



AVEVAWORLD

APRIL 9, 2025

Vir Biotechnology & Cognizant: RAPID Lab Time Series Data Capture using AVEVA™ CONNECT

SESS-69

Scott Schaecher – Vir Biotechnology
Rachel-Korwin Miller – Vir Biotechnology
Balu Karthikeyan – Cognizant

Vir Biotechnology's "PI" in the Sky

RAPID Lab Time Series Data Capture using
AVEVA™ CONNECT

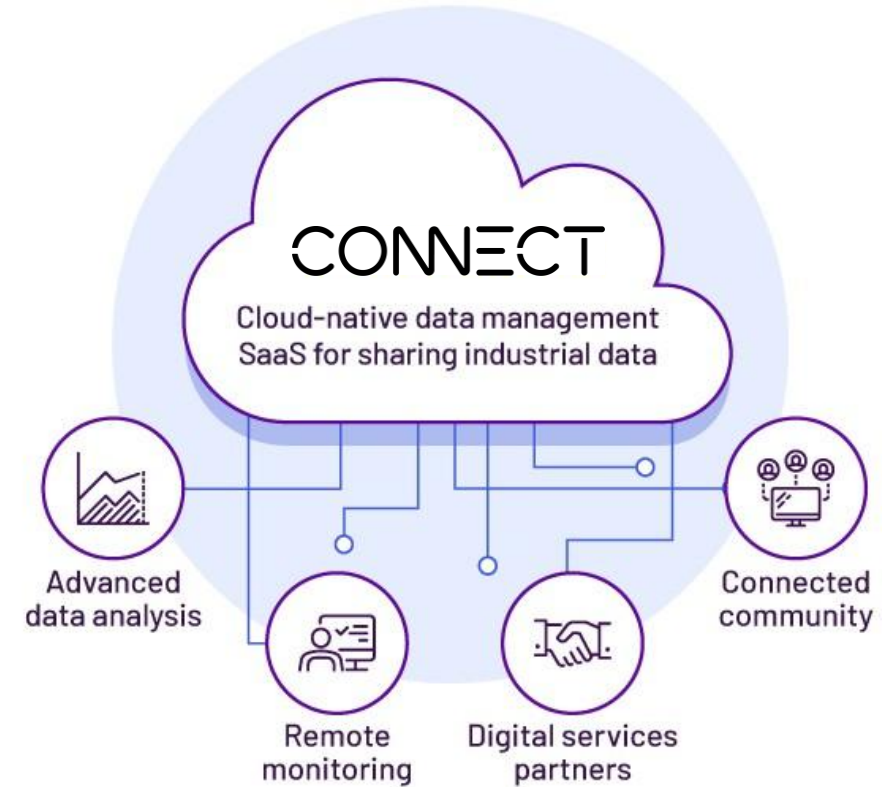
AVEVA World 2025

April 7-10 2025



Presentation Outline

- Why CONNECT Data Services (fka., AVEVA Data Hub)?
- Project Scope
- Implementation
- Next steps



Vir Biotechnology Project Team

Core Team



**Nirel
Salazar**
Upstream PD



**Michael
Nelson**
Upstream PD

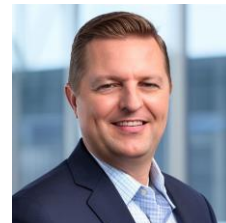


**Victor
Saucedo**
PD Data Eng

IT Team



**Todd
Slaby**
PD LIS



**Scott
Schaecher**
Business
Partner

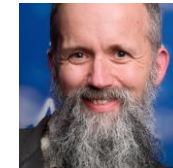
Stakeholders



**Rachel
Miller**
ELN/LIMS



**Jay
Patel**
SDMS



**Robert
Beckerdite**
Info Sec



**Kristen
Douglas**
PD Sr Dir



**Eric
Fallon**
PD VP

Cognizant Team

Name	Images	Role	Responsibilities	Email
David Gomez		SME	Subject Matter Expert	David.gomez@cognizant.com
Balasubramaniam Karthikeyan		SME & Lead	Spearhead development	balasubramaniam.karthikeyan@cognizant.com
Cory Ruzicka		Project Manager	Monitoring delivery of Cognizant tasks & deliverables.	Cory.ruzicka@cognizant.com
Isha Havale		Project Engineer	Engineering Implementation	Isha.havale@cognizant.com



About Vir Biotechnology



- Founded in 2017
- One of the first covid antibodies
 - Sotrovimab
- Rapid growth
- Cognizant as technology partner

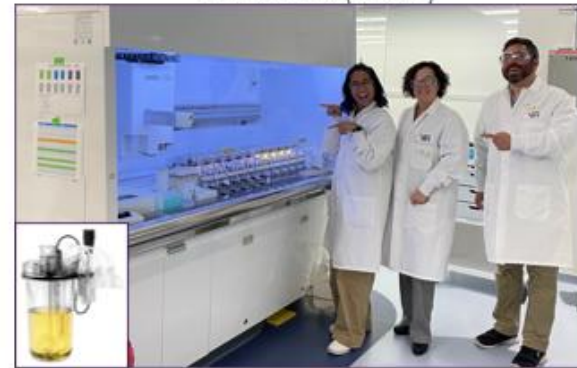
Cell Line Development
Beacon Optofluidic CLD System



- Screens 4,000 cells in 7 days to select highly-productive clones
- nL → 250mL



Process Development
High-Throughput Automated
Bioreactors (AMBR)



- CLD confirmation, final clone screening
- Predicts pilot scale cell culture performance
 - 250mL → 5L → 50L → 200L
- Predict pilot scale Ab purification performance



Tox Manufacturing
200L Bioreactor & Purification



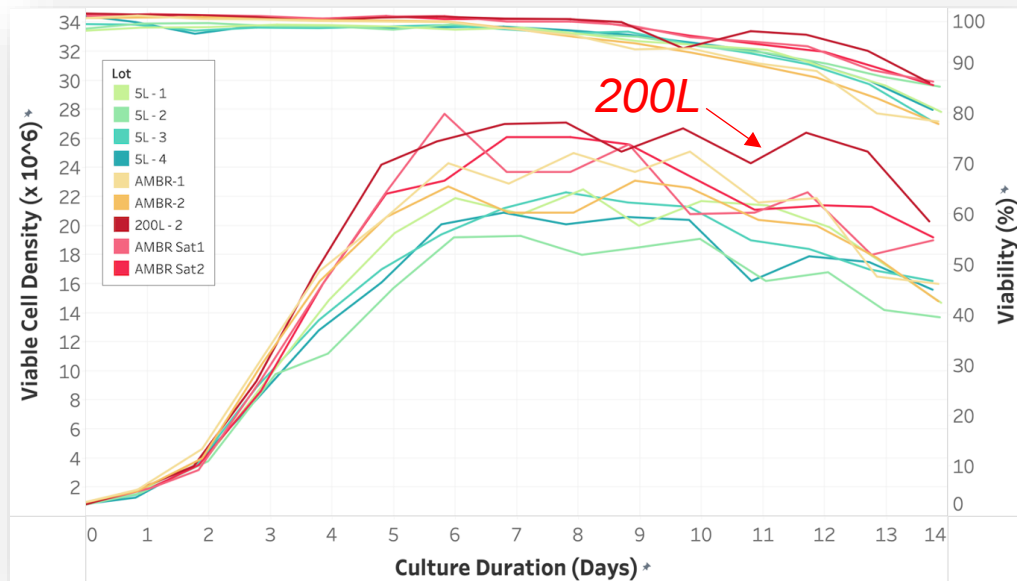
- 1-2 month manufacturing process
- Full PQA testing in-house
- Drug Product filling and tox stability

RAPID Lab – lots of data to be collected

Data must be findable, accessible and interoperable across technologies

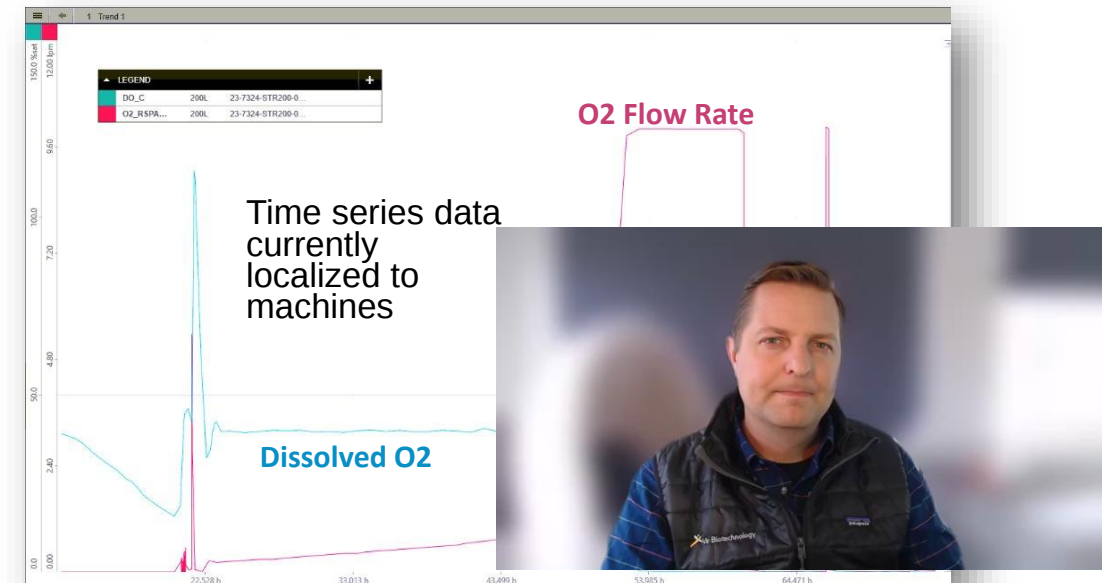
At-Line/Off-Line Data (Registry)

- Batch Records for every bioreactor run
- Data collected and processed from samples offline – not connected to real time monitoring
- Must be captured in association with batch record and sample metadata



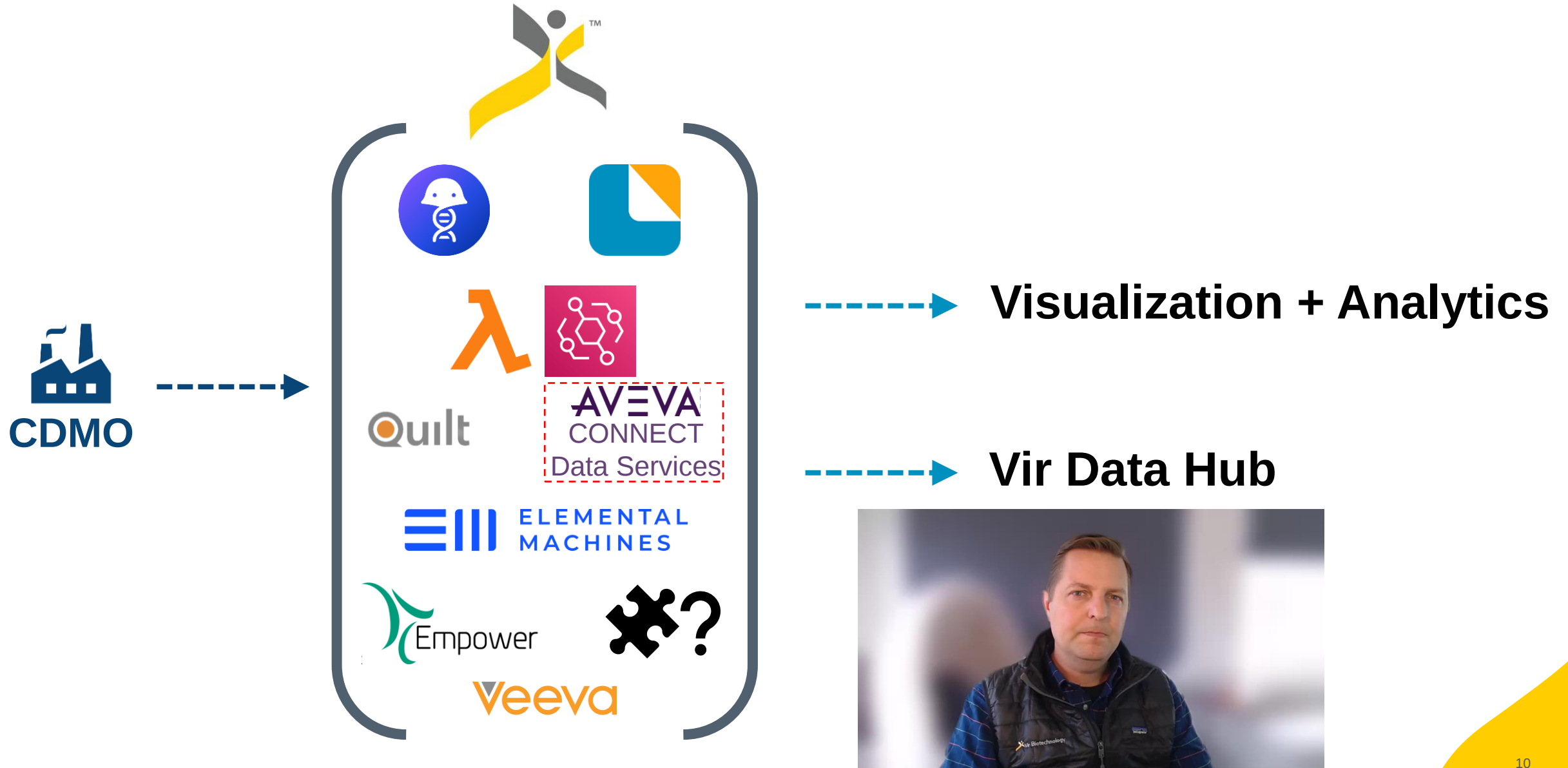
Inline Data (Data Historian)

- It's critical to monitor numerous parameters in real time to enable course correction or identify problems
- Capture time series data from many sensors
- Thresholds can be set to enable real time notifications

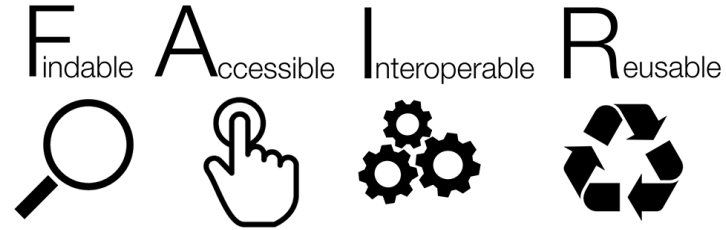


The Vision of a Scientific Data Cloud

An integrated and queryable standardized Data Mesh



Vir's "PI in the sky"



Business Value

1. One-stop for All Real-time Bioreactor Data
2. Built-in Trending and Visualization
3. Single End-point for Data Retrieval for Tech Ops
4. Improved potential for collaboration with CDMOs, CROs
5. Platform can scale as Vir grows, matures

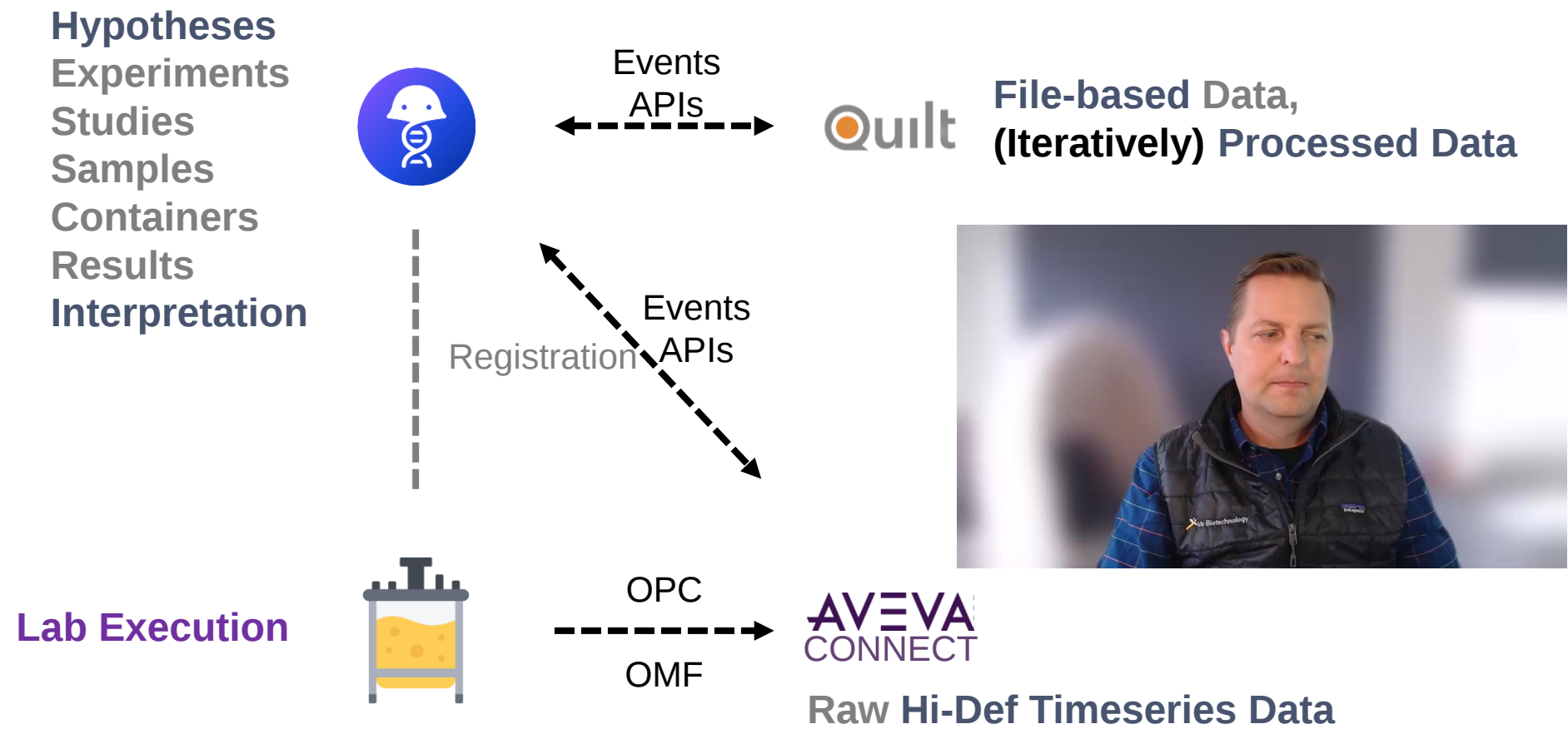
IT Benefits

- ↓ on-prem IT infrastructure
- ↓ cloud IT costs
- Data centralization-capability
- Modern REST API + OMF
- PowerBI Integration-capability
- Industry Leading Partner



Benchling, Quilt, and CONNECT as part of Scientific Data Cloud

collectively capture the majority of technical data powering Vir



Project Scope

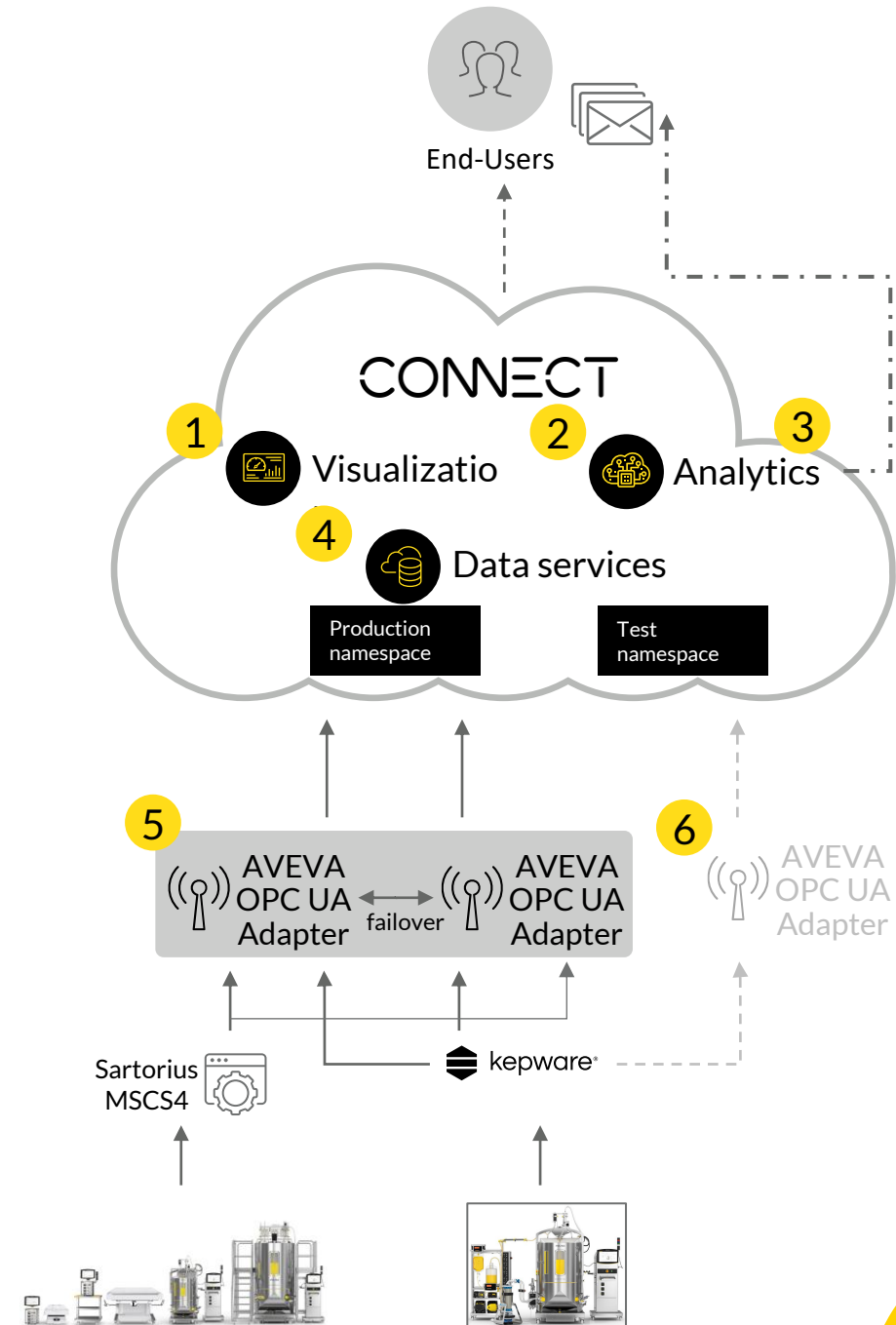
Rollout the CONNECT Data Services to capture process inline data and event data.

Successful roll-out of the project aims to achieve the following direct and indirect benefits:

- **Enhanced visibility and accessibility of process data** to scientists through persistent data views shareable across the organization
- Improved data quality and consistency through **standardized data patterns and formats**
- **Reduced manual effort and errors in data collection** and processing
- Increased efficiency and productivity in data-driven **decision making and optimization**
- **Leveraged data analytics and insights** to support innovation and continuous improvement

Lighthouse architecture

1. Scientists trend datasets to analyze bioreactor batches with CONNECT Visualization Services
2. AVEVA Advanced Analytics
 - Calculations (threads) to monitor bioreactor operations
 - Events generated for bioreactor runs and equipment states
 - Events written to Data Services
3. AVEVA Advanced Analytics
 - Email alerts sent for equipment excursions
4. AVEVA CONNECT Data Services
 - Asset creation with asset rules
5. AVEVA OPC UA Adapters for Production
 - Redundancy with failover Adapter pair
6. AVEVA OPC UA Adapter for Testing
 - Decommissioned after testing



In-House Antibody Development Strategy

“RAPID Lab” Development and pre-clinical material generation

RAPID: Recombinant Antibody Production for Immunological Diseases

Cell Line Development Beacon Optofluidic CLD System



- Screens 4,000 cells in 7 days to select highly-productive clones
- nL → 250mL

Process Development High-Throughput Automated Bioreactors (AMBR)



- CLD confirmation, final clone screening
- Predicts pilot scale cell culture performance
 - 250mL → 5L → 50L → 200L
- Predict pilot scale Ab purification performance

Tox Manufacturing 200L Bioreactor & Purification



- 1-2 month manufacturing process
- Full PQA testing in-house
- Drug Product filling and tox stability

Adapter to Streams to Asset Rules to Assets – no coding!

CONNECT Data services ▸ Edge Data Store & Adapters

1

Device Name ↑	Status	Type	Version	Last Contacted
VSF2-AVEVA1	Good	AVEVA Adapter for OPC UA	1.5....	a few seconds ago
VSF2-AVEVA2	Good	AVEVA Adapter for OPC UA	1.5....	a few seconds ago

CONNECT Data services ▸ Sequential Data Store

2

Name ↓	Id
SF_MFCS4.2.RRM2.Tot_FLOW_F_Setp.State	SF_MFCS4.2.RRM2.Tot_FLOW_F_Setp.State
SF_MFCS4.2.RRM2.Tot_FLOW_F_Setp.Setpoint	SF_MFCS4.2.RRM2.Tot_FLOW_F_Setp.Setpoint
SF_MFCS4.2.RRM2.Tot_FLOW_F_Setp.OutputMin	SF_MFCS4.2.RRM2.Tot_FLOW_F_Setp.OutputMin
SF_MFCS4.2.RRM2.Tot_FLOW_F_Setp.OutputMax	SF_MFCS4.2.RRM2.Tot_FLOW_F_Setp.OutputMax

CONNECT Data services ▸ Asset Rules

3

State	Rule	Description
▶	10092024_AMBRReactor_AssetRule	AMBR Reactor and streams based on Asset Type
▶	10152024_200LReactor_AssetRule	200L Reactor and streams based on Asset Type
▶	10152024_BDCUReactor_AssetRule	BDCU Reactor Asset Rule
▶	10162024_LRMReactor_AssetRule	LRM Reactor and streams based on Asset Type
▶	10162024_RRMReactor_AssetRule	RRM Reactor and streams based on Asset Type

CONNECT Data services ▸ Asset Explorer

4

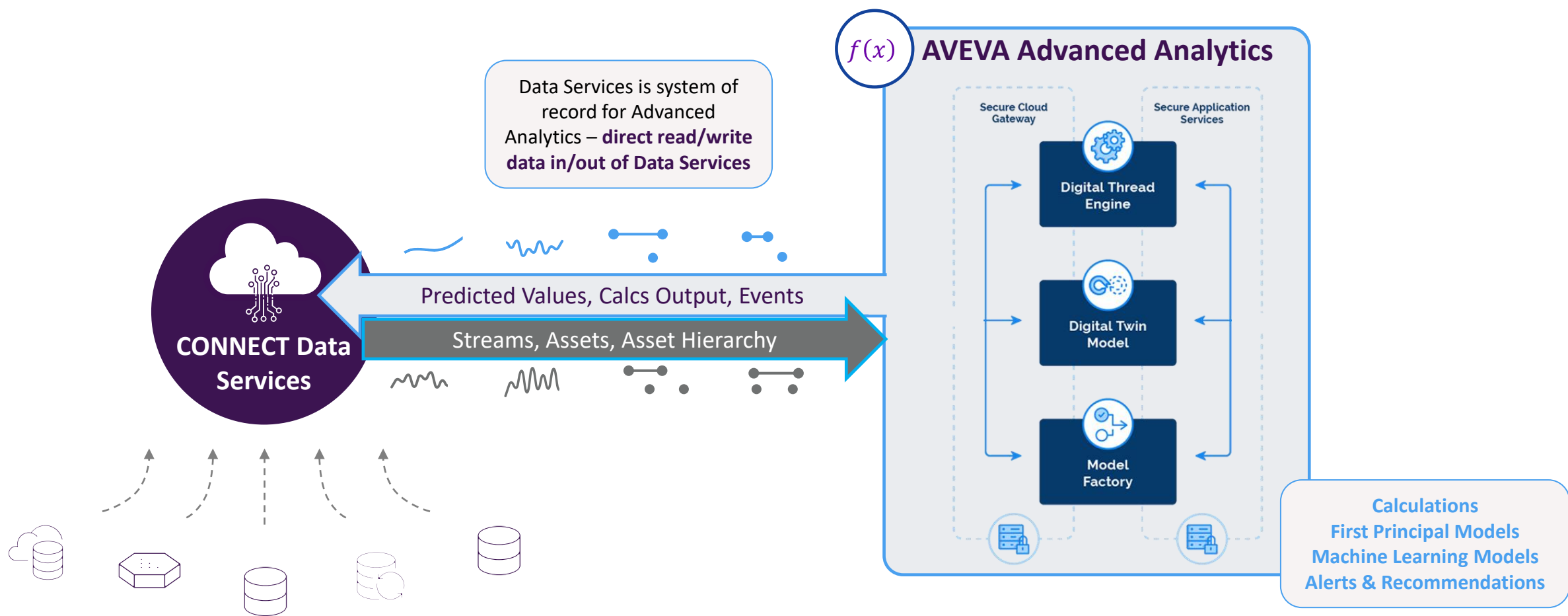
PROD Parent Prod Asset	PROD-SF_AMBR250-Biorea... PROD SF_AMBR250 Bioreactor	PROD-SF_AMBR250-Biorea... PROD SF_AMBR250 Bioreactor	PROD-SF_AMBR250-Biorea... PROD SF_AMBR250 Bioreactor
PROD-SF_AMBR250-Biorea... PROD SF_AMBR250 Bioreactor	PROD-SF_AMBR250-Biorea... PROD SF_AMBR250 Bioreactor	PROD-SF_AMBR250-Biorea... PROD SF_AMBR250 Bioreactor	PROD-SF_AMBR250-Biorea... PROD SF_AMBR250 Bioreactor
PROD-SF_AMBR250-Biorea... PROD SF_AMBR250 Bioreactor	PROD-SF_AMBR250-Biorea... PROD SF_AMBR250 Bioreactor	PROD-SF_AMBR250-Biorea... PROD SF_AMBR250 Bioreactor	PROD-SF_AMBR250-Biorea... PROD SF_AMBR250 Bioreactor
PROD-SF_AMBR250-Biorea... PROD SF_AMBR250 Bioreactor	PROD-SF_MFCS4-200L PROD 200L Reactor	PROD-SF_MFCS4-BDCU03 PROD BDCU Reactor	PROD-SF_MFCS4-BDCU04 PROD BDCU Reactor
PROD-SF_MFCS4-BDCU05 PROD BDCU Reactor	PROD-SF_MFCS4-BDCU06 PROD BDCU Reactor	PROD-SF_MFCS4-LRM1 PROD LRM Reactor	PROD-SF_MFCS4-RRM2 PROD RRM Reactor

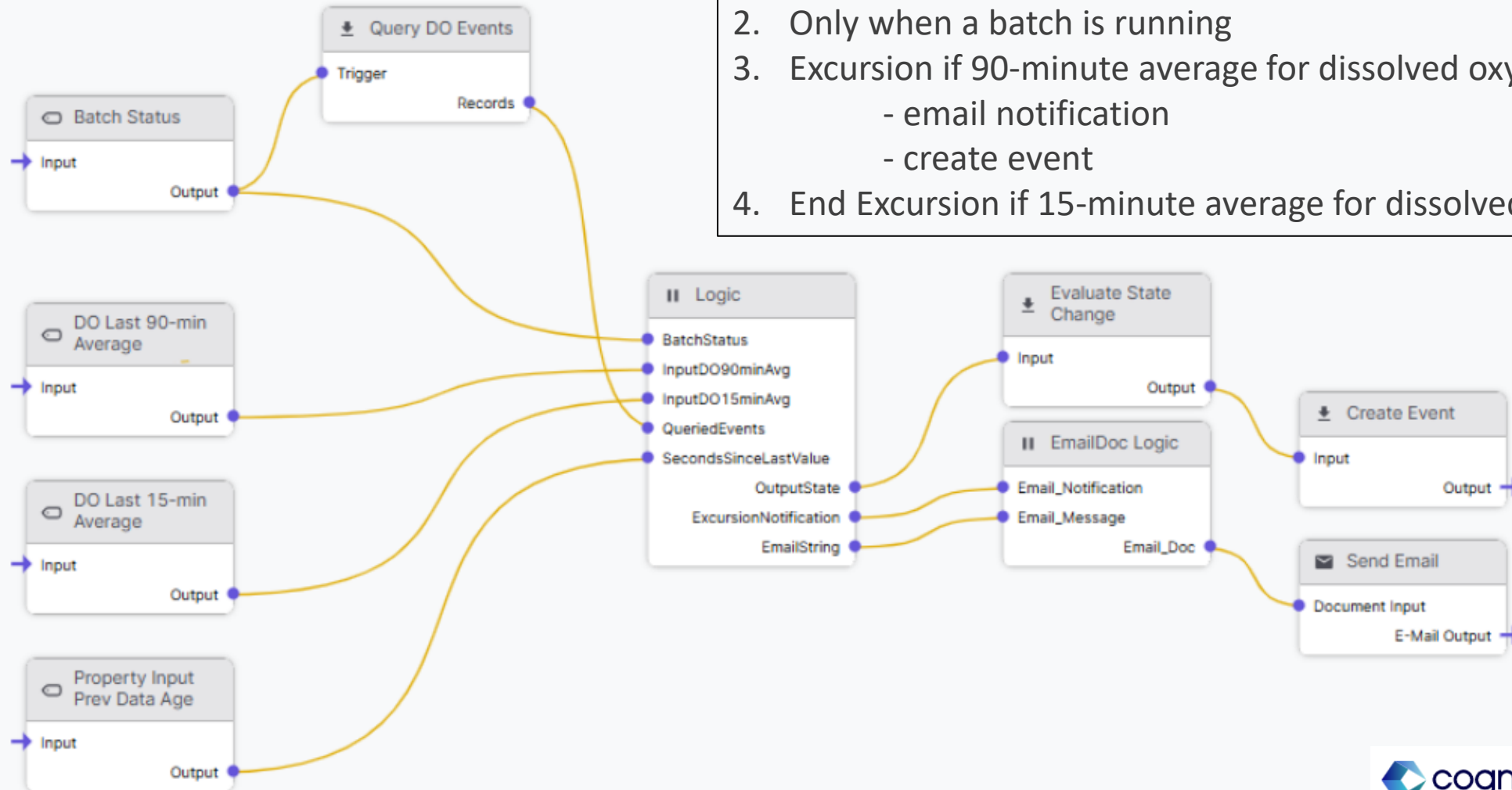
Monitoring requirements

Advanced Analytics Configuration Status

TEST Env		Assets																			
			Bioreactor 01	Bioreactor 02	Bioreactor 03	Bioreactor 04	Bioreactor 05	Bioreactor 06	Bioreactor 07	Bioreactor 08	Bioreactor 09	Bioreactor 10	Bioreactor 11	Bioreactor 12	LRM1	RRM2	200L	BDCU3 (B3)	BDCU4 (B4)	BDCU5 (B5)	BDCU6 (B6)
Event Types	Flow	Flowrate, Pump A	valid	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	n/a	n/a	n/a	n/a	n/a	n/a	n/a
		Flowrate, Pump B	valid	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	n/a	n/a	n/a	n/a	n/a	n/a	n/a
		Flowrate, Pump C	valid	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	n/a	n/a	n/a	n/a	n/a	n/a	n/a
		Flowrate, Pump D	valid	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	n/a	n/a	n/a	n/a	n/a	n/a	n/a
		Flowrate, Pump I	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	drop	n/a	n/a	n/a	n/a
		Flowrate, Pump J	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	drop	n/a	n/a	n/a	n/a
	Stir	Agitation Rate	valid	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	n/a	n/a	valid	n/a	n/a	n/a	n/a
		Rocker Rate	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	valid	valid	n/a	n/a	n/a	n/a	n/a
	Vol	High Volume	valid	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	n/a	n/a	valid	n/a	n/a	n/a	n/a
	Temp	Temp, Clamp Plate	valid	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	n/a	n/a	n/a	n/a	n/a	n/a	n/a
		Temp, Vessel	valid	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	caveats	caveats	valid	n/a	n/a	n/a	n/a
	Press	Pressure, Vessel	valid	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	n/a	n/a	n/a	n/a	n/a	n/a	n/a
		Pressure, Inlet Air	valid	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	n/a	n/a	n/a	n/a	n/a	n/a	n/a
		Pressure, Inlet CO2	valid	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Pressure, Inlet O2		valid	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
DO	DO Sat%	valid	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	to-do	pending	valid	failed	n/a	n/a	n/a	n/a	

AVEVA Advanced Analytics



 Configure

Logic:

1. If stale data
 - create event
2. Only when a batch is running
3. Excursion if 90-minute average for dissolved oxygen is < 10
 - email notification
 - create event
4. End Excursion if 15-minute average for dissolved oxygen > 10

Threads and Classes

(calculations and templates)

#	bioreactors	threads	total threads
12	AMBR	14	168
1	200L	5	5
2	Rocker Bioreactors	3	6

Thread Builder / PROD_AMBR250 Bioreactor Calcs

Add a Project

bk

Threads | Auto Deactivated Threads | Settings | Status | Performance

Name	Type	Description	Execution	Trigger	Applies To	Instances	Error	Is Active	Created By	Modified By	Modified On
PROD_AMBR Agitation Rate Excursion	Unknown	PROD_AMBR Agitation Rate Excursion	Twin	Fast Time	PROD-SF_AMBR250-Bioreactor (Class	12	X	X	Balasubramaniam Karthikeyan	Scott Schaecher	Mar 12th, 2025
PROD_AMBR Clamp Plate Temperature Excursion	Unknown	PROD_AMBR Clamp Plate Temperature Excursion	Twin	Fast Time	PROD-SF_AMBR250-Bioreactor (Class	12	X	X	Balasubramaniam Karthikeyan	Scott Schaecher	Mar 12th, 2025
PROD_AMBR DO2 Saturation % Excursion	Unknown	PROD_AMBR DO2 Saturation % Excursion	Twin	Fast Time	PROD-SF_AMBR250-Bioreactor (Class	12	X	X	Balasubramaniam Karthikeyan	Scott Schaecher	Mar 12th, 2025
PROD_AMBR High Volume Level	Unknown	PROD_AMBR High Volume Level	Twin	Fast Time	PROD-SF_AMBR250-Bioreactor (Class	12	X	X	Balasubramaniam Karthikeyan	Scott Schaecher	Mar 12th, 2025
PROD_AMBR Inlet Gas (Air) Flow Excursion	Unknown	PROD_AMBR Inlet Gas (Air) Flow Excursion	Twin	Fast Time	PROD-SF_AMBR250-Bioreactor (Class	12	X	X	Balasubramaniam Karthikeyan	Scott Schaecher	Mar 12th, 2025
PROD_AMBR Inlet Gas (Air) Pressure Excursion	Unknown	PROD_AMBR Inlet Gas (Air) Pressure Excursion	Twin	Fast Time	PROD-SF_AMBR250-Bioreactor (Class	12	X	X	Balasubramaniam Karthikeyan	Scott Schaecher	Mar 12th, 2025
PROD_AMBR Inlet Gas (CO2) Pressure Excursion	Unknown	PROD_AMBR Inlet Gas (CO2) Pressure Excursion	Twin	Fast Time	PROD-SF_AMBR250-Bioreactor (Class	12	X	X	Balasubramaniam Karthikeyan	Scott Schaecher	Mar 12th, 2025
PROD_AMBR Inlet Gas (O2) Pressure Excursion	Unknown	PROD_AMBR Inlet Gas (O2) Pressure Excursion	Twin	Fast Time	PROD-SF_AMBR250-Bioreactor (Class	12	X	X	Balasubramaniam Karthikeyan	Scott Schaecher	Mar 12th, 2025
PROD_AMBR Pump A Flow Rate Excursion	Unknown	PROD_AMBR Pump A Flow Rate Excursion	Twin	Fast Time	PROD-SF_AMBR250-Bioreactor (Class	12	X	X	Balasubramaniam Karthikeyan	Balasubramaniam Karthikeyan	Jan 15th, 2025

Thread Builder / PROD_200L Reactor Calcs

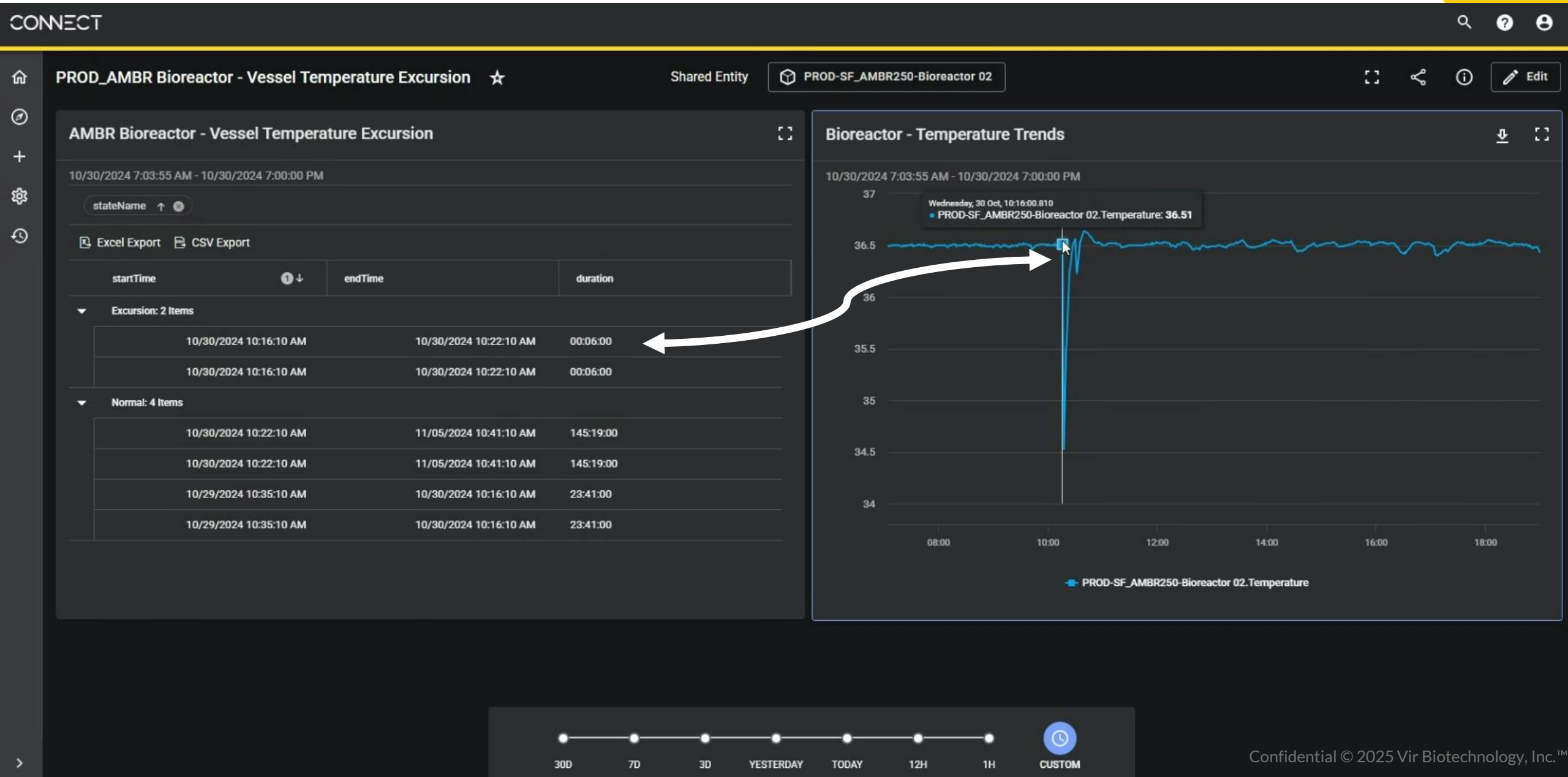
Add a Project

bk

Threads | Auto Deactivated Threads | Settings | Status | Performance

Name	Type	Description	Execution	Trigger	Applies To	Instances	Error	Is Active	Created By	Modified By	Modified On
PROD_200L DO2 Saturation % Excursion	Unknown	PROD_200L DO2 Saturation % Excursion	Twin	Fast Time	PROD / PROD-SF_MFCS4-200L		X	✓	Balasubramaniam Karthikeyan	Balasubramaniam Karthikeyan	Jan 3rd, 2025
PROD_200L High Warning Level	Unknown	PROD_200L High Warning Level	Twin	Fast Time	PROD / PROD-SF_MFCS4-200L		X	✓	Balasubramaniam Karthikeyan	Balasubramaniam Karthikeyan	Jan 3rd, 2025
PROD_200L Pump K Flow Rate Excursion	Unknown	PROD_200L Pump K Flow Rate Excursion	Twin	Fast Time	PROD / PROD-SF_MFCS4-200L		X	X	Balasubramaniam Karthikeyan	Balasubramaniam Karthikeyan	Jan 14th, 2025
PROD_200L Reactor Agitation Rate Excursion	Unknown	PROD_200L Reactor Agitation Rate Excursion	Twin	Fast Time	PROD / PROD-SF_MFCS4-200L		X	✓	Balasubramaniam Karthikeyan	Balasubramaniam Karthikeyan	Jan 3rd, 2025
PROD_200L Reactor Temperature Excursion	Unknown	PROD_200L Reactor Temperature Excursion	Twin	Fast Time	PROD / PROD-SF_MFCS4-200L		X	✓	Balasubramaniam Karthikeyan	Balasubramaniam Karthikeyan	Jan 3rd, 2025

CONNECT Visualization Services for viewing generated events & time series data



- Home
- Browse
- Create
- Configu
- Recent

PROD-SF_AMBR250-Bioreactor 01-3L and all 12 ambr monitor ☆

quickly view asset information, KPIs, and sophisticated analysis.

pH

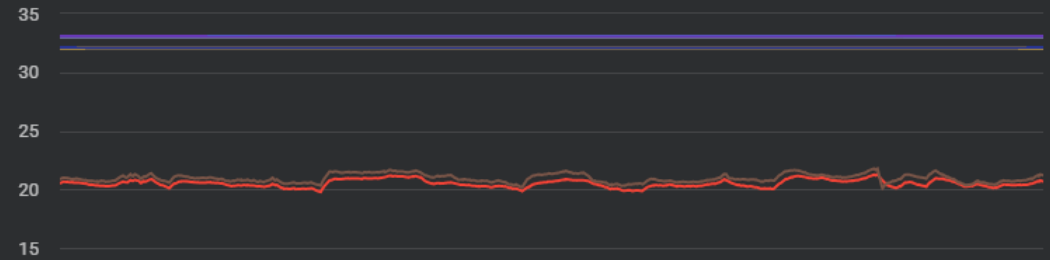
03/22/2025 12:00:00 AM - 03/28/2025 12:15:47 PM



▲ 1/4 ▼
 SF_AMBR250.Bioreactor 01.pH
 SF_AMBR250.Bioreactor 02.pH
 SF_AMBR250.Bioreactor 03.pH
 SF_AMBR250.Bioreactor 04.pH

Temp

03/22/2025 12:00:00 AM - 03/28/2025 12:15:47 PM



STREAMS

2,948

VISUALIZATIONS

25

PROD-SF_AMBR250-Bior...

2 views

Modified: 1/14/2025 8:44 AM
mnelson@vir.bio

PROD-SF_AMBR250-Bior...

0 views

Modified: 1/14/2025 8:44 AM
System

PROD-SF_AMBR250-Bior...

0 views

Modified: 1/14/2025 8:44 AM
System

Project Deliverables

- Vir Bio captures all online process data from mammalian cell culture bioreactors using AVEVA CONNECT Data Services as a system of record.
- Vir Bio selects all bioreactor process data to run analyses and generate events.
- Events are stored in Vir's Scientific Data Management System (SDMS) and documents hyperlinks to persistent URLs in AVEVA CONNECT for the source of the data files documented in Vir's ELN.
- Demonstrating ease of cross-referencing and cross-platform hyperlinking in a "scientific data cloud".
- Vir Bio uses AVEVA Advanced Analytics to send notifications via email and text messaging when a warning/alerting event occurs.
- Vir Bio uses a dashboard in the CONNECT visualization to display statuses and KPIs of reactors.

Vir Biotechnology transforms bioprocess development with real-time data capture and analytics

Challenge

- Process improvement predictions from data analysis can result in significant gains to antibody production, translating to millions of dollars in cost savings; however:
 - Previous efforts required manual data finding, cleansing, and formatting (30% of project time)
 - Real-time data needed to drive process improvements was not available
 - Building and managing a centralized on-prem solution was not sustainable

Solution

- Centralized data capture from multiple bioreactor process control systems through CONNECT; enabled optimization predictions with AVEVA™ Advanced Analytics

Results

- Created a single source of truth for comparative bioprocess analyses to save up to 25% of scientist time previously spent working with data silos
- Enabled real-time system alerts allowing corrective action to prevent critical process failures
- Improved potential for collaboration with external manufacturing partners by enabling data sharing and standardizing data models



“

“By adopting a cloud-first strategy with CONNECT we have been able to unify our data sources, mitigating operational risks and improving yield production.”

Scott Schaecher, Director R&D IT, Vir Biotechnology

AVEVA

Next Steps

- Add downstream process data into AVEVA CONNECT Data Services platform
- Integrate CONNECT with business intelligence tools to disseminate reactor run statuses to company's SharePoint pages for wider visibility.
- Consolidate CONNECT and cloud-based Laboratory Information Management System (LIMS) to manage run events and offline sample data.
- Future data exchange with external partners
- Federate user authentication with identity provider

Thank you

Balu Karthikeyan

Rachel Korwin-Miller

Scott Schaecher

