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Development of an intensified neutron camera system for high sensitivity white-beam imaging

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Thermal Neutron Imaging is a steadily expanding area of imaging technology and techniques with increasing interest from applications such as cultural heritage, palaeontology, and metallurgy [1,2]. Increased demand for access combined with a limited number of suitable beamlines requires efficient use of available beamtime [3,4]. N-Cam is a new experimental neutron camera system designed with increased sensitivity, thus able to capture detailed images with reduced exposure time as compared to most neutron cameras. N-Cam utilizes a 20μm thick Gadox scintillator applied directly onto the input window of an image intensifier. In experiments performed at the Rutherford Appleton Laboratory ISIS-IMAT facility, N-Cam demonstrated high contrast imaging with 10 lp/mm spatial resolution in 5 second exposures over a 75mm field of view. The Modular Transfer Function was calculated at multiple positions to assess the direction dependence of spatial resolution as seen in Figure 1. The fractional standard deviation of a 24 mm × 24 mm region is given as a function of binned pixel size in Figure 2, where T = 5 seconds and Fn = 2 × 107 n/(s·cm2). The data are well fit with the given equation, resulting in an estimated DQE = 16%. Additional data on contrast-to-noise and tomography will also be presented.

[1] B. Schillinger et al, J. Imaging, 4(1) (2018), 22
[2] E. Lehmann et al, Physics Procedia, 88 (2017), 5 – 12
[3] W. Kockelmann et al, J. Imaging, 4(3) (2018), 47
[4] E. Lehmann et al, Physics Procedia, 88 (2017), 140 – 147

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