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Construction of a Quasi-Monoenergetic Neutron Source for Fast-Neutron Imaging

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Lawrence Livermore National Laboratory is developing a high-brightness, quasi-monoenergetic neutron source for fast-neutron imaging. Past and on-going image quality index (IQI) measurements of various objects show that there is great promise for fast-neutron imaging, specifically for imaging structural and material integrity of low-density materials within high density enclosures. Simulations, calculations, and measurements show that discerning detail in the low-density materials as well as interfaces between low- and high-density materials is greatly improved using fast-neutron imaging compared to X-rays and has high potential for seeing corrosion between different materials. The intensity of the neutron source is expected to be 1011 n/s/sr with a fixed energy at 10 MeV with 5% bandwidth at 0-degrees. A 7-MeV pulsed linear accelerator will drive the neutron source. The accelerator will deliver a 300-uA average current deuteron beam onto a pulsed deuterium windowless gas target. The gas target is necessary because of the combined beam power and the requirement for a small source spot size. We will present the results of measurements of fast-neutron imaging we have made with different source types. We will discuss our source construction and plan forward for fast-neutron imaging.

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