REFERENCES
1. R. L. McCrory, J. M. Soures, C. P. Verdon, F. J. Marshall, S. A. Letzring, S. Skupsky, T. J. Kessler, R. L. Kremens, J. P. Knauer, H. Kim, J. Delettrez, and R. L. Keck, *Nature* **335**, 225 (1988).
2. F. J. Marshall, S. A. Letzring, C. P. Verdon, S. Skupsky, R. L. Keck, J. P. Knauer, R. L. Kremens, D. K. Bradley, T. Kessler, J. Delettrez, H. Kim, J. M. Soures, and R. L. McCrory, "Cryogenic Laser Fusion Target Implosion Studies Performed with the OMEGA UV Laser System" (submitted for publication).
3. S. Skupsky and S. Kacenjar, *J. Appl. Phys.* **52**, 2608 (1981).
4. S. Kacenjar, S. Skupsky, A. Entenberg, L. Goldman, and M. Richardson, *Phys. Rev. Lett.* **49**, 463 (1982).
5. S. Kacenjar, L. M. Goldman, A. Entenberg, and S. Skupsky, *J. Appl. Phys.* **56**, 2027 (1984).

1.B A Semiautomated Knock-On Recording System

The "knock-on" technique for measuring target density has been described elsewhere in this issue. Here we describe our new semiautomated counting and measuring system, which has considerably eased the task of making the actual measurement.

Knock-ons are detected in thin (~ 150-μm) CR-39 plastic. The ions passing through the plastic damage it and, if the plastic is later etched in a hot sodium hydroxide solution, small pits can be observed where the particles entered on the front surface and exited on the back surface.

In order to avoid counting noise pits produced by protons or defects in the plastic, while obtaining energy information on the D and T ions, it is necessary when counting to note the diameter of the pits and if a pit on the top surface is coincident with a pit on the bottom surface (the particle made it all the way through the plastic) or not (it did not make it all the way through). Since the pits are small, 10 to 20 μm in diameter, this counting and measuring must be done under a microscope; because of the resulting limited field of view, many fields must be counted to cover an entire detector. In the past this has been done entirely by hand using a conventional microscope – a very tedious and slow process.

In order to improve the speed and accuracy with which knock-on detectors can be counted, LLE has assembled a computerized microscope system. This system consists of a Nikon optical microscope equipped with both a diascopic (transmitted) and episcopic (reflected) bright-field/dark-field illumination system. The microscope has been fitted with a Maerhauser computer-controllable stage with 0.25-μm resolution and focus control. The microscope image is fed by a Javelin CCD camera to a Data Translation frame grabber installed in a Digital Equipment VAXstation II/GPX workstation, which also provides stage control. In addition to providing the digitized image to the VAXstation, the frame grabber drives a video monitor to allow direct display of its contents.

At present the system operates in a semiautomatic mode, i.e., an operator is required to recognize a track, and the system handles track measurement, recording, and scan pattern control. Track measurement is quite simple. While viewing the image on the frame grabber monitor, the operator uses the VAXstation mouse to position a cursor on a track and then clicks the mouse. The system measures the track and outlines it, and the operator verifies that the measurement is satisfactory. Should the outline be unsatisfactory, the operator has various image-filtering options as well as microscope illumination options that can enhance the image to allow proper measurement. A re-click on the mouse will then cause the system to remeasure the track. The operator shifts to the other side of the detector with a click on another mouse key. If there is a coincident track, it is measured. The operator then returns to the top of the detector and continues measuring any other tracks in view. Once all tracks in view are measured, the press of a key advances the stage to the next location on the detector.

The system records considerable information about a track. In general, since the particles may go through the detectors at small angles, the tracks are ellipsoidal. Therefore, the system records major and minor track diameter, orientation, and track position for both top and bottom surface in the case of coincident tracks. Track-diameter-measurement repeatability is better than 0.2 μm and position repeatability is better than 1 μm.

In addition to making the measurement process considerably easier, the new system permits us to look at the data in greater detail. For example, we can readily produce histograms of the coincident, noncoincident diameter distribution, which permits a direct determination of the critical track diameter below which protons can no longer be distinguished from deuterons and tritons. We can also compare counts on a track-by-track basis on measurements made by different operators on the same detector, to provide an indication of count accuracy.

Because of the computer-controlled stage and track coordinate recording, we are able to use detector configurations that we could not have considered without the computerized system. In fact, our current configuration, which utilizes circular detectors with annular filtering, would not be countable without such a system.

The system is easily programmable and it can be readily changed to meet changing requirements. An obvious enhancement to the system would be automatic track recognition, which could eliminate the need