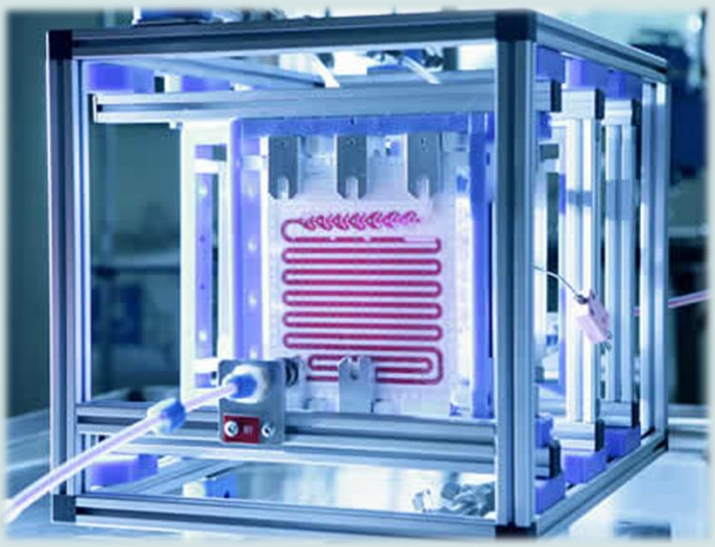
Monitor. Control. Optimise.

Make to Order Process Platform

New Product Development Tool for Micro Reactor Operation



The Need…

A new generation of continuous small scale reactors have recently come onto the market, allowing manufacturers to move away from traditional batch manufacturing processes. Typical benefits of such systems include waste reduction of 10-15%, energy reduction of 40-70% and solvent hold up that is the order of 10% of the equivalent batch process.

The major benefit of these reactors is their ability to manufacture a number of products using a single reactor by rapidly adjusting the operating conditions.

Currently these reactors are operated in a staff intensive fashion. Development activities, such as Design of Experiment trials, are conducted manually with an operator performing each operation to move the process from one DoE point to the next and being present during periods of steady operation to ensure the process remains within the desired conditions.

The ability to automate this process will speed up process development time and aid the identification of both the Design Space and the dynamic models for advanced control schemes.

The system provides the ability to identify multiple product operating spaces, enhancing rapid prototyping in a safe and efficient manner.

The Objectives…

Develop automation system for a flow micro-reactor utilising standard equipment where possible to maximise flexibility.

Design and develop a software tool for the management of rapid prototyping in new product development.

Provide an intuitive User Interface to enable an automated Design of Experiment trial with minimal operator intervention.

Taking into account these are new processes, allow alarming and reversion to a safe state in the presence of undesirable process conditions.

Utilise the resultant information for both the identification of the Operating Space and advanced controller development, to give rapid optimal operation.

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PERCEPTIVE ENGINEERING LTD

AstraZeneca

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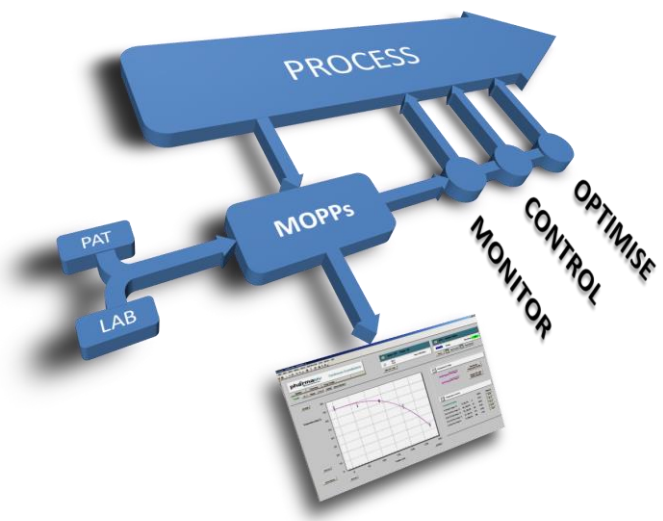
The Strategy…

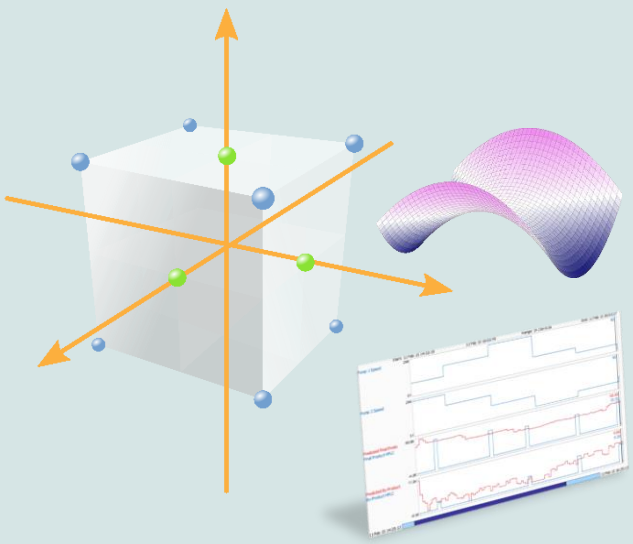
A Corning® Advanced Flow™ reactor was used to represent the API reaction stage of pharmaceutical manufacture.

An automation system was developed using standard equipment and modern communication systems allowing the remote operation of both the process and the associated ancillary equipment.

Through consultation with end-users, the software requirements were defined including the ability to detect the presence of steady state operation and automatically trigger the next step in order to minimise waste, and the capabilities to input a sample schedule which is then used to alert the operator to the need to perform manuals sampling if required.



The functionality was designed and developed to fit into Perceptive Engineering's existing robust industrial automation offerings, building on the Advanced Process Control functionality and the ability to develop calibration models using both spectral and process data.



Dynamic steps are automatically superimposed upon the DoE sequence generating suitable data for Design Space exploration.

The Results…

A fully automated reactor system was developed allowing the operation of the process via both a local intuitive operator GUI and also remote access for cases where local operation is undesirable due to HSE requirements.

The tool developed allows users to define the experimental procedure, incorporating the experimental factors, sequence order, disturbance frequency and magnitude. The software uses this to compute an initial process sequence of set points changes over a defined period of time. Intermediate dynamic steps are superimposed upon the DoE sequence generating suitable data for controller modelling. The user can then interrogate and adjust the experimental plan prior to online implementation.

The results from the experimental plan can then be used to identify the desired operating region and develop an advanced process controller allowing optimal operation and disturbance rejection during manufacture.