

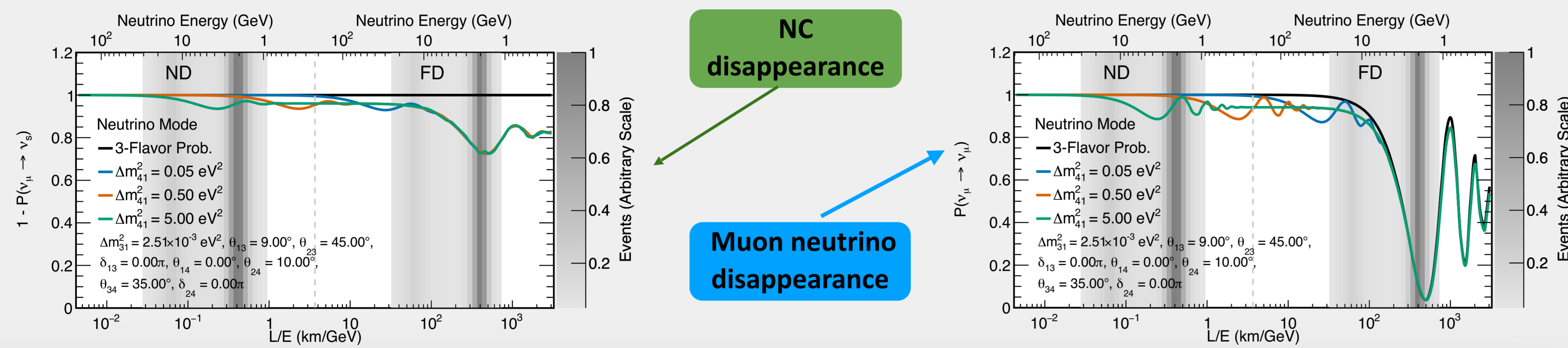
First Sterile Neutrino Search at NOvA Experiment Using both Neutrino and Antineutrino Data

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3+1 Sterile Neutrino Mixing Model

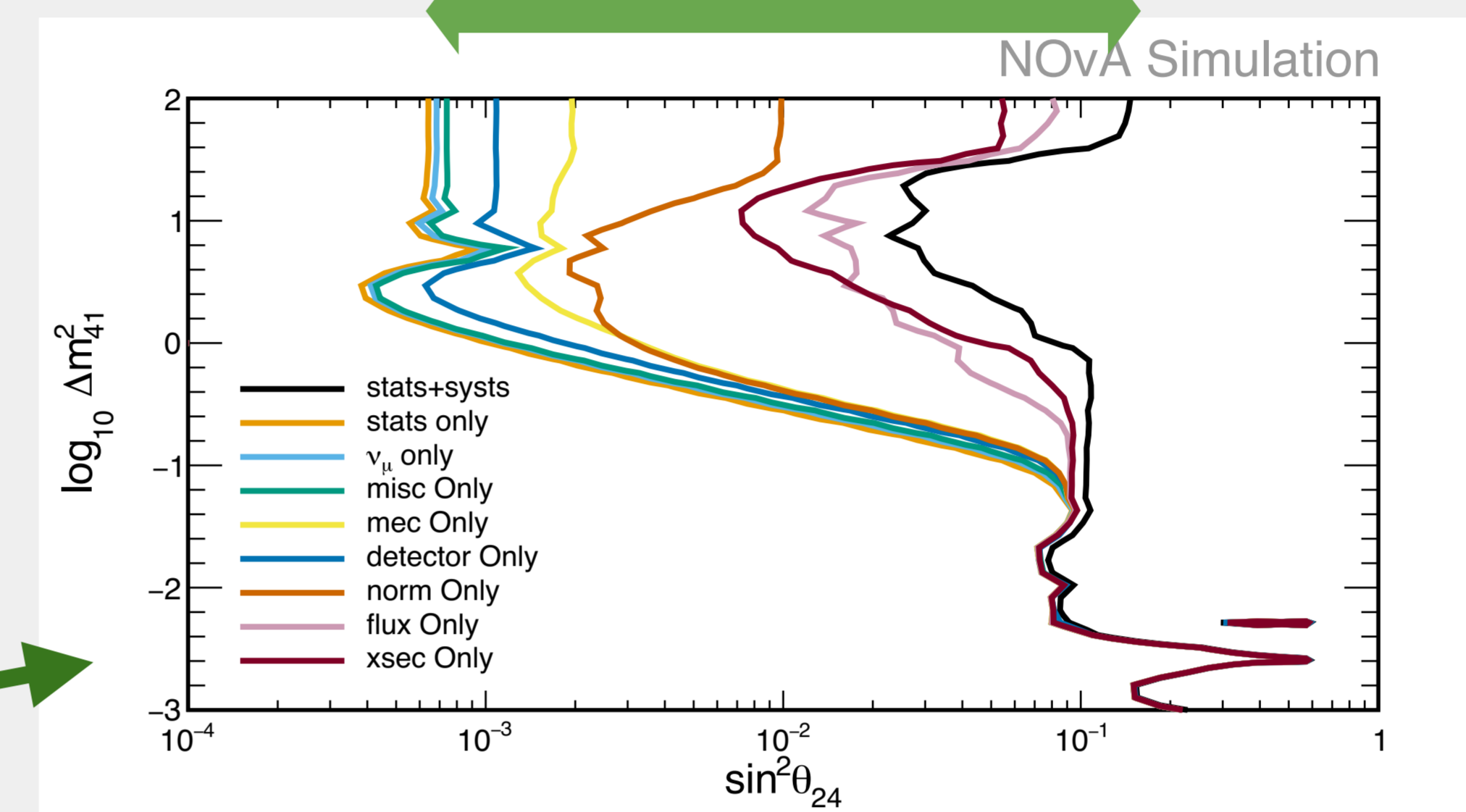
- NC interactions are flavor independent, giving clear measurement of active \rightarrow sterile disappearance.
- Additionally, this analysis also uses ν_μ - disappearance channel.
- NOvA 2025 sterile analysis results show **leading limits** on $\sin^2\theta_{24}$ in high regions of Δm_{41}^2 with FHC POT 13.6E+20 [1].



What limits our Sensitivity?

- Systematics significantly affect the results.
- **Cross-section** and **Flux** uncertainties are dominant.
- High Δm_{41}^2 region is primarily improved through additional constraints on the systematics.
- Low Δm_{41}^2 region improved through more statistics.

Impact of Systematics



Improving our limits!

Current Limits!
See this poster

Comprehensive strategy to improve limits!

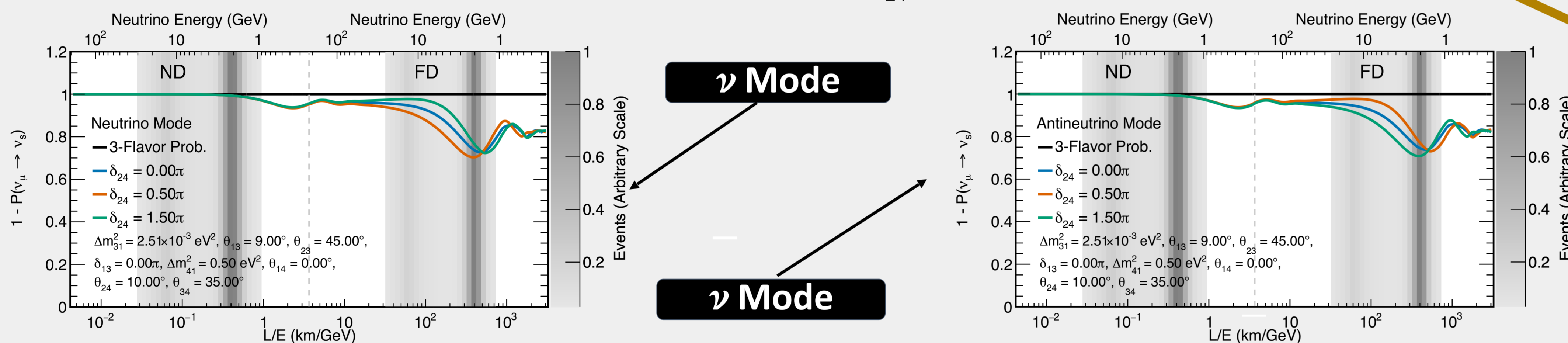
Improving our L/E resolution
See Jessica's Poster (#206).

Including ν_e appearance channel
See Bishnu's poster (#21)

Additional samples for disambiguating oscillations and systematic effects
See Adam's poster (#194)

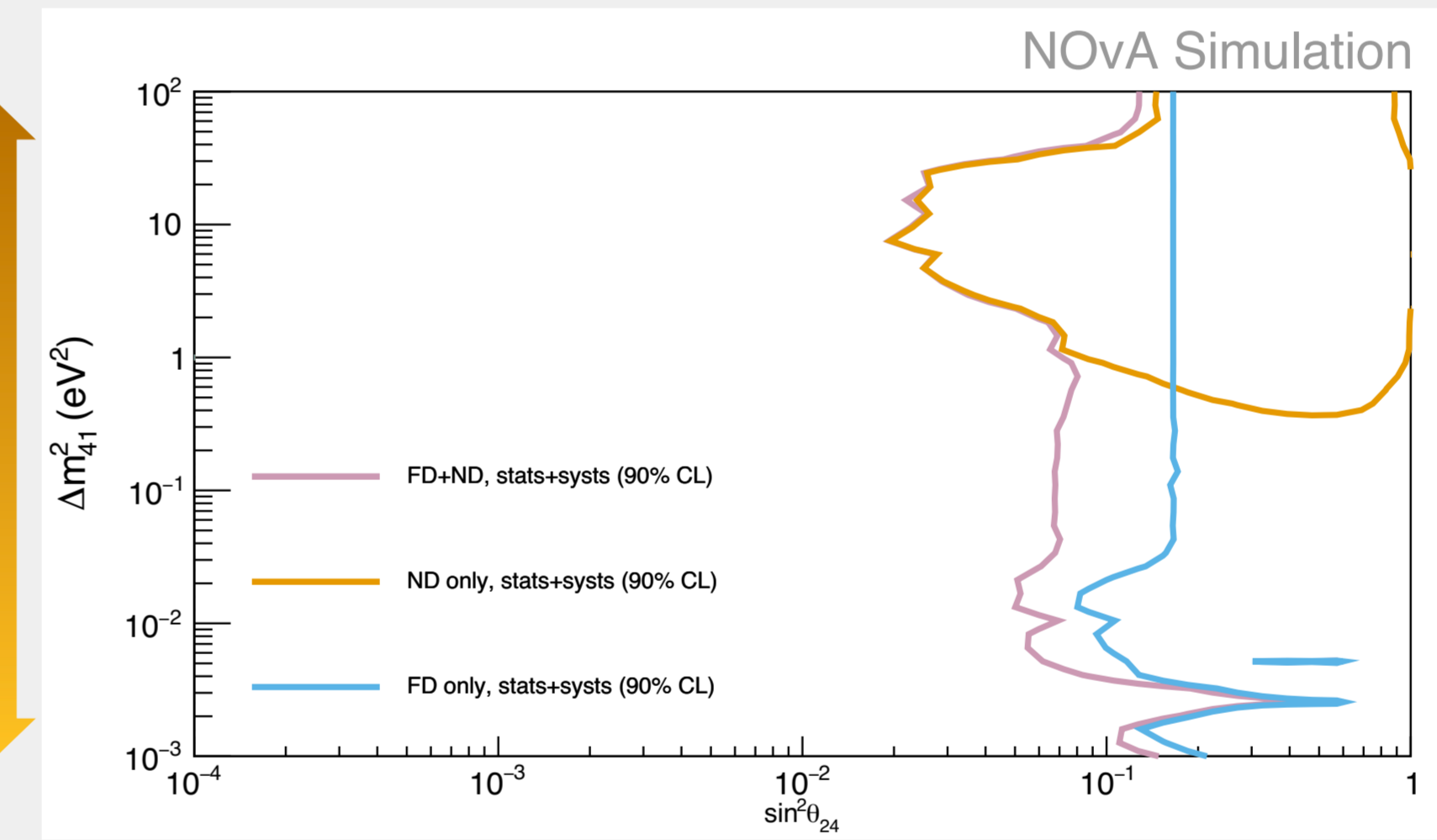
Additional Data

- Sensitivity contour of $\sin^2\theta_{24}$ vs. Δm_{41}^2 with FHC POT 13.6E+20, split into individual systematic groups show statistically limited region is unchanged.
- With double the FHC POT (27.2E+20) and additional RHC POT (12.6E+20) sample should improve the stats-limited region.
- Joint FHC + RHC fit improves constraint on extra CP-violating phases (δ_{24}).



High Δm_{41}^2

Low Δm_{41}^2

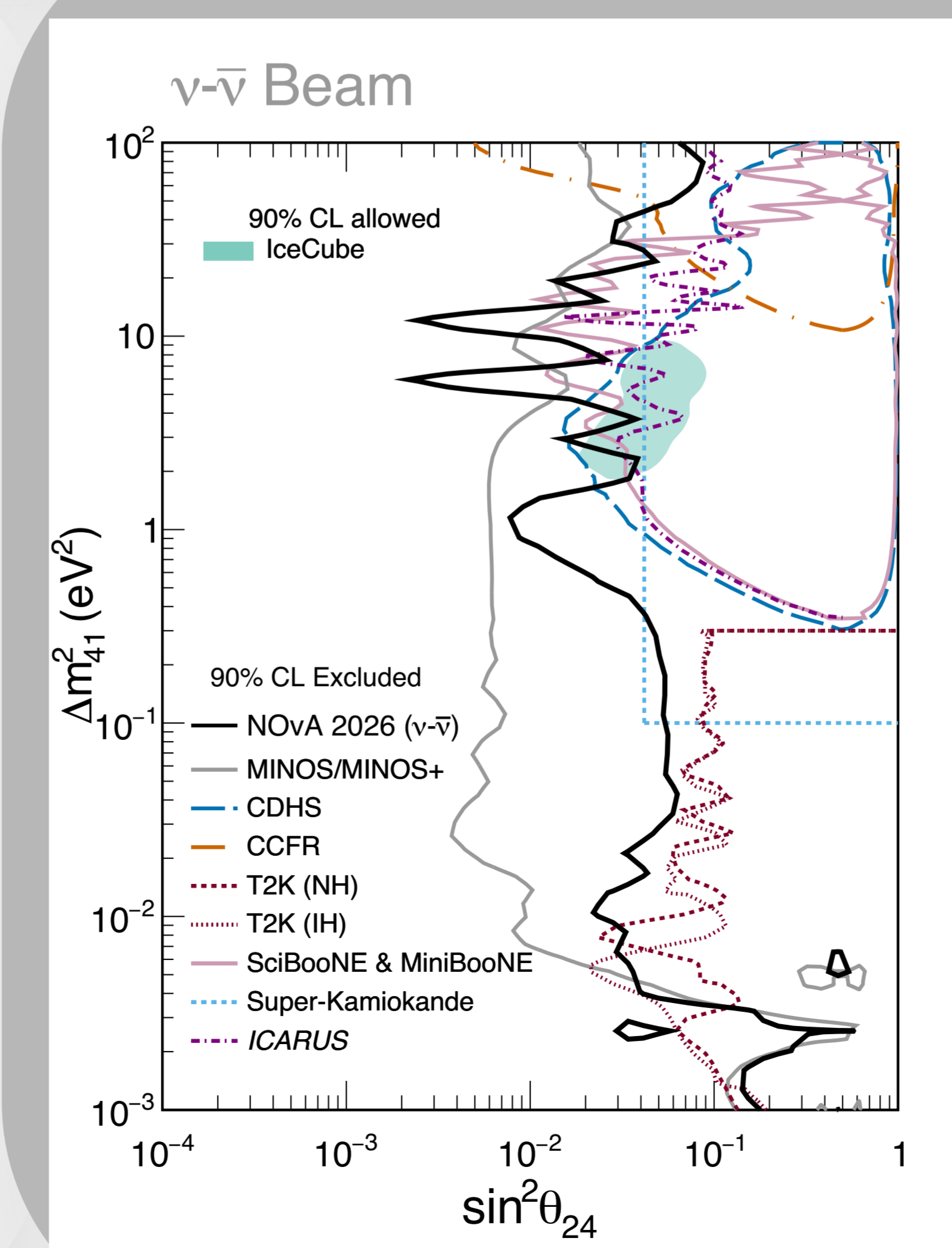
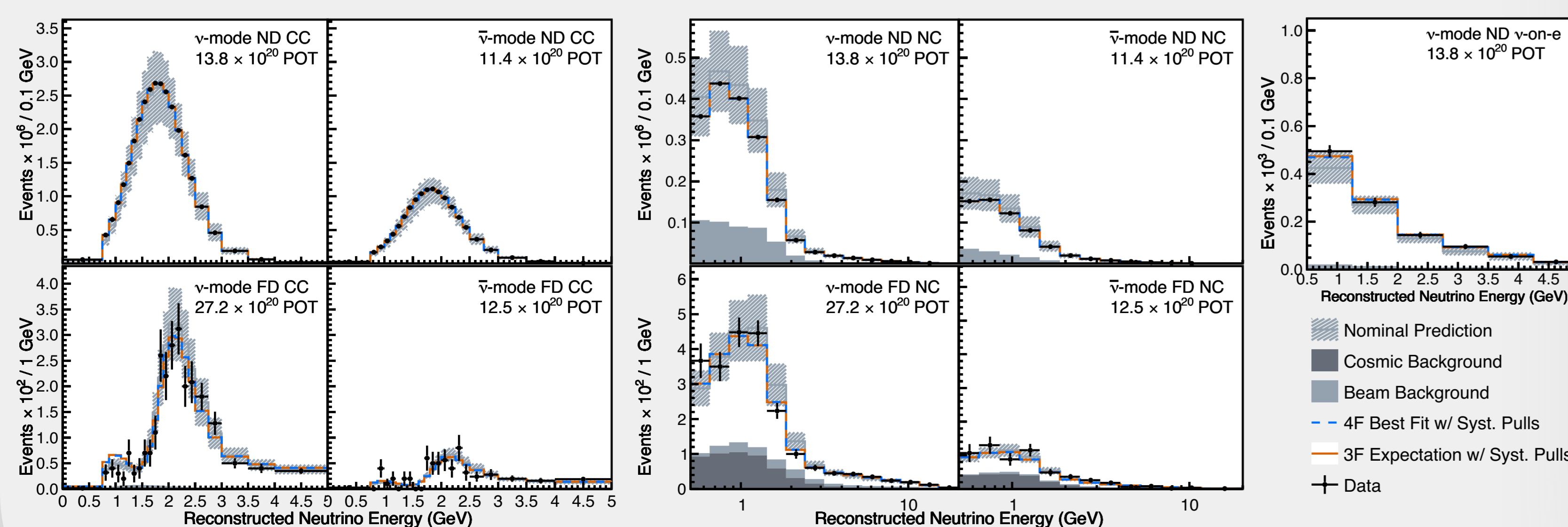


Including $\nu \rightarrow e$ Sample

- $\nu \rightarrow e$ scattering is a purely leptonic process with very low cross-section systematics $\sim 0.2 - 0.4\%$ [2].
- This sample should help us disambiguate **flux effects** from **cross-section effects**, constraining the overall model.

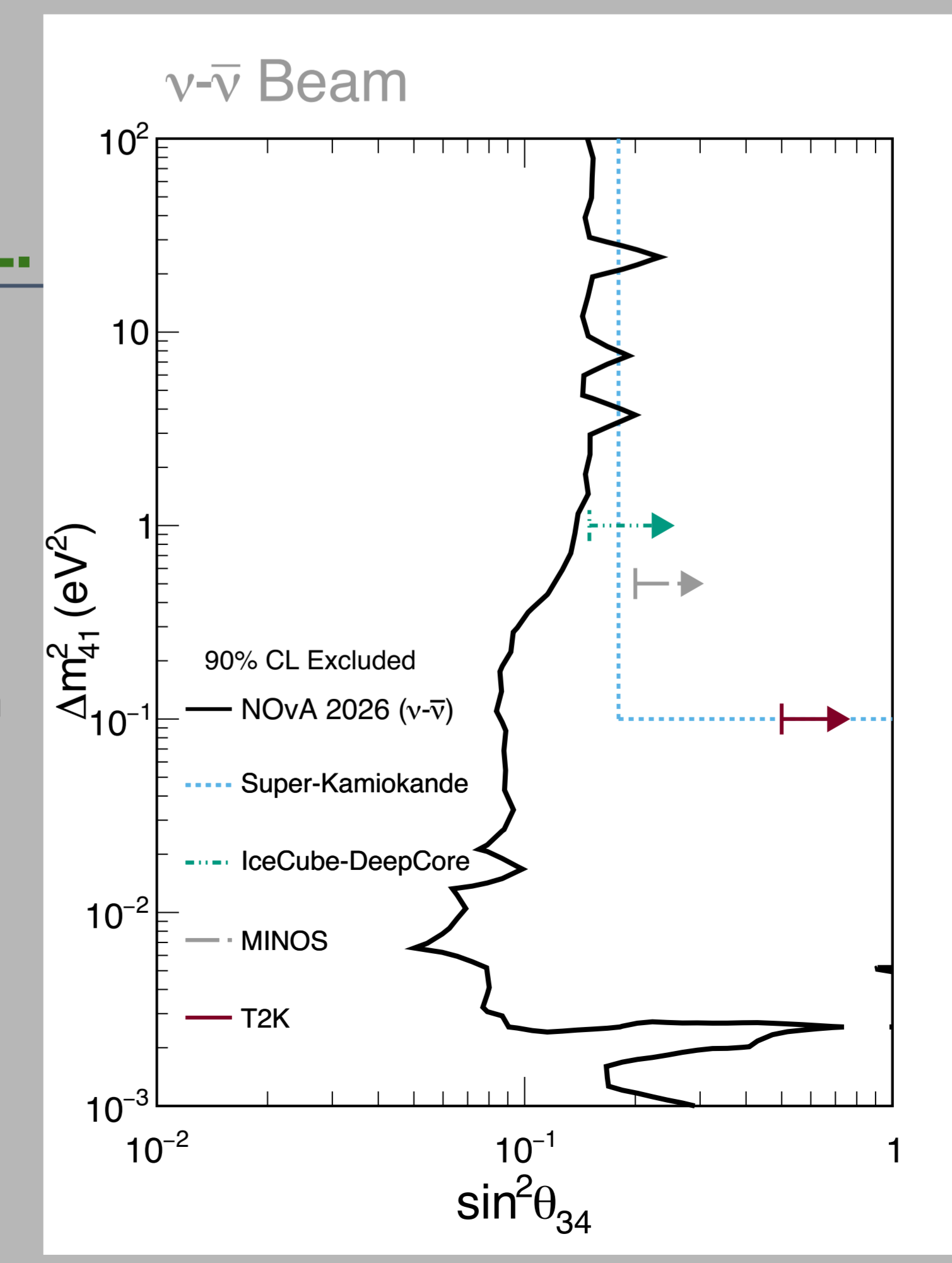
Reconstructed Energy Spectra

- Reconstructed energy spectra shows no evidence of excess/deficit of events in any of the sample.



Data Limits at 90% C.L.

- NOvA presents the world leading limits in the $\sin^2\theta_{34}$ vs. Δm_{41}^2 parameter space.
- Rejecting large amount of the 90% C.L. allowed region by IceCube experiment in $\sin^2\theta_{24}$ vs. Δm_{41}^2
- Results are consistent with no sterile oscillations at 90% C.L.



Acknowledgement:

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Literature Cited

- [1] M. Acero *et al.*, *Phys.Rev.Lett.*, vol. 134, no. 8, p. 081804, 2025.
- [2] E. Valencia *et al.*, *Phys.Rev.D.*, vol.100, no. 14, p. 092001, 2019.