Imperial College London

KING'S College LONDON

Preparing for the Precision Era: New Ways of Presenting T2K 2020 Oscillation Results

Marvin Pfaff, Andres Lopez Moreno, Ed Atkin, Patrick Dunne
on behalf of the T2K Collaboration

Current Presentations of Oscillation Results

Current presentations are based on the PMNS parameterisation:

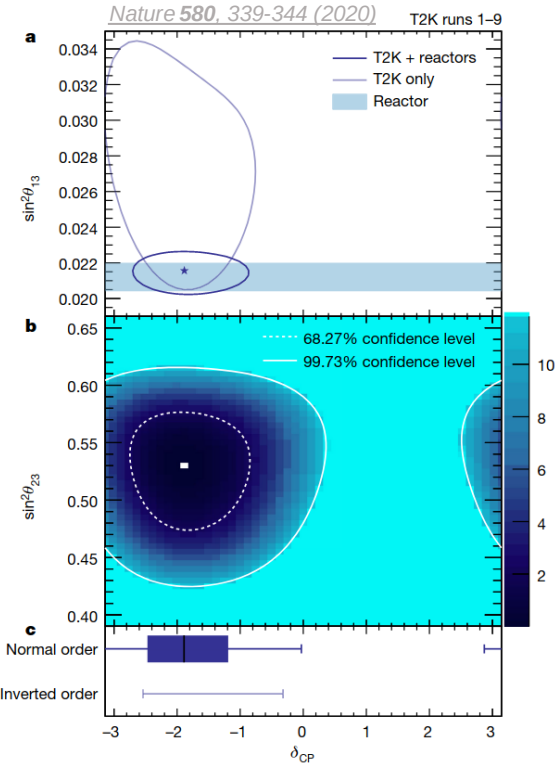
$$U_{\mathrm{PMNS}} = \begin{pmatrix} U_{e1} & U_{e2} & U_{e3} \\ U_{\mu 1} & U_{\mu 2} & U_{\mu 3} \\ U_{\tau 1} & U_{\tau 2} & U_{\tau 3} \end{pmatrix} =$$

Sov. Phys. JETP 7, 172-173 (1958), Prog. Theo. Phys. 28, 870-880 (1962)

$$= \begin{pmatrix} 1 & 0 & 0 \\ 0 & c_{23} & s_{23} \\ 0 & -s_{23} & c_{23} \end{pmatrix} \begin{pmatrix} c_{13} & 0 & s_{13}e^{-i\delta} \\ 0 & 1 & 0 \\ -s_{13}e^{i\delta} & 0 & c_{13} \end{pmatrix} \begin{pmatrix} c_{12} & s_{12} & 0 \\ -s_{12} & c_{12} & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

4 free parameters

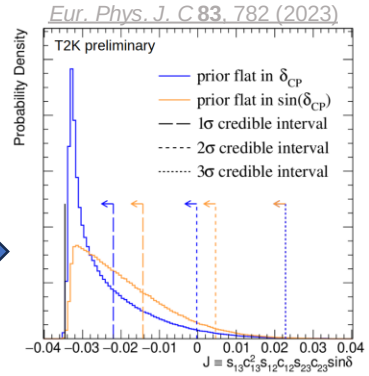
Nature **580**, 339-344 (2020)



Recently included

Jarlskog Invariant: $J_{\mathrm{PMNS}} = s_{13}c_{13}^2 s_{12}c_{12}s_{23}c_{23}\sin(\delta_{\mathrm{CP}})$

Eur. Phys. J. C **83**, 782 (2023)



→ In case of non-unitarity, PMNS parameterisation does not hold anymore

New Presentations of Oscillation Results

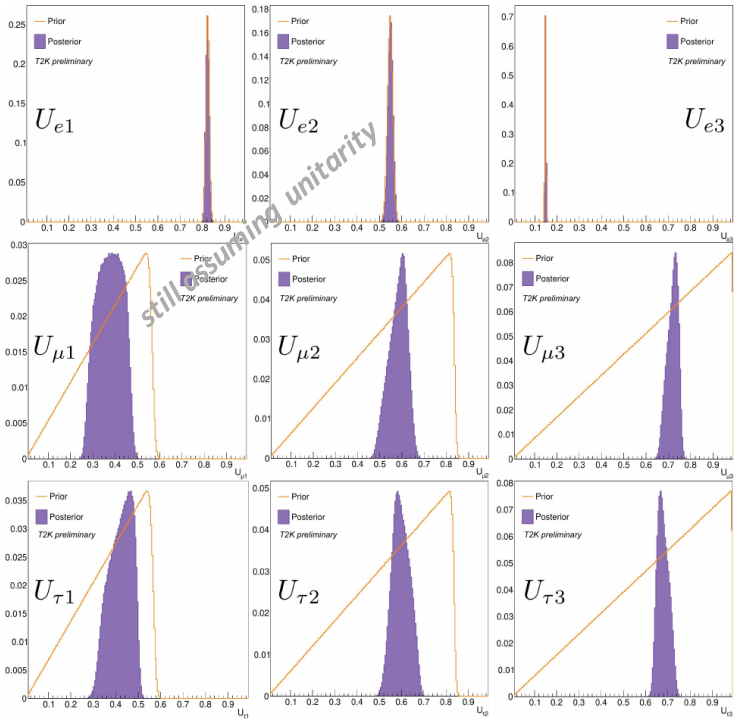
- General 3x3 leptonic mixing matrix (LMM) can be defined as:

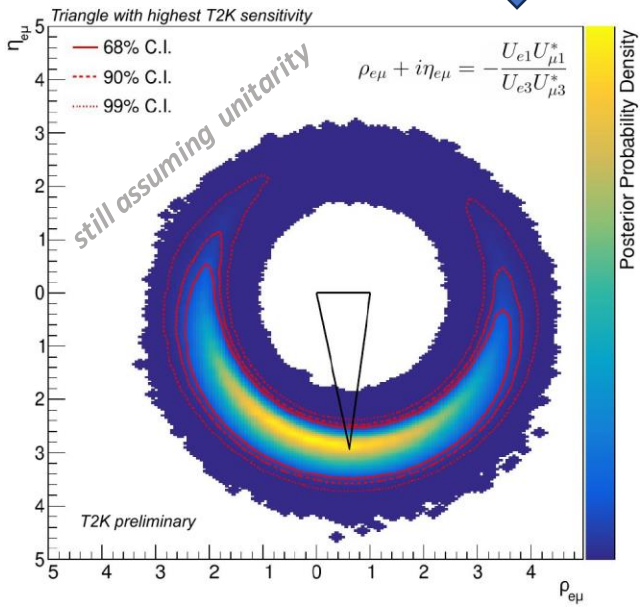
Phys. Rev. D 102, 115027 (2020)

$$U_{LMM} = \begin{pmatrix} |U_{e1}| & |U_{e2}|e^{i\phi_{e2}} & |U_{e3}|e^{i\phi_{e3}} \\ |U_{\mu 1}| & |U_{\mu 2}| & |U_{\mu 3}| \\ |U_{\tau 1}| & |U_{\tau 2}|e^{i\phi_{\tau 2}} & |U_{\tau 3}|e^{i\phi_{\tau 3}} \end{pmatrix}$$

→ ***13 free parameters***

→ ***need presentations that don't change in case of non-unitarity or can test non-unitarity***





Next Step: