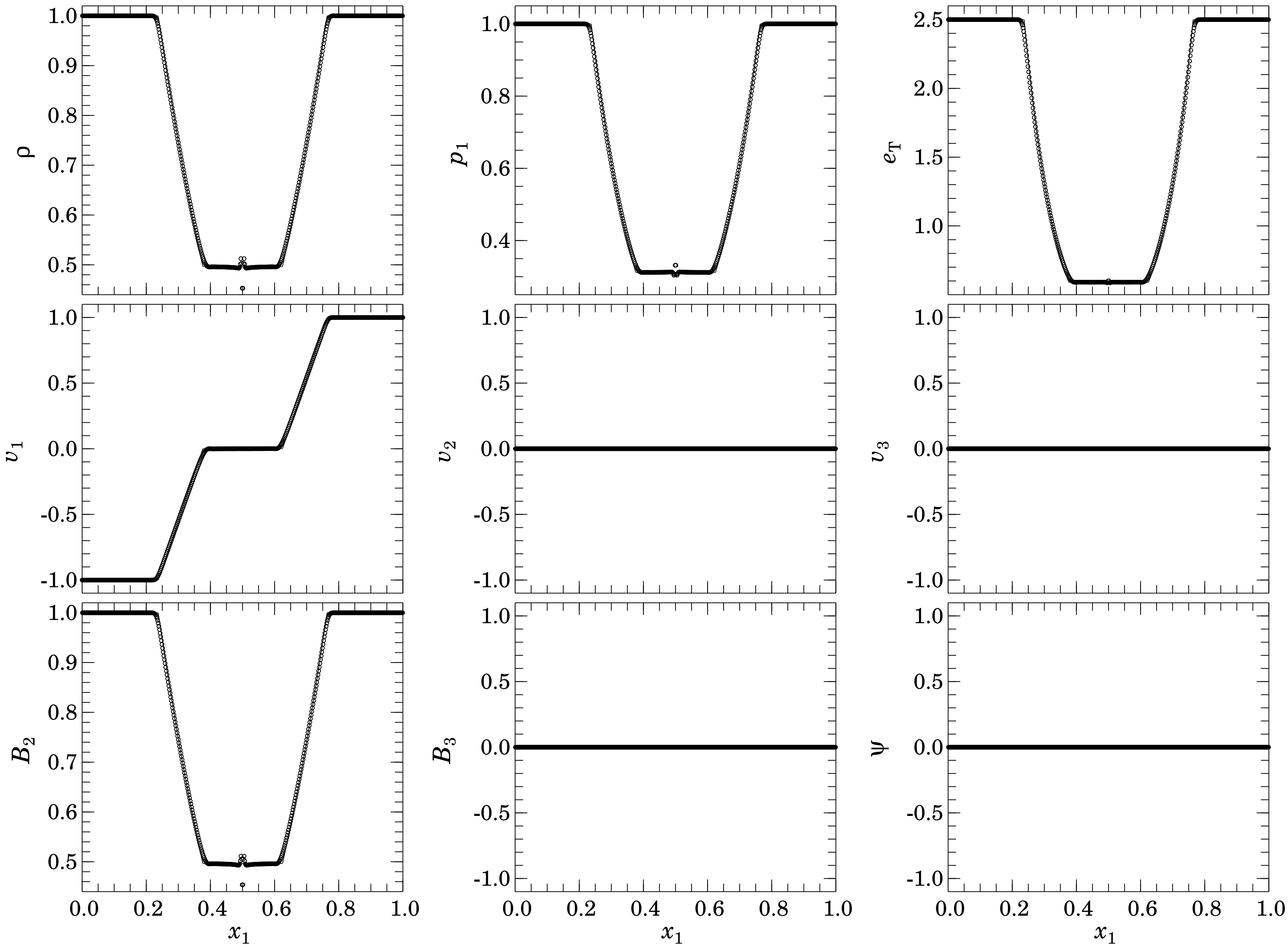
ZEUS-3D 1-D Gallery #6: $v_\perp = 0$; $B_\| = 0$



This is Fig. 3*b* from Ryu & Jones (1995, ApJ, 442, 228), showing the solution of the MHD shock tube test with the left state $(\rho, v_1, v_2, v_3, B_2, B_3, p_1) = [1, -1, 0, 0, 1, 0, 1]$ and the right state $[1, 1, 0, 0, 1, 0, 1]$ with $B_1 = 0$ and $\gamma = 5/3$ at time $t = 0.1$. At $t = 0$, the discontinuity is at $x_1 = 0.5$.

Open circles are the `dzeus35` solution using 512 zones, `CMoC`, the total energy equation, and third-order interpolation with the contact steepener engaged. `dzeus35` parameters controlling the time step and artificial viscosity are: `courno=0.75`, `qcon=1.0`, and `qlin=0.4`. Lines are the results from the non-linear Riemann solver described in Ryu & Jones.

Plots show from left to right two oppositely-moving magneto-acoustical ($B_1 = 0$) rarefactions. The "glitch" in ρ, p_1, and B_2 at $x_1 = 0.5$ is numerical in origin, appears in fully upwinded schemes as well, and persists because the location of the original discontinuity is stationary, preventing grid diffusion from dissipating the transients resulting from the initially hyper-resolved (one zone) discontinuity. The higher-than-usual linear viscosity (`qlin=0.4`) is to prevent `dzeus35` from fitting "rarefaction shocks" in the rarefaction waves (see problems #13–14 in the *ZEUS-3D* 1-D Gallery).