RCNP EXPERIMENT E

PROPOSAL FOR EXPERIMENT AT RCNP

24 July 2016

TITLE:
Measurement of gamma-rays from neutron-oxygen interaction

SPOKESPERSON:

Full Name	Yusuke Koshio
Institution	Department of Physics, Okayama University
Title or Position	Associate Professor
Address	3-1-1 Tsushima-naka, Kita-ku, Okayama, 7008530, Japan
Phone number	+81-86-251-7817
FAX number	+81-86-251-7830
E-mail	koshio@okayama-u.ac.jp

EXPERIMENTAL GROUP:

Full Name	Institution	Title or Position
Y. Ashida	Department of Physics, Kyoto University	(M2)
G. Collazuol	Department of Physics and Astronomy, University of Padova	(AP)
D. Fukuda	Department of Physics, Okayama University	(D1)
A. Konaka	TRIUMF / RCNP, Osaka University	(P)
H. Nagata	Department of Physics, Okayama University	(M2)
H. Nakaya	Department of Physics, Kyoto University	(P)
C. Nantais	Department of Physics, Toronto University	(D1)
T. Shima	RCNP, Osaka University	(AP)
A. Suzuki	Department of Physics, Kobe University	(AP)
Y. Takeuchi	Department of Physics, Kobe University	(P)
H. Tanaka	Department of Physics, Toronto University	(P)
R. Wendell	Department of Physics, Kyoto University	(AP)
T. Yano	Department of Physics, Kobe University	(AP)

RUNNING TIME: Installation time without beam — 2 days
Data runs — 3 days

BEAM LINE: Ring : N0 course

BEAM REQUIREMENTS:

Type of particle	proton
Beam energy	392 and 80 MeV
Beam intensity	30 nA (after frequency division of 1/9)
Energy resolution	$\leq$ 1 MeV
Other requirements	halo-free, small emittance, beam pulsing time interval of the proton pulse $\leq$ 800 ns

BUDGET: Experimental expenses — 0 yen
(covered by JSPS KAKENHI Grant Number 26400292, Y.Koshio, Kiban-C, 2014-2016)

RCNP EXPERIMENT E

TITLE:
Measurement of gamma rays from neutron-oxygen interaction

SPOKESPERSON: Yusuke Koshio

SUMMARY OF THE PROPOSAL

We propose to measure the characteristics of gamma rays generated in neutron-oxygen interactions using the RCNP monoenergetic neutron beam. This measurement will not only provide fundamental information about gamma-ray emission in such interactions but will also provide essential information for neutrino experiments. Recently, the first observation of the neutrino-oxygen neutral current quasi-elastic interaction was reported by the T2K experiment; a result which is important to supernova neutrino detection, sterile neutrino search and dark matter search experiments. Observation of the gamma ray generated in the neutrino-oxygen interaction is the primary goal of the T2K measurement. However, these neutrino interactions also produce secondary nucleons, both neutrons and protons, whose subsequent interactions with oxygen nuclei often produce gamma rays that are a background to the primary measurement. Uncertainties in the production mechanism of these backgrounds are a large source of uncertainty in the T2K measurement. Due to its quasi-monoenergetic nature, the N0 neutron beam at RCNP is well suited to the systematic measurement of gamma-ray emission from neutron-oxygen interactions. Here, we propose a pilot experiment to estimate the backgrounds, verify the feasibility of, and to establish the optimal detector setup for such a gamma ray measurement. This represents one step towards realizing a full experiment to measure these gamma rays and thereby establish a robust simulation of the emission process.