
KLOE-to-SAND: review and milestones

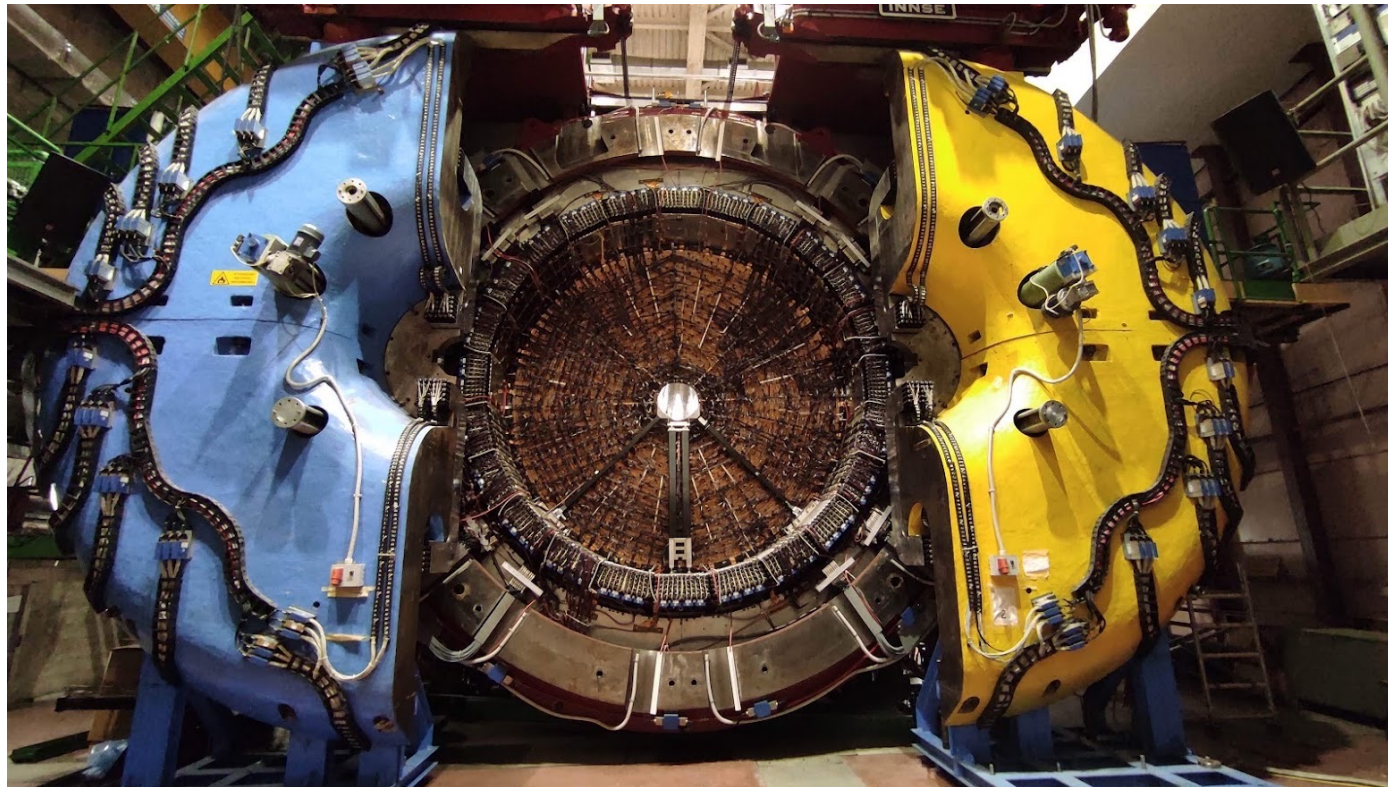
Antonio Di Domenico

Dipartimento di Fisica, Sapienza Università di Roma
and INFN-Roma, Italy



Danilo Domenici

INFN-LNF, Frascati, Italy



Meeting DUNE-Italia – Ferrara, 28-30 Ottobre 2024

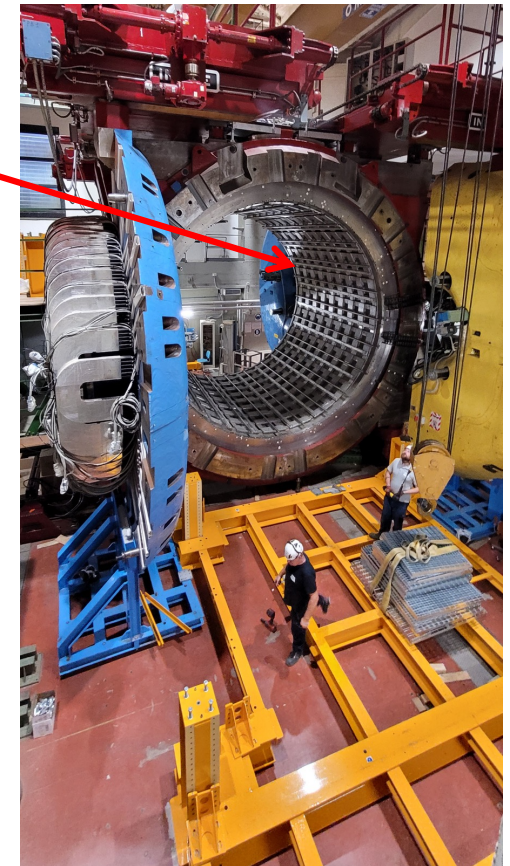
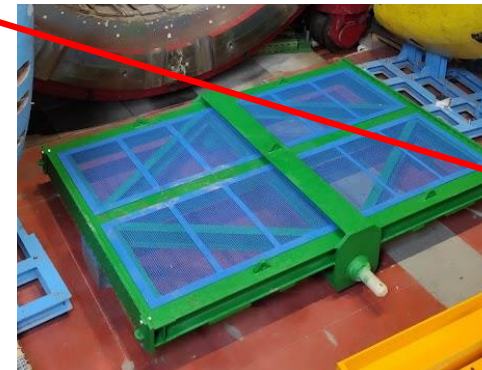
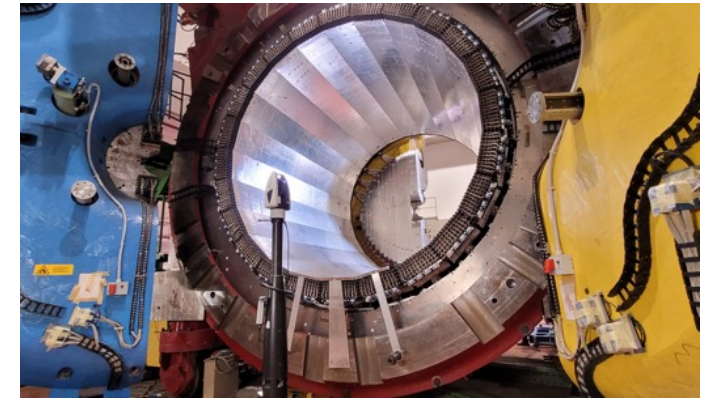
KLOE-to-SAND activities at LNF

Plan of operations:

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

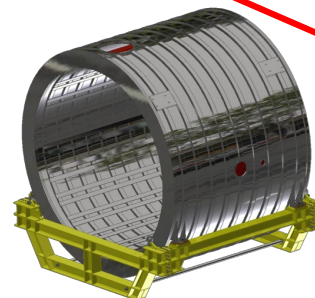
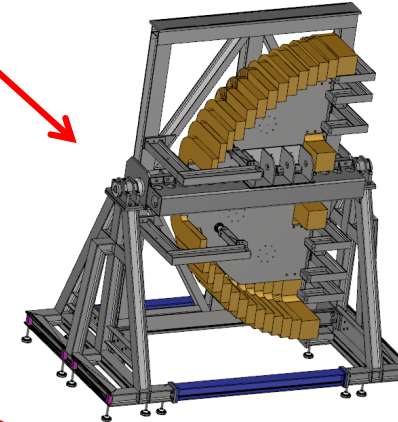
Calorimeter

- ✓ Laser tracker survey before ECAL dismounting
- ✓ Extraction of Barrel (24 modules)
 - insertion/extraction machine refurbished
 - movable platform built
- Dismounting of EndCaps
 - original insertion/extraction/rotation machine has been refurbished and modified
- Consolidation and test of ECAL modules
- Studies for the ECAL working point & FEE



Magnet and Yoke

- Installation of new Power Supply
 - new Power supply unit and revamping of passive components (OCEM)
 - revamping/update of control system
- Cooling of coil
- Operational test of magnet at LNF
 - in preparation
- Extraction of coil
- Dismounting of Iron Yoke



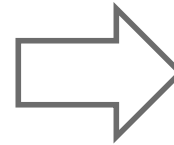
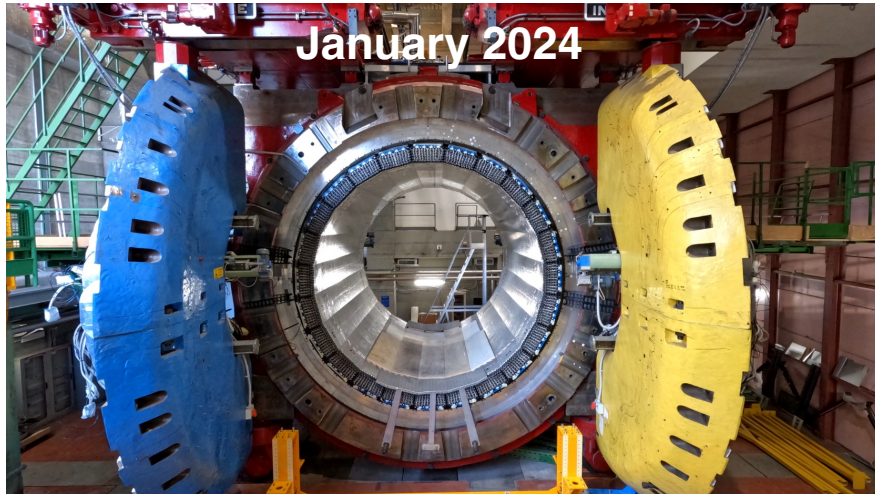
Packaging & Shipping at Fermilab

KLOE-to-SAND, ECAL and Magnet sessions

Mon 28/10	
Stampa PDF Schermo intero Vista dettagliata Applica	
15:00	KLOE-to-SAND review and milestones <i>Antonio Di Domenico et al.</i>
16:00	ECAL end-cap dismounting <i>Francesco Noto</i>
	ECAL and MAGNET: overview of commissioning a... <i>Claudio Silverio Mo...</i>
17:00	Magnet: test at LNF and FNAL: preparation, cryogenics, and compliance <i>Giovanni Ottavio Delle Monache</i>
	Magnet: status of power supply <i>Alessandro Vannozzi</i>
18:00	Magnet: dismounting and handling <i>Alessandro Saputi</i>
	Iron Yoke: dismounting and shipping <i>Danilo Domenici</i>
19:00	

Tue 29/10	
Stampa PDF Schermo intero Vista dettagliata Applica	
09:00	ECAL: Refurbishment of modules <i>Fabrizio Raffaelli</i>
	ECAL: Electronics <i>Antonio Di Domenico</i>
10:00	ECAL: Test stand at LNF <i>Antonio Di Domenico</i>
	ECAL: shipping <i>Danilo Domenici</i>

Extraction of the ECAL-Barrel

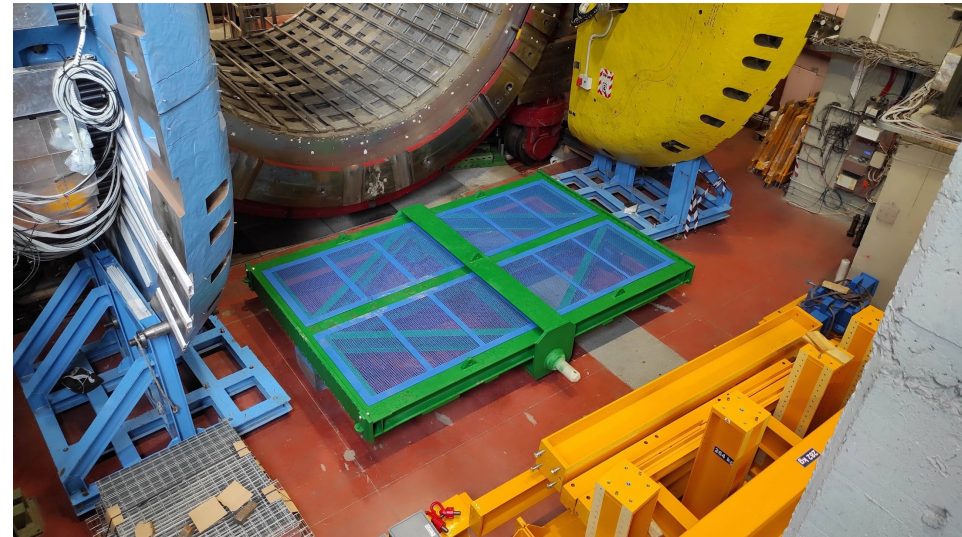


Barrel Extraction tools:

- Variable height platform: ready for FNAL
- Insertion cradle: ok for LNF, minor adjustments to be done to be ready for FNAL

Preparation of dismantling ECAL End-caps

- All mechanical tools ~ready
- Slight modification of the base holding the frame requested for safety certification (UE + US)
- Document with detailed procedure is being completed, after a first meeting with LNF safety office
- Start testing dismantling procedure

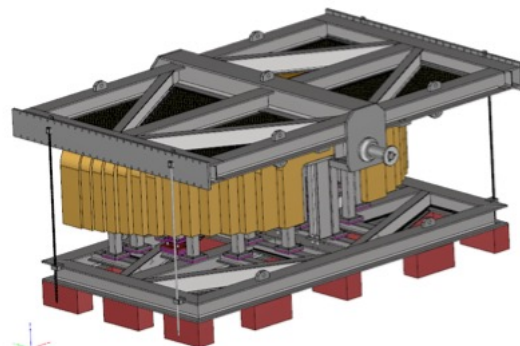
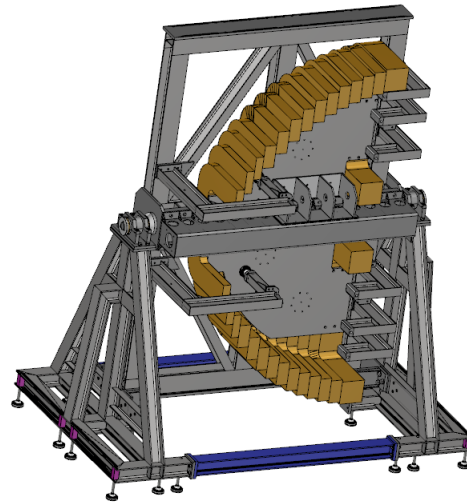
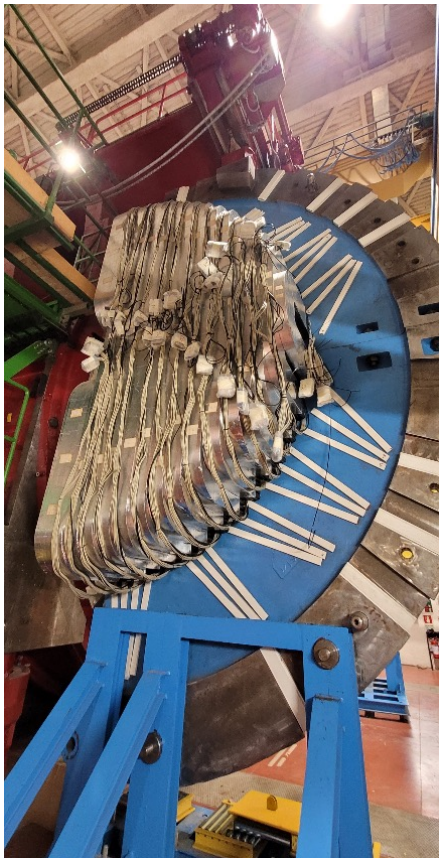


Rotation frame

(rotation from vertical to horizontal)

Support frame

(handling and shipping)



ECAL module consolidation and test



Consolidation

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



Operational Test

- test basic performance with cosmic rays
- test of new FEE prototypes (comparison with old KLOE electronics)

24 Modules are stored each on its own support that will be used also for the transportation
An experimental area is being set up for Consolidation and Operational test of the modules

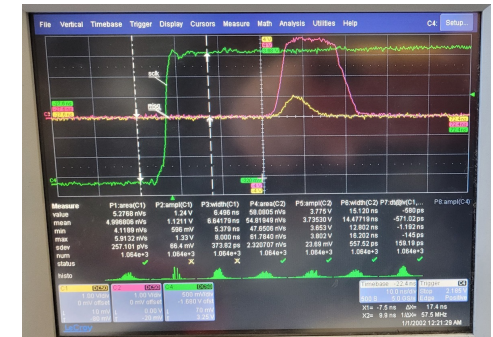
ECAL signal+HV cables
15+15 m long
in 12 storage boxes



Optimization and choice of FEE for ECAL

Optimization of PMT working point in SAND

- MC studies of ECAL response to neutrino beam
- expected dynamic range in term of photoelectrons
- experimental study of PMT preamplifier in linear and saturation regimes



Two possible solutions of FEE investigated with CAEN

DT5203+A5256

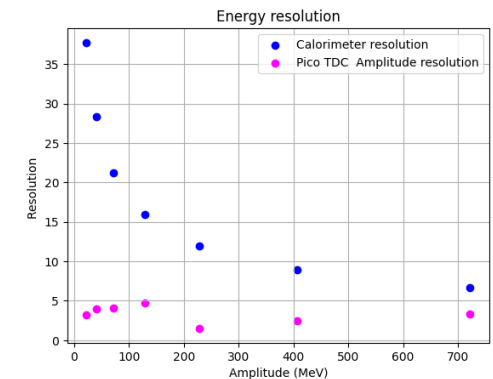


PicoTDC + discr. double threshold with ToT

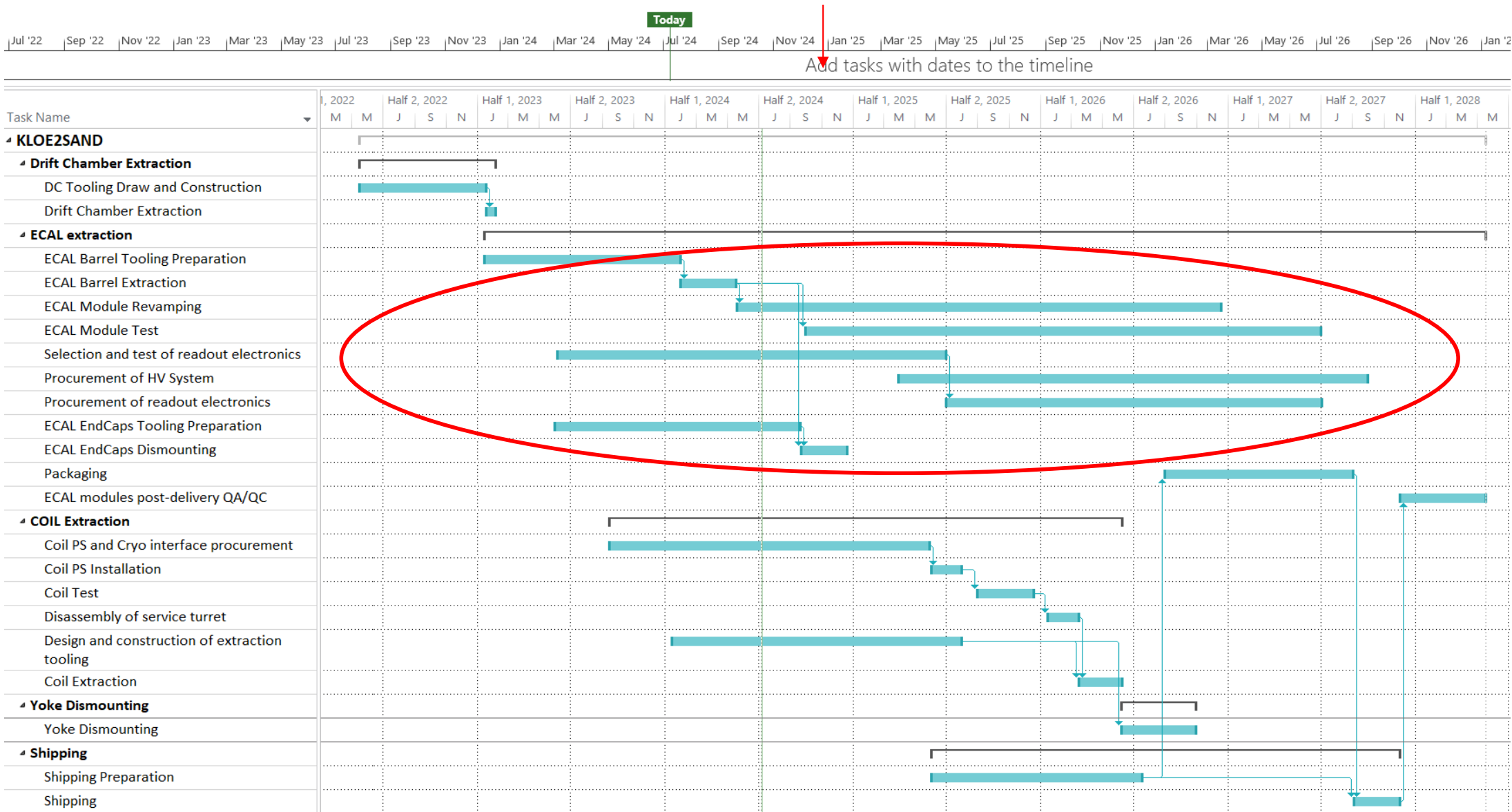
A5204
RADIOROC with
picoTDC



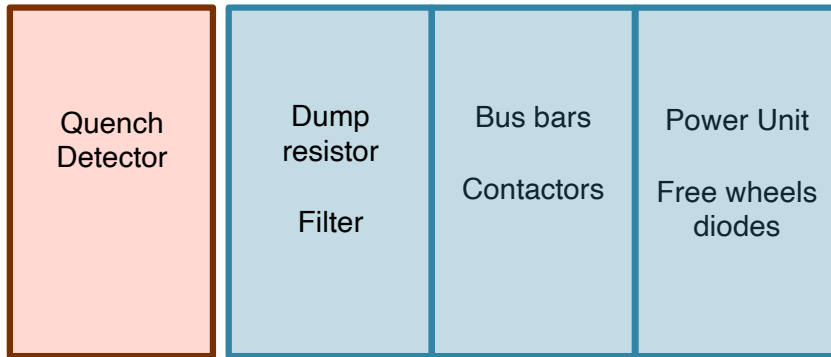
PicoTDC + discr. single threshold with ToT (for all signals) + peak sensing ADC with slow shaper – dead time 20 μ s and good resolution (for rarer signals of large amplitude); feasibility study in progress



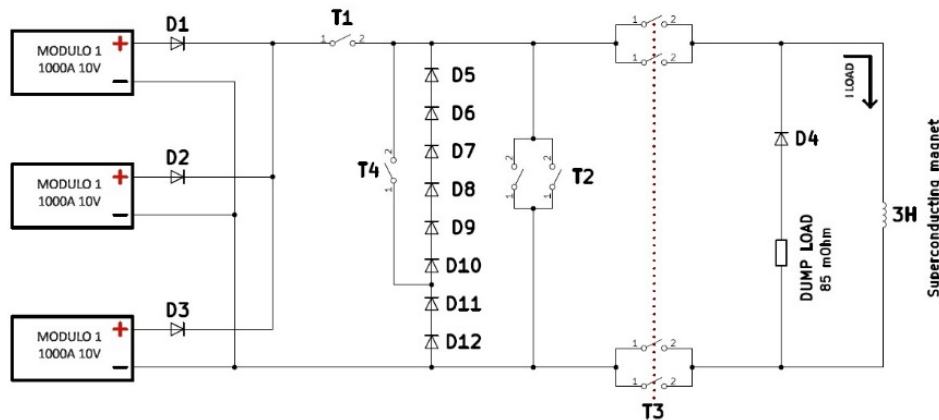
KLOE-to-SAND Project Time Schedule



Superconductive Magnet Activities



Power Supply
contactors, busbars and other passive components can be saved after test
10V/3000A power unit provided new by OCEM
due delivery date in 8-12 months



Control System
to be migrated from LabVIEW to most recent SW release



Superconductive Magnet Activities

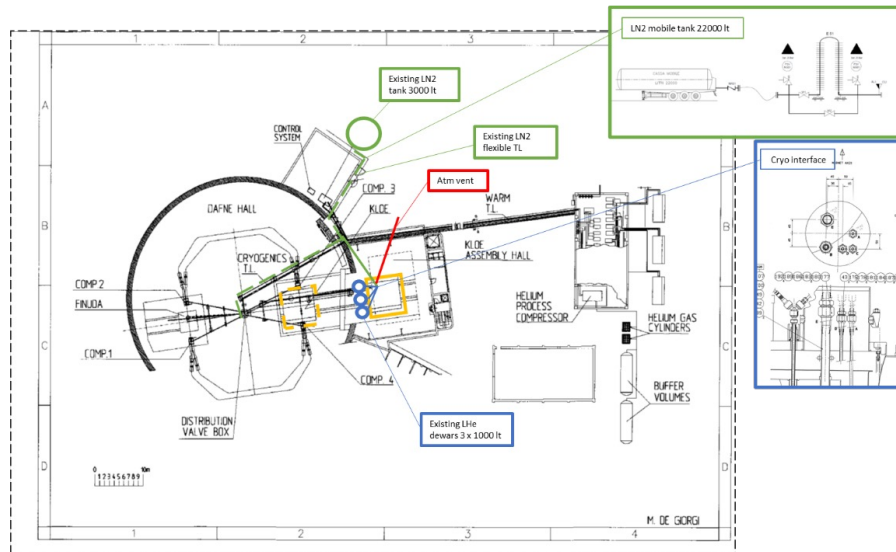
Magnet Test

- warm test to check electrical, mechanical, fluidic and control status at 300K
- cooling with cryogenic liquids (36kl LN₂ + 6kl LHe) poured from tanks
- no need for cryogenic plant
- cold test to check same status at 4.3K
- coil energized at low current to test power supply and quench detector



FNAL Validation

progress made to define the procedure to declare the magnet Fit For Service



Magnet Cryostat Extraction

Service Turret Dismantling

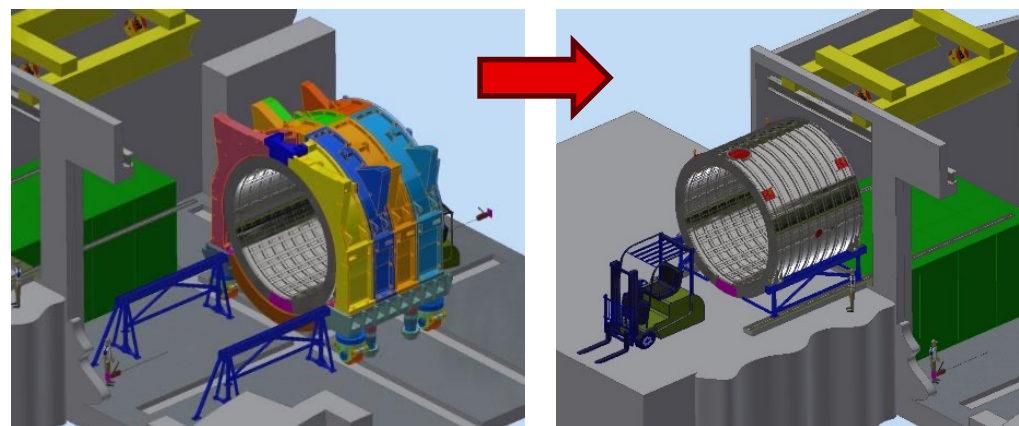
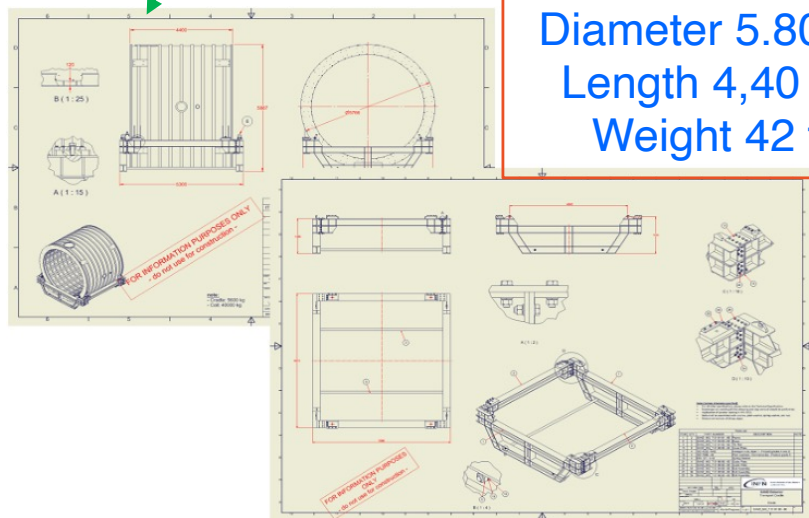
ASG (Ansaldo) to be contracted for dismantling and assembly at FNAL

Coil Extraction

Tools drawings ready
Procedure details under definition



Diameter 5.80 m
Length 4,40 m
Weight 42 t



Iron yoke disassembly

Iron yoke Disassembly

34 parts with maximum 20t weight
total weight 800t
contacts to be arranged with assembly
company



Preliminary Shipping Plan

ECAL

Barrel and End-caps will be packed on their supports inside suitable boxes (1 for each module)
Accelerators, thermometers, hygrometers will record environmental variables
Boxes will travel inside standard containers

Magnet

Needs an extra-load transportation (5.8m x 4.4m)
Will travel with vinylic layer protection

Iron Yoke

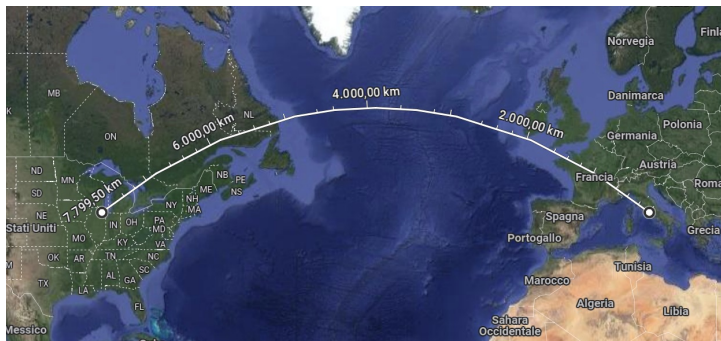
All parts within standard dimension transportation



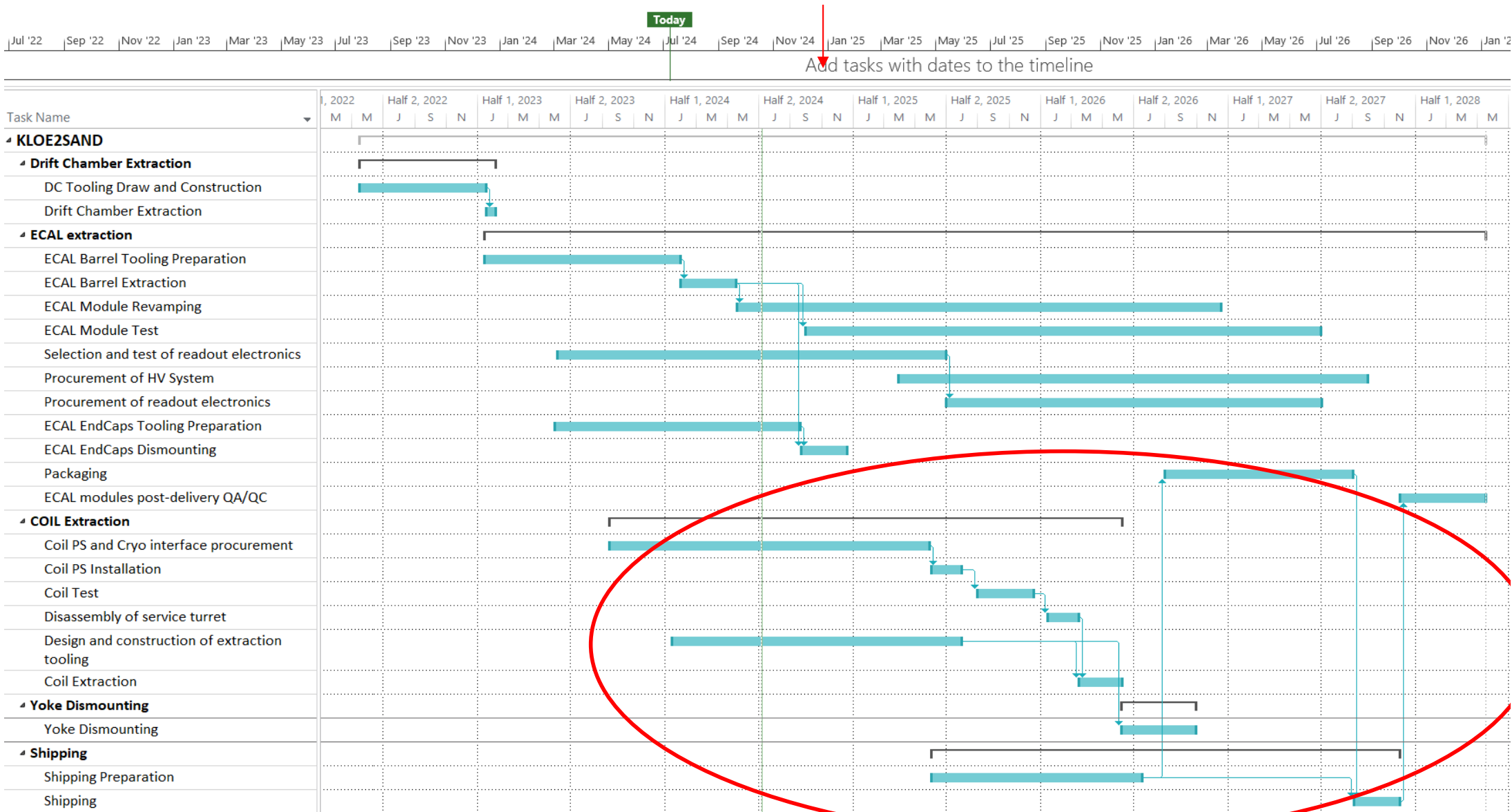
Company already contracted for:

- design and realize the needed packaging
- plan the transport
- subcontract transportation companies
- manage the bureaucratic part

Plane option for ECAL not yet excluded



KLOE-to-SAND Project Time Schedule



INFN Scientific Commission Review on SAND – 11 and 12 July 2024

21 presentations: project, ECAL, Magnet, Tracker, Grain, Software, Installation, etc.
Discussion on funds requests
Closeout report with very useful comments

PDR on KLOE components of SAND – 22 and 23 July 2024

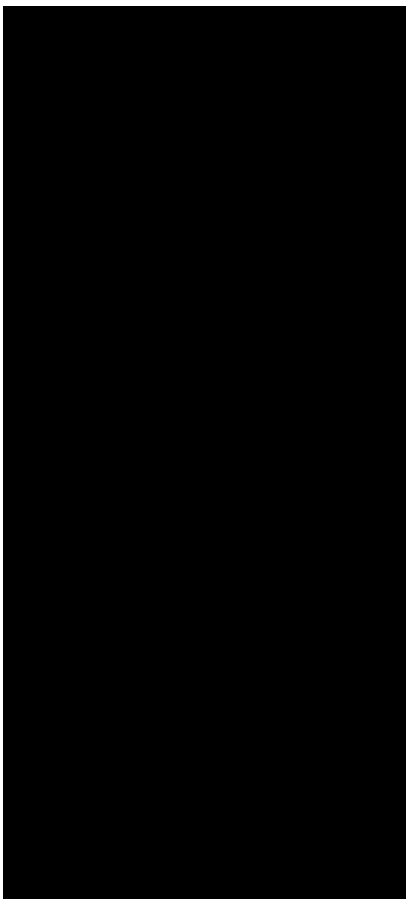
10 presentations: project, TDR, detectors, schedule, etc.
Very useful executive sessions
List of 40 questions from committee all addressed
10 Recommendations

TDR ND - SAND part - ECAL and Magnet

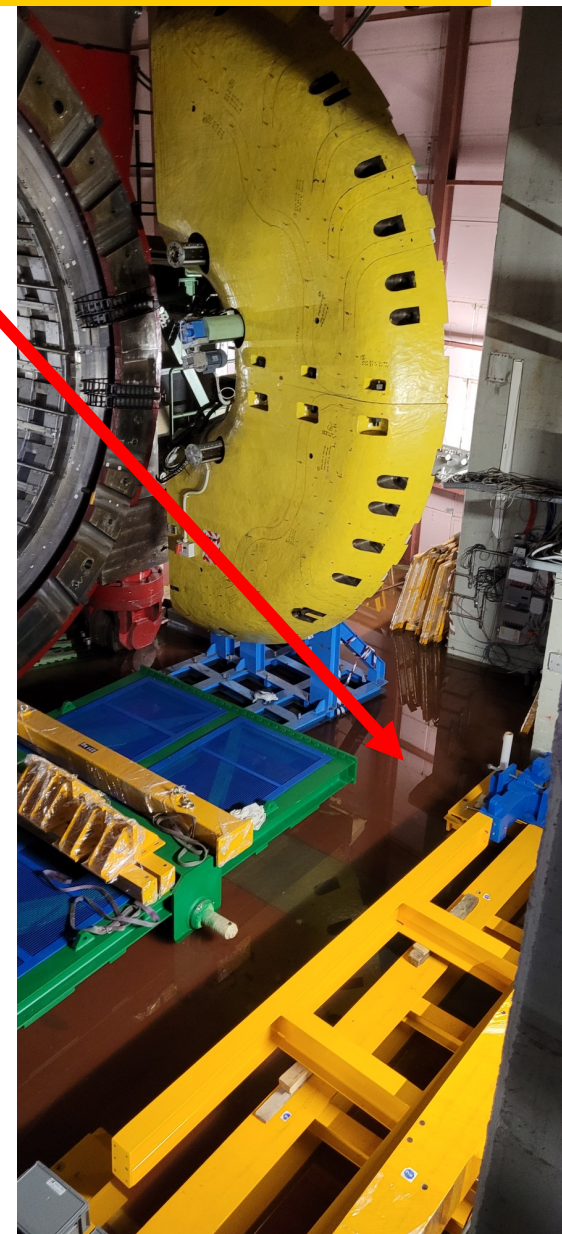
a draft has been presented for the PDR: 65 (ECAL) + 30(Magnet) = 95 pages
to be done:
Review and update (in progress)
Implementation of PDR recommendations (+ answers to some reviewer questions)
=> expand hazard & risk analysis, shipping details, resource loaded schedule and cost analysis.

Flooding of the KLOE assembly hall

Due to bad weather and heavy rainfall occurred during Sept. 8th and 9th, the KLOE building was flooded.



flooded floor



Flooding of the KLOE assembly hall

In total 16 boxes soaked, 60 PMT+base each, corresponding to 8 complete barrel modules: in total ~ 1000 PMTs + bases



In addition ~ 150 spare bases stored in the “alte energie” building ground floor (also flooded).





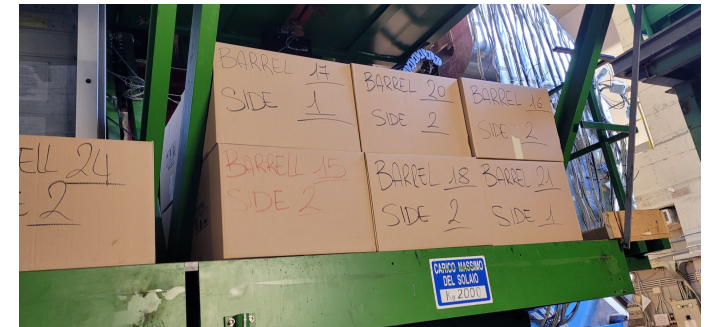
affected also parts of the movable platform
stored in the KLOE assembly hall
=> cleaned



Flooding of the KLOE assembly hall

on Tuesday Sept. 13th a new floor flooding.

PMTs safe!



Flooding of the KLOE assembly hall

- KLOE assembly hall (and DAFNE hall) is temporarily not accessible for security reasons
- Pumping out of water from the hall completed
- The hall is again accessible starting from the last week.
- Temporary countermeasures will be taken to contain/limit new possible events (e.g. sandbags protections etc.) while the LNF experts are studying the problem and investigating possible long term solutions.



Cleaning, drying and test of wet PMTs and bases

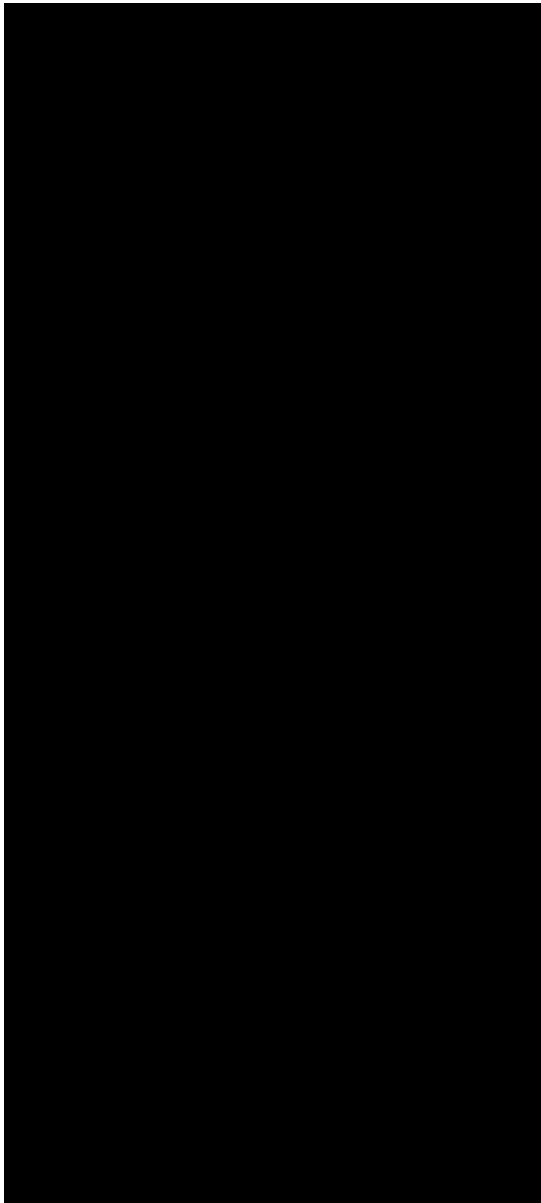
PMTs and bases were promptly removed from soaked paper bags, dried with paper cloath and stored in new bags



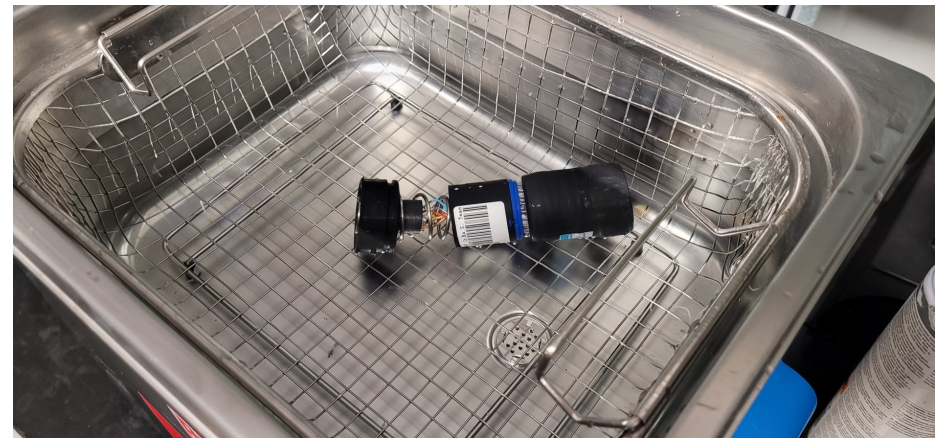
Cleaning, drying and test of wet PMTs and bases



Cleaning, drying and test of wet PMTs and bases



Test of ultrasonic washing of PMT+base
=> the labels are not affected by the procedure!



Cleaning, drying and test of wet PMTs and bases



Large ultrasonic washing machine available at LNF to wash and clean PMTs and/or bases

Large climatic room available at LNF to dry PMTs and/or bases



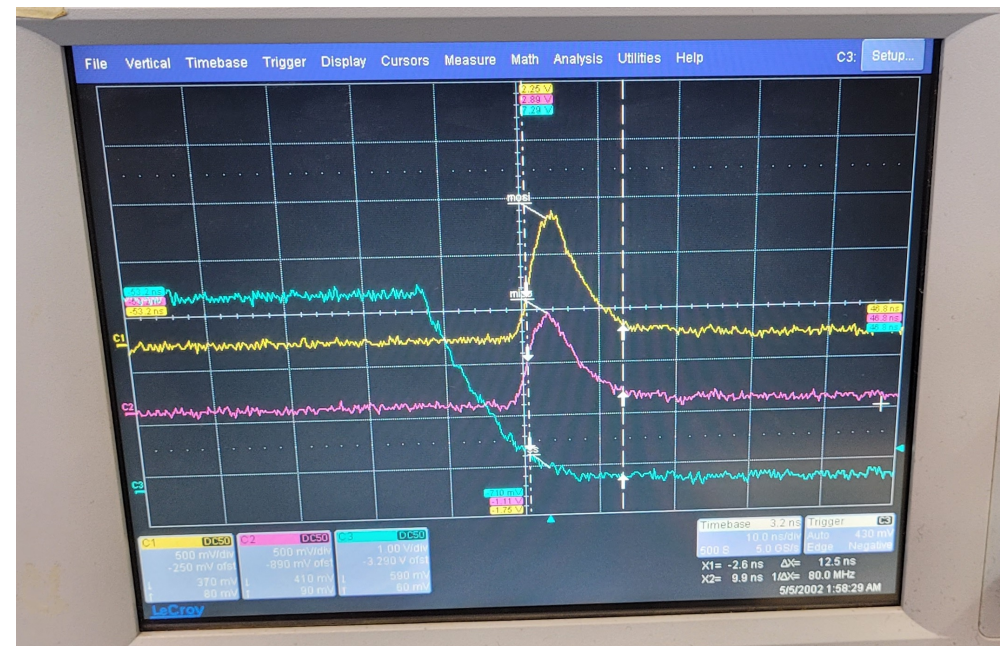
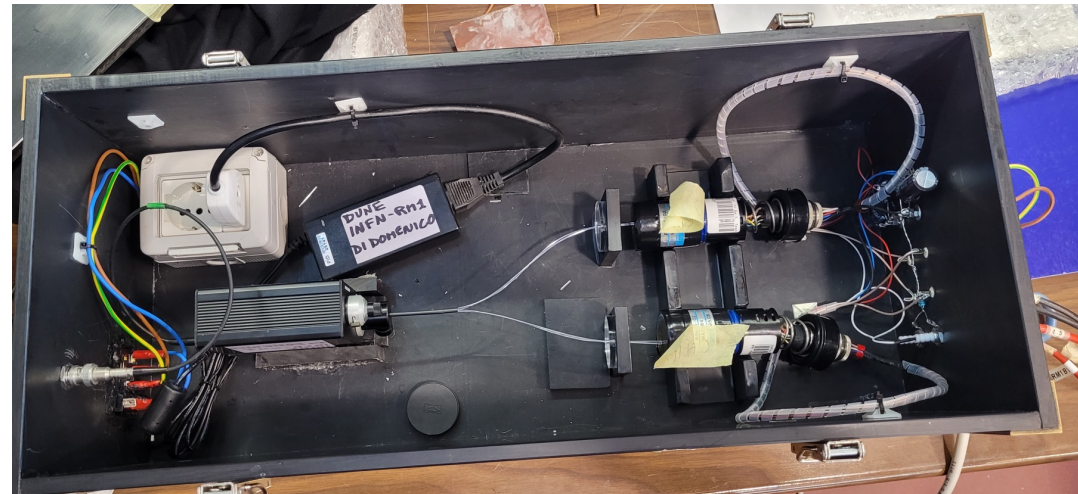
Cleaning, drying and test of wet PMTs and bases

Two PVC frames holding PMTs and bases have been built, 64 units each, and fitting the clearance of the washing machine.



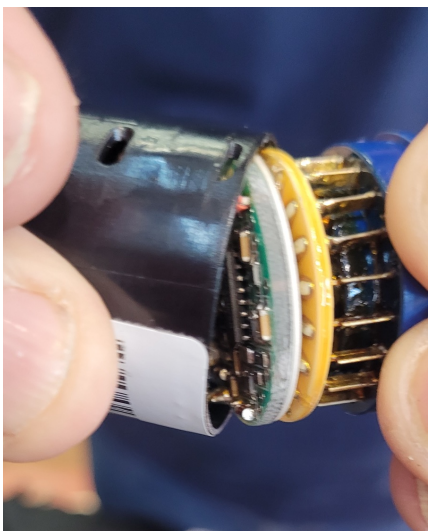
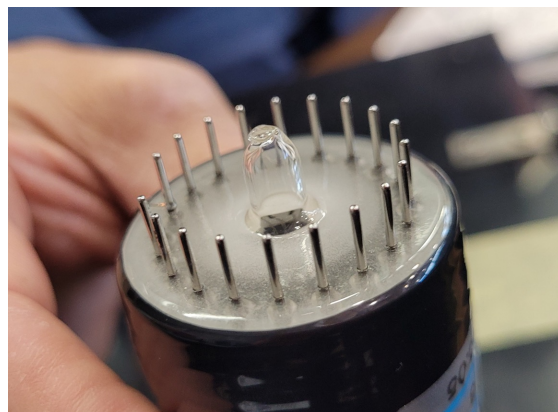
Cleaning, drying and test of wet PMTs and bases

To test PMTs and bases a new black box has been instrumented with LED driver, connectors etc. (the old one is at CAEN) and completed with PMTs holders.

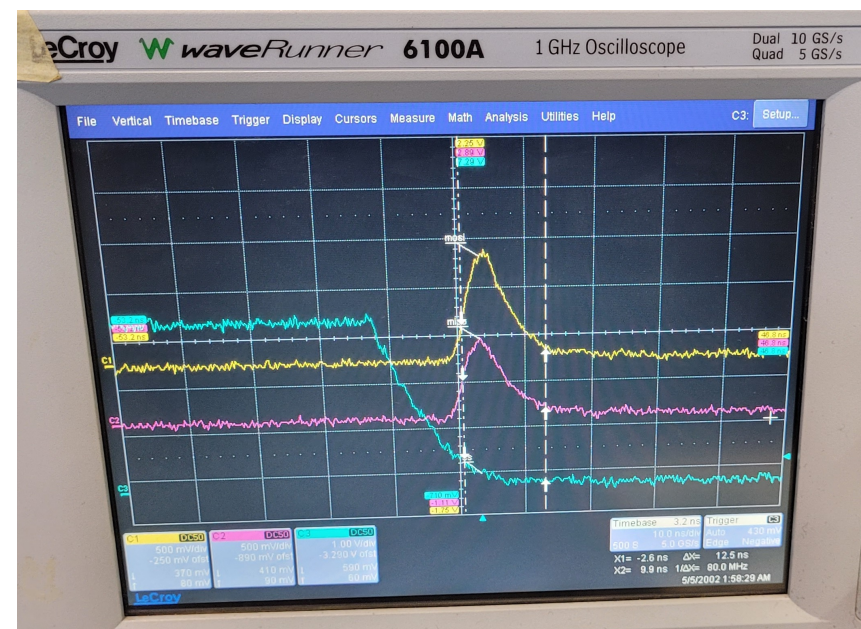


Cleaning, drying and test of wet PMTs and bases

wet PMT + base
after simple hand
drying and
cleaning



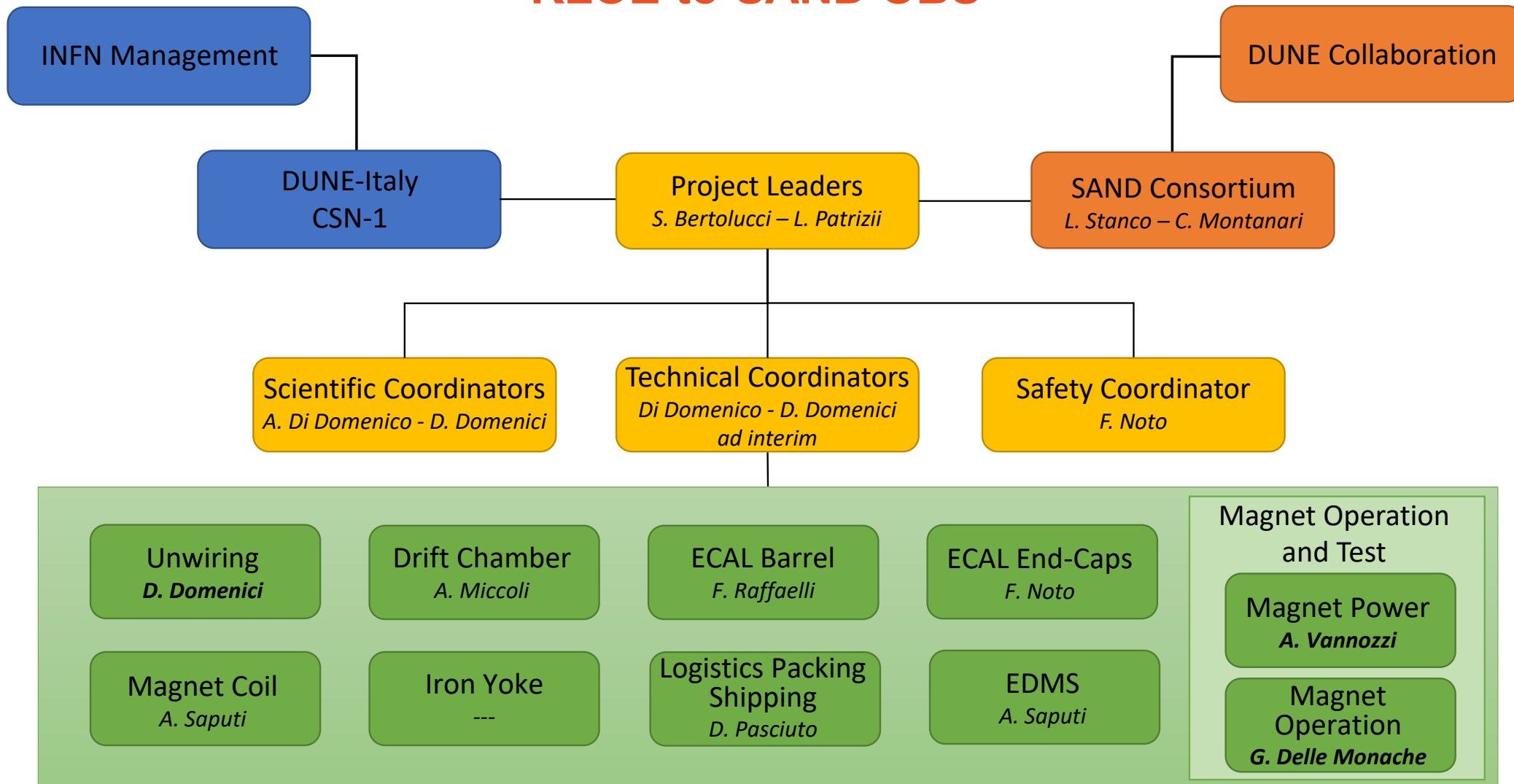
This week all bases will be dried in the climatic room (a ~12 h run), and then tested.



A deeper investigation is needed for cleaning the ~150 spare bases, due to different flooding conditions

spare slides

KLOE-to-SAND OBS



KLOE-to-SAND PDR review: recommendations



Questions to KLOE-to-SAND PDR Review

Recommendation 1 (Review Material):

International LBNF/DUNE management needs to ensure that all review material is available and posted at least one week prior to the review

The recommendation is received and understood.

Recommendation 2 (Reviews for the SAND System):

Establish a series of coordinated future reviews for the ECAL, magnet and possibly other SAND systems with well defined expectations among the SAND consortium, Fermilab and the DUNE management team leading up to installation in the ND hall, by the end of CY2024.

The recommendation is received and understood. We will establish a series of coordinated reviews for the SAND ECAL and magnet systems from now up to their installation in the ND hall, by the end of CY2024

Recommendation 3 (Risk Review):

A dedicated risk review should take place before the Preliminary TDR is completed

We did a preliminary risk analysis for the PDR. A detailed risk analysis for all subcomponents is part of the preliminary TDR. We will organize a risk review before the submission of the preliminary TDR for all subcomponents that have a sufficiently developed risk analysis.

Recommendation 4 (Hazard Analysis):

Consider developing a preliminary hazard analysis in coordination with Fermilab EH&S before the Preliminary TDR is completed.

The TDR chapter on safety is supposed to be written in close collaboration with Fermilab ES&H. This will include a preliminary hazard analysis. It has to be noted that a Fermilab ES&H interface with SAND has not yet been identified.

Recommendation 5 (Shipping Plan):

The SAND consortium should develop a shipping plan including an end-to-end shipping test to ensure that there are no unexpected issues.

Additional planning should be completed prior to the Preliminary TDR.

We placed an order to a specialized company for developing the shipping plan for SAND components. End-to-end shipping tests will be defined also in collaboration with Fermilab. We expect to get a preliminary result in time to be inserted in the TDR.

Recommendation 6 (Shipping Cost and Schedule):

Initial feedback from shipping companies should be solicited to inform estimates of cost, time for permitting, and schedule.

We are already (see previous recommendation) in contact with a company specialized in shipping of very large loads from Europe to USA. Costs, time for permitting and schedule strongly depend on carrier (plane or boat), type of shipping (dedicated or scheduled) and number of possible transshipments. All these variables will be addressed in the shipping plan.

Recommendation 7 (Test and storage at FNAL and DOE regulatory requirements):

Agree upon testing and storage locations at FNAL to ensure the availability of the required infrastructure (cranes, openings, access etc.) and to meet FNAL and DOE regulatory requirements. Provide dates, as documented in the KLOE-to-SAND project schedule, when those facilities will be needed.

In cooperation with DUNE's logistic coordinator we are identifying suitable test and storage areas at FNAL equipped with the necessary facilities. Occupation of the identified spaces will be then submitted then to the relevant FNAL authorities for approval.

Recommendation 8 (FESHM requirements):

Provide a document with FESHM requirements for pressure, electrical and magnetic testing both in the pre-installation testing area and in the ND hall.

Requirements for Pressure, electrical and magnetic tests according to Fermilab Environment, Safety and Health Manual (FESHM) will be provided and explicitly mentioned in a dedicated document (or as annex to a more general document, e.g. FDR) for both test area and ND hall.

Recommendation 9 (list of items and their specification):

Provide a list of items to be lowered into the ND hall during installation along with their weight, dimensions and the rigging equipment required.

A list containing the heavier parts of the magnet, the yoke and the ECAL, with weights and dimensions, have been delivered to the I&I team about two years ago. This list will be complemented with information about additional components (platforms, installation tools, cabinets, etc..) and it will be provided in time to prepare the required equipment for lowering all parts in the ND hall.

Recommendation 10 (Magnet shipping plan):

The detailed shipping plan and statement of work for the magnet shipping contract should be available prior to the FDR

The magnet shipping is part of the complete plan that will be delivered by the specialized company we have contracted out, and that will be available before the FDR.