DUNE Project Status

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DUNE PMG Meeting

19 September 2017

Fermilab DUNE

Outline

- ES&H Update
- QA Update
- Schedule & Budget Status
- PM Update
- Far Detector Report
- ProtoDUNE-SP Report
  - Design & Construction – reports by subsystem
  - Onsite - installation & instrumentation
- ProtoDUNE-DP Report
- Upcoming Events

ES&H

- Support meetings & discussions relating to installation activities relating to ProtoDUNE detector at CERN
- Equivalency review for training classes at Fermilab and CERN.
  - CERN EHS Group completed their review Fermilab training classes
    - Confined space class is equivalent; with the exception that, the entry supervisor must complete a CERN orientation on confined space. Per CERN requirements, Fermilab medical office or home institution will supply a medical evaluation form for individuals accessing confined spaces.
    - Fall protection class is equivalent; with the exception that, a CERN practical factors class is required
    - Arial lift training is not considered equivalent with CERN Safe Operation of Mobile elevating working platform. Must take at CERN.
- Sept. 1, Bruises on arms (First aid)
  - CERN EHN1 Coordinator was helping to position a load on the clean room rail system when the hoist and load fell from the rail
  - Awaiting CERN incident investigation report

Quality Assurance

- Participated in a review of the testing of the Cold Electronics ASIC Chips at Brookhaven National Lab (BNL).
- Developing a revision to the LBNF/DUNE QA Plan to incorporate the responsibilities of the DUNE Technical Director, Project Managers and Consortium Leaders.
- Performing follow up on the recommendations from the Production Readiness Reviews. Verified responses from BNL for Cold Electronics and Stony Brook for the Field Cage Top and Bottom Panels.

DUNE Milestones

	August 2017 P6 Update	July 2017 P6 Update	Variance	Comments
Completed In August				
T4 MS - ProtoDUNE SP First APA Production Electronics @ CERN	8/29/2017	8/29/2017	-	
T4 MS - ProtoDUNE SP Cryostat Installation Complete	9/20/2017	8/31/2017	(20)	Welding still in progress. Welding of the roof took longer than anticipated, because of the number of penetrations, which are a deviation from GTT standard practice. Also because of the delay there were fewer welders available for a period of time.
T4 MS - Stakeholders Submit FINAL Requirements & Interfaces for FSCF	9/22/2017	9/12/2017	(10)	Finalization of requirements and signoffs required additional time
T4 MS - ProtoDUNE SP 35ton HV Test (Phase 2) Complete	10/6/2017	9/12/2017	(24)	Delayed approval for cryo operations
T4 MS - ProtoDUNE SP Cold Integration Testing of APA#1 Complete	11/17/2017	11/17/2017	-	
T4 MS - ProtoDUNE PSL APA #2 Arrives @ CERN	11/21/2017	11/21/2017	-	
T4 MS - ProtoDUNE SP First APA Installed in Cryostat	11/21/2017	11/21/2017	-	

DUNE Stop Light Report – Cumulative as of August 30, 2017

Currency in: $K	Current Period							Cumulative to Date	
	Budget	Earned	Actuals	SV ($)	SV (%)	CV ($)	CV (%)	SPI	CPI
131.02 DUNE	976	992	2,354	15	2%	(1,363)	-137%	0.98	0.87
131.02.01 Project Office - DUNE	154	154	183	0	0%	(30)	-19%	1.00	0.96
131.02.02 Far Detector	823	838	2,171	15	2%	(1,333)	-159%	0.98	0.86
131.02.02.20 Far Detector - Detectors 1-4	110	120	143	10	9%	(23)	-19%	1.03	0.87
131.02.02.30 ProtoDUNE Design and Construction	550	624	1,797	74	13%	(1,173)	-188%	0.98	0.85
131.02.02.40 ProtoDUNE Onsite	163	94	232	(69)	-42%	(137)	-146%	0.93	0.86
131.02.03 Near Detector	0	0	0	0	0%	0	0%	-	0.00
Total	**976**	**992**	**2,354**	**15**	**2%**	**(1,363)**	**-137%**	**0.98**	**0.87**

Last month: SPI = 0.98, CPI = 0.92

- August cost variance on ProtoDUNE Design and Construction impacted by two costs not scheduled for August:
  - Payment of invoice (through Apr 2017) for APA work
  - Accrual of CERN DAQ Slow Control work
- Implementing closer review of monthly planned activities to minimize such variances

Project Management Highlights

- Installation work at CERN
  - Integration work of PD & CE into APA#1
  - Incident on 1 September shifted some effort to field cage work in Bldg 182
  - Procedures continue to be developed
- FY18 Planning
  - CR planning impacted by increased August costs
  - Budget & schedule review
    - ProtoDUNE – Q1 & Q2
    - Far Detector activities revised
    - FY18 SOWs in process
  - Funding profile scenarios (with LBNF)
- First meetings of FD consortia; technical leads announced
  - Development of WBS & mapping of institutional responsibilities
  - Preparation for Technical Design Reports in 2019

Project Management Highlights

DUNE Review Recommendations, DOE IPR, 28 Feb-2 Mar

Define minimal, quantifiable requirements that ProtoDUNE must achieve so that DUNE will have successful LBNC, CD-2, and CD-3b reviews. Define a date for each of these sets of requirements to be achieved. Due Date: May 1, 2017.	James, with Thomson	Complete 17 March 2017; docdb#2765
Use project management tools to manage the schedule, costs, and possible scope reductions so as to achieve the ProtoDUNE requirements. The planning should extend beyond integration. Due Date: June 1, 2017.	Macier	Added milestone for FD decisions; Evaluating additional milestones
Develop a plan and budget with clearly defined objectives for operating ProtoDUNE at CERN. Due Date: October 1, 2017.	James	FY18 operations budget
Assemble a task force to address photon detection in preparation for CD-2. Due Date: May 1, 2017.	James	Complete
Establish and document, with the DUNE Collaboration, the detector performance requirements necessary to achieve the physics goals for CP violation, proton decay, and astrophysical neutrinos of the DUNE project for the TDR.	James	
Perform a comprehensive review of your bottom-up cost estimate (including CORE costs) prior to the next OPA review.	Macier	FY18 planning & Consortia Technical Proposals
DOE should work with LBNF/DUNE and international partners to better define CD2 requirements for non-DOE contributions.	Carolan	

Project Management Highlights

DUNE Review Recommendations, LBNC, 22-24 June

Recommendation	Responsible	
The ProtoDUNE-SP management team should prepare a table with the list of the CE components to be delivered by the BNL team, their status (e.g. “Prototype”, “procurement in progress”, “all components on hand”), expected or estimated delivery dates for APA1, 2,3,4,5,6). This table should also include details of any staged delivery plan. A prioritized plan for assignment of resources to these components should be prepared.	James	✓
The WIB is in a second iteration. 5 are needed for use in the cold box test of APA1 at CERN and only 1 board is available. The ProtoDUNE-SP management should work with the BNL team to identify sufficient WIBs to allow efficient operation of the cold box testing for APA1, presently scheduled for the first week in August, and to provide boards as needed to DAQ developers for system integration.	James	✓
The ProtoDUNE-SP CE System Manager should communicate with the Construction Coordinator on a weekly basis through this critical period (4-16 weeks).	James	✓
The LBNC points of contact for CE, Planning and Schedule should follow up with ProtoDUNE-SP management and the BNL team responsible for the cold and warm electronics deliverables in the next POC interaction, which should take place in approximately one month.	James	✓

Far Detector - Cryostat Interface Definition

1. Signal Penetration specification
Cable Routing –mock-up center APA tube done. Will now plan a realistic prototype. No cryostat changes foreseen. [no change]

2. Detector Support Structure
Additional Supports for the endwall are in the CERN model. Installation switchyard is being developed. Beam length changes to reduce roof penetrations.

3. Cleanroom-TCO interface
Waiting on resolution of interface issues from the cryostat.

4. HV feedthru Penetrations
Studying moving the HV penetrations off-axis to give space for the mechanical supports.

5. Cryogenic monitoring Interface
New consortia and taskforce formed. Meeting several times a week to converge on a proposed configuration

6. Calibration Penetrations
New consortia and taskforce formed. Meeting several times a week to converge on a proposed configuration

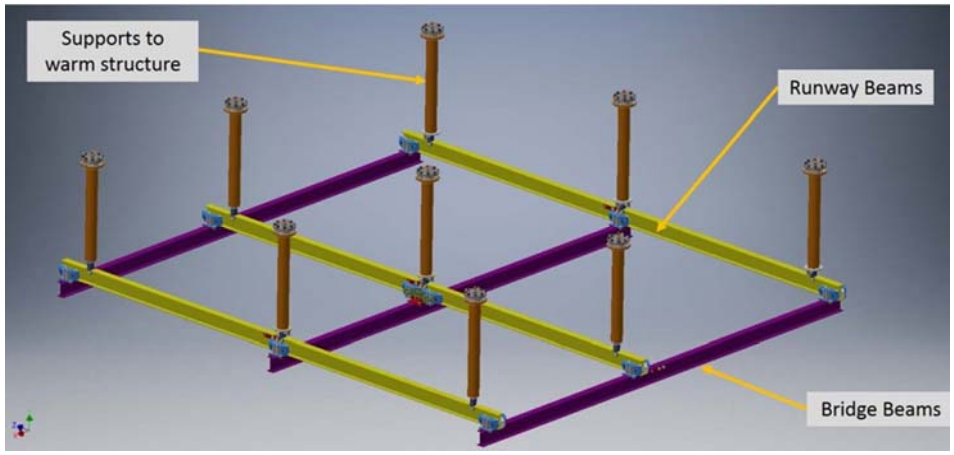
7. Rack Placement and Cable Trays
No progress

8. Infrastructure Floor load, Lights, HVAC, cable hooks
No Progress

SPPD Design & Construction – Subsystem Reports

APA

- US APA#1: outfitted with Photon Detectors & Cold Electronics
- US APA#2: v-plane winding & soldering complete last week
- UK APA#1: x-plane winding complete



Photon Detector

- Production continues; assembly of bars for APA#2 underway

DSS

- Installation of runway & bridge beams

Cold Electronics

- Testing of production ASICs (FE & ADC); ADCs for APA#2 selected

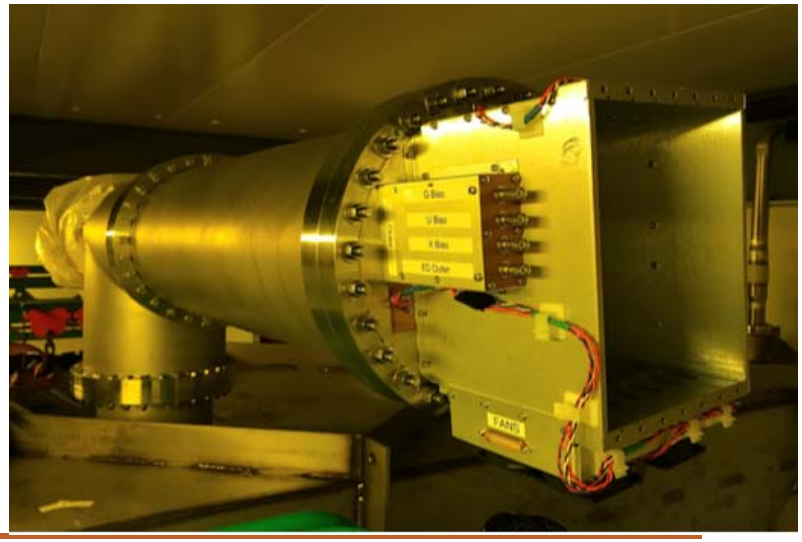
CPA/FC/HV

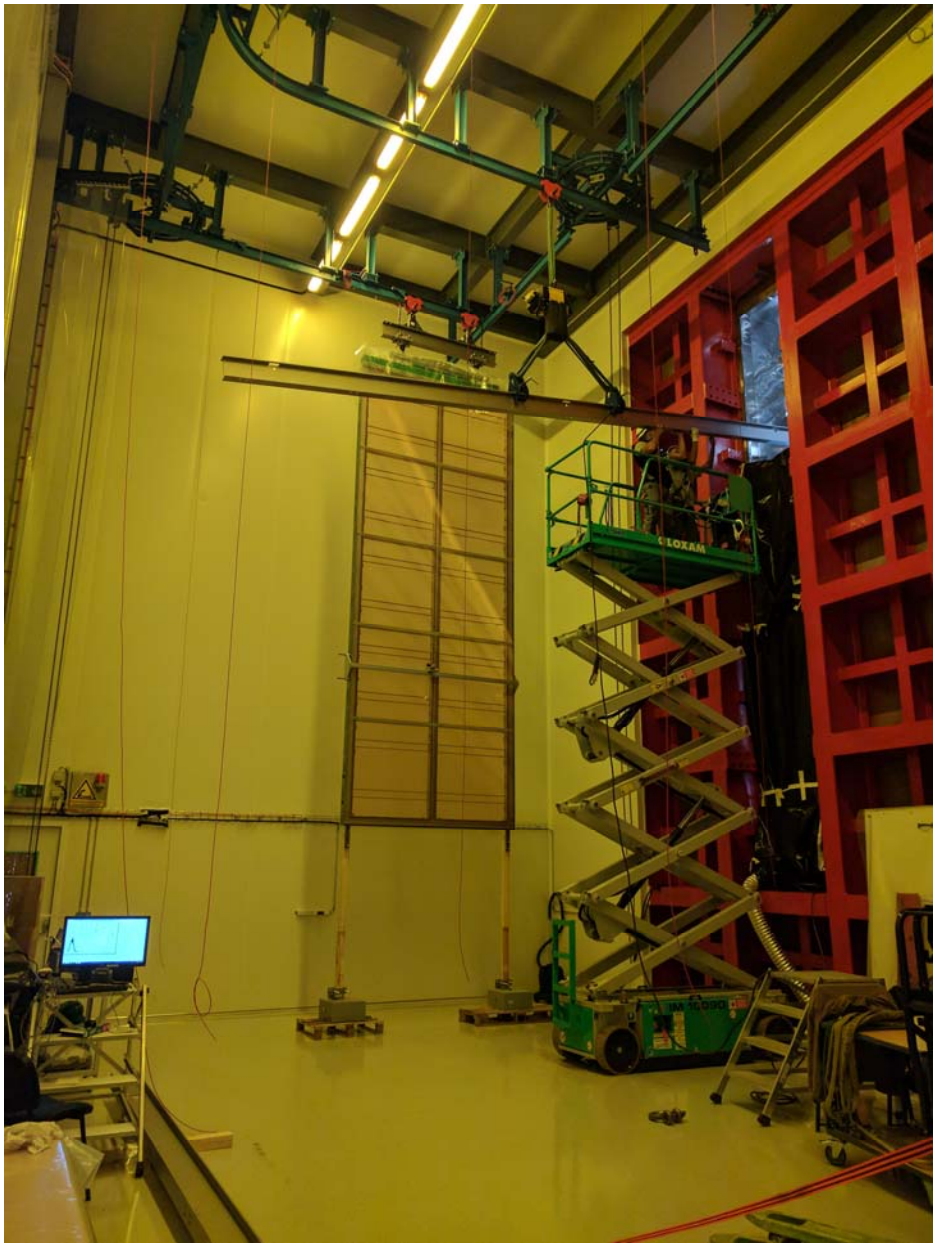
- CPA assembly underway with field shaping strips (goal to ship by 1 Oct)
- Field cage fabrication: nine (of 12) modules completed & delivered to EHN1
- HV Phase 2 test at PC4 (with beam plug) now running

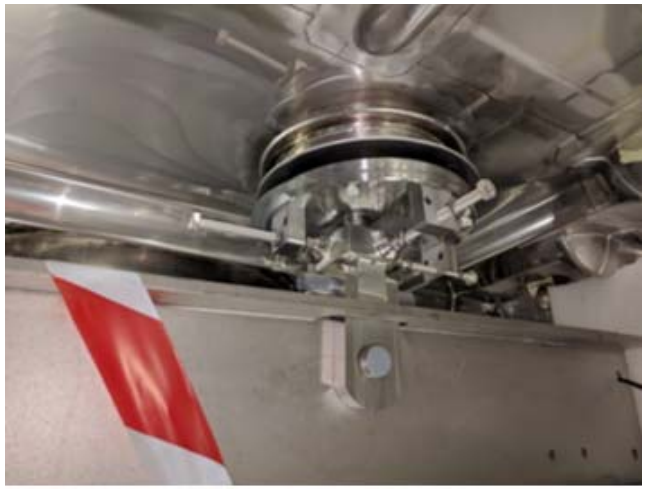
ProtoDUNE-SP Onsite

- Detector Integration [EHN1 CleanRoom]
  - *APA: wire tension measurement (~300 wires in X,U,V,G planes)*
    - Differences from ±5% to ±15% depending on the plane wrt to PSL measurements.
    - APA orientation during the tension measurements might be the main reason
  - *CE boards integration completed*
    - Installed and tested 20 CE boxes on APA1; Installed Tee, flange, and hardware on cold box
  - *PD: integration complete*
    - Installed and tested 10 PD bars on APA1
- Detector Installation [pDUNE-SP Cryostat]
  - *Cryostat: membrane welding complete -*
    - First leak check successfully accomplished. More extended He leak check to be performed
  - *DSS: in progress*
    - Runway beams in place inside cryostat; transverse beams to be mounted
- Detector Construction [CERN - Bldg 182]
  - FC panels: Top & Bottom Panels assembly almost completed; panels stored in EHN1
- Neutrino Platform Infrastructure [CERN]
  - Cold Box completed - external LN2 storage in place and plumbing completed.
  - Tee Pipe, PD and CE flange installed on top of cold box
  - Ready for cryo-test / commissioning (expected during last week of Sept.)


Piano Tuner
ORANGE







ProtoDUNE-SP Onsite

Accident reported in pDUNE-SP Clean Room:

- On Friday afternoon (September 1st) at CERN while being moved into the cryostat, a bridge beam for the ProtoDUNE-SP detector support system (DSS) was traveling via hoist on the clean room rail system. A junction of the rail system shifted position unexpectedly and the hoist and beam fell to the ground. No one was injured, the CERN EHN1 Technical Coordinator had superficial abrasions on his arm and was transported to the hospital as a precaution and was released the same afternoon.
- As required, during DSS beam movement and following accident the ProtoDUNE detector integration activity was suspended and no protoDUNE personnel were present in the Clean Room.
- The Clean Room was immediately closed and CERN Safety Authorities (HSE) opened an investigation.
- An inspection was carried on Sept. 4 by CERN Safety Authorities and then the Clean Room was re-opened to protoDUNE Detector integration activity.
- FEA calculations and Safety documentation for the rail system have been re-examined and confirmed by CERN HSE. In line with advice from HSE, the Neutrino Platform replaced a portion of the rail system and modified turntables and junctions/switches with manually operated hardware locks.
- An extensive static and dynamic test (1.5 T load) of the portion of the rail system involved in the accident has been successfully performed by CERN HSE on Sept. 15 and qualified for use.
- Same load test procedure will be performed for all other rail system branches in the course of the current week.
- A final report is being prepared by CERN Safety authorities and will be circulated as soon as available.

ProtoDUNE-SP Onsite

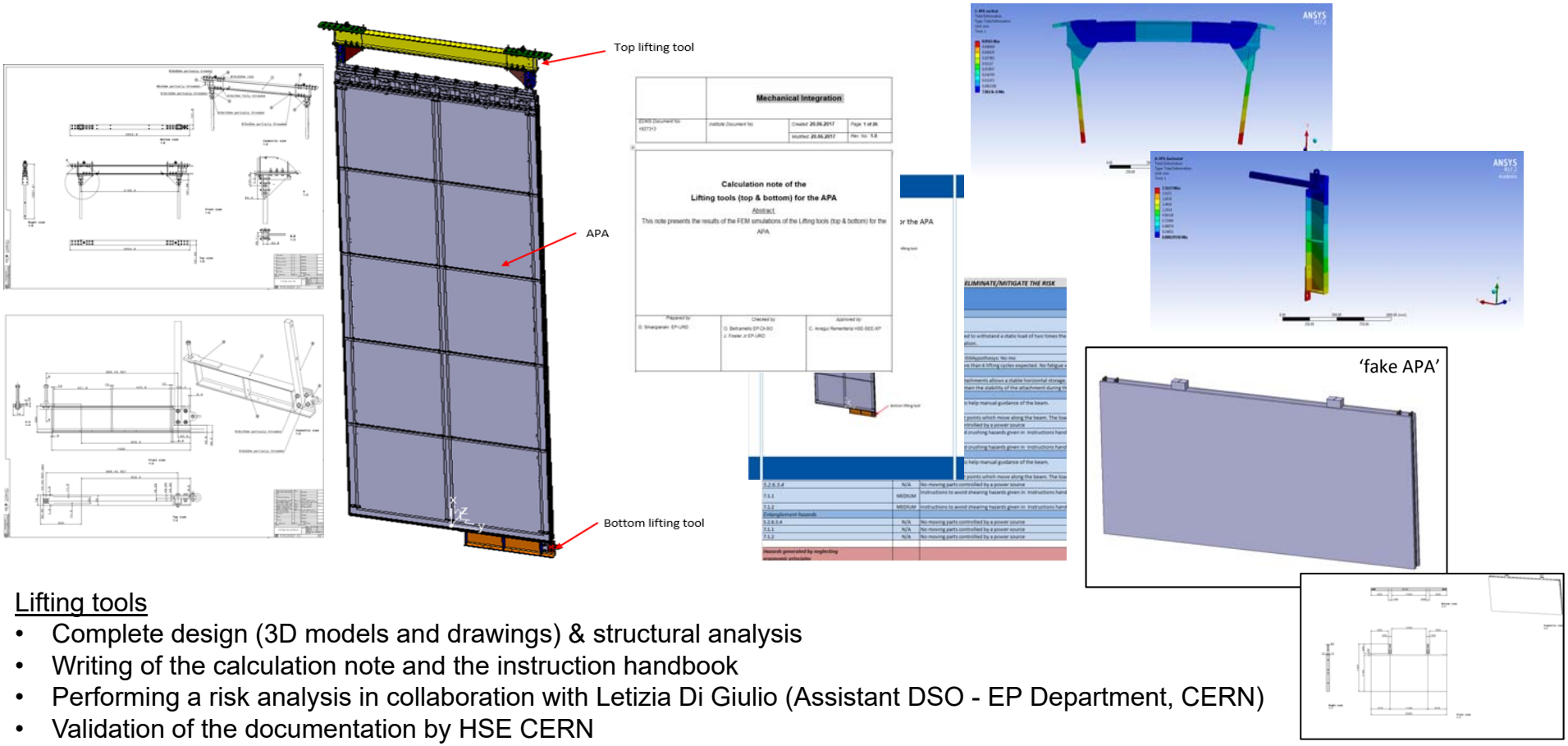
- Instrumentation
  - *Beam Instrumentation:*
    - effort to push for installation of magnets (H4 tertiary beam line) before end of the year shutdown
    - Beam Plug constructed, tested (LBNL) and now installed in 35T at FNAL. Full test in LAr and nominal HV started.
  - *Cryo-Instrumentation:*
    - T-Gradient sensors (Hawaii) tested in LAr in LAPPD at FNAL
    - T-Gradient sensors (and cables and connectors) tested in LN2 at Valencia
    - Purity Monitors: construction of FE Electronics under way, Digitizers purchased, software under development
  - *External Instrumentation:*
    - Muon tracker system: defined assembly & test area in EHN1 for CRT units
    - Transportation of modules at CERN (from Strasbourg)

ProtoDUNE-SP Onsite

- DAQ & Computing
  - Incorporated WIB into Vertical Slice test set-up and interfaced with DAQ and timing
  - DAQ: excellent progress - preparation for DATA Challenge in early Nov.-
  - Computing: working on integration of the FNAL, CERN Tier0 and NP facilities (Data Challenge)
- Data Reconstruction & Analysis
  - Progress in TPC track to Beam particle incident trajectory matching algorithm:
  - Space Charge effect play a major role; correction needed for efficient matching
- Organizational Items:
  - Run Plan document and Beam time request in preparation for SPSC:
    - Progress in identifying main steps and durations of Cryo-commissioning phase - in cooperation with Neutrino Platform
    - Meeting w/ SPS Operation Coordinator (H. Wilkens) to understand current perspectives of beam availability in EHN1 until Long Shutdown 2 (LS2) start (end Nov.18)
  - Detailed plan for Cold Box test phase (starting during 1st week of Oct) under discussion
    - Primary goal: coordination of CE, PD and DAQ debugging and test before integrated test in cold

Prepared by D.Smargianaki, 9/18/2017

ProtoDUNE-SP Onsite



Lifting tools

- Complete design (3D models and drawings) & structural analysis
- Writing of the calculation note and the instruction handbook
- Performing a risk analysis in collaboration with Letizia Di Giulio (Assistant DSO - EP Department, CERN)
- Validation of the documentation by HSE CERN

'fake APA'- for test and certification of the lifting tools by HSE CERN

- Complete design (3D model and drawings)

Special thanks to William Miller Jr and his team, Daniel Wenman, Jack Fowler, Roberto Acciarri, Filippo Resnati, Letizia Di Giulio and to all the CERN teams for their collaboration and help

** Risk assessment has been performed in collaboration with Letizia Di Giulio (Assistant DSO - EP Department, CERN)*

Prepared by D.Smargianaki, 9/18/2017

ProtoDUNE-SP Onsite

Top lifting tool

Bottom lifting tool

Supervision of the manufacturing of the lifting tools and the 'fake APA' at CERN

'fake APA'

Prepared by D.Smargianaki, 9/18/2017

ProtoDUNE-SP Onsite

Test and certification of the lifting tools performed by CERN

Vertical position

45deg

Horizontal position

Full rotation test of the lifting tools using the ‘fake APA’

Prepared by D.Smargianaki, 9/18/2017

ProtoDUNE-SP Onsite

Test was successful

The tools were certified for using them with the real APA

Certification stickers

Prepared by D.Smargianaki, 9/18/2017

ProtoDUNE-SP Onsite

Preparation of the APA for lifting and rotation

Opening of the box
&
Preparation of the APA for lifting & rotation

APA ready for lifting & rotation

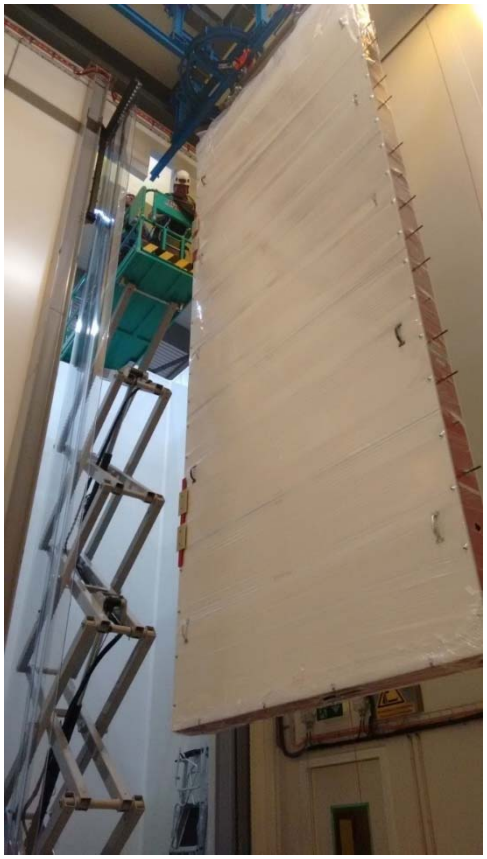
Prepared by D.Smargianaki, 9/18/2017

ProtoDUNE-SP Onsite

Lifting and Rotation of the APA

Horizontal position

45deg

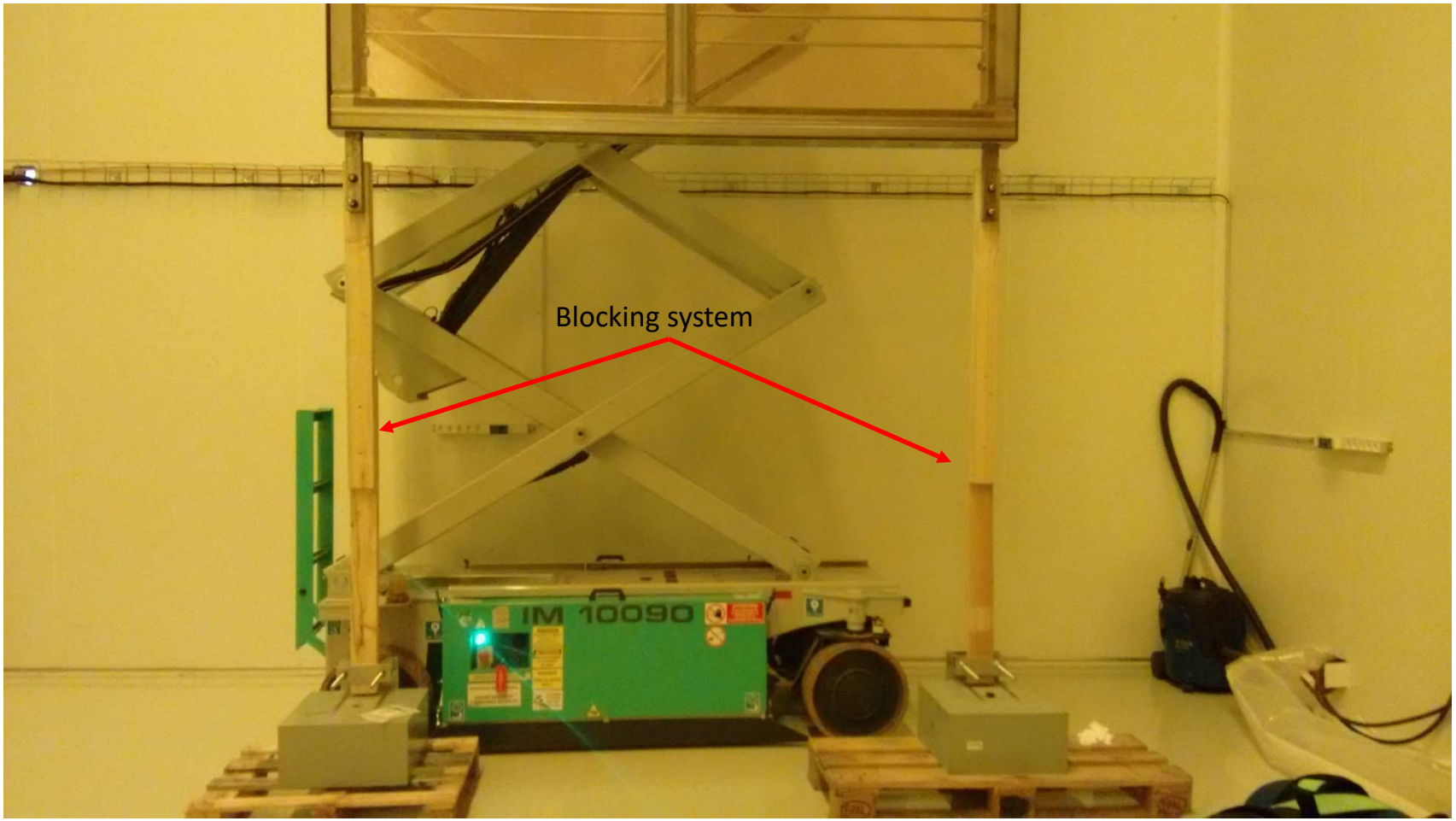


Vertical position
APA ready for works in the clean room

Prepared by D.Smargianaki, 9/18/2017

ProtoDUNE-SP Onsite

Preparation of the APA for surveying (blocking the bottom)



Prepared by D.Smargianaki, 9/18/2017

ProtoDUNE-SP Onsite

Storing the lifting tools for APA#2

Lifting tools - stored and waiting for APA#2

Dual-Phase - Technical Progress

- Dual phase 1x1x3 prototype continues operations
- 1x1x3 Review on 25 September
- Development of WBS as part of FD consortia effort

Upcoming Events

- 1x1x3 review, 25 September 2017 at CERN
- Electrical & Grounding Connections Review, 26-27 Sept at CERN
- SPSC Meeting, 19-20 Oct. 19-20 at CERN. Report on Run Plan for Summer 2018 and Beam Time Request
- LBNC Review, 26-28 October at SURF
- RRB Meeting, 2 November at Fermilab
- Signoff on SP cryostat feedthrus, 1st week of November by video
- Near Detector workshop, 6-7 November at CERN
- DUNE Collaboration Meeting, 29 Jan -1 Feb at CERN
- DOE IPR, late February 2018 at Fermilab