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J – PARC T60 Experiment : Status and Proposal for Oct Run

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We have carried out a test experiment (T60) that equips Emulsion Cloud Chamber (ECC) as a main detector. The aim of this experiment is a feasibility study to make a future experimental plan for the study of low energy neutrino – nucleus interactions and the exploration of sterile neutrino by using emulsion detector at J – PARC.

[1] Status

From the end of October 2014 to the end of May 2016, we installed a few kg iron target, a few kg water target and 60kg iron target emulsion detectors in turn at SS floor in the Neutrino Facility of J – PARC and they have been exposed to the anti-neutrino beam. We successfully confirmed the following points.

- The initial and long term performance (signal efficiency and noise density) of the newly developed emulsion films was confirmed.
- The handling method of the emulsion detectors at J – PARC site was established.
- First detection and analysis of neutrino events with a few kg iron target nuclear emulsion detector was done and the hybrid analysis between the emulsion detector and T2K near detector, INGRID to identify muon was demonstrated. These results will be submitted to journal as a technical paper near future.
- First detection of neutrino – water interaction with a few kg water target emulsion detector was achieved.
- The mass production and development of the emulsion films of 60kg iron target emulsion detector was performed well. The installation and long term operation (~4 months) of the middle size of detector was also confirmed. The suppression of signal disappearance was found at cold temperature (~10°C) with a cooling chamber.

[2] Future prospects

The scanning of films for the 60kg iron target emulsion detector is now on progress (~60 % is done in the beginning of Oct.). The scanning will be finished in the end of Oct. and event analysis will be started after scanning.

We plan to install several hundred kg water target ECC in 2018, after increasing beam intensity. So we would like to establish the structure of the water target ECC in the beam exposure at Oct 2016.

[3] Proposal for 2016 Oct Run

1. Aim

In previous exposure for the water target ECC (May 2015), we used 250um-thickness steel plate, 300um and 400um-thickness acrylic plate as the support plate for emulsion films. We found the distortion of films in each structure. So in this time, we will use much harder plate as the support plate for emulsion films (500um-thickness steel plate and 2mm-thickness acrylic plate).

Beam exposure is planned from the end of Oct 2016 to beam end (probably Feb. 2017). This test experiment can run parasitically with T2K, therefore we request no dedicated beam time nor beam condition. In this exposure, the expected number of neutrino-water events is more than 200 events (neutrino beam case). So we will also check event analysis scheme which is established by using iron-target ECC in water-target ECC.

2. Experimental set up:

The experimental setup is almost same of May 2015. An emulsion layer has 1 plastic sheet or iron plates between 2 emulsion films. They are packed in vacuum. The water target region is composed of emulsion layers interleaved with frame type plastic spacer which has large hole as shown in Fig.1. The emulsion chamber is fixed by springs in a water reservoir as shown in Fig.2. The water reservoir is installed in a cool box as shown in Fig.3.

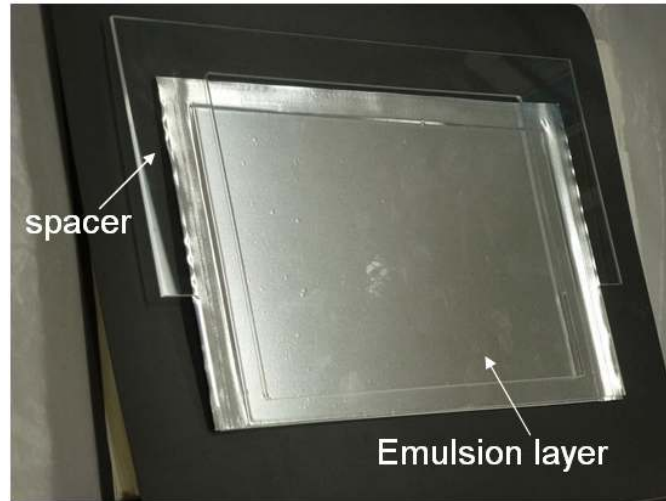


Figure.1 Emulsion tracker and spacer

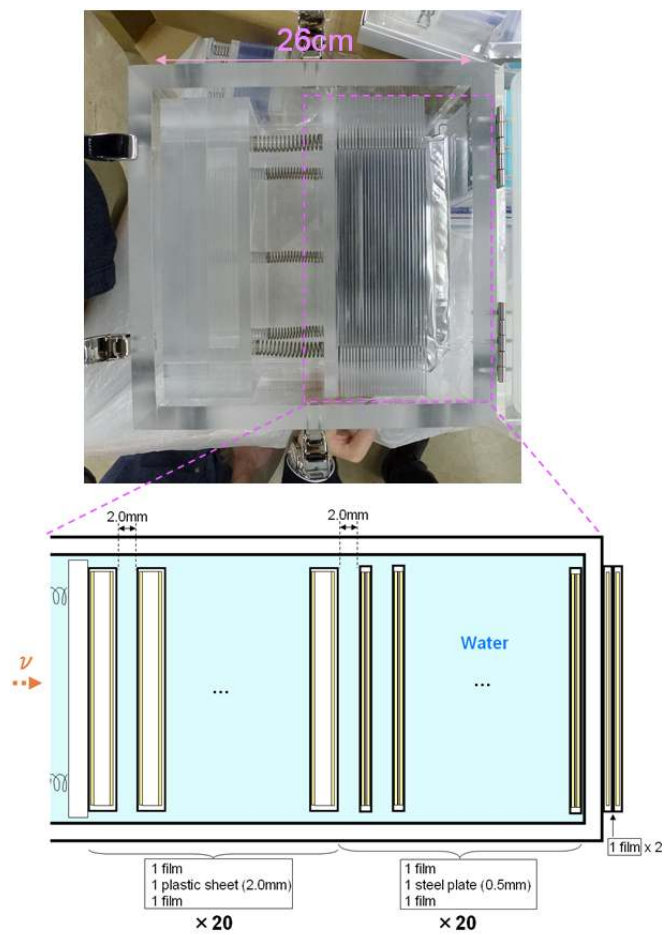


Figure.2 Water target emulsion chamber



13 cm – air space is needed around this box.

Figure.3 Cool box

The weight of water target is about 1.5 kg and total weight of detector is about 40kg. We would like to place this detector in SS floor of Neutrino Facility in J – PARC.

3. Schedule:

The end of Oct. : detector installation and data taking start.
 The end of Feb. : detector un-installation and emulsion film development. Then the analysis is start.

If beam end is extended, we would like to keep the detector at SS floor to accumulate neutrino events to beam end.

4. Requests:

We request the following to operate the test experiment from this Oct until the end of beam (probably the end of next Feb.).

- Site for detector in the SS floor. The space needed for this is ~70 cm x ~80cm x ~90cm.
- Electricity (~140W) for the cool box.