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Electrostatic discharge sensitivity of titanium potassium perchlorate (TKP) at varying densities

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Motivation

Why are we interested in ESD sensitivity of pyrotechnics?

How do we measure the sensitivity of pyrotechnics and what is different about this work?

Is the information valuable?

ESD in manufacturing

Pyrotechnics are susceptible to ESD initiation

Standard established ~0.1mJ

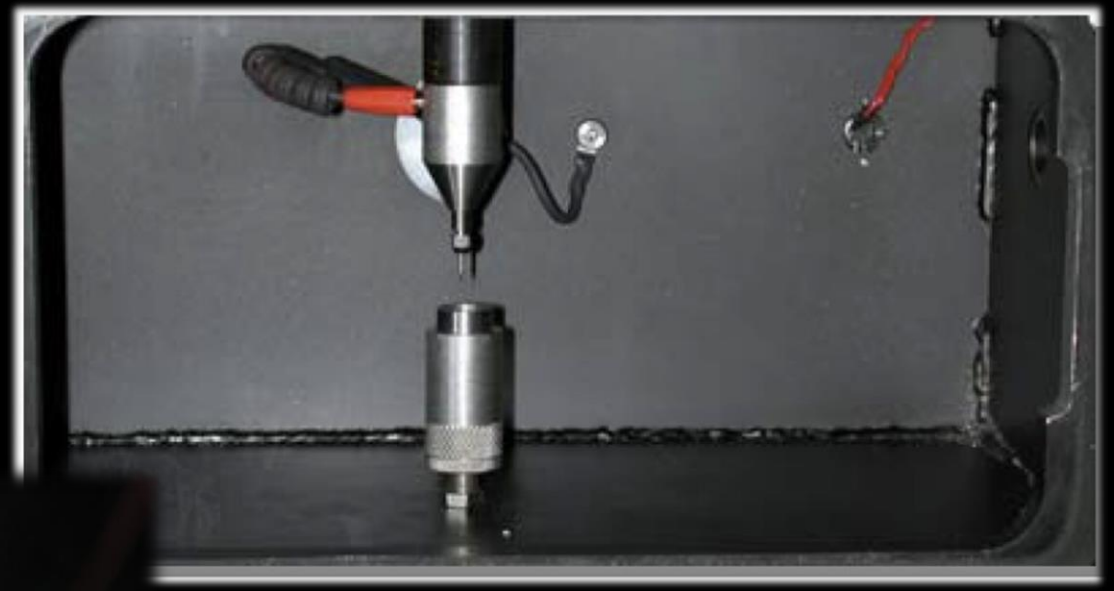
Leads to design decisions

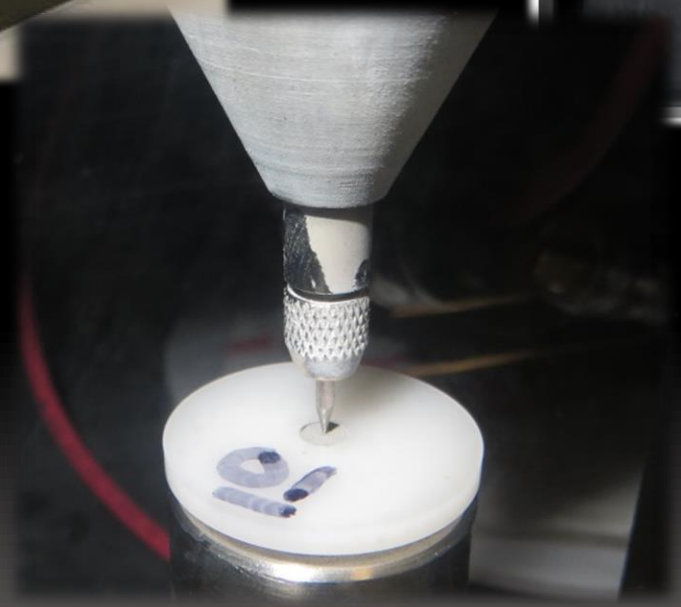
ESD in research and design

Design constraints compromise performance/initiation

Drives research

Standard tester



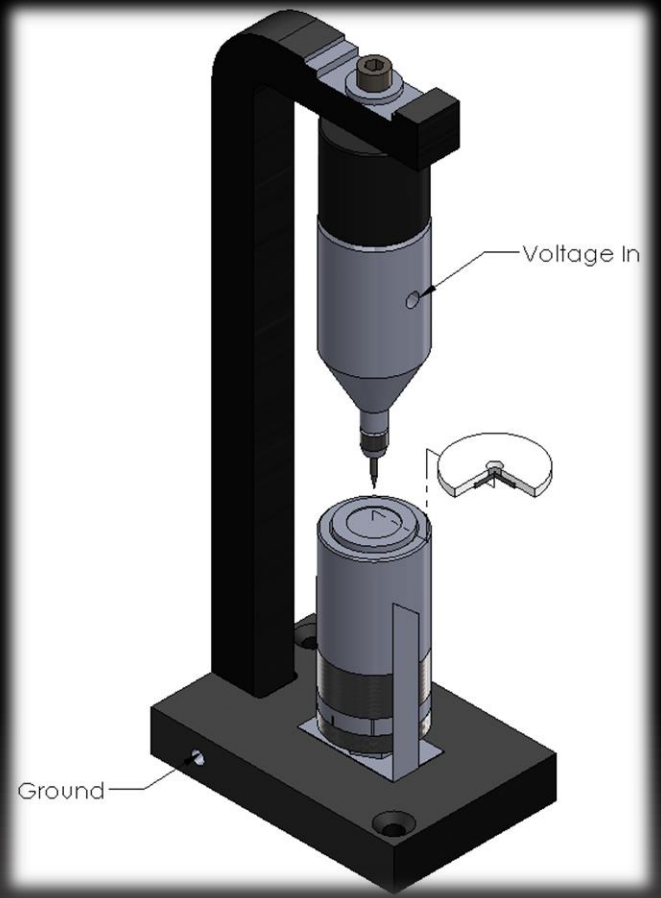


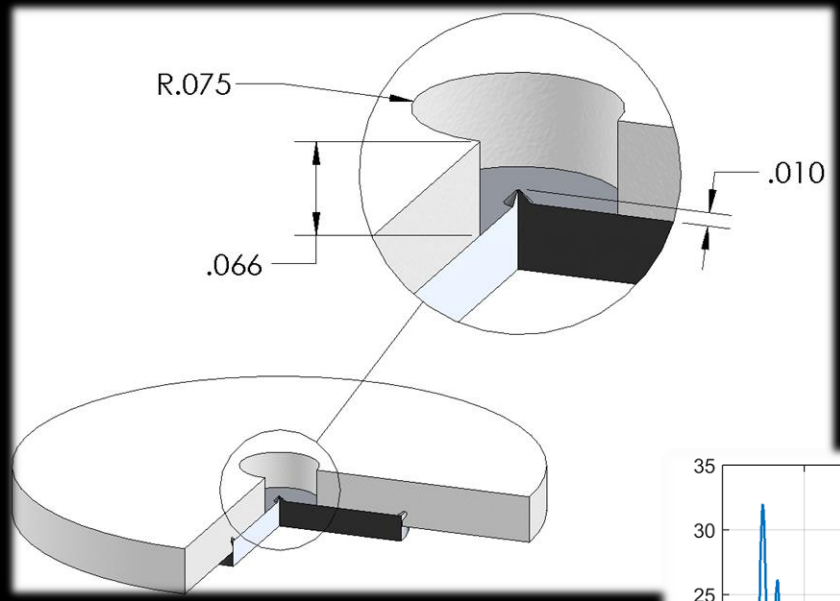
MIL-STD-331C Parameters	
Maximum Voltage [V]	25
Resistance [Ω]	500
Capacitance [pF]	500
Inductance [μH]	5

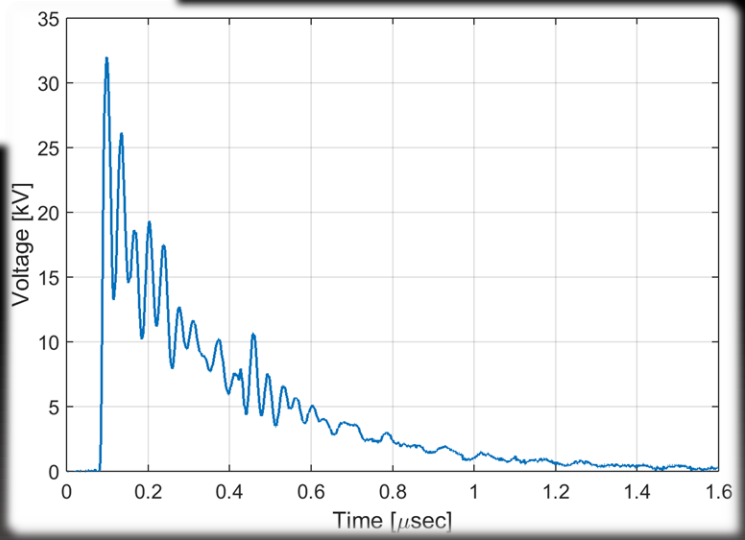
Electro-Tech Systems Inc. Model 931

Human Body Model Waveform MIL-STD-331C

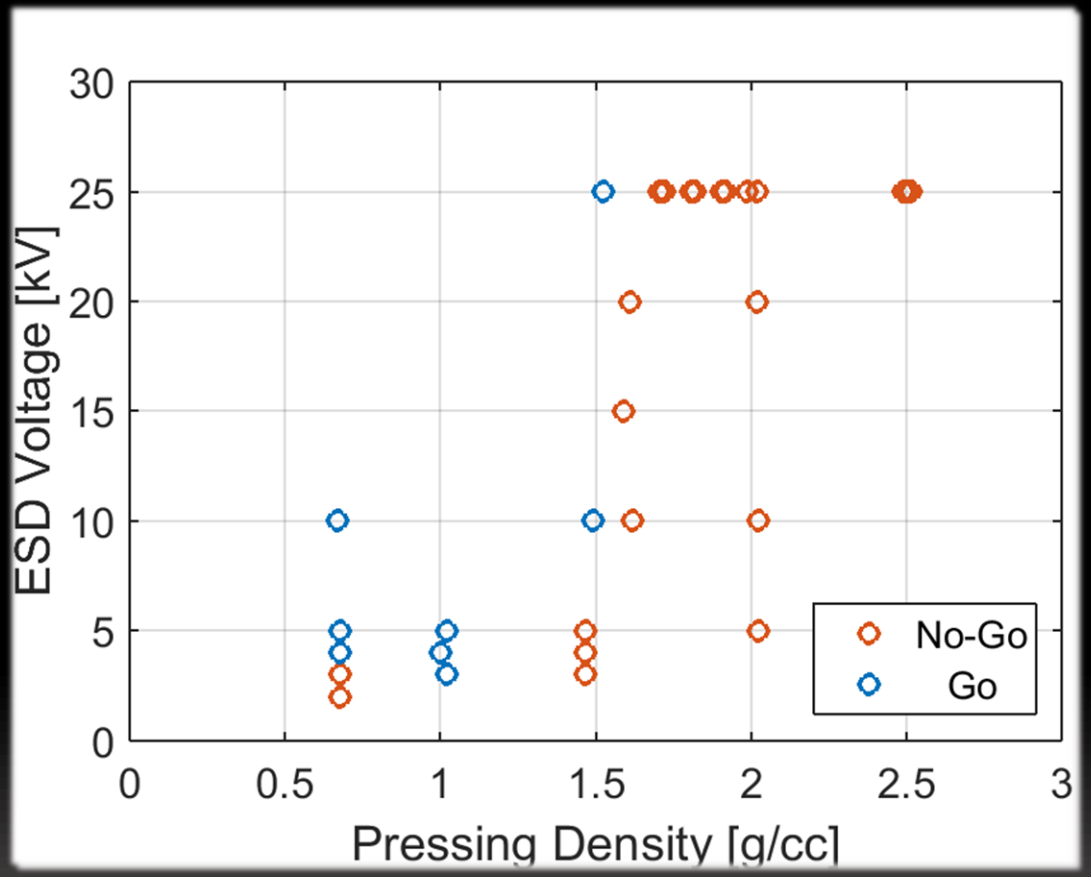
Modifications to the tester



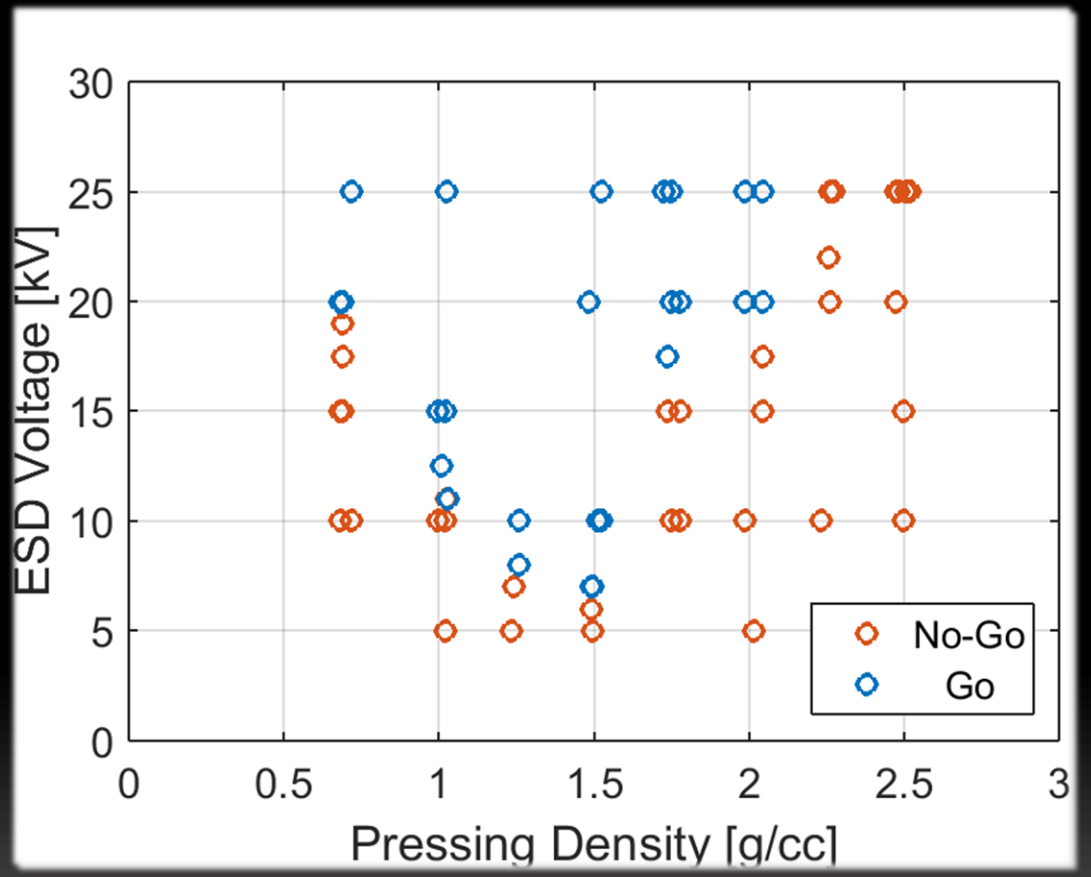




ESD sensitivity with density



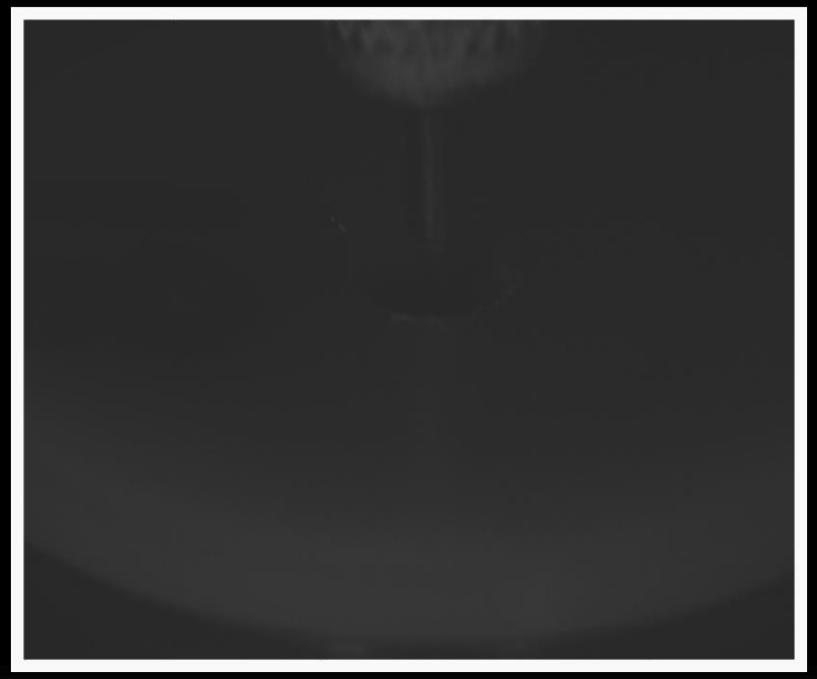
TKP-I



TKP-II

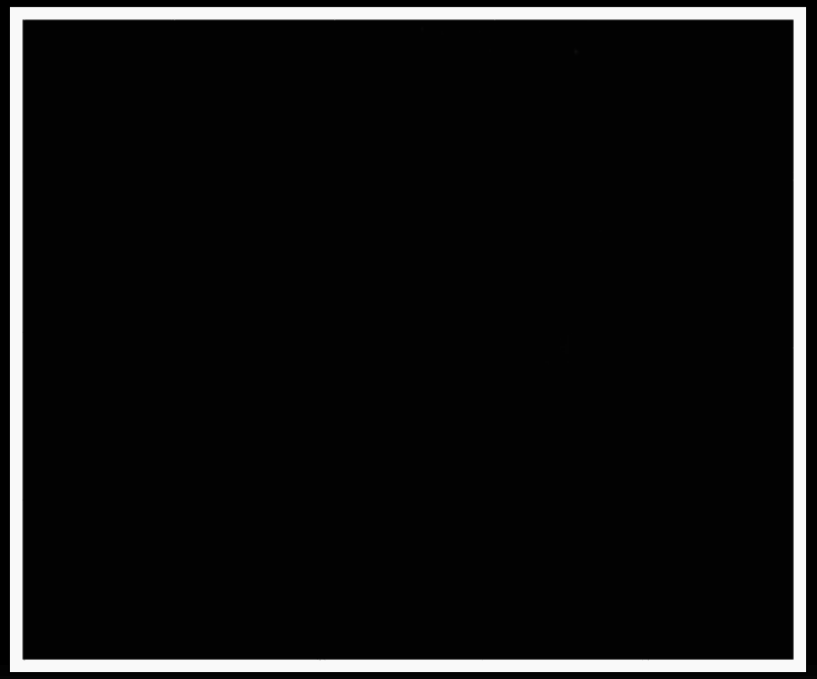
High-speed video of ESD

No Go



Go

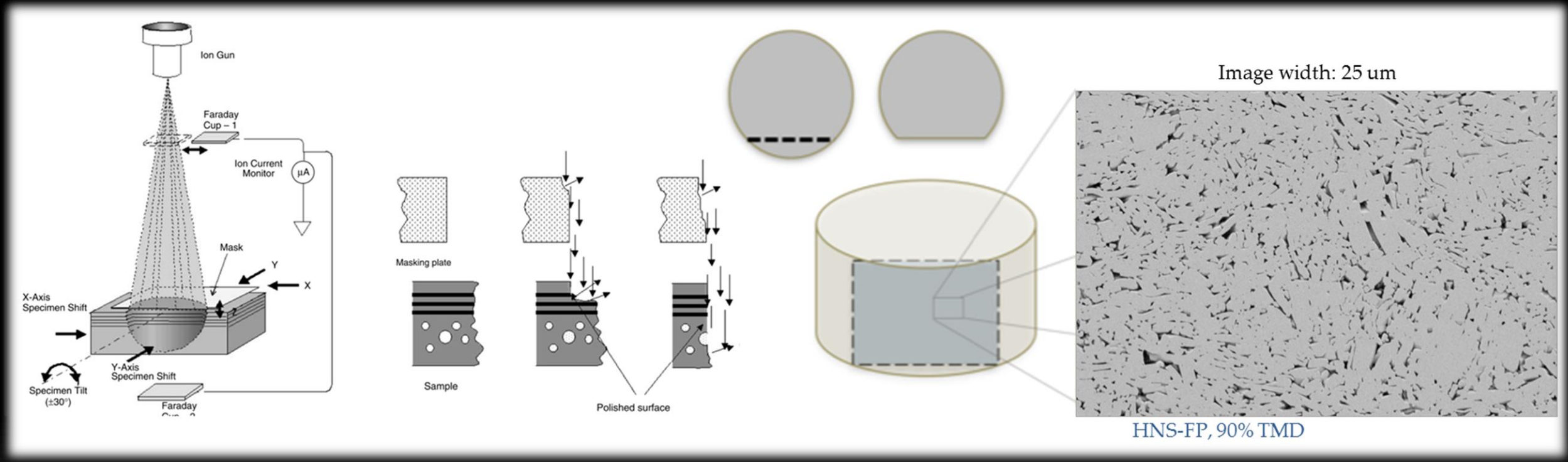
Partial



High-speed video of ESD

Wicked Go!

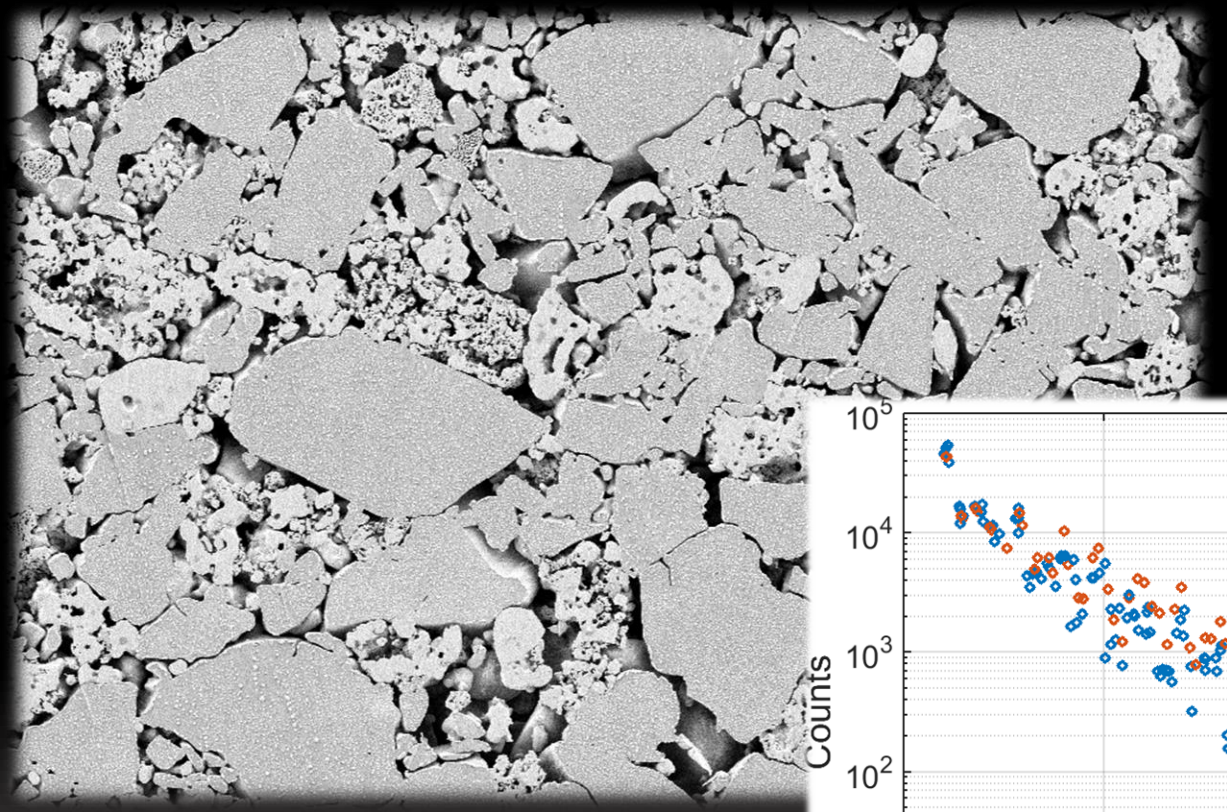
Capturing porosity



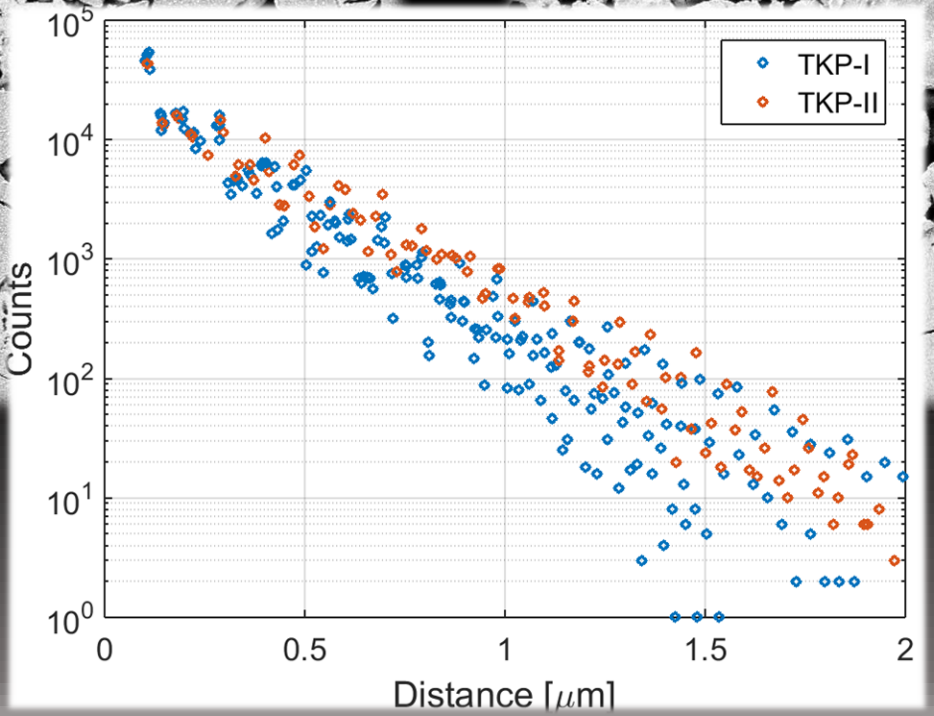
Cross-sectioned pellets, Ar-Ion beam milling technique

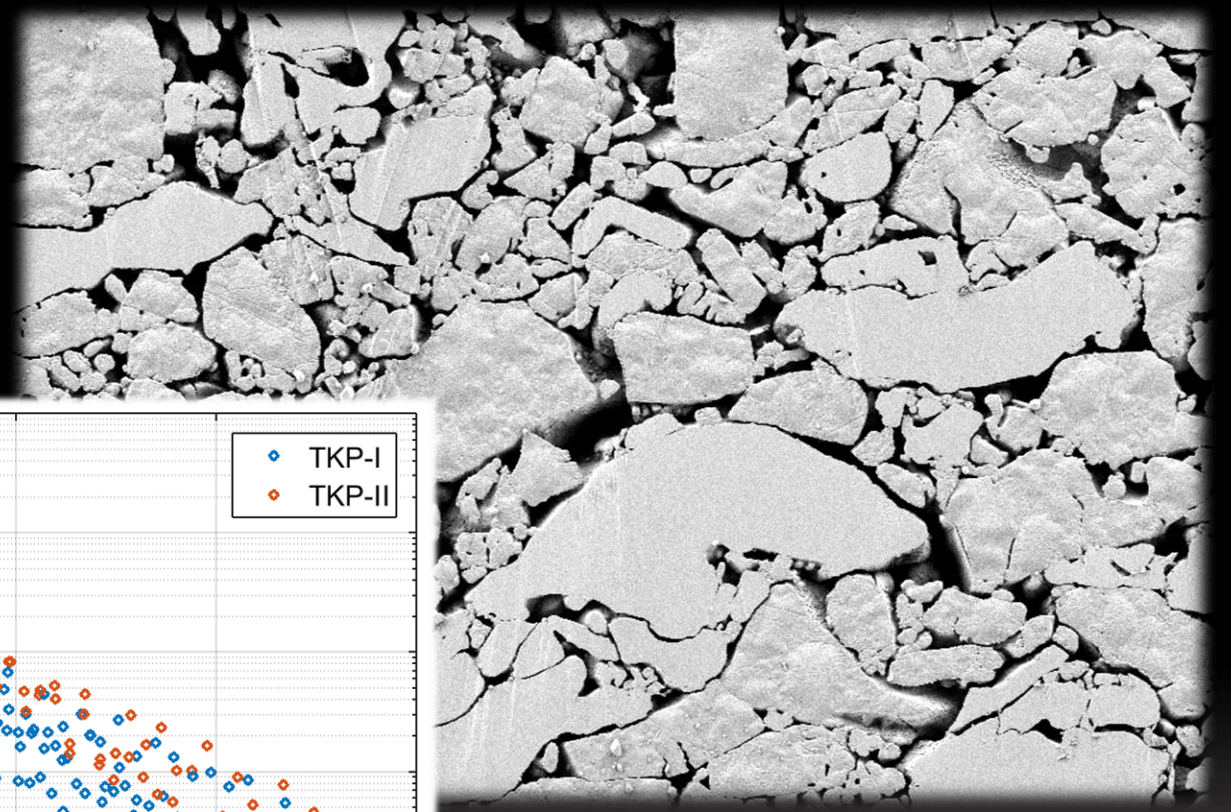
Size and distance

High density



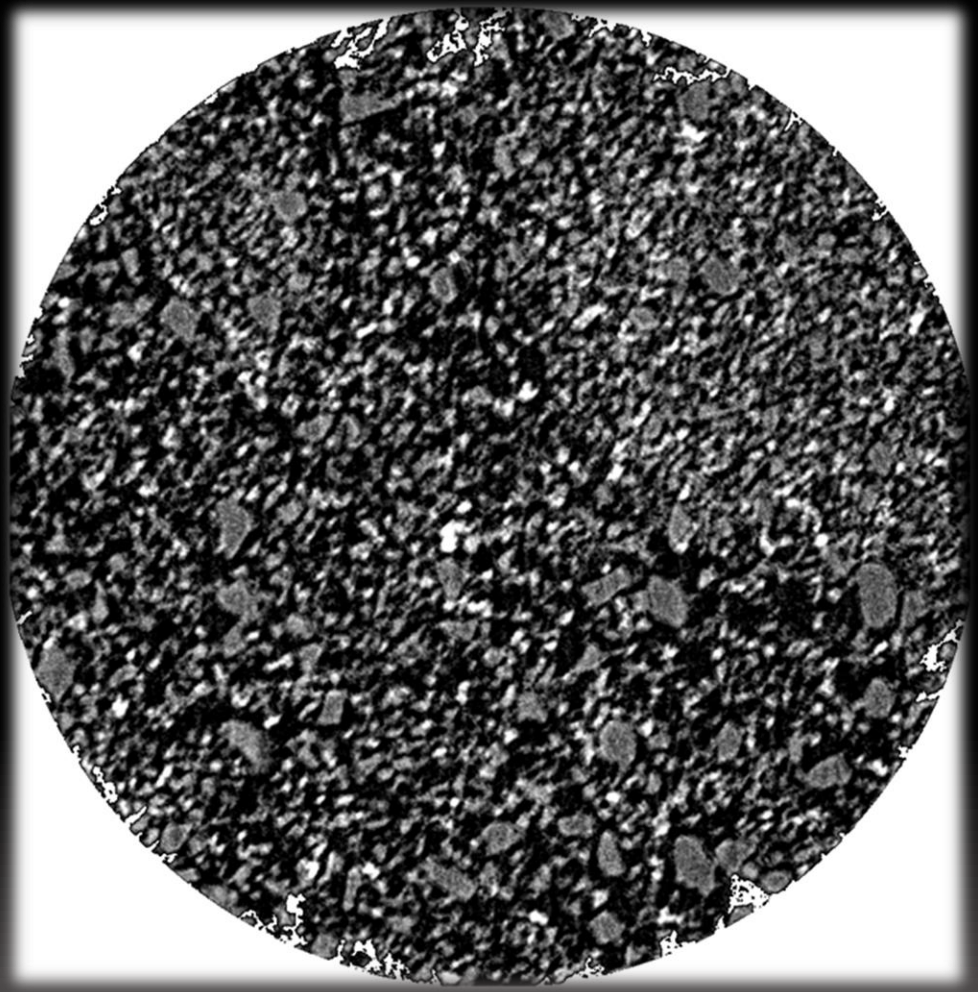
TKP-I





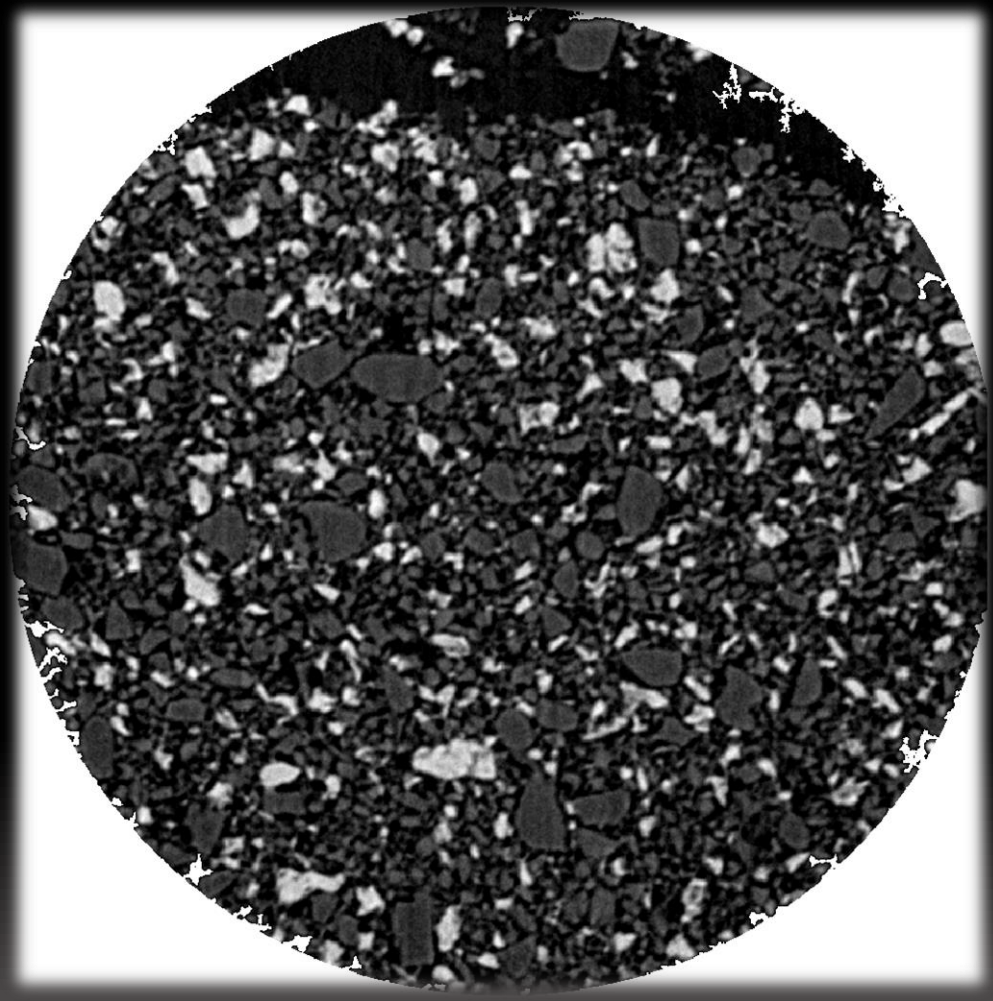
TKP-II

CT of powder



TKP-I low density

CT of powder



TKP-II low density

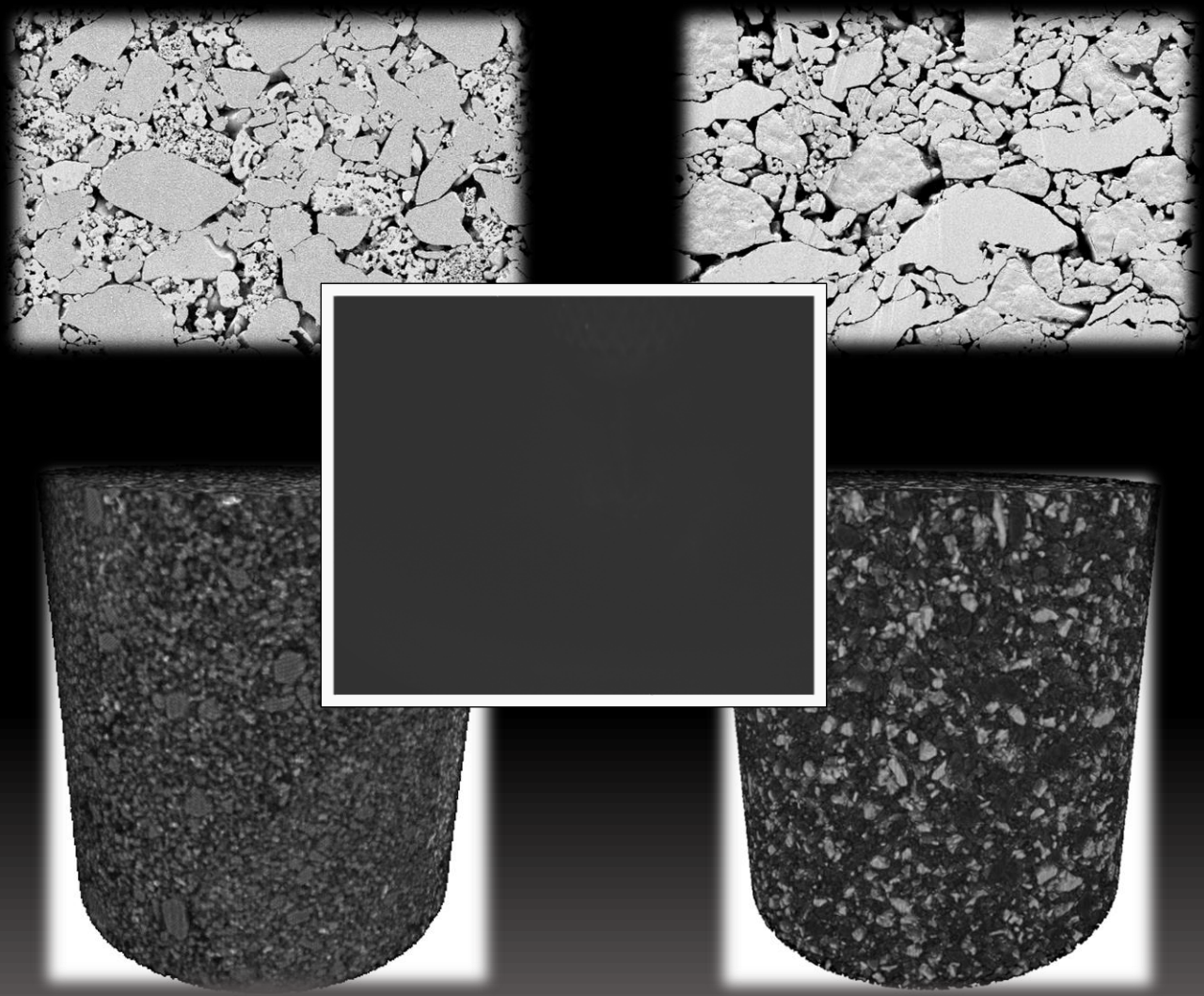
Summary

Change in sensitivity based on the pressed powder density

Visualize particles and voids within a pressed powder cavity

ESD sensitivity seems to align with Euclidean distance of pores at a density

Micro-CT is promising for analysis of low density powders



Acknowledgments
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