

Purpose: To evaluate the performance of the OCTOPUS™-10X optical CT scanner (MGS Research, Inc., Madison, CT) based on a single laser diode and a single photodiode detector. **Method and Materials:** Optical CT scanner using a single laser beam and a single photodiode detector does not suffer from the light scattering problem inherent in scanners using broad light sources. The OCTOPUS™-10X optical CT scanner is an upgrade of the OCTOPUS™ research scanner with improved design for faster motion of the laser beam and faster data acquisition process. The motion of the laser beam in the new configuration is driven by the rotational motion of a scanning mirror. The center of the scanning mirror and the center of the photodiode detector are adjusted to be on the focal spots of two coaxial Fresnel lenses. A glass water tank is placed between the two Fresnel lenses to house gel phantoms and matching liquids. The laser beam scans over the water tank in parallel beam geometry for projection data as the scanning mirror rotates at the speed of less than 0.1 second per circle. Signal sampling is performed independently of the motion of the scanning mirror. Technical issues with regard to the new design of the scanner are addressed, including projection data extraction from raw samples, non-uniform pixel averaging and reference image normalization. **Results:** The mechanical stability of the scanner, the accuracy of the non-uniform pixel averaging algorithm and the effectiveness of the reference image normalization method are analyzed. Gamma analysis are performed between the 3D dose distributions from the gel measurement and the Eclipse planning system for a 12MeV, 6cm x 6cm single electron field irradiation and a 5-field IMRT plan. **Conclusion:** The OCTOPUS™-10X optical CT scanner can reconstruct 3D dose distribution from gel dosimeters with reasonable accuracy in a timely fashion.