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X-ray diffraction of dynamically compressed matter on the Z-accelerator[1] TOMMY AO, MARIUS SCHOLLMEIER, PATRICIA KALITA, PAUL GARD, JAMES WILLIAMS, CAROLINE BLADA, HEATH HANSHAW, IAN SMITH, JONATHON SHORES, CHRISTOPHER SPEAS, CHRISTOPHER SEAGLE, Sandia National Laboratories — Experiments on the Sandia Z-accelerator have demonstrated the ability to produce dynamically compressed states of matter with unprecedented uniformity, duration, and size, which are ideal for investigations of fundamental material properties. X-ray diffraction (XRD) is a key material science measurement since it provides direct observation of the compression and strain of the crystal lattice, and is used to detect and identify phase transitions. Because of the low signal levels of XRD and due to the destructive nature of Z-Dynamic Materials Properties (DMP) experiments, it is very challenging to detect the XRD pattern close to the Z-DMP load and recover the data. Instead, a new Spherical Crystal Diffraction Imager (SCDI) diagnostic has been developed to relay the diffracted x-rays away from the load debris field. The SCDI diagnostic utilizes the Z-Beamlet laser to generate 6.2-keV Mn Heα x-rays to probe a shock-compressed sample on the Z-DMP load. A spherically bent crystal composed of highly oriented pyrolytic graphite (HOPG) is used to collect and focus the diffracted x-rays into a 1-inch thick tungsten housing, where an image plate is used to record the data.

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