

BEDOGNI-1: Single moderator directional spectrometer for inline monitoring of epithermal neutron beams in BNCT facilities

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A well-characterized neutron beam is crucial for a successful BNCT treatment planning. In particular, experimental knowledge of the energy-distribution of the neutron fluence, often known only by Monte Carlo simulation, is highly desirable.

Single-moderator neutron spectrometers, introduced in recent years, proved their applicability in a number of workplaces, from medicine to large-scale neutron science facilities. These devices succeeded in the difficult challenge of condensing the functionality of a Bonner Spheres Spectrometer into a single moderator, embedding multiple thermal neutron detectors. These detectors are simultaneously acquired, thus making real-time spectrometry possible on a wide energy range.

A specific design, called NCT-WES (Neutron Capture TheraCpy Wide Energy Spectrometer), was conceived for rapid and precise spectrometric measurements in neutron capture therapy facilities, where the energy distribution of the field is mainly epithermal. The main advantages of this spectrometer, when used as real-time spectrum monitor in BNCT, are:

- the directional response, obtained through a collimated aperture, allow neglecting room-scatter;
- the geometry is optimized to enhance resolving power in the epithermal range;
- the use of radiation tolerant silicon carbide detectors allows exposing the device to very large integrated neutron fluences

A general view of the device is presented in Figure 1. The following parts are shown: the boron-lined collimating aperture, and the extractable drawer containing the thermal neutron detectors. The overall cylinder has height = diameter = 40 cm.

This communication describes the NCT-WES device, intended as an advanced beam quality tool for the BNCT community.

