Self-similar compression flows in spherical geometry: numerical calculations and implementations

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During the previous APS-SCCM meeting (2007) we exhibited a set of theoretical solutions for the implosion of a sphere initiated by a strong shock. We assumed that:

1. The sphere contains a perfect gas with a polytropic coefficient $\gamma=5/3$. 2. The shock follows the equation: $r_s/r_0=\left(-t/t_{foc}\right)^\alpha$ where $\alpha$ is a positive constant and where $-t_{foc}<t<0$ The well known G.Guderley solution corresponds to $\alpha = \alpha_{ref} = 0.6883$ and we showed that one other self-similar solution exists for each value of $\alpha$ between 0 and $\alpha_{ref}$. In this paper, we continue this work by solving numerically two particular problems with shock parameter $\alpha=1/2$ and $\alpha=2/3$. The theoretical solutions are obtained with a very good accuracy. For example, the relative gap on the focalization time is less than $1/10000$. Then, we use one of these implosions ($\alpha=2/3$) to generate thermonuclear neutrons in DT gas. These neutrons are obtained very early, before the focalization of the initial shock.