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Nuclear data program for NCT at the n_TOF Collaboration at CERN

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The n_TOF Collaboration, neutron time-of-flight, is the spallation neutron source facility located at the European Organization for Nuclear Research (CERN) based on a 20 GeV/c proton beam impinging on a lead target. n_TOF is a unique facility in the world due to the state-of-the-art of detectors, the data acquisition system and the characteristics of its neutron beam, i.e., high instantaneous flux in a wide energy range –from few meV to 1 GeV–, high energy resolution which allows resolving resonances and low repetition rate of the primary pulsed proton beam. The facility is in operation since 2001 and counts with two experimental rooms: n_TOF-EAR1, located at 185 m from the spallation target along the horizontal direction of the incoming proton beam, and n_TOF-EAR2, along the vertical direction at 20 m from the target was built in 2014. n_TOF is mainly dedicated to measure neutron-induced cross sections for nuclear technology, astrophysics, basic nuclear physics and medical physics. The nuclear data program for medical applications started in 2012 with the measurement of the 33S(n,a) cross section at the n_TOF-EAR1. This isotope is of interest in Boron Neutron Capture Therapy (BNCT) as a cooperative target to 10B because of its large cross section in the epithermal neutron energy range, the most suitable one for the accelerator based neutron sources. This measurement, in which the resonance region was successfully resolved, was completed in 2015 at n_TOF-EAR2, extending the cross section values from 10 keV down to the thermal point for the first time.
In 2017, two additional experiments were carried out at n_TOF-EAR2 with the aim of improving the dosimetry in BNCT treatments. In this case, the (n,p) cross section reaction on 14N and 35Cl were performed; the knowledge on the contribution to the total dose due to the proton emission is essential to preserve healthy tissues during the irradiation what has motivated this experiment. Continuing this program, in summer 2018 it is foreseen the measurement of the 35Cl(n,g) in order to increase the amount of data available on this reaction with the goal of enhancing the treatment planning in BNCT, in particular in case of brain cancer since it is in the brain where the higher concentration of 35Cl is found in the human body.

Primary authors: Mr OGALLAR RUIZ, Francisco (University of Granada and CERN); Dr SABATE-GILARTE, Marta (University of Seville / CERN)

Presenter: RUIZ, Francisco Ogallar (University of Granada)

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