



**National Institute for Nuclear Physics**

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# **INFN CSN1 Meeting DUNE/SAND Report**

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# Deep Underground Neutrino Experiment (DUNE) based at Fermilab Long Baseline Neutrino Facility

Muon neutrinos/antineutrinos from **high power proton beam (1.2 MW)**  
Massive underground **liquid Argon TPC (4 x 17 kt – 40 kt fiducial volume )**  
**Near Detector (ND)** to characterize the beam

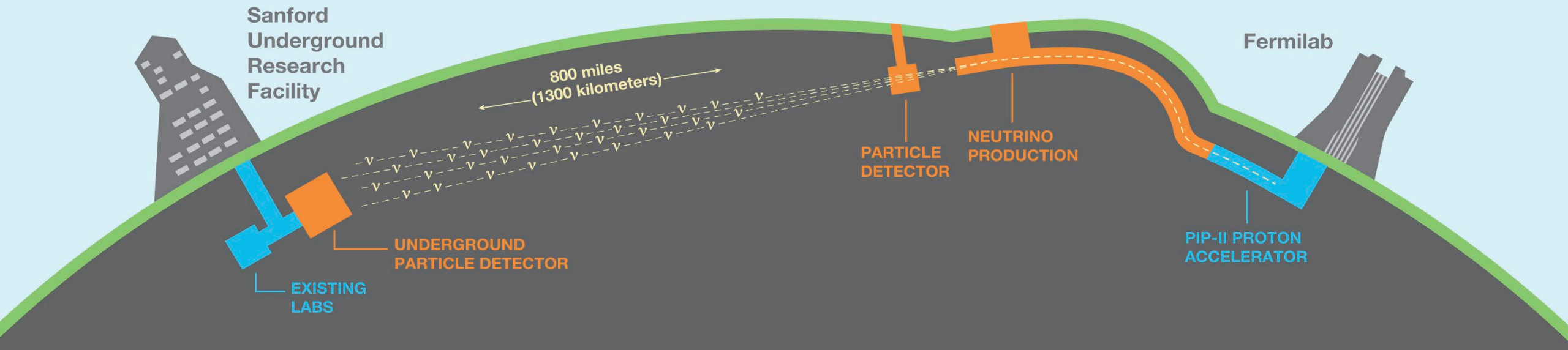
determine the mass hierarchy and measure the value of  $\delta_{CP}$



South Dakota

1300 km

Chicago



# FAR SITE

Building & Site Infrastructures activities experiencing substantial delays, the foreseen beneficial occupancy of the caverns, foreseen by end June 2025 moved to **January 2026**

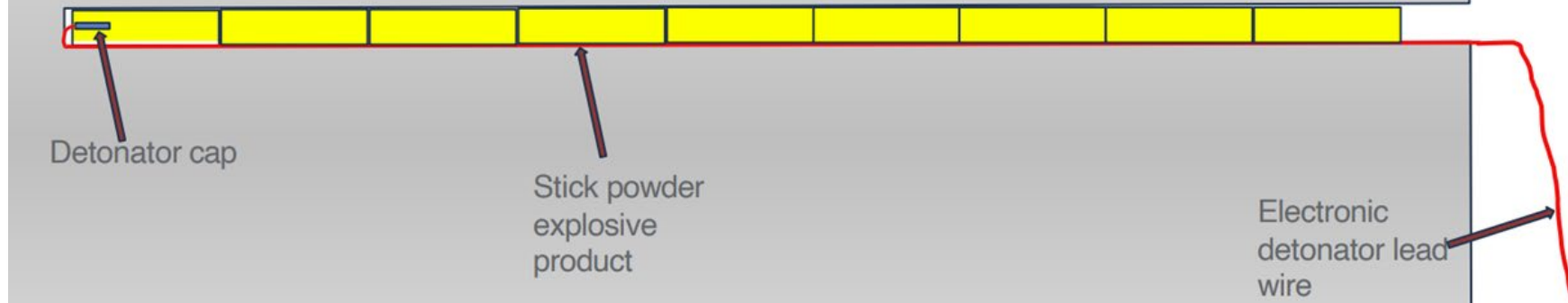
66 m long  
18 m wide  
27 m high

Crane rails out of specs

will be used mobile cranes +  
central hoist to build the cryostat



## Loaded holes used for excavation



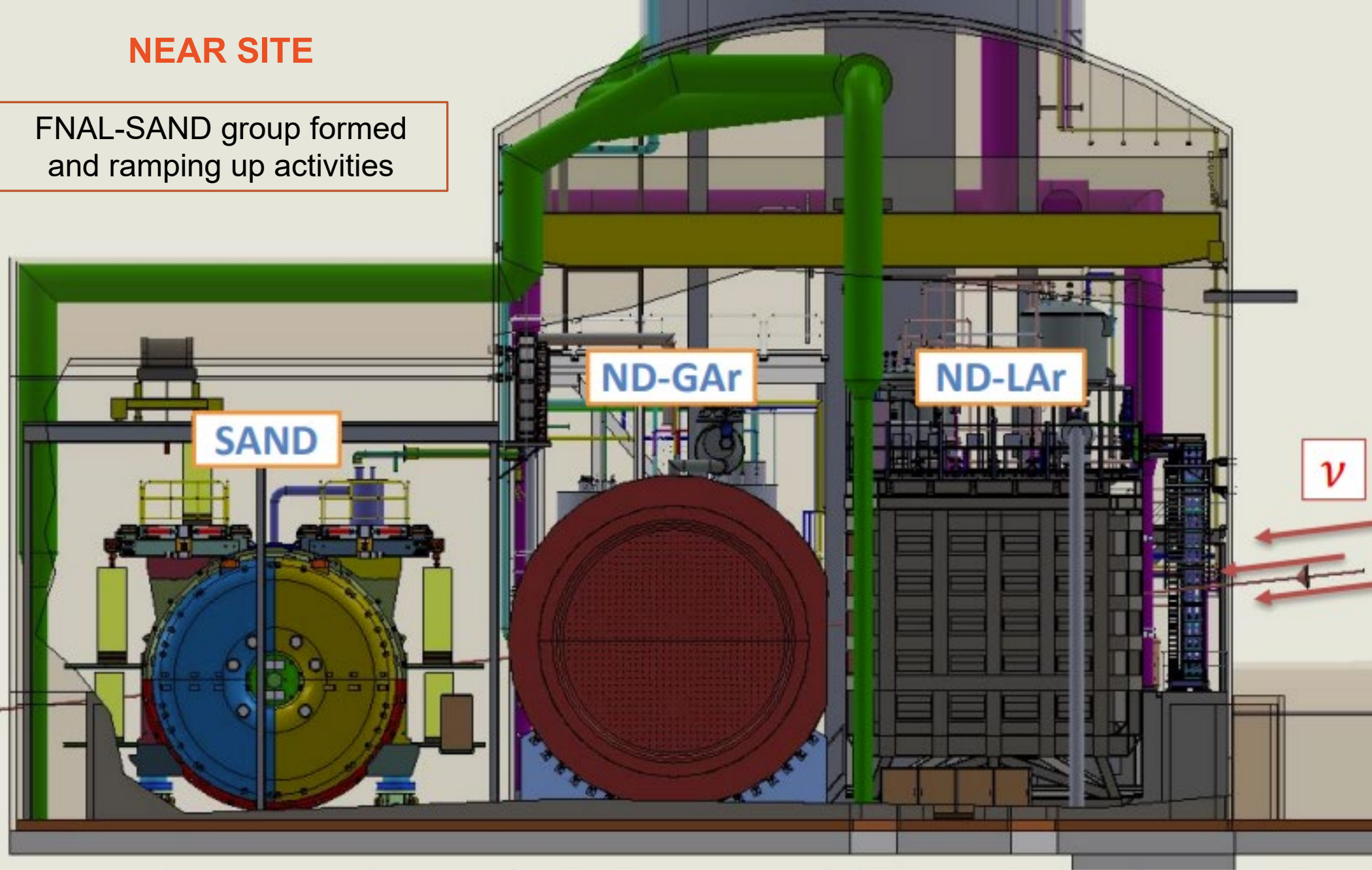
- 127,480 shots during excavations
- 600 km of lead wire
- 31 misfires
- 2 locations found with remnant material

No evidence of connected  
detonators

No risk to continued work

## NEAR SITE

FNAL-SAND group formed  
and ramping up activities



# SAND – System for on-Axis Neutrino Detection

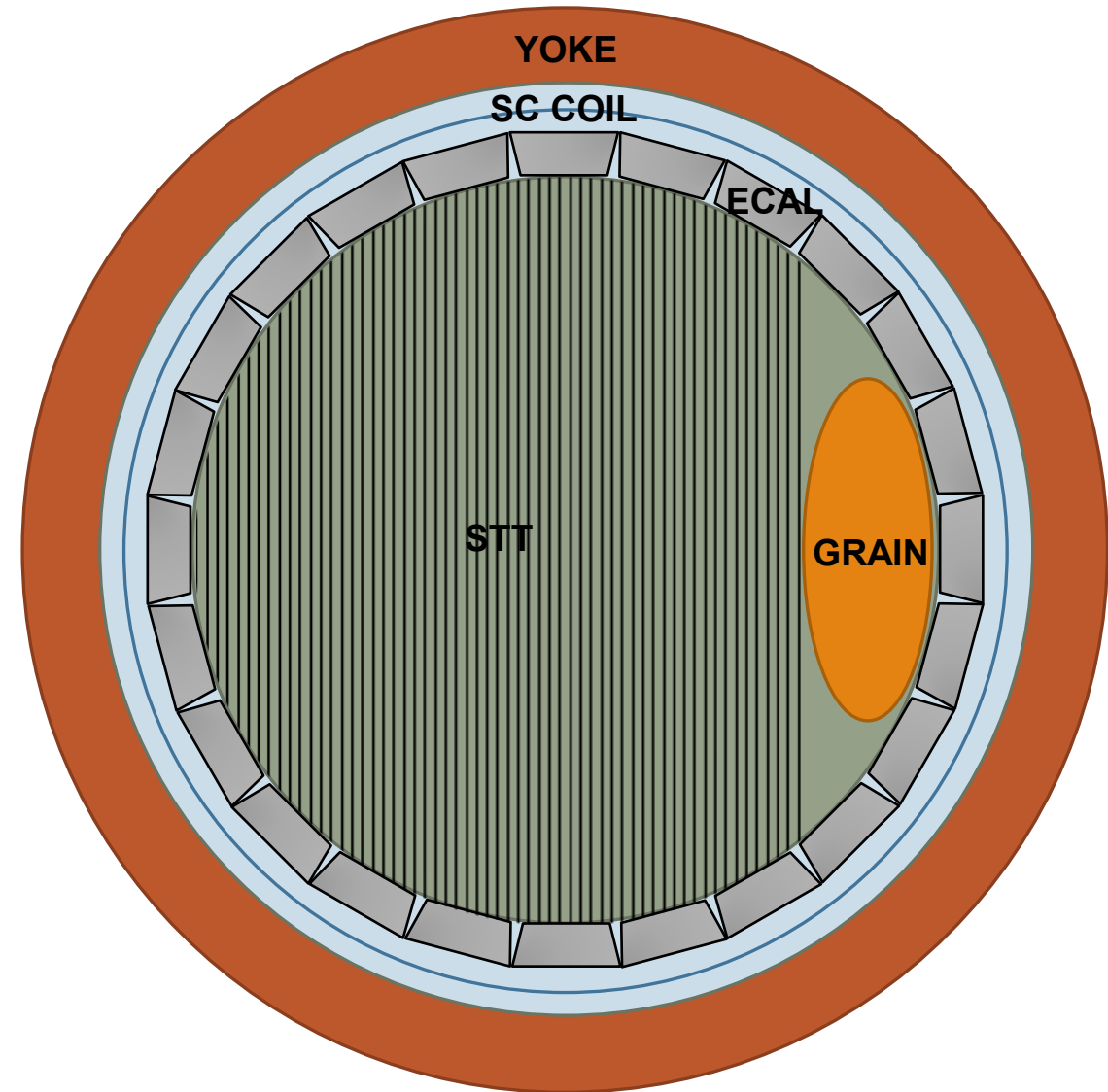
Multipurpose detector  
high performance ECAL, light-targeted tracker,  
LAr target, all in magnetic field, always on beam axis

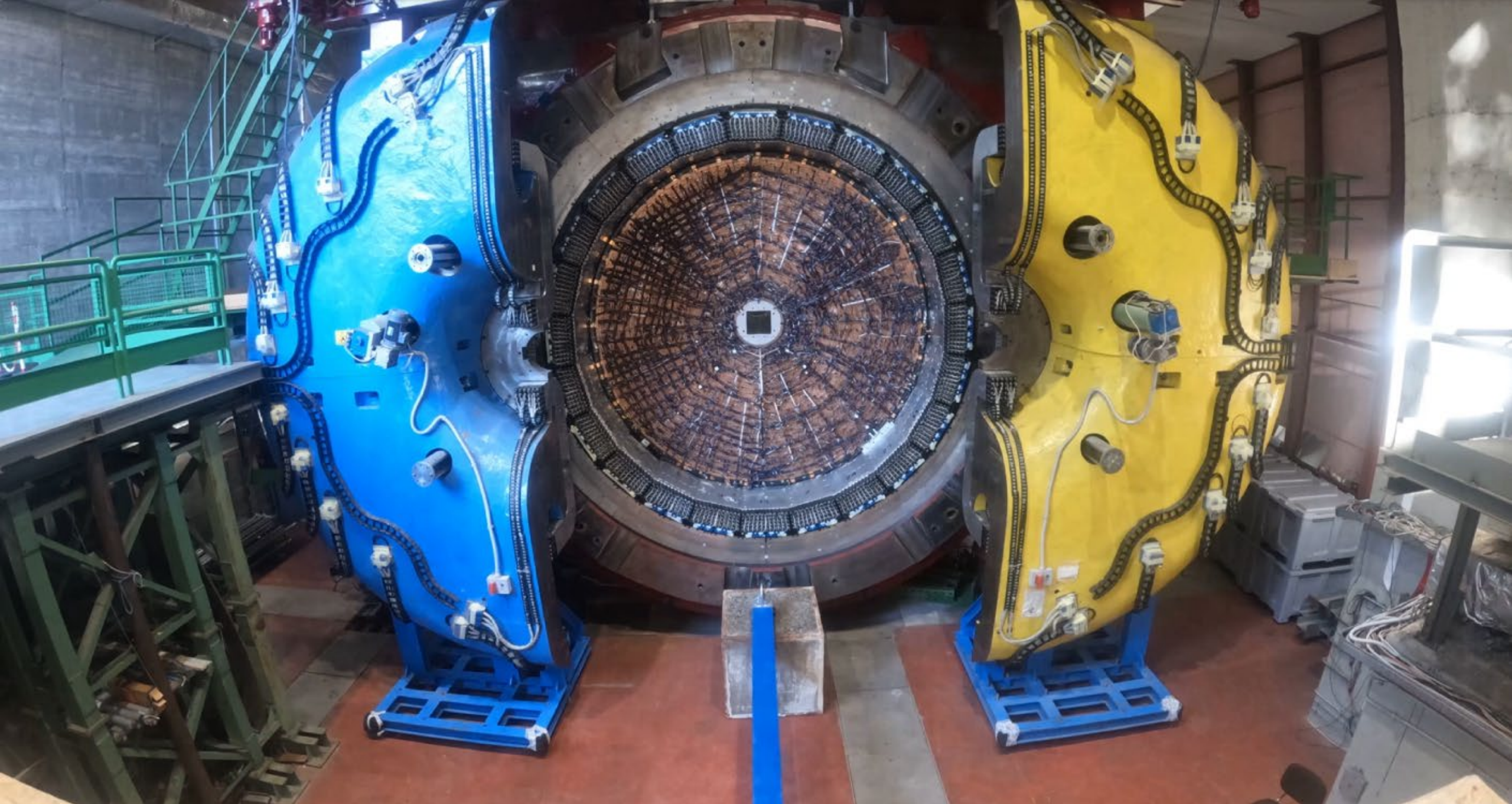
**GRAIN** – 1 ton liquid Argon target with VUV imaging system (fully optical read-out)

**STT** – 5 ton Straw-Tube tracker with “solid-H” target  $\text{CH}_2$  and C interleaved slabs

**ECAL** - KLOE Lead Scintillating Fibers calorimeter (Barrell + EndCaps)

**MAGNET** – KLOE 0.6T superconductive coil + Fe Yoke



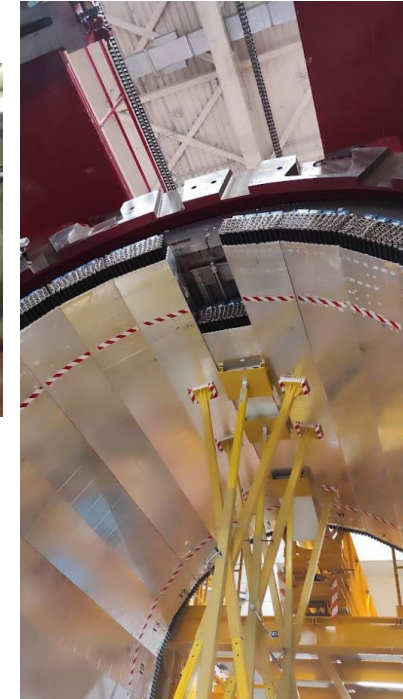


# KLOE-to-SAND Operation Activities at LNF

- Removal of all the cables and the FEE+HV racks
- Extraction of the Drift Chamber

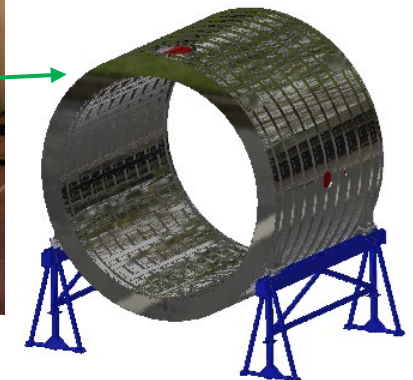
## CALORIMETER

- Laser Tracker survey
- Extraction of Barrel (24 modules)
- Dismounting of 4 End-Caps
- Modules consolidation
- Operational test



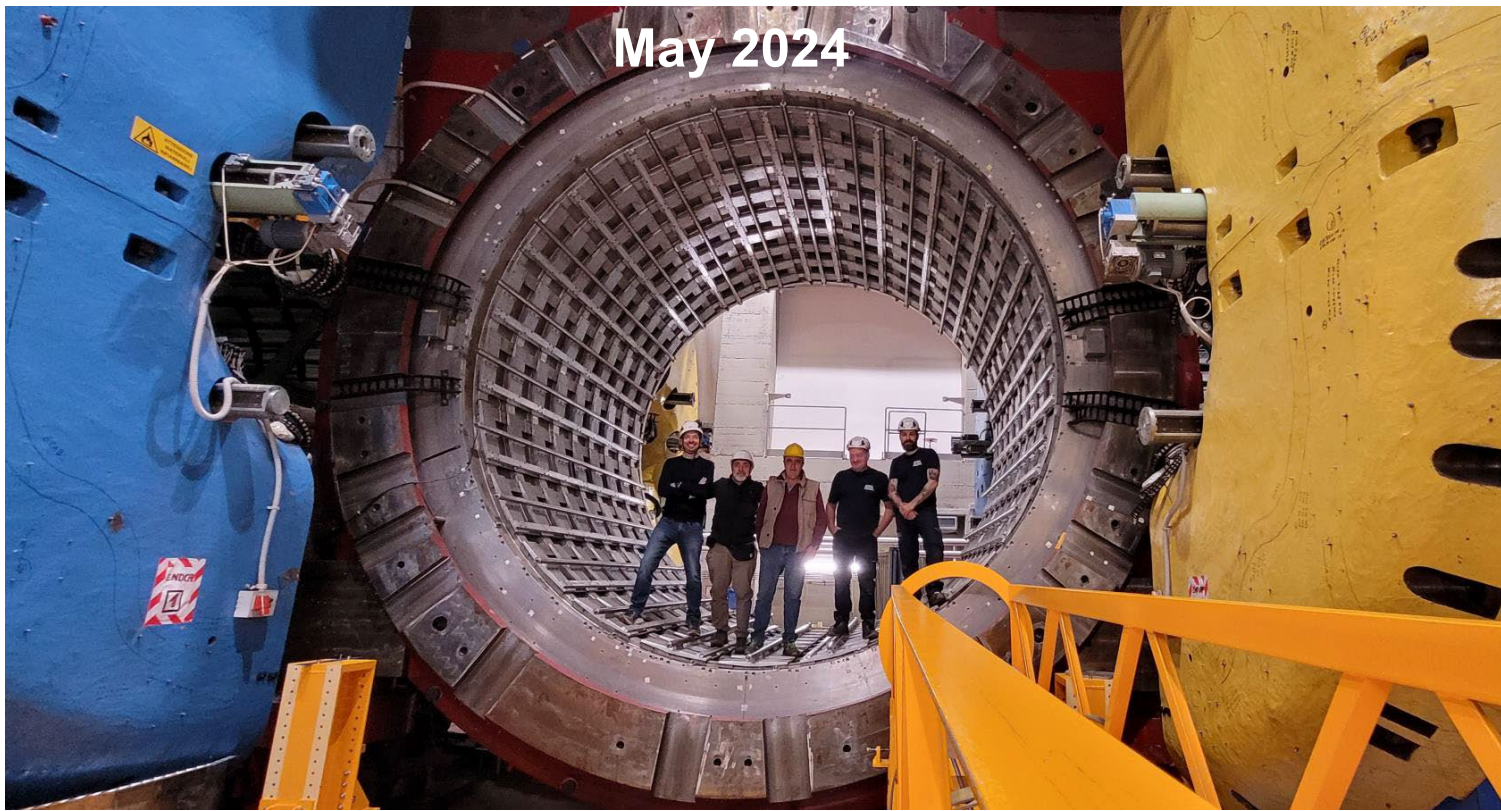
## MAGNET AND YOKE

- Installation of new Power Supply
- Cooling and operational test
- Extraction of the Cryostat
- Dismounting of the Iron Yoke
- Packaging and Shipping





May 2024



24 Modules of ECAL Barrel extracted

### Consolidation

- Gluing of delaminated parts
- Replace light-guides protections
- Wrap with new Aluminum-Fiberglass tape

### Operational Test

- Space and Time resolution with cosmic muons



## De-laminated module



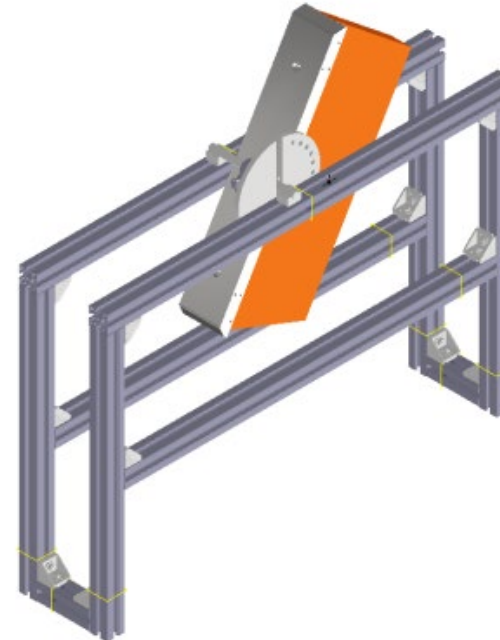
specimen for glue tests

**GLUE**

Loctite Henkel EA9483 adhesive

**TAPE**

3M aluminum+glass fiber or plastic+glass fiber



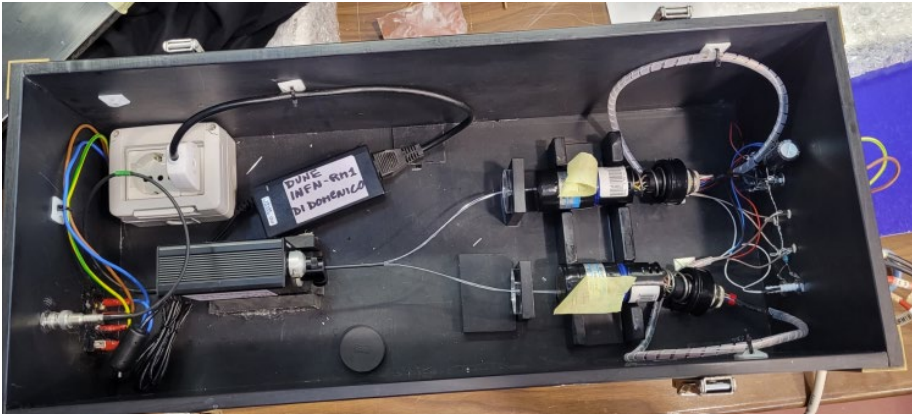
Single lap shear test  
ISO 4587-2003

To test tape under load we are preparing a setup to explore all possible orientations of the modules in the barrel



dried in climatic room:  
~1000 bases  
from barrel modules  
~150 spare bases  
(no end plug and  
connector)

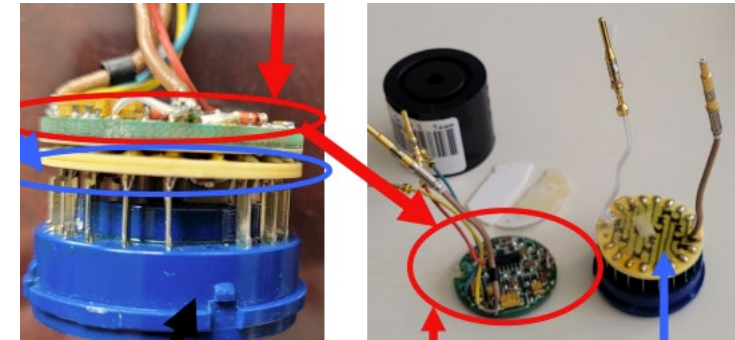
Feasibility to build 5000  
new bases investigated  
with INFN-Pisa



960 PMT+bases tested:

- 3 PMT not working
- 34 bases not working (no signal)
- 6 base signal not stable
- 3 bases signal pins bent

150 (not flooded) PMT+bases  
tested:



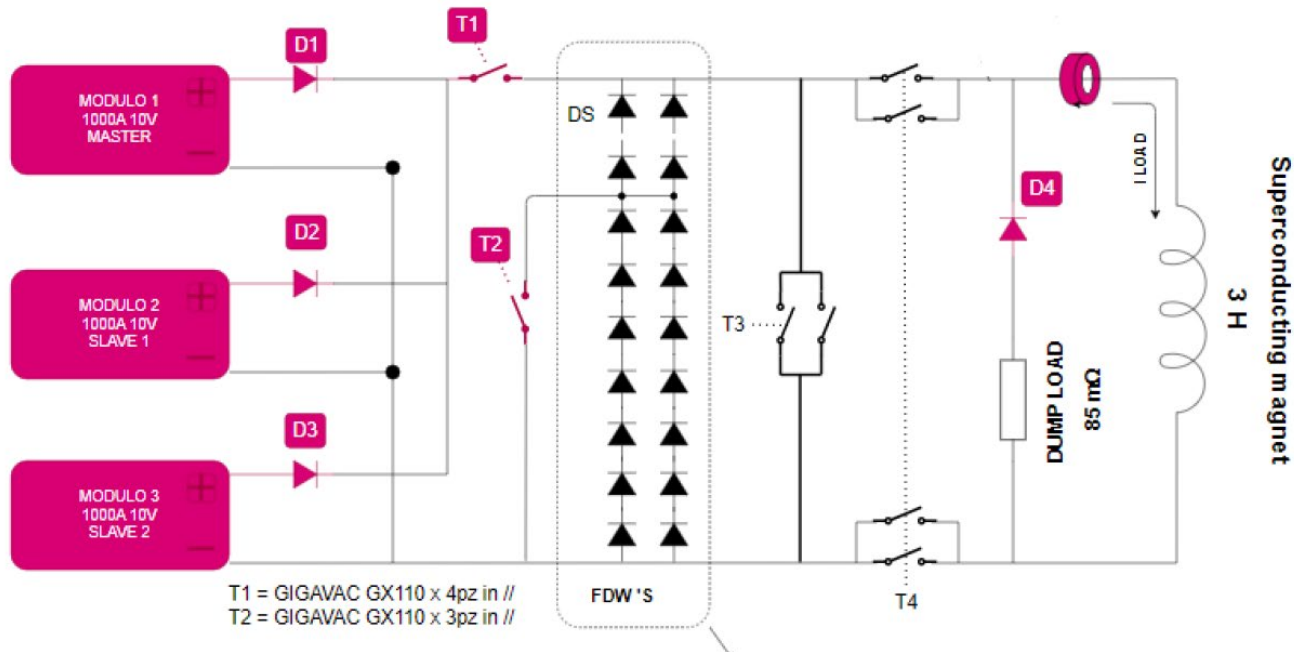
# Superconductive Magnet Power Supply

Rendered layout of new PS

Refurbished parts tested perfectly working:  
18 freewheeling diodes (FDW)  
T3-T4 contactors

**NEW**

3 power units 10V/3000A  
other 24 components



due delivery date  
Autumn/Winter 2025

**Control System**

to be migrated from LabVIEW  
to most recent SW release

## Service Turret

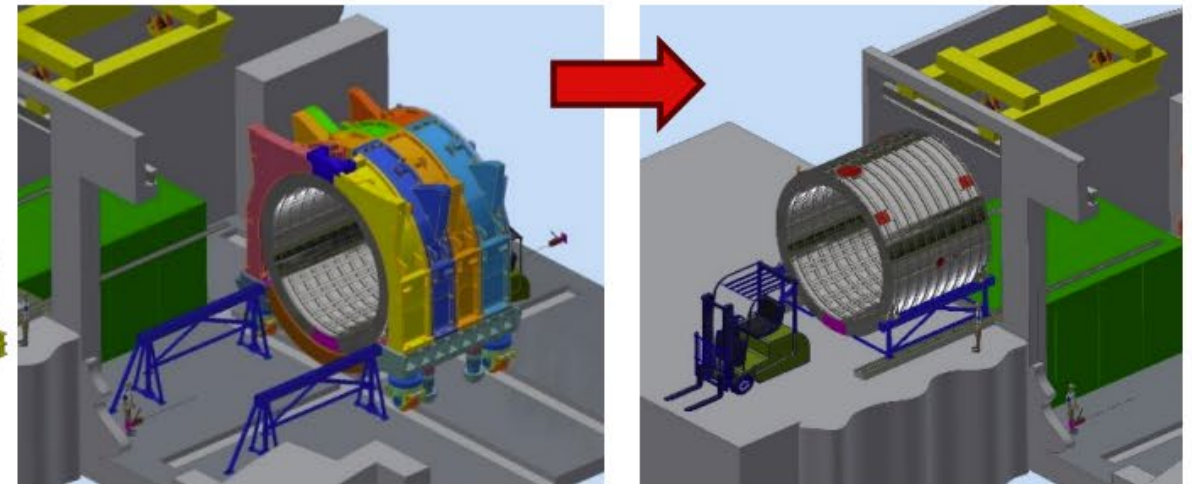
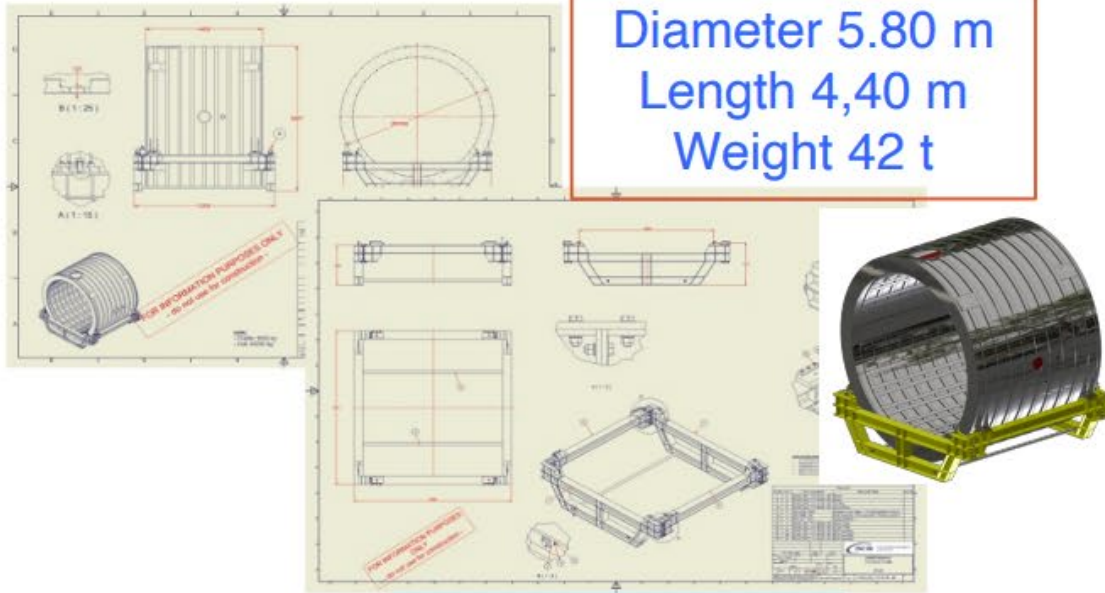
A specialized company to be contracted for dismantling and assembly at FNAL

## Coil Extraction

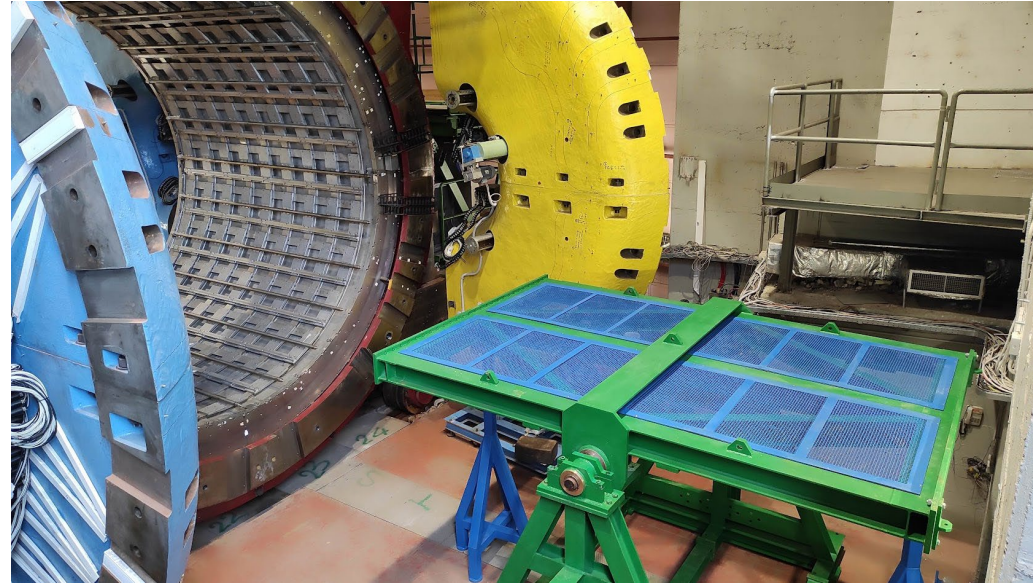
Mechanical tools drawings ready.  
Detailed operative design and offer from a company ready.



Diameter 5.80 m  
Length 4,40 m  
Weight 42 t



# ECAL End-Caps Dismounting



All procedures must be agreed with LNF and FNAL Safety Offices

Transport frames ready

Rotation frame completely refurbished

Movements tested in February w/o full load



# DUNE ITALIA

## Ruoli

**S. Bertolucci: Co-spokesperson**

### PDS Consortium

F. Terranova (MIB) Co-technical coordinator

P. Carniti (MIB) FD1integration engineer

### WG Convenors

C. Cattadori (MIB) Photocollection

M. Pozzato (BO) Photosensors

C. Gotti (MIB) Warm electronics

**Ricercatori: 117 (53.7 FTE)**

**Tecnologi: 33 (6.7 FTE)**

**Tecnici: 18**

### PDS Consortium

L. Stanco (PD) Consortium Leader

C. Montanari (PV) Technical Leader

P. Bernardini (LE) TDR Editor Chair

### WG Convenors

A. Di Domenico (RM1),  
D. Domenici (LNF) ECAL

G. Delle Monache (LNF) Magnet

S. Di Falco (PI), G. Sirri (BO) Tracker

L. Di Noto (GE), A. Montanari (BO) GRAIN

P. Gauzzi (RM1), A. Surdo (LE) Calibration

S. Di Domizio (GE), N. Tosi (BO) Timing/Slow Control

M. Tenti (BO) Software&Physics

