The CERN Neutrino Platform

08-11-2016

M.Nessi, CERN

ν e, μ, τ, …

European strategy

“Rapid progress in neutrino oscillation physics, with significant European involvement, has established a strong scientific case for a long-baseline neutrino programme exploring CP violation and the mass hierarchy in the neutrino sector. CERN should develop a neutrino program to ***pave the way*** *for a substantial European role in future long-baseline experiments. Europe should explore the possibility of major participation in leading long-baseline neutrino projects in the US and Japan.”*

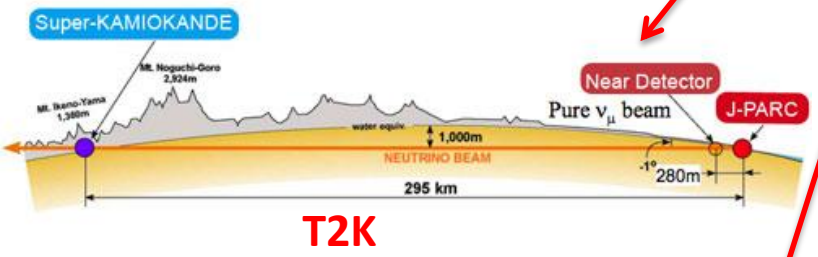
Our interpretation

- ✓ *no ν beams at CERN !*
- ✓ *ν beams in the US and in Japan*
- ✓ *A structure at CERN to foster an active involvement of Europe and CERN in the US and Japanese new facilities*

→ Neutrino Platform as a project at CERN

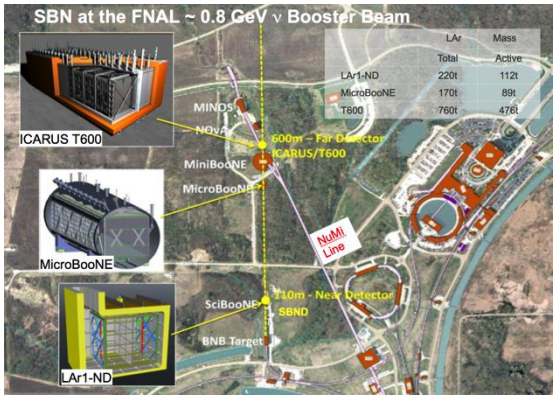
ν future landscape (oscillation physics)

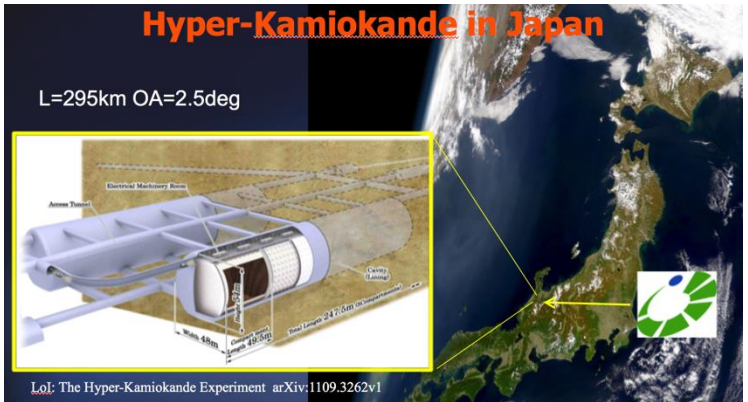
Neutrino Platform at CERN



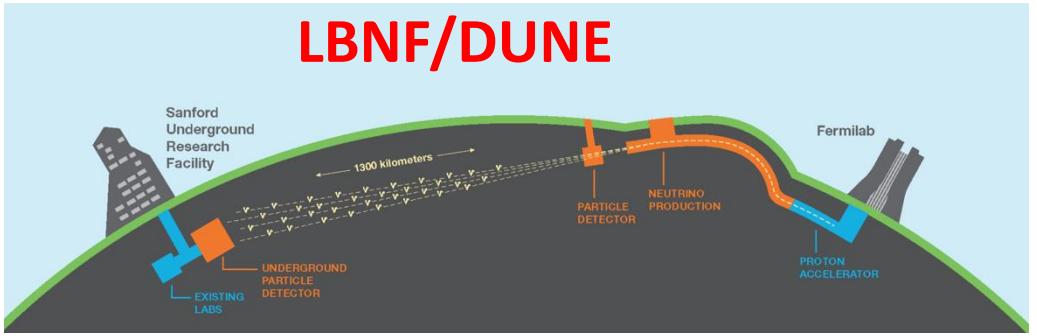
T2K

SBN (short baseline)





LBNF/DUNE



How does the CERN NP fit in all this?

- ✓ With a long history and experience in Neutrino Physics in Europe
- ✓ As a support structure for all activities, where CERN expertise can be a VALUE
- ✓ As the support Laboratory for all European Groups interested in a collaborative effort
- ✓ As a unique R&D and tests facility of detectors and components (hardware and software)
- ✓ As a research group active at these facilities

How to get a new project in ?

- Get in contact with us (Eckhard and myself) to prepare the ground for a possible R&D activity
- Submit a LOI to the CERN SPCS committee for approval
- If YES : receive approval from CERN research board and become a real experiment/collaboration
- Finalize with us a MOU addendum (to the main MOU Frame) defining the project in term of WPs and resources. Define the support needed from CERN
- Get FAs and CERN management signature (MOU)

MOU frame

Memorandum of Understanding

for providing a framework for developing a Neutrino Program at CERN

between

The EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH, an Intergovernmental Organization having its seat at Geneva, Switzerland, ('CERN,'), as the Host Laboratory,

on the one hand,

and

The FUNDING AGENCIES/INSTITUTIONS PARTICIPATING IN THE NEUTRINO PHYSICS RESEARCH PROJECTS AT CERN ('the Neutrino Institutions'),

on the other hand,

(collectively "the Parties")

Preamble

(a) As endorsed by the CERN Research Board at its meeting of August 28th, 2013 and detailed in Annex 1, CERN has decided to develop a Neutrino Program at CERN ('the Neutrino Program') to pave the way for a substantial European role in future Long-Baseline Experiments and explore the possibility of major participation of Europe in leading Long-baseline Neutrino Projects in the United States and Japan;

(b) The Neutrino Institutions, including possibly CERN, wish to collaborate in the research and development (R&D) and construction of prototypes, equipment and related infrastructure for the Neutrino Program and have obtained the support of their Funding Agencies to enable them to participate in the Neutrino Program;

https://edms.cern.ch/document/1353815

As of Today we have 6 MOU addenda active !!

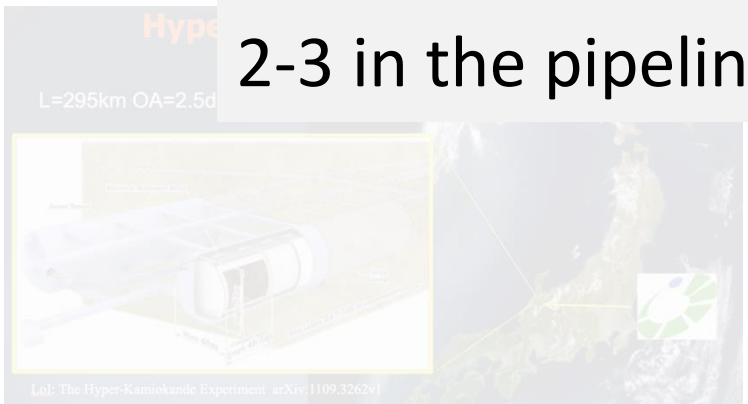
ν Platform Projects (oscillation physics)

Neutrino Platform at CERN

6 Projects presented to the SPSC and approved:

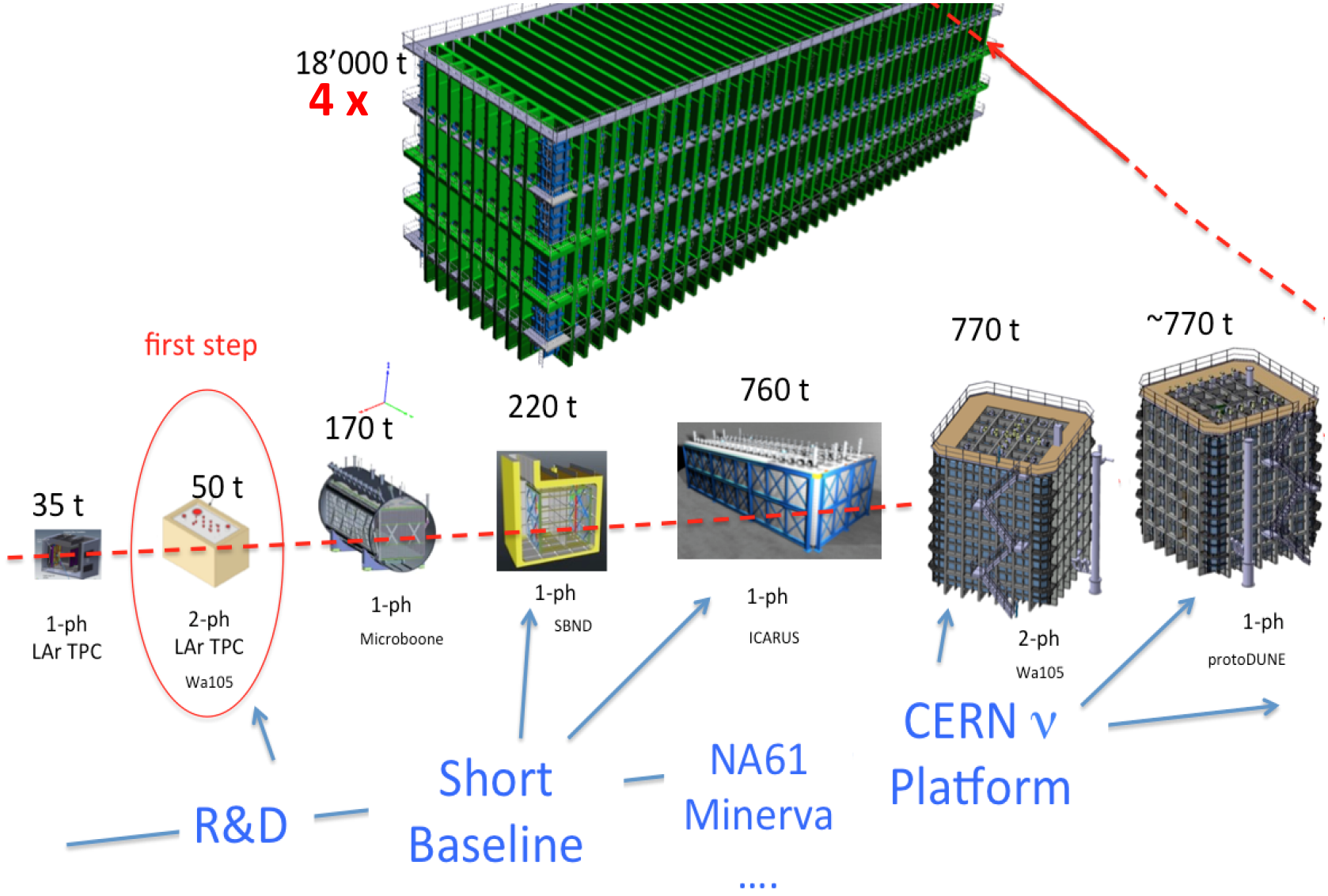
- ✓*NP01: WA104, ICARUS as far detector for SBN*
- ✓*NP02: WA105, demonstrator + engineering prototype for a double ph. TPC*
- ✓*NP03: PLAFOND, an generic R&D framework*
- ✓*NP04: ProtoDUNE, engineering prototype for a single phase TPC*
- ✓*NP05: Baby Mind, a muon spectrometer for the WAGASCI experiment at T2K*
- ✓*ArgonCube : a modular TPC R&D*

2-3 in the pipeline

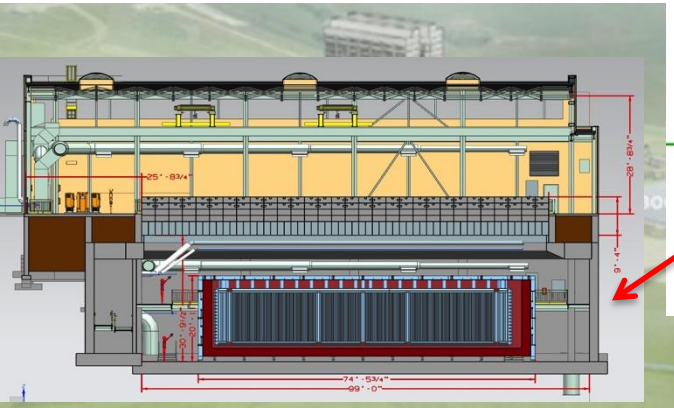


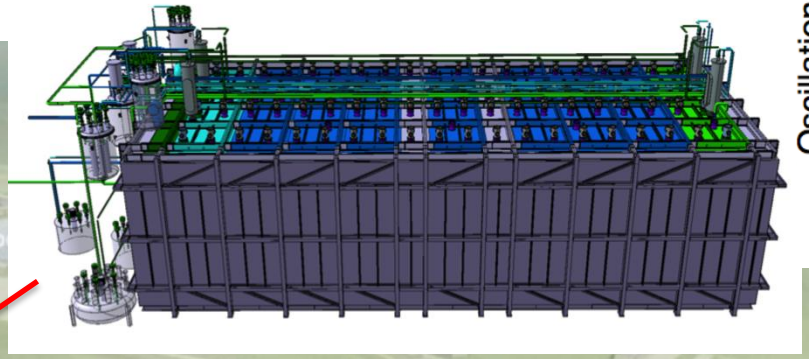
Step by step (LAr TPCs)

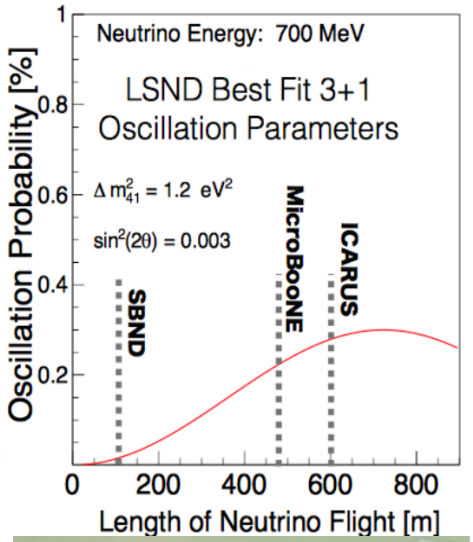
- …. the large scale is a big and new challenge



NP01: WA104→ICARUS, delivery to FNAL early 2017, installation and commissioning during 2017







ICARUS T600
476t Active Mass

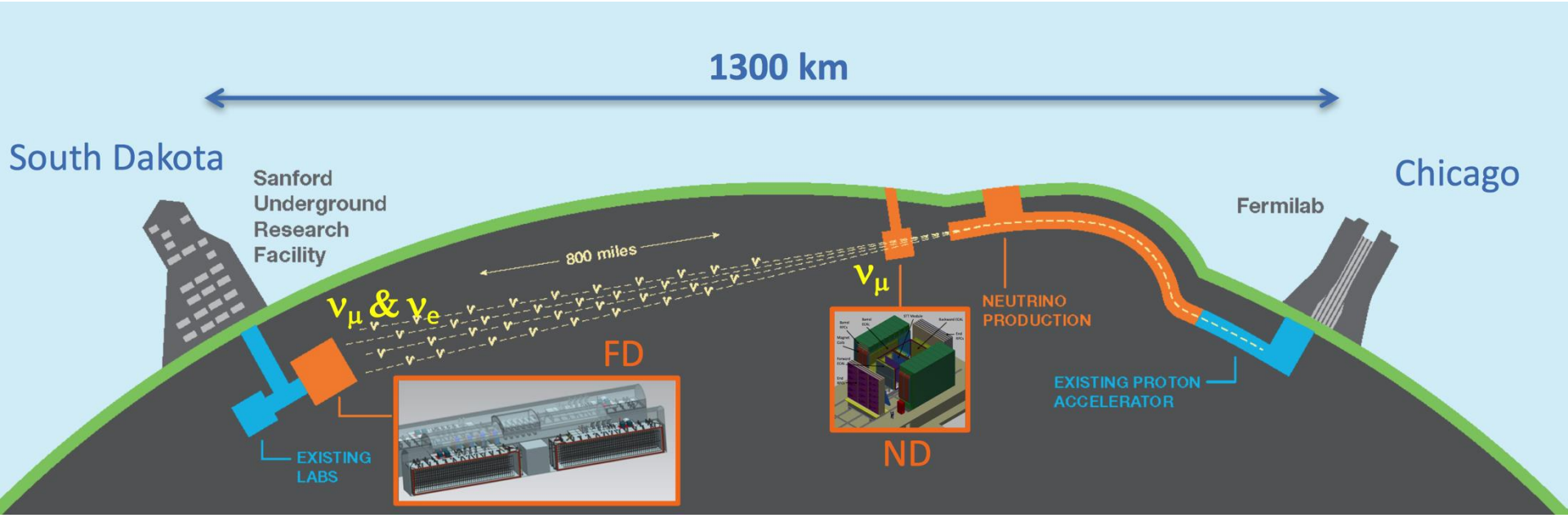
MicroBooNE
89t Active Mass

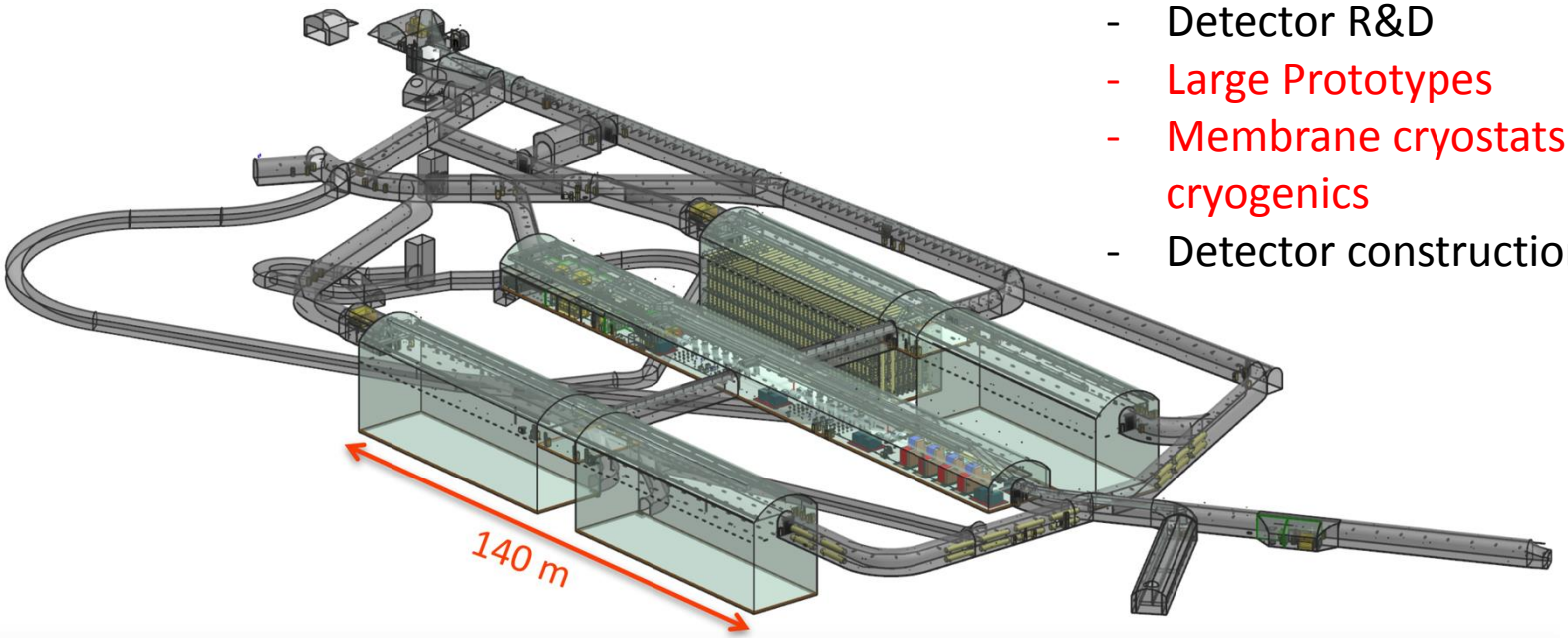
SBND
112t Active Mass

The ICARUS Detector arrived at CERN and is now being reshaped (CERN-INFN coll.)

It will be moved to the FNAL SBN in April 2017 and then installed and commissioned (two vessels) !!

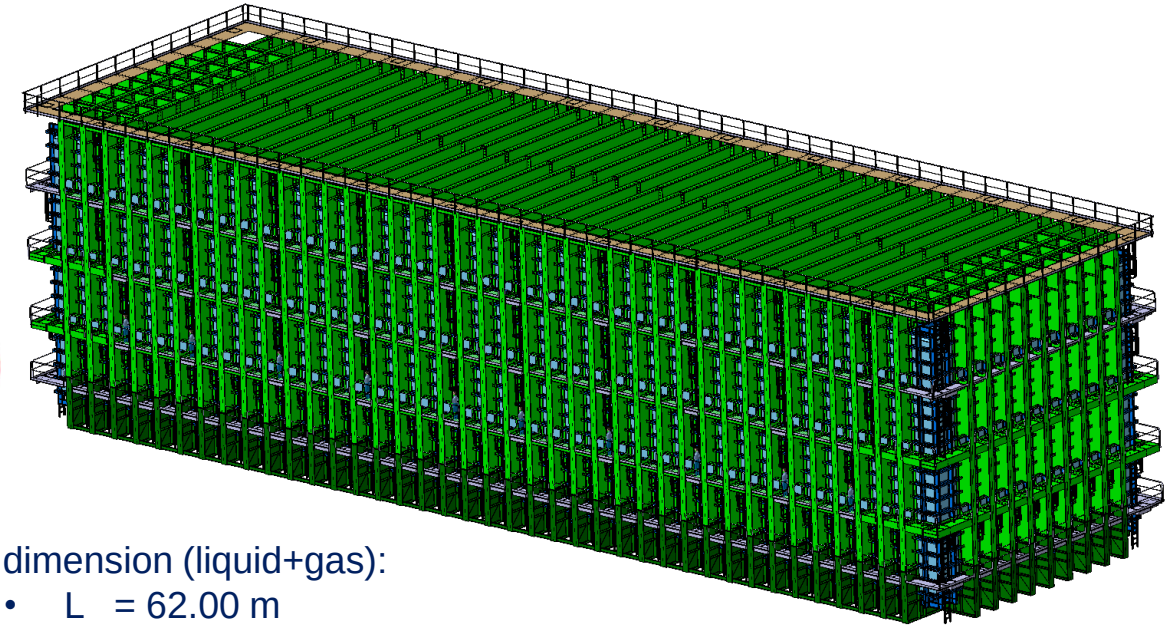
LBNF/DUNE long baseline

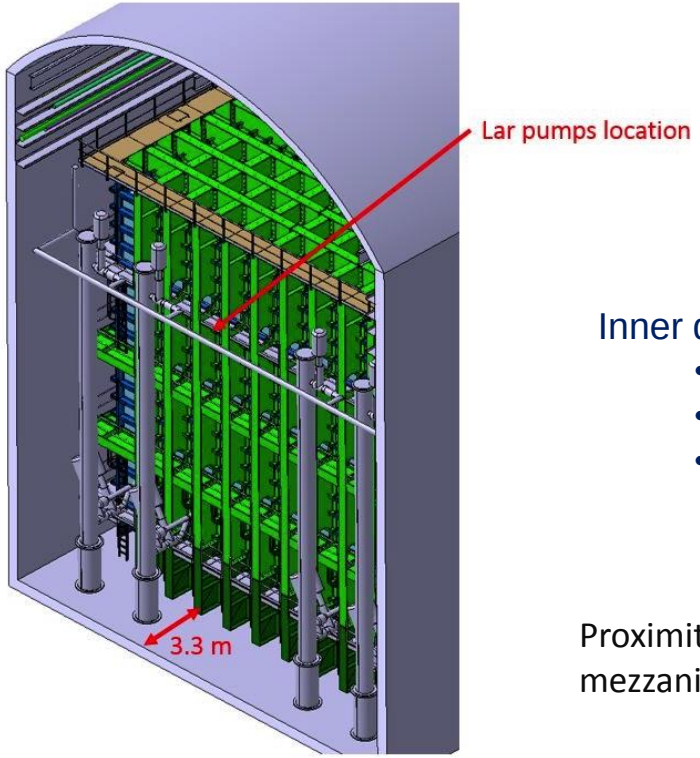




- Detector R&D
- Large Prototypes
- Membrane cryostats and cryogenics
- Detector construction

LBNF : cryostats (~18KT LAr)

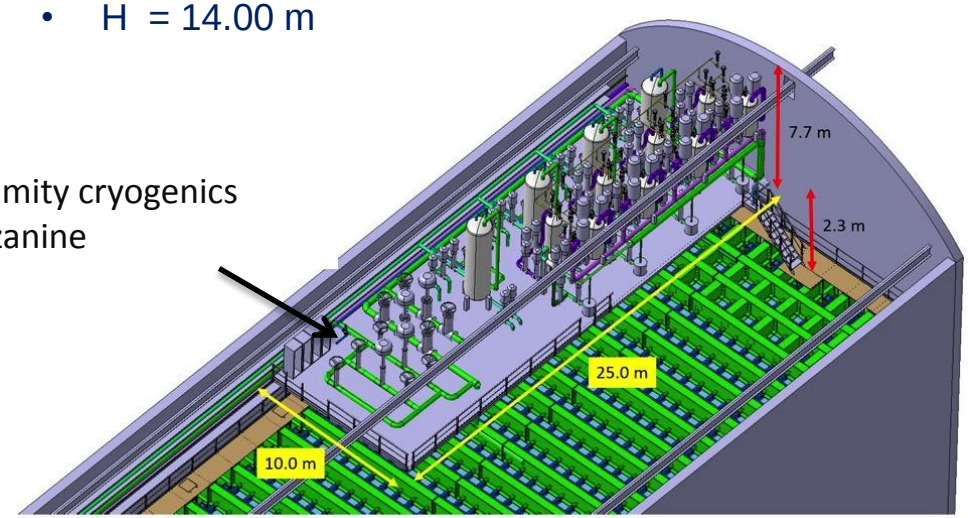




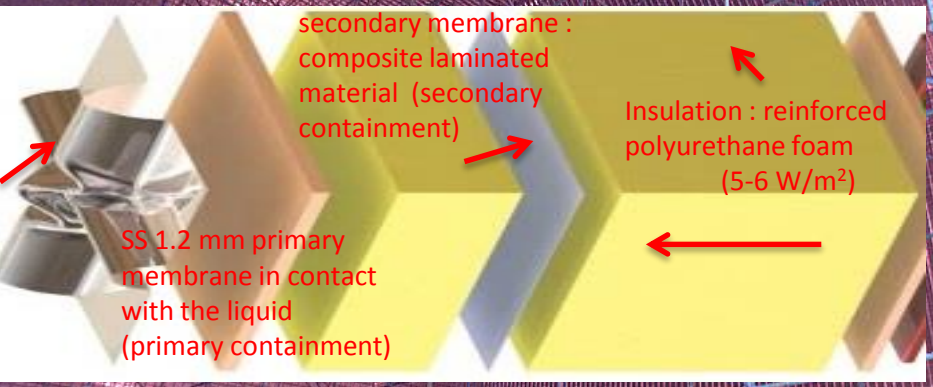
Inner dimension (liquid+gas):

- L = 62.00 m
- W = 15.10 m
- H = 14.00 m

Proximity cryogenics mezzanine

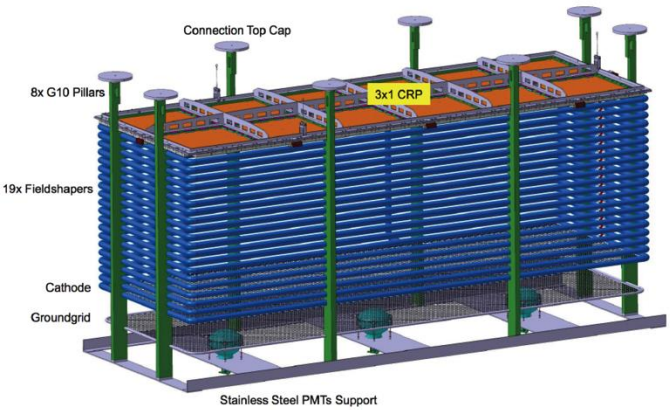


Then Cold Membrane Vessel (LNG industry technology)



NP02 3x1x1 demonstrator experience

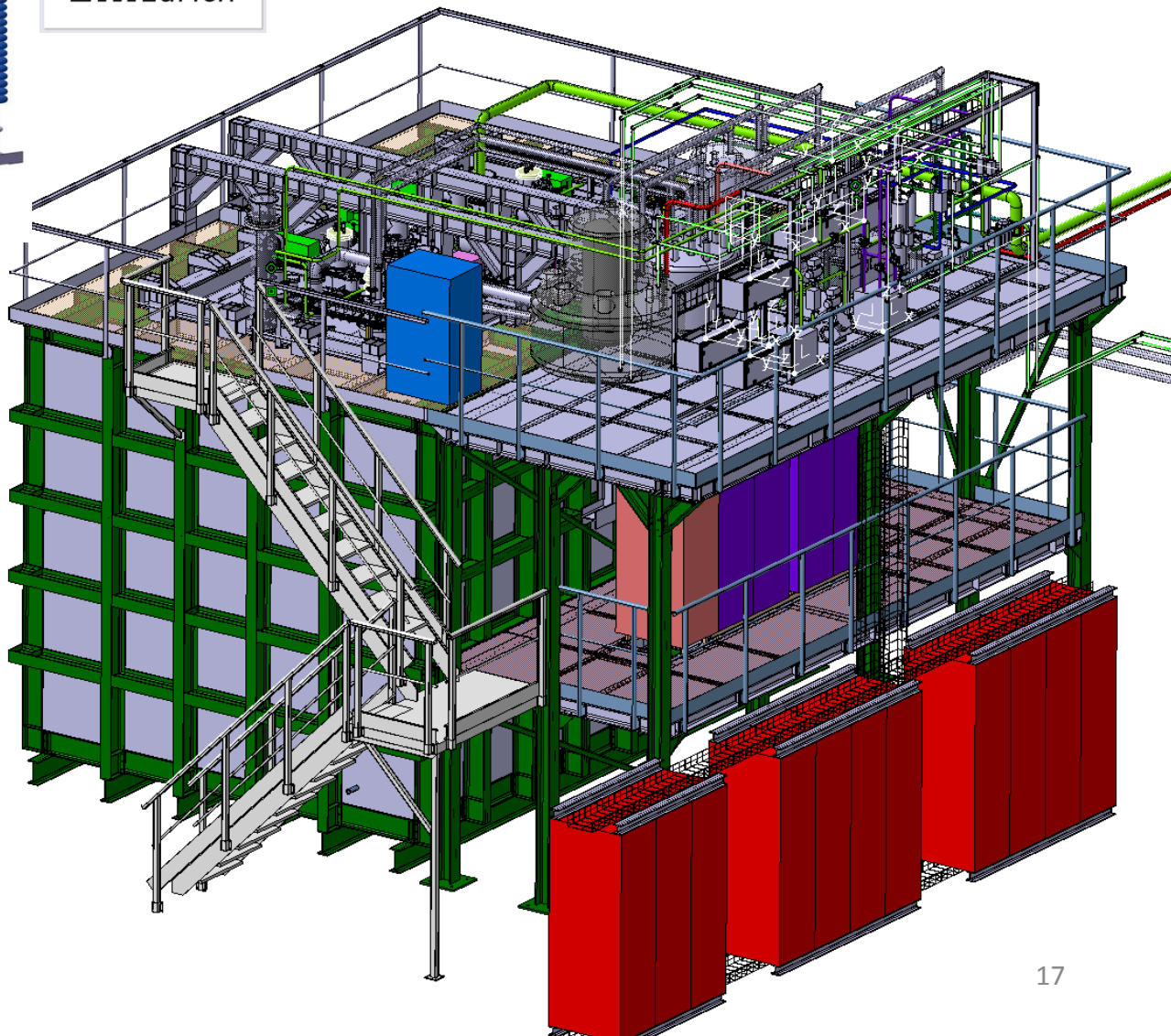
NP02 : WA105 LAr double Phase demonstrator



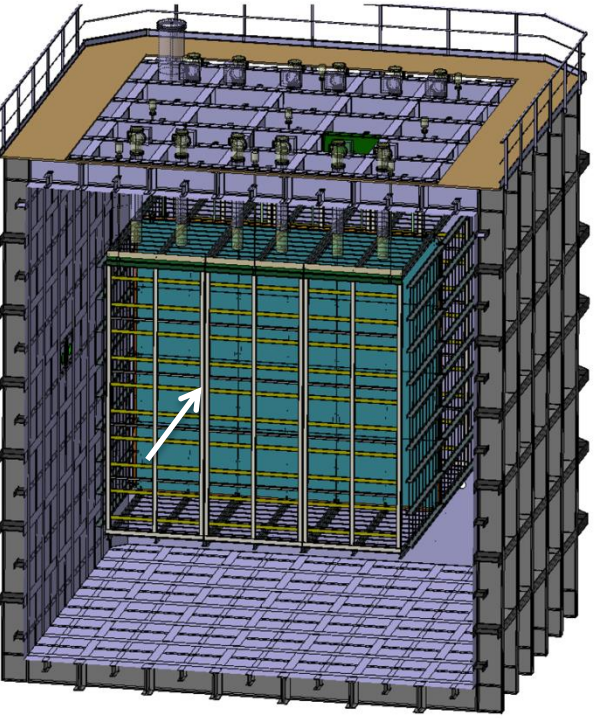
3x1x1 WA105 demonstrator module

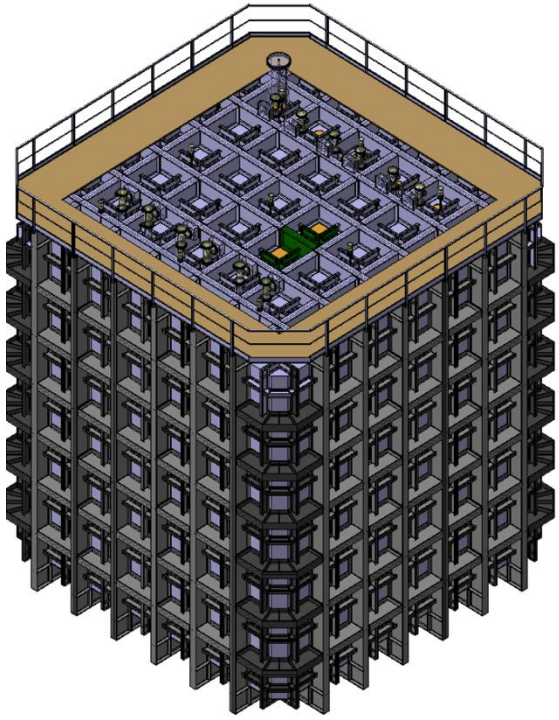
Ready to start cool down in the next few weeks!!

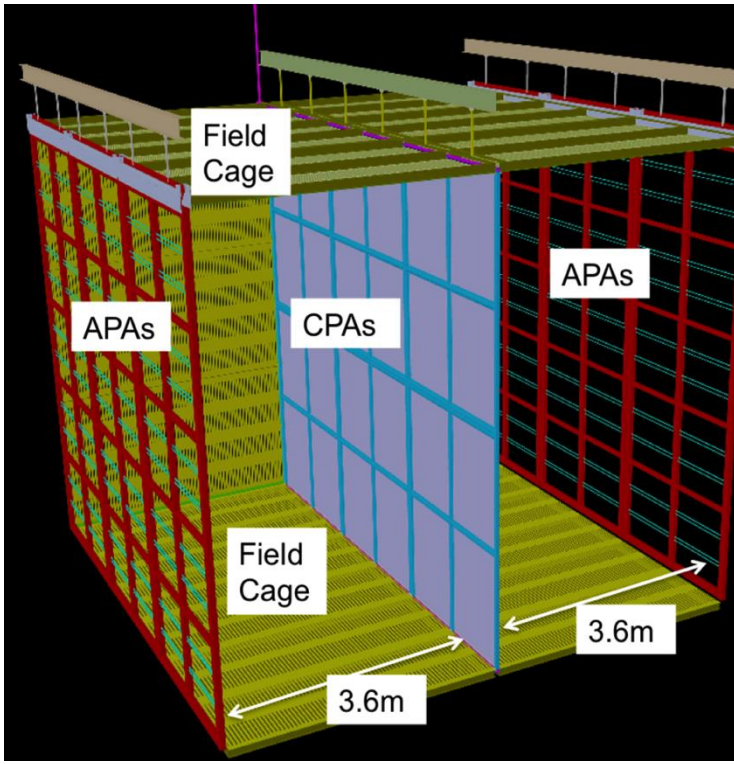
Experimental setup (cryostat, cryogenics, control system, DAQ)



Single phase protoDUNE





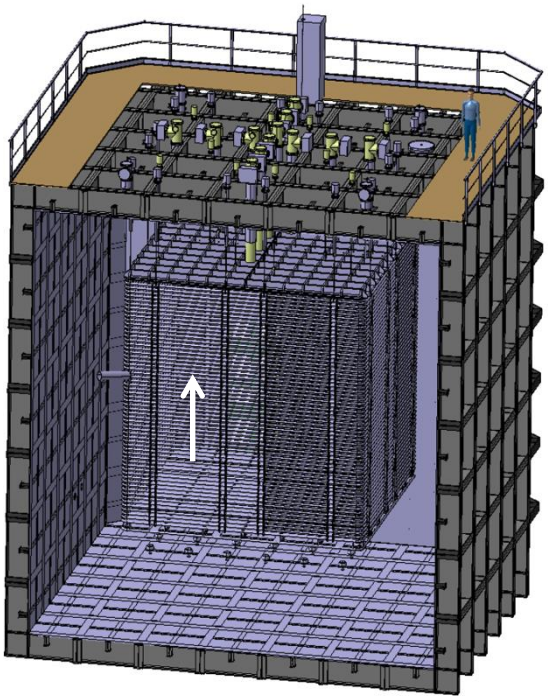


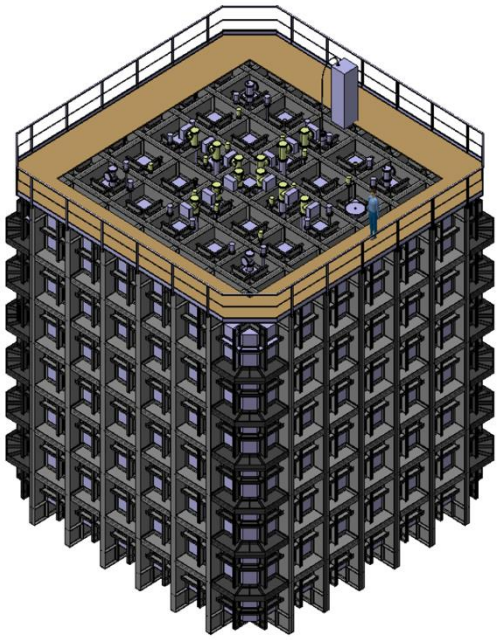
Single phase LAr TPC

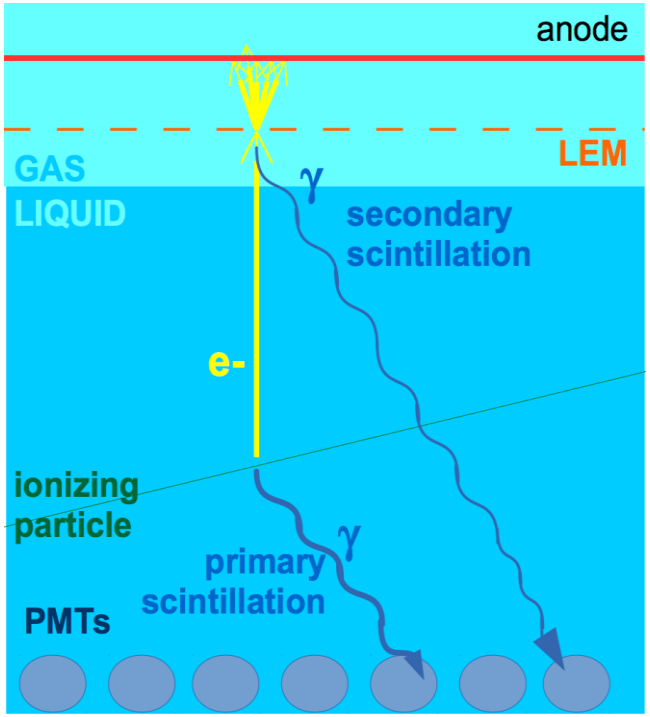
Operational in early 2018,
SPS calibration beams in 2018

Active volume ~ 7x7x6 m^3

Double phase protoDUNE







Double phase LAr TPC

Operational in early 2018,

SPS calibration beams in 2018

Active volume 6x6x6 m^3

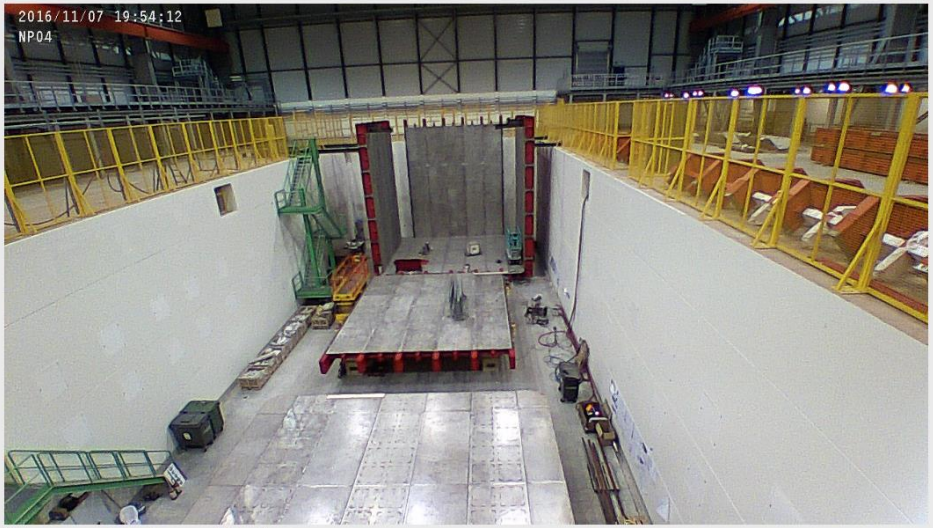
Building EHN1-extension, received the 6th of September from Civil Engineering

http://cenf-ehn1-np.web.cern.ch

Camera NP02

*Images updated every 30 minutes.

Camera NP04



*Images updated every 30 minutes.

Welcome to EHN1-Neutrino Platform Facility

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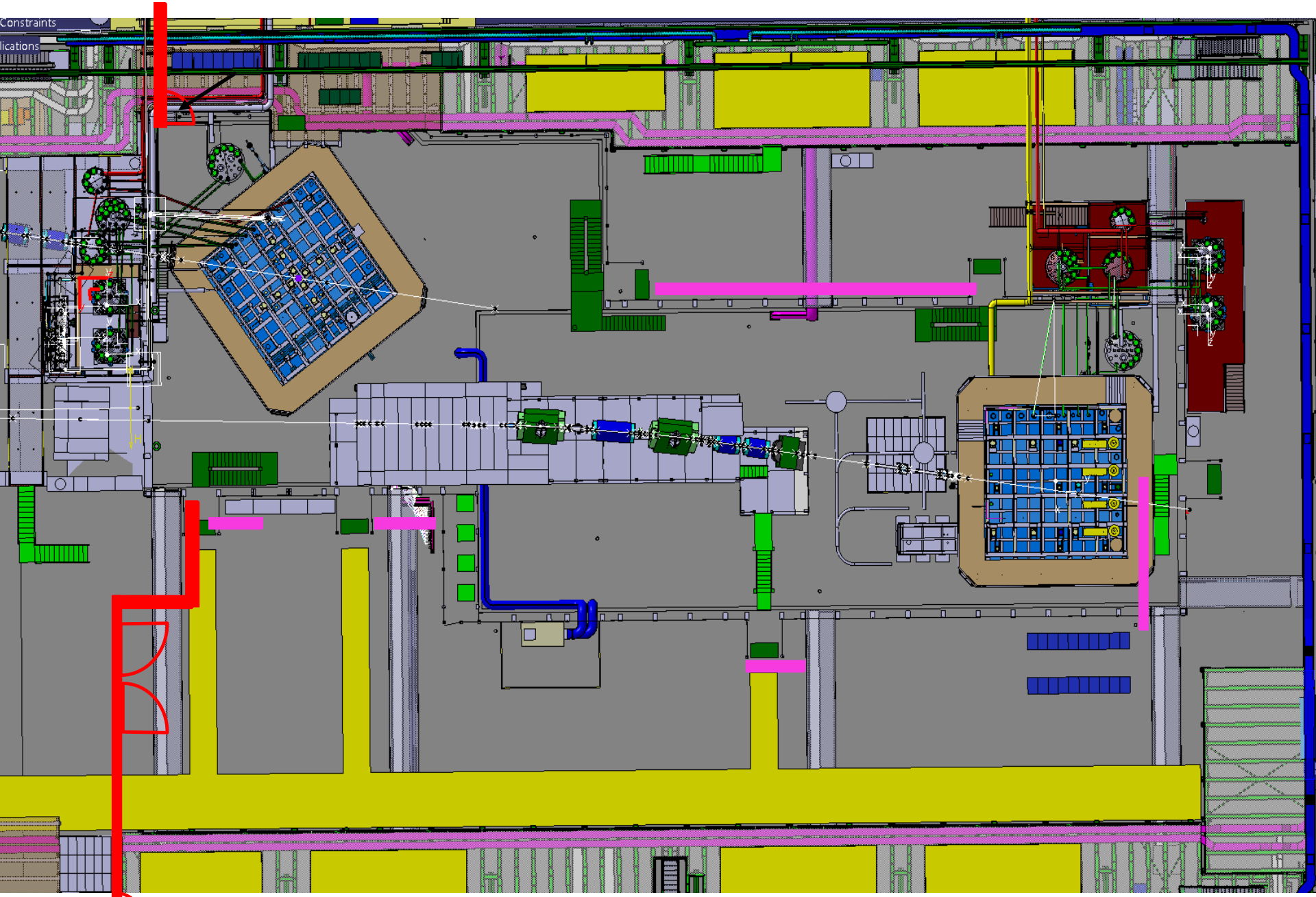
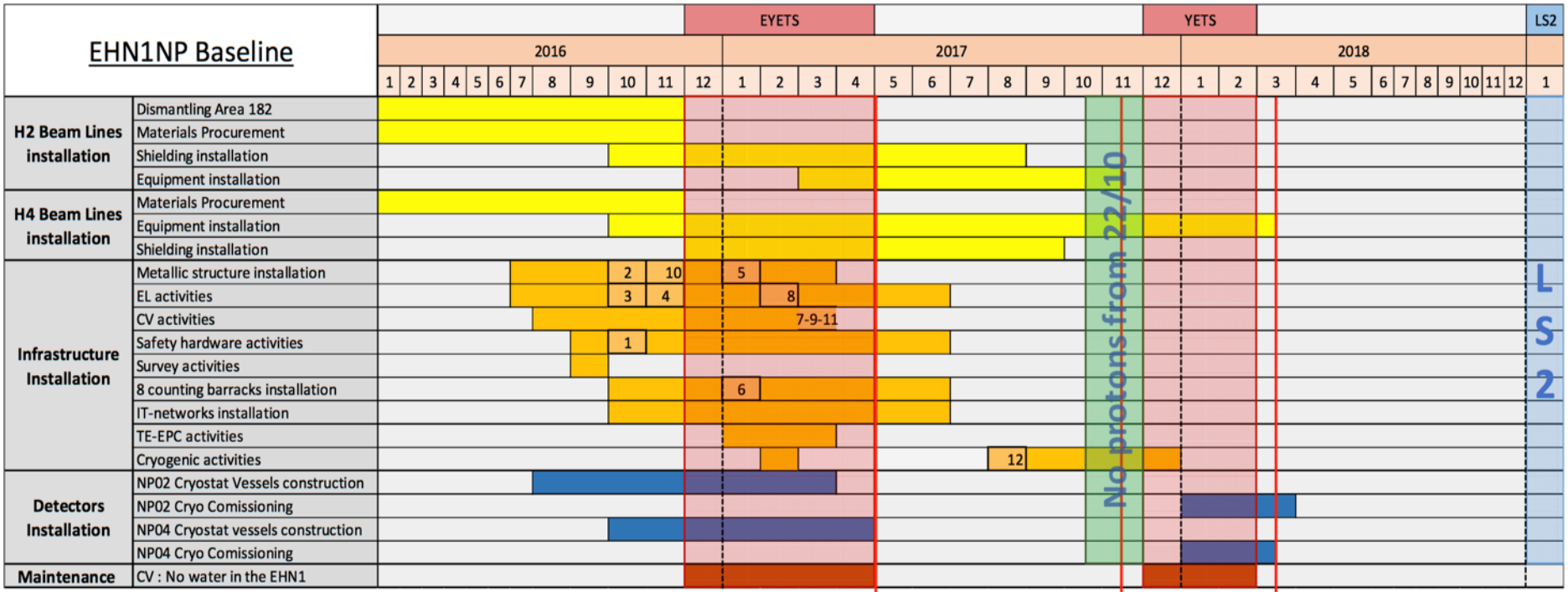
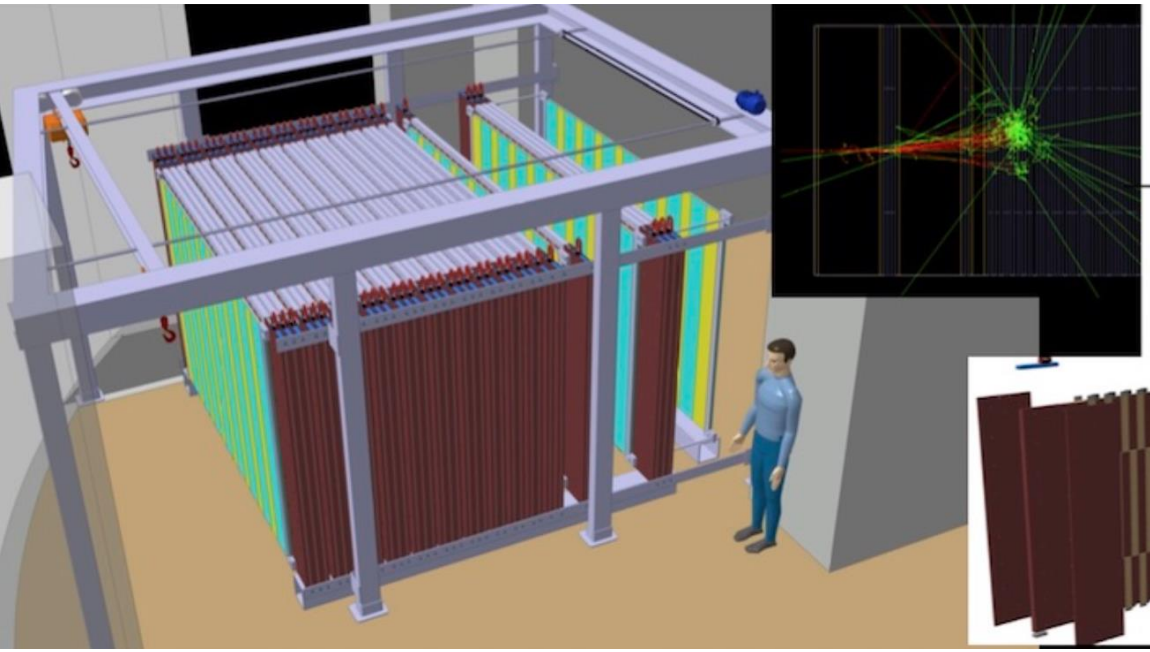

Constraints
lications

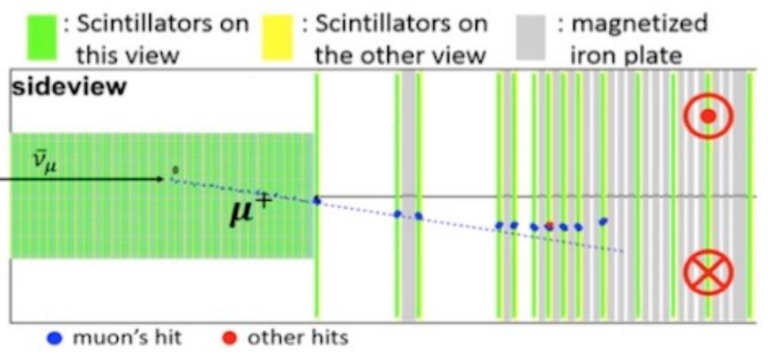
https://edms.cern.ch/document/1725184

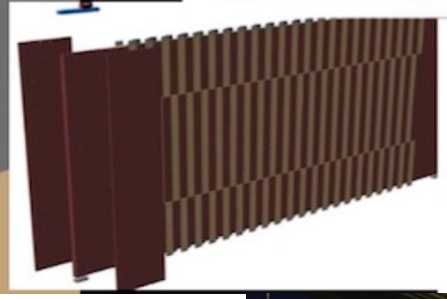


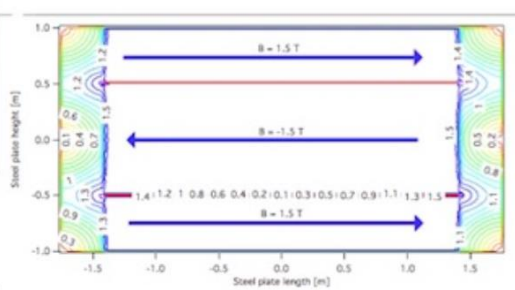
1 : All PPE and PPX doors (mechanics)
2 : All building doors (mechanics)
3 : Lights
4 : Cable trays in the trenches
5 : Access system including IMPACT (susy) after IT installation& cable campaign
6 : Baracks installed
7 : Building ventilation
8 : Electricity in the barracks
9 : Water cooling in 2 baracks for computing
10 : Mechanical platforms to reach the top of the detectors
11 : LAr extraction in the pits
12 : Cryogenics areas ready for installation

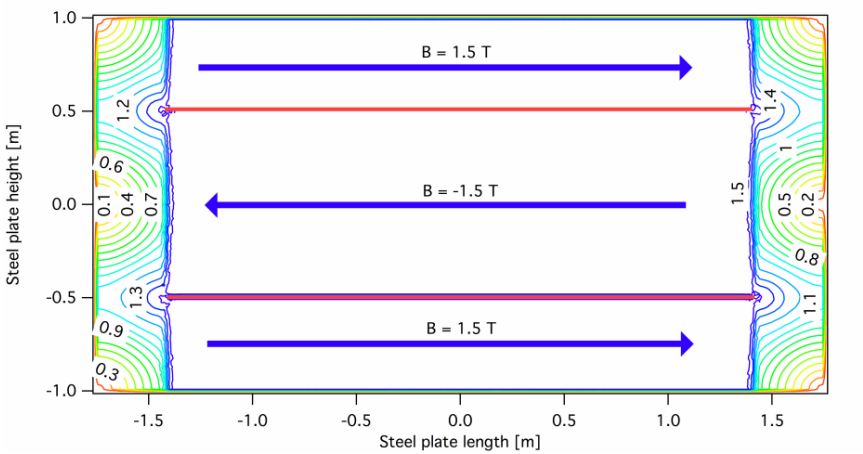
NP05: Baby Mind, a muon spectrometer for the WAGASCI experiment at T2K











CERN Neutrino Platform effort summary

- Unique opportunity to rebuild a strong European Neutrino community
- Immediate physics potential with the exploitation of the short baseline at FNAL and the T2K new near detector
- Major contribution to the infrastructure of LBNF
- Design and construction of new large detector prototypes
- Generic R&D on new detectors and data handling
- Participation in the construction, commissioning and physics exploitation of the new high intensity facilities