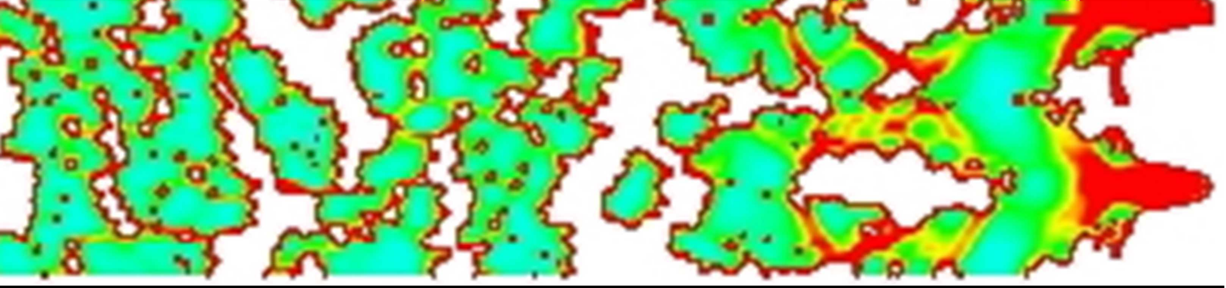
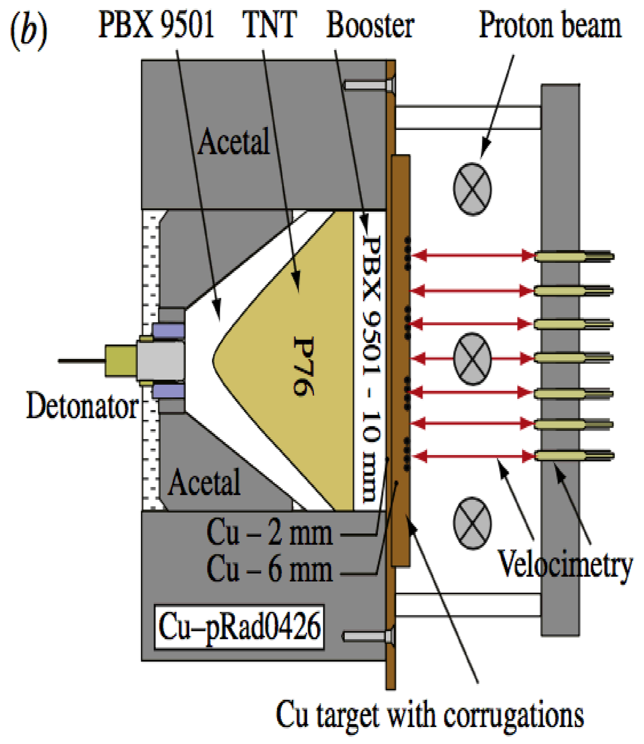
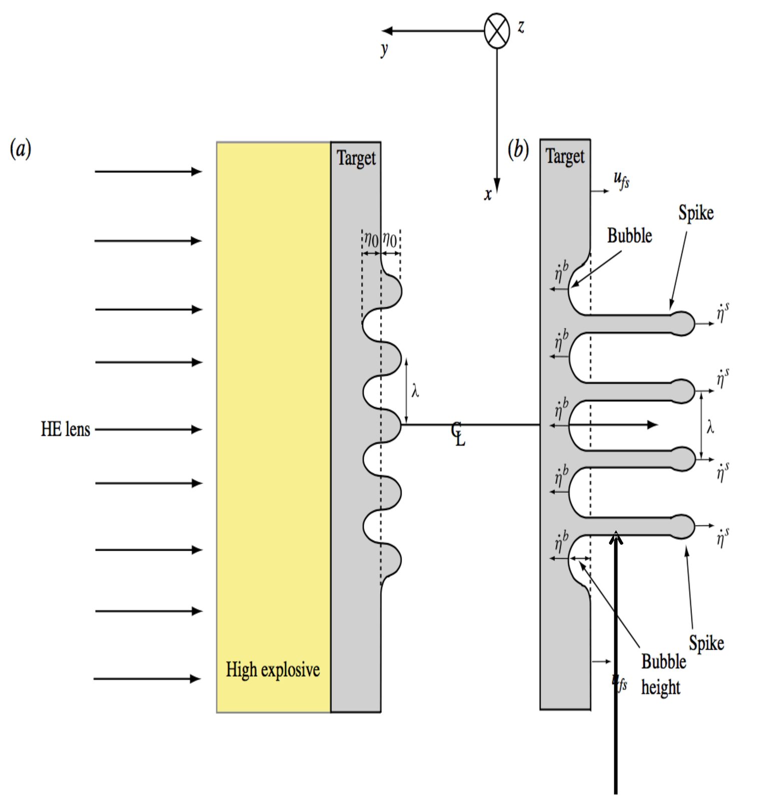


SAND2017-8582C

Motivation: Strength model characterization traditionally has relied on experimental data from a lower-strain-rate regime $10^{-4} - 10^{4}\ s^{-1}$ than we access in our shock physics applications $10^{4} - 10^{9}\ s^{-1}$. This extrapolation could lead to inaccurate results so we are looking for additional experiments that can be used to verify material behavior and optimize material parameter fits in these higher strain-rate regimes.



"Unstable Richtmyer-Meshkov growth of solid and liquid metals in vacuum"; J. Fluid Mech (2012), vol. 703 Buttler et al.



Plasticity determines maximum perturbation amplitude

Modify target "corrugation" to study strength

η_0 = initial perturbation amplitude

λ = wavelength

$k = 2\pi/\lambda$

Larger $\eta_0 k$, more deformation

Aim for arrest and growth to study strength effects

Experiments for $\eta_0 k$ =0.12,0.35, 0.75, and 1.5

For $\eta_0 k$ = .35, RMI strain-rates of ~10^7 and arrest and growth of instability observed

Experiments for $\eta_0 k$ =0.12,0.35, 0.75, and 1.5

Simulation Details

RMI geometry $\eta_0 k$ = .35

2D 5 μm / cell mesh resolution

Periodic boundary conditions in x

9501: JWL EOS with program burn

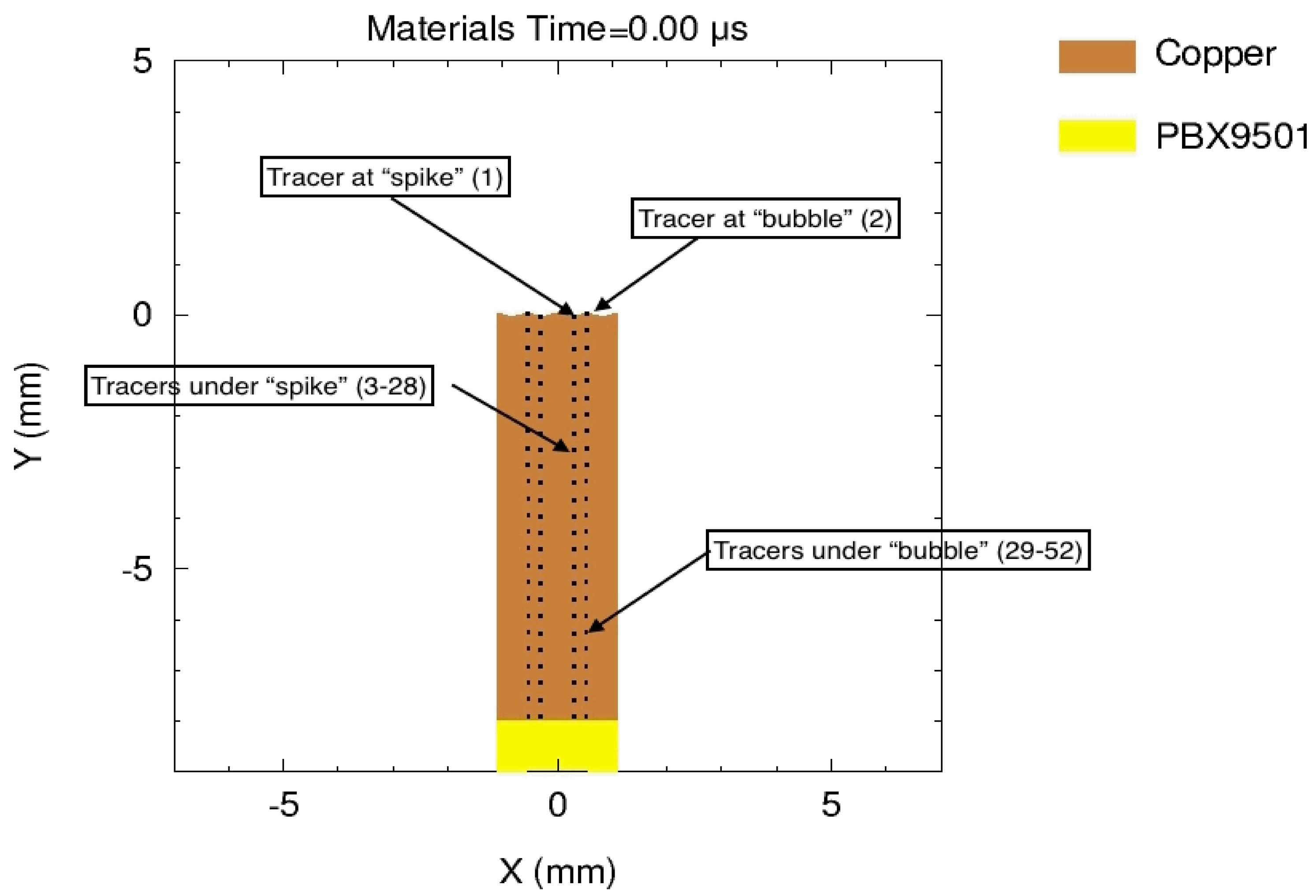
Copper Equation-of-state: Mie-Grüneisen

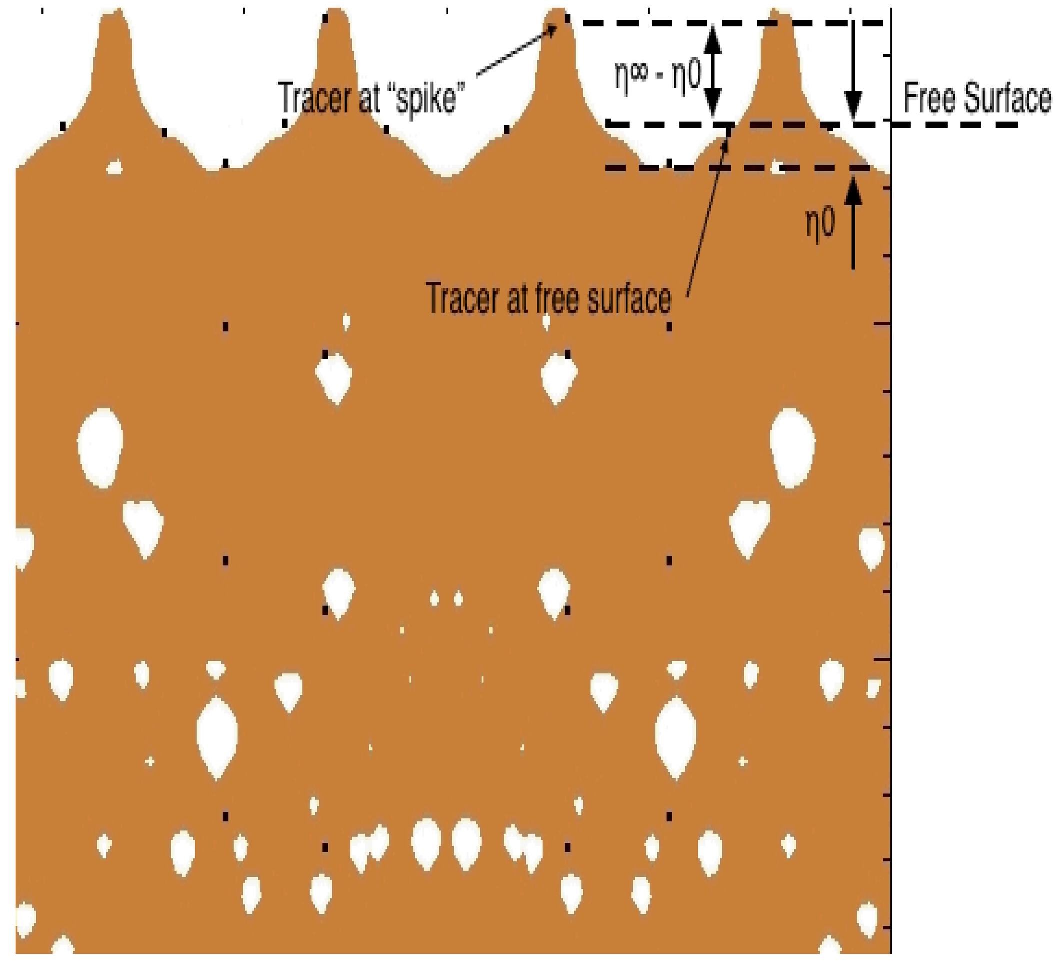
Strength Models: PTW

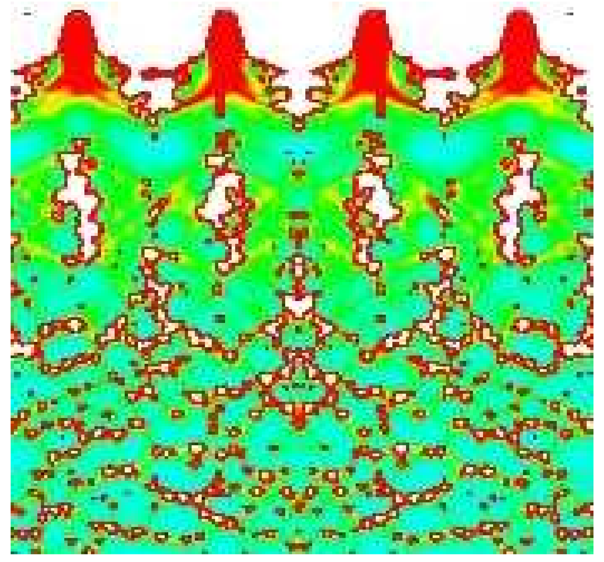
MTS

Johnson-Cook

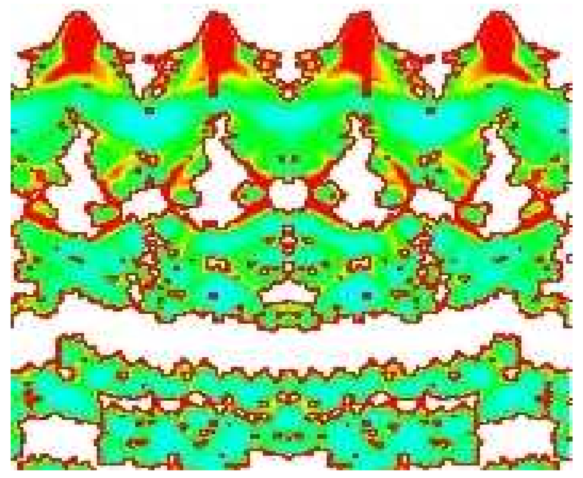
Failure: Pressure based



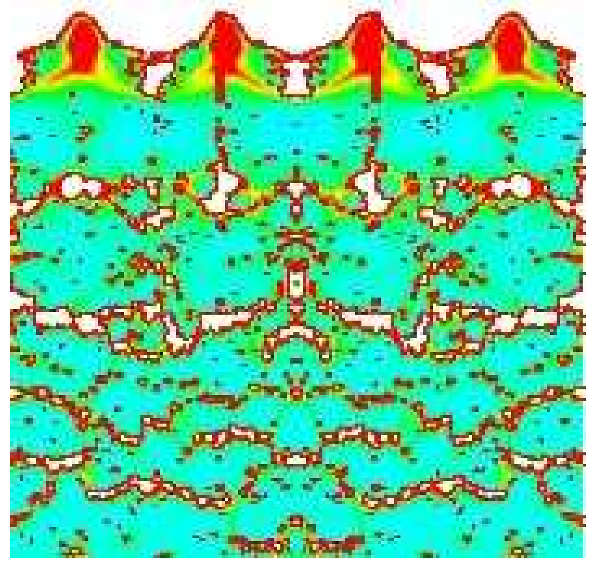




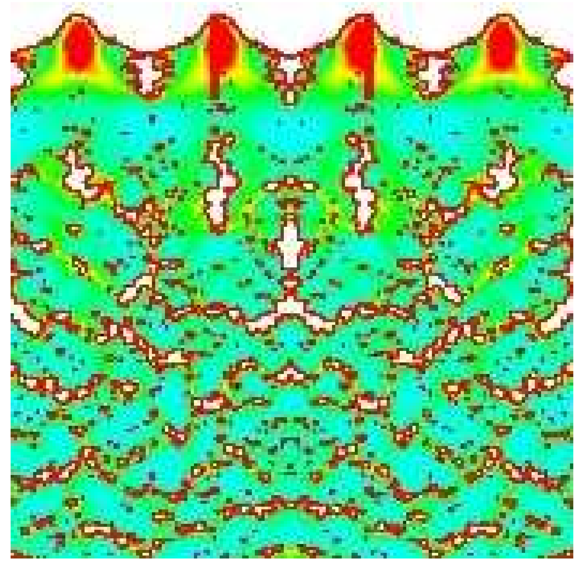
Johnson-Cook



High Rate Johnson-Cook



MTS



PTW

Strength Model	$\eta_\infty - \eta_0$ (μm)	Peak Velocity (mm/μs)
Johnson-Cook (Cu)	245	2.17
PTW(Cu)	103	2.11
MTS (OFHC Cu)	127	2.10
High-Rate Johnson-Cook	164	2.15
Experiment (1/2 Cu)	**160**	**2.15**

experimental velocity uncertainty: $O(0.01 - 0.02\ mm(\mu s)^{-1})$

"Unstable Richtmyer-Meshkov growth of solid and liquid metals in vacuum", W.T. Buttler et al.