E383

RCNP EXPERIMENT E

PROPOSAL FOR EXPERIMENT AT RCNP

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TITLE:
Study of Radiation Damage of Silicon Sensor

SPOKESPERSON:

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EXPERIMENTAL GROUP:

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Tomonori Kubota	Department of Physics, Tokyo Institute of Technology	(M1)
Kazuhiko Hara	Department of Physics, University of Tsukuba	Assistant Professor

RUNNING TIME:

Installation time without beam	1 days(for each beam time)
Development of device	1 days
Test running time for experiment	1 days
Data runs	3 days

BEAM LINE: Ring : ENN course

BEAM REQUIREMENTS:

Type of particle	proton
Beam energy	400 MeV
Beam intensity	< 0.1 nA
Any other requirements	halo-free, small emittance

BUDGET:

Experimental expenses	0 yen

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SUMMARY OF THE PROPOSAL

The luminosity upgrade of LHC is planned. Keeping the pace with this upgrade, the silicon strip detector at ATLAS will be also replaced to more rad-hard detector. In order to survive the fluence equivalent to $\sim 10^{15}$ 1 MeV neutron per cm^2, we are developing n-in-p silicon sensor.

Here we propose an experiment at ENN beam line of proton synchrotron to study and characterize the radiation damage of the newly developed silicon sensor. The following shows the procedure of the study.

- The collected charge at the sensor will be measured as a function of the bias voltage for some sensors with different irradiation dose level.
- We extract the charge trapping and depletion voltage from the charge collection measurement.
- The advantage of the n-in-p sensor compared to the conventional p-in-n is that the charge collection efficiency is expected to be high even below the full depletion. This feature will be confirmed.

Because there was no large application of n-in-p sensors so far, the success of our R&D project would be a big milestone in developing rad-hard detector. The validation of the performance of the prototype sensor by this experiment is needed to move further step of the R&D.

We use reference detectors to identify the location of particle incident to the device under test (DUT), and two (or three) trigger hodoscopes on top of the DUT. Since the output charge from each strip of DUT is read out by custom made DAQ system, once we know the hit position of particles at the DUT, we can measure the output charge from the strip which has a hit of particle.

Given the intense proton beam by the cyclotron, the data acquisition rate is expected to be completely limited by our DAQ capability to ∼100Hz. Given this 100Hz of data taking rate, we request three days of data run with contingency, and a few days of preparation periods.