SLAC in NDLAr

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SLAC NATIONAL ACCELERATOR LABORATORY

Stanford University | U.S. DEPARTMENT OF ENERGY

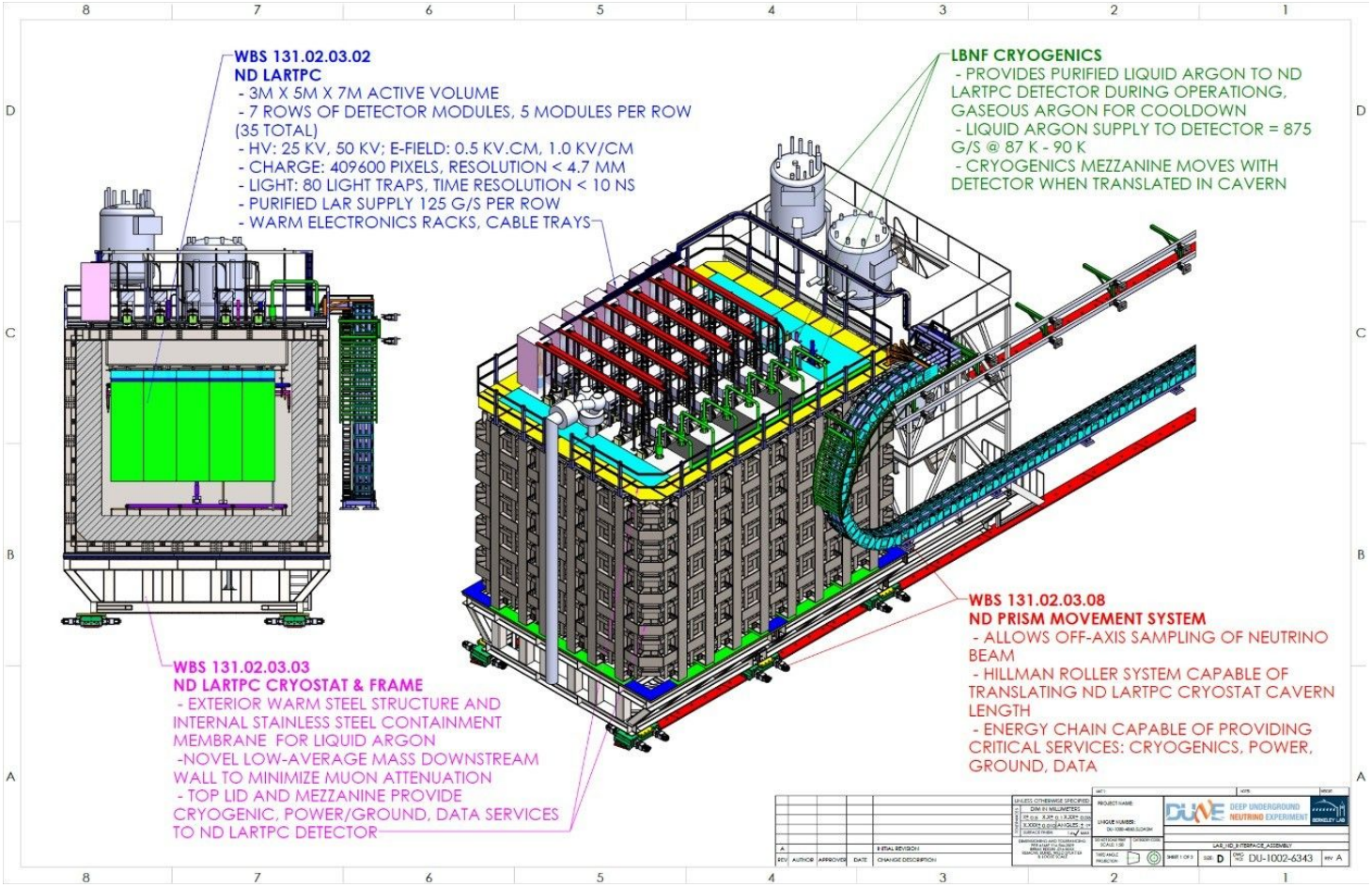
DUNE NDLAr

574 m from the first focusing horn.
Very high multiplicity environment.

Modular design to reduce pile up by containing prompt scintillation light.

Active volume:
5 m long x 3 m tall x 7 m wide.

Split into 35 modules.



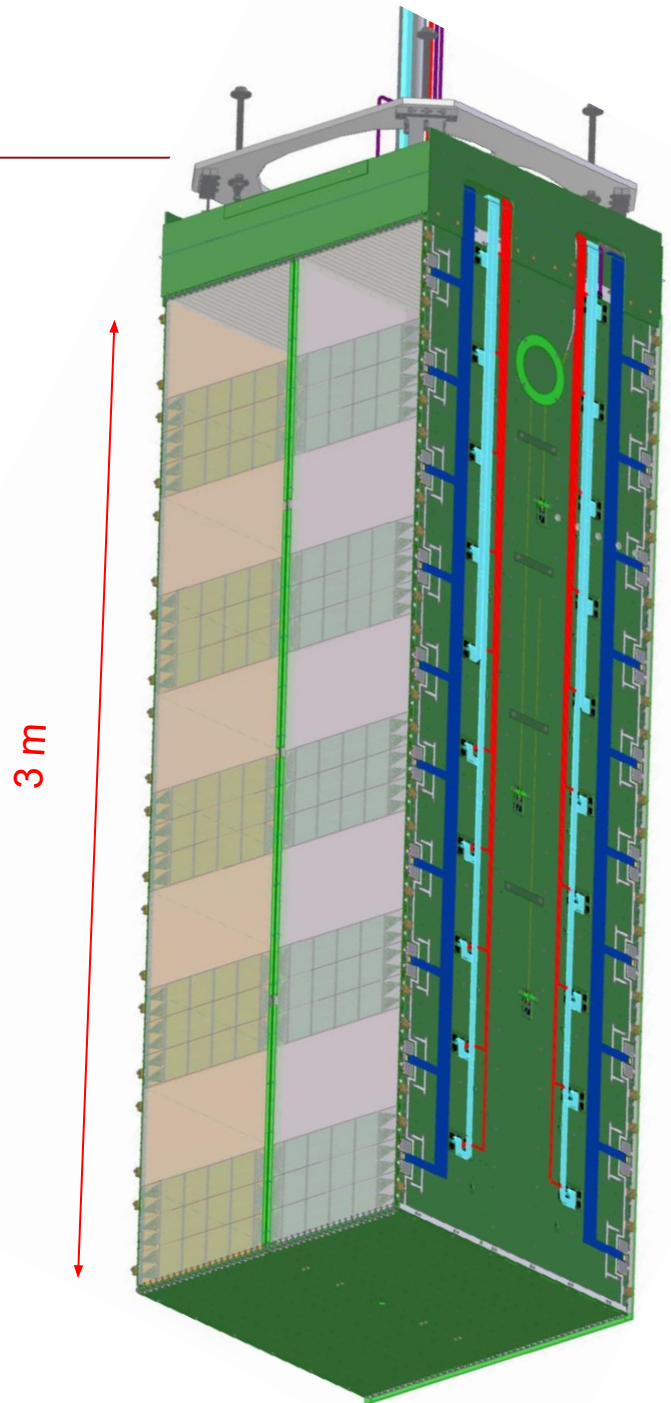
NDLAr Modules

Active volume 1 x 1 x 3 m^3.

Central cathode supporting two 50 cm drift TPCs.

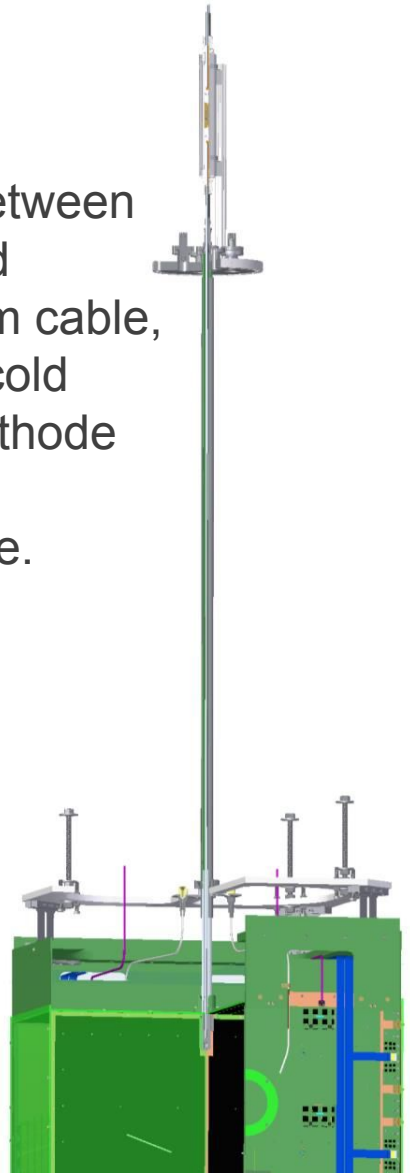
Nominal 0.5 kV/cm (25 kV at cathode).

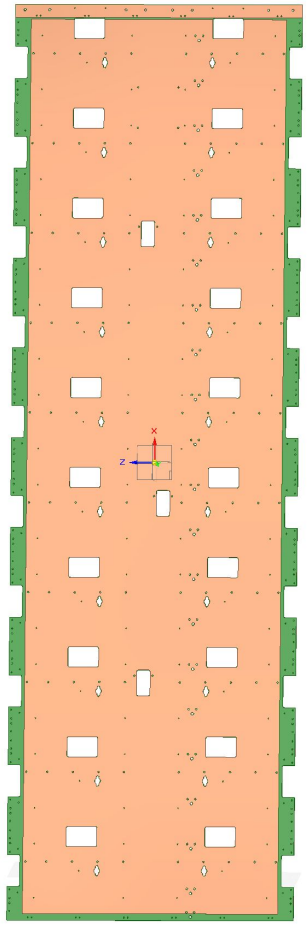
Dielectric shielding from fiberglass structure.



SLAC Scope: Field Structures

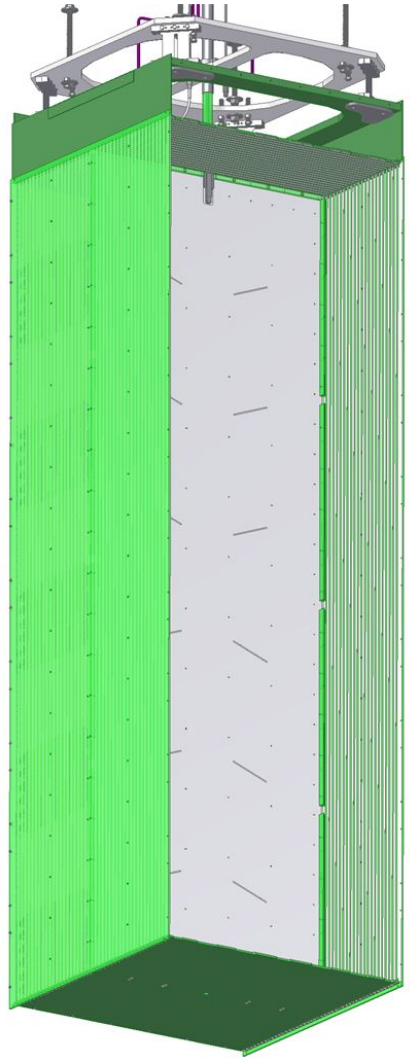
HV Cable & Feedthrough
Connection between HV supply and cathode: Warm cable, feedthrough, cold cable, and cathode connection.
Resistive cable.





Anode support plane
Integrate all instrumentation & calibration. Provide rigidity to TPC.
Provide HV ground return.

Cathode & Field Shell
Liquid fence to direct LAr.
TPC panels.
Maximal active volume.
Dielectric shielding.
Opaque to scintillation light.



Responsibilities & Status

Mechanical engineer (Knut), technician (Bob), and L3 (me) (CAM and Lead engineer LBNL).

Design Largely complete, minor changes possible post FSD/FDR findings.

Prototyping Small scale complete. FSD is final stage.

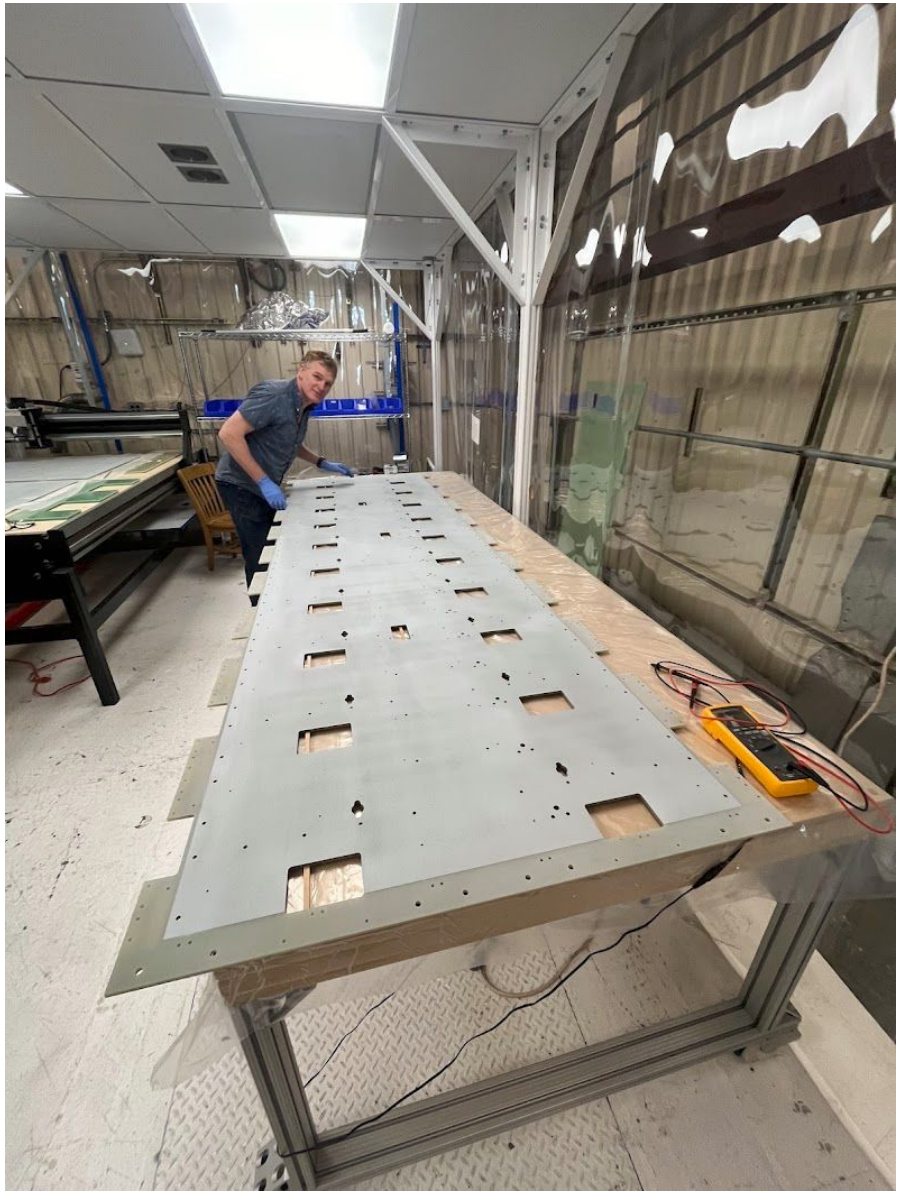
QA/QC The FSD production has informed much of the QA/QC procedures. Needs documenting.

Production Small production batches have been demonstrated for FSD. Industrialisation is the goal, this will be challenging.

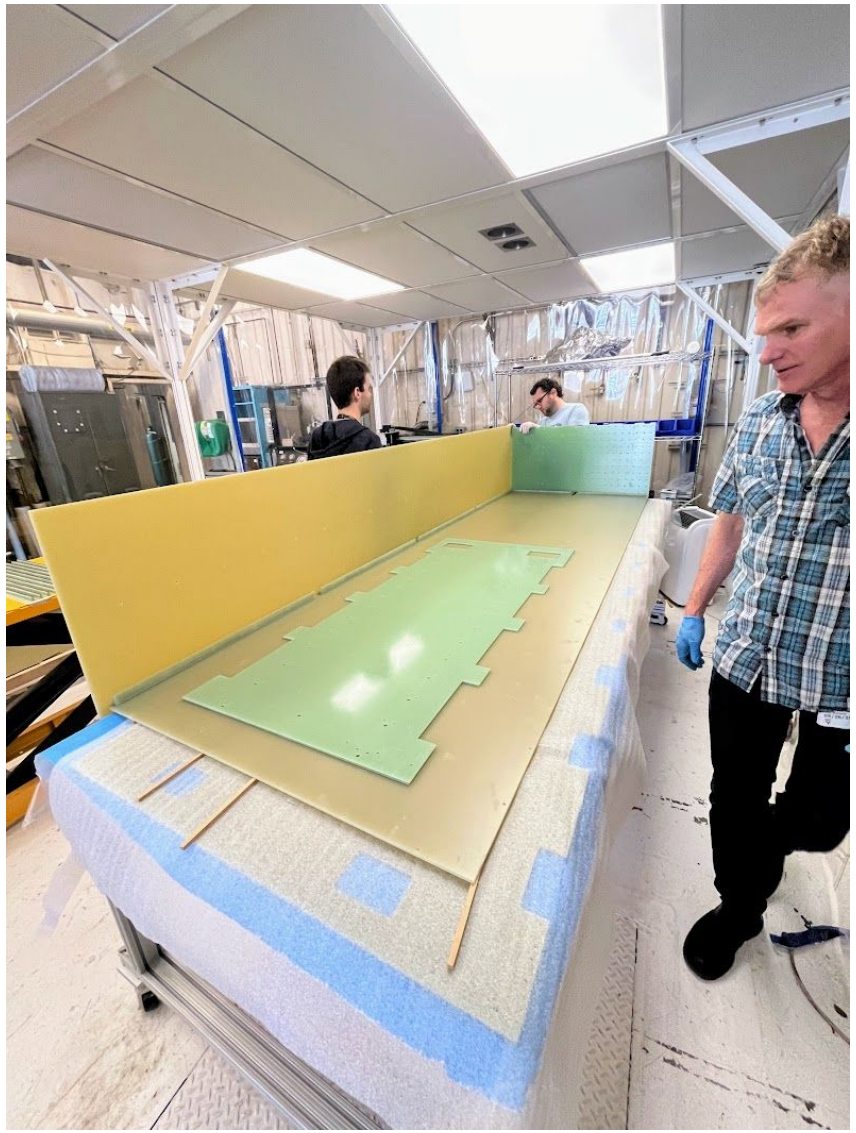
Documentation Lacking, significant updates needed post FSD production.

Note, assembly/installation is Bern/CSU/FNAL

Production



Production



Issues & Challenges

Ensuring analysis is ready for FSD: We must turn around results quickly to inform decisions. Therefore, we cannot wait for analysis to be developed after the fact.

Redundancy and backup: When we lost our engineer last year, there was no way to bring another up to speed in time. Working on this.

Moving goal posts: we were tasked with providing an additional module for cryo testing in May/June. This was not planned in the US project and has delayed/rushed other work. Its operation is now delayed until August/September.

…resources to build and operate QA/QC test stands. Currently delayed ~1 year.

Upcoming Milestones

August Cyro test of full-scale uninstrumented module, in Bern. (shifters wanted)

October Full-scale demonstrator operation, in Bern. (shifters wanted)

October Final design review**???** (extremely unlikely)

January Five module production. Demonstration of full production chains. ‘Uge effort.

April Production readiness review??? (extremely unlikely)

Needs and opportunities

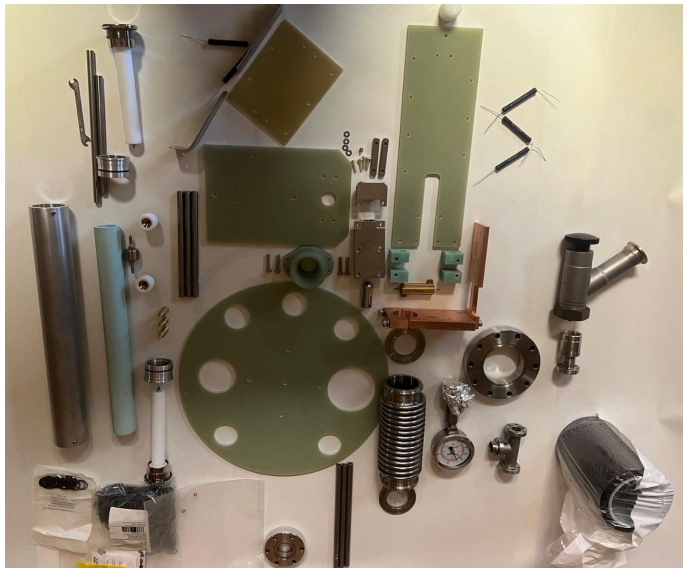
Spatial distortion map:

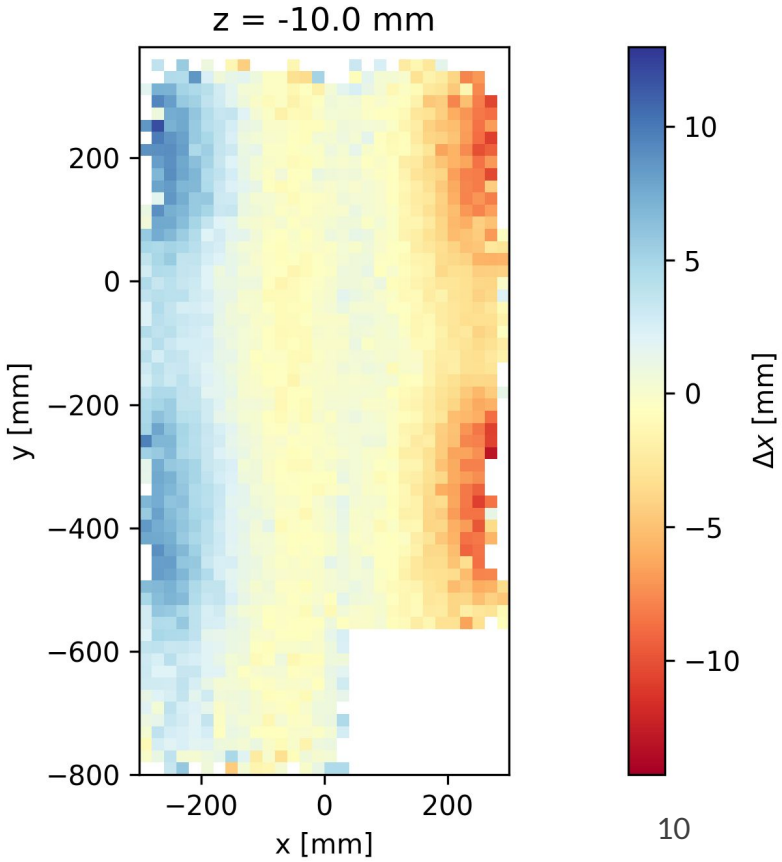
Yifan is currently advising 3 students working on this for the 2x2 with the hope that application to the FSD is trivial. More input here would inspire confidence in delivering for the FDR. If the current schedule is correct, help is needed immediately.

Cold test stand(s) & QC:

We are about to assemble the HV cold test stand.

In addition, we need a test stand to study photon emission.





Cold test stand

Reviewers familiar with the LZ resistor issue advised testing all HV components with a light collection comparable to the final geometry.

Build a TPC of equal drift to the ND, testing resistor PCBs and clips. Study field-dependent photon emission.

The TPC will be housed in a purpose built open-mouth dewar to enable fast-turnaround.