A High Resolution ν-Experiment at the Intensity Frontier

✳ The PMNS Matrix Elements

❧Θ_{13} Sensitivity; ❧Sensitivity; ❧**ν-**Mass Hierarchy; ❧Resolving degeneracies

⇕ ⇒ *Need systematic precision & redundancy*

✳ Beyond PMNS

❧Θ_{23} = 45^0 ? ; ❧CPT Violation ? ; ❧High Δm**2 Oscillation ?

⇒ Phenomenon that defies the Zeitghist

✳ The familiar, beautiful neighborhood

❧Cross-section; ❧Sum rules; ❧Isospin Physics

❧Sin**2(Θw): (special HE run) precision commensurate with Colliders

❧Heavy neutrinos

❧……..

❧Rewriting the **ν-**text-book

What we need:

- ***Flux***

  νμ ↔ μ-; **ν**e ↔ e-; *and* anti-**ν**μ ↔ μ+; anti-**ν**e ↔ e+

  Absolute and Relative flux (E***ν***); (anti)**ν**-$\mathcal{N}$ucleus

- ***Energy Scale***

  Charged-particle momentum; 4-Calorimetric Coverage; missing-P_T

- *Measurement of Secondary* $\pi^{0/+/-}$ *in* **ν**-*Hadron-shower (CC & NC)*

  Proton/ K / π ID

- *~100 Million* **ν**μ-*CC*

it follows:

- *Light, 'Transparent' Tracker*

  ~*0.1* gm/cm^3 with electron-ID (TR-capability); γ

- *B-Field*

- *4π-Coverage: Calorimeter and μ*

Absolute Neutrino Flux in LBNE & Beyond

by Xinchun Tian

✴ *Muon Sample:* $\nu_{mu} + e^- \rightarrow \nu_e + \mu^-$ (Single, forward μ-: IMD)

❧Elegant, Simple: but steep, though calculable, threshold Eν≥11 GeV

❧Systematic advantage of STT (HIRESMNU) lies in avoiding the error that the CCFR or CHARM-II incurred in extrapolating the background to the signal $\zeta = Pe(1-\cos\Theta e) \leq Cut$

⇒ σ(IMD) known ⇒ Absolute-ϕ(ν_x) *at High-*Eν (*11* ≤*E*ν≤ *30 GeV*)

✴ *Electron Sample:* $\nu_x + e^- \rightarrow \nu_x + e^-$ (Single, forward e-: Elas)

❧92% are from ν_{mu}

Using Collider measurements, the Weak Mixing Angle (0.23) at Q~0.1 GeV, known to ≤1% precision,

⇒ σ($\nu_x e^-$NC) known ⇒ Absolute-ϕ(ν_x) *at Low-*Eν (*1* ≤*E*ν≤ *5 GeV*)

Redeem our Pledge:

- *Systematics for Oscillation*

- *P(*$\nu_\mu \rightarrow \nu_e$*) down to 10^-4*

  Need external measurements of (K^+/π^+), (K^-/K^+), (K^0/K^+)

- *P(*$\nu_\mu \rightarrow \nu_\tau$*) down to <10^-5* ⇐ *A High Energy run*

- *Precision measurements*

A program as rich in Physics as those of collider experiments: > 100 papers