

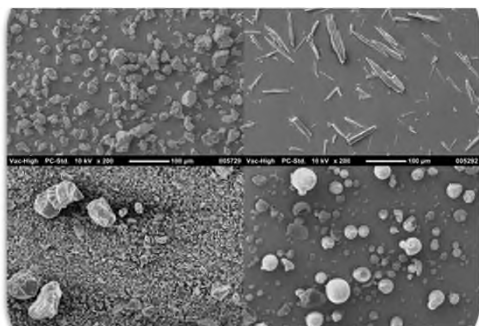
Shifting particle landscapes: Moving beyond D_{50}

30th September 2025

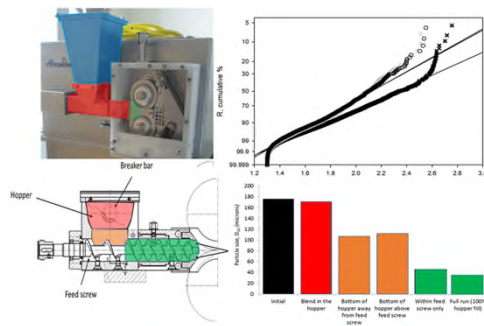
John Gamble, PhD.
Materials Science & Engineering



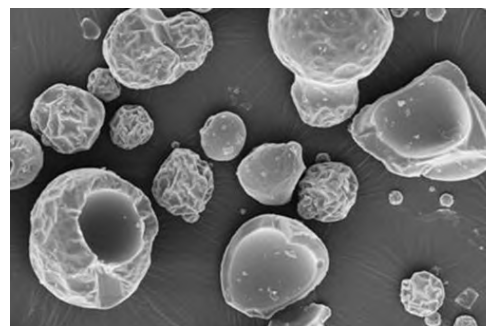
Areas of interest



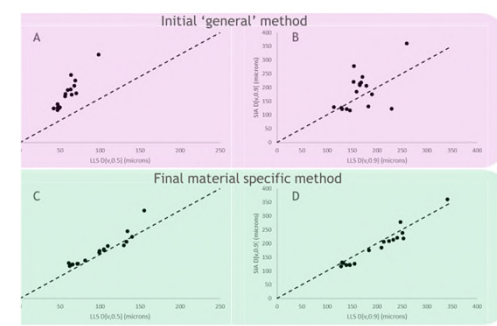
Use of particle size and shape to predict powder manufacturability / behaviour



Understanding the impact of processing on single components within multi-component systems



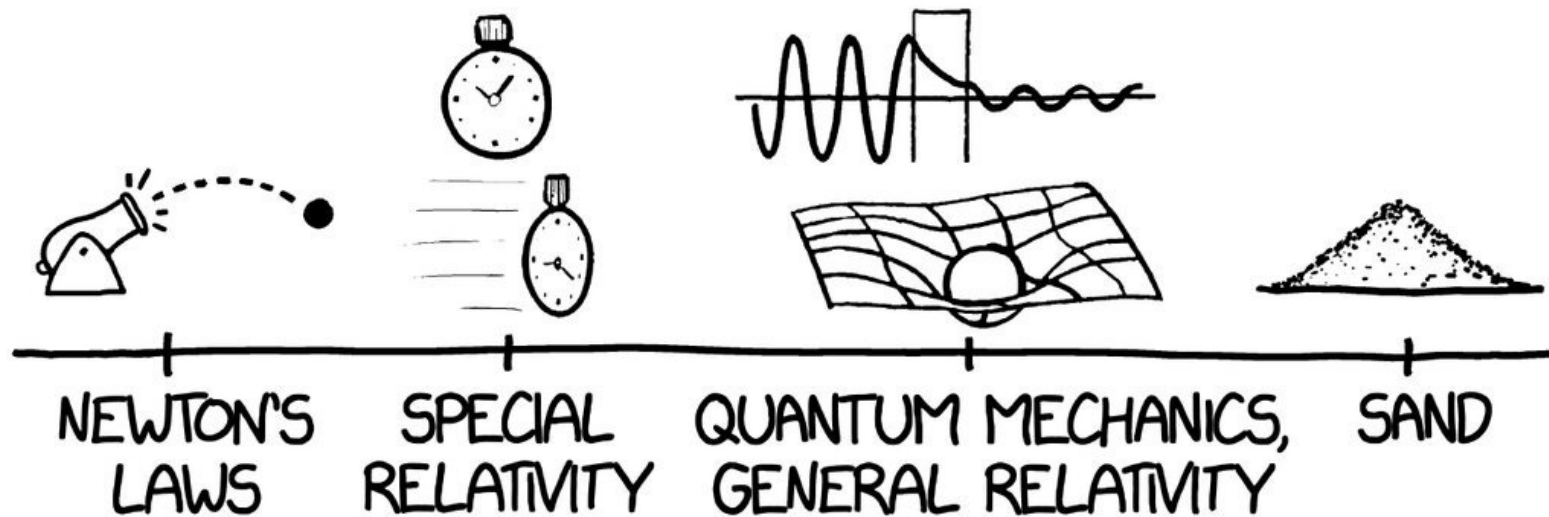
Characterisation of hollow particles (e.g., spray dried particles).



Creation of meaningful data and data structuring for modelling

The New York Times

AREAS OF PHYSICS BY DIFFICULTY
HARDER →

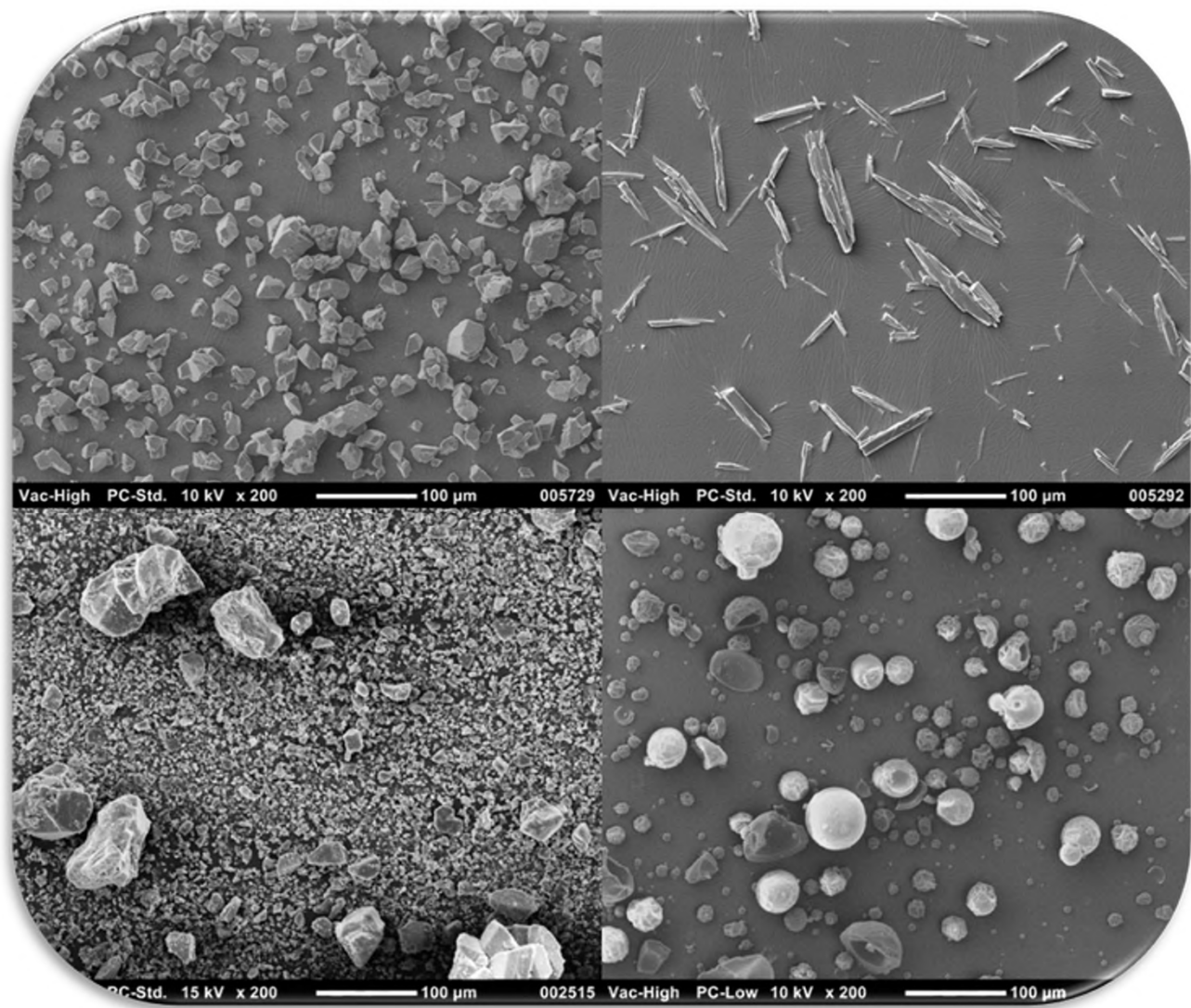


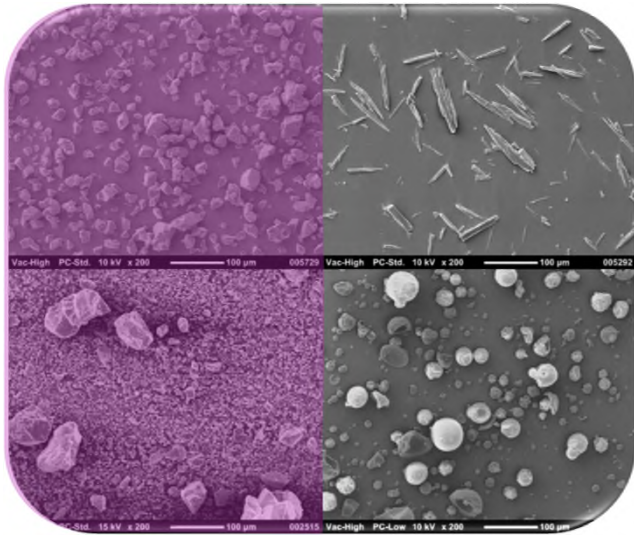
<https://www.nytimes.com/2020/11/09/science/what-makes-sand-soft.html>

“...it must be realised that particle size is not an objective in itself but is a means to an end, the end being the correlation of powder properties with some process of manufacture, usage or preparation”

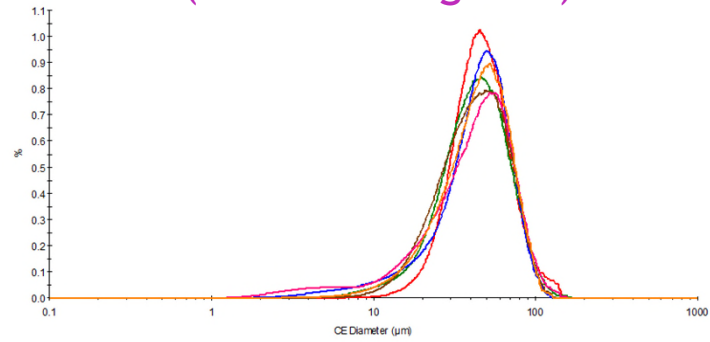
Harold Heywood (1966)



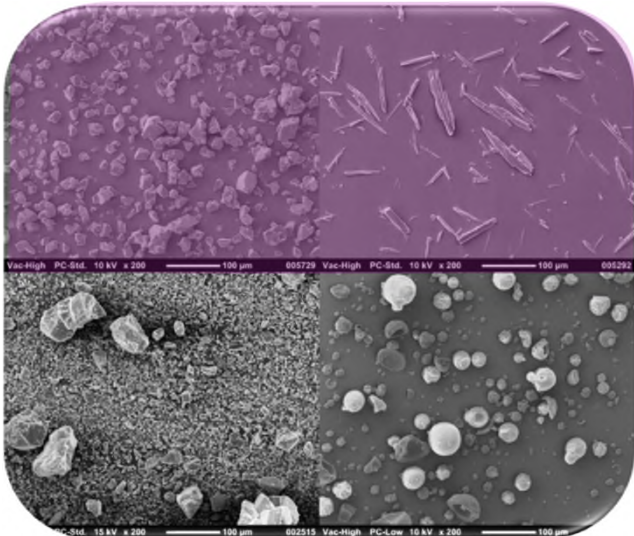
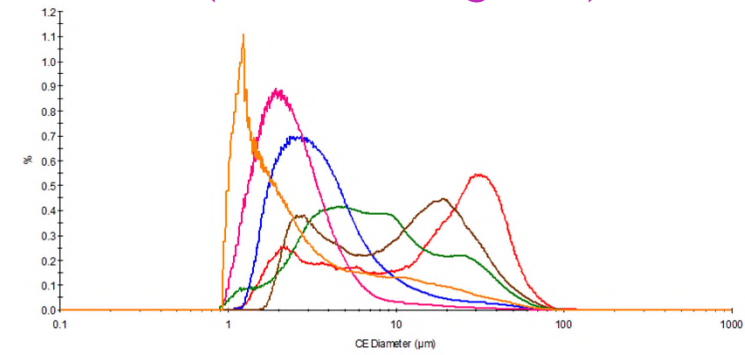




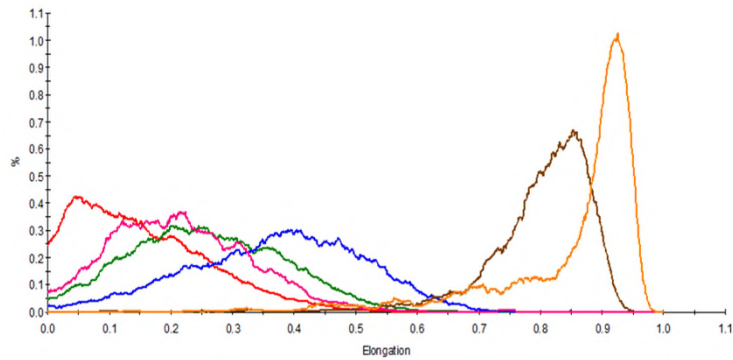
Size (volume weighted)



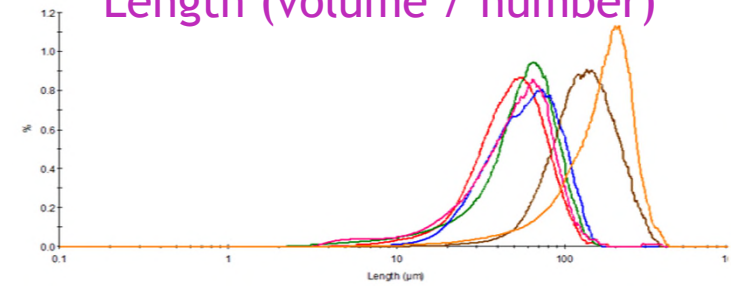
Size (number weighted)



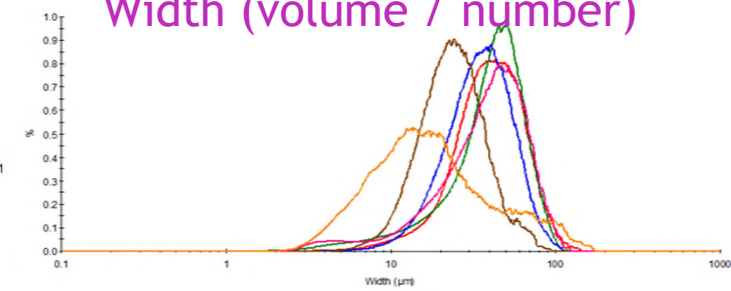
Elongation (volume / number)



Length (volume / number)



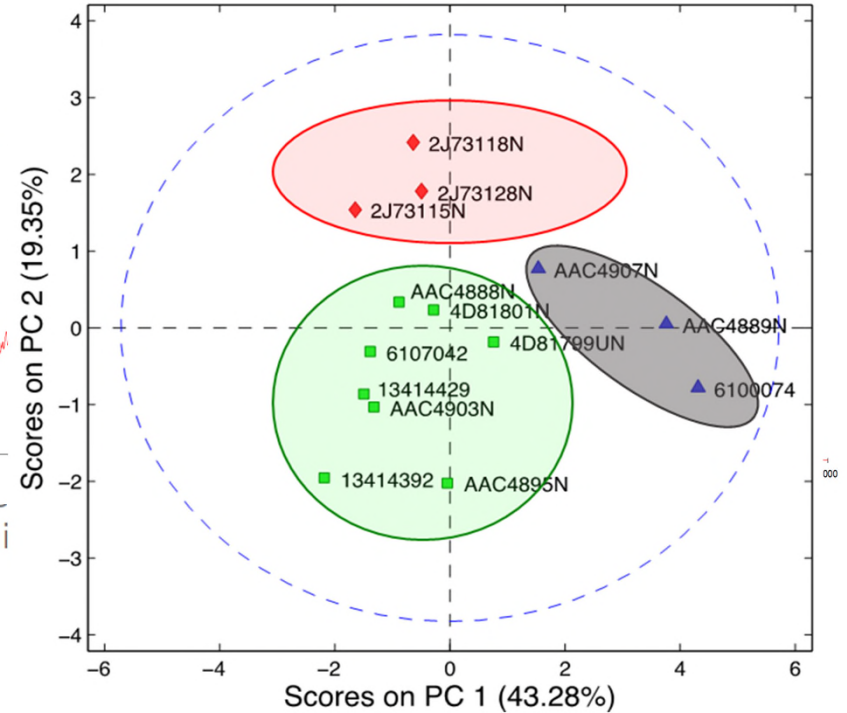
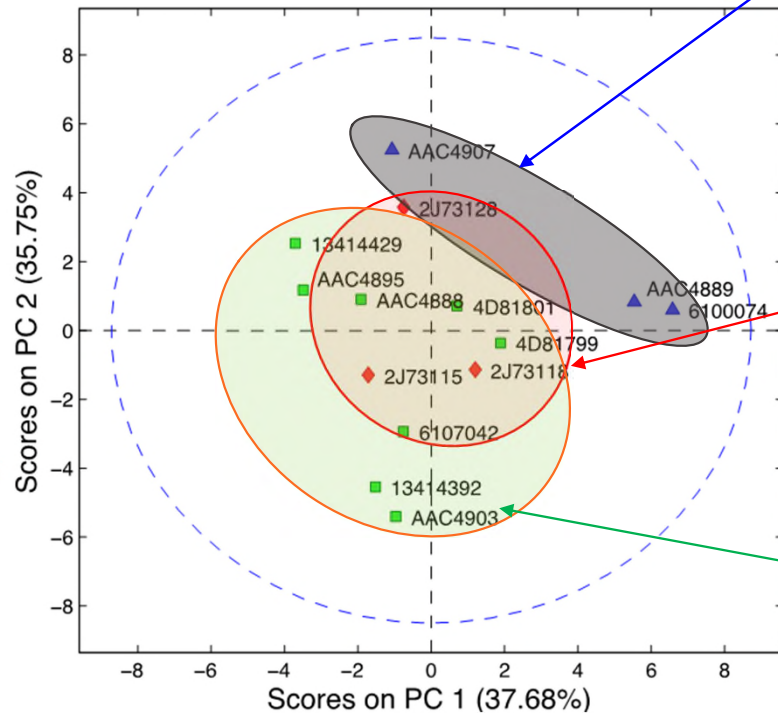
Width (volume / number)

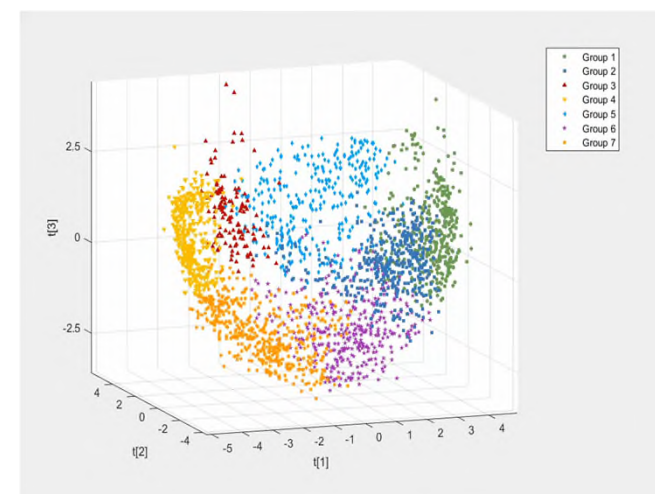
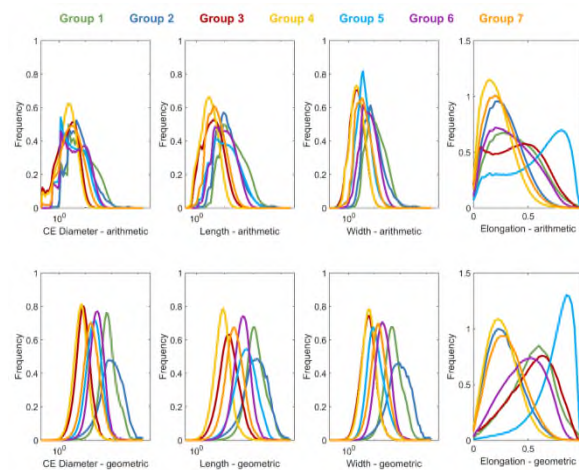
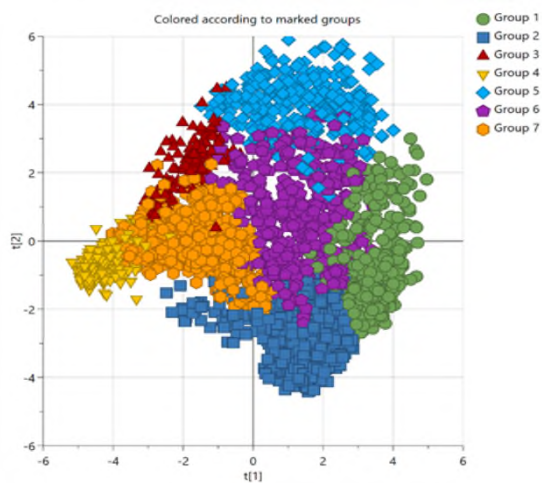
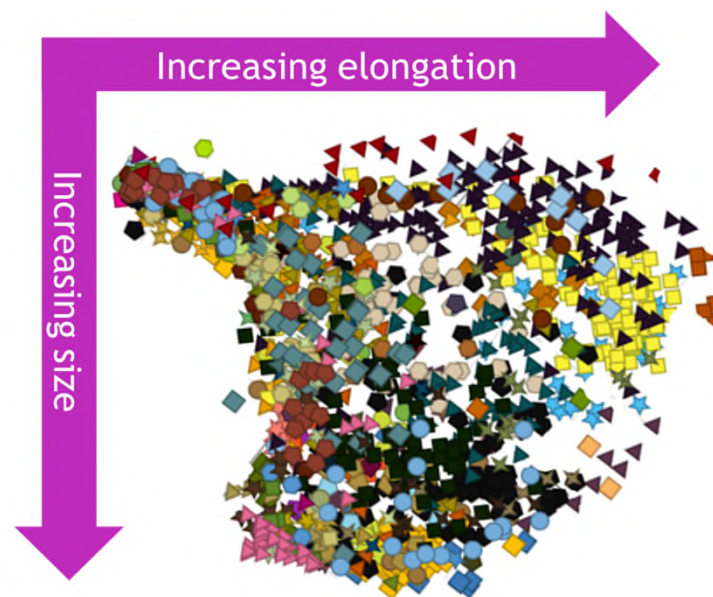


Percentiles

Using D_{10} , D_{50} and D_{90}

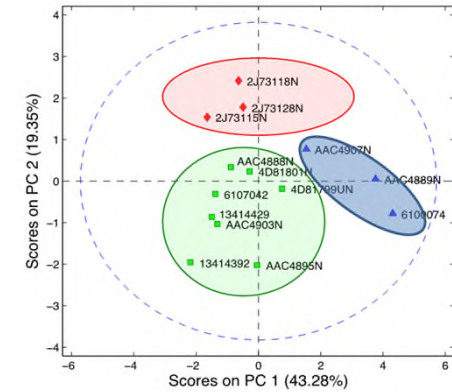
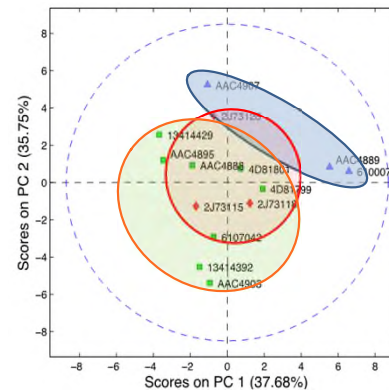
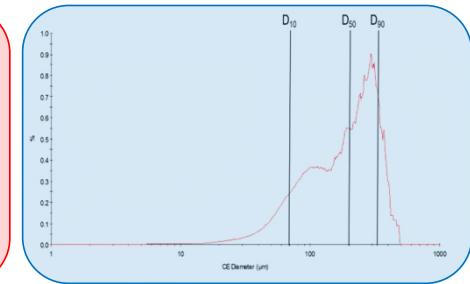
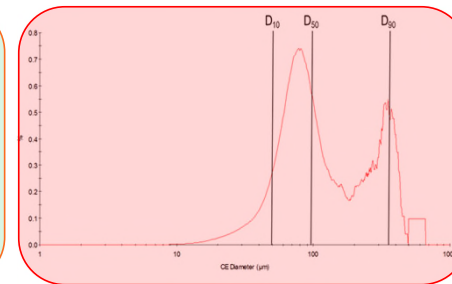
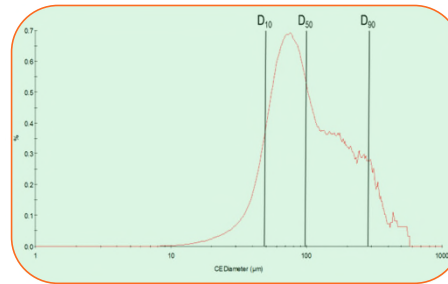
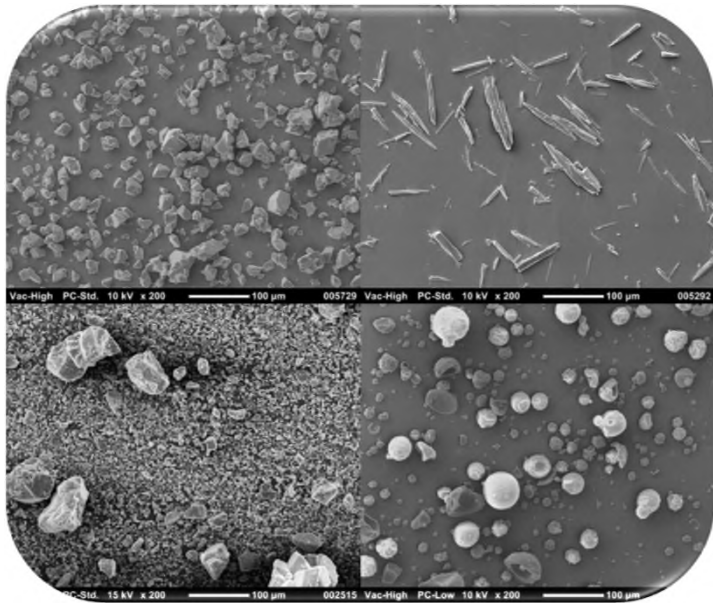
Using whole distributions





The vision:

Combination of modelling and materials science to de-risk product and process related risk and influence development team's decision making via the analysis of the distributions of size and shape





Similarity / surrogate
identification



Bulk powder
properties



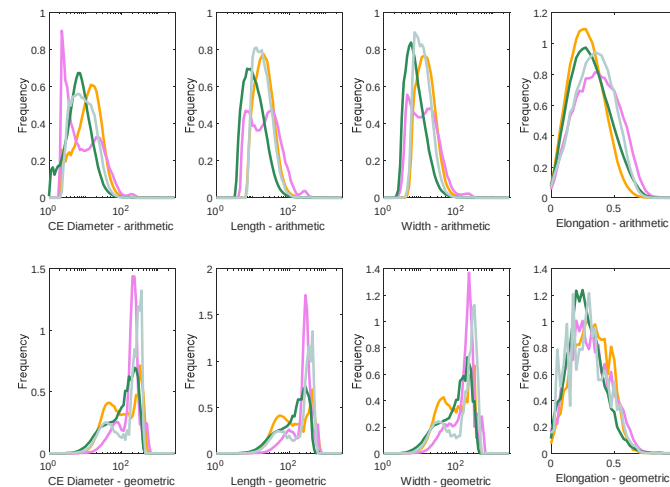
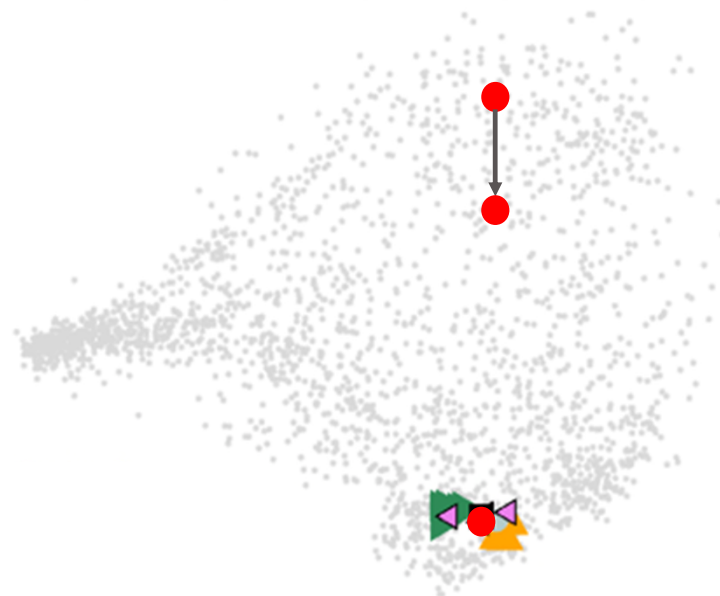
Process route
suitability



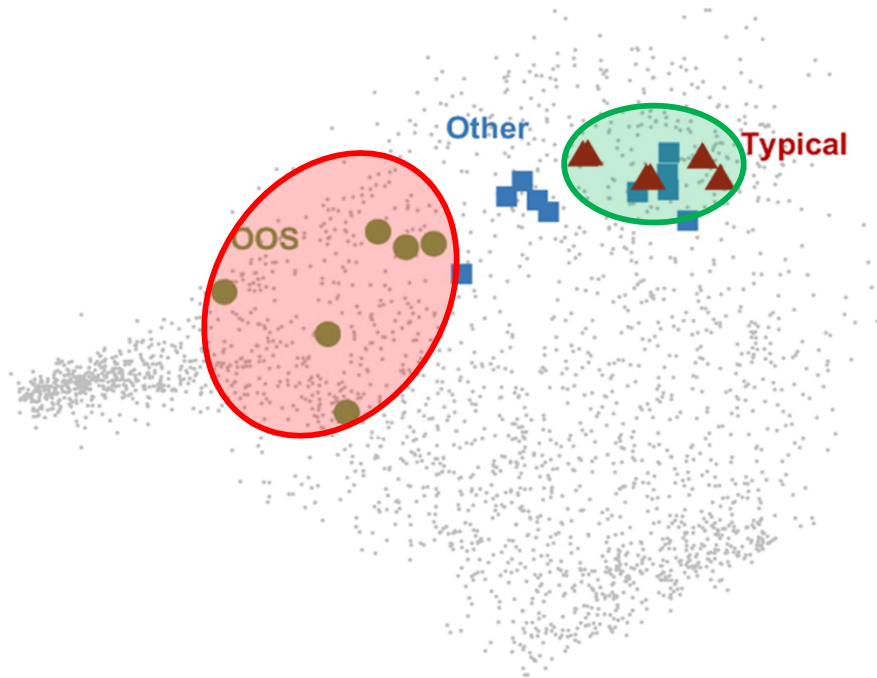
Formulation risk
identification



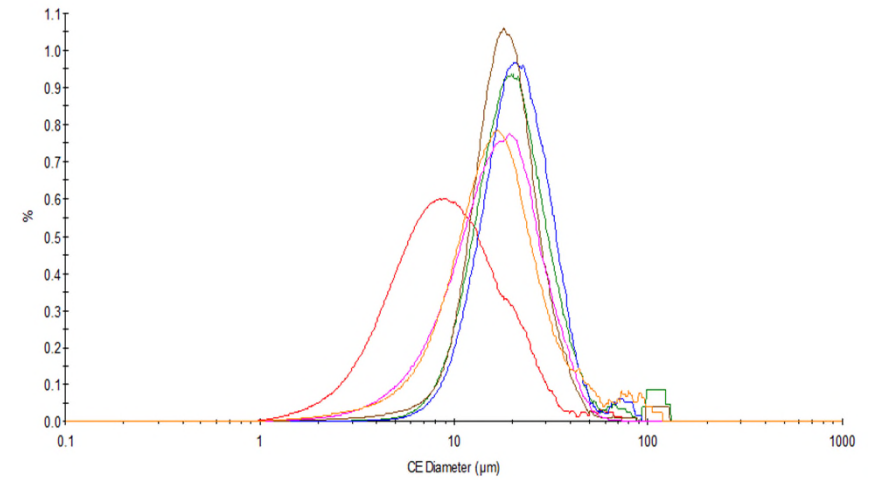
Translational tool



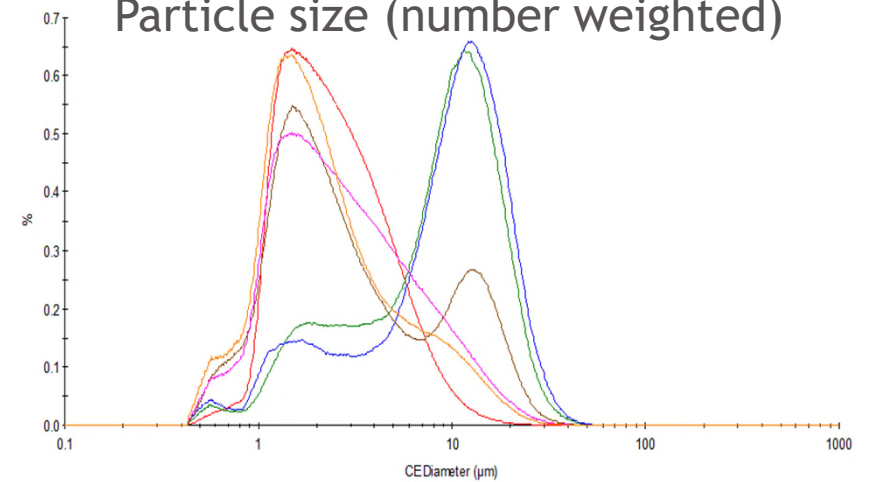
Product investigations



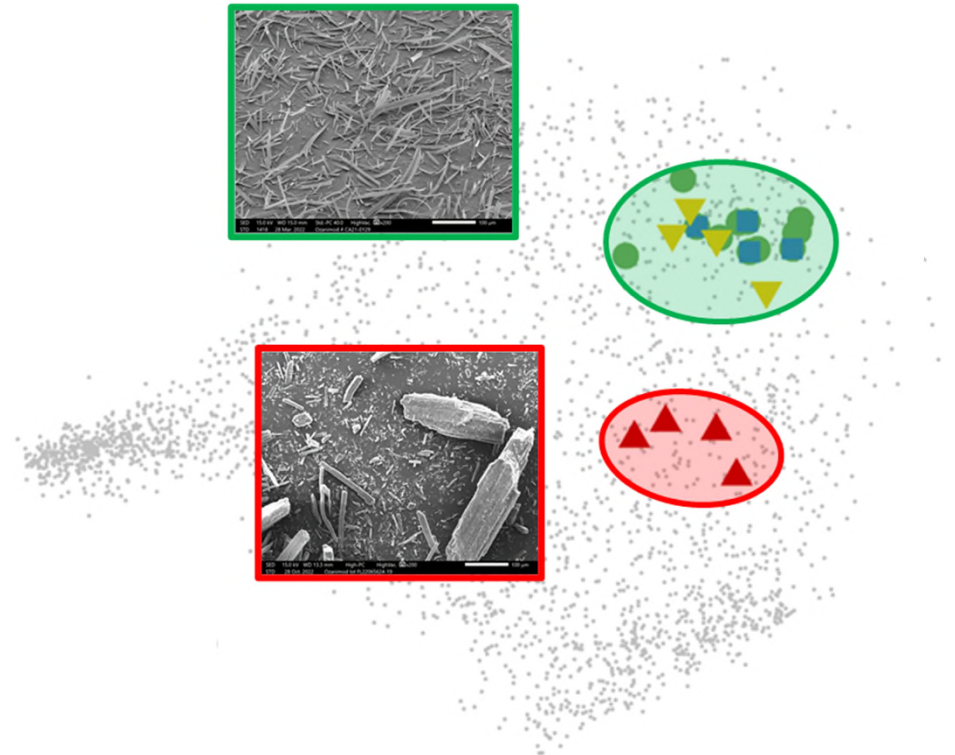
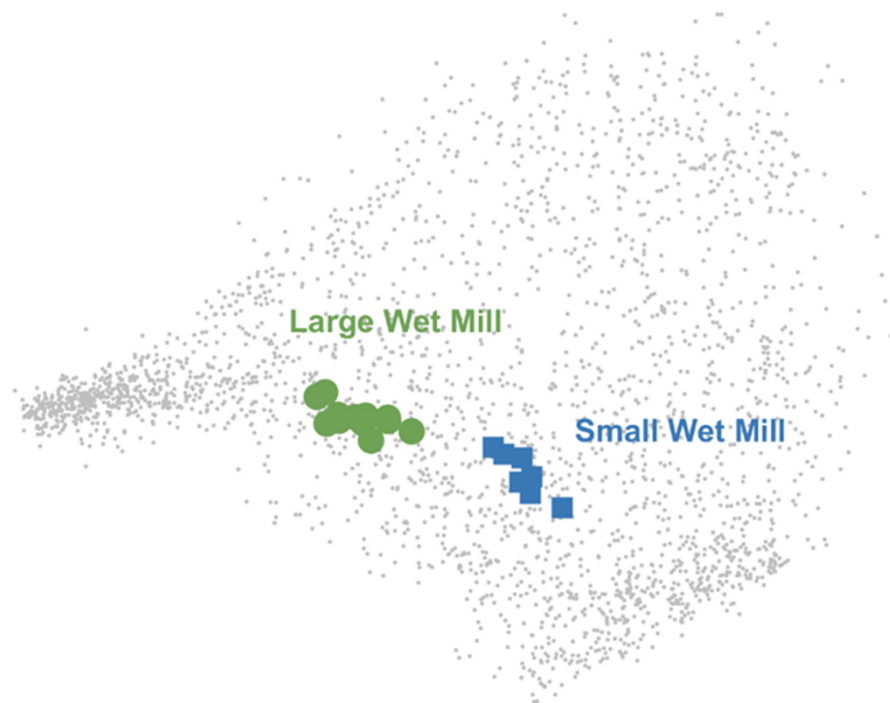
Particle size (volume weighted)



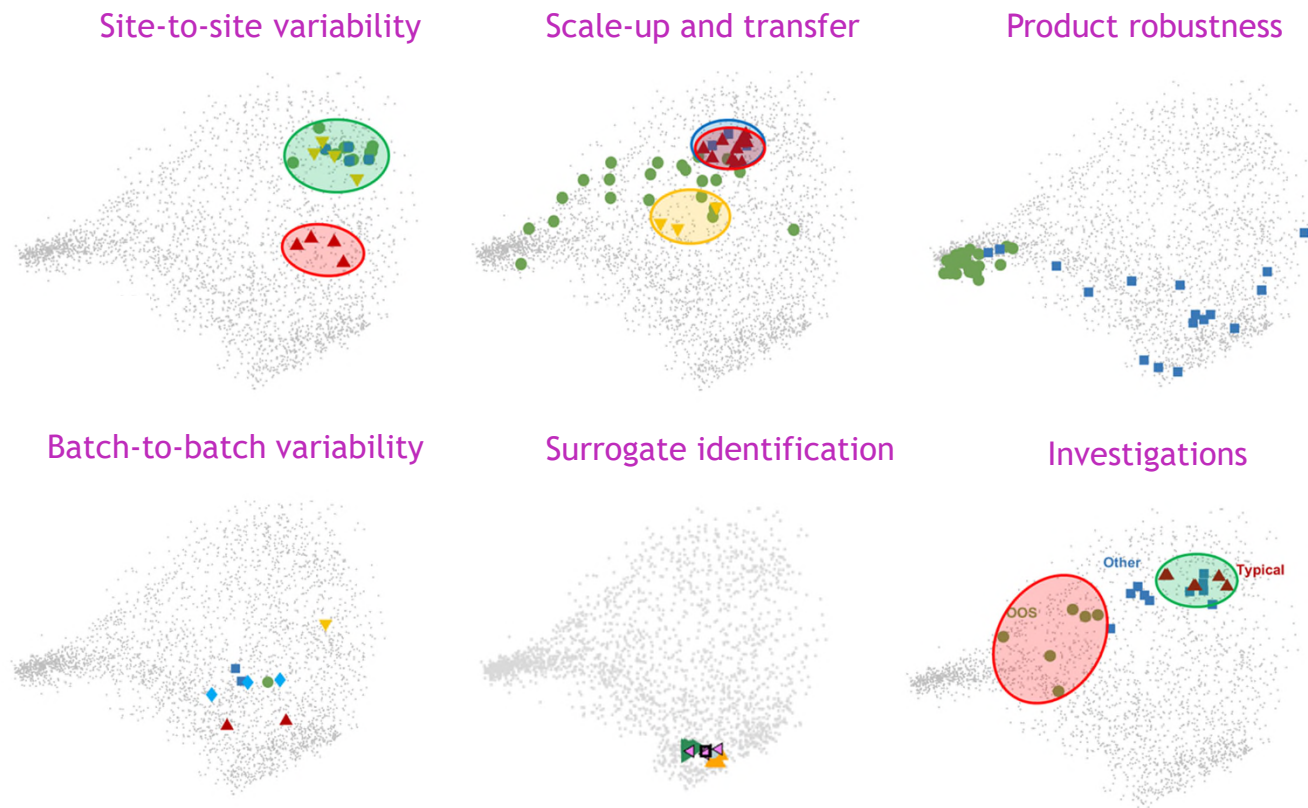
Particle size (number weighted)



Enabling robust products



- Approach now being applied across development assets to predict and mitigate issues / identify surrogate materials
- Also applied within commercial arena to
 - baseline products and excipients
 - Assess vendor/site/scale variability
 - Support investigations
- Plans for the next generation of the model are moving forward



Conclusions

- Appropriate characterisation is critical to better understanding the behaviour of powders
- Both size and shape are important characteristics
- Blind use of percentiles can lead to erroneous models / predictions



Questions: John.gamble@bms.com