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4.41 Using time-resolved penumbral imaging to measure low x-ray emission signals from capsule implosions at the NIF

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``We have developed an experimental platform at the National Ignition Facility to measure x-ray Thompson scattering (XRTS) spectra from indirectly-driven capsule implosions that create extreme density conditions near stagnation [1]. To account for shot-to-shot fluctuations in the implosion timing, we use x-ray self-emission at stagnation as a timing fiducial. Due to lower implosion velocity, low gas fill, and hot spot symmetry perturbations, the hot spot emission is 100 – 1000x weaker than that of standard ICF implosions. To address this challenge, we have developed and fielded a new pinhole-imaging snout that exploits time-resolved penumbral imaging [2,3]. Though use of 150 ⊠m diameter, penumbral-quality pinholes reduces the direct spatial resolution of the images, a 2D image can be reconstructed through analysis of the penumbra. Despite fluctuations of the x-ray flash intensity of up to 5x, the emission time history is strikingly similar from shot to shot, and slightly asymmetric with respect to peak x-ray emission. Emission times vary by up to 250 ps and can be determined with an accuracy of 50 ps. 1. D. Kraus et al, J. Phys.: Conf. Series 717, 012067 (2016). 2. B. Bachmann et al., Rev. Sci. Instrum. 85, 11D614 (2014). 3. B. Bachmann et al., Rev. Sci. Instrum. 87, 11E201 (2016).''

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