E400

RCNP EXPERIMENT E

PROPOSAL FOR EXPERIMENT AT RCNP

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TITLE:

Study of neutron production from deuteron-induced reactions for energies up to 200 MeV

SPOKESPERSON:

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EXPERIMENTAL GROUP:

Full Name	Institution	Title or Position
Yukinobu WATANABE	IGSES, Kyushu Univ.	Professor
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Kouhei NAGAOKA	IGSES, Kyushu Univ.	Student (MC1)
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Ryotaro OGATA	IGSES, Kyushu Univ.	Student (MC1)
Yosuke IWAMOTO	JAEA	Senior Research Engineer
Daiki SATOH	JAEA	Researcher
Tatsushi SHIMA	RCNP, Osaka Univ.	Assistant Professor

RUNNING TIME: Installation time without beam 1 day
Data runs 3 days

BEAM LINE: Ring, N0 course

BEAM REQUIREMENTS:

Type of particle	deuteron
Beam energy	100 MeV
Beam intensity	1-50 nA
Any other requirements	halo-free, small emittance, beam pulsing

BUDGET: Targets 500,000 yen

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SUMMARY OF THE PROPOSAL

We propose a new systematic measurement of (d,xn) reactions for energies up to 200 MeV in order to develop an evaluated nuclear data library required for the engineering design of accelerator-driven neutron sources in various applications, *e.g.*, irradiation testing of fusion reactor materials, boron neutron capture therapy, production of radio-isotopes for medical use, *etc*. In our proposed experiments, double-differential neutron production cross sections (DDXs) will be measured over the broad range of angles (0°, 2.5°, 5°, 10°, 15°, 20°, 25°, 45°, 90°, and 120°) for some targets ranging from ^{9}Be to ^{208}Pb at 100 MeV, because there are systematic experimental (d,xp) data for the same energy and target nuclei but no (d,xn) data. In the first experiment, we plan to measure the DDXs for two or three candidate targets (*i.e.*, ^{12}C, ^{27}Al, and ^{58}Ni). Simultaneous analyses of the newly-measured (d,xn) and the existing (d,xp) data will be useful to verify a theoretical model code system which we are now developing using the CDCC, the Glauber model, and the statistical decay model. In the analyses, it will be possible to investigate the Coulomb effect in the exit channel of stripping and elastic breakup processes, which result in the characteristic broad bump observed around half the incident energy in the nucleon spectra at small angles.

Measurements of neutron and gamma-rays production yields from thick targets bombarded by 100-MeV deuterons are also planned for benchmark test of the particle transport code PHITS as well as characterization of (d,xn) neutron sources. In the case of the thick targets, neutrons and gamma-rays are emitted from deuteron-induced reactions at energies ranging from the incident energy down to zero energy because of energy loss in the thick target. Therefore, the experimental neutron and gamma-rays production yields data are suitable for the validation of evaluated nuclear data over the wide energy range using the particle transport code. In addition, the experimental thick target neutron yields (TTNYs) for candidate targets (Li, Be, and C) will provide us the basis data of (d,n) neutron field complementary to two standard neutron fields which are currently available at RCNP: the quasi-monoenergetic Li(p,xn) neutron source (100 to 400MeV) and the W(p,xn) spallation neutron source.

Our required beam time will be total 3 days for both the measurements of DDXs and TTNYs at 100 MeV.