

LEAST SQUARE METHOD FOR RIDGE FILTER DESIGN IN THE PROTON WOBBLING NOZZLE

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Abstract

Monte Carlo method was widely used in radiotherapy such as patient dose calculation, quality assurance verification, beam line design and commissioning of therapy facilities... In this work, many pristine Bragg peaks corresponding to each step's thickness of the considered ridge filters (5 cm-LE, 5 cm-HE, 10 cm and 11 cm SOBP width) of the proton middle wobbling nozzle at Chang Gung Memorial Hospital (CGMH) were simulated by PTSim Monte Carlo code. Moreover, we implemented the Least Square method to generate the optimized weighting factors and then built up the new ridge filters from the G4MRidgeFilter class. The obtained depth dose results by simulation were compared to the measurements performed by a PTW MP3 water tank and a Markus ionization chamber. The experimental and simulated SOBP depth doses were in a good agreement. The difference in range, distal dose fall-off and modulation width after optimization were below 2 mm, 0.5 mm and 3 mm, respectively. Besides, the newly designed ridge filters were also verified by other different energy proton beams. And all their flatness were within 2.5 %.

Keywords: Least Square method, Ridge filter, Proton wobbling nozzle, PTSim Monte Carlo, Spread out Bragg peak