

# Precise Measurement of Prompt $\gamma$ -ray in the $^{14}\text{N}(n,\gamma)^{15}\text{N}$ Reaction

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The prompt  $\gamma$ -rays from the  $^{14}\text{N}(n,\gamma)^{15}\text{N}$  reaction are expected to be an intensity standards in the energy up to 11 MeV. Capture  $\gamma$ -ray standards with intensity values accurate to 1.0 % or more are required. In the previous paper, prompt  $\gamma$ -ray intensities were determined using the balance method with 2-4 % accuracy [1,2]. In this method, precise level scheme was needed. Fifty eight  $\gamma$ -rays have been found in  $^{14}\text{N}(n,\gamma)^{15}\text{N}$  reaction.

So far a melamine ( $\text{C}_3\text{H}_6\text{N}_6$ ) was used for the target. The target, however, had a problem that the background increased under 2 MeV. Furthermore, the H prevented  $^{14}\text{N}$  from capturing neutrons efficiently due to its large cross section. These problems were improved by the liquid nitrogen target [3]. Accordingly, we aimed to determine the intensities with 1.0 % accuracy by using the liquid nitrogen target.

Experiments were carried out by using thermal-neutron beam at the B-4 guide tube (neutron flux  $5 \times 10^7 \text{ n/cm}^2 \cdot \text{s}$ ) of the Kyoto University Reactor. The liquid nitrogen was used for the target. Capture  $\gamma$ -rays emitted from  $^{15}\text{N}$  were measured with 22 % and 38 % HPGe detectors that were located at 15-24 cm from the target (Fig.1). Single measurements were performed five times in order to improve the reliability.

In the present work, we determined the  $\gamma$ -rays intensities in the  $^{14}\text{N}(n,\gamma)^{15}\text{N}$  reaction with 0.3-0.5 % accuracy. The results of the five measurements were consistent. Present accuracy was 5-8 times as improved as previous reports. Comparing the previous intensity with the present intensity, previous ones deviated 2 % or more (Fig. 2).

**Reference:** [1] T. J. Kennett et al., Nucl. Instr. and Meth. **A249**, 366 (1986).

[2] E. T. Journey et al., Phys. Rev. **C56**, 118 (1997).

[3] M. Hirano et al., 2001 Symposium on Nuclear Data, JAERI Tokai, Nov.

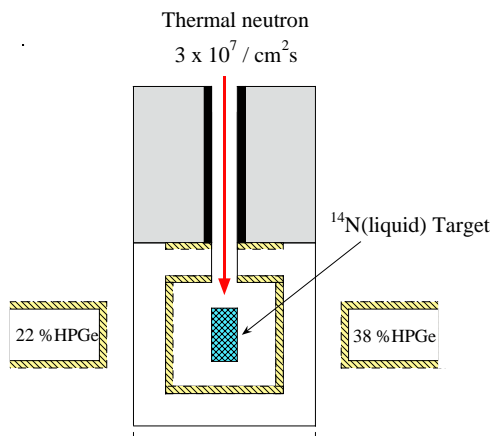


Fig.1 Measuring system for  $^{14}\text{N}(n,\gamma)^{15}\text{N}$  reaction. Detector to target distance is 15-24 cm.

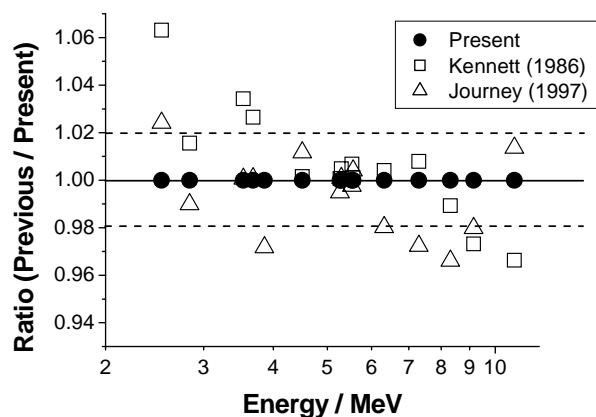


Fig.2 Previous to present ratio of intensities. Previous ones deviated 2 % or more.