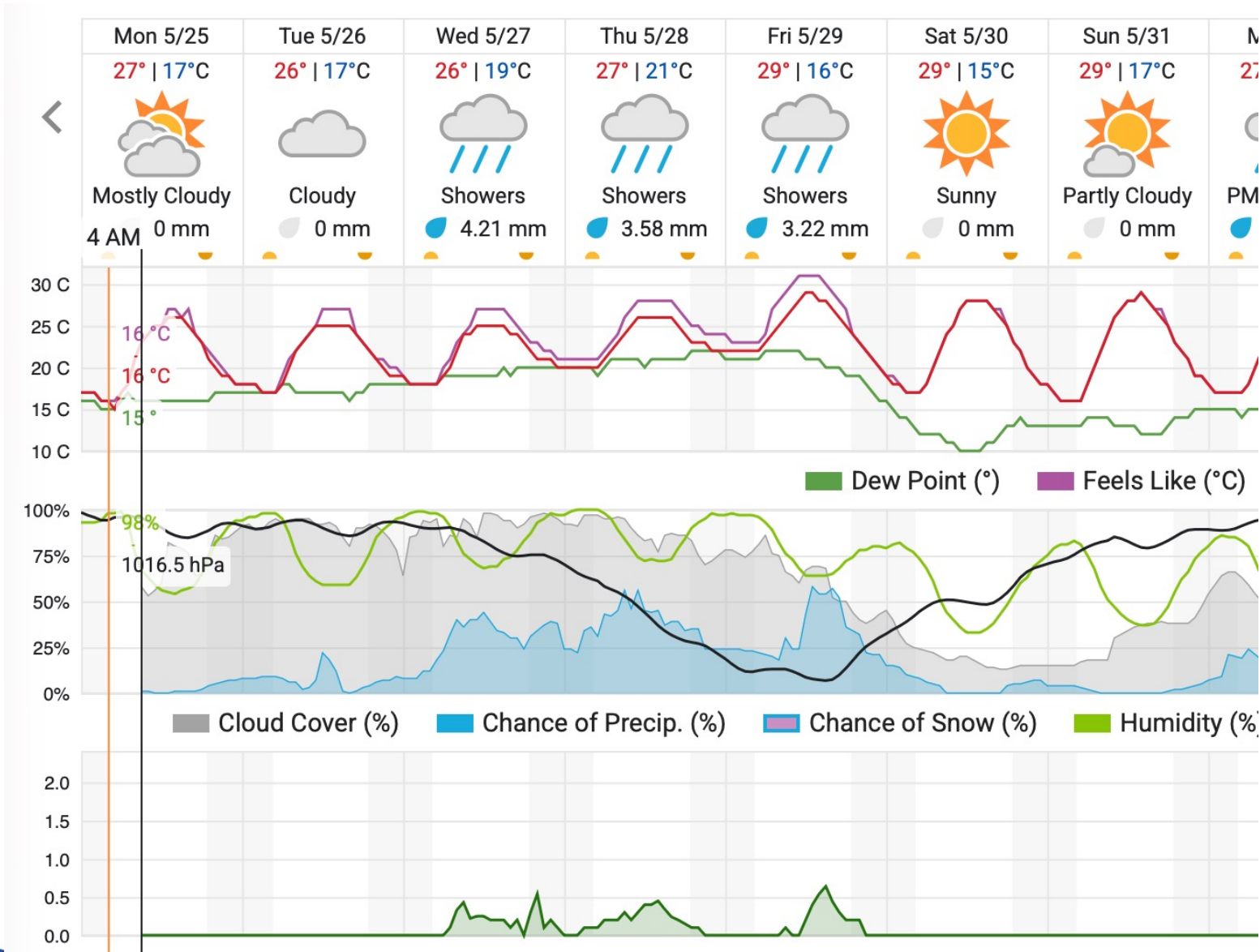


Welcome

6th New Physics Opportunities at Neutrino Facilities Workshop (NPN2026)

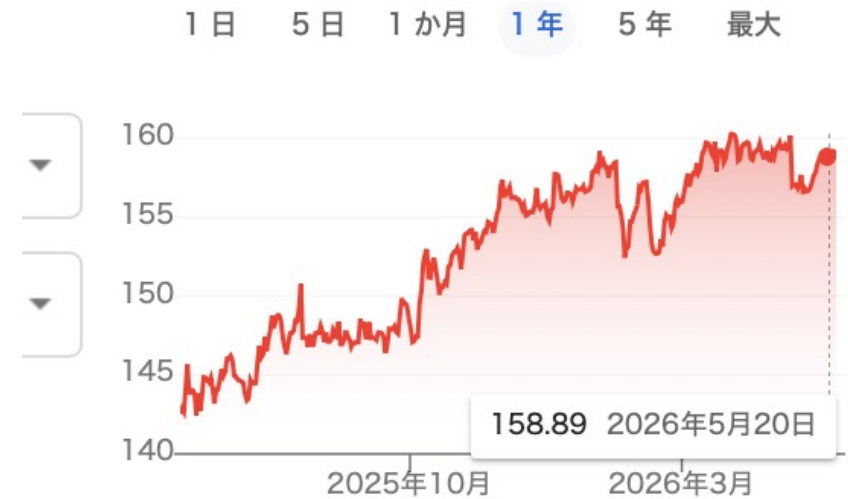
Shoji ASAI (KEK)

Relatively High Temperature(~ 30 Degree) & Humidity (> 80-100%)



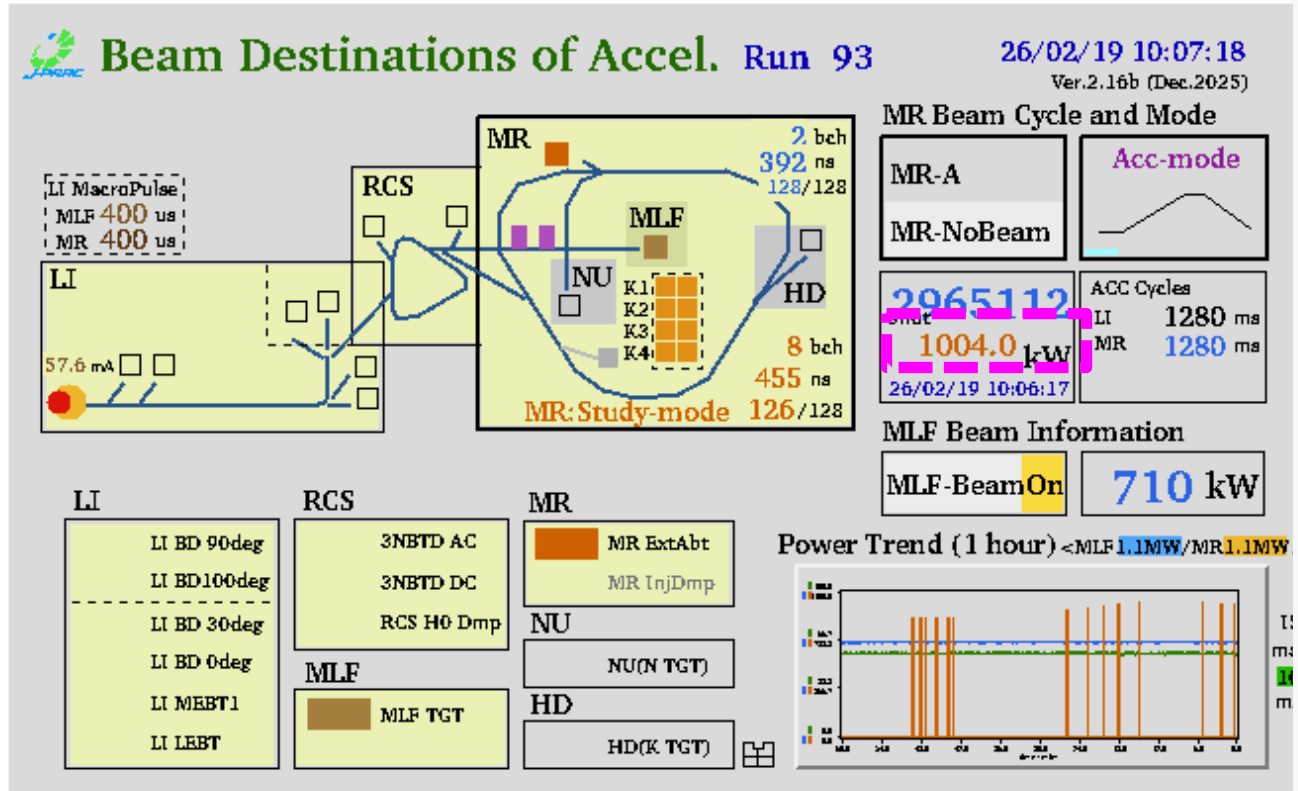
Be careful

1USD = 158.92 USD

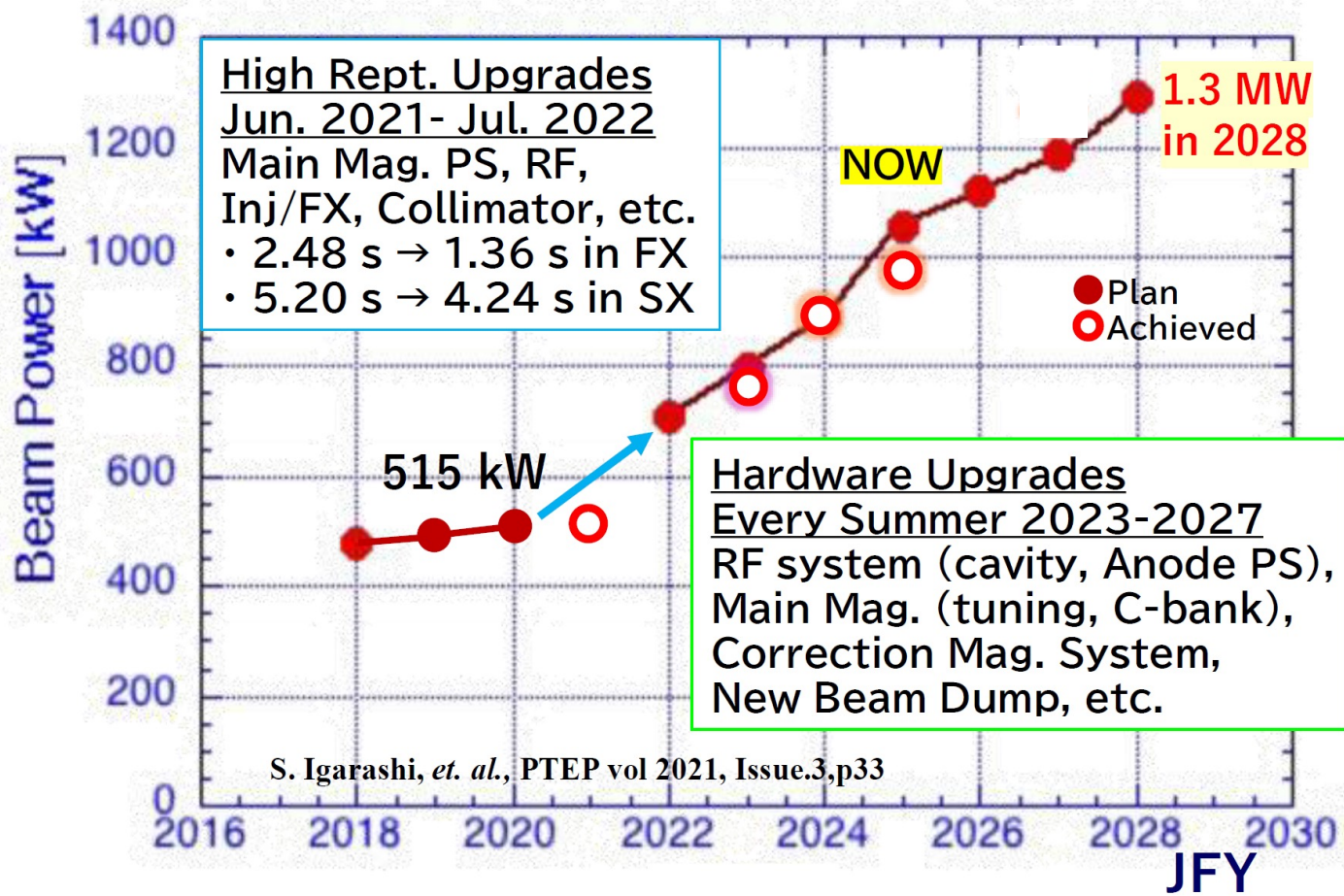


J-PARC MR upgrade for Neutrino

19th Feb. J-PARC MR Achieved **1MW**



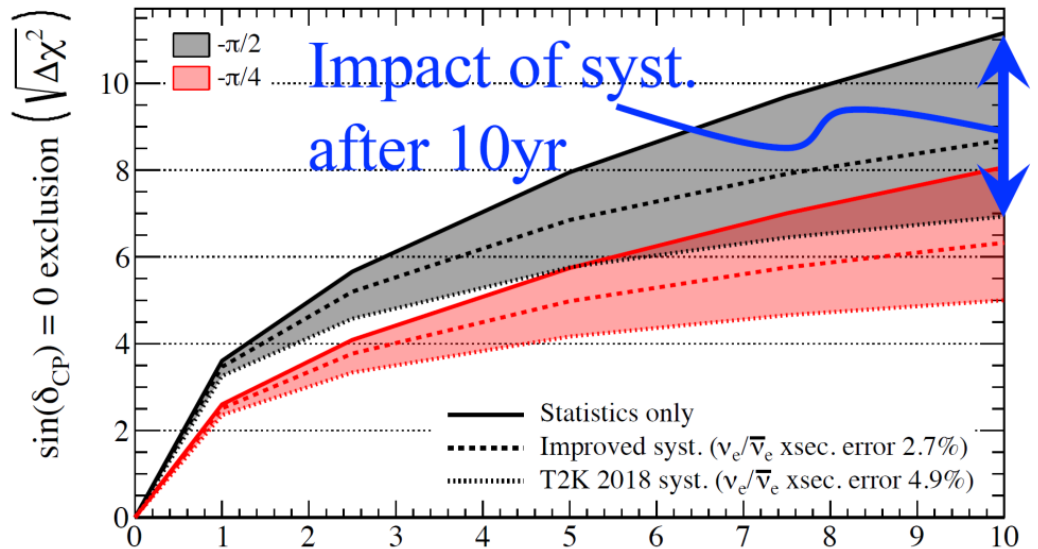
Acc. Power Update is on Schedule



After the fire accident, KEK J-PARC group works from morning till midnight. They work, work and keeping working. I hope we can announce soon.

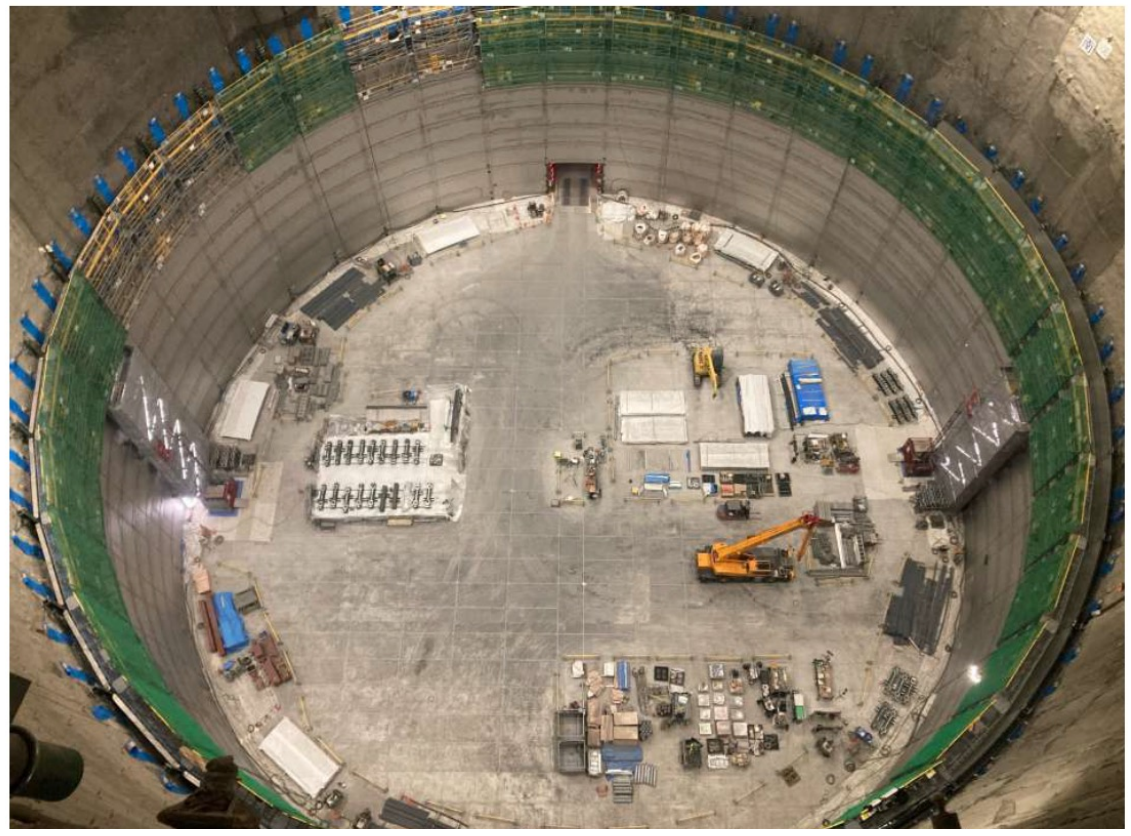
Far + IWCD Construction

δ_{CP} Projected sensitivity to CPV



Hyper-K preliminary
 True normal ordering (known)
 $\sin^2(\theta_{13}) = 0.0218$ $\sin^2(\theta_{23}) = 0.528$ $|\Delta m_{32}^2| = 2.509E-3$

HK Far:
 Water vessel
 is under
 construction



IWCD
 Construction



IWCD key detector for discovery of CP violation
Systematic error on water-neutrino interaction is not small.
IWCD reduces this systematic error significantly.

We are aiming
 start of
 data taking
 in 2028 JFY

$\delta_{CP} = -\pi/2$ (3 years \rightarrow 2 years run for 5σ)
 $\delta_{CP} = -\pi/4$ (10 years \rightarrow 5 years run for 5σ)

Let's go to ~2035!!!



2431 Japanese Yen

© Fujiko-Pro, Shogakukan, TV-Asahi, Shin-ei, and ADK

PMNS Matrix

Neutrino mass (Δm^2)

Mass ordering

Mixing Angle • CPV \rightarrow 4 parameters

Beyond 3 neutrino mixing model

$$\begin{pmatrix} \nu_e \\ \nu_\mu \\ \nu_\tau \end{pmatrix} = \begin{pmatrix} U_{e1} & U_{e2} & U_{e3} \\ U_{\mu 1} & U_{\mu 2} & U_{\mu 3} \\ U_{\tau 1} & U_{\tau 2} & U_{\tau 3} \end{pmatrix} \begin{pmatrix} \nu_1 \\ \nu_2 \\ \nu_3 \end{pmatrix}$$

HK, DUNE

Reactor experiments

JUNO

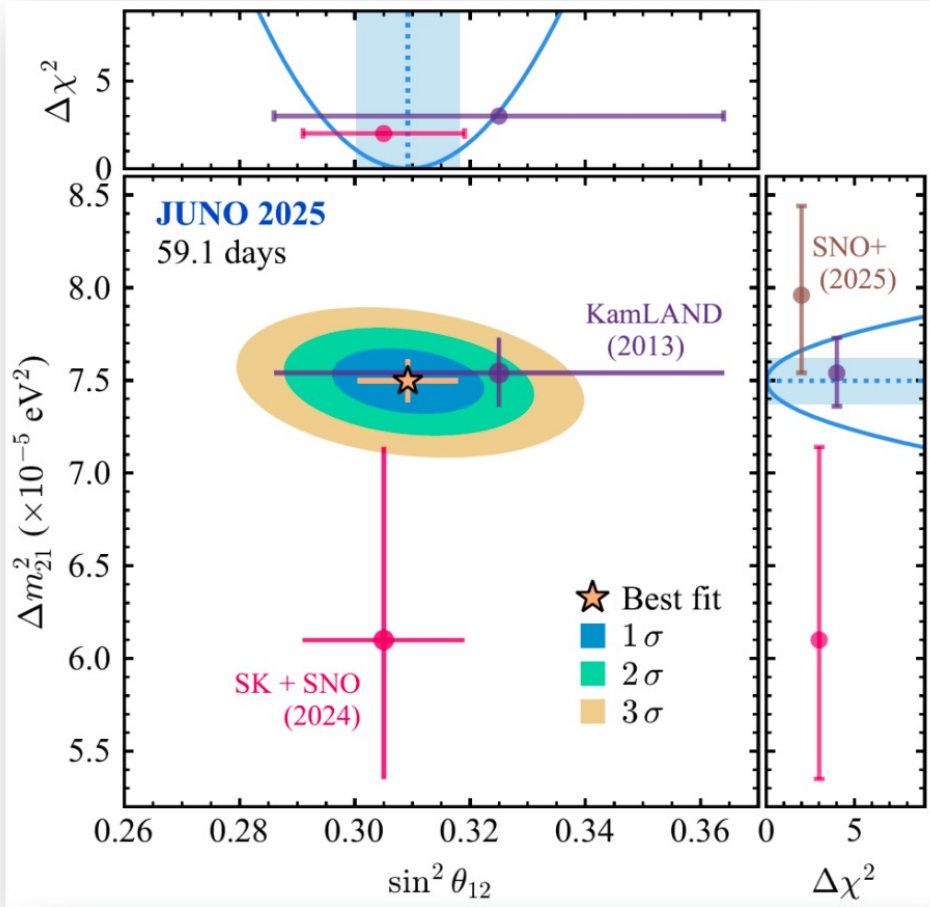
$$= \begin{bmatrix} 1 & 0 & 0 \\ 0 & c_{23} & s_{23} \\ 0 & -s_{23} & c_{23} \end{bmatrix} \begin{bmatrix} c_{13} & 0 \\ 0 & s_{13}e^{-i\delta_{13}} \\ -s_{13}e^{i\delta_{13}} & c_{13} \end{bmatrix} \begin{bmatrix} c_{12} & s_{12} & 0 \\ -s_{12} & c_{12} & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} c_{12}c_{13} & s_{12}c_{13} & s_{13}e^{-i\delta_{13}} \\ -s_{12}c_{23} - c_{12}s_{23}s_{13}e^{i\delta_{13}} & c_{12}c_{23} - s_{12}s_{23}s_{13}e^{i\delta_{13}} & s_{23}c_{13} \\ s_{12}s_{23} - c_{12}c_{23}s_{13}e^{i\delta_{13}} & -c_{12}s_{23} - s_{12}c_{23}s_{13}e^{i\delta_{13}} & c_{23}c_{13} \end{bmatrix}.$$

JUNO

will determine mass ordering

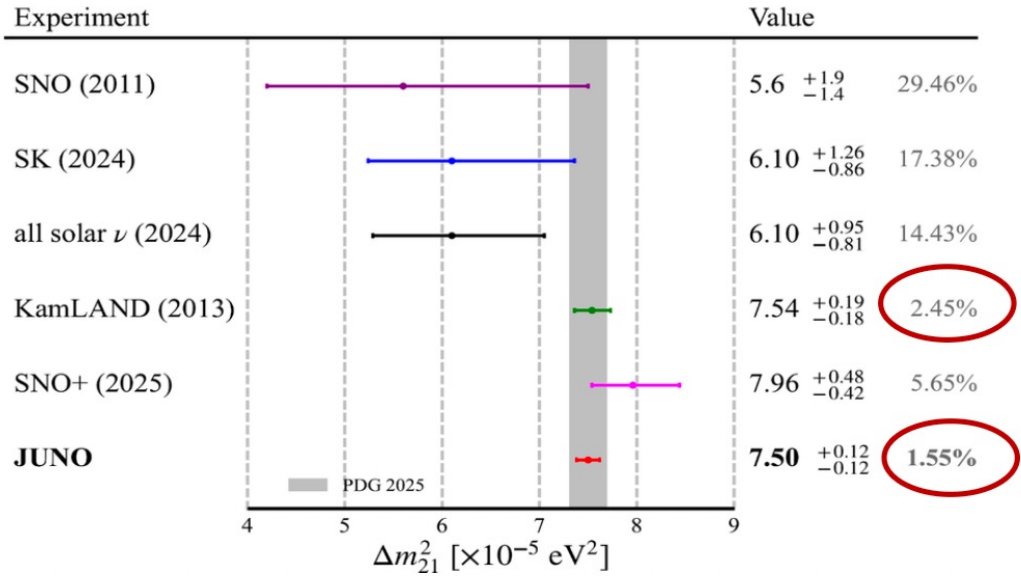
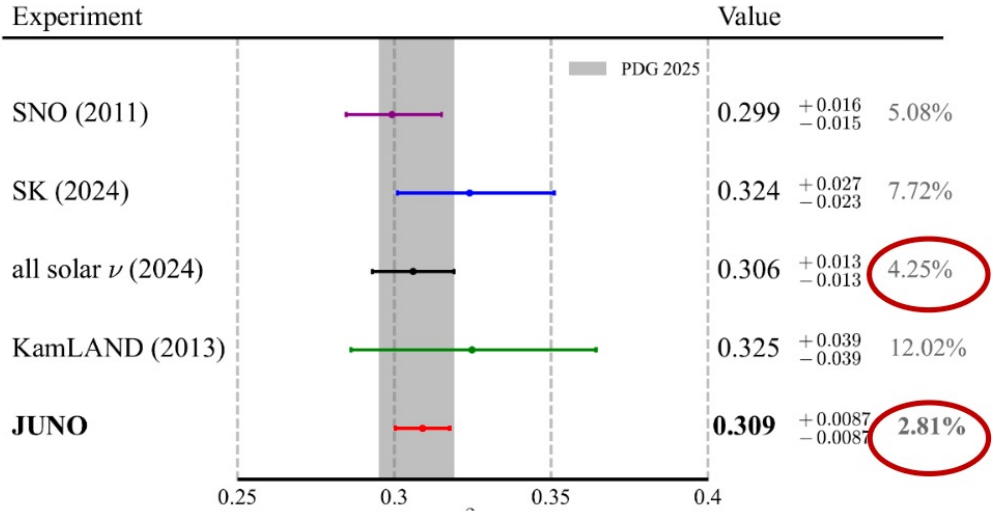
2- 3% error both on mass mixing angle (2025)

Less than 1%



$$\sin^2 \theta_{12} = 0.3092 \pm 0.0087,$$

$$\Delta m_{21}^2 = (7.50 \pm 0.12) \times 10^{-5} \text{ eV}^2$$



Consistent results from three independent analyses

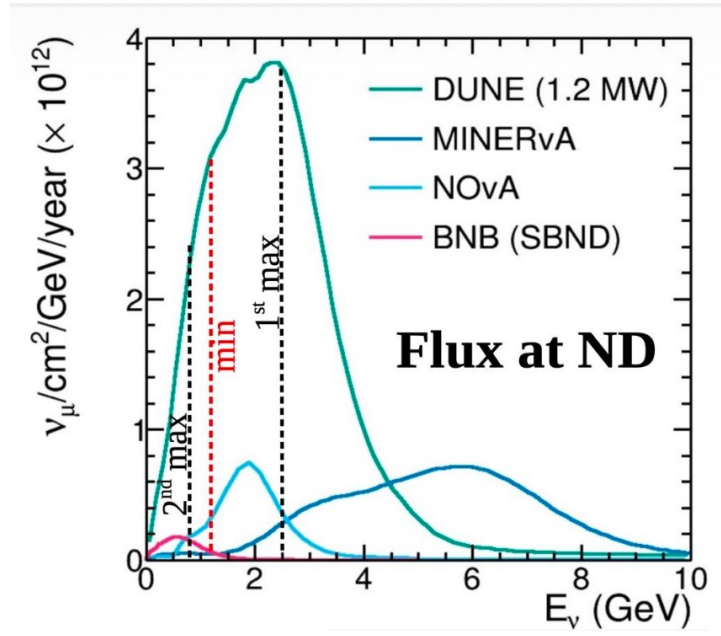
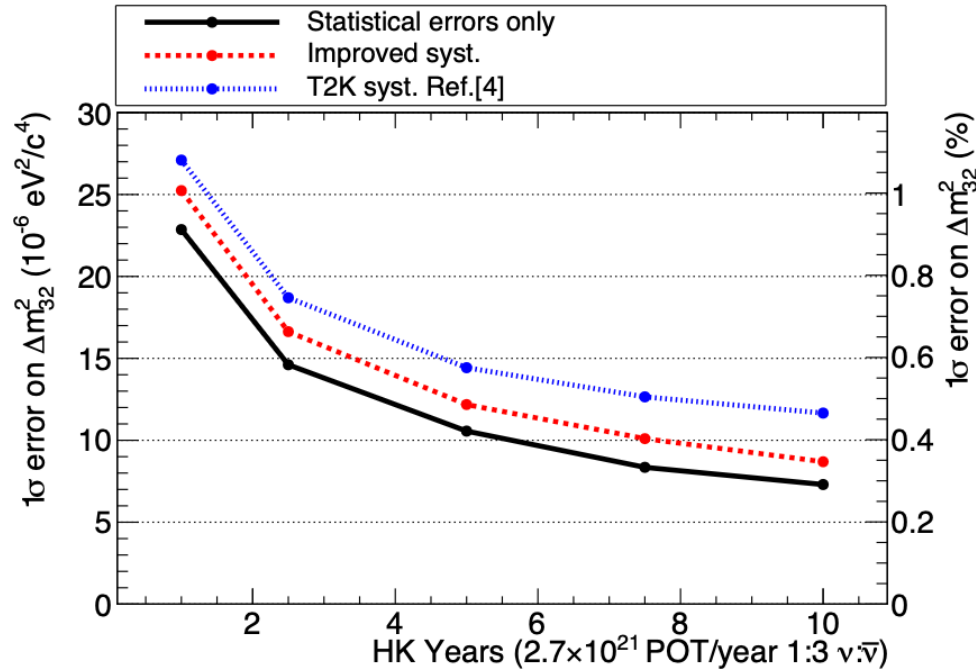
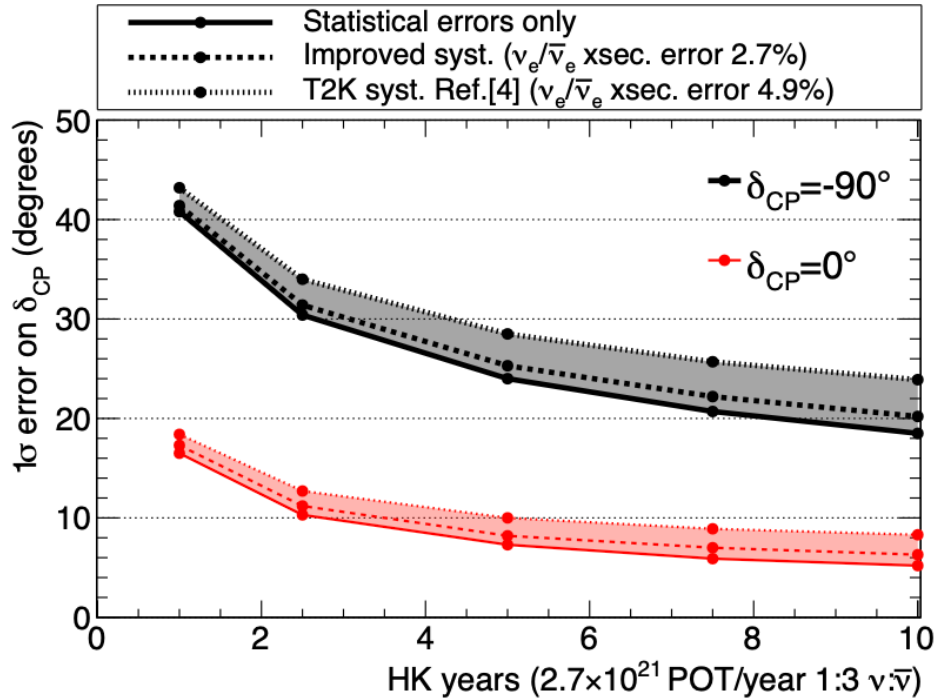
[arXiv: 2511.14593](https://arxiv.org/abs/2511.14593)

T2K/ HK

CPV, θ_{23} , Δm^2_{32}

Max CPV case error 20%
D Mass 0.5%

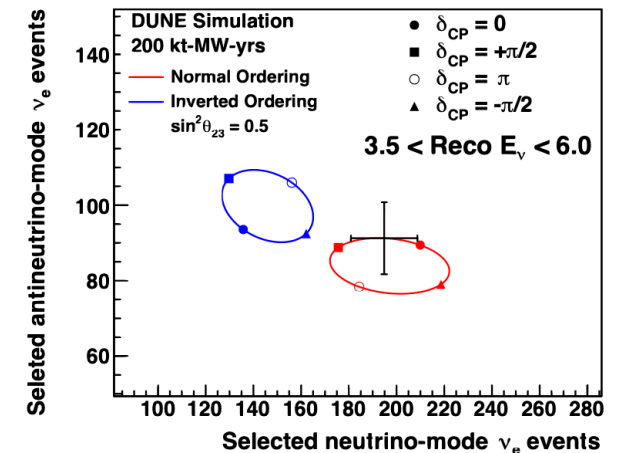
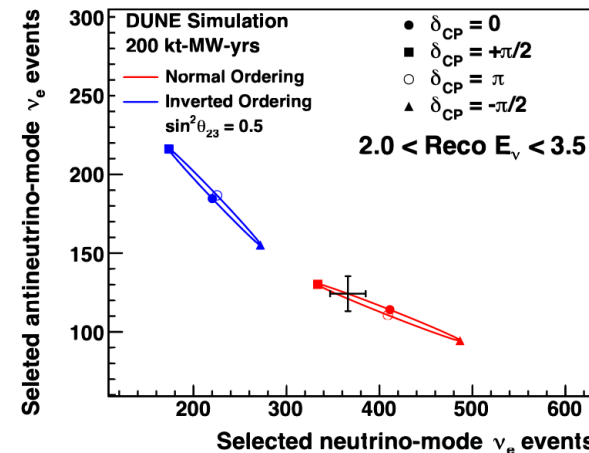
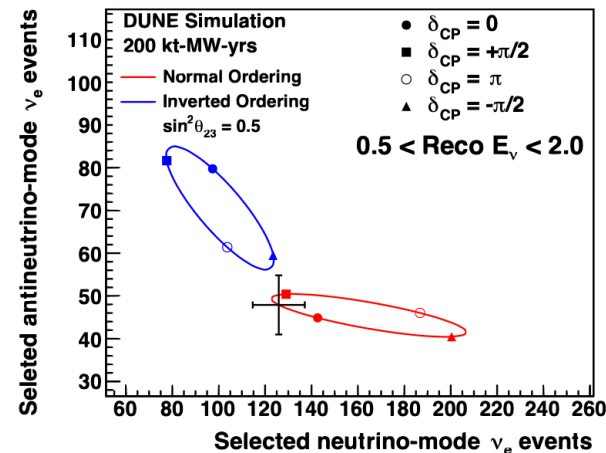
DUNE



can cover "wide E/L" to examine Beyond Minimal

P. Granger (NuFact2025)

Check δ_{CP} , MO in various energy consistency with Minimal



Let's discuss

- 1) How many accuracies are necessary in PMNS matrix elements?
How to obtain "High energy Physics $> 10\text{TeV}$ " from the results
much Higher energy scale
- 2) How to probe "high energy" from the neutrino
results / Possibility
- 3) Additional CP phase ?
- 4) Majorana or Dirac
(Normal ordering case)
- 5) Post HK/JUNO program



➤ GUT / Matter-Anti matter



➤ Physics $> 10\text{ TeV}$



➤ Current energy scale $\sim 1\text{GeV}$