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Dose calibration and spot-size reconstruction using self-developing x-ray films in a linear induction accelerator-produced flash x-ray source

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Linear induction accelerators such as the DARHT at Los Alamos National Laboratory are used as sources for flash x-ray diagnosis of dynamic events. The source characteristics of primary interest are the source intensity, the source spot-size, and the illumination uniformity which are determined by the electron beam parameters. We utilize self-developing x-ray film to characterize the x-ray source with a combination of penumbral imaging and spatial dose profile measurements. The penumbral imaging method makes use of a thick, tungsten collimator and Fourier transform methods to reconstruct a source image. Modeling of the bremsstrahlung source profile allows the inference of the beam convergence angle within the x-ray converter target. The two parameters together can be used to estimate the beam emittance. In one example, a self-developing film is exposed with 1300 Roentgen on-axis dose. In one example, a source with Gaussian fall-off of $280\mu\text{m}$ is reconstructed from the penumbral image and an inferred convergence angle of about 2.6° yields a normalized emittance of approximately 900 mm-mrad.

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Footnotes

I have read and accept the Privacy Policy Statement

Yes

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