Contribution ID: **86** Type: **Poster**

An independent measurement of theta_13 using Hydrogen neutron capture at Daya Bay

The Daya Bay Experiment can make an independent measurement of reactor antineutrino disappearance using interactions identified by neutron capture on Hydrogen (n-H). Six 20-ton Gd-loaded and six 22-ton undoped scintillating targets provide nearly the same statistical precision using n-H interactions as the existing Gadolinium neutron capture result from Daya Bay. Several new techniques were developed to meet the challenges from the higher background and different systematics due to the lower neutron capture energy (2.2 MeV), the longer capture time (200 us), and the larger energy loss at the detector boundary. With the statistical and the major systematic uncertainties independent from the previous Gd capture study, this work allows for strong and independent evidence of reactor antineutrino disappearance. With the disappearance attributed to oscillation, theta_13 can be estimated with precision comparable to the existing Daya Bay measurement using neutron capture on Gadolinium. The combined Hydrogen and Gadolinium results should provide the most sensitive measurement of the neutrino mixing angle theta_13.

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Track Classification: Reactor Neutrino Oscillations