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Interpenetration, stagnation and deflection of supersonic tungsten plasma flows produced by wire-array Z-pinches GEORGE SWADLING, SERGEY LEBEDEV, GUY BURDIAK, LEE SUTTLE, SIDDHARTH PATANKAR, ROLAND SMITH, MATTHEW BENNETT, GARTETH HALL, FRANCISCO SUZUKI-VIDAL, Imperial College, JIANQIANG YUAN, Institute of Fluid Physics, ADAM HARVEY-THOMPSON, Sandia National Laboratories, WOICHECH ROZMUS, University of Alberta — We present Thomson Scattering measurements [G F Swadling et al, Phys. Rev. Lett., (Accepted 17 June 2014)] of the interpenetration, stagnation and deflection of supersonic tungsten plasma flows, produced in wire array z-pinch experiments on the MAGPIE (1.4MA, 240ns) pulsed power generator at Imperial College London. These measurements were made at early times in the evolution of the arrays, prior to the formation of the dense precursor column (120ns), when the collisional scale length between the streams was still significant compared to the scale length of the array. The scattering geometry used in these experiments allowed independent measurements of the radial and axial velocity distributions of the interacting flows; temporally and spatially resolved measurements were made over seven points across the array diameter. Analysis of the Thomson spectra provides evidence of flow interpenetration; the flows decelerate and are heated over an extended distance (1.5mm) before they fully stagnate. A previously unobserved axial deflection of the plasma flow towards the anode as it approaches the array axis provides evidence of the presence of a significant (20 T) toroidal magnetic field embedded within the precursor column at early times.

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