AbstractID: 4844 Title: A critical review of the performance of Varian"s new Anisotropic Analytical Algorithm (AAA) utilized in photon treatment planning

Purpose: To critically review the performance of the Anisotropic Analytical Algorithm with respect to accuracy across a complete range of 3D and IMRT treatment fields and its ability to account for tissue heterogeneities, hard and dynamic wedges, multileaf collimated beams and dynamic leaf motions.

Method and Materials: AAA generated monitor units are compared with predicted monitor units generated by measurements at central axis in a water phantom for open fields, hard and dynamic wedges and multileaf collimated fields. AAA predicted doses are compared against measured doses in a anthropomorphic chest phantom in a complex arrangement of beams for both 6 and 18 MV photons, multileaf collimated beams and dynamic wedges. AAA predicted isodose curves are compared by digital subtraction against film recorded isodose curves.

Results: For 6 and 18 MV photons open field beams had an average error of 0.01 and 0.00% and a maximum error of 1.17 and 1.24%; hard wedged fields had an average error of 0.12 and 0.53% and a maximum error of 1.16 and 2.32%; dynamic wedges had an average error of 1.28 and 1.87 and a maximum error of 3.3 and 4.8% respectively. These measurements had a measurement error of $\pm$1%. In the chest phantom measurements the dose was evaluated for 1) Isocenter dose, 2) Off-axis dose, and 3) Out-of-field dose. The results showed for 6 and 18 MV the average error was 1) 2.3%, 0.4%, 2) 0.7%, 4.4% and 3) 0.2%, 0.3% respectively. The digital subtraction analysis showed similar results and is displayed and analyzed.

Conclusion: The AAA algorithm is a robust and accurate calculation engine. It shows consistent accuracy throughout the useful range of field sizes and depths. It demonstrates an improved accuracy with hard wedge beam hardening and tissue heterogeneities and successfully manages electron contamination above 5 cm in depth.