ADVANCED PROCESS CONTROL AND PROCESS ANALYTICAL TECHNOLOGY FOR CONTINUOUS BIOPROCESSING

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Continuous bioprocessing promises several advantages over traditional batch processes: smaller footprint, shorter turnaround time and increased flexibility to name a few. However, continuous bioprocessing places significantly higher demands on process control and understanding. The UK Integrated Continuous Biomanufacturing (ICBM) project brings together a consortium of 5 partners to develop an integrated, end-to-end, continuous biologics production system at development scale, which will be used as a tool for continuous process development. This project aims to build a flexible control system that can detect changes and automatically adapt the process, reducing necessary intervention, improving product consistency and maximizing output.

In order to successfully perform continuous operation, unit operations have to be automated and controlled and their interactions understood. To achieve this, we have employed a combination of advanced process control (APC) and process analytical technologies (PATs) to construct a fully automated and integrated bioprocessing system. Whereas an underlying layer of conventional process control focuses on the safe and uninterrupted operation of the processing rig, PAT and APC are used to gather information and understanding about the process in real time and optimize it accordingly. This modular architecture allows us to maximize the flexibility and reliability of the system while at the same time profiting from insights given by advanced data analytics.

As part of the project, several PAT systems have been assessed for their potential control of upstream and downstream unit operations. For example, mass spectrometry protocols have been developed and tested, enabling in-process assessment of product purity. On-line spectroscopic mid-IR has been evaluated in test processes for control of downstream product aggregation and bioreactor feeding.

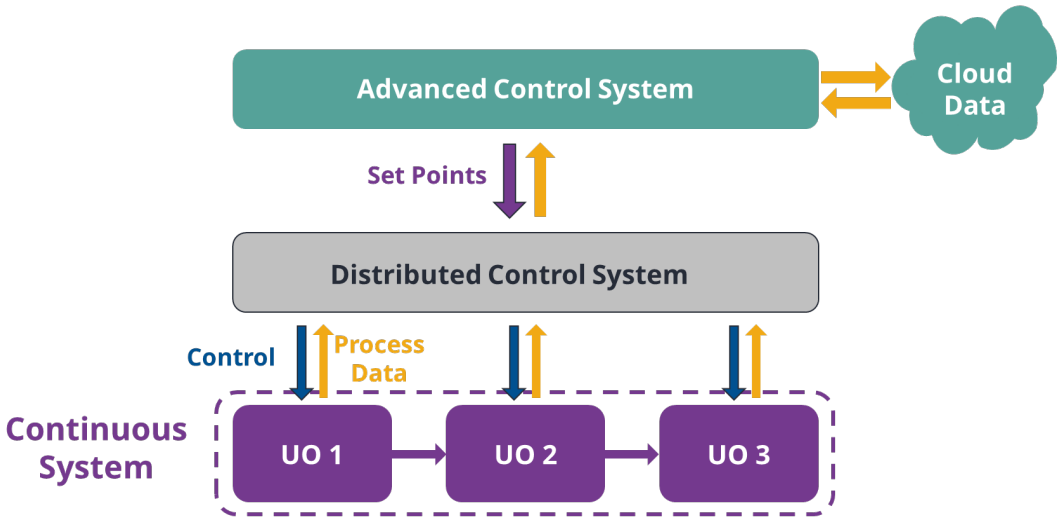

Figure 1 – Continuous Process Control Architecture