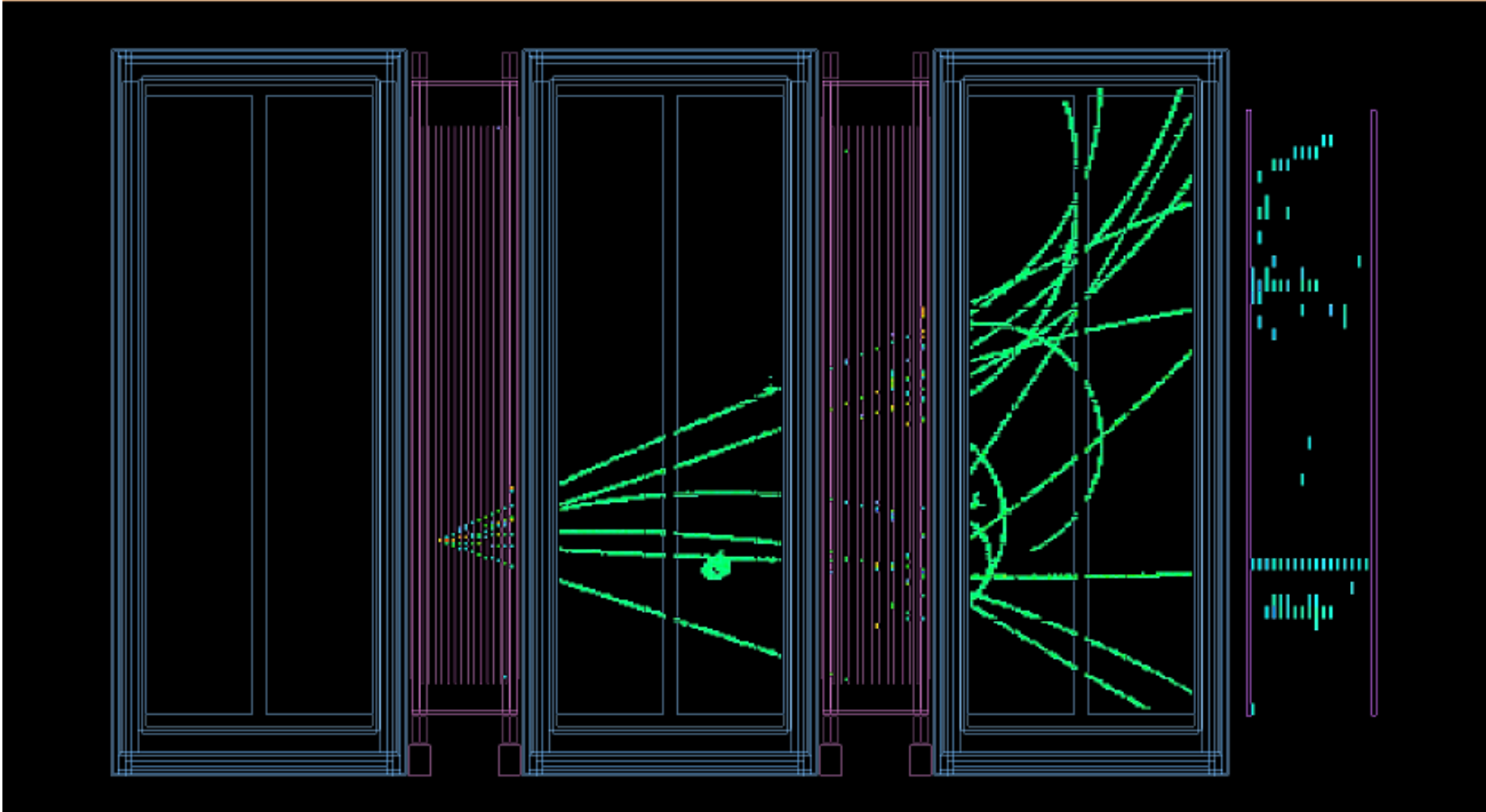


Workshop on neutrino near detectors based on gas TPCs

Goals of the workshop

Event number : 110284 | Partition : 63 | Run number : 4200 | Spill : 0 | SubRun number : 25 | Time : Mon 2010-03-22 14:06:35 JST | Trigger : Beam Spill





We are happy to welcome >70 participants from

**Armenia,
CERN,
France,
Germany,
Greece,
Italy,
Japan,
Netherlands,
Poland,
Spain,
Sweden,
Switzerland,
Russia,
UK,
USA**

**PLEASE REGISTER IF YOU ARE ATTENDING
AND ESPECIALLY IF YOU ARE GIVING A TALK!**



Near detector challenges

Measure event rates at the near detector for the various channels of relevance for the oscillation analyses -- as normalization or as background

- Charged Current interactions of ν_μ $\bar{\nu}_\mu$ ν_e $\bar{\nu}_e$
- neutral current interactions

Within the same phase space, same target & same flux (+ small corrections) than in the far detector

- Differences lead to systematic errors
- Differences in neutrino spectrum due to oscillations are unavoidable

Provide enough information to understand the effects resulting from the flux shape difference

- in particular the energy response function $P(E_\nu^{\text{rec}} - E_\nu^{\text{true}})$
- or more information to help build a reliable model of neutrino interactions

Provide enough information to measure or constrain the double ratio $(\nu_e/\nu_\mu)/(\bar{\nu}_\mu/\bar{\nu}_e)$ cross-section ratio which directly enters the CP asymmetry.

MUCH OF OSCILLATION 'ART' IS IN THE NEAR DETECTOR!



Several near detector projects involve Gas TPCs

1. Presently the T2K ND280 TPC, working beautifully (with a few shortcomings)

2. T2K upgrade of the magnetic ND280

aim is to provide by 2020

full angular coverage for neutrino events using new side TPCs

water targets

significantly smaller systematic errors in view of T2K/T2K-II/HyperK

electron neutrino (gamma background) / muon neutrino cross-sections

Also : a state-of-the-art project and opportunity to gain experience and collaborate

3. High pressure TPC project(s)

earlier work on LBNO near detector

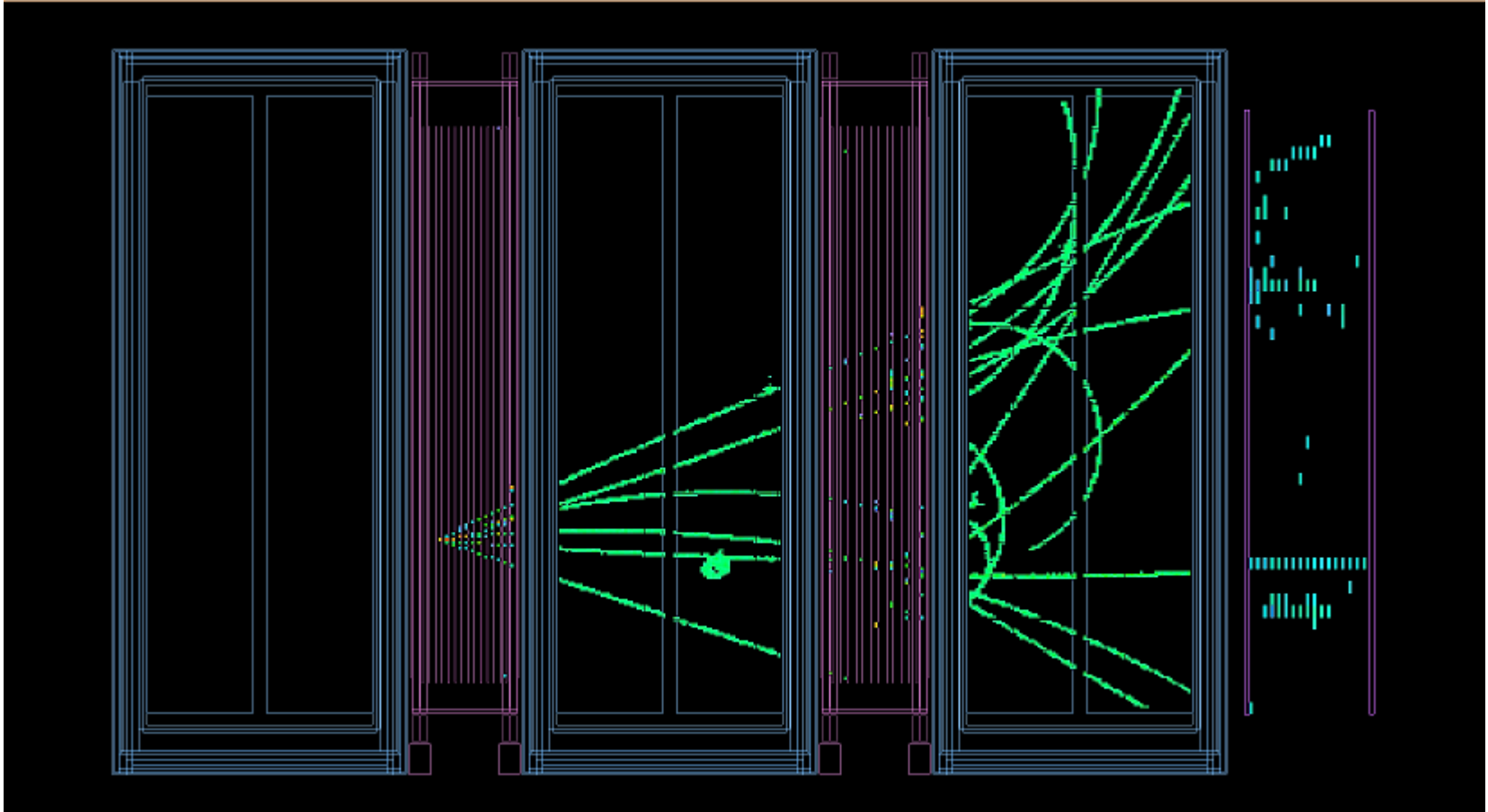
rate and target nucleus are well adapted for LArg far detector

at T2K/HyperK : a way to investigate the nuclear interaction model by exceptional visibility of vertex activity

at DUNE : a near detector with high sensitivity to nuclear activity
a sufficient event rate as near detector (no pile-up)

T2K ND280 today

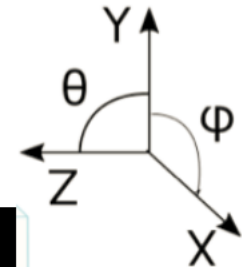
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0.18 T UA1/NOMAD magnet + ECAL and SMRD Side Muon Range Detector

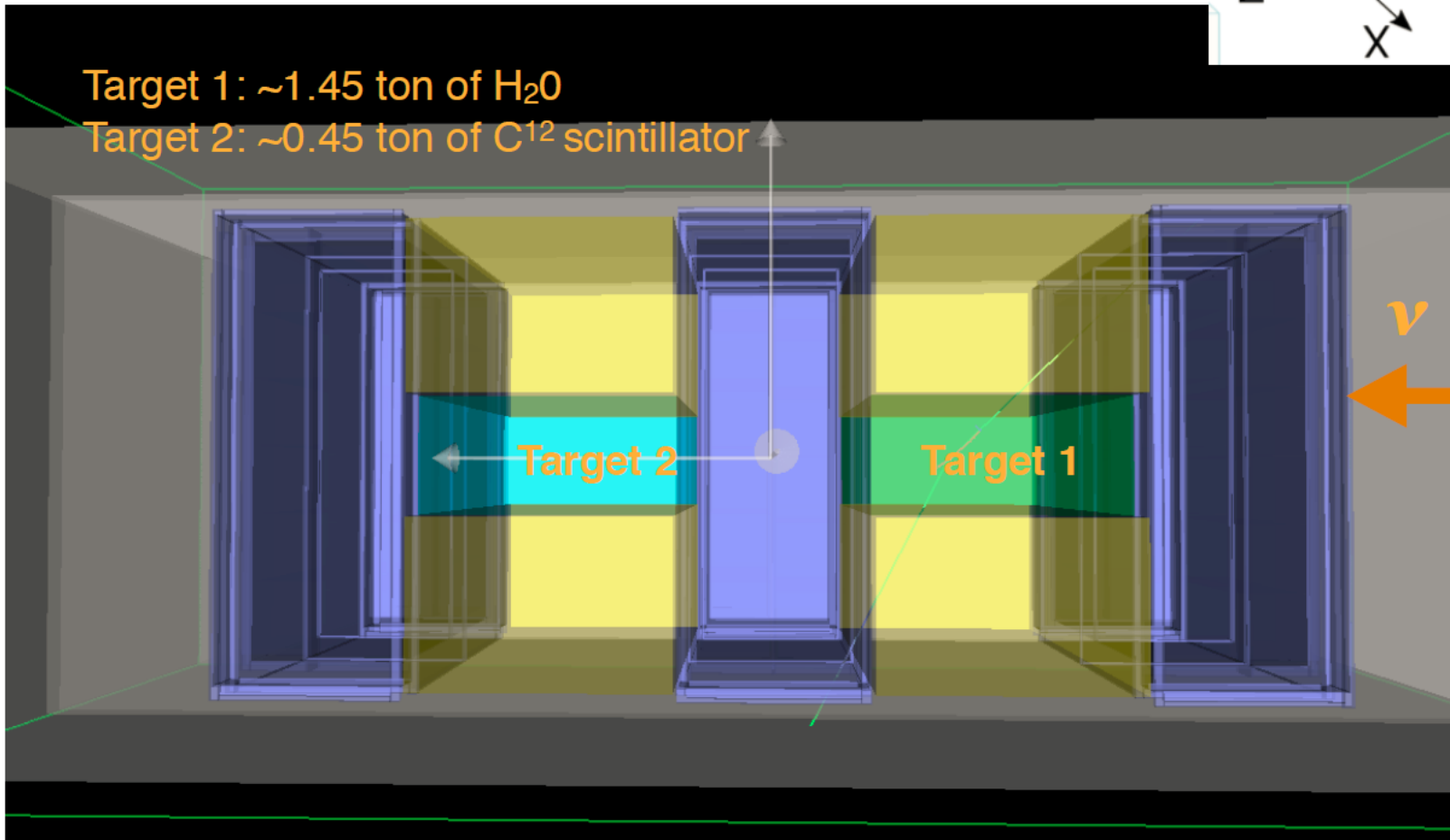
ND280 upgrade

- B // E (along X)
- TPCs read-out on YZ plane
- Charged track is reconstructed in a TPC if length > 200mm (consistent > than 18 hits on read-out plane)

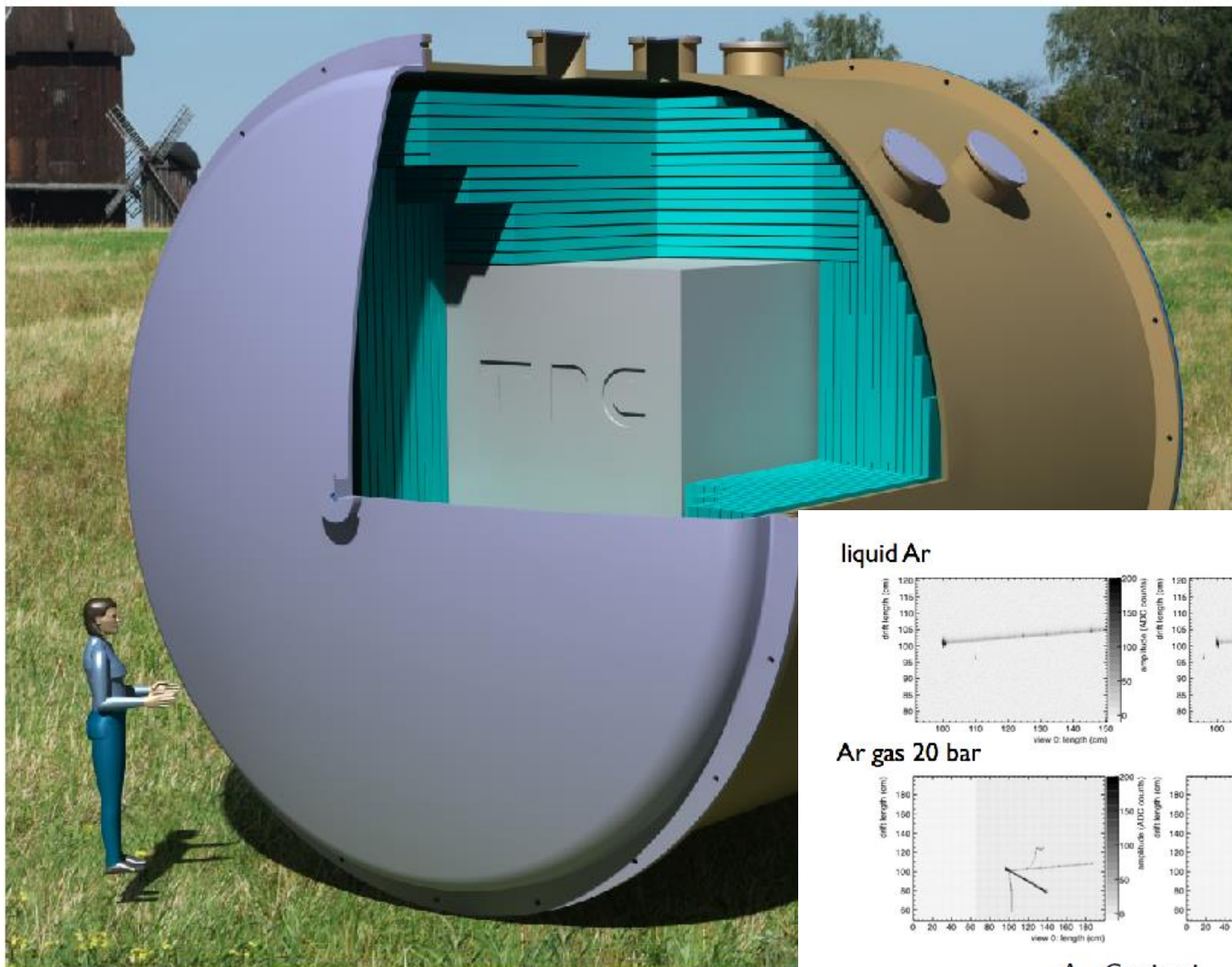


Target 1: ~1.45 ton of H₂O

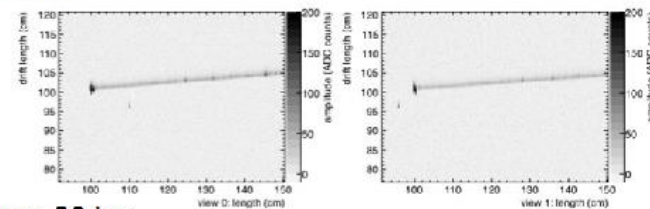
Target 2: ~0.45 ton of C¹² scintillator



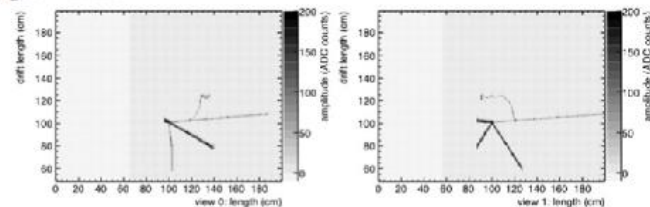
The Near Detector Concept



liquid Ar



Ar gas 20 bar

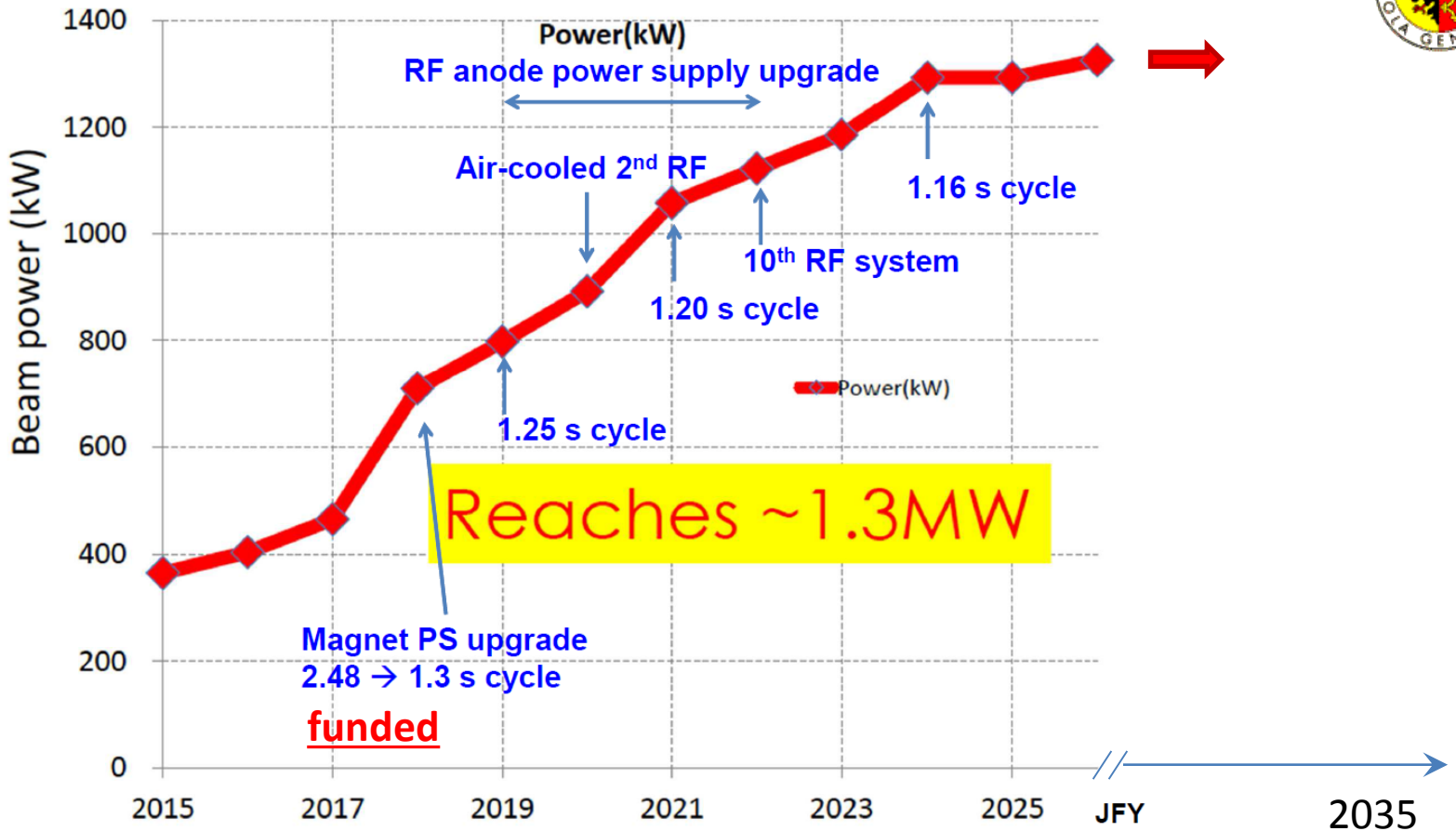


A. Curioni



Beam power projection of MR fast extraction

Koseki
NUFACT16



T2K-II

T2HK (prop.)

0.2

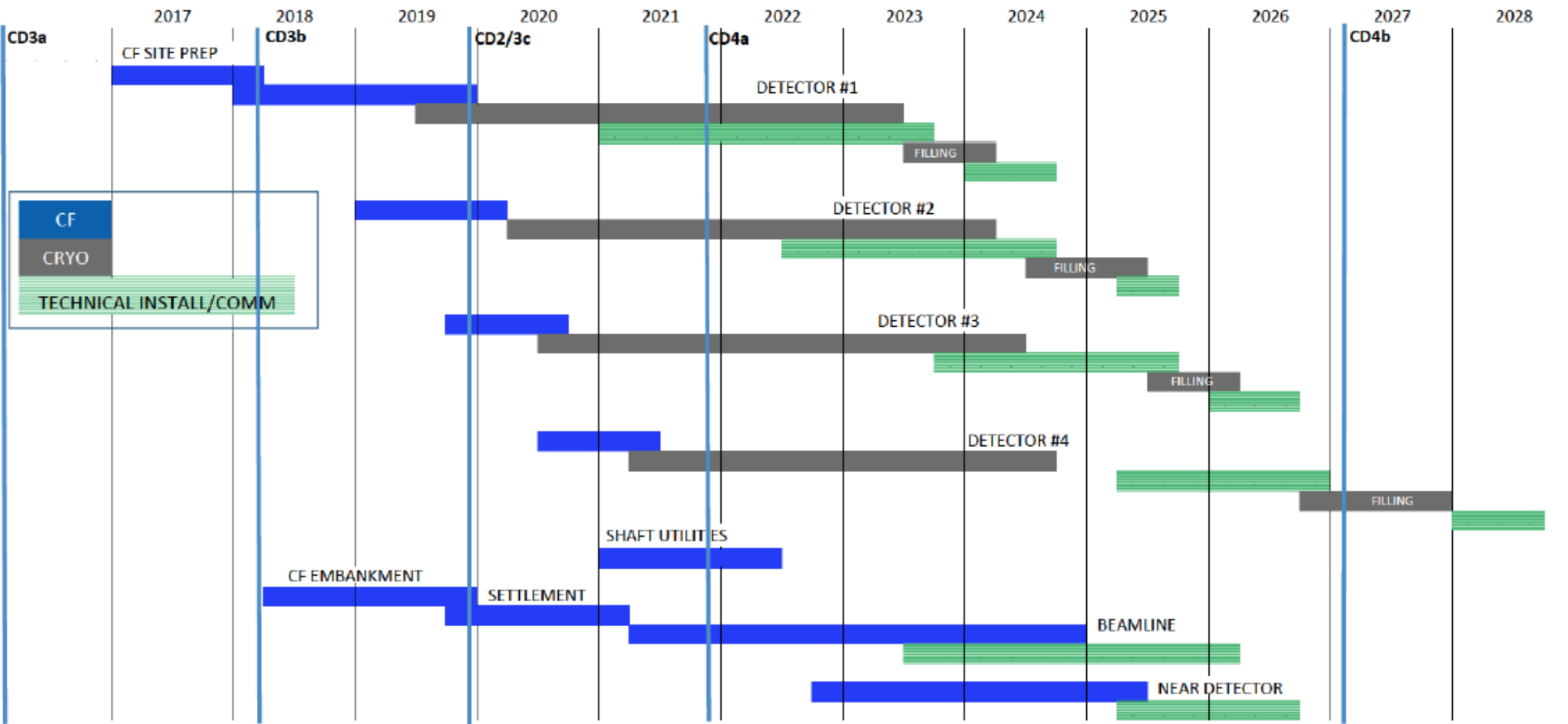
1

3

30

$\frac{30\text{GeV p.o.t} \cdot \text{kton}}{7.10^{21} * 22.5}$
(T2K approved)

event numbers = 15 / 150 times today's.
Systematics need reduction accordingly!



DUNE Schedule *as of CDR* <http://arxiv.org/abs/1601.05471>
Beam starts (with 1.2 MW capability) 2026 with 2 far detectors, upgrade to 2.4Mw ~6 yrs later.



Goal of this workshop:

- **Collaboration/synergy to develop state-of-the-art techniques**
- **Acquire experience by building the required TPCs**
 - **Start with ND280 upgrade (normal pressure)**
 - **R&D for longer time scale HP TPCs**
 - **CERN natural base and support for EU groups**
 - **International collaboration (Europe, Japan, Russia, US +...)**
- **More practically, review projects and ideas**
 - **identify areas of expertise (or lack thereof)**
 - **who does what etc...**
 - **agree on terms for SPSC proposal to be discussed tomorrow**
 - **agree on terms for e.g. EU funding proposal**