From innovation to commercialisation

FSTG Formulation 4.0

13 December 2018

IMPLEMENTING ASPECTS OF THE 4IR TOOLBOX TO IMPROVE POWDER FORMULATION PROCESSES

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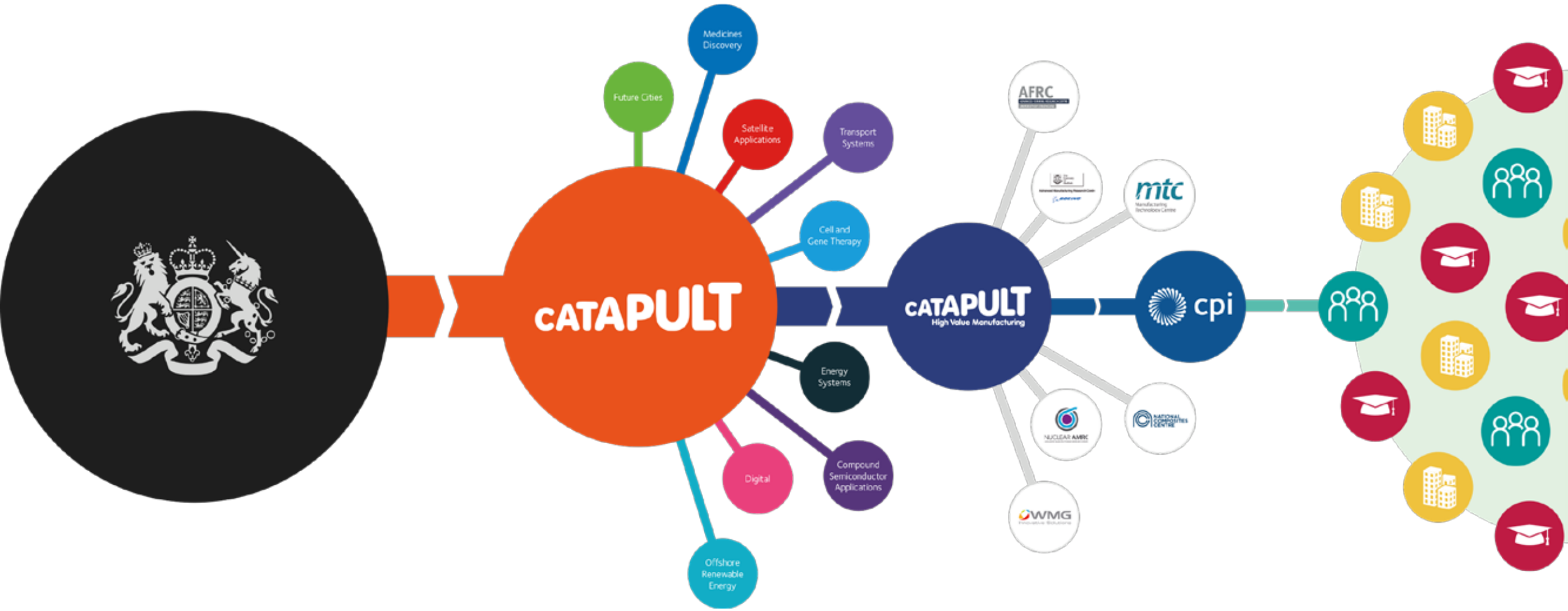
Manager, Complex Particles, CPI

BREAKDOWN OF TALK

- Who I am
- Brief overview of CPI (which I will skip over significant sections of)
- Brief overview of the (two) project (s) I'll be discussing
- Implementation of digital twin, PAT infrastructure and control models
- Summary and learning


Medicines Discovery
Future Cities
Satellite Applications
Transport Systems
Cell and Gene Therapy
CATAPULT
Energy Systems
Digital
Compound Semiconductor Applications
Offshore Renewable Energy
CATAPULT
High Value Manufacturing
AFRC
mtc
cpi
NUCLEAR AMRC
WMG

Home to four
NATIONAL CENTRES

Where I make my coffee

CAPABILITY THEMES

PREDICTIVE DESIGN

Faster Innovation

Faster, more reliable approaches to get to an ideal formulation design

RADICAL EFFECTS

Bigger Innovation

Unexpected synergistic effects to deliver bigger or disruptive benefits

MANUFACTURABILITY

Process Innovation

Optimised, reliable system to guarantee the ideal delivery of a formulated product

4IR CAPABILITY

Innovation Enabler

A critical foundational component for knowledge management and problem solving

CROSS-SECTOR INDUSTRY NEED

PREDICTIVE DESIGN

Faster Innovation

Faster, more reliable approaches to get to an ideal formulation design

MANUFACTURABILITY

Process Innovation

Optimised, reliable system to guarantee the ideal delivery of a formulated product

Need for a better understanding of how to **make and control** particulate formulations in manufacturing and scale-up

…to allow for more predictive design, integrated quality and enable the delivery of **faster innovation** and **greater productivity**

BUILDING BLOCKS OF THIS TALK

‘All models are wrong, some models are useful’

George Box (statistician)

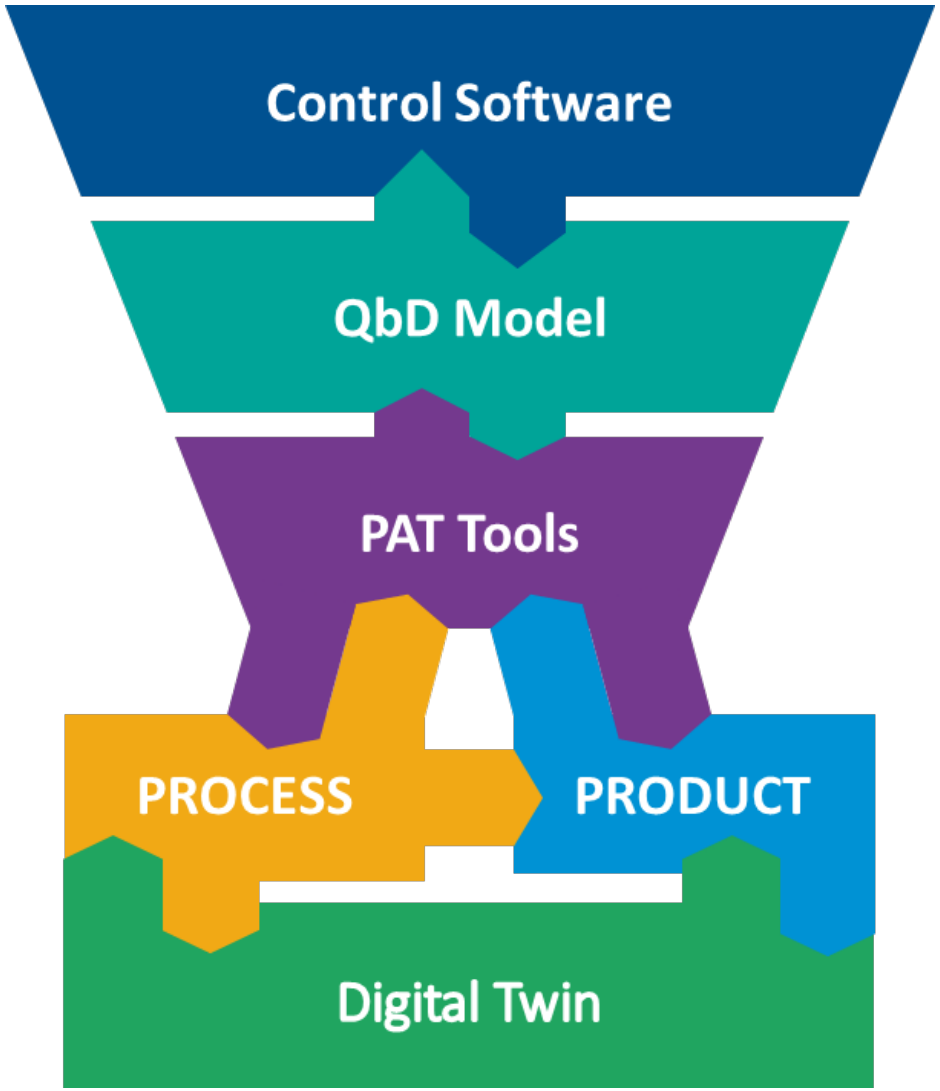
‘The future is already here- it’s just not very evenly distributed’

William Gibson (writer)

Continuous manufacturing

- Enables real time alteration of processing parameters
- Agility
- Readily scalable

BUILDING BLOCKS OF THE TALK



Real time alteration of physical asset parameters to ensure good quality product

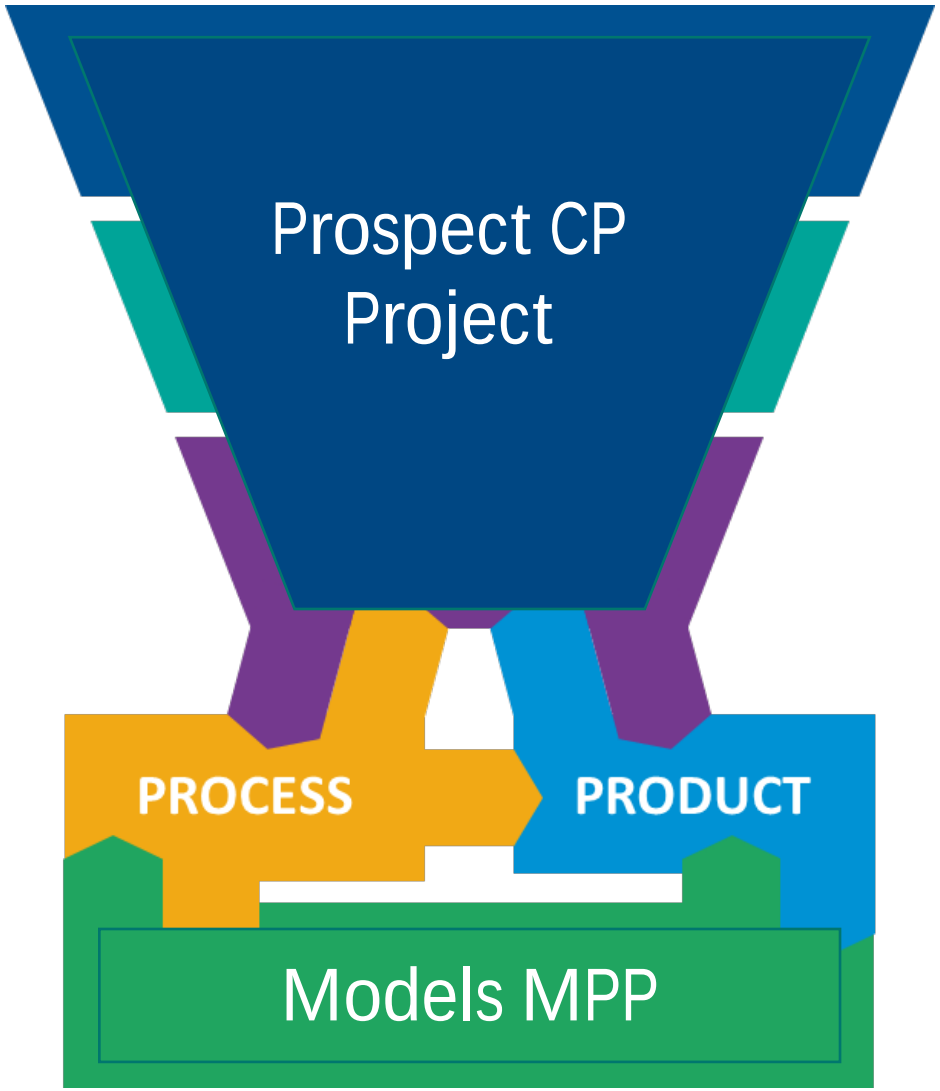
Understanding of the quality of data, and its interaction with the products quality

Means of chemical and physical interrogation of the product, sensors need to be appropriate and well integrated

Physical asset, where you produce a formulation

Model that helps you understand where to begin

BUILDING BLOCKS OF THE TALK



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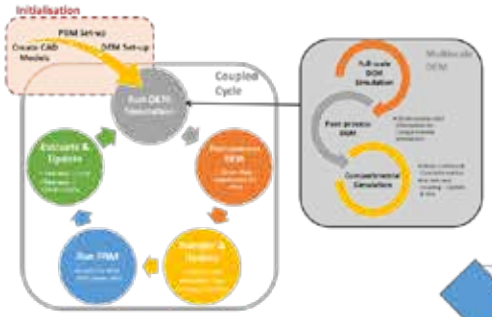
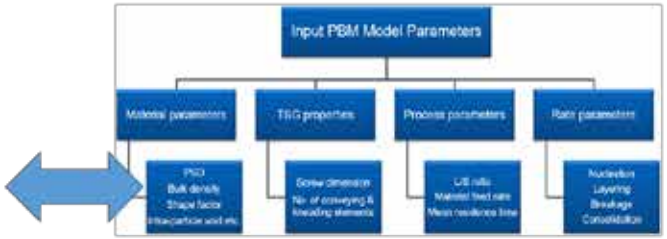
Digital Twin of Twin Screw Wet Granulation Process

Discrete elements model (smaller scale)

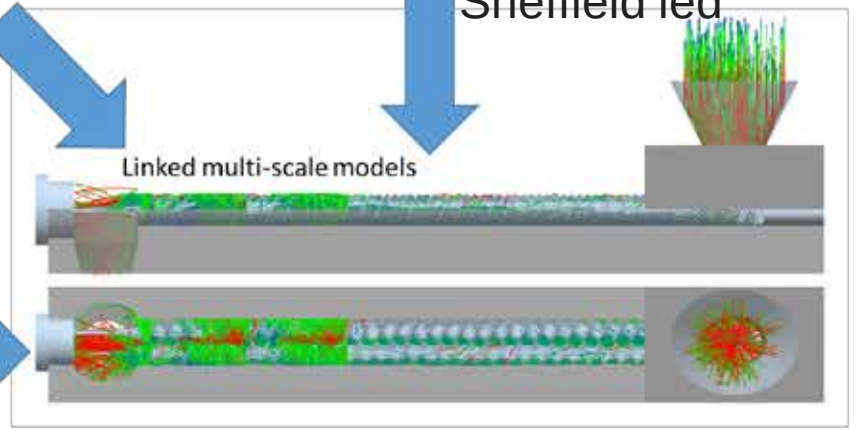


Population Balance model (larger scale)



Edinburgh led

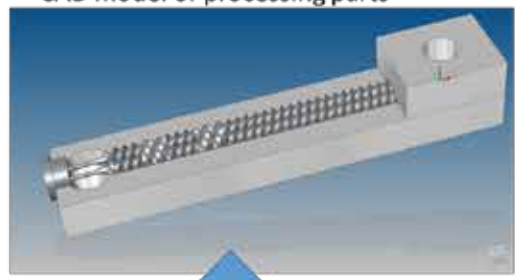
Sheffield led



ConsiGma 1 model is a side effect of the broader project to utilise academic models in industry

Output= Prediction of product parameters and more agile determination of high quality products in the real world with less materials waste

CAD model of processing parts



Equipment- GEA Consigma 1 Twin Screw Granulator

Models for Particulate Processing (MPP)

MPP project

- Generated a framework for linking multi-scale models
- This has, and will, enable integration of multi-scale models
- The information is not linked in real time to our process models

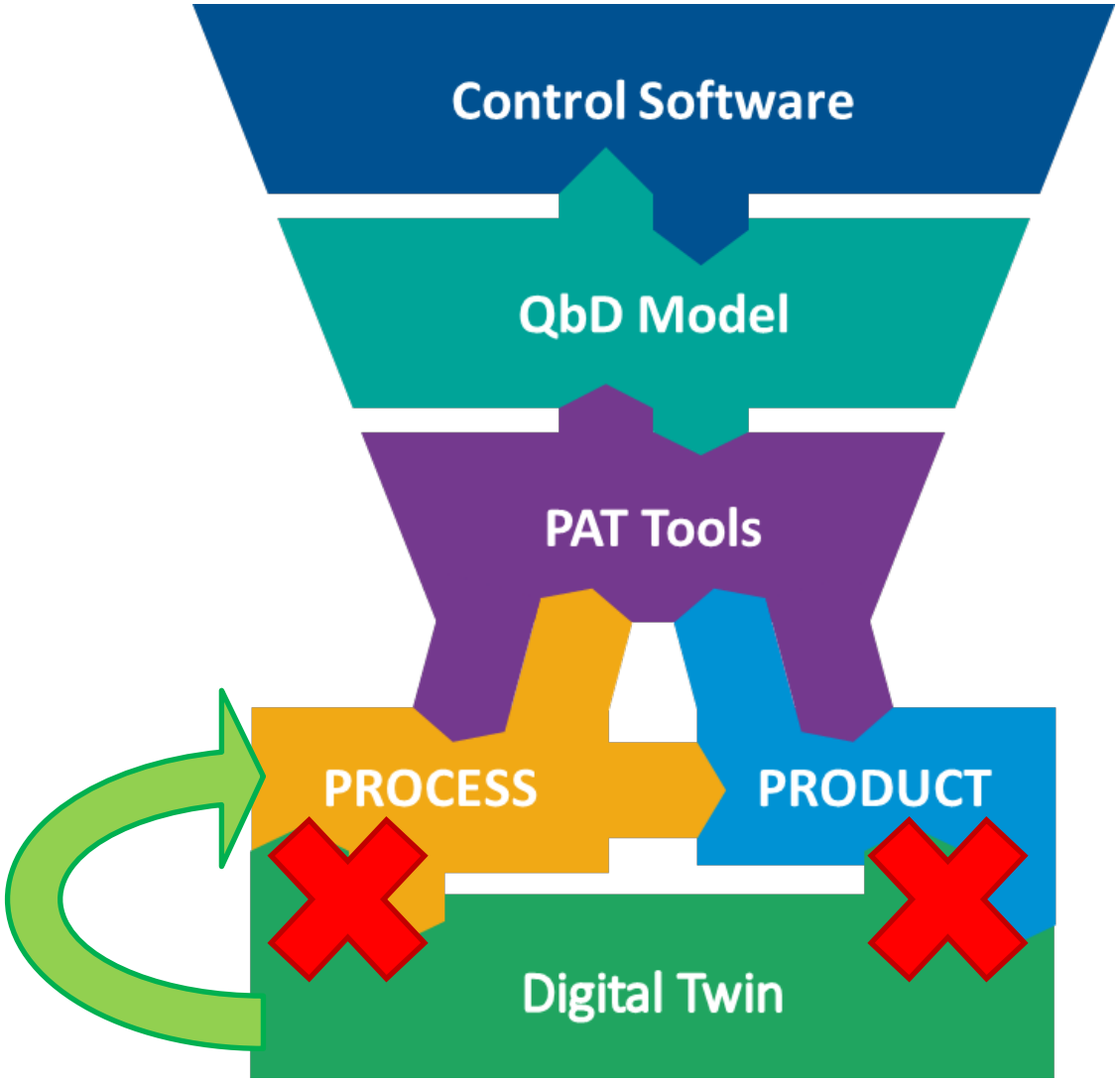
- Made possible by our partners: Thank you!

MPP interested in knowing more?

17th January free 1 day meeting as part of the project dissemination

- https://www.northeasttechnologypark.com/event/integrated-control-in-powder-formulations/

Building blocks of the talk- what we can't do (yet)



'The future is already here- it's just not very evenly distributed'
William Gibson (writer)

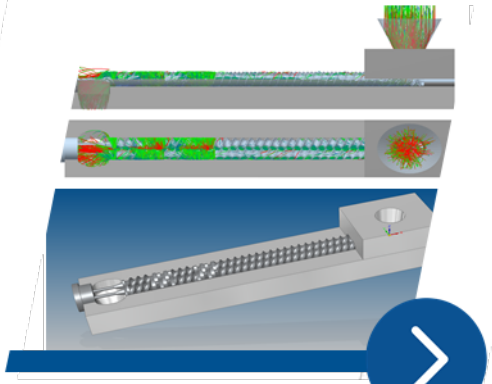
Our models aren't linked in real time

Model that helps you understand where to begin

Is still useful, even if it's not linked in real time

PROSPECT CP (COMPLEX PARTICLES)

Proving of real-world, scalable, predictive tools and technologies for particulate formulations



Modelling the dynamics of material and process

Enabling predictive scale up

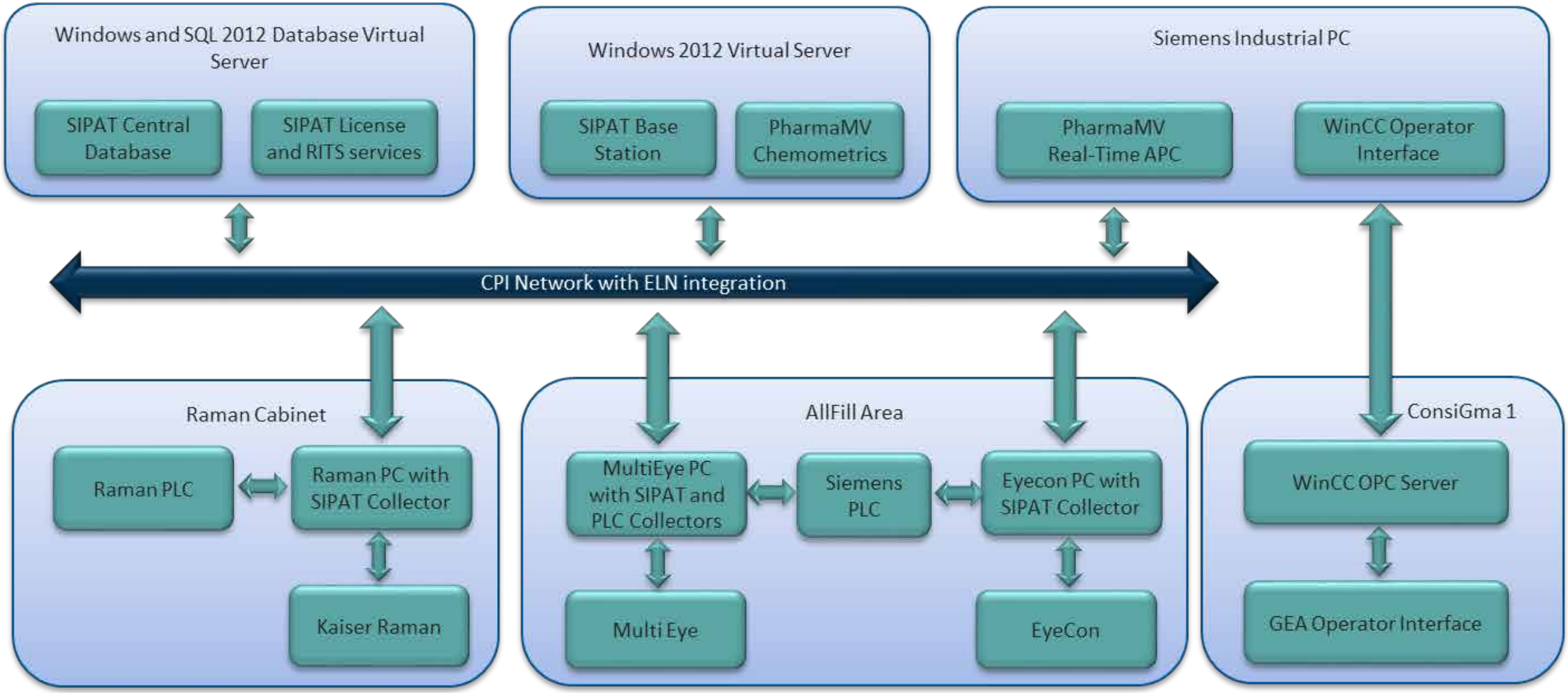
Validate new sensor technologies

Develop process analytical techniques

Project reaching conclusion

Two year project just beginning

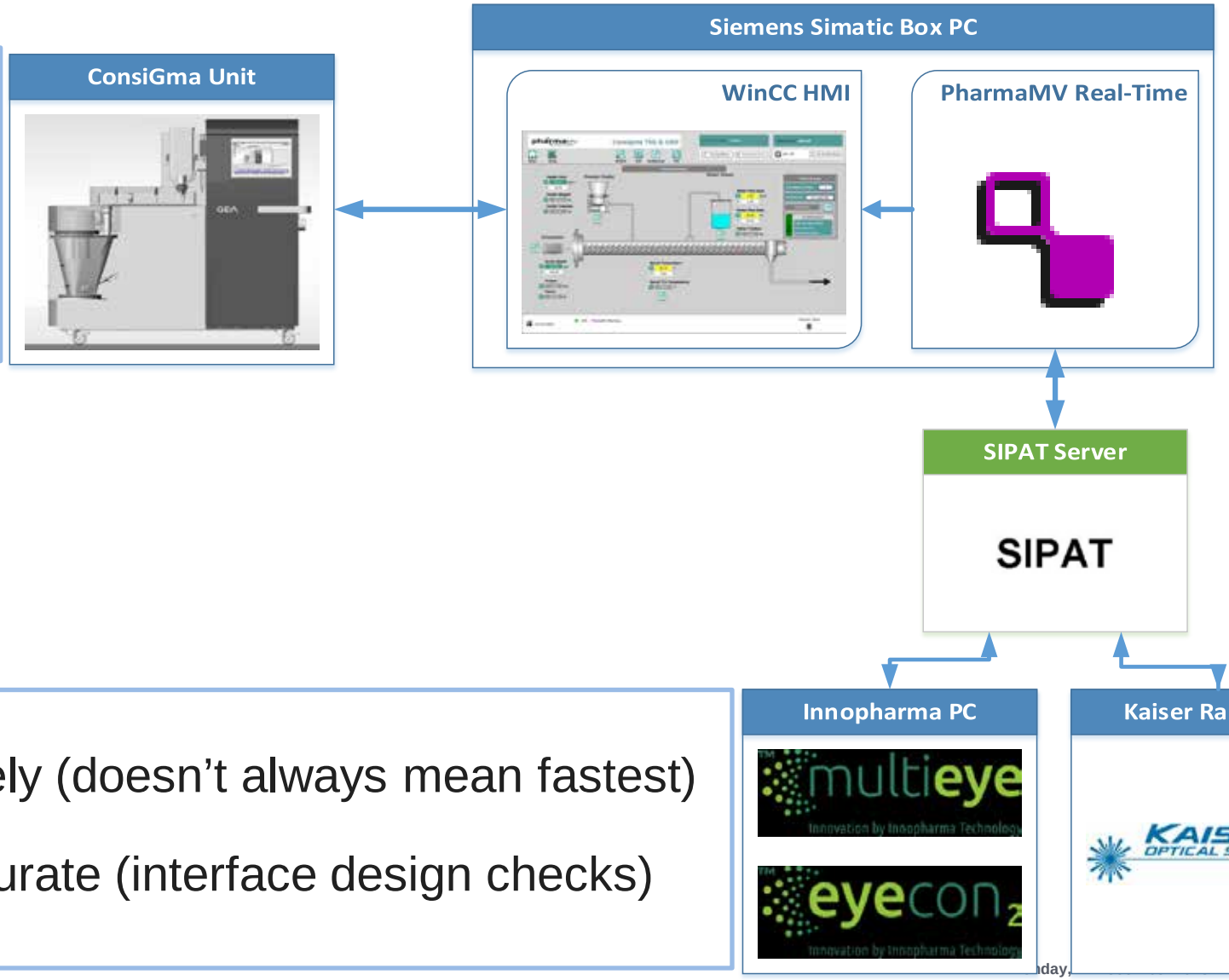
Advanced Process Control Infrastructure



Advanced Process Control Infrastructure

Requires containment

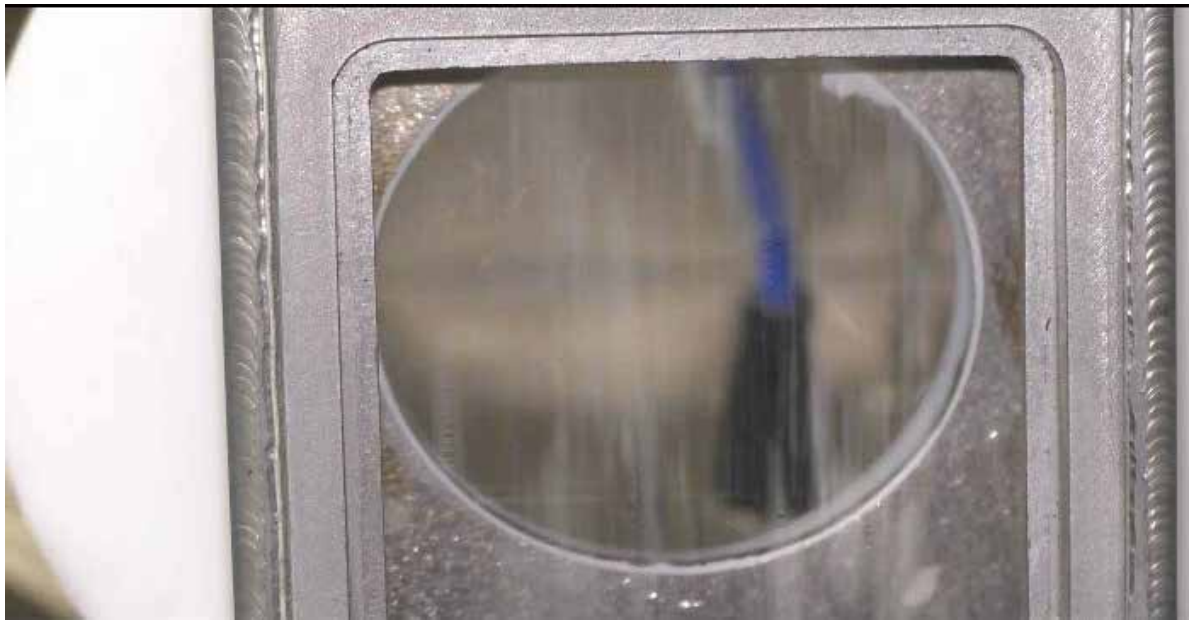
Need to be sure that feedback incorporates safety cut offs



No use if the information is not timely (doesn't always mean fastest)

No use if the information is not accurate (interface design checks)

e.g. PAT interface

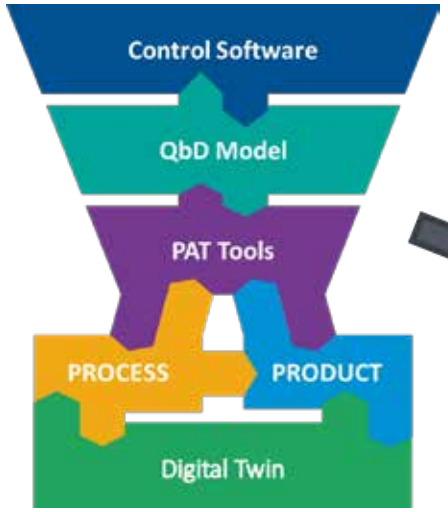


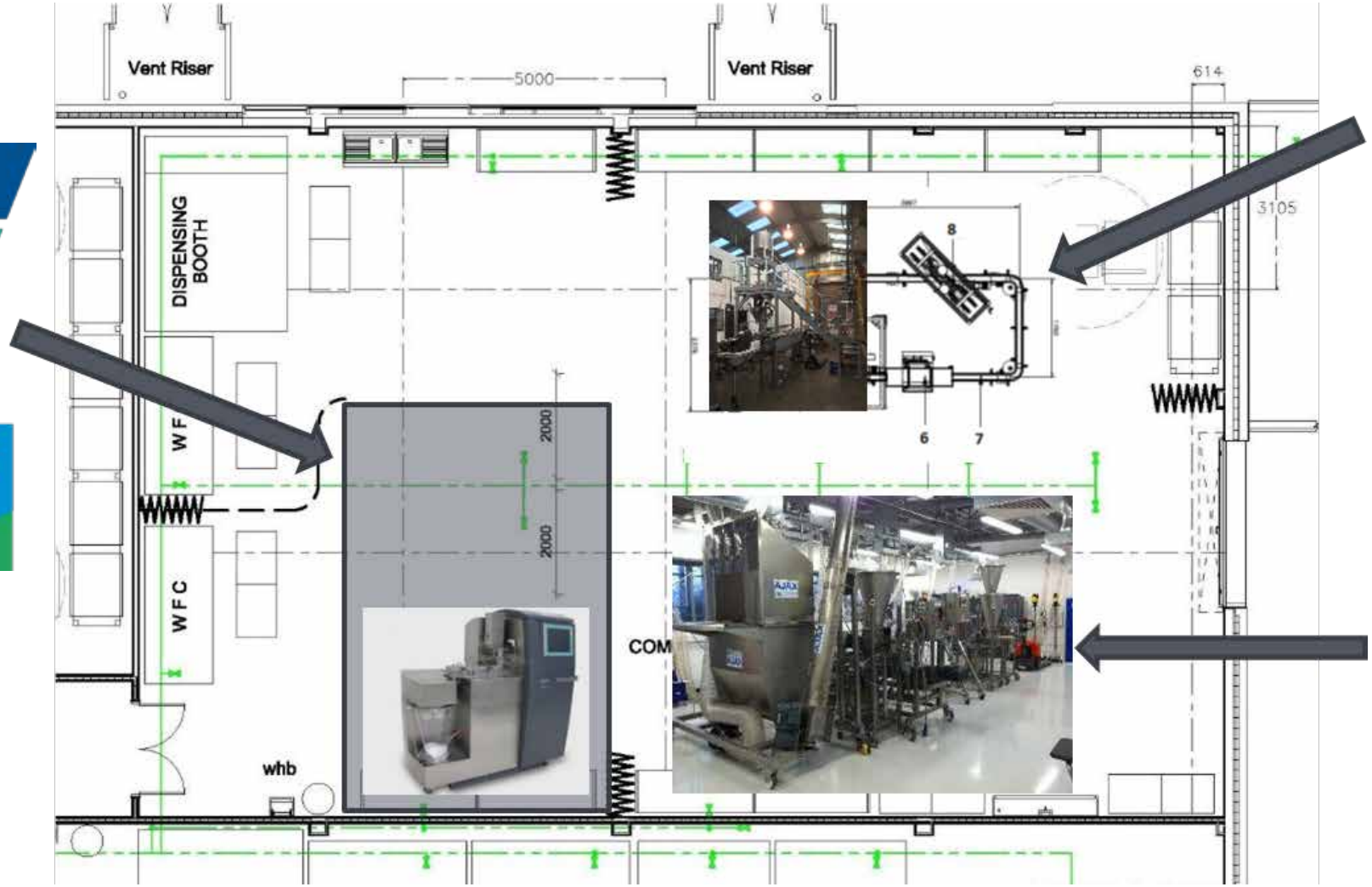
Particle size and shape window = right design

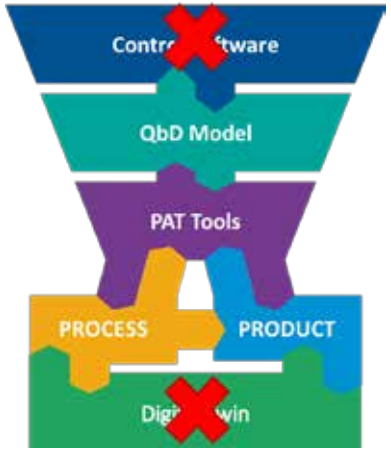
‘All models are wrong, some models are useful’
George Box (statistician)

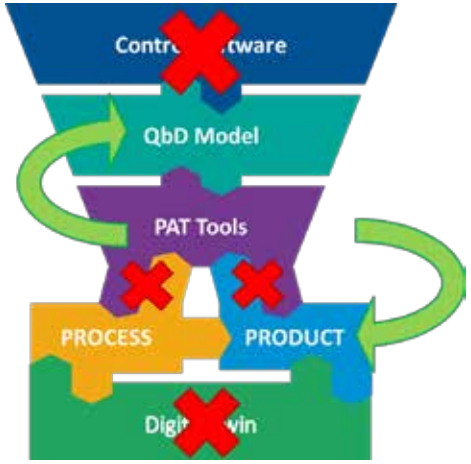
IR window = may be the right design

What this enables us to do









What it doesn’t enable us to do

- We do not have control models for all of our powder capabilities
  - Control of associated software can be hard and expensive to integrate
  - Some of our processing assets don’t have control software

- We have not yet integrated MindSphere (Siemens cloud technology) into our processes

Summary

- Through a ‘digital twin’ and models predictive control project we have enabled predictive design of manufacturability within a powders laboratory

- You do not have to fully integrate every asset to improve product quality and the efficiency of a facility
  - For those that you do the significant benefit is scalable agile processes with tight quality specifications

- It is possible to create a flexible infrastructure, but it won’t enable all assets to operate in the same way

THANK YOU

for more information

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