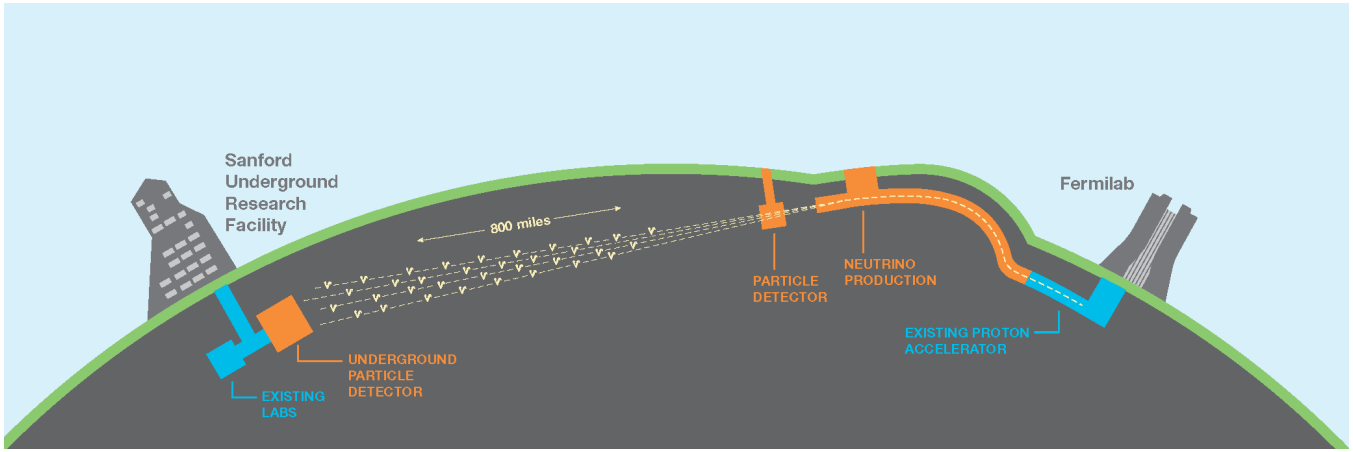


DUNE Collaboration: Status, Management and Organization

Mark Thomson

On behalf of the DUNE collaboration

DOE Review, 11th August 2016

UNIVERSITY OF CAMBRIDGE

DUNE

DUNE

- **This Presentation**
  - **1. Past Milestones** — Past
  - **2. Collaboration Status** — Present
  - **3. Organization and Management** — Present
  - **4. Strategy for the Far Detector** — Present
  - **5. ProtoDUNEs** — Present
    - Status, Organization, EoIs, Risks
  - **6. DUNE strategy (2016 – 2019)** — Next Steps
  - **7. Conclusions**

1. DUNE Timeline

- **Met many milestones in the last 16 months**
  - **March** Co-spokespersons elected and TC/RC appointed ✔
  - April First DUNE Collaboration Meeting ✔
  - **May** First DUNE Executive Committee meeting ✔
  - **July** DOE CD-1-R Review ✔
  - **July** Scientific/Detector Coordinators appointed ✔
  - Sept 2nd Collaboration Meeting and move to regular WG schedule ✔
  - **Dec** DOE CD-3a Review ✔
  - **Dec** Full integration of dual-phase (WA105) into DUNE ✔
  - **Dec** ProtoDUNE-SP approved at CERN ✔

2015

2016

  - **Jan** ProtoDUNE-SP leadership team in place ✔
  - Jan 3rd Collaboration Meeting & ProtoDUNE "Expressions of Interest" ✔
  - **Apr** European and Latin Americas DUNE meetings ✔
  - **May** ProtoDUNE organization defined ✔
  - May 4th Collaboration Meeting (South Dakota) ✔
  - **Jun** Collaboration strategy for 2016-2019 approved ✔
  - **July** Institutional responsibilities for ProtoDUNE defined ✔

Looking ahead: Strategic Goals

- **DUNE is committed to delivering:**
  - Two large-scale engineering prototype detectors (protoDUNE-SP and protoDUNE-DP) operational at CERN in 2018
  - DUNE TDR for the CD-2 Review in 2019
  - 20-kt (fiducial mass) Far Detector ready for beam in 2026
    - Two 10-kt detector modules (not necessarily the same design)
  - Near detector system(s) operational in time for first beam
- **The detailed implementation strategy for 2016 – 2019 was approved by DUNE-EC in June 2016**
  - Summary of some key points and collaboration milestones given towards end of this presentation

2. DUNE Collaboration Status

The DUNE Collaboration

Starting from P5 (2014)

- **Called for formation of "LBNF":**
  - as an international collaboration
  - ambitious scientific goals:
    - Discovery of Leptonic CP-violation
    - Proton decay
    - Supernova burst neutrinos

Resulted in the formation of the DUNE collaboration with strong representation from:

- LBNE (mostly US)
- LBNO (mostly Europe)
- Other interested institutes

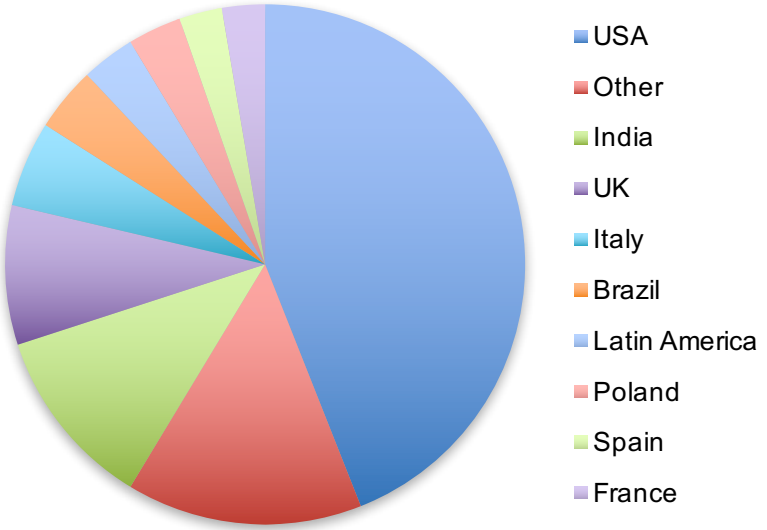
- **Collaboration continues to grow…**

The DUNE Collaboration

As of today **from**

890 Collaborators **156 Institutes**

Armenia, Brazil, Bulgaria, Canada, Colombia, Czech Republic, Finland, France, Greece, India, Iran, Italy, Japan, Madagascar, Mexico, Netherlands, Peru, Poland, Romania, Russia, South Korea, Spain, Sweden, Switzerland, Turkey, **UK**, Ukraine, USA



DUNE has broad international support and is growing
~80 new collaborators so far this calendar year

Continued international growth

- **DUNE is an ambitious undertaking**
  - Aiming for ~75 % international (non-DOE) resource
- **Actively pursuing enlargement of the collaboration:**
  - **Europe:** DUNE meeting @ CERN (7^{th} – 8^{th} April)
    - 70 participants from 13 nations
  - **Latin Americas:** neutrino meeting @ FNAL (27^{th} – 28^{th} April)
    - 65 participants from 7 LA nations
    - Interest in DUNE from new institutes
    - Already seeing increase in LA involvement
  - **Asia** no targeted meeting(s) as of yet
    - But new involvement from South Korea + interest from China

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- **Perception of progress in US is very important**
  - **CD-3a approval will be a very significant message**
  - **Maintaining impressive momentum in US is essential**

3. DUNE Organization

Organizational Challenges

- **Large and diverse international collaboration**
  - Aim to fully engage broad spectrum of collaborators in the DUNE scientific and detector activities
- **The collaboration is likely to grow significantly**
  - Management structures need to be scale effectively to a collaboration of >1000 scientists, c.f. ~3000 in ATLAS or CMS
- **CERN prototypes (2018) & CD-2 (2019) = major goals**
  - Need to effectively utilize the collaboration resources, both financial and human resources
  - Further engage international community
  - For the large-scale prototypes, managing the transition to major detector construction activities

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DUNE organizational structures guided by experience from LHC experiments and elsewhere

DUNE Management Team

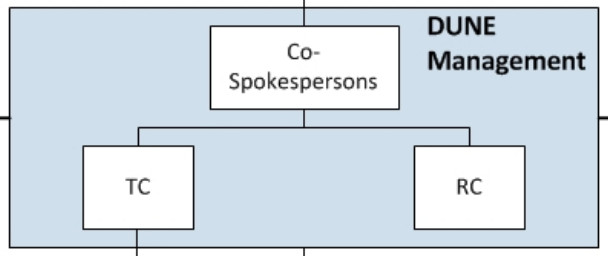
Management team in place since April 2015

Co-spokespersons:
A. Rubbia
M. Thomson

Technical coordinator:
E. James

Resource coordinator:
C.K. Jung

International project manager:
S. Kettell



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DUNE

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- high-level organizational structures working effectively

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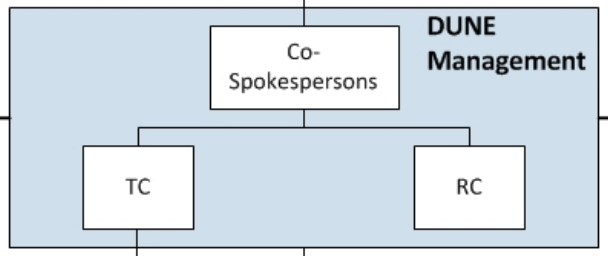

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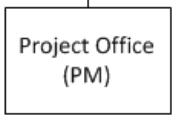

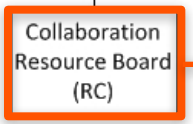

EC meeting weekly since May 2015

TB and CRB running effectively since end 2015

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DUNE

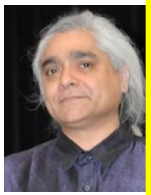
DUNE Coordination Team

- Very strong team in place

Far Detector WG	Near Detector WG	CERN prototypes WG	Accelerator & Beam interface WG	Computing & Software WG	Physics WG

COORDINATORS

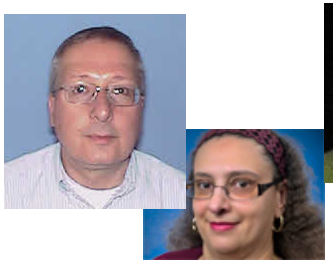
T. Bolton



S. Mishra
K-B. Luk

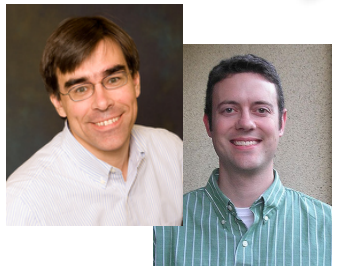
F. Cavanna
C. Touramanis
Dep: T. Kuttter

D. Autiero
T. Hasagawa



A. Marchionni
Dep: Mary Bishai

T. Junk
Dep:
A. Farbin



J. Urheim
Dep:
R. Patterson

- Plan rotation of some coordination/convenorship roles annually

→ September 2016

High-level Task Forces

- Three high-level **Task Forces** charged to address strategically important scientific issues:
  - **Focus on critical questions on the path to CD-2**
  - Activities cross boundaries of various working groups
    - For example physics, reconstruction software and far detector WGs
  - Will deliver final reports in March 2017
- Strong and effective leadership

TF 1: Near Detector Optimiz.	TF 2: Far Detector Optimiz.	TF 3: Beam Optimiz.
Steve Brice	**Lisa Whitehead**	**Alfons Weber**
Deputy: **Dan Cherdak**	Deputy: **Andy Blake**	Deputy: **Laura Fields**
Deputy: **Kendall Mahn**	Deputy: **Slavic Gaiymov**	

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Providing real momentum as we move towards CD-2

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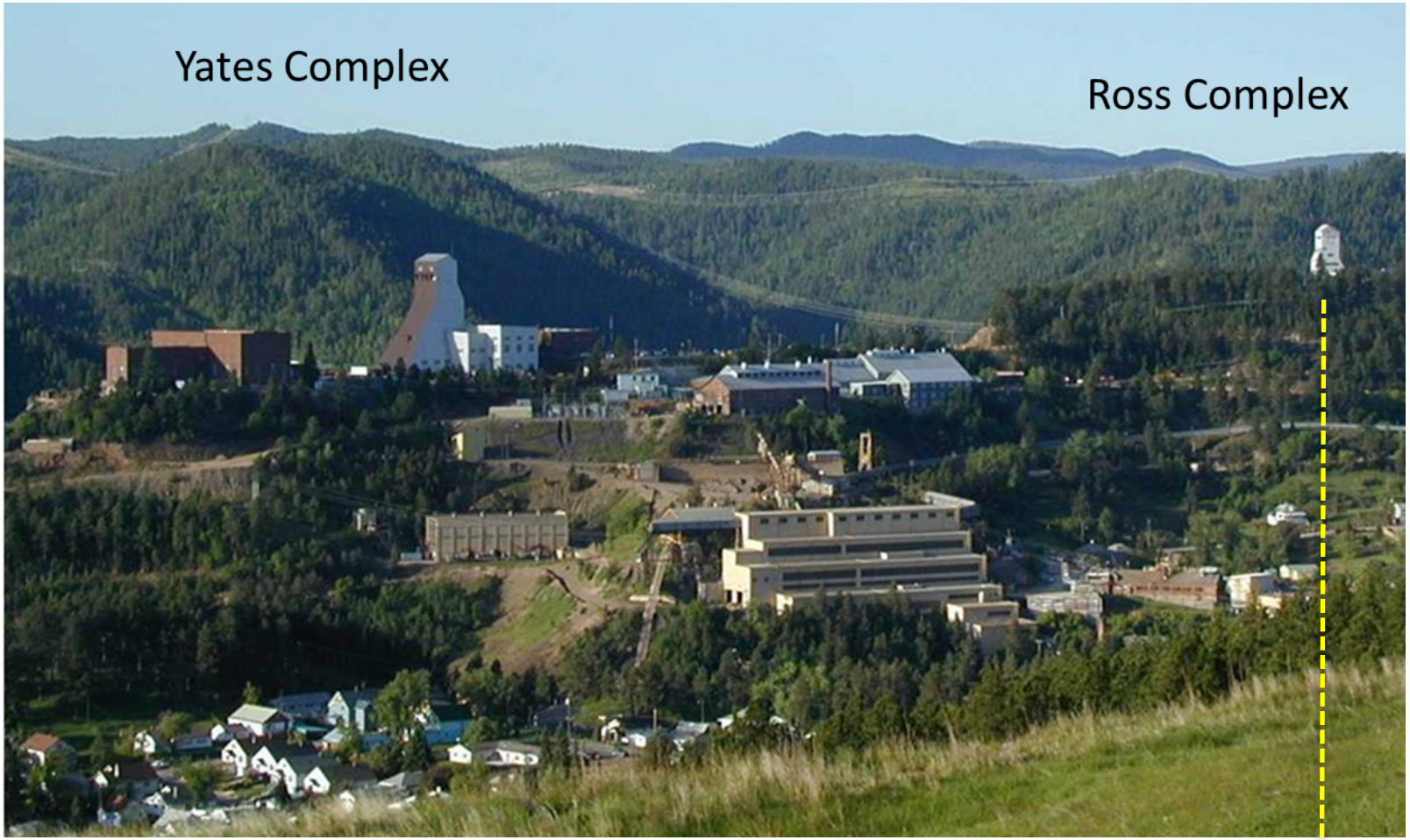
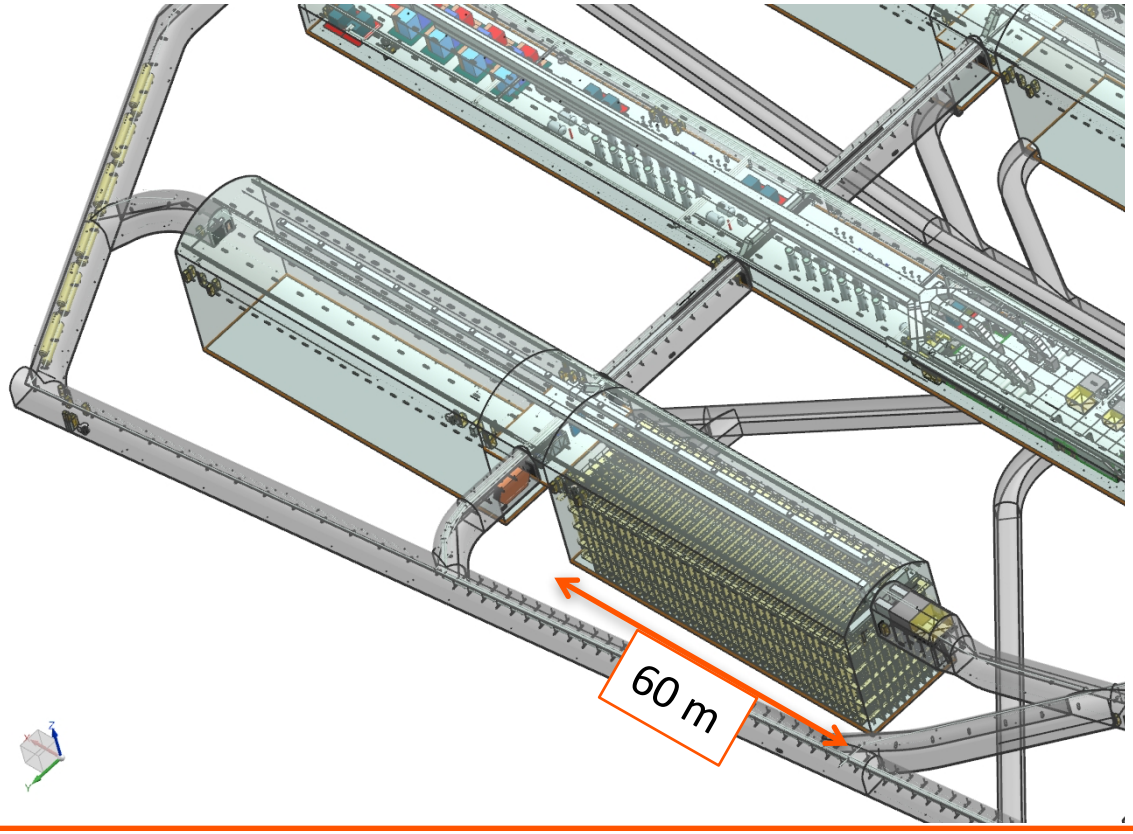
4. Far Detector Strategy



Staged Approach to 40 kt (fiducial)

- **Four chambers hosting four independent 10-kt FD modules**
  - Flexibility for staging & evolution of LAr-TPC technology design
    - Assume four **identical** cryostats: 15.1 (W) x 14.0 (H) x 62 (L) m^3
    - Assume the four 10-kt modules will be similar but **not identical**



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  - Single-Phase (Ionization read out in the Liquid Ar)
    - Demonstrated by ICARUS & MicroBooNE
    - Basis of first 10-kt detector
  - Dual-Phase (Ionization amplified and read out in Gas Ar)
    - Pioneered by WA105 (protoDUNE-DP)
    - Option for second and/or subsequent detector modules

Focus of DOE-funded effort

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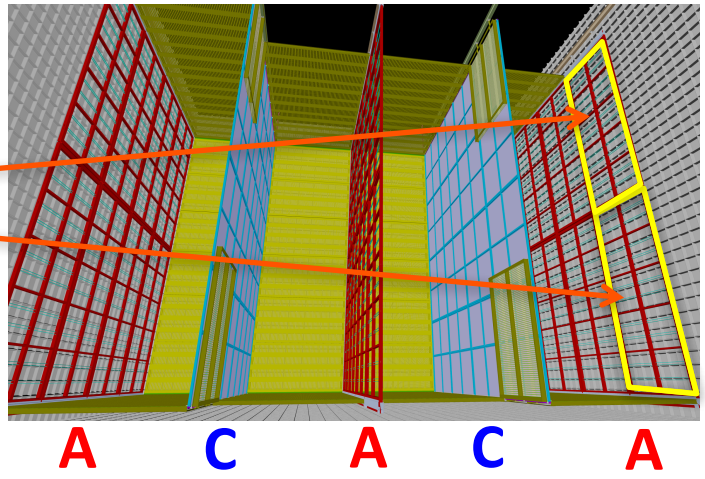
    - Option for second and/or subsequent detector modules
- **Design of facility at SURF meets DUNE requirements**
  - Technical & Scientific

Focus of DOE-funded effort

Staging strategy

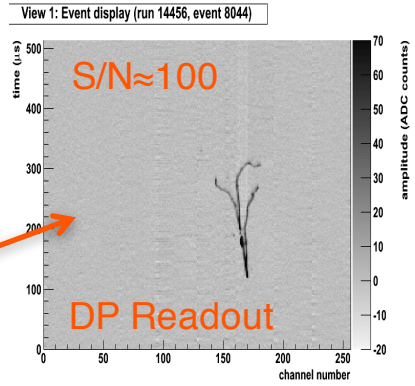
First far detector module:

- **Modular implementation of Single-Phase TPC**
  - Active volume: **12m x 14m x 58m**
  - 150 Anode Plane Assemblies (APA)
    - 6m high x 2.3m wide
  - 200 Cathode Plane Assemblies
    - Cathode @ -180 kV for 3.5m drift



Second & subsequent far detector modules

- Not assumed to be exactly the same, could be:
  - Evolution of single-phase design
  - Dual-phase readout – potential benefits



Far Detector Development

e.g. single-phase APA/CPA LAr-TPC:

- Design is already well advanced – evolution from ICARUS
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  - 35-t prototype (run ended 03/2016)
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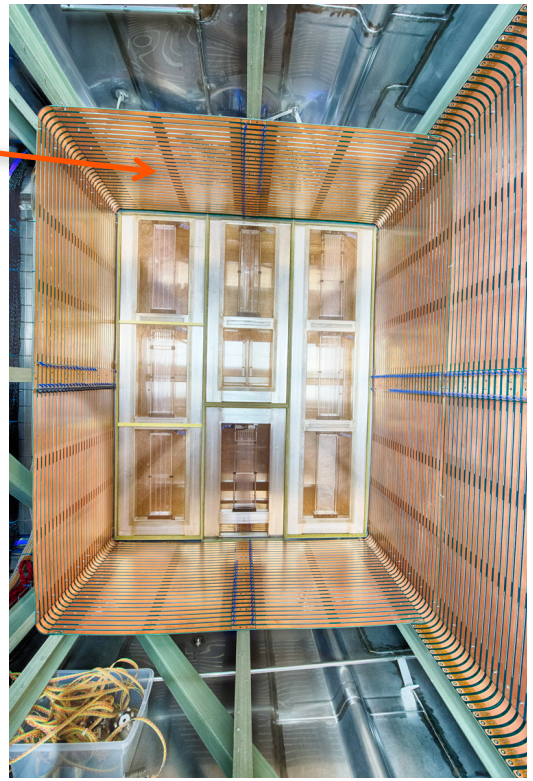

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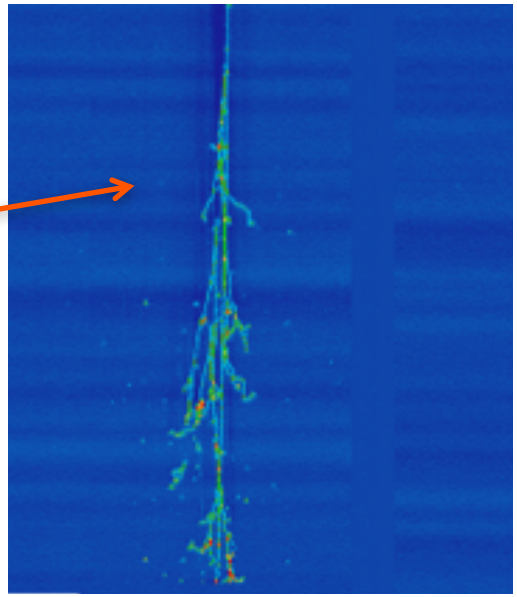

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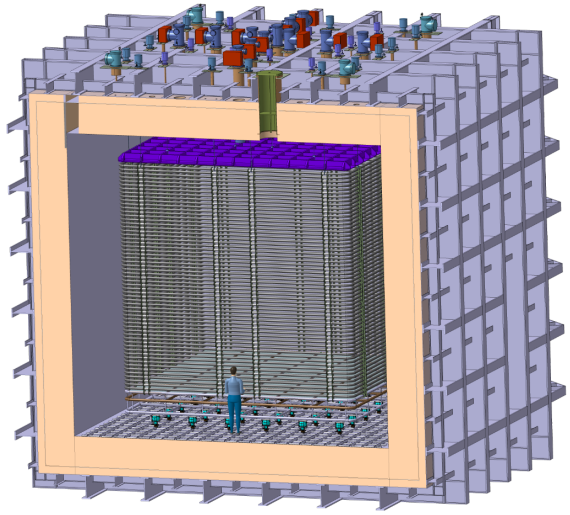
  - **Single-Phase & Dual-Phase**
  - Engineering prototypes, e.g. SP:
    - 6 full-sized drift cells c.f. 150 in the far det.
  - Aiming for operation in 2018



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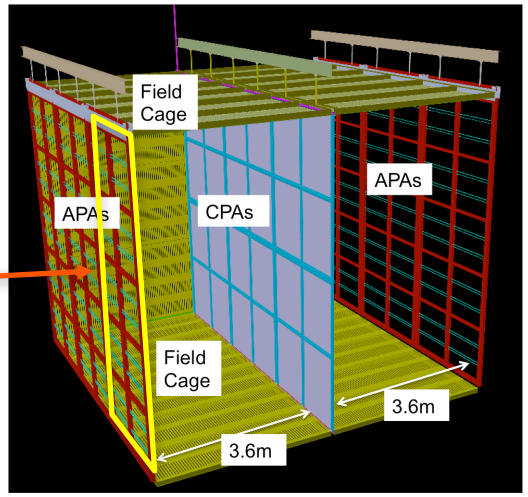

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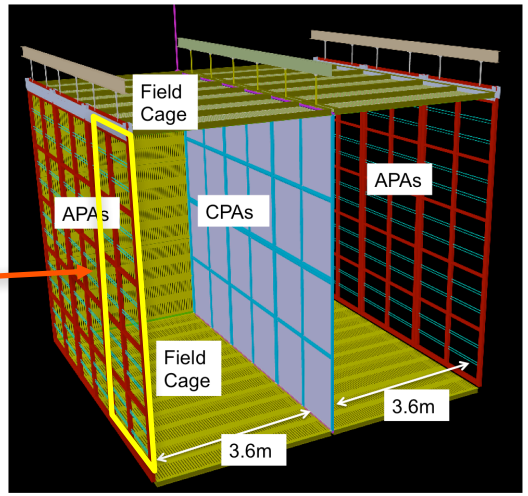
Large-scale prototypes at CERN are a crucial step in the DUNE Far Detector development



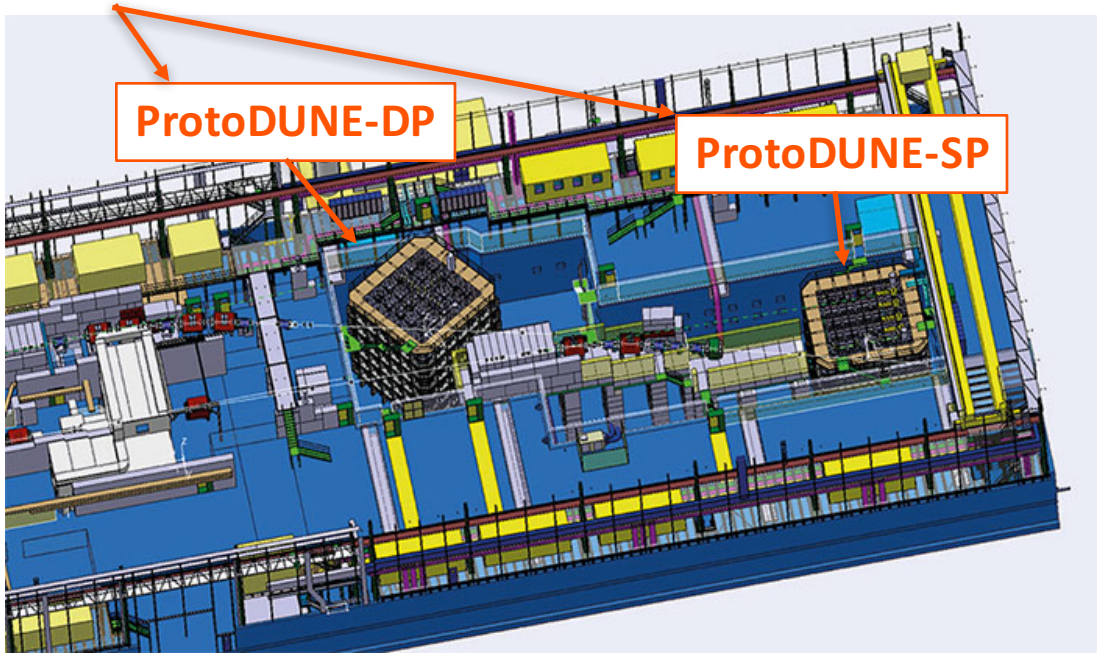
5. ProtoDUNEs

CERN North Area: 27/4/2016

CERN Neutrino Platform

CERN support of international neutrino program

- **Major** CERN infrastructure investment for DUNE:
  - New building: EHN1 extension in the North area
  - Two tertiary charged-particle beam lines
  - Two large (8x8x8 m^3) cryostats & cryogenic systems



Beneficial occupancy later this year

ProtoDUNE Organization

- **For success in the ProtoDUNE program:**
  - Need an effective well-defined organizational structure (and the right people)
- **ProtoDUNE organization put in place in 2016**
  - Main challenge was relation between PD-SP and FD WG

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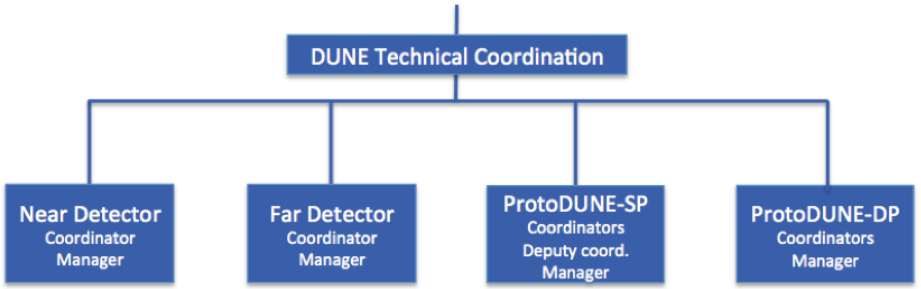
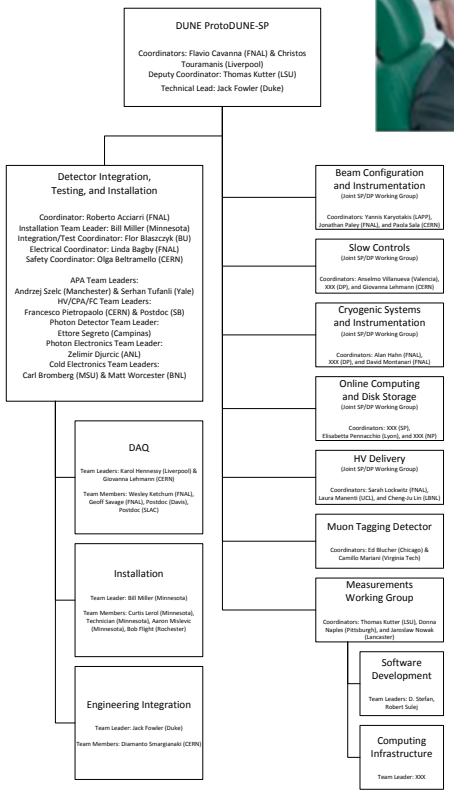


- **Clearly defined division of responsibilities:**
  - FD WG responsible for delivery of main detector elements to CERN as prototypes for the FD [on path to CD-2]
  - PD-SP WG responsible for all SP activities at CERN
  - All technical decisions go through DUNE technical board

ProtoDUNE-SP Organization

- General structure

FD WGs | **PD-SP WG**



Detector component fabrication

- Majority of roles “team on the ground at CERN” now filled

ProtoDUNE-SP Organization

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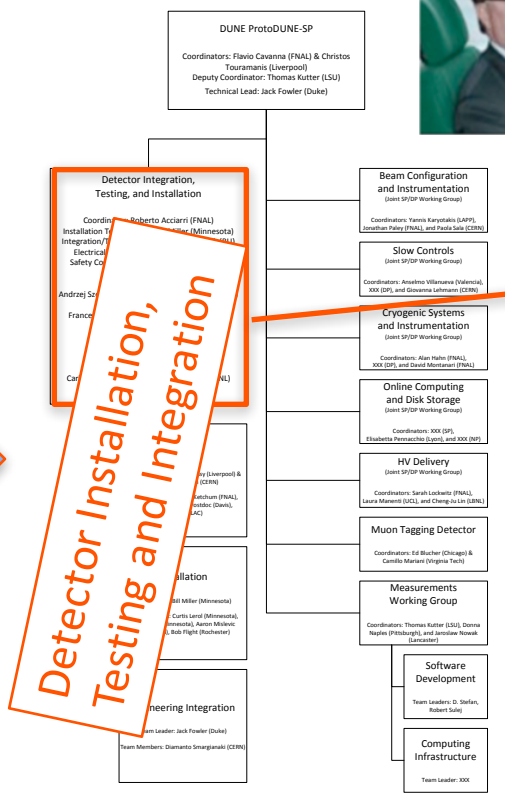
Detector component fabrication



Detector Integration,
Testing, and Installation

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Installation Team Leader: Bill Miller (Minnesota)
Integration/Test Coordinator: Flor Blaszczyk (BU)
Electrical Coordinator: Linda Bagby (FNAL)
Safety Coordinator: Olga Beltramello (CERN)

APA Team Leaders:
Andrzej Szelc (Manchester) & Serhan Tufanli (Yale)
HV/CPA/FC Team Leaders:
Francesco Pietropaolo (CERN) & Postdoc (SB)
Photon Detector Team Leader:
Ettore Segreto (Campinas)
Photon Electronics Team Leader:
Zelimir Djurcic (ANL)
Cold Electronics Team Leaders:
Carl Bromberg (MSU) & Matt Worcester (BNL)

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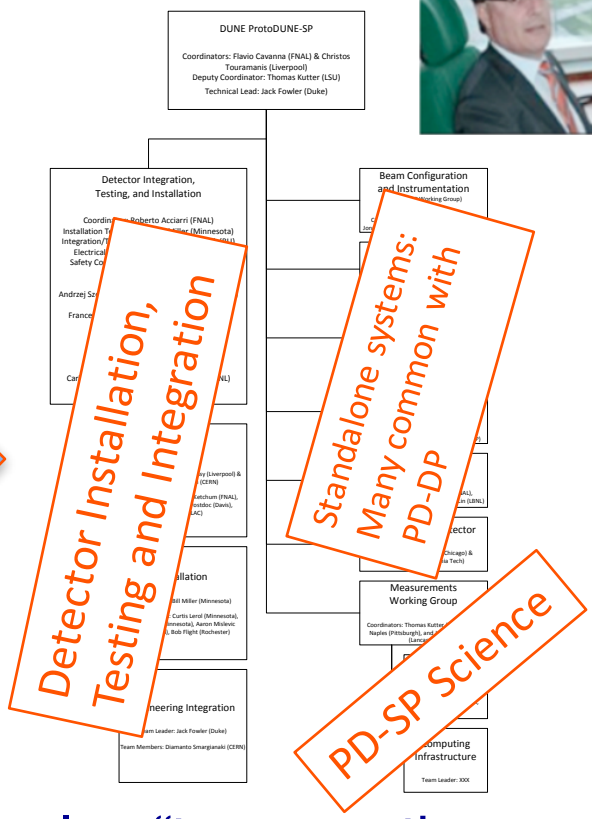
FD WGs | **PD-SP WG**

Detector component fabrication



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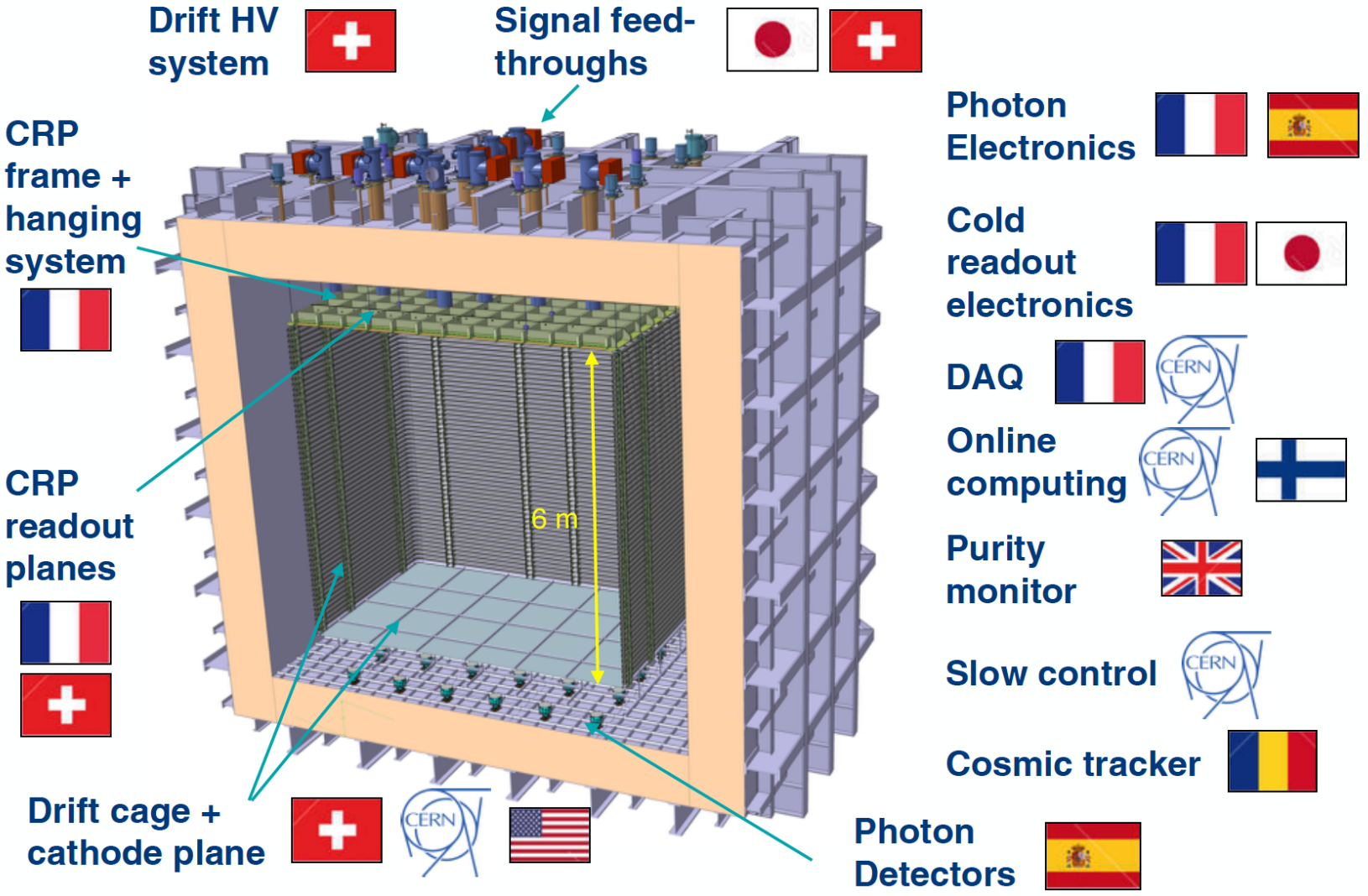
ProtoDUNE EoIs

- **January 2016 "ProtoDUNE":**
  - Call for "Expressions of interest" in PD-SP & PD-DP
    - Covered detector construction & scientific activities
  - Provided opportunity for all collaborating institutes to participate
- **Generally very successful process**
  - 59 institutes submitted EoIs
  - All areas covered!
  - WG convenors, coordinating assembly of final teams
- **Tasks/Resource Matrix**
  - Responsibilities (mostly ~90 %) finalized at the end of **July 2016**
- **Recent news**
  - Significant UK (STFC) investment in ProtoDUNE-SP:
    - Three of the six PD-SP APAs and contribution to DAQ system

ProtoDUNE-DP Responsibilities



ProtoDUNE-SP Responsibilities

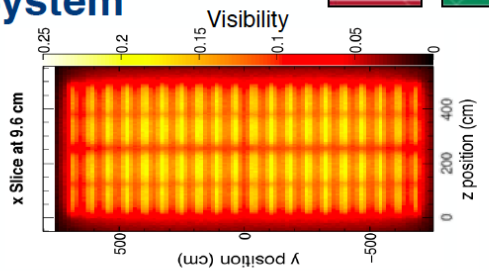
Drift HV system

Signal feed-throughs

Anode Plane Assemblies (APA)

Field cage

Photon Detector System



Cold readout electronics

DAQ

Slow control

Cathode Plane Assemblies (CPA)

6. DUNE Strategy: 2016 - 2019

DUNE Strategic Goals 2016 - 2019

Top-level goals for 2016 – 2019:

- **Construction and operation of large-scale prototypes at CERN**
  - Critical to demonstrate that the DUNE collaboration can implement a major construction activity
- **Preparation of DUNE TDR for CD-2**
  - A major scientific and technical goal for the collaboration
- **Enlarging the Collaboration**
  - Further internationalization is essential to meet our goals. Firm US commitment (CD-3a approval) will be a major “trigger”
- **Resource matrix for construction of DUNE**
  - Funding for TDR scope needs to be in place by 2019

DUNE Strategic Goals 2016 - 2019

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Current focus is on ProtoDUNE program at CERN but work towards CD-2/3 must proceed in parallel

Strategic view of protoDUNE program

- **Large-scale prototyping/calibration**
  - **Production (delivery of the detector components to CERN):**
    - **stress testing of the production and quality assurance processes** of detector components
    - mitigate the associated risks for the far detector.
  - **Installation:**
    - **test of the interfaces between the detector elements**
    - mitigate the associated risks for the far detector.
  - **Operation (cosmic-ray data):**
    - **validation of the detector designs and performance**.
  - **Test beam (data analysis):**
    - **essential detector and physics calibration benchmarks**
    - not necessary for the finalization of the FD.

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Engineering risk mitigation for CD-2

Physics calibration for oscillation analyses

Strategy/Plans for the Far Detector

- **Strategy/Plans include:**
  - Build collaboration detector activities around "consortia of institutions" responsible for detector sub-systems
  - Defined the timetable and process for the formation of consortia
    - Follows successful EoI process
  - In Q3 2017 replace FD WG organization with sub-detector consortia
    - Further evolution towards LHC GPD organization structure
  - Use the consortia to facilitate the process whereby institutions take on responsibility for concrete tasks
    - Believe this will help develop specific proposals/funding requests
  - Preliminary design for first 10-kt FD module by Q4 2017 and a design decision for second 10-kt module in 2018

Strategy/Plans for the Near Detector

- **Near Detector**
  - plans are not yet as well evolved as for Far Detector
  - aim for Near Detector to be part of the CD-2 TDR, but could come later
  - use the outcome ND task force to inform the possible design directions for the DUNE near detector.
  - aim for design choice in 2017, based on:
    - the scientific arguments presented in the final report of the near detector task force;
    - technical readiness and risk as assessed by the Technical Board;
    - interests of the collaboration institutions;
    - availability of funding and opportunities to bring in new funding.
  - identify a large set of groups interested in ND construction
    - Recently strengthened ND leadership to pursue this aim

Collaboration medium-term milestones

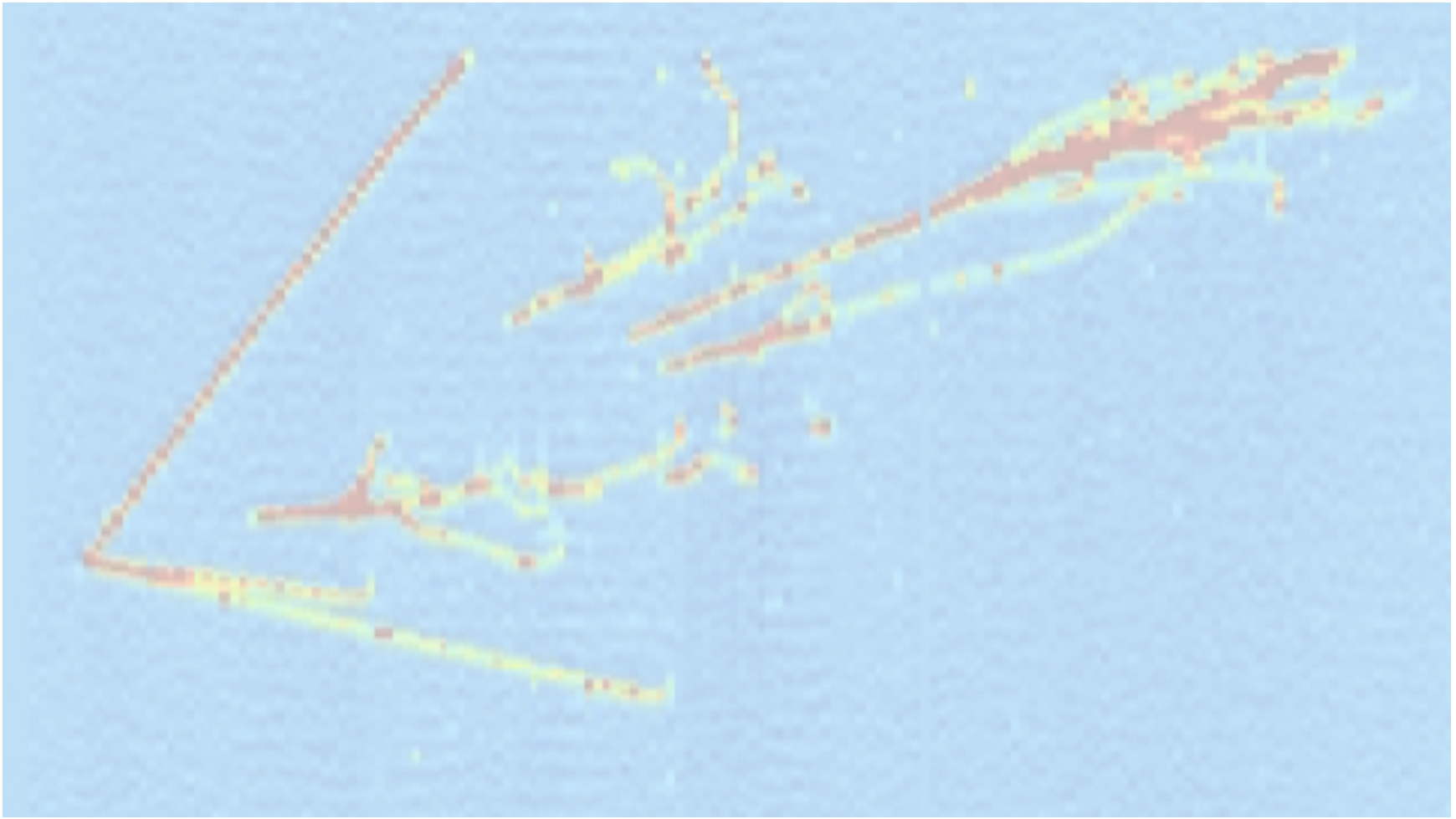
- **Q3/2016:** completion of design reviews for ProtoDUNE-SP (in progress)
- **Q3/2016:** TDR for ProtoDUNE-SP including final resource matrix (in progress)
- **Q2/2017:** Delivery of final TF reports
- **Q3/2017:** Initial consortia for FD construction in place
- **Q4/2017:** Decision on conceptual design of ND
- **Q4/2017:** Preliminary design of first 10-kt FD module
- **Q2/2018:** Completion of DUNE prototypes at CERN
- **Qn 2018:** Decision on design first two 10-kt FD modules
- **Q4/2018:** Start of TDR writing
- **Q1/2019:** International commitments for CD-2 scope "finalized"
- **Q4/2019:** CD-2/3 DOE Independent Project Review of LBNF/DUNE

Dates refer to calendar years

CD-3a schedule updates

- **LBNF is working closely with DUNE to balance priorities**
- **Aim to ensure that we meet the top-level DUNE goals:**
  - protoDUNE-SP and protoDUNE-DP operational at CERN in 2018
  - Non-beam physics as early as possible: 2024/2025
  - 20-kt (fiducial mass) Far Detector ready for beam in 2026
- **FY16/17 appropriations and revised profile**
  - Impact minimized through careful balancing of priorities
  - **With revised profile still meet the top-level DUNE goals**
  - As we move forward, maintaining momentum in the US is a crucial signal to the international scientific community

7. Summary



7. Summary

- ★ **A great deal of progress in the last year**
- ★ **DUNE has a strong and focused management team**
- ★ **CD-3a approval important for internationalization**
  - a strong signal to non-US funding agencies
- ★ **CD-3a design and current schedule meets DUNE's technical and scientific goals**
  - important to maintain momentum in the US
- ★ **DUNE is committed to being ready for physics in 2025 and beam in 2026**

Questions?