

**Stony Brook University  
The Graduate School**

Doctoral Defense Announcement

**Abstract**

Measurement of the Single Neutral Pion Production Cross Section in Neutral-Current  
Neutrino Interactions in the T2K Pi-zero Detector

By

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The T2K experiment is a long baseline neutrino oscillation experiment designed to directly measure  $\nu_\mu \rightarrow \nu_e$  oscillation, thereby providing a measurement of  $\theta_{13}$ , the last unknown neutrino mixing angle. To achieve this goal, a beam of muon neutrinos is produced at the Japanese Proton Accelerator Research Complex in Tokai, Japan and sent 295 kilometers across Japan towards the Super-Kamiokande detector. One of the major backgrounds of the  $\nu_e$  appearance measurement is from neutral current  $\nu_\mu$  interactions where a single  $\pi^0$  is produced and the photons from the  $\pi^0$  decay mimic the  $\nu_e$  appearance signal. In order to constrain the uncertainty on this background, a  $\pi^0$ -detector has been constructed as part of the T2K near detector facility at 280 meters from the proton beam target.

This thesis presents a measurement of the neutral current single  $\pi^0$  production cross section using  $8.55 \times 10^{19}$  POT of T2K data. This is achieved by using pre-defined selection criteria in order to enhance the invariant mass distribution of  $\pi^0$  candidate events. An extended likelihood fit is then performed on the data distribution in order to extract the number of signal events. It is hoped that with this measurement T2K will be able to reduce its systematic errors and therefore increase the significance of the  $\theta_{13}$  measurement.

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