DENSITY AND TEMPERATURE MEASUREMENTS IN THE ELM SIMULATING PLASMA (ESP) GUN

T.K. Gray[1], B.C. Masters[1], R. Stubbers[1,2], D.N. Ruzic[1]
[1]University of Illinois – Plasma Material Interaction Group, 103 South Goodwin Avenue, Urbana, IL 61801
[2]Starfire Industries LLC, 60 Hazelwood Drive, Champaign, IL 61820
tkgray2@uiuc.edu

Edge Localized Modes (ELMs) represent a significant disruption to current and future fusion reactors. Of concern in a device such as the International Thermonuclear Experimental Reactor (ITER) is that ELMs could be the limiting factor for successful operation. ITER ELMs are predicted to impart between 1 – 10 MJ/m^2 onto the surface of the diverter and first wall of the reactor. This could lead to significant erosion of the diverters and possible melting. The ELM Simulating Plasma gun (ESP-gun) currently being operated at UIUC is intended to produce plasmas similar to those found in ELM events from TOKAMAKS. ESP-gun operates with several small pulse forming networks (PFN) each triggered sequentially and producing a ringing, under-damped current waveform with a peak current in excess of 50 kA. Each PFN is connected to the conical theta pinch to produce high temperature, high density plasmas similar to ELM events. These plasmas are intended to reproduce the plasma conditions and potential material damage in an ITER level ELM event.

A Triple Langmuir Probe (TLP) has been used to diagnosis and measure the quality of the plasmas produced by the ESP-gun. To date, electron densities of $1(10)^{19}$ $/m^3$ and greater with electron temperatures greater than 50 eV in the target area have been measured. The plasma has been explored axially from the plasma column under the conical theta pinch to the target as well as investigated radially. From these measurements, plasma energies are calculated. Diagnostics planned for the facility are for fast, IR measurements during the simulated ELM event as well as deposition monitors. Based on these measurements, a model is proposed for the pinch and subsequent translation of the plasma down into the target region.