E382

RCNP EXPERIMENT E

PROPOSAL FOR EXPERIMENT AT RCNP

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TITLE:

A beam test of beam intensity monitor for J-PARC Hadron Facility, using residual gas ionization and calorimetry of beam dump

SPOKESPERSON:

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EXPERIMENTAL GROUP:

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Hiroaki Watanabe	IPNS/KEK	(Assistant Professor)
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RUNNING TIME:	Installation time without beam	1 day
	Data runs	2 days
BEAM LINE:		Ring : ENN course
BEAM REQUIREMENTS:	Type of particle	p
	Beam energy	65 MeV
	Beam intensity	≤ 5 μA
	Current reproducibility	$\leq 5\%$
BUDGET:	Experimental expenses	0 yen

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SUMMARY OF THE PROPOSAL

We propose a test experiment to measure the beam response of newly developed beam intensity monitors using residual gas ionization and calorimetry of beam dump.
The residual gas ionization current monitor (RGICM) measures the beam intensity by collecting electrons or ions produced in residual gas at $\sim$ 1 Pa vacuum when proton beams pass through a gap of electrodes. Diffusion of the produced electrons (or ions) under $\sim$1 Pa vacuum is reduced by magnetic field of $\sim$400 Gauss, that is applied parallel to the electric field in the gap. The precision of the RGICM depends on stability of vacuum pressure and errors of low current measurement ($\sim$1 nA).
Calorimetry of beam dump can be a way to measure beam intensity. The beam intensity is estimated by measuring time-response of temperature rise of thermocouples attached on metallic core. This method is only applicable for spill-by-spill beam extraction from proton synchrotron because cooling time is always necessary to measure the baseline.
In both case of monitors, the measured intensity is compared to the one measured with the Faraday cup installed together. The final goal is to evaluate precision measurement with RGICM and mini-dump.
A list of beam test is as follows,

1. Beam intensity dependence from 0.1 μA to 5 μA,
2. Vacuum pressure dependence from 0.1 Pa to 100 Pa for RGICM,
3. Beam extraction period dependence for beam dump,
4. Beam position dependence (horizontal and vertical), and
5. Beam size dependence.

Beam time requirement is one day for preparation/installation and two days for beam measurement with two monitors.