JUNO Oscillation Analysis

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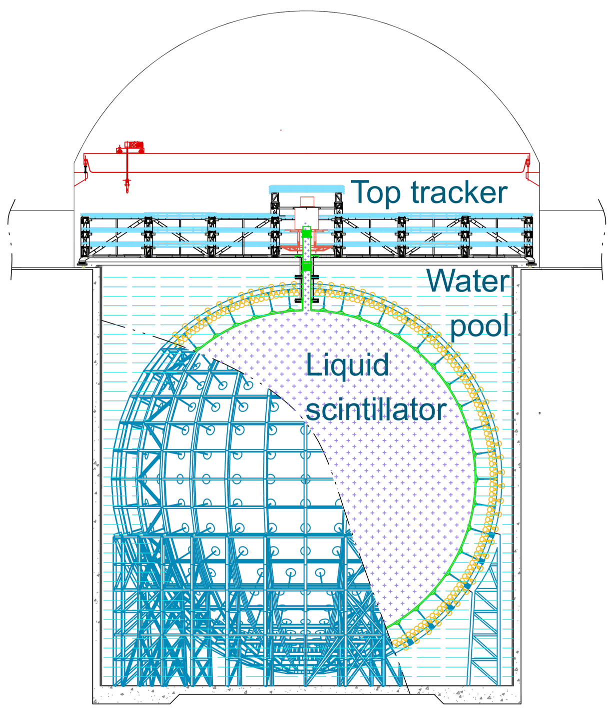
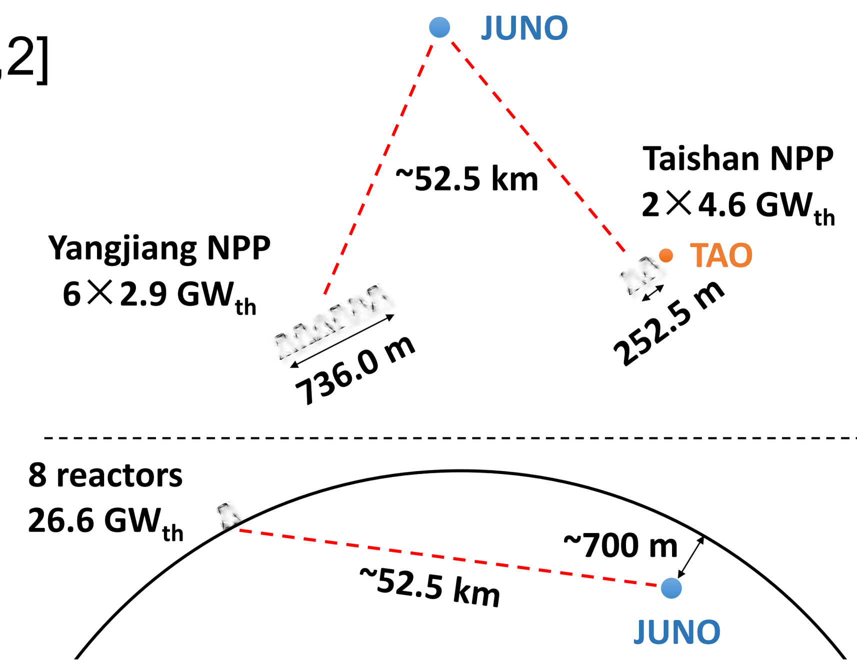
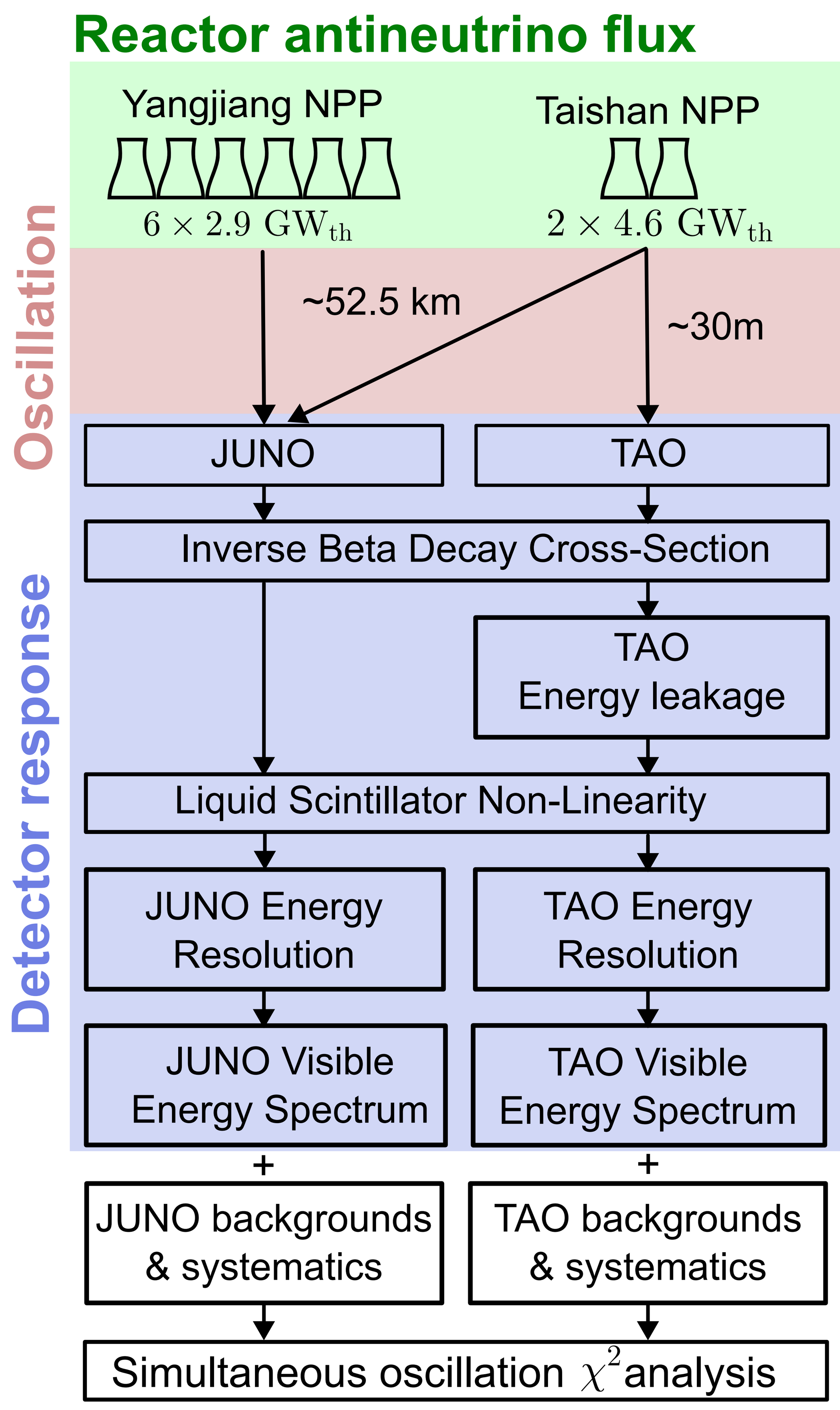


JUNO is multi-purpose liquid scintillator detector under construction in China [1,2]

- 20 kt of liquid scintillator
- Diameter of 35 m
- Energy resolution ~3% at 1 MeV
- Energy scale uncertainty <1%
- Baseline is optimized for Neutrino Mass Ordering determination
- Taishan Neutrino Observatory (TAO) spectrum is used in simultaneous oscillation χ^2 analysis acting like a natural constraint for the antineutrino spectrum shape



Analysis Scheme

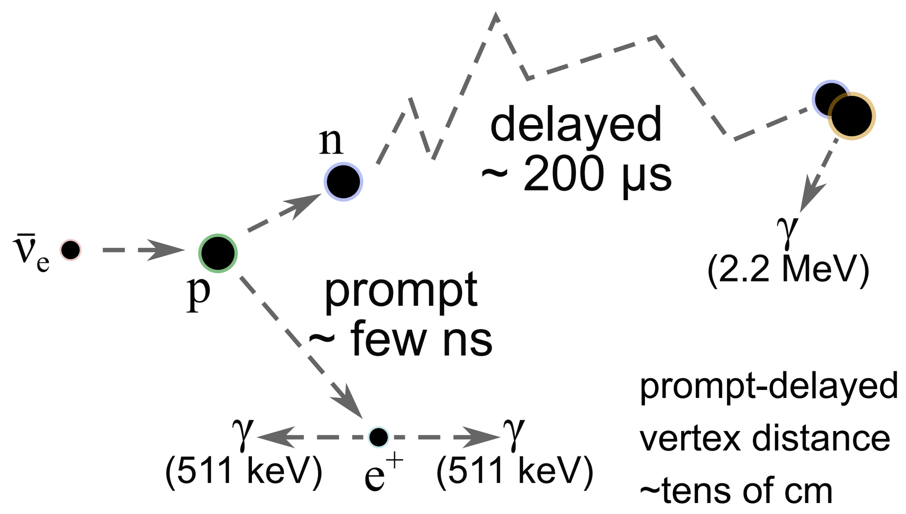


Inverse Beta Decay (IBD)

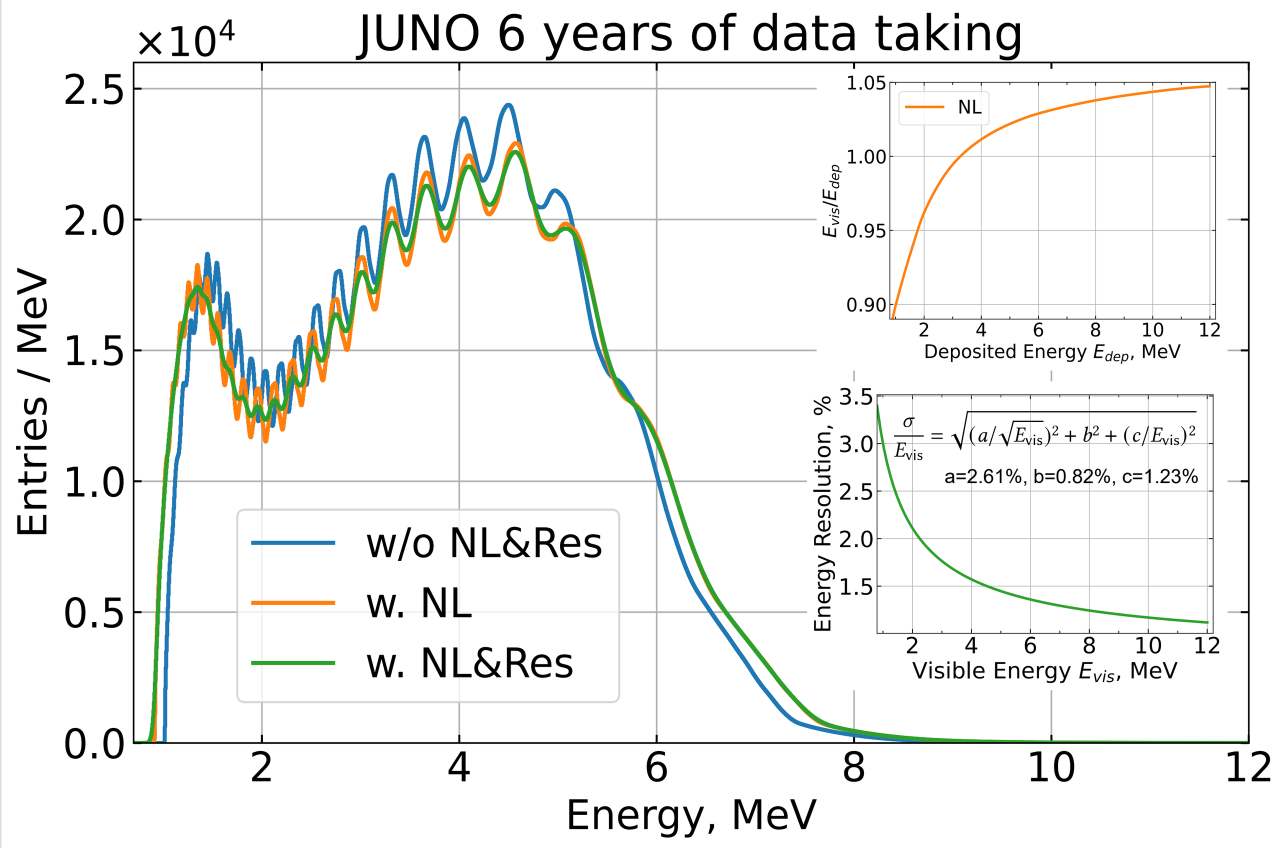
Signal source: $\bar{\nu}_e$ from fission of ^{235}U, ^{238}U, ^{239}Pu, and ^{241}Pu

$\bar{\nu}_e$ detected via IBD reaction:

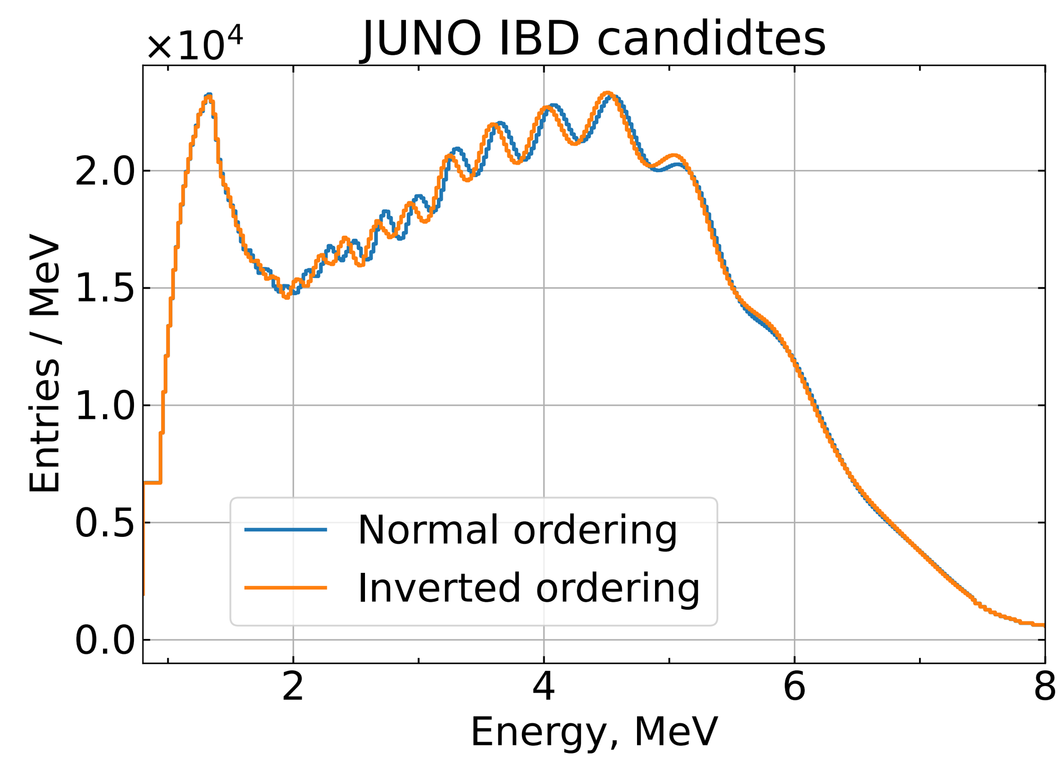
$$\bar{\nu}_e + p \rightarrow e^+ + n$$

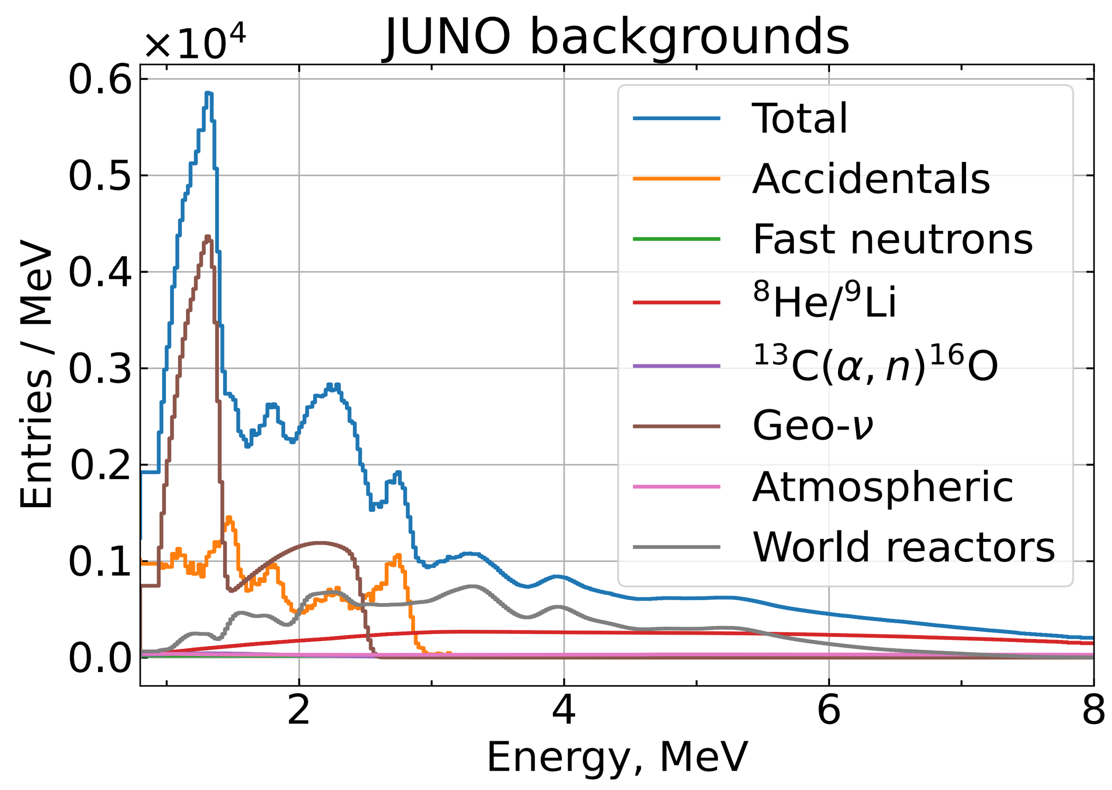


Detector response

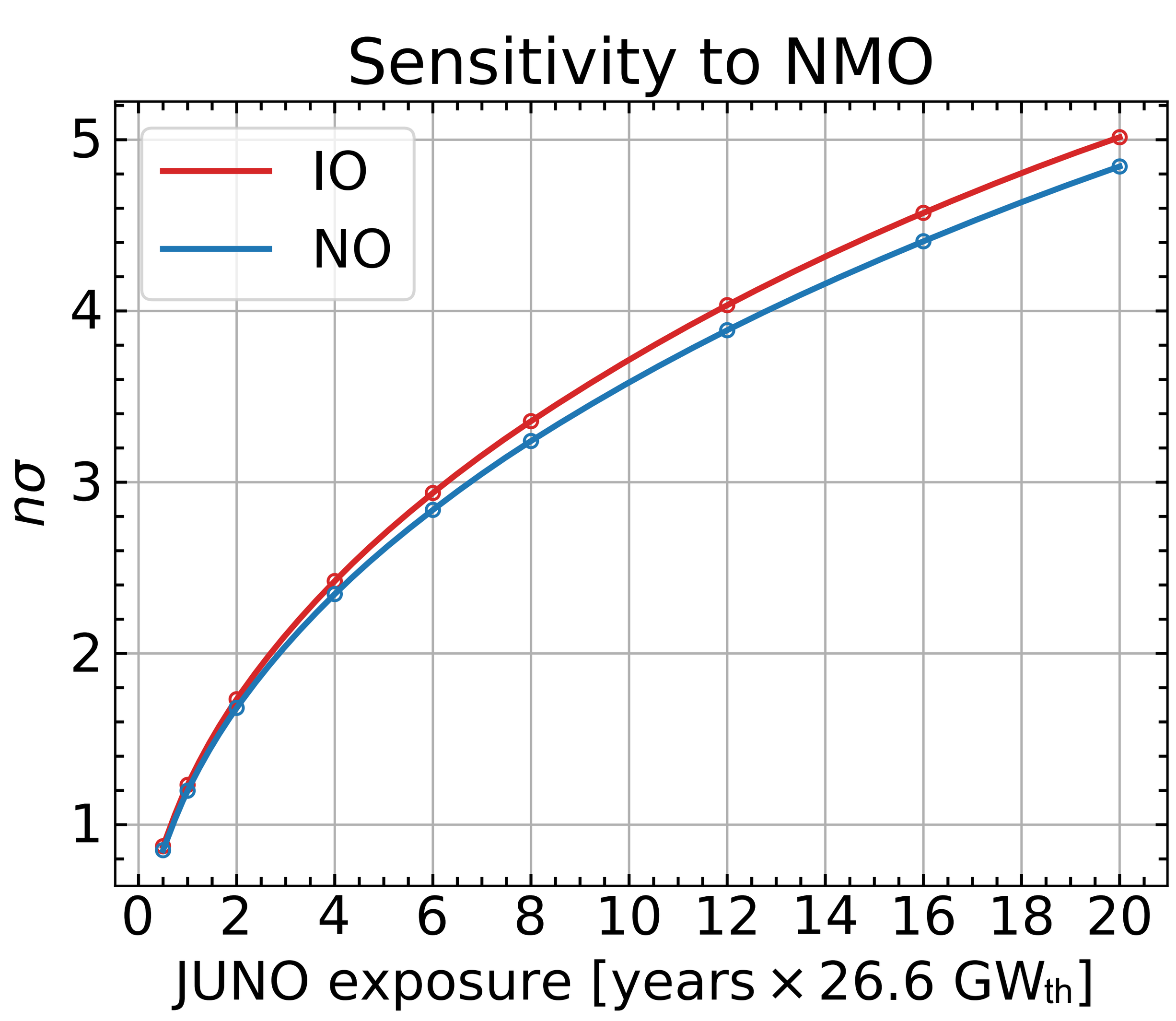


Signal and backgrounds





Current oscillation analysis results



Sensitivity to oscillation parameters [3]

	Central Value	PDG2020	100 days	6 years
Δm^2_{31} ($\times 10^{-3}$ eV^2)	2.5283	±0.034 (1.3%)	±0.021 (0.8%)	±0.0047 (0.2%)
Δm^2_{21} ($\times 10^{-5}$ eV^2)	7.53	±0.18 (2.4%)	±0.074 (1.0%)	±0.024 (0.3%)
$\sin^2\theta_{12}$	0.307	±0.013 (4.2%)	±0.0058 (1.9%)	±0.0016 (0.5%)
$\sin^2\theta_{13}$	0.0218	±0.0007 (3.2%)	±0.010 (47.9%)	±0.0026 (12.1%)

Conclusion:

- JUNO can reach 3σ median sensitivity to NMO with ~6 years × 26.6 GW$_{th}$ exposure
- JUNO will achieve sub-percent precision to oscillation parameters Δm^2_{31}, Δm^2_{21}, and $\sin^2\theta_{12}$ after 6 years of data taking

References:

[1] Abusleme, A. et al. The Design and Technology Development of the JUNO Central Detector

[2] Jie Zhao on behalf of the JUNO collaboration, JUNO Status & Prospects, Neutrino 2022 conference

[3] Abusleme, A. et al. Sub-percent precision measurement of neutrino oscillation parameters with JUNO