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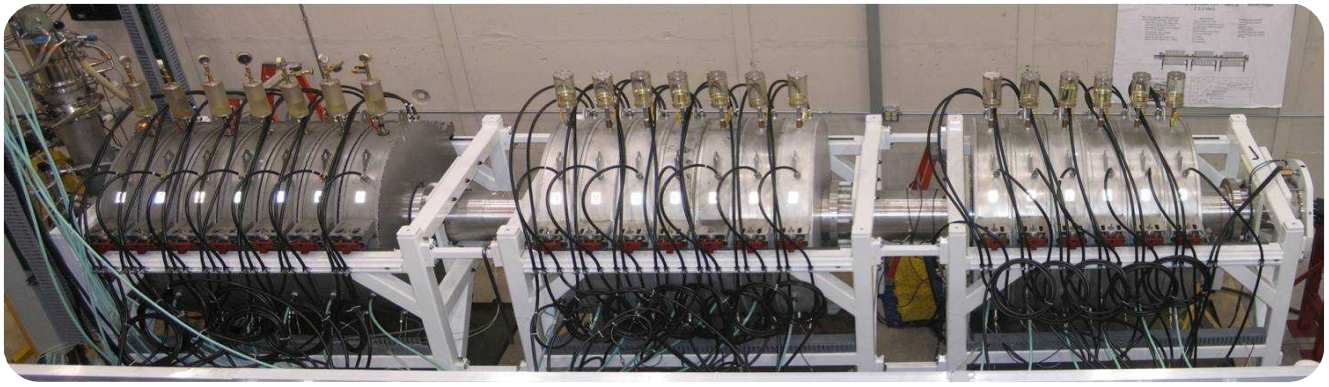

Ursa Minor

A 2-MV Linear Transformer Driver (LTD) for Electron Beam Diode Research

The Ursa Minor linear transformer driver (LTD) is a 21-cavity voltage adder that was upgraded from the seven-cavity Sandia Linear Transformer Driver for Radiography (LTDR) in 2010 [1-2]. Ursa Minor is the highest voltage LTD of its kind and has more series cavities than any other LTD currently in operation. The 21 cavities are coupled to a coaxial magnetically insulated transmission line (MITL) which drives a electron beam diode load. Ursa Minor has been used to drive large area electron beam loads for radiation production and MITL coupling studies. In addition, experiments have been conducted with Rod Pinch and Self Magnetic Pinch (SMP) diodes.

Ursa Minor consists of 21 series LTD cavities in three groups. Voltage monitors are installed in each cavity to measure the cavity output voltage. B-dot current monitors are installed in the anode and cathode of the MITL at four axial locations. Radiation monitors include PIN diodes, TLDs, positioned near the axis of the accelerator about 1-m from the diode. The PIN diodes measure dose rate as a function of time and the TLDs measure total x-ray dose on one or more shots. X-ray imaging is done with image plates and x-ray pin hole cameras.

Each LTD cavity contains 10 parallel bricks. In an LTD, a brick is an individual circuit with two high voltage DC capacitors charged to opposite polarity and connected through a spark gap switch. The number of bricks per cavity is selected to provide the desired output current. The capacitance per brick determines the output pulse shape. For a fixed circuit loop inductance, higher capacitance per brick will increase the output pulse risetime and the peak output current.

In addition to electron beam diode studies, Ursa Minor is used to evaluate LTD technology at a system level. This information is critical for scaling to much larger LTD systems.

Ursa Minor Specifications

Peak Output Voltage	2.5 MV
Number of series cavities	21
Number of parallel bricks per cavity	10
Total number of switches	210
Total number of capacitors	420
Cavity diameter	1.3 m
Total length	7 m

[1] J. Leckbee, S. Cordova, B. Oliver, D. L. Johnson, M. Toury, R. Rosol, and B. Bui, "Linear transformer driver (LTD) research for radiographic applications," in *Proc. 18th IEEE Int. Pulsed Power Conf.*, 2011, pp. 614–618.

[2] J. J. Leckbee, T. D. Pointon, S. R. Cordova, B. V. Oliver, T. J. Webb, M. Toury, M. Caron, and D. W. Droemer, "Commissioning and power flow studies of the 2.5-MeV Ursa Minor LTD," in Proc. IEEE Int. Power Modulator and High Voltage Conf, 2012, pp.

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