# The National Diagnostics Strategy in the U.S.

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With the support of the U.S. Department of Energy, the High-Energy-Density (HED)/Inertial Confinement Fusion (ICF) Community has developed a national diagnostics strategy to develop and exploit new technologies that will significantly enhance the experimental capabilities at the major HED facilities in the U.S. (NIF, Z and Omega). Central to this strategy are a group of innovative diagnostics that represent major national investments with the potential to transform measurement capability for HED and ICF science in the US. Since the last IFSA meeting, significant new capabilities have been qualified for operation on the NIF, Z, and Omega. These include (1) high-spatial-resolution, multiframe, single line-of-sight x-ray imaging systems [1] on with additional instruments (additional frames, views and imaging optics) under development; (2) optical Thomson scattering on the NIF at $3\omega$ with a development path for $5\omega$ to support plasma-characterization measurements inside hohlraums and in the corona of a directly driven capsule; (3) hot-spot imaging using primary neutrons along multiple lines of sight for [2] 3-D imaging; and (4) high-resolving-power ($E/\Delta E > 2000$) x-ray spectroscopy [3] to study hot-electron equilibration, ionization dynamics, and hot-spot conditions. Significant R&D is underway or nearing realization on additional “transformative” measurements that include highly time-resolved $\gamma$ spectroscopy, a time-resolved neutron spectrometer [4] to study hot-spot dynamics, hard x-ray imaging (>15 keV), and time-resolved x-ray diffraction to explore the dynamics of materials undergoing phase changes. The talk will describe the new capabilities, the continuing development of existing instruments within the National Diagnostics Plan, and conclude with ideas for longer-term measurement requirements in the national strategy. This material is based upon work supported by the Department of Energy National Nuclear Security Administration under Award Number DE-NA0001944, the University of Rochester, and the New York State Energy Research and Development Authority.

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