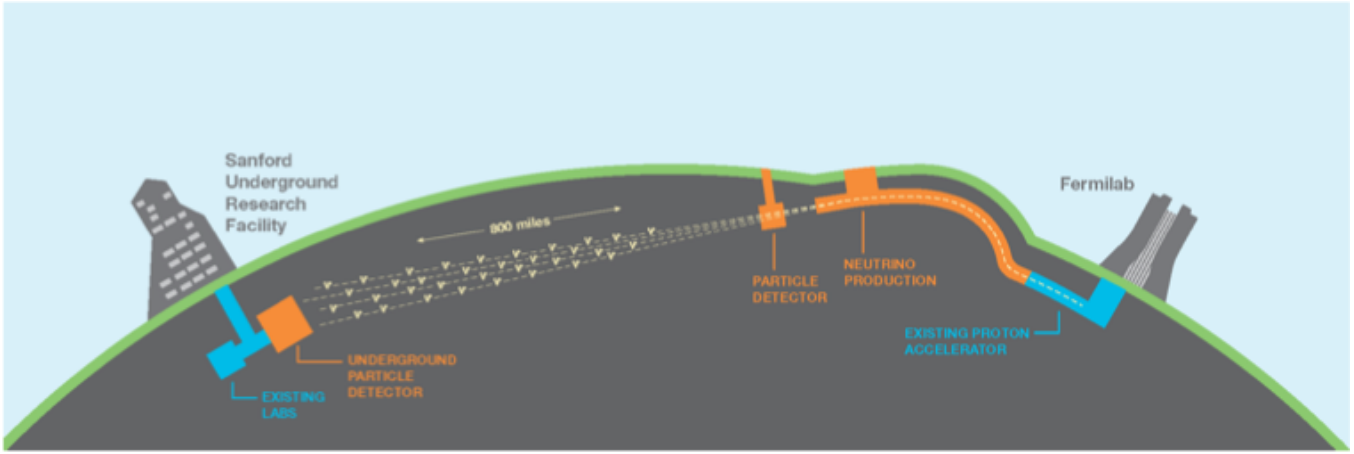


DUNE Planning, Strategy and Organization

Ed Blucher (on behalf of Mark Thomson)

Journée DUNE

Paris, 22nd January 2018

UNIVERSITY OF CAMBRIDGE

DUNE

DUNE Organization/Planning

- **This presentation:**
  - 1. DUNE as an international collaboration
  - 2. Far Detector Strategy
    - Planning
    - Consortia
  - 3. Technical Design Reports
    - Timeline
  - 4. DUNE Organization
  - 5. Near Detector Status
  - 6. Summary

1. DUNE as an International Collaboration

International from day one

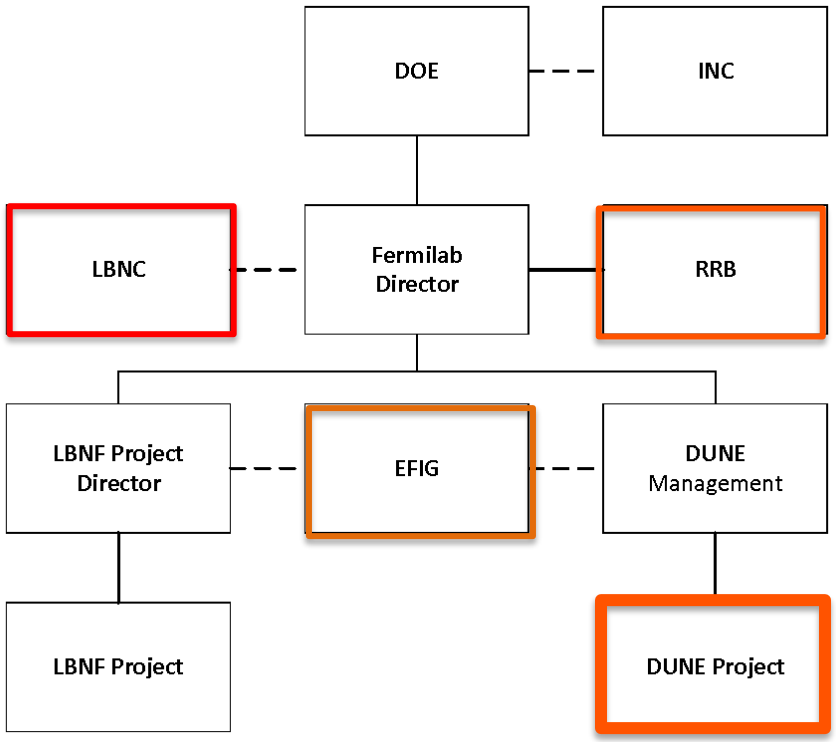
- **US-hosted – but truly international**
  - a first for the US
- **Model for international partnerships:**
  - LBNF/DUNE developed as an international partnership
  - Governance modelled on that of the LHC:
    - **Facility:** LHC ↔ LBNF
    - **Experiment:** ATLAS/CMS ↔ DUNE
- **International Funding Model:**
  - LBNF and PIP-II: US-hosted projects with international contributions

    (for LBNF aim: ~75% US, ~25% non US)
  - DUNE: an international science collaboration

    (aim: ~25% US, **~75% non-US**)

International Governance

- **Model for international governance broadly follows that of the LHC experiments**



- **LBNC (c.f. LHCC)**
  - International project oversight
    - Technical
    - Management
  - Will review/approve TDR
- **RRB**
  - Funding agencies
  - Agree money-matrix
- **EFIG**
  - Interaction with LBNF
  - Joint decisions

Organizational Challenges

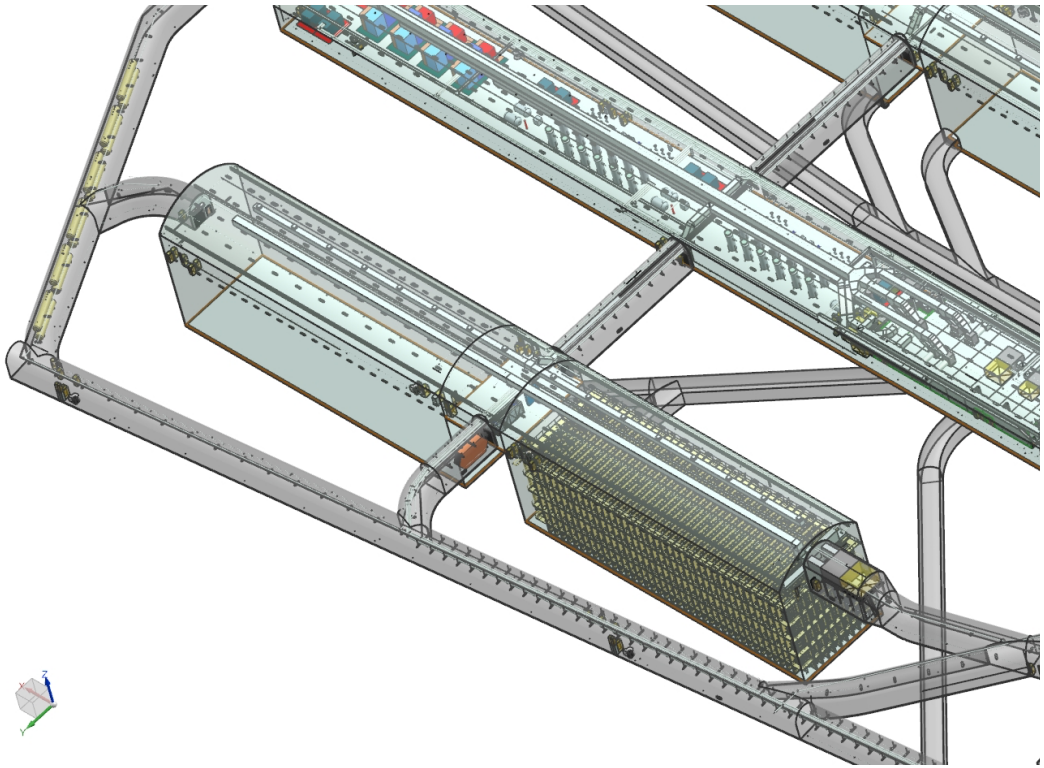
- **Large and diverse international collaboration**
  - Aim to fully engage the broad spectrum of collaborators in the DUNE scientific and detector activities
- **The collaboration is likely to grow significantly**
  - Management structures need to be scale effectively to a collaboration of ~1500 (?) scientists, c.f. ~3000 in ATLAS or CMS
- **CERN prototypes (2018) & TDR (2019) are major goals**
  - Need to effectively utilize the collaboration resources, both financial and human resources
- **Construction project in 2020s**
  - Much larger scale to previous neutrino experiments

DUNE organizational structures guided by experience from LHC experiments and elsewhere

2. Far Detector Strategy

Far Detector Strategy

- **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**



Far Detector Strategy

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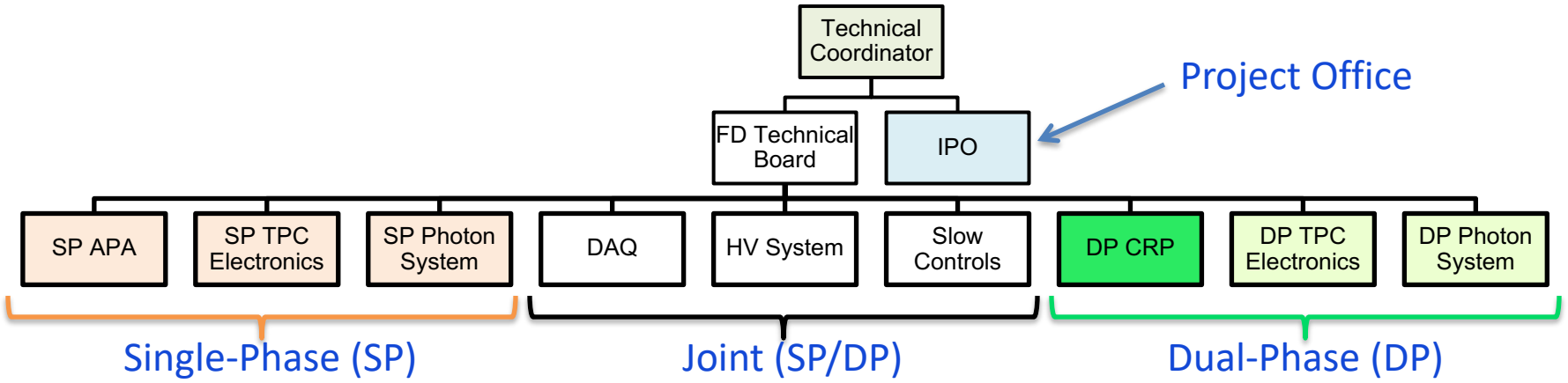
    - Assume four **identical** cryostats: 15.1 (W) x 14.0 (H) x 62 (L) m^3
    - Assume the four 10-kt modules will be similar but **not identical**
- **DUNE is pursuing two LAr-TPC technologies**
  - Single-Phase
    - Technology is mature, e.g. ICARUS, MicroBooNE
  - Dual-Phase
    - Lower TRL
    - But a number of potential advantages
  - **DUNE intends to deploy both technologies**
- **Decisions/Staging will depend on:**
  - Results from ProtoDUNEs and Money/Interests

Far Detector Consortia

- **Goal:**
  - Develop **funding matrix** for Far Detector TDRs by mid-2019
  - Scope for 2019:
    - (at least) **two** of the **four** 17-kton far detector modules
  - Ultimately want funding matrix for full experiment
    - **Near Detector** funding matrix on timescale of ND TDR (mid-2020)
    - Remaining Far Detector modules [total four]
- **Strategy:**
  - Build **consortia** of institutions responsible for a particular system
    - Analogous to detector-system collaborations within LHC experiments
  - Start by identifying interests within collaboration
    - Institutions identify WBS elements where they wish to take responsibility
    - Iterate with funding agencies ⇒ RRB-agreed funding matrix by 2019

Far Detector Consortia



- **Consortia operate within the DUNE collaboration**
  - Each consortium works within collaboration rules:
    - Elected Consortium Leader (faculty scientist or equivalent)
    - Technical Lead – acts as project manager
    - Consortium Board with a representative from each institution
    - Internal Project Management Board (PMB) with representatives from each contributing national project

Details are defined in the DUNE management plan


Deep Underground Neutrino Experiment
Management Plan – v1.0
dune-doc-2145
April 17, 2017

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Consortium Leadership (Aug. 2017)

- **Single-Phase**
  - APA: Stefan Söldner-Rembold (Manchester)
  - Photon Detection System: Ettore Segreto (Campinas)
  - TPC Electronics: Dave Christian (FNAL)
- **Dual-Phase**
  - CRP: TBD (due to health issues)
  - Photon Detection System: Ines Gil Botella (CIEMAT)
  - TPC Electronics: Dario Autiero (IPNL)
- **Joint**
  - HV System: Francesco Pietropaolo (CERN)
  - DAQ: Dave Newbold (Bristol)
  - Slow Controls/Instrumentation: Sowjanya Gollapinni (Tennessee)

Interests in consortia

- **Consortia are a key part of constructing money-matrix for funding of DUNE**
  - Driven by scientific/technical interests within the collaboration
  - Needs to be matched to potential funding opportunities
- **We need 4 FD modules: working with "2 + 1 + 1 model"**
  - Reflects current expectations of what might be reasonable from funding perspective at time of TDR in 2019
    - 2 Single-Phase FD modules
    - 1 Dual-Phase FD module
    - 1 [As yet] Completely uncovered FD module – TBD at later date
- **For TDR in 2019**
  - Seeking approval of (at least) two FD modules

Consortia Status

- **FD Consortia are up and running since Aug. 2017**
  - working very effectively
  - **But not closed to new collaborators**
- **DUNE now has a first iteration of the Far Detector WBS**
  - driven by consortia
- **Institutions have expressed interest in WBS elements:**
  - gives a first picture of coverage for FD construction & gaps…
  - **Still plenty of opportunities for new groups**
- **Based on initial interests, can see a plausible route to funding on TDR timescales for**
  - 2 Single-Phase FD modules
  - 1 Dual-Phase FD module

Planning for funding of DUNE

- **Assumed timeline for DUNE (and LBNF) reviews**
  - May-2018: Technical Proposal for DUNE (+costs, responsibilities)
  - Jan/Feb 2019: **RRB** for to provide funding status
  - April 2019: LBNF and DUNE internal/external TDR reviews
  - July 2019: **LBNC review of TDRs**
    Review of international DUNE construction project
  - Sept 2019: **RRB** to confirm **funding** status for construction
    validation of **international** funding model
  - October 2019: DOE **CD-2** Review of LBNF/DUNE & "**CD-3**" review for far site and two far detector modules
  - August 2020: DOE "**CD-3**" for near facilities and near detector
- **In less than two years**
  - Need **technical designs** and understanding of **funding model**

3. DUNE TDRs

TDR Plans

- **Structure**
  - The TDR will consist of multiple volumes. Each volume is expected to be between 150 – 200 pages, may be some exceptions
  - Detector volumes (single-phase and dual-phase) divided into:
    - Overview volume
    - Sub-system volumes
- **Volumes**
  - Volume 1: Executive Summary
  - Volume 2: Physics
  - Volume 3: Single-Phase Far Detector: Overview
    - + sub-system volumes
  - Volume 4: Dual-Phase Far Detector: Overview
    - + sub-system volumes
  - CDRs: Computing and Near Detector

TDR Status and Technical Prop.

- **Editorial team in place and working**
  - Central team
  - Physics
  - Detectors – at least one editor from each consortium
- **Technical proposal**
  - Currently working on "Technical Proposal"
  - Follows structure of TDR – intended as a step in developing the TDR
- **Technical proposal structure**
  - Volume 1: Executive Summary
  - Volume 2: Single-Phase Far Detector: Overview
  - Volume 3: Dual-Phase Far Detector: Overview
  - Volume 4: Computing

Role of protoDUNEs

- **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 measurements** of physics response of detector
    - not necessary for the finalization of the FD design

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Risk mitigation and understanding of costs for TDR

Detector validation for TDR

Physics calibration for oscillation analyses

4. DUNE Management

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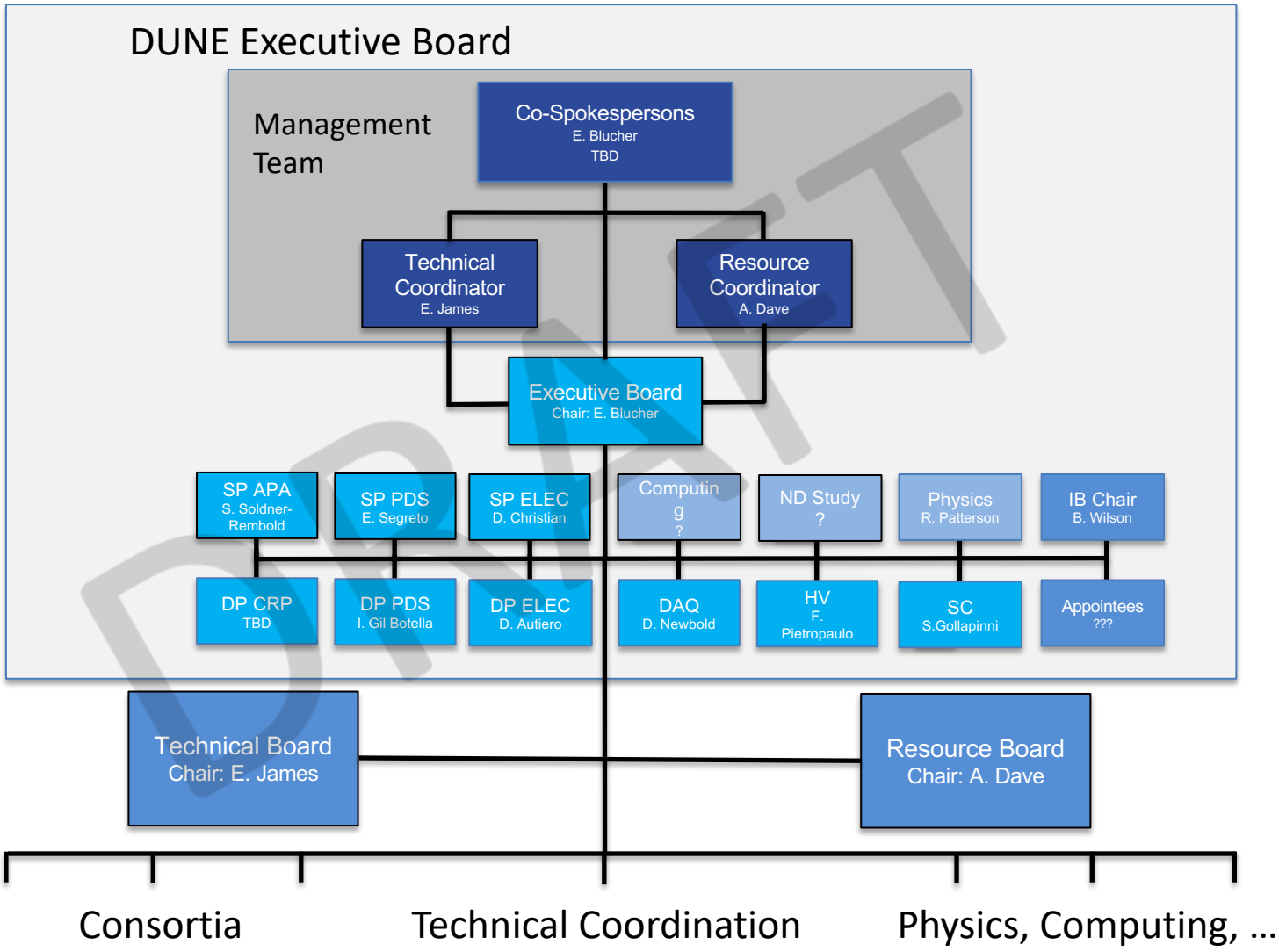
Management of DUNE

- **Many moving parts…**
  - ProtoDUNEs
  - Detector Consortia
  - Physics
  - National level and plans for funding
  - Technical Design Reports
- **Well-defined Management Structures**
  - Collaboration governance
  - DUNE management plan
- **Currently updating structures to manage TDR decisions and construction phase**
  - Evolution from current arrangements
  - Aiming for greater collaboration representation in decision making

Future Management Structure



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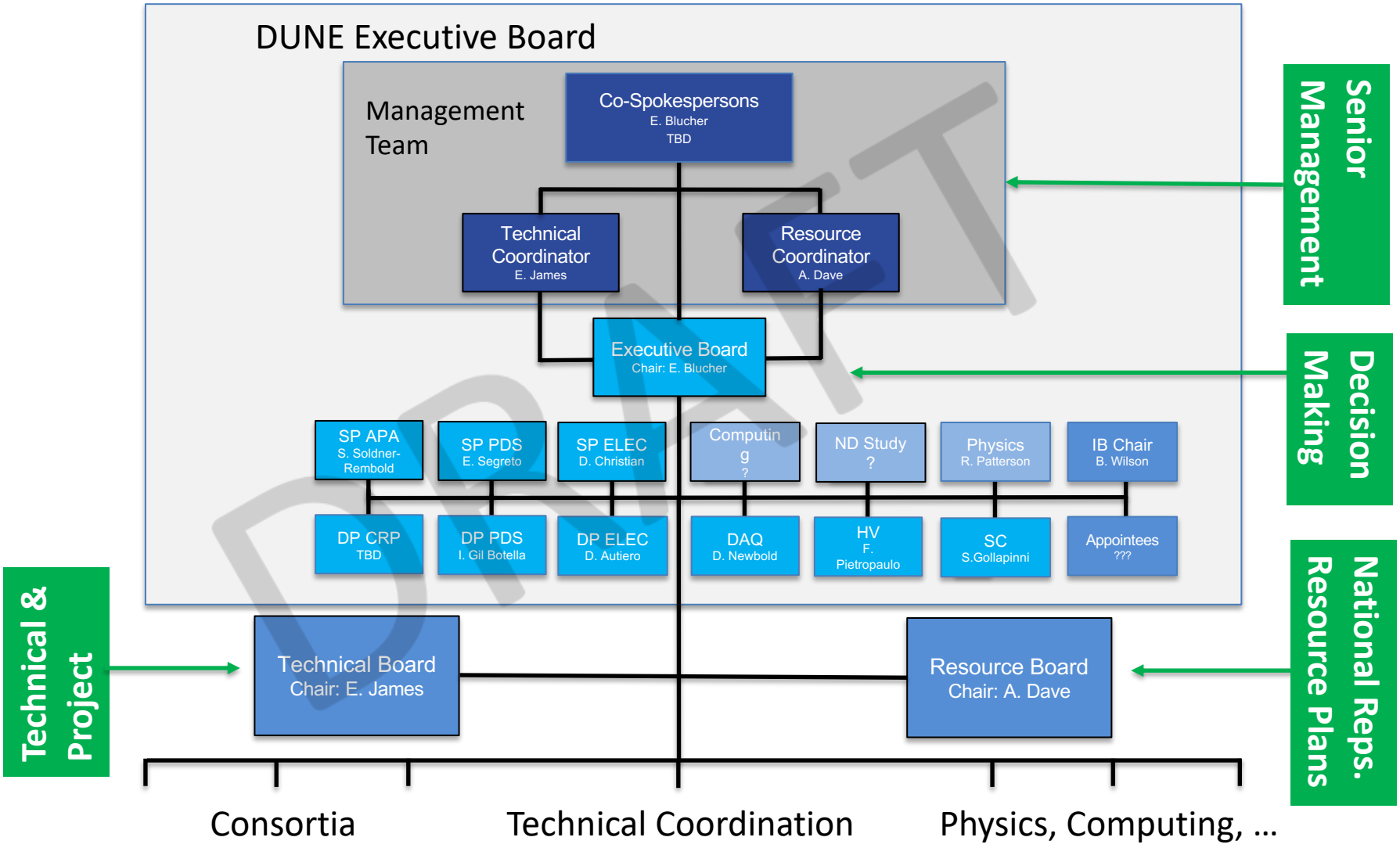

5. Status of Near Detector

5. Near Detector Status

- **Currently working on agreed collaboration concept**
  - Process to converge in May 2018
    - Conceptual design report in 2019
  - Once concept is agreed will initiate process to form ND consortia
  - Initial interests from: Germany, Italy, Russia, Switzerland, UK, US
- **Concept study reached agreement on a number of issues, e.g.**
  - Baseline aim is LAr-TPC + a magnetized Multi-Purpose Tracker
  - LAr-TPC should not be magnetized
- **Identified four main outstanding questions, e.g.**
  - Dipole or solenoid magnet
  - HP-TPC or straw-tube tracker
- **Have agreed a process and milestones to address these questions**
- **STILL PLENTY OF OPPORTUNITIES FOR NEW PEOPLE**

6. Summary

6. Summary

- **DUNE is an International Collaboration**
  - Management & governance broadly follow model of LHC experiments
- **Clear Strategy for Far Detector**
  - 2 + 1 + 1 model
  - Opportunities for new collaborators
- **Plans for TDR are in place**
  - The real work has started
- **Good progress on ND Concept**
  - Opportunities for new collaborators
- **France is already making important contributions**
  - France is in the position to be one of the leading nations in DUNE

Questions ?