



Contribution ID: 77

Type: **Poster Session**

Nitrogen gas scintillation counter for highly-intense heavy ion beams with negligible radiation damage

Tuesday, 4 October 2022 19:52 (8 minutes)

Experiments using RI beams often require identification of the nuclides. In case of projectile-fragment separator, the identification is performed by measuring time-of-flight, energy loss, and magnetic rigidity. Radiation damage to these detectors has become a problem due to the highly intense heavy ion beams. We have solved this problem by developing a nitrogen gas scintillation counter in which radiation damage can be ignored by flowing the nitrogen gas continuously.

The detector is designed to install at the focal plane of the BigRIPS in RIKEN. The sensitive volume of 50 cm x 50 cm x 100 cm is filled with N₂ gas at a pressure of 1 atm. The effective area is 60 mm in diameter. The photons are detected with PMTs, which are connected to both sides of the sensitive volume. The detection is easy since the main emission wavelength is 300-400 nm. The detection efficiency is sufficient for heavy RI beams even though the number of photons is less than that produced in noble gases. The short decay time constant at each wavelength makes it possible to use the counter as a time-of-flight counter for a highly intense beam. In this presentation, we will report (1) the scintillation light yield in the detector measured with a ²⁴¹Am source, (2) the intrinsic time resolution measured at CYRIC, Tohoku University, and (3) particle identification of ¹³²Sn at RIBF.

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Session Classification: Poster Session