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An Ultrafast X-ray Diagnostic Suite for Burning Plasmas KEVIN BAKER, RICHARD STEWART, PAUL STEELE, STEVE VERNON, WARREN HSING, SUSAN HAYNES, Lawrence Livermore National Lab — Ignition designs on the National Ignition Facility predict $\sim 10^{19}$ neutrons in a time of 15 – 20 ps. The very short burn time and small size of the burning plasma will require x-ray diagnostics with time resolutions of a few ps and high spatial resolution which can function in extremely large neutron fluxes. One promising solution to this challenge is to perform an ultrafast conversion of the x-ray signals into the optical regime, <100 fs, and to relay image the signal out of the chamber and into a shielded bunker. A diagnostic suite, Grating Actuated Transient Optical Recorder (GATOR), has been developed which uses the ultrafast near-band-edge change in the optical index of refraction of semiconductors caused by x-ray generated free carriers to achieve this goal. The GATOR diagnostic suite has been tested on a laser-produced x-ray source at the Jupiter Laser Facility and the performance of this diagnostic suite, which includes a multi-temporal frame 2-D imager, a continuous-time 1-D imager and a single channel continuous-time recorder, is presented. This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

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