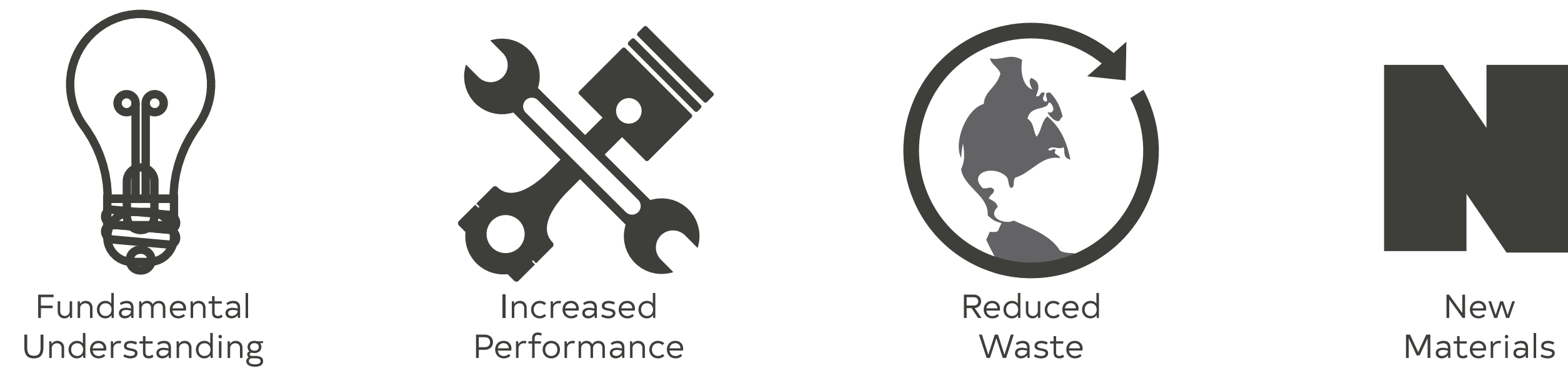


## Why Study Single Particles?



Many macroscopic materials are made (or can only be made) with small particles. Therefore, a fundamental understanding of their microstructures and behavior when compacted is necessary to advance our models and industry.

## My Methods

- Visually characterize a powder
- Identify powder with high particle sphericity
- Place sample on test plate
- Prepare particle
- Run breakage and load-unload tests
- Gather data

### Challenges

- Finding spherical particles
- Isolating particle on compression plate
- Focusing side camera for image and video acquisition

### MCT Capabilities

- Particle diameter: 1-500  $\mu\text{m}$
- Displacement range: 0-100  $\mu\text{m}$
- Displacement increment: 1 nm
- Load range: 0.05-4.9 N

### Side Camera

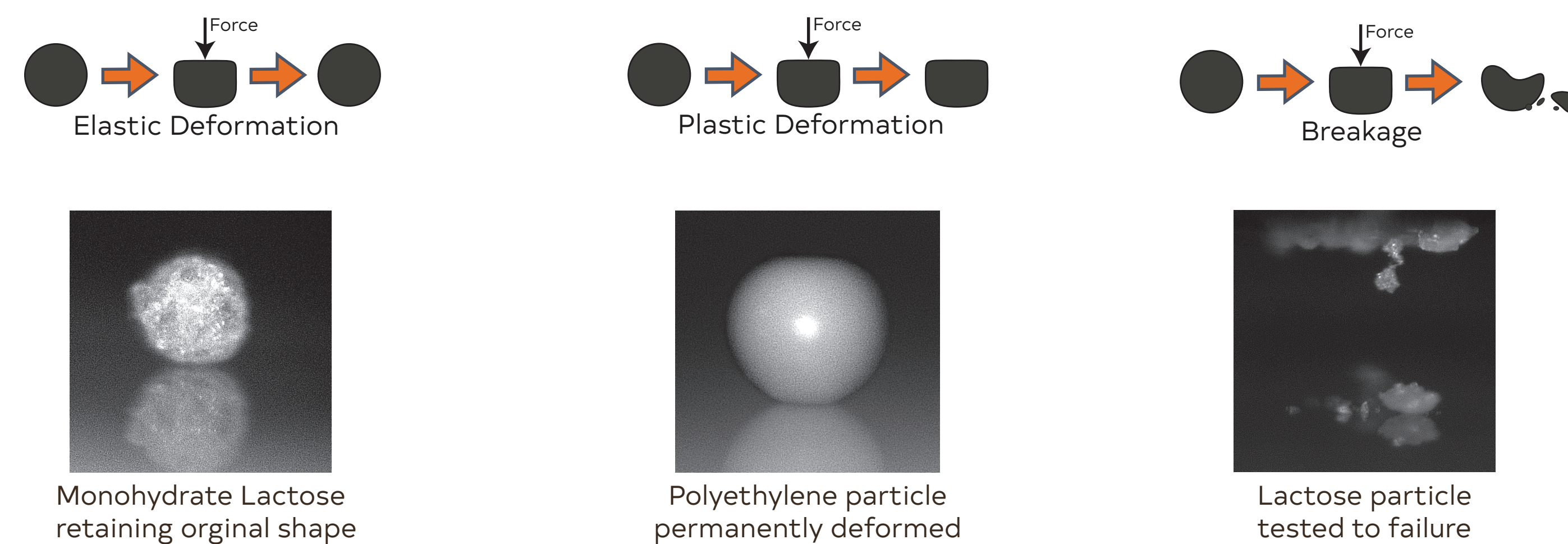
- Records particle deformation under diametrical compression



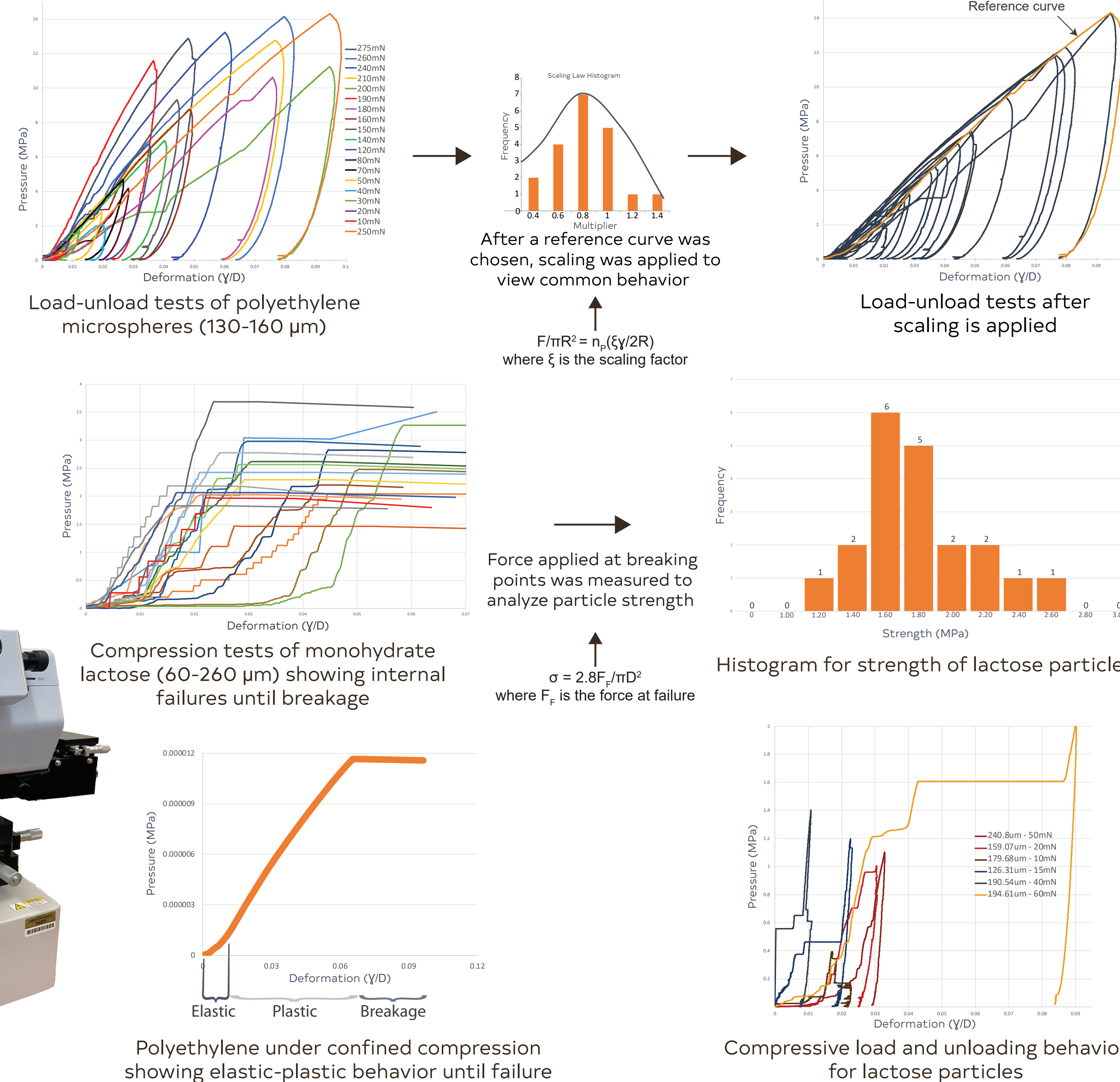
Shimadzu micro-compression tester

## What Was Measured

- Monohydrate lactose and polyethylene particles
- Particle scale mechanical properties
- Focus on 60-250  $\mu\text{m}$  particles



## Results

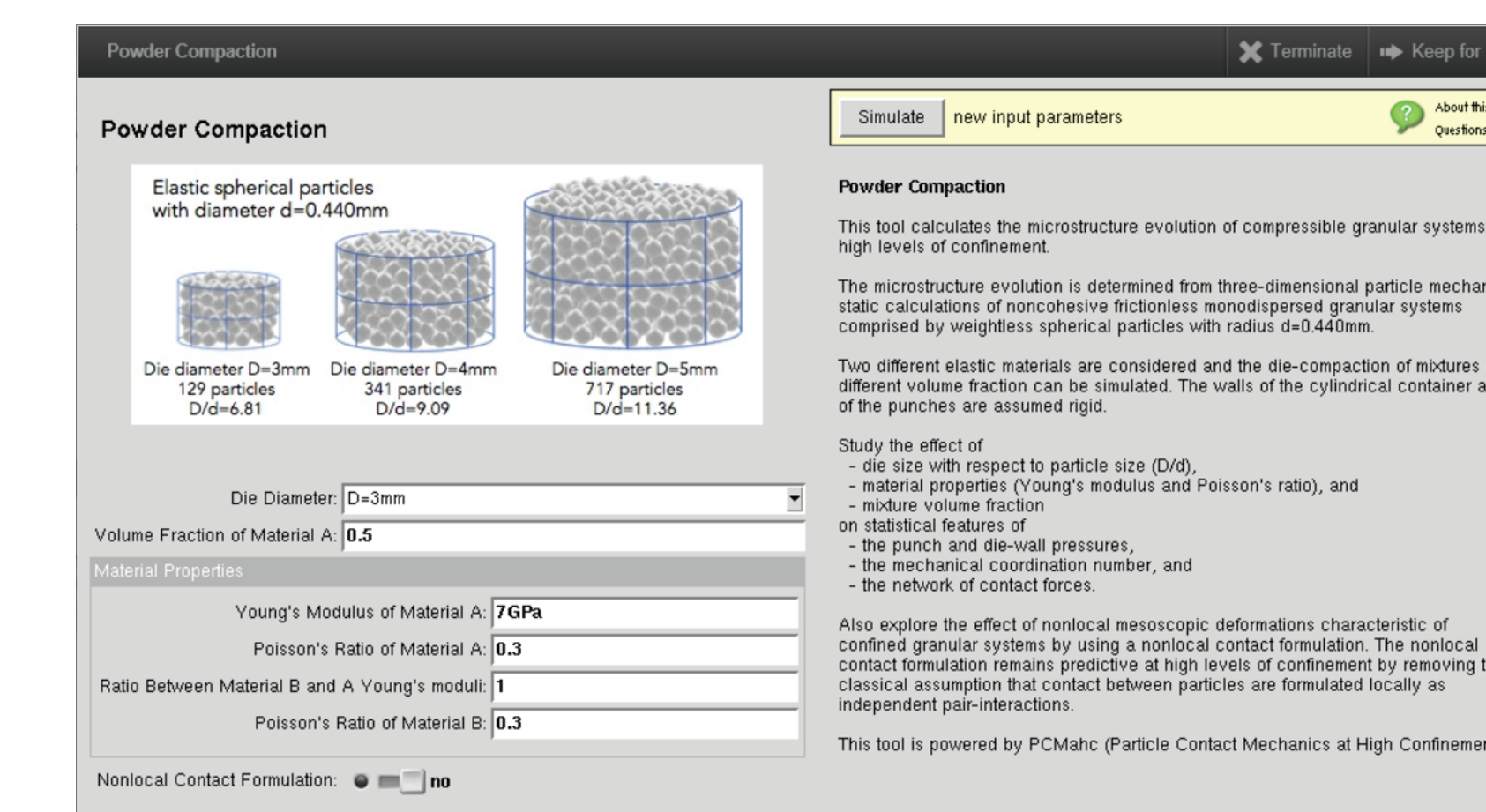


## What did the study find?

- Lactose and polyethylene exhibit brittle failures
- Polyethylene exhibits plastic loading and elastic unloading
- Lactose unloads elastically at failure points
- Max lactose particle strength centers around 1.6-1.8 MPa

## What's next?

- Collaborate with NanoHUB particle and powder compaction tools research group.
- Use results found to verify computational tool's calculations
- Characterize new materials for further study
- Create methodology to standardize characterization



Screenshot of current compaction tool

<https://nanohub.org/resources/gscmpaction>

## References

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- [2] Antonyuk, S., Tomas, J., Heinrich, S. & Mörl, L. Breakage behaviour of spherical granulates by compression. *Chemical Engineering Science* 60, 4031-4044 (2005).
- [3] Shimadzu Corporation. MCT-500 Series User Manual. Shimadzu Corporation. Nd.

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