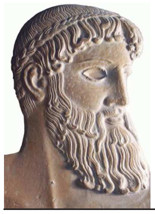
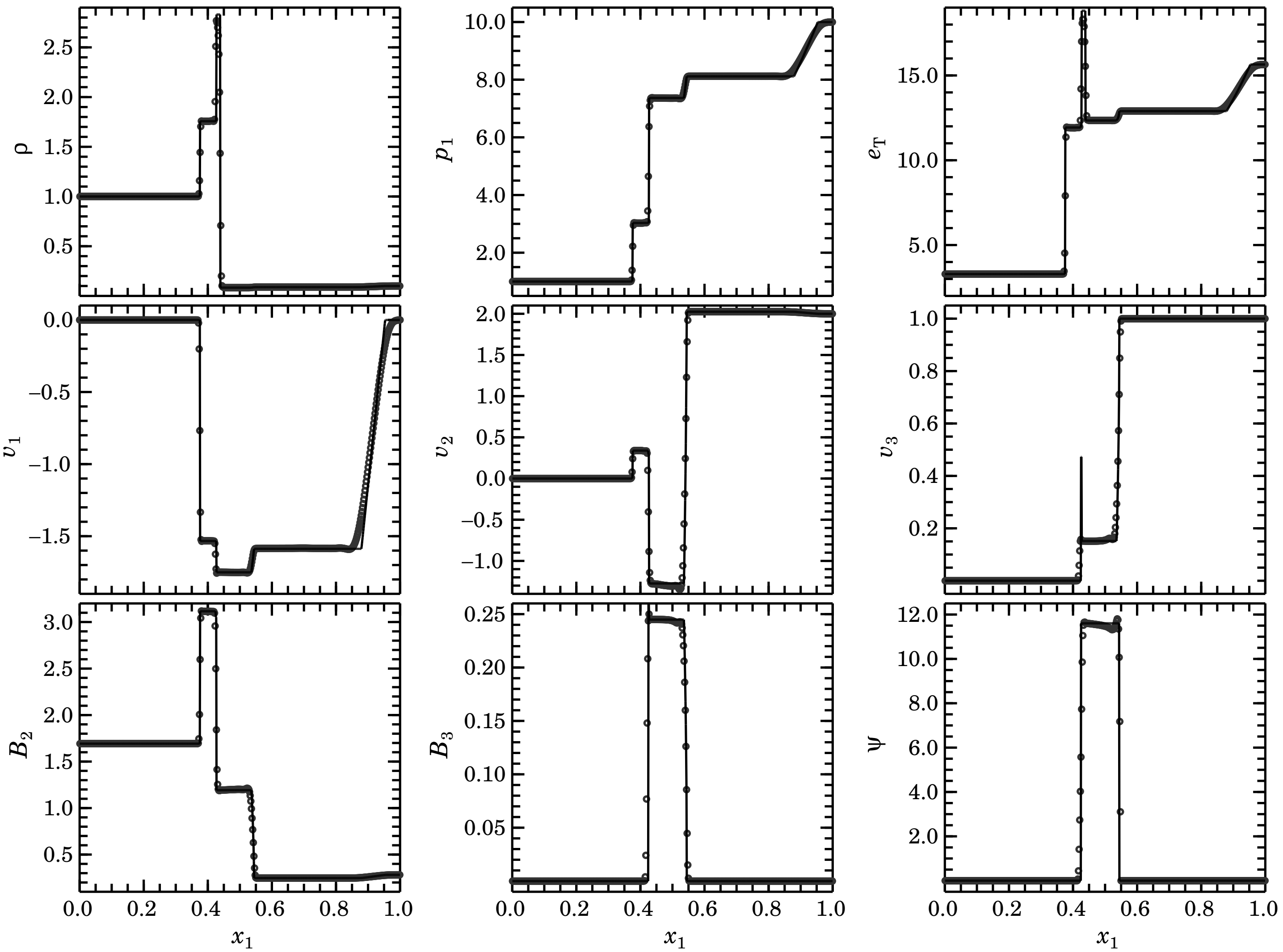


ZEUS-3D 1-D Gallery #12: "3-D field"



This is Fig. 2*b* from Ryu & Jones (1995, ApJ, 442, 228; RJ95), showing the solution of the MHD shock tube problem with the left state $(\rho, v_1, v_2, v_3, B_2, B_3, p_1) = [1, 0, 0, 0, 6/(4\pi)^{1/2}, 0, 1]$ and the right state $[0.1, 0, 2, 1, 1/(4\pi)^{1/2}, 0, 10]$ with $B_1 = 3/(4\pi)^{1/2}$ and $\gamma = 5/3$ at time $t = 0.035$. At $t = 0$, the discontinuity is at $x_1 = 0.5$. Plots show from left to right: (1) fast shock, (2) rotational discontinuity (at $x_1 \sim 0.425$), (3) slow shock (at $x_1 \sim 0.426$), (4) contact discontinuity (at $x_1 \sim 0.44$), (5) slow rarefaction (at $x_1 \sim 0.54$), (6) rotational discontinuity (at $x_1 \sim 0.55$), and (7) 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 left-moving rotational discontinuity and slow shock are nearly degenerate and, since `dzeus36` needs several zones to resolve the structure, the "spike" in v_3 and B_3 are not resolved. Ryu & Jones' TVD scheme requires only a few zones to resolve this structure and yields a few numerical values within the spike. Similar to Fig. 1b from RJ95, this problem could not be done by any release of *ZEUS-3D* previous to Version 3.5.