

**Innovation in Collaboration: an Intro to the NFC**  
**National Formulation Centre**  
**FSTG Encapsulation Event, Edinburgh, 10<sup>th</sup> June 2016**

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**CATAPULT**  
High Value Manufacturing



# Who are CPI?



CPI is a UK technology innovation centre and the Process element of the Government's High Value Manufacturing Catapult.



**National Printable  
Electronics Centre**



**Formulation**



**Industrial Biotechnology  
& Biorefining**



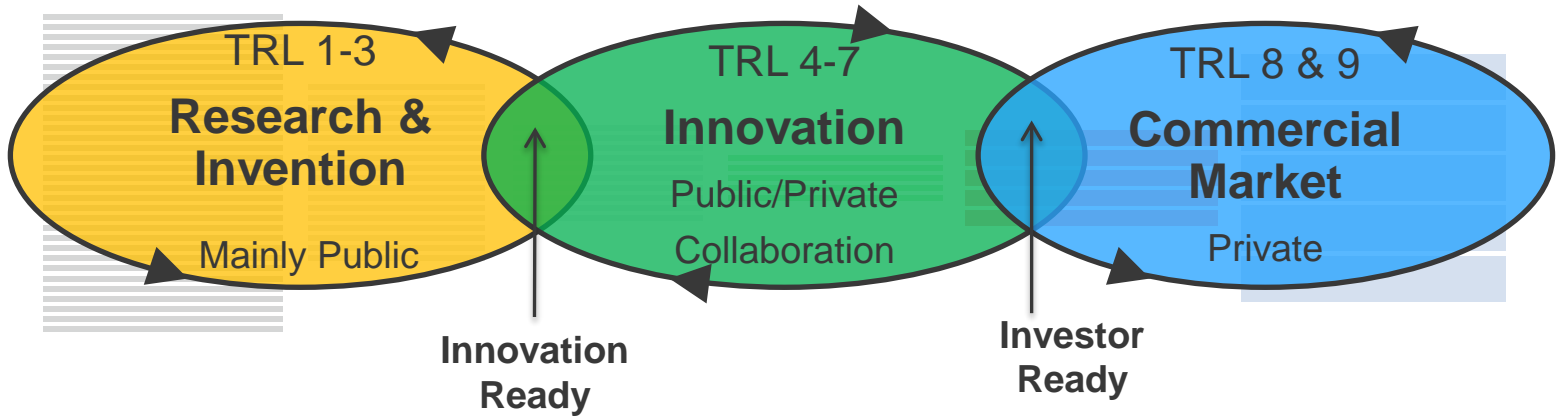
**National Biologics  
Manufacturing Centre**

We use applied knowledge in science and engineering combined with state of the art facilities to enable our clients to **develop, prove, prototype** and **scale-up** the next generation of products and processes.

# De-risking Translation from Invention to Invoices



- We support companies crossing the gap between research and commercialisation.



# Formulation (Integrate to Deliver Surprising Benefits)



Formulation, the creation of multi-component, often multi-phase products, is an enabling capability

Creating value through intricate microstructures and powerful ingredient synergies

Underpins many sectors in our economy and high-value manufacturing industries globally.

The formulated products market in the UK is worth around £180 billion pa with a potential for companies in emerging overseas markets of around £1,000 billion pa



# The National Formulation Centre - Overview



Create value for UK-based companies through Formulation science by enabling;  
Bigger, Cheaper or Faster innovation.

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**Productivity from value-creating strategic alliances** with industry and the wider UK formulation eco-system (inc SME/supply chain and Knowledge Base (Academic) partners)

**Create and use an industry-led portfolio of advanced capabilities.**  
**Sweat the UK assets** by best harnessing current capabilities (in academia or elsewhere) and then plugging any critical gaps identified by developing “open access capability”

**Sustainability from enduring access and application of advanced capabilities**

# FORMULATION CHALLENGE

## Move from Art to Science

- Productivity and Simplification for UK-Based R&D and Manufacturing by development and expansion of best **Modelling practice** as we move to **Predictive Design**

Move Formulation from Art to Science (Predictive Design/ Radical Effects / Manufacturability)

### Learn Thoroughly

High Throughput Tools and Digital Knowledge Management Systems

### Model

Move beyond simple models to more integrated systems

### Predictive Design

Ultimate goal for all Formulators

## Underpinning Technologies

Handling Solids/Liquids

Assess Properties / Test Applications

Scale Up

Colloid Science

Polymer Science

Analytical Sciences

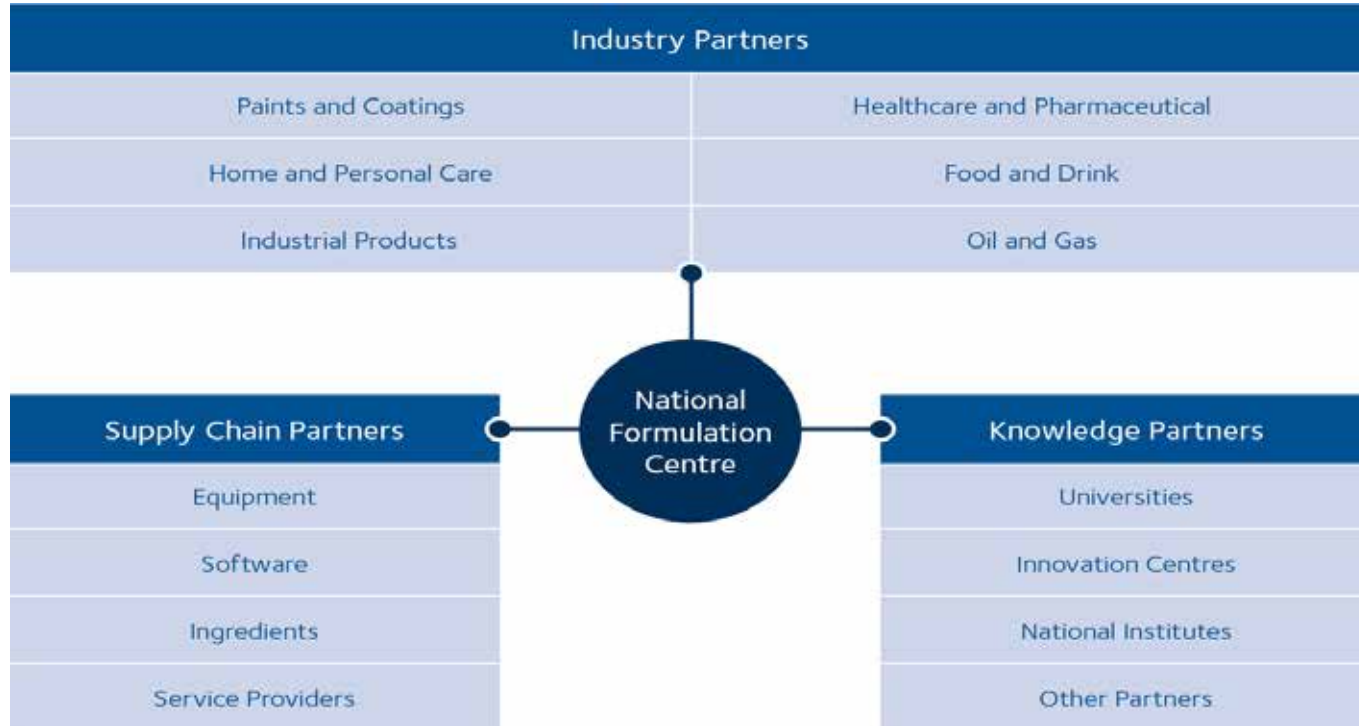
Metrology

Manufacturability

# Structure – Activating the Innovation Eco-system



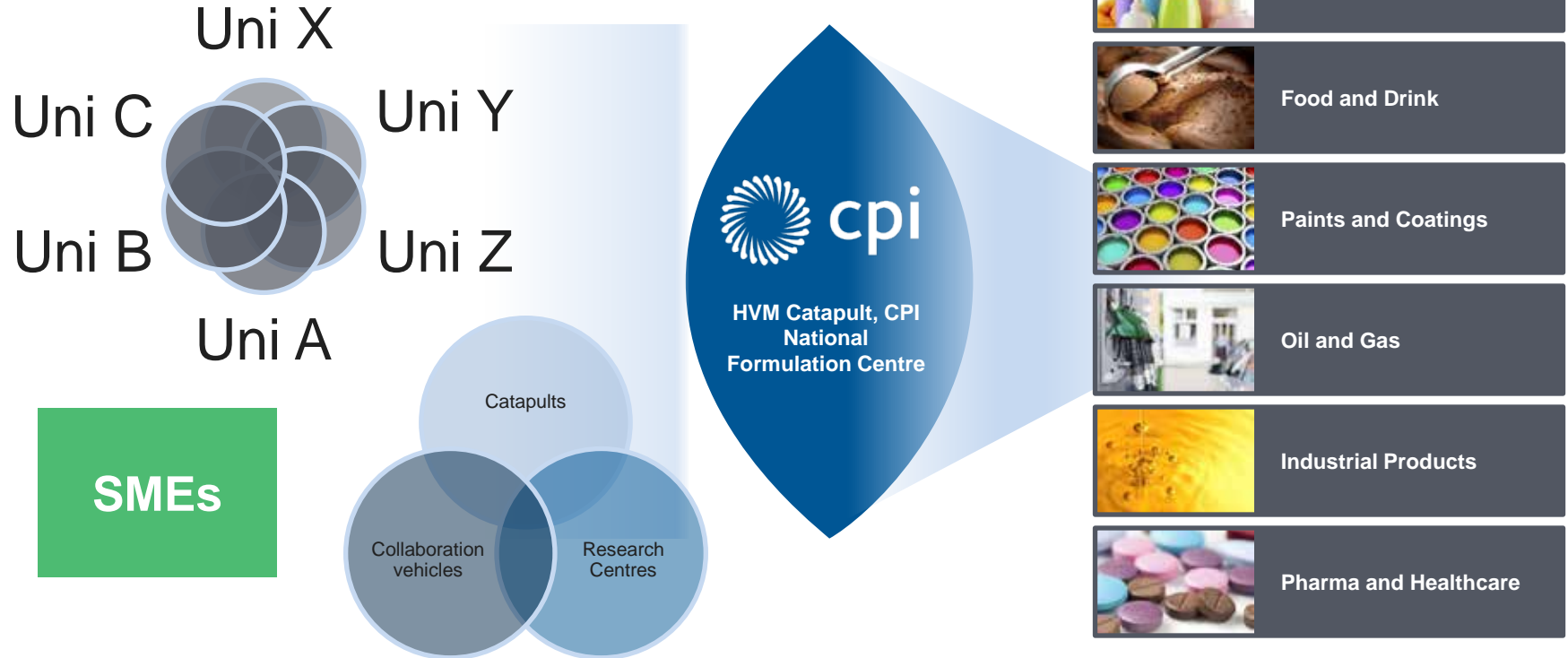
*Frames capability challenges (what's needed)*



*Co-develops associated technologies (what's possible)*

*Provides scientific understanding and enabling capabilities (possibility)*

# Lens for UK Formulation Innovation Eco-system (Clarity and Focus)





# Capability Themes to Work Against



## Predictive Designs

### Faster Innovation

Faster, more reliable approaches to get to ideal formulation design

## Radical Effects

### Bigger Innovation

Unexpected synergistic effects to deliver bigger/disruptive benefits

## Manufacturability

### Process Innovation

Optimised, reliable system to guarantee ideal formulated product delivery

## Big Data

### Innovation Enabler

Critical foundational component for knowledge management and problem solving

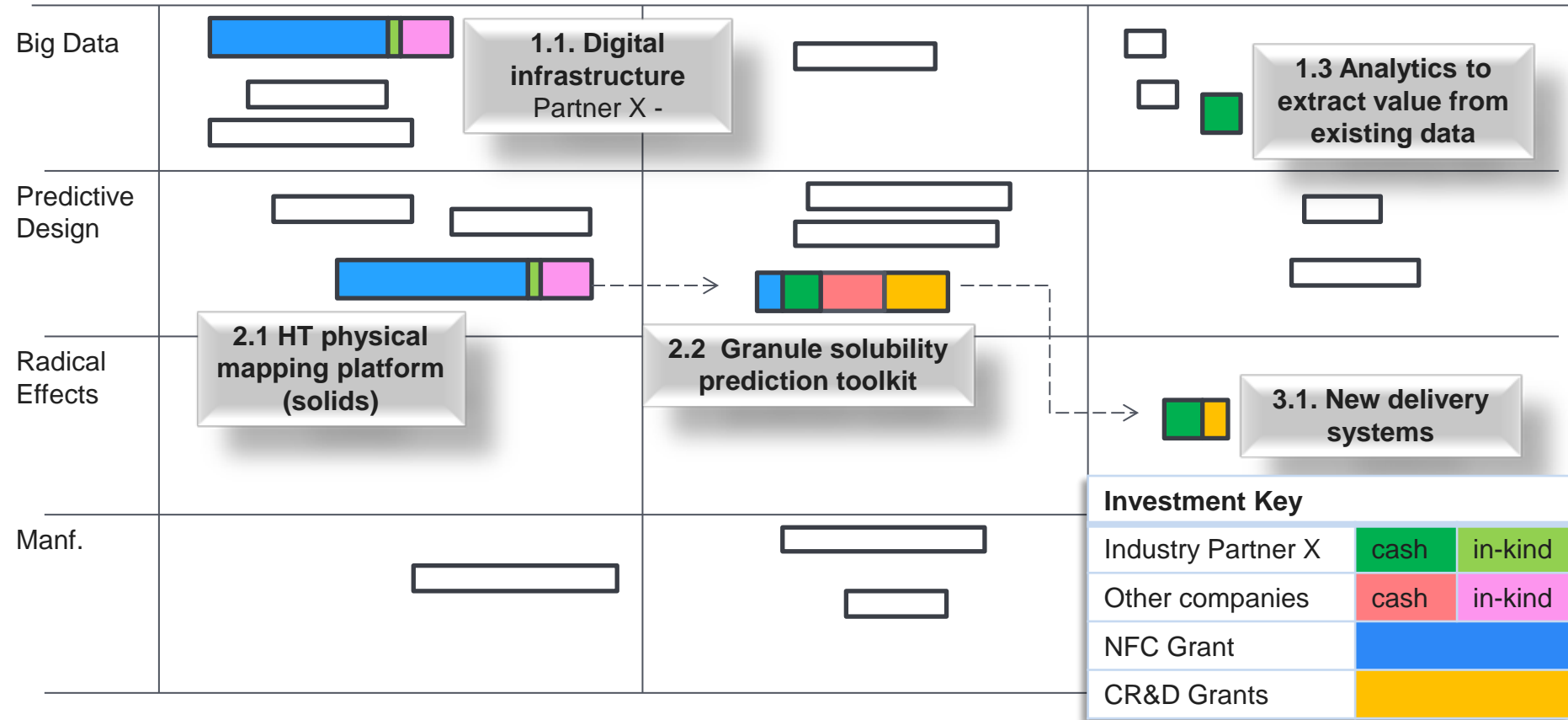
# NFC Creating Unique, Vital and Sustainable Capability



Build Open Access Capability

Refining Capability using CRD

Private Application of Capability



# National Formulation Centre

## Project Funnel – June 16



Incubation

Activation

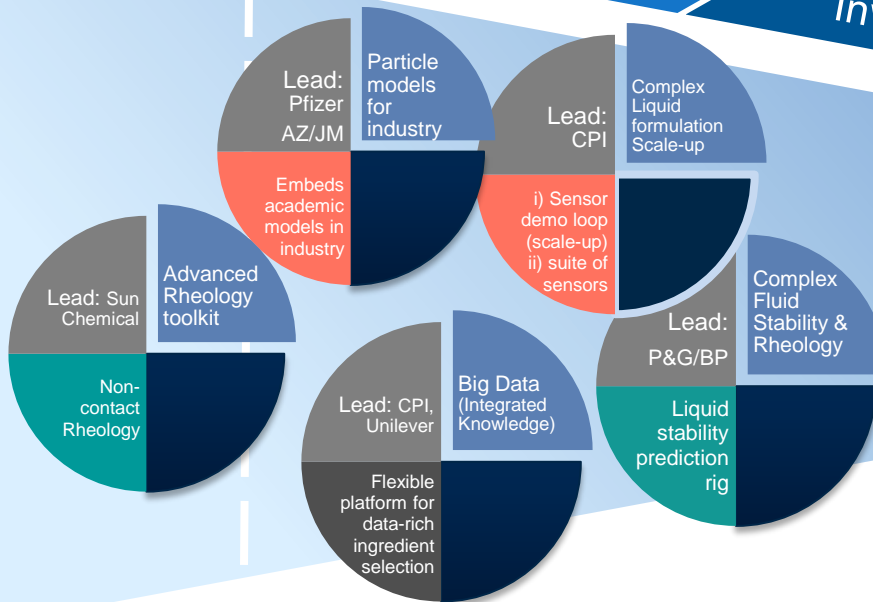
Building

Investment

Manufacturability

Predictive Design

Big Data

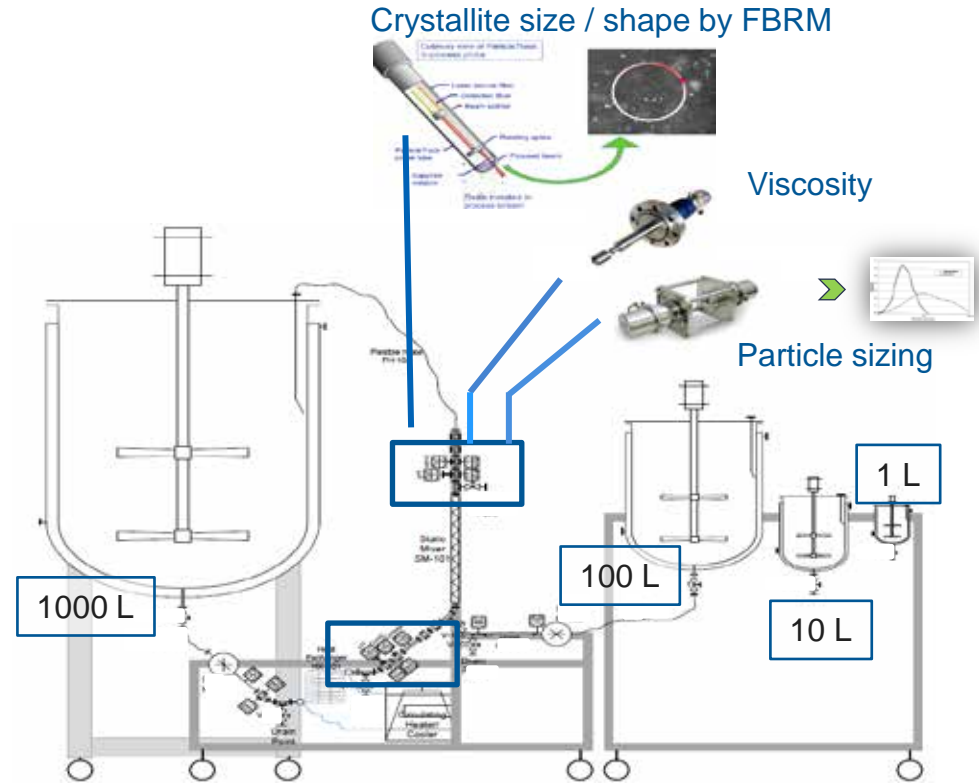


# Complex Liquid Formulations Scalability Understanding



## Current status

- Foundation platform ordered as NO facility in UK to learn across 10Ls scale.
- Interim location (Birmingham Uni)
- NFC “**Cleaning in process manufacturing**” study to inform follow-on project
  - focussing innovation needs
  - quantifying cross-sector value
- Liquids Understanding Research Infrastructure open Q4 2016



# Democratising High Throughput Experimentation (efficiency in R&D)



HTE platform with Solids & Liquids Handling vital core learning capability for all. Access for broader user base (SMEs etc.)

- High flexibility with range of online & offline screens

- Immediate use in:

- Validation datasets in support of NFC portfolio projects
- Private funded assessments

- Allows sharing of Development s & Capacity with key partners i.e. MIF

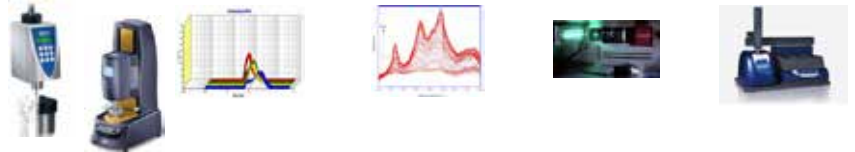
- System procured, will be commissioned Q4 2016

Add solids, liquids, highly viscous materials to mg resolution while formulation is being processed

Integrated and automated stirring, shaking, at controlled temperature, pressure. Real-time control of formulation parameters including Temp, shear rate and viscosity, scraping speed, pH



Integrated screens complemented by separate conventional lab capability

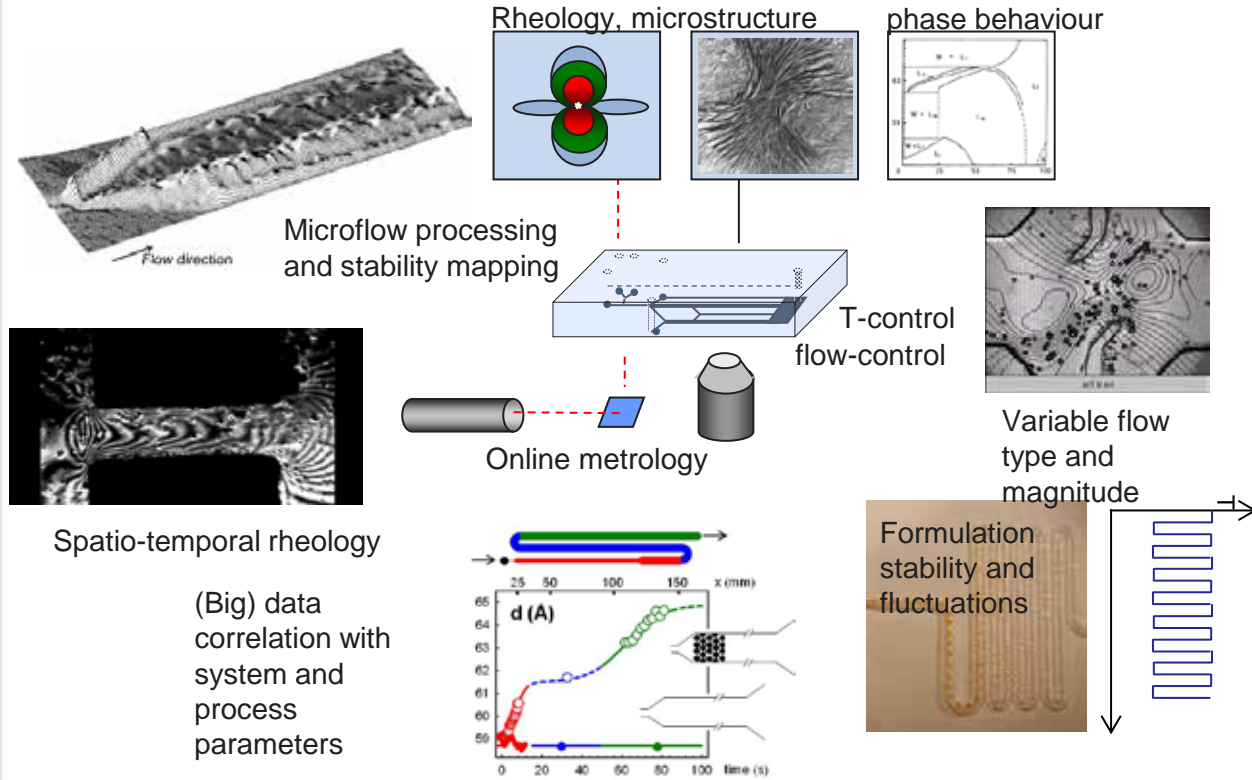


# Complex Fluid Stability & Rheology Assessment Tool



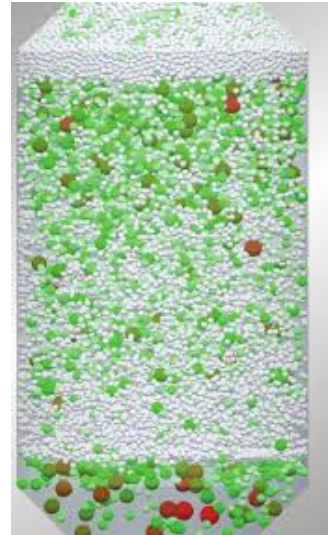
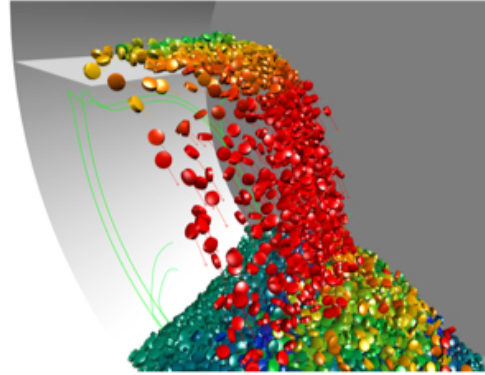
## Current status

- Rapid/Resource Efficient assessment of liquid product stability and failure predictions is a huge challenge today with no efficient options. Hence developing a unique capability.
- Technical plan being refined ensuring optimal value and impact for industry .
- Associate Partners to ensure future-proofing for cross-sector base
- Finalising contracts (target end June)
- Target start Q3 2016.



# Implementation of Particle Models for Industry

- Currently major capability gap to transfer models from Academia to Industry.
- Methodology and framework for translating models to industry
- Wet granulation case study which will fit as a tool within CPI- Chariot granules facility
- Methodology /best practice guide and support network can be applied to other manufacturing processes
  - Driving step-change modelling adoption
  - Complement commercial vendors
  - Creating UK hub for model commercialisation and in-silico development

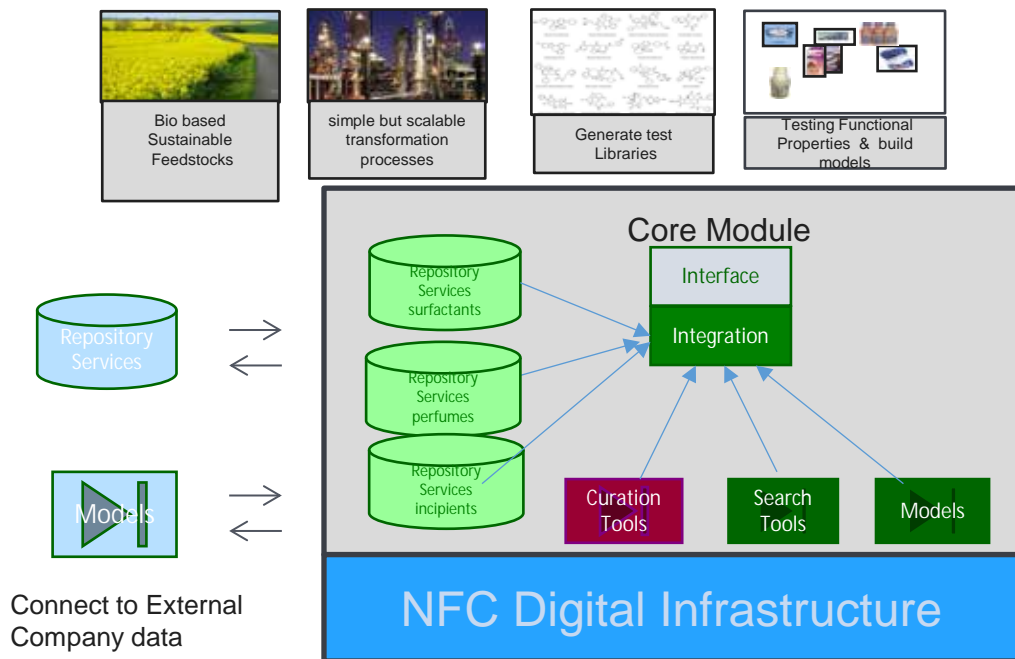


# Big Data - Integrated Knowledge System for Formulation



## Current Status

- This enables moving from art to science requires faster access to integrated knowledge to guide future product development, which is NOT available to industry today.
- Building on £1.5m IUK demo project
- NFC seeking additional end-user partners
- NFC working in partnership with Digital Catapult
- Q3 2016 – target start

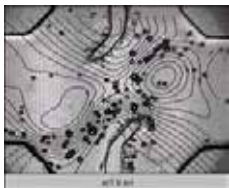




# Formulation Lighthouse Vision 2030



- Productivity and Simplification in Innovation from Predictive Design.
- Ultimately created autonomously, from self-learning systems (IoT connected)



Current Art of Formulated Products

More robust understanding of complex systems to enable model development

- Solids
- Liquids

Predictive Design from Models of evolving systems

- Innovation efficiency
- Productivity
- R&D Simplification

Develop Truly delightful products in function and design (STEM to STEAM)

Autonomous learning with systems IoT enabled to formulate against real need/conditions

# Thank you...

For more information visit [www.uk-cpi.com](http://www.uk-cpi.com)

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