

AbstractID: 8494 Title: Variable beam dose rate and DMLC IMRT to moving body anatomy

**Purpose:** To introduce new method of delivery of DMLC IMRT therapy to moving body anatomy. The shaping of intensity maps over moving target and healthy tissue is achieved through simultaneous control of leaf motions and beam dose rates.

**Methods and Materials:** Formulas relating leaf speeds and beam dose rates for delivering planned intensity profiles to static and moving targets in DMLC IMRT are derived and tested for multiple intensity maps and multiple target motion patterns. The analysis of equations that define algorithms for DMLC IMRT delivery under variable beam dose rate reveals multitude of delivery strategies. A specific sub-class of strategies is distinguished that is suitable for clinical applications. This equivalent class of deliveries is notable for the condition of invariant, in target frame of reference, motion of leaves provided they are defined as functions of cumulative number of monitor units and not functions of time. This special subclass of equivalent DMLC IMRT delivery strategies to moving body anatomy generalizes existing techniques of Varian DMLC IMRT irradiation methodology to static body anatomy.

**Results:** We illustrate first how new algorithms work for DMLC IMRT deliveries to static targets. Then we show how newly derived algorithms deliver intensity maps to moving targets when variable beam dose rates are applied. Later we present an example of how new deliveries work in case when they are adapted in real time, when random motion of the target is registered at treatment. Finally, we show how variable beam dose rate can be used to improve dose distributions in IMRT therapy to moving body anatomy relative to optimized dose distributions achievable with IMRT to static targets.

**Conclusion:** The DMLC IMRT utilizing variable beam dose rate allows improving radiation therapy of moving body anatomy.