A requirement for the development of EUV (5-50 nm) laser applications is a pulse power driver system that can deliver high peak currents and fast rise-times in order to be able to pump these lasers effectively. We report here the initial results in the development of a high current driver that is efficient, compact and scalable for EUV lasers.

The pulse power driver is based on a low inductance integrated multiple-capacitor assembly developed by Specscan Sdn. Bhd and was tested on a well-established capillary-discharge 46.9nm Ne-like Ar laser. The pulse power driver comprises four (4) folded aluminum foil and dielectric film capacitors arranged in a two-stage LC-inversion circuit. These are built into a compact 0.5 m square assembly with a pair of input bar electrodes mounted on one side and output bar electrodes on the opposite side. Twenty (20) equal lengths of HV coaxial cables are used as transmission lines connecting the output bar electrodes to a capillary discharge device. A pressurized spark-gap switch is attached to the input bar electrodes, and the system is charged with +10kV and −10kV across the input terminals, requiring a total input energy of 20.6J. Upon triggering, a quadruple increase in output voltage of approximately 40 kV is obtained.

The pre-ionized capillary discharge device uses a 10 cm long alumina tube with inner and outer diameters of 2.8 and 5.6 mm respectively. Triggering the pulse power device, a discharge in Ar with a peak current of around 15.5 kA and a quarter wave rise rime of 40 ns was measured. A fast photodiode with appropriate filters was used to measure a laser pulse emitted at 46 ns from the beginning of the discharge and 6 ns after the current peaked. Using these measured values, a total circuit inductance of 25.7 nH was derived and is close to the value estimated from the physical dimensions of the discharge loop circuit.

Of particular interest to note is that the new driver system requires only 20 J of input energy in order to generate 15kA of peak discharge current (i.e. at 750 A/J). This is to be compared to existing capillary discharge driver systems that can generate up to 200 kA peak current but requiring up to 8 kJ of energy input (i.e. at 25 A/J). Scaling of the new driver system can be expected in the future by increasing the operating voltage and capacitance and will be discussed.