Future neutrino physics using the upgraded ND280 detector of the T2K experiment



The Tokai-to-Kamioka (T2K) experiment



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Neutrino interactions and the OA



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Motivation for ND280

We compare **data vs MC** in the ND280 to improve the modeling and constrain the systematic errors (**flux** and **xsec**)



talk by

J. Walsh

The current ND280 detector



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The upgraded ND280 detector



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A new tracker concept (SuperFGD)



C. Jesús-Valls | SuperFGD A new 3D plastic scintillator technology for the near detector ND280 upgrade of the T2K experiment

Improvements in tracking for low momentum tracks



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Improvements in tracking Current FGDs PID is much worse than TPCs

Charge particles beamtest @CERN (2018)

The SuperFGD Prototype charged particle beam tests **JINST 15 P12003**



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Neutron capabilities



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Improvements in timing



Michel Electron detection ~50% • Due to better electronics Crucial to separate low momentum p/π

OOFV rejection

OOFV rejection

- Current ToF information resolution ~few ns.
- Upgrade ToF information < ns.

Only ~20% OOFV comes from neutrals (~mainly neutrons)



decrease by up to 80%

Specially important for backward going tracks

 Better timing information translates into better purity!

High impact if $CC1\pi$ SK samples are added to OA.



Example of a CC1\pi interaction in the upgraded ND280



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Improvement in systematics



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Conclusions



- Upgrade in **2022**!
- Very exciting neutrino physics possibilities in T2K ahead of us.
- ND280 upgrade will benefit our understanding on neutrino oscillations and neutrinonucleus scattering.

