Purpose: The generalized metrics of GMTF and GDQE were used to evaluate the effect of focal-spot choice on system performance of the Micro-Angiographic Fluoroscope (MAF) imager with a geometric magnification common for neuro-endovascular interventions.

Methods: The MAF, a newly developed high-resolution detector with very low instrumentation noise and large variable gain, was used for the study. It has 35-micron pixels and a 500-micron thick CsI HR-type phosphor. The detector MTF was measured using the slanted edge method and the focal spot MTFs were measured using a standard pin-hole assembly. For the comparison analysis, the GMTF and GDQE were determined for three different focal spots (0.3 mm, 0.5 mm and 0.8 mm) with a magnification factor of 1.25. A stainless-steel stent was also imaged with the same magnification for all three focal spots.

Results: The MAF's performance is affected significantly by the choice of focal-spot size because of its very high resolution. The GMTF and GDQE comparison for three focal spots showed significant degradation, increasing from small to large focal spot. The GMTF values were found to be 0.09, 0.05 and 0.01 at 5 cycles/mm for the small, medium and large focal spot, respectively. The corresponding values for GDQE were 0.1, 0.03 and 0.001. These results demonstrating the effect of choice of focal spot on the image quality are supported by line profiles obtained across the stent images.

Conclusions: The results of this study demonstrate the significance of focal-spot size on system performance when using a high-resolution detector with a realistic magnification and shows the importance of choosing the minimum focal-spot size.

(Support: NIH-Grant R01EB002873)

Funding Support, Disclosures, and Conflict of Interest:

NIH Grants R01-EB008425, R01-EB002873 and an equipment grant from Toshiba Medical Systems Corp.