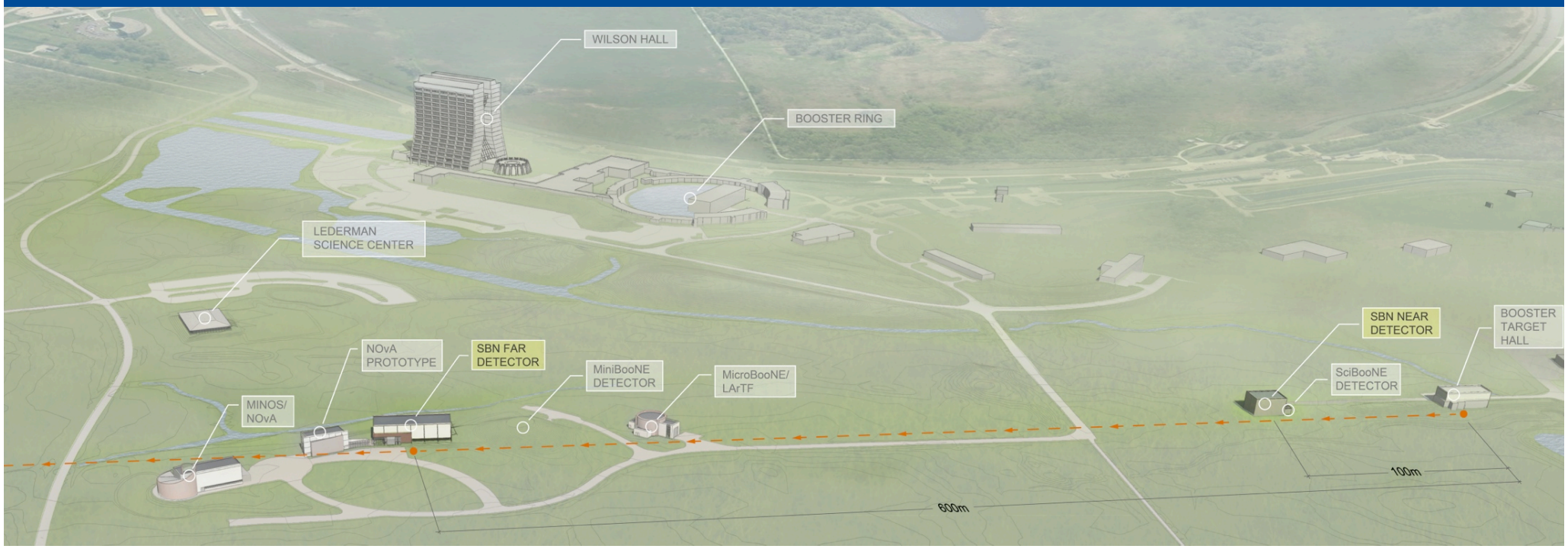


SBN Program Status

Peter Wilson – SBN Program Coordinator

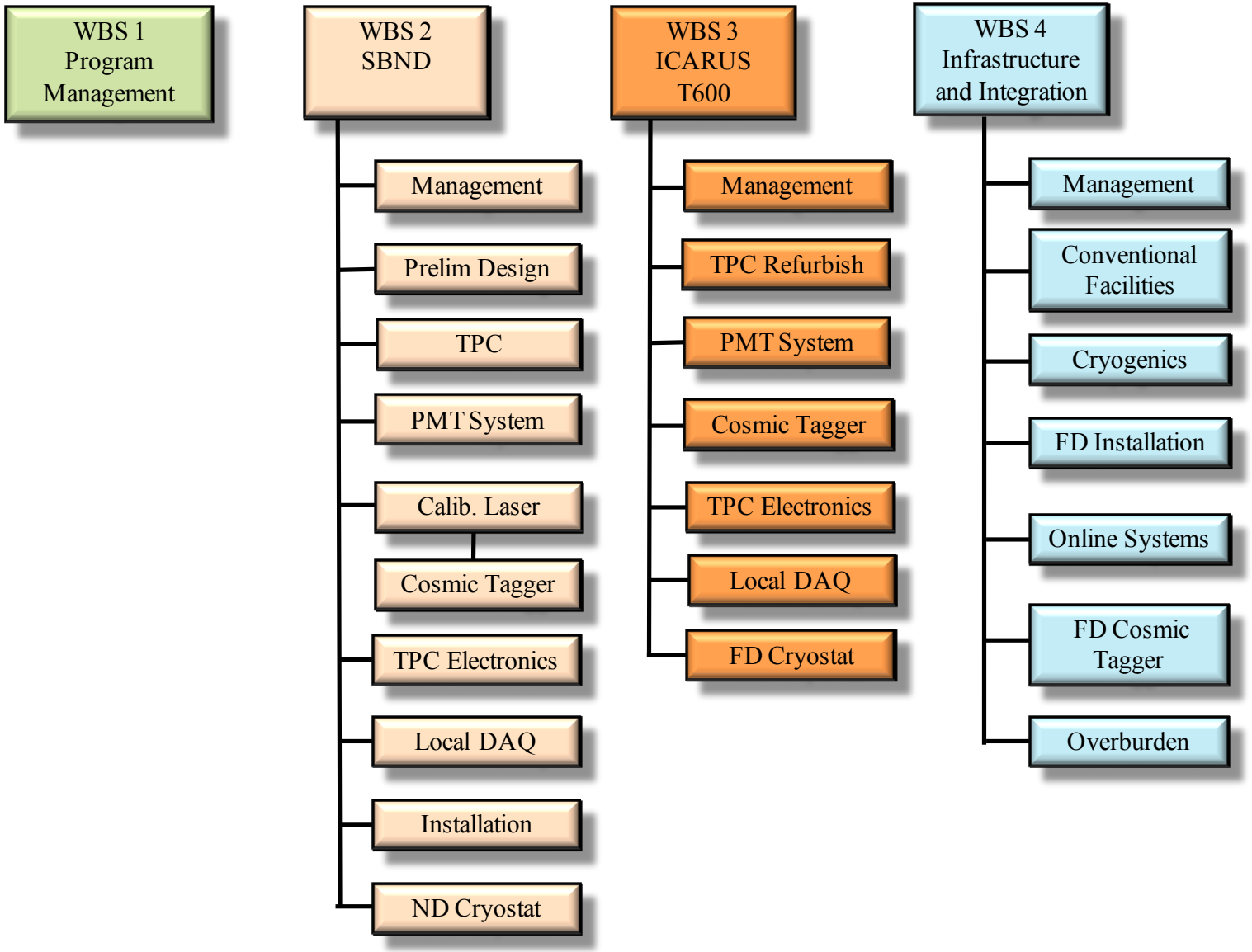
SBN Oversight Board

16 May 2018

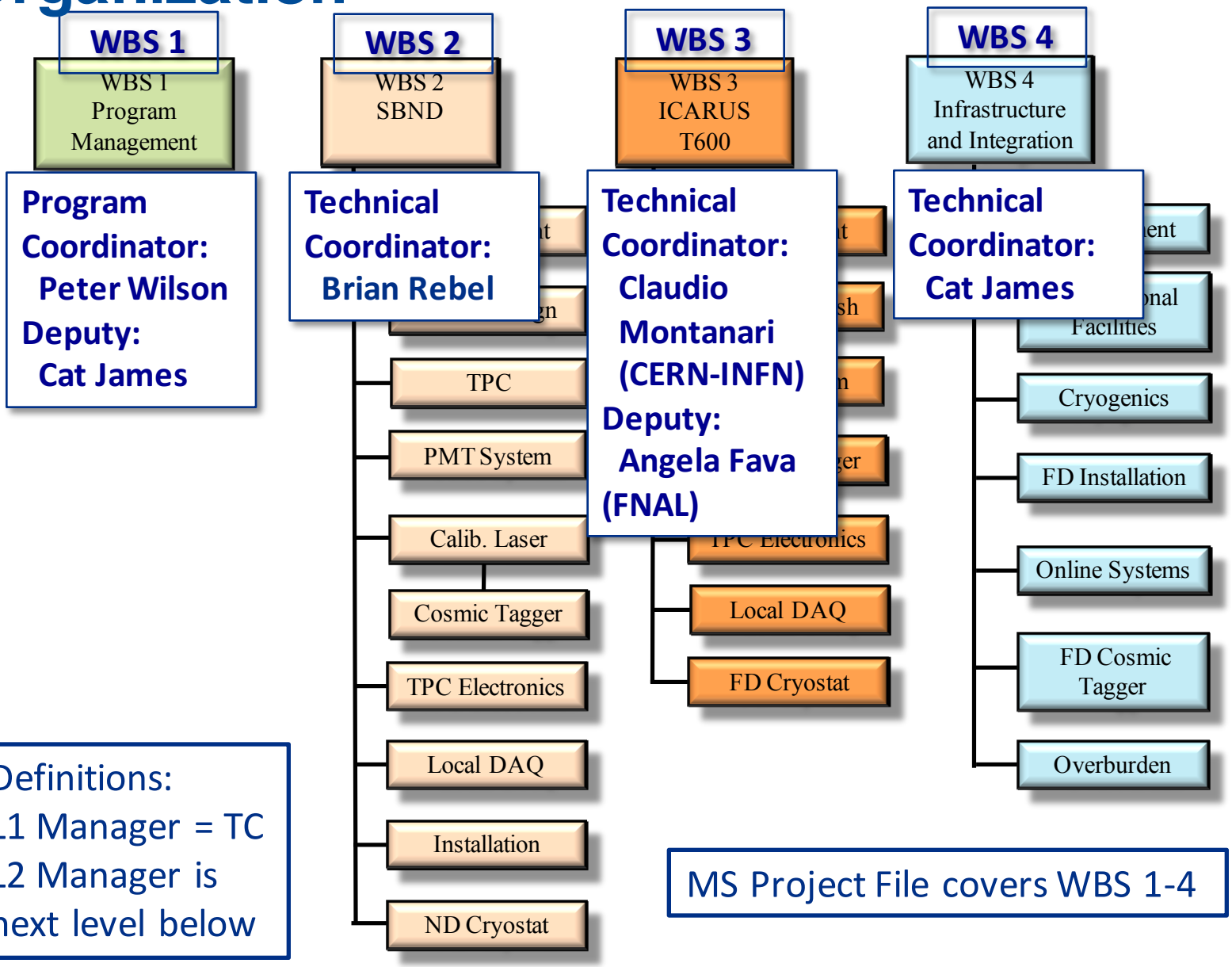
Preamble

- Cat James presented an update of the program at the RRB meeting in April to most of this audience.
- This status report will be formatted much like our monthly reports to the SBN Program Management Group (PMG). Monthly PMGs are organized by Fermilab for each project or major program to communicate status of the program to key laboratory stakeholders:
  - Divisions providing resources
  - Laboratory finance/budget office
  - Laboratory Chief Project Officer
  - DOE managers
- This talk will concatenate what will be shown shown in three presentations at the PMG:
  - SBN Overview – Peter Wilson
  - SBND Status – Brian Rebel
  - ICARUS and Infrastructure Status – Cat James
- All past PMG slides are available in the SBN docDB

Organization



Organization



Definitions:
L1 Manager = TC
L2 Manager is next level below

MS Project File covers WBS 1-4

Short Baseline Neutrino

WBS 1: Management

Personnel Changes

- Fernanda Garcia (FNAL/AD) stepped down as the ICARUS Installation Coordinator (L2 Manger for Installation) as she moves to a full time role on the PIP II project. Congratulations to Fernanda and thanks for everything she has done.
- Aria Soha (FNAL ND) took over as the ICARUS Installation Coordinator effective in late April. Fernanda continues to provide support during transition and will remain a member of Fermilab group on ICARUS.

- Angela Fava (FNAL ND) has taken over as Deputy Technical Coordinator for ICARUS now that focus of activities is at Fermilab. Andrea Zani (CERN) was the previous deputy.

- Brian Rebel has accepted a faculty position with Univ of Wisconsin which is joint with Fermilab. He will remain as SBND Technical Coordinator until at least the end of CY 2018. We are working to identify a deputy to start in the next few months who could then take over in 2019.

WBS 2: SBND Status

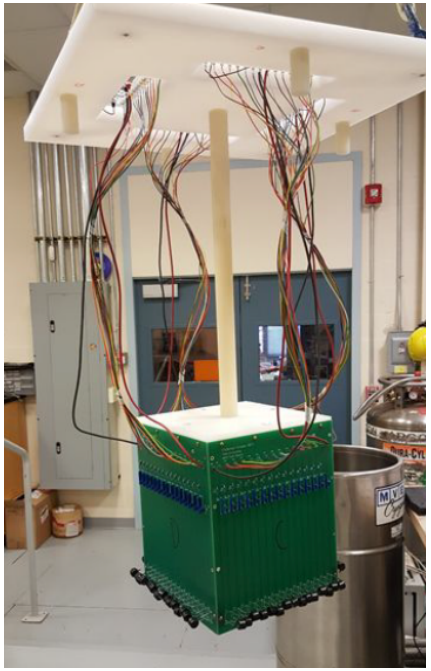
Slides from Brian Rebel

WBS 2.3 TPC

- CPA frame is ready to ship, working with Mike Dinnon to avoid import duties
- UK frame has about 400 U layer wires installed, wiring is on hold due to geometry board problem
  - Original order of boards was produced with the mirror image of the necessary layout
  - Those boards do not fit on the plane and would cause a number of channels to be unused if we tried to make them fit
  - New boards are on order, with a lead time of about 3 working weeks
  - In the mean time, UK crew is assembling the transport frame and preparing the next APA frame for wiring
- US frame has complete Y layer, V layer work is on-going
- Technical Coordinator visited Yale in April to see how wiring was going

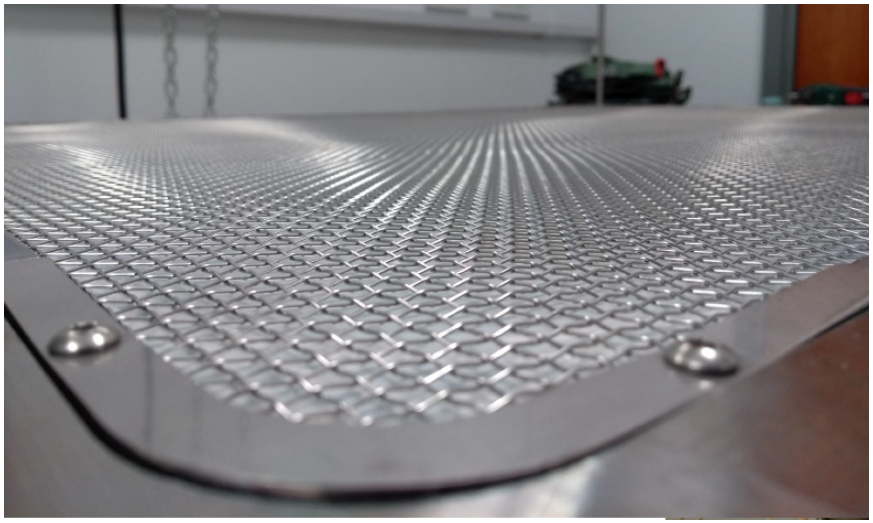
WBS 2.3 TPC

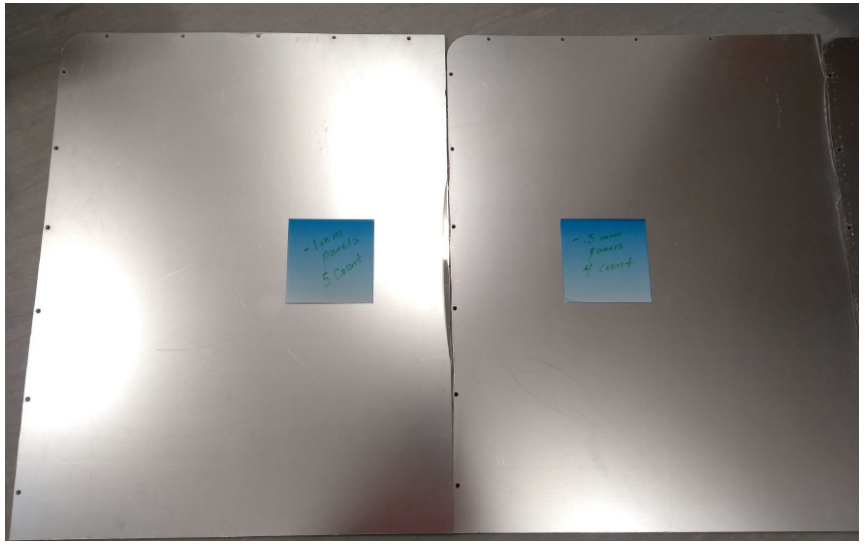
- Field cage production facility is ready to go at Yale
- Working with Yale and CERN to ship the aluminum profiles to US, Fermilab paying for shipment
- Assembly will start in June
- Yale group has QC'ed the components for the divider boards and assembled the boards



WBS 2.4 PDS

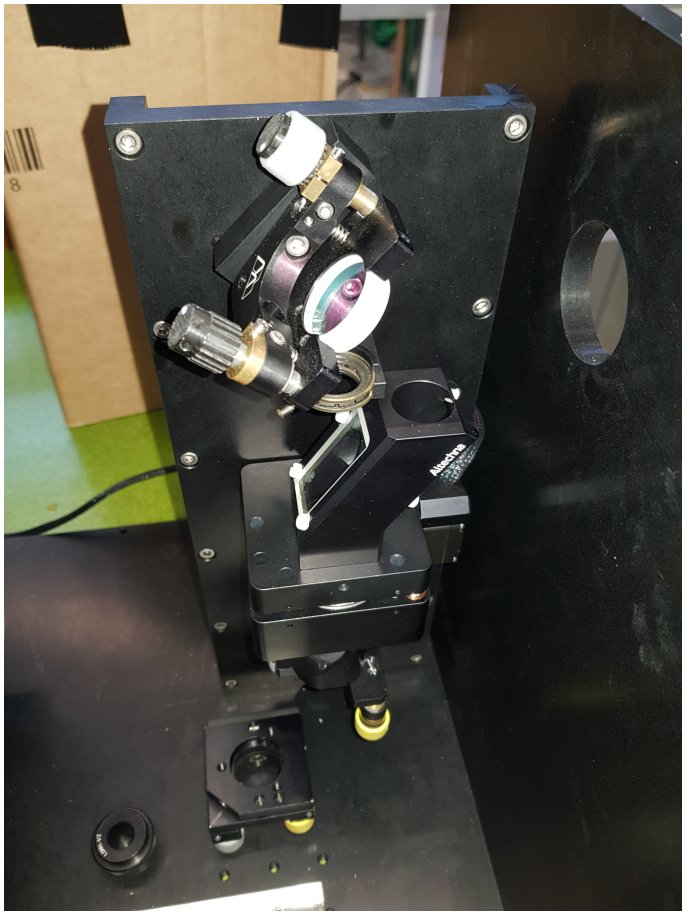
- Light reflecting foils are progressing
- Foil dimensions have been adjusted to better fit in the CPA frames
- Technique for stretching the mesh has been tested at Manchester
- TPB deposition tests also showing promising results
- Should be ready to install the foils whenever the assembly team says go

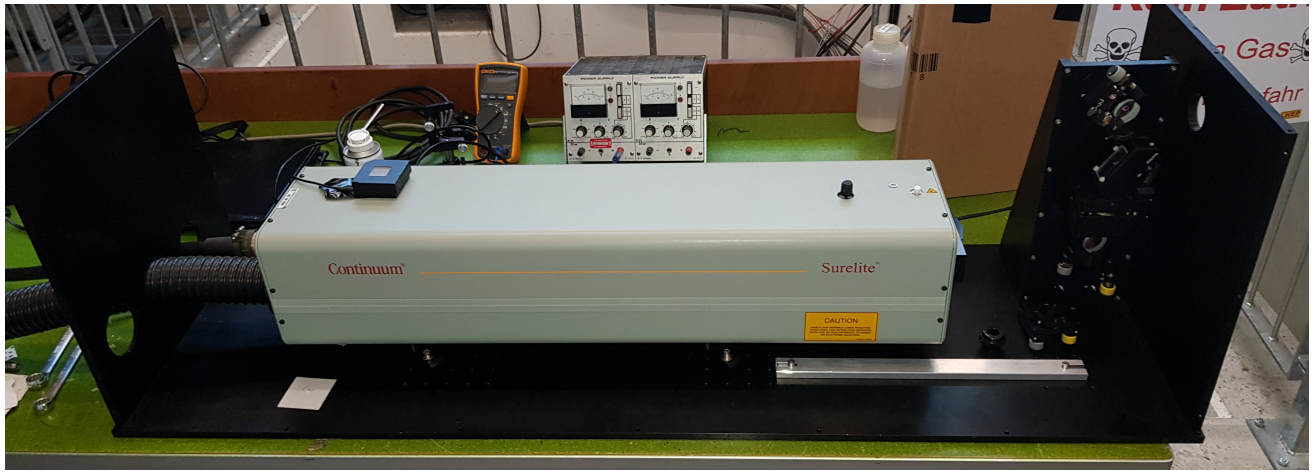




WBS 2.5 CRT/Laser

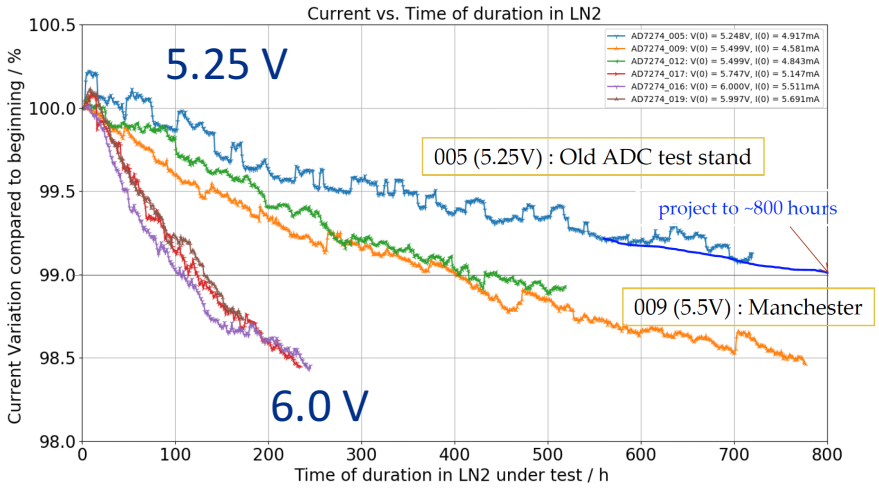
- 104 CRT modules made of 143, 66 delivered
- First laser box assembled, tested and improved
- Now ready to replicate the design
- Rotating laser head assembly is in progress

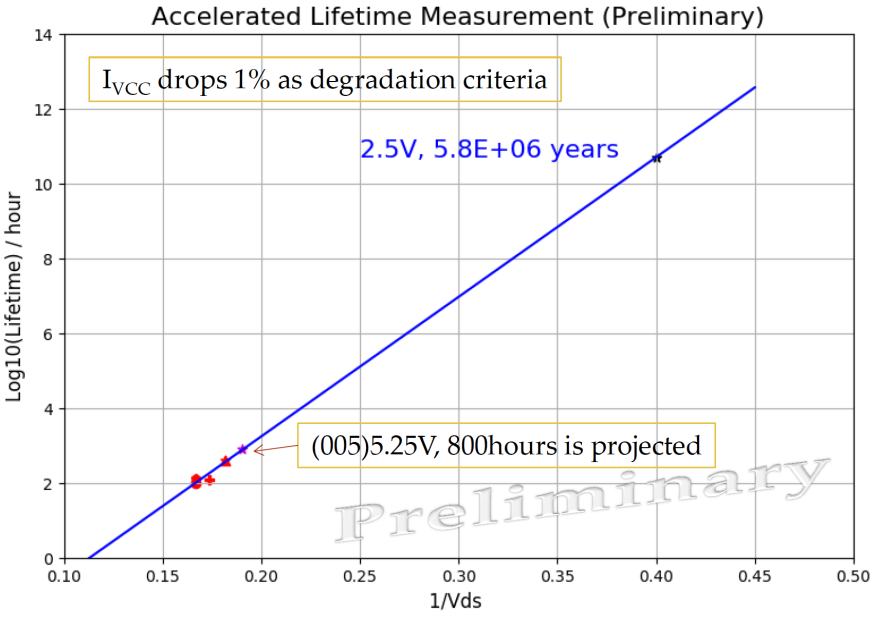




WBS 2.6: Electronics

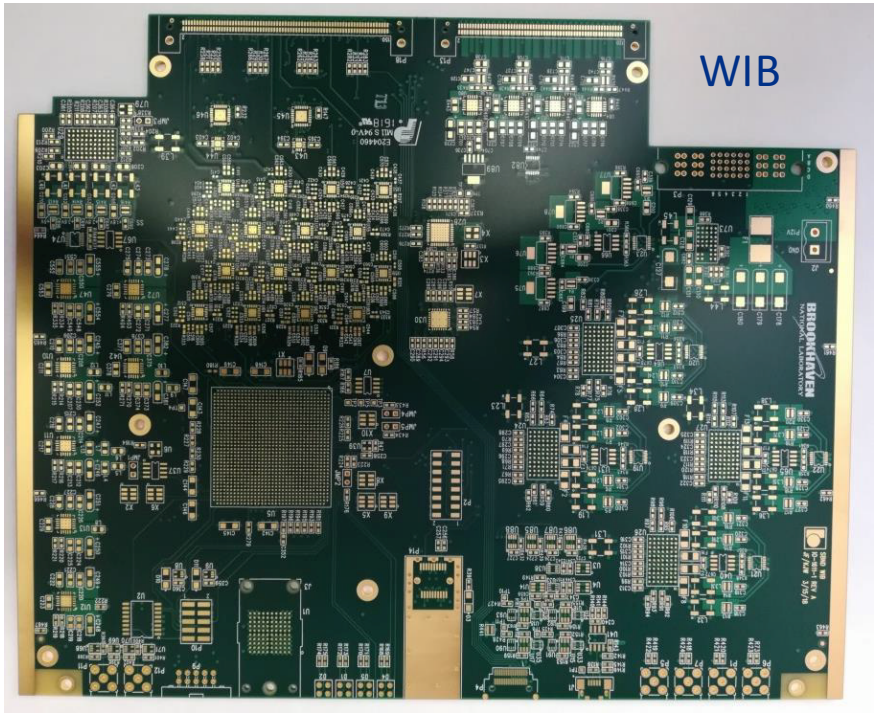
- Commerical Off The Shelf ADC lifetime studies are on-going at BNL and Manchester to provide data for a publication on the method
- Consistent results in the two test stands
- Top plot shows how current varies as a function of stressed time in LN2
- Clearly see how the variations degrade more quickly at higher stressed voltages
- Service lifetime projected to be 5.8 x 10^6 yr
- Warm interface boards are being assembled now
- Flange PCB boards are also being assembled
- Power and signal cables for the VST have also arrived
- Will do a noise test with the 40% DUNE APA at BNL in May

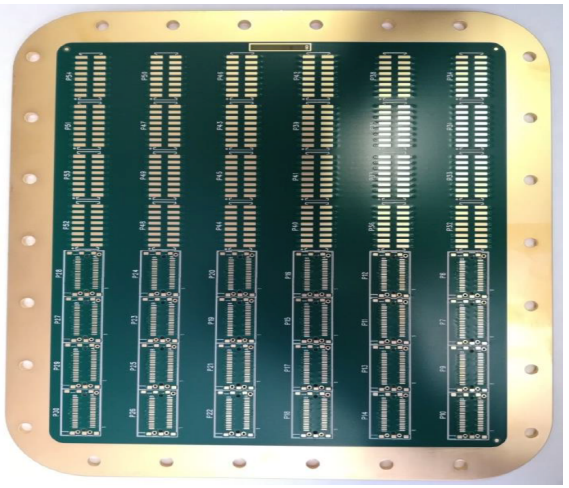




Vertical Slice Test (at LAriAT)

- Work toward the VST is progressing
- BNL-Nevis integration tests scheduled for week of May 21
- Electronics shipped to FNAL week of May 28
- Installation and commissioning June 4 - 18
- If all goes well we can start running June 18
- Pictures show components of the readout electronics system that are in production
- VST is accomplishing goal of being a kickstart to this production



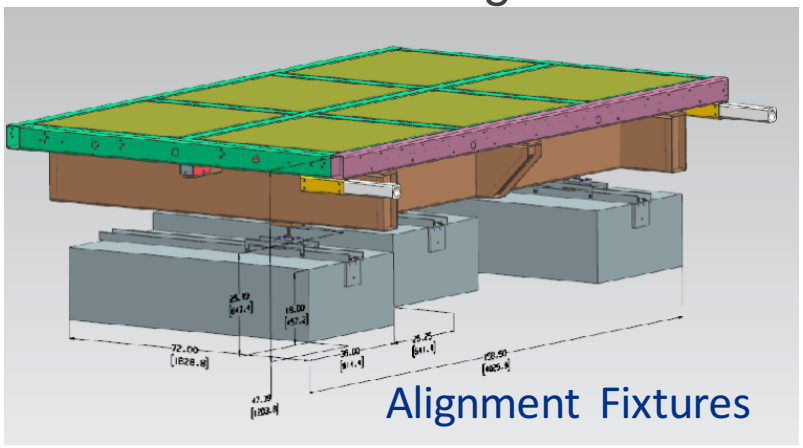


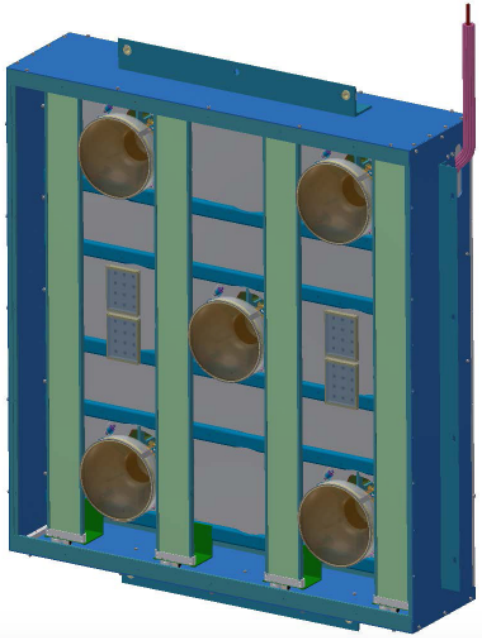
Flange board

WBS 2.8 Assembly

- Gantries are assembled in tent, tent is ready to go in Dzero Assembly bulding at FNAL
- Looking at cable routing for the PDS
- Simulations have started to give us a specification for misalignment that has been poorly defined to this point
- Mock APA pieces have been ordered and construction of the practice frames will be done soon
- Intended to practice through June, then real APAs arrive
- 6 weeks to fabricate alignment fixtures

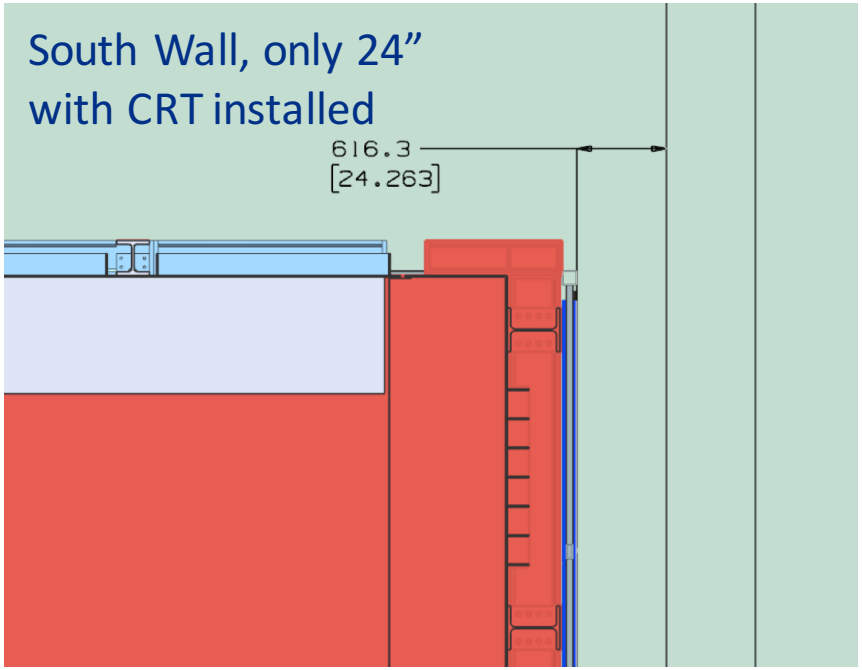

Gantries

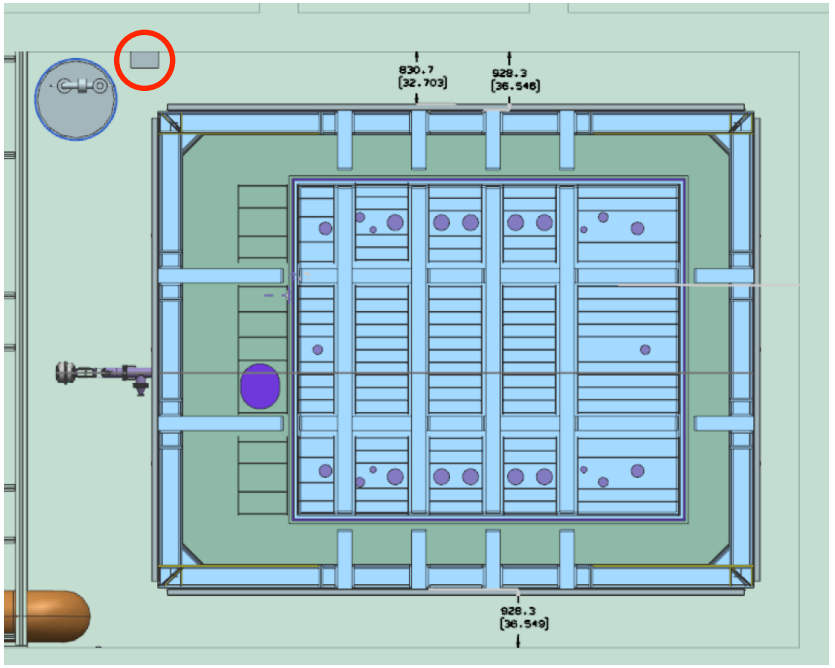

Alignment Fixtures


PDS Cables

WBS 2.9 Cryostat and Cryogenics

- The GTT design price came in higher than expected, so CERN is looking for ways to bring it in line with expectations
- One option is to use more insulation than initially envisioned, 80 cm all the way around rather than 60 cm
- Have checked with ESH&Q and it looks like we should *just* fit with the larger footprint
- The south end will have only 24 inches between the CRT and wall, 28 inches is fine by OSHA, we may have to take special measures
- May have to move circled sump panel in bottom picture
- Have communicated with CERN that the footprint cannot get bigger





WBS 3&4: ICARUS and Infrastructure Status

Slides from Cat James

Outfitting – Technical progress

- Crane upgrade
  - Started Apr 30, completed that week
  - Upgrade to 33 tons (US)
  - Load tested to 122% (80,000 lbs)
- Procurements
  - Steel for “ledge riser” and top CRT support beams
  - Steel for cryogenics support structure
  - Fiberglass decking and guardrails for the top of the warm vessel
  - Approved POs but held up by…. ?

The hardware made interesting sounds when picking up 80,000 lbs…….

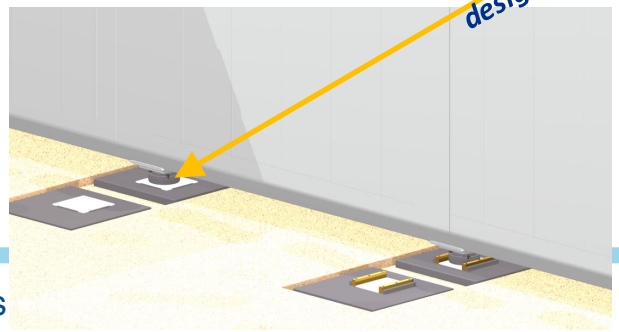
FD Installation Update

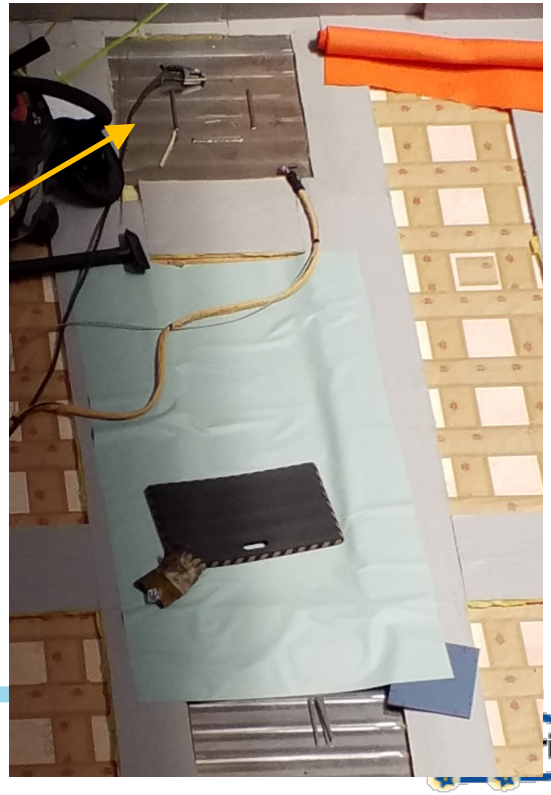
- Rigging
  - We have signed a contract with Emmert International
    - Emmert moved the g-2 ring from BNL to FNAL and installed in the g-2 building
    - SBN has formed a Rigging Technical Oversight committee (RTO)
    - RTO has had 3 meetings with Emmert (minutes posted to DocDB-6191)
    - We expect to see a proposed rigging plan from Emmert this morning
    - Reminder – we plan a multi-step review process (by RTO, by stakeholders, by external engineers)

- Before rigging the vessels, there are things to get done, and all are in progress
  - Cold Feet + Footpads
    - determines final positioning of Cryostats inside the Warm Box
  - Install Cold Shield inside the Warm Vessel
  - Weld and re-bolt cryostat doors

Far Detector Installation – Cold Feet & Footpads

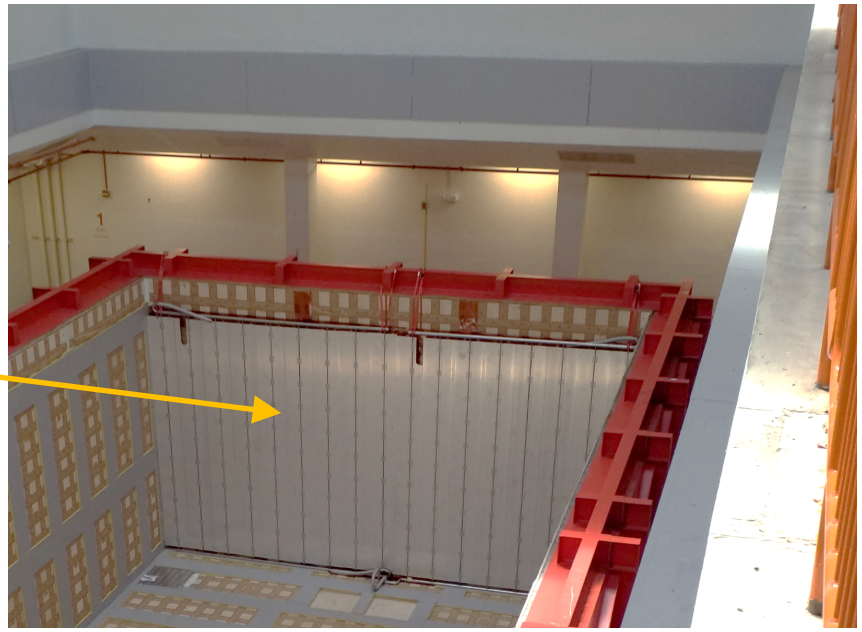
- Each Cryostat has 10 feet for mechanical support
  - 5 each long side
  - Each has a shim block which controls relative vertical position of each, compensating for non-level of cryostat box
  - All shim block machining is completed, and all 20 cold feet are installed on the two vessels
- The cold feet sit upon steel plates
  - The plates hold “pads” of HDPE to allow easy slipping during thermal contraction; HDPE pads are held in place by bars welded to steel plate surface
  - A few of the pads also have “constraint walls”, so that the directions of thermal contraction are controlled
  - Footpad assembly is in progress; all installed next week, followed by Alignment check to verify positions



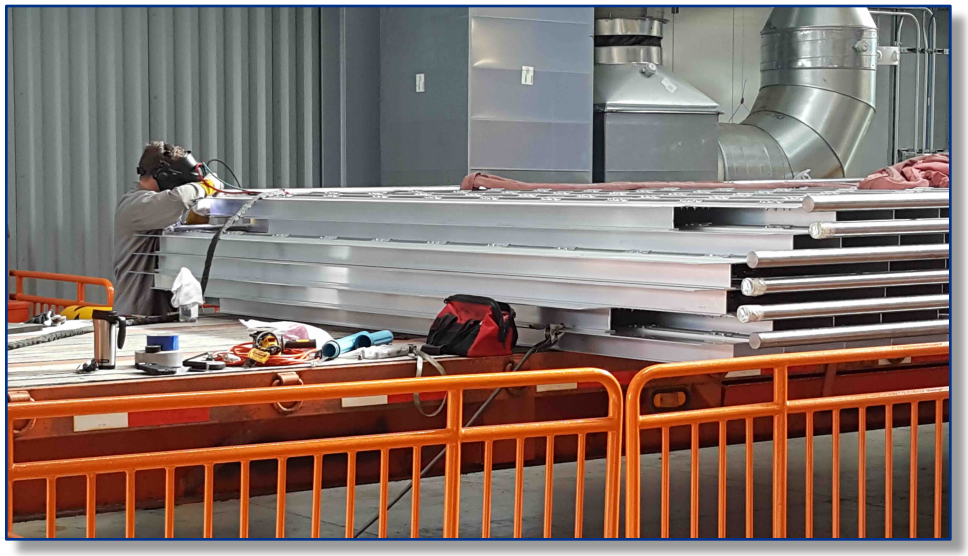


FD Installation – Cold Shield

- Assembly and installation in progress
  - 2 south wall panels
    - complete & installed
  - 2 north wall panels
    - Assembled
    - some remaining in/out pipe welding
    - Installed after east/west panels
  - 6 bottom panels
    - Assembled
    - In/out pipe welding in progress
    - Installed after footpads are completed
  - 6 east/west wall panels
    - Assembly in progress
    - Installed after bottom panels are in place
  - 6 top panels
    - Not yet started
    - Installed after the cryostats are rigged in



Installation Team



FD Installation – Cryostat Doors

- Sealing the doors has two main steps
  - Welding the seam
    - Welders have a CERN-reviewed procedure
  - Replacing the bolts
    - Which includes sealing these with a cryo-proof epoxy
- Status
  - Welding
    - Cryostats are enclosed in tents, providing adequate environment for welding
    - Welders performed a heating test; confirmed for themselves that they could get a large enough area to a temperature appropriate for welding this aluminum material
      - However, the precise temperature to reach is being discussed with CERN engineer
    - A beveled groove around the door/cryostat seam was machined at CERN. The groove was covered prior to shipping last year, to prevent water from seeping in. With the tents set up, we removed the covering and observed that the machined groove is shallower than the CERN specification in a few areas.
    - CERN is shipping the tool used to make the groove, so we can assess if we can repeat the machining in these spots; CERN is also assessing whether the specification can be relaxed.
    - Once started, welders estimate 4 man-days per door (4 doors)
  - Bolt replacement
    - All parts on site; supply of the specific epoxy is ordered

Cost and Schedule

Schedule Change Requests

- The tracks changes in the program resource loaded schedule, either changes in milestones or projected DOE costs, through a formal process known as change control
- Every month when we update sections of the schedule these proposed changes are incorporated into Change Requests from system managers and then approved by the program management and Neutrino Division Management

Change Requests – approved since April PMG

CR #	WBS	WBS Desc	Date	Description	Cost + or (-)	Delay (Days)
				Budgeted cost before change requests	$28,966,444	
11	4.3	Cryo	4/24/18	Update FD controls to projection to complete. Update of ND plan including experience from FD actual work.	$55,242	0
15	2.3	SBND TPC	4/22/18	Update milestones and tasks to reflect actual plan (e.g. consolidation of reviews)	0	0
14	4.2 & 4.4	ICARUS Install	4/30/18	Incorporate delays in deliveries of cold shield components, door welding and rigging into schedule.	$109,517	60
12	4.6	FD CRT	5/9/18	Update readout plan after technology choice for Side CRT of 3mm SiPMs. Also include cost of readout servers.	($154,265)	0
				Budgeted cost after change requests	$28,976,938	

- Over the past few months cost increases have been offset by opportunities found to save money

Upcoming Change Requests

CR #	WBS	WBS Desc	Date	Description	Cost + or (-)	Delay (Days)
13	2.7 & 4.5	DAQ	June	Tweaks to CR 7		

- Director's Review will be at the end June
- We plan to show statusing of schedule through May at the review
- We have frozen the schedule as of May 4

Cost to Complete – end of FY18 Q2 summary

- Regularized quarterly summary of DOE financed components of the program. Output of cost scrutiny group led by Gina Rameika.
- Delays in ICARUS installation are shifting costs to later in FY18 and from FY18 to FY19. Shortfall in FY18 is shrinking due to shift.
- Shows a shortfall in funding of about $4M in FY19. Lab management is in discussion with DOE for additional $4M by FY19 to cover this shortfall.

Results : End FY18Q2 | $K

Milestone	FY15	FY16	FY17	FY18Q1-2	Oblg	FY18Q3-4	FY19	FY20	FY21Q1	Total	Cost + Oblg	ETC
I-1 ICARUS ready to fill	$ 310	$ 989	$ 4,354	$ 1,036	$ 403	$ 2,567	$ 837	$ -	$ -	$ 10,496	$ 7,092	$ 3,404
I-2 ICARUS filled and ready for commissioning	$ -	$ 3	$ 79	$ 229	$ -	$ 1,610	$ 889	$ 30	$ -	$ 2,840	$ 312	$ 2,529
I-3a ICARUS CRT installed and operating	$ -	$ 41	$ 171	$ 7	$ -	$ 14	$ 1,380	$ 40	$ -	$ 1,652	$ 218	$ 1,433
I-3b ICARUS shielding in place	$ -	$ -	$ -	$ -	$ -	$ -	$ 847	$ 102	$ -	$ 948	$ -	$ 948
ICARUS Total	$ 310	$ 1,034	$ 4,604	$ 1,272	$ 403	$ 4,191	$ 3,953	$ 171	$ -	$ 15,937	$ 7,622	$ 8,315
S-1 SBND ready to transport to detector hall	$ 286	$ 1,843	$ 1,777	$ 916	$ 195	$ 1,429	$ 1,053	$ -	$ -	$ 7,499	$ 5,017	$ 2,482
S-2 SBND ready to fill	$ 80	$ 826	$ 472	$ 116	$ -	$ 886	$ 2,640	$ 1,022	$ -	$ 6,042	$ 1,494	$ 4,548
S-3 SBND filled and ready for commissioning	$ -	$ -	$ 11	$ 11	$ -	$ 15	$ 399	$ 993	$ -	$ 1,429	$ 22	$ 1,407
S-4a SBND CRT installed and operating	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 264	$ 264	$ -	$ 264
S-4b SBND shielding installed	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 183	$ 155	$ 337	$ -	$ 337
SBND Total	$ 366	$ 2,669	$ 2,260	$ 1,043	$ 195	$ 2,330	$ 4,093	$ 2,197	$ 419	$ 15,571	$ 6,533	$ 9,038
Technical Program Management (SWF)	$ 169	$ 345	$ 484	$ 304	$ 63	$ 203	$ 281	$ 112	$ -	$ 1,962	$ 1,366	$ 596
SBN Program Annual Costs to Date	$ 845	$ 4,048	$ 7,348	$ 2,618	$ 661	$ 6,724	$ 8,326	$ 2,480	$ 419	$ 33,469	$ 15,520	$ 17,949
SBN Program Cumulative Costs to Date	$ 845	$ 4,894	$ 12,241	$ 14,860	$ 15,520							
Budget						$ 6,526	$ 4,615	$ 4,615				
Surplus/Deficit						$ (198)	$ (3,711)					
With carry over							$ (3,910)					

Short Baseline Neutrino

Environment Safety Health & Quality Assurance

- Mike Dinnon has become the Neutrino Division Quality Assurance representative. As a member of the SBN program he is keeping an eye on QA issues such as how the cold shield piping is assembled.

Upcoming Events

- Upcoming PMGs
  - No June PMG due to Director's review
- Director's review planned for June 26-28

SBN Director's Review

- The next Director's Review for SBN is scheduled for June 26-28
- The charge and format are very different from the three previous reviews:
  - Focus on schedule elements and integrated schedule
  - Not a review of technical choices or cost
  - Small breakout sessions discussing deliverable tasks with respect to schedule,
- Gina Rameika has agreed to chair the review

<u>Agenda blocks:</u>

Tues 8-9am: Plenary Overview
9-noon: ICARUS Breakouts - installation
SBND Breakouts - assembly
afternoon: committee discussion
Wed 8-9am: answers to questions
9-noon: ICARUS install to commissioning
SBND installation
afternoon: committee work on report
Thurs 9-10:30 Dry Runs
11-noon closeout

<u>Breakout groups:</u>

- ICARUS Front-end electronics
- SBND Front-end electronics
- Common DAQ, slow controls & monitoring
- ICARUS installation
- SBND detector and cryostat
- SBND installation
- ICARUS and SBND Cryogenics
- Integrated schedule

Schedule

ICARUS Key Milestones on DOE schedule

Milestone	Description	Forecast Date Tech Driven
I-1	ICARUS detectors are ready to fill with liquid argon	May 2019
I-2	ICARUS detectors are filled with liquid argon and ready for detector commissioning (LAr purity adequate for physics has been achieved)	Nov 2019
I-3a	ICARUS detectors are ready for physics data - *CRT is operational*	Jan 2020
I-3b	ICARUS detectors are ready for physics data - *Shielding in place*	Feb 2020

- Milestones reflect realistic timelines in the DOE project style but with no explicit schedule float
- The collaboration is working toward a more accelerated schedule
  - An objective of Director's Review will be to reconcile schedules
- Past history suggests that the aggressive milestones are often missed

SBND Milestones on DOE schedule

Milestone	Description	Forecast Date Tech Driven
S-1	SBND is ready for transport from Dzero Assembly Building to the SBN ND hall	Aug 2019
S-2	SBND detector is ready to fill with liquid argon	June 2020
S-3	SBND detector is filled with liquid argon and ready for detector commissioning (LAr purity adequate for physics has been achieved)	Oct 2020
S-4a	SBND detectors are ready for physics data - *CRT is operational*	Nov 2020
S-4b	SBND detectors are ready for physics data - *Shielding in place*	Dec 2020

- Milestones reflect realistic timelines in the DOE project style but with no explicit schedule float
- Past history suggests that the aggressive milestones are often missed

Backup

Cost to Complete – end of FY18 Q1 summary

- Regularized quarterly summary of DOE financed components of the program.
- Shows a shortfall in funding of about $4M in FY19. Request has been made to the DOE for additional $4M by FY19 to cover this shortfall.

Results : End FY18Q1	$K									
Milestone	**FY15**	**FY16**	**FY17**	**FY18Q1**	**FY18Q2-4**	**FY19**	**FY20**	**Total**	**Cost+Oblg**	**ETC**
I-1 ICARUS ready to fill	$ 310	$ 989	$ 4,354	$ 600	$ 3,370	$ 492	$ -	$ 10,115	$ 6,253	$ 3,862
I-2 ICARUS filled and ready for commissioning	$ -	$ 3	$ 79	$ 94	$ 2,077	$ 350	$ -	$ 2,604	$ 177	$ 2,427
I-3a ICARUS CRT installed and operating	$ -	$ 41	$ 171	$ 4	$ 307	$ 1,105	$ 40	$ 1,667	$ 215	$ 1,452
I-3b ICARUS shielding in place	$ -	$ -	$ -	$ -	$ -	$ 888	$ 60	$ 948	$ -	$ 948
ICARUS Total	$ 310	$ 1,034	$ 4,604	$ 698	$ 5,754	$ 2,835	$ 100	$ 15,335	$ 6,645	$ 8,689
S-1 SBND ready to transport to detector hall	$ 286	$ 1,843	$ 1,777	$ 402	$ 2,171	$ 1,462	$ -	$ 7,941	$ 4,308	$ 3,633
S-2 SBND ready to fill	$ 80	$ 826	$ 472	$ 54	$ 1,200	$ 3,049	$ 753	$ 6,434	$ 1,432	$ 5,002
S-3 SBND filled and ready for commissioning	$ -	$ -	$ 11	$ 7	$ 35	$ 371	$ 993	$ 1,417	$ 17	$ 1,400
S-4a SBND CRT installed and operating	$ -	$ -	$ -	$ -	$ -	$ -	$ 264	$ 264	$ -	$ 264
S-4b SBND shielding installed	$ -	$ -	$ -	$ -	$ -	$ -	$ 337	$ 337	$ -	$ 337
SBND Total	$ 366	$ 2,669	$ 2,260	$ 463	$ 3,406	$ 4,882	$ 2,347	$ 16,394	$ 5,758	$ 10,636
Technical Program Management (SWF)	$ 169	$ 345	$ 484	$ 184	$ 378	$ 281	$ 112	$ 1,954	$ 1,183	$ 770
SBN Program Annual Costs to Date	$ 845	$ 4,048	$ 7,348	$ 1,345	$ 9,538	$ 7,998	$ 2,559	$ 33,682	$ 13,586	$ 20,095
SBN Program Cumulative Costs to Date	$ 845	$ 4,894	$ 12,241	$ 13,586						
Budget					$ 9,016	$ 4,615				
Surplus/Deficit					$ (522)	$ (3,383)				
Total shortfall						$ (3,905)				

Short Baseline Neutrino