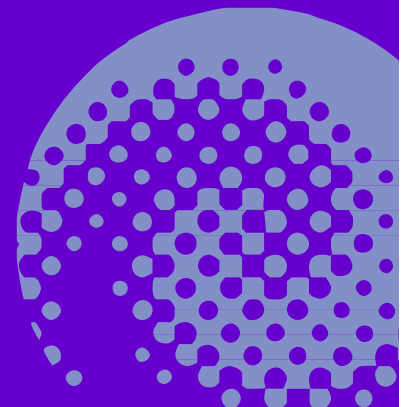


# PI Meeting Grangemouth

26<sup>th</sup> April 07

Ian Laird

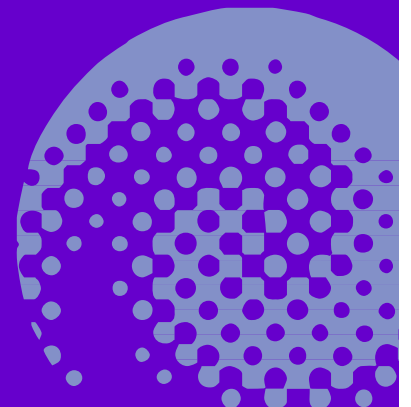
Managing Director



# NiTech - The Company



- Founded by Prof Xiong-Wei Ni as spin-out from Heriot-Watt University
- Provide technology licences, consultancy, design & support
  - Equipment supply through appropriate partners
  - Currently working for a range of clients including academic, FTSE, and European organisations
- IP includes granted patents and patent applications



# Batch production of a photochemical at James Robinson Ltd (JRL)



27 m

© NiTec



Replaced by...

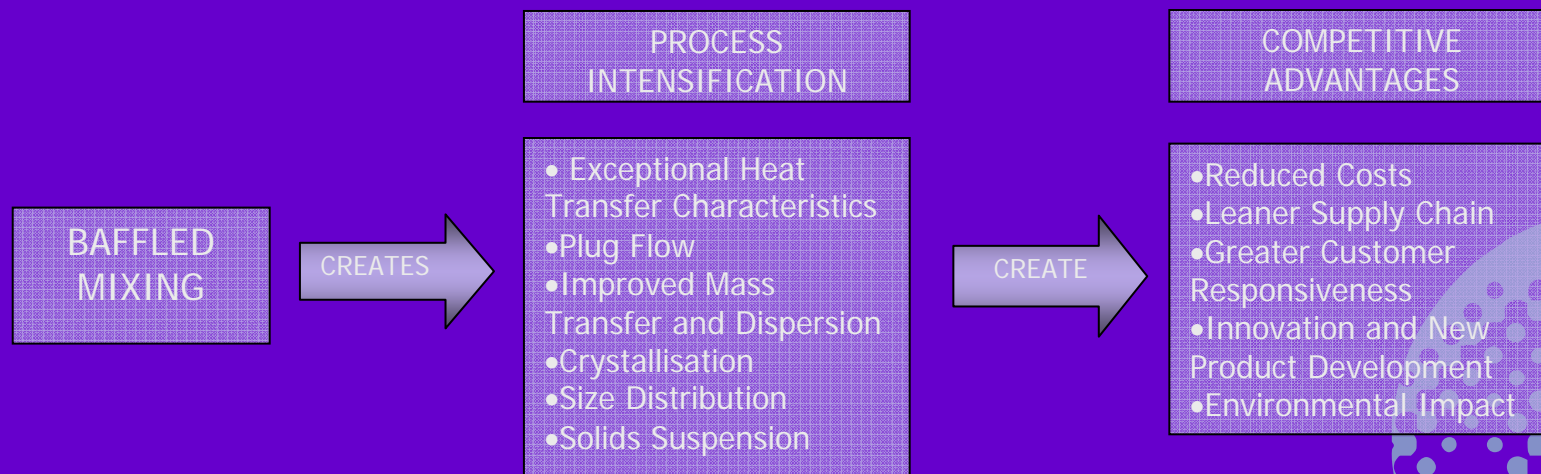
2.5 m

# Lower cost / Better quality

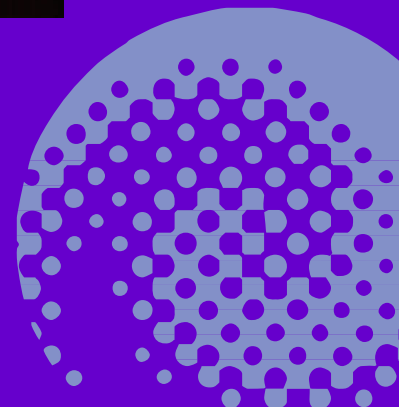
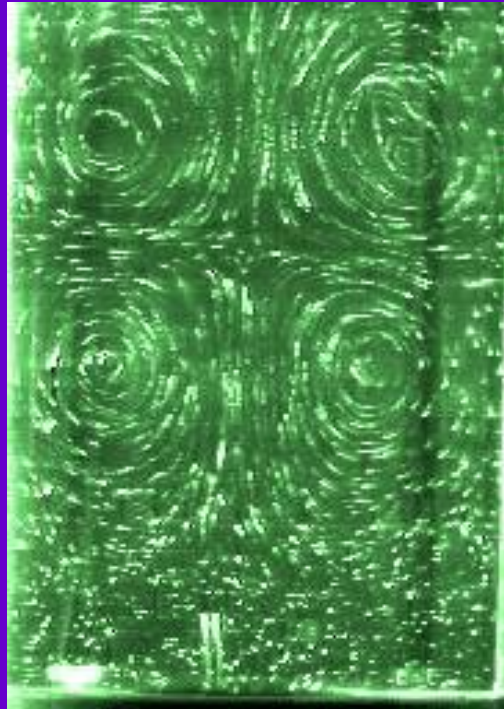
- Lower Cost
  - 95% reduction in space
  - 95% reduction in lead time
  - 50% reduction in Capital Cost
  - 99% reduction in waste / toxic emissions
- Improved control of product
  - More consistency
  - Greater control over product characteristics
  - Faster time to market

# The Proposition

- Oscillatory Baffled Reactor (OBR)
  - Very effective mixing and dispersion
  - Control of solid creation, formation, suspension & separation
- Continuous OBR (COBR)
  - Enables and enhances continuous processing

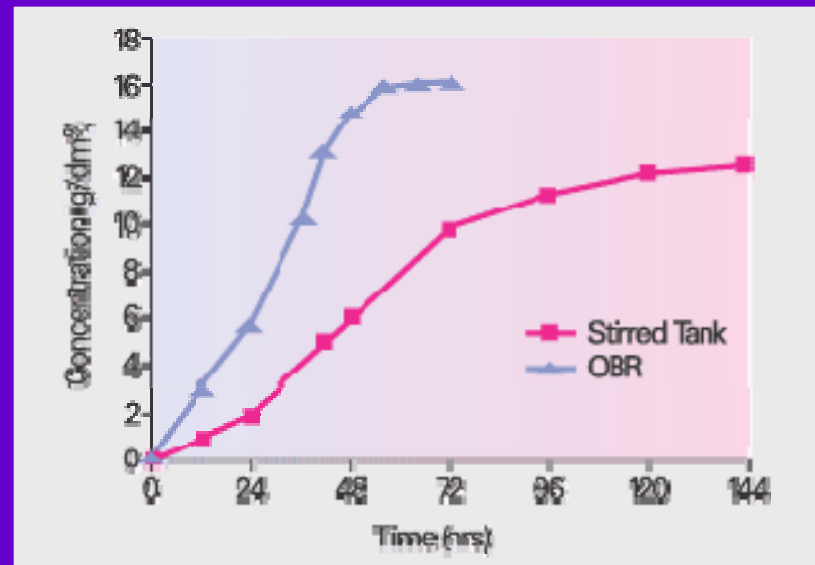
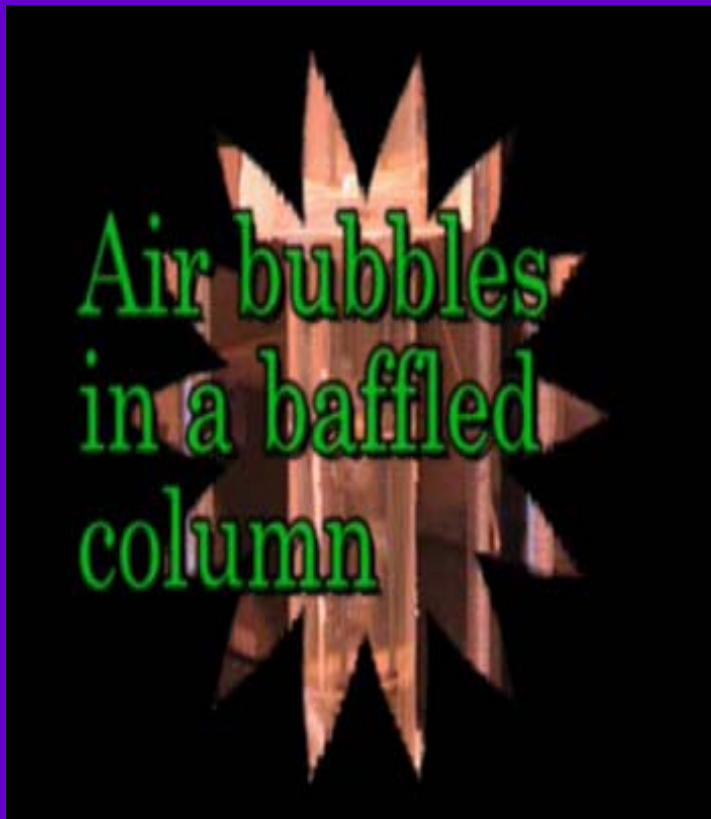


# Demonstration of Radial Mixing with good dispersion



# Improved Gas and Liquid dispersion

Fermentation of a biopolymer



## Gas dispersion

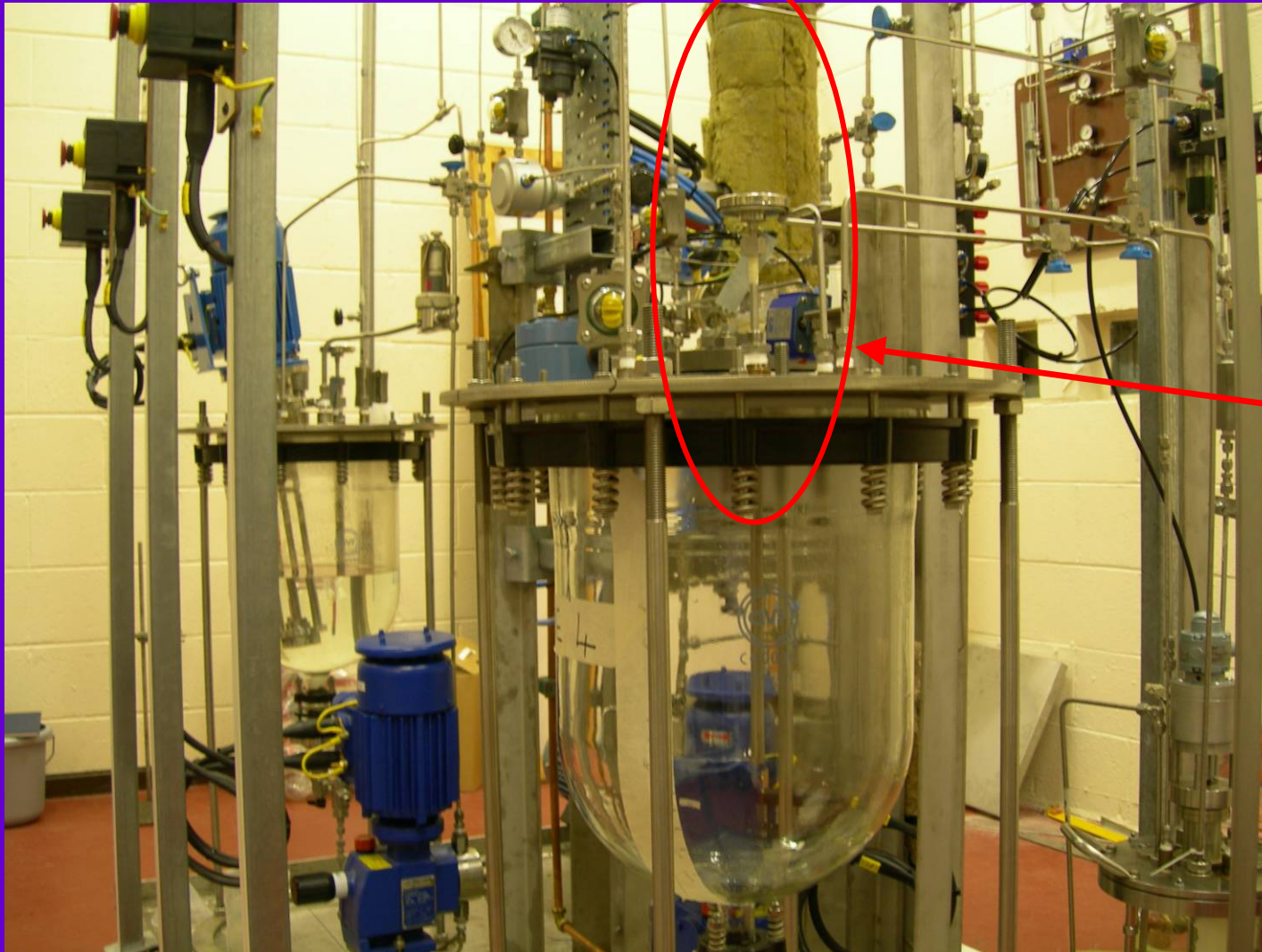
Bubble retention time considerably improved

Bubble sizes are smaller and more uniform

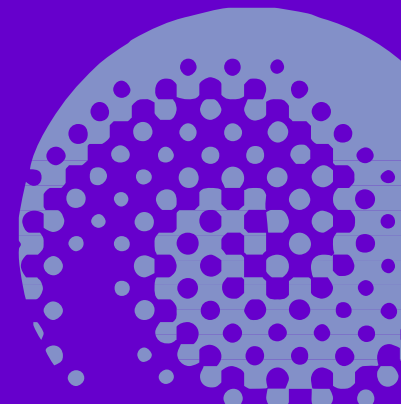
Gas holdup is significantly increased

Higher mass transfer rates

# Continuous Small Scale Hydrogenation (S-L-G)



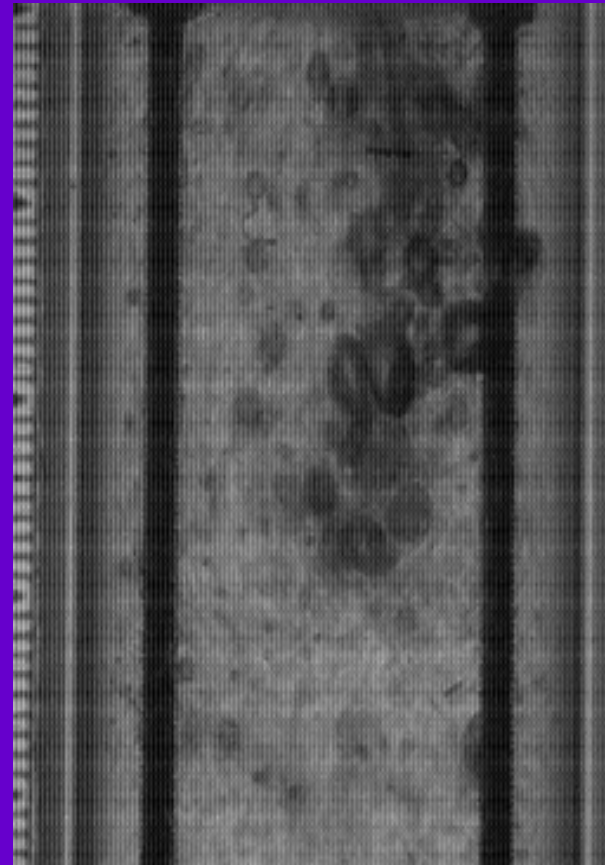
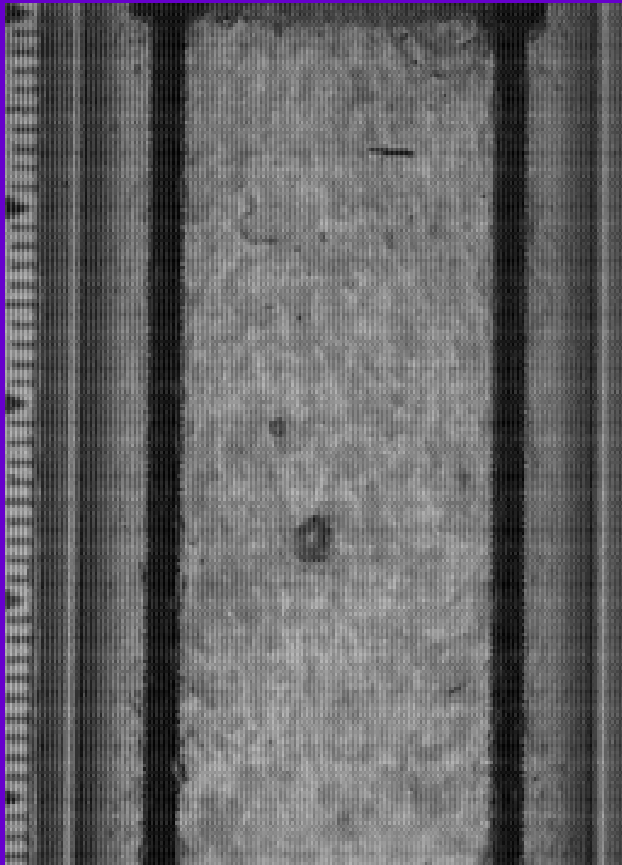
Reactor  
Column



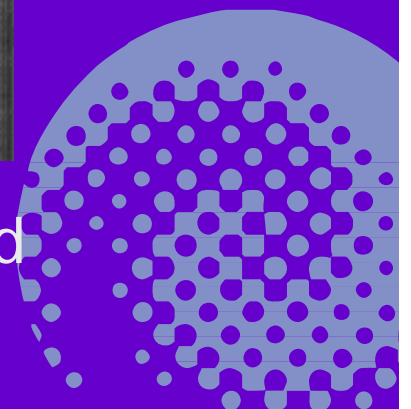


# Liquid – Liquid Mixing

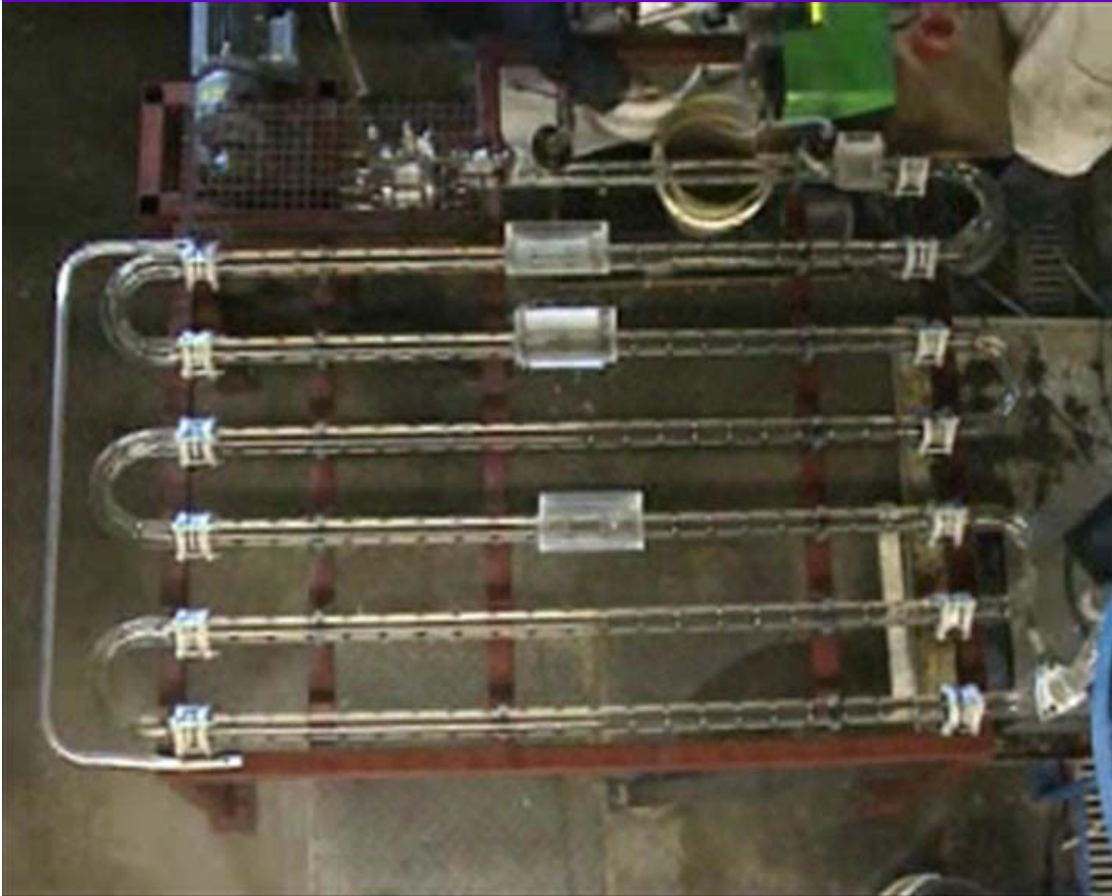
## C8 mixing in water



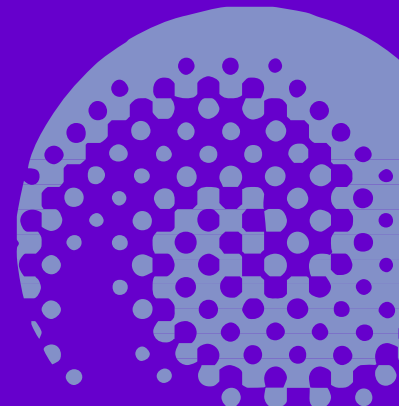
With gas being dragged  
down from surface



# Handling Solids within COBR:

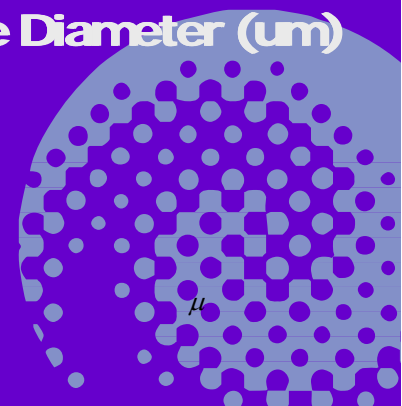
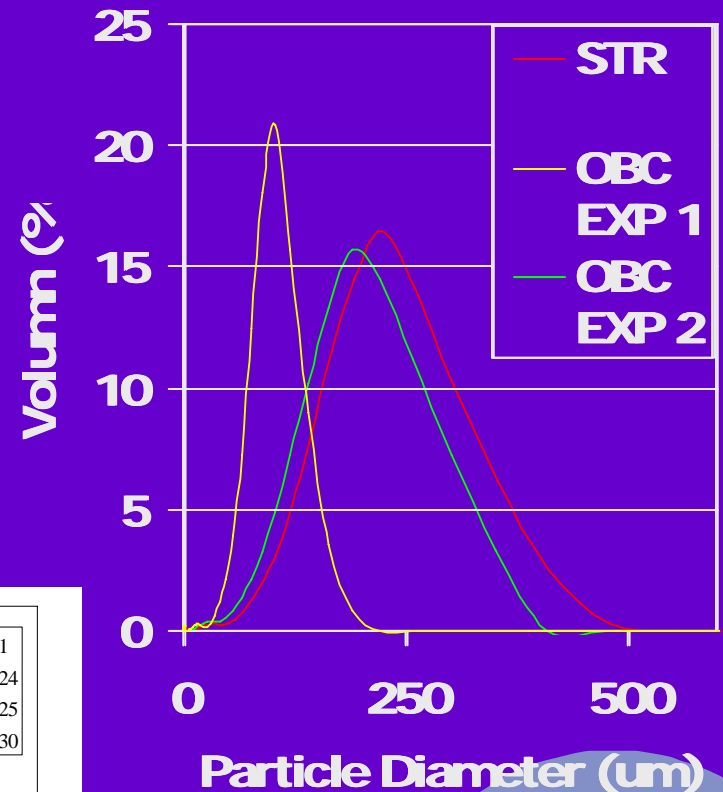
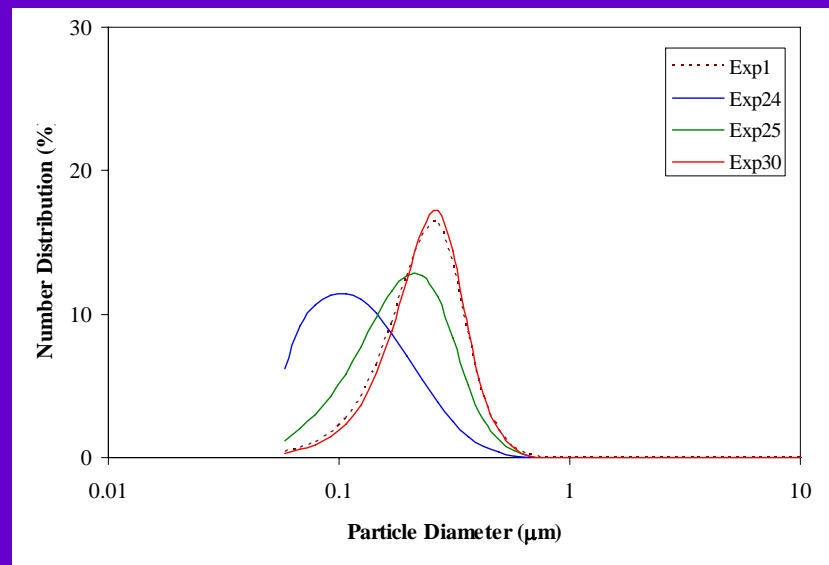


- Mixing is controlled by oscillations, not the net flow as in the case of turbulent flows
- Plug flow characteristics are obtained in laminar flows
- This allows significantly shorter length of reactor and much compact reactor setup than conventional systems



# Particle Size distribution

- More uniform size can be achieved
- Greater control on outcome
- Low shear environment
- multiple size distributions possible



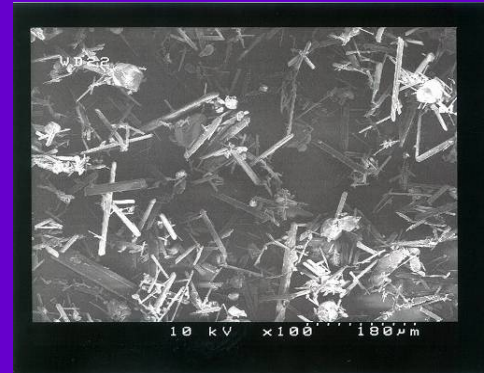
# Challenges in Crystallisation

- Inconsistent polymorphs
- Non-uniform crystal size
- Difficult in achieving accurate cooling profile and control
- Large volume and time consuming
- Large amount of out-of-spec products

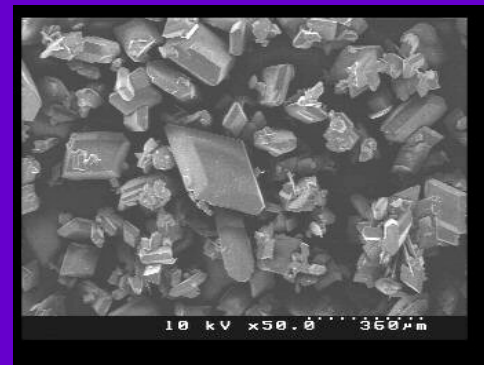
# Polymorphism

- COBR enables greater control over process conditions
  - Less process variation
  - Greater product consistency
- Able to be more selective on actual outcomes achieved

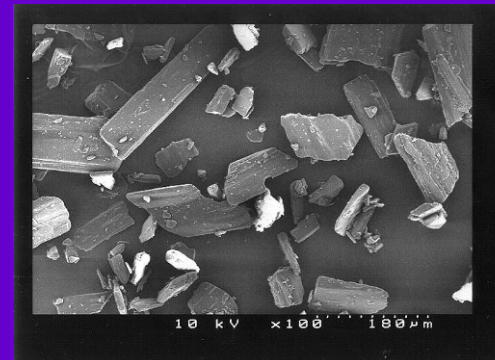
$\alpha + \beta$  crystals



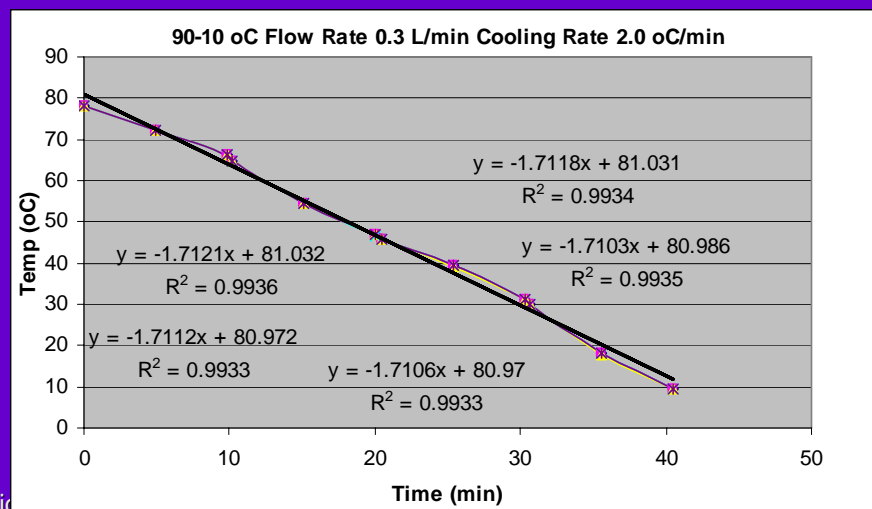
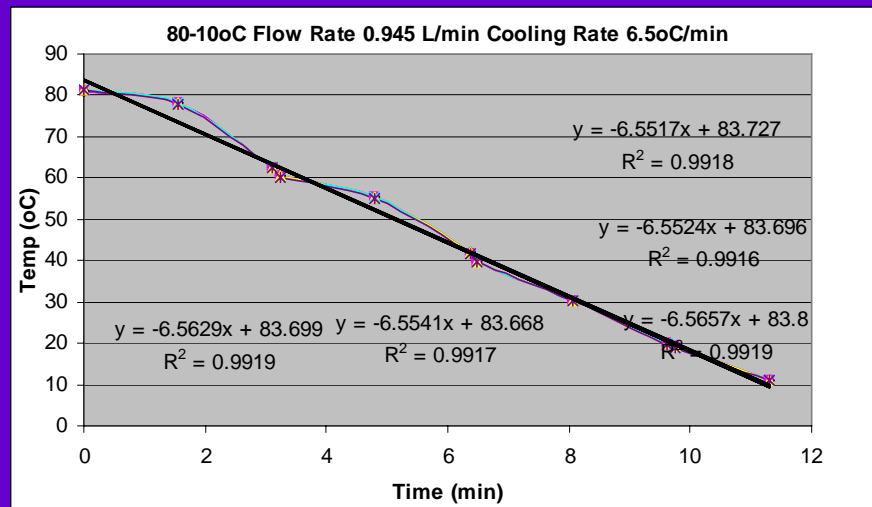
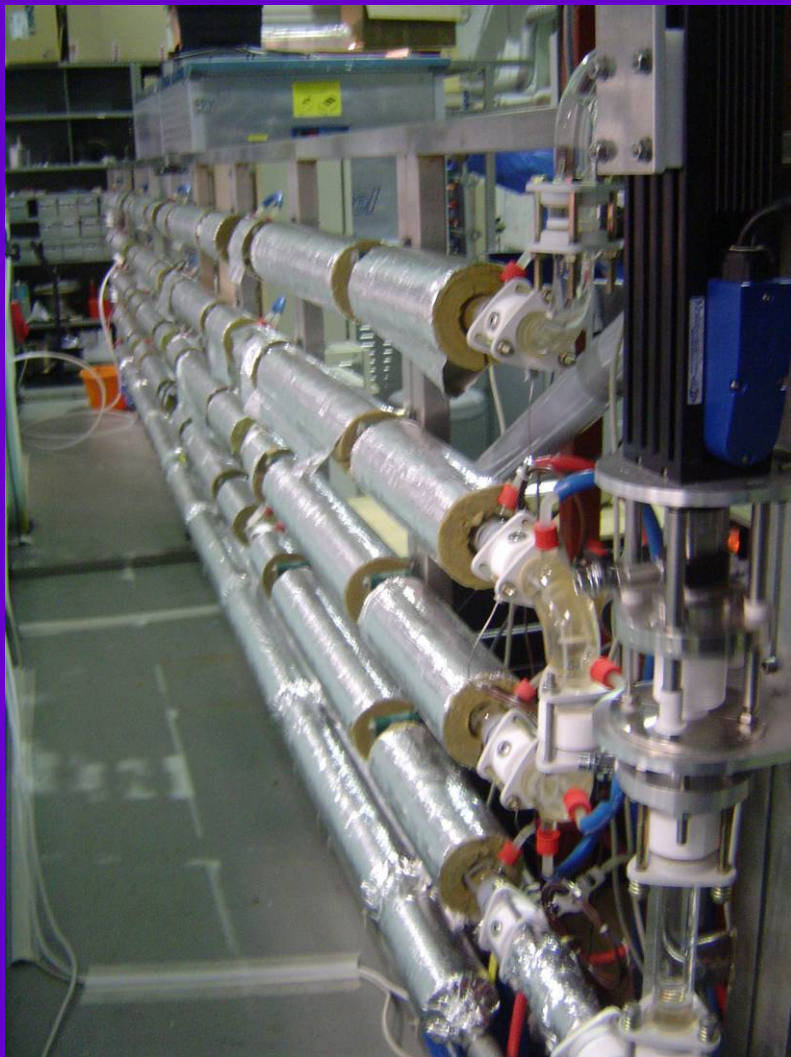
$\alpha$  crystal



$\beta$  crystals



# Control over Cooling Profile



# NiTech's focus

- Assisting companies in the process industries to be more competitive
  - Working with customers on specific applications – e.g:
    - Pharma intermediates
    - Flavouring & fragrances (fine chemicals)
    - Starches
    - Polymers
    - Adhesives
    - Oils
    - Dyes
    - Speciality and bulk chemicals

New Polymer Development



Multi-stage processes



Hydroformylation under high pressure

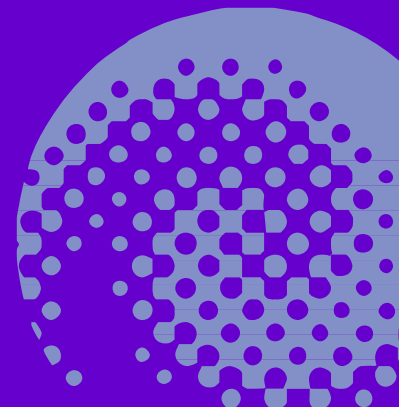


Waste Water Treatment



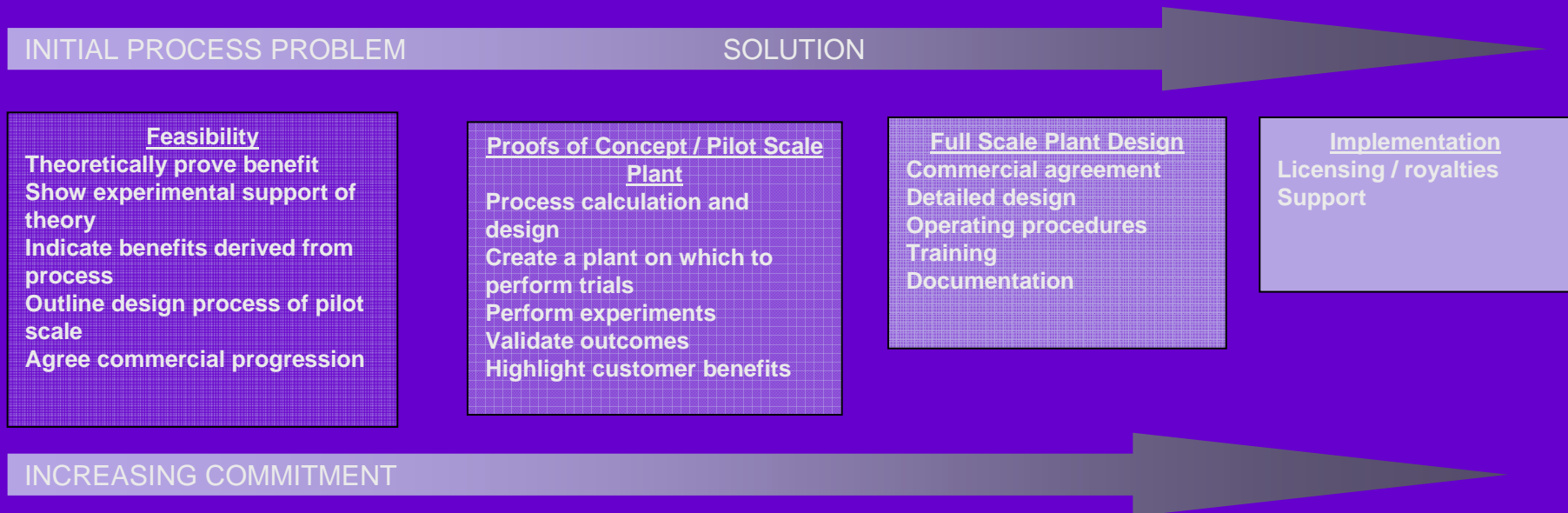
Good technology is  
not enough

Focus on  
Value Creation





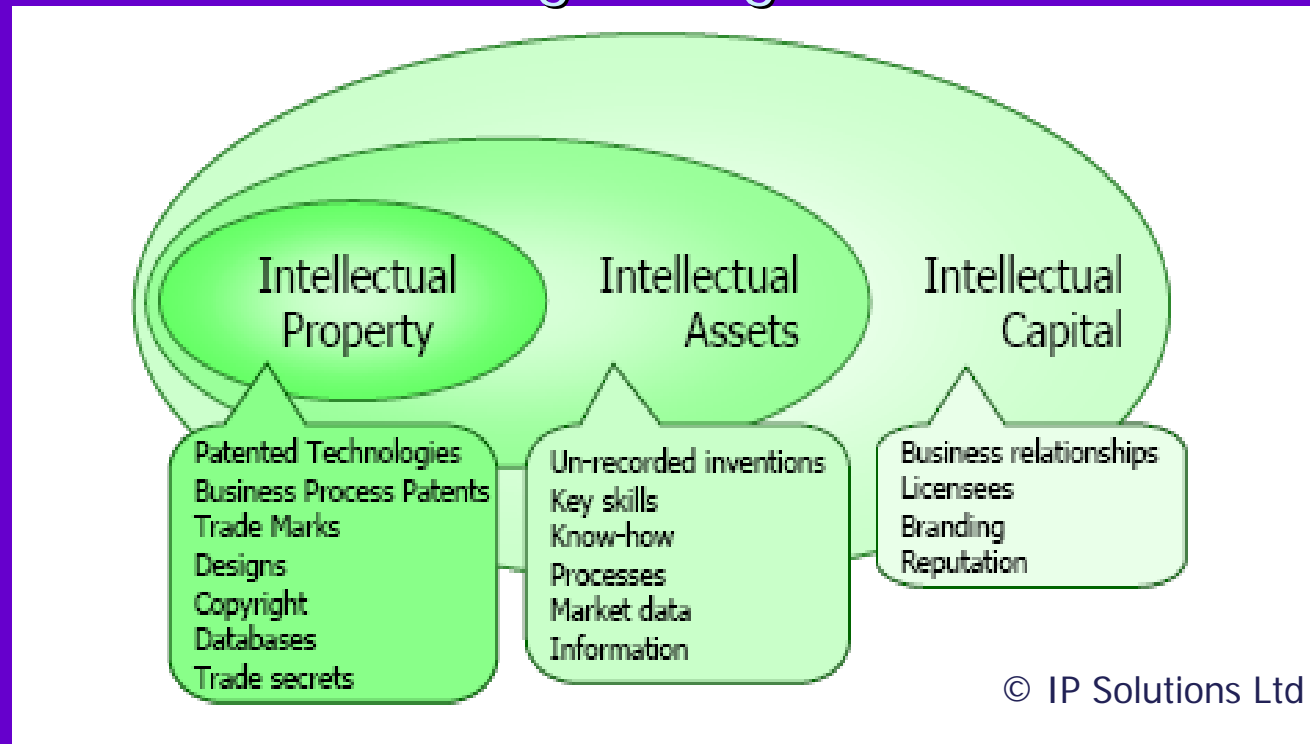
# Value Creation - External



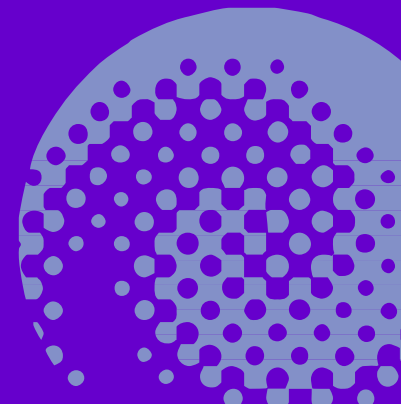
- Solve problems
- Create value for customer
- Commitment from customer
- Overcome risk / demonstration of technology

# Value Creation - Internal

## Building Strong Intellectual Assets

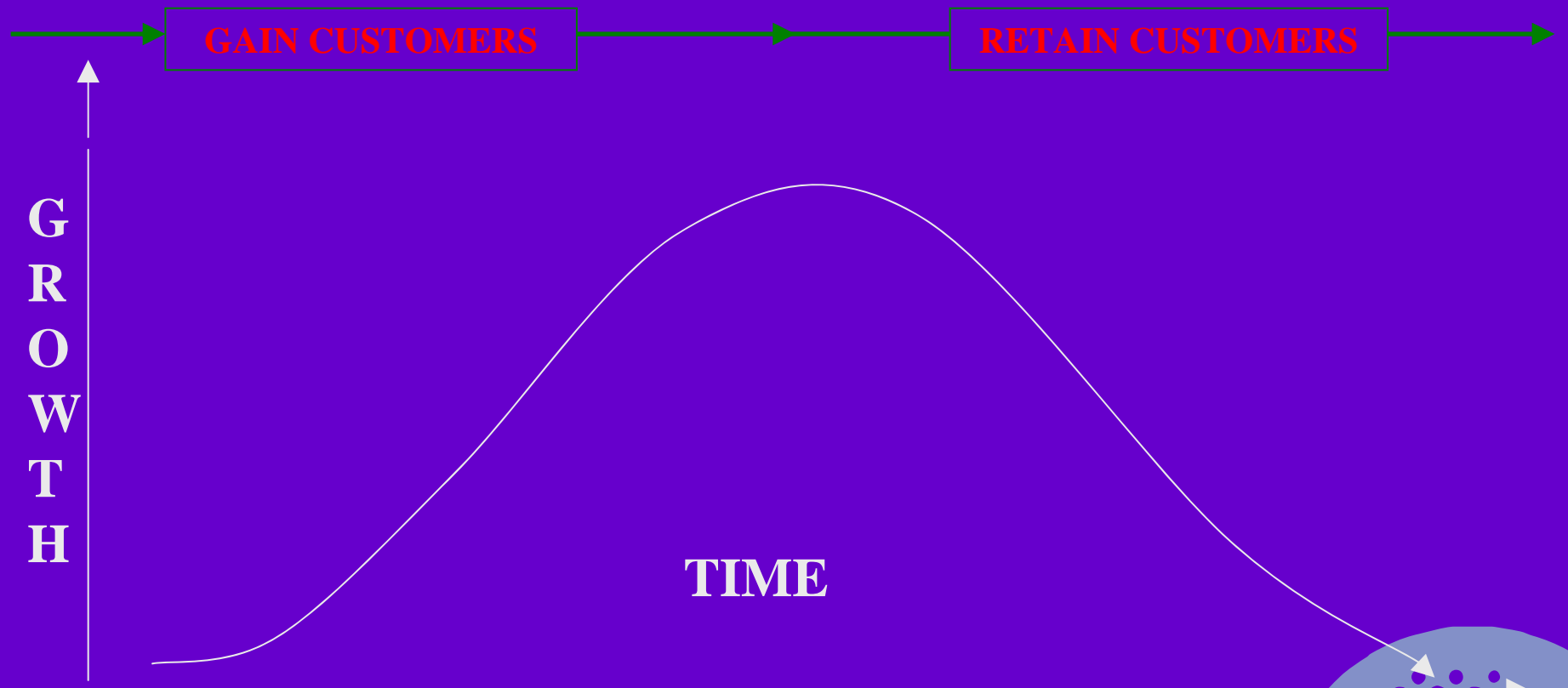


- More than good technology
- More than patents
- Team, Relationships
- Business Processes
- Ability to build value?



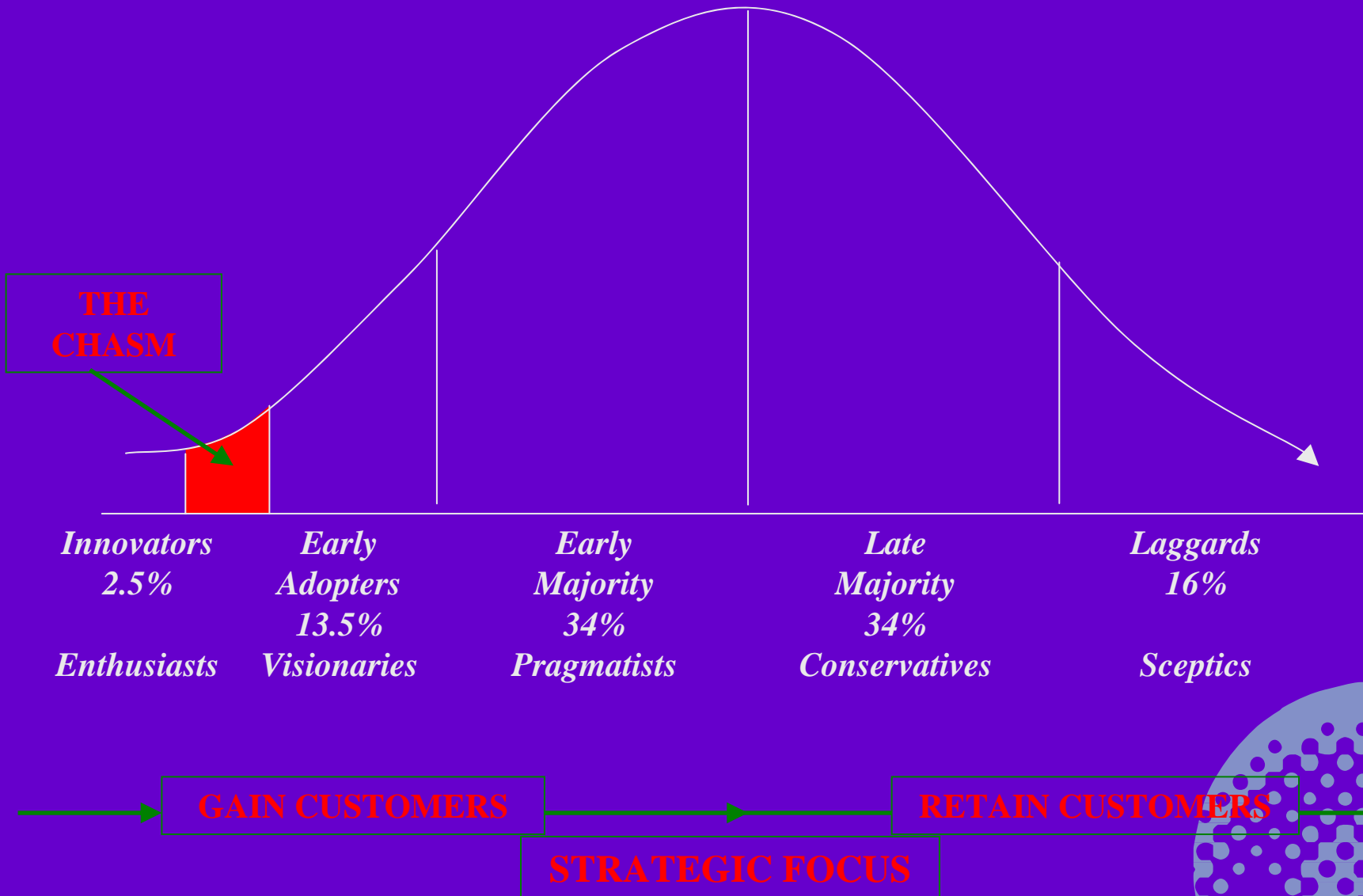
# THE BUSINESS LIFECYCLE

## STRATEGIC FOCUS



# THE BUSINESS LIFECYCLE

## Who are the customers?



# INDUSTRY STRUCTURES ARE CHANGING

## YESTERDAY



## TODAY

Margin is being squeezed out of many quasi-specialties and intermediates

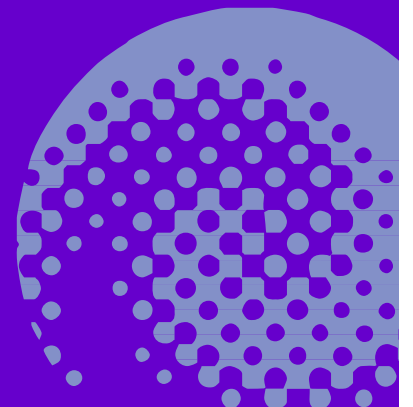
*ROCE driven companies*

*Innovation driven companies*

**Lowest Cost Suppliers**

**Value In Use Providers**

How can PI create  
additional value for  
your business?





Thankyou

[www.nitechsolutions.co.uk](http://www.nitechsolutions.co.uk)

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