DUNE ND-LAr Institute Board

October 20, 2022

Agenda

- MoU process
- Prototyping Taskforce
- 2x2 organization and update
- Physics Organization

MoU

Reviews 2022: huge progress !

- Successful **PDR (technical)**. Report received, very positive with a few recommendations to be implemented for the demonstrator program (cryogenics, HV). Remaining recommendations for the FRD (simulating heat input in cryostat, HV breakdowns, QA/QC, management).
  -> We have a design baseline.
  (7x5 array of 1x1x3 m3 modular, optically segmented liquid argon TPCs with pixel readout.)

- **CD1RR (funding)**. “The Near Detector is not a cost driver of the project, but it is the science driver for neutrino oscillation physics. Within the Near Detector project, a highly performant liquid argon detector is essential to deliver neutrino oscillation physics results.
  -> The design baseline satisfies an essential requirement of DUNE.

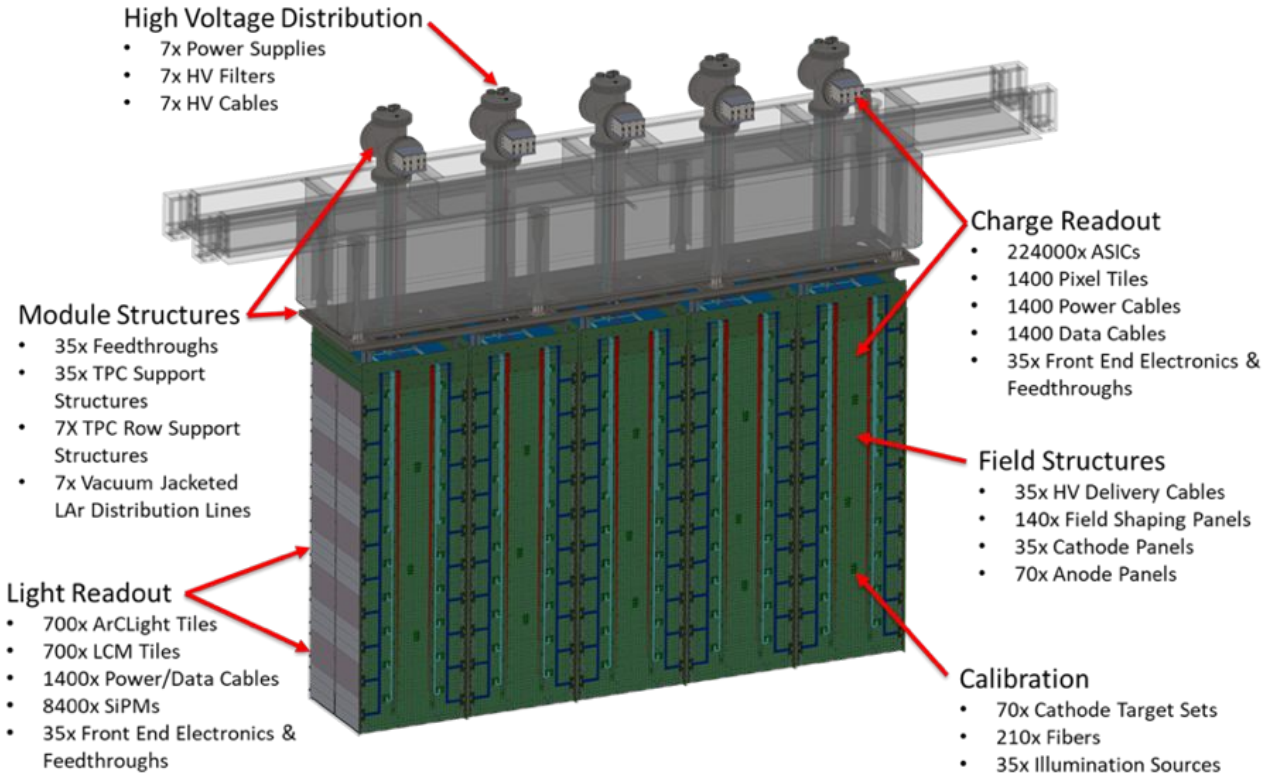
- **LBNC (international)**. “ND-LAr well established approach”, “cannot be descoped without seriously harming the physics performance”.
  -> International review body reaffirms the approach with ND-LAr.

MoU

- Presented initial draft in August
  - Annex for ND-LAr to the DUNE multi-institutional MoUs
- Circulated versions to non-US institutions for scope comments (US institutions more directly involved earlier through US-project WBS)
- Feedback from DUNE resource coordinator (G. Barker)
- Very detailed MoU, compared to others
- Funding will be included in appendix only, also not in WBS tables
- Formatting changes, no content change, to what presented in August

- Timeline:
  - Will not be able to sign within weeks, DOE aiing at “before CD2”
  - Consensus needed now to proceed with other funding agencies (i.e. CH)

Overview of deliverables



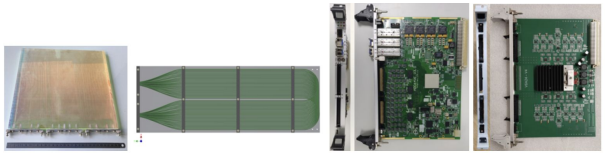
Open questions

- Include only institutions with scope in construction ?
  - The MoU only includes construction funds
  - E.g. not mention institutions who are contributing exclusively to analysis
  - Factorize Consortium membership from MoU signing
- Include demonstrators ?
  - Proposal to mention this in the general part, but have the scope tables only include construction units plus yield
- Include spares ?
  - Open…

Structure for each WBS (example light readout)

As presented in August, minor modifications

- Design sketches



- Scope summary, text form, consistent with US-p
- Deliverables (table with items)
- Contributing institutions
  - Design
  - Delivery of components
  - QA/QC
  - Assembly
  - ND A&T and I&I fraction

	Task/Item	Qty
1	LCMs	2100
2	ArCLights	700
3	SiPMs	8400
4	Cold-PCBs	2800
5	Light Readout Feedthroughs	70
6	Microcoax Cables (diff lenghts)	1400
7	SiPM PS (Biasing) modules	70
8	SiPM PS & VGA control units	35
9	VGA unit	280
10	ADCs (readout)	175
11	ADC sync and trigger units	35
12	WR switch	2
13	VXS crates	35
14	HV power units	35
15	Optical cables	245
16	LV power units	35
17	Power&Signal Adapter boards	280
18	LRO Slow control software	-
19	LRO DAQ software	-

Prototyping Taskforce

Taskforce on demonstrators from PDR to FDR

- Task Force set up Sep. 20th
- Chaired by M. Weber (consortium lead)
  - Deliberate choice to have the consortium drive the task force
  - Members: L. Suter, M. Mooney, J. Sinclair, T. Markiewicz, I. Kreslo, M. Soderberg, D. Harris, D. Dwyer (ex-officio), A. Lambert (ex-officio)
- 4 meetings per week
  - Initial week collecting input
  - Define scenarios
  - Work out scenarios and write report
- Draft report is available, 24pp (attached to meeting page)
- Processing feed-back before finalizing the report in October

Charge from DUNE TD

1. Review and, if needed, update the technical maturation plan (“the plan”).
   a. Review and update the technical risks in the risk registry, considering the outcomes of the PDRev.
   b. Define an operation and test plan that addresses these risks on the path to the final design.
2. Summarize constraints/opportunities at the facilities relevant for the plan including:
   a. Physical and other practical constraints that may limit its scope
   b. Existing infrastructure that can be reused and scope constraints that may result.
   c. Schedule and availability
3. Propose an updated execution of the plan considering the proposed facilities (LAr@Bern, 2x2@FNAL, MATF@FNAL, FSDTF@ SLAC):
   a. Assume LAr@Bern is the primary site and assess its ability to execute parts (if not all) of the maturation plan and retire risks on the path to final design
   b. If any aspect of the plan cannot be fulfilled at LAr@Bern, propose how they can be executed by either :
      i. Specific modifications to the currently planned LAr@Bern facility
      ii. Adapting other facilities (including possibly other than those mentioned here) to specifically address them
   c. Estimate the cost differential for the updated plan
   d. Evaluate its impact on the QA/QC plan for module production

Path from concept to construction

Single Cube

Published July 2021

CDR

Conceptual design review

Single Module

TRL-6

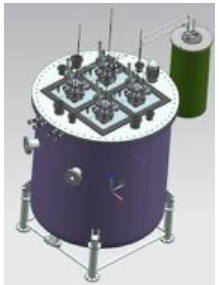
We are here

June 2022

PDR

Preliminary design review

2x2 neutrino beam test



Full size demonstrator(s)

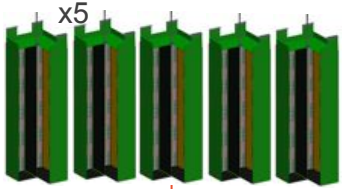
TRL-7

+ 1.5 Years

FDR

Final design review

Pre-production x5



+ 1 Year

PRR

Production readiness review

Scenarios for Demonstrators

A. **Bern and SLAC FSD** (default consortium planning)

B. **Only Bern FSD 2023** + MATF 2024 (N2, LAr maybe if re-using Bern equipment)

C. **No FSD pre-FDR**

Full Size modules warm tested only pre-FDR (FDR is early 2024)

Summary of the Executive summary:

- Assume the 2x2 to be independent and to proceed
- Scenario B a minimal realistic scenario that offers a compromise that satisfies the risk mitigation while minimizing costs.
- Scenario C was a nice exercise, but no way could be found to make it remotely viable.
- Scenario A remains the preference of the task force. To enable Scenario A a clear statement needs to be made in October 2022 that delineates funding, schedule and scope.

2x2 organization and status

2x2

- Cryostat at FNAL
- Mod-0 and Mod-1 at FNAL and modified
- Minerva installation underground significantly advanced

Missed the milestone to have
all modules ready for installation at the end of Sept 2022

Assessed the situation Oct 13th

- Defined more clearly the separation of responsibilities between “modules” (James/Louise) and infrastructures (Ting)
- Reiterated 2x2 priority with FNAL leadership
- Acknowledged need for a single point of contact and coordinator
- Acknowledged weakness in communications at several levels

2x2 next steps

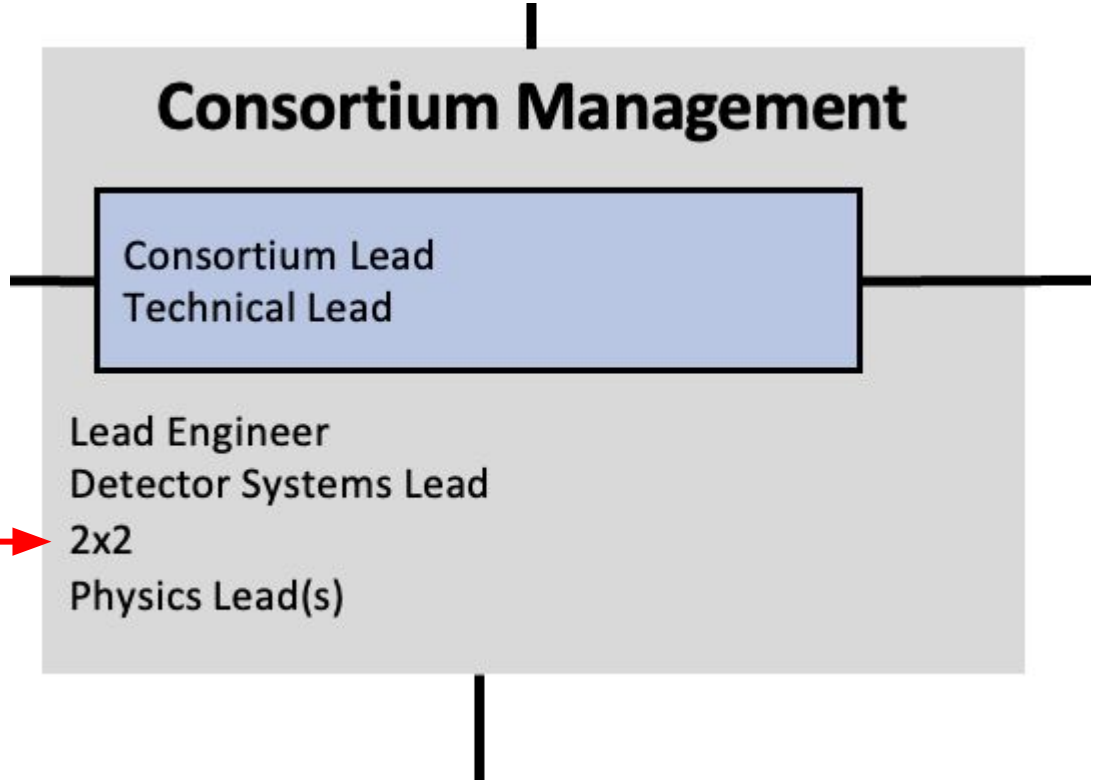
Management

- Install a single overall coordinator
- Improve 2x2 communication with entire Consortium (single weekly org meeting open to all, communicate via general consortium email list and slack channel)
- Define new milestones
- Prepare new schedule
- Complete installation plans, procedures, clearances, approvals
    - To be reviewed in December 2022

Technical

- Complete the construction of the last two modules (realistic to occur by Xmas 2022)
- Complete installation of Minerva planes
- Install Cryostat and insert modules
- Delivery (Jan 2022) and assembly cryo system
- Move from LArTF and connect readout, slow control
- Integrate and commission system

Proposal to add 2x2 lead to the Consortium Mgmt



Physics organization

Physics

SLIDE from August IB meeting

- Contact Andy Mastbaum and Pedro Ochoa for any questions / commitments
- DUNE simulation/reco/analysis of ND, ND-LAr, would profit from more dedicated involvement
- We need to have the simulation / reconstruction for the 2x2 data in early 2023
  - **Data ! Neutrino data!**
  - Benchmark for ND-LAr
  - We plan a set of workshops in 2022 to channel and drive effort

    If you have PostDocs to contribute to preparations, please let Andy/Pedro know
- In general we plan to expand significantly the analysis/physics organization of the consortium over the next weeks/months.

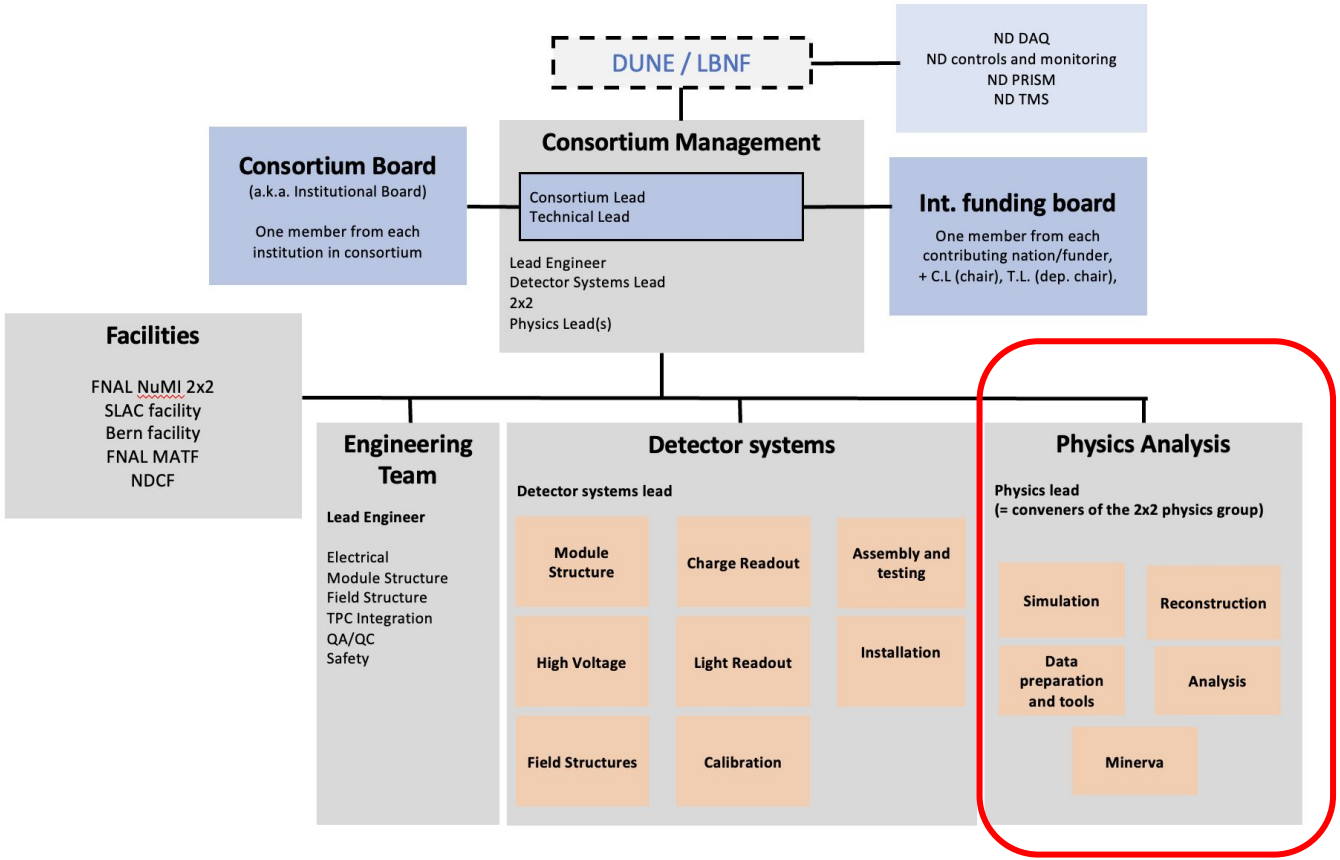
Physics organization

- Contacted DUNE physics coordinators about adding a 2x2 physics group
  - Positive feedback
  - Agreement that integrating the analysis of the 2x2 better into DUNE is beneficial
  - Negotiations with DUNE leadership and sensitivity to precedence cleared
  - Initially Pedro and Andy identified as conveners

- Open point: how to implement in org charts
  - ND-LAr consortium has pushed back to the idea that it is cut off from (not excluded, but has no formal role in) analysis of 2x2 data
  - Who owns the data?
  - Can we create links in the org charts to explicitly have the new group under physics coordination and the consortium ?

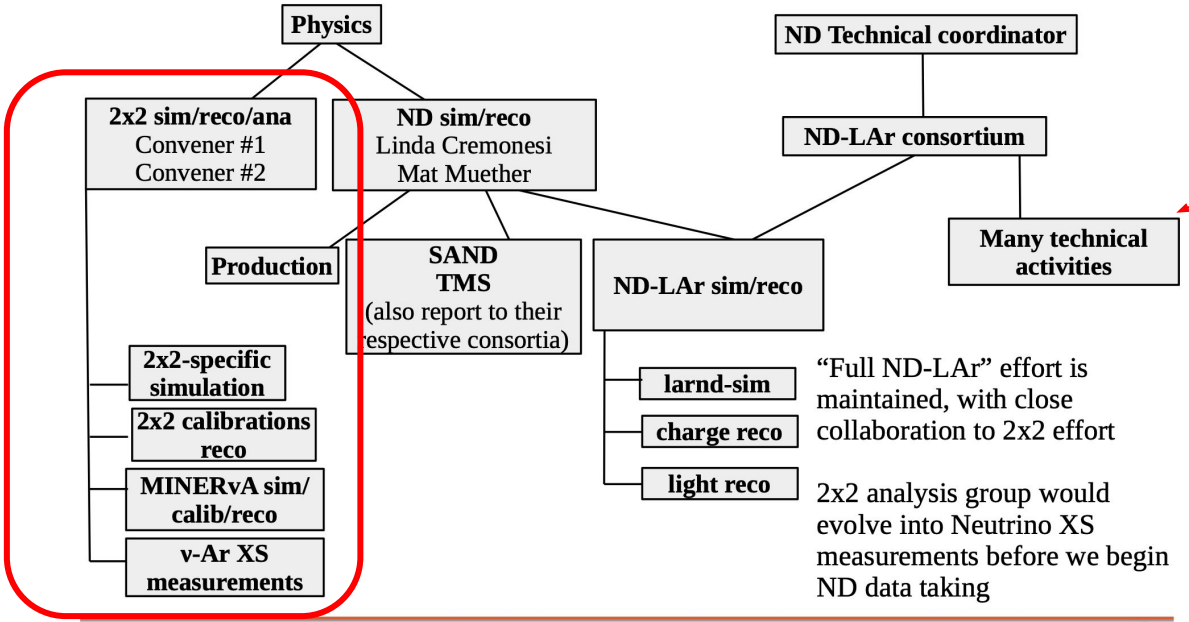
Weber opinion: 2x2, having neutrino data, is special. Close contacts of physics coordination and consortium lead needs to be established on its use.

Idea in August



Proposal DUNE physics coordination

Partial org chart with new group



Definition of ND-LAr…

Possible solution