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Combining HighRes Biosolutions Cellario™ with Titian Software's Mosaic for Efficient Sample Management Workflows

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INTRODUCTION

Today's labs are required to manage and track all their research samples, processes and procedures across multiple instruments and controlling software systems from a range of different suppliers. This range of equipment makes effective tracking of samples and data more difficult as there are multiple handover points between systems.

Each time these handover points are managed manually, it is difficult to avoid introducing errors. However, to automate the handover is hard as the equipment used differs for each lab and bespoke integrations are expensive and time-consuming to create.

Titian Software and HighRes Biosolutions offer an alternative solution by providing an existing integration that joins a docking system for different instrumentation with the instrument control, workflow management, sample tracking, audit trail and inventory updates required for a smooth sample management process.

TITIAN'S MOSAIC SOFTWARE

Titian's Mosaic sample management software workflow mimics the business processes that are performed on samples in a customer's laboratory. All liquid handling operations performed as part of this workflow can be captured by Mosaic in a variety of ways. The most secure is to directly integrate Mosaic with the automated liquid handler's controlling software. This dramatically reduces the need for user intervention and eliminates potential sources of error during file manipulation.

All typical pipetting operations of sample solutions performed on automated systems are supported by Titian's Mosaic software. These include, but are not limited to: well-to-well transfers, compound serialisation, plate replication, transfers from microtubes to plates, etc.

When coupled with an automated system's software, such as HighRes' Cellario, the user is given a powerful platform for managing his daily operations, keeping track of sample movements, and meeting the research goals of the laboratory.

HIGHRES BIOSOLUTIONS AUTOMATION PLATFORMS

HighRes Biosolutions provides state-of-the-art robotic liquid handling platforms for life science applications. Their MicroStar and NanoCell systems use unique docking technology for moving automated peripherals and storage devices into and around the lab on configurable "MicroCarts" for maximum workflow efficiencies and flexibility. Other automation offerings are also available, and all are driven by HighRes' Cellario dynamic scheduling software.


Key features of HighRes' automated systems include:

- Diverse workstation modularity and ability to scale systems according to customer specifications
- Adaptive, dynamic system scheduling based on an intuitive design that greatly facilitates the end user experience
- Able to accommodate a wide range of different devices and device types:

- Liquid handlers
    - Variable span liquid handlers (Tecan Fluent, Hamilton Star, etc.)
    - Block replication devices (Agilent Bravo, HighRes Prime, etc.)
    - Low volume pipetting (SPT Labtech mosquito, etc.)
    - Nanopipetting (Beckman Coulter Echo, BioSero ATS100)
    - Bulk dispensing (Thermo Combi, etc.)
- Storage devices and incubators (Cytomat, Liconic, automated stackers, etc.)
- Labware processing peripherals (labellers, sealers, peelers, cappers, centrifuges, etc.)

- Devices are positioned for access to the central processing robot via configurable MicroCarts
- Unique docking technology allows for swift reconfiguration of systems for optimal efficiency
    - One system can be adapted for multiple purposes by changing instrumentation. For example, a user can perform acoustic transfers as well as high volume dose responses on the same system by making a quick and simple swap-out of liquid handlers.
    - Materials can be easily moved between systems; as in moving the prepared plates from a replication system to either a storage buffer or directly onto a screening system.
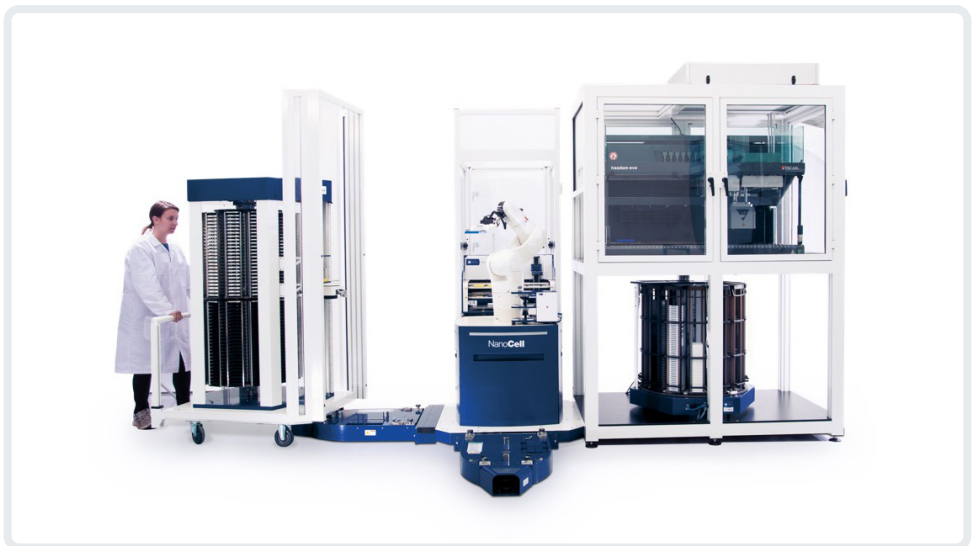
These systems along with their associated devices are controlled using the HighRes Cellario dynamic scheduling application.

MOSAIC-CELLARIO INTEGRATION

Mosaic software interfaces with Cellario using Titian's Cellario Fulfilment Module (CFM) to allow order creation and workflow tracking.

CFM communicates directly with Cellario via a Cellario module known as the Cellario Order Broker. This module feeds processing job parameters into Cellario for execution.

The diagram below describes the Cellario integration high level architecture:
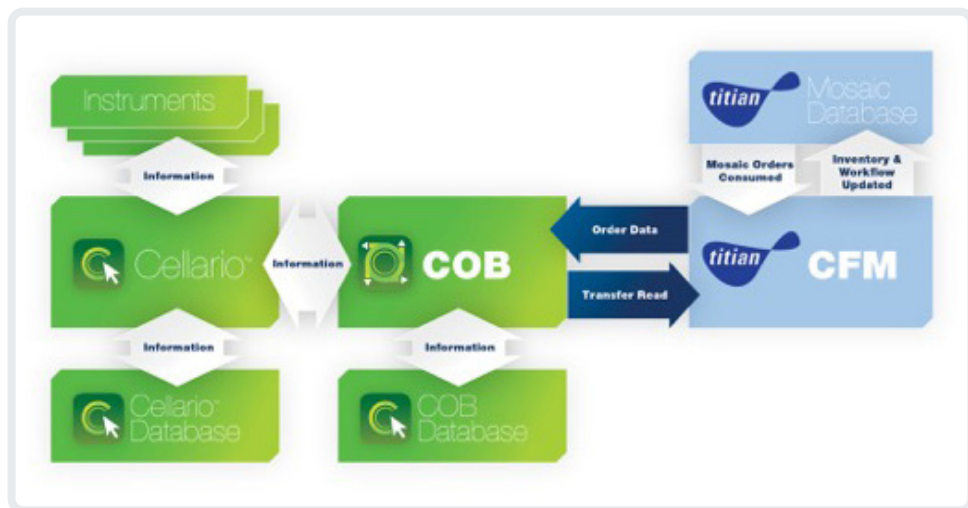
The high level process for the integration is as follows:

1. An operator uses the CFM desktop application to:

    a. Select an Order(s) to fulfil from the Mosaic database

    b. Select which of the Mosaic order outputs to create for a Cellario job

    c. Select a preferred tip layout from a validated list that fit the required work

    d. Create and send a job to the Cellario Order Broker (COB)

2. CFM creates an XML Job specification containing all the Order parameters, including input/output labware items and the specific transfers to be performed.

3. CFM submits the Job specification to the Cellario Order Broker (COB) web service

4. The operator fulfils the job using Cellario to control the required HighRes automation components

   – Cellario tools allow users to identify and manage production bottlenecks due to over allocation of critical resources such as liquid handlers

   – Ongoing production runs can be easily paused to add in jobs with higher priority

5. The Mosaic Transfer Reader polls the COB web service for notifications and transfers information, updates the Mosaic inventory and workflow and notifies COB when all transfers are processed.

BENEFITS OF THE MOSAIC-CELLARIO INTEGRATION

CFM offers several distinct advantages when compared to some other machine integration fulfilment software:

▪ All necessary workflow and transfer data is provided up-front to Cellario. This means users can track assay control additions and allows labware labelling to be highly configurable. It also ensures that network connectivity or server issues mid-run does not impede production work.

▪ Cellario automatically performs a pre-run checklist and inventory scan to ensure the system has exactly what it needs to produce the required output

▪ Jobs are specified independently of the liquid handler type. This allows maximum flexibility when carrying out the work, including parallel processing across multiple liquid handlers

▪ A flexible Cellario template is automatically selected based on the output required and the parameters given. This is further refined to perform only the steps needed for fulfilment. This massively reduces time spent creating and maintaining multiple automation protocols on other systems.

▪ Loosely coupled architecture results in significant cost savings in terms of configuration, testing and maintenance

- Well-defined Cellario web services interface avoids Cellario/Mosaic version incompatibilities
- The Mosaic Transfer Reader processes transfers only when they are completed (successfully or otherwise)

CELLARIO WORKFLOW PROCESSES SUPPORTED BY MOSAIC

Mosaic's powerful workflow management will support the following Cellario process types:

- Serialisation
- Replication
- Serialisation in combination with a subsequent Replication
- Acoustic Dose Response
- Cherry Pick
- Add Control
- Plate labelling

EXAMPLE: MOSAIC ORDER FULFILMENT

The steps that an operator undertakes to fulfil a Mosaic order workflow step (in situ serialisation) on a HighRes workstation are as follows:

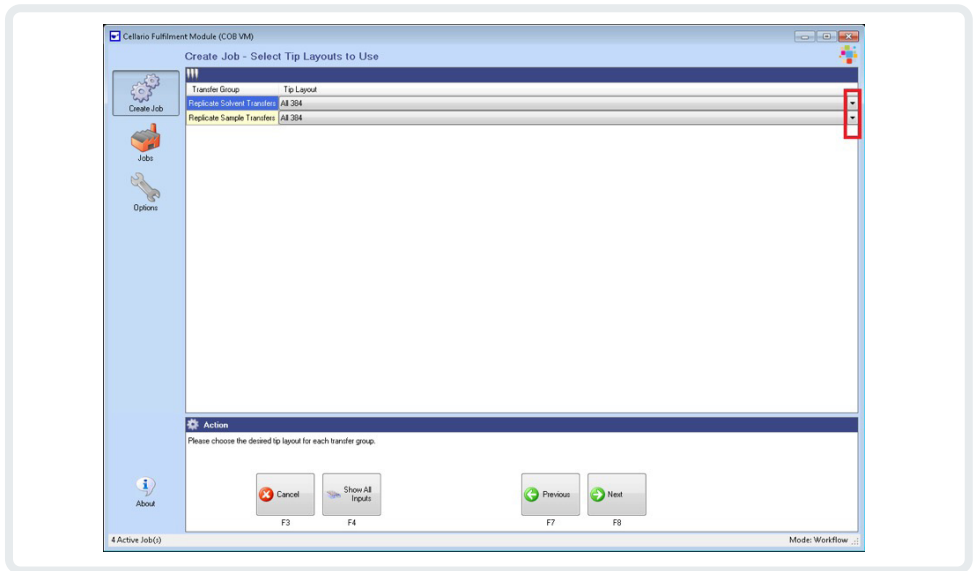1. In the Titian CFM application, select the Mosaic order(s) for which you would like to create a Cellario job.
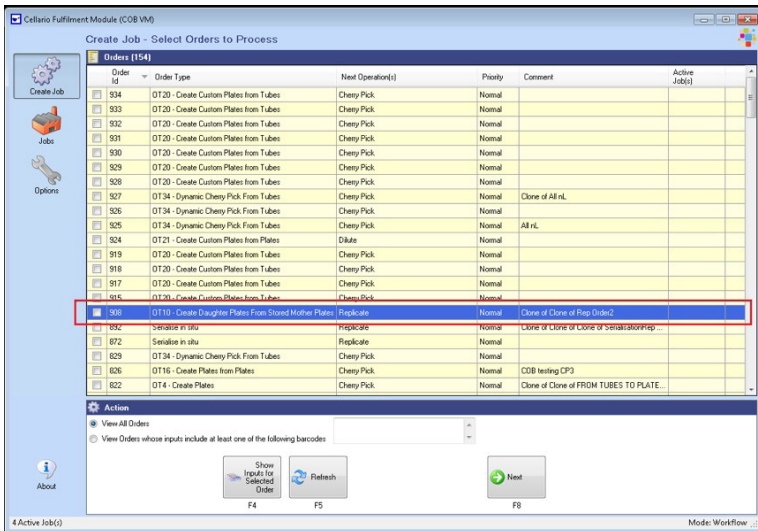
2. Select which output labware (i.e. from your Mosaic streams) you wish to create during the run.
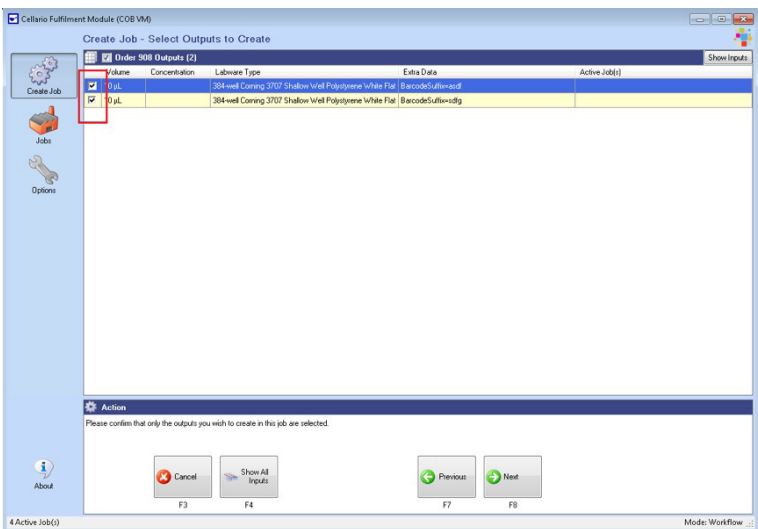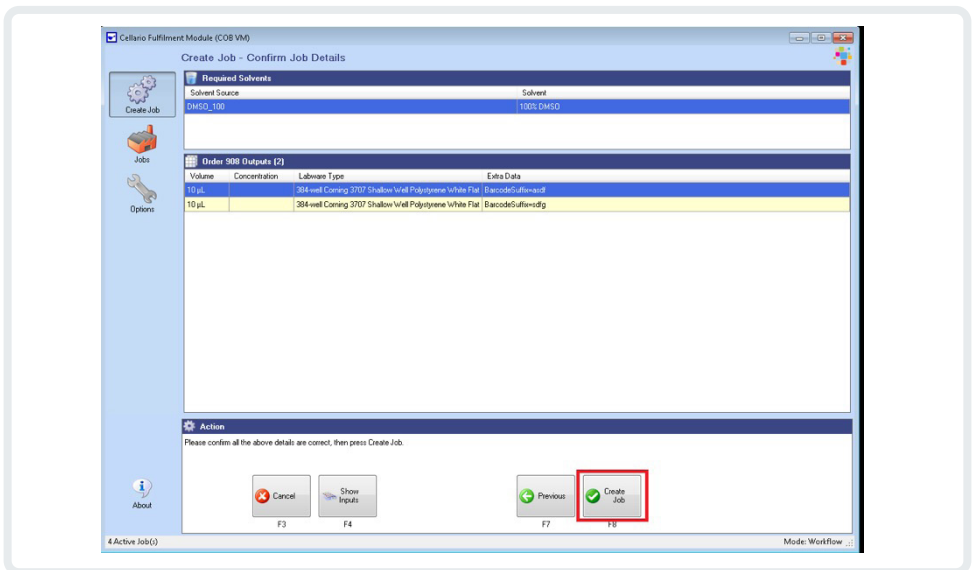

3. Confirm one of the CFM suggested tip layouts. All of these layouts are calculated to be valid and CFM always suggests the most efficient layout for Cellario to use.

**4.** Confirm the CFM job parameters and create the job.

5. The Job appears in COB and is automatically associated with the correct master template Cellario Protocol based on the job parameters, e.g. Replication workflow fragment with < 5 copies maps to Cellario protocol X.

6. Using the HighRes COB interface, assign labware locations, scan and validate the source and destination labware on the HighRes workstation.
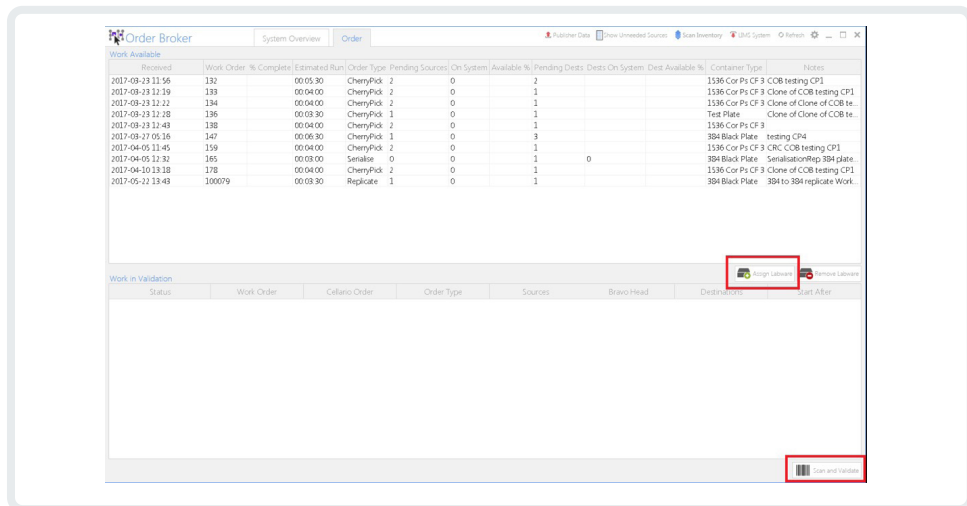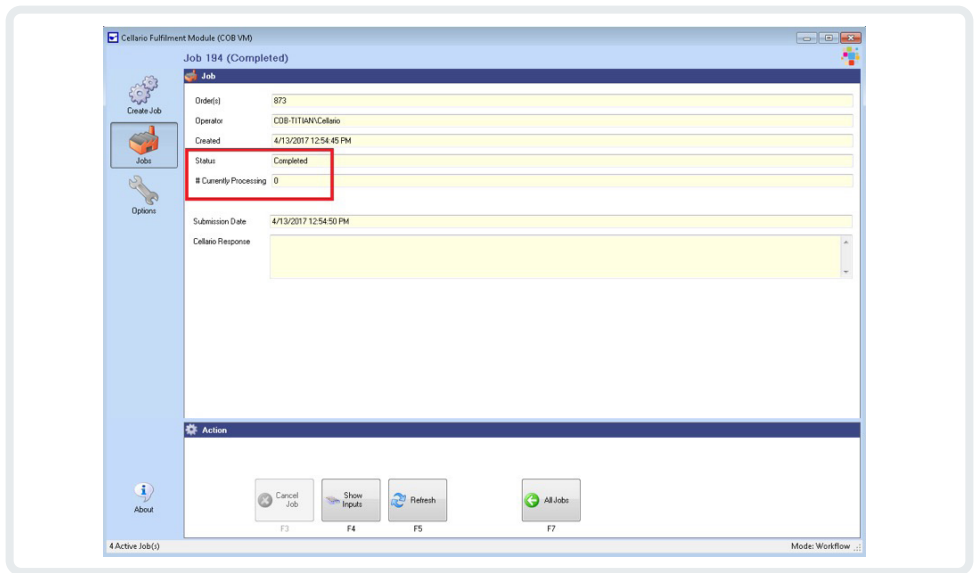

7. Fulfil the job in Cellario
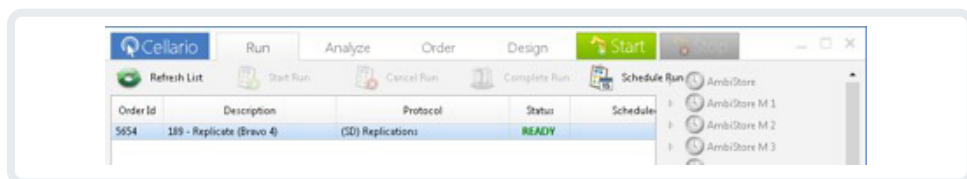
8. The Mosaic inventory and workflow will be updated as Cellario reports each completed transfer for the Mosaic Transfer Reader to process.

9. After the job has finished the operator should click 'Complete Run' in Cellario, where upon labware will be unlocked in Mosaic and can be unloaded from the machine.

SUMMARY

Titian and HighRes have collaborated to provide the life sciences user with a high quality, simple and effective solution to manage and track all your research samples, processes and procedures. Titian's Mosaic sample management software and HighRes' automation platforms with COB/Cellario combine to provide a truly seamless process in automated sample management order fulfilment.

Titian/Mosaic:

- Industry leader in providing sample management software to users within the life sciences
- Mosaic provides enormous capability, maximal flexibility and is configurable to make it the best fit for your procedures and workflows
- Mosaic offers extremely detailed inventory recording, with advanced inventory concepts, for complete knowledge of sample whereabouts and a full audit trail

- CFM guides the operator and focuses on providing essential process parameters to Cellario without having to be concerned with automation control logic. This enables each system to do what it does best.

HighRes/Cellario:

- Provision of highly flexible robotic workstations. The unique modularity of the systems allows for a vast array of workstation configurations.
- Adaptive automation scheduling that makes it easy for users to adapt to their processes
- Highly developed Cellario web services allows for efficient external job parameter processing from CFM and the transfer of process results data to Mosaic

Titian Mosaic sample management software combined with HighRes automation platforms provide complementary functionalities for enabling your research capabilities. Both companies produce superior products which continue to lead the industry in their respective areas. Together, the combination is truly synergistic with each focusing on its own strengths to work interdependently with the other.

ABOUT TITIAN SOFTWARE

Mosaic Sample Management is Titian Software's comprehensive, configurable and modular software product to control and monitor all aspects of sample storage, preparation and delivery. From small biotech to global pharma, Mosaic helps to provide a seamless, error-free sample supply chain and audit trail. Titian's industry leading Mosaic Sample Management software is available as a tailored solution for all of your sample management requirements, or as optimised packages pre-configured for rapid deployment.

ABOUT HIGHRES BIOSOLUTIONS

HighRes Biosolutions design and build innovative laboratory automation systems, dynamic scheduling software, and lab automation instruments that help accelerate and streamline discovery for pharmaceutical, biotech, and academic research clients. HighRes automated laboratory equipment and systems have been effectively applied for a diverse range of research applications, including: drug discovery, genomics, ag-bio, cell-based assays, and molecular diagnostics. At the heart of every HighRes system is their highly flexible scheduling software known as Cellario.

AUTHORS:

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Paul Kay was a senior scientist at Roche for 15 years, specialising in automation and compound logistics. He followed this with nine years at Merck as Compound Logistics Coordinator, before joining Titian Software in 2011 as a business application consultant.

ARTHUR YARWOOD

Fascinated by mathematics and programming, Arthur spent 11 years at Sony, specialising in tools programming, asset management and databases. He joined Titian in 2012 and is now a team leader and project manager on Mosaic.

MARK DORING

Mark Doring worked for Schering Plough for 25 years as a biochemist in new lead discovery, focusing on high throughput screening assay performance, development and compound preparation with an emphasis on automation and informatics. He joined Titian Software in 2015 as a business application consultant.

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