Science Campaign-1 Pulsed Power Efforts

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Abstract

The PHELIX portable pulsed-power driver is discussed. It is composed of two air-insulated, single Marx modules capable of storing 300 kJ of electrical energy. The Marx are cable coupled to a toroidal transformer with a 4:1 winding ratio. The experimental load is located at the center of the transformer. The components are mounted in a 8’x10’x18’ boxcar which can be moved in and out of the beam line at the LANL proton radiography facility and prevents EMI within the facility. PHELIX has successfully completed two liner implosion experiments with full diagnostic return from flash X-ray imaging, optical Faraday load current, and multi-channel PDV. Computational modeling with both the legacy 1D MHD code RAVEN and the LANL ASC-LAP FLAG code show good agreement with data.
PHELIX Technology

Two Air-Insulated 120 kV Marx Modules (300 kJ)

Toroidal Transformer 40 Cables (4:1 Winding)

Experimental Load
PHELIX Boxcar Prevents EMI at pRad

Top View

Transformer and Load

Marx Modules

Proton Beam

PHELIX at LANL Proton Radiography Facility
PHELIX Liner Demonstration (PLD-1) Showed High Uniformity and Symmetry

Single Frame Flash X-Radiography

T = 0.0 μs

T = 14.5 μs

PLD-1 Load

12 Channel PDV

Load Current

Load Current

Liner

Load Current

Liner

Load Current

Load Current

Load Current

Load Current

Load Current

Load Current

Load Current

Load Current

Load Current

Load Current

Load Current
1-D MHD Modeling of PLD-1

Liner Inner Surface Velocity

V (m/s)

T (µs)

- FLAG
- PDV Data
- RAVEN
PLD-2 - Shock Release of Tungsten Power from Target

SEM
Tungsten Powder

Optical Faraday Rotation

Flash X-Radiography

Liner on Target Load

t = 0.0 µs
t = 27.0 µs

Comparison of PLD-1 & PLD-2 Currents

- PLD-1 Faraday Average
- PLD-2 Faraday #1
- PLD-2 Faraday #2
2D Modeling with ASC-LAP FLAG Code for Ejecta Transport Model Validation

Time = 15.000

Time = 22.001

Time = 27.001

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