NOvA Experiment



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Neutrino Telescopes 2015



NuMI Off-Axis V_e Appearance Experiment

Long-baseline neutrino oscillation experiment $E \approx 2 \text{ GeV}$ L = 810 km

Oscillations at atmospheric regime

NuMI beam produced at Fermilab v_{μ} and \overline{v}_{μ} beam modes $(\overline{v}_{\mu}) \rightarrow (\overline{v}_{x})$ oscillations

Two detector experiment Near Detector (Fermilab, IL) Measure beam before oscillations Far Detector (Ash River, MN) Measure oscillated beam

Comparison reduces systematics





3 Categories of Physics Topics

Accelerator v Oscillation Physics Uses Near and Far Detectors

Accelerator v Near Detector Physics Cross-sections

Non-accelerator Physics Supernova v Monopoles



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Oscillation Measurements:

 ν_{e} Appearance $\theta_{13},\,\delta_{CP}^{},\,mass$ hierarchy

 v_{μ} Disappeanace sin²(2θ₂₃), | Δm^{2}_{32} |

Combined Appearance and Disappearance Octant of $\theta^{}_{_{23}}$

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NOvA Detectors



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 v_E Event Selectors



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v Event Selectors

L



Sensitivities: Mass Hierarchy

1σ and 2σ contours for 2 example measurements

Hierarchy resolution as a function of true value of δ_{CP}



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Sensitivities: CP Violation

1σ and 2σ contours for 2 example measurements

Ruling out no CP violation as function of true value of δ_{CP}



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Sensitivities: Disappearance



Can resolve non-maximal mixing for values of θ_{23} that are currently allowed at 90% CL

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Sensitivities: θ_{23} Octant

Significance of determining octant as function of true value of $\underline{\delta}_{_{CP}}$



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Total Number of Protons Delivered to NOvA



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Good agreement between cosmic rays simulation and data









Verified neutrino beam window with limited hand-scanning to maintain blindness



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Hand-scanned events





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ND Beam Events



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Mass Hierarchy Up to 3σ determination for best $\delta_{_{\rm CP}}$ case

Octant Resolution Up to 3σ determination for best δ_{CP} case and sin²($2\theta_{23}$)=0.95

Precision Measurement of θ_{23} and Δm^2_{32}

Taking data with Near and Far Detectors

Expect 1st oscillation results this year!