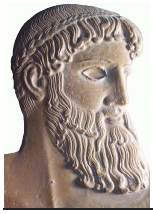
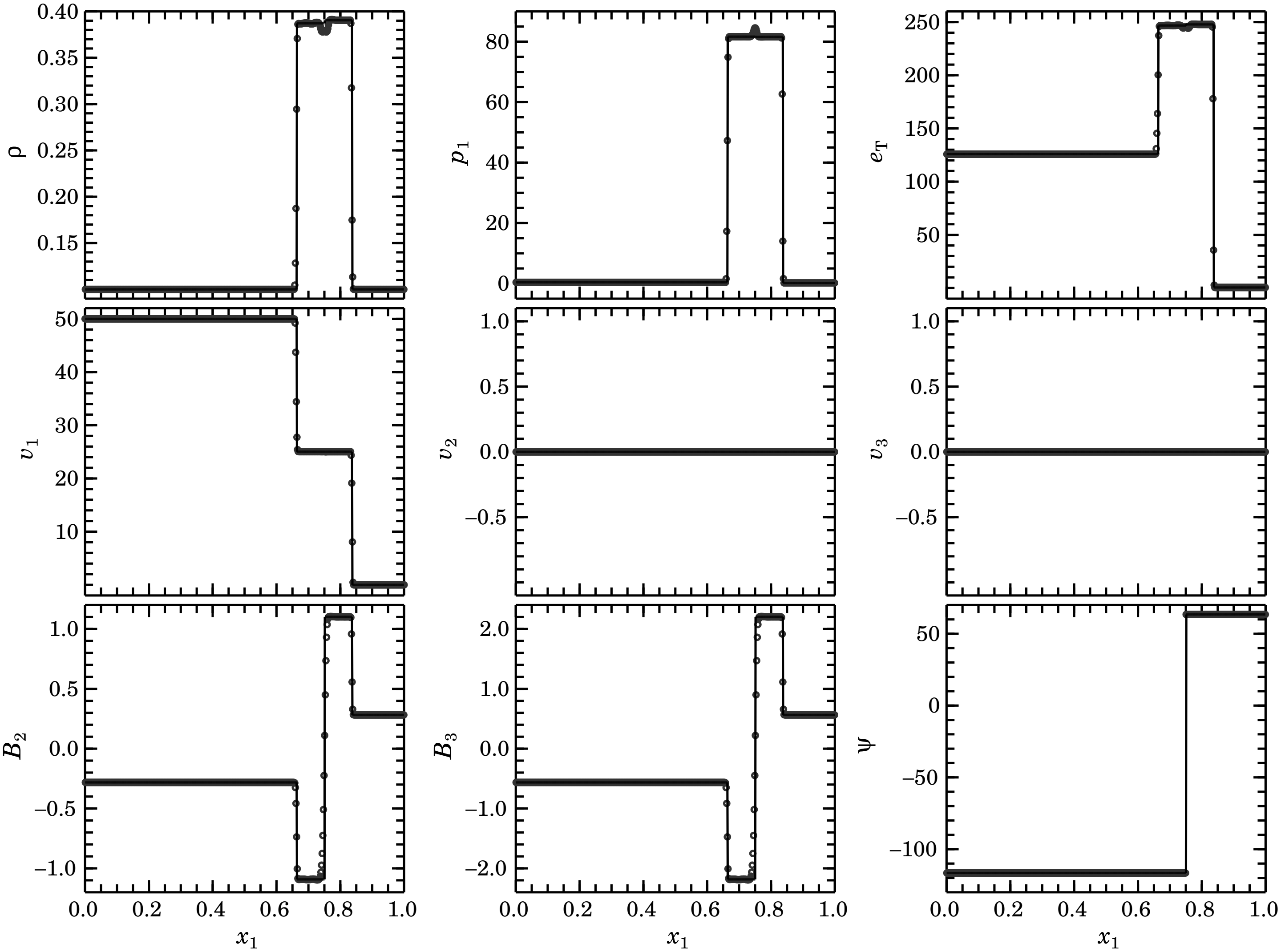


ZEUS-3D 1-D Gallery #13: $v_\perp = 0$; $B_\parallel = 0$



This is Fig. 3*a* from Ryu & Jones (1995, ApJ, 442, 228), showing the solution of the MHD shock tube problem with the left state $(\rho, v_1, v_2, v_3, B_2, B_3, p_1) = [0.1, 50, 0, 0, -1/(4\pi)^{1/2}, -2/(4\pi)^{1/2}, 0.4]$ and the right state $[0.1, 0, 0, 0, 1/(4\pi)^{1/2}, 2/(4\pi)^{1/2}, 0.2]$ with $B_1 = 0$ and $\gamma = 5/3$ at time $t = 0.01$. At $t = 0$, the discontinuity is at $x_1 = 0.5$. Plots show from left to right: (1) magneto-acoustical shock, (2) tangential discontinuity (at $x_1 \sim 0.75$), and (3) magneto-acoustical shock. (When $B_1 = 0$, as in this case, neither slow nor Alfvén waves propagate, and the fast waves become *magneto-acoustical* waves.)

Open circles are the `dzeus36` solution using 512 zones, `CMoC`, the total energy equation, and second-order interpolation (no contact steepener). `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 "glitch" in ρ, p_1, and e_T at $x_1 \sim 0.75$ is numerical in origin, and appears in upwinded schemes such as TVD as well. It is a result of numerical and artificial viscous stresses at the original discontinuity, and can be nearly eliminated by setting the artificial viscous parameters to zero (at the expense of stability elsewhere).