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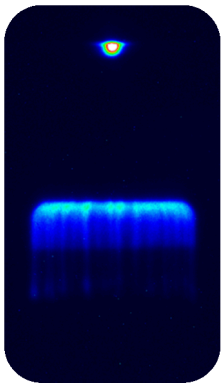

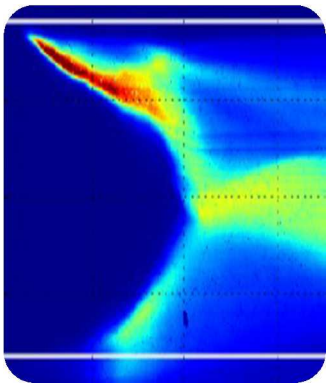

RITS-6

A six-cell induction voltage accelerator for electron beam diode research

Inductive Voltage Adder (IVA) accelerators with a magnetically insulated transmission line (MITL) have been used at Sandia National Laboratories to study accelerators and diodes for radiographic applications. The Radiographic Integrated Test Stand (RITS-6) is a flexible accelerator system designed to provide a platform to specifically study pulsed power issues of IVA accelerators for radiographic applications and to study the physics of radiographic diodes [1].

A three cell system, RITS-3, has been used to study power flow and radiographic diodes for over three years with voltages ranging from 4 to 6.4 MV. Both high (43 Ω) and low (24 Ω) impedance magnetically insulated transmission lines (MITL) have been tested. An expansion to a six stage system, RITS-6, was implemented in 2005.

RITS-6 is a flexible system that has been run in both positive and negative output polarities with load voltage ranging from 2-11 MV. Two MITL stalks have been fielded for high (80 Ω) and low (40 Ω) impedance configurations.

RITS-6 has been used to study beam physics and optimization of the Self-Magnetic Pinch (SMP) and Rod-Pinch diodes [2-4].

The diagnostic suite includes spectroscopy, visible light streak cameras, and high speed framing cameras for studying plasmas generated in the diodes [5]. The radiographic properties of the diodes are studied using image plates, gamma cameras, x-ray pin hole cameras, collimators, step wedges, and other test objects.

The pulse compression sequence includes:

- One Marx generator with 36 capacitors and an erected capacitance of 61.1 nF. The output pulse risetime is about 1 μs

- Two Intermediate storage capacitors with an output risetime of about 200 ns.
- Two Laser triggered gas switches designed for up to 3.25 MV each
- Six pulse forming lines with an output pulse width of about 70 ns and risetime of ~10 ns. Each PFL include peaking and prepulse suppression switches
- Six Voltage adder cells with Metglas isolation cores and Rexolite insulator rings
- Delivers a 70-ns FWHM voltage pulse to an electron beam load
- Typical output:
  - 40-Ω MITL = 6 – 8 MV
  - 80-Ω MITL = 8 – 11 MV

[1] D. Johnson, et. al., "Status of the 10 MV, 120 kA RITS-6 Inductive Voltage Adder," *in Proc. IEEE Pulsed Power Conf.*, 2005, pp. 314-317.

[2] K. D. Hahn, et. al., "Overview of Self-Magnetically Pinched-Diode Investigations on RITS-6," *IEEE Trans. Plasma Sci.* Vol. 38, No. 10, pp. 2652-2662, Oct. 2010.

[3] N. Bennett, et. al., "Shot Reproducibility of the self-magnetic-pinch diode at 4.5 MV," Phys. Rev. ST-AB, Vol. 17, 050401, 2014.

[4] J. J. Leckbee, et. al., "Positive-Polarity Rod-Pinch Experiments on the RITS-6 Accelerator," *in Proc. IEEE Pulsed Power Conf.*, 2013, pp. 492-496.

[5] M. D. Johnston, et. al., "Absolute Calibration Method for Nanosecond-resolved, Time-streaked, Fiber Optic Light Collection, Spectroscopyt Systems," Rev. Sci. Instrum., Vol. 83, 083108, 2012.

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