Abstract Submitted
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Mapping Isotopic Distributions in Cargo to Detect SNM and its Configuration[1] DENNIS P. MCNABB, Lawrence Livermore National Laboratory — Plans to demonstrate isotope-specific imaging using nuclear resonance fluorescence (NRF) *via* tunable quasi-monochromatic (Thomson) photon sources, while at the same time providing a conventional radiograph of the bulk matter distribution, will be discussed. The implementation of NRF-based imaging depends strongly on the nature of the X-ray illumination source [1]. Monte Carlo simulations used to study source properties to study the sensitivity of the technique in thick cargos for different photon source characteristics will be presented. Thomson or inverse-Compton scattering of laser photons from beams of relativistic electrons produce beams that are quasi-monochromatic, highly collimated and have been shown to scale in spectral brightness as the square of the X-ray energy [2]. A source with a larger fraction of the photons in the region of the resonance energy will result in higher signal-to-noise ratios with considerably less dose than conventional Bremsstrahlung-based machines. The ability to make an isotope-specific image has the potential to transform the special nuclear material detection problem from simply identifying high optical depth cargo or high-Z material, to unambiguous detection and verification of the specific contraband material. The high spectral brightness of this technology significantly reduces the radiological dose required for detection and largely eliminates artifacts due to small-angle Compton scattering. In collaboration with C.P.J Barty, F.V. Hartemann, J. Pruet, S.G. Anderson, P.D. Barnes, D.J. Gibson, C.A. Hagmann, J.E. Hernandez, M.S. Johnson, I. Jovanovic, M. J. Messerly, E.B. Norman, M.Y. Shverdin, C.W. Siders, and A.M. Tremaine, Lawrence Livermore National Laboratory. [1] J. Pruet, D.P. McNabb, C.A. Hagmann, F.V. Hartemann, and C.P.J. Barty J. Appl. Phys., in press (2006). [2] F.V. Hartemann et al., PRLSTAB 8, 100702 (2005).

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