Convergence is tested by first doing a standard run of the code saving the values of the timesteps. Then one doubles the number of timesteps by halving the timestep values and taking two half-steps for each step. Then one quadruples the number by taking quarter-steps, and so on. Figure (2) on the right shows three sets of timestep values used for the convergenge test.

Figure (3) below shows that the value of $X_{^4He}$ from the Thomas et al code shows 2nd. order convergence.

$$X_{^4He} = 0.2392602277 - (0.2474541681 \times 10^{-2})d^2$$

where d = the # of divisions per timestep. But the Texas code shows only 1st. order convergence.

$$X_{^4He} = 0.2394509836 + (0.3832102957 \times 10^{-3})d$$

Solution: The Thomas et al code has the correct scheme that calculates the two time derivatives for the second-order Runge-Kutta method of calculating $Y_{n+1}(i)$. When the Texas code is rewritten to follow the Thomas et al code's model, it then has second-order convergence.

$$X_{^4He} = 0.2394508633 - (0.1509902093 \times 10^{-3})d^2$$

shown above in Figure (3).