MLF Experimental Report	提出日 Date of Report 24th May 2010
課題番号 Project No. 2009B0032 実験課題名 Title of experiment Measurement of an Extinction Ratio of MLF Proton Beam 実験責任者名 Name of principal investigator Masaharu Aoki 所属 Affiliation Osaka University	装置責任者 Name of responsible person Naritoshi Kawamura 装置名 Name of Instrument/(BL No.) D2 実施日 Date of Experiment 2009/12/15 12:00 ~ 2009/12/16 20:00

試料、実験方法、利用の結果得られた主なデータ、考察、結論等を、記述して下さい。(適宜、図表添付のこと)
Please report your samples, experimental method and results, discussion and conclusions. Please add figures and tables for better explanation.

1. 試料 Name of sample(s) and chemical formula, or compositions including physical form.

N/A

2. 実験方法及び結果 (実験がうまくいかなかった場合、その理由を記述してください。)
Experimental method and results. If you failed to conduct experiment as planned, please describe reasons.

The purpose of the experiment was to measure the extinction ratio of the pulsed proton beam from RCS to MLF. In order to do that, we used the secondary electrons those immediately produced by the primary proton by the process such as $\pi^0 \rightarrow 2\gamma$, $\gamma \rightarrow e^+e^-$. If there were any of those prompt electrons observed in the delayed timing after the primary proton pulse, it would be due to off-timing protons hitting the muon target. Figure 1 shows schematic layout of the detector system placed at the exit of the D2 beam line. The method for the measurement was different from that we used in the previous experiment (2009A0023) in the following:

1) The beam line momentum was set at 105 MeV/c to avoid delayed electron coming from the decay of μ^- bound in the atomic orbit.
2) A Lead absorber used in the previous measurement was removed.
3) The distance between the first counter (B1) and the second counter (B2) was set about 1 m for time-of-flight (TOF) measurement.

The range of μ^- in the beam with 105 MeV/c momentum is much larger than the total thickness of the plastic

counter assembly. A fraction of muons may stop in the last counter due to large energy loss, and delayed electrons coming from the muon decay will move to upstream hitting through counter assembly. Such events can be rejected by using TOF information.

After setting up the detector assembly and calibration, we succeeded to collect data for 4 hours at 105 MeV/c. Waveforms from four counters were recorded by using flash ADC, and the waveform was analyzed afterwards. Figure 2 shows the time spectrum of the coincidence between B1 and B2. The false coincidences coming from the accidental coincidences were already subtracted in the Fig.2. The residual exponential component may come from μ^- decay where the μ^- stopped in somewhere in the counter assembly. These can be rejected by using TOF information, but the TOF analysis is not completed yet at this time. Since the baseline of the waveform is rather noisier than the previous experiment, further calibration is necessary to obtain good TOF information. Nonetheless, it can be concluded that the observed extinction ratio is less than 6×10^{-7}.

We also studied the number of B1−B2 coincidence at the time region prior to the primary proton pulse. This information gives us the information about the potential source of extinction degradation coming from the beam halo of the primary proton buckets in a RCS ring. None of the coincidence signal was observed for 4 hours of data taking, and from this, the probability of seeing the protons extracted from the RCS even if the kicker is off is only less than 8×10^{-10}. This result is totally limited by statistics.

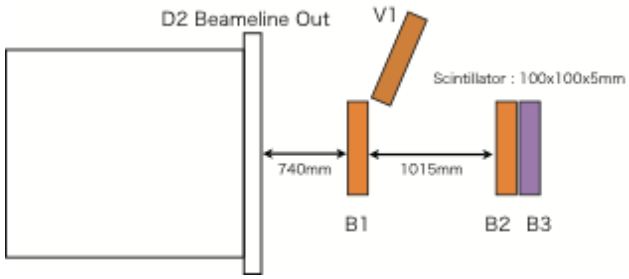

Fig. 1 Setup

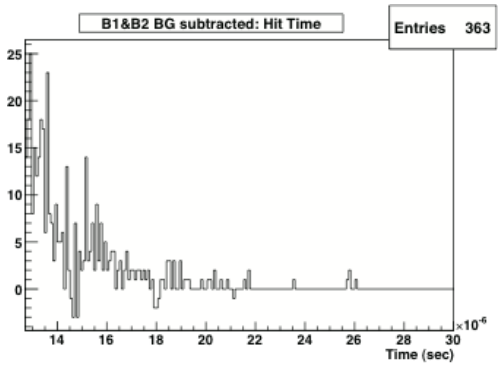

Fig. 2 Time spectrum of B1 and B2 coincidence. The effect coming from accidental coincidence was already subtracted. No TOF analysis applied yet.