

**AbstractID: 8646 Title: Cone beam CT acquisition during volumetric arc radiotherapy delivery: correction for induced artifacts**

**Purpose:** To evaluate the feasibility of kV cone beam CT (CBCT) acquisition simultaneously with volumetric modulated arc therapy (VMAT) delivery, and to test a method to correct for degradation of image quality due to VMAT delivery.

**Method and Materials:** A commercial CBCT system was modified to enable simultaneous CBCT acquisition with VMAT delivery. CBCT scans of an image quality phantom were acquired during VMAT delivery while varying the VMAT parameters. Dose rate, energy, and field size of the VMAT delivery, and phantom size, were varied to evaluate the effect on image quality. The mean and standard deviation of the signal in a known location was quantified both in the raw 2D projection images and also in the reconstructed 3D CBCT images. A nonlinear filter was tested to remove structural artifact and noise. An analytical scatter correction model was developed and used to remove scatter generated by the VMAT beam.

**Results:** Structural artifact was reduced in the CBCT projections with a nonlinear filter. Scatter generated from the VMAT delivery varied with field size and dose rate, and minimally with phantom size. An analytical scatter model was constructed based on the VMAT fluence (field area times dose rate) for each CBCT projection, and applied to reduce scatter per projection. Applying the model improved uniformity from 7.9% to 3.0% and improved the contrast to noise ratio from 0.97 to 1.84.

**Conclusion:** Megavoltage scatter, and its per projection variation, is the largest component contributing to degradation of CBCT image quality during VMAT delivery. The degradation was reduced with a scatter model based on the VMAT delivery. A secondary component was structural artifact related to the repetition rate of the megavoltage beam and the readout mechanism of the kV detector.

**Conflict of Interest (only if applicable):** Research sponsored by Elekta, Inc.