Table 1: Summary of runs. Run 164 is the old AGB run. Run 177 is the new AGB run. The main difference is that the new run has extra refinement around particle 1.

Run	MaxLvl	δ [$R_\odot$]	r_{soft}/δ	Size [$R_\odot$]	Outer Buff [1D cells]	Inner Buff [1D cells]	Maxlevel Cells (3D)	Nodes	Comp time [hr/1.2 d]
164	3	0.28	9	—	16	—	—	128	~ 2
177	5	0.070	34	24	8	8	6×10^7	8	15

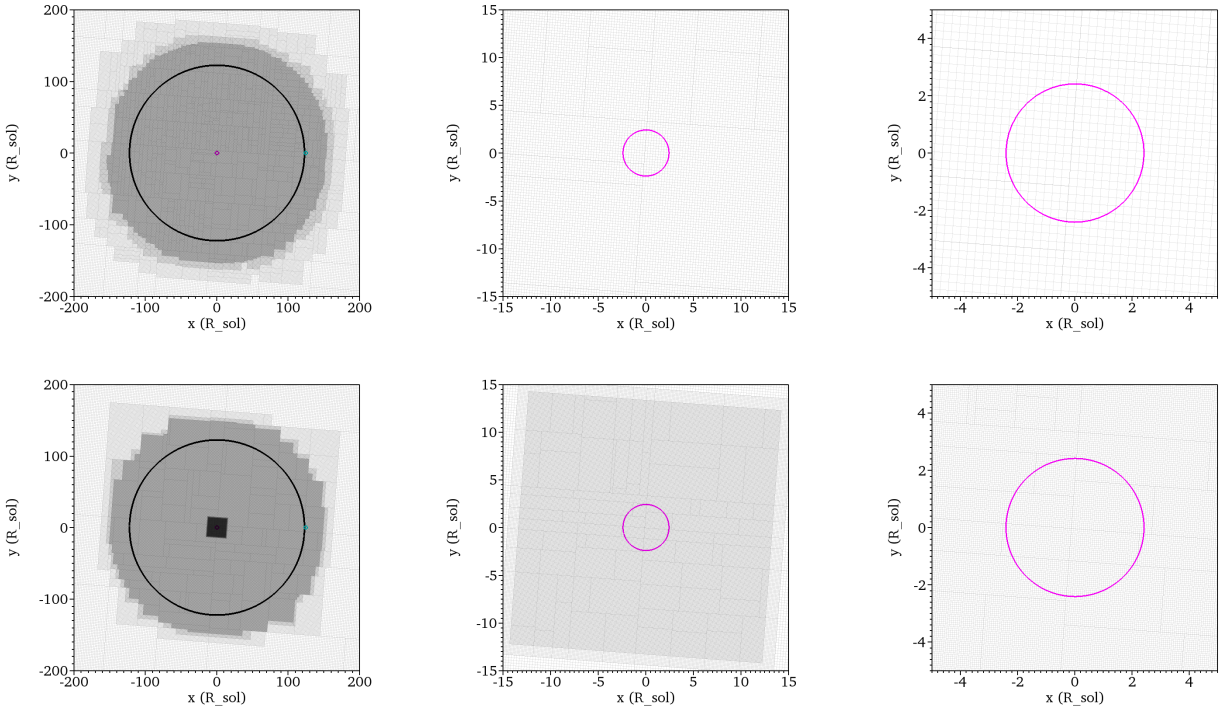

Figure 1: Rows from top to bottom show Runs 164 and 177, respectively, at $t = 1.2$ d. The point is to show the difference in the refinement between the two runs. In Run 164 (top), this refinement was used for the first 48.1 d, after which the radius of the spherical refinement (level 3 AMR) region was reduced from 144 $R_\odot$ to 101 $R_\odot$.

Table 2: Changes in energy terms when going from Run 177 (new AGB run) to Run 164 (old AGB run). See Fig. 7. All energies are in units of 10^{47} erg.

	Run 164 − Run 177			Run 177 − Run 183		
	$t = 47.0$ d	$t = 60.0$ d	$t = 100.0$ d	$t = 47.0$ d	$t = 60.0$ d	$t = 100.0$ d
$\boldsymbol{E_{\rm tot,box}}$	**+0.088**	**+0.107**	**+0.151**			
$E_{\rm bulk,1}$	+0.004	−0.002	−0.002			
$E_{\rm bulk,2}$	−0.013	−0.030	+0.000			
$E_{\rm pot,1-2}$	−0.005	+0.005	−0.001			
$E_{\rm bulk,gas,box}$	+0.022	+0.043	−0.034			
$E_{\rm int,gas,box}$	−0.093	−0.079	−0.079			
$E_{\rm pot,gas-gas,box}$	+0.042	+0.044	+0.043			
$E_{\rm pot,gas-1,box}$	+0.114	+0.125	+0.164			
$E_{\rm pot,gas-2,box}$	+0.011	−0.001	+0.059			

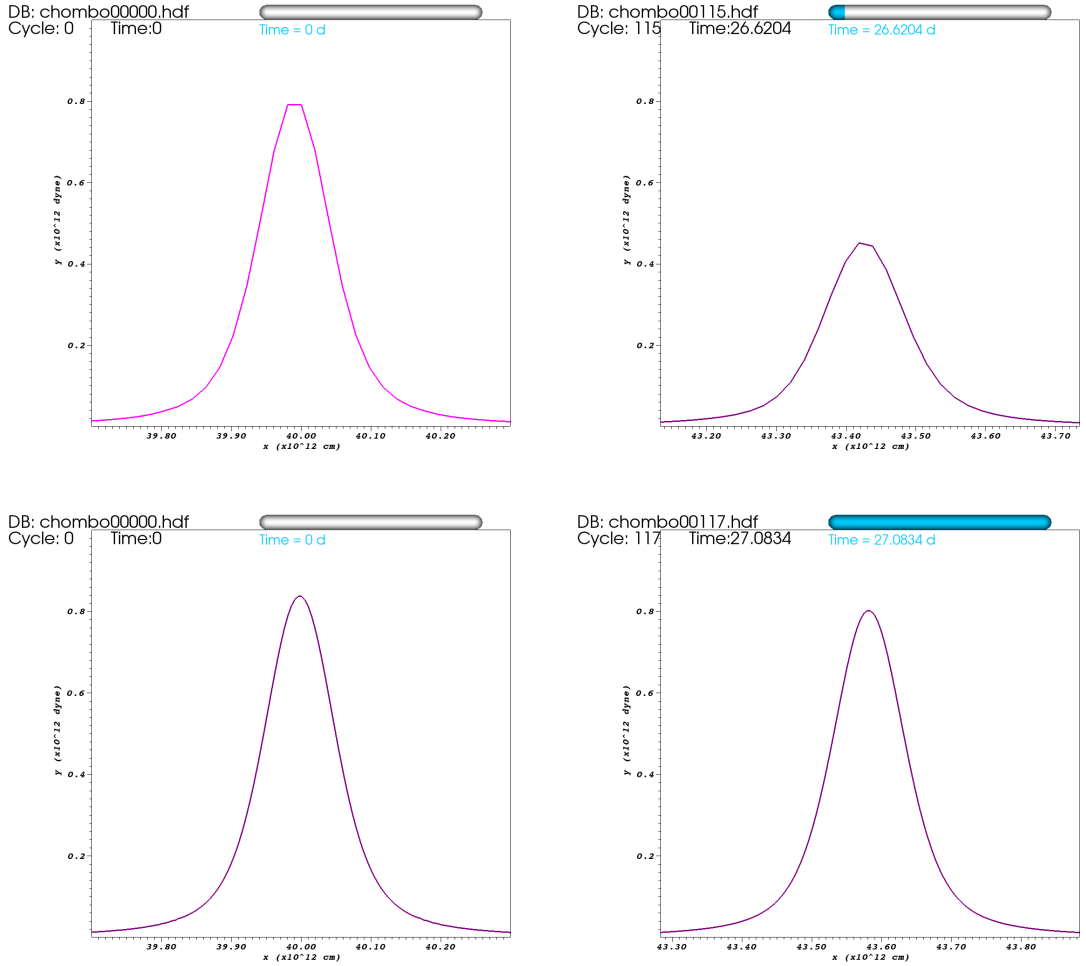

Figure 2: From top to bottom Runs 164 and 177. Pressure profiles of the central region of the AGB. The left panels show snapshots at $t = 0$. The right panels show snapshots at 26.6 d and 27.1 d, respectively. For reference, $\mathrm{R}_\odot = 0.07 \times 10^{12}$ cm and $r_{\rm soft} = 2.4\,\mathrm{R}_\odot = 0.17 \times 10^{12}$ cm. Comparison of the right panels shows us that much of the reduction in the pressure peak at the AGB center is caused by the lack of numerical resolution. Some reduction of the peak seen in Run 177 could be physical, in principle, owing to tidal forces.

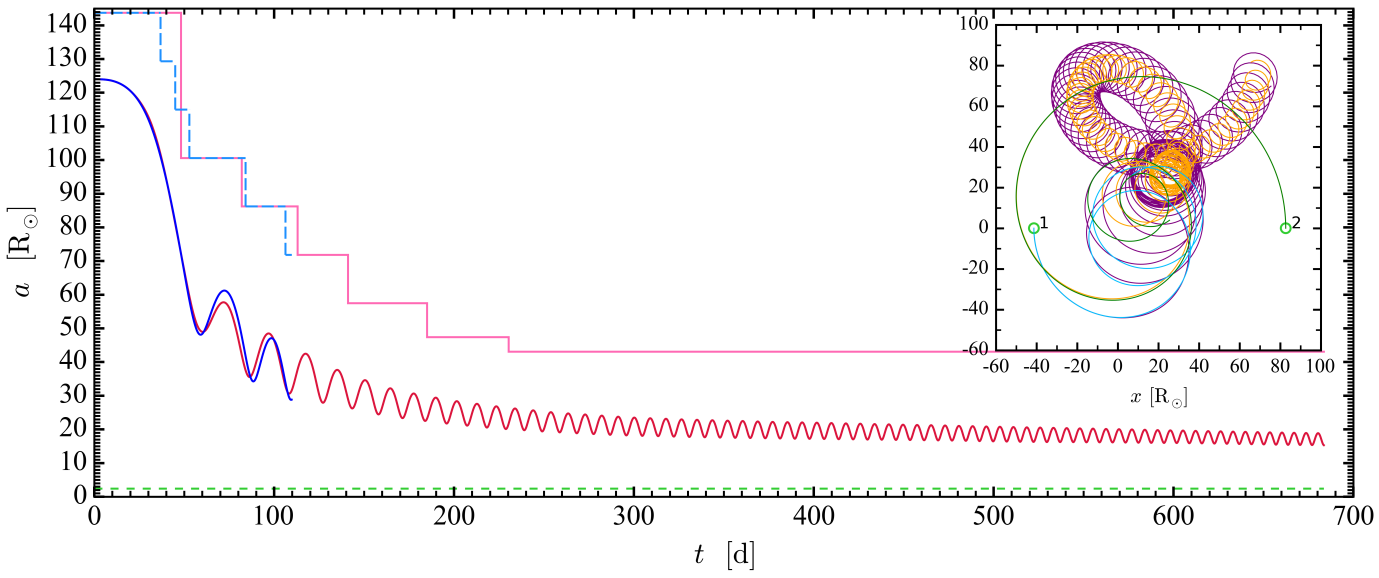

Figure 3: Inter-particle separation vs time for Runs 164 and 177. Jagged line shows the refinement radius of the spherical AMR level 3 region. The center of the refinement region is changed from particle 1 to the particle CM at $t = 76.9$ d in Run 164, and at $t = 61.3$ d in Run 177.

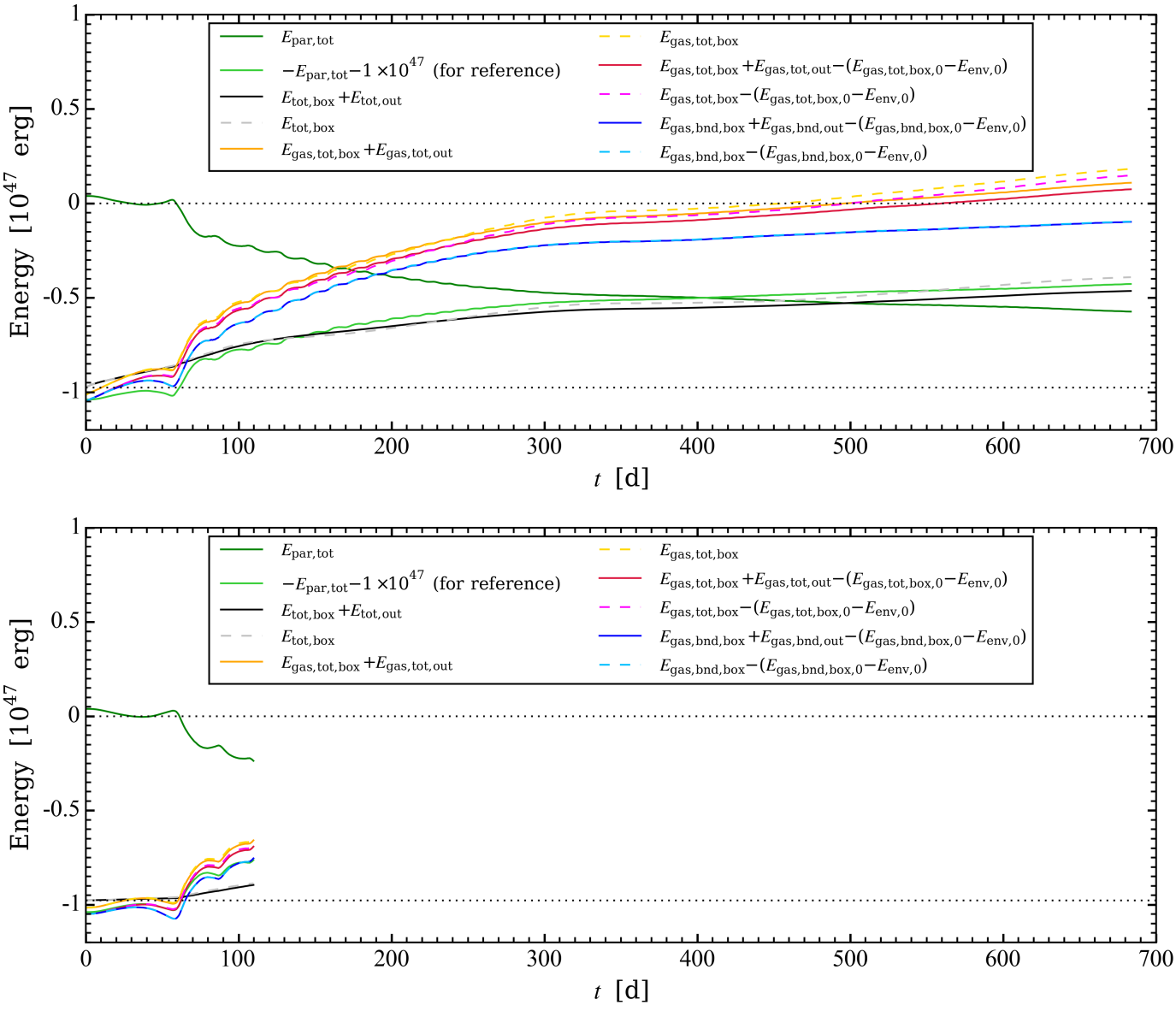

Figure 4: From top to bottom Runs 164 and 177.

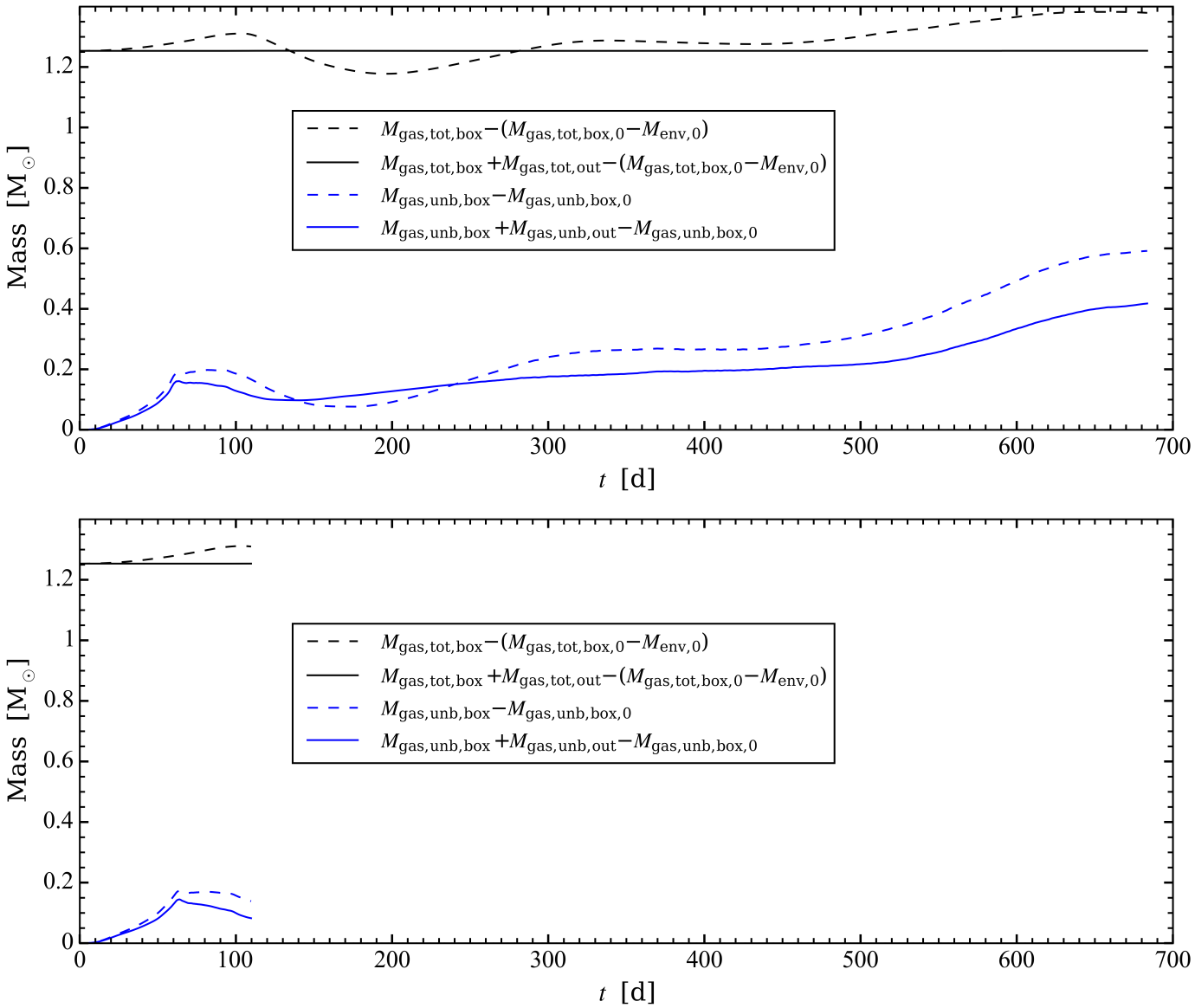

Figure 5: From top to bottom Runs 164 and 177. The solid blue cuve showing the change in unbound mass is similar between the two runs, almost identical up to the peak in the unbound mass curve, and then showing a greater difference thereafter. About 20-30% less matter is unbound in Run 177 compared to Run 164 at $t = 100$ d. Thus, the run which gains more energy unbinds more material, as expected, but not drastically more.

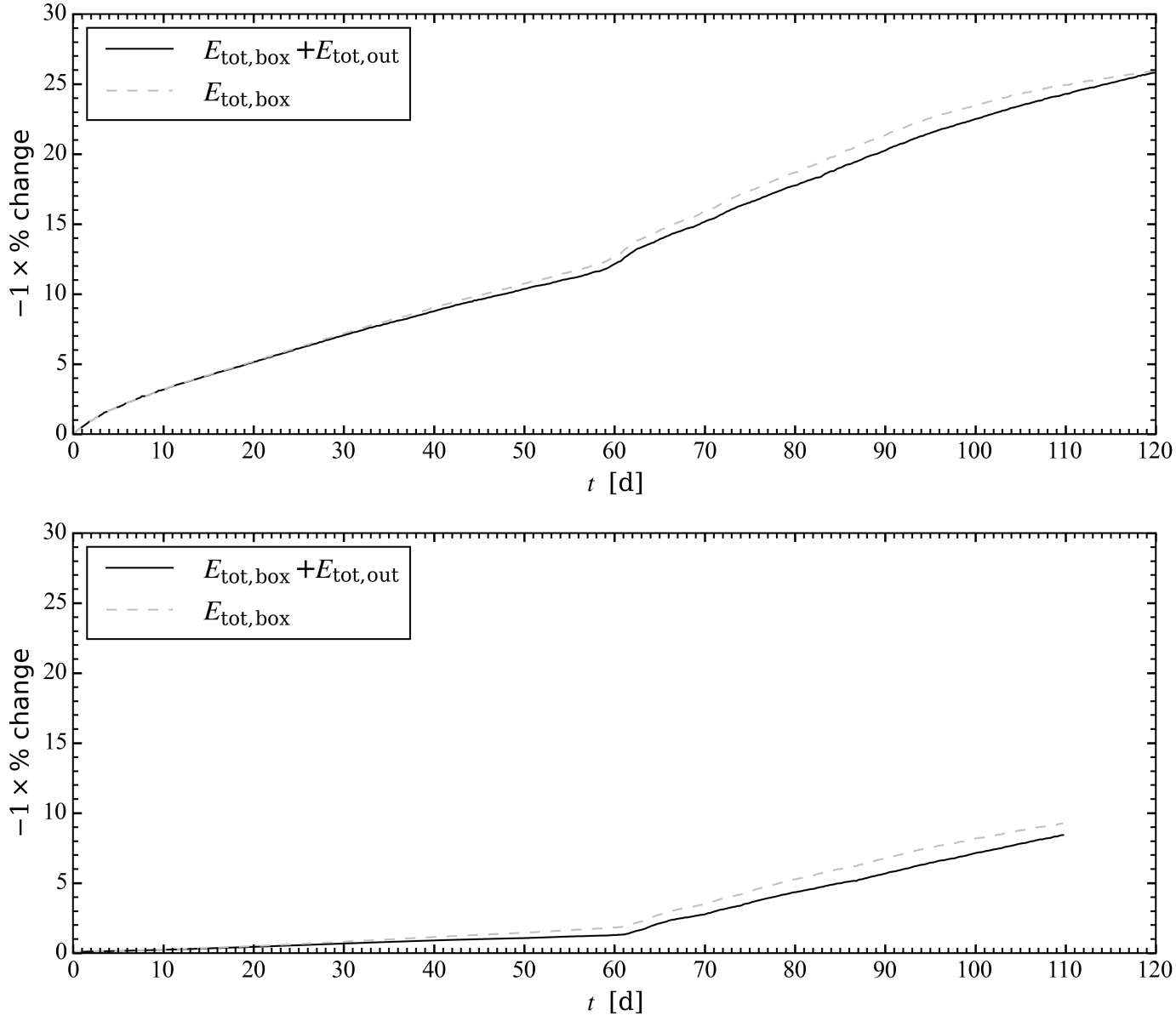

Figure 6: From top to bottom Runs 164 and 177. The energy conservation for Run 177 is about 10 times better than for Run 164 up until just after the first periastron passage at $t \approx 60\,\mathrm{d}$. Since the resolution around particle 1 is the only important difference between the two runs, this tells us that the energy non-conservation is related to the difference in resolution. After this time, the rate of energy gain for Run 177 is about 60% of that of Run 164. From Paper I we know that particle 2 "accretes" mass in a quasi-steady bulge around it after the first periastron passage. Thus the magnitudes of the gas-particle 2 potential energy and gas-gas potential energy near particle 2 are enhanced compared to earlier times (for the first of these, see Fig. 7 below). Thus, after $t \approx 60\,\mathrm{d}$, the resolution around particle 2 is likely to be important with regard to energy conservation. Hence I have submitted a run (Run 183) like Run 177 but with higher resolution around particle 2 from $t = 44.9\,\mathrm{d}$. I have made the resolution around particle 2 the same as that around particle 1.

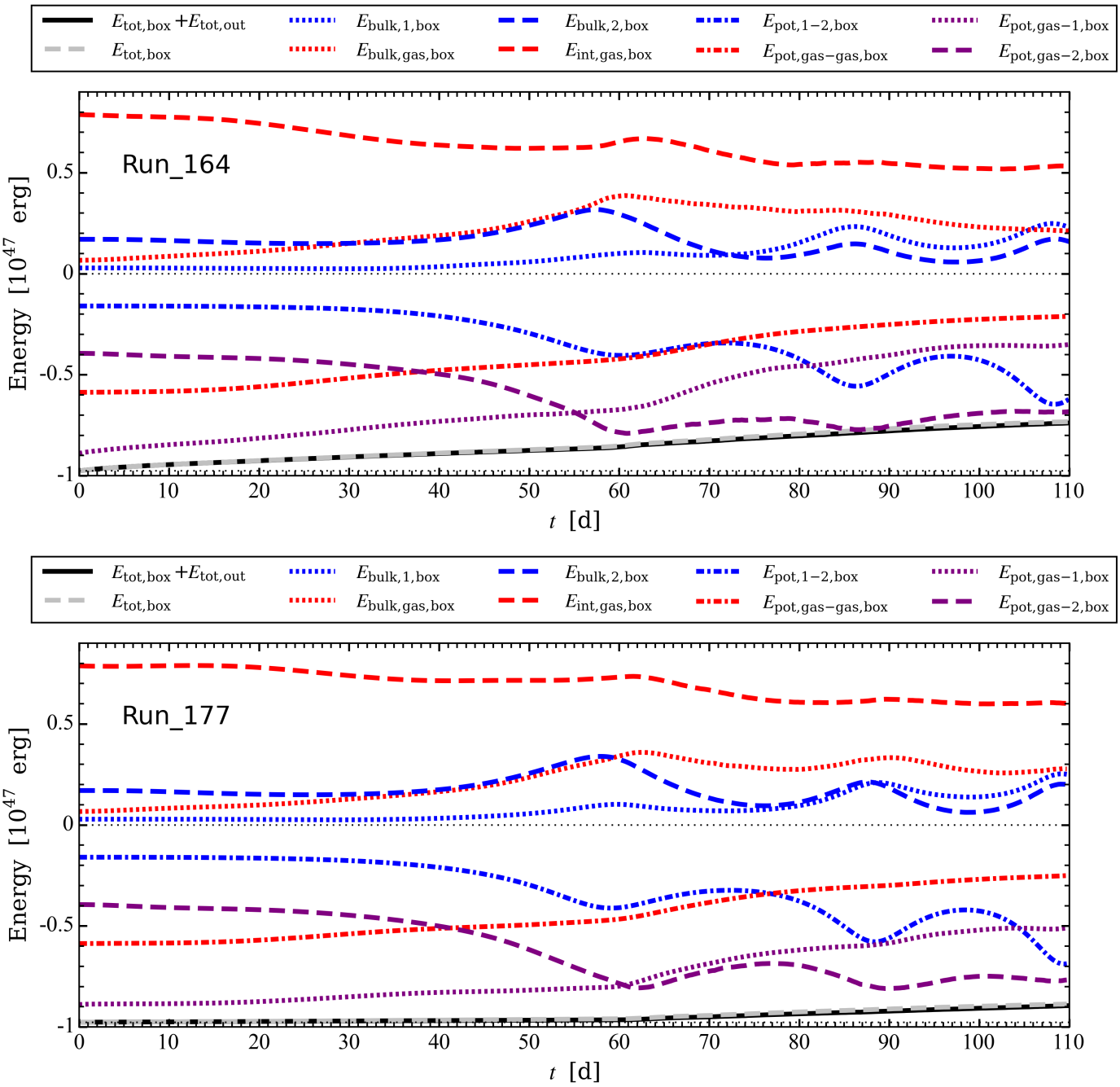

Figure 7: From top to bottom Runs 164 and 177. Note that the largest change is in the particle 1-gas potential energy.

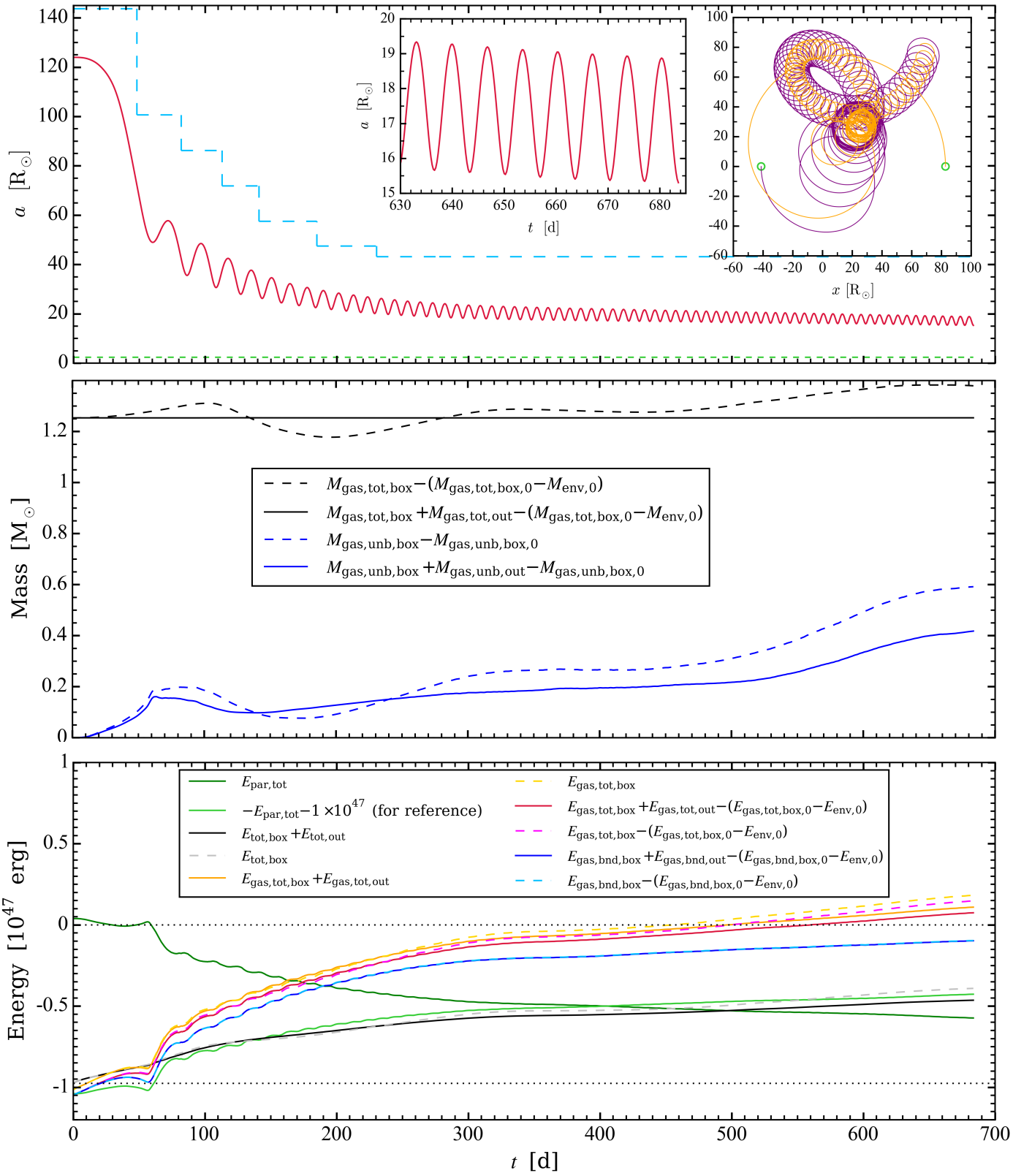

Figure 8: Orbit, mass and energy, Run 164. These plots show the entire evolution for the old AGB run.