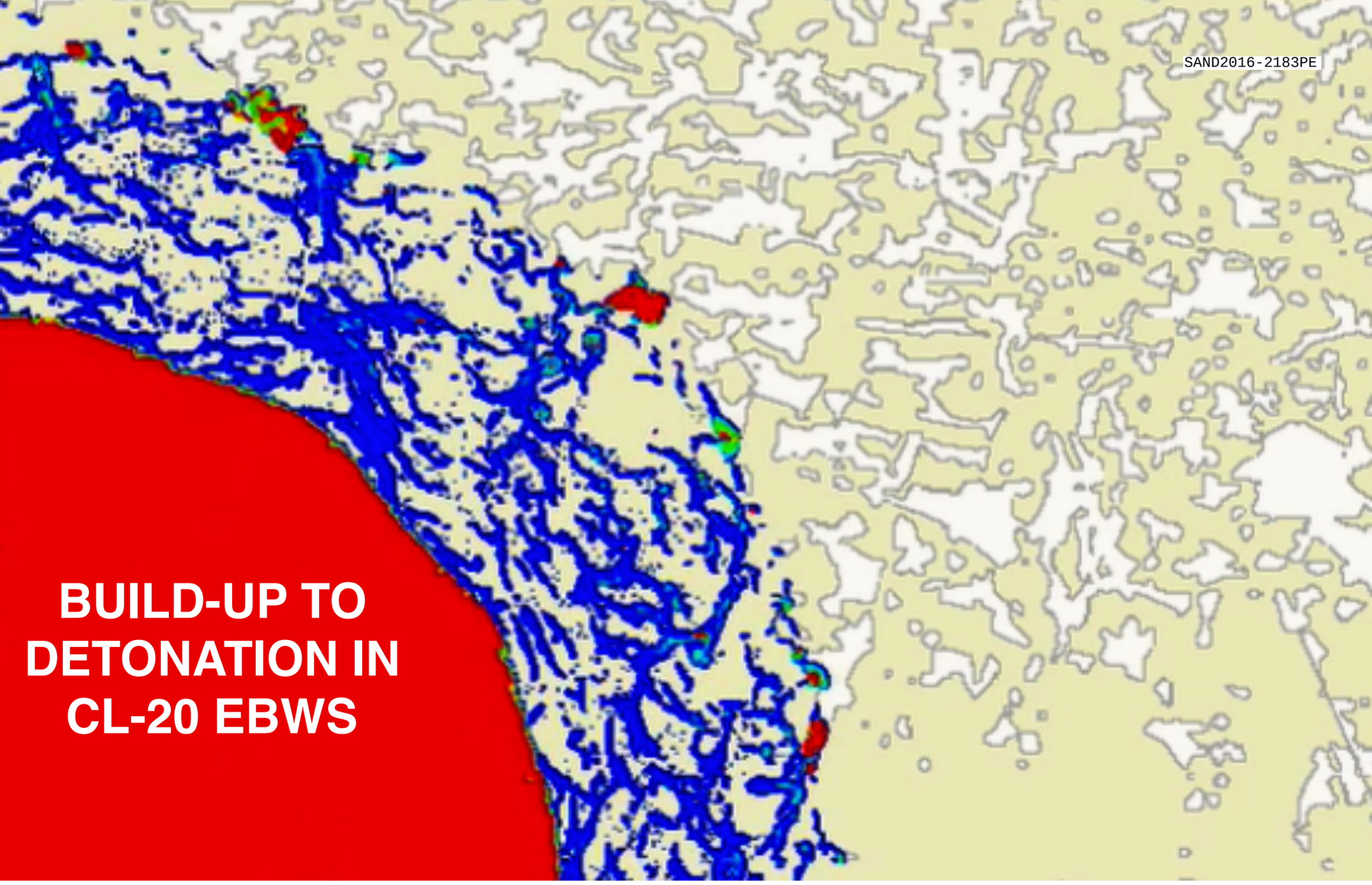


BUILD-UP TO DETONATION IN CL-20 EBWS

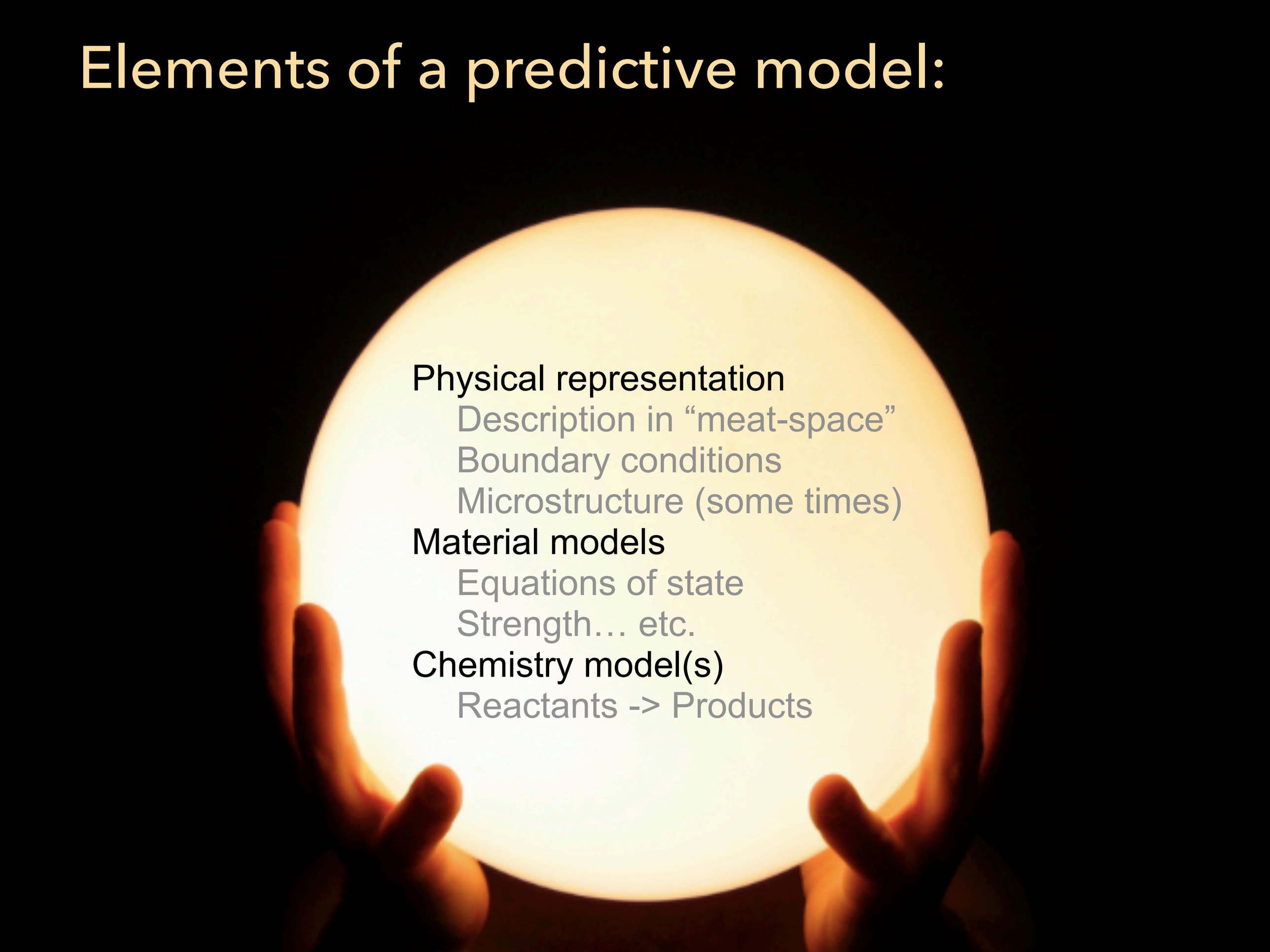
RYAN R. WIXOM

Joseph Olles, Todd Reedy, Barry Ritchey, Pat Ball, Chris Colburn

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Is a truly predictive EBW/Detonator model in our future?

Elements of a predictive model:

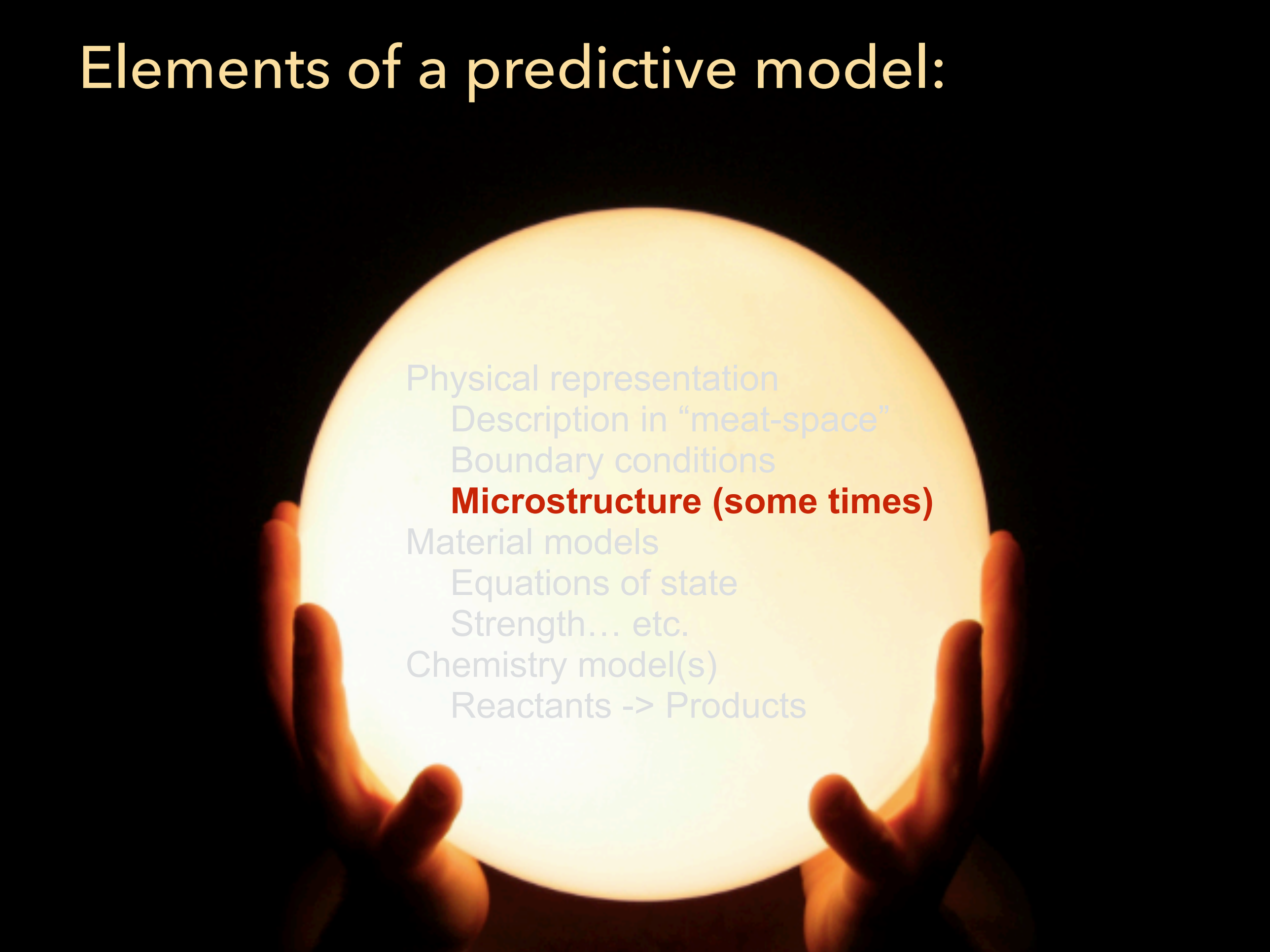


Physical representation
- Description in “meat-space”
- Boundary conditions
- Microstructure (some times)

Material models
- Equations of state
- Strength… etc.

Chemistry model(s)
- Reactants -> Products

Elements of a predictive model:



Physical representation
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- **Microstructure (some times)**

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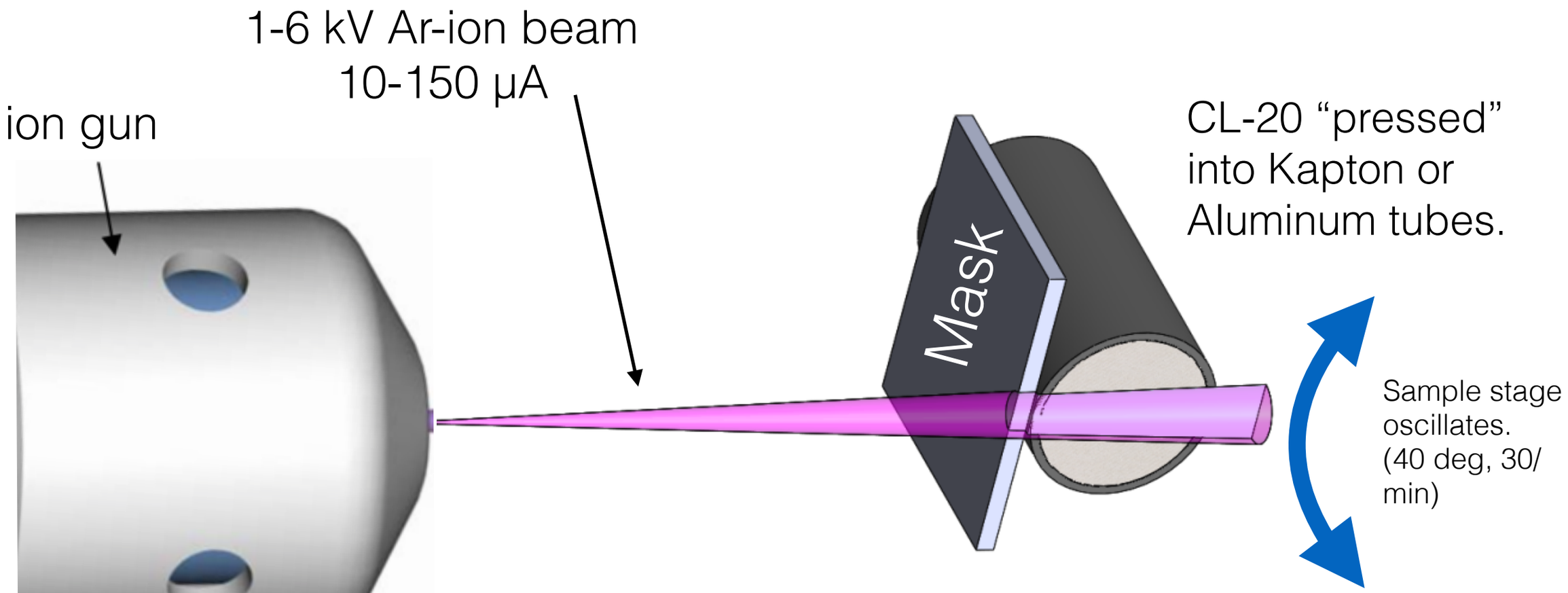
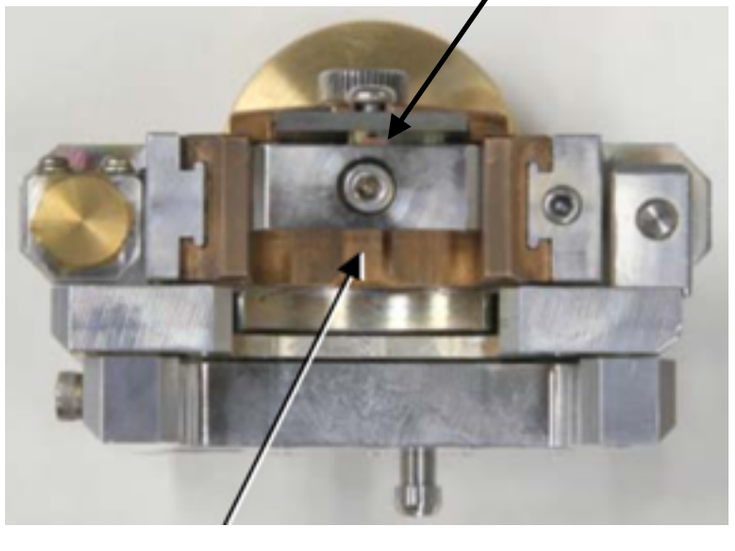
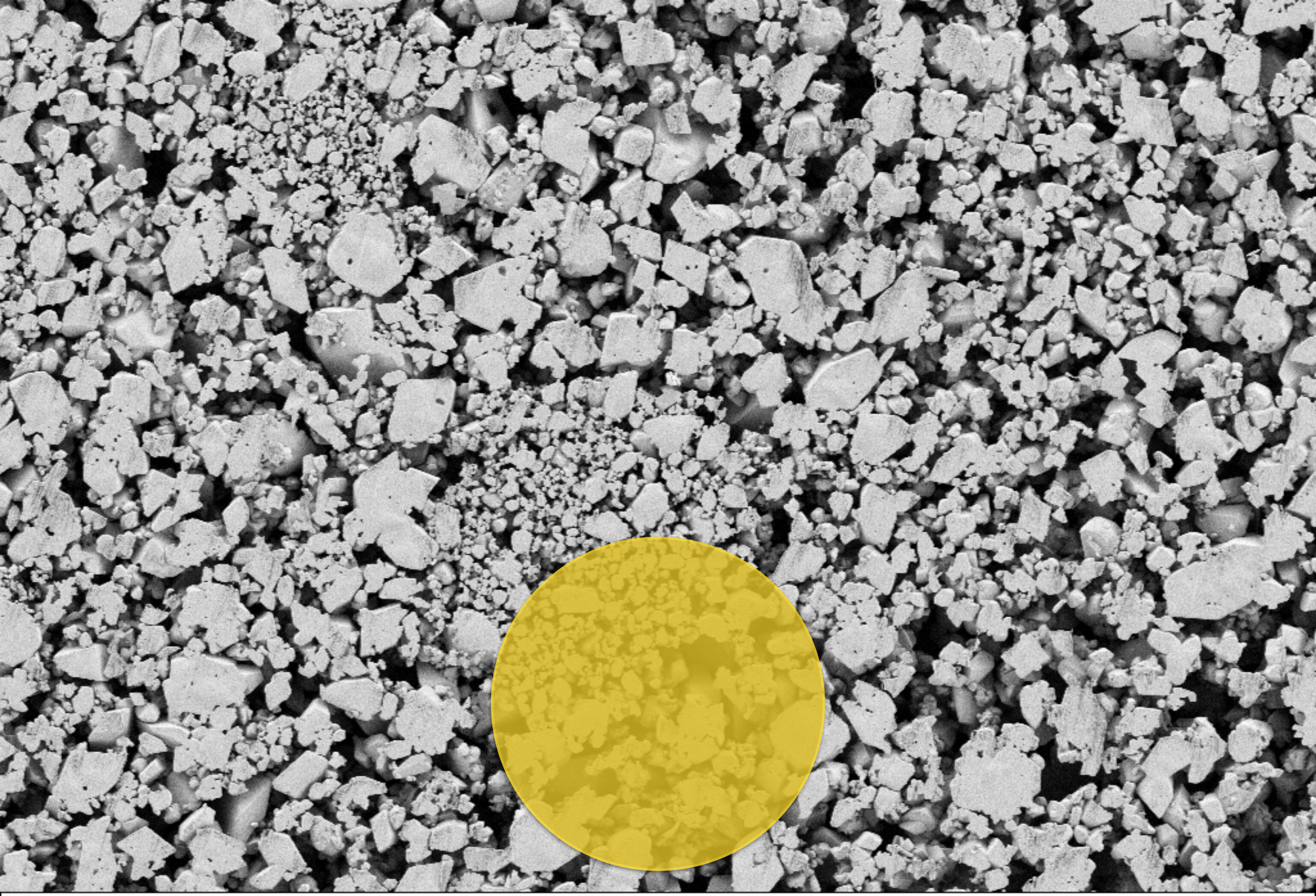
- Reactants -> Products

Microstructure of low-density samples: It's Tricky.





Hitachi IM4000



CL-20-05 ~300µm down
Ion Polished
File= 05_100um-300down.tif

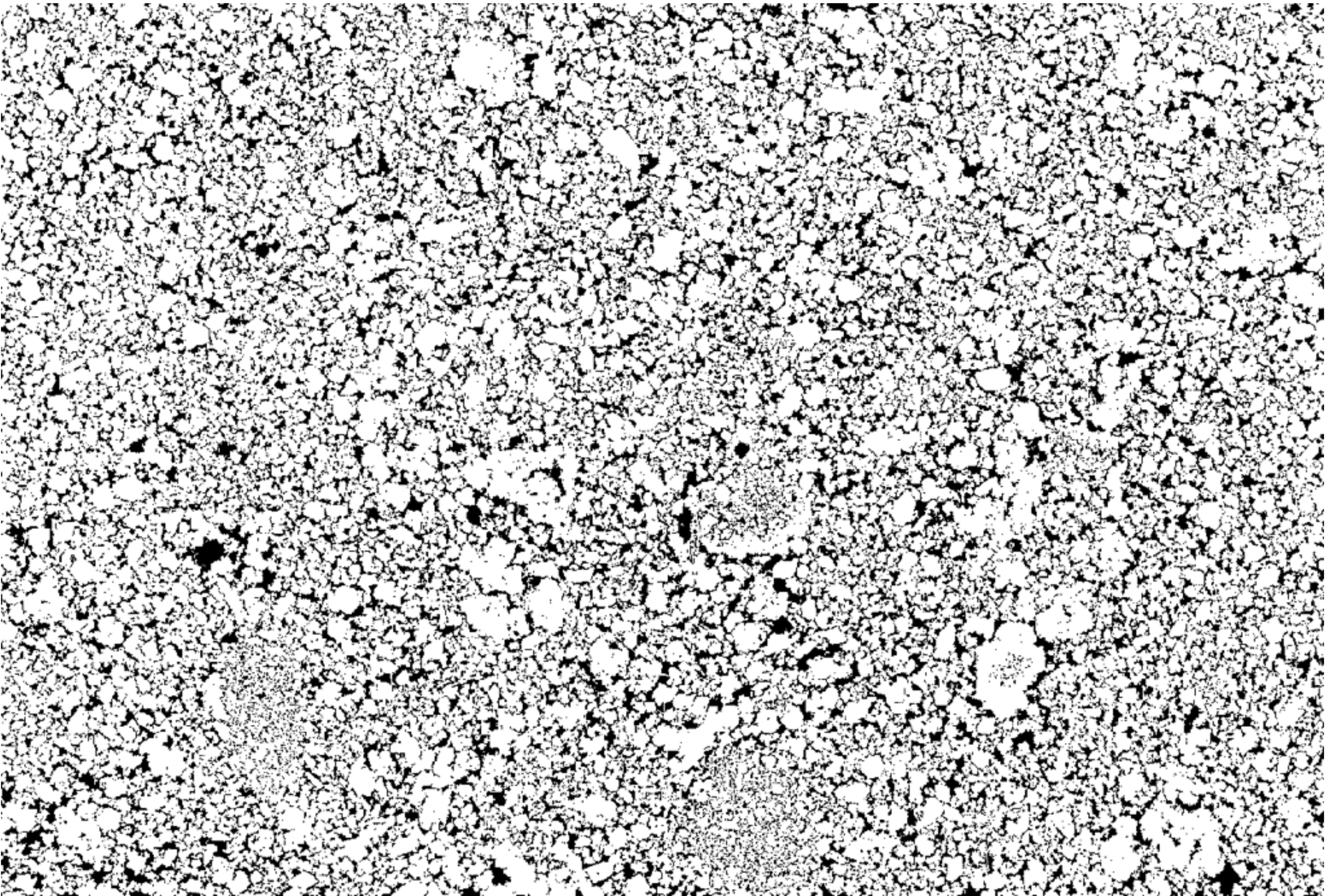
10 µm*

Mag = 1.14 K X
Width = 100.0 µm
EHT = 1.20 kV

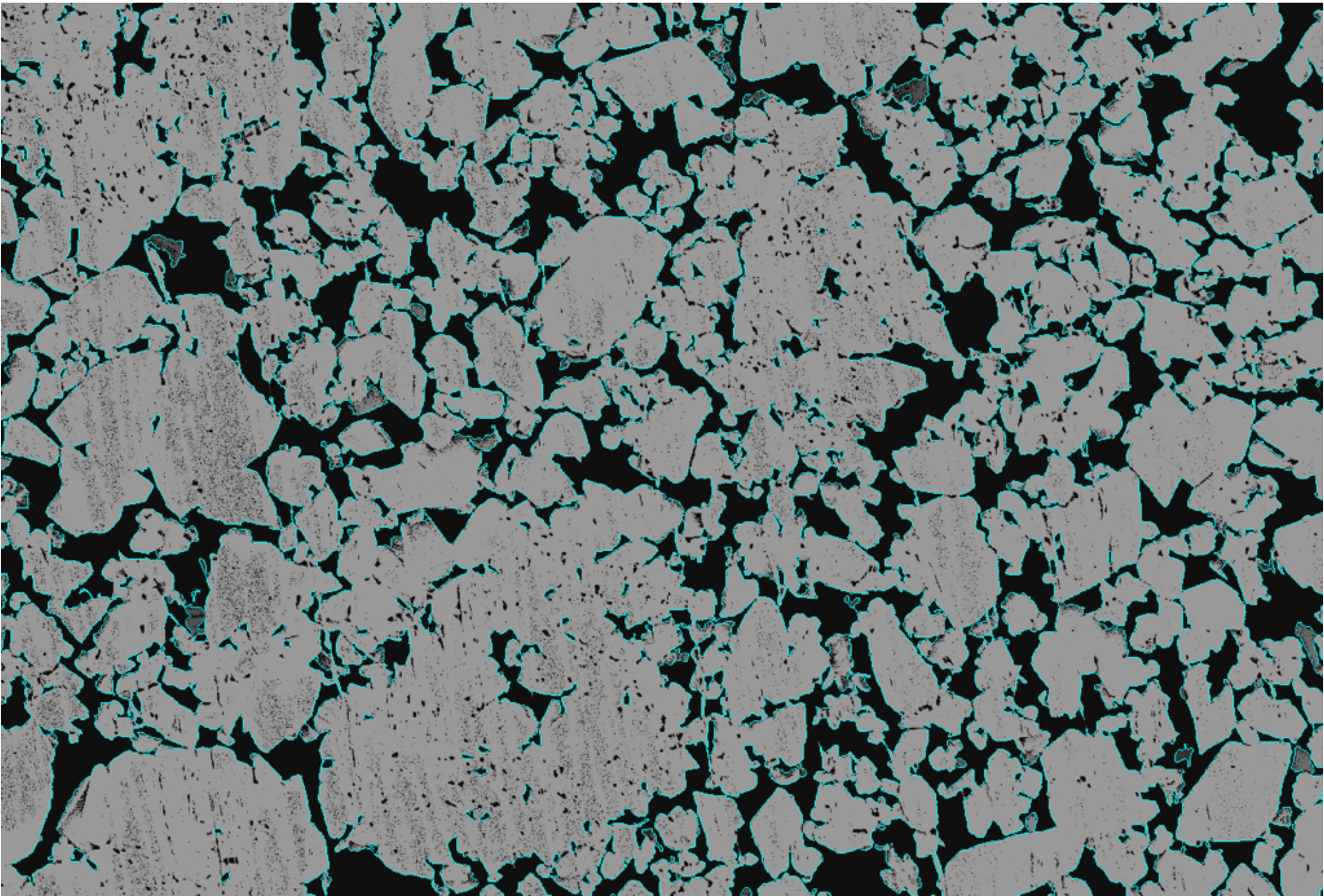
WD = 3.5 mm
Stage at T = 0.0 °
Signal A = SE2

Date :27 Aug 2014
Ref Mag > Polaroid 545
Chamber = 1.84e-003 Pa

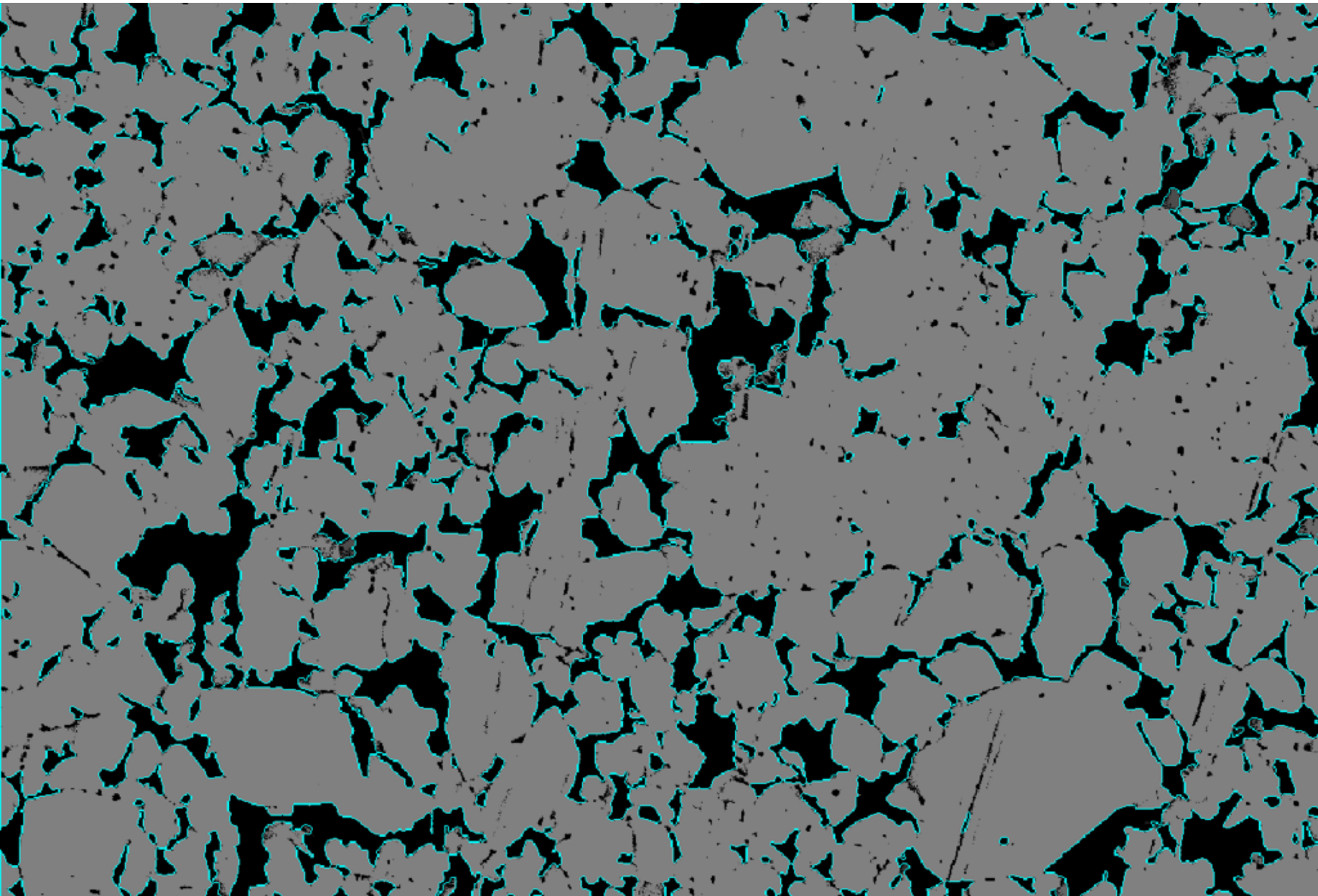
400 µm FOV, 10-20nm pxls, ~76.98 % TMD, ~1.0 m²/g SSA



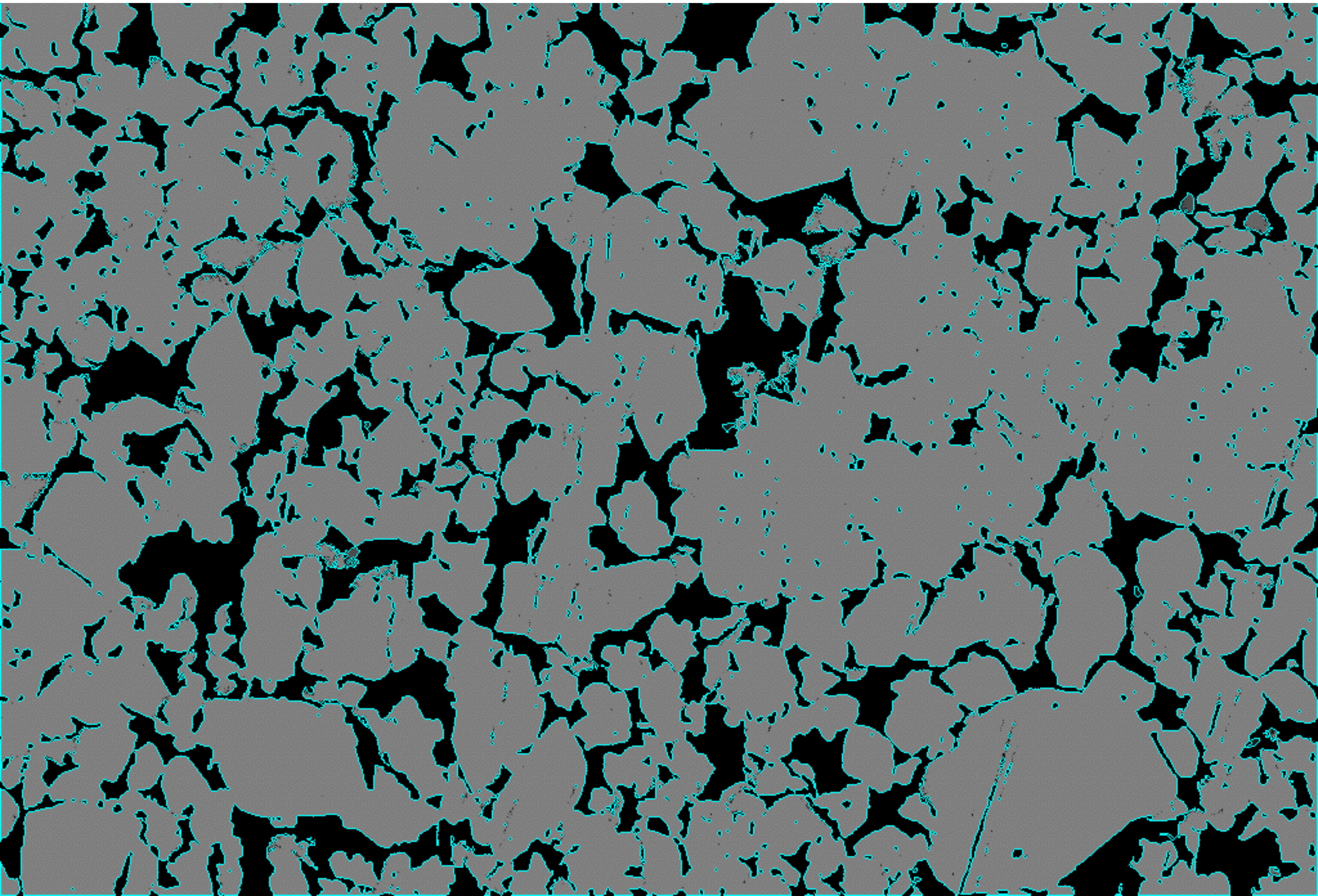
Need to quantify error in density and SSA



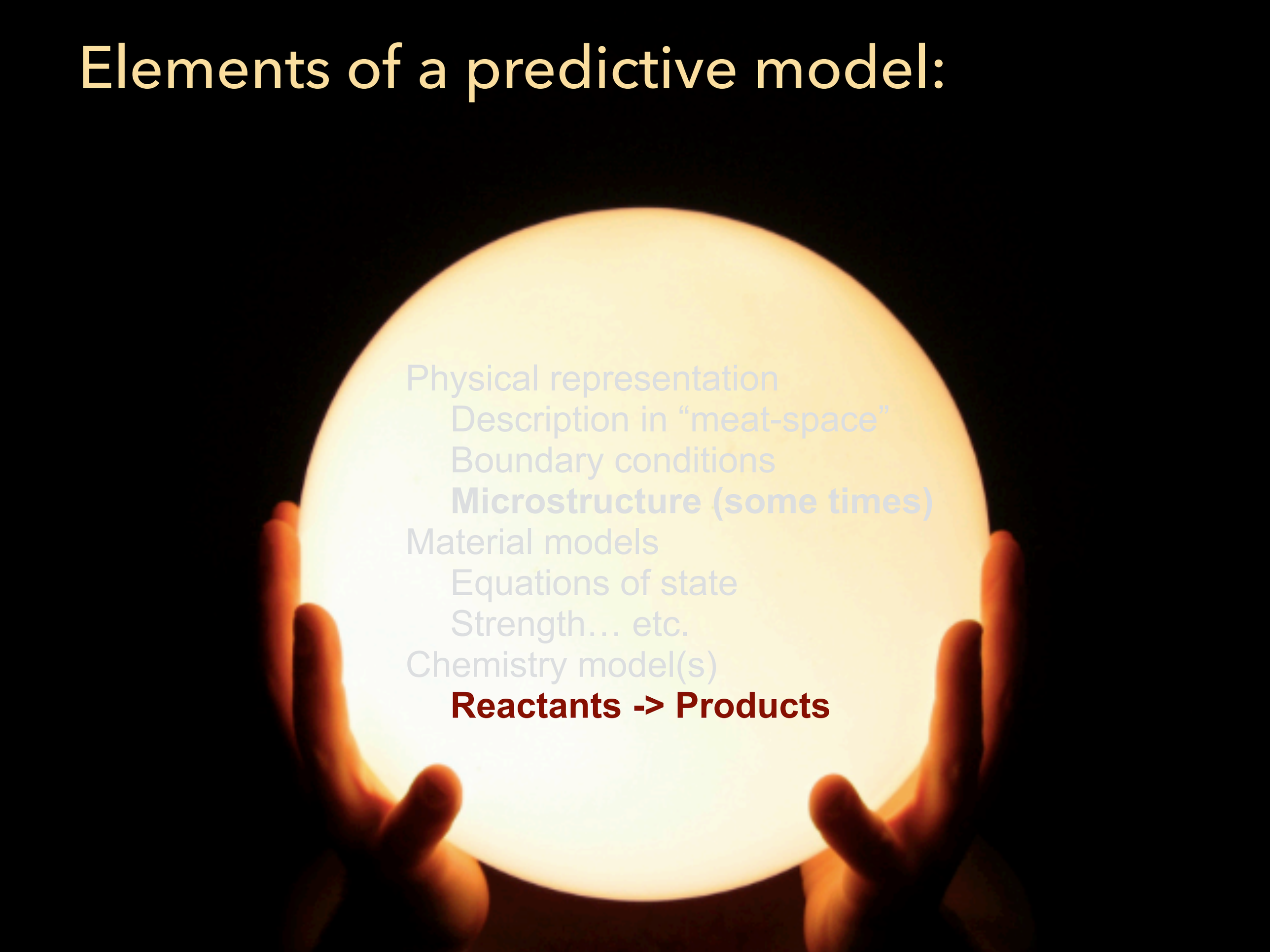
TMD: 76.83%, SSA: 0.94 m²/g



TMD: 74.22%, SSA: 1.3 m²/g



Elements of a predictive model:



Physical representation
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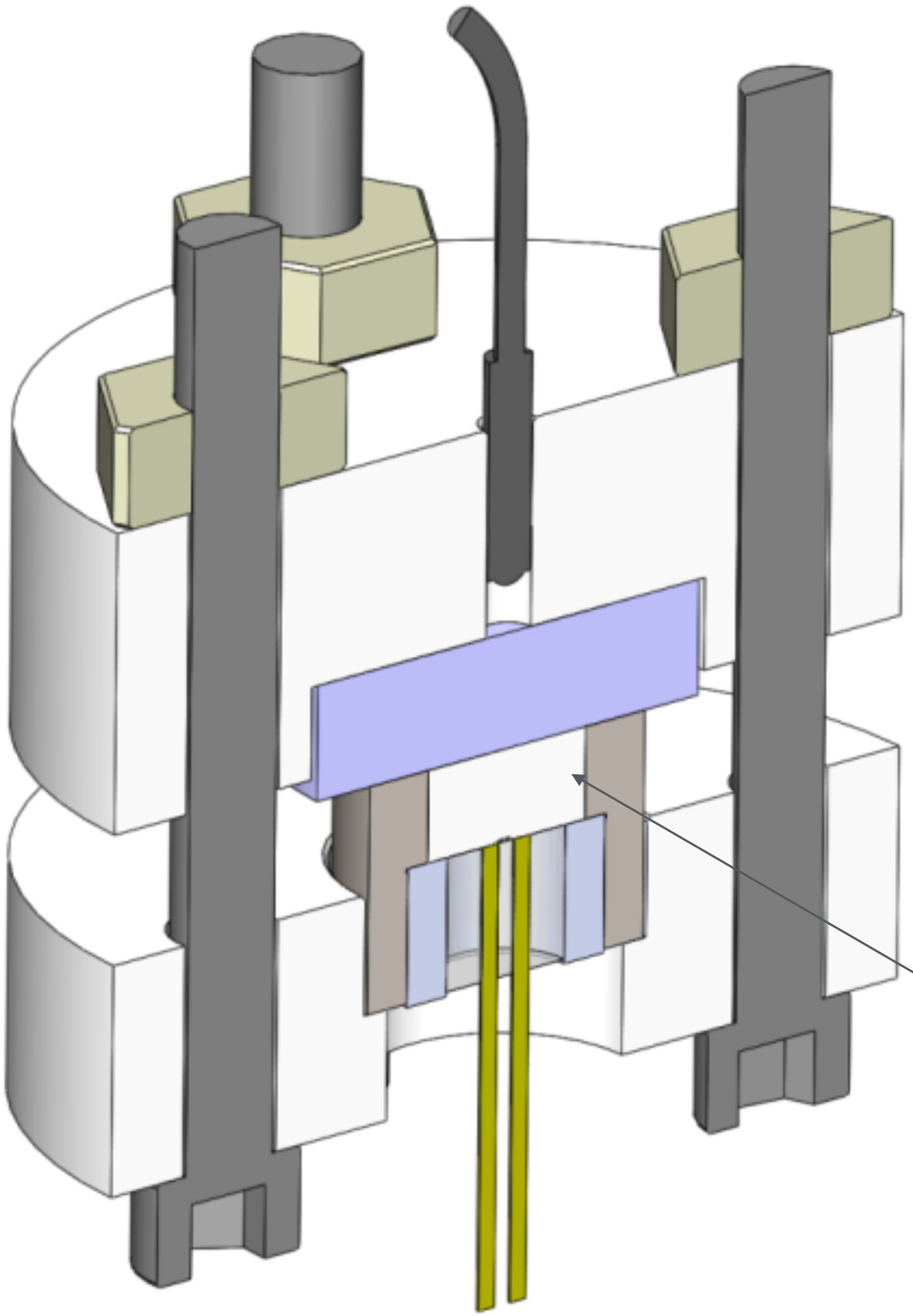
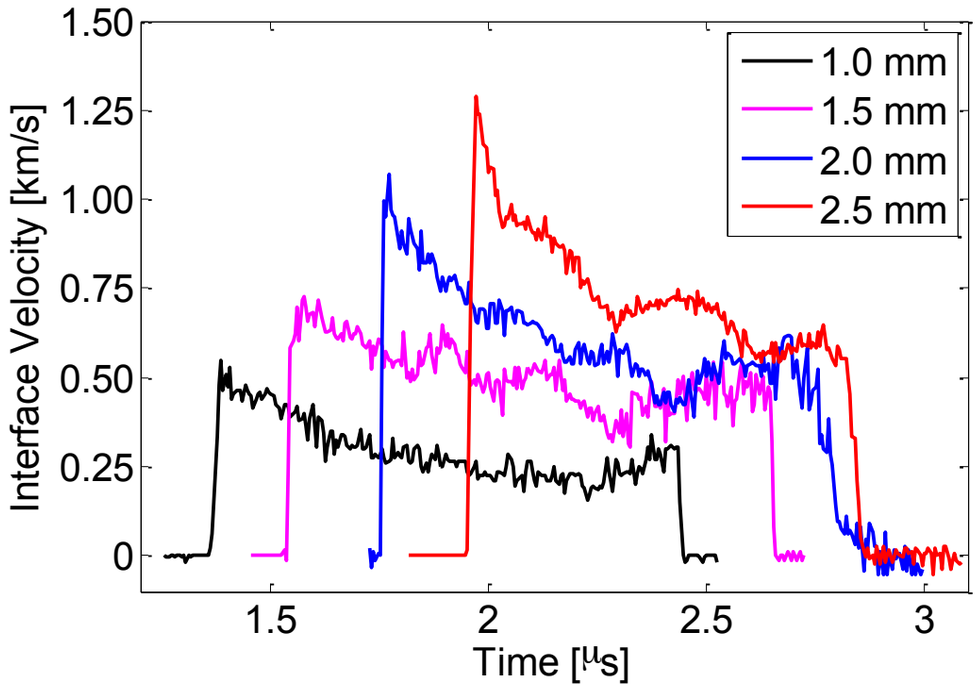
Chemistry model(s)
- **Reactants -> Products**

Q: Can we capture the build-up to steady detonation using PDV?



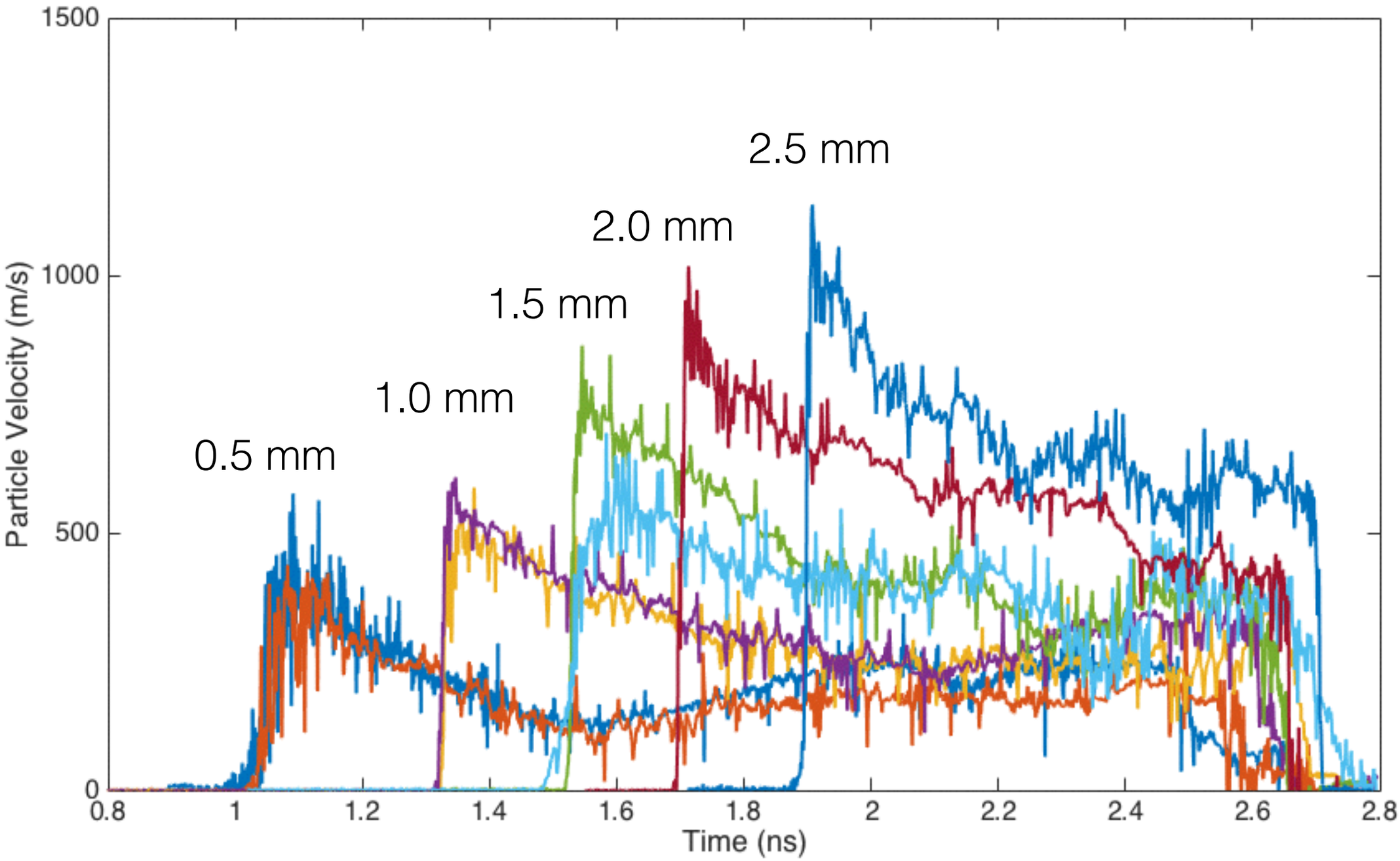
Detonator column varied in length 0.010” - 0.200”

A: YES



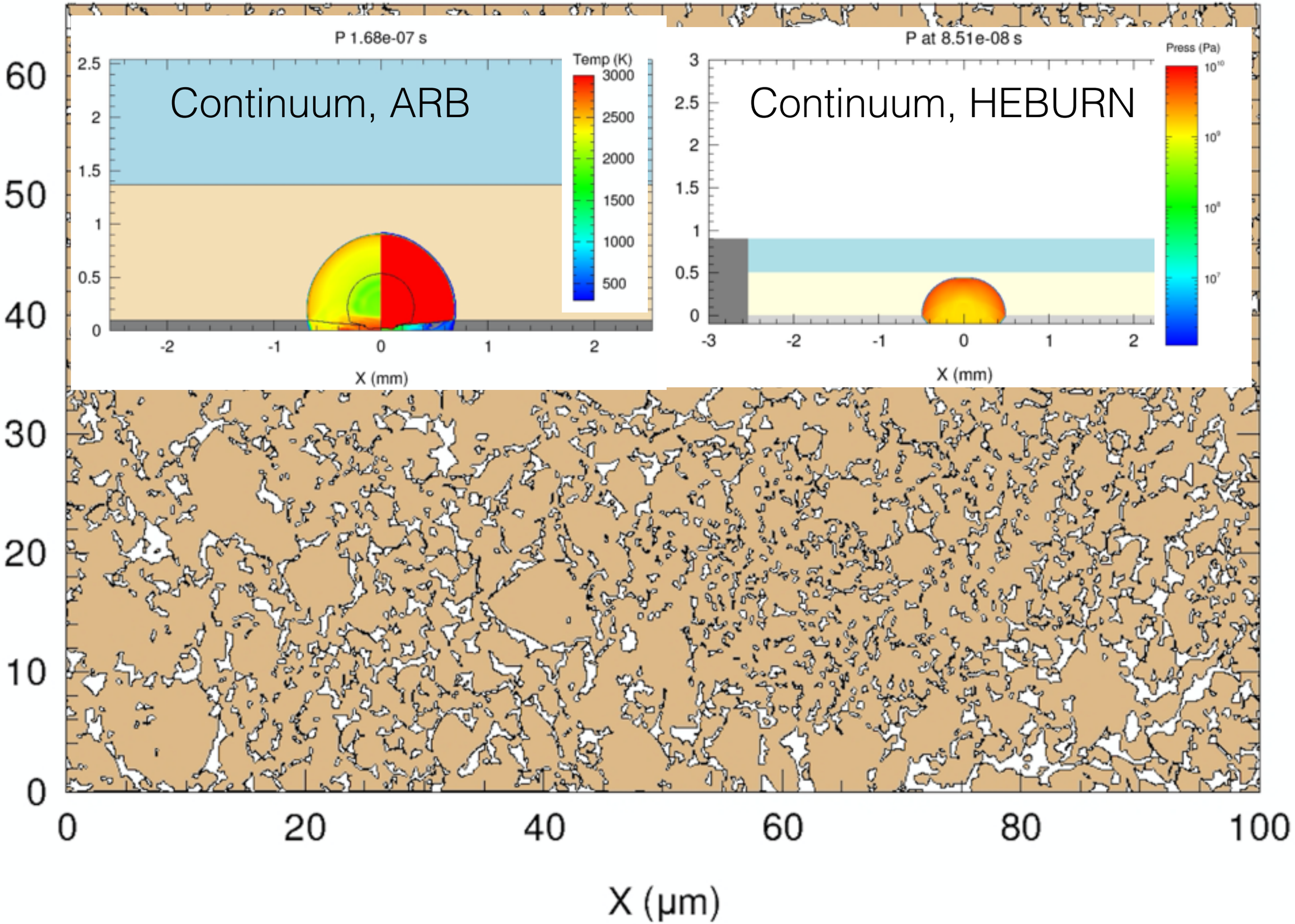
Have complete 8 additional ‘test’ shots

Plan is for 100 shots. 5 barrel lengths, 4 materials



*For now, arbitrarily shifted in time

Goal: Calibrate burn models to PDV data



Summary

Analyzing microstructure from relevant samples (size, density, powder lot)

Collecting particle velocity histories during the build-up to steady detonation. We plan 100 shots this summer.

Have improved hardware and probe alignment techniques

We will optimize reacting flow chemistry models using DAKOTA. Velocities will be used as objective function.