

Accelerating Viral Vector Manufacturing

Automation of cell-based assays: QC implementation strategies and challenges

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Agenda

1

Introduction to OXB

Innovation engine and technologies

2

Delivering Quality At Scale

Lab Automation For Analytical Excellence

3

Case Study Applications

4

Concluding remarks and Q&A

Take home message



Unique competitive positioning

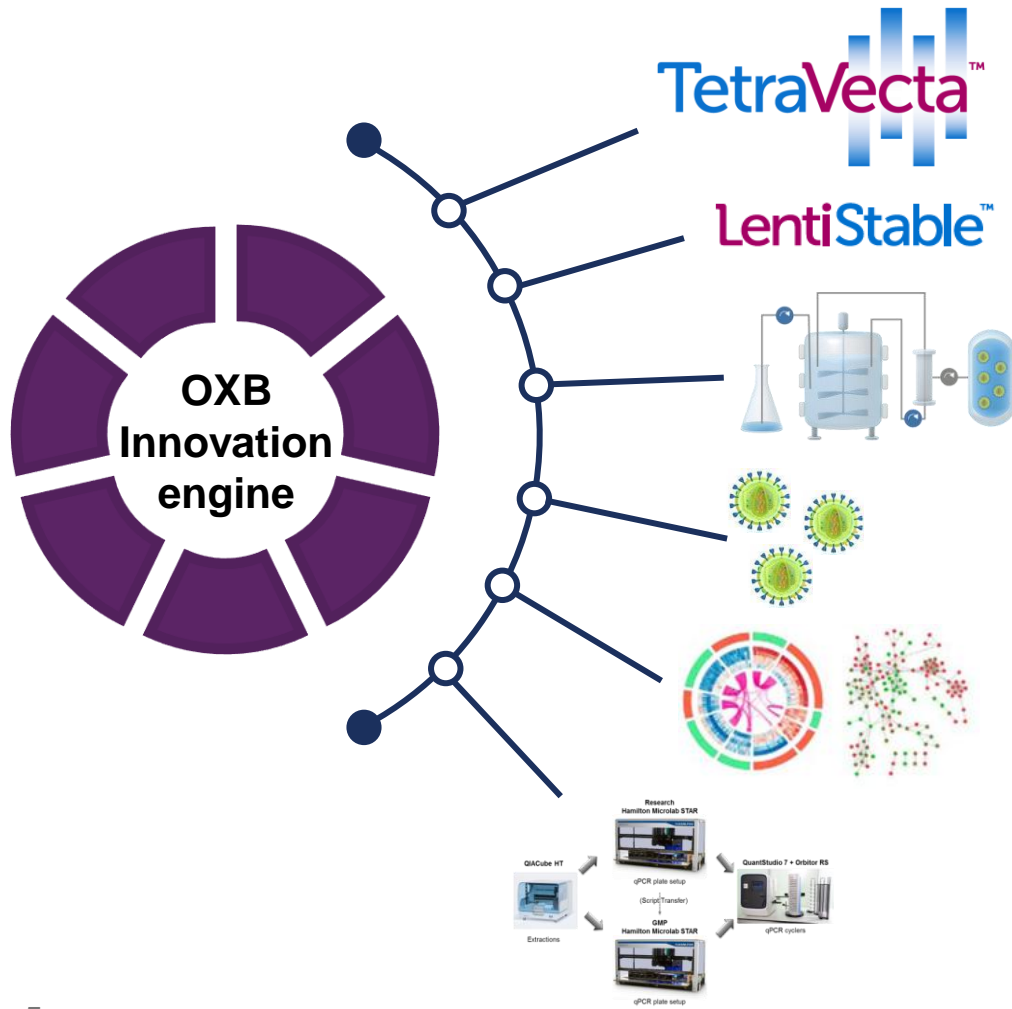
- ✓ **Best-in-class capabilities** across AAV, lentivirus & other vector types
- ✓ **Trusted by global industry leaders** – successful collaborations with big pharma, established biotech and emerging biotech
- ✓ **State-of-the-art facilities & scalable production capabilities** designed to meet the growing demand for C>s
- ✓ **Deep scientific know-how** – a team of world-leading specialists in viral vector optimisation
- ✓ **Cutting-edge technology** – leveraging 30 years of insights to enhance speed, efficacy, quality and safety in new therapies
- ✓ **Global reach & strategic positioning** with manufacturing facilities located in key biotech hubs

 30 Years of manufacturing experience	 ~1000 Successful GMP batches since 2014	 40+ Client programmes	 30+ IND submissions	 65+ Successful audits
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The Importance of Innovation in a CDMO

Our innovation engine has delivered multiple breakthrough LV technologies



Next generation lentiviral vectors

Producer cell lines

Perfusion process with enhancers (U1 snRNA and I3A small molecule)

Design of Experiments (DoE) studies to optimise plasmid ratio and transduction

Proteomics / transcriptomics including advanced mass spec

Automated assays

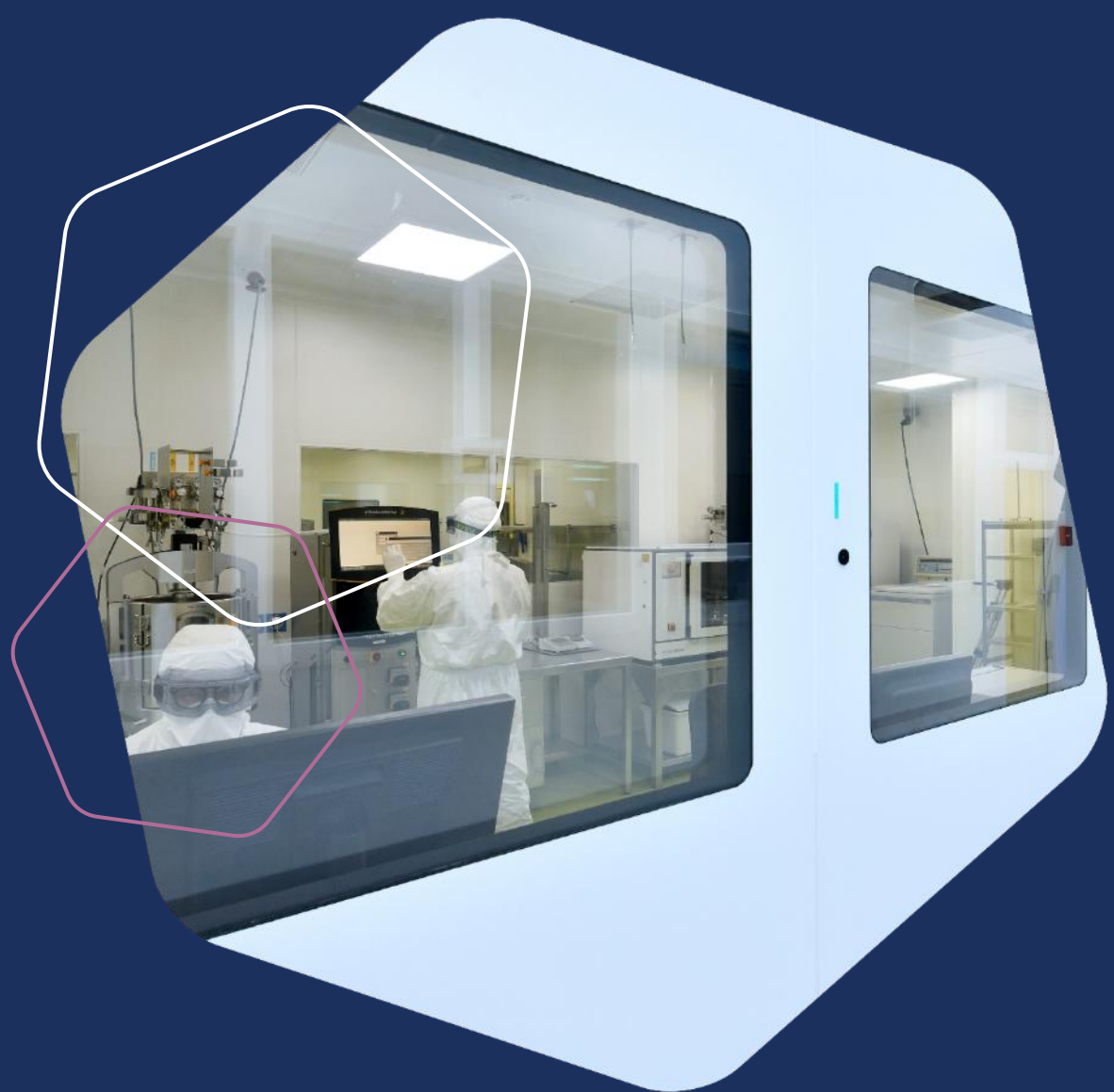
Cell and vector engineering to increase capability and productivity

Large scale bioprocessing to increase yield and improve purity

Maximise data integration and analysis

Analytical development to characterise vectors and achieve rapid batch release

Delivering Quality at Scale: Lab Automation for Analytical Excellence



Viral vector analytics

Lentiviral Vector Manufacturing Process

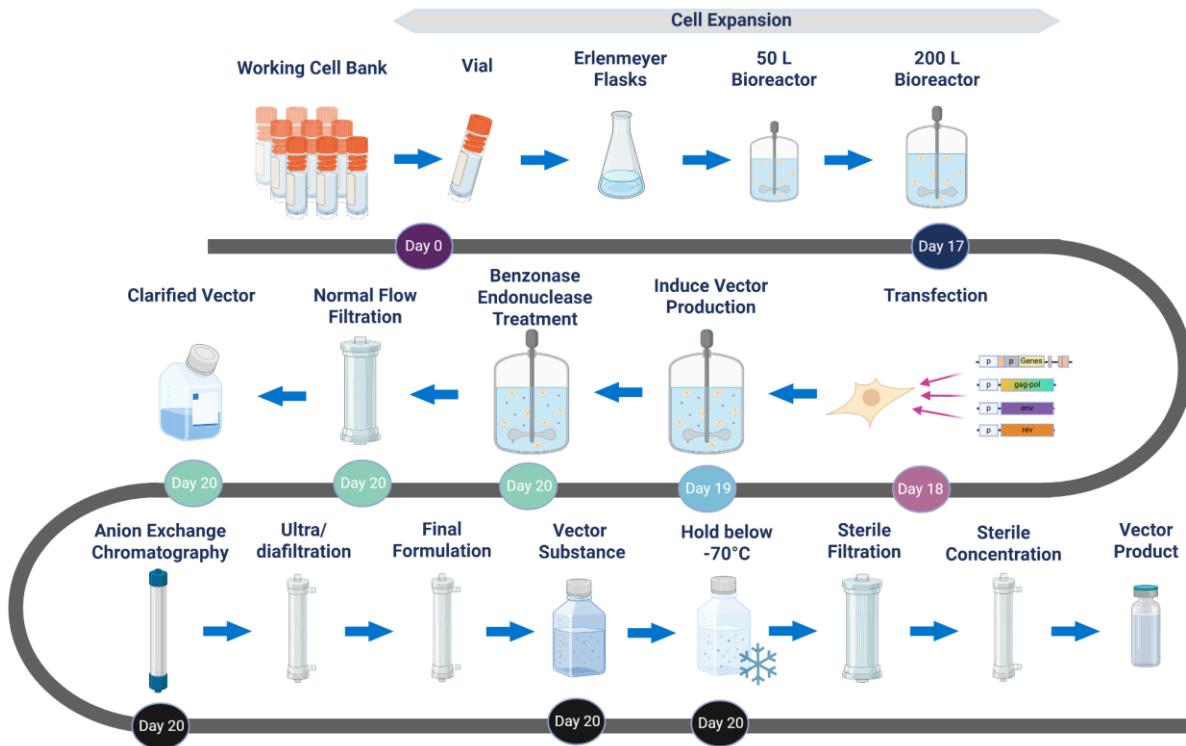


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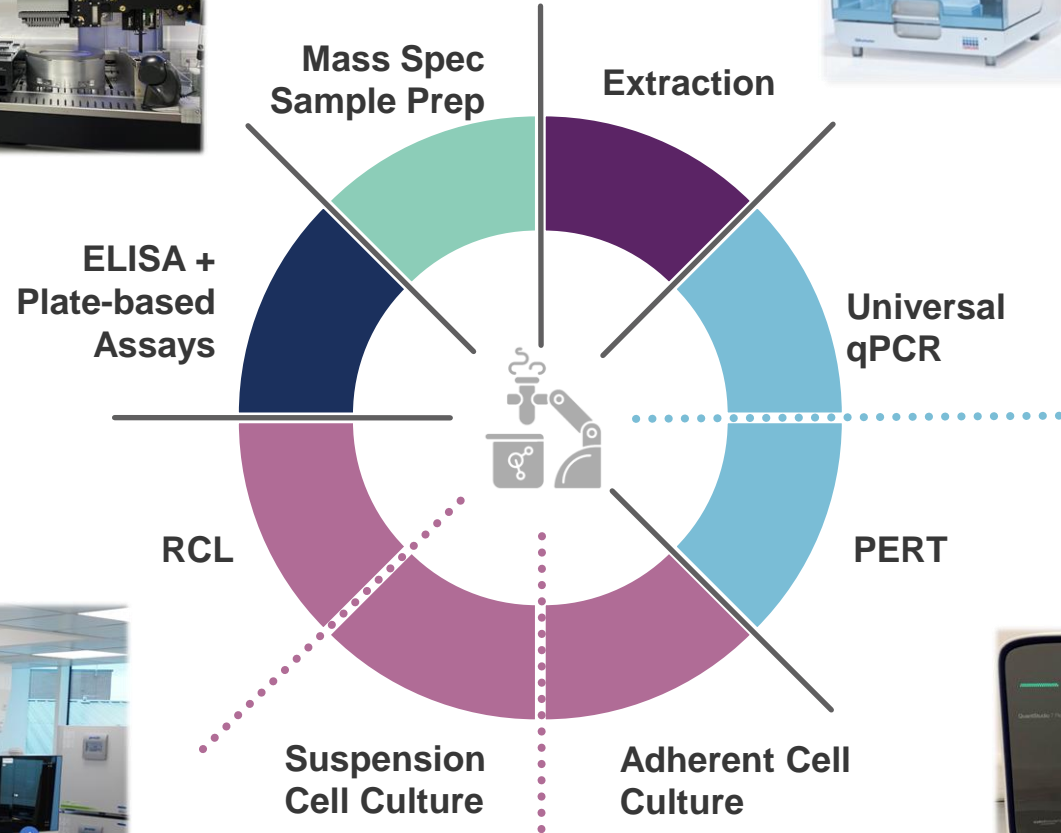
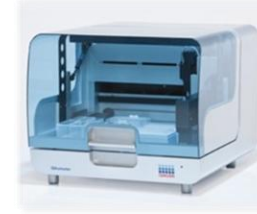
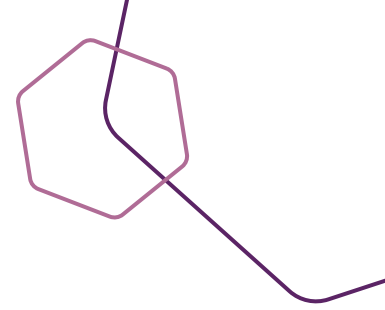
Analytical QC Testing

Identity/Potency Tests	(Im)Purity Tests	Safety Tests
Vector titre	Benzonase	RCL + RCL-CC
Vector genome (RNA) concentration	Residual host cell proteins	Endotoxin
PERT	Total residual DNA	Sterility
p24 antigen	Plasmid residual DNA	Mycoplasma
	Residual BSA	

QC release testing – challenges

- Physio-chemical composition
- Biological activity
- Extractions and sample processing
- Multi-step cell culture
- Operator variability
- Complex data analysis
- Extensive documentation

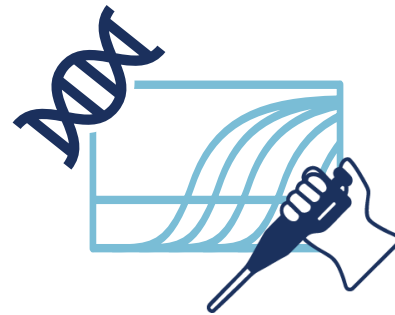
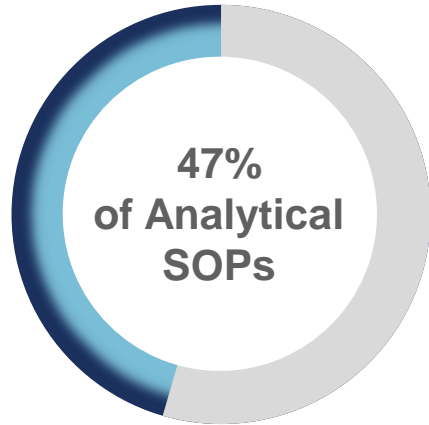
Extensive Automated Analytics Deliver Scalable Results



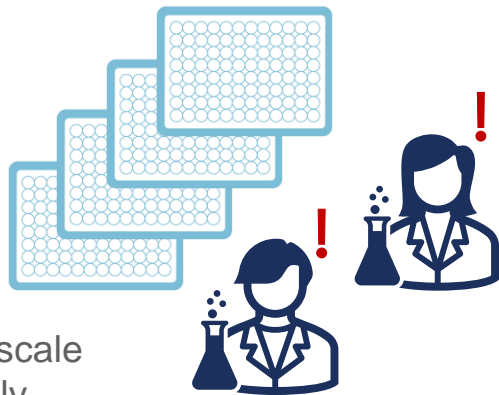
A photograph of a person in a white lab coat and protective gear, including a face shield and gloves, operating a computer monitor in a laboratory setting. The person is standing in front of a large, dark monitor that displays some data. The background shows laboratory equipment and a clean, professional environment. The image is framed by a purple, abstract shape that resembles a molecular structure or a stylized 'X' shape.

Automated qPCR Workflows

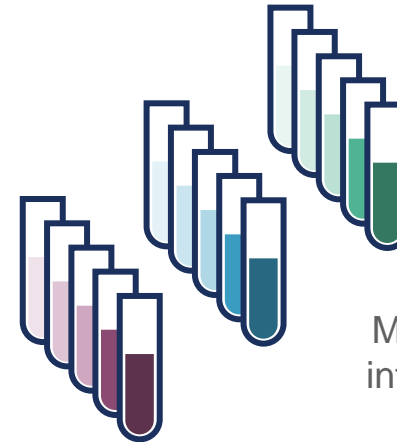
Manual qPCR – delivery challenges



15,000 samples/year
~300 operator hours

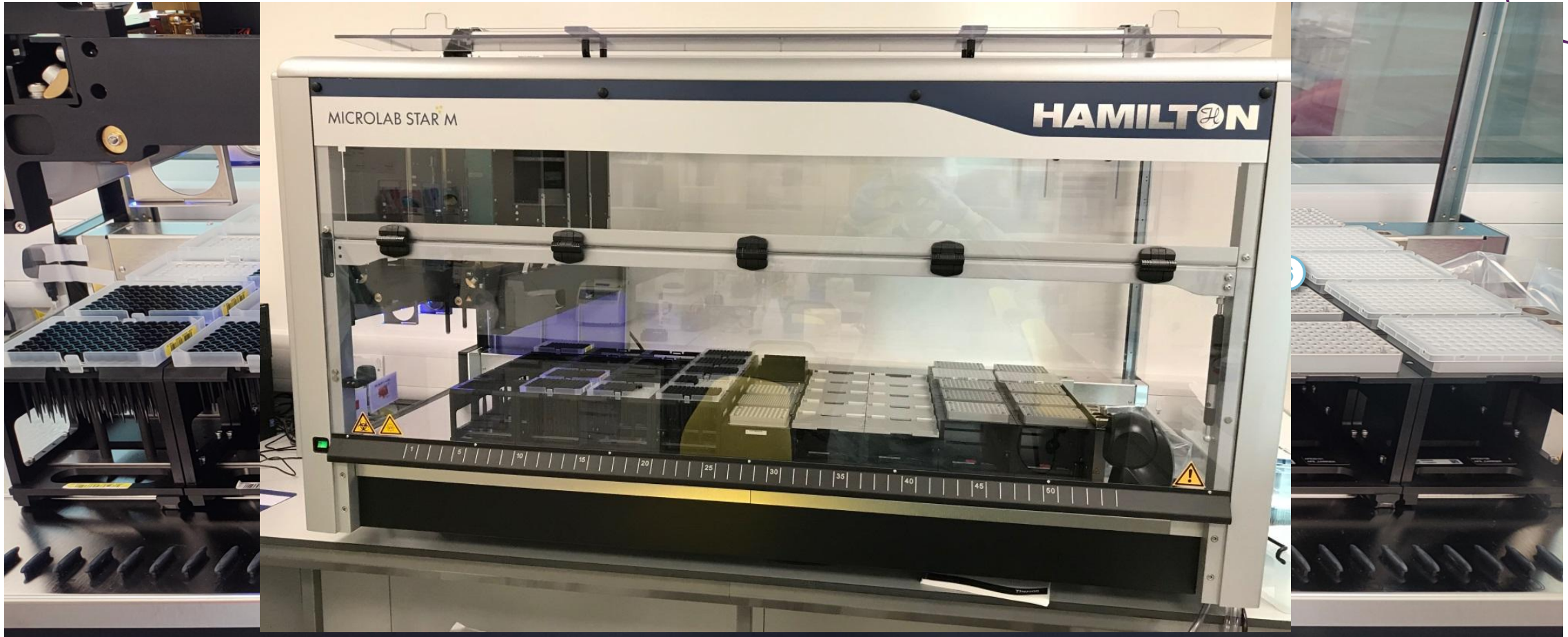


Difficult to scale
manually



Multiple and variable
intermediate dilutions

Overcoming qPCR capacity constraints with automation



1. High & Low Volume Tips
2. Tube Racks – Reagents
3. Mini Plates – Control Input
4. PCR Plates – Sample Input
5. QIacube Racks – Sample Input
6. PCR Plates – Dilution & Assay Plates

Configured for compliant flexibility

Step ID	Sample ID	Rack Barcode	Well ID	Dilution 1	Dilution 2
1508					
1509					
1520	123.01	101856577414921	A1	5	N/A
1521	123.01	101856577414921	B1	5	10
1522	123.01	101856577414921	C1	5	10
1523	123.01	101856577414921	D1	5	10
1524	123.01	101856577414921	E1	5	10
1525	123.01	101856577414921	F1	5	10
1526	123.01	101856577414921	G1	5	10
1527	123.03	101856577414921			
1528	123.03	101856577414921			
1529	123.04	101856577414921			
1530	123.04	101856577414921			
1531	123.05	101856577414921			

Automation solutions must be configured:

- Complex scripts

Co-developed methods:

- Optimised pipetting
- Error prevention
- Data Integrity

Flexibility added via worklists:

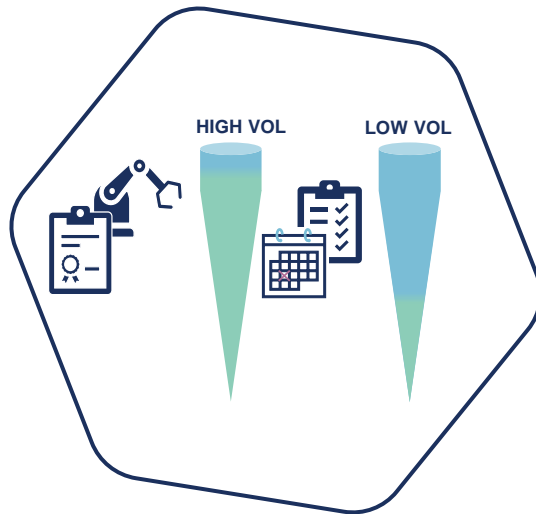
- Locked Hamilton protocols
- Assay-specific Worklists

Continuously expanding capabilities

Comprehensive GMP validation strategy

Instrument Qualification

- Vendor IQ/OQ
- OXB PQ
- Routine volume verification



Computer Systems Validation

- User access control
- Locked Venus Methods
- Output file data integrity
- Audit trails
- Instrument reports & error flagging



Method Validation

- Validate code in Worklist generator
- Validate Worklist import to Venus Methods
- Validate Venus Methods



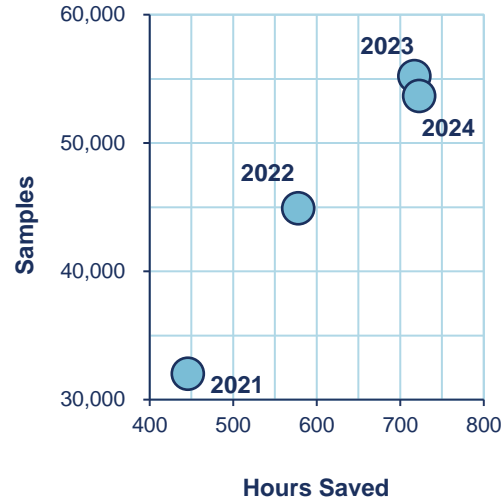
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Improved Efficiencies

Faster Data Delivery

Robust Results

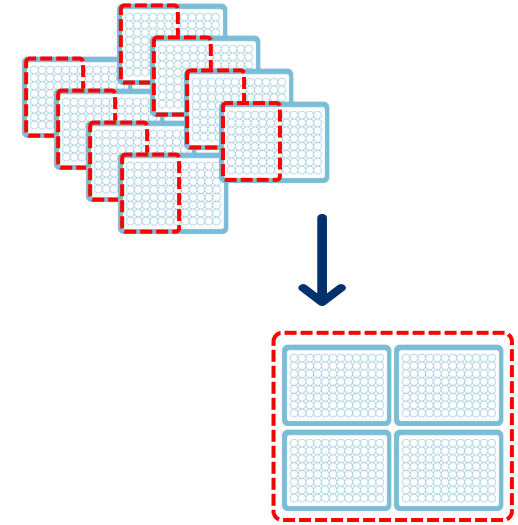
Increased Throughput



Overnight Runs



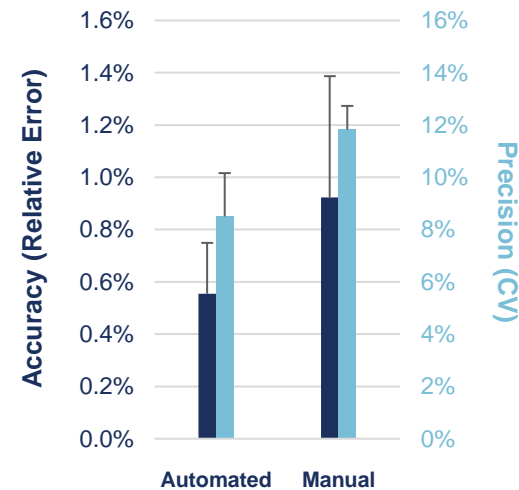
Efficient Batching



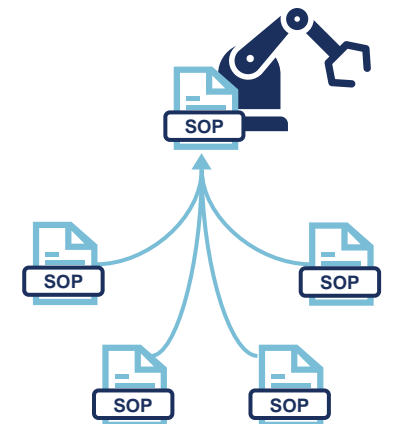
Low Sample Repeat Rate



Improved Accuracy and Precision



Simplified Training





Automated Cell- Based Assays

Integration assay for lentiviral titre assessment

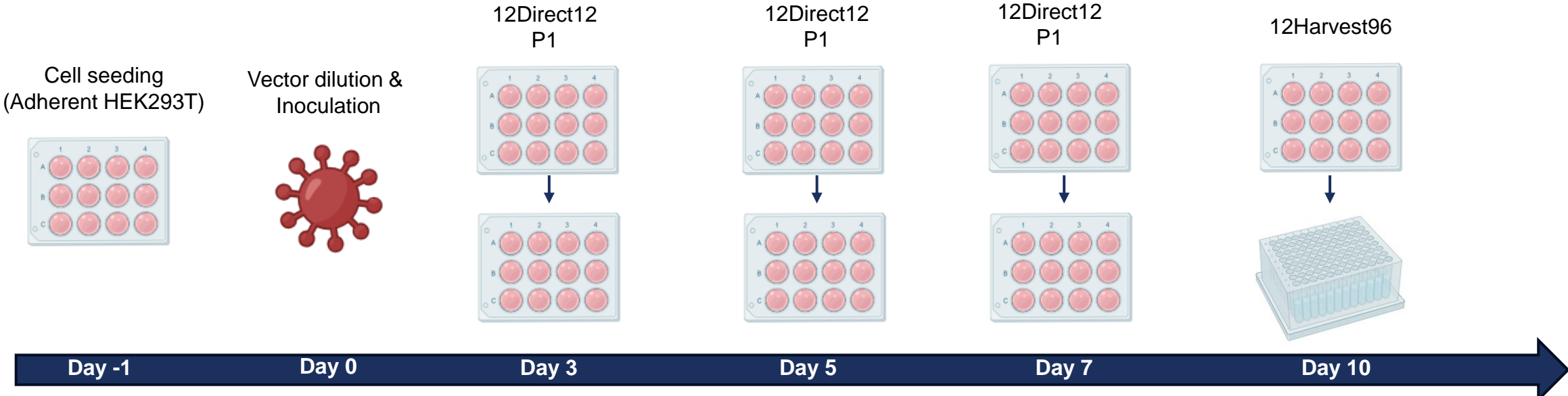
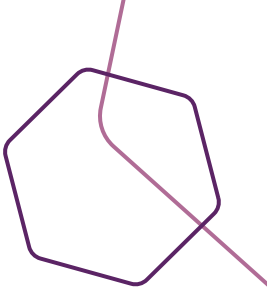


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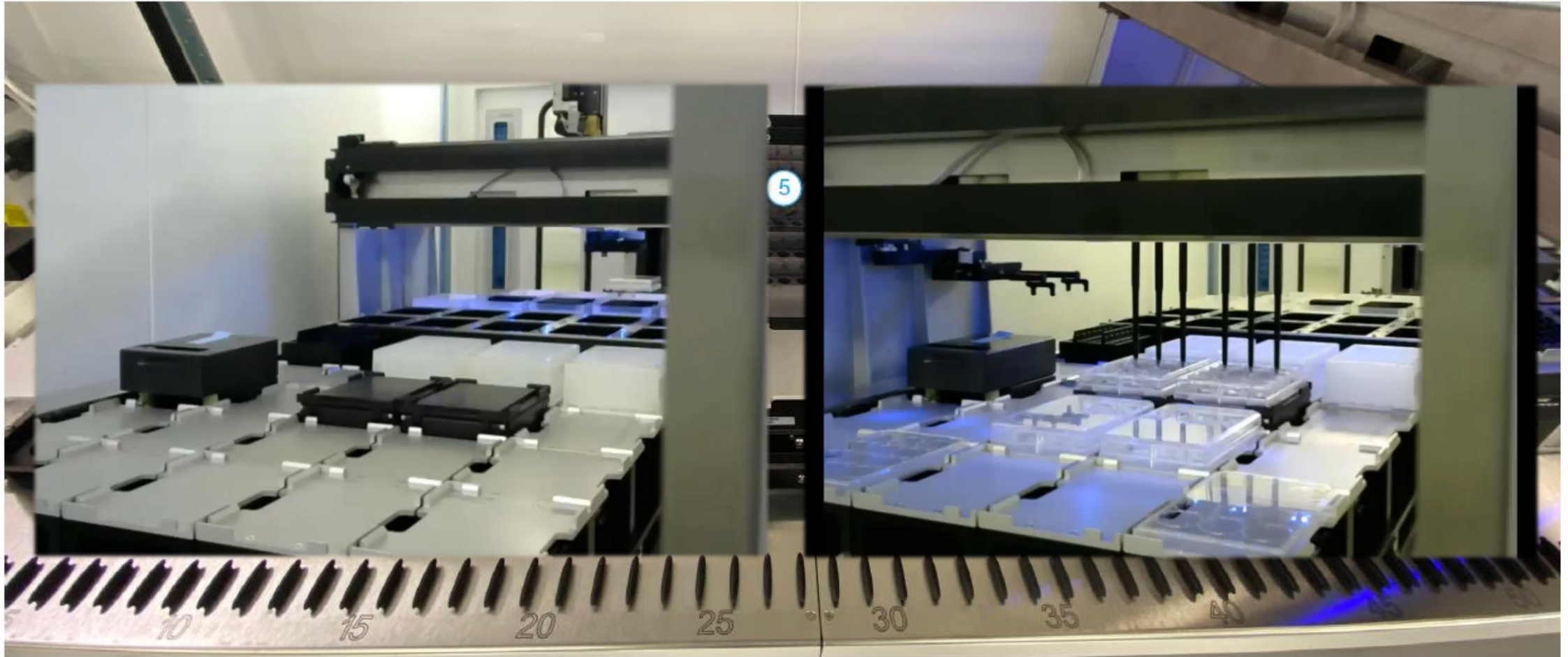


Transforming cell-culture workflows through automation



- 1. Cytomat C5 Incubator
- 2. Hamilton Microlab STAR
- 3. Linear Transfer Stations
- 4. Cytomat C10 Hotel
- 5. Class II Biological Safety Cabinet

Transforming cell-culture workflows through automation



1. Cell Culture Plates & Lids
2. Liquid Waste Drain
3. Tilt Modules
4. Heated Media & Reagent Reservoirs
5. Reagent Tube Racks
6. Deep-Well Plates
7. High Volume Tips

Automated workflow

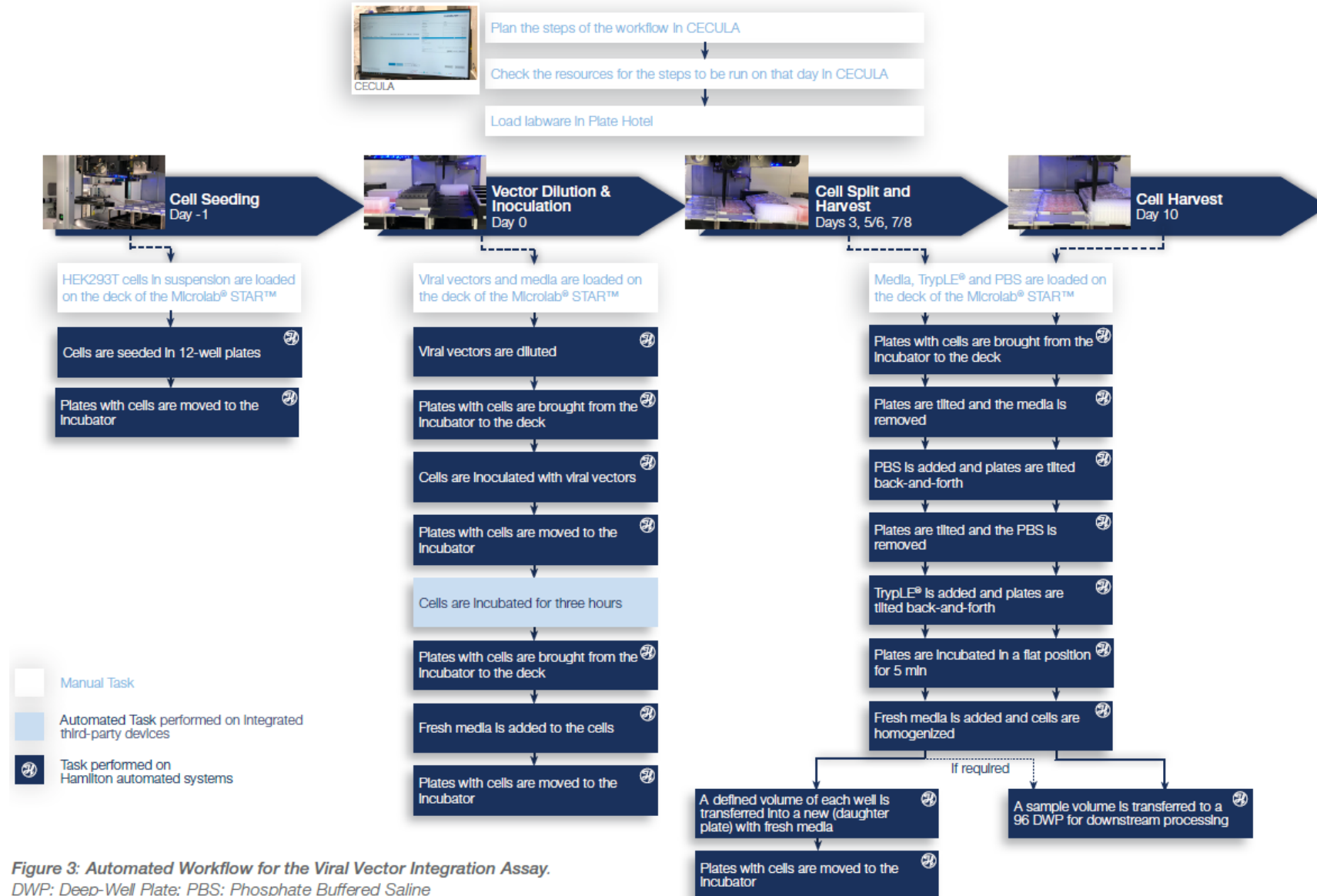
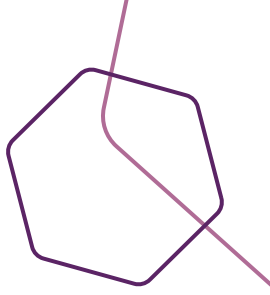


Figure 3: Automated Workflow for the Viral Vector Integration Assay.
 DWP: Deep-Well Plate; PBS: Phosphate Buffered Saline

Analytical Qualification Performance

Demonstration of equivalence between manual vs automated workflows



Study 1: Assessment of Adherent Cell transfer and harvest efficiency



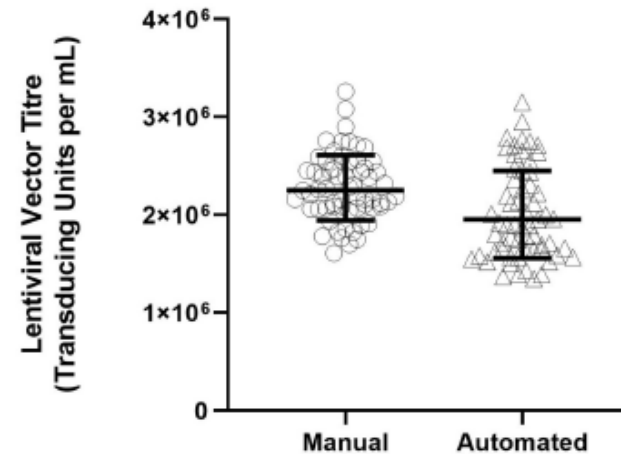
Study 2: Assessment of Performance following Automated passaging and harvest



Study 3: Assessment of Performance following Automated dilution, passaging and harvest

Overall study results:

- Transfer accuracy = 97%
- Transfer precision < 12%
- Cell viability >98%

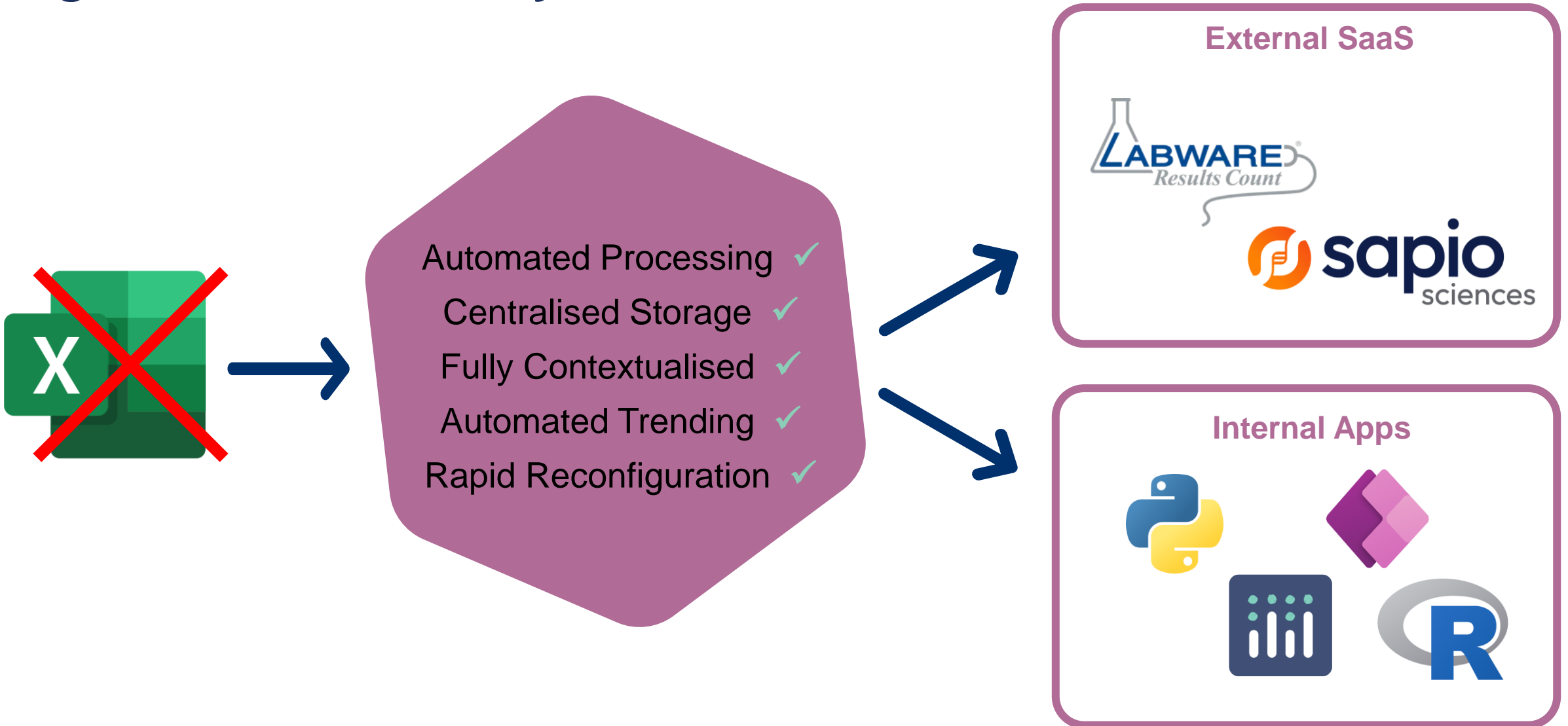


- No statistically significant differences between manual vs automated workflows

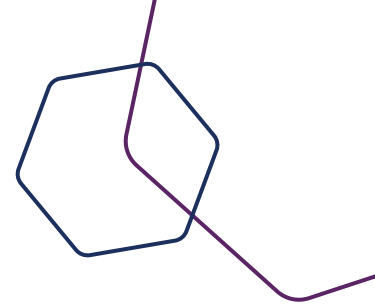


Transforming Data Delivery

Digital-driven efficiency



Reducing costs in Cell & Gene Therapy through data leveraging and automation



Rapid development

- Reduced cost of development
- Faster to GMP with optimised conditions



Streamlined manufacturing

- Integrates multiple steps into closed, automated workflows
- Shortens production cycles and reduces manual interventions



Lower labor costs

- Reduces reliance on large, specialised workforce



Enhanced consistency and quality

- Automated analytics increases throughput
- Reduces human error and batch failures
- Improves product traceability and compliance



Scalability

- Extensive platform data and scaled models enables scale-out and scale-up without proportional cost increase
- Supports growing patient demand efficiently



Faster time-to-market

- Accelerates delivery of therapies
- Improves ROI and patient access

Let's deliver life-changing therapies together

A global quality and innovation-led
CDMO in cell and gene therapy

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