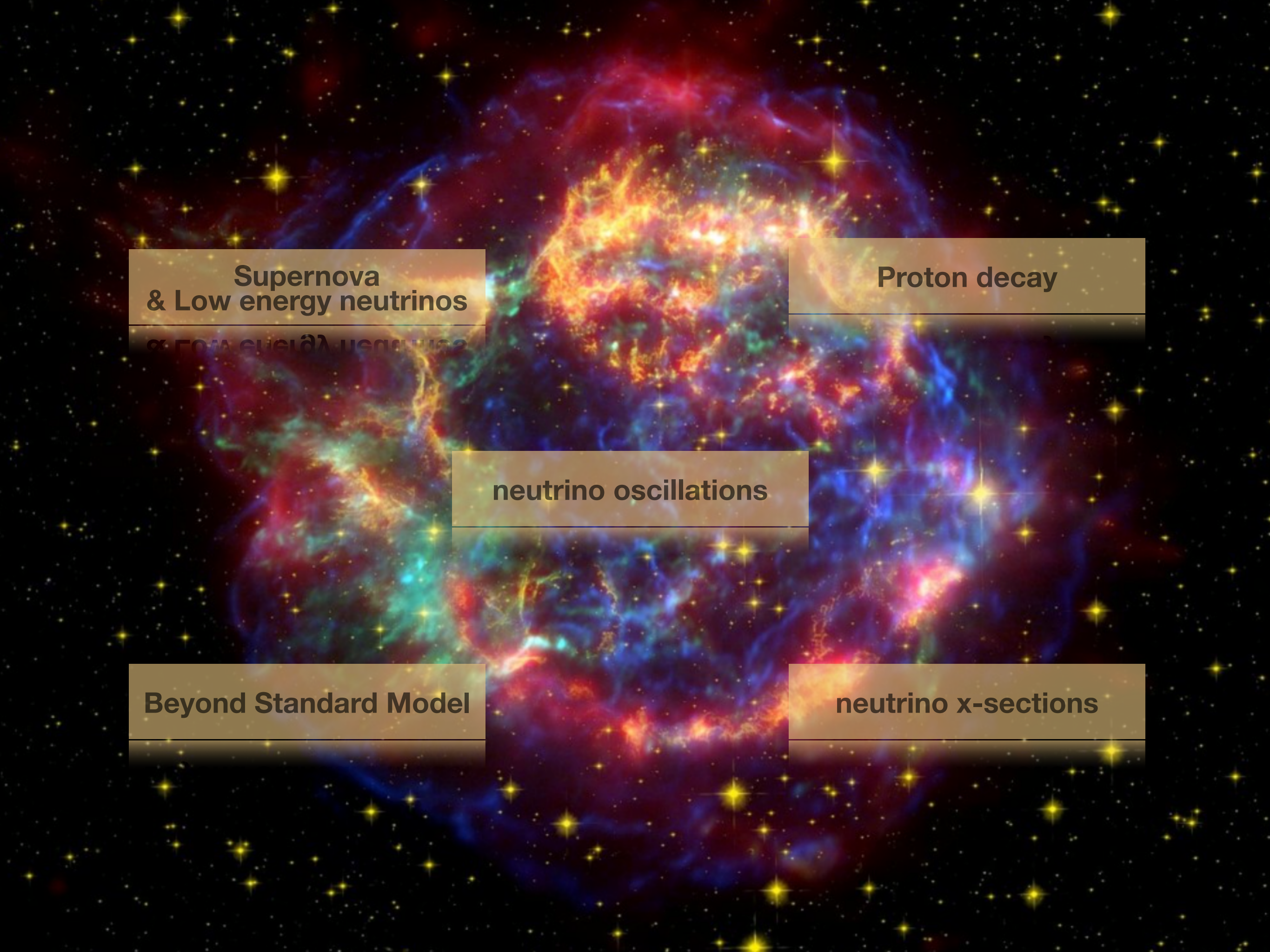


DUNE and its far detectors

Anselmo Cervera
IFIC



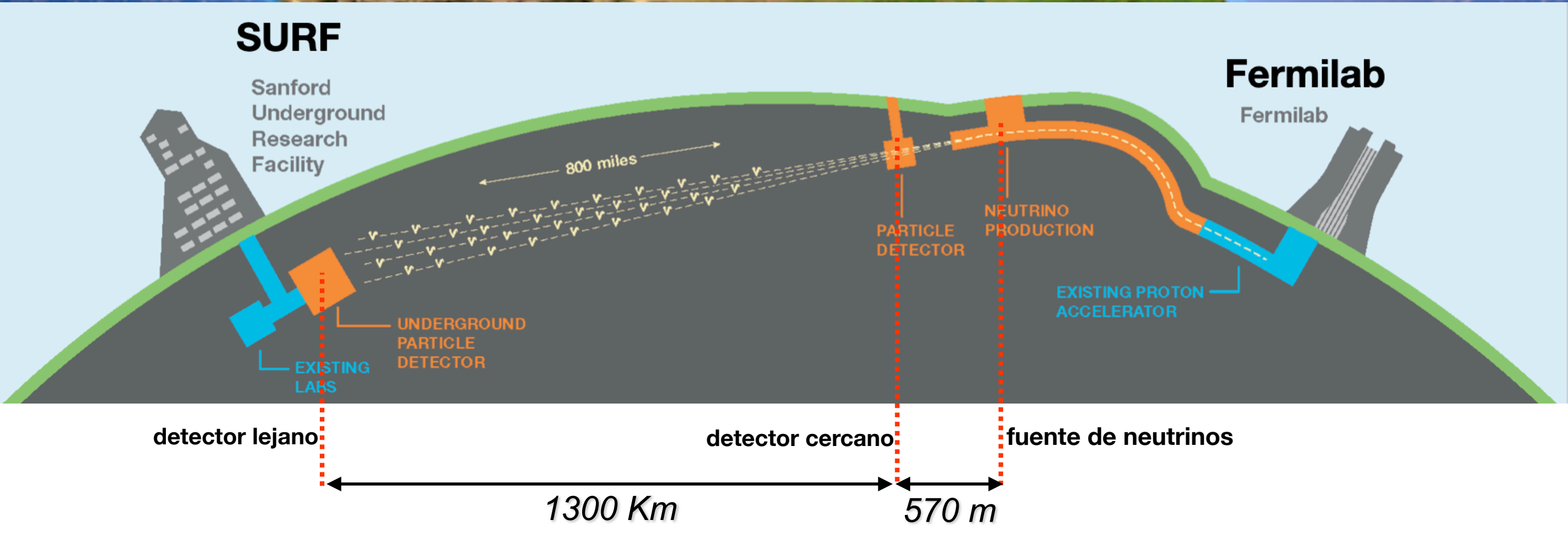
**Supernova
& Low energy neutrinos**

Proton decay

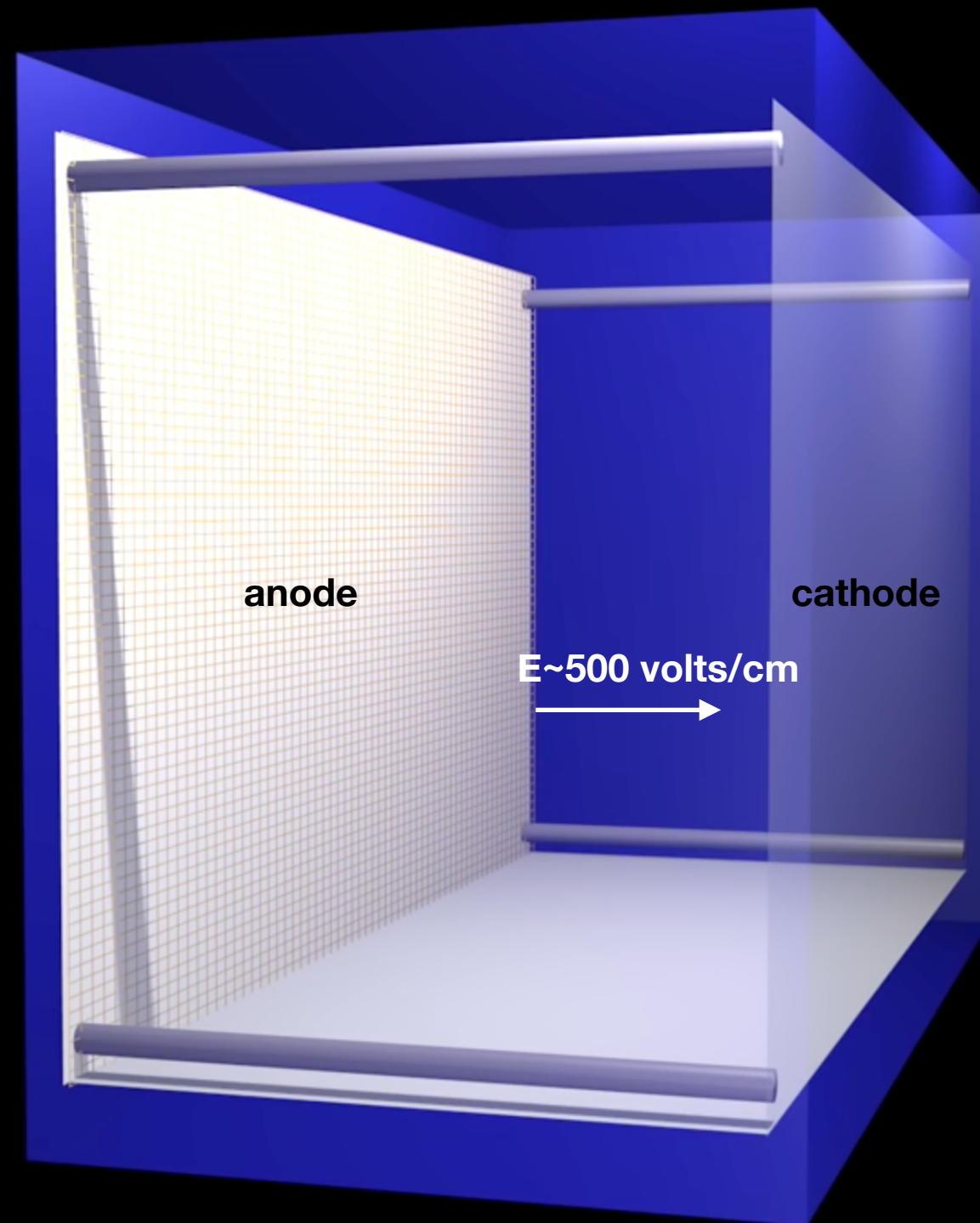
neutrino oscillations

Beyond Standard Model

neutrino x-sections



Time Projection Chamber (TPC)

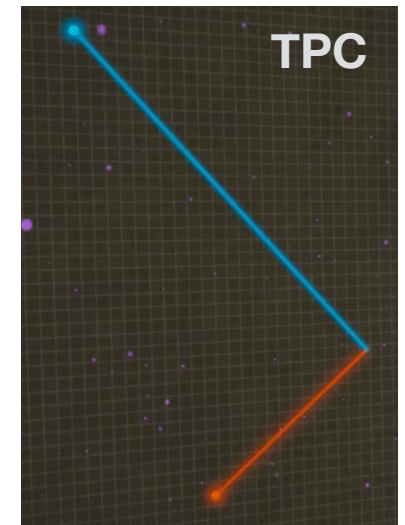


Particle detection in DUNE

- A charged particle crossing the detector does two things:

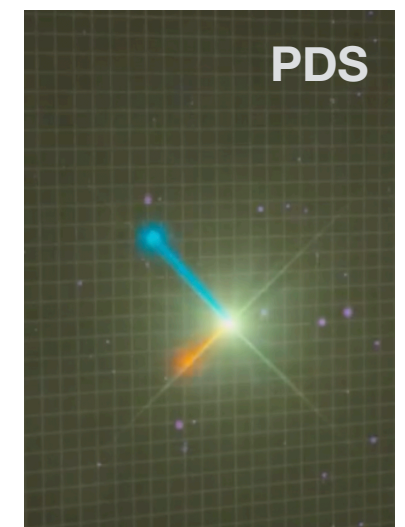
- **Inionization:** removes electrons from argon atoms

- An E-field drifts them towards an anode
- Produces a 3D image of the event + event energy



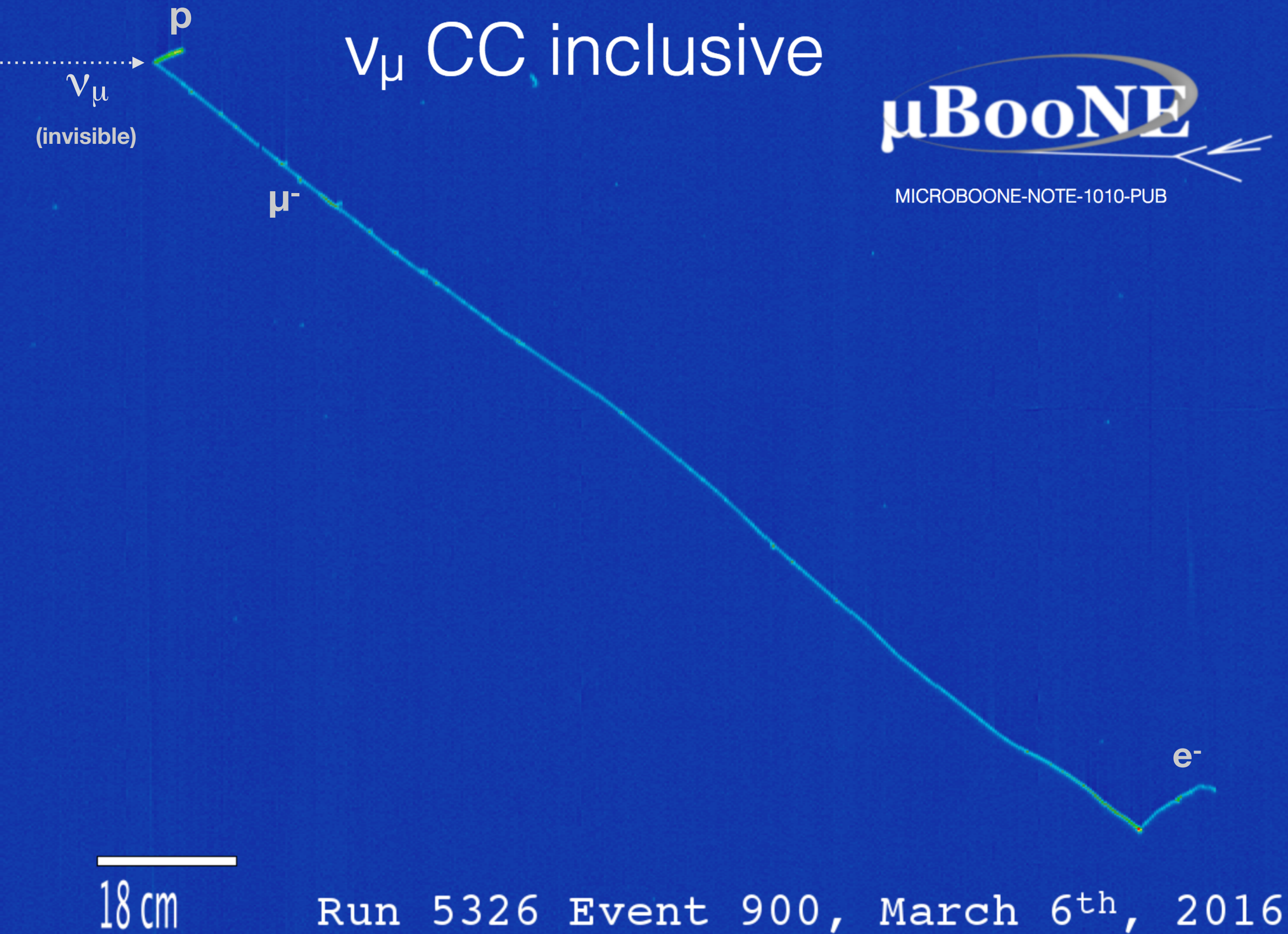
- **Scintillation:** excites argon atoms, which immediately decay producing light

- Triggers the 3D picture + event energy



Like using lightning and thunder to find distance.

TPC is slow (10^{-3}), photons are fast (10^{-6})

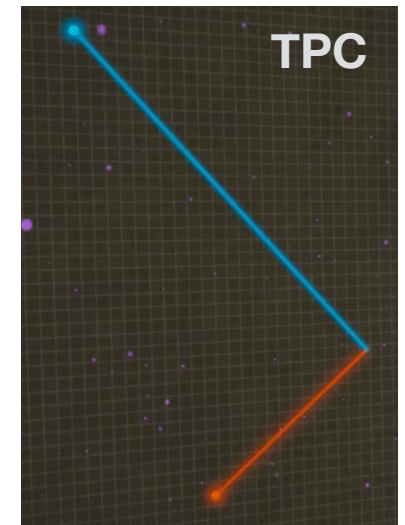


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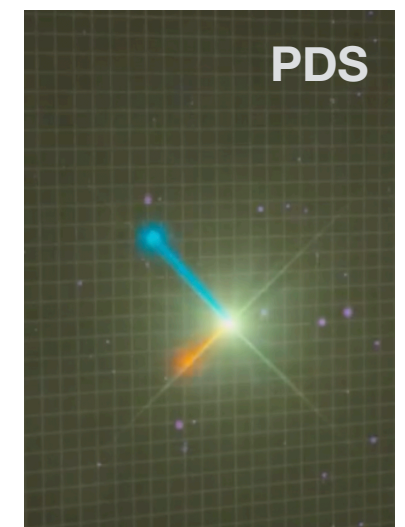
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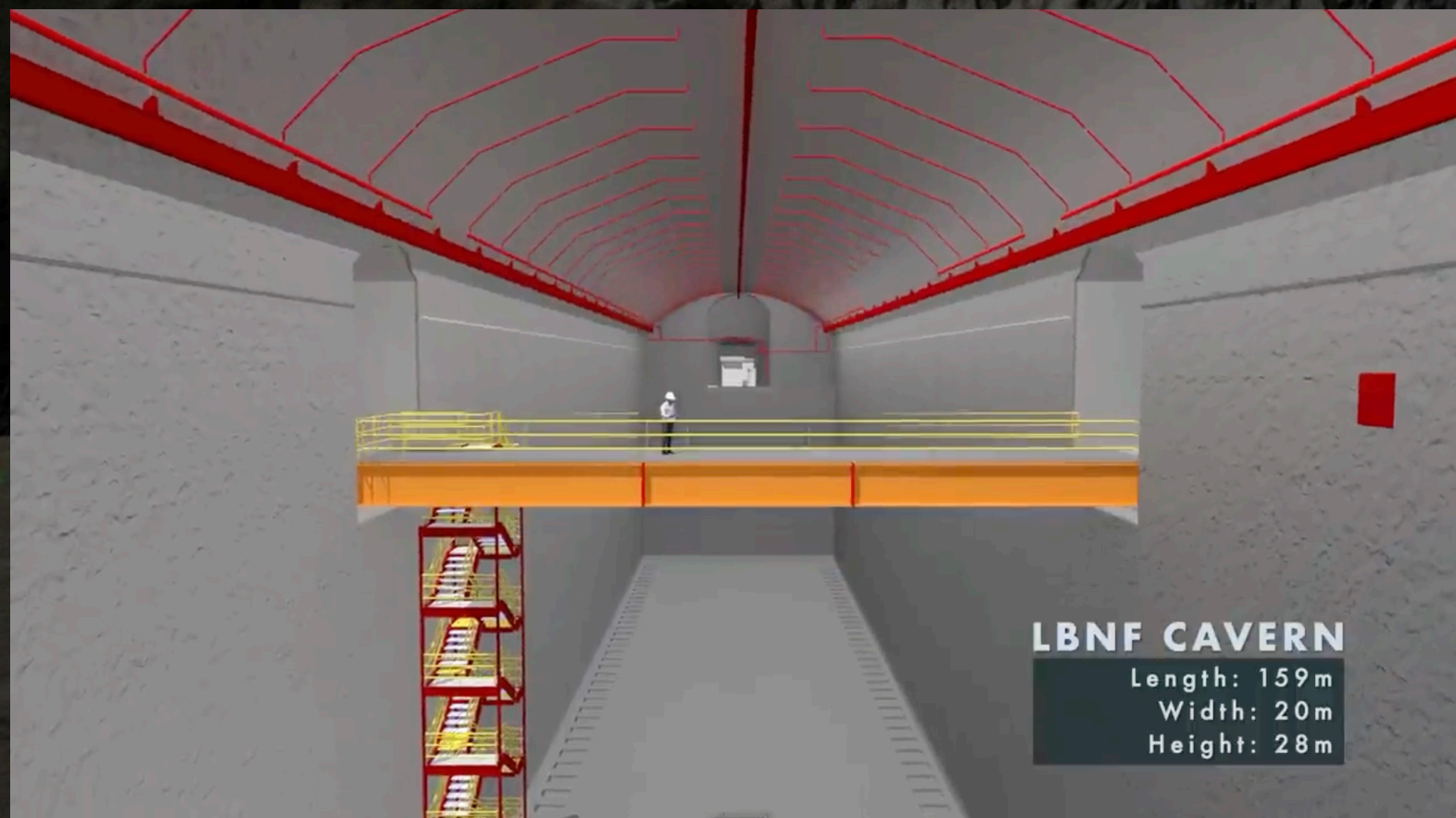
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Why Liquid Argon ? 87 K

- **Dense:**
40% denser than water
- **Cheap:** abundant
(1 % of the atmosphere)
- **Ionizes easily:**
55,000 electrons/cm
- **Excellent scintillation:**
20,000 photons/MeV
(@ 500 V/cm)



The far detector complex



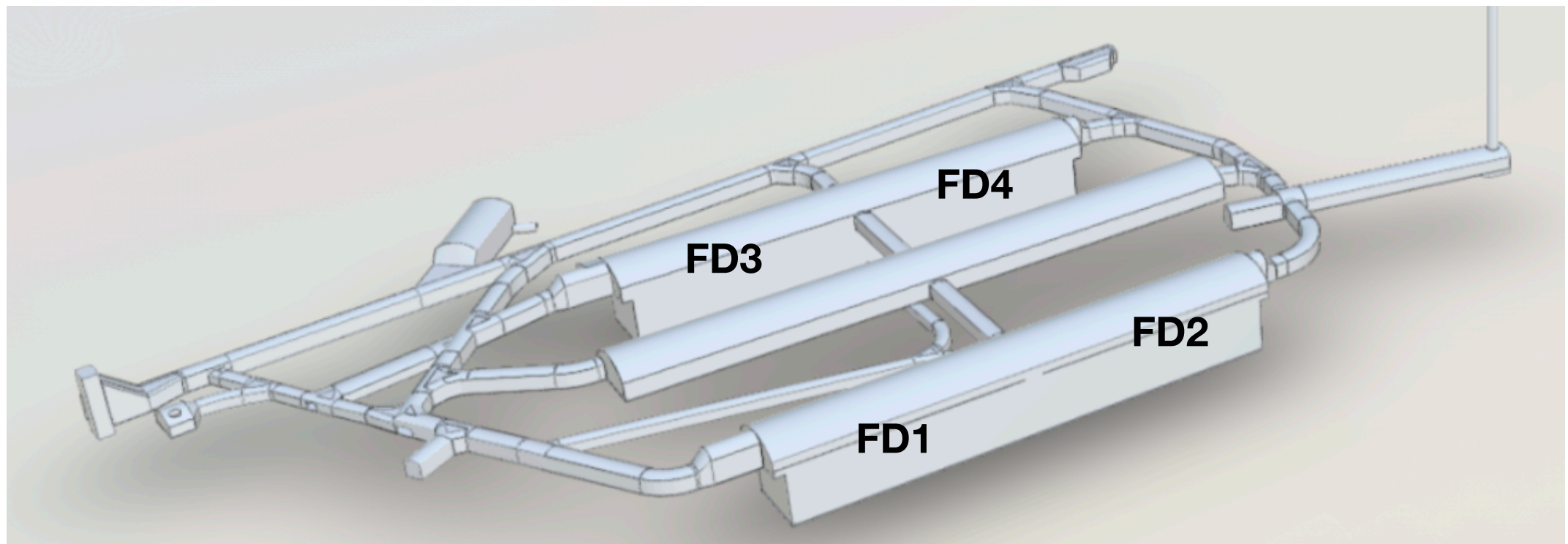
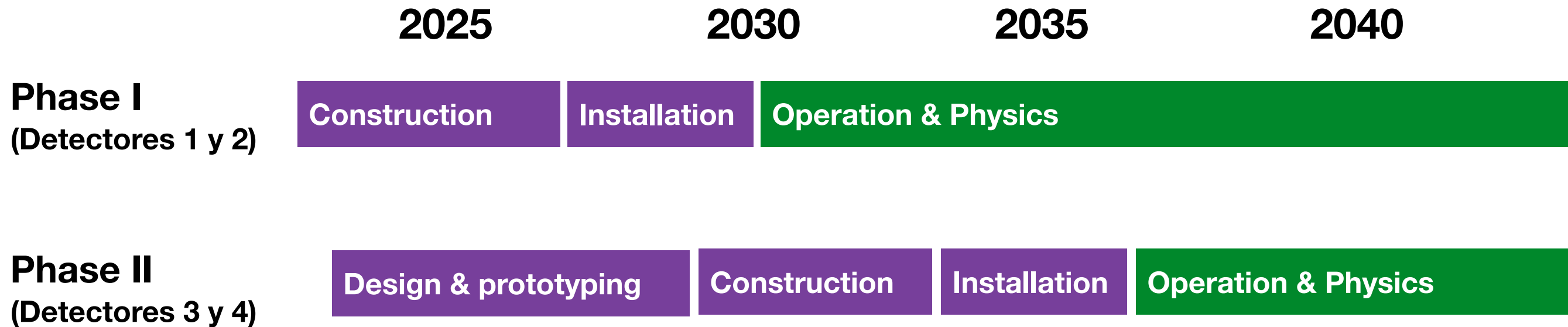
LBNF CAVERN

Length: 159m

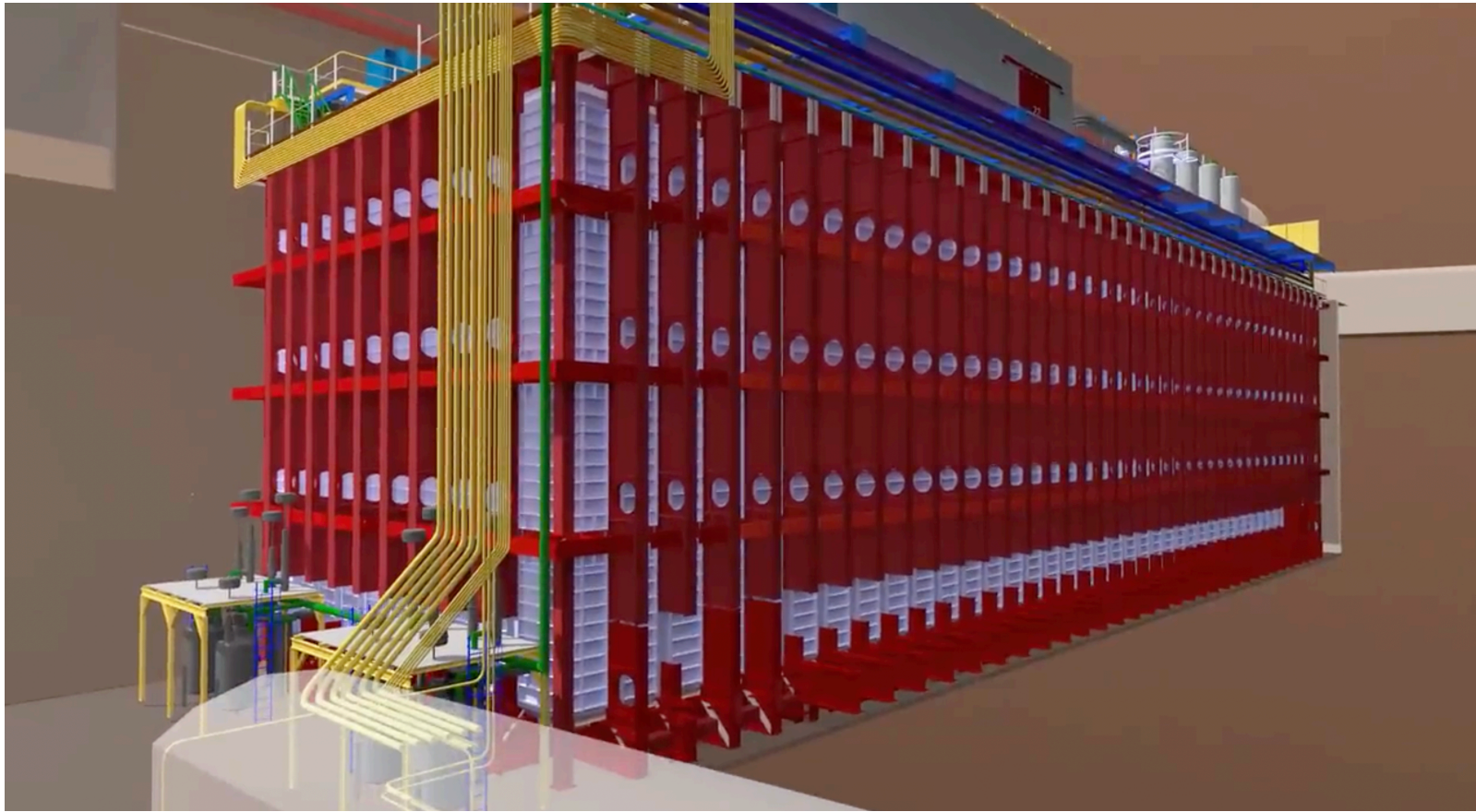
Width: 20m

Height: 28m

FDs timeline

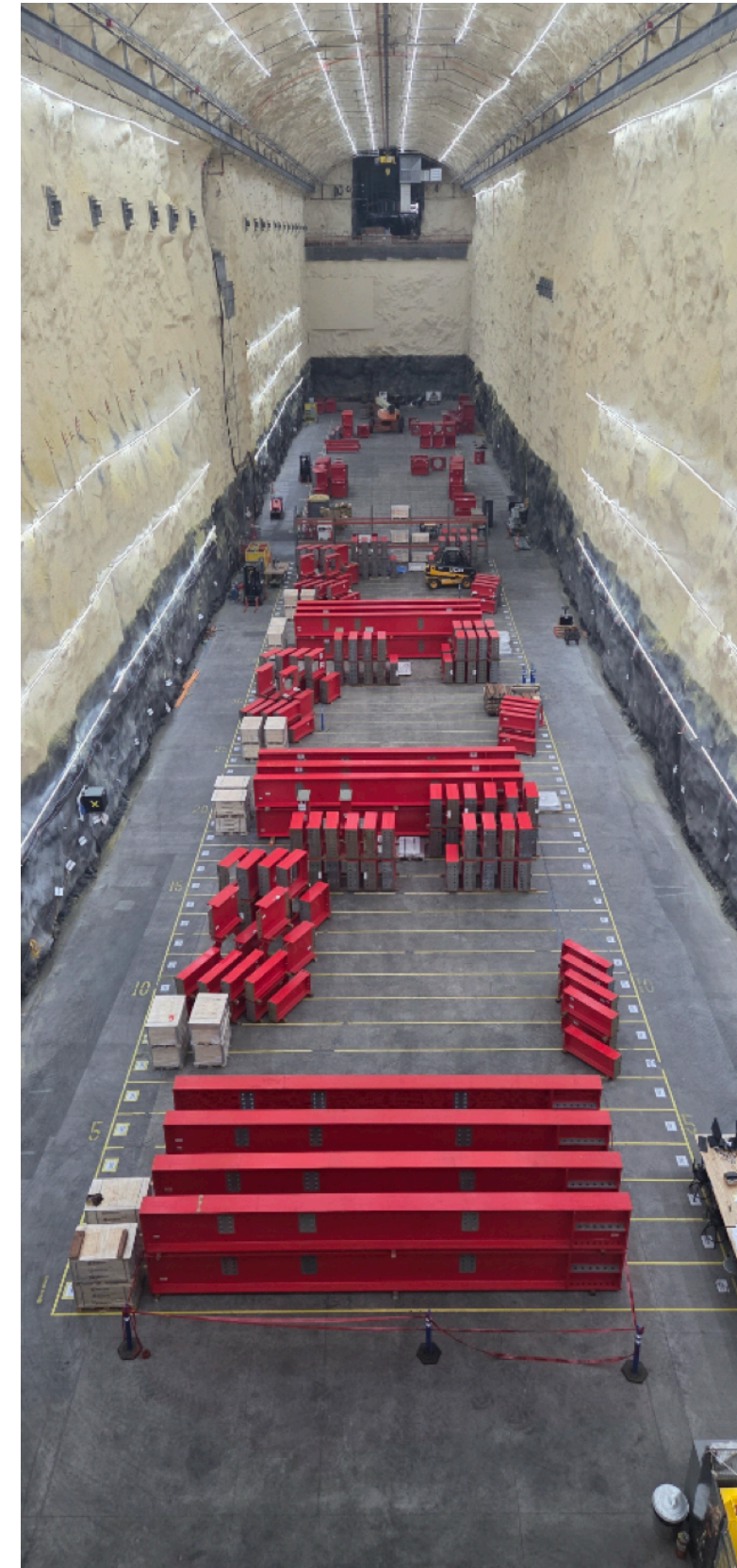


This is really happening



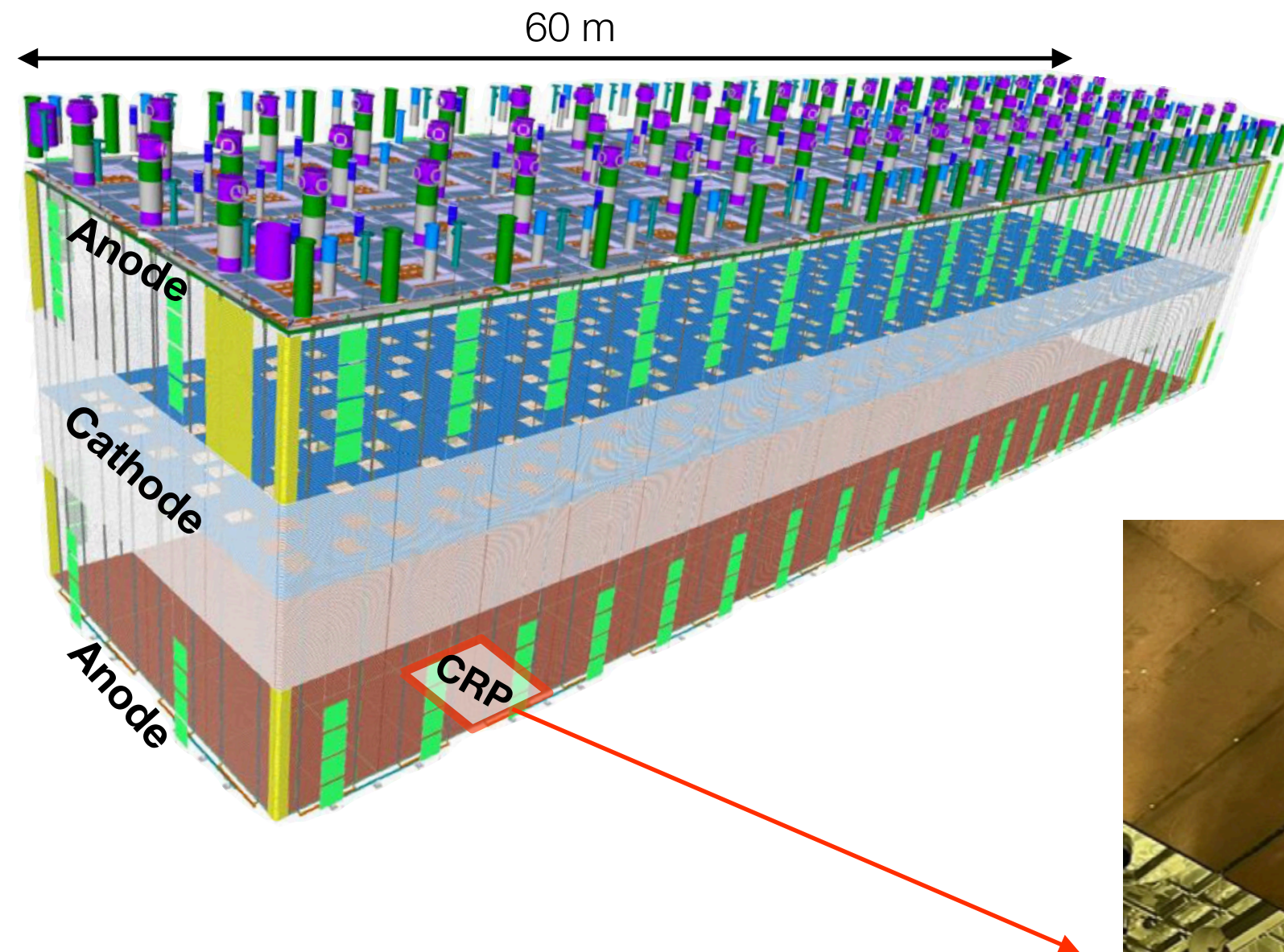
- The cryostat is currently being built

South Cavern, morning, 6 July



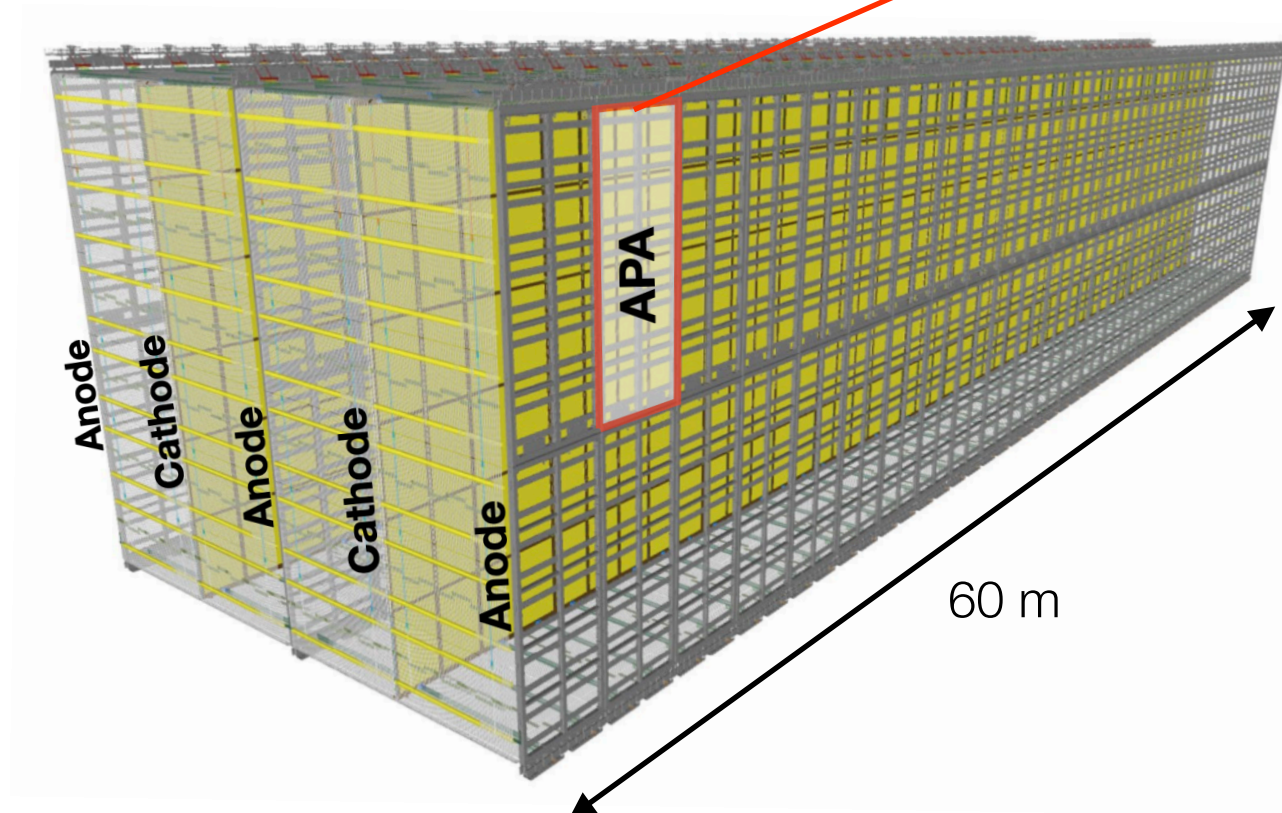
Phase-I far detectors

FD-VD (Vertical drift module)



Phase-I far detectors

FD-HD (Horizontal drift module)



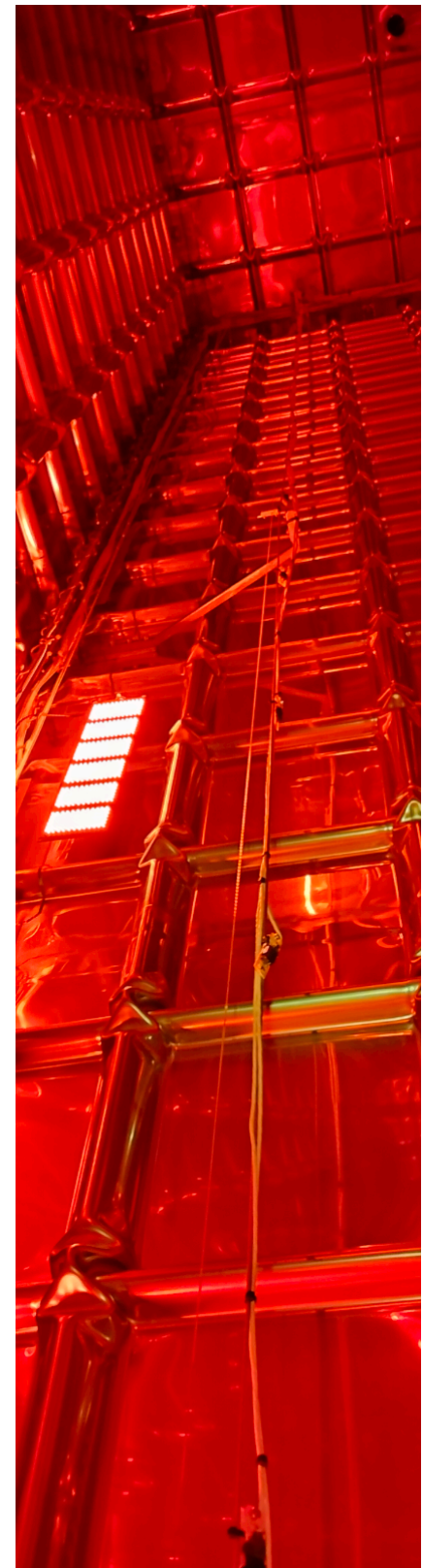
Prototypes at CERN



ProtoDUNE-HD



ProtoDUNE-VD



DUNE at IFIC

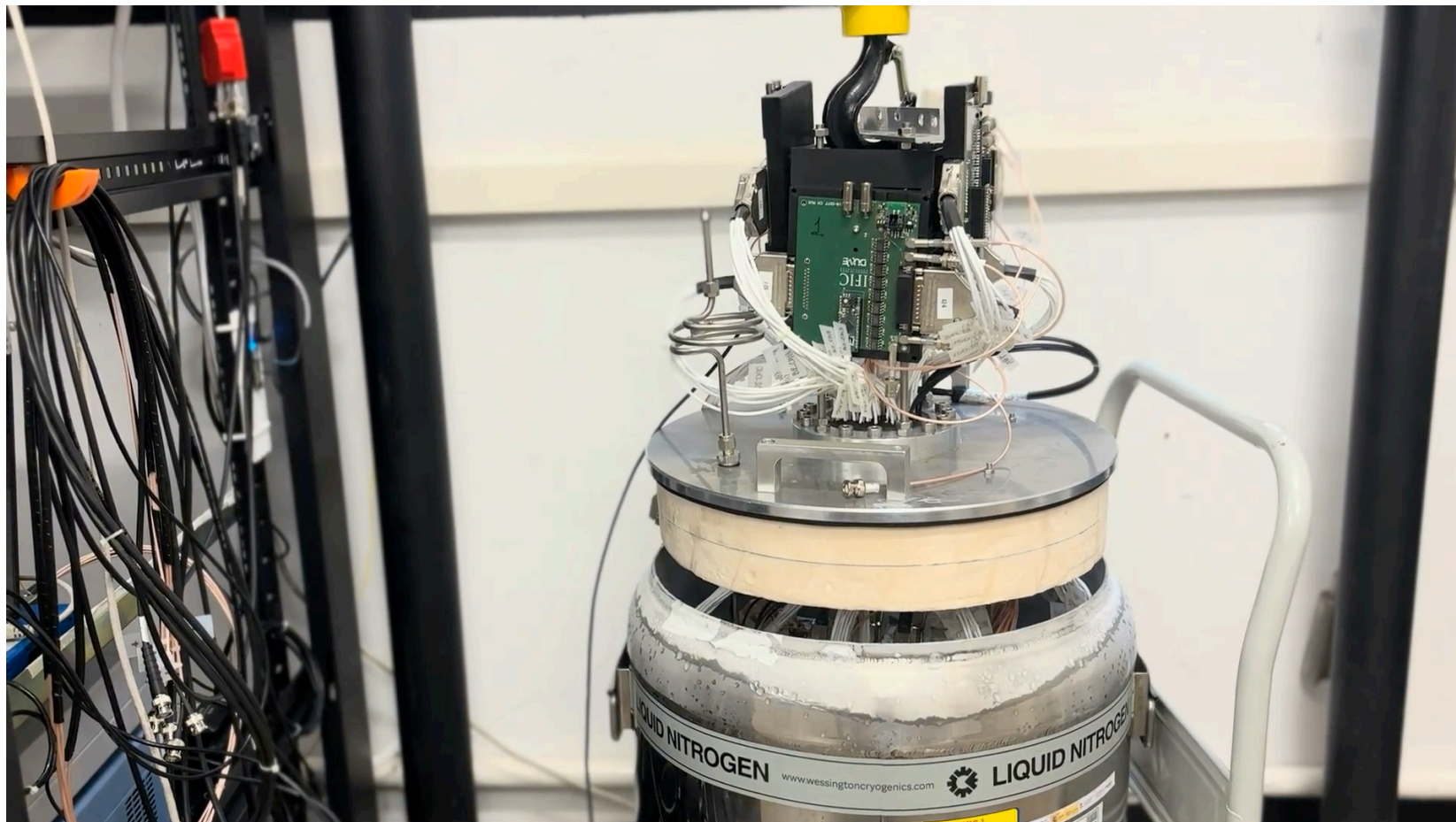
- We have a large group at IFIC (17 people) and big responsibilities in DUNE:
 - Michel Sorel is the Physics co-coordinator
 - A. Cervera is one of the far detector technical coordinators
- We are involved in two main areas at the hardware level:
 - Temperature monitoring system: IFIC's responsibility
 - Photon detection system: in collaboration with many other institutes all around the world
- We also participate in the preparation for physics:
 - Physics analyses in the CERN prototypes
 - Proton decay and atmospheric neutrino oscillations with simulations

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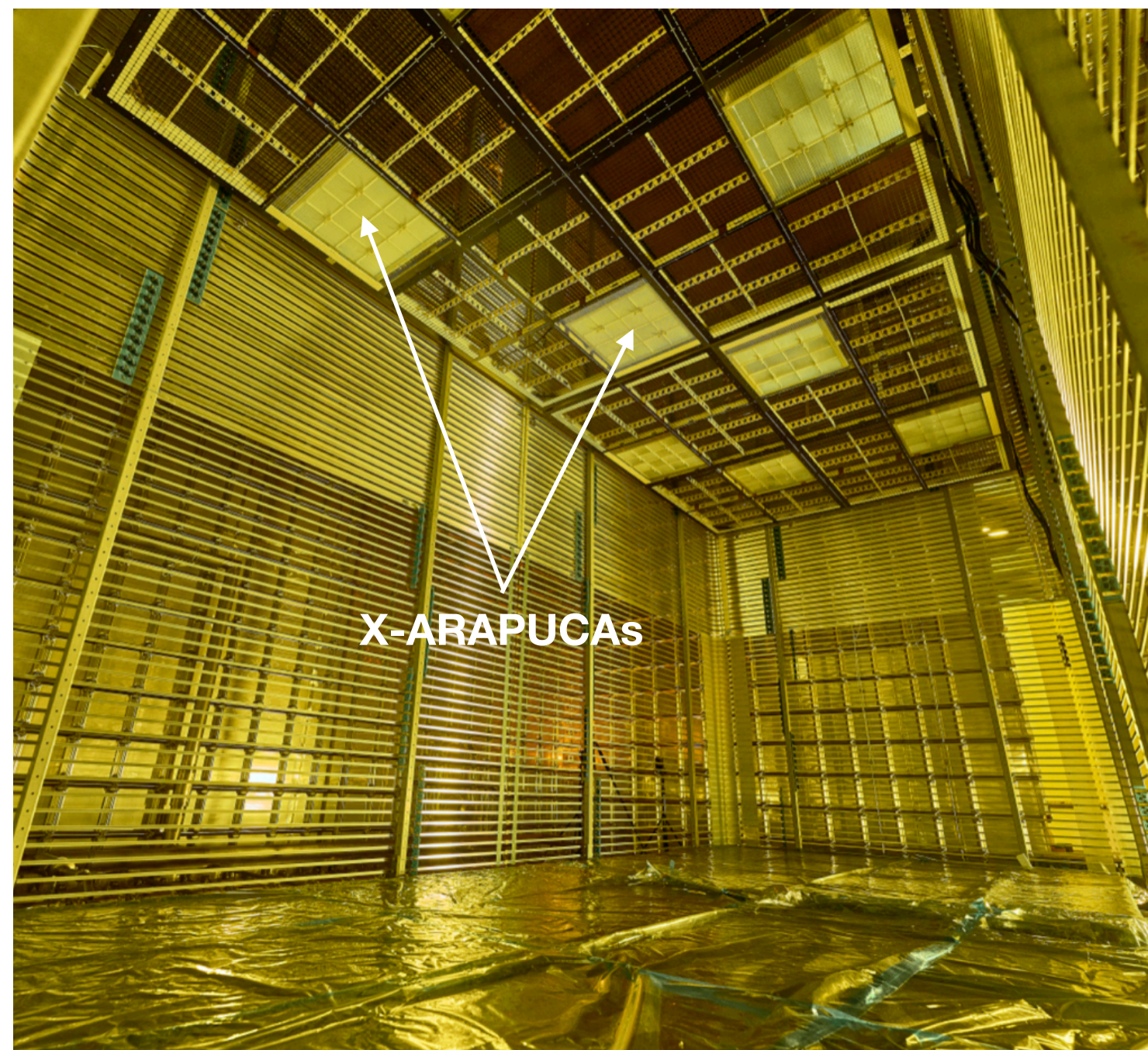
The summer school

- Over the years, we have worked on software development and physics analyses for several neutrino experiments, including T2K, NEXT, and DUNE.
- But during these two weeks, we'd like to show you a different side of our work: the hands-on experimental activities that make up our everyday life in the lab.

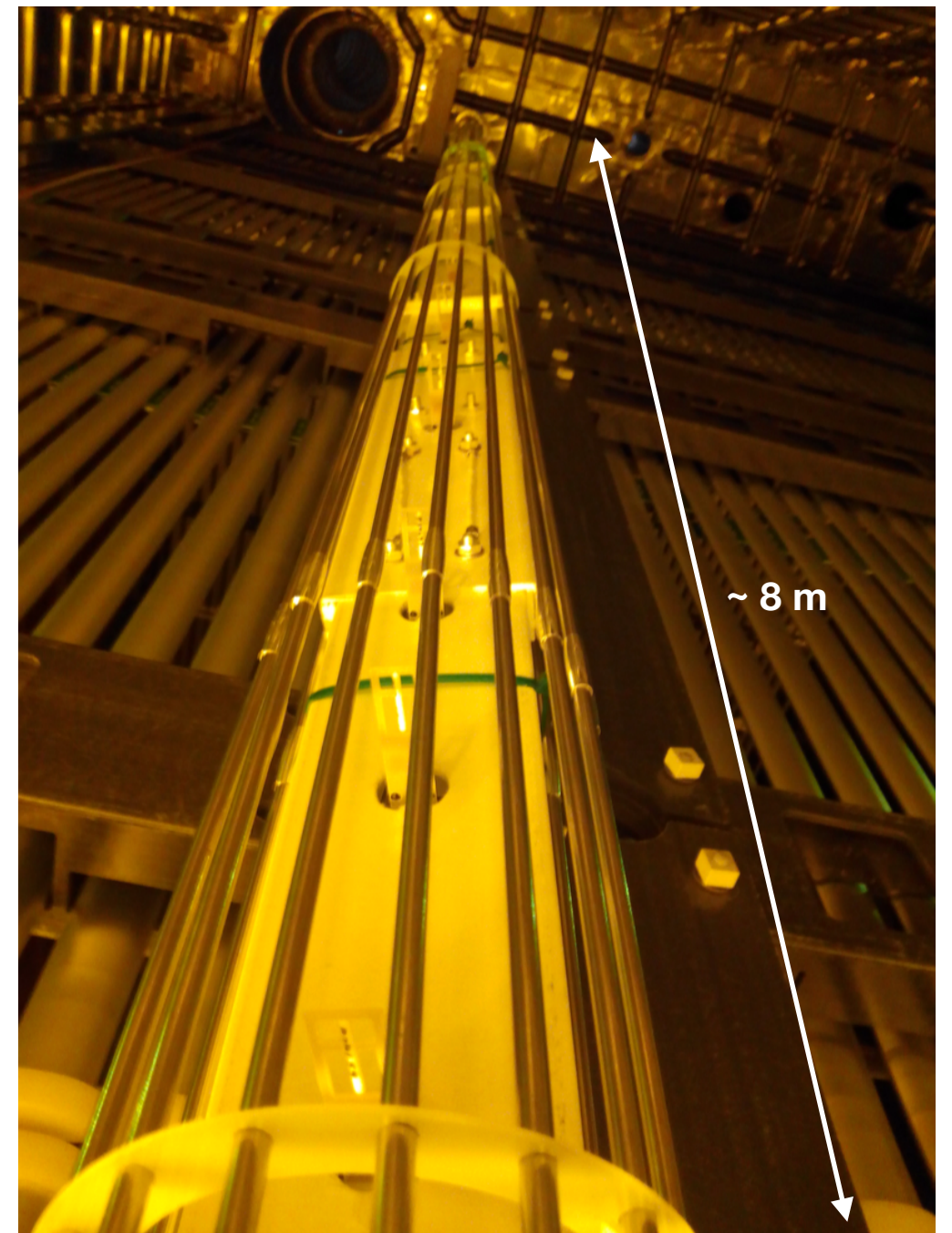


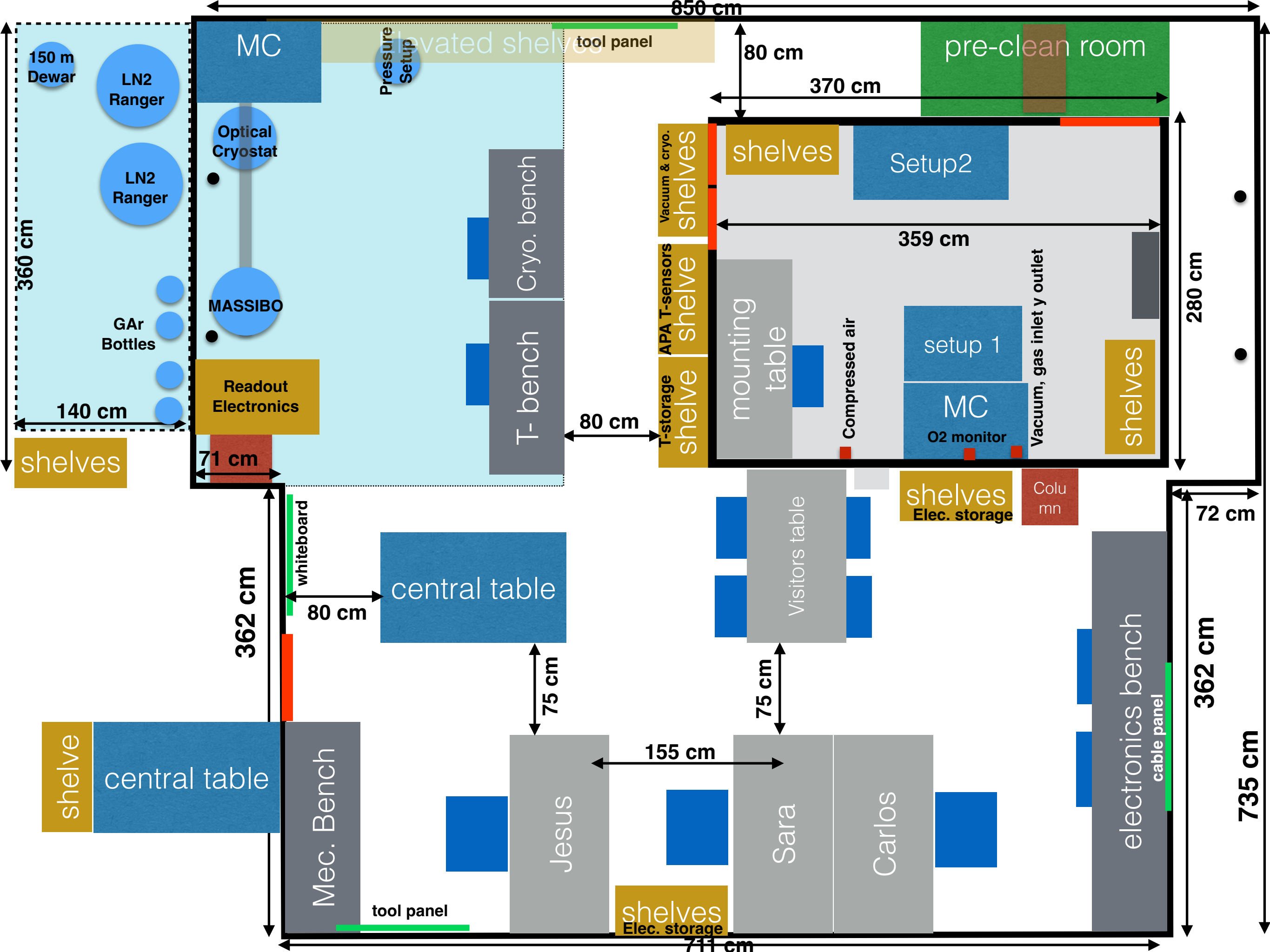
Our hardware activities

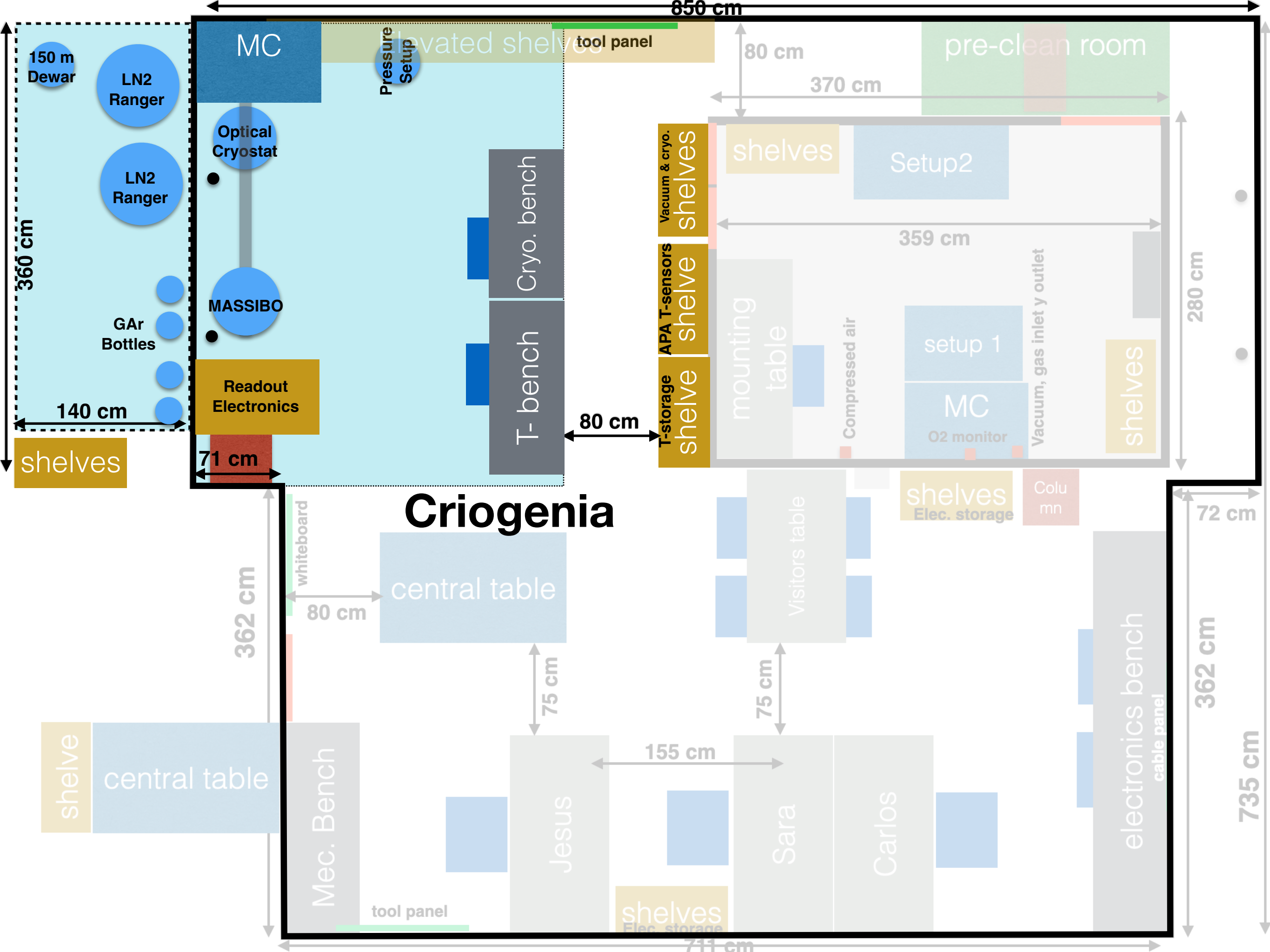
Photon detection in ProtoDUNE-VD

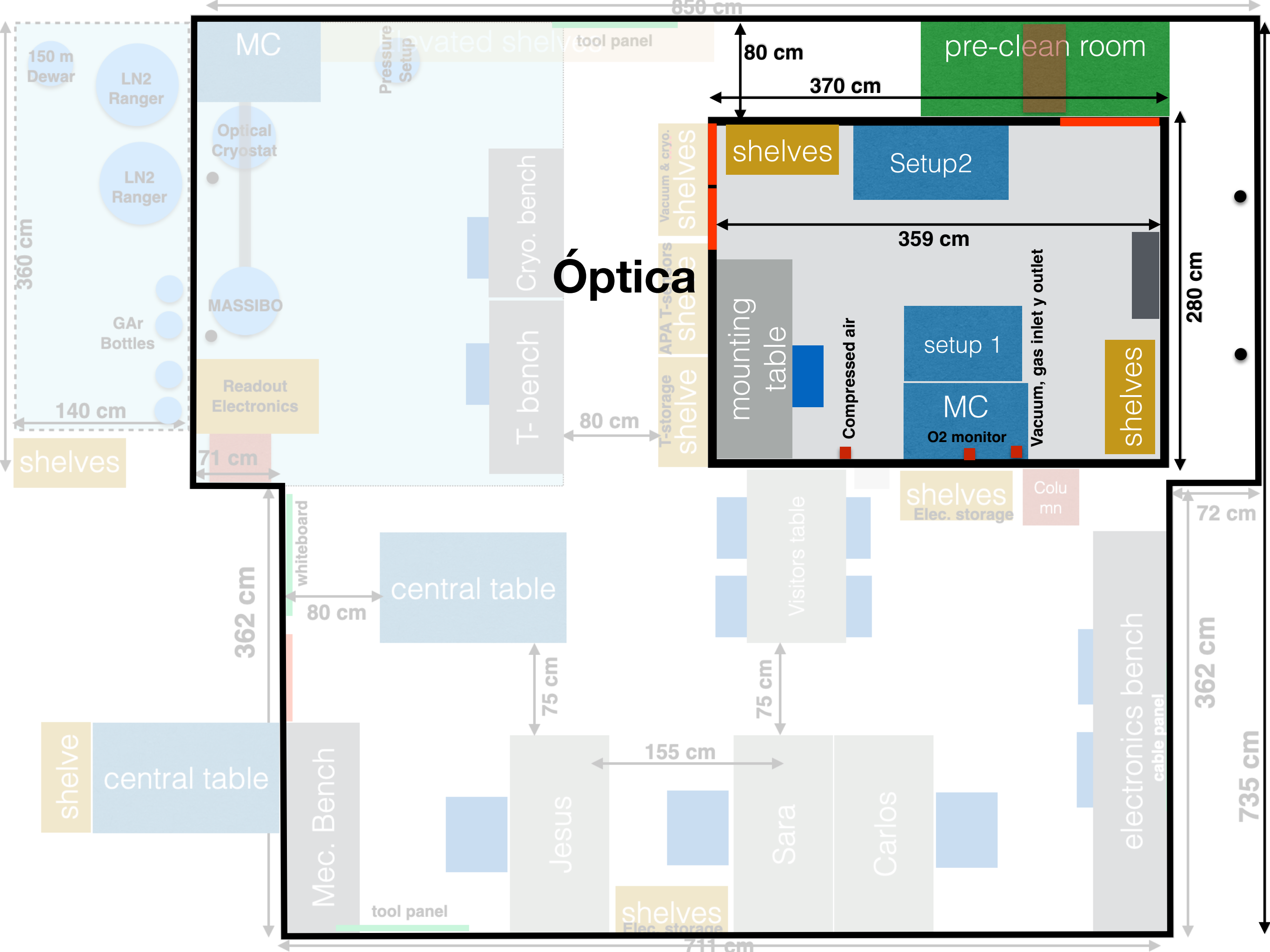


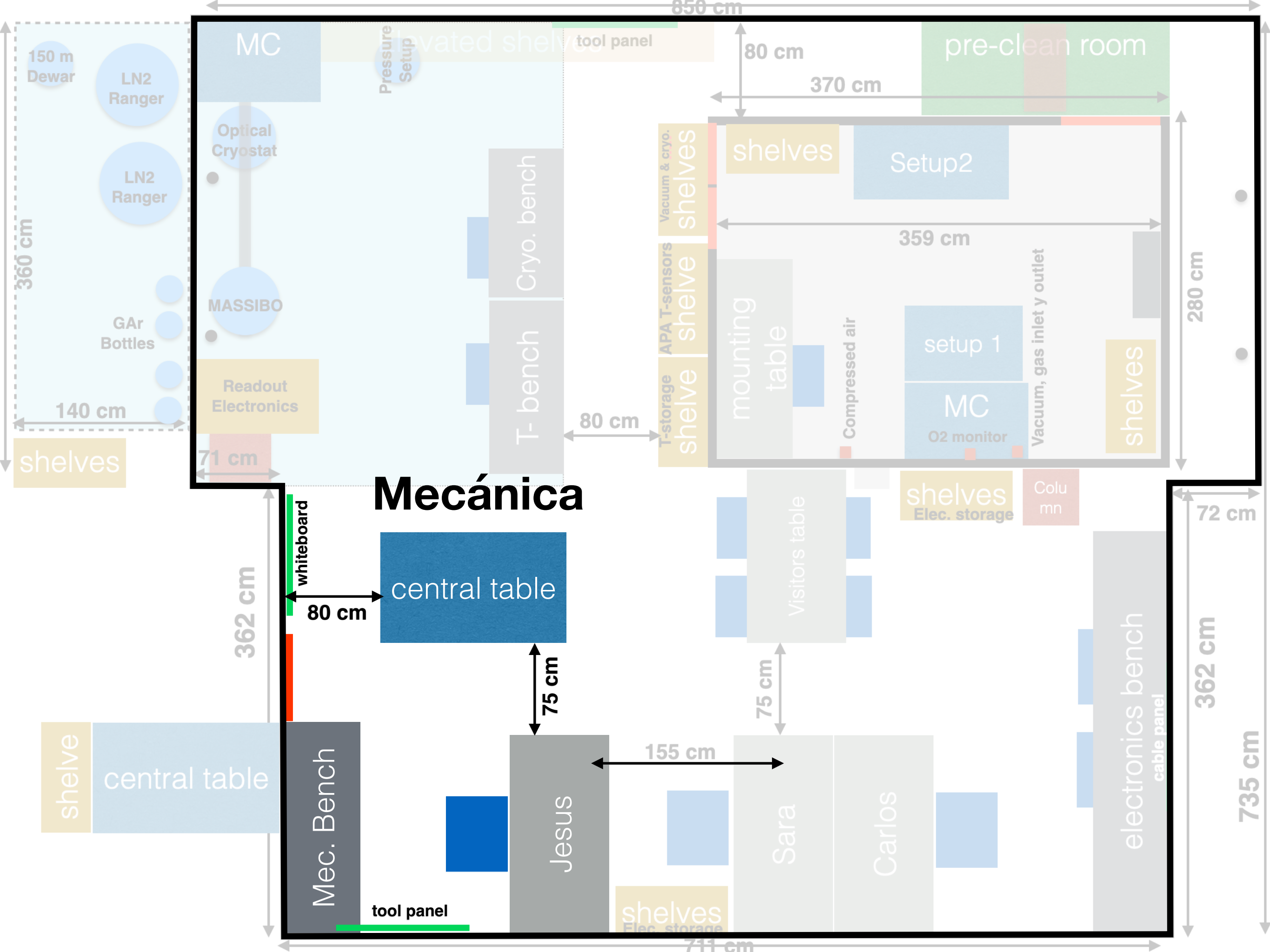
T-Gradient monitor in ProtoDUNE-HD

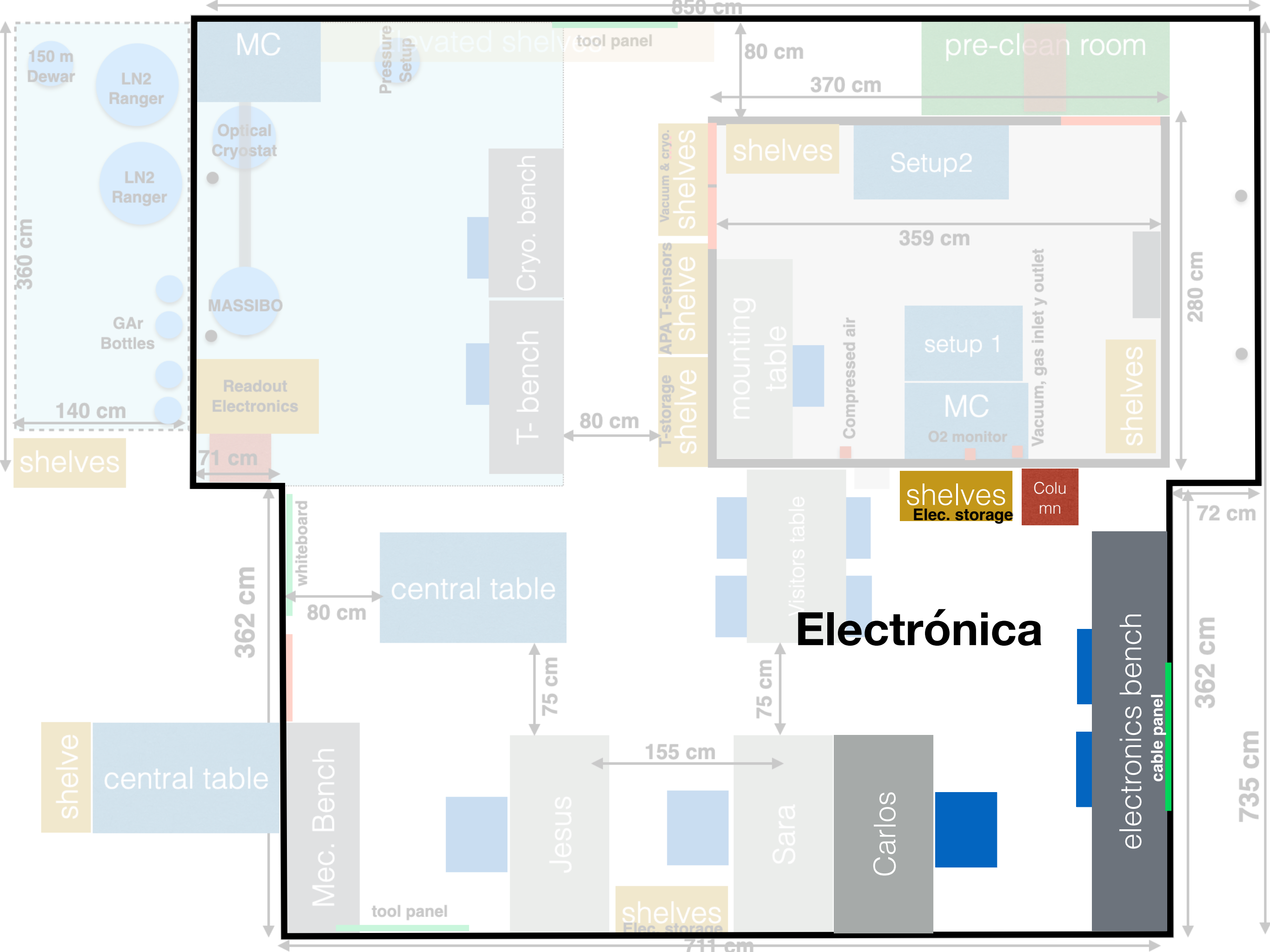












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 VALENCIA

Experimental Neutrino Physics

Welcome to the **Experimental Neutrino Physics Group** at **IFIC**, where the mysteries of the universe are not just contemplated, but actively unraveled. Here, amidst the dance of elusive particles, we seek to understand the fundamental building blocks of reality. Our quest is driven by curiosity, fuelled by innovation, and anchored in rigorous scientific inquiry.

NEW article: *Millikelvin-precision temperature sensing for advanced cryogenic detectors*



Group members

Our group is composed of a diverse team, including physicists, engineers, technicians, and administrative staff, all working together to support and advance our research activities



Research

An outline of the physics topics we are investigating, the experiments we are actively involved in, and the associated technological developments both within our laboratory and through collaborations with industry



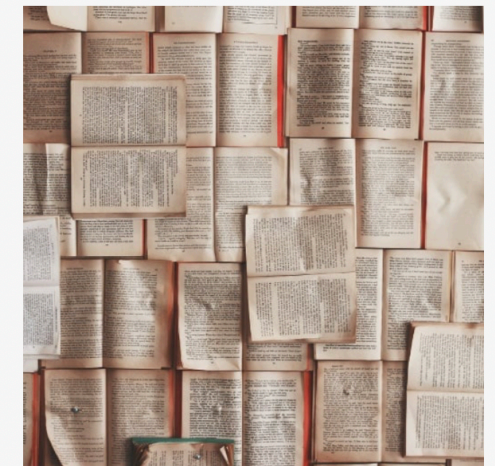
News

Stay up to date with the latest scientific results, project developments, significant events, and milestones from our group and the collaborative experiments we take part in



Join our group – Job offers

Details on how to become part of our research group—whether as a PhD student, research engineer, postdoctoral fellow, or tenure-track faculty member—including application procedures, requirements, and available positions



Selected results

A curated selection of scientific results spanning two decades, including doctoral theses, peer-reviewed articles, experimental findings, and other research outputs

<https://neutrinos.ific.uv.es/>

Working with us

