NS C

This test is to show a 1.4 $M_\odot$ neutron star beginning ignition of elements in its envelope. Therefore, this test should be cut off when total power from reactions burning carbon exceeds $10^3 L_\odot$ (`power_c_burn_upper_limit = 1d3`).

Note: `MESA` is not computing the core of the neutron star, consider the "core" of the model the bottom of the envelope.

This test case creates the envelope of a neutron star, and accretes pure ^{12}C at a rate of $1.7 \times 10^{-9} M_\odot$/yr (`mass_change = 1.7d-9`). The neutron star accretes for about 14 years before ignition, as shown by the luminosity (figure 1) and effective temperature (figure 2) plots below.

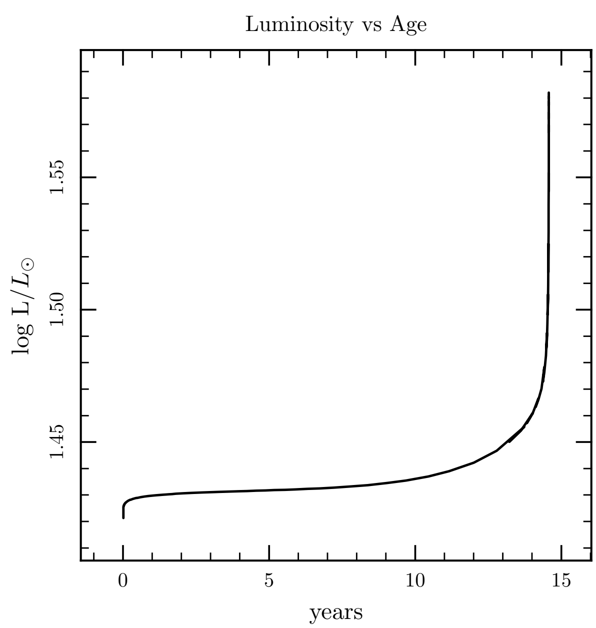

Figure 1: Luminosity plot shows lead up to burst

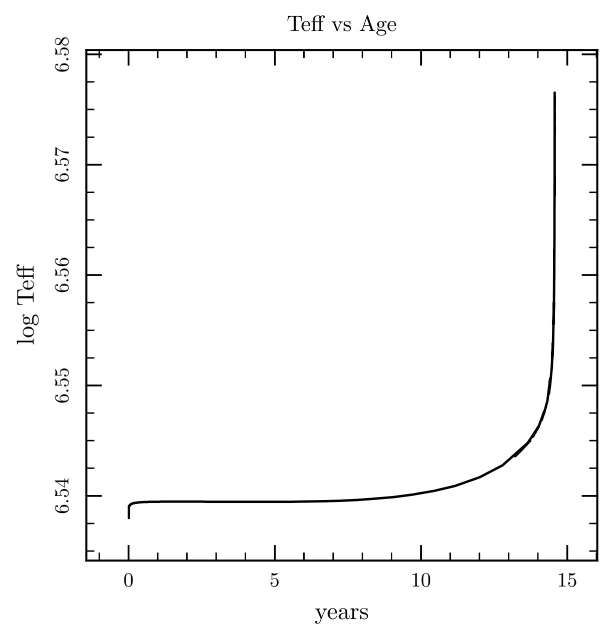

Figure 2: Effective temperature shows lead up to burst

Below is an abundance profile (figure 3), showing the log of the mass fractions of elements in the envelope, plotted against logP. This shows that the envelope is mainly composed of carbon.

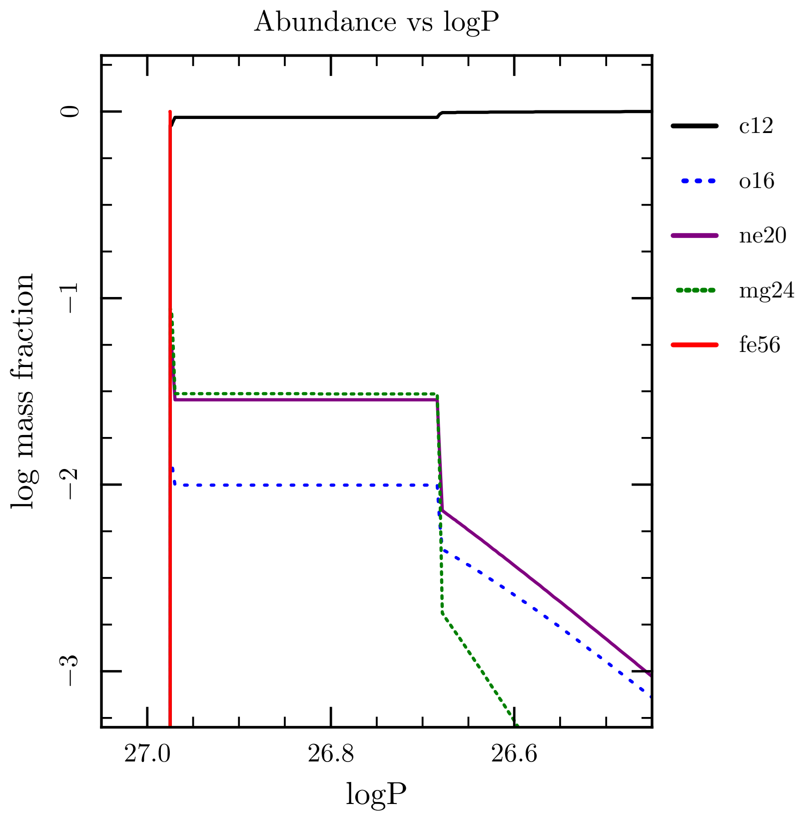

Figure 3: Abundance profile showing that the envelope is mainly carbon

The burning rate profile to the left (figure 4) shows that, even though the envelope is mainly carbon, neon is the dominant burning element. The profile to the right (figure 5) shows the spike in temperature at the bottom of the envelope at the start of burning.

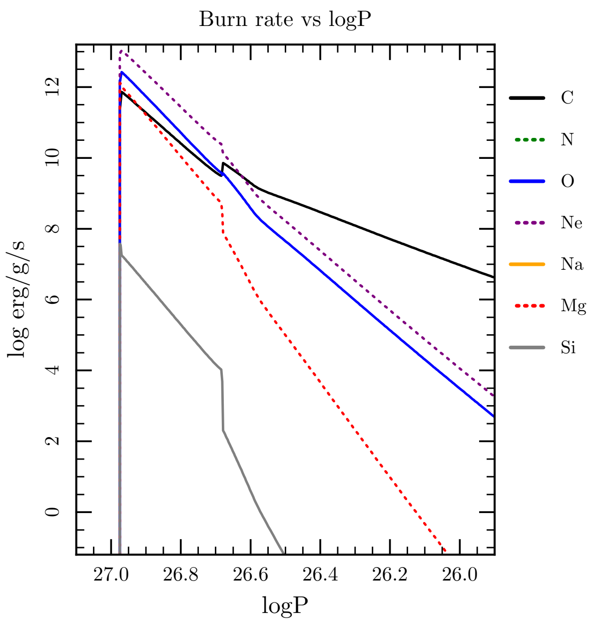

Figure 4: Burning rate profile, dominated by neon burning

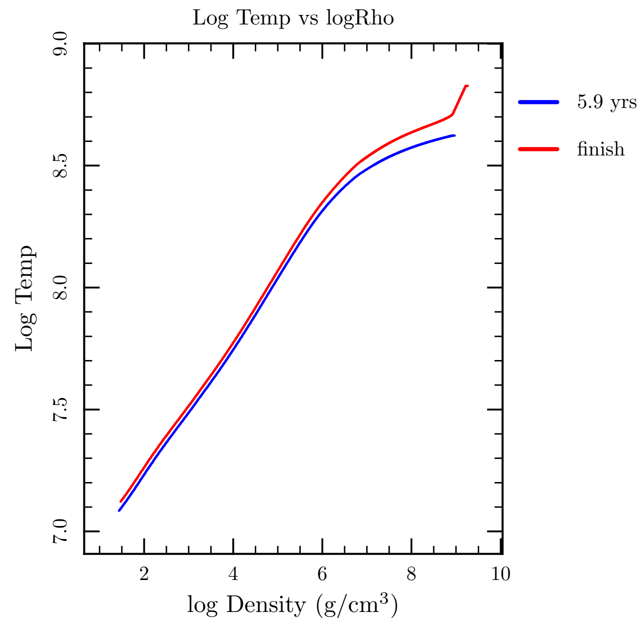

Figure 5: Temperature vs Density profile shows spike at bottom of envelope at start of burning

This final plot (figure 6) shows a few internal `MESA` variables, such as the size of the time-step, the number of zones, and the number of retries against the model number in order to give some understanding of how hard `MESA` is working throughout the run and where some areas of problems/interest might be.

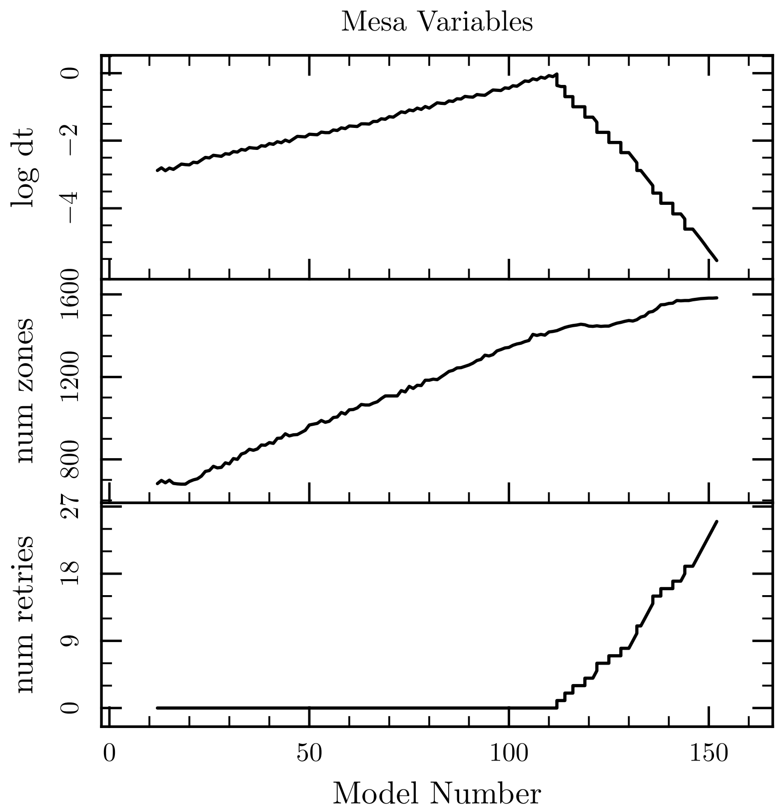

Figure 6: `MESA` variables plotted against model number show how hard `MESA` is working