AbstractID: 12874 Title: Imaging properties of the OCTOPUS^{TM}-IQ scanner in combination with a new polymer gel dosimeter

Purpose: To characterize imaging properties of the OCTOPUSTM-IQ scanner in combination with the new BANG™3-Pro2 polymer gel formulation. **Method and Materials:** Four non-irradiated cylindrical gel dosimeters were constructedwith 12.7 cm diameter and 20 cm long thin-wall acrylic containers. Two of the gels were blank with no inserts, and the other two had acupuncture (0.3 mm diameter) needles inserted vertically along the gel axis and at 45° angle from the center of the gel container. The needle gels were used for spatial resolution and geometrical distortion assessment of reconstructed scanner images. The blank gels with no inserts were used for volumetric response uniformity and reproducibility. The gels were scanned with 0.25 – 1.0 mm ranges slice resolution along the gel long axis and reconstructed at 0.25 – 1.0 mm voxel resolutions. This was accomplished using two different configurations of the scanning laser beam elliptical cross section. Point spread functions (PSF) and their Full Width at Half Maximum (FWHM) were evaluated. **Results:** Examinations of in-plane/cross-plane and depth response profiles indicated that the optical density outputs of the dosimetry system (optical CT scanner + gel) were significantly uniform with insignificant gel-to-gel differences (mean and standard OD deviation = 0.028 (±0.004)) cm-1. With high resolution scanning mode and 0.25 mm pixel size, the measured PSF at the center of the gel dosimeter have a FWHM of 0.95 mm in along the gel axis. No off-axis geometrical distribution is observed up to the maximum useful reconstructed image radius of 50 mm from the gel dosimeter center axis. **Conclusion:** An assessment of imaging properties of the latest OCTOPUS scanner with a new gel formulation was performed. The results indicate that the system's versatile resolution capability can yield sub-millimeter 3D image resolution for high-precision dosimetry QA applications.