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Maxwell–Boltzmann-like neutron spectrum production at kT=28 keV for Maxwellian averaged cross section measurement.

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To calculate the reaction rate in the neutron capture processes it is common to work with the Maxwellian Average Cross Section (MACS), defined as the reaction rate scaled by the most probable neutron velocity of the Maxwell-Boltzmann distribution. For the s-process mainly, the MACS directly describes the reaction rate inside the stars, for a given temperature and neutron density. Hence, the importance of determining the MACS with the least possible uncertainty. Before any MACS measurement, a characterized neutron beam with a spectrum as similar as possible to the stellar spectrum is mandatory, and this is the main purpose of this work. The experiment was performed at the CN Van der Graaff accelerator at the LNL-INFN, in Italy. In the experimental measurement, the ^{7}Li(p,n)^{7}Be nuclear reaction was employed as neutron source. A method based on the idea of shaping the proton beam energy to shape the neutron beam spectrum was used to produce a Maxwell-Boltzmann neutron spectrum. To obtain a Maxwell-Boltzmann neutron spectrum with 28 keV of thermal temperature, an initial proton energy of 3170 keV and a 51 μm thickness aluminum (Al) foil, as proton energy shaper, were employed. Using a 600 kHz proton pulsed beam at the Van de Graaff accelerator, the neutron time of flight spectrometry (TOF) was implemented to determine the neutron spectrum over a flight path of 50 cm. Differential angular neutron energy distributions from 0 to 90 degrees in steps of 10° were measured to obtain the 0°-90° integrated neutron spectra. The results of the experimental measurement will be reported in the talk.

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