

AbstractID: 3051 Title: A total-imaging-system generalized performance comparison of an x-ray image intensifier and a microangiographic system in neurovascular angiography: Effect of focal spot and scatter

Purpose: To quantify the total-system performance of an x-ray image intensifier and compare it with a microangiographic system in terms of the generalized metrics of GMTF, GNNPS, GNEQ, and GDQE which include the effect of geometric-unsharpness, scatter from the patient, as well as the detector characteristics. This presentation expands on our previous work with generalized imaging-system metrics to include a detailed study of the effect of varying the focal-spot.

Method and Materials: A commercial x-ray image intensifier (XII) C-arm unit and a high-resolution ROI microangiographic detector were evaluated with reference to their performance in neurovascular angiographic studies. The study was performed using clinically relevant spectra and conditions specific for each system. A uniform head-equivalent phantom was used, and images were acquired for 60 to 100 kVp at a source-to-image distance of 100 cm for the XII and 75 cm for the microangiographic system. The detector, focal-spot, and scatter unsharpness were quantified in terms of their respective MTF's, and the scatter fraction was determined. These were combined to express a Generalized MTF (GMTF) with spatial frequencies referenced to the object plane. The effect of varying field-size, air-gap and focal-spot size (0.3 mm and 0.6 mm nominal) was studied. A detailed total-system evaluation of the two systems was carried out in terms of the generalized performance metrics of GMTF, GNNPS, GNEQ, and GDQE.

Results: The results of the GMTF and GDQE comparison of the two systems indicate that the microangiographic system performs substantially better than the II at higher spatial frequencies, as needed in image-guided, neuro-interventional procedures. Use of a smaller focal spot further improves its high frequency behavior.

Conclusion: This generalized approach can provide a more realistic evaluation of total-system performance leading to improved system designs tailored to the specific imaging task.

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