

Delivery of dose to the tumor site inevitably includes irradiating organs at risk and non-critical normal tissues. Hence, treatment planning involves distributing the dose to non-tumor tissue in such a way as to minimize the risk of complications. This is achieved through modification of various planning parameters such as beam number, orientation, weight, energy and clinical parameters such as tumor size and margin. This work studied the variation of non-tumor integral dose (NTID) as a function of listed parameters. NTID is defined as a measure of the total energy deposited in non-tumor tissue. Three clinical cases (nasopharynx, liver and prostate) were selected for this purpose. Plans were generated with 2, 4, 8, 12 and 36 equally spaced beams. Beam orientation was varied for 2-12 beams. Beams were shaped to the projection of the CTV with negative, zero and positive margins. All plans were normalized to the same tumor integral dose (within  $\pm 3\%$ ). NTID varied by  $<3.5\%$  for the three cases with beam number and margin size and  $<4\%$  and  $<10\%$  with changes in beam orientation and weighting when using  $\geq 8$  beams. Positive tumor margins resulted in lower NTID variation with beam number. These data support the hypothesis that NTID is relatively independent of beam orientation or relative weighting when many beams are used. Optimization, therefore, can only find the best distribution of dose; it cannot reduce the energy imparted. NTID might provide a boundary value for the cost function in plan optimization.