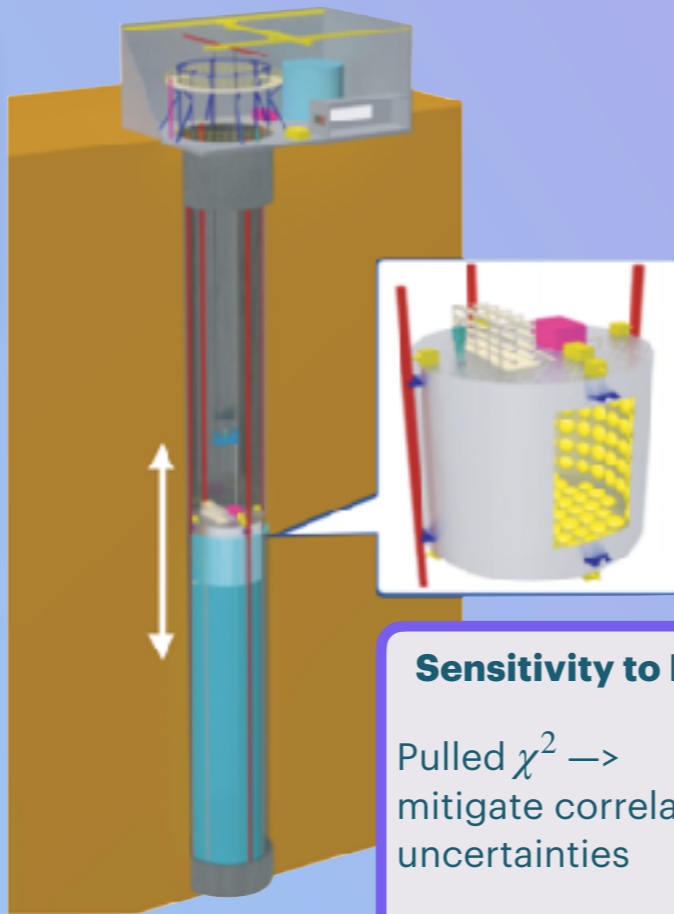
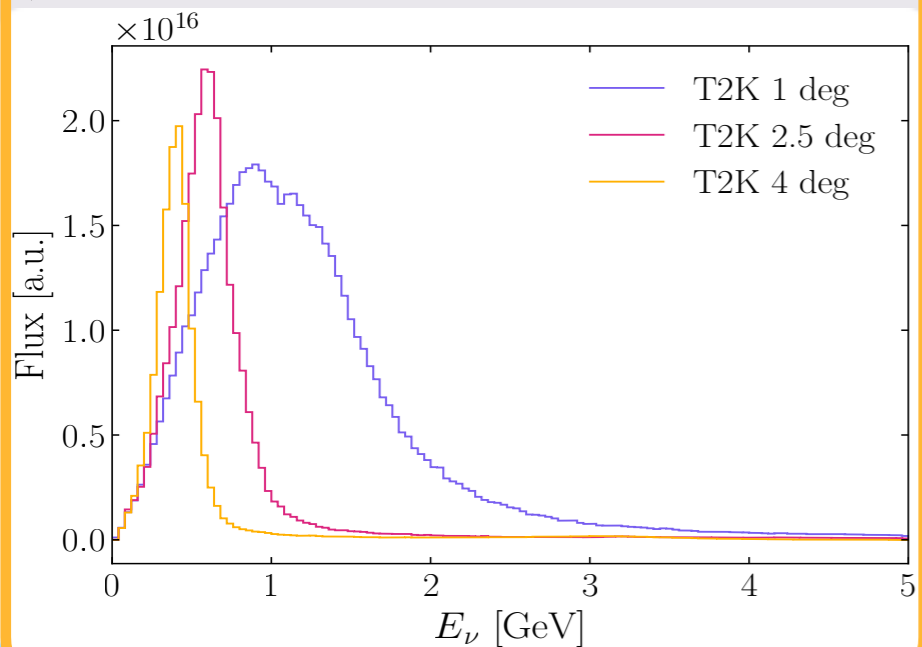


Testing Neutrino Non-Standard Interaction with the Intermediate Water Cherenkov Detector

Thomas Schwemberger with Volodymyr Takhistov

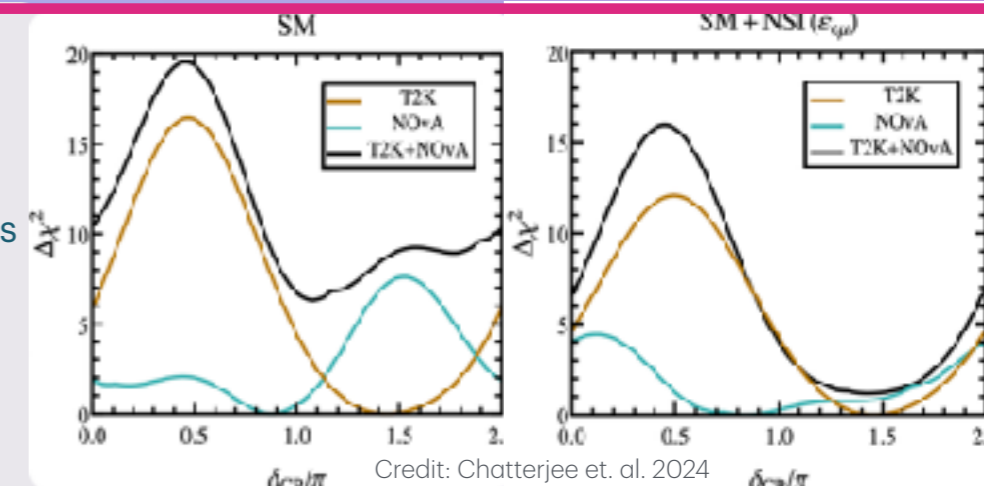
The Intermediate Water Cherenkov Detector (IWCD)

- Moveable detector taking measurements of the T2HK beam at multiple off-axis angles
- ◆ 870m from J-PARC (minimal oscillation effects)
- ◆ 0.76 k-tonne detector



Credit: Hyper-K collaboration

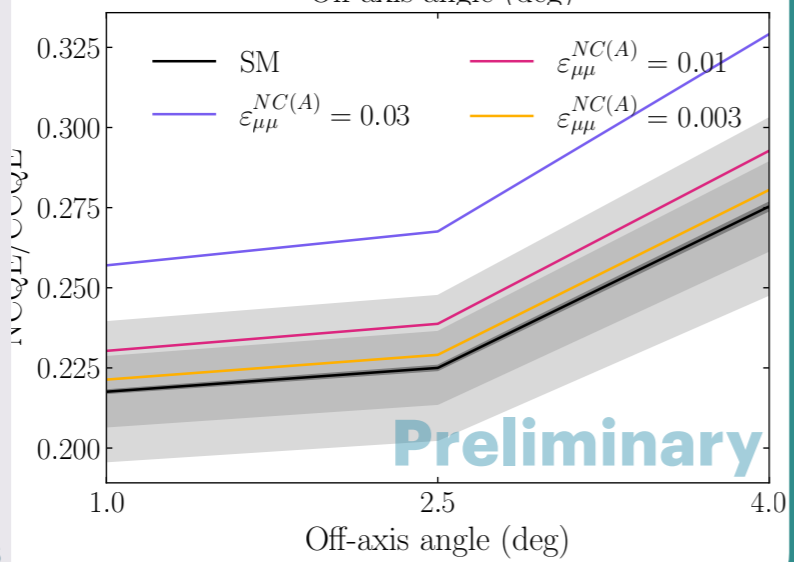
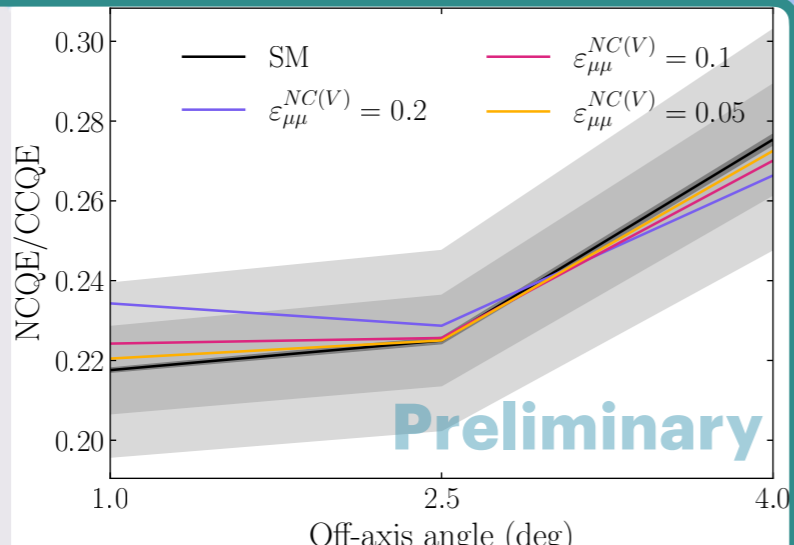
- ### Neutrino Non-Standard Interactions
- Implications for:
- ◆ Particle decays
 - ◆ PMNS parameters
 - ◆ Oscillations
 - ◆ **Scattering**
 - ◆ **CP violation**



Credit: Chatterjee et. al. 2024

Ratio of event rates

- Cancel uncertainties in:
- ◆ Water propagation
 - ◆ PMT gain/efficiency
 - ◆ Detector geometry



Multiple Angle Measurements

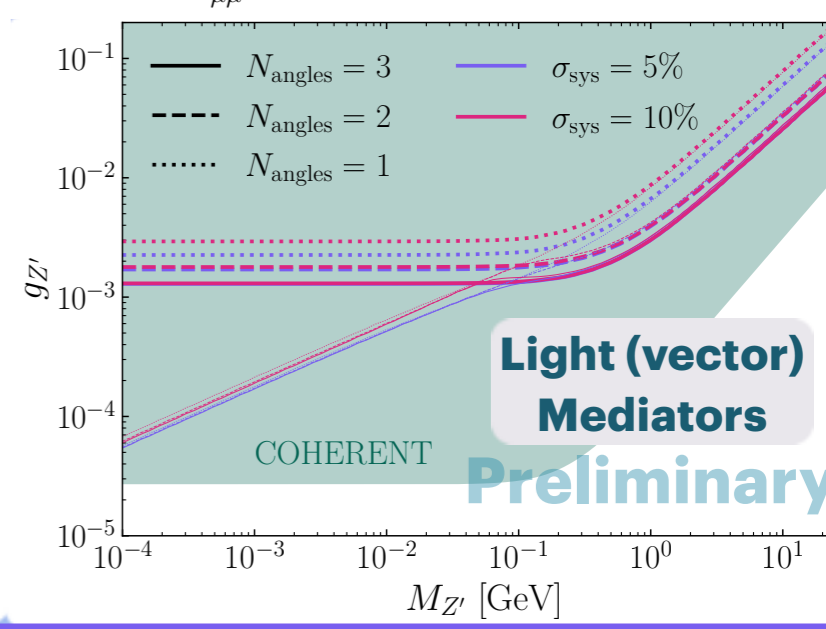
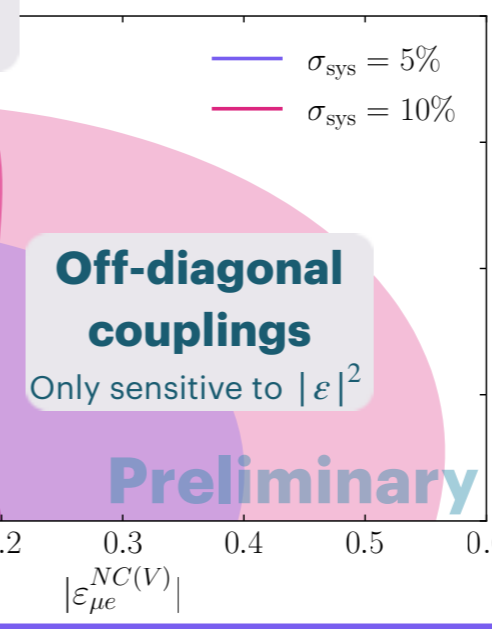
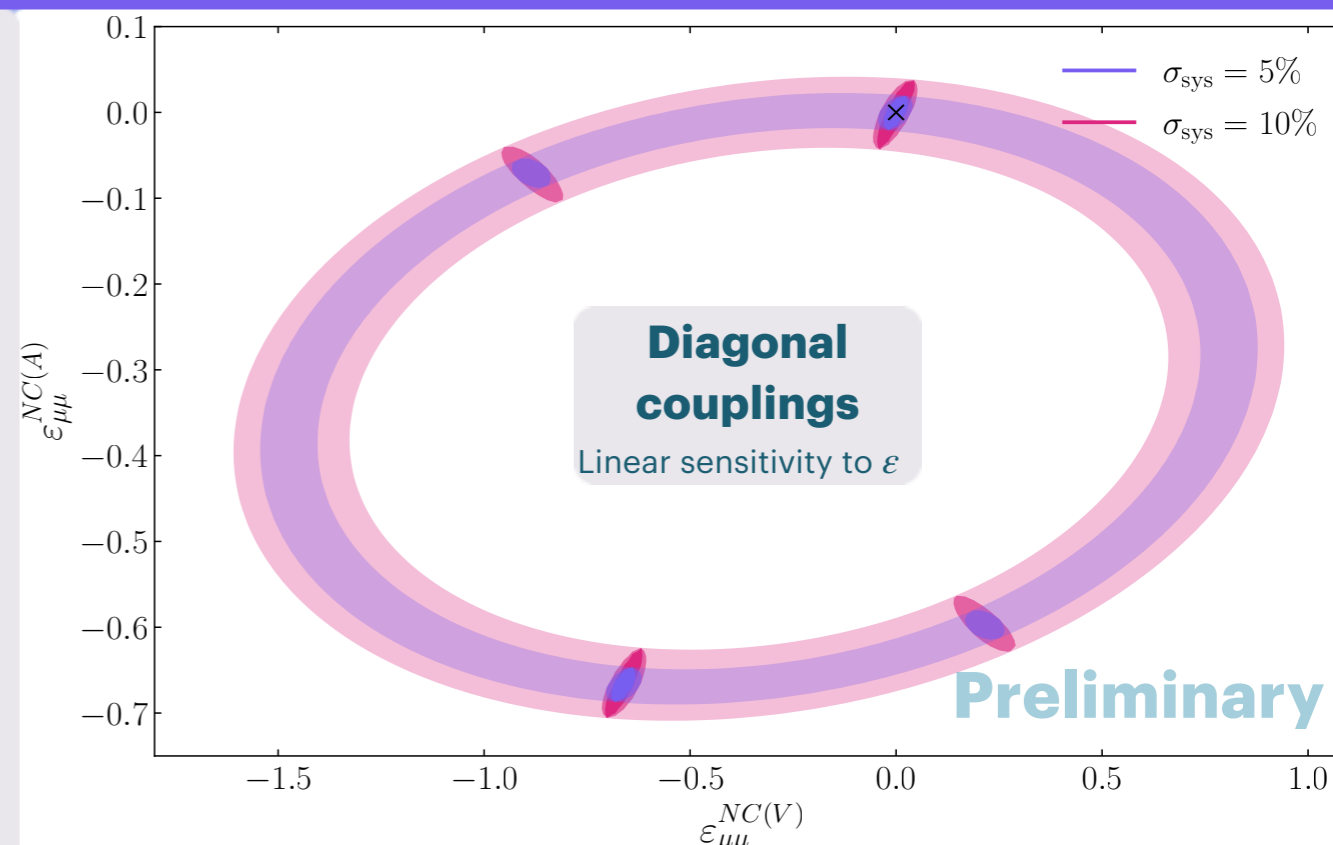
- Use the moving detector to:
- ◆ Sample multiple neutrino energies
 - ◆ Mitigate uncertainties in beam flux

- Vector NSI:** strong energy dependence
Axial NSI: strong normalization of event rate, but degenerate with many uncertainties

Sensitivity to NSI

Pulled $\chi^2 \rightarrow$ mitigate correlated uncertainties

- One angle: total degeneracy along ring
- Two angles: four degenerate regions
- Three angles: two degenerate regions
- Weaker sensitivity to off-diagonal couplings, light mediators



Light (vector) Mediators

COHERENT