AbstractID: 11017 Title: The determination of optimal Hounsfield unit assignment of materials in a 2 dimensional diode array used in the calculation of rotational therapy verification plans.

Purpose: To determine the optimal Hounsfield unit (HU) assignments for the materials in a two dimensional diode detector array used for the quality assurance of rotational radiotherapy.

Method and Materials: A 2 dimensional diode array (MapCheck, Sun Nuclear Corporation) with a surrounding uniform density phantom (MapPhan) was imaged with 2.5 mm CT slices. The array contains a plane of 445 solid state detectors in contact on both the top and bottom with a fiberglass pc board and polycarbonate plate. The attenuating properties of this entire detector assembly were modeled in the eclipse planning system by assigning different HU to the materials and comparing calculated (AAA 8.2.23 algorithm, Varian Medical Systems) and measured dose. The diodes were assigned HU of -50, 0, 50 or 3000, and the polycarbonate plates were assigned HU of -50, 0, 50, 150, 250 or 350. Rectangular fields of length 25cm and widths of 5cm, 10cm and 30cm, were planned with different HU assignments and measured in a 358^{o} arc.

Results: Comparisons were made using the agreement rate between calculated and measured results within 2% dose. The phantom defined by uniform density had 99.1%, 95.7% and 92.4% agreement for HU values of -50, 0, and 50 respectively. Definitions of the polycarbonate plates of HU of 50, 150, 250, and 350 yielded calculation agreements with measurement of 96.4%. 93.3%, 90.3% and 84.5%. When each of the 445 diodes is assigned 3000 HU, the 2% dose agreement rate is 94.2% and pixel density correction yielded an agreement of 60.4%.

Conclusion: The best results were obtain with uniform HU assignments of 0 or -50 HU or by defining the polycarbonate plates with a HU of 50 and the remainder of the assembly 0 HU. Unacceptable results are obtained when using pixel based density corrections.