DUNE Near Detector: Perspective from NDDG

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for the **DUNE Near Detector Design Group (NDDG)**

HISTORY AND ORGANIZATION

- Near Detector Design Group (NDDG) follows from the Near Detector Concept Study
- DUNE doc 8184

Report from the DUNE Near Detector Concept Study Group

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- Highly recommended reading
  - Things have changed somewhat but not much
  - Explains much of the reasoning/assumptions that go into to the current design
  - Series of recommendations articulate the starting point for the design concept
- Not the intention of this talk to explain the design
  - The following talks will do this in ample detail

RECOMMENDATIONS

- Main components
  - Segmented LAr detector (“ArgonCube”) with/for:
    - Short drift distance (~50 cm)
    - Optically isolated LAr scintillation detection
    - Pixel readout
  - “Multi-Purpose Detector” (MPD)
    - Magnetized
    - High pressure gas TPC (HPgTPC)
    - 3D scintillating tracker (3DST)
  - DUNE-PRISM
    - Detectors moveable off-axis
- Evolution of design following report
  - 3DST is now a separate system (3DST-S) with magnetic spectrometer and calorimetry
  - MPD now includes ECAL and possibly muon detectors around the HPgTPC
  - LAr+MPD move for DUNE-PRISM
  - 3DST-S stays on-axis

R1) The LArTPC at the near site should be optically segmented, with a short drift space and 2-dimensional pixelated readout, similar to the concept being studied by the ArgonCube collaboration.

R2) The design of a mobile LAr detector that can make measurements at one or more off-axis positions should go forward (DUNE-PRISM).

R3) Additional study of the DUNE-PRISM for technical feasibility and cost should be made.

R4) The underground experimental hall should be rotated by 90° about the vertical axis to allow for moving the near detector off the beam axis.

R5) The dimension of the hall in the beam direction that is usable for the experiment must be at least 17 m. A wider span should be considered, if the geo-technical conditions are favorable.

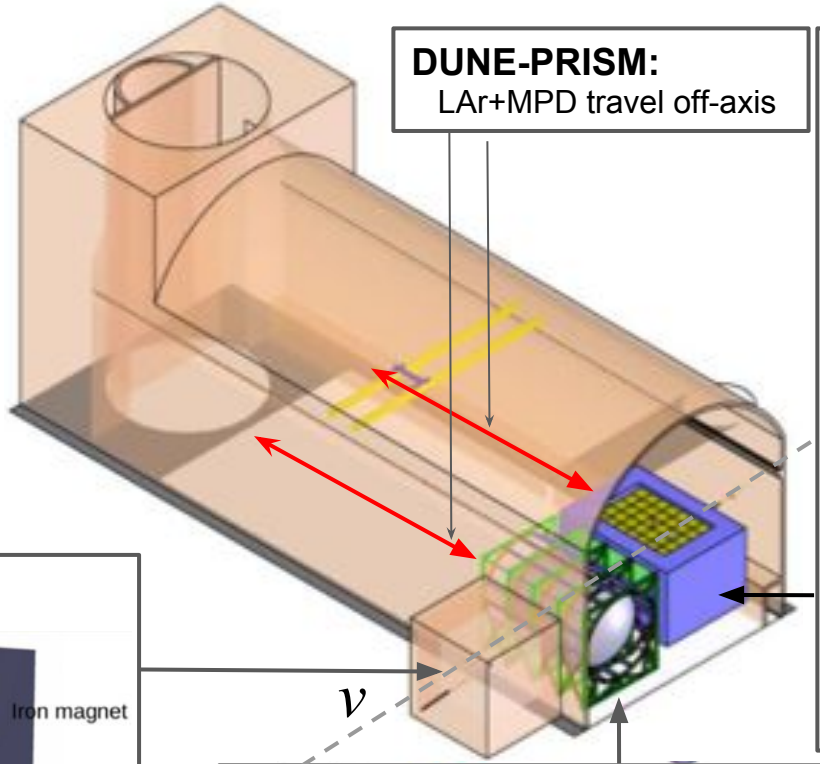
R6) The experimental floor area must be at least 42.5 m × 17 m and the hook height must be at least 13 m, measured from the floor.

R7) A newly built dipole is the preferred magnet for the downstream spectrometer of the DUNE near-detector complex.

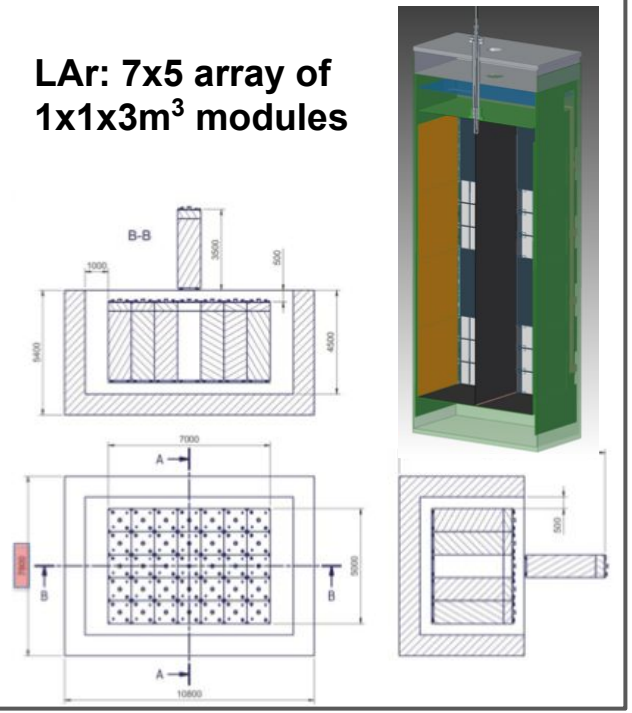
R8) The recommended concept is a near detector suite consisting of a LArTPC and a HPgTPC + 3DST combination in a single magnet.

R9) The option of filling the HPgTPC with hydrogen should also be investigated.

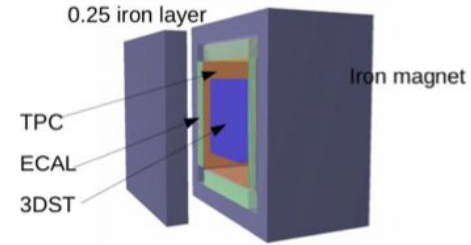
DUNE-PRISM:
LAr+MPD travel off-axis



LAr: 7x5 array of 1x1x3m^3 modules



3DST-S



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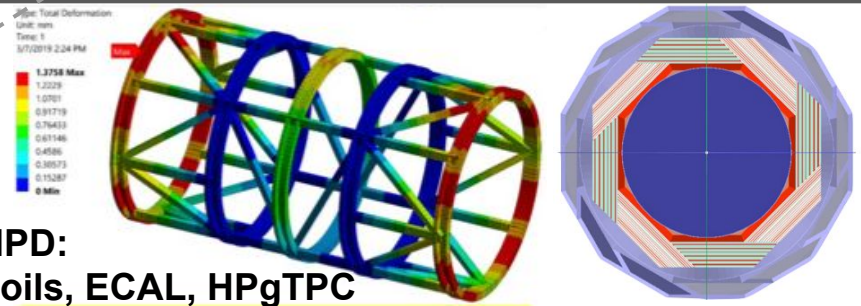
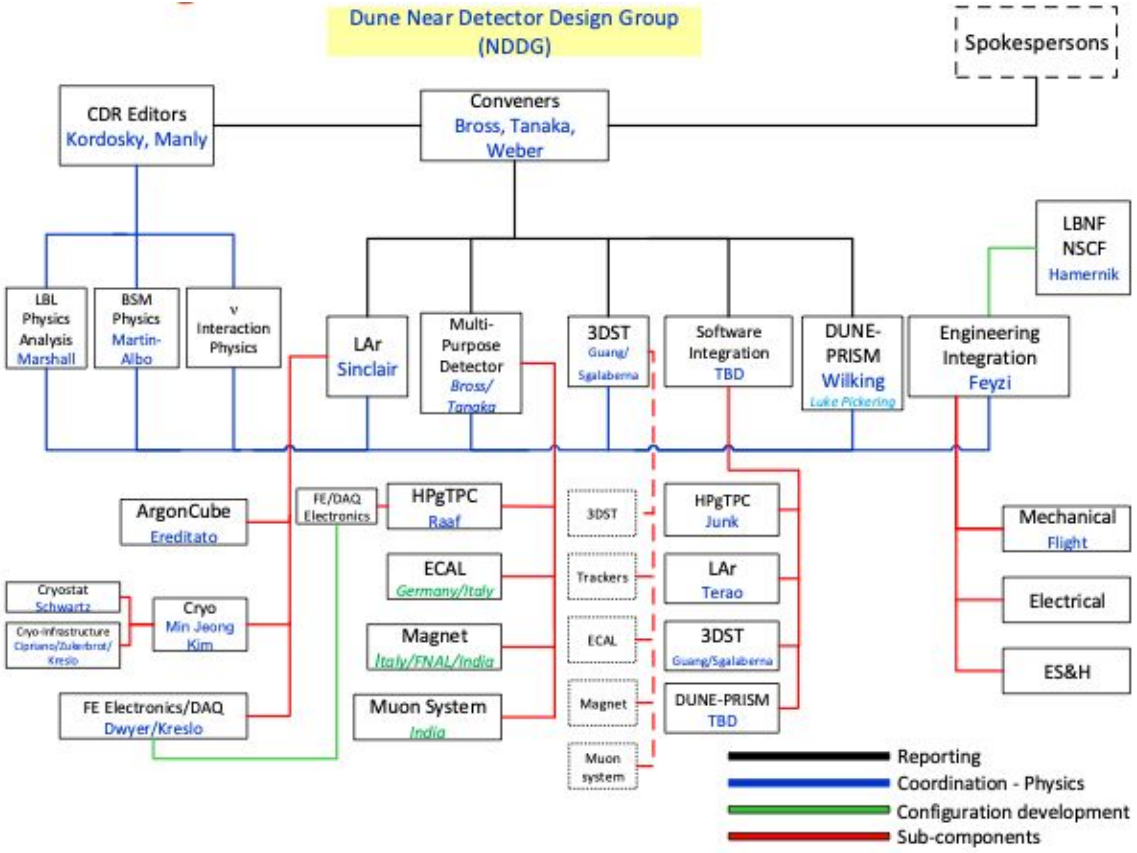


MPD:
Coils, ECAL, HPgTPC

NDDG Organization



non-US interests:

- LAr:
  - Switzerland, Russia, UK
- MPD:
  - HPgTPC (UK)
  - ECAL (Germany, Italy)
  - Magnet (Italy, India)
  - Muon (India)
- 3DST:
  - CERN, Russia, South Korea, Spain

RELATION BETWEEN NDDG AND US-DUNE ND

- The design of the ND is the responsibility of the (international) DUNE collaboration through the NDDG
  - We must push forward with the current concept and develop/optimize it both technically and scientifically
  - It is essential for this effort to be scientifically driven and for the collaboration as a whole to “buy in” to the design, regardless of eventual contributions and roles.
  - Review by the Long Baseline Neutrino Committee (LBNC) is a critical part of the process
- Understanding the US effort is critical to the success of both the design and eventual construction of DUNE ND
  - Resources everywhere (not just in the US) are (highly) uncertain and constrained
  - Highly targeted and leveraged contributions will be essential towards a successful US ND effort and the DUNE ND effort overall

TIMELINES/MILESTONES

- 3 May: 1st Executive Summary Submission to LBNC for review
- 27 May: Updated version of ES to LBNC
- 20-24 May: DUNE CM – May 20-24
- 24 May: Written feedback from LBNC
- 25-27 May: DUNE ND WS – May 25-27
- 2 June: Slides for LBNC ND review delivered to LBNC
- 4 June: LBNC ND Review
- End 2019: End of 2019
- End 2020: ND TDR