PROPOSAL FOR EXPERIMENT AT RCNP

12 February 2016

Title or Position

TITLE:

Measurement of Triple Differential Cross Section of pp \to pp π^0 Reaction and Feasibility Studies of (p, 2p) Reaction for Pionic Atom Spectroscopy SPOKESPERSON:

Full Name Hiroyuki Fujioka

Institution Department of Physics, Kyoto University

Title or Position Assistant Professor

Address Kitashirakawa-Oiwakecho, Sakyo-ku, Kyoto 606-8502, JAPAN

Phone number +81-75-753-3853 FAX number +81-75-753-3887

E-mail fujioka@scphys.kyoto-u.ac.jp

Full Name Takahiro Kawabata

Institution Department of Physics, Kyoto University

Title or Position Associate Professor

Address Kitashirakawa-Oiwakecho, Sakyo-ku, Kyoto 606-8502, JAPAN

Phone number +81-75-753-3832 FAX number +81-75-753-3887

E-mail kawabata@scphys.kyoto-u.ac.jp

Institution

EXPERIMENTAL GROUP:

Full Name

Hiroyuki Fujioka	Department of Physics, Kyoto University	Assistant Professor
Takahiro Kawabata	Department of Physics, Kyoto University	Associate Professor
Tatsuya Furuno	Department of Physics, Kyoto University	Graduate Student (D2)
Miho Tsumura	Department of Physics, Kyoto University	Graduate Student (D2)
Motoki Murata	Department of Physics, Kyoto University	Graduate Student (D1)
Akane Sakaue	Department of Physics, Kyoto University	Graduate Student (M1)
Takahiro Morimoto	Department of Physics, Kyoto University	Graduate Student (M1)
Kenta Itahashi	RIKEN Nishina Center	Senior Research Scientist
Takahiro Nishi	RIKEN Nishina Center	Special Postdoctoral Researcher
Ryugo S. Hayano	Department of Physics, University of Tokyo	Professor
Yoshiki K. Tanaka	Department of Physics, University of Tokyo	Graduate Student (D3)
Yuni N. Watanabe	Department of Physics, University of Tokyo	Graduate Student (D1)
Atsushi Tamii	RCNP, Osaka University	Associate Professor
Guillaume Gev	RCNP Osaka University	Postdoc

Guillaume Gey RCNP, Osaka University Postdoc Satoshi Adachi RCNP, Osaka University Researcher

Azusa Inoue RCNP, Osaka University Graduate Student (M2)

Takashi Hashimoto Institute for Basic Science Research Fellow

RUNNING TIME: Installation time without beam 4 days

Beam commissioning etc. 1 day
Optics study 1 day
(p,2p) measurement 2 days

BEAM LINE: Ring: WS course

BEAM REQUIREMENTS:

 $\begin{array}{ll} \mbox{Type of particle} & p \\ \mbox{Beam energy} & 416 \mbox{ MeV} \\ \mbox{Beam intensity} & \leq 200 \mbox{ nA} \\ \mbox{Other requirements} & \mbox{energy resolution} \leq 300 \mbox{ keV} \\ \mbox{ halo-free, small emittance, vertically defocused} \end{array}$

BUDGET: Experimental expenses (slits) 200 kyen

travel expenses 300 kyen

TITLE:

Measurement of Triple Differential Cross Section of pp \to pp π^0 Reaction and Feasibility Studies of (p, 2p) Reaction for Pionic Atom Spectroscopy

SPOKESPERSON: Hiroyuki FUJIOKA, Takahiro KAWABATA

SUMMARY OF THE PROPOSAL

We propose a three-body reaction (p,2p) so as to populate deeply-bound pionic states. Two ejectile protons will be measured by Grand Raiden and LAS set at 25.5°. Accidental backgrounds will be removed by using the correlation between vertical coordinates of the reaction vertices reconstructed from the focal-plane detectors.

In order to demonstrate this background rejection method, the triple differential cross section of the pp \to pp π^0 reaction will be measured. Furthermore, the background level in the Sn(p,2p) reaction near the π emission threshold with and without background rejection will be investigated. We expect a good signal-to-noise ratio ($\approx 1/10$) even before background rejection in the former reaction, while the spectroscopy of deeply-bound pionic atoms with the latter reaction requires the rejection of accidental background due to its huge contribution.