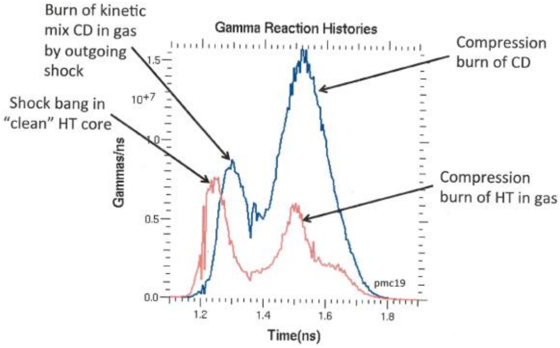
USING HT AND DT GAMMA RAYS TO DIAGNOSE MIX IN OMEGA CAPSULE IMPLOSIONS

M.J. Schmitt[1], H.W. Herrmann[1], Y.H. Kim[1], A.M. McEvoy[1], N.M. Hoffman[1],
B.A. Hammel[2] and S.M. Sepke[2]
[1]Los Alamos National Laboratory, Los Alamos, NM, USA
[2]Lawrence Livermore National Laboratory, Livermore, CA, USA
mjs@lanl.gov

Experimental evidence [1] indicates that shell material can be driven into the core of Omega capsule implosions on the same time scale as the initial convergent shock. It has been hypothesized that large temperature gradients at the fuel/shell interface in thin exploding pusher capsules diffusively drives shell material into the gas core shortly after shock coalescence. We propose a method to temporally resolve and observe the evolution of shell material into the capsule core as a function of fuel/shell interface temperature (which can be varied by varying the capsule shell thickness). Our proposed method uses a CD plastic capsule filled with 50/50 HT gas and diagnosed using gas Cherenkov Detection (GCD) to temporally resolve both the HT "clean" and DT "mix" gamma ray burn histories as depicted in the figure below. Here the gamma ray time histories are simulated using Hydra [2] for an Omega CD capsule where a sub-micron layer of the inside surface of the shell is mixed into the outer half of the gas region.



It will be shown that these burn history profiles are sensitive to the depth to which shell material mixes into the gas region. An experiment to observe these differences as a function of capsule shell thickness is proposed to determine if interface mixing is consistent with thermal diffusion $\left(\lambda_{ion} \propto T_{ion}^2 / Z_{ion}^2 \rho\right)$ at the gas/shell interface. Since hydrodynamic mixing from shell perturbations, such as the mounting stalk and glue, could complicate these types of capsule-averaged temporal measurements, simulations including their effects also will be shown.

This research was supported by the US DOE/NNSA, performed in part at LANL, operated by LANS LLC under contract number DE-AC52-06NA25396.

[1] H.G. Rinderknecht, et al., Phys Rev Lett **112** 135001 (2014).
[2] M.M. Marinak, et al., Phys Plasmas **3**, 2070 (1996).