

SBN Program Status

Peter Wilson – SBN Program Coordinator

Oversight Board

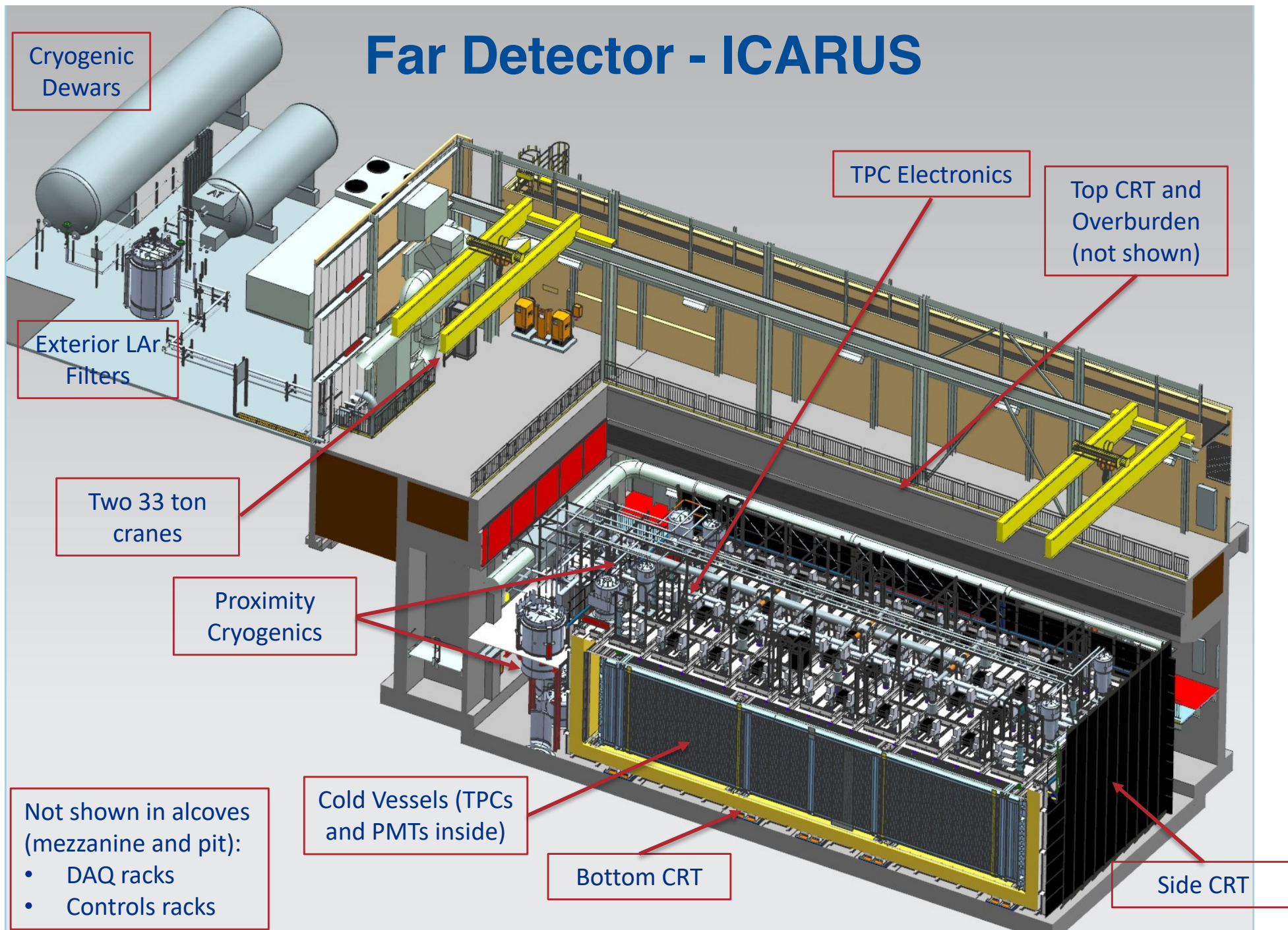
13 September 2019

Outline

- ICARUS technical progress
- SBND technical progress
- Transition to Operations Planning
- Booster Neutrino Beam in 2020-21
- Upcoming Reviews

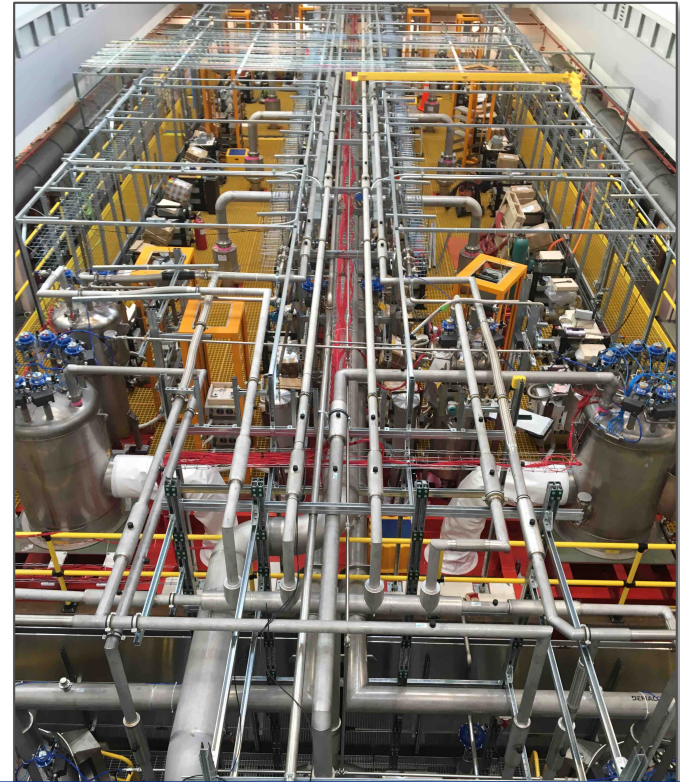


Far Detector - ICARUS



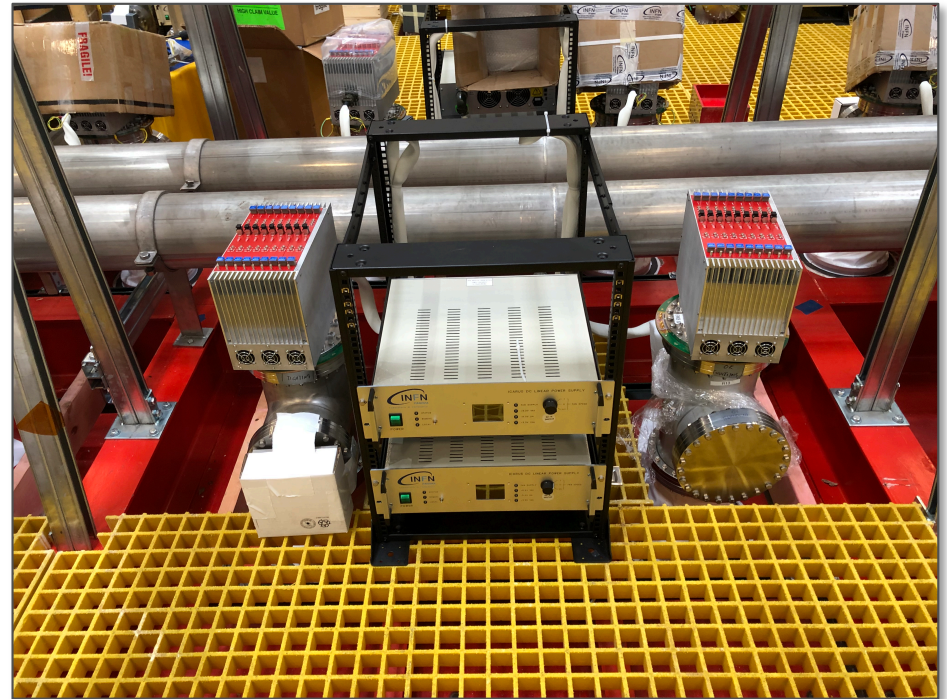
Far Detector Progress

- Cryogenics
 - Final few items to complete hardware installation
 - Controls and ODH wiring near complete
 - Controls programming in progress
- Infrastructure - electricians
 - Outlets on vessel top completed
 - Outlets for west mezzanine DAQ racks in progress
 - Outlets for east mezzanine PMT racks starting
 - Electrical work continues on critical path
- Readout and DAQ Electronics infrastructure
 - Main cable tray installation on top of the detector complete
 - PMT readout racks setup
 - DAQ racks in place
 - First EVB/DAQ servers onsite remaining severals due in early October
 - Networking:
 - Cable tray (yellow in photo) components on order, also used for DAQ and PMT fibers
 - Network switches in hand
 - Completion in October on critical path



Far Detector Progress

- TPC Front end electronics
 - All electronics installed and tested
 - Noise characterization studies completed
 - Measured effect of building systems on electronic noise (negligible)
 - Some noisy channels in a few corner chimneys
 - Proposal to make a two day intervention the week of Sept 23
 - Cables for wire bias and timing distribution near completion, installation in one to two weeks
- PMT system
 - Installation of cabling to digitizers and calibration fibers started. Remaining cables in transit from CERN with DAQ servers (early Oct).
 - Preparing for installation of calibration laser
- CRT system
 - North wall dedicated to Simone Marcocci (FNAL postdoc) on Sept 11
 - Mounting system for east and west wall CRTs being installed. Main CRT installation after fill.
 - Production progress well at Frascati for top CRT – ship at end of the calendar year.



Cryogenics Commissioning Activities

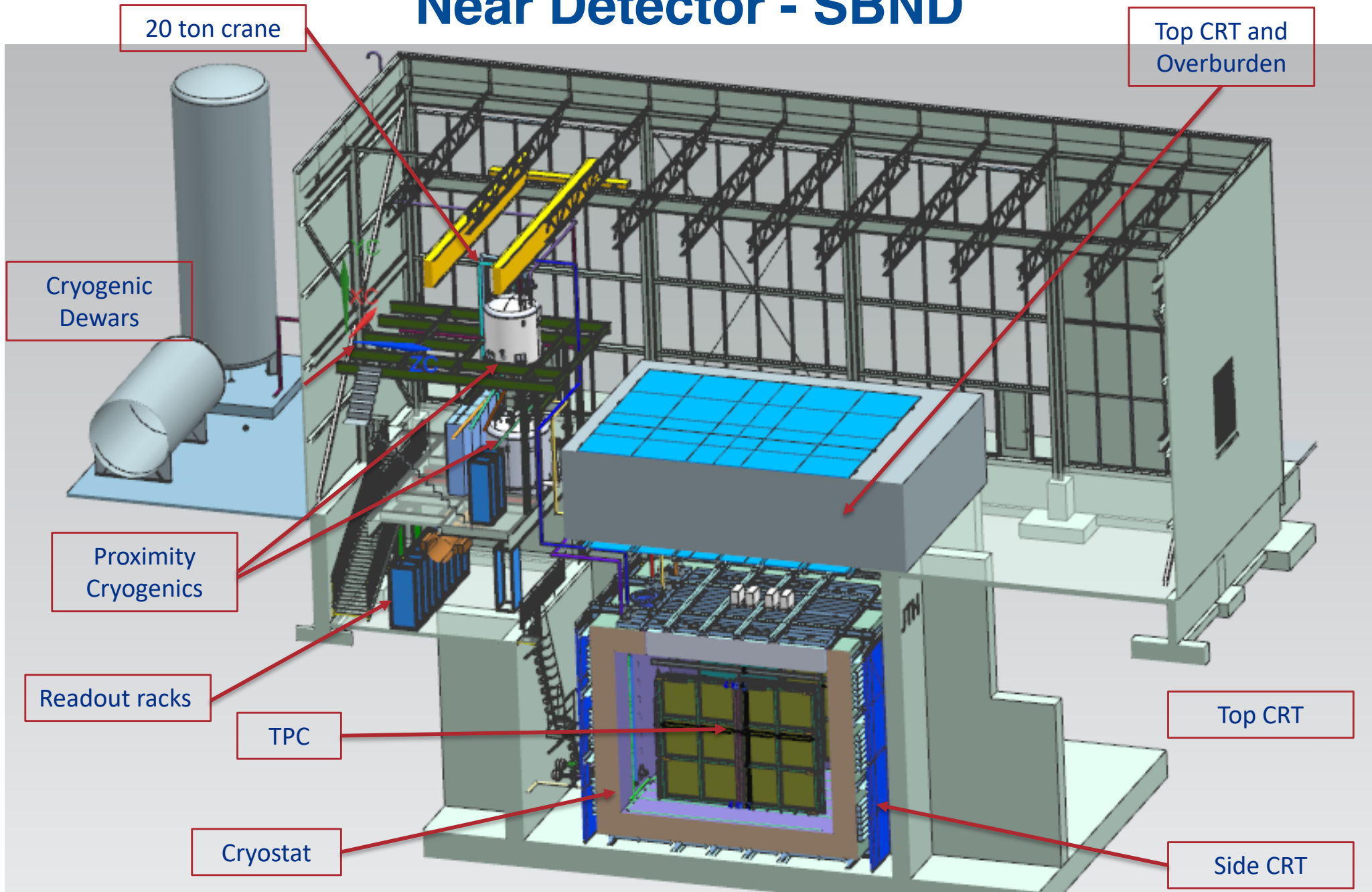
- Vacuum operation started 10th June
 - Continue pumping until the start of cool-down
- Cool-down and liquid argon filling
 - Liquid Argon contract in place – requires >21 day notice to start daily delivery
 - LN2 dewar operation approved, certified and filled in July
 - LAr dewar operation approved, certification and fill in next week
 - Scheduling of final steps to start LAr fill in progress
 - Controls hardware checkout ~ end of September
 - Controls programming checkout ~ end of September
 - ODH system active - early October
 - Final system checkout by CERN and FNAL engineering – early October
 - Approval (pORC) to start LN2 cooldown – early October
 - Start LN2 cooldown – late October
 - Start LAr fill – early November
- CERN engineering participates, in person, starting from final checkout through the fill process.
 - Includes monitoring of cold vessel strain gauges
 - CERN has a safety documentation & review process similar to Fermilab's, and the participation satisfies their sign-off procedure

ICARUS Milestones to I-1 Ready to Fill

(after July statusing)

Intermediate Milestone	Owner	Baseline Date	Forecast Date		Actual Date
Vessels rigged into building	P. Wilson	16-Aug-2018		✓	16-Aug-2018
Manholes welded and vacuum test successful	C. Montanari	10-Oct-2018		✓	11-Oct-2018
Warm Vessel roof complete	C. James	15-Nov-2018		✓	31-Oct-2018
Cryo Platform complete	C. James	15-Dec-2018		✓	04-Oct-2018
Proximity cryogenics installation begins	B. Norris	15-Jan-2019		✓	28-Jan-2019
DBB & flanges installation complete and tested	A. Fava	15-Feb-2019		✓	15-Mar-2019
Cold proximity cryogenics installation complete	B. Norris	15-Apr-2019		✓	21-June-2019
1 st T300 readout installation complete	A. Fava	15-Mar-2019		✓	11-Apr-2019
All detector readout installed	A. Fava	1-May-2019		✓	17-May-2019
Begin vacuum pumping	C. Montanari	15-Jul-2019		✓	10-June-2019
Cryogenic operation approved	B. Norris	15-Jul-2019	20-Sept-2019		
I1: ICARUS detectors ready to fill with LAr	P. Wilson	30-May-2019	20-Sept-2019	f	

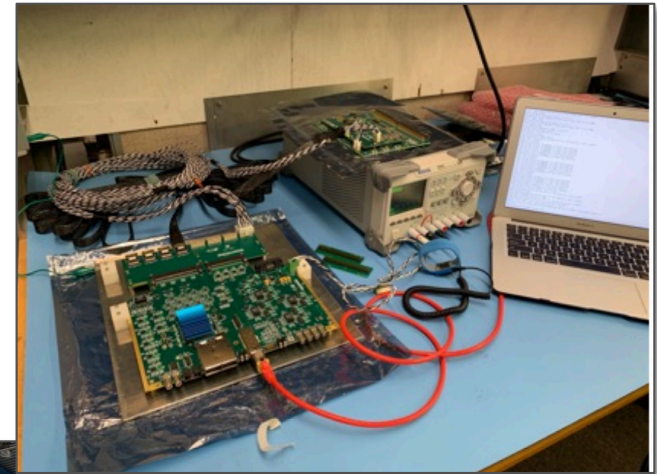
Near Detector - SBND



Near Detector Progress

- TPC Electronics
 - Production nearing completion – remaining part is
 - All Front-End Mother Boards delivered to Fermilab and ready to install
- Photon detection systems
 - PMTs under test at LANL
 - Adopted plan to shift R&D photon system from light guide bars + ARAPUCA to ARAPUCA + X-ARAPUCA. X-ARAPUCAs will use electronics developed for light guide bars (based on Mu2e CRT electronics). Aligning with current DUNE development direction
- TPC assembly (at Dzero):
 - First Anode Plane pair (of two pairs) complete and ready to install
 - Cathode Plane Assembly is ready to install
 - Field cage components are ready to install
 - assembly and transport fixture (atf) complete
 - Need to assemble tenting etc
 - Completing support beams and mounting components
 - Technical review of detailed assembly procedures Sept 18-19
 - Includes all TPC components and light detection systems

*Cold electronics
reception test
at Fermilab*



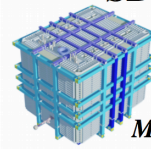
*Assembly
and
transport
fixture*



Near Detector Cryostat

- Warm vessel frame preassembly completed at CERN and components delivered to Fermilab in late August
- Side plate fabrication at CERN completed and shipped at the end of August. Delivery expected around Oct 1
- Shimming and bottom CRT installation start next week
- Warm vessel installation starts Sept 30 with team from CERN, INFN and FNAL
- Design of membrane completed by GTT. CERN is working with CERN on pricing and delivery schedule.
- Installation of the membrane is on critical path for SBND completion

SBND Cryostat frame pre-assembly @ CERN



May 28th
Cryostat frame pre-assembly ongoing



July 10th
Frame pre-assembly and painting near completion

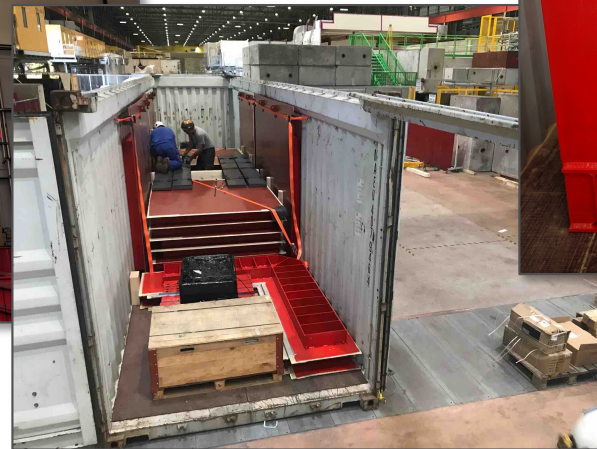


July 15th
Painting and trial assembly completed. Getting ready for shipping

(credit: Roberto Acciarri)



Loading of shipping containers at CERN



Unloading of shipping containers at FNAL



Near Detector Cryogenics

- Demaco completed install of proximity cryogenics July 23.
 - Completed work with ~2 week effort in July (estimate was 3-4 weeks)
 - Ends a 6 month installation campaign at far and near detector buildings
- Remaining FNAL deliverables about to enter final design before procurement: incorporating lessons learned from protoDUNES and ICARUS



ND Proximity Cryogenics

SBND Milestones to S-1 SBND ready to move

(after July statusing)

Intermediate Milestone	Owner	Baseline Date	Forecast Date (Schedule)		Actual Date
First set of APAs shipped to Fermilab	K. Mavrokoridis	24-Sept 2018		✓	4-Mar-2019
PO for COTS ADCs placed	H. Chen	10-Oct-2018		✓	30-Oct-2018
All TPC Components at Fermilab	K. Mavrokoridis	1-Mar-2019		✓	27-Mar-2019
Complete atf assembly at DAB	J. Zennamo	1-May-2019	14-Aug-2019	a	
50% of motherboards delivered to Fermilab	H. Chen	15-May-2019		✓	22-May-19
APAs and CPAs installed in atf	J. Zennamo	15-Jun-2019	31-Oct-2019	b	
Field cage assembly complete	J. Zennamo	15-Jul-2019	11-Dec-2019	b	
Cold electronics installed and tested	H. Chen	23-Aug-2019	23-Jan-2020	b	
S1: TPC ready to move to SBN ND	A. Schukraft	30-Aug-2019	28-Jan-2020	b	

- a) The atf fabrication delay propagates through the rest of the schedule leading to S1.
- b) Planning to accelerate the schedule by parallelizing some of these tasks. Expect S1 before end of CY 2019.

SBND Milestones to S-2 Ready to Fill

(after July statusing)

Intermediate Milestone	Owner	Baseline Date	Forecast Date		Actual Date
GTT Design Study Begins	M. Nessi	1-Feb-2019		✓	26-Apr-2019
Delivery of warm box steel	M. Nessi	15-Jun-2019	16-Sept-2019		
Warm vessel installation complete	M. Nessi	15-Jul-2019	15-Nov-2019		
TPC Transport to ND building complete	J. Zennamo	15-Sept-2019	5-Feb-2020		
Cryostat material arrives at Fermilab	M. Nessi	1-Oct-2019	12-Nov-2019	C	
Cryostat top plug is ready to attach to atf	M. Nessi	1-Nov-2019	25-Mar-2020	C	
Membrane Cryostat Completed	M. Kim	1-Mar-2020	22-Jan-2020	C	
Plug welded to cryostat	M. Kim, J. Zennamo	15-Apr-2020	9-Jul-2020	C	
Cryogenic operation approved	M. Geynisman	1-Jul-2020	30-Sept-2020	C	
S2: SBND detector is ready to fill with liquid Argon	A. Schukraft	15-Jul-2020	30-Sept-2020	C	

c) Membrane cryostat and top cap schedule are not updated and subject to change

Transition to Operation Planning

- Address commissioning and operations plans for both detectors and associated support (e.g. cryogenics, online computing, data storage)
- Transition to Operations Team
 - Angela Aparicio – Neutrino Division (ND) Safety Officer
 - Steve Brice – ND Representative
 - Angela Fava – Far Detector Deputy Technical Coordinator and Commissioning Coordinator
 - Claudio Montanari – Far Detector Technical Coordinator
 - Barry Norris – SBN Program Engineer and Head of ND Technical Support Dept
 - Dave Schmitz – SBND collaboration representative
 - Michelle Stancari – Near Detector Commissioning Coordinator
 - Peter Wilson – Program Coordinator, chair of TOT
 - Bob Wilson – ICARUS collaboration representative
 - Wes Ketchum - Scientific Computing Division representative
- Meetings since February to define organizations and prepare Experiment Operations Plan (EOP)
 - Outline of EOP discussed at last meeting.
 - EOP is the primary document to be reviewed in the Operations Readiness Review
- ND Technical Support Dept finishing Cryogenics Operations Support plan
 - Extension of existing support plan for MicroBooNE to support all LAr detectors detectors
 - Takes effect as cryo commissioning completes

BNB Beam – Start of 2019-2020 beam period

Earliest Dates for Establishing Beam (as of 9/4/19)

- Linac:..... Week of Sept 23rd (2)
- Booster:..... Week of Sept 30th (1)(2)(3)
- BNB :..... Week of Sept 30th (1)(3)
- Main Injector/Recycler..... Week of Oct 7th (1)(3)
- NuMI (target scans) Week of Oct 7th (1)(3)
- (HEP Beam) Week of Oct 14th (1)(3)
- Muon Campus Week of Oct 7th (1)(3)
- Switchyard Dump **(these are WAG)**
 - (TLM Comish 4 weeks) Week of Oct 14th – Nov 11th
 - Users Week of Nov 11th – Dec 2nd

The week shift to our turn on schedule is driven by:

- (1) Domestic water system
- (2) Feeder re-routing
- (3) Cable pulls in MI-8

Note: standard FNAL beam schedule is based on US Fiscal year with beam operation typically starting in October (beginning of FY) and ending with a maintenance shutdown of several months at the end of the summer



Beam schedule in Fiscal Year 2020 (FY20)

Slides from Mary
Convery (Deputy Head of
Accelerator Division)

Differences compared to FY19

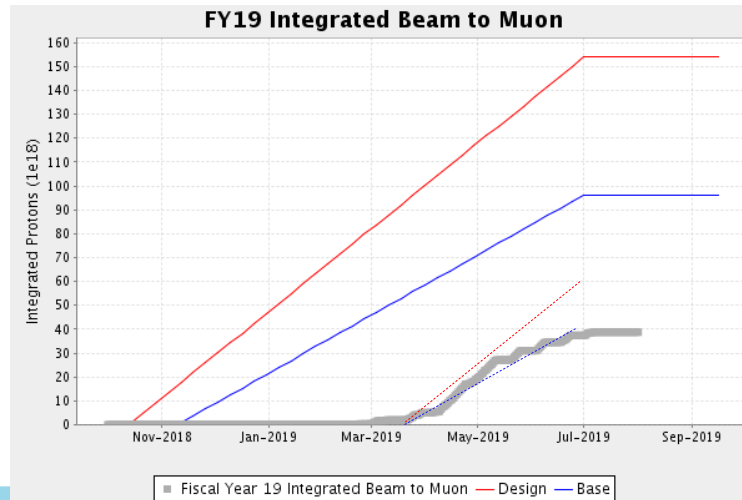
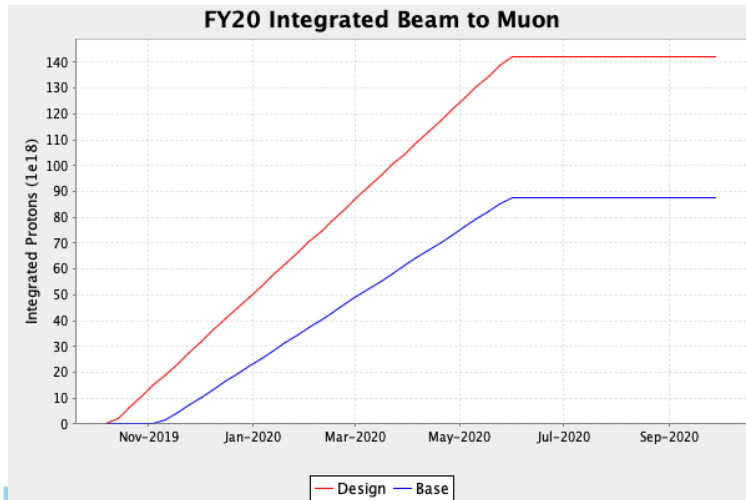
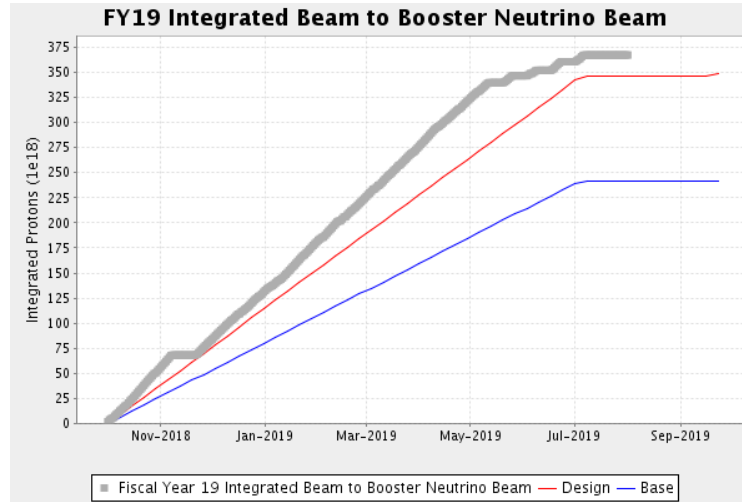
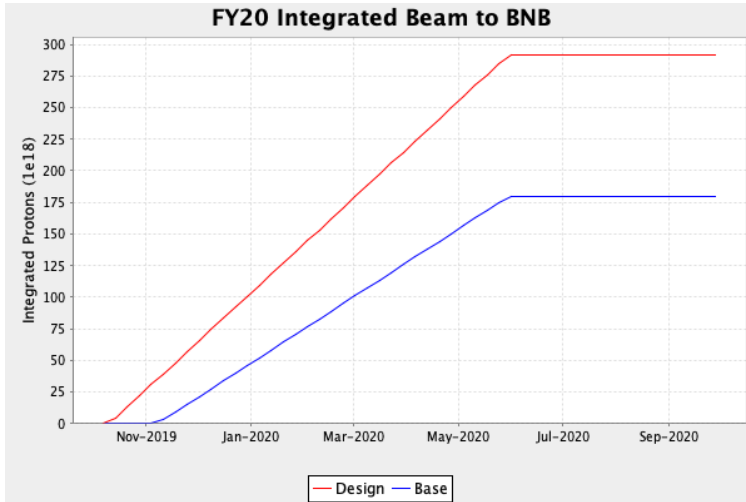
- Summer shutdown will start in June and will be 5 months in duration for LBNF site prep near the MI, including removing a cooling pond and replacing it with a cooling tower
- If the accelerator operations budget is similar to FY19, or if there is a continuing resolution, we would not turn on the MI until sufficient funding is available
- We have been told that the lab's priority would be to operate ICARUS and g-2 and to save money by not ramping the MI

Beam Delivery Goals in 2020

Slides from Mary Convery (Deputy Head of Accelerator Division)

8 GeV program

Red = Design
Blue = Base



3 8/1/2019

Beam in 2021

- Expect FY 2021 beam startup to be similar to FY 2020 or slightly later accommodating the 5 month FY2020 shutdown
 - BNB startup between Oct 1 and Nov 1
- Expect FY 2021 shutdown to be normal duration of about 3 months probably starting in July
- Performance curves for BNB delivery of protons/month to BNB should be similar to 2019 and 2020

Upcoming Reviews

- There will be a Operations Readiness Review held by the laboratory in February 2020 covering: *SBN Operations Phase 1: Far Detector Only*
 - Preparation for this review is the responsibility of the collaboration
 - A follow-up review will occur when the Near Detector makes the transition to operations
 - Exact review date still to be set. Should occur with sufficient time to have established functionality of major detector systems
- The next SBN Director's Review is scheduled for the week of Feb 17, 2020. The review will be focused on completing the SBND installation and transition of SBND to operations



Backup



Safety and Work Planning

- Safety of people must remain the top priority for the SBN program. This is the responsibility of everyone involved.
- A work planning process was created by Aria Soha (Far Detector Installation Coordinator) which has been used for installation activities by Fermilab, CERN, Demaco, and the collaboration.
 - The goal is safe and efficient planning of work
 - Flexibility to allow for unknowns is essential
 - If the conditions change: stop and discuss the plan before continuing
- This process has been adopted for SBND activities
- As ICARUS transitions from installation to commissioning Aria's role as Installation Coordinator is coming to an end, Primary responsibility moves to Commissioning organization
- Need to maintain discipline of planning work through these transitions
 - Written work plans for major activities
 - Work plans will now be presented and reviewed in the Wednesday morning ICARUS meeting
 - Hazard Analyses for activities with significant hazards per Fermilab Environment Safety and Health Manual (FESHM) chapter
 - Discuss all work of the day at daily Toolbox Meeting (currently at 8am at SBN FD)

ODH and Work Planning

- Before the LN2 is introduced into the cold shields the area below grade in the SBN FD Building will become an Oxygen Deficiency Hazard (ODH) Class 1 area
 - Work below grade will only be permitted for ODH Qualified personnel: ODH training and medical exam by Fermilab
 - This will remain in effect for the duration of the experiment
 - Details of implementation will be communicated in the coming weeks
- During cryogenics commissioning (LN2 cooldown and Lar fill) additional restrictions will be in place that will severely limit access below grade
 - Will require permission and escort by Cryo team
 - These will remain in place until cryogenics have been stabilized after the fill
 - Need to get as much installation completed as possible before cooldown
- These restrictions encourage us all to plan work on the detector and mezzanines even more carefully to perform remaining installations efficiently and minimize future access