

Synergies between n_TOF and ISOLDE –neutron beams and radioactive ion

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The n_TOF facility at CERN features two different beam lines, with rather different characteristics and possibilities for neutron cross section measurements, for applications in nuclear astrophysics, advanced nuclear technologies and basic nuclear science. The 185m horizontal beam line feeds the first experimental area (EAR1), where extremely high-resolution measurements can be performed. EAR2, placed at approximately 20m on top of the spallation target, provides a factor 50 higher neutron flux, while maintaining a good energy resolution. So far, several measurements low-mass radioactive samples have been possible at n_TOF. Several parameters determine the feasibility of a neutron capture cross section: intrinsic activity, type of emitted radiation, mass, cross section, and others.

The n_TOF Collaboration succeeded to measure capture cross sections on record-low half-lives of a few years and sub-milligram masses (corresponding to number of nuclei in the samples of 1017 – 1019) [1-3]. With the upgrade of spallation target area, the possibility of perform measurements at a distance of only 2-3 meters from the spallation assembly (NEAR Station) is being investigated. This will allow to measure neutron cross sections on even lower masses.

The possibility to produce sample material at the present or upgraded ISOLDE facility and then irradiated at n_TOF will represent, therefore, a great opportunity for synergy between these two CERN facilities.

These ideas will be put forward and examples of these opportunities will be presented.

[1] Neutron Capture on the s-Process Branching Point Tm-171 via Time-of-Flight and Activation
C. Guerrero, J. Lereendegui-Marco, M. Paul, M. Tessler, S. Heinritz, C. Domingo-Pardo, S. Cristallo, R. Dressler, S. Halfon, N. Kivel, et al. (The n_TOF Collaboration)
Physical Review Letters 125, 142701 (2020)
<https://dx.doi.org/10.1103/physrevlett.125.142701>

[2] Time-of-flight and activation experiments on Pm-147 and Tm-171 for astrophysics
C. Guerrero, J. Lereendegui-Marco, C. Domingo-Pardo, A. Casanovas, R. Dressler, S. Halfon, S. Heinritz, N. Kivel, U. Köster, M. Paul, et al. (The n_TOF Collaboration)
EPJ Web of Conferences 146, 01007 (2017)
<https://dx.doi.org/10.1051/epjconf/201714601007>

[3] Neutron Capture Cross Section of Unstable Ni-63: Implications for Stellar Nucleosynthesis
C. Lederer, C. Massimi, S. Altstadt, J. Andrzejewski, L. Audouin, M. Barbagallo, V. Bécaries, F. Bečvář, F. Belloni, E. Berthoumieux, et al. (The n_TOF Collaboration)
Physical Review Letters 110, 022501 (2013)
<https://dx.doi.org/10.1103/PhysRevLett.110.022501>

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