



Contribution ID: 79

Type: Poster

A portable X-pinch driver for hard X-ray radiography, diffraction and absorption measurements

Tuesday, 20 June 2017 13:30 (1h 30m)

High energy density physics experiments often require the use of short pulses of hard X-ray probing radiation to make measurements of the conditions produced –for instance using X-ray diffraction to examine phase changes as a material is subject to multi-Mbar pressures. In pulsed power experiments such probing radiation has often been produced by an X-pinch, where two or more crossed fine metallic wires are driven by a $\sim 100\text{kA}$ 100ns current and the magnetically driven implosion at the crossing point of the wires causes the formation of a micro-diode.

Until recently the pulsed power requirements for driving X-pinches have limited their use. Often the X-pinch has utilized the same current pulse driving the experiment it is probing –limiting the time scale over which it can probe - and many 'portable' drivers in reality weigh several 100kgs, and have the location of the X-pinch fixed directly on top of a capacitor bank/water line making them difficult to field.

We report on a new X-pinch driver in development at Imperial College London. The driver is based on LTD brick technology, utilizing ball gap switches and dry air/plastic insulation. The overall size of the driver is $\sim 30\text{x}30\text{x}90\text{ cm}$ including a stalk of 7cm diameter, 25cm long to enable insertion into external vacuum chambers. The weight of the driver is $\ll 100\text{kg}$, and it can be orientated in any direction. It should be capable of producing currents up to $\sim 200\text{kA}$ in 270ns ; resulting in $\sim 100\text{mJ}$ bursts of 22keV radiation from a silver wire load.

Acknowledgements This work was supported by the Institute of Shock Physics, funded by AWE Aldermaston, and the NNSA under DOE Cooperative Agreement Nos. DE-F03-02NA00057 and DE-SC-0001063.

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Session Classification: Poster session II - High-Energy Density Physics and Technology

Track Classification: High-Energy Density Physics and Technology