

LA-UR-12-22012

Approved for public release; distribution is unlimited.

Title: LANL C10.2 Projects in FY13

Author(s):
Batha, Steven H.
Fincke, James R.
Schmitt, Mark J.

Intended for: ICF Execs Meeting, 2012-06-12 (Washington, District Of Columbia,
United States)



Disclaimer:

Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by the Los Alamos National Security, LLC for the National Nuclear Security Administration of the U.S. Department of Energy under contract DE-AC52-06NA25396. By approving this article, the publisher recognizes that the U.S. Government retains nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or to allow others to do so, for U.S. Government purposes.

Los Alamos National Laboratory requests that the publisher identify this article as work performed under the auspices of the U.S. Department of Energy. Los Alamos National Laboratory strongly supports academic freedom and a researcher's right to publish; as an institution, however, the Laboratory does not endorse the viewpoint of a publication or guarantee its technical correctness.

LANL C10.2 Projects in FY13

Steven H. Batha

James Fincke and Mark Schmitt

June 12, 2012

ICF Execs Meeting

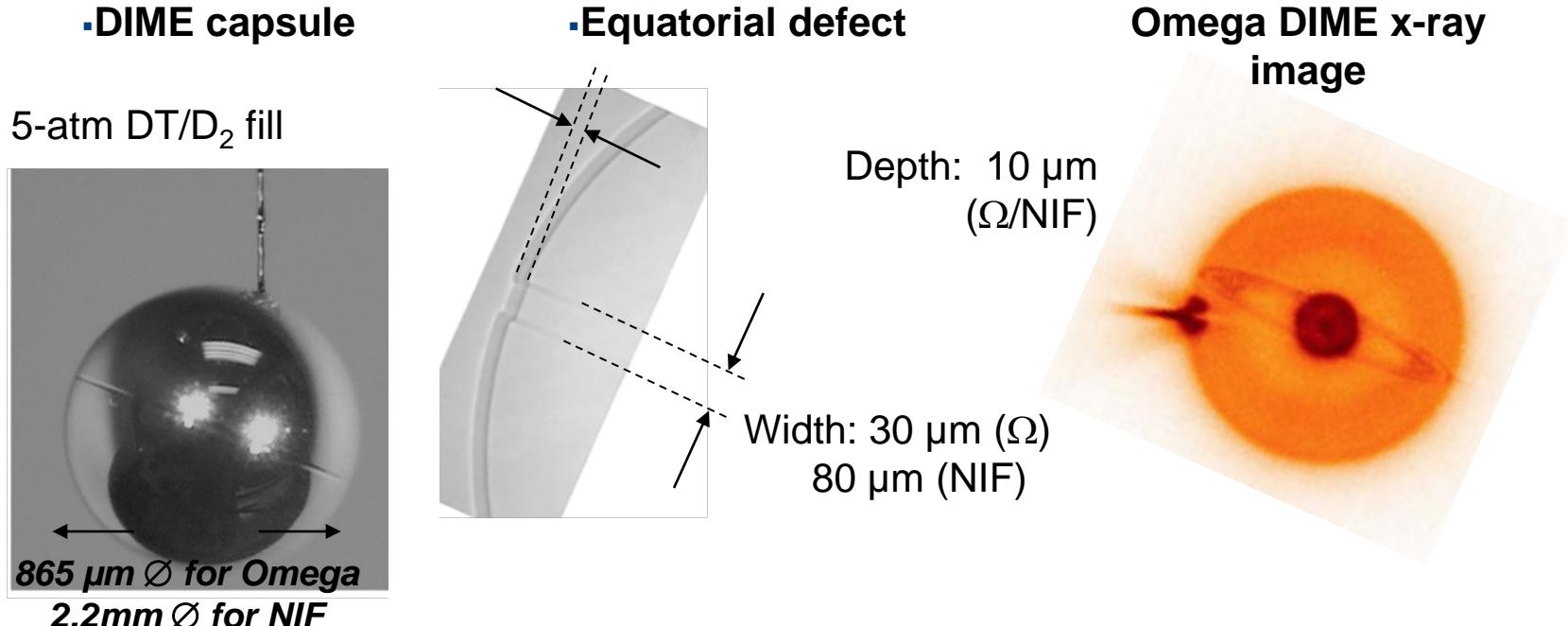
Washington, DC

LANL has two projects in C10.2

- **Defect-Induced Mix Experiment (DIME)**
 - Ongoing, several runs at Omega
 - NIF shots this summer
- **Shock/Shear**
 - Tested at Omega for two years
 - NIF shots in second half of FY13
- **Each project is jointly funded by C10.2, other C10 MTEs, and Science Campaigns**

•DIME is investigating 4π and feature-induced mix in spherically convergent ICF implosions by using imaging of the mix layer

- Measure mix in perturbed and unperturbed ICF capsules
- Determine the effects of mix on DT burn

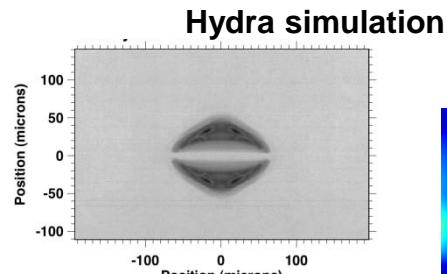
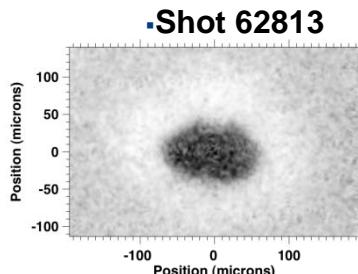


- 2 μm thick mid-Z doped layers at different depths are used to assess mix

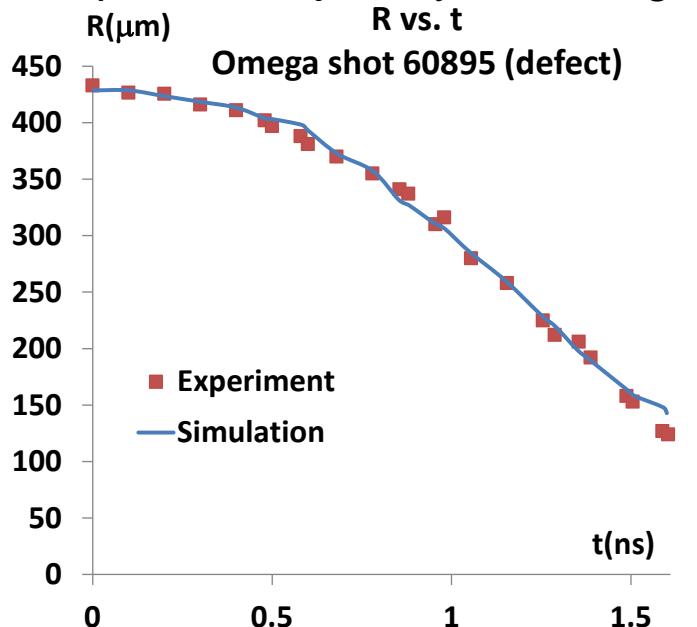
DIME prepared for NIF by demonstrated its PDD mix platform on Omega including imaging mid-Z doped layers and defects

- Hydra calculations show excellent agreement with implosion trajectory (as determined by simulated x-ray self-emission)
- Spectral imaging has revealed pentagonal laser imprinting of mix in the imploded core (from the pole)
- DIME on NIF will baseline PDD CH capsules with dopant imaging this year

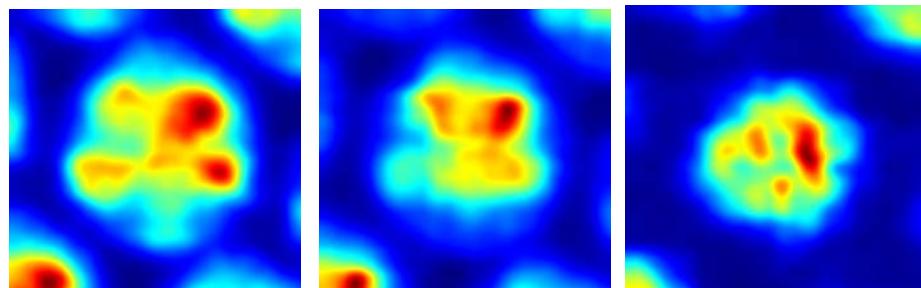
DIME Omega x-ray images



Implosion trajectory for Omega DIME



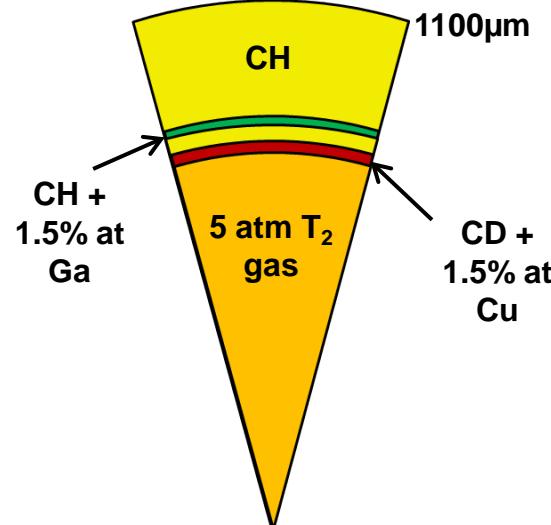
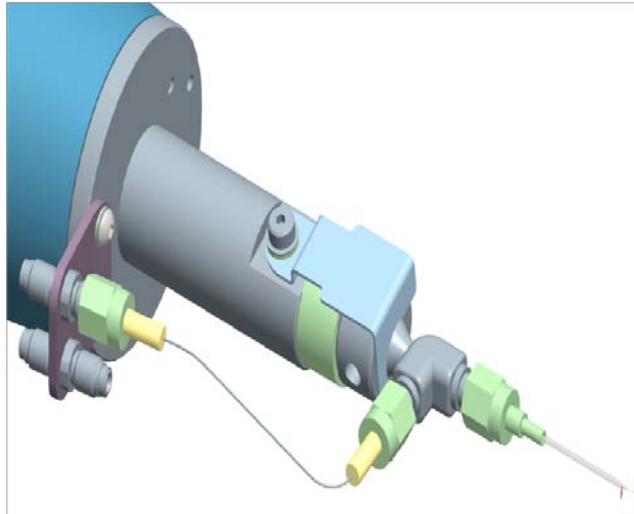
Post-processed DIME Omega He_α images



Postprocessed images courtesy of Roberto Mancini, UNR Analysis Team

-DIME in FY13 will focus on PDD symmetry-dependent mix and moving burn into the mix region for validation of mix/burn models

- Measure polar angle symmetry versus laser power and pointing tuning
- Measure symmetry dependent 4π mix uniformity and depth using new MMI diagnostic
 - Imaging of spectral dopants provides uniformity, temperature and density
- Measure spatially dependent 4π mix and burn in CD/T₂ capsules/gas targets
 - Separated nuclear reactants burn mainly in the mix layer
- Measure defect induced mix and its spatially dependent effects on burn



Re-Shock and Shear are two laser-driven experiments designed to study the turbulent mixing of materials.



Experimental Objective: Perform experiments to study the physics of re-shock and shear-driven mix under HED conditions.

Project Motivation:

ICF: Shock waves traverse capsule defects and initiate mix between shell and fuel, degrading yield.

Astrophysical jets: Supernova remnants, young stellar objects, and planetary nebulae are subject to complex evolution involving shock and shear.



Project Objective: Provide detailed quantitative data to validate and improve the BHR-2 mix model in the RAGE hydrodynamic code.

Funded by 10.2 and other components of program

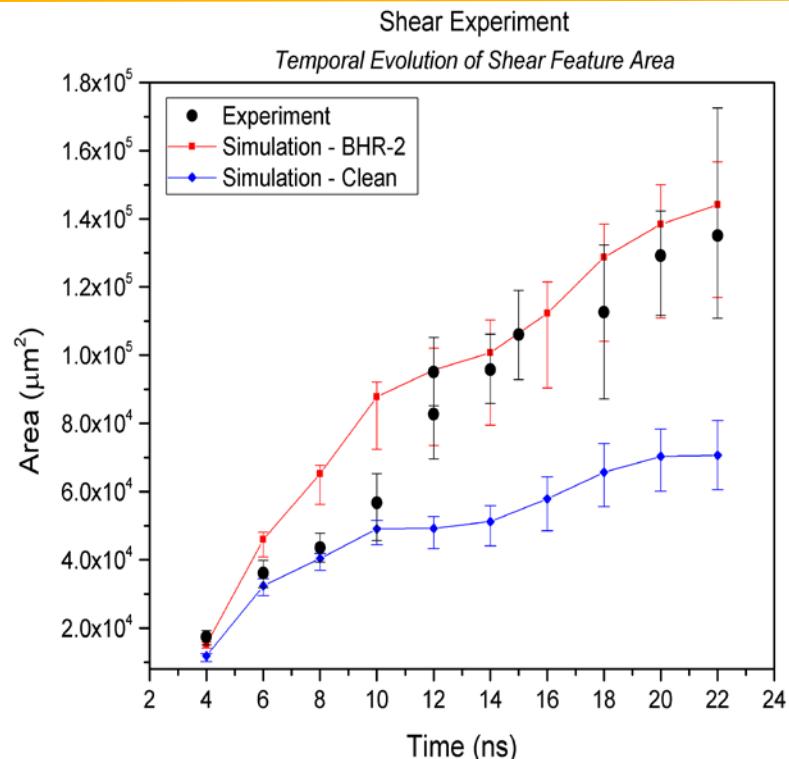
- *Theoretical Design, XTD Division; J. Fincke, L. Welser-Sherrill, F. Doss*
- *Experimental Physics, P Division; E. Loomis, K. Flippo, D. Offermann, P. Keiter*
- *High Resolution LES Simulations, XCP Division; B. Haines, F. Grinstein*

In FY-2012 43 shear and re-shock experimental shots were executed on the OMEGA laser and a complete time history obtained for both

- Data was compared to both pre-shot and post shot calculations.
- Modeling included both BHR and LES calculations.
- Results are currently being used to examine the relative importance of select model terms.



- Turbulent K-H structure is evident in radiograph



- Shear layer evolution, typical radiograph at left, composite growth curve above

The FY-2013 goal is to transition the experiment to NIF where the larger scale will provide a longer time period for mix layer growth

- The HED-Council has recommended 6 -Tier 1 shots on NIF in FY-13
- The counter-propagating shear platform uses shocks to produce flow in opposite directions across a dense plate.
- Observation of late time turbulent growth requires larger targets and longer pulses supporting the shocks and delaying formation of the rarefactions.
- Both the colliding shock and shear experiments use the same basic setup and diagnostics and are virtually interchangeable.
- FY-13 will primarily address platform development and obtain shear data at late time.

