Purpose: In fluoroscopy-guided clinical procedures that involve tracking objects over long treatment times, there is a need for reducing the amount of imaging dose delivered to the patient and the operating staff. In this study, we introduce a feedback metric to minimize tube current while maintaining a targeting precision threshold.

Method and Materials: An acrylic sphere (1.6mm in diameter) was imaged at tube currents ranging from 0.5 mA to 0.9mA (1s) at a fixed energy of 50kVp. The images were acquired on a Varian Paxscan 4030A (2048x1536 pixels, 1100 mm source-to-axis distance, 1570 mm source-to-detector distance). A state feedback metric (tr(C)) based on the current object position was computed and plotted as a function of the tube current. Next, the sphere was tracked using a particle filter with a bowtie filter (4.3-764mm thickness, Al) in the background. The tr(C) was used by a PID controller to modulate the tube current in order to maintain a specified precision as the sphere traversed regions of varying thickness corresponding to the bowtie filter.

Result: Comparison of the feedback framework with a similar system employing fixed exposure reveals a dose savings of up to 43% when using an operating uncertainty of 194 mm2.

Conclusion: This work presents a relation between tr(C) and the tube current which can be leveraged to reduce imaging dose to patients and staff.