

## AbstractID: 7530 Title: Localizing through Optimization of Image Acquisition Rate and Tube Current in X-ray Fluoroscopy-Guided Therapy

**Purpose:** Numerous models exist that relate the parameters of an imaging system to the image quality. Unfortunately, very little is known about the relation between the parameters of an imaging modality and the corresponding targeting precision which is of key importance in many image-guided procedures. The purpose of this study is to explore the relation between imaging parameters and the geometric precision that can be achieved, and to show that such relations can be exploited in a framework in which the geometric objectives of a therapy can be used as feedback to drive the parameters of an imaging system and the associated therapy within constraints.

**Method and Materials:** The task of localizing a sphere that is subject to respiratory motion and imaged under X-ray fluoroscopy is considered. Two cases are considered: (i) a system that modulates the temporal sampling frequency using feedback of uncertainty while tracking the sphere in order to maintain a specified maximum spatial uncertainty while minimizing exposure, and (ii) a system that modulates the tube current in order to maintain the localization uncertainty within the specified level as the sphere traverses a noise field. The performance of the proposed system is contrasted with a similar system that does not employ feedback of uncertainty.

**Results:** It is observed that a relation exists between the localization uncertainty and the imaging parameters considered, namely, the temporal sampling frequency and the tube current. The use of uncertainty as feedback allows tradeoffs between targeting precision and imaging parameters to be controlled.

**Conclusion:** The proposed framework can: (i) automatically maintain the geometric objectives of the therapy whenever possible and report to the operator when these objectives cannot be achieved, (ii) optimize the system parameters by dynamically assigning them based on feedback of performance, and (iii) reduce the level of human intervention required to carry out the therapy.