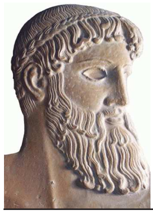
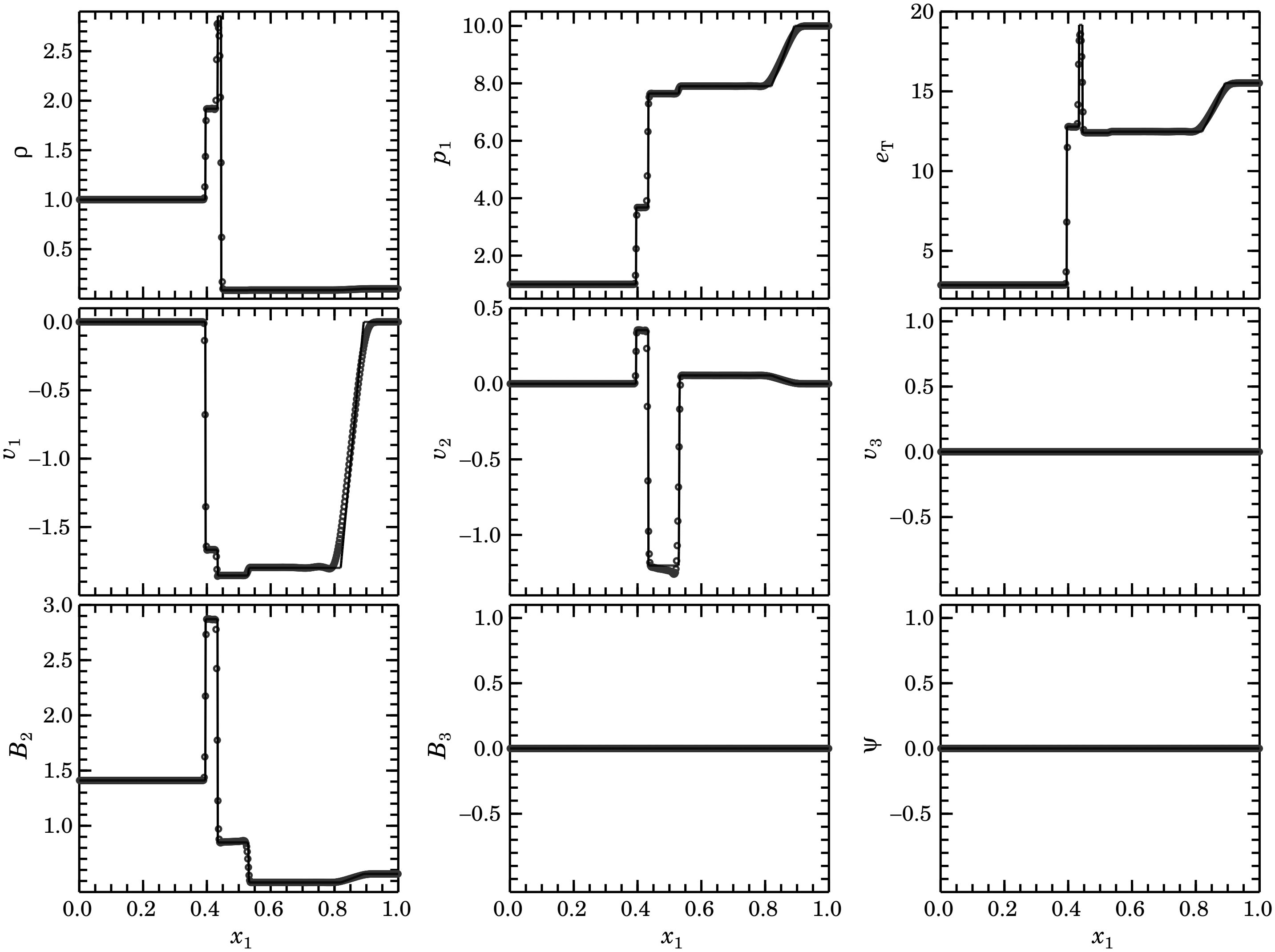


ZEUS-3D 1-D Gallery #10: "2-D field"



This is Fig. 1*b* from Ryu & Jones (1995, ApJ, 442, 228), showing the solution of the MHD shock tube problem with the left state $(\rho, v_1, v_2, v_3, B_2, B_3, p_1) = [1, 0, 0, 0, 5/(4\pi)^{1/2}, 0, 1]$ and the right state $[0.1, 0, 0, 0, 2/(4\pi)^{1/2}, 0, 10]$ with $B_1 = 3/(4\pi)^{1/2}$ and $\gamma = 5/3$ at time $t = 0.03$. At $t = 0$, the discontinuity is at $x_1 = 0.5$. Plots show from left to right: (1) fast shock, (2) slow shock (at $x_1 \sim 0.43$), (3) contact discontinuity (at $x_1 \sim 0.45$), (4) slow rarefaction (at $x_1 \sim 0.53$), and (5) a fast rarefaction.

Open circles are the `dzeus36` solution using 512 zones, `CMoC`, the total energy equation, and third-order interpolation with the contact steepener disengaged. `dzeus36` parameters controlling the time step and artificial viscosity are: `courno=0.75`, `qcon=1.0`, and `qlin=0.2`. Lines are the results from the non-linear Riemann solver described in Ryu & Jones.

There are no significant differences between the `dzeus36` and `dzeus35` solutions. The lower negative values of v_2 are also found in fully upwinded schemes (*e.g.*, Ryu & Jones' TVD), as are the small oscillations in v_1 at the base of the fast rarefaction. *No publicly available version of ZEUS-3D prior to Version 3.5 can do this problem without severe oscillations in* p_1, e_T, *and* v_2 *between the slow waves, which result from the use of "consistent advection"* (Norman & Wilson, 1978, ApJ, 224, 497) *in the energy equations.*