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First demonstration of an inductively driven X-pinch for diagnosing high energy density experiments on the Z Pulsed Power Facility[1] CLAYTON E. MYERS, DAVID A. YAGER-ELORRIAGA, MATTHEW R. GOMEZ, BRIAN T. HUTSEL, MICHAEL KOSSOW, DEREK C. LAMPPA, LARRY M. LUCERO, ADAM M. STEINER, TIMOTHY J. WEBB, Sandia National Laboratories — Penetrating X-rays are one of the most effective tools for diagnosing high energy density experiments, whether through radiographic imaging or X-ray diffraction. To expand the X-ray diagnostic capabilities at the 26-MA Z Pulsed Power Facility, we have recently developed a new diagnostic X-ray source called the inductively driven X-pinch (IDXP). This X-ray source is powered by a miniature transmission line that is inductively coupled to fringe magnetic fields in the final power feed. The transmission line redirects a small amount of Z's magnetic energy into a secondary cavity where 150+ kA of current is delivered to a hybrid X-pinch. In this paper, we describe the multi-stage development of the IDXP concept, through experiments both on Z and in a surrogate setup on the 1-MA Mykonos facility. Initial short-circuit experiments to verify power flow were followed by X-ray source development experiments on Mykonos and then on Z. The creation of an X-pinch hot spot is verified through a combination of X-ray diode traces, laser shadowgraphy, and fiducial radiographs. When fully implemented on Z, IDXPs will greatly increase the number of available radiography frames and lines of sight for diagnosing high energy density experiments.

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