

SANTOS-1: Neutron Dosimetry and Neutron Field Characterization

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The BNCT dosimetry is much more complex than standard radiotherapy dosimetry where the gamma rays will produce mainly electrons releasing all their kinetic energies in ionization. The BNCT dosimetry needs to measure or to estimate by simulations not only the number of neutron captures on ^{10}B , ^1H or on ^{14}N but also the gamma production by some of these neutron captures and their interaction on tissues. The neutron capture on ^{10}B and on ^{14}N will produce nuclear recoils (^4He , ^7Li , H and ^{14}C). These nuclear recoils are the main contribution to the high LET ($> 200 \text{ keV/um}$) produced by the BNCT.

The neutron capture cross section depends on the neutron energy. The neutron production on targets by compact accelerators opens an important degree of freedom to optimize the neutron field produced and then optimize the BNCT dose on tumors reducing the secondary dose on healthy tissues. The epithermal neutron energies can be optimized to the tumor depths [1].

The Beam Shaping Assemblies (BSAs) around the targets or moderators will define the neutron field used in BNCT. Many different designs, based on different simulations are available. An optimization of these designs can be envisaged.

It is for all these reasons that the BNCT dosimetry is strongly related to the Neutron Field produced at the target and after moderation. Both have to be evaluated for each neutron source. The neutron spectrometer developed by the LPSC team [2] can help to get the reference measurements needed to normalize methods and neutron dosimetry estimations.

References

[1] On the Epithermal Neutron Energy Limit for AB-BNCT: Study and Impact on new energy limits.
M. Hervé, N. Sauzet, D. Santos, to be published by PhysicaA (2020)

[2] Neutron spectroscopy from 1 to 15 MeV with Mimac-FastN, a mobile and directional fast neutron spectrometer and an active phantom for BNCT and PFBT
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