

Emulsion Neutrino Detector at T2K beam line (Extension of T60 experiment)

T60 collaboration

Exclusive summary

We have carried out T60 experiment, an emulsion neutrino detector experiment, at T2K neutrino beam line. One future prospect of the experiment is muon-neutrino to electron-neutrino appearance search for sterile neutrino. Emulsion detectors have been tested at T60 experiment in 2014 on SS floor and showed good performance. Emulsion-related environmental problems have to be investigated and solved through this experiment. We propose extensive neutrino exposition of an enlarged emulsion detector. Electron-neutrino interactions are expected to be detected.

An Emulsion Detector has been proposed at T2K neutrino beam line in order to explore neutrino interactions with their exceptional spatial resolution. Exploration of LSND and MiniBooNE anomaly is within our reach with 1 ton scale emulsion detector.

We have tested detectors of newly developed emulsion gel at T60 experiment in 2014. Emulsion gel of 4 kg has been produced at Nagoya university. Emulsion films are also produced with the gel there. Basic performance of the emulsion gel was investigated prior to the neutrino exposure. Sensitivity and fading properties were monitored for 60 days and found that the grain density was kept more than 60 grains per 100 μm even after 60 days in a cooler box (~ 10 degree). The fog density was kept less than 10 grains per cm^2 . We found that cooler box temperature is necessary especially for the long term exposure. An ECC module of iron plates of 3kg was exposed to neutrino beam at SS floor from January to April of 2015. After the exposure, emulsion films were subjected to a development at Toho University and the plates were scanned on HTS at Nagoya university. Emulsion films are found to be in good condition and some neutrino interactions have been found and located in the ECC. An ECC module of water and iron target of 6kg is exposed in May of 2015.

Further exposure is proposed from November of 2015. Location of the detector is supposed to be on SS floor of the neutrino experimental hall, that should be consulted with T2K group. Size of the detector will be up to one cubic meter including cooler box as shown in Figure 1. AC power supply of several hundred watts is required for the cooler box. An ECC of 70kg of iron target shown in Figure 2 is planned to be installed as the

main detector module. The module is composed of 320 layers of emulsion films interleaved with 500 μ m thick steel plates. Optionally a new emulsion shifter module is going to be installed. We expect 4k neutrino interactions and 30 electron-neutrino CC interactions after 4 months exposure.

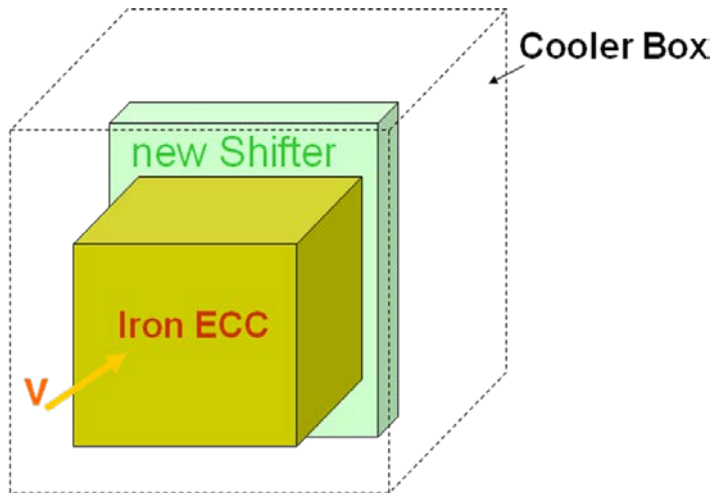


Fig. 1

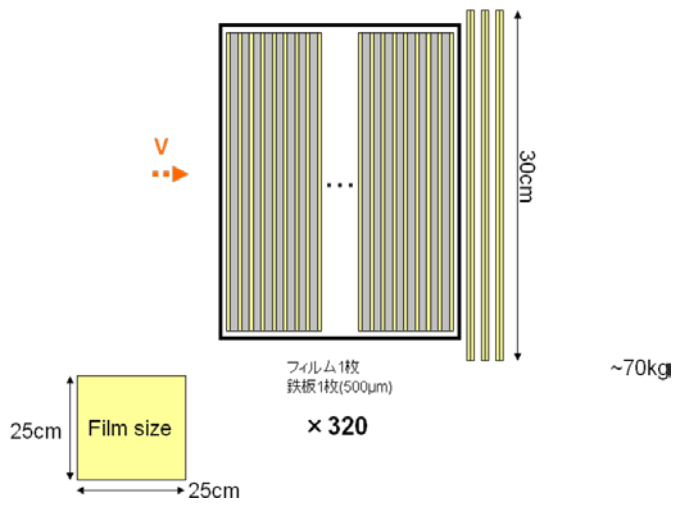


Fig.2