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A self consistent model for relativistic electron transport in a resistive plasma DAMON SWATTON, AWE, MATTHEW HUNT, University College London, STEPHEN HUGHES, DAVID CHAPMAN, AWE — In this paper we develop a model for describing the early time transport of hot electrons in a resistive plasma to investigate the onset of hot electron field inhibition in laser-plasma experiments. We consider a 1D plasma into which a monoenergetic, relativistic beam of electrons is injected. The beam is represented by a collisionless fluid, so that the momentum conservation and continuity equations apply, and the electric field is calculated from Ampere's law. We find that the plasma supplies a return current that rapidly neutralises the inward flux, and that the electric field becomes a constant behind the beam front. We show that these findings agree well with Monte Carlo electron transport codes. We consider our model to be an improvement on other analytical models because: (i) it does not assume a vanishing net current density; (ii) the system is closed via Maxwell's equations rather than by assuming a Boltzmann distribution for the hot electrons; and (iii) it does not predict the infinite electron speeds characteristic of diffusion models. It also offers a future method for considering a temperature dependent resistivity, or the two-dimensional problem where magnetic fields are important.

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