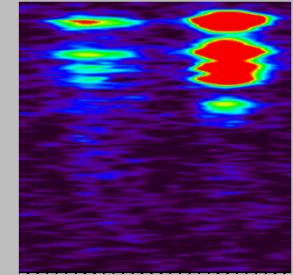
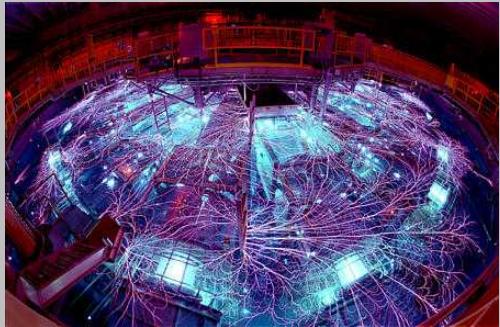


Exceptional service in the national interest



First Results from Shocked Foam XRTS on Z

E.C. Harding, T. Ao, J.E. Bailey, L. Shulenburger, C.T. Seagle, D.B. Sinars,
G.A. Rochau, S.B. Hansen, G. Loisel, M.P. Desjarlais, L.P. Mix, M. Geissel,
I.C. Smith, R.W. Lemke

Sandia National Laboratories, Albuquerque, NM

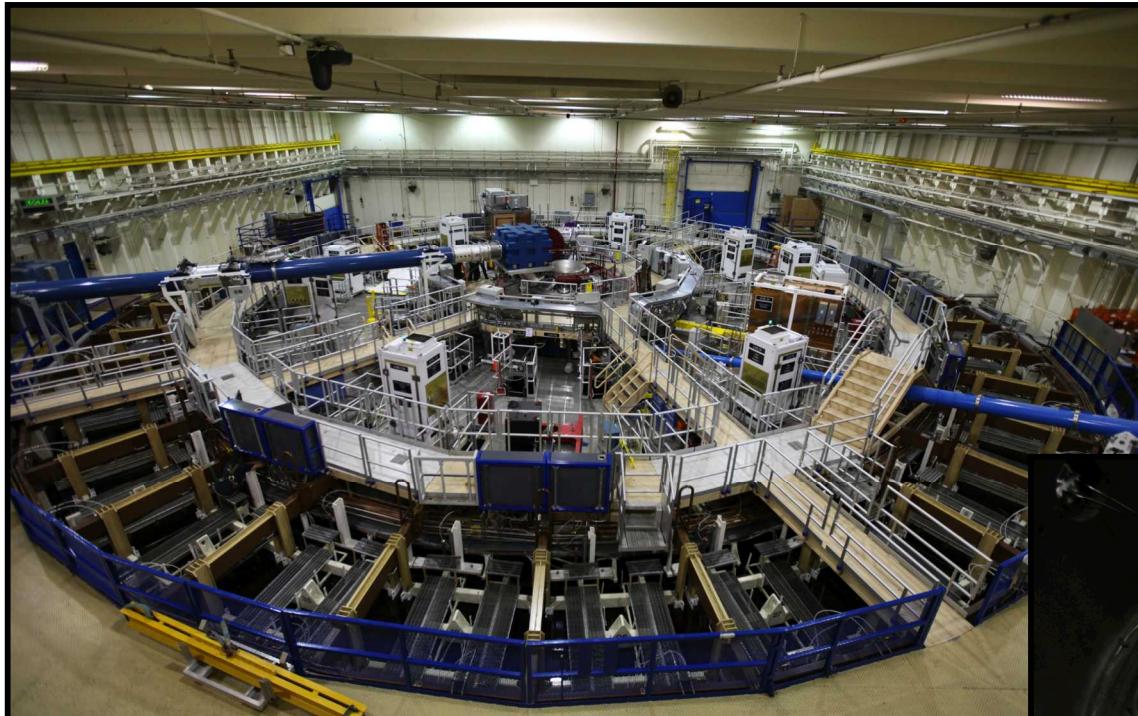
G. Gregori
University of Oxford, Oxford, UK



Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

The Z machine is an impressive MJ class, pulse-power driver that frequently challenges diagnostic survivability.

Z Machine Panorama



22 MJ peak stored energy
~1 MJ to target
26 MA peak current
100–300 ns pulse lengths

Machine Center



We are working to develop a space-resolved XRTS technique for shock and ramp loaded targets on Z.

Magnetically launched flyer plates drive sample

25 km/s

\mathbf{B}

Al flyer plate

Z Beamlet Laser
2 kJ, 2ns

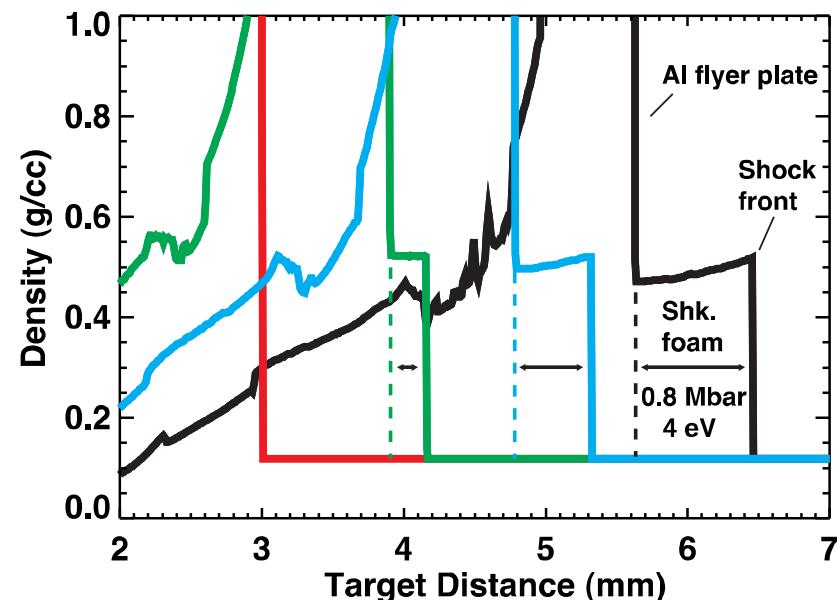
Mn
6 keV

Spatial resolution in this direction

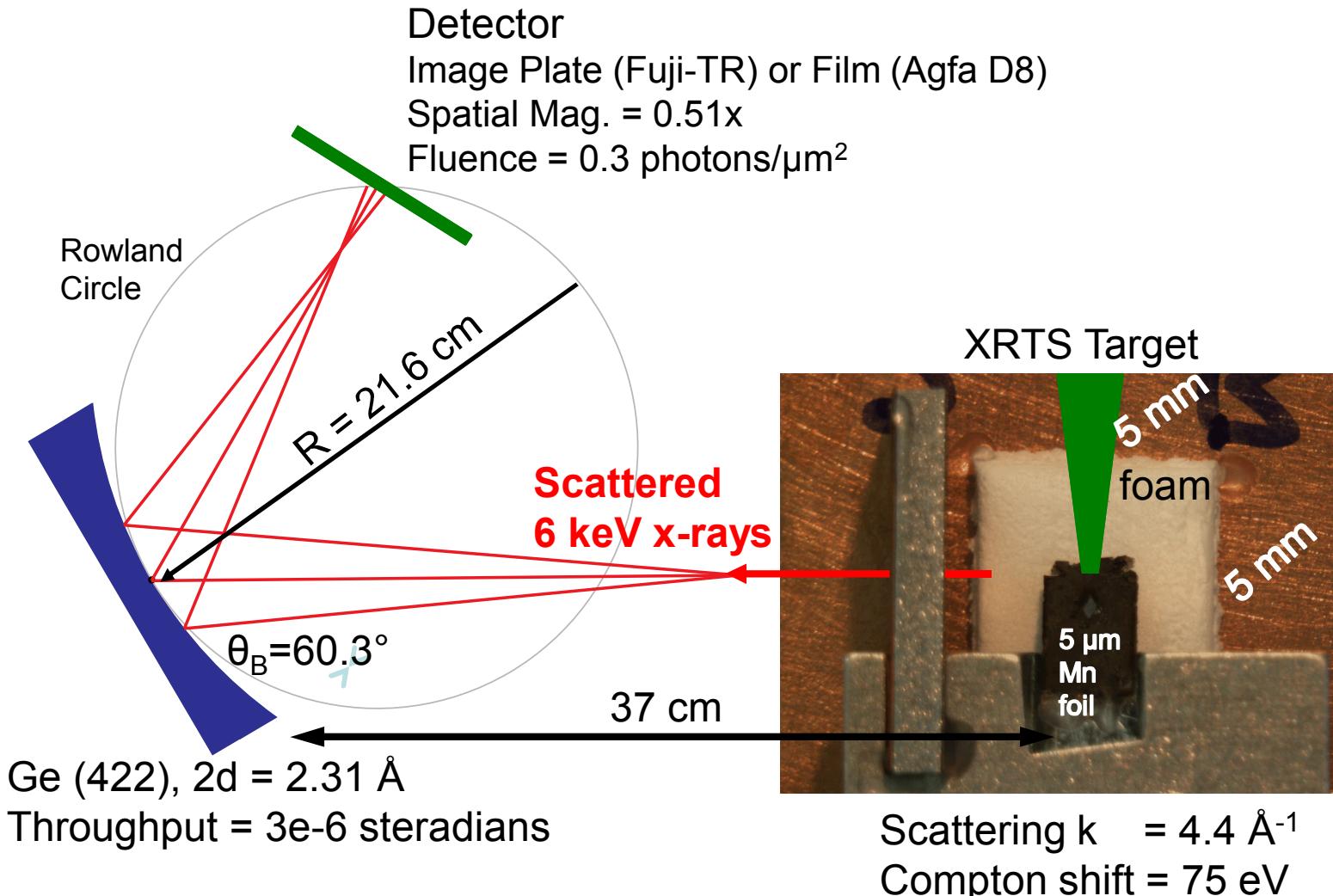
A spherically bent crystal spectrometer provides a spatially resolved spectrum

Large, uniform samples of WDM are generated with the flyer plate drive.

Density Profiles ($\Delta t = 40$ ns)

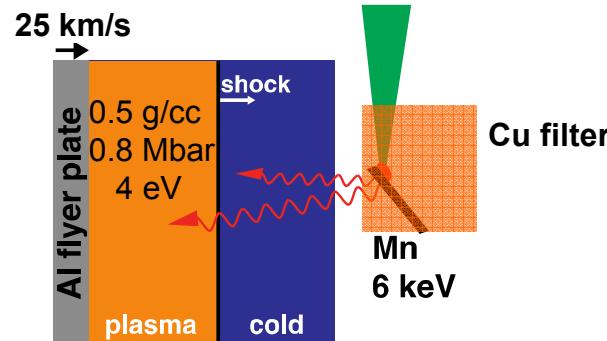
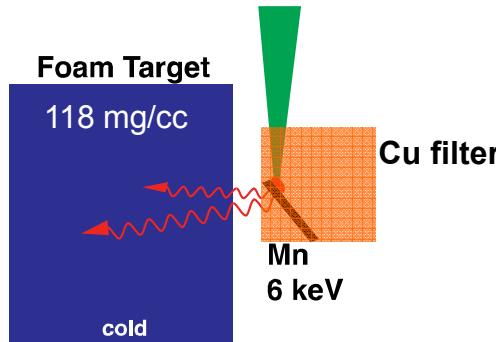


A new spectrometer and target were developed to enable space-resolved XRTS measurements on Z.¹



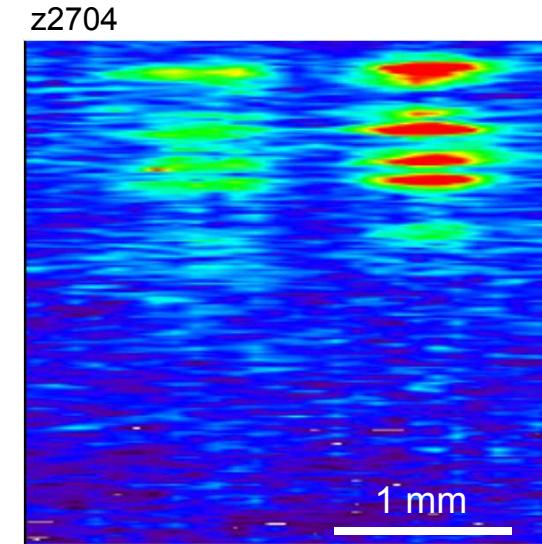
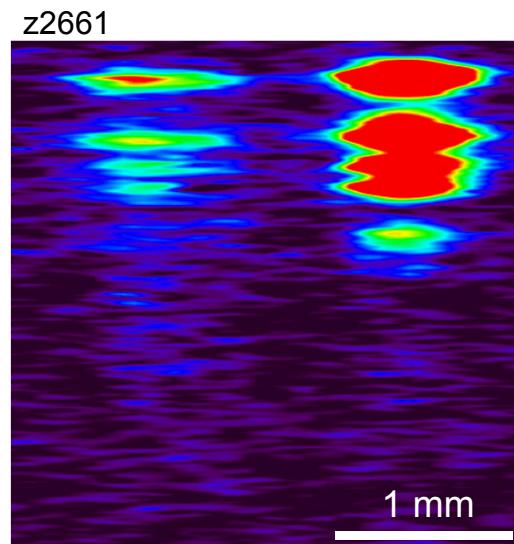
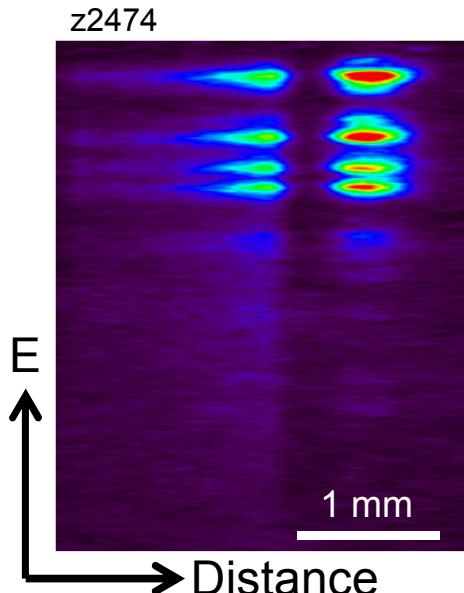
¹T. Ao *et. al.* JQSRT 2014

Two shots successfully recorded scattering signal from unshocked and shocked foam.



Repeat Shot

Using film (Agfa D8) results in improved spatial resolution.



SPECT3D is used to generate a simulated image of the scattering signal.*

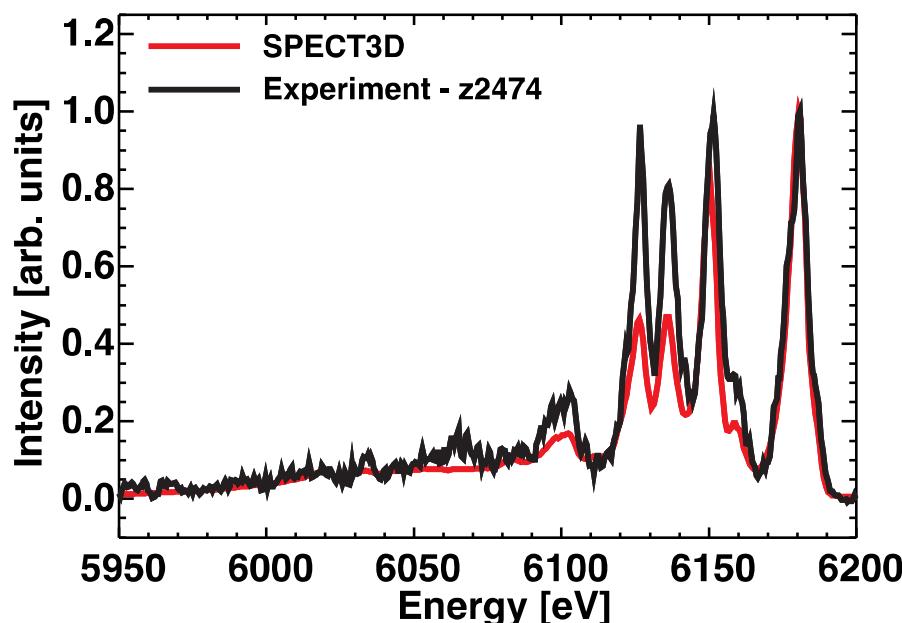
SPECT3D cartoon

Sample images from
SPECT3D

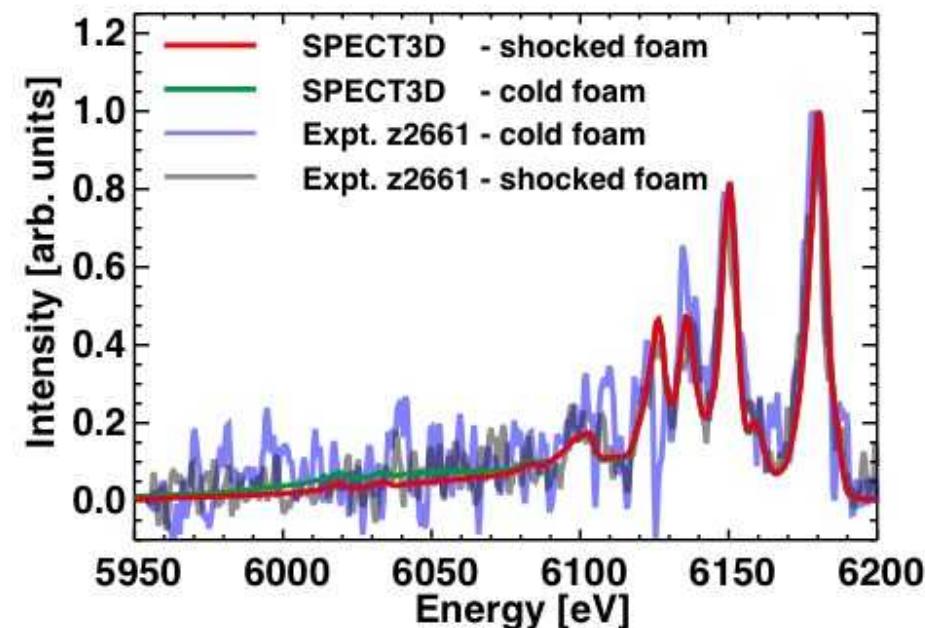
*Golovkin *et. al.*, HEDP 2013

SPECT3D reproduces the relative signal difference between the elastic and inelastic scattering.

Comparison of Cold Foam Spectra
Shot z2474

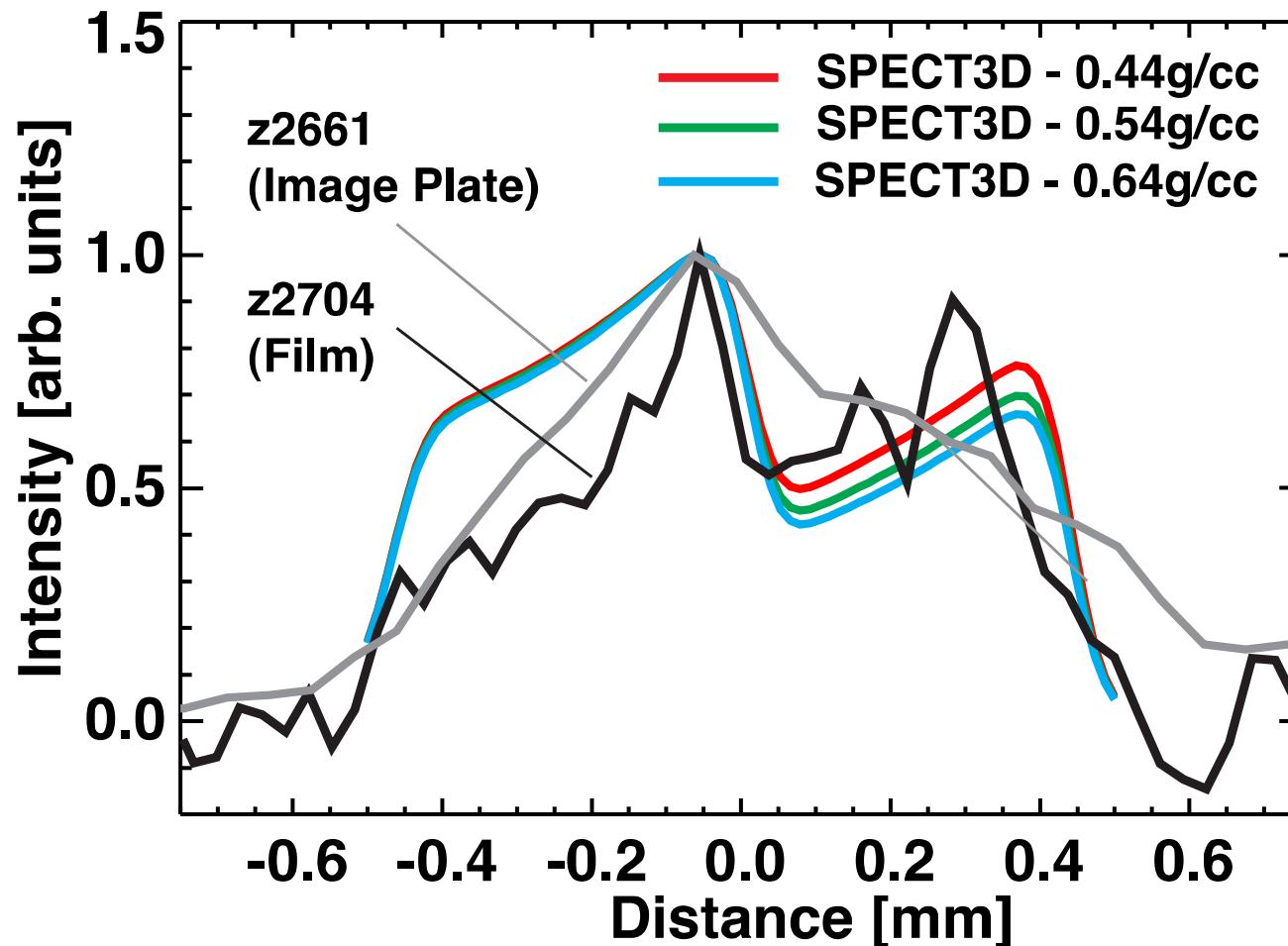


Shocked and unshocked foam spectra

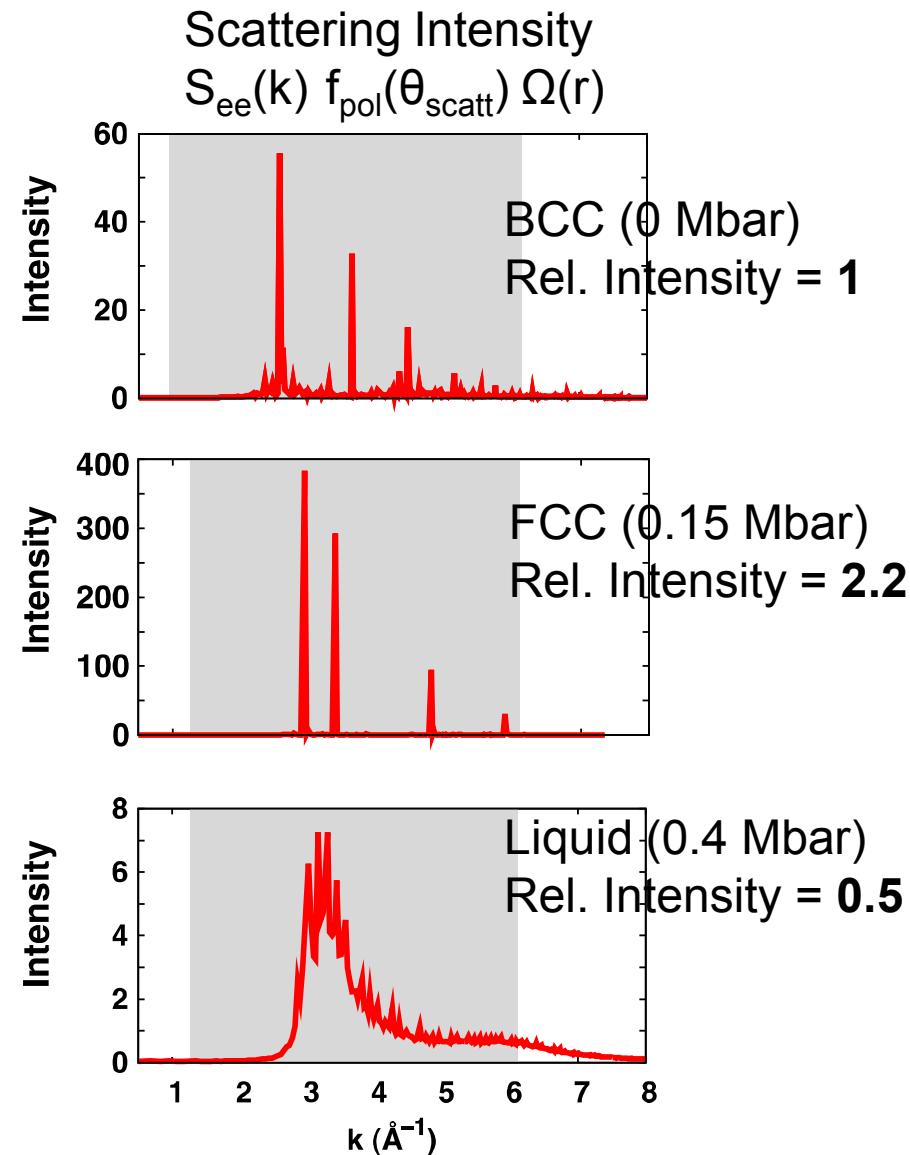
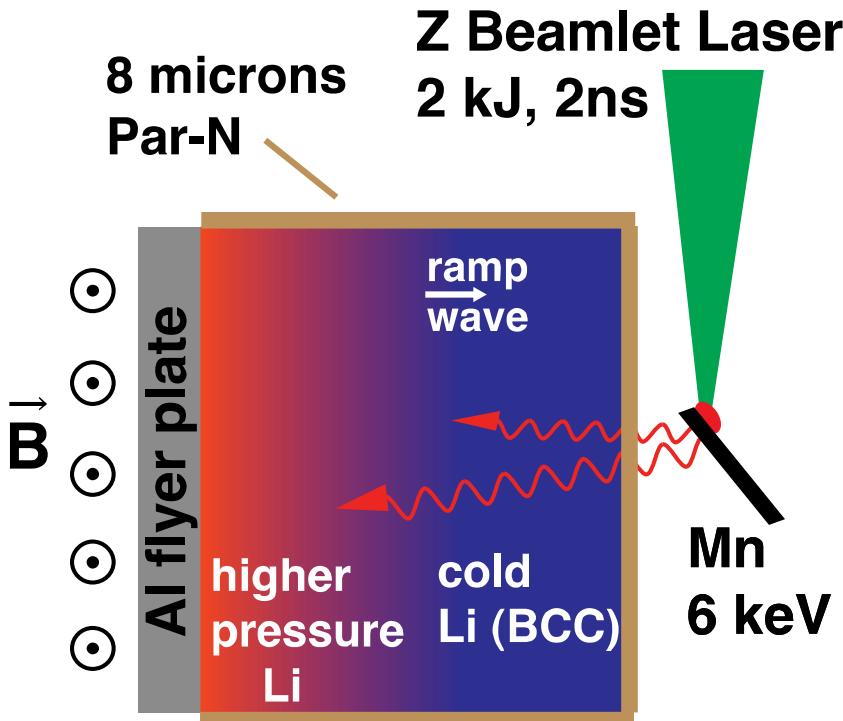


The experimental scattering spectra are consistent with the prediction that shock and unshocked foam should produce the same spectrum.

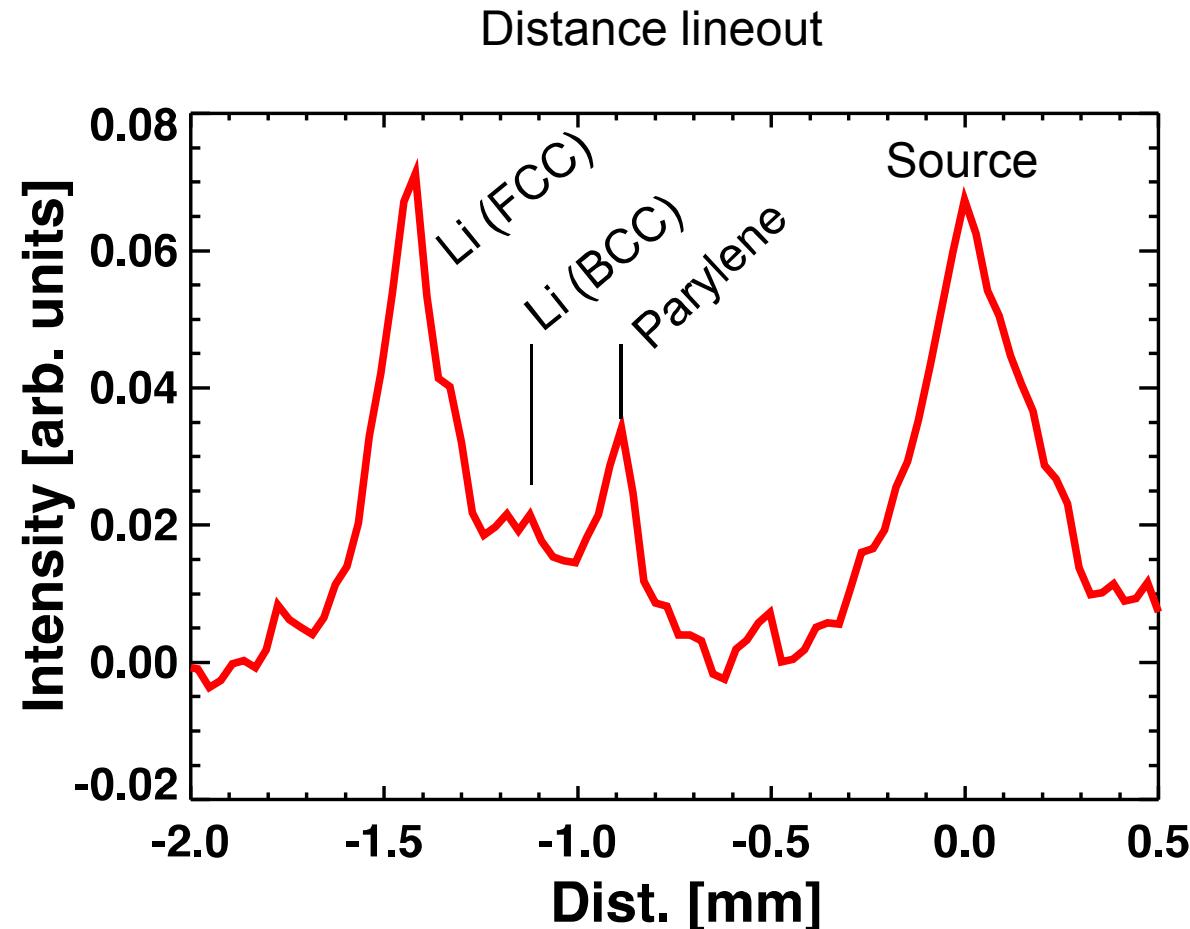
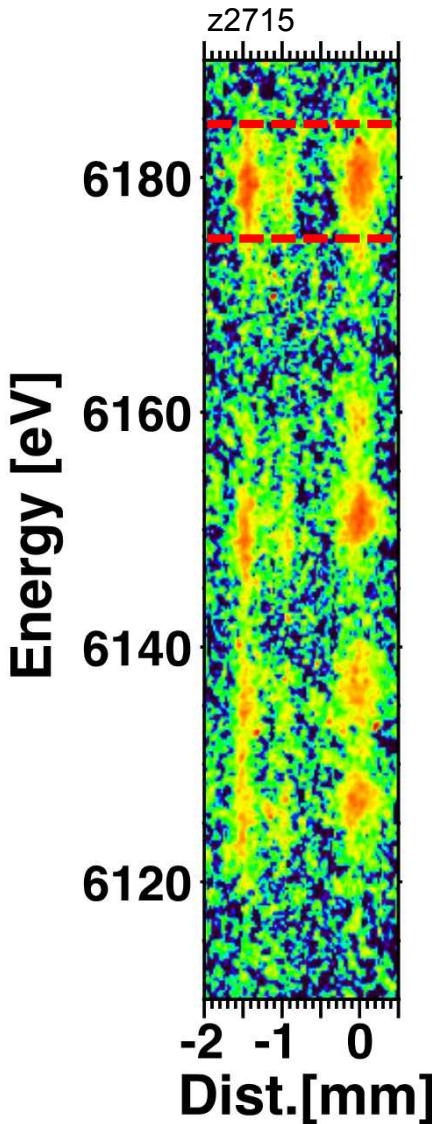
The intensity jump of the elastic signal is related to the density jump across the shock front.



The XRTS technique has now been extend to ramped compressed Li targets on Z.



The observed intensity variations in the elastic signal suggest a phase change has occurred in the Li.



Summary: