

AUTOMATED FORMULATION & DATA MANAGEMENT FOR NEW PRODUCT INNOVATION

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24-04-2017

OUTLINE OF TALK

- Unilever & why we are interested in Automated Formulation
- End to End Automated Formulation & Data Management
- Key Challenges
- The Geoff Robot
- The Materials Innovation Factory



ABOUT UNILEVER



“MAKE
CLEANLINESS
COMMONPLACE
”

UNILEVER IS A GLOBAL COMPANY

THE AMERICAS

- €17.3 BILLION TURNOVER
- 0.4% UNDERLYING VOLUME GROWTH
- 32% OF GROUP TURNOVER

EUROPE

- €13.6 BILLION TURNOVER
- 2.6% UNDERLYING VOLUME GROWTH
- 26% OF GROUP TURNOVER

ASIA/AMET/RUB

- €22.4 BILLION TURNOVER
- 3.0% UNDERLYING VOLUME GROWTH
- 42% OF GROUP TURNOVER

2015 TURNOVER = €53.3
BN

WE MAKE MANY OF THE WORLD'S FAVOURITE BRANDS



WHY WOULD UNILEVER USE AUTOMATION IN R&D?

THE WORLD FACES NEW AND BIGGER CHALLENGES





MAKE
SUSTAINABLE
LIVING
COMMONPLACE

A NEW WAY OF DOING BUSINESS



**SUSTAINABLY SOURCED
RAW MATERIALS**



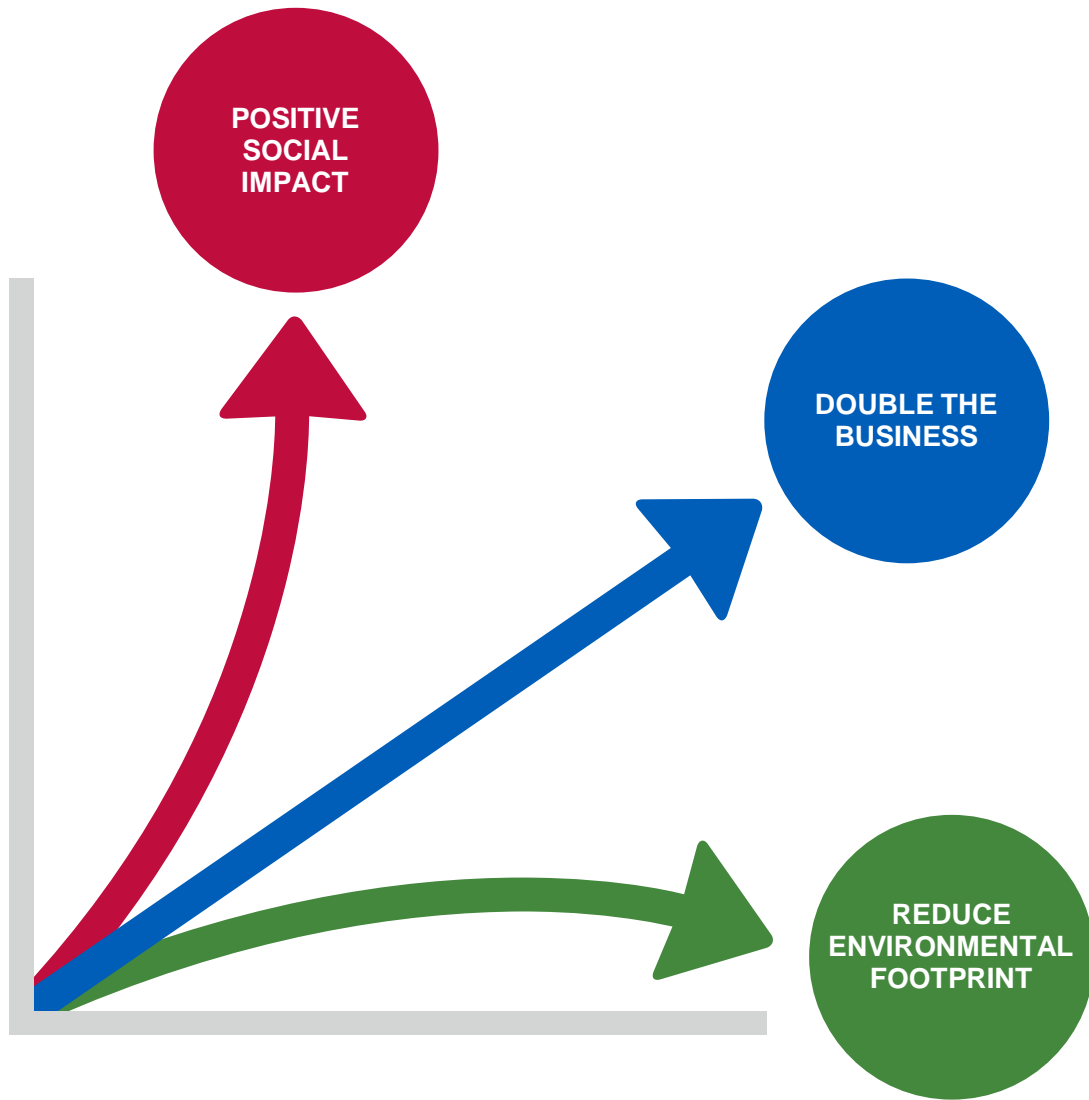
**EQUAL OPPORTUNITY
& SUSTAINABLE
LIVELIHOODS**



**THE PLANET PROTECTED
FOR FUTURE GENERATIONS**



**ACCESS TO WATER
SANITATION &
HYGIENE FOR ALL**



OUR VISION

TO DOUBLE THE SIZE
OF OUR BUSINESS,
WHILST REDUCING
OUR ENVIRONMENTAL
FOOTPRINT AND
INCREASING OUR POSITIVE
SOCIAL IMPACT



DRIVING INNOVATION



BIGGER BETTER FASTER INNOVATION

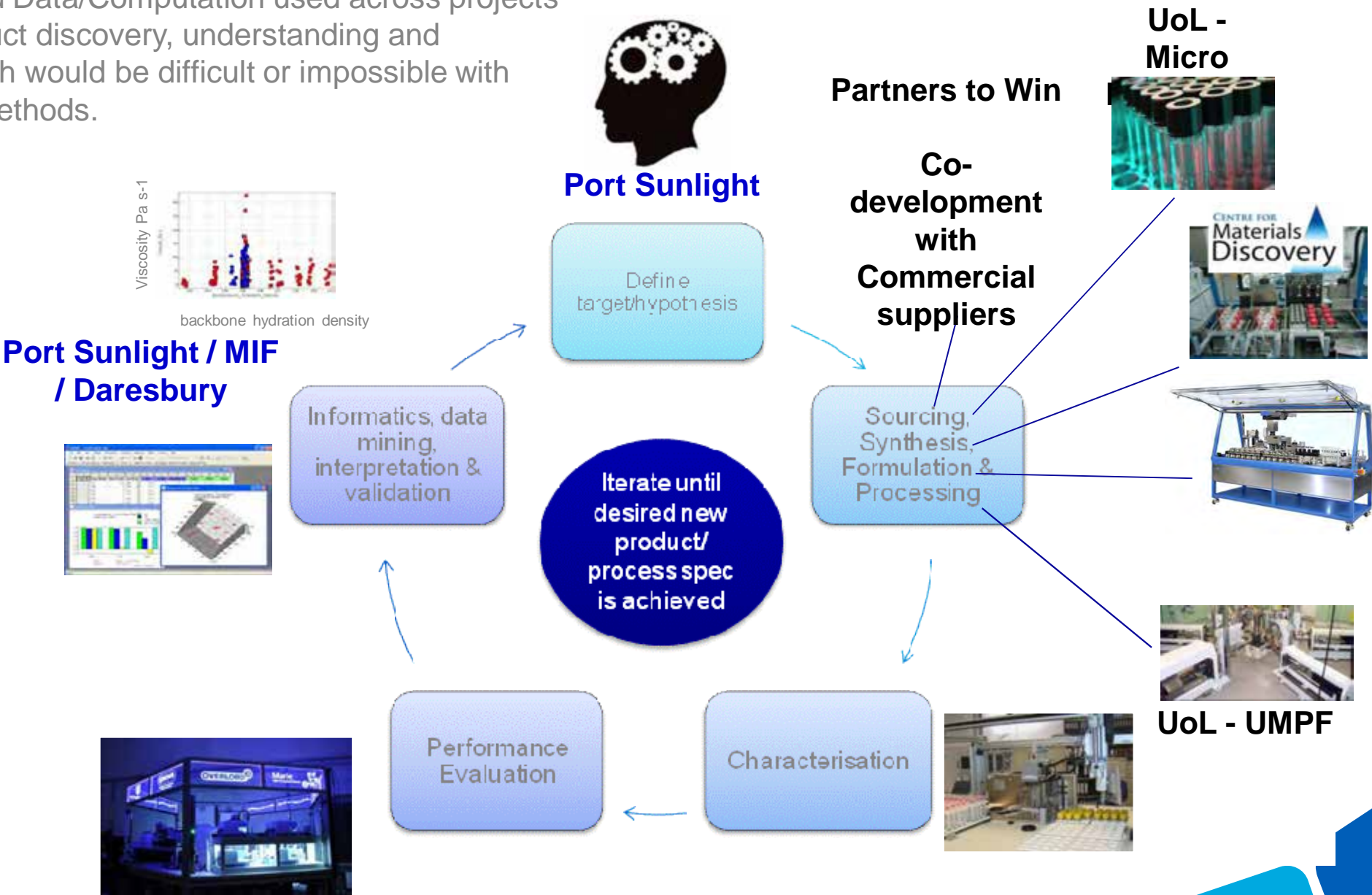
To meet the ambition of USLP, we must radically reformulate our entire Homecare and Personal Care portfolio by 2020, this is not achievable with traditional bench science. Instead we use a mix of automation and computation to explore wider formulation spaces faster.



END TO END AUTOMATION & DATA MANAGEMENT

'END TO END' AUTOMATION & HIGH THROUGHPUT

Automation and Data/Computation used across projects to enable product discovery, understanding and innovation which would be difficult or impossible with conventional methods.



'HIGH THROUGHPUT OPERATING SYSTEM'



FLOW

- Registration of Materials, Lots, Formulations (with processing) and Substrates



EMS



- Experiment configuration with meta data capture



Harmony/Overlord

- 'Common Interface between instruments and EMS'

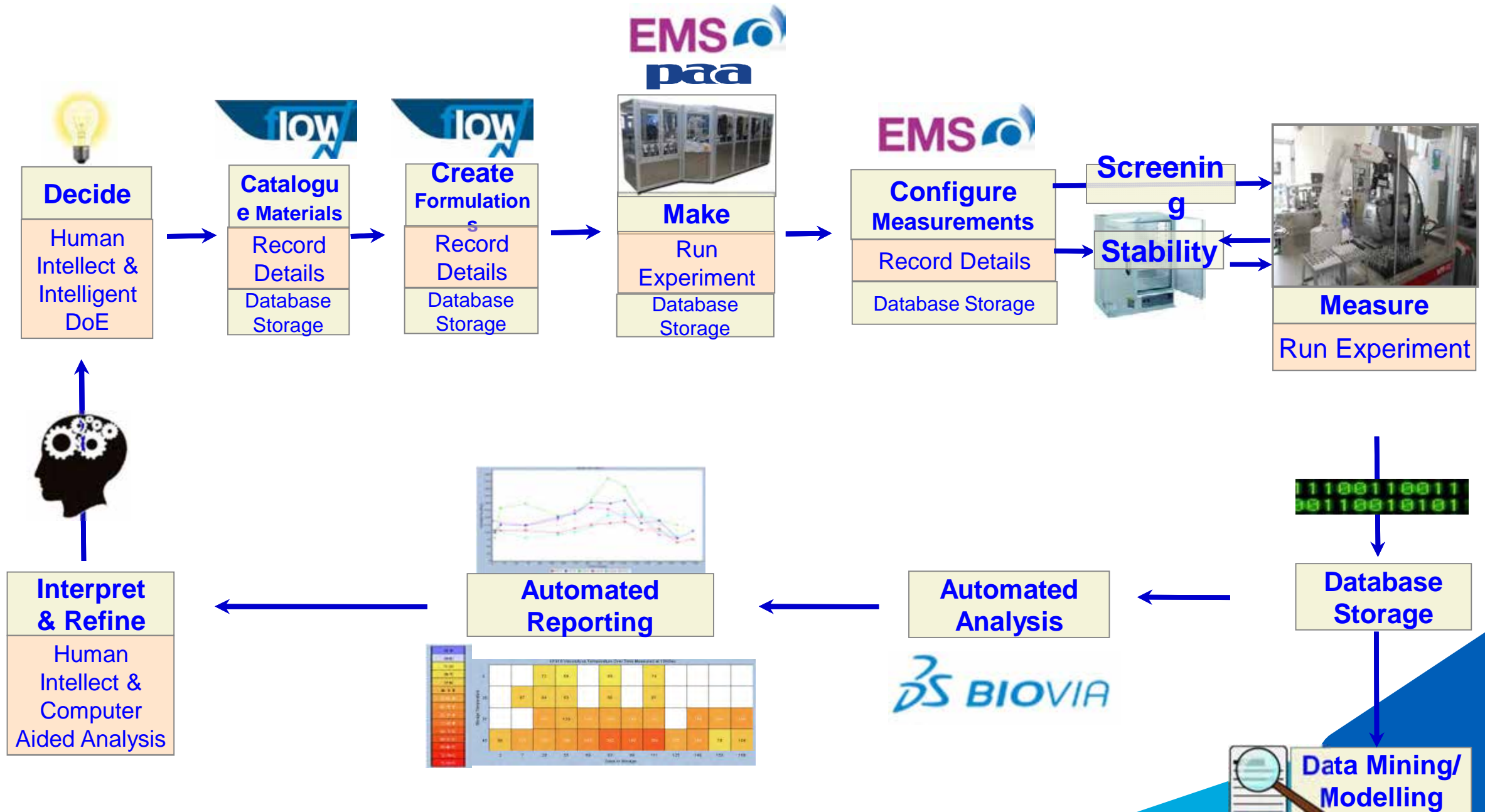


Pipeline Pilot



- Experiment Validation, Analysis and Reporting

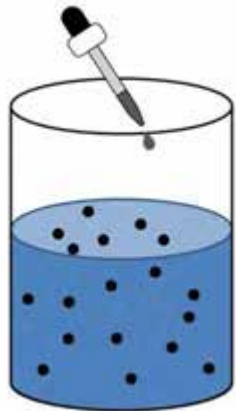
HTOS In Practice



KEY CHALLENGES

DIVERSE RAW MATERIAL PALLETTE

- Viscous liquids with entrapped air



- Suspensions

- Powders



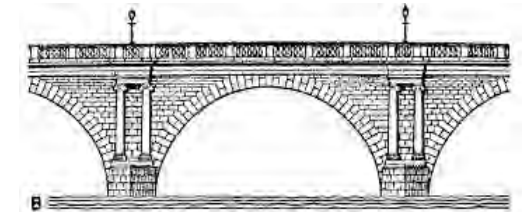
- Hot Liquids



- Sticky Powders



- Bridging powders



DIVERSE PRODUCT PORTFOLIO



... from Domestos to Dove Shampoo

... Persil Laundry Liquid & Comfort Fabric Conditioner

DIVERSE USER NEEDS



- Mixing Liquid Products

- Precise Dosing Control



- Foam detection



- pH Measurement & Goal seeking



- Thickness Measurement & Goal seeking



- Hot Processing



- Temperature control



- Homogenisation

GEOFF AUTOMATED FORMULATION ROBOT

AUTOMATED FORMULATION – ‘GEOFF’ ROBOT

Formulation
Pot Input &
Output

24 x 800 g
Batches per run

4 x
Formulation
Stations



Gravimetric
dispensing

Configurable
mixers

Formulation
in Final Pot

Homogeniser

Temp Control

Clean Mixers
in Place

pH adjustment

Viscosity
adjustment

Foam
detection

Modularity and
redundancy

Standardised software
for ingredients & process

Hot
Liquids

Viscous
Liquids

Suspensions

Powder
s

AUTOMATED FORMULATION – POWDERS



**Powder
Module**



**Removable
Powder
Hopper**



Powder Boat



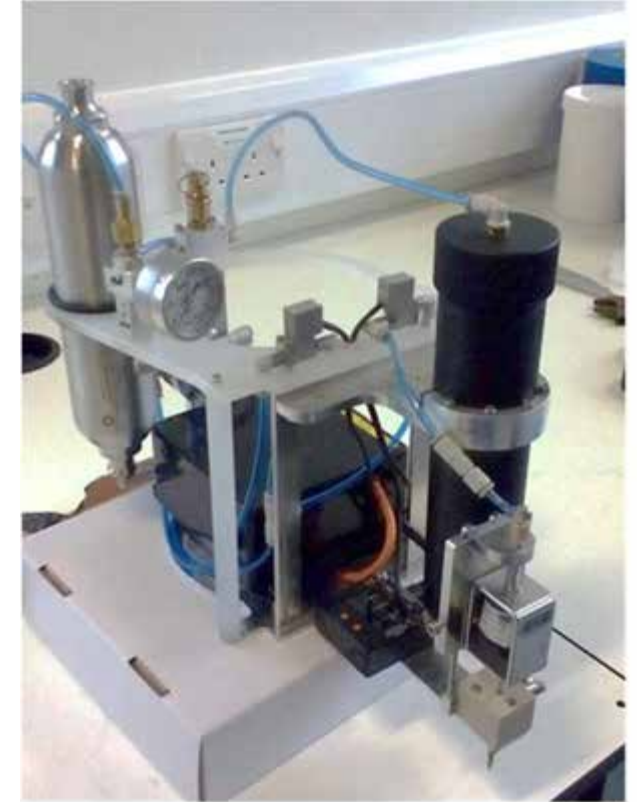
AUTOMATED FORMULATION – LIQUIDS



**Viscous
Dispensing**



**Hot Liquid
and
Suspension
Dispensing**



**Small
Volume
Pressure
Dispensing**

AUTOMATED FORMULATION – GEOFF



Capping and Decapping



Removal of
module



MATERIALS INNOVATION FACTORY

MATERIALS INNOVATION FACTORY



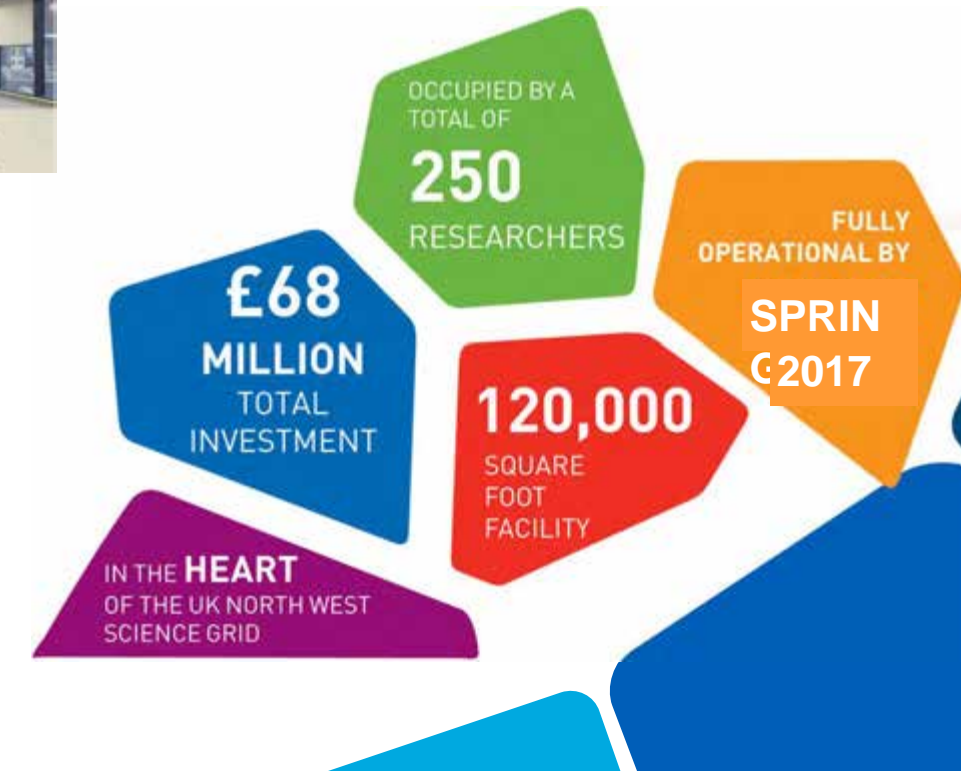
- A world's leading centre for **Computer Aided Materials Science**, focusing on materials chemistry, soft solids and complex mixtures.
- 9 Dedicated Academics & 12 Technical support staff for the **Open Access Area (OAA)**
- OAA operates on a credits system; credits available to 3rd parties as well as Uni. Of Liverpool & Unilever to create a sustainable business model
- OAA contains leading edge automation comprising specifically purchased kit & Unilever donated kit.



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LIVERPOOL



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HIGHER EDUCATION
FUNDING COUNCIL
FOR ENGLAND



PARTNERING

Leading edge
automation

Suppliers

Integration
Specialists

Informatics
Providers

Partners

Labman
Automation
LIMITED
www.labman.co.uk
bespoke laboratory automation



CENTRE FOR
Materials
Discovery

ThermoFisher
SCIENTIFIC
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HAMILTON



Daresbury Science
& Innovation
Campus

 **TECAN.**

 **CHEMSPEED**
TECHNOLOGIES



 UNIVERSITY OF
LIVERPOOL
Materials Innovation Factory



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hefce
FOR ENGLAND

THANK YOU – ANY QUESTIONS?

Thank you

Any Questions?



Acknowledgements

Labman Automation Ltd
Regional Growth Fund & BIS
Unilever

Mark Auty
Mark Newman
Andy Mitchell