Title: Intensity Modulated Radiation Therapy (IMRT) using Very High Energy Electron Beams

Abstract:

IMRT may be defined as the ability to control beam fluence as a function of direction and position. IMRT with photons may be performed during beam generation by control of incident electrons on the target, or after beam generation by using shielding blocks, compensators or collimators. Some sophisticated methods or beam control post-generation are commercially available and under development (e.g. dynamic multileaf collimation, tomotherapy).

Fluence of charged particle beams may be easily controlled electromagnetically. The most commonly used electron energies(6-25MeV), have a clinical range of less than 6 cm with large penumbra, large angular spread and cannot be practically used for deeper tissues due to unacceptable normal tissue dose. There has been relatively recent development in higher energy electron therapy (30-50MeV) from a racetrack microtron with useful range of 8-10cm (1,2,3). For electron energies 100-200MeV d_{max} occurs at 10-20cm in tissue and the practical range extends beyond a typical patient body, thereby eliminating the large lateral spread and reducing normal tissue dose. The use of a pencil beam scanning device allows for extremely fast and efficient software fluence control as well as eliminates the need for collimators, blocks and beam modifying devices. The advantages of this proposed treatment can be evaluated through treatment simulations by Monte Carlo calculations. Preliminary studies also indicate that technology for building necessary devices for this therapy exists and that demands of radiation protection can be satisfied.

References attached as supporting document.