: CRT Bottom layer installed (Sept. 2019)



SBN Analysis Infrastructure WG

Working alongside the current SBN working groups and ICARUS/SBND physics groups, focusing on **basic infrastructure** and **software organization**

Main focus topics

- **Release Management**
  - Maintain high-quality releases of SBN-specific software packages
- **Production and Resource Management**
  - Work with Fermilab Scientific Computing Division and SBN collaboration to maintain production workflows, and manage access to data
- **Simulation Software Management**
  - Develop infrastructure to support data-driven detector simulations and maintain consistent configuration
- **Analysis Software Management**
  - Develop infrastructure to process & analyze data & simulation in a consistent way
- **Beam and "Dirt" Simulation**
  - Develop and improve beamline simulations and uncertainties

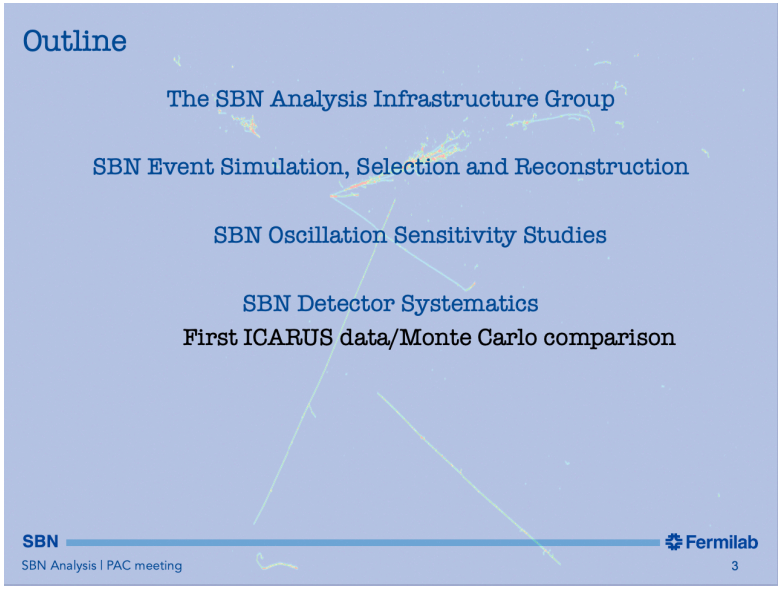
SBN Analysis Infrastructure WG

Recent Activities

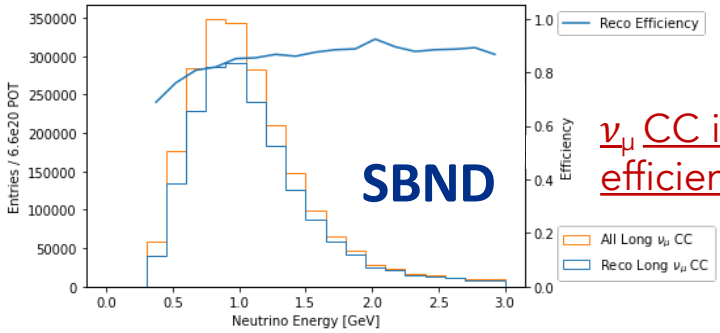
- Restructure software infrastructure to enable **seamless sharing of code across the SBN**
  - Further developing common analysis framework for SBN analysis
- Preparing for first **large scale SBN-wide Production**
  - Successful first test production,
    producing 500,000 SBND and ICARUS simulated events
  - Using lessons learned to inform 2021 production planning, with plans for >15 million simulation events and all available ICARUS data events (~5 million anticipated)
- Preparing a new **software release** to allow for the consistent processing of **data and simulation** across ICARUS and SBND

SBN Analysis WG

”Status of the SBN Analysis Working Group” presented by O.P. at the Physics Advisory Committee (PAC) meeting on December 8th, 2020



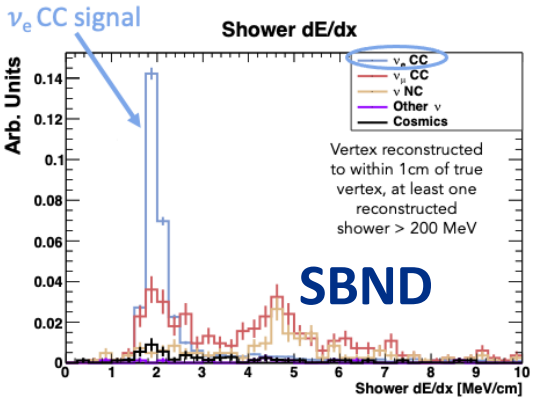
ν_μ CC Event Selection – Current status



ν_μ CC integrated efficiency: 83.4%

For reference, ν_μ CC efficiency assumed in the SBN proposal: 80%

ν_e CC Event Selection – Current status

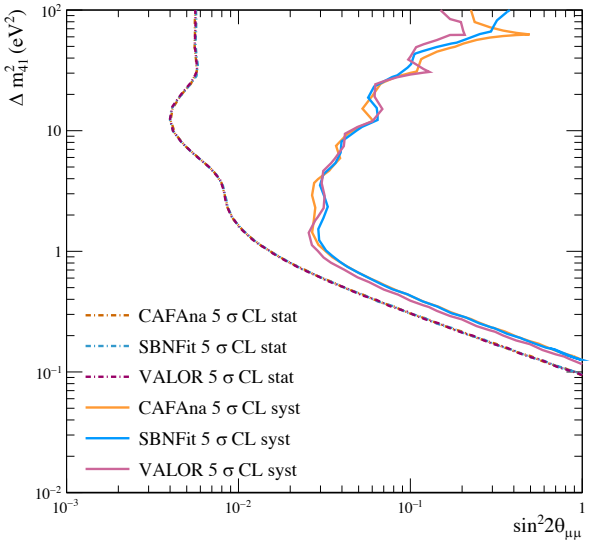


Not yet there!
Some problems at reconstruction level are not SBN-specific

SBN Analysis WG

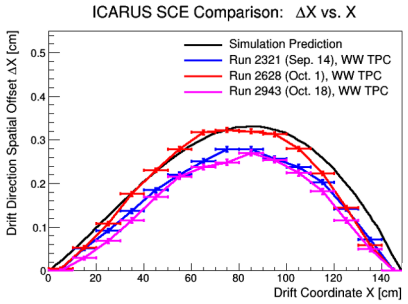
SBN Oscillation Sensitivities

3+1 ν_μ disappearance sensitivity
(proposal-era event selection and systematic assignments)

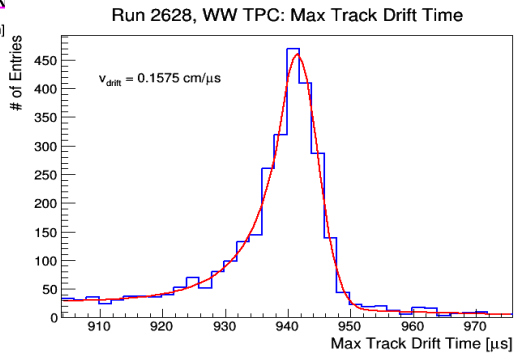


Mock data analysis, ν_μ and ν_e joint analysis and joint analysis of exclusive samples

First ICARUS data/Monte Carlo comparisons



tuning simulation w/ **first ICARUS data**



Summary

Making progress toward
SBN oscillation physics sensitivity results
based on the full event simulation and reconstruction.

Measurements from SBN data
begin to be used to refine and tune the simulations
and address detector systematics.

SBN tools for neutrino event selection and reconstruction
and for background rejection
will be soon validated with real data!

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SBN Analysis | PAC meeting 36