

AbstractID: 7532 Title: Extra-focal analytical source model for the radiation output from a linear accelerator

**Purpose:** To describe in detail the recently improved extra-focal photon source component of an accurate analytical source model for the radiation output from a linear accelerator.

**Method and Materials:** In the Anisotropic Analytical Algorithm used in the Eclipse™ Integrated Treatment Planning System (Varian Medical Systems Inc.) the radiation output from a linear accelerator is modeled using a multiple-source model with separate sub-sources for primary photon radiation, extra-focal photon radiation and electron contamination. Closely related to this, analytical models for accessories such as hard wedges and dynamic wedges are included. We describe in detail the extra-focal photon source component. A recent improvement to the extra-focal source leading to enhanced accuracy in cases of small MLC apertures that are common during IMRT treatments is discussed. Another related improvement significantly improves the modeling of the Varian Enhanced Dynamic Wedge (EDW).

**Results:** The new extra-focal source model significantly improves the modeling of small MLC apertures that occur during dynamic IMRT treatments. In our test case to water phantom the maximum error (disregarding the buildup region) in depth dose curves has been reduced to 1% of dose maximum. Modeling of the Varian Enhanced Dynamic Wedge has been significantly improved also: in our example dataset the worst case deviation of local value at CAX has been reduced by more than 50%.

**Conclusion:** The analytical source and accessory models used in the Anisotropic Analytical Algorithm in combination with a scheme to optimize the free parameters of the model has been already shown to be clinically acceptable. In this work we discuss two improvements related to the extra-focal source model which further improve its accuracy.

**Conflict of Interest:** The authors are employed by Varian Medical Systems Finland Oy.