AbstractID: 1928 Title: Including scatter dose in IMRT optimization calculations

The IMRT dose calculation algorithm influences both the plan quality and the speed of the optimization process. In order to accelerate the optimization routine time and reduce memory requirements, various methods have been introduced to reduce the amount of scatter which is included in the representation of beamlets. Fast and flexible optimization methods can be developed if the beamlets can be represented as matrices. We studied several different methods to reduce the number of low dose (scatter) elements in the beamlet matrices. One method implements hard thresholding at a given fraction of the maximum dose (say 1%). The second method (introduced by Thieke et al., Med. Phys., 29: 676-681 (2002)) uses a probabilistic sampling of the low dose. We tested the methods on an IMRT plan with 5 equally spaced angle beams. The frequency of the probabilistic sampling in this test was 2.5%. Then we optimized the obtained beamlets with a quadratic programming method using Mosek's MatLab toolbox on PIII 2.1 GHz. The simple thresholding method produced an RMS error (difference with full scatter inclusion) of 1.2%, which had 4.1 times less elements, and was 5.1 times faster than the original full dose optimization. The probabilistic sampling method produced an RMS error of 0.4%, with 3.1 times less elements, and was 3.3 times faster than the original. The results show that the probabilistic method is significantly more accurate than the thresholding, while still offering a substantial acceleration of the optimization process.