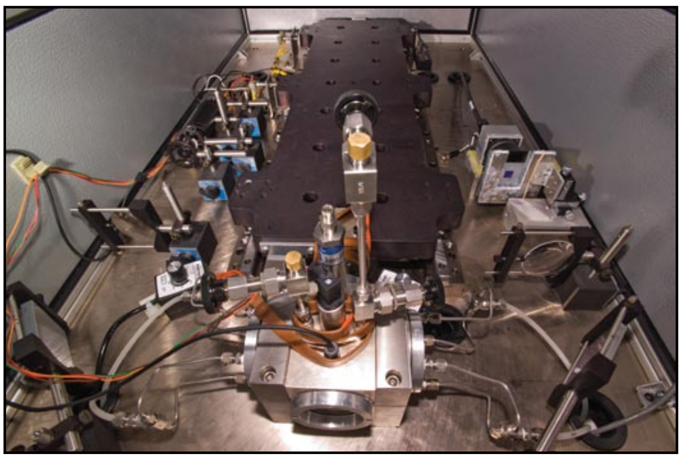
About the Cover:

A high-spatial-resolution neutron detector, based on a high-pressure freon bubble chamber, is being developed at LLE to image the 14-MeV neutrons emitted from the hot-spot region of fusion experiments on the OMEGA Laser System (see **Aperture Tolerances for Neutron-Imaging Systems in Inertial Confinement Fusion** on p. 203). As high-energy neutrons scatter in the supercritical freon, the ion recoil deposits energy locally (within a few microns of the scatter site), raising the temperature above the boiling point and forming a single bubble that quickly grows to more than 100 μm in diameter. The density distribution of these bubbles reflects the spatial distribution of the incident neutron flux. Graduate student Marian Ghilea is shown pointing to connectors and valves used to pressurize and fill the chamber with freon, while LLE Senior Scientist Craig Sangster looks on. A series of pressure and temperature sensors and the overpressure relief valve are found on top of the custom aluminum block that houses the bubble chamber. Water heated to 60°C is circulated within the aluminum housing and around the bubble chamber to maintain a uniform temperature throughout the freon.



A top-down view of the bubble chamber and the imaging optics is shown. The linear motor used to drive the chamber expansion mechanism (to rapidly adjust the pressure in the freon at shot time) dominates the central area of the optical table. A 653-nm laser is used to probe the bubble density distribution using the Schlieren technique (the bubble density will be too high to count them individually). With proper timing, it should be possible to image the bubble distribution when the bubbles have grown to approximately 100 μm in diameter. The anticipated spatial resolution will be significantly better than more-conventional pixelated scintillator arrays that have a typical resolution of one millimeter. The higher detector spatial resolution will reduce the magnification requirements for neutron-imaging systems on OMEGA and the NIF. Lower magnification requirements relax some of the more costly design constraints for these ignition-relevant diagnostics.

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