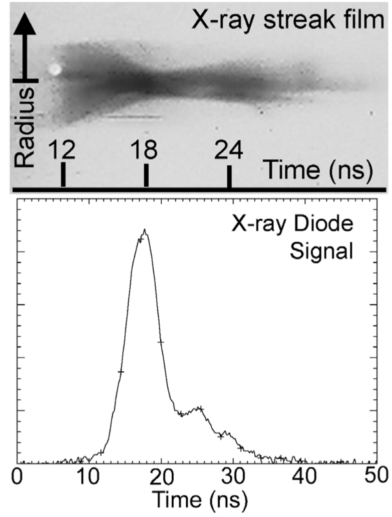
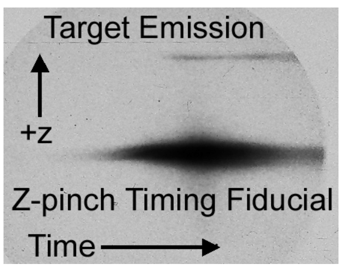
1673 News Notes: December 2002 Edition



New X-ray streak camera diagnostic

Earlier this year, an x-ray streak camera diagnostic (developed by David Wenger, Daniel Sinars, and Keith Keller) was installed on one of the nine radial lines of sight (LOS 1/2) of the Z-machine. The streak camera provides sub-keV x-ray images of z-pinch implosions and experimental targets the Z-machine load with one dimension of spatial resolution and continuous time resolution. For some experiments, it is useful to know not only when the radiation is emitted, but from where. A unique feature of this diagnostic system is the use of an x-ray mirror that helps provide a well-defined spectral bandpass.

One recent use of this diagnostic has been to look from the side at the on-axis stagnation of an imploding wire array. The evolution of the implosion can be observed in x-ray streak camera images such as the one shown in the upper right. Along the vertical direction of the image the diagnostic records a one-dimensional image of the radial emission of the imploding wire array. This one-dimensional image is "swept" across the detector along the horizontal direction of the image shown, giving continuous time resolution along this direction. Thus, looking from left to right, we can see the sudden onset of radiation at about t = 12 ns. During the next 6 ns, the emitting plasma is steadily compressed onto the axis. As it does so, it continues to heat and emits even more radiation until the maximum compression and peak radiation occur at about t = 18 ns. At this time, the confinement begins to break down, the plasma expands and cools, and the radiation begins to decrease. Using this image, we can thereby correlate the x-ray emission to the dynamics of the wire array. For comparison, the electronic signal from an x-ray diode from the same test is shown. The x-ray diode records the time history of the radiation intensity, but unlike the streak camera it does not provide any information about the spatial location of the emission. Thus, the x-ray streak camera can be used as a tool to get more information about z pinches.



A second use of the x-ray streak camera diagnostic has been to study radiation physics. Scientists from Los Alamos National Laboratories have used the x-ray streak camera to measure how radiation propagates through heated materials. An example streak camera image from such a test is shown to the left. The radiation source in these experiments was a wire array surrounded by a solid-wall return-current can that acted as a hohlraum radiation case. A small hole in the return-current can through which the wire array could be seen was used as a timing fiducial to tell when the wire array began to emit radiation. A second hole in the return-current can was placed on the axis of the system, above the wire array. A target material was placed above this hole, where it could be heated by the radiation from the wire array. Though the target did not initially transmit any x rays, as it was heated it became less opaque and x rays began to pass through. Using the streak camera, the time at which the radiation "burn-through" of the target occurred was measured relative to the x-ray emission from the wire array. This information is being used to test complex radiation physics models. For additional details regarding this diagnostic, contact David Wenger (dfwenge@sandia.gov) or Daniel Sinars (dbsinar@sandia.gov).

Edited by Daniel B. Sinars, dbsinar@sandia.gov ; Org. 1673 is managed by John L. Porter, jlporte@sandia.gov
Sandia National Laboratories, PO Box 5800, Albuquerque, NM 87185-1193.