

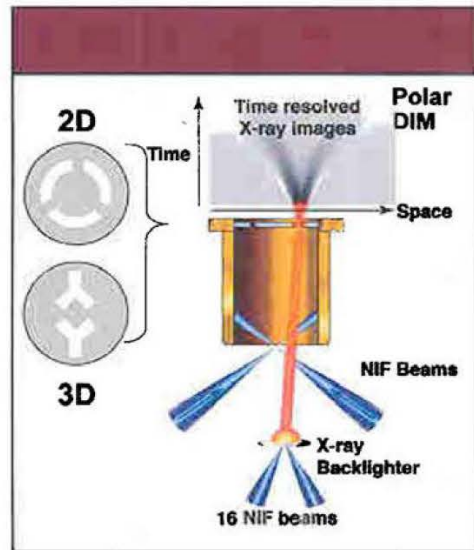
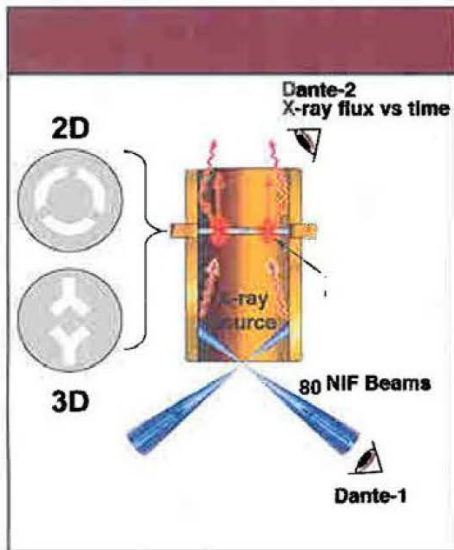
Lawrence Livermore National Laboratory

Weapons and Complex Integration (WCI) High Energy Density Experiments on NIF in FY2011 (A Joint WCI-NIF Success)

Presented to SEAB
Oct. 12, 2011

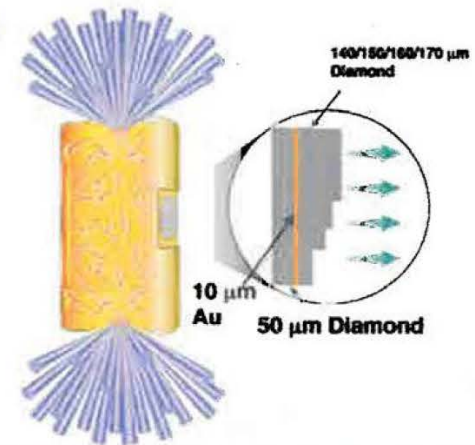
Dr. Omar A. Hurricane
AX-Division
Weapons & Complex Integration (WCI)

Our FY2011 NIF experiments focused on three areas of importance to Stockpile Stewardship

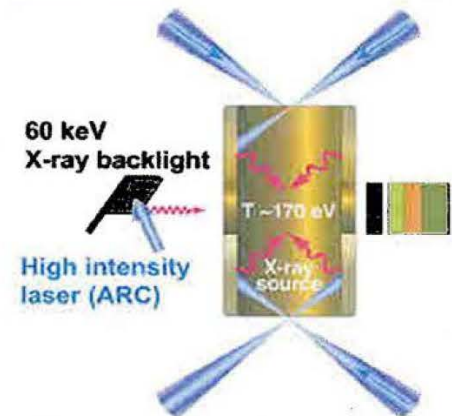


Radiation Transport

We produced 34 successful NIF experiments in ~ 1 month (27 days)



EOS at high pressures

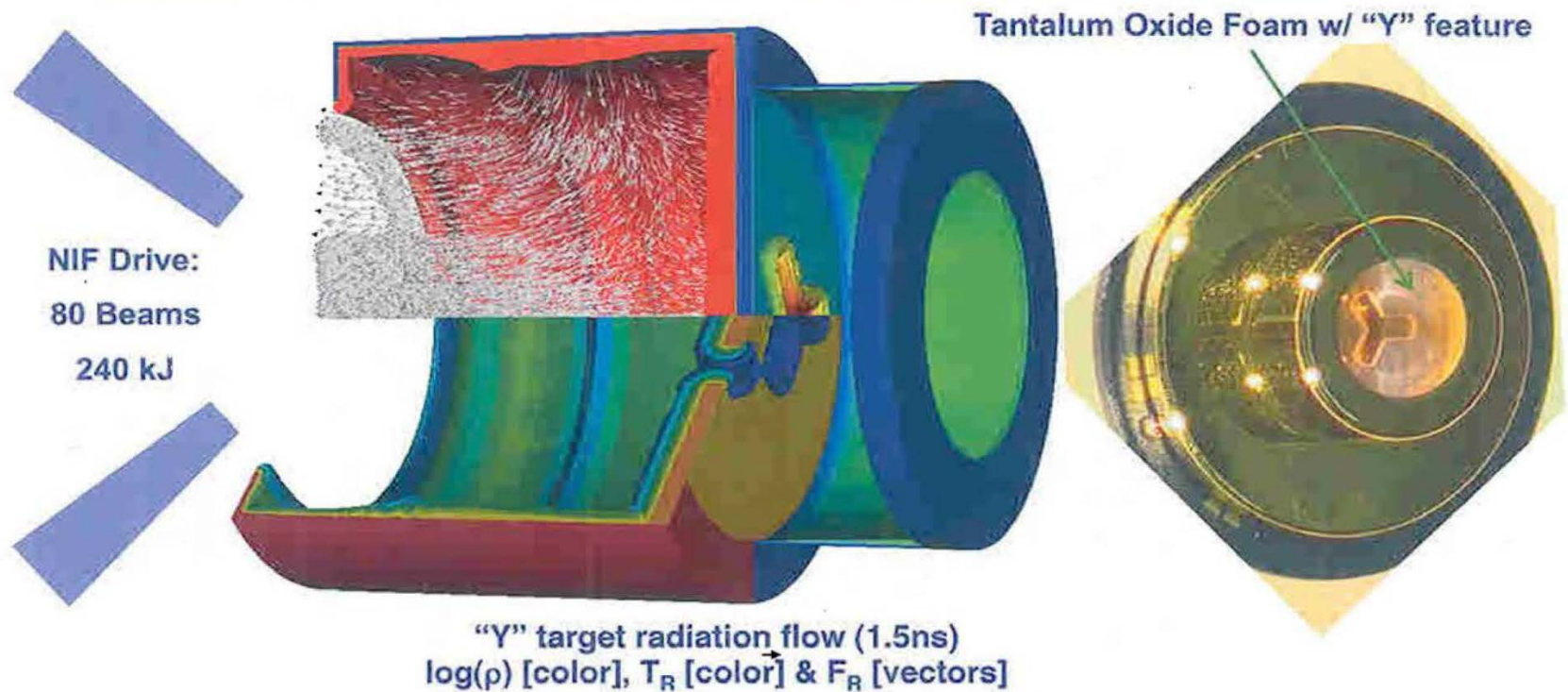


Material Strength at high pressures

Modeling radiation transport in 3-D exercises and tests LLNL's parallel computing capabilities

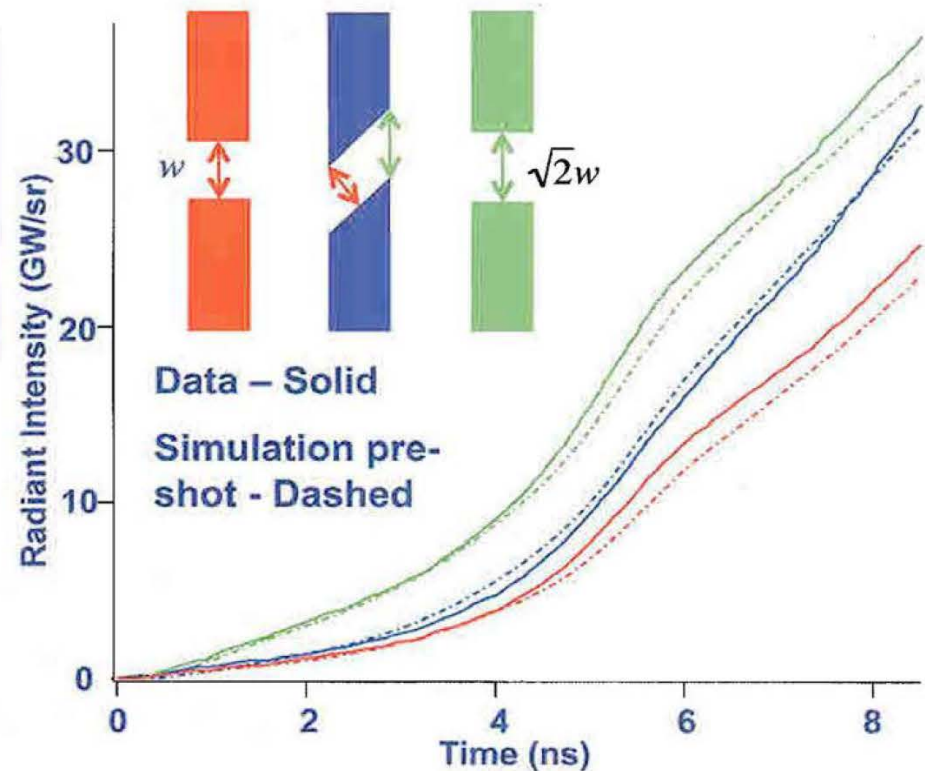
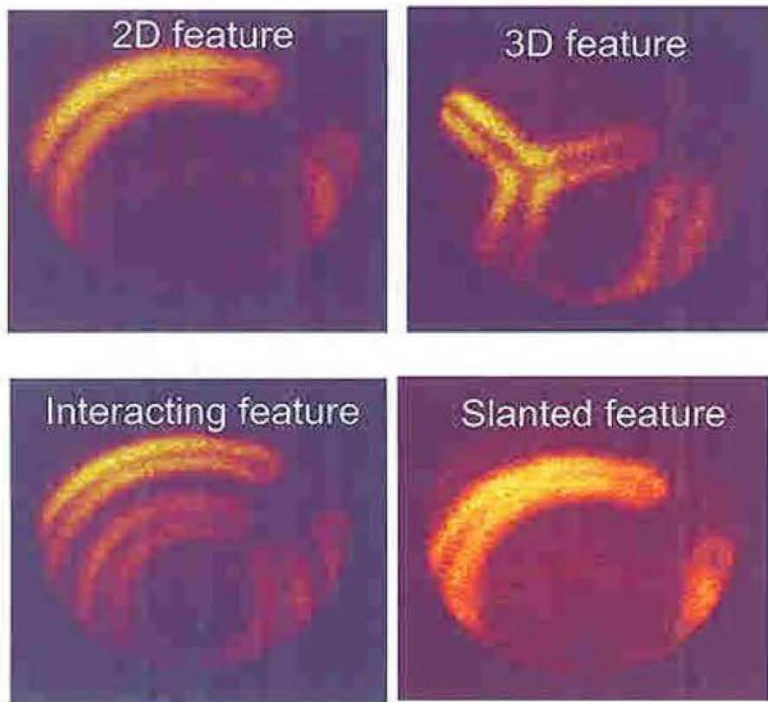
- A true transport algorithm (S_N) is required (diffusion approximation does not capture the relevant physics)

Required resource for the "Y" target: 20 days on 2816 CPUs with 5.8GB per CPU



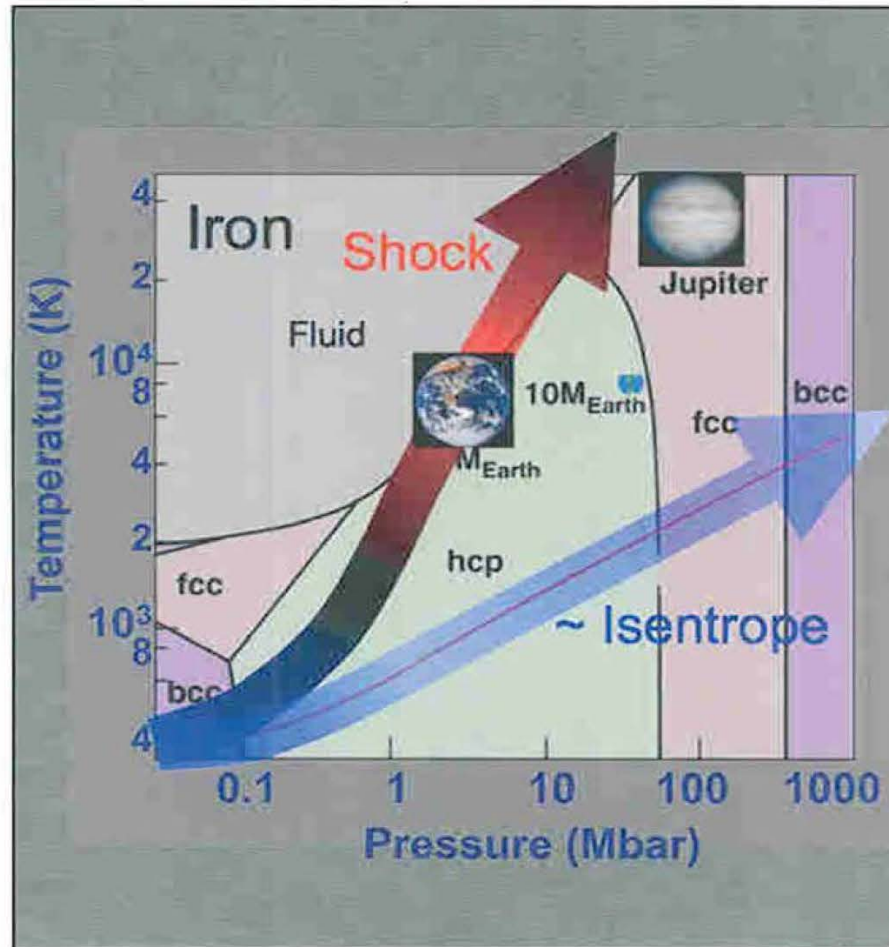
LLNL carried out both calorimetry and streak radiography experiments to examine Radiation Transport through a variety of test geometries

Time integrated X-ray emission from SXI-U illustrate the variety of geometries fielded

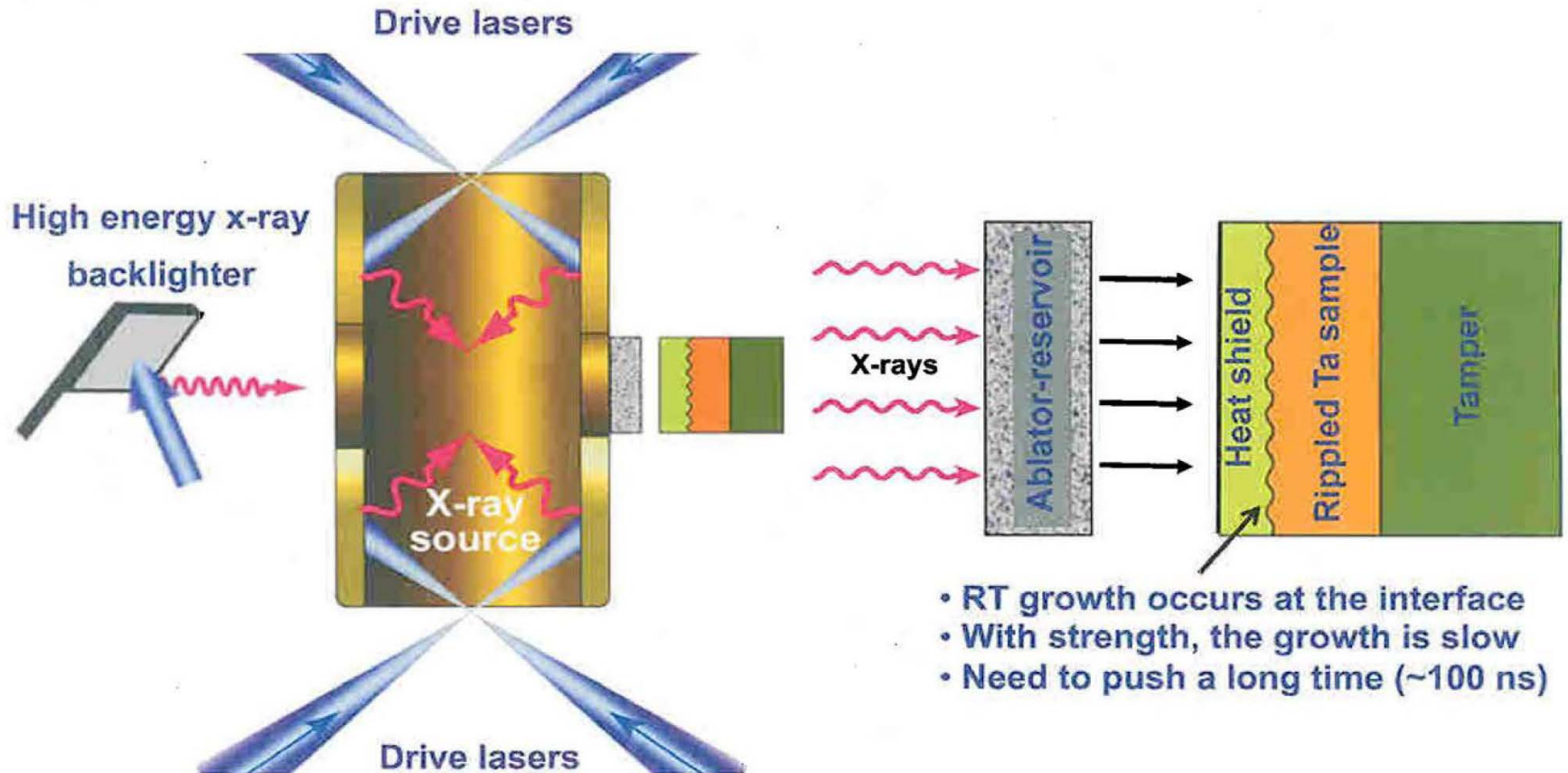


“Trio” of expts validate predictive capability

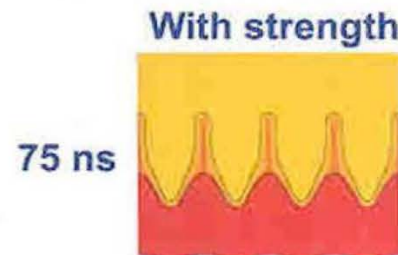
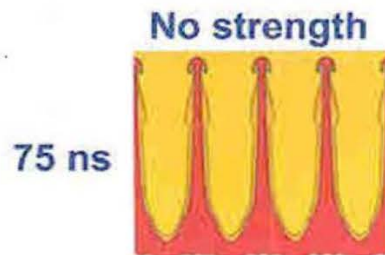
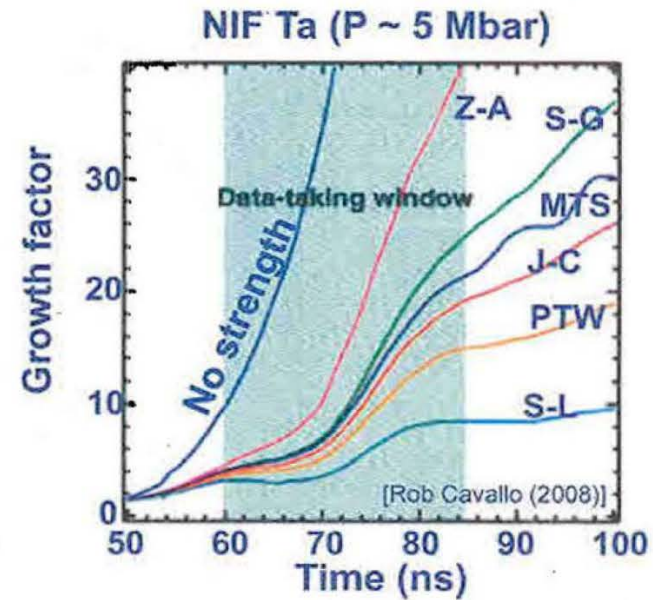
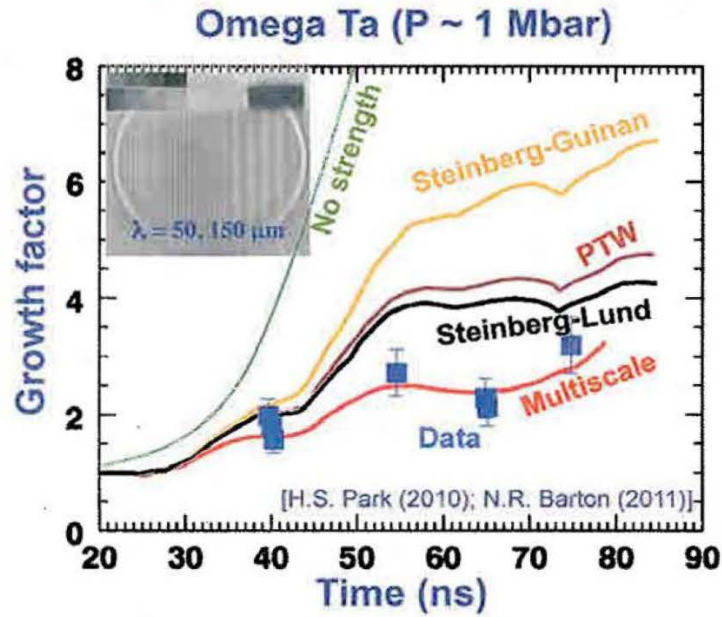
Radiation transport work validate physics at high temperatures ... at low temperature and high pressure, material properties are important



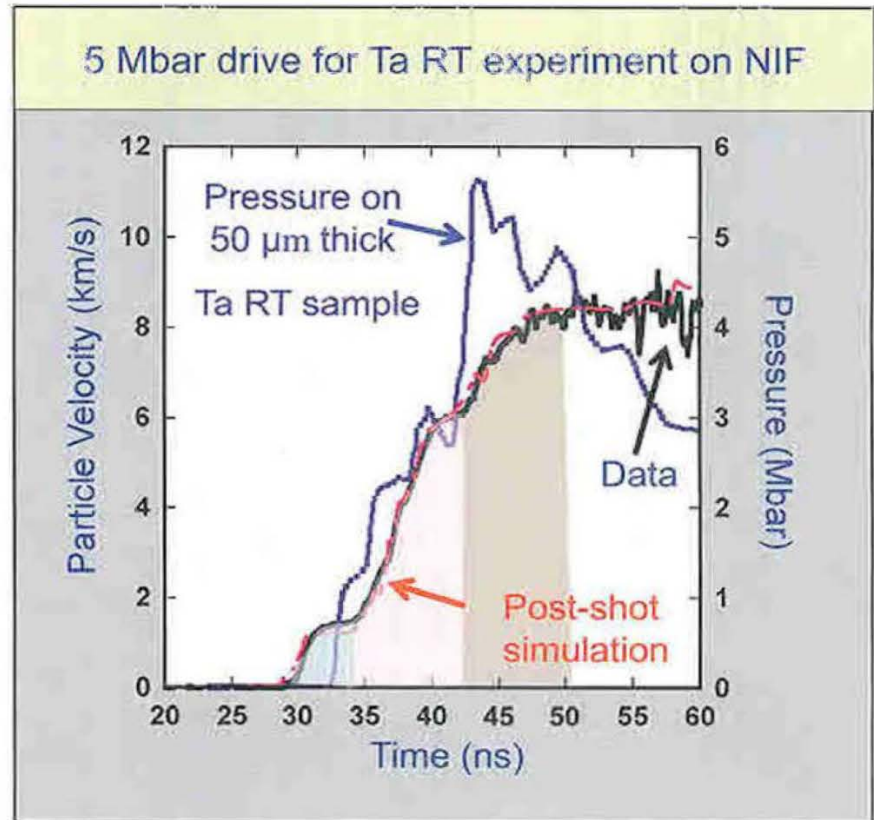
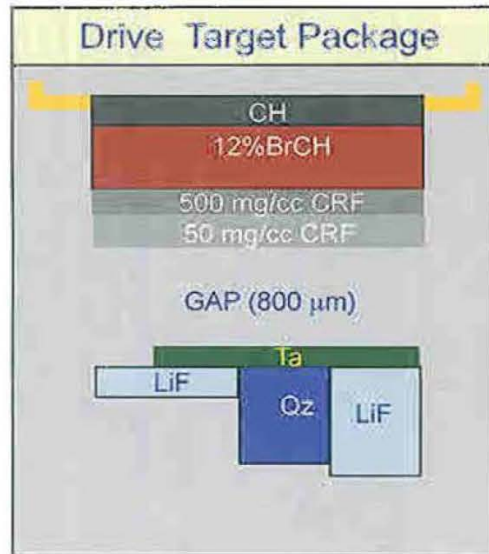
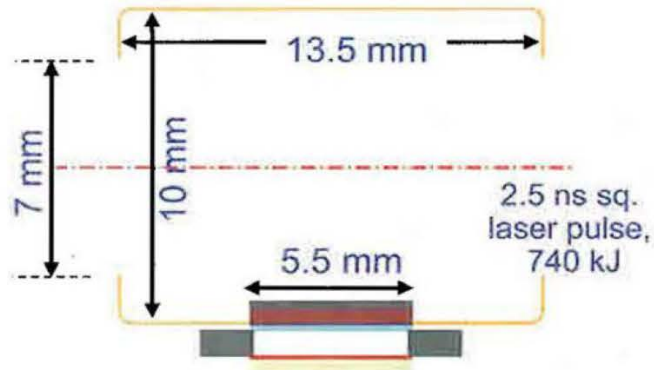
LLNL has developed a Rayleigh-Taylor (RT) platform to validate high pressure, high strain-rate strength models



The RT strength platform is a stringent test of existing strength models

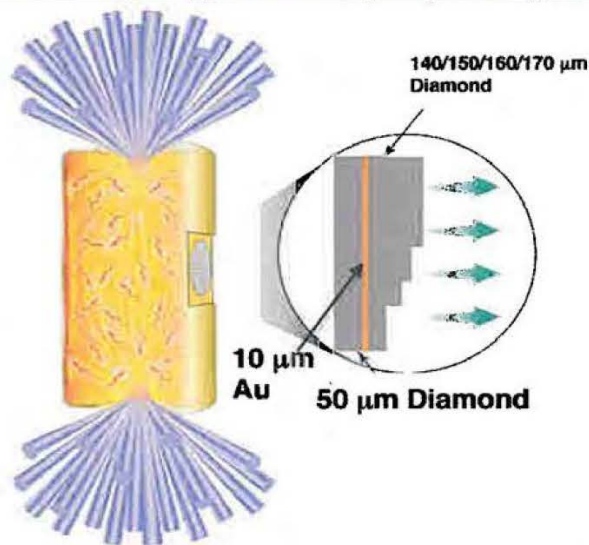


Our first two shots on NIF demonstrated the required drive for the 5 Mbar Ta RT experiment



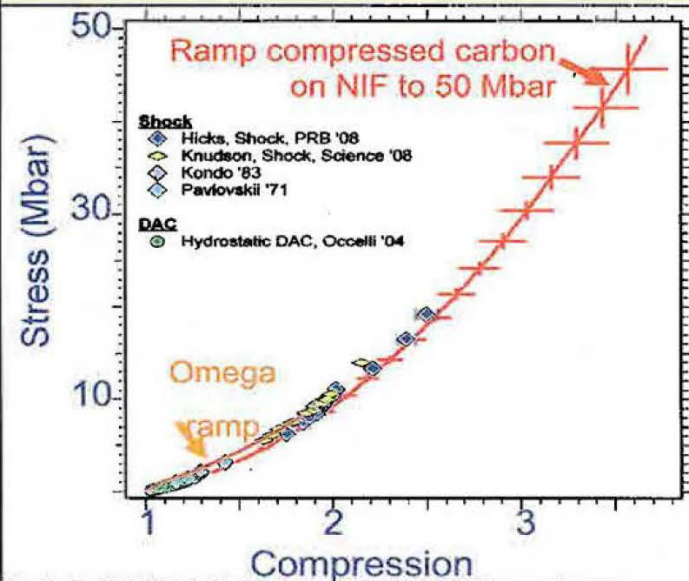
NIF has ramp compressed carbon to obtain EOS data at ~50 Mbars, 5x higher than previous record

We have developed a platform to ramp compress solids to 50 Mbar on NIF



- This year ~ 100 Mbar platform
- In 3 years a 10 Gbar platform with convergent shocks

NIF achieved 17 times the maximum diamond anvil cell pressure



Researchers: Ray Smith, Jon Eggert, D. Braun (LLNL); R. Jeanloz (UCB); T. Duffy (Princeton)



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IET Leads: P.I. J. Eggert, (Ta) T. Perry, (Diamond) R. Smith

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LL-WCI-U-2011-522763

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HED experiments help to train our current personnel and to continue to attract the “best and the brightest”

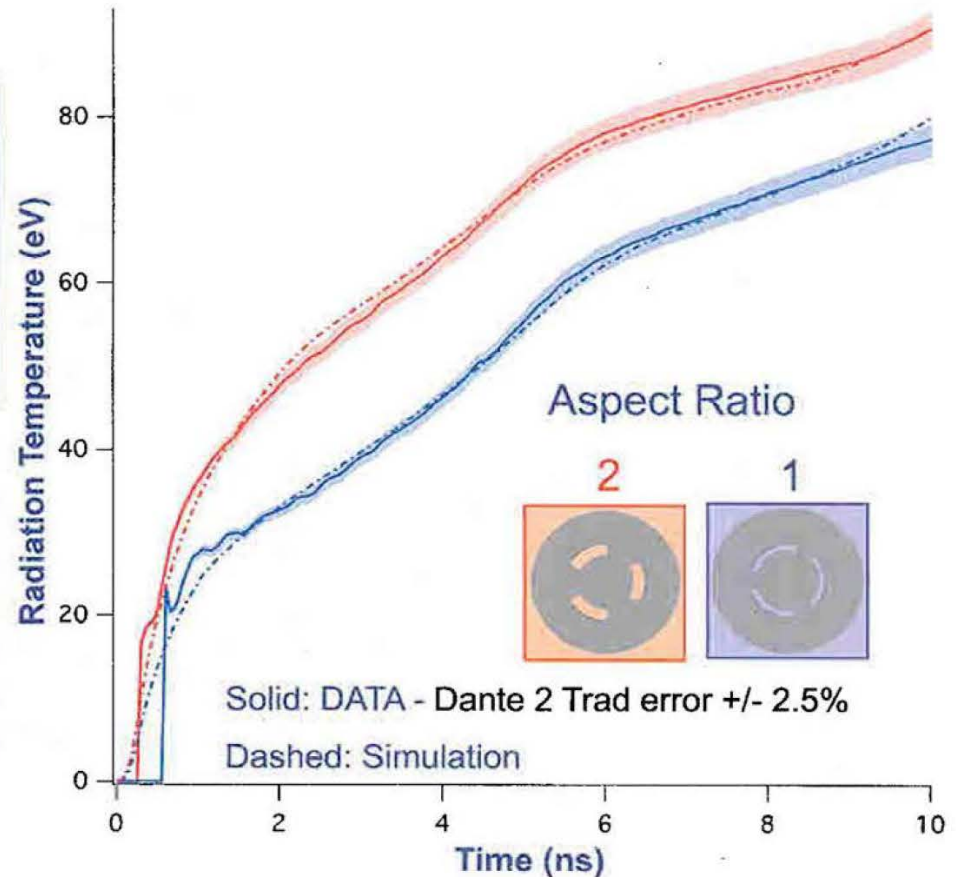
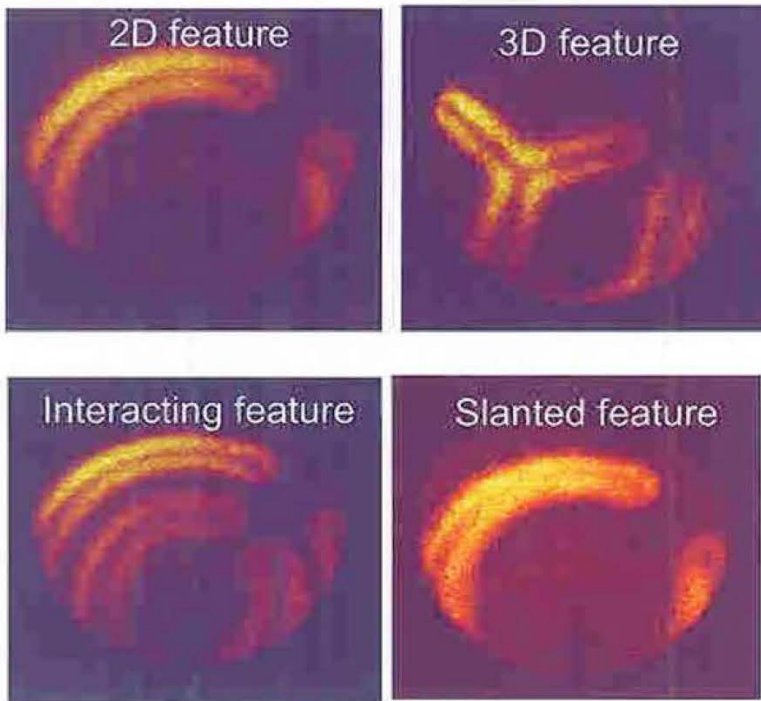
- Successful HED experiments require working in large multidisciplinary teams
- Individual and team contributions are required for success



Excess...

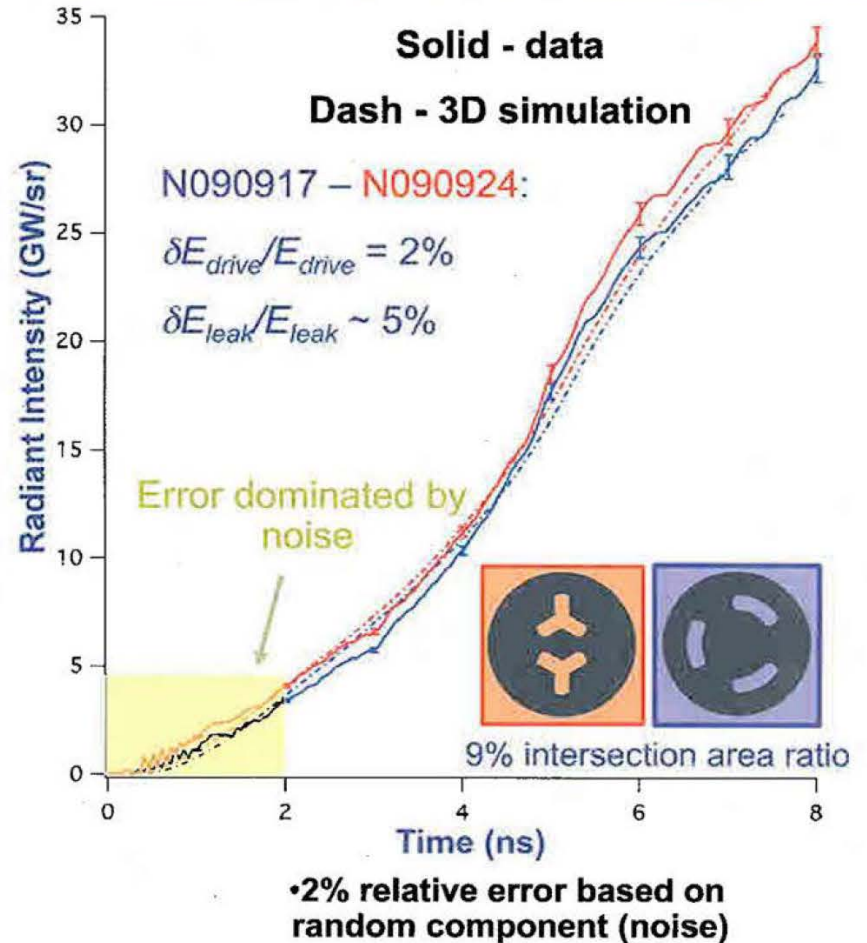
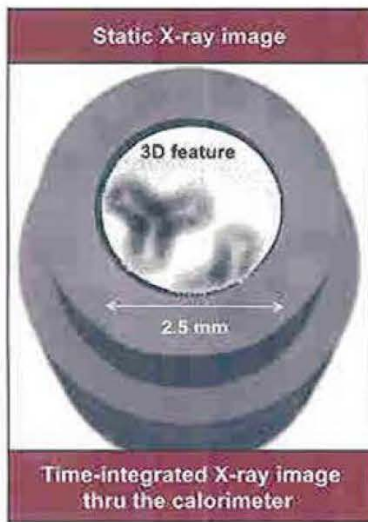
LLNL carried out both calorimetry and streak radiography experiments to examine Radiation Transport through a variety of test geometries

Time integrated X-ray emission from SXI-U illustrate the variety of geometries fielded



NIF data validated our predictions of radiation transport through 2D and 3D test objects, indicating that our model is in-line with reality

Time integrated SXI image on "Y" feature



Multiscale models of strength, based on information passing, have been developed to bridge this range of scales

