Contribution ID: **10** Type: **Talk**

Introduction of a new test area for neutron detection instruments with a dominant high energy neutron component at PSI

Monday 7 July 2025 13:30 (15 minutes)

Neutron radiation fields around high-energy particle accelerator facilities or at high altitudes often have a broad energy distribution with significant component of neutrons with energies greater than 20 MeV. Reference fields with comparable conditions are desirable for the calibration of monitoring instruments and dosemeters to be used in these environments. In the present study, a suitable area for this purpose is investigated.
The PSI High Intensity Proton Accelerator facility (HIPA) is a cascade of three accelerators that delivers a proton beam with a final energy of 590 MeV and, at present, a maximal current of 2.2 mA. The beam passes through two graphite targets, and it is used to produce intense beams of secondary particles feeding experimental areas for research in multiple disciplines. A collimation system ensures a reproducible position of the beam spot on the targets.
The experimental areas are heavily shielded by layers of concrete and iron. This setup outside the shielding above the targets provides a steady neutron field with a broad spectral neutron distribution and dominant high-energy component, which can be used as test area for survey instruments and dosimeters. The area is accessible from May to December with mean availability of 95%, considering normal operation of HIPA.
The neutron spectral distribution of this area is characterized at two positions by measurements with an extended range Bonner Sphere spectrometer (ERBSS). The results are compared to Monte Carlo simulations using the multi-purpose particle transport code FLUKA. Three commercially available extended range survey instruments sensitive to neutron radiation constantly monitor the field intensity in addition to a proton current monitor positioned upstream the target. Long term investigations of the reading of these instruments in addition to measurements of the intensity gradient of the neutron field showed that it can be considered as a reference workplace field with a dominant high-energy neutron component.

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Session Classification: Accelerator Facilities 2

Track Classification: Day 1: Health and Radiation Protection; Science and Technology: Materials and Instrumentation