

Charged Pion Production Explorations Using the NOvA Near Detector

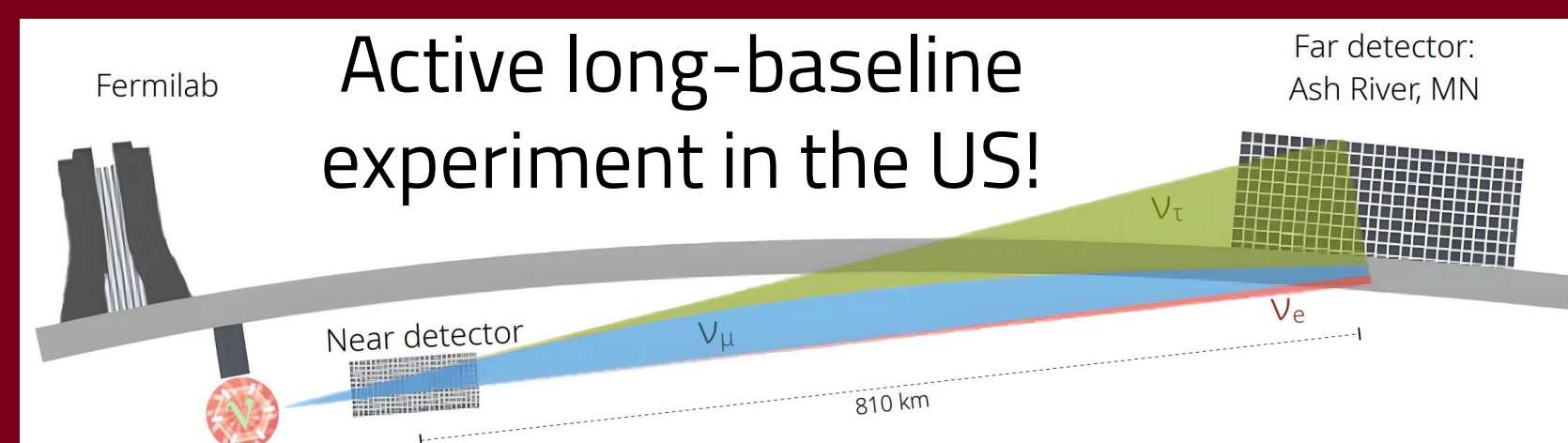


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The NOvA Beam Energy, Pion Topologies, and Pion Angular Reconstruction



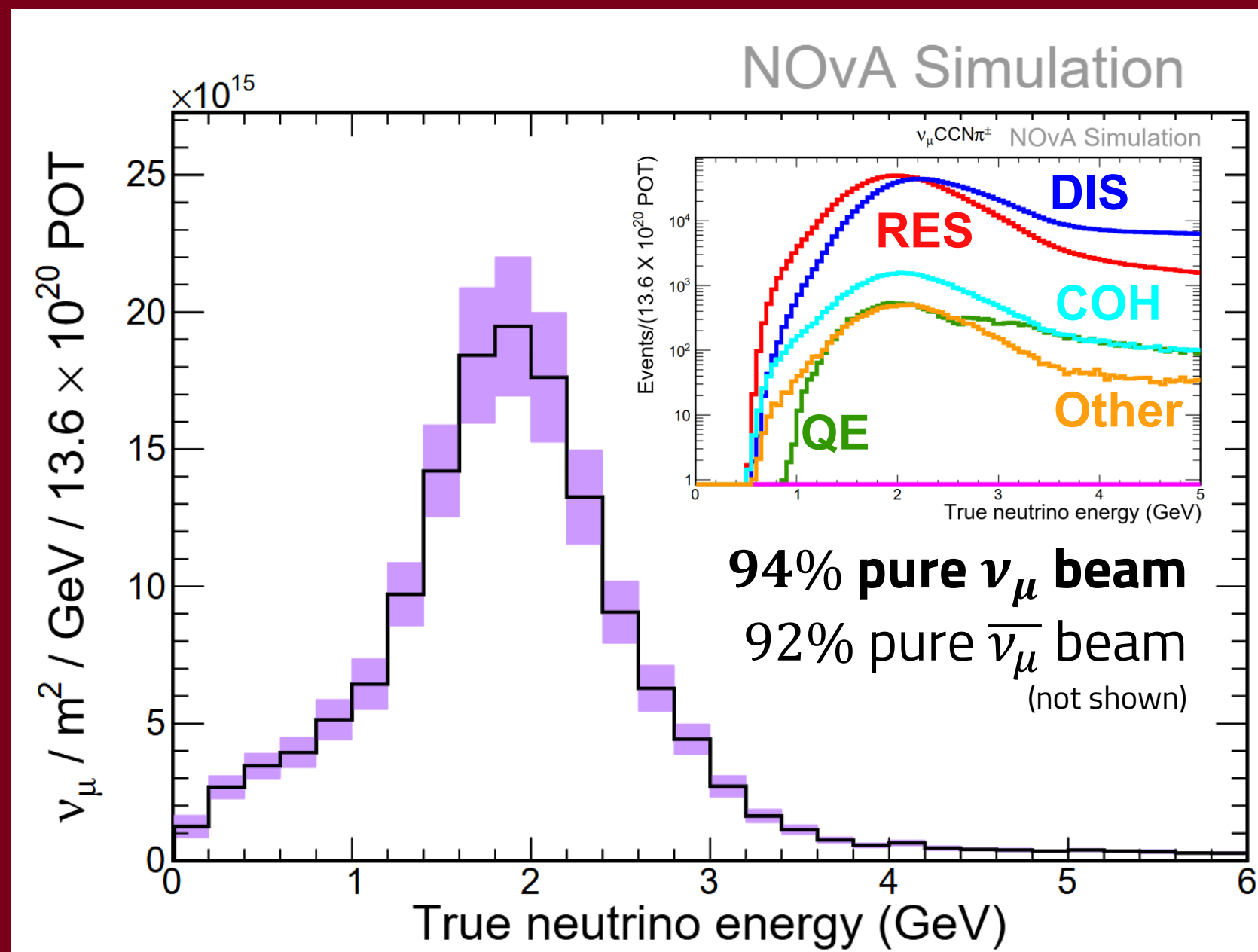
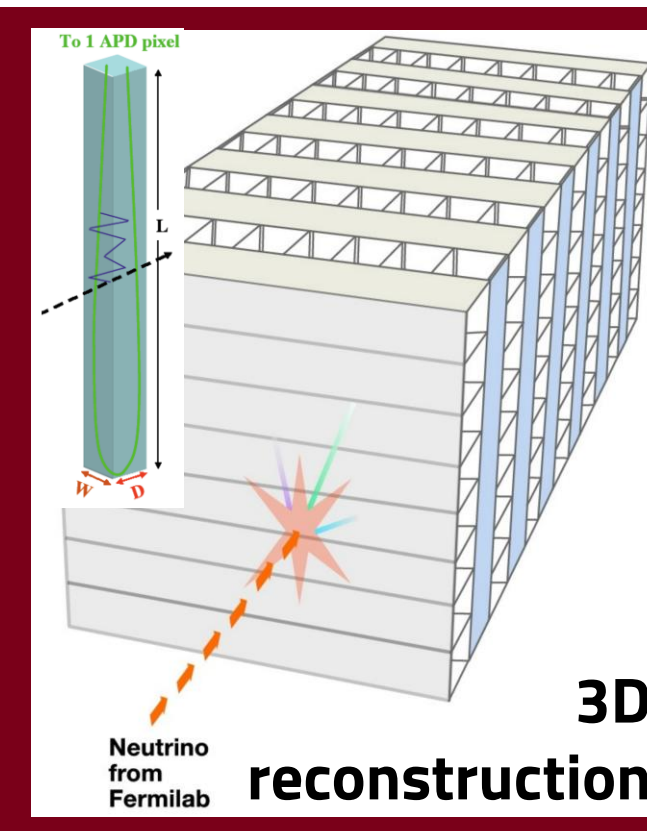
NOvA sits off axis to the FNAL NuMI beamline

- $\langle E_\nu \rangle \sim 2\text{GeV}$
- CC RES + DIS!!

Segmented liquid scintillator detectors

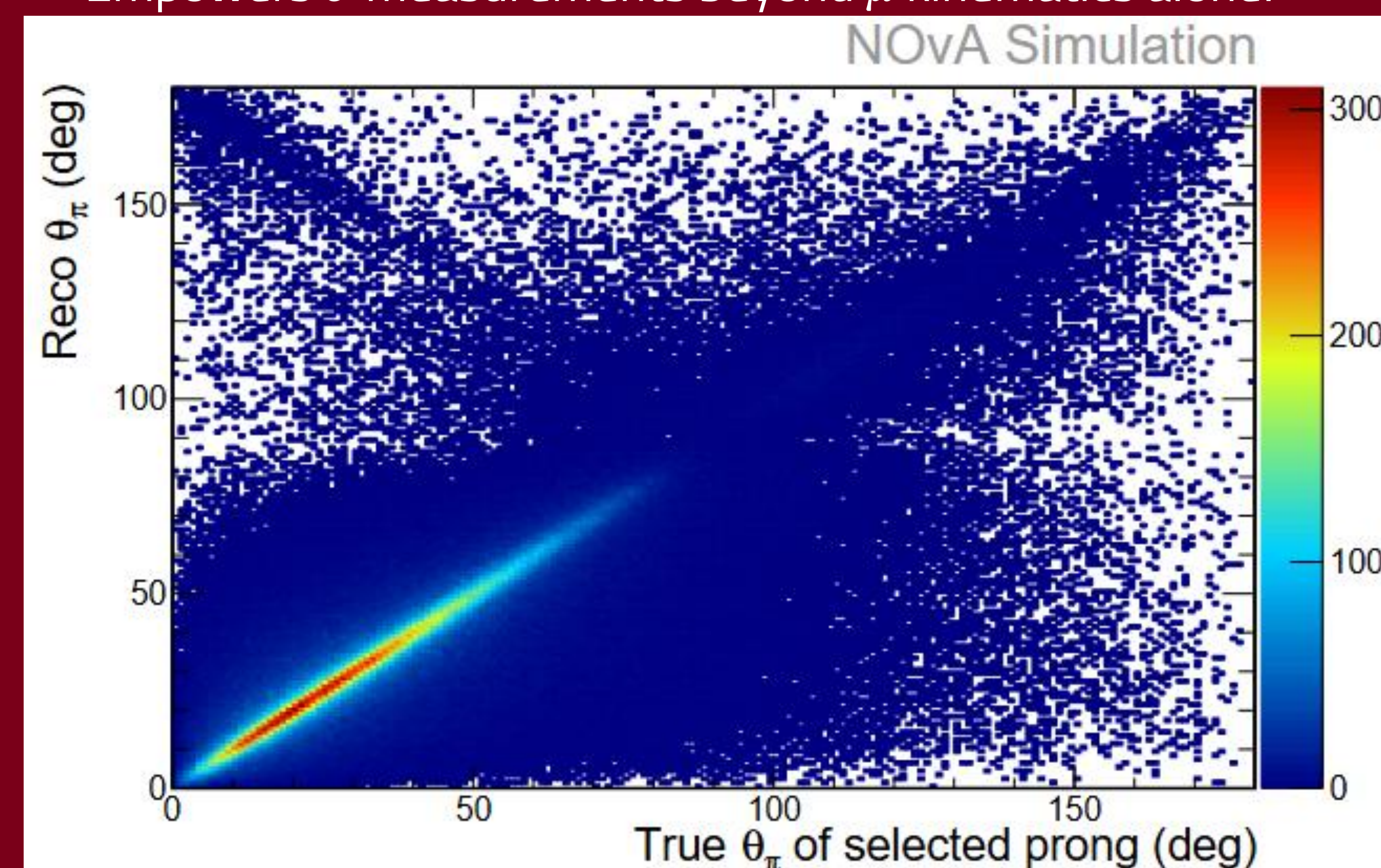
$1\mu\pi X$ selection

- $\sim 67\%$ purity, $\sim 5\%$ efficiency



LS cells $\sim 4\text{cm}$ width + (x, y) orientation: limits tracking resolution

- **Pion identification possible** – E_π difficult, θ_π easier!
- Empowers σ measurements beyond μ kinematics alone!

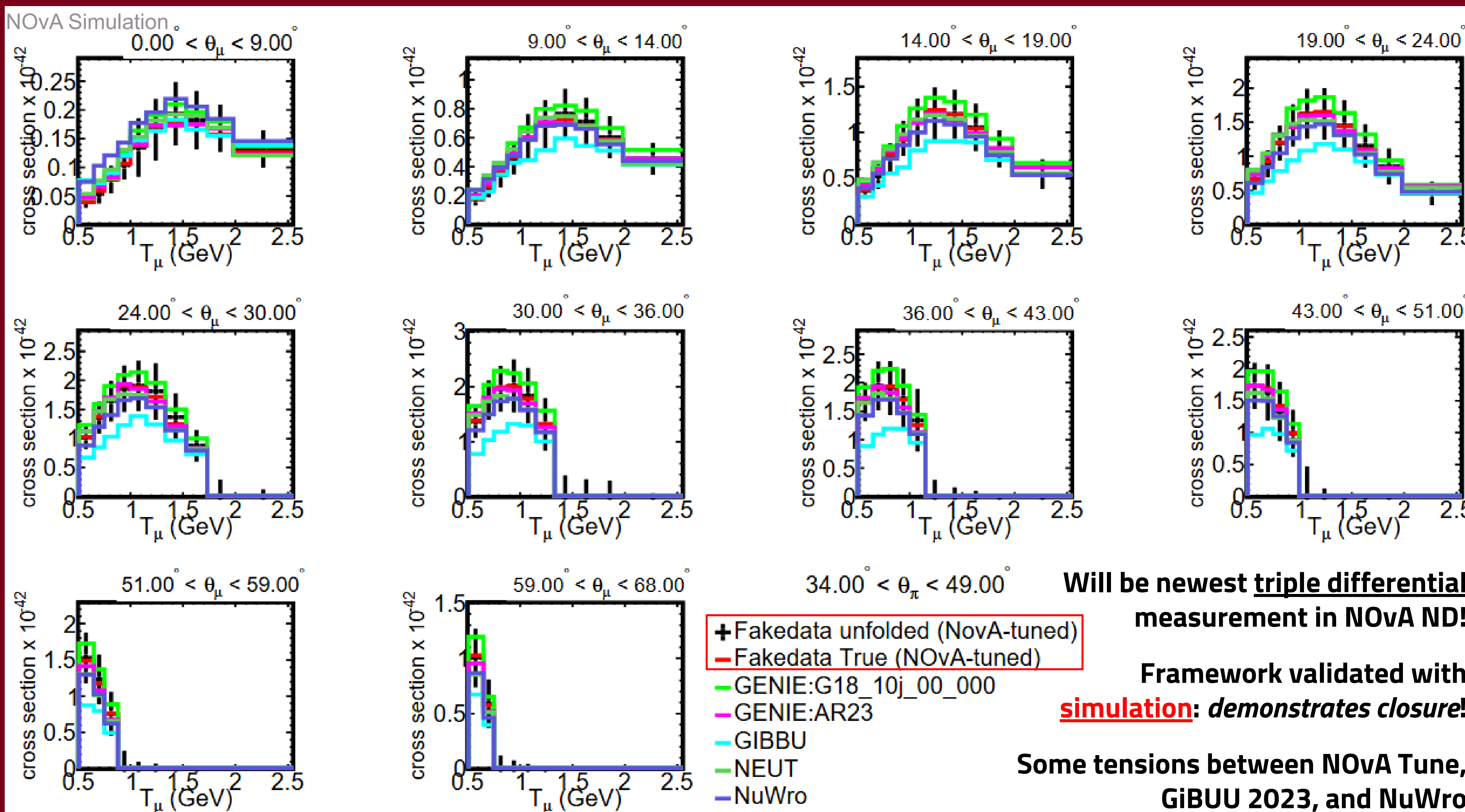


NOvA can measure high statistics pion-enhanced samples via multidifferential cross sections directly relevant to the resonance region in DUNE



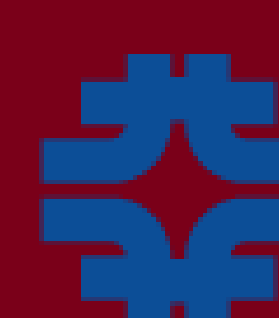
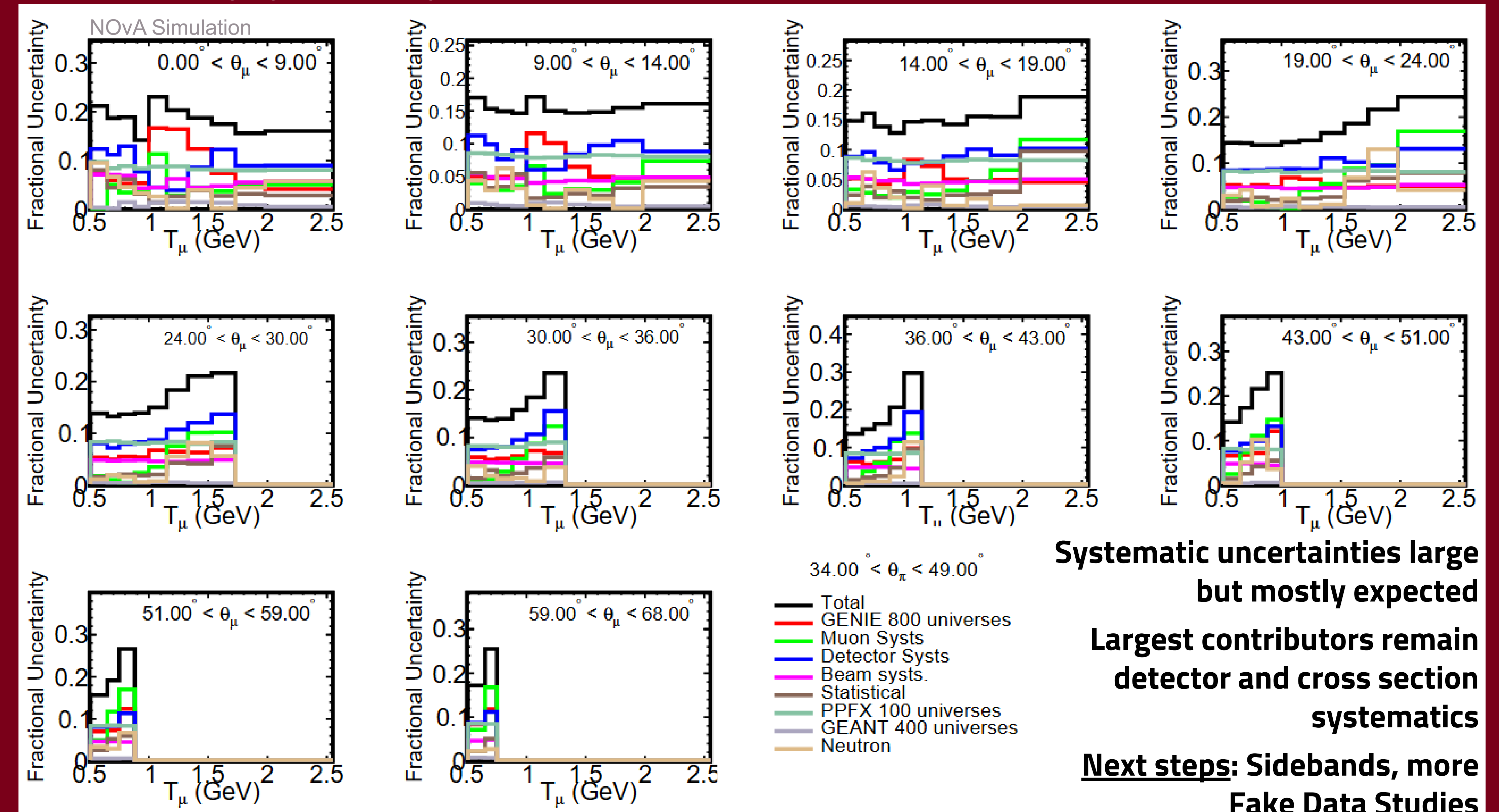
Triple Differential Cross Sections in μ Kinematics & Leading π^\pm Angle—Looking Toward DUNE

Comparisons between forthcoming data and various generators can inform future modeling and tuning efforts, improving our understanding of CC RES and DIS as we approach DUNE



Systematics Uncertainties Well Developed

Large cross section uncertainties highlight a challenge for DUNE—encouraging further, high statistics, precision explorations of the CC RES and DIS phase space



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