

# **X-Ray and Plasma Dynamics of An Intermediate Size Capillary Discharge**

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## **Abstract**

A small pulsed power generator, 150 kA and 120 ns, is used to form a plasma in a 5-mm diameter alumina ceramic tube. A hollow cathode geometry is used and a preionized plasma is formed in an initial vacuum background by focussing a pulsed Nd:YAG laser onto a metallic target in the hollow cathode volume. The evolution of the preionizing plasma and its expansion into the main discharge volume may be assisted by applying a current of order Amps for a variable time before the main discharge current is applied. Strong electron beams are observed both during the preionizing stage and during the start of the main current. The plasma species and temporal evolution during the main discharge is observed using X-ray spectroscopy and X-ray pinhole imaging. On varying the rate of rise of the current in the pinching phase, the transient hollow cathode effect was found to be significant at early times in the discharge in the case of the lower value of . Both the pinch temperature and diameter depend on varying the from 1.5 to 3 10 A/s. The implications of plasma injection for metal vapor capillary discharges are discussed.

**Key words:** Capillary discharge, plasma injection, transient plasmas, pulsed XUV source.