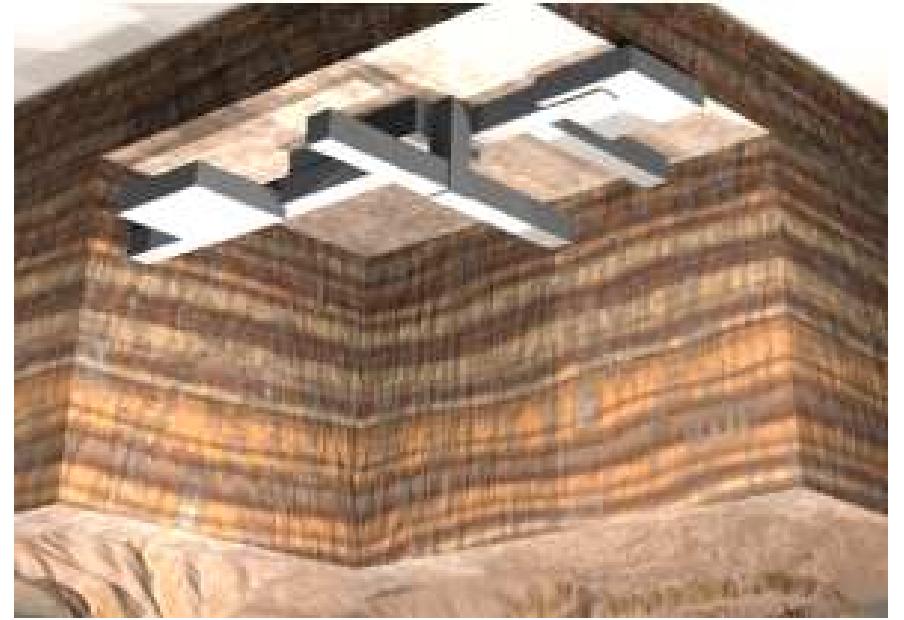


unable to predict effects of rock-fall/rockburst due to seismic event

Nuclear Waste Repositories

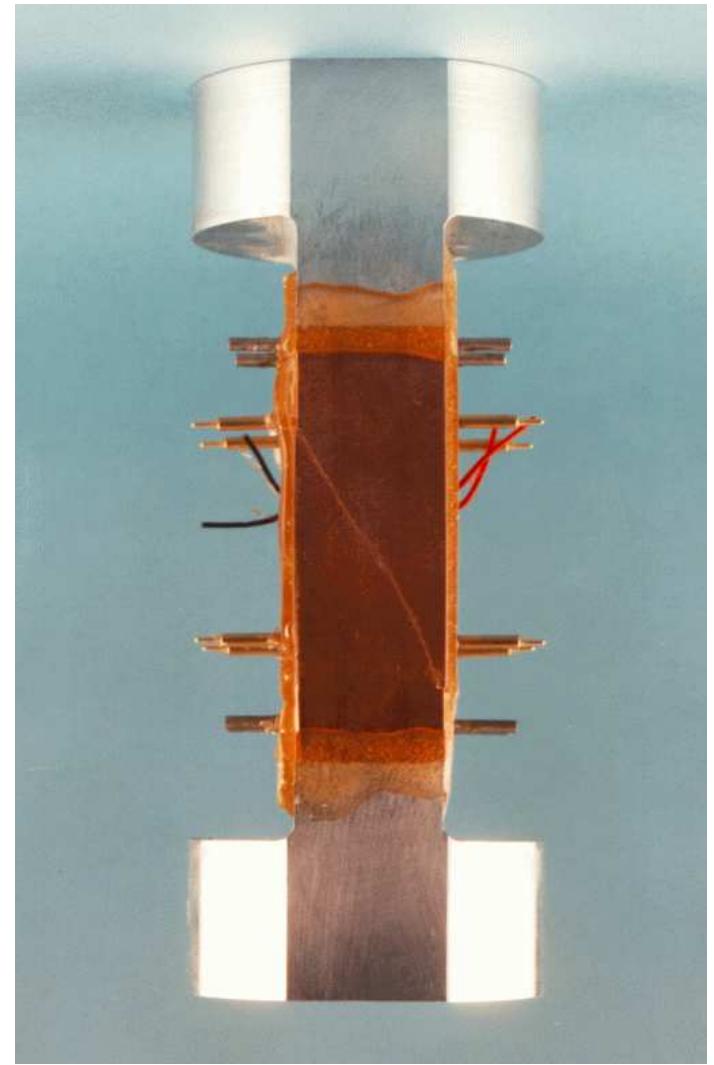
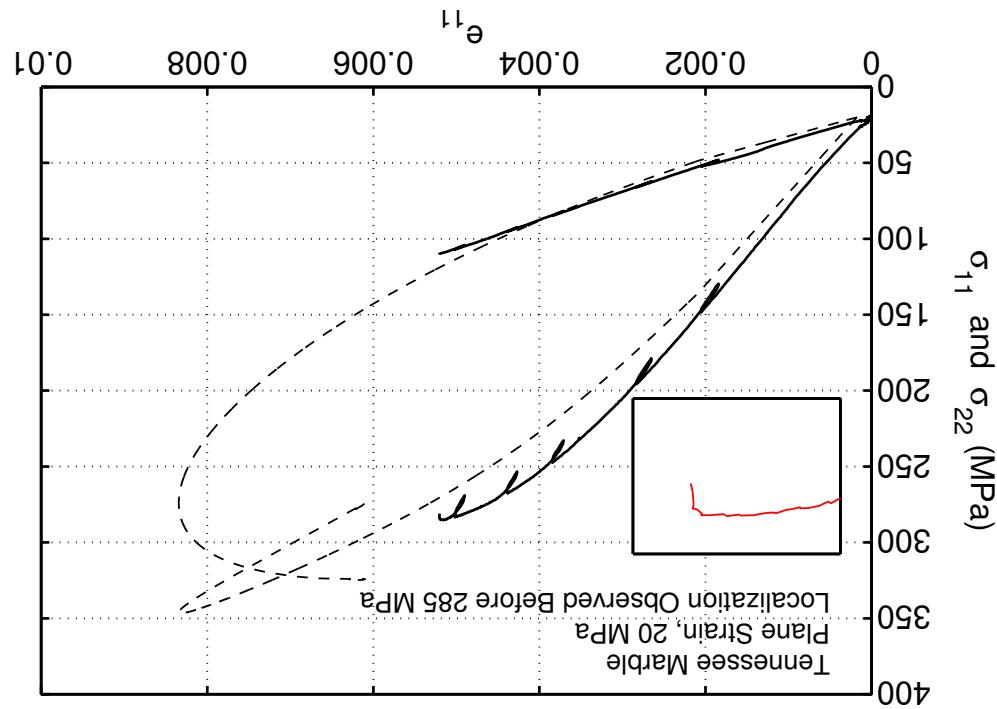


- **Objective:** Develop a geomaterial constitutive model and computational method that can predictively model the transition of continuous rock-like material to fragmented rock material within the context of coupled solid-fluid-mechanical physics.

Coupled solid-fluid-mechanical computational modeling of fracture and fragmentation in geomaterials

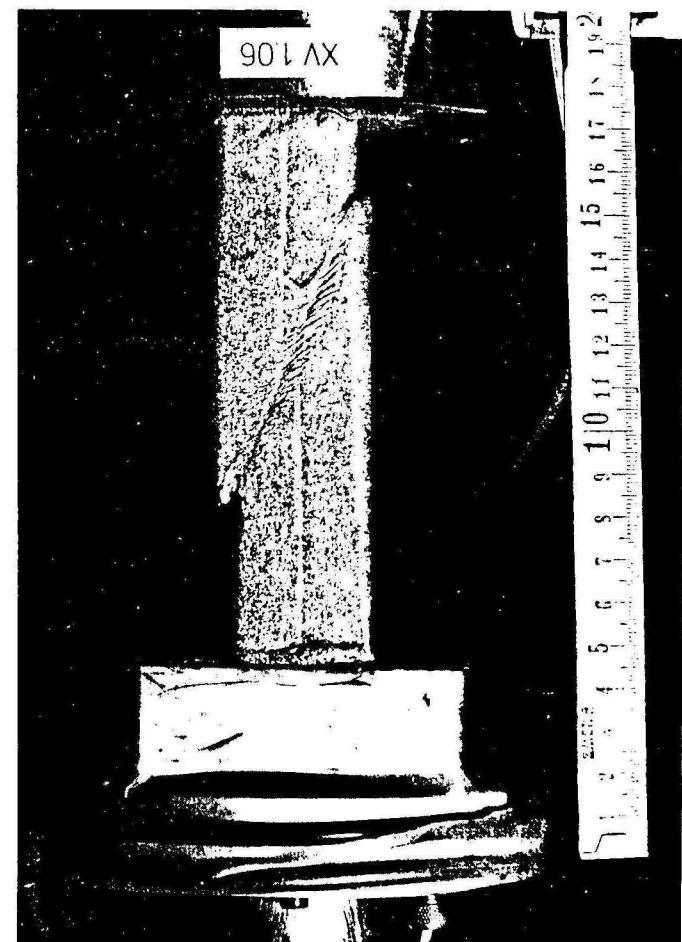
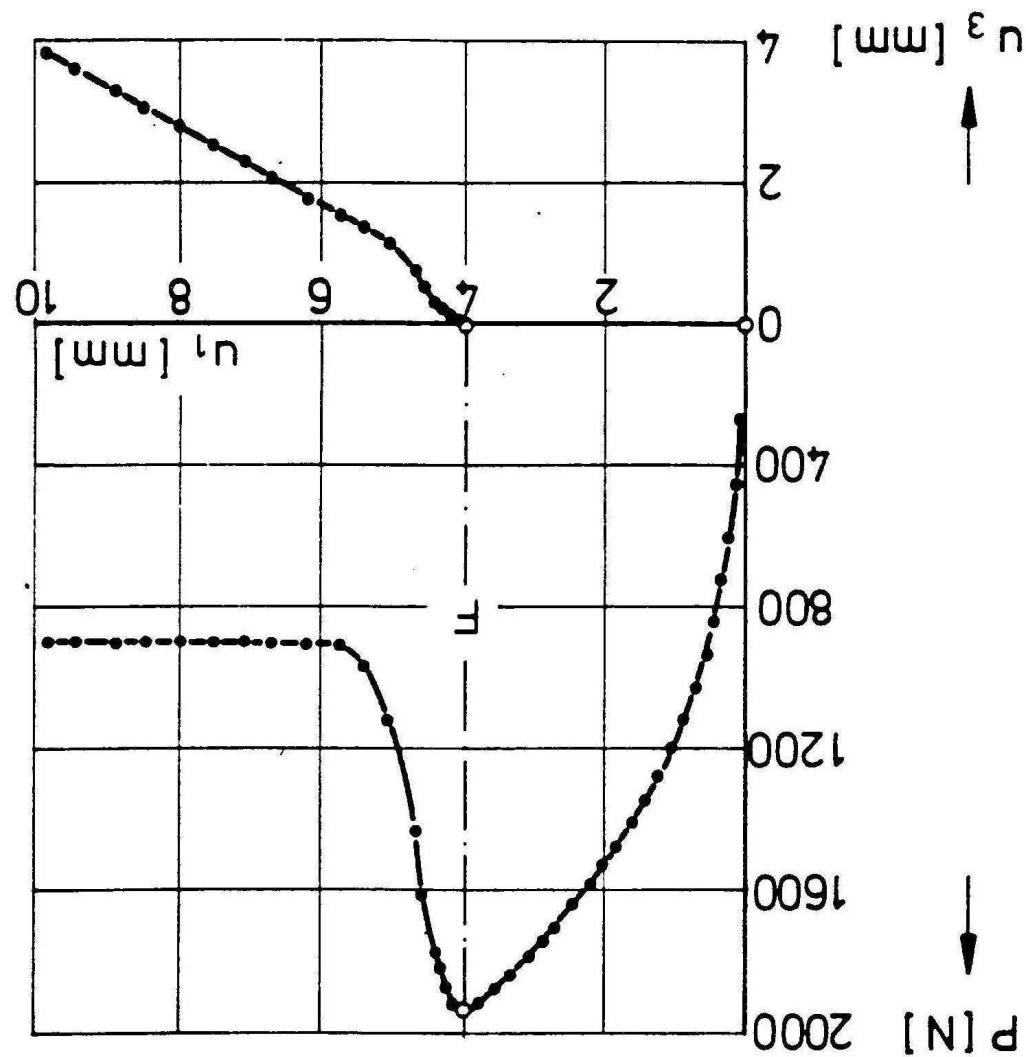
unable to predict depth of penetration and shock-structure-interaction effects on buried target

HDBT



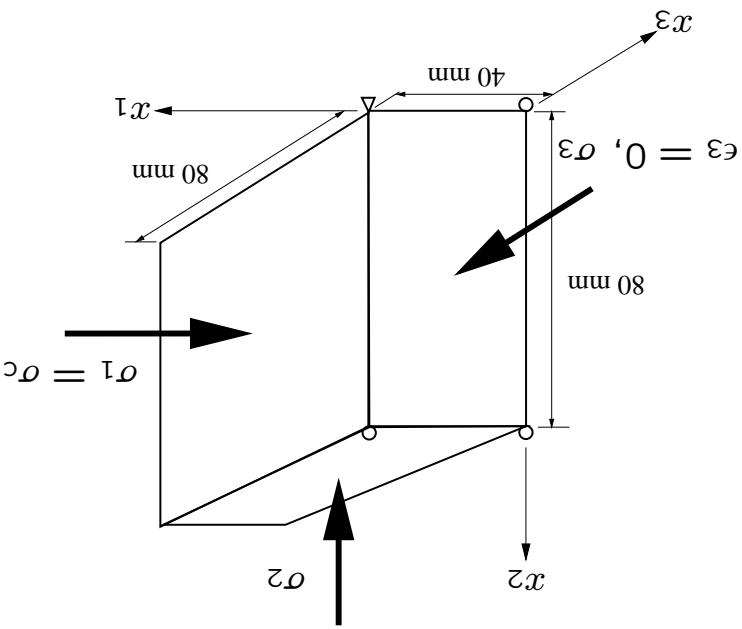
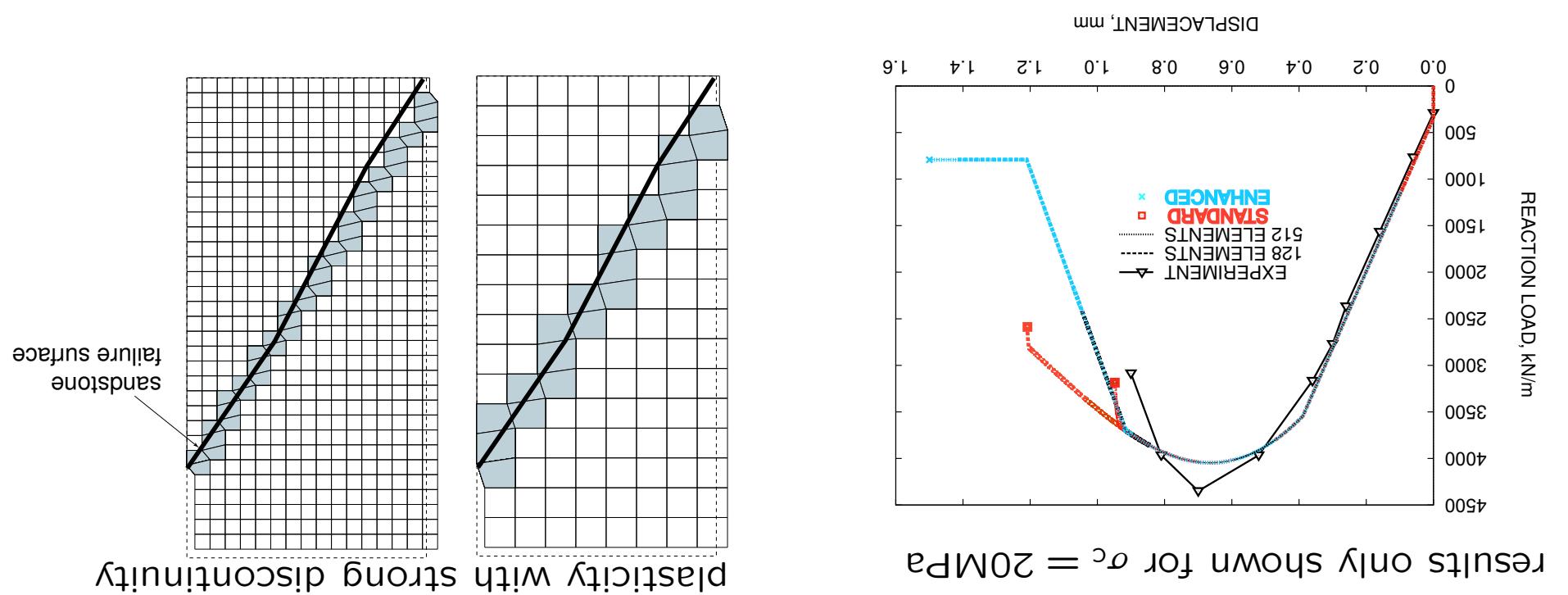
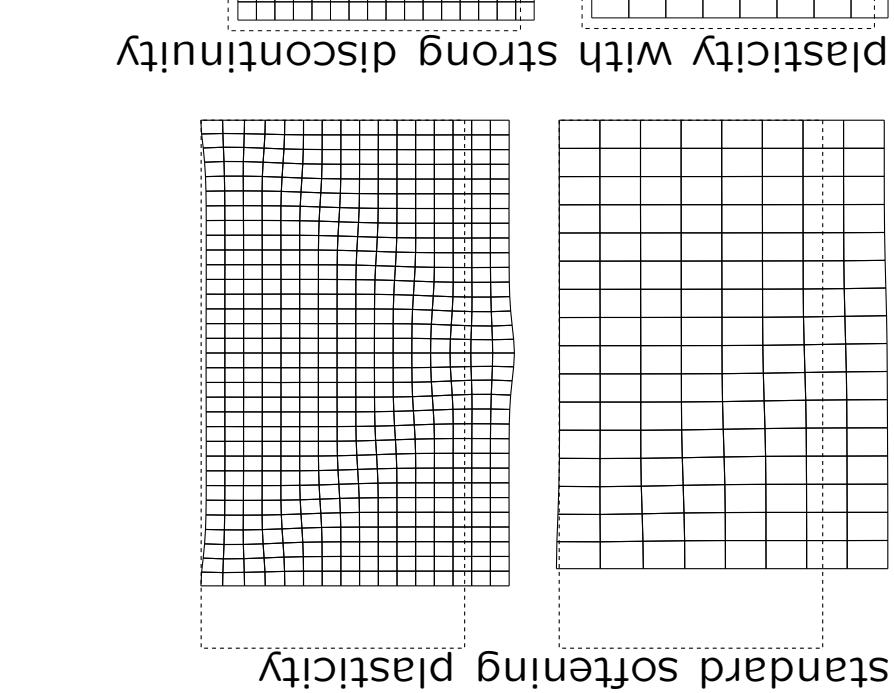
Tennessee Marble (D. Holcomb, 6117)

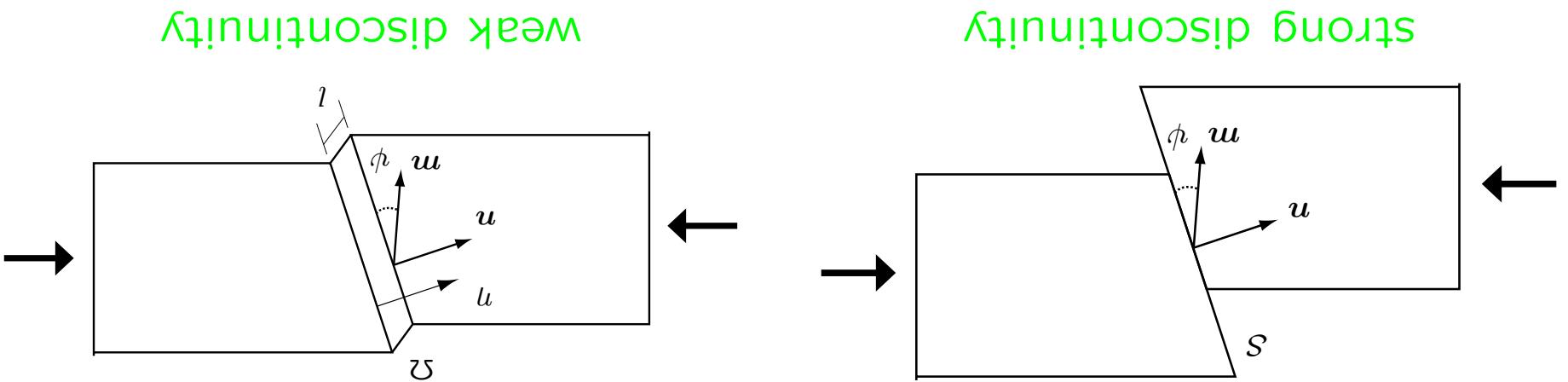
Technical Issue: onset of localization and post-localization response
 in geomaterials



Dense sand (Varoulakis et al. 1978, 1981)

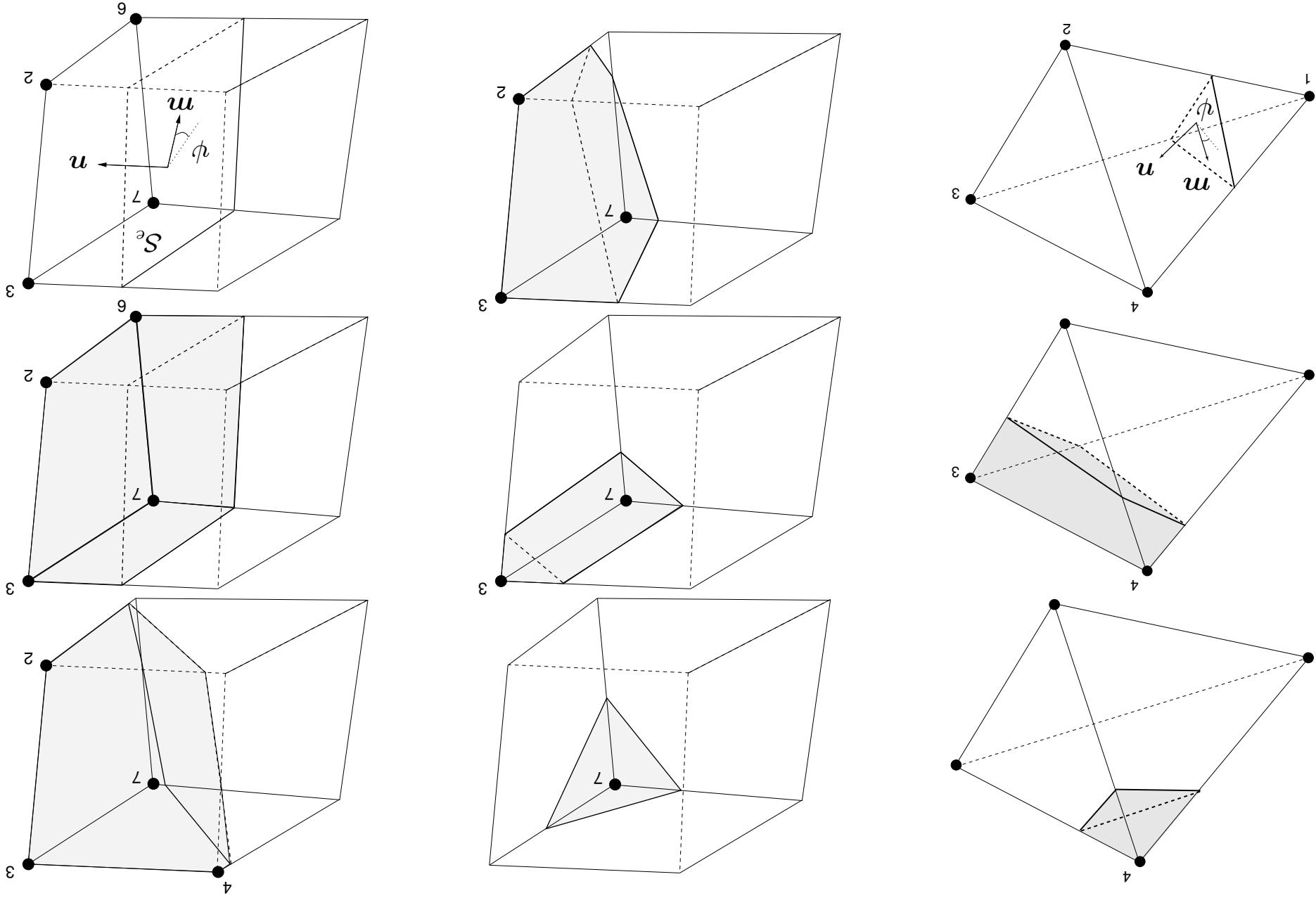
Technical Issues: onset of localization, post-localization response, mesh-dependence; Gosford sandstone (Ord et al. 1991, Regueiro & Borja 2001)





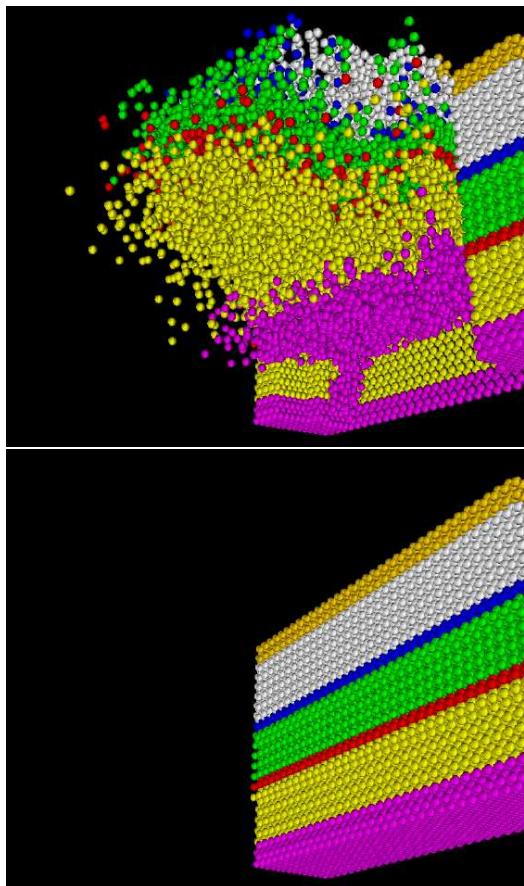
- this proposal: Strong and Weak Discontinuity Plasticity / Enhanced Strain Finite Element / RE-Mesh Contacting Free Surfaces / Coupled DEM/FEM for fragmentation / Coupled physics
- Cohesive Zone / Meshfree (Klein et al. 2001)
- Cohesive Zone / Finite Element Method (Xu & Needleman 1994, 1996)
- Linear Elastic Fracture Mechanics / X-FEM (Moes et al. 1999, 2002)

Bifurcated response models and their numerical implementation
based on a variational statement of equilibrium

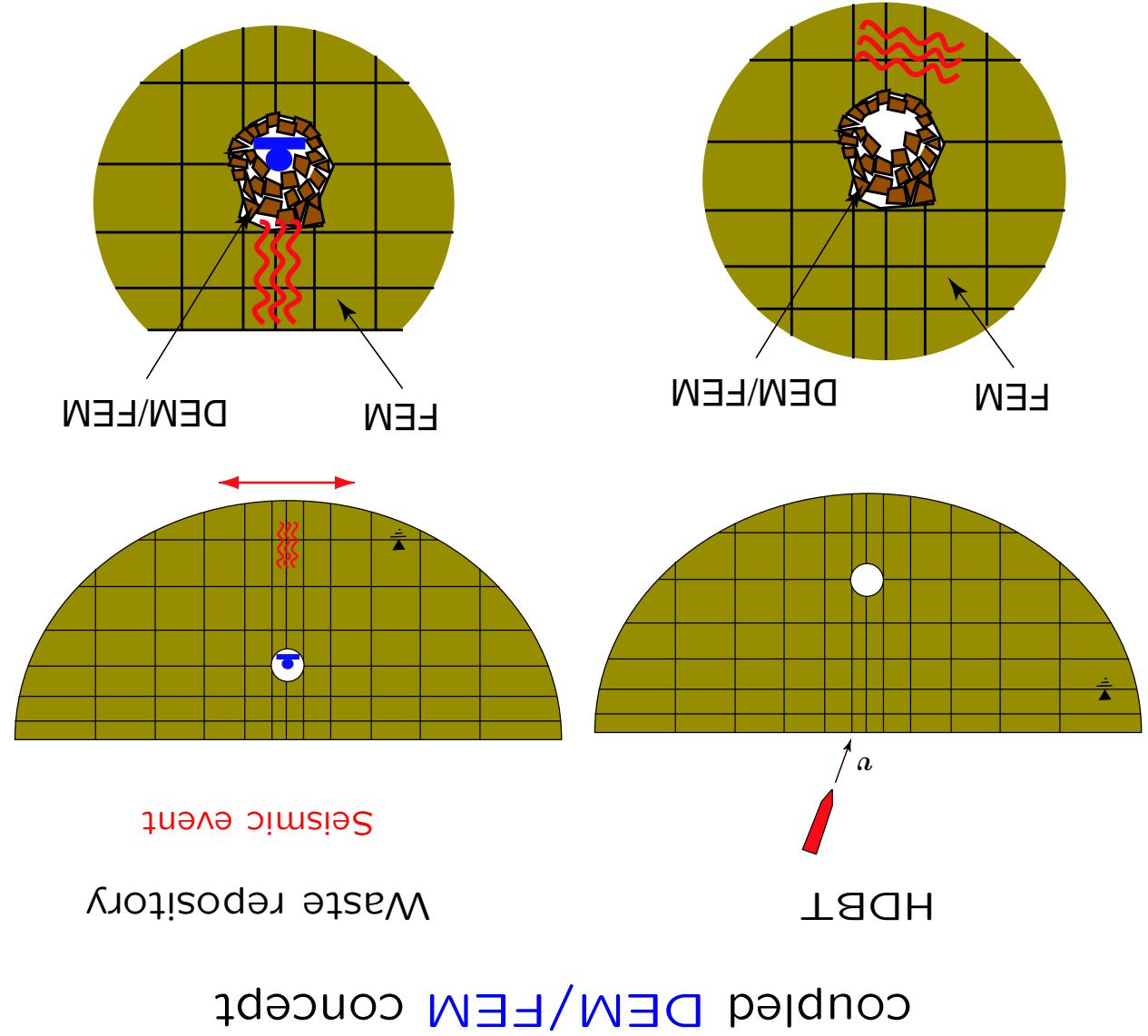


Regueiro et al. 2002

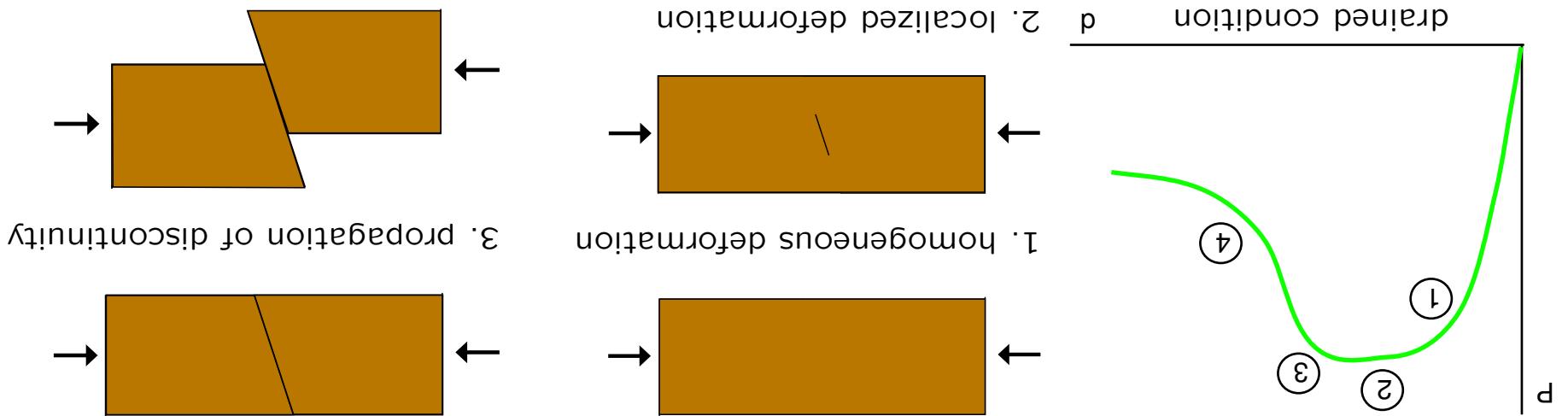
Enhanced Strain Hexahedral and Tetrahedral Finite Elements



Sandia DEM capability



- coupled solid-fluid-mechanical physics with strong and weak discontinuities
 - level sets to track geometry of evolving surface (or band) through mesh
 - adaptive re-mesh and contacting free surfaces for large slip and crack opening
 - 3D enhanced strain implementation (Hex and Tet elements)
 - geomaterial plasticity model with strong and weak discontinuity kinematics capturing transition to post-failure response
 - coupled DEM/FEM
 - coordinated experimental (6117), modeling, and computational effort
- Develop a new modeling capability:
4. post-localization/fragmentation



within coupled solid-fluid-mechanical physics

Summary: modeling transition from continuous rock to fragmented rock material