Evaluation of New Exit Detector Based Transit Dosimetry Software for TomoTherapy Treatments

Methods for calculating transit dose using data acquired during treatment delivery are of keen interest to radiation oncology clinics to improve their quality control programs and to support adaptive treatment approaches. Using transit dosimetry for each fraction of treatment has the potential to catch machine errors, patient setup error and movement, and patient weight loss. Previous research has been published exploring the use of the TomoTherapy exit detector array for 3D dose verification¹, but to date there is no third party commercial product available for clinical use. This study reviews our initial experience working with Math Resolutions, LLC in the testing and implementation of the newly developed Dosimetry Check software for TomoTherapy treatments.

Figure 1. TomoTherapy planning station displays a 2.5 cm field width pituitary plan with isodose regions.
Figure 2. Dosimetry Check software transverse, coronal and sagittal displays of transit dose distribution comparison for the above pituitary plan. Green isodose lines display the TPS plan dose, magenta show the DC reconstructed dose, both in cGy.

Figure 3. Dose distribution comparisons through X-, Y-, and Z-axis. Dotted line shows the treatment planning system plan, solid shows the DC plan calculated using the exit detectors data.

While the current Dosimetry Check post-treatment verification platform that uses the exit detector data collected during the treatment delivery and analyzing it off-line is currently unable to catch a real time error, the transit dose calculation has other advantages. Differences in the dose comparison seen after reconstructing the exit dose on the planning CT could indicate patient weight loss, incorrect positioning, or a machine malfunction. This information could then be used in an adaptive approach to correct remaining treatments.

References: