AbstractID: 7582 Title: Motion in Tomotherapy:some dosimetric observations

Purpose: Tomotherapy is an approach to delivering radiation where the patient is continuously transported through a modulated slit of radiation. Concern arises as to how much the patient's internal motion (e.g. breathing) affects the dose deposited in the anatomy. A simple model is presented which qualitatively explains the motion-induced dose variations which were measured from film.

Method and Materials: Modeling was based on the dose delivery parameters of the commercial tomotherapy unit which was used to deliver typical patient plans. Dosimetry films were irradiated while a phantom was static, and also oscillating +/- 10mm at a typical breathing repetition period of 6 seconds.

Results: Comparing the static and moving cases (for the same plan), in the high dose regions (~250 cGy) the measured doses are very similar (typically within 7%) except for the penumbra region. These results are consistent with recently independently published data, but are much less than some previous papers had suggested.

Our model proposes that the surprisingly modest dose variation can be qualitatively understood in terms of the delivery mechanism of the equipment which in this case has a maximum dose rate of 850 cGy/min at isocenter. Two factors are especially important: (1) to obtain a high dose level, a particular voxel of patient anatomy must be irradiated for a long period of time (at least ~ 20 seconds), which intrinsically allows for significant averaging over the breathing cycle; (2) the usual CTV dose uniformity requirement encourages angular symmetry and hence, due to the gantry rotation period, more temporal averaging.

Conclusion: The model shows that certain dose delivery features, and attributes of a **clinical** plan, are important in reducing motion-induced dose variance. A fully accurate calculation is beyond the scope of this presentation, and each clinical plan should be independently evaluated.