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Direct measurement of magnetic flux compression on the Z pulsed-power accelerator R.D. MCBRIDE, Sandia National Laboratories and the University of Michigan, D.E. BLISS, M.R. MARTIN, C.A. JENNINGS, D.C. LAMPPA, D.H. DOLAN, R.W. LEMKE, D.C. ROVANG, G.A. ROCHAU, M.E. CUNEO, D.B. SINARS, Sandia National Laboratories, T.P. INTRATOR, T.E. WEBER, Los Alamos National Laboratory — We report on the progress made to date for directly measuring magnetic flux compression on Z. Each experiment consisted of an initially solid aluminum liner (a cylindrical tube), which was imploded using Z's drive current (0–20 MA in 100 ns). The imploding liner compresses a 10–20-T axial seed field, $B_z(0)$, supplied by an independently driven Helmholtz coil pair. Assuming perfect flux conservation, the axial field amplification should be well described by $B_z(t) = B_z(0)[R(0)/R(t)]^2$, where R is the liner's inner surface radius. With perfect flux conservation, B_z and dB_z/dt values exceeding 10^4 T and 10^{12} T/s, respectively, are expected. These large values, the diminishing liner volume, and the harsh environment on Z, make it particularly challenging to measure these fields directly. We report on our latest efforts to do so using a fiber-optic-based Faraday rotation diagnostic, where the magneto-active portion of the sensor is made from terbium-doped optical fiber. We have now used this diagnostic to measure a flux-compressed magnetic field to over 600 T prior to the imploding liner hitting the on-axis fiber housing. This project was funded in part by Sandia's LDRD program and US DOE-NNSA contract DE-AC04-94AL85000.

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