

AbstractID: 11434 Title: A 3D solution for advanced photon arc therapy quality assurance

**Purpose:** Recently, radiation treatment technology has out-paced the advances in QA technology, and a critical gap has been created within the arc motion delivery systems such as Rapid Arc<sup>®</sup>, High Art<sup>®</sup>, and VMAT<sup>®</sup>. Gantry position, speed and MU rate create extra degrees of complexity unaccounted for by several traditional 2D QA verifications due to directional dependence and/or inadequate spatial resolution. We present the 1<sup>st</sup> 3D dosimetry verification of a Rapid Arc treatment and general dosimetry technique based on a radio-chromic plastic (PRESAGE<sup>TM</sup>)/optical-CT (OCTOPUS<sup>TM</sup>) combination suitable for today's complex treatment technology.

**Method and Materials:** A radio-chromic plastic cylinder 17cm diameter x 11cm height was used to verify a simplistic Rapid Arc 6MV prostate plan. The radiation induced OD change (proportional to dose delivered) was acquired by an optical-CT scanner with a voxel size of 1x1x2.5mm<sup>3</sup>. The measured distribution was then compared with the corresponding dose distribution calculated by the treatment planning system (Eclipse<sup>®</sup> AAA, voxel size 2.5x2.5x2.5mm<sup>3</sup>). Comparisons between the two dose distributions were made using dose profiles and stacked 2D gamma maps (with criteria 3% dose difference and 3mm distance to agreement) for a quasi 3D gamma volume.

**Results:** The 3D dose distribution measured profiles in the dosimeter showed agreement amongst the calculated treatment plan down to lower dose regions (down to ~35%). Gamma map comparisons show the dosimeter measurements generally agree with the calculated treatment plan with a few low dose bath problem areas superior and inferior. More traditional QA techniques showed the same discrepancy areas of the plan. This aided in the verification of the system commissioning process.

**Conclusion:** Radio-chromic plastic/optical-CT dosimetry techniques are capable of providing 3D, high spatial resolution verification for patient QA with advanced treatment techniques or commissioning, and the potential for its use at other treatment sites where the fluence is more complex.