Nuclear Astrophysics at NEAR/n_TOF: Feasibility study of MACS measurements

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The accuracy of neutron capture rates is of significant importance in the field of nuclear astrophysics [1]. In particular, fundamental input can be provided through the determination of Maxwellian Averaged Cross-Sections (MACS) for key temperatures of stellar environments.

During CERN's Long Shutdown 2 (2019-2021), a new high-flux irradiation station (NEAR) was constructed at the n_TOF facility, suitable for the study of radiation effects on materials as well as for measuring neutron-induced reaction cross-sections through the activation technique [3]. The energies of the neutrons reaching NEAR span a wide spectrum, from thermal up to the GeV region. With the use of proper materials as filters and moderators, this wide spectrum can be shaped into a Maxwell-Boltzmann distribution. In this way, the MACS of various isotopes can be directly measured by means of the activation technique [4].

In this work, the feasibility study of MACS measurements at NEAR/n_TOF will be presented, the experimental set-up used for the validation will be described and some first experimental results will be discussed.

[1] N. Nishimura, et al (2017), Monthly Notices of the Royal Astronomical Society, **469**, 2, (2017)
[3] M. Ferrari et al., Design development and implementation of the near area and its neutron irradiation station at the n_TOF facility at CERN (2022)
[4] M.E. Stamati, A. Manna, G. Gervino et al., INTC-I-222 (2021)