AbstractID: 11307 Title: First experience of high resolution 3D optical-CT scanning of an anthropomorphic, leuco-dye doped, radiochromic plastic dosimeter

Purpose: To investigate feasibility of high-resolution three dimensional (3D) optical-CT scanning of an anthropomorphic leuco-dye doped radiochromic plastic dosimeter. **Method and Materials:** An anthropomorphic head phantom made out of PRESAGE™ (a leuco-dye-doped radiochromic plastic) was from Heuris Pharma. Co-planar alignment marks (visible on x-ray CT and optical-CT) were placed on the surface. These were used to setup the phantom for x-ray CT and treatment and for registration of measured dose from optical-CT with the eclipse treatment planning system calculations. A RapidArc™ treatment for brain tumor was delivered and radiochromic response was scanned using optical-CT. Optical-CT (pre-irradiation and post-irradiation) was with a commercial laser beam scanner called OCTOPUS-5X™ (MGS Research Inc). The following imaging parameters were used: Image matrix of 418x418, pixel size of 0.5 mm, 1200 projections at 0.3 degree angular increments and inter-slice spacing of 2.5 mm. The relationship between post-irradiation radiochromic response and dose was established by irradiation of 1 cm path-length cuvettes to a known dose and measuring the corresponding optical density change. **Results:** Pre-irradiation and post-irradiation optical-CT scans of the head-phantom were promising with artefacts generally confined to the edge because of refractive index mismatch between scanning fluid and phantom material. Even with a refractive index mismatch, challenging surfaces like the nose and ears were reconstructed with clarity. A profile through the center of the reconstructed central slice was flat suggesting uniform optical density. Further improvements to optical-CT images are possible by satisfying the Nyquist sampling-sufficiency criteria and with precise refractive index matching. Cuvette irradiations confirmed that the relationship between delivered dose and radiochromic response was linear with a slope of 0.0144 OD change per Gray. **Conclusion:** Results suggest that anthropomorphic dosimetry phantoms could be used for patient specific 3D quality-assurance in the near future, which represents a major advance in the field of 3D dosimetry.