AbstractID: 10720 Title: Cumulative rectal dose surface histogram (DSH) using homologous point sets.

Purpose: Present a metric to compare the outer rectal wall surface cumulative daily treatment dose with the original plan.

Materials and Methods: The rectum outer surface was contoured for 28 fractions of a patient undergoing prostate tomotherapy without bowel preparation. The rectal variations could be divided into three ranges corresponding to a rectal filling of “empty”, “half” and “full” with approximately 61%, 21% and 18% of the data in each respective region. We use points on the outer surface of the rectum to calculate a Dose Surface Histogram (DSH). The set of points on the planning surface is the reference for all daily treatments. Doses on the daily contour are mapped onto the reference contour. Every point on the planning contour has a homologous point on the daily contour. Rapid calculations are performed using an in-house MATLAB algorithm. For each treatment fraction, the dose D(*i*) to point *i* on the planning contour is equal to the dose D(*j*) where *j* is the previously determined corresponding point on the daily contour. The cumulative dose to point *i* is the sum of all the daily D(*j*).

Results: A DSH was calculated for the plan and a representative daily MVCT slice. The cumulative DSH was compared to the nominal “average” DSH computed by simply averaging the plan and daily DSHs. There are significant differences above 80% of the prescribed dose. DSHs for a representative contour in each of the empty, half, and full rectum regions indicated 5% difference between the cumulative and planned rectum for doses below 70% and variations of 10 to 20% at higher doses.

Conclusions: Cumulative DSHs accurately indicate the dosimetric effect of daily variations in rectal filling. A general technique to compute cumulative DSHs has been developed as an efficient metric to determine if adaptive planning is required.