Microdosimetric Inventigations at the Fast Neutron Therapy Facility at Fermilab

Katja M. Langen

Microdosimetry was used to investigate three issues at the neutron therapy facility (NTF) at Fermilab.

Firstly, the conversion factor from absorbed dose in A-150 tissue equivalent plastic to absorbed dose in ICRU tissue was determined. For this, the effective neutron kerma factor ratios, i.e. oxygen to A-150 tissue equivalent plastic and carbon to A-150 tissue equivalent plastic, were measured in the neutron beam. An A-150 tissue equivalent plastic to ICRU tissue absorbed dose conversion factor of 0.92 +- 0.04 was determined.

Secondly, variations in the radiobiological effectiveness (RBE) in the beam were mapped by determining variations in two related quantities, e* and R, with field size and depth in tissue. Maximal variation in e* and R of 9% and 15% respectively were determined.

Lastly, the feasibility of utilizing the boron neutron capture reaction on boron-10 to selectively enhance the tumor dose in the NTF beam was investigated. In the unmodified beam, a negligible enhancement for a 50 ppm boron loading was measured. To boost the boron dose enhancement to 3% it was necessary to change the primary proton energy from 66 MeV to 37 MeV and to filter the beam by 90 mm of tungsten.

The feasibility of measuring microdosimetric spectra in the NTF beam was proven and its usefulness demonstrated.