Introduction
Simulations of explosive expansion of heated metal containers have been performed using the UINTAH computational framework. Plasticity models form an integral component of the simulation. Confidence in the accuracy of the plasticity models improves our confidence in the integrated simulation.

Taylor Impact Test
A flat-ended cylindrical projectile is fired at high velocity on to a rigid target (Taylor, 1948). The deformed shape provides information that can be used to validate plasticity models and simulations.

Materials, Models, Metrics
Materials:
Simulations were run using models for OFHC and ETP copper, 6061-T6 aluminum alloy, and 4340 steel.

Empirical Plasticity Models:
- Steinberg–Cochran–Guinan + Steinberg–Lund
- Johnson–Cook

Physically Motivated Plasticity Models:
- Mechanical Threshold Stress (Follansbee–Kocks)
- Preston–Tonks–Wallace

Validation Metrics:
- Correlation between experimental and simulated profiles
- Final length/diameter/bulge diameter
- Final volume (deformation is isochoric)
- Length of elastic zone in deformed sample
- Contours of plastic strain
- Time of contact of cylinder with anvil
- Percentage conversion of kinetic energy into strain energy

Results

Copper (fcc) Room Temperature
Model Sensitivity

Mesh Sensitivity

Copper (fcc) High Temperature
No-slip contact

Friction contact

Aluminum (fcc)
Room Temperature (298 K)

High Temperature

Mesh Sensitivity

Steel (bcc)
Room Temperature

High Temperature

Conclusion: Need better models for high-temperature/high-velocity simulations.