Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Clinical implementation of proton Monte Carlo dose calculation.[1]
HARALD PAGANETTI, Massachusetts General Hospital, HONGYU JIANG, SHASHIDHAR KOLLIPARA, HANNE KOOY — Goal was the clinical implementation of Monte Carlo dose calculation for use in parallel to a commercial planning system. Treatment heads were modeled in detail. To describe the patient anatomy, Hounsfield Units were converted into materials with explicit element composition and density. We developed a method to dynamically assign the mass density to the materials during particle transport. Memory for CT voxels is assigned dynamically. A software link was created between the commercial planning system, the treatment machine control system and the Monte Carlo program. The prescribed range and modulation are automatically translated into the corresponding settings of the treatment head. For broad beam modulation treatment, the Monte Carlo code simulates apertures and compensators based on the milling machine files. Treatment information, like prescribed dose per field, size of the air gap, couch angle and gantry angle, is read from the departmental patient database. For absolute dosimetry, the dose delivered to the patient per monitor unit is calculated based on the simulation of the reading of a segmented transmission ionization chamber. Dose calculations are done on the CT grid resolution and have been performed for various treatment sites. Monte Carlo results can be imported into the planning system.

[1]Work supported by NIH PO1 CA 21239

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Date submitted: 28 Nov 2005 Electronic form version 1.4