

Implications of latest T2K results

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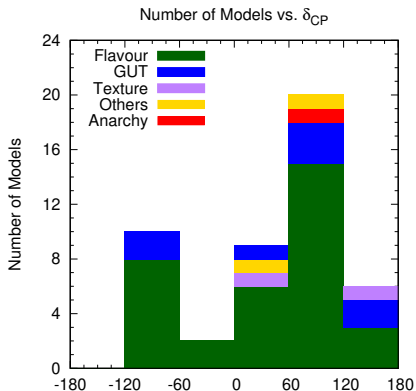
KTH Royal Institute of Technology
Stockholm, Sweden

OKC BSM Meeting
April 28, 2020

Q & A

Q: Why we want to measure δ_{CP}

A: To understand the theory



T2K Exposure

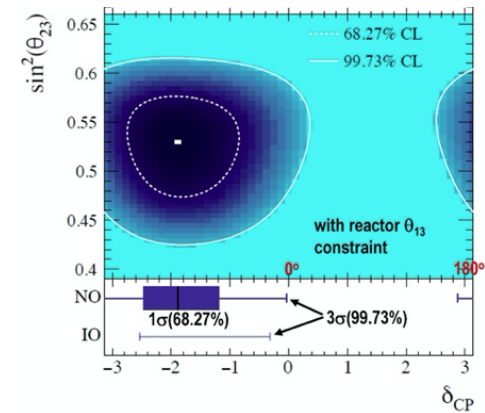
Total Approved Exposure: 7.8×10^{21} POT

Data Analysed: $1.49 \times 10^{21}(\nu) + 1.64 \times 10^{21}(\bar{\nu})$ (2009 - 2018)

40% analysed so far

Nature 580, 339–344(2020), POT: protons on target

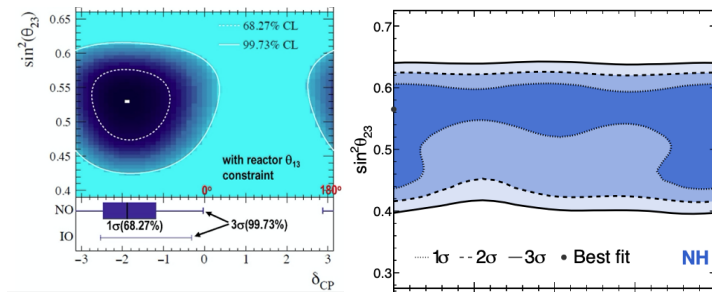
Results from T2K



$$\delta_{CP} = -108^\circ$$

0° and 180° excluded $> 2 \sigma$

Comparison with $\text{NO}\nu\text{A}$

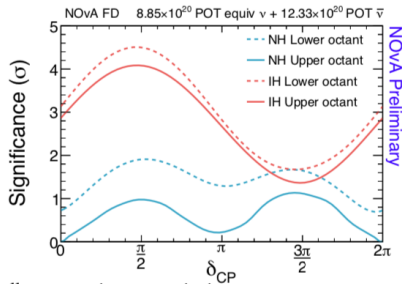
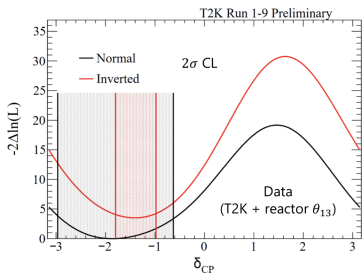


$\text{NO}\nu\text{A}$ best-fit is ruled by $\text{T2K} > 2\sigma$

$\text{NO}\nu\text{A}$ scale 0° to 360°

Nature 580, 339–344(2020) (T2K), Phys.Rev.Lett. 123, (2019) 151803 ($\text{NO}\nu\text{A}$)

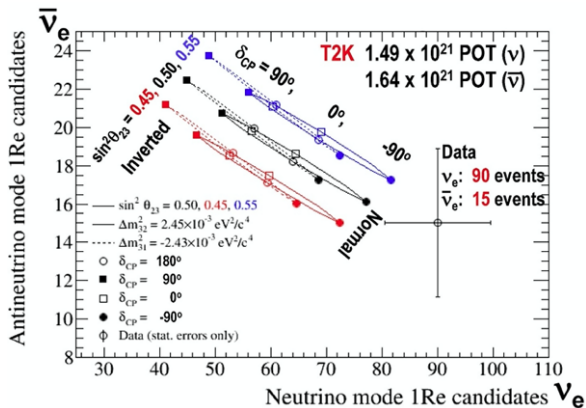
Comparison with $\text{NO}\nu\text{A}$



$\text{NO}\nu\text{A}$ best-fit is excluded by T2K $> 2\sigma$

Nufact 2019

To be understood



ν events: More than expected

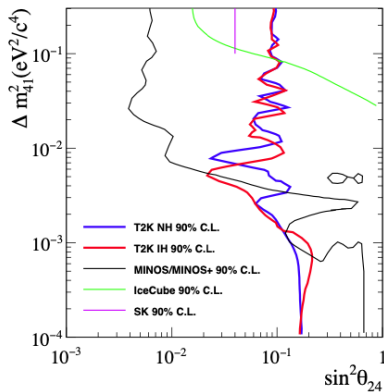
$\bar{\nu}$ events: Less than expected

Closer Look

Super-K Selection	Predicted				Observed
	$\delta_{CP} = -\pi/2$	$\delta_{CP} = 0$	$\delta_{CP} = \pi/2$	$\delta_{CP} = \pi/2$	
ν_μ CCQE-like	272.4	272.0	272.4	272.8	243
ν_e CCQE-like	74.4	62.2	50.6	62.7	75
ν_e CC1 π -like	7.0	6.1	4.9	5.8	15
$\bar{\nu}_\mu$ CCQE-like	139.5	139.2	139.5	139.9	140
$\bar{\nu}_e$ CCQE-like	17.1	19.6	21.7	19.3	15

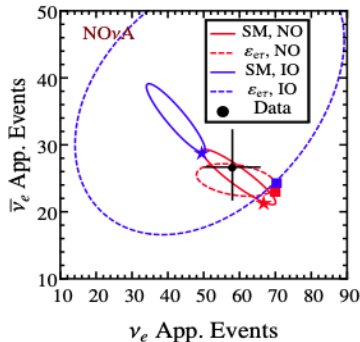
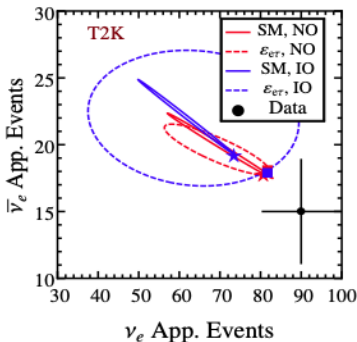
ν_e CC1 π events has to be understood

3+1 fit

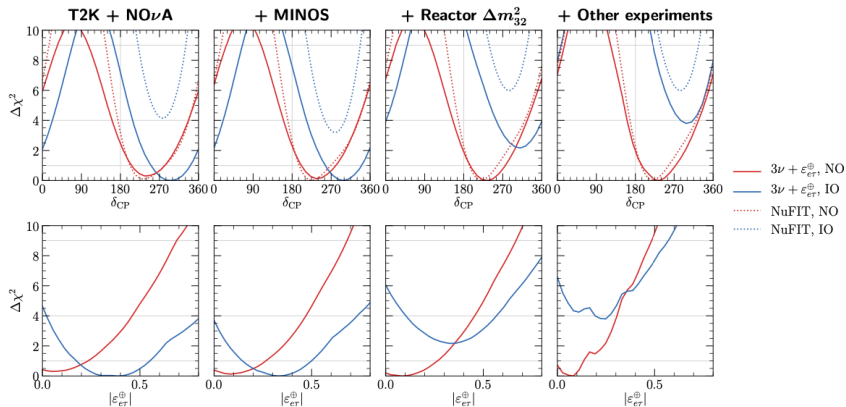


No evidence

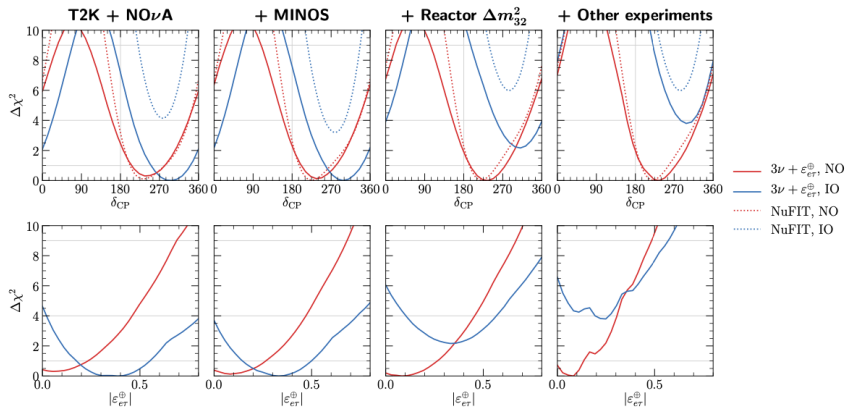
$$\mathcal{L} = -G_F \epsilon_{\alpha\beta}^f \bar{\nu}_\alpha \gamma^\mu \nu_\beta \bar{f} \gamma_\mu f$$



Hierarchy sensitivity vanished in the presence of NSI



Addition of more data brings the sensitivity back



Addition of more data brings the sensitivity back

2004.04745

Thank you