Purpose:
To study the accuracy of localization during fluoroscopy for static and moving objects and its dependence on quantum noise determined by exposure and temporal filtering and on motion blur determined by speed of object movement.

Methods:A stainless steel stent (90 micron struts) used as object of interest was mounted on a stepper motor controlled linear stage with effective step size of 1.7 micron. The new high resolution 35- micron-pixel Microangiographic Fluoroscope (MAF) was used for imaging the stent as it was moved forward 7500 steps and brought back to the original position for different speeds. Fluoroscopy was performed at 4 different exposures. The object detection algorithm available in LabVIEW IMAQ Vision software was used to localize the stent using different temporal filtering weights.

Results:
(a) For fixed exposure, stationary object localization accuracy is improved by a factor of 5 for higher temporal filtering compared to no temporal filtering; however, for moving objects the error in localization increased 50 percent due to motion blurring when the filter weight was increased from 4 to 8.
(b) For fixed temporal filtering, localization accuracy improved with higher exposure. Doubling the exposure improved accuracy 3 times for stationary and 1.5 times for the moving object.
(c) Localization accuracy for stationary objects at a given dose and temporal filtering is similar to that at twice the dose and half the temporal filtering weight, whereas that for moving objects was found to be slightly better for the latter case.
(d) Localization accuracy was observed to decrease proportionally with increased object speed due to increased motion blur.

Conclusions:Localization accuracy in high quantum noise situations can be improved by increasing the temporal filtering. There is a need to implement variable weight temporal filtering depending on the amount of motion detected.

Funding Support, Disclosures, and Conflict of Interest:

Support: NIH Grants R01-EB008425, R01-EB002873