

THE FULL SCALE TEST DEMONSTRATOR TEST FACILITY

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MISSION NEED

- The Full Scale Demonstrator Test Facility (“FSD-TF” or “FSD”) will operate the first complete, full-sized ND-LAr module (1x1x3m³)
- The successful construction, deployment, and operation of the first module is an essential element of achieving TRL7 on the path to CD-3:
 - DOE: Technical Readiness Assessment Guide:
 - ***TRL7: Full-scale similar system validation in relevant environment***
 - Transition from “engineering” scale (e.g. 2x2 modules) to full-sized system

REQUIREMENTS

The FSD-TF must support:

- Operation of a full-sized ND-LAr module
 - Dewar of sufficient size, lids/flanges with appropriate feedthroughs
 - Cryogenics infrastructure to sustain LAr supply, cooling, purification, and circulation
 - Services to support the operation, readout, and monitoring of the ND-LAr module
- Assembly and integration of the ND-LAr module
 - Clean room space with overhead crane
 - Fixtures, workspaces, and all associated for assembly
- Installation of the ND-LAr module into the cryogenic system
 - Craning access with hook height sufficient to place module into dewar
 - Related infrastructure to access and maintain services
- While not fully specified, expect ~3 cycles of operation each O(1 month)
- Meeting/work space in close proximity
- Prototypes production assembly/testing at the Module Assembly Test Facility
 - Facility design and procedure/operations for production module testing

SCOPE

Partially in-kind
In-kind

- Cryostat:
 - dewar, lid, *removable “physics” lid*
- Cryogenics:
 - LAr purifier, phase separator, condenser, pump assembly, flow monitoring, **purity monitor**, particulate filtering, ancillary hardware, flowmeter
 - **LN₂ storage tank**, LAr storage tank
 - Cryogenic control and monitoring system
- Facility
 - **Mezzanine, ODH system, clean power/ground, clean room**, racks/cable trays
- TPC Integration
 - Tooling, layout, equipment, support for integration manager appointed by consortium
- Operations
 - Facility operations support, support for run coordinator appointed by consortium
 - Delivery of cryogenics (LAr/LN₂)
- Management:
 - **Integrated design/construction/management of facility**
 - **Systems engineering**
 - **System safety**

SCHEDULE AND COST

Assumption is that first modules will be available for test April 2023

Flexibility to adjust depending on expected timescale to construct first module

Design w/ Reviews	April-December 2021
Procurement	January-August 2022
Installation	September-December 2022
Commissioning	January-March 2023
Operation	Beginning April 2023

Cost

- Working on labor estimates and soliciting budgetary quotes targeting end of April
- Collaborative work with experienced experts can reduce/refine cost estimation
- Proximity cryo systems at FSD/MIF could/should be ~identical

RESOURCE GAPS/ISSUES/RISKS+OPPORTUNITIES

- No resource gaps identified
 - Design/Procurement/Fabrication
 - Personnel resources identified
 - Opportunity to work FNAL, Bern, etc. collaboratively to design/plan system
 - Installation/Commissioning:
 - Experienced cryogenic technical personnel from SLAC FPD available
 - Operations:
 - Experienced TPC integration personnel available
 - All phases
 - SLAC in-kind personnel available
- Risks/Issues:
 - Schedule does not have a lot of float . . . decisions need to be made

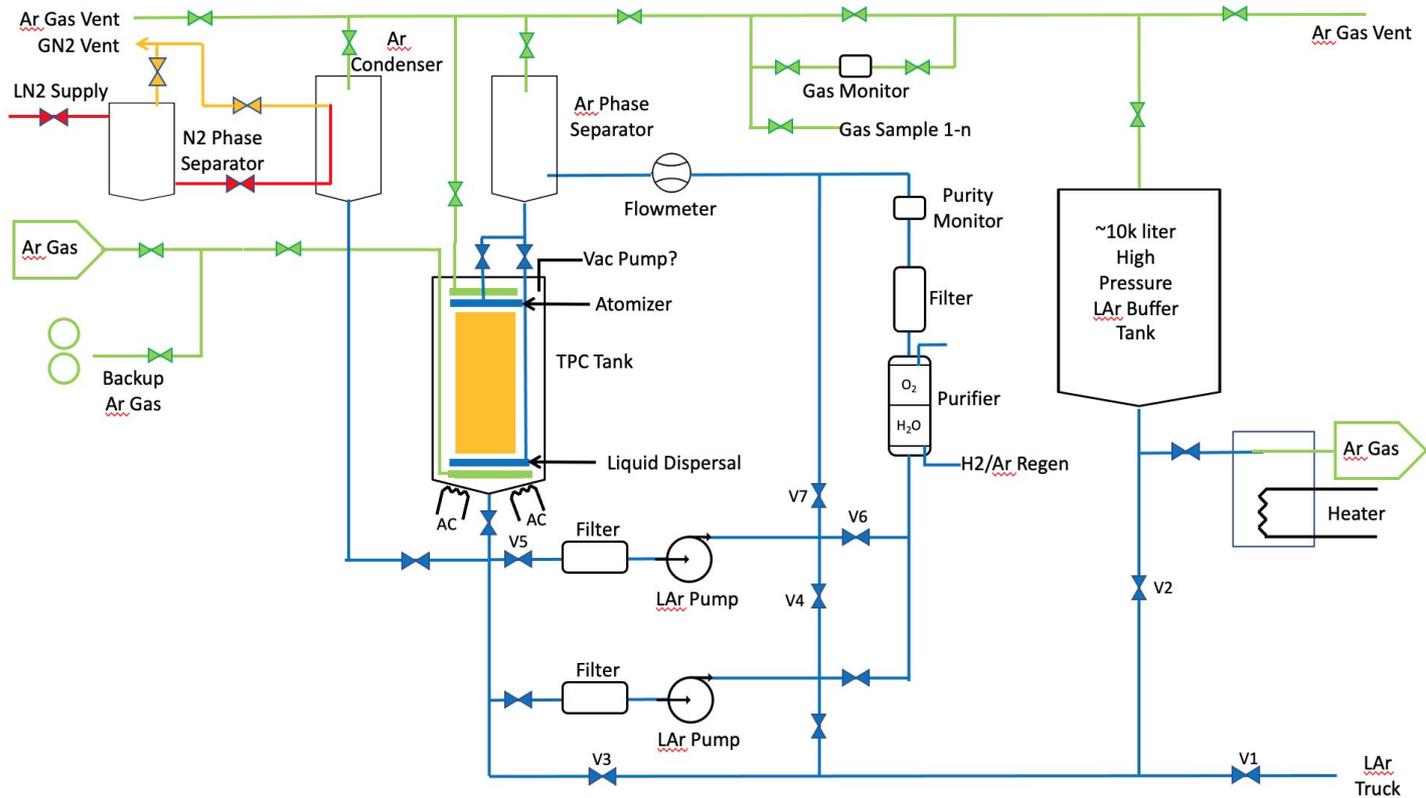
ISSUES

- The development of FSD and MATF should be coordinated
 - SLAC has had 2 very useful discussions with Mike Z and Mike G at Fermilab. The consensus seemed to be that a very effective collaborative effort can be made.
 - Need stakeholders to decide the path forward.
 - Common design effort so that FSD can prototype/test as much of the MATF as possible
 - Common components
 - Where sensible/efficient, parts from the FSD could be used at MATF
- As the first operation of a full-scale ND-LAr module, the FSD may have a more extensive testing program than at MATF
 - In relation to the above point, the FSD should be used to study/optimize the MATF testing program for the module production
- Challenge/Issue: how to optimize this coordination

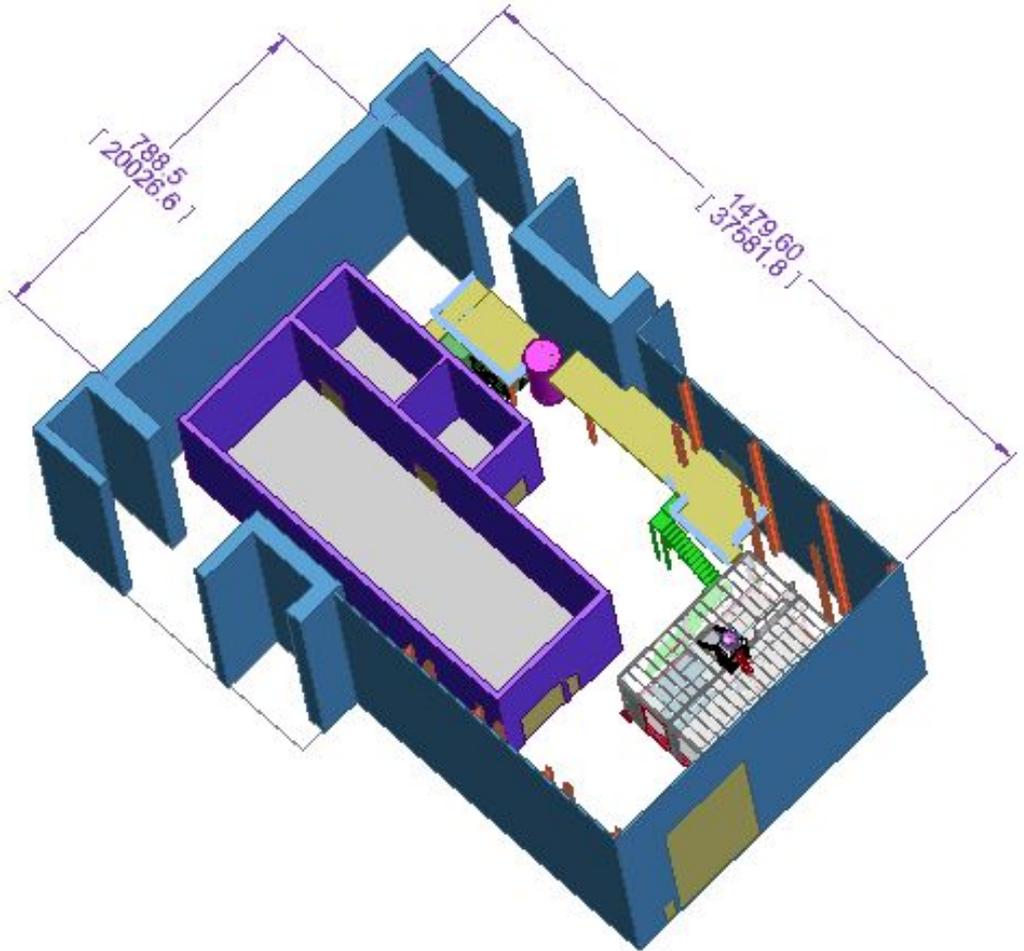
SUMMARY

We are ready to move forward with FSD!

Simplified P & ID (2021-02-11)



3D CAD of
Test Dewar &
Clean Room in
IR2 with current
access platforms



9000 gallon LN2 plumbed to local manifold in IR2 High Bay w/ 50-Ton and 10-Ton Cranes w/ 10.5m hook height

9000 gal LN2



Local LN2 Manifold

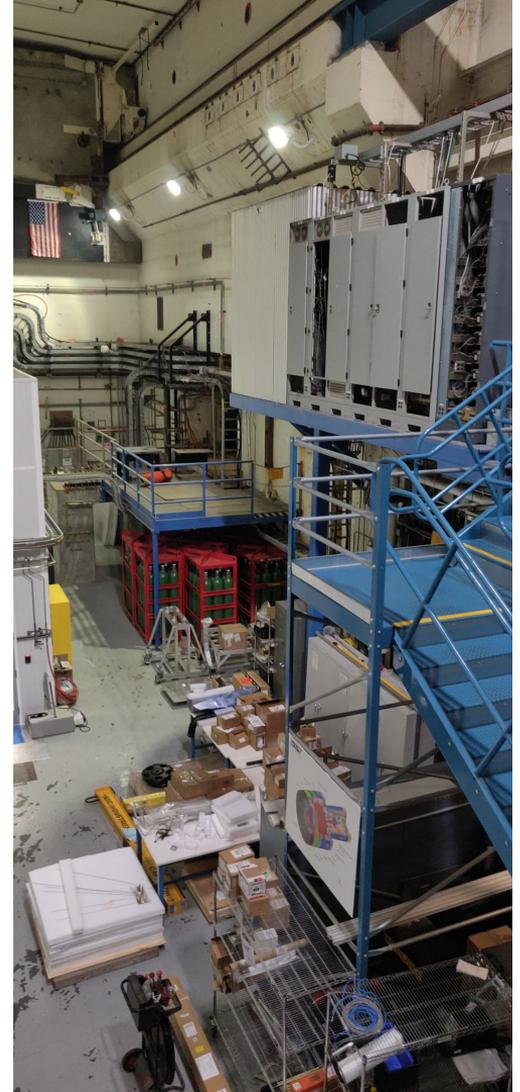


50 Ton and 10 Ton crane, 10.5 m hook height



Existing ~5m high platform accessed through existing stairs will be cleaned of old equipment and extended to provide access to dewar lid.

LSST cleanroom w/6m crane hook will be available



Major M&S Items (Red Items Exist)

Cryostat

- Cryostat
- Cryostat Flange
- Cryostat Removable lid

Proximity Cryogenics

- Proximity Cryogenics System
- LAr Purifier
- LAr Phase Separator
- LAr Condenser
- LN Phase Separator
- Pump Assembly
- Purity Monitor
- Particulate Filters
- Flowmeter
- Ancillary Hardware

External Cryogenics System

- Nitrogen Storage Tank
- Argon Storage Tank
- N₂ and Argon supply and vent lines
- Cryogenic Control System

Facility

- High Bay with Crane Access
- Safety systems (ODH)
- Mezzanine
- Clean Room w/ Crane Access
- Clean power and ground
- Racks and cable trays