AbstractID: 10436 Title: Image-guided Radiotherapy using Nanotube Stantionary Tomosynthesis Technology

Purpose: To develop image guidance approaches for clinical application of Nanotube Stationary Tomosynthesis (NST), a nanotechnology-based online image-guided radiotherapy (IGRT) technology that is capable of unprecedented temporal-resolution and imaging speed.

Method and Materials: NST is an accelerator gantry-mounted multi-source array kV imaging technology under development by Siemens. Using a single image panel, the patient can be imaged by 50 x-ray sources on the array in the treatment volume within ~ 2 sec before and even during treatment. However, translating the NST's imaging acquisition strengths into real clinical benefits requires significant software development including new image registration tools that take full advantage of the real-time aspects of tomosynthesis imaging while minimizing its intrinsic resolution limitation. We propose a fast, versatile image registration approach that: integrates information from the large field-of-view projection images, the high-temporal resolution tomosynthesis images, and the high spatial-resolution planning 3D CT image; has tradeoffs to balance the user's needs of quality vs. speed; and potentially extracts a daily image deformation from NST tomosynthesis image for soft tissue based IGRT and treatment course dose accumulation.

Results: We have developed the initial image registration approaches for clinical testing of the first protocol type NST IGRT system. In this presentation we will describe the proposed NST IGRT image registration approaches in lung and prostate treatments and discuss imaging dose and imaging dose reduction approaches. Other aspects of the NST technology including system design, NST reconstruction, image registration, and imaging geometry may be presented separately in the meeting.

Conclusion: We have demonstrated that Nanotube Stationary Tomosynthesis technology has the potential to offer temporal resolution and imaging speed - important features that have not been adequately addressed by the existing IGRT technology today.

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