AbstractID: 7422 Title: A novel quality assurance monitor for real-time verification of IMRT and IGART

Purpose: To develop an independent treatment verification method which can validate radiation field delivery in real-time throughout the treatment course. The system is designed to capture common treatment delivery errors, and is intended to eliminate the need for pre-treatment dosimetric quality assurance of intensity modulated radiation therapy (IMRT) and enable the implementation of image guided adaptive radiation therapy. **Method and Materials:** A monitoring system, termed Integral Quality Monitor (IQM), has been developed that utilizes an area integrated energy fluence monitoring sensor (AIMS) positioned after the final beam shaping device (i.e. multileaf collimator (MLC)) and a signal prediction algorithm, IQM_Calc. The AIMS consists of a novel large area ionization chamber with a gradient oriented along the direction of the MLC motion. The measured signal from the AIMS can be compared in real-time with the IQM_Calc predicted values. A prototype AIMS has been built with 2 mm thick Aluminum plates, an area of 22 cm $\times$ 22 cm and continuously varying electrode separation of 2 to 22 mm. The IQM_Calc uses a modified sector integration of MLC defined apertures and accounts for MLC characteristics such as: rounded leaf ends, transmission, and relative output factor. Testing of the IQM system was performed on Varian and Elekta linear accelerators. **Results:** Initial results for prostate IMRT fields show an average agreement of 2% between the measured IQM signals and the IQM_Calc results. For a 3 mm simulated MLC leaf positioning error, the signal of a prostate IMRT field changed by 2%. **Conclusion:** It is demonstrated that the prototype IQM system has the capability of verifying the accuracy of treatment delivery in real-time. The system is also capable of capturing common treatment errors. The IQM system has the potential of playing an important role in the challenging QA environment of modern radiation therapy.