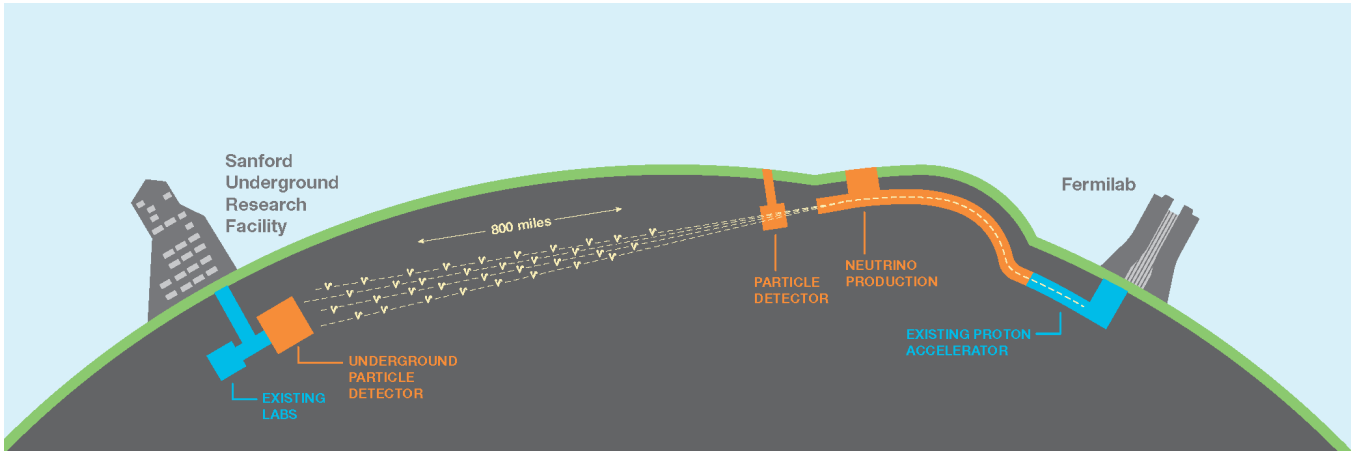


ProtoDUNE Overview

Eric James

LBNC Meeting

22 June – 24 June 2017

Fermilab DUNE

DUNE Collaboration Priorities

- Construction and operation of the ProtoDUNE detectors at CERN
- Preparation of the DUNE Technical Design Reports (TDRs)
  - Needed for at least the first two far detector modules by early 2019
  - Must be accompanied by credible funding model for detector construction
- These are the key activities that get DUNE to the planned installation of the first 10-kton far detector at SURF in the early 2020's and ensure its leadership position within the international landscape for the CP-violation measurements

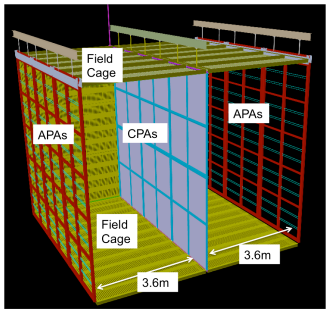
DUNE Far Detector Prototyping

Single-Phase

35-TON

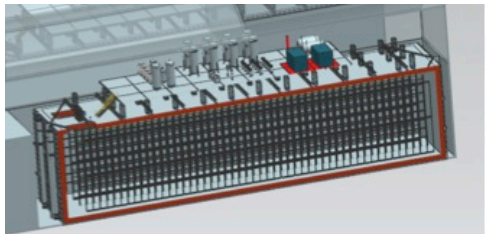
2016

ProtoDUNE-SP



2018

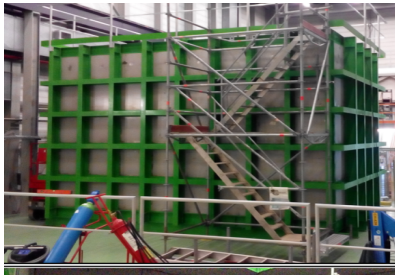
DUNE Reference Design



2024

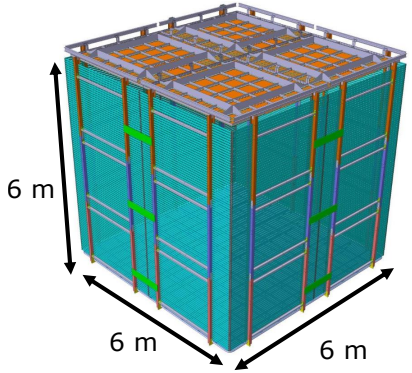
Dual-Phase

WA105 (1x1x3 m^3)



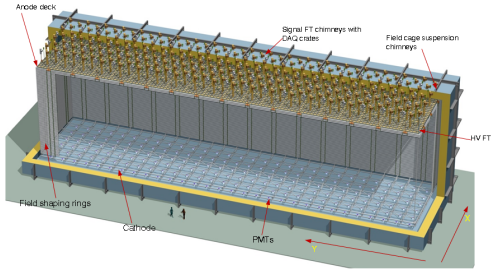
2017

ProtoDUNE-DP



2018

DUNE Alternative Design



ProtoDUNE Goals

- Mitigation of risks associated with current detector designs
- Prototyping of construction facilities needed for production of detector components
  - ProtoDUNE detectors are assembled from same full-scale components used to construct the far detector modules
- Early detection of potential issues with construction methods and detector performance
- Obtaining required calibration of detector response to particle interactions in test beam

Document summarizing objectives of the ProtoDUNE program in the context of baselining Far Detectors (DUNE DocDB #2765)

Since Last LBNC review …

- Significant progress across all ProtoDUNE-related efforts, which will be highlighted in the next few slides and detailed in subsequent presentations
- Schedule slippages in a number of key areas requiring organizational re-planning and adaptation of mitigation strategies

ProtoDUNE-SP Progress

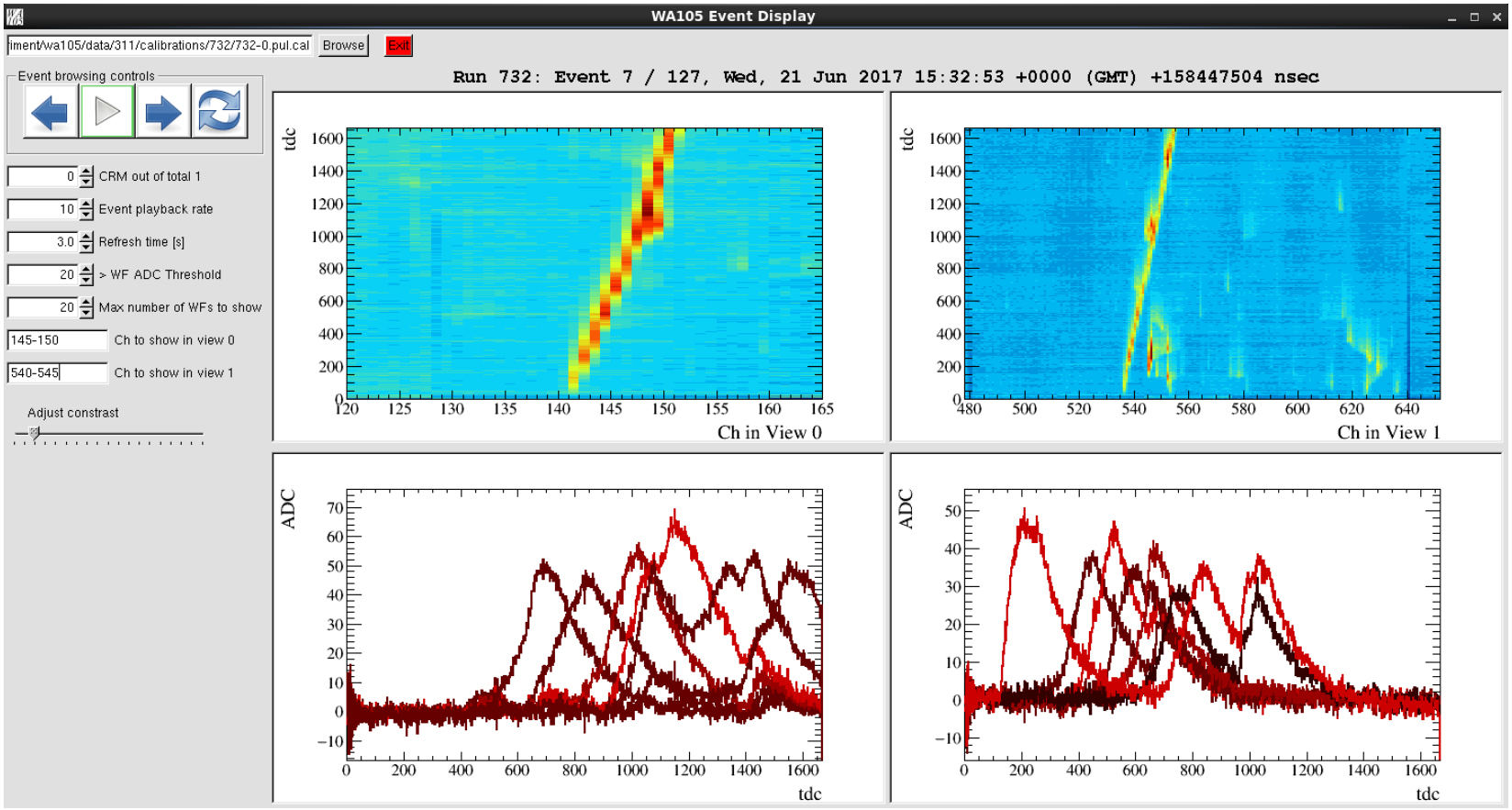
- First APA module completed at PSL (will be shipped on 7/11)
- Detector Support Structure (DSS) design complete, all parts ordered, and supporting engineering documentation delivered to CERN (plan to install in late July)
- Packaged FE and ADC chips delivered to BNL and testing is underway (anticipating early-August delivery of 1st APA boards)
- Photon Detector Modules for 1st APA have been produced and will be shipped to CERN in mid-July
- DAQ system has undergone extensive integration testing and is currently being re-located to its permanent home in EHN1
- Substantial progress on the EHN1 facilities (Cryostat, Clean Room, and Cold Box)

ProtoDUNE-SP Progress

ProtoDUNE-DP Progress

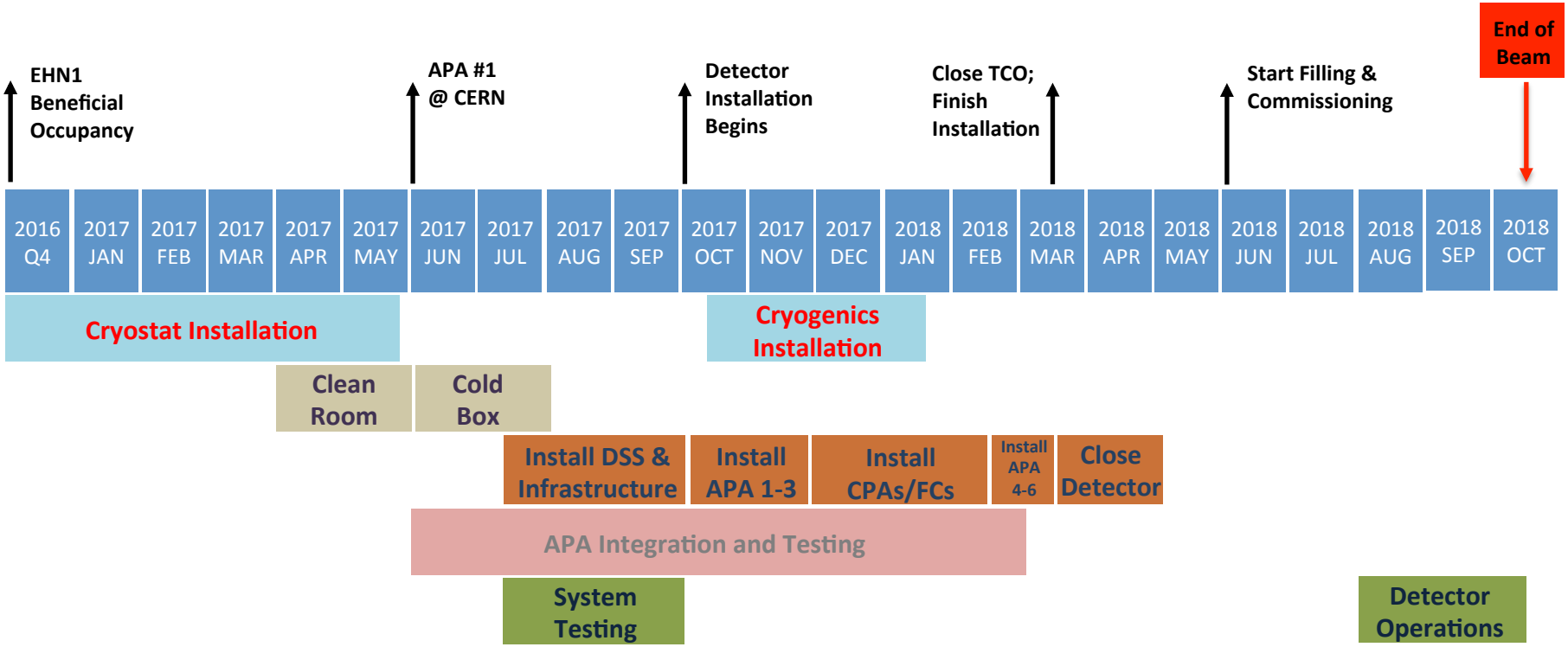
- First operation of 1x1x3 m^3 prototype following significant efforts to debug issues with cryostat
- Setup of clean room in building 185 to initiate production of LEM modules
- Substantial progress on the EHN1 facilities (Cryostat and Clean Room)

ProtoDUNE-DP Progress

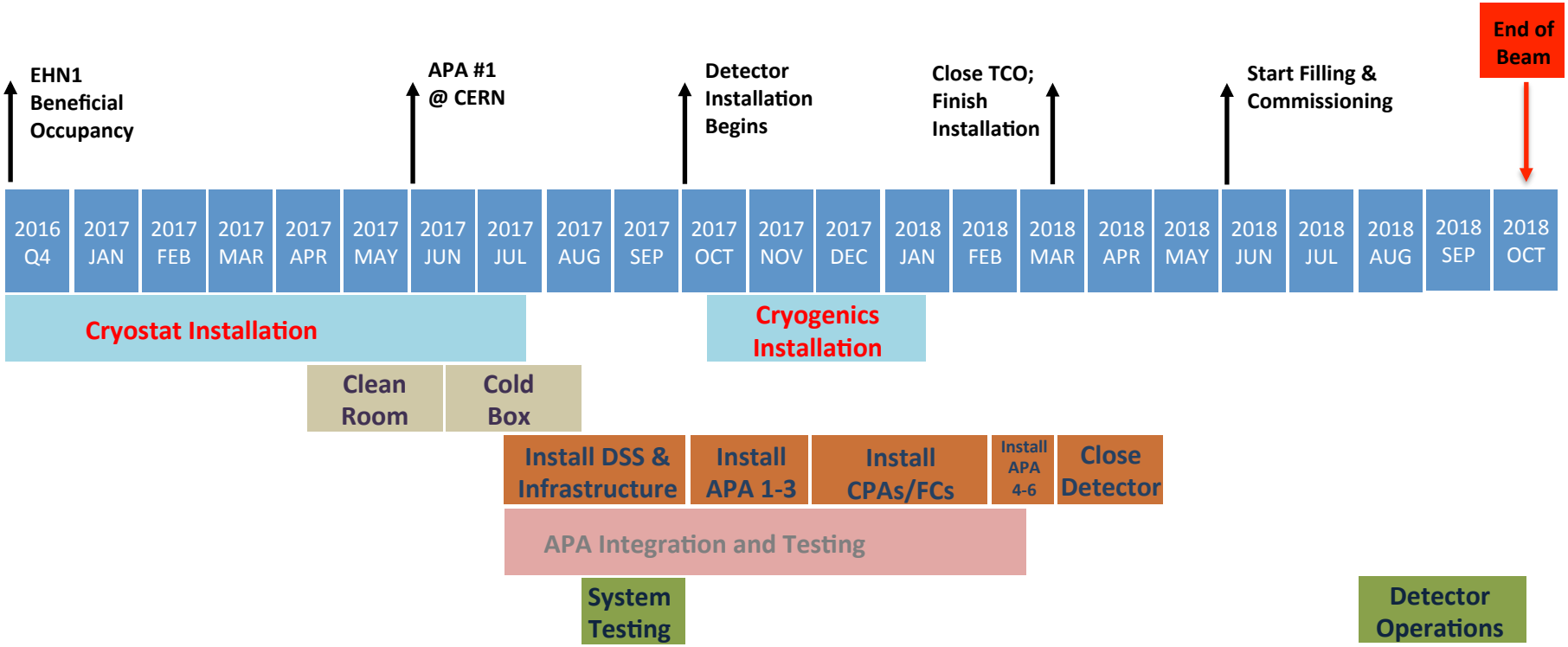


First tracks observed in 1x1x3 m^3 detector!

ProtoDUNE-SP Schedule (March)



ProtoDUNE-SP Schedule (June)



Short-term Concerns (SP)

- Time available for critical system integration testing in Cold Box has been reduced
  - To avoid further slippage, we have agreed on a plan for sectioning off a portion of the clean room in order to begin integration of first APA independent of Cryostat completion and/or DSS installation dates
- Start of the integration testing period has been pushed to later in the summer
  - Working where possible to adjust travel plans for key on-site personnel
  - Working to ensure that needed resources will be available during August vacation period

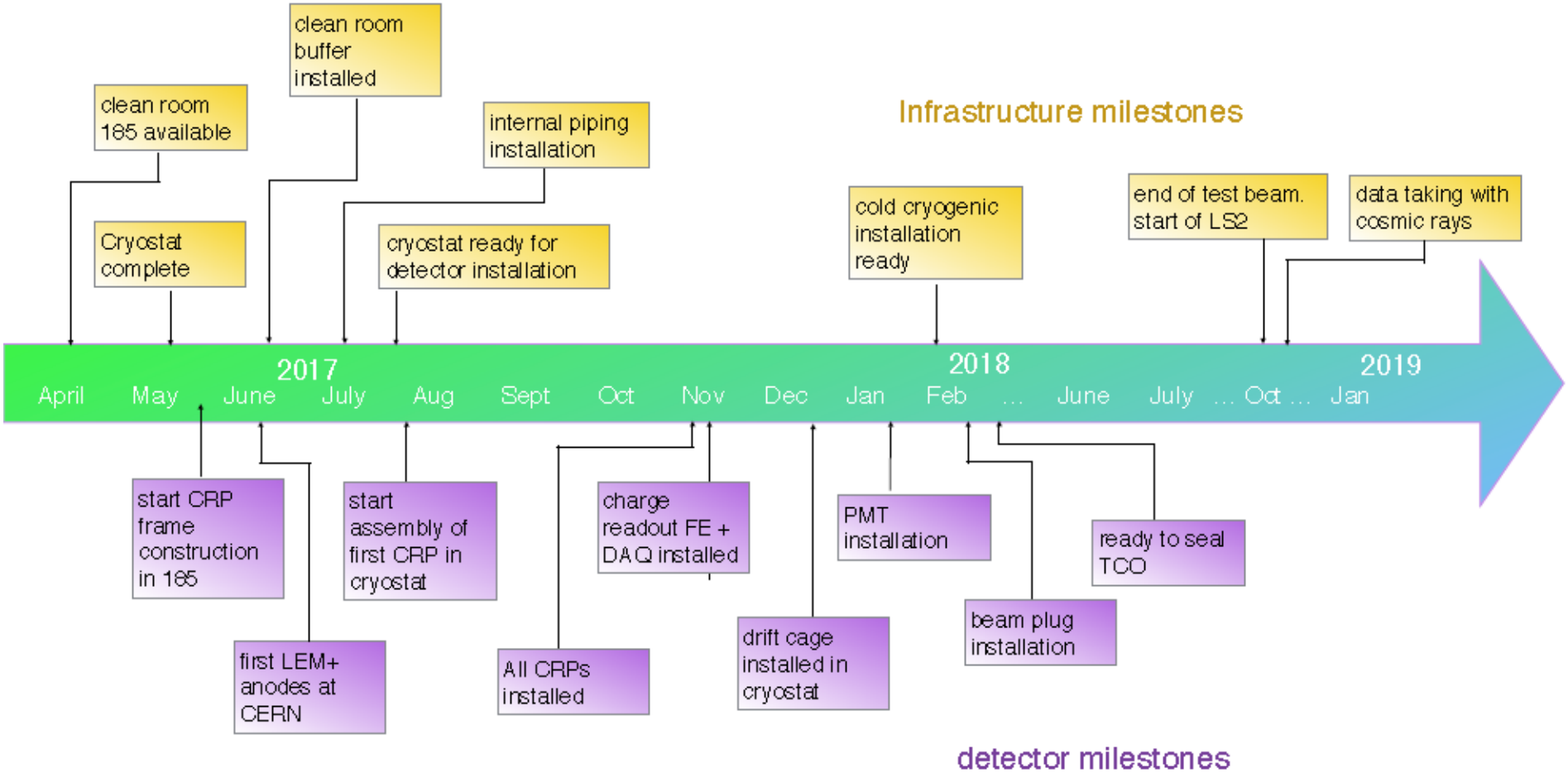
Longer-term Concerns (SP)

- The installation schedule is still driven by the delivery dates for APAs 2-6
  - Quality issues with the frames for APA #2 has delayed the start of winding at PSL by several weeks
  - The UK winding machine is close to being operational but winding of the first UK APA has not yet started
- Introducing these delays into current schedule starts to reduce the available time window for beam operation
  - Expect that the ~ 4 month time period for building APA #1 can be reduced based on lessons-learned
    - However, some of the expected time savings is already incorporated within the current schedule

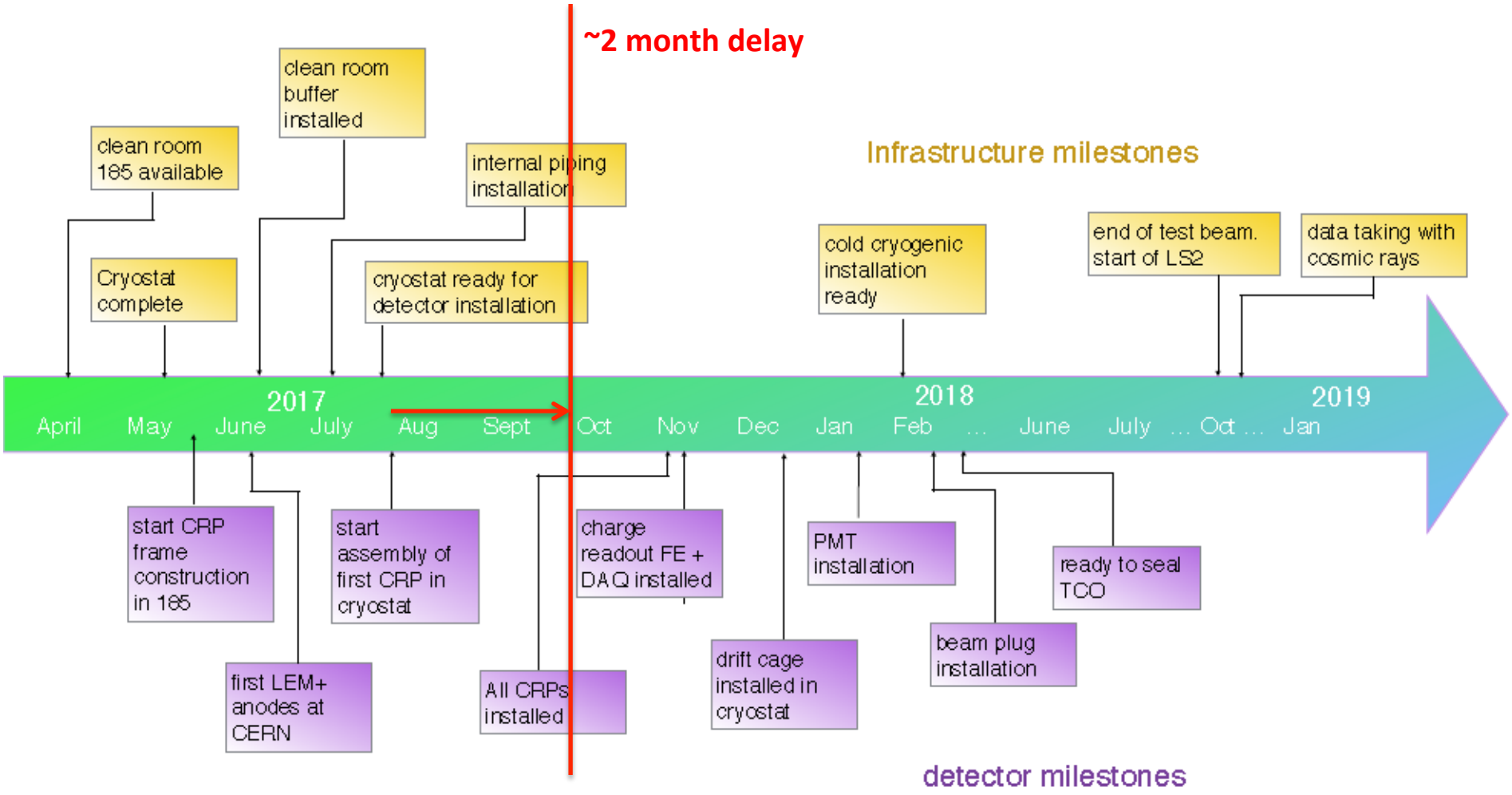
Longer-term Concerns (SP)

- Focusing on parallel construction of APA modules as a potential avenue for further accelerating the schedule
- Considering production of a 4th APA module at PSL if there is time available (requires schedule acceleration)
- In the event that the last one or two APAs are not available in time, we do maintain the option of installing a four APA detector configuration
  - Minimal physics impact
  - Decision needs to be taken on time scale of November 2017

ProtoDUNE-DP Schedule (April)



ProtoDUNE-DP Schedule (June)



Short-term Concerns (DP)

- Later than expected operation of 1x1x3 m^3 detector requires resources that could otherwise be directed to ProtoDUNE
  - Need to understand 1x1x3 m^3 run plan and impact on the near-term ProtoDUNE-DP construction/installation effort

Longer-term Concerns (DP)

- The installation schedule is sequential and fixed on the back end to the required date for closing the temporary construction opening (TCO)
  - Need to understand if the individual installation activities can be accelerated to make up for the delays being incurred on the front end of the schedule
- Note that there is no detector de-scoping option available for ProtoDUNE-DP along the lines of what was previously described for ProtoDUNE-SP

Project Office Activities

- ProtoDUNE Detector Design Reviews complete
  - Recommendations reviewed and incorporated as appropriate in the final designs
- ProtoDUNE Production Readiness Reviews (PRRs) mostly complete
  - Written reports from the DUNE QA Manager focusing on the formal, written QA/QC plans for each of the detector components
  - Action items from these reports being addressed and followed up on by the QA Manager
- Joint Detector Design/Production Readiness Review held for the ProtoDUNE-DP detector at CERN on April 24-25

Summary

- DUNE is focused on its highest priority near-term objectives
  - Operating the ProtoDUNE detectors at CERN in 2018
  - Preparing Technical Design Reports for the first two far detector modules in advance of far detector baselining in 2019
- Since the March LBNC meeting, there has been significant progress on all ProtoDUNE-related efforts
- The schedule for collecting beam data in 2018 remains very tight and we continue to implement mitigation strategies as necessary to deal with delays that do manifest themselves