The Stellar $^{72}$Ge($n, \gamma$) Cross Section: A First Measurement at n_TOF

M. Dietz$^a$, C. Lederer-Woods$^a$, and the n_TOF Collaboration$^b$

$^a$School of Physics and Astronomy, University of Edinburgh, United Kingdom,
$^b$European Organization for Nuclear Research (CERN), Switzerland

The slow neutron capture process (s-process) is responsible for producing about half of the elemental abundances heavier than iron in the universe. Neutron capture cross sections on stable isotopes are a key nuclear physics input for s-process studies. The $^{72}$Ge($n, \gamma$) Maxwellian Average Cross Section (MACS) has an important influence on production of isotopes between Ge and Zr in the s-process in massive stars [1] and so far only theoretical estimations are available [2]. An experiment was carried out at the neutron time-of-flight facility n_TOF [3] at CERN to measure the $^{72}$Ge($n, \gamma$) reaction for the first time at stellar neutron energies. At n_TOF, neutrons over a large energy range (few meV to several GeV) are produced by spallation reactions of a highly energetic (20 GeV/c), pulsed proton beam impinging on a massive Pb target. The capture measurement was performed using an enriched $^{72}$GeO$_2$ sample at a distance of 184 m from the spallation target (Experimental Area 1), which allows a measurement with high neutron energy resolution. The prompt gamma rays produced after neutron capture were detected with a set of liquid scintillation detectors (C$_6$D$_6$), which met the experimental requirements of low neutron sensitivity [4]. The neutron capture yield is derived from the counting spectra taking into account the neutron flux and the gamma-ray detection efficiency using the Pulse Height Weighting Technique [5]. The experiment, data analysis and preliminary results will be presented.

References