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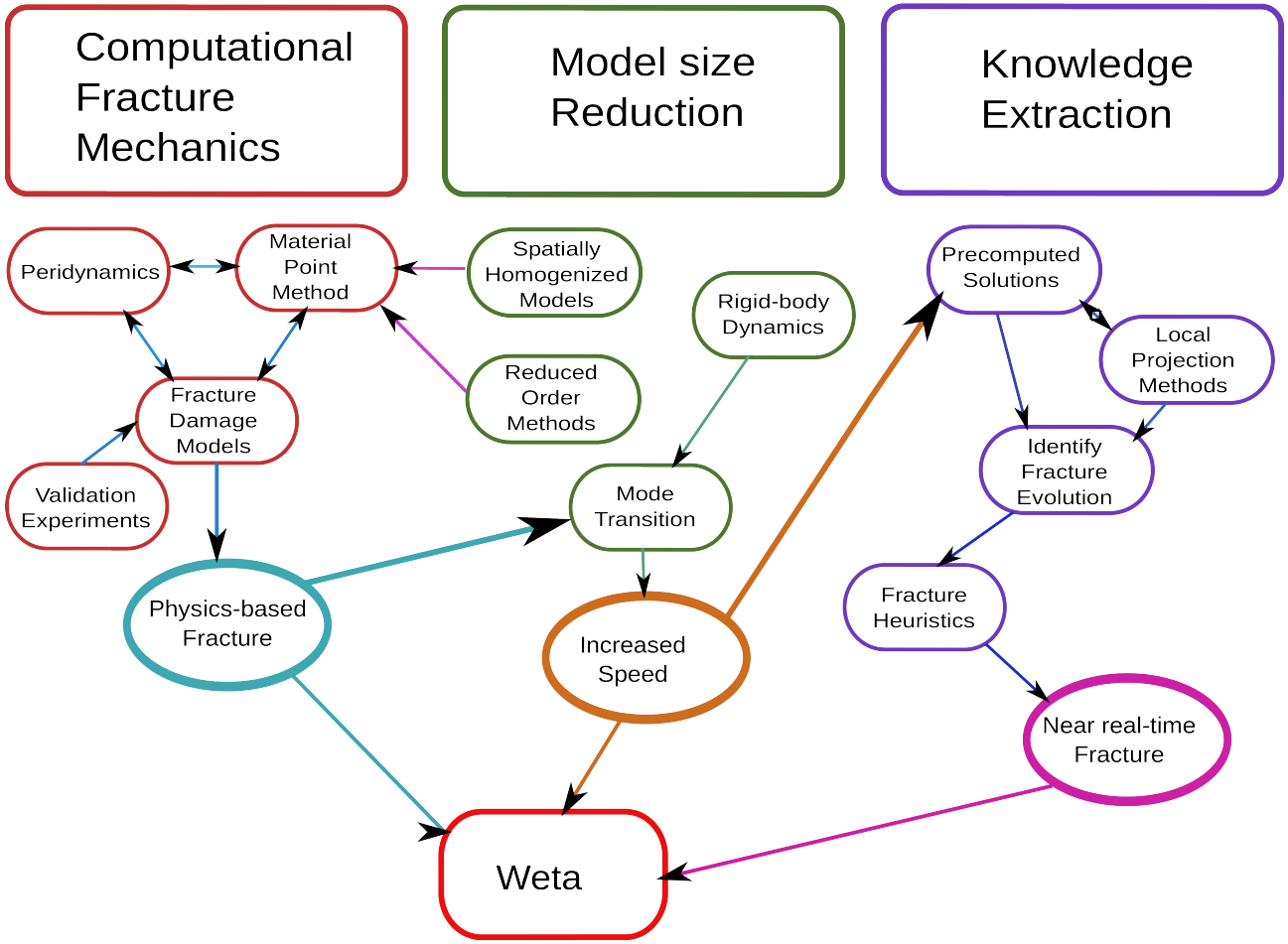
Fast Fracture Effects

Status Update

March 2013

The proposed plan



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Coarse-grained milestones (+2 months)

- 1.1.1 Implementation of peridynamics (01 May 2013)
- 1.1.2 Development of material models (01 April 2014)
- 1.1.3 Transition - MPM and peridynamics (01 July 2014)

- 1.2.1 Development of homogenized models (10 Jan 2014)
- 1.2.2 Implementation of rigid body dynamics (01 July 2013)
- 1.2.3 Transition - rigid and deformable (01 June 2014)

Finer-grained milestones

Fracture mechanics

- Software infrastructure
- Material models for clay, sand, wood
- Standalone peridynamics implementation
- Parallel MPM/peridynamics design

Target date: 30 April 2013

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Finer-grained milestones

Model-order reduction

Rigid Body Dynamics Integration – Particle based rigid bodies

- Standalone multi-material serial rigid MPM (Python)
- Develop contact handling for rigid/rigid and deformable/rigid
- Develop tie constraints to create hybrid rigid/deformable bodies

Target date: 30 April 2013

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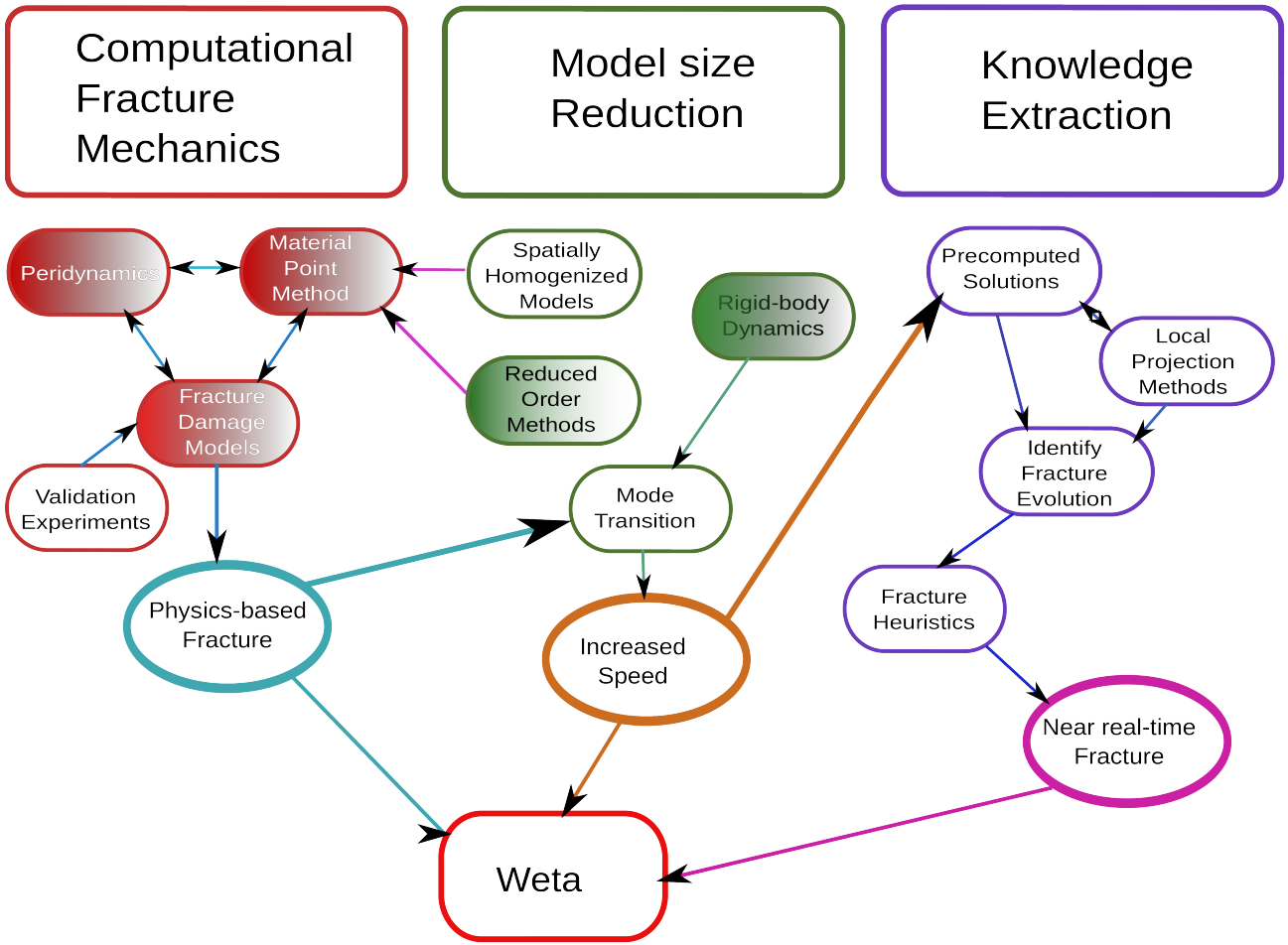
Current status



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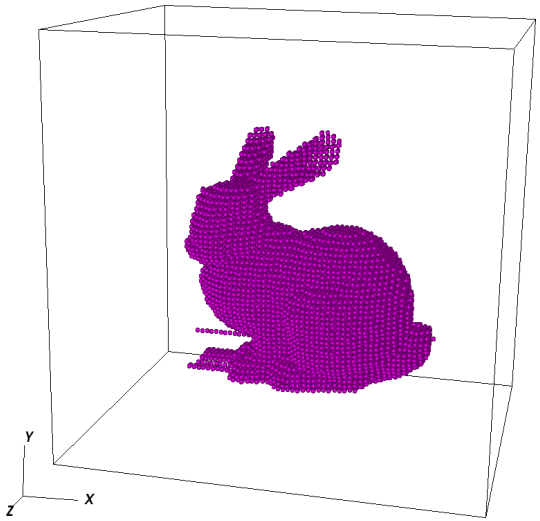
Infrastructure

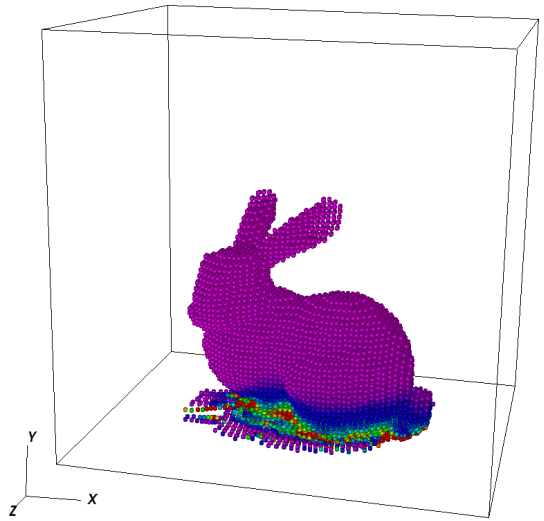
- Using Weta git repository and Callaghan Innovation wiki
- UINTAH framework simplified and renamed Vaango
- Build simplified with cmake
- EMUNE 2D peridynamics code added
- Peridigm 3D peridynamics code added
- Regression testing ?

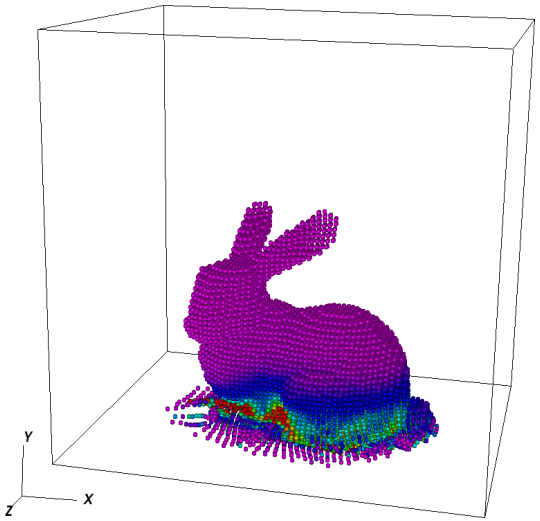
Material point method and models

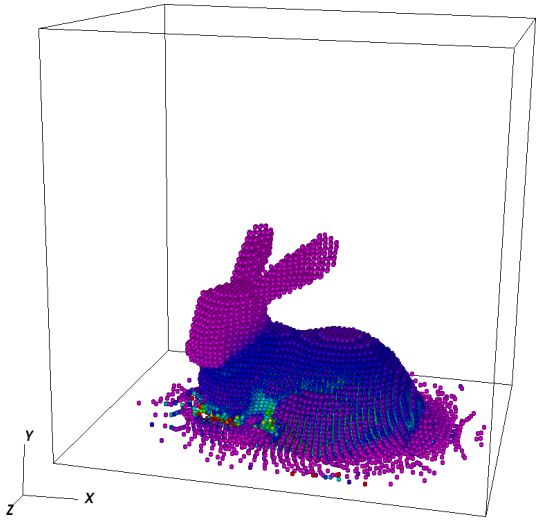
- Deformation gradient algorithm now consistent for all materials
- Damage evolution model infrastructure now available for all materials
- CAM-Clay soil model added

CAM-clay bunny









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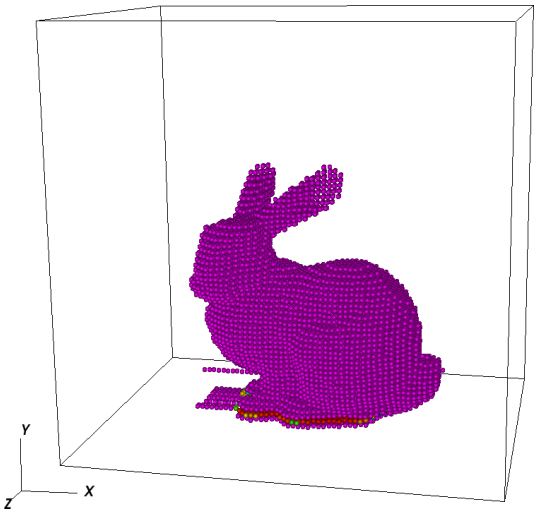
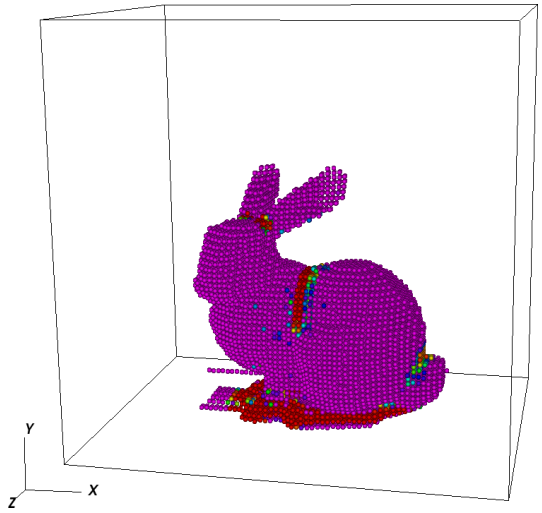
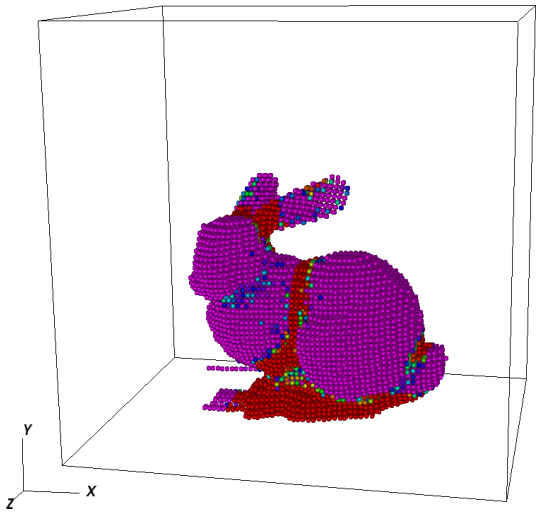
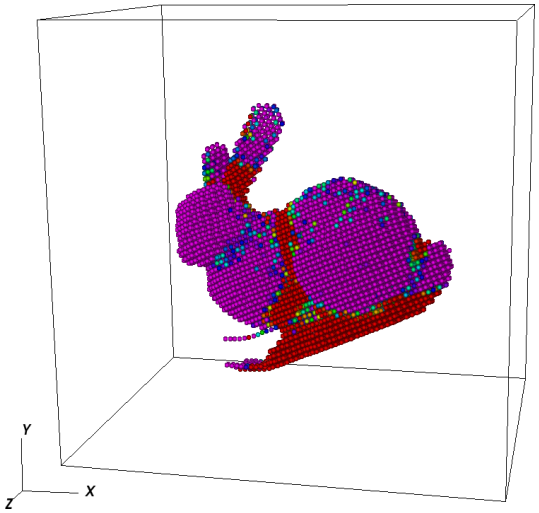
Brittle damage bunny









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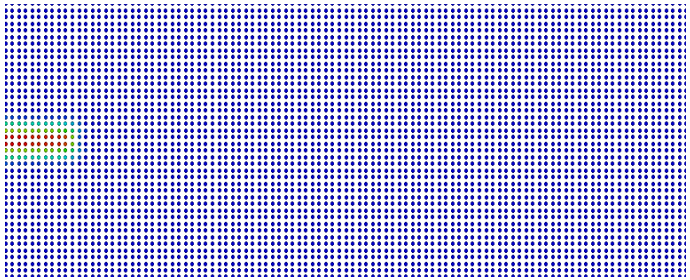
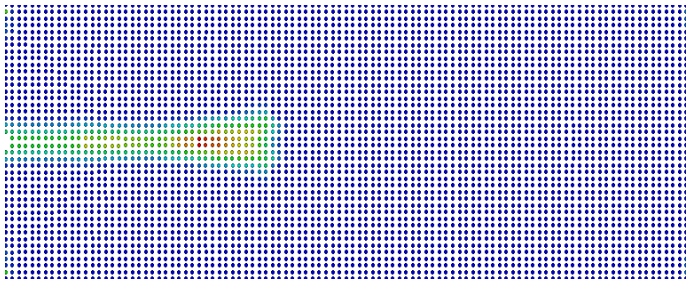
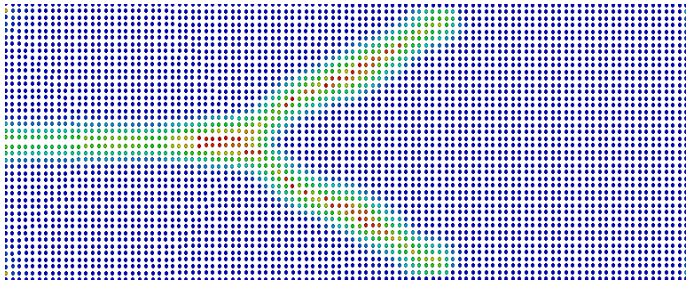
Peridynamics

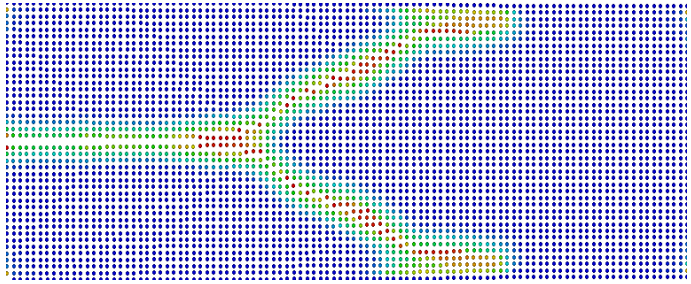
- Serial multi-material peridynamics code in development
- Parallel multi-material peridynamics code design under consideration

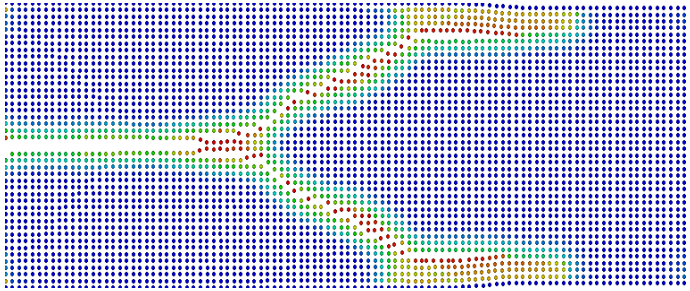
EMUNE 2D crack in composite

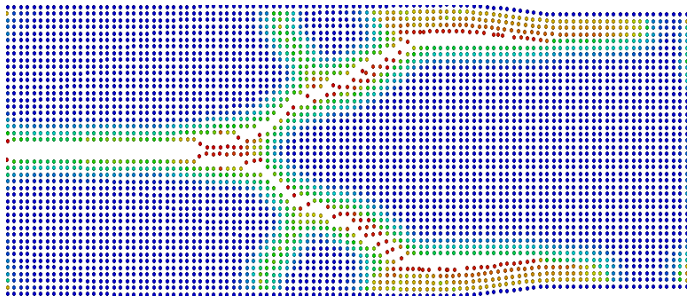












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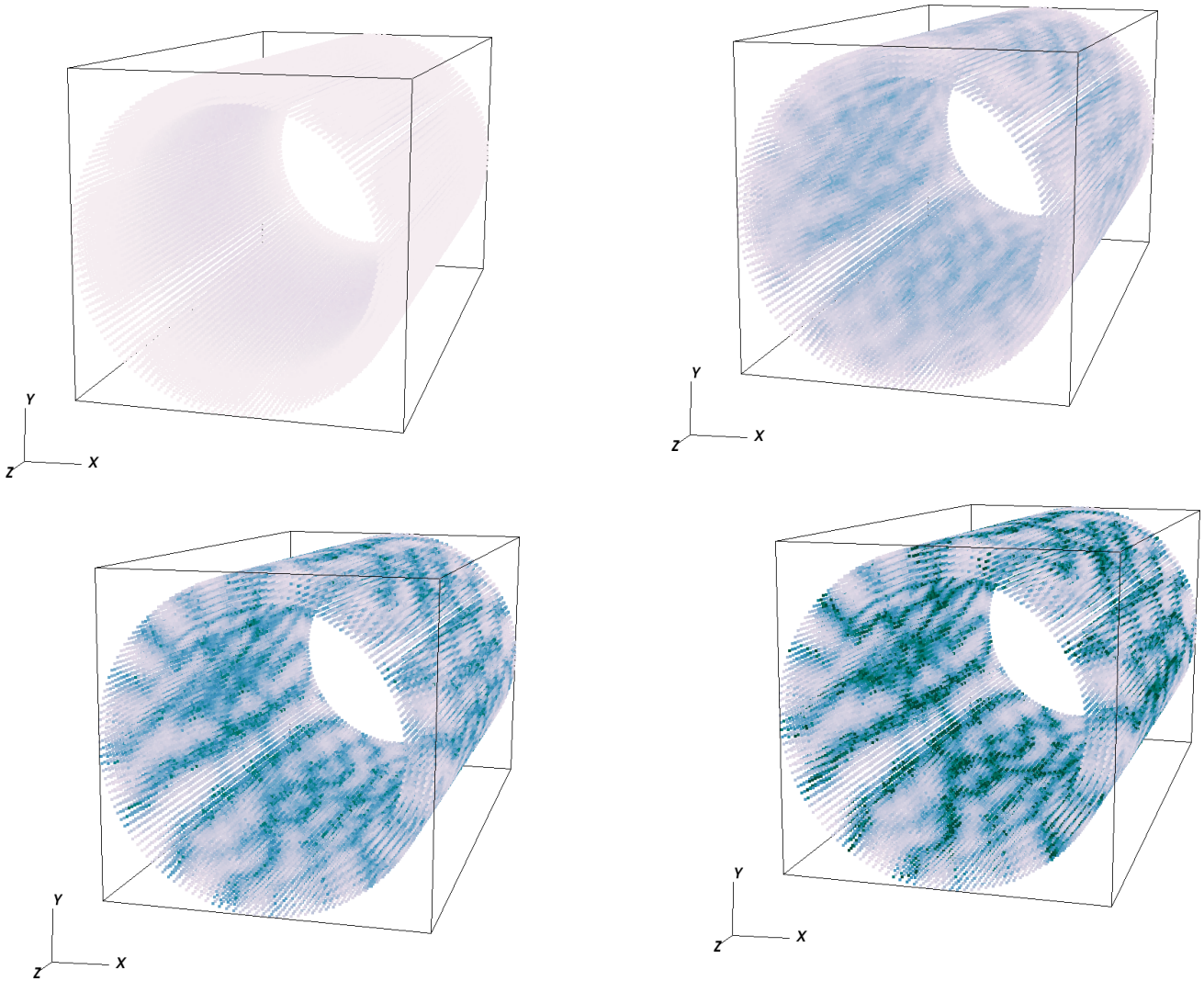
PERIDIGM brittle damage



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Rigid body dynamics

- Bullet rigid body dynamics explored
- A rigid MPM code is being developed in Python

Model order reduction

- Intern hired to explore various approaches

Near-term outlook

- PhD student will start on computational fracture in April 2013
- ME students will start working on model order reduction problems in July 2013
- Kumar/Florin will start exploring wood material models in May 2013
- Bryan/Kumar will have a better idea about rigid body algorithms by June 2013
- Geoff will be able to start experiments in June/July 2013
- Peridynamics code design will need significant Weta inputs

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Questions?

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