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n_ACT@BDF: A high intensity & high energy neutron activation station at the CERN Beam Dump Facility

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The Beam Dump Facility (BDF) at CERN is a new, general-purpose intensity-frontier experimental facility operating in beam-dump mode at the CERN SPS accelerator. It is designed to search for feebly interacting GeV-scale particles and to perform measurements in neutrino physics, serving the Search for Hidden Particles (SHiP) experiment (SPSC-P-369).

The high-energy (400 GeV/c), high-intensity (350 kW) proton beam from the SPS, impacting BDF's tungsten production target, generates a unique particle spectrum, fluences, and radiation dose in the region surrounding the target. This presents an opportunity to create synergies to exploit the target complex for additional purposes, without perturbing the main physics goals of BDF and SHiP.

A Letter of Intent has been submitted by the n_TOF Collaboration for a parasitic Neutron Activation Station (n_ACT, CERN-SPSC-2024-027) to utilize the copious neutrons produced in the spallation target. Due to the high-energy and intensity proton beam, a wide-energy neutron spectrum is generated, including a large quantity of high-energy neutrons, extending up to few GeVs, which could be exploited for physics research.

This contribution will detail the scientific case, feasibility considerations, as well as the plan for a complete scientific and technical proposal by the end of 2025, aiming for a staged start-up from 2031, with full implementation by 2035.

Authors: MENGONI, Alberto; MANNA, Alice (University of Bologna); LEDERER-WOODS, Claudia; GUNSING, Frank (CEA Saclay, Irfu); CALVIANI, Marco; BACAK, Michael; PATRONIS, Nikolaos (Department of Physics, University of Ioannina); MILAZZO, Paolo Maria

Presenter: BACAK, Michael

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