

LIU-3: Recommendations of characterizing and commissioning a clinical BNCT neutron beam

Yuan-Hao Liu^{1,2}, Wei-Lin Chen¹, Chao Wang¹, Neng Pu¹, Diyun Shu^{1,2}

¹*Neuboron Medtech Ltd., Nanjing, Jiangsu Province, P.R. China*

²*Nanjing University of Aeronautics and Astronautics, Nanjing, Jiangsu Province, P.R. China*

The characterization and commission of a BNCT beam are essential for its beam design verification and clinical validation. A set of measurement techniques has been developed and conducted in the Tsing Hua Open-pool Reactor (THOR, Hsinchu) and the High Flux Reactor (HFR, Petten) BNCT neutron beams^{1,2}. The developed tool kit was further improved recently and will be applied on the new accelerator-based BNCT facility built in the Xiamen Humanity Hospital. The tool kit is consisted of the following techniques:

1. Neutron intensity³ – neutron activation technique is applied to determine the neutron beam intensity according to the measured activities of the irradiated metal foils;
2. Neutron spectrum^{4,5} – 1) multiple activation foils loaded in a modified lollipop-like spheres, 2) the unfolding code SAND-EX and 3) Monte Carlo determined response functions, are proposed to obtain the required spectrum;
3. Neutron and gamma-ray dose⁶ – the paired ionization chamber technique is proposed to obtain the dose rates after a series of sophisticated corrections;
4. On-line beam monitoring⁷ – fission chambers or BF₃ ones are proposed to serve the purpose of monitoring the real-time beam intensity and provide the necessary time information for normalization and correction;
5. Neutron spatial distribution⁸ – indirect neutron radiography is applied which has a combination of a large piece of activation foil to cover the region of interest, and a planar reader, e.g. imaging plate system;

The measurement techniques mentioned above need very carefully calibrated and corrected procedures to obtain the desired physical information. Among the correction factors, the Monte Carlo determined and derived correction factors are of crucial, such as self-shielding correction, detector response functions, and *a priori* information. With the proposed tool kit and correction methods, one can derive the essential beam characterization, including time, energy, spatial, and angular distributions. Details of the beam characterization and commissioning will be presented in our presentation.

References

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