AbstractID: 11802 Title: Implementation of 2D Arrays for TomoTherapy Patient-Specific QA

Purpose: 2D arrays were not designed for rotational delivery modalities such as TomoTherapy. This study explores their clinical use and develops a methodology for minimizing their limitations.

Method and Materials: The MatriXX ion chamber array (MULTICube phantom) and the MapCHECK diode array (MapPHAN phantom) were calibrated using a TomoTherapy plan with a contour enclosing the center diode/ion chamber and an adjacent ion chamber in solid water for absolute dose calibration. Eight prototype TomoTherapy treatment plans were created with various directional blocks to restrict beam delivery angles. Delivery verification plans for these prototype plans and for multiple clinical patient plans were created using MVCT images of each array in its respective phantom and then delivered. For comparison, film and ion chamber measurements were made with the cylindrical TomoTherapy cheese phantom.

Results: Clinically, less than 5% of more than 100 patient treatment plans verified with these 2D arrays had pass rates less than 95% for a 3%/3-mm DTA criterion. Relative dose comparisons for the failing plans all had pass rates above 95%, indicating a calibration/scaling error. DQAs for a prototype plan that restricted beams to a 45 degree lateral arc had pass rates of ~40% (absolute error > 5%) for both devices, indicating a problem with lateral beams. Similar arc restrictions in the AP/PA plane produced plans with pass rates > 95% for both devices. To minimize these effects, two approaches were explored. Histograms of MLC leaf opening times as a function of projection angle were used to either determine the optimal device orientation or to determine a calibration procedure that more closely matched the angular distribution of delivery beams.

Conclusion: Both devices can be used with TomoTherapy satisfactorily, but care must be taken to orient and calibrate the 2D array under delivery conditions that more closely match the treatment delivery conditions.