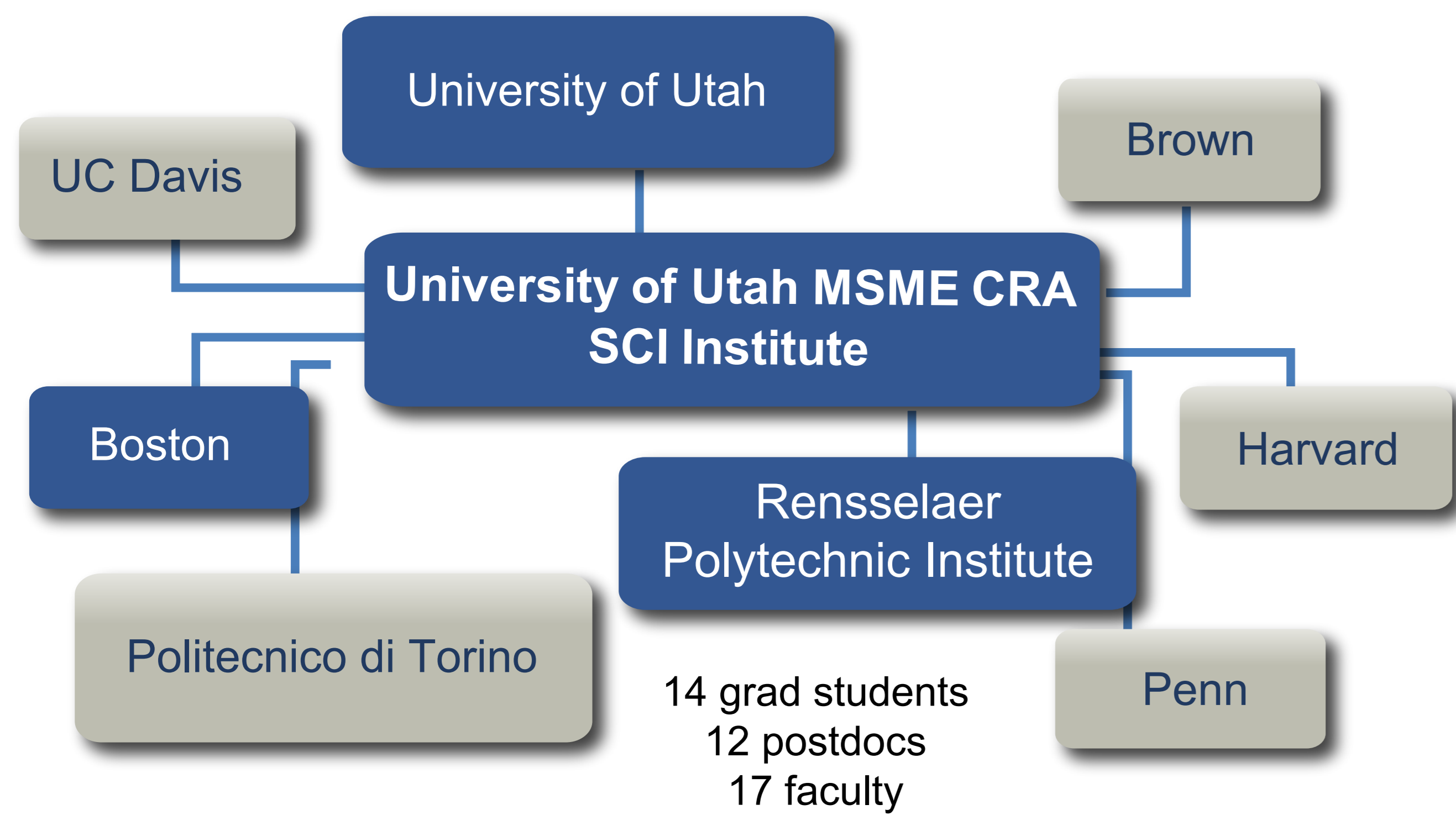


Army Collaborative Research Alliance (CRA): MSME :Electronic Materials by Design

Dr. Martin Berzins, Program Manager, Utah ; Meredith Reed, Alliance Manager, Army Research Lab.;
Utah Team - Dimitry Bedrov, Feng Liu, Mike Kirby, and Valeria Molinero



Greatest Strength: People



Future Capabilities

will rely on the ability to specifically design materials for continued Army Soldier superiority on the battlefield



Materials in Extreme Dynamic Environment (MEDE) Collaborative Research Alliance

Multiscale Modeling of Electronic Materials (MSME) Collaborative Research Alliance

Approach

Fundamental research with a "materials by design" approach to relate the response of structural and electronic materials across critical length & time scales to specific properties

Multiscale/Multidisciplinary Materials Design Approach

- Modeling and Simulation
- Bridging the Scales
- Uncertainty Quantification
- Synthesis and Processing
- Advanced Experimental Techniques
- Validation

Electronic and Protection Materials for U.S. Army Systems

Goal: Materials by design through validated multiscale modeling across relevant scales

Army Need

Multifunctional hybrid materials for Sensors, Devices, Power & Energy, Vehicle & Soldier Protection

Today

Materials Modeling

Future

Materials by Design

Approach

Focused long term research program enabled by:
Collaborative Research Alliances
Integrated with Crosscutting ARL Mission Programs

ARL Enterprise for Multiscale Research of Materials

Foundation for the Army!
Future of the Nation!

Future Payoffs

Materials by Design Capability for the Army to:

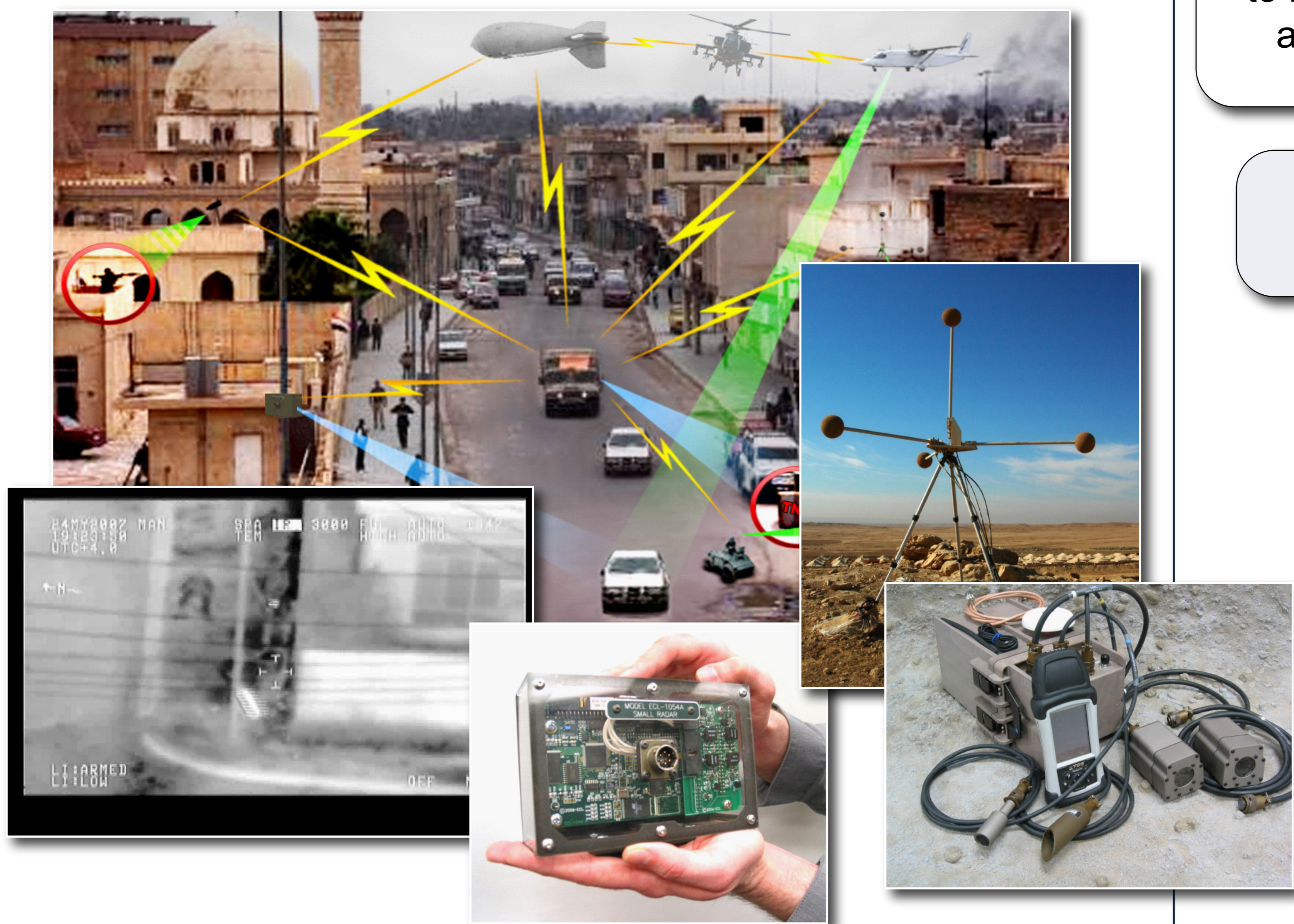
Provide an Enterprise for Innovation

Empower Unburden and Protect

Sensors, Devices, Power and Energy
3X in energy density
30% more efficient
30% longer lifetimes
Vehicle and Soldier Protection
1/3 savings in weight

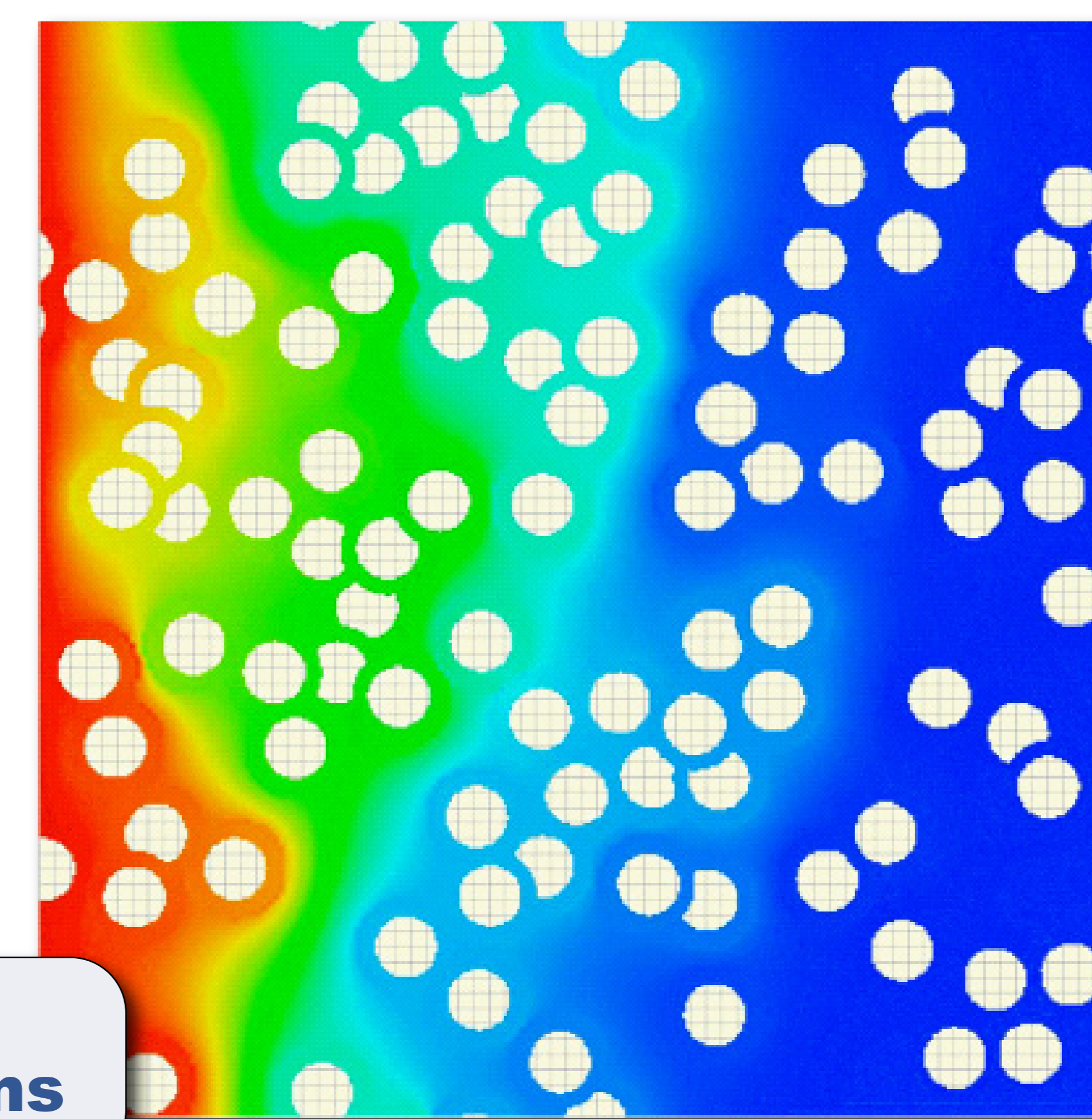
Application Areas

- Electrochemical Energy
- Hybrid Photonics
- Heterogeneous Metamorphic Electronics
- Crosscutting Themes



Extending Uintah to MPM-MD

Different physics on finest mesh – model for MD continuum coupling



Gas concentration in nanoparticle (white) Polymer membrane

Red = high conc.
Blue = low conc.

EXTEND Uintah code to multiscale calculation

Example Tensile test using MPM/ AMR with MD

