

Thomas Mundy
Imperial College Plasma Physics Group

Submitted for the 2023 IEEE International Conference on Plasma Physics

The Novel "Hairpin" Geometry for Power Flow Studies

To better understand current losses in the MITL of high-power pulsed power machines, experiments may be conducted at scale in smaller facilities. However, on typical 1 MA peak current pulsed power drivers, it is difficult to produce the required current densities and magnetic fields. In this poster, we present a novel experiment that is being tested on the MAGPIE driver at Imperial College. Called the "hairpin", this geometry uses small wires of circular cross-section bent into slightly inductive loops. Wire bending is inexpensive, so manufacturing costs are dramatically reduced compared to stripline experiments. In addition, the curvature of the wire cross-section provides field enhancement at the apex of the curve, making even higher magnetic and electric field strength attainable. Lastly, the inductance of the loop can easily be varied, providing precise tuning of the electric and magnetic field strengths in the experiment. Simulations using the COMSOL multiphysics software are presented, and compared with similar simulations using the GORGON code. These indicate that magnetic fields from 70 T to 300 T and electric fields from 30 MV/m to 650 MV/m can be produced with this geometry on MAGPIE. Preliminary results from an experimental campaign on MAGPIE are then presented and compared with the simulations.

This research was funded by Sandia National Laboratories and the US Department of Energy under DE-NA003764