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Transport of high intensity laser-generated hot electrons in cone coupled wire targets[1]

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In this talk, we present results from a series of experiments where cone-wire targets were employed both to assess hot electron coupling efficiency, and to reveal the source temperature of the hot electrons. Experiments were performed on the petawatt laser at the Rutherford Appleton Laboratory. A 500J, 1ps laser (I $\sim$ 4 x 10^{20} W/cm^{-2}) was focused by an f/3 off-axis parabolic mirror into hollow aluminum cones joined at their tip to Cu wires of diameters from 10 to 40 μm. The three main diagnostics fielded were a copper K_{alpha} Bragg crystal imager, a single hit CCD camera spectrometer and a Highly Oriented Pyrolytic Graphite (HOPG) spectrometer. The resulting data were cross-calibrated to obtain the absolute K_{alpha} yield. Comparison of the axially diminishing absolute Cu K_α intensity with modeling shows that the penetration of the hot electrons is consistent with one dimensional ohmic potential limited transport (1/e length $\sim$ 100 μm). The laser coupling efficiency to electron energy within the wire is shown to be proportional to the cross sectional area of the wire, reaching 15% for 40 μm wires. We find that the hot electron temperature within the wire was $\leq$750 keV, significantly lower than that predicted by the ponderomotive scaling. A comparison of the experimental results with 2D hybrid PIC simulations using e-PLAS code will be presented and relevance to Fast Ignition will be discussed at the meeting.
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