RECENT ADVANCES IN X-RAY DIAGNOSTIC CAPABILITIES AT THE NATIONAL IGNITION FACILITY

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Experiments at the National Ignition Facility rely on a comprehensive suite of x-ray diagnostics, including framing cameras, streak cameras, spectrometers, diode arrays, filter fluorescers and static imagers. These diagnostics play a key role in characterizing the performance of the hohlraum, the symmetry of the drive, the implosion trajectory of the capsule, and the stagnation characteristics.

Recently, three new x-ray imaging diagnostics have been developed for the NIF. These instruments push the boundaries of performance in terms of temporal resolution, spatial resolution, and signal-to-noise at high photon energies. The DIXI (Dilation X-ray Imager) instrument [1] is currently the world's fastest x-ray framing camera, capturing self-emission images of the capsule hot spot with <10ps temporal resolution. The KBO (Kirkpatrick Baez Optic) microscope [2] is a high-throughput imaging diagnostic, which is capable of capturing narrow-band, spectrally-selected images with <9μm spatial resolution. The AXIS (ARC X-ray Imaging System) diagnostic [3] is the detector for Compton radiography driven by the ARC (Advanced Radiography Capability) laser, and is capable of recording x-ray images at 50-200keV with detective quantum efficiency several times greater than other x-ray cameras available at the NIF [4].

In addition, several existing x-ray diagnostics have undergone upgrades to significantly improve their performance. An overview of the x-ray diagnostic capability at the NIF will be presented, and the design and improved performance of new and upgraded x-ray diagnostics will be discussed.

[1] S. R. Nagel et al, Rev. Sci. Instrum. 85, 11E504 (2014)
[2] L. A. Pickworth et al, Rev. Sci. Instrum. 85, 11D611 (2014)
[3] G. N. Hall et al, Rev. Sci. Instrum. 85, 11D624 (2014)
[4] N. Izumi et al, Rev. Sci. Instrum. 85, 11D623 (2014)

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