RCNP EXPERIMENT E169

PROPOSAL FOR EXPERIMENT AT RCNP

28/05/2001

TITLE:

Test measurement of coherent pion production in ^{12}C(p,nπ^+)^{12}C(g.s.) at $E_p = 400$ MeV

SPOKESPERSON:

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EXPERIMENTAL GROUP:

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RUNNING TIME:

Test runs for experiment	3 days
Data runs	4 days

BEAM LINE: WS (WS beam line + LAS + NPOL2)

BEAM REQUIREMENTS:

Type of particle	Unpolarized Protons
Beam energy	400 MeV
Beam intensity	900 nA on target
Energy resolution	$<$ 300 keV (FWHM)
Time resolution	$<$ 500 ps (FWHM)
WS transport mode	Achromatic Modes

BUDGET:

Summary of budget request	2,500,000
Experimental expenses	2,300,000
Travel plan	200,000

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SPOKESPERSON: Yasuhiro SAKEMI

SUMMARY OF THE PROPOSAL

We would like to establish the experimental technique to measure **C**oherent **P**ion **P**roduction (CPP) by means of ^{12}C(p,nπ^+)^{12}C(g.s.) reaction at $E_p = 400$ MeV. The physics goal of this experiment is to investigate the production process of the coherent pions propagating through nuclear interior, which can be qualitatively interpreted as the emission of a virtual pion from the projectile proton, followed by its elastic scattering with the target nucleus, till it becomes a real pion (π^+) with the target left in the ground state(g.s.). This process is sensitive to the longitudinal part of the spin-isospin interaction involving the Δ excitation. The cross section of the CPP will be used to limit the value of the Landau-Migdal parameter $g'_{\Delta\Delta}$ which shows a short range correlation of the Δ-hole residual interaction and is sensitive to the property of the predicted pion condensation phase in the nuclear matter.

The cross section of the reaction $p +^{12} C \rightarrow n + \pi^+ +^{12} C(g.s.)$ is measured at WS course in coincidence with the emitted pions. The neutron counters NPOL2 developed at NTOF facility will be used to detect the scattered neutrons, and the positive pions (π^+) emitted together with neutrons are momentum analysed and detected by the LAS spectrometer. This will become a first accurate measurement of the cross section for the CPP using the charge exchange (p,n) reaction by separating the ground state of the residual ^{12}C nucleus from the excited states with the high resolution detector system such as the LAS and NPOL2. We will also be able to get an quantitative information on $g'_{\Delta\Delta}$ from the experiment for the first time. In this experiment, the experimental technique to measure the CPP in the clean background condition will be established, and the angular distribution of the coherent pions is measured.