THE CHARACTERISTICS OF LCS GAMMA-RAY BEAMS USED FOR PHOTODISINTEGRATION OF 9BE

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Quasi-monochromatic gamma-ray beams are produced in the laser Compton scattering (LCS) in the beamline BL01 at the NewSUBARU synchrotron radiation facility. It is of essential importance to understand the characteristics of LCS γ-ray beams in the measurement of photonuclear reaction cross sections: 1) the absolute energy, 2) the energy distribution, and 3) the flux. We present the characteristics of the LCS γ-ray beam used for photodisintegration of ^{9}Be through the $1/2^{+}$ state and pygmy dipole resonance (PDR).

We produced LCS γ-ray beams with a grating-fixed CO_2 laser (λ=10.5915μm) in the energy region near the n + ^{8}Be threshold at 1665 keV and a Nd:YVO_4 laser (λ=1064nm) in the energy region relevant to detection of PDR, 5 – 17 MeV. The electron beam energy was changed in a range of 954 - 1121 MeV. A double collimation system with apertures of 3mm and 1mm (3mm and 2mm) was used to produce low-energy (high-energy) γ-ray beams. A 64mm × 60mm high-purity Ge detector and a 3.5" × 4.0" $LaBr_3$(Ce) detector were used as an energy profile monitor for the low- and high-energy γ-ray beams, respectively. A 8" × 12" NaI(Tl) detector was used as a flux monitor with 100% detection efficiency. Response functions of the profile monitors were analyzed with the GEANT4 Monte Carlo code with the kinematics of laser Compton backscattering incorporated, to determine the ene rgy distribution of the LCS γ-ray beam incident on a ^{9}Be target. The energy spread of the LCS γ-ray beam was 1 – 2% in FWHM. The energy calibration of the Ge detector in its response to low-energy γ-ray beams was made with the standard γ-ray sources. In contrast, the energy calibration of the $LaBr_3$(Ce) detector in its response to high-energy γ-ray beams was made with reference to the electron beam energy which is calibrated with accuracy of the order of 10^{-5} [1].

The flux of a "continuous" γ-ray beam produced with the CO_2 CW laser was determined by direct counting of individual photons. In contrast, the flux of a pulsed γ-ray beam produced with the Nd:YVO_4 Q-switch laser was determined with an empirical formula based on the Poisson fitting method [2, 3].

REFERENCES

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