Contribution ID: **37**   Type: **Oral**

The CERN n_TOF facility: high accuracy measurements of neutron induced cross sections

Tuesday 9 July 2024 16:45 (15 minutes)

Based on an idea by Carlo Rubbia, the n_TOF facility at CERN has been built and has been operating for over 20 years. It is a neutron spallation source, driven by the 20 GeV/c proton beam from the CERN PS accelerator. Neutrons in a very wide energy range (from GeV, down to sub-eV kinetic energy) are generated by a massive Lead spallation target feeding two experimental areas. EAR1, horizonal with respect to the proton beam direction is set at 185 meters from the spallation target. EAR2, on the vertical line from the spallation source, is placed at 20 m. Neutron energies for experiments are selected by the time-of-flight technique (hence the name n_TOF), while the long flight paths ensure a very good energy resolution.

Over one hundred experiments have been performed by the n_TOF Collaboration at CERN, with applications ranging from nuclear astrophysics (synthesis of the heavy elements in stars, big bang nucleosynthesis, nuclear cosmo-chronology), to advanced nuclear technologies (nuclear data for applications, nuclear safety) to basic nuclear science (structure and decay of highly excited compound states).

During the planned shutdown of the CERN accelerator complex between 2019 and 2021, the facility went through a substantial upgrade with a new target-moderator assembly, refurbishing of the neutron beam lines and experimental areas. An additional measuring and irradiation station (the NEAR Station) has been envisaged and its capabilities for performing material test studies and new physics opportunities are presently explored.

An overview of the facility and of the activities performed at CERN will be presented, with a particular emphasis on the most relevant experiments for nuclear astrophysics.

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Session Classification: Measurements II

Track Classification: Experimental facilities