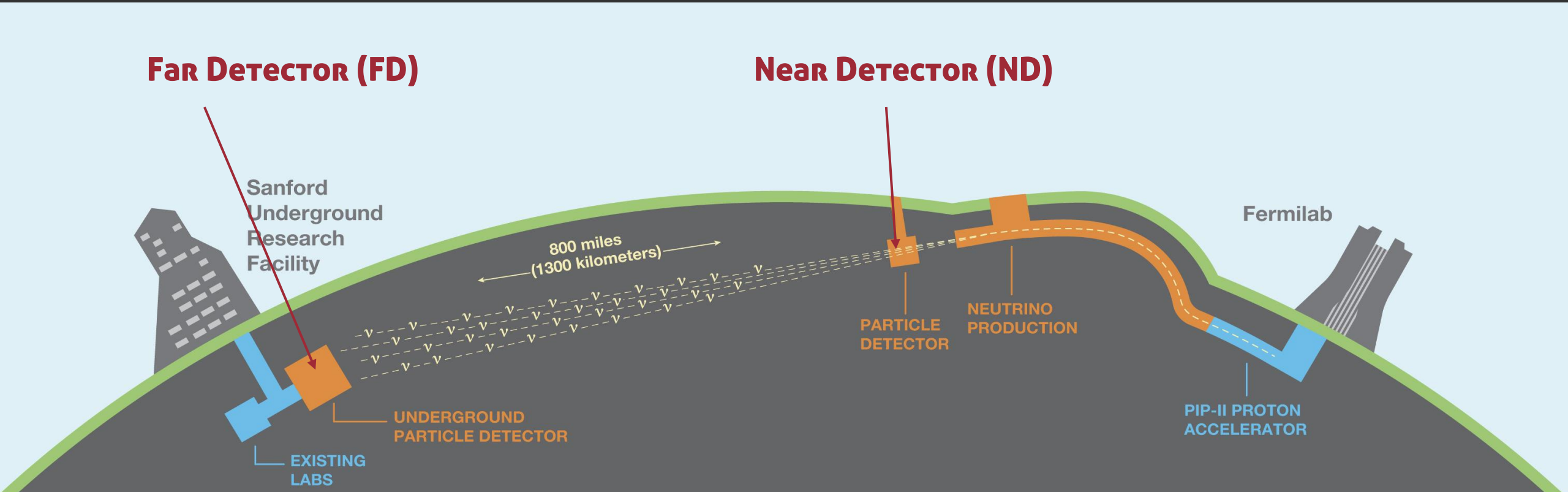
DUNE
NU_AT_FNAL

neutrino oscillation study with
Long Baseline Neutrino Facility at FNAL

DUNE

- Oscillazione del neutrino con fascio
- Studio di neutrini da Supernovae
- Decadimento del protone

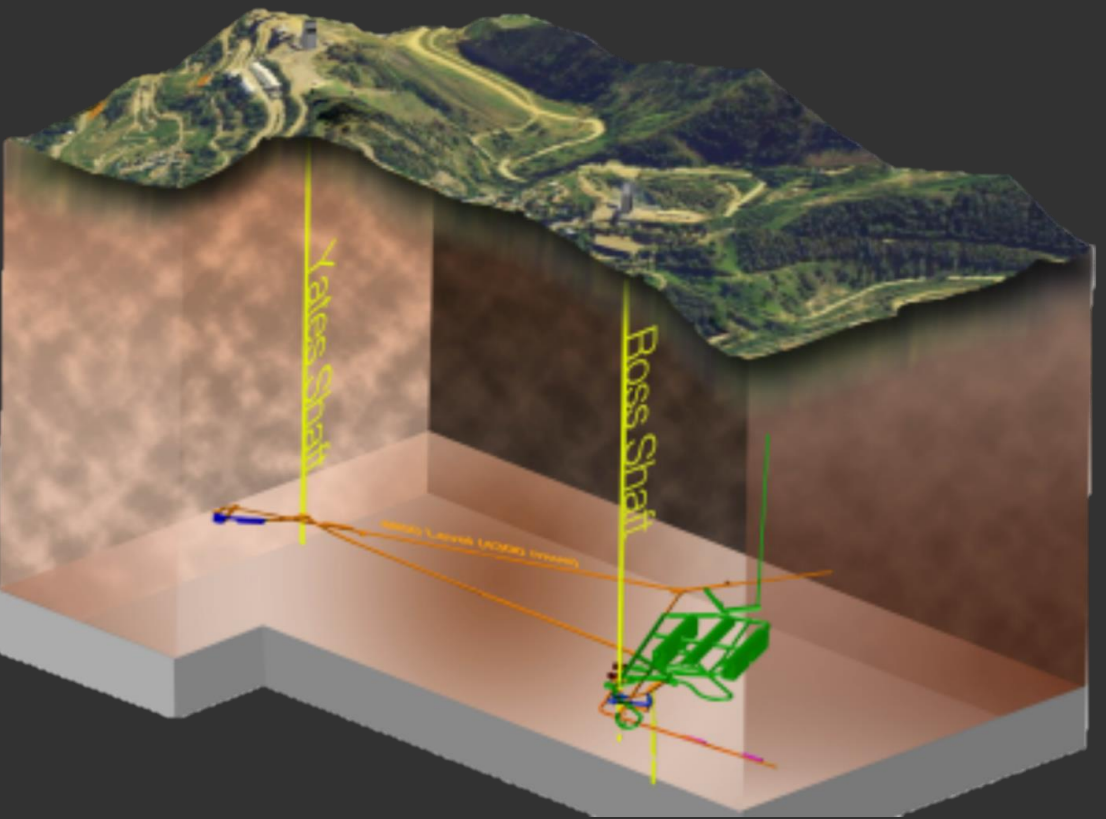


DUNE PHYSICS

CP Violation

$$\delta_{CP} \sim P\left(\nu_\mu \rightarrow \nu_{e,\tau}\right) - P\left(\bar{\nu}_\mu \rightarrow \bar{\nu}_{e,\tau}\right)$$

Far Detector (FD)
Homestake Gold mine
South Dakota



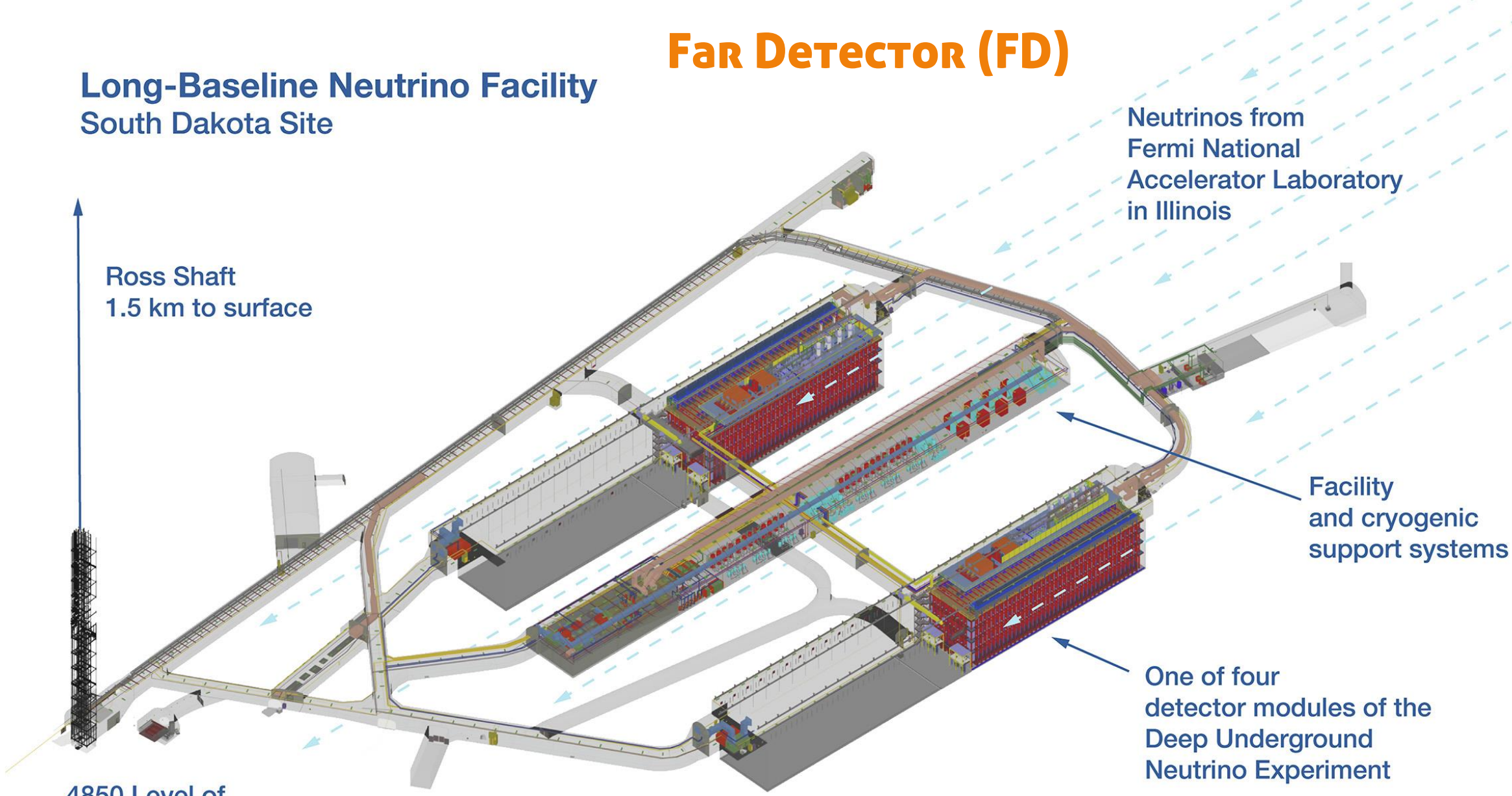
Matter Effect

even w/o CPV $\qquad \delta_{CP} \neq 0$

Short Baseline $\rightarrow$ neglet Matter Effect

Long Baseline $\rightarrow$ measure Matter Effect

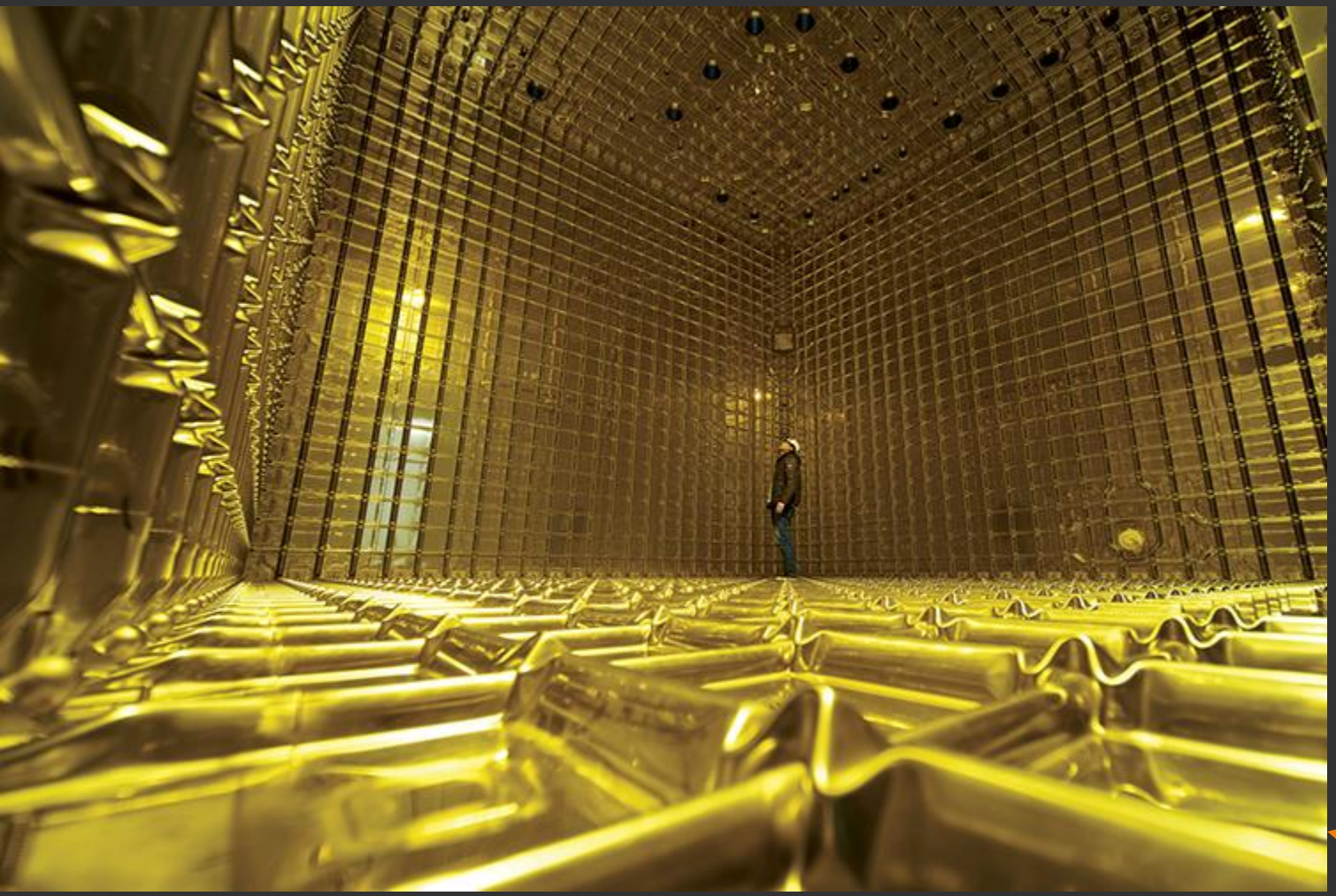
Far Detector (FD)



1.2 MW beam
40 kt LAr target

→ **120 kt · MW · yr by 2035**

Far Detector (FD)



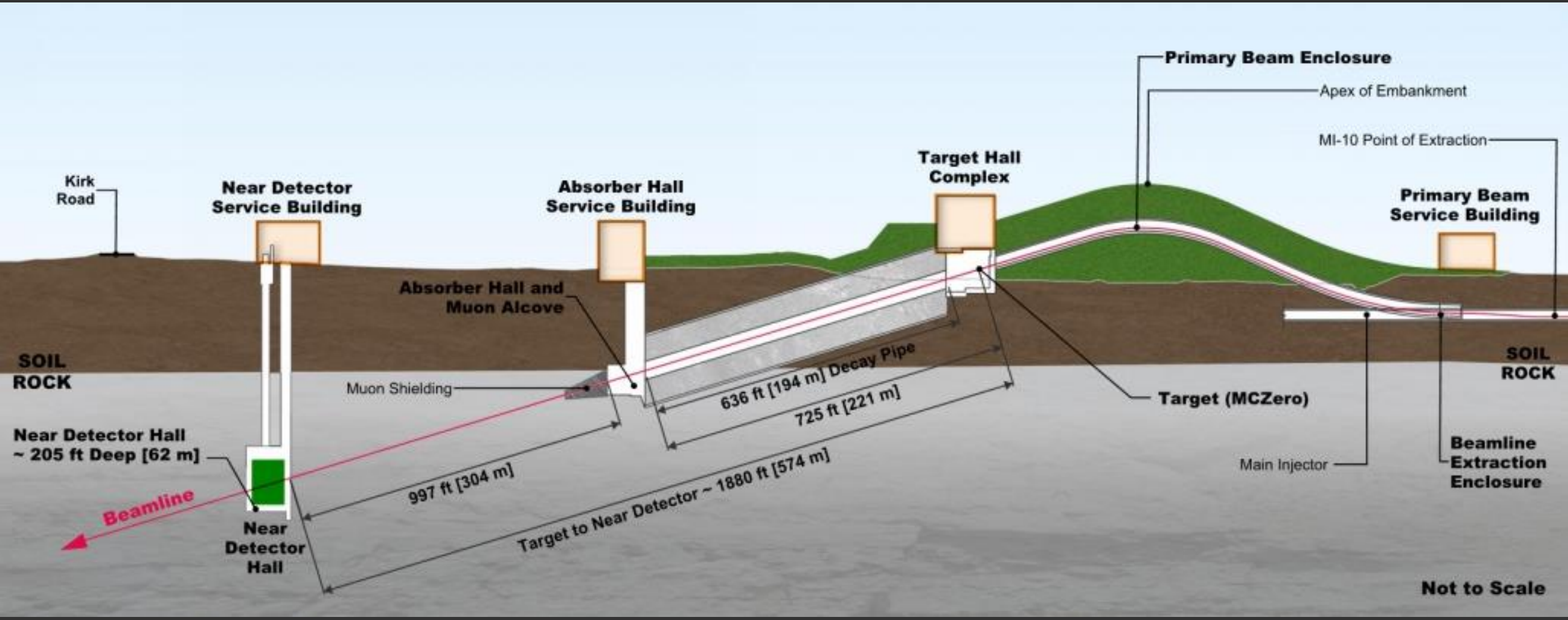
4 LAr TPC
70 kt total volume
40 kt fiducial volume

doppia lettura
elettroni/fotoni

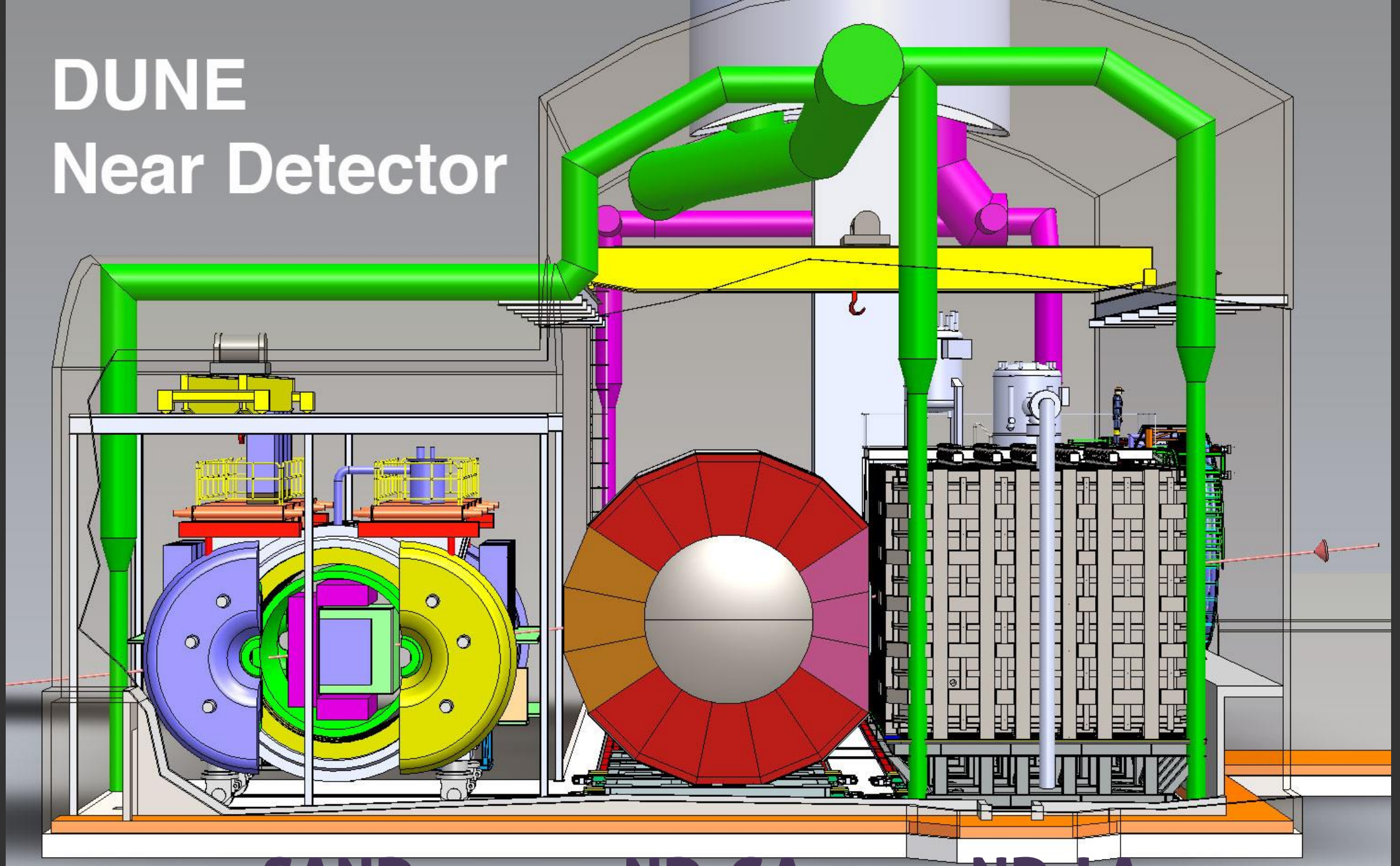
INFN (MIB) in charge of
design and construction of
Photon Detection System

ProtoDUNE
2 x 1 kt LAr TPC at SPS

Near Detector (ND)

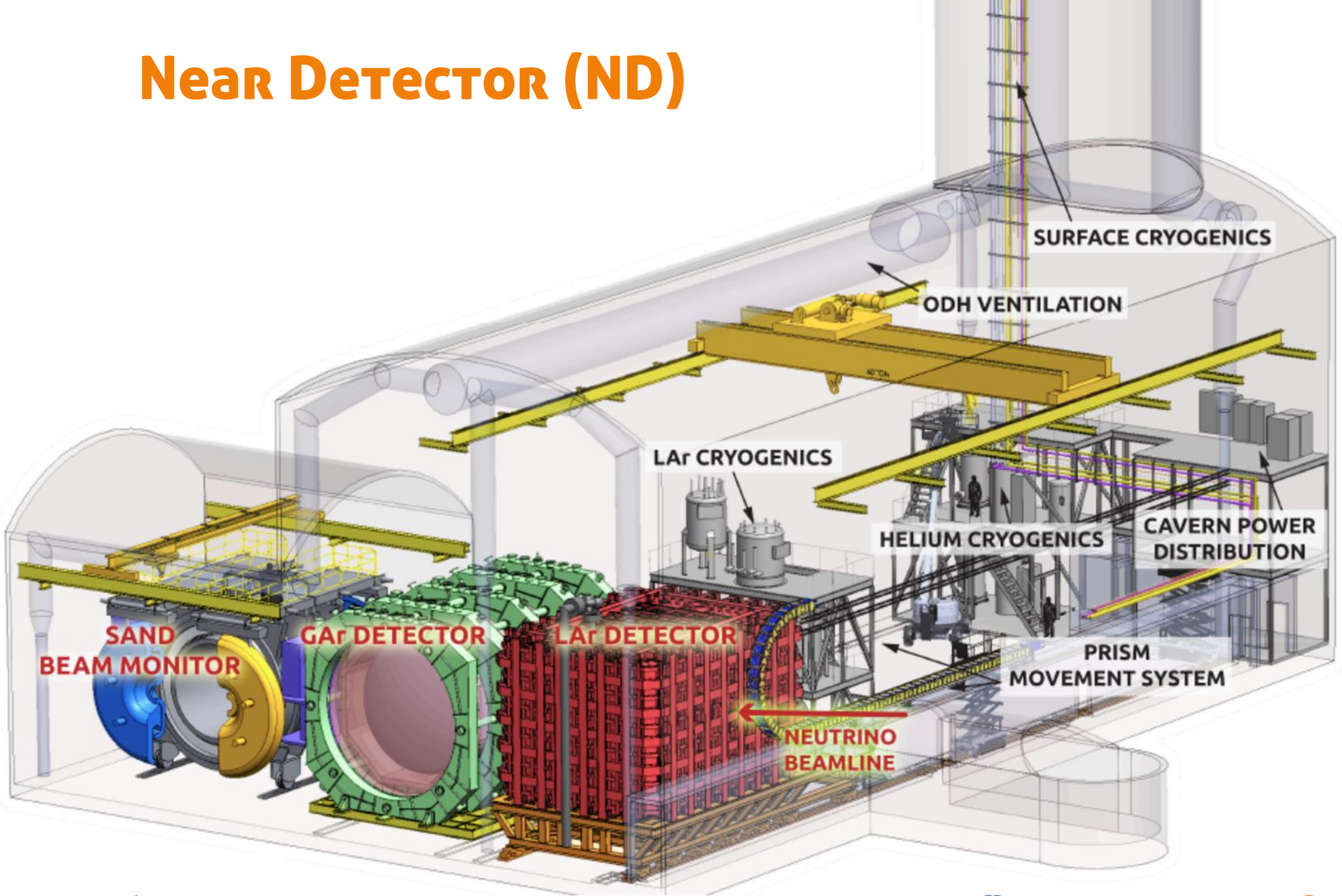


DUNE
Near Detector

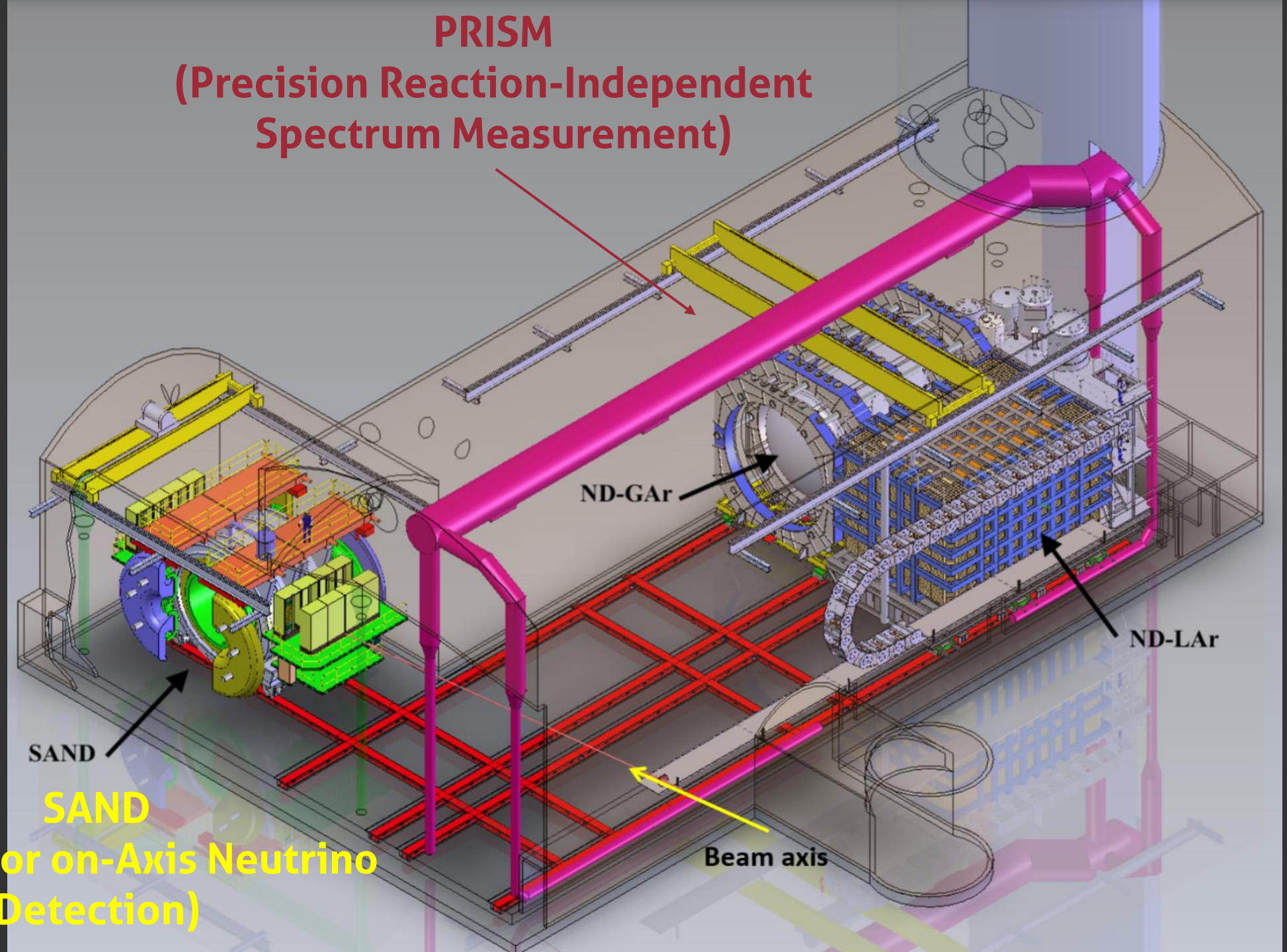


SAND ND-GAr ND-LAr

Near Detector (ND)

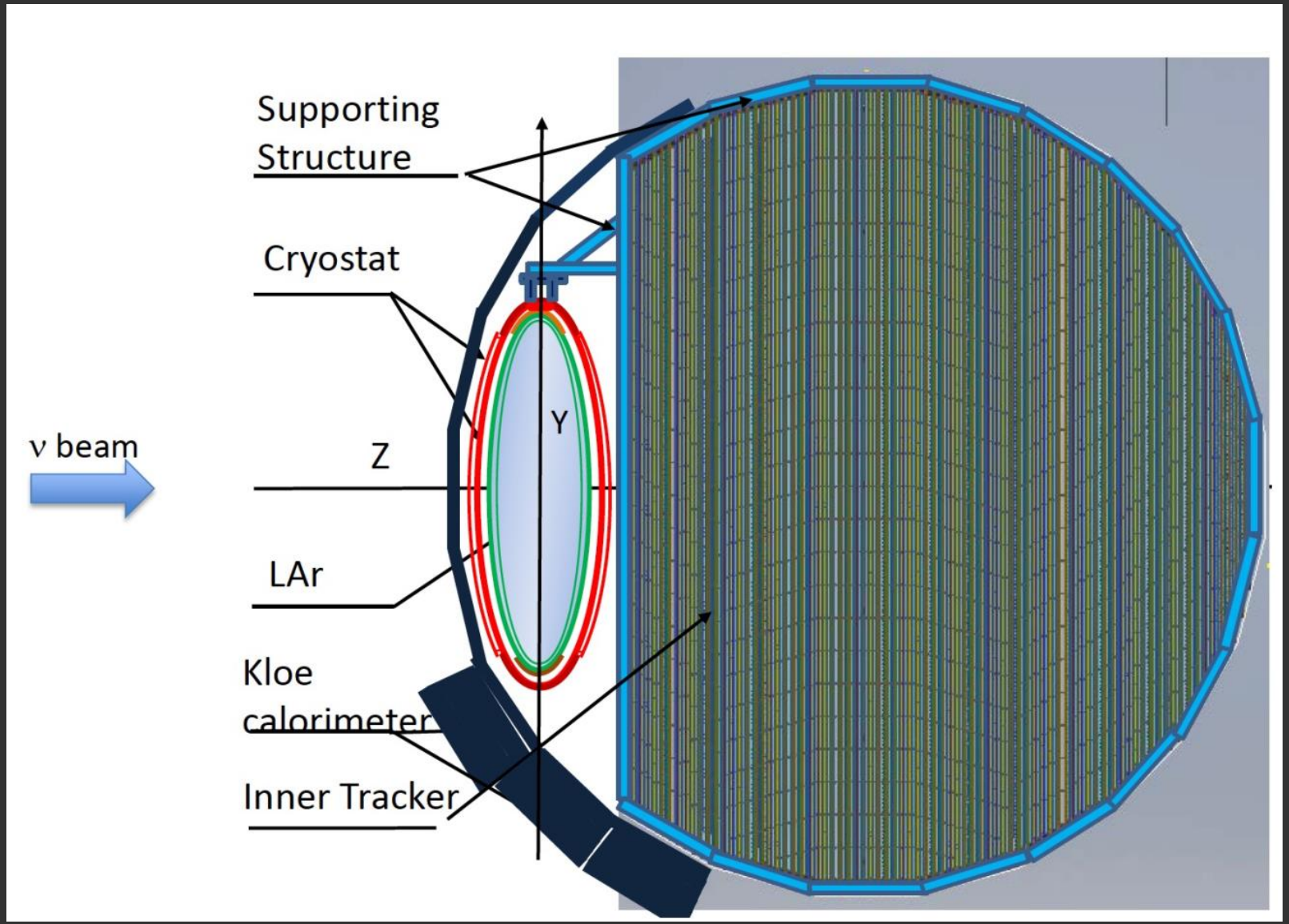


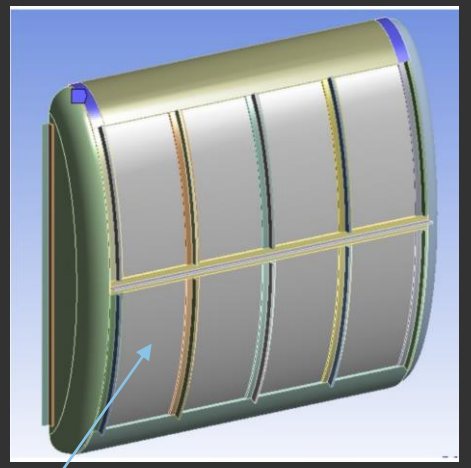
PRISM
(Precision Reaction-Independent Spectrum Measurement)



SAND
(System for on-Axis Neutrino Detection)

SAND subdetectors



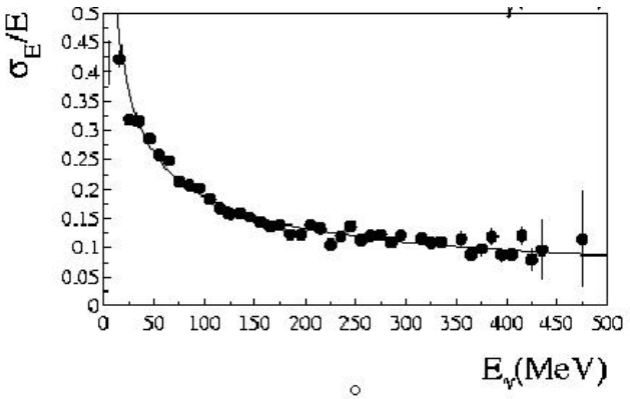


- LAr target
- Straw Tubes Tracker
- Electromagnetic calorimeter
- 0.6 T magnetic field

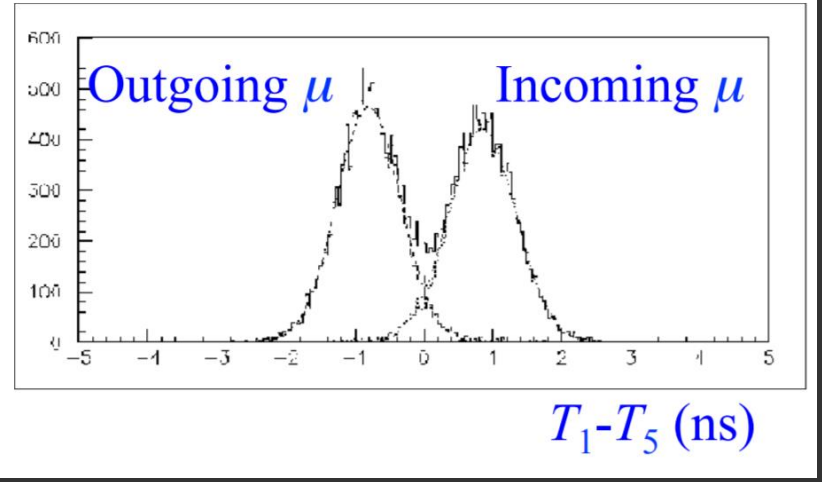
KLOE
EMC + coil + yoke

KLOE EMC performance

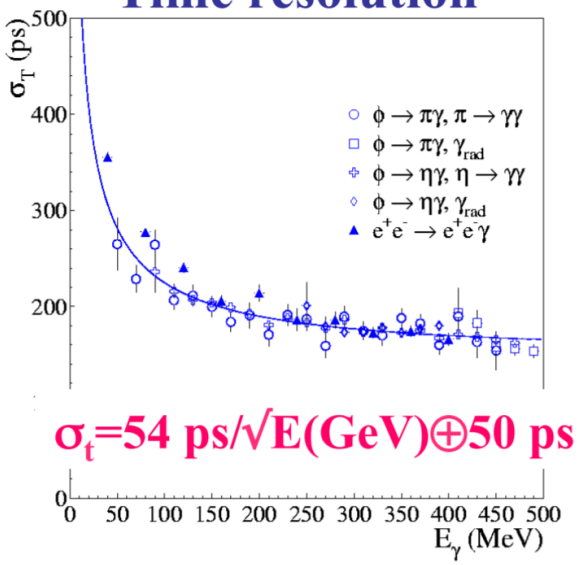
Energy resolution:
$\sigma_E/E=5.7\%/\sqrt{E(GeV)}$



cosmic muons discrimination

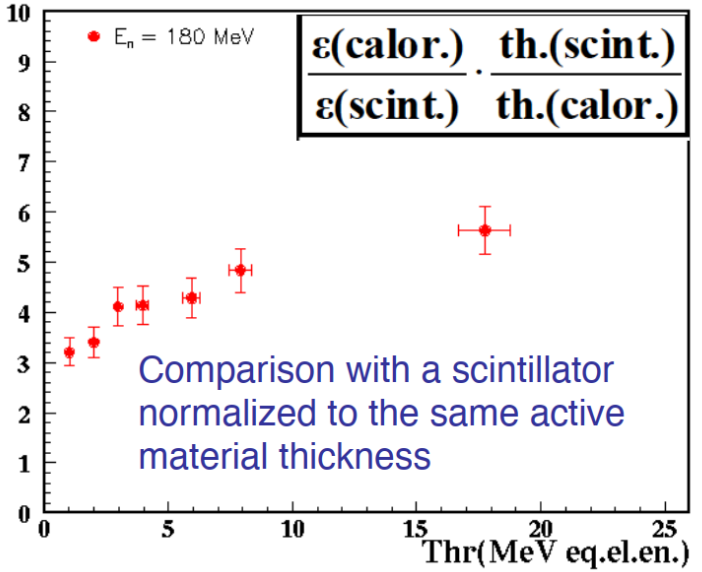


Time resolution

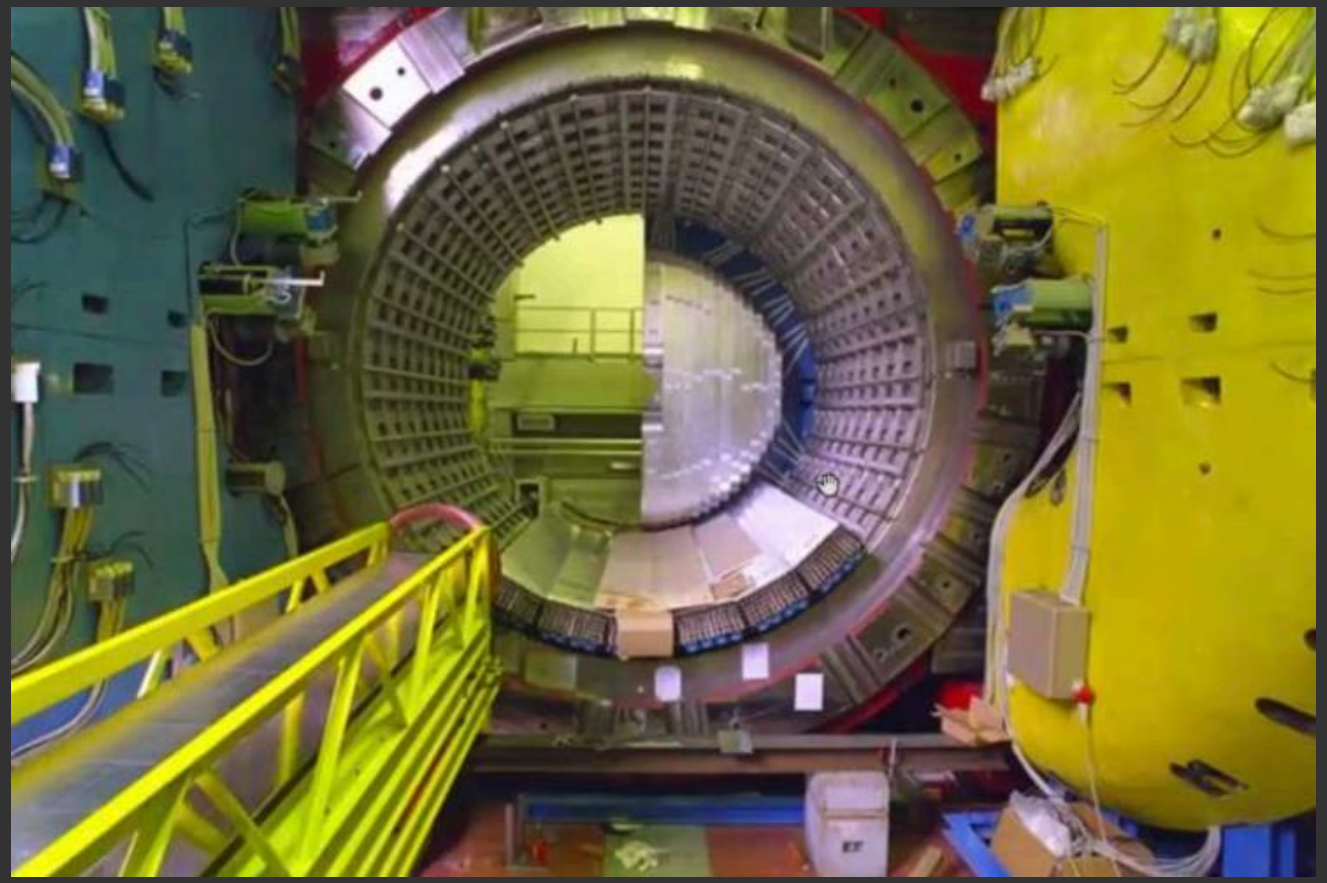


$\sigma_t=54\ ps/\sqrt{E(GeV)}\oplus 50\ ps$

neutrons detection



KLOE → SAND



- remove Drift Chamber (and find a location for exhibit)
- dismounting 24 barrell modules and 2x32 endcaps modules
- store EMC modules at LNF
- ship EMC to FNAL

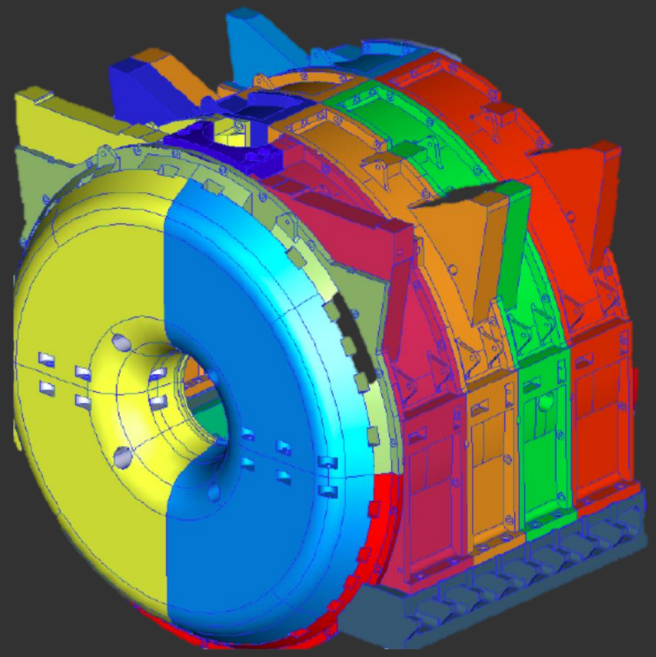
- refurbish/rebuild all tools
- test/replace/clean up PMTs

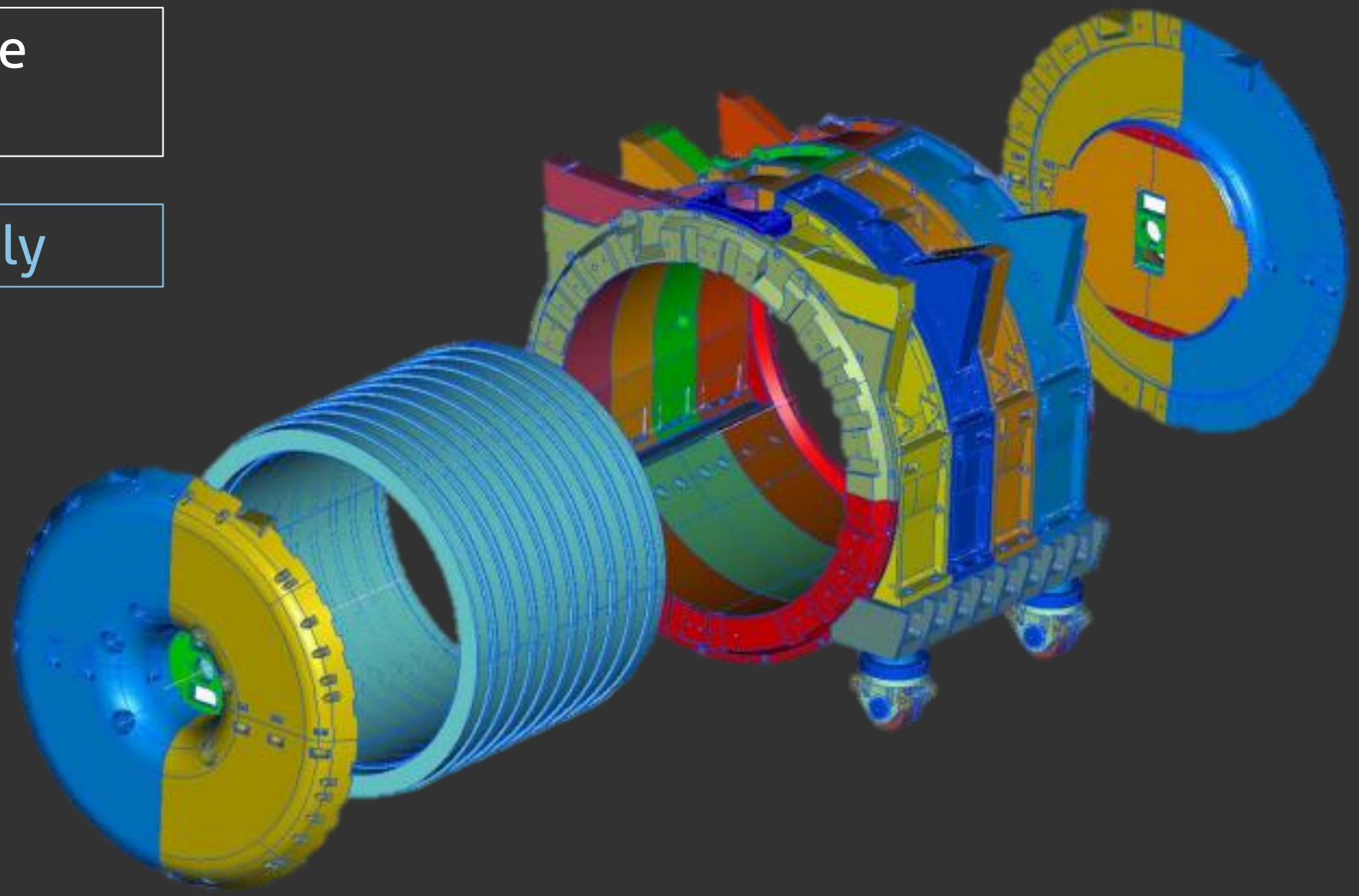
- define new LV/HV/FE/trigger

KLOE → SAND

- dismount coil and iron yoke
- ship magnet to FNAL

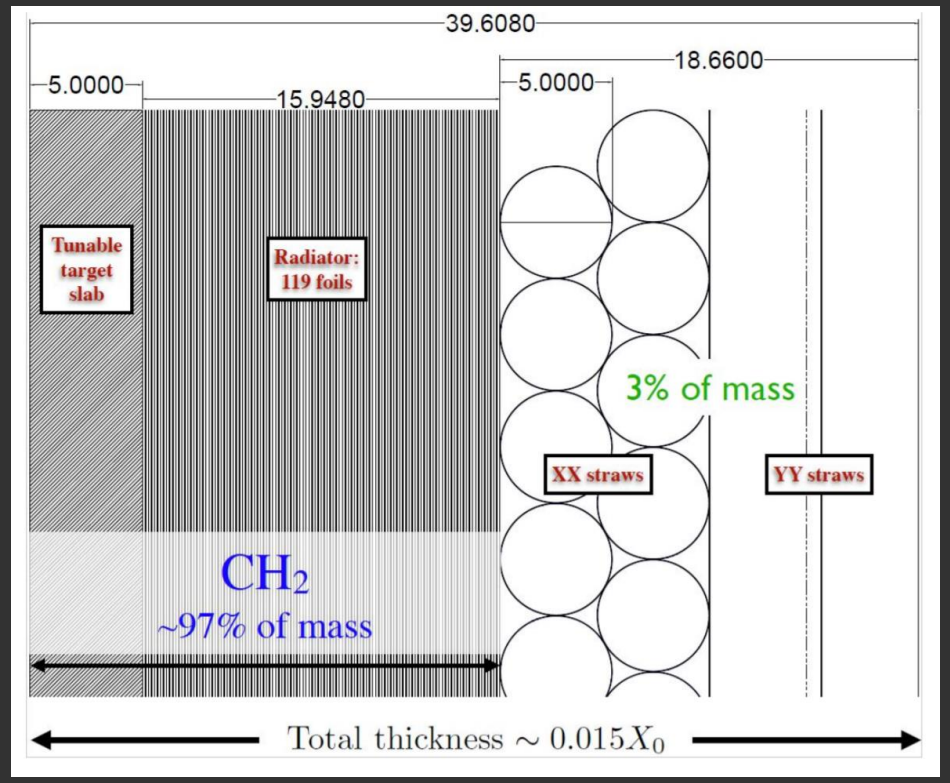
- renew magnet power supply



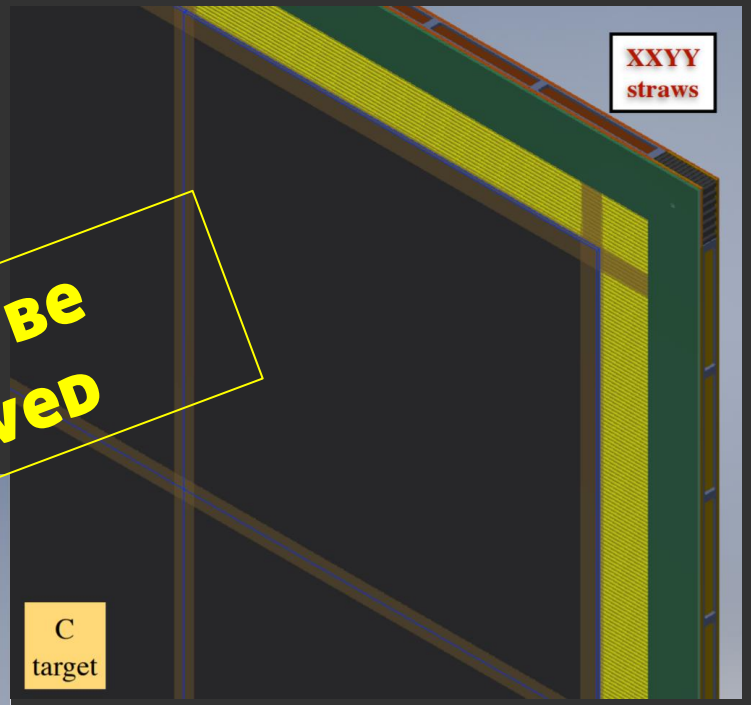


KLOE → SAND

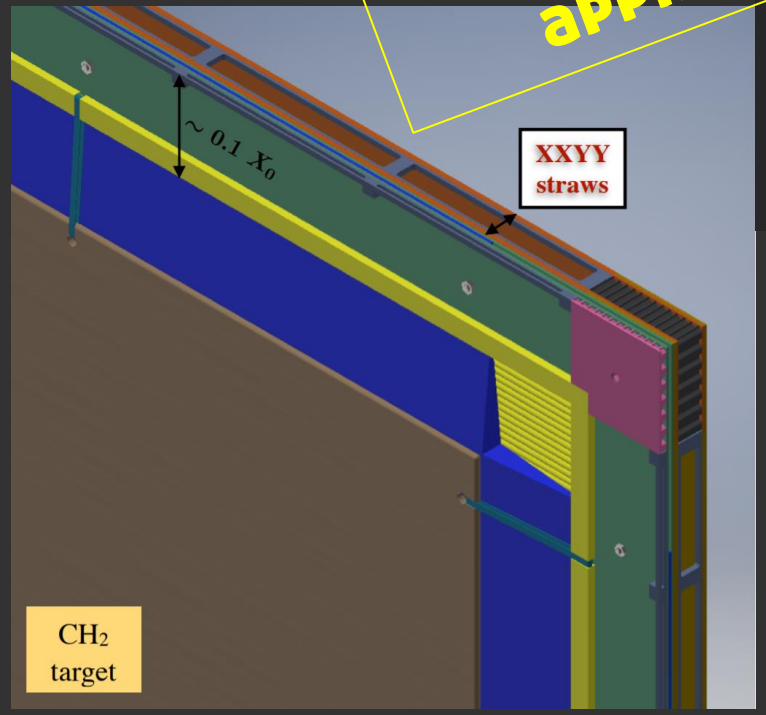
SAND Straw Tube Tracker



«solid hydrogen» target
C and CH_2 subtraction after kinematic selection



STILL TO Be aPPROVeD



- 5 t fiducial mass
- 90 modules
- 2023-25 production in (at least) 3 sites

2022

costruzione Modulo-0 a LNF (70k€)

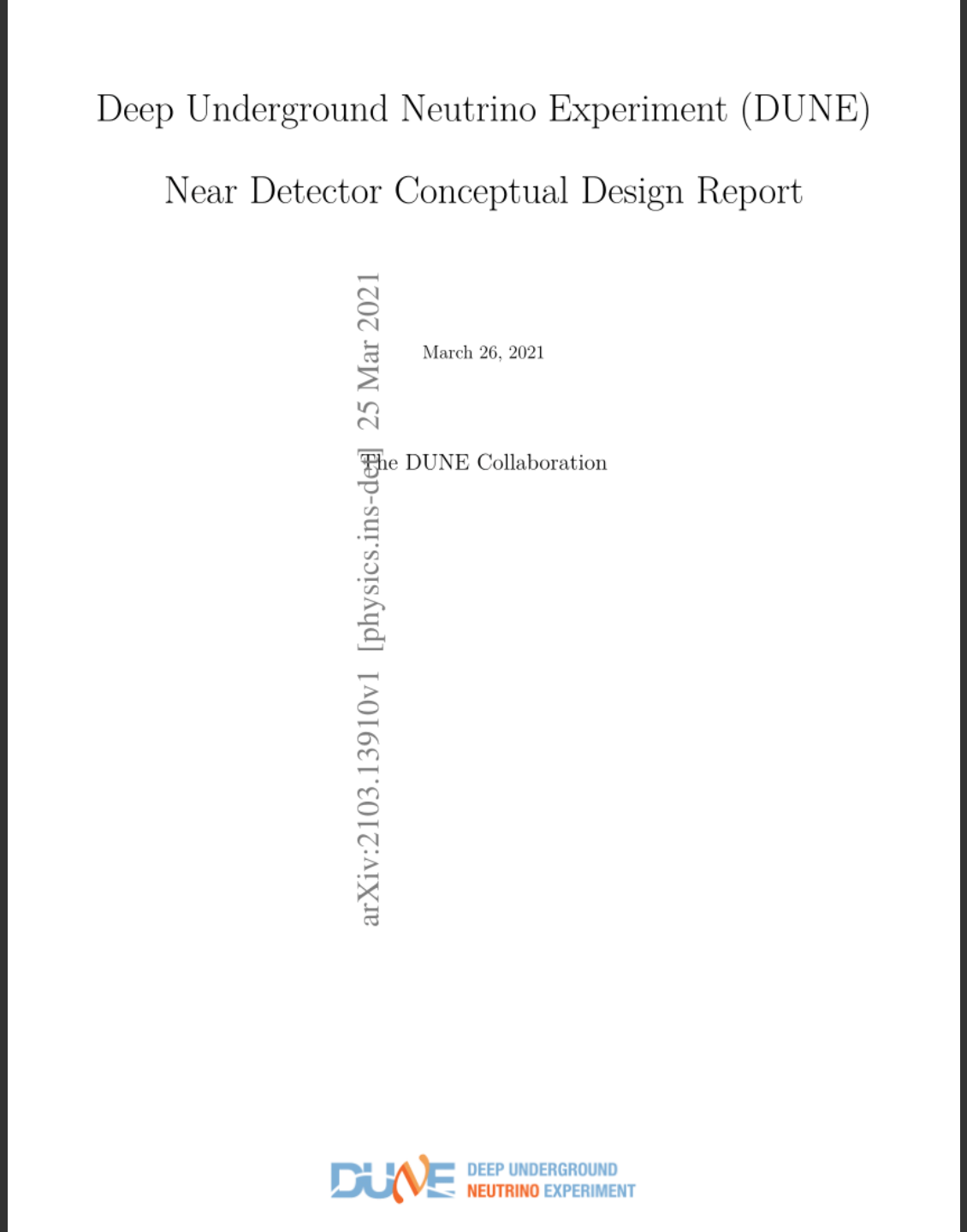
DUNE Timeline and People

H1 2022	H2 2022	H1 2023	H2 2023	H1 2024	H2 2024	H1 2025	H2 2026	H1 2027	H2 2027	H1 2028	H2 2028	H1 2029	H2 2029
dismounting KLOE ECAL + Magnet					shipping ECAL to FNAL		SAND mounting cabling commissioning					Day1 data taking →	

D. Domenici	40% resp. loc.
S. Miscetti	10%
S. Giovannella	10%
F. Happacher	10%
I. Sarra	10%
E. Diociaiuti	10%
L. Benussi	10%
M. Iliescu	??

Richieste

- 8k€ missioni
- 20k€ consumo
- 2mu tecnico per supporto scablaggio KLOE



Near Detector Conceptual Design Report

https://arxiv.org/abs/2103.13910

ESPP Scientific Recomendations

- Full exploitation of the physics potential of LHC and high-luminosity LHC
- Highest-priority next collider: e+e Higgs factory
- Increased R&D on accelerator technologies: high-field superconducting magnets, high gradient accelerating structures, plasma wakefield, muon colliders, ERL, etc.
- Investigation of the technical and financial feasibility of a future ≥ 100 TeV hadron collider at CERN, with e+e - Higgs and electroweak factory as a possible first stage
- Support to long-baseline neutrino projects in US and Japan, in particular successful implementation of DUNE at LBNF
- Support to high-impact scientific diversity programme complementary to high-E colliders
- Support to R&D on detector, SW and computing, as crucial tools for the field
- Support to theory as an essential driver for particle physics