

CERN test facilities for prototyping

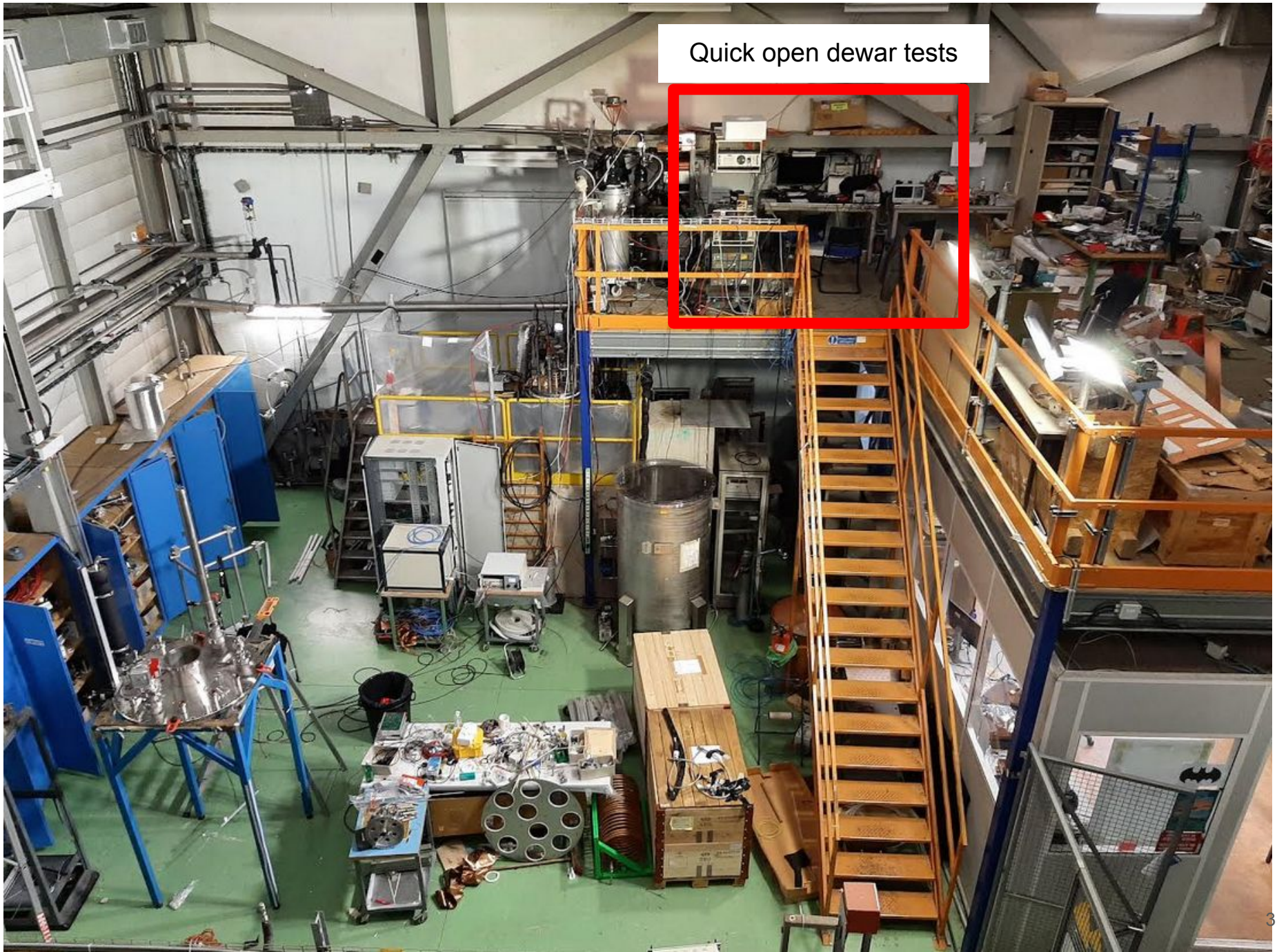
F. Pietropaolo, S. Tufanli



- LArTPC R&D facility at CERN Bld-182
 - LArTPC hardware and spares
 - Dedicated LAr tank outside the building
 - 10T crane in the hall



Quick open dewar tests

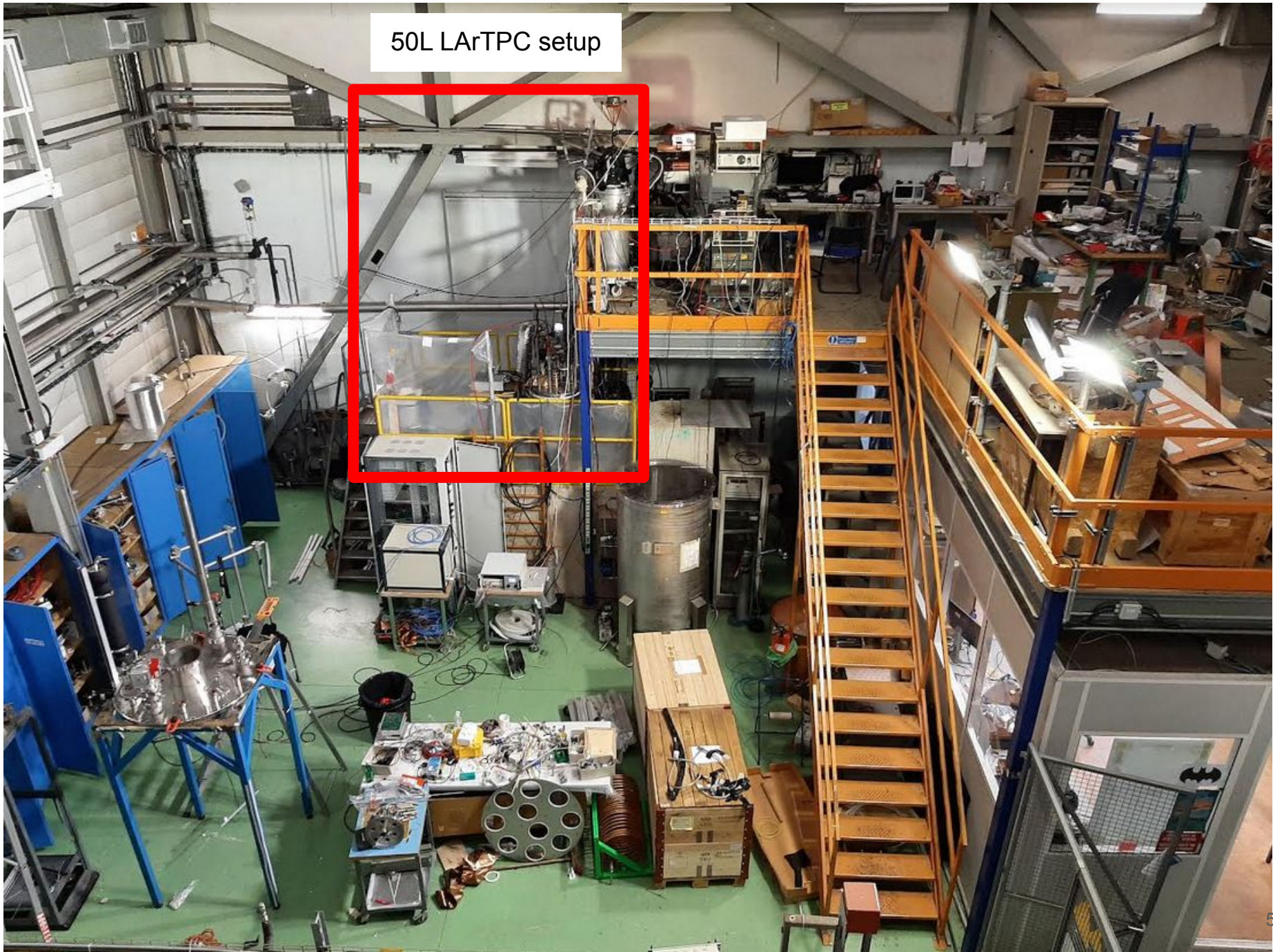


Quick open dewar tests

- Quick development, functionality and compatibility tests in LAr
- Multiple different size open dewars are available
- Easy to fill a dewar in 30min and perform quick tests in LAr
- Few examples from the previous tests:
 - Cryogenic cameras for NP04 and NP02
 - Material tests for CRPs
 - Initial PoF tests, DC-DC converter (some went into the 50L tests as well)
 - Material tests for high voltage system
 - ...

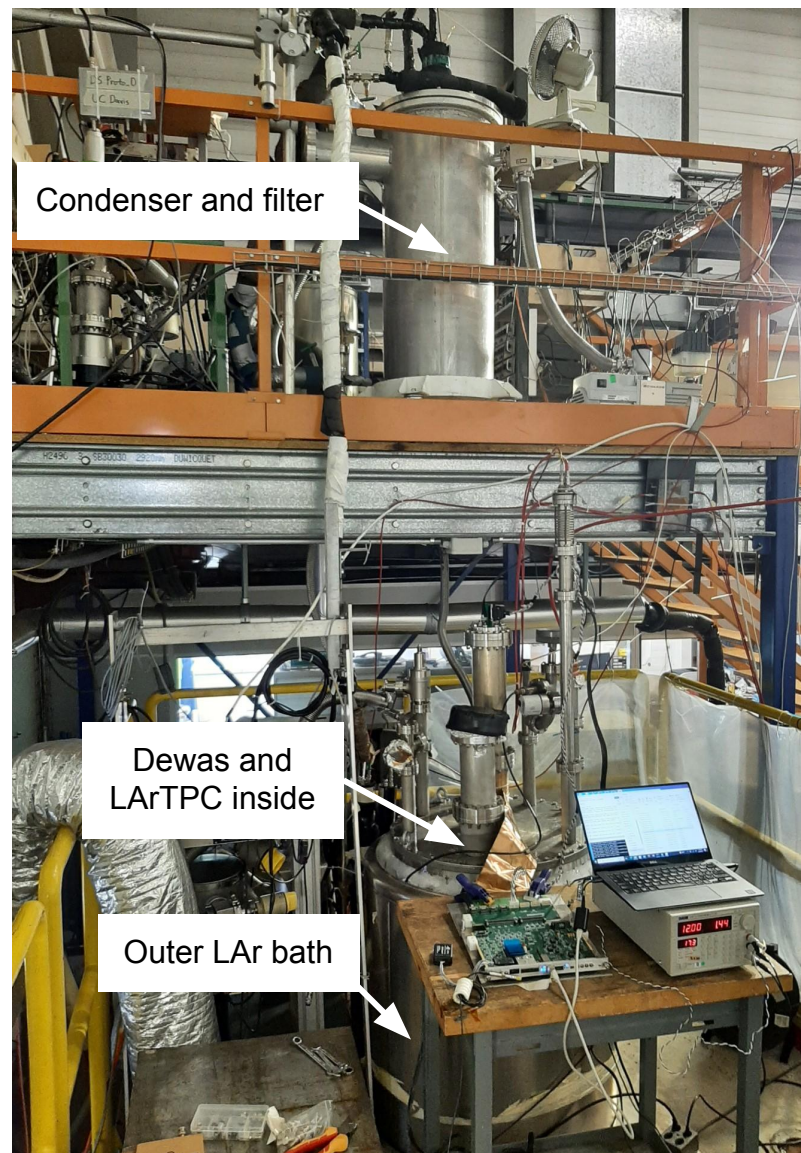


50L LArTPC setup



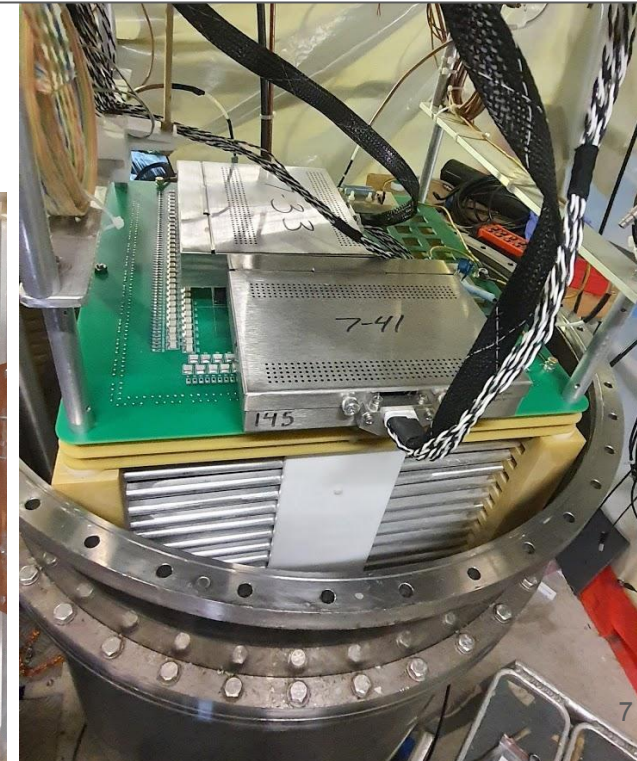
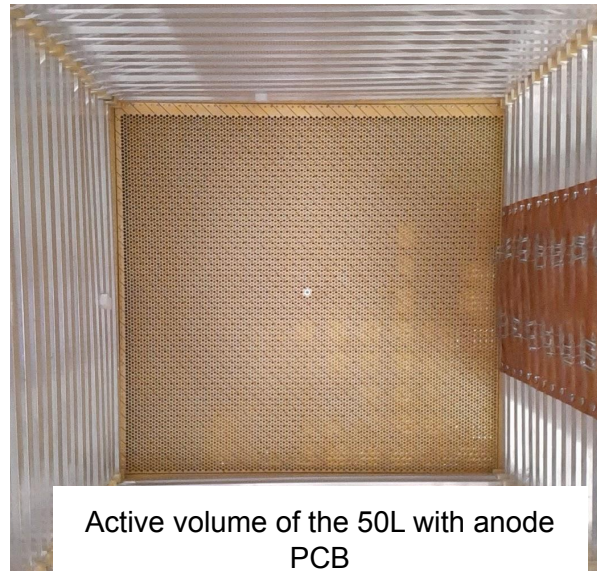
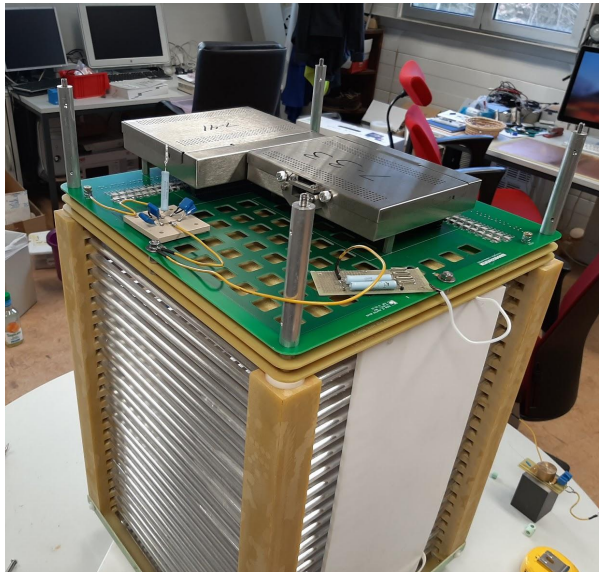
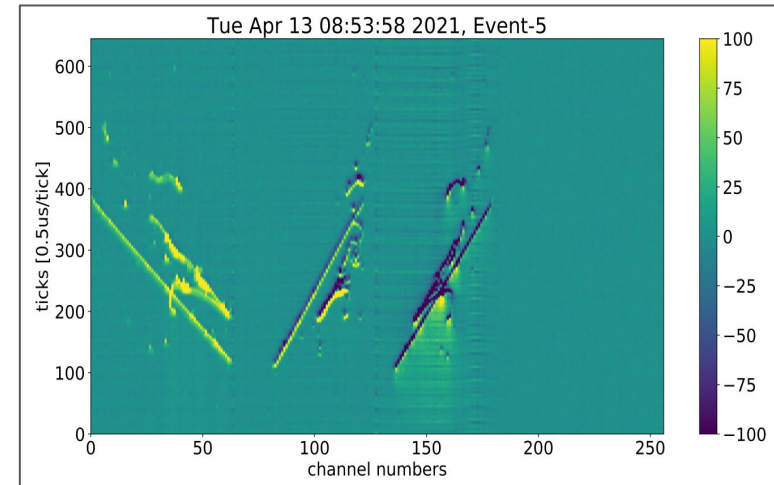
50L LArTPC setup

- Prototyping activities at 50L setup has been quick and efficient way to tests new ideas/questions related to the LArTPCs
- Current setup has:
 - 50L LArTPC equipped with 3 view PCB anode and cold electronics
 - An inner dewar for LArTPC
 - An outer LAr bath for the initial cooling down and filling
 - Filtering system
 - A condenser
 - Pumping systems
 - Auxiliary instrumentation for cryogenic operations and monitoring
- Once it is filled, it works as a closed system where evaporated Ar goes through the filter, condensed and return back to the dewar
- Possible to run it for longer periods of time with perfect LAr lifetime
 - As an example, first 2-view CRP prototype took data for ~1.5 months



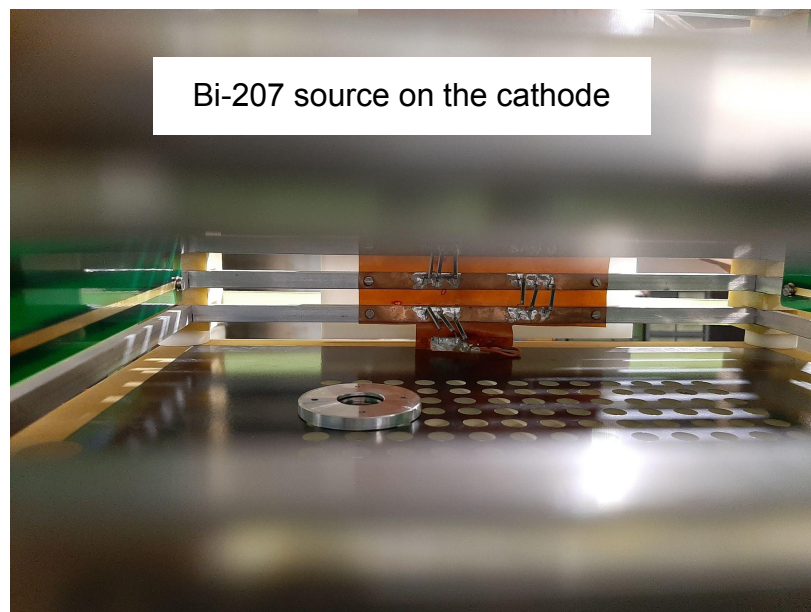
Example: Vertical Drift CRP development at 50L setup

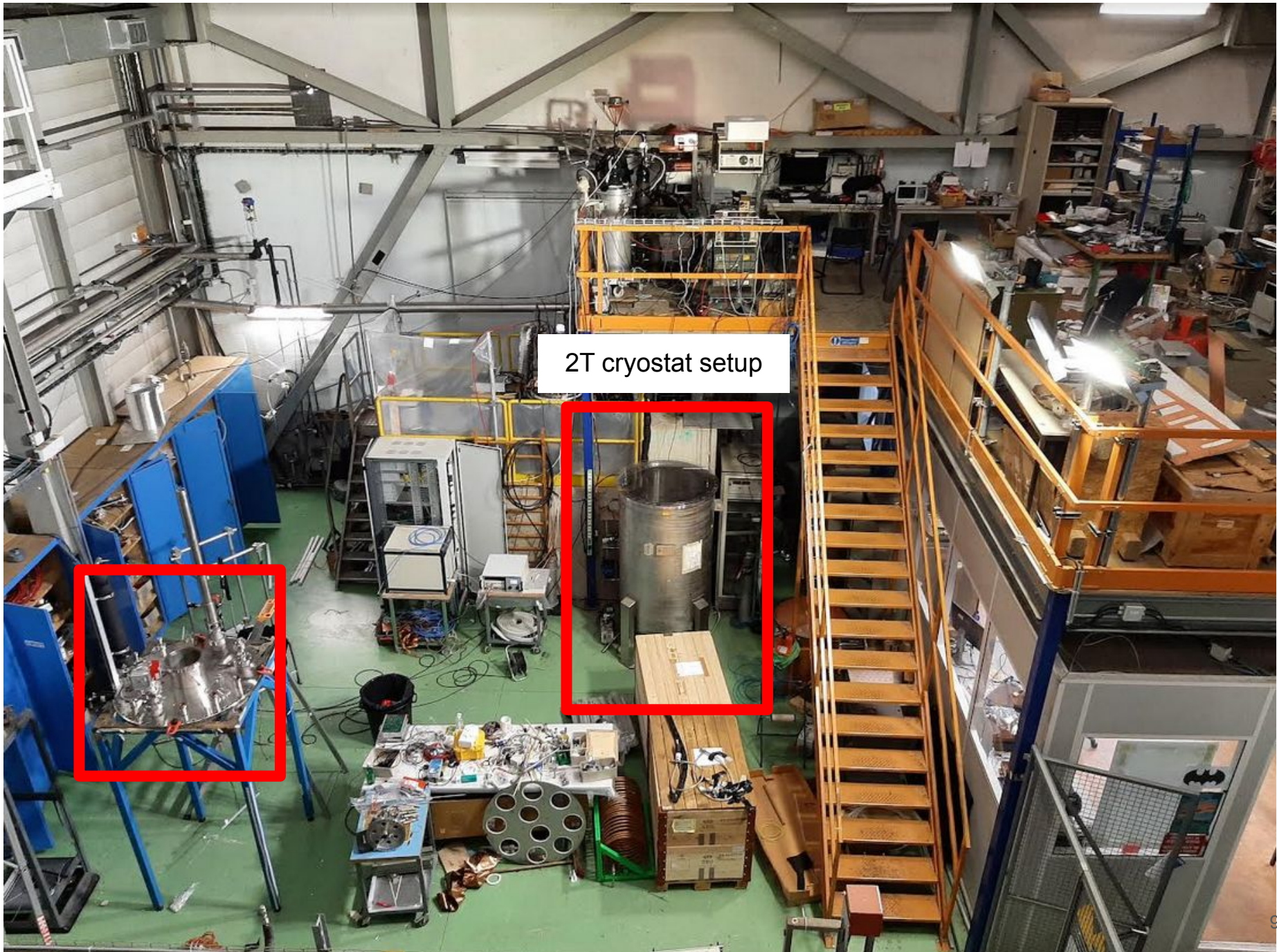
- Tests were started in Spring 2020 and since then we've conducted several important runs and addressed different questions related to perforated PCB based charge readout
- The main tests have been
 - 2-view PCB anode
 - 3-view PCB anode without shift plane with 48, 0, 90 strip orientation
 - 3-view PCB anode with ± 30 and edge connectors



Current 50L tests

- 3view CRP electron transparency scan to validate simulations (collaboration with CRP consortium)
- Using Bi-207 as a calibration source (collaboration with CALCI)
- Insulator field cage walls
 - Similar electrical setup as the “aluminum profiles embedding X-Arapucas”
 - Started to collect cosmic tracks with a dedicated trigger to study any possible effects around the insulator field cage walls
- Possible more test: Ethernet based continuous readout with online hit identification (collaboration with DAQ consortium)



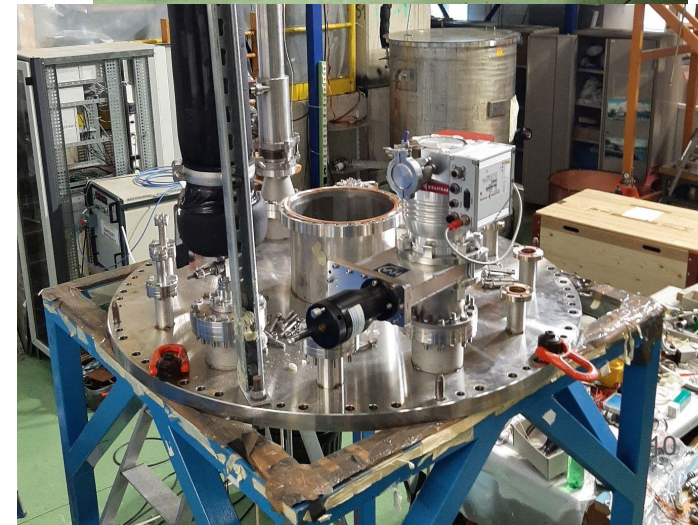


2T cryostat setup



2T cryostat setup

- Vacuum insulated large dewar with 1m diameter, 1.8m depth. 3D model of the setup can be found in the following link:
<https://cernbox.cern.ch/s/9EeZBitw2vHfse6>
- Current setup has:
 - A vacuum insulated large dewar
 - Filtering system for the initial LAr filling
 - Pumping systems
 - Auxiliary instrumentation for cryogenic operations and monitoring
 - (possibility to implement recirculation system)
- Setup is suitable for larger prototype tests



Example: HV test at 300kV

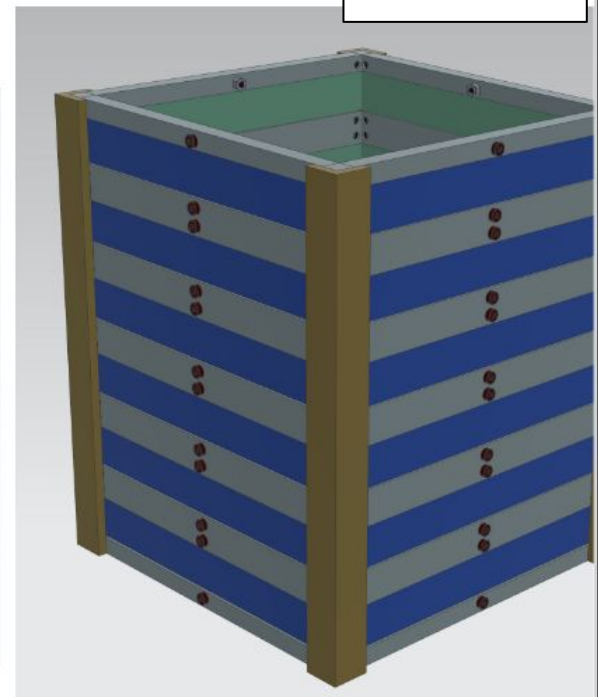
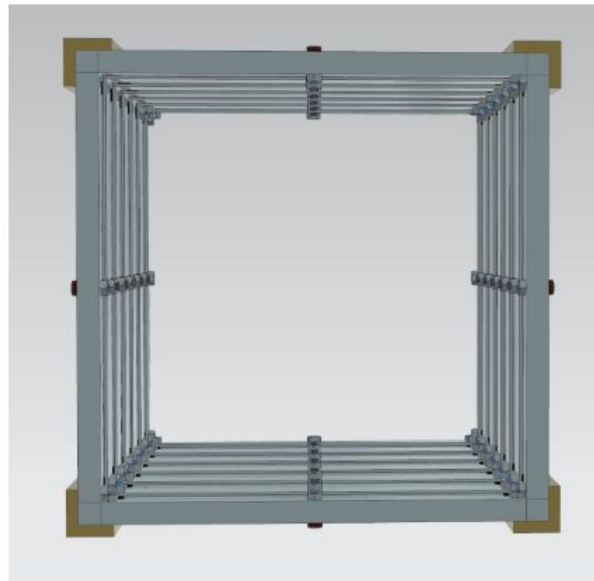
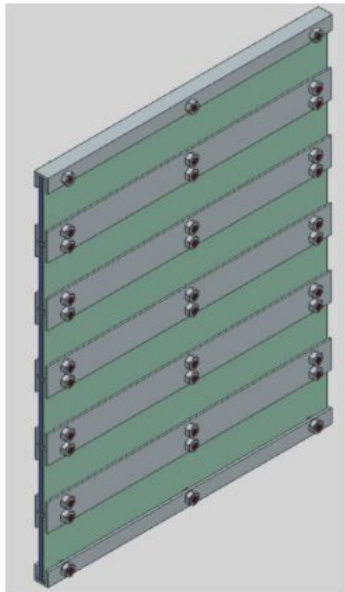
- Demonstration of the HV operations at 300kV at the FD2 electrical boundary conditions
 - HVFT operating at 300kV for extended period of time
 - Material and geometry confirmation for the insulator material
 - Developing mechanical support structure for the HVFT and HV extender



Possible tests at 50L and/or 2T for VD-FD3

- Table-top size prototypes: 50L is ideal for the first step of a staged prototyping activity
- Larger sized module tests: With 1m diameter and 1.8m depth, 2T cryostat might be a good place for mid/large size prototypes
 - If needed we can integrate perforated PCB based charge readout system for this setup too

Table top prototype for 50lt @ CERN - start in 2023, build and operate in 2024



Concluding remarks

- Setup at CERN, Bld-182 have been very effective for LAr R&D and detector development
- We welcome all collaborators who has new ideas/questions that needs to be tested in LAr to use our facilities
- Given many years of operations, we have plenty of hardware that can be re-utilized for different tests
- We have support from the Neutrino Platform design and engineering office, which helps us to participate building new small scale detector components
- Looking forward to collaborate for the FD3 tests @182