Breaking Boundaries: simple and robust automation of highly variable bioassays

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Abstract

Automation - the use of technology to perform tasks with minimal human intervention has become a driving force behind revolutionizing industries across the globe. From manufacturing to healthcare, automation has proven to be a game-changer in terms of efficiency, productivity, and cost-effectiveness.
In this poster, we will explore the various aspects of automation and its impact on different field in research. Let us embark on a journey that explores the evolution from a manual assay to a fully automated complex assay with high flexibility. We will examine the benefits, challenges, and advancements associated with this transformative process.

Introduction

1. Therapeutic obstacle: pre-existing Anti-Drug Antibodies (pADA)

Anti-drug antibodies biotherapeutics

What will be analyzed?
Biological therapeutic molecules of all scaffolds.

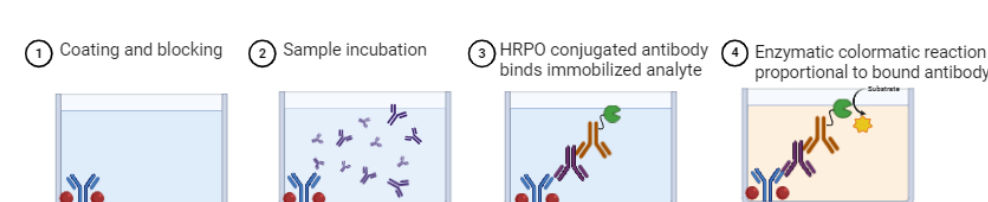**Why do we screen for those pADAs in non exposed individuals?**
Development and selection of less immunogenic drugs.
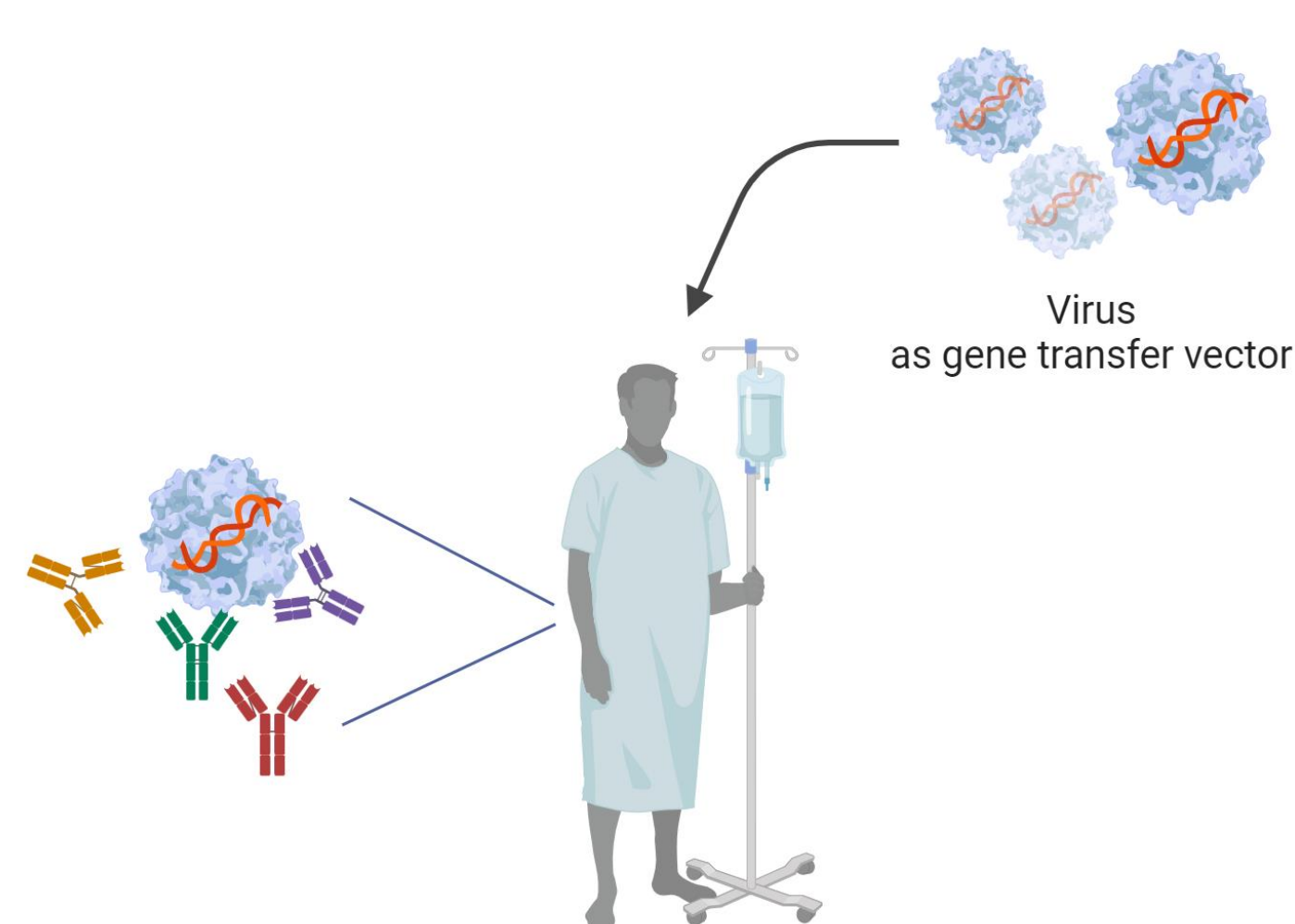Evaluate pADA in healthy donors as well as test patient populations.
Learn & understand mechanisms of immunogenicity.

How can we detect pre-existing antibodies?
ELISA (Enzyme Linked Immuno Sorbent Assay)

Immunogenicity in gene therapy

Virus as gene transfer vector

Pre-existing antibodies indicate prior exposure to endogenous viral infection.

The impact of pre-existing immunity may lead to reduced efficacy and increased safety risks of drugs.

2. The Timekeeper's Companion: Enhancing Efficiency with Scheduler Software

The key to successful assay automation is a scheduling software offering a maximum of flexibility to handle highly variable, time-critical processes in a robust and efficient way.

M720 ELISA

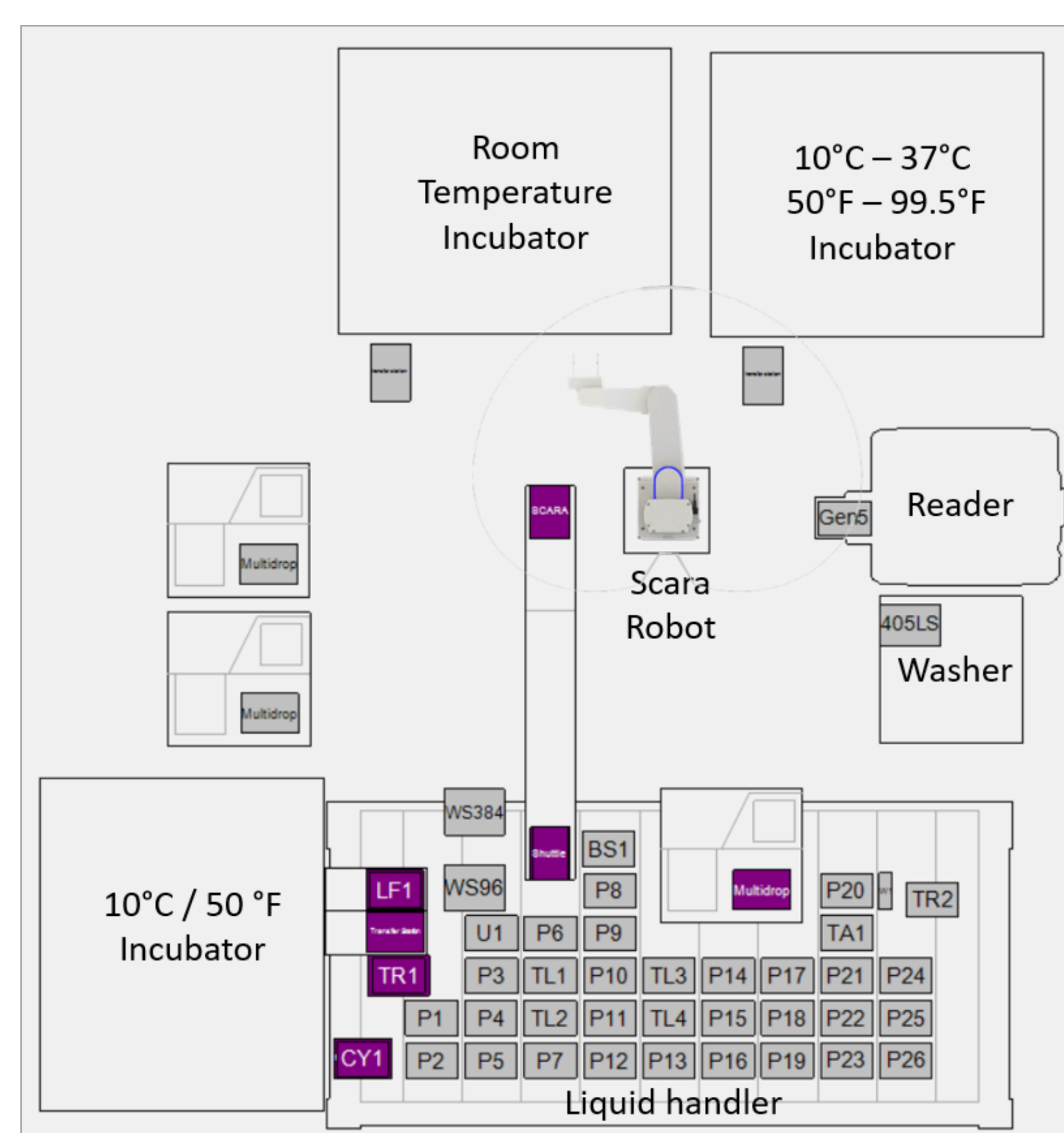Method for ELISA with decision trees
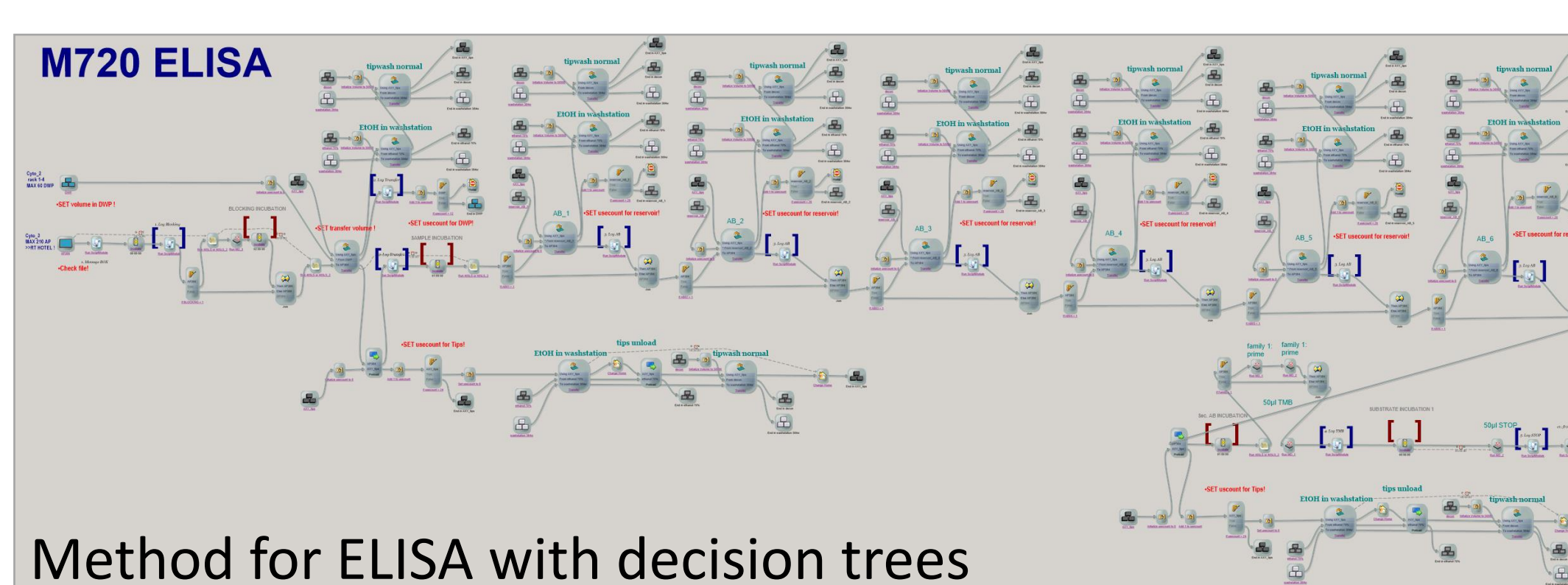
One custom csv file contains the information for start positions, decision trees and incubation times.

The scheduler calculates the optimal plate offset in advance, depicted in a Gantt chart including all the labware involved.

Incubation Times

Schedule View
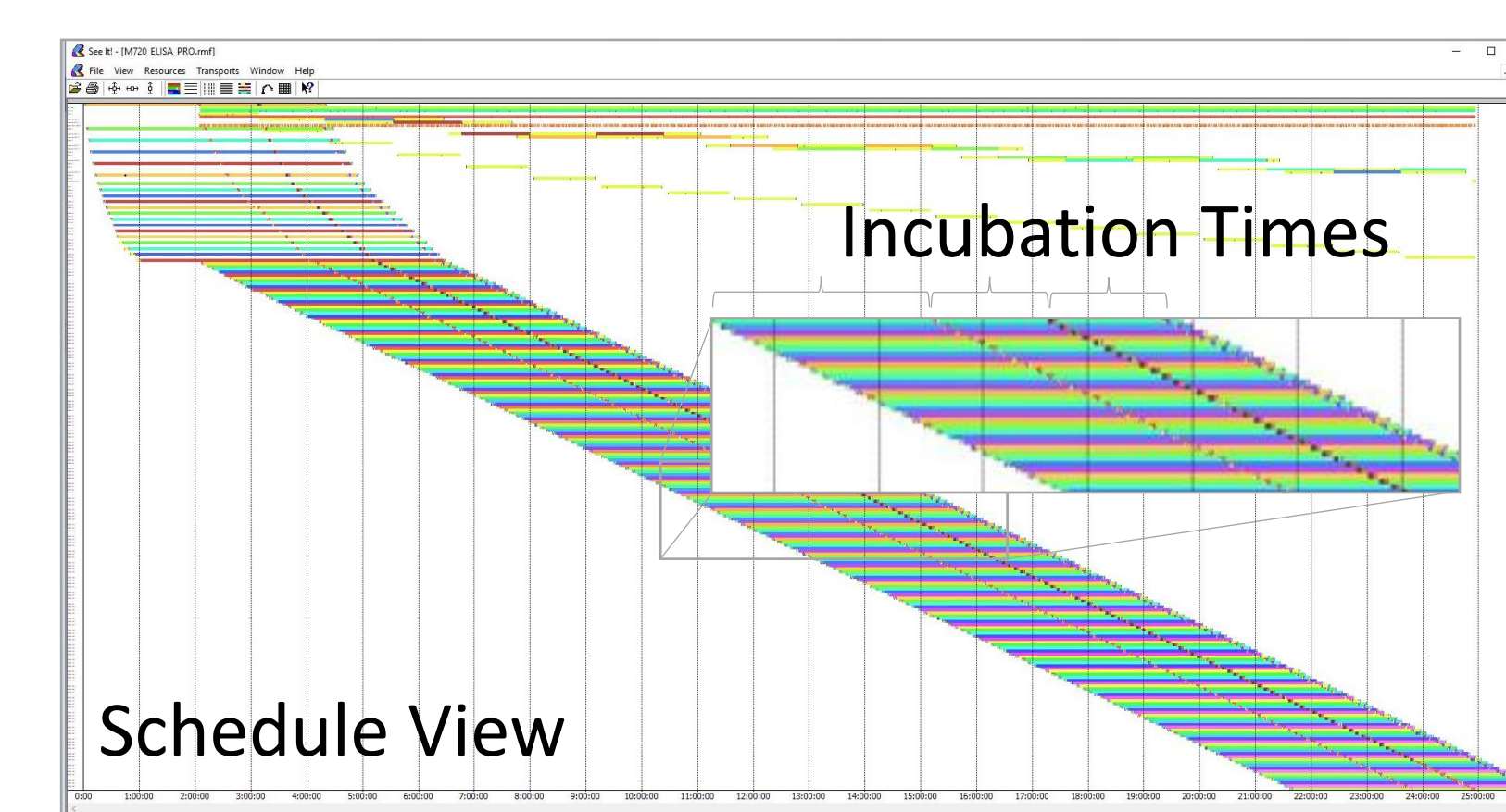
3. Streamlining Processes with a fully Automated Platform

Schematic layout of the robotic ELISA platform

Room Temperature Incubator

10°C – 37°C
50°F – 99.5°F
Incubator

Reader

Gen6

Scara Robot

405LS
Washer

10°C / 50 °F Incubator

WS384
LF1 WS96 Shuttle BS1
TR1 U1 P6 P9 P8
CY1 P1 P4 TL2 TL1 TL3 Multidrop P20 TA1 TR2
P3 TL1 P10 TL3 P14 P17 P21 P24
P2 P5 P7 P12 P13 P16 P19 P23 P26

Liquid handler

Required automation devices
- Incubator
- Dispenser
- Liquid handler
- Laminar flow
- Plate washer
- Reader
- SCARA

Liquid handler with a Multichannel-head
- 384-well head
- Tip washing station
- sterile housing with direct integration of incubator and dispenser

4. Data comparison

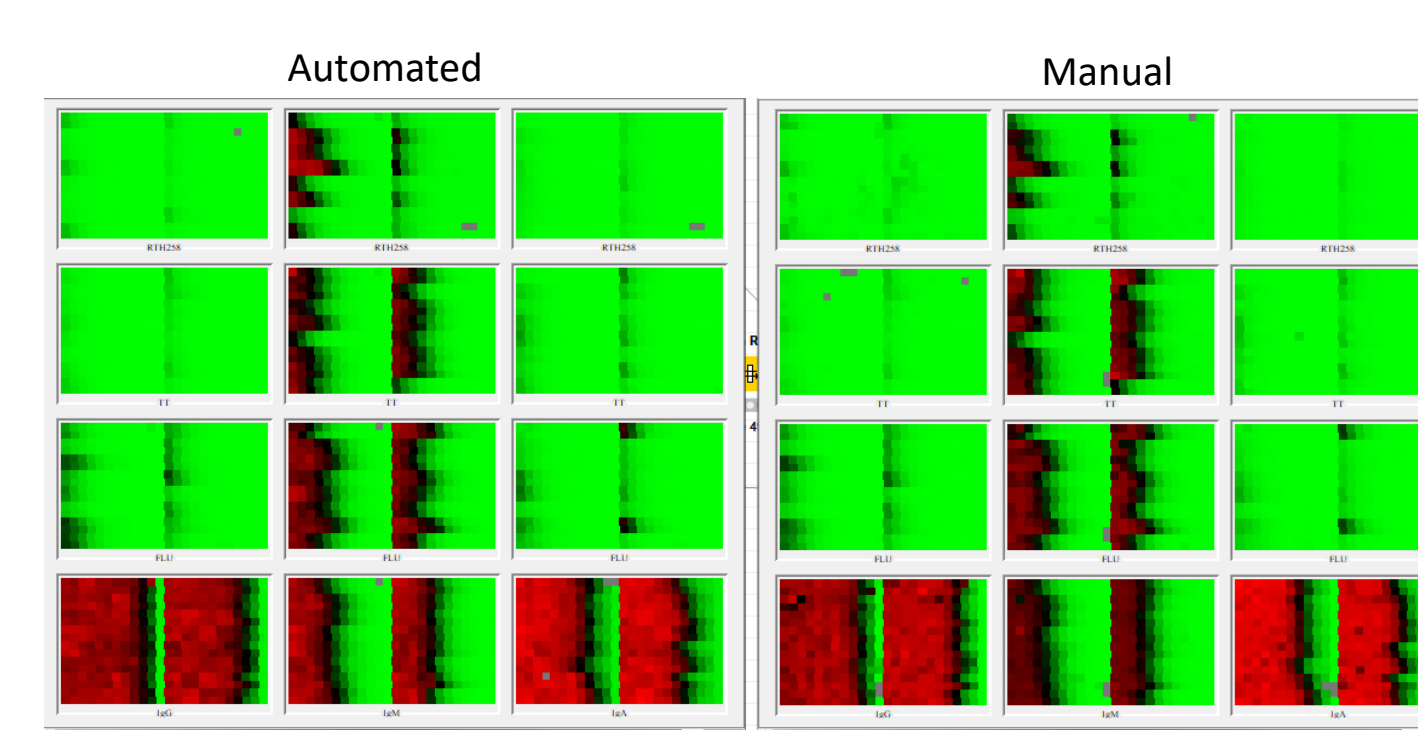**Unveiling Differences between Automation and Manual**

Automated   Manual

Figure1 Coated plates with Compound, Tetanus toxin, FLU mix and IgA / IgG / IgM
Dynamic range ratio OD: Automated: **43** / Manual: **21**
maximum signal level
minimum signal level = ratio
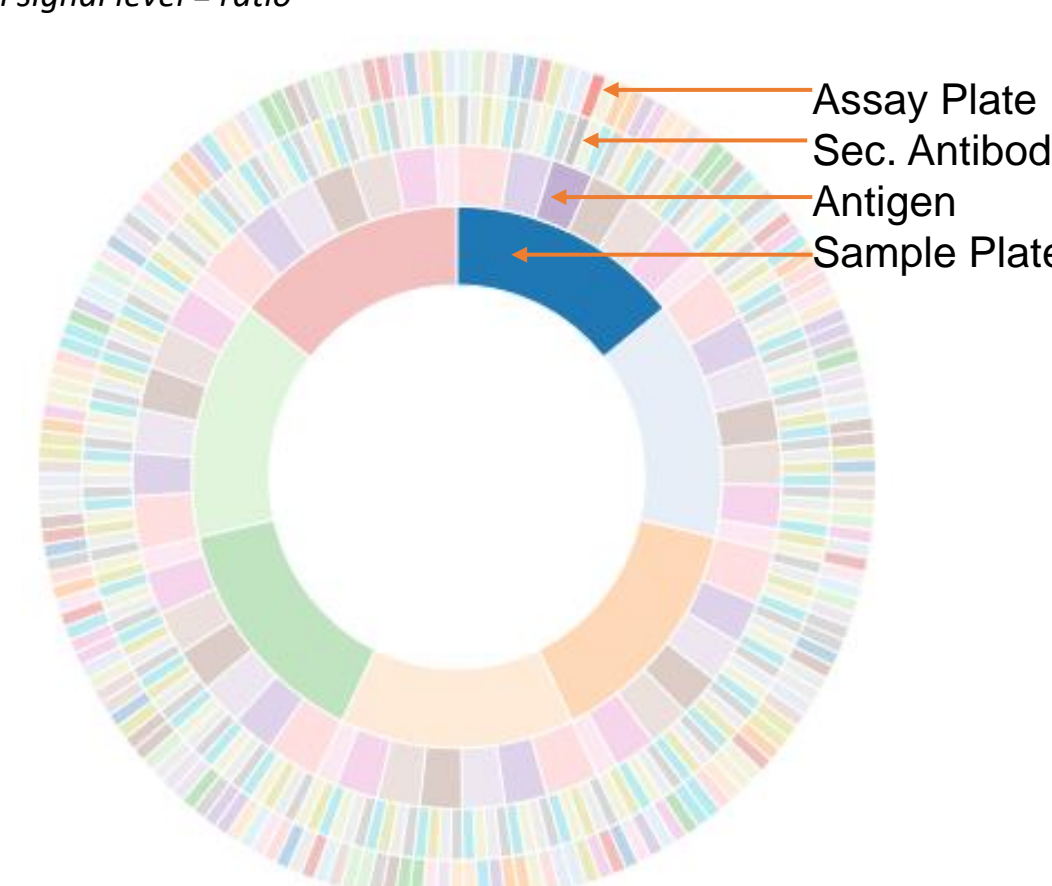
Assay Plate
Sec. Antibody
Antigen
Sample Plate

Figure2

Validation of ELISA Assay
Figure1: representative data demonstrating a strong correlation between manually performed assays and those conducted through automation.

Serum titer comparison
Figure2: assay variability *Figure3*: titers from the automated assay with different antigen and secondary antibodies.

Background spread

Manual   Automated

OD readout

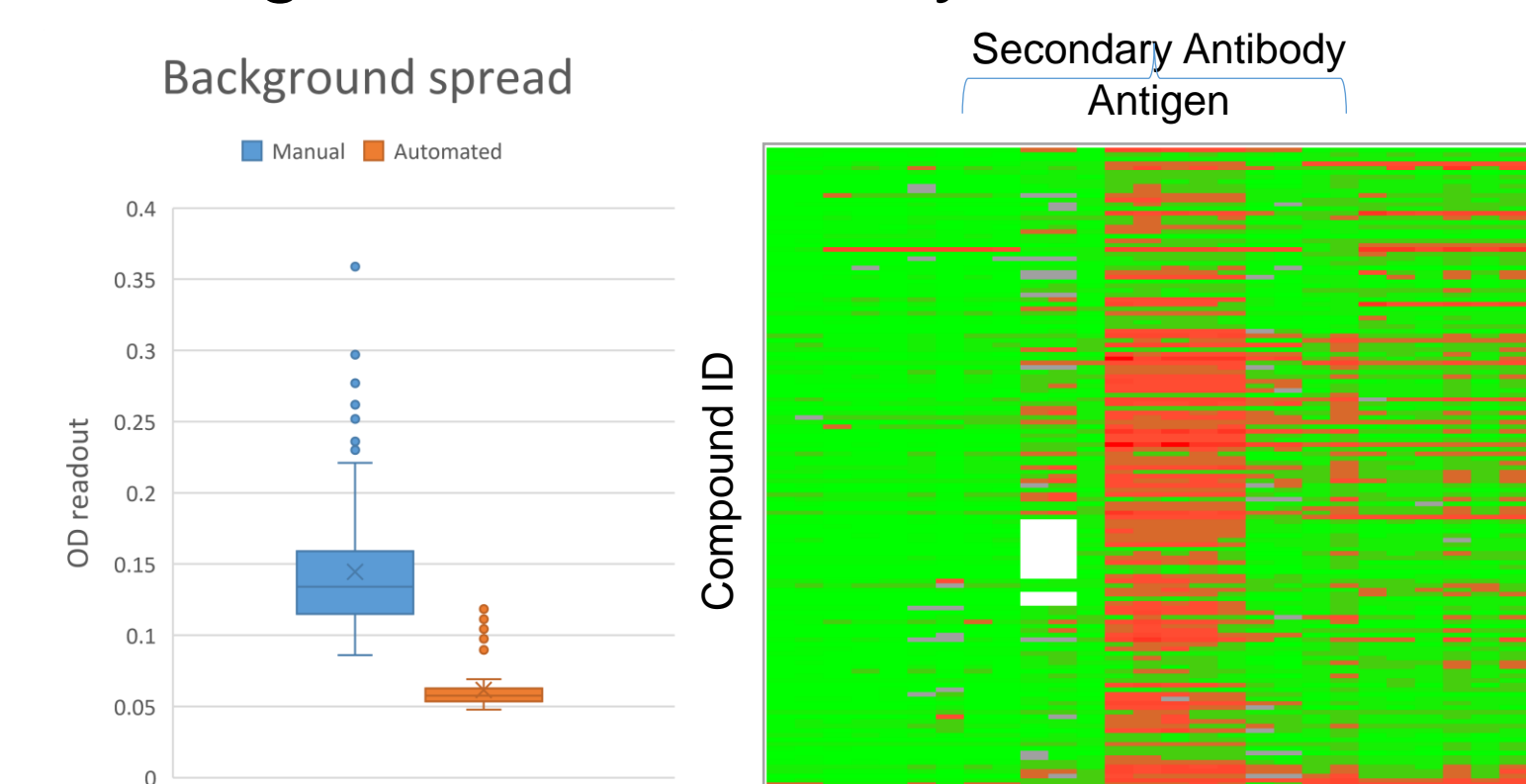Secondary Antibody
Antigen

Compound ID

Figure3 Titer / red high to green low binder

Summary & Conclusion

The Power of Adaptability: Unlocking Possibilities with a Highly Flexible Platform

We have developed a versatile fully automated ELISA assay platform, capable of coating up to 12 antigens and offering a choice of 6 secondary antibodies. With this flexibility, we can process **72 test conditions in one run**, capturing comprehensive data through Genedata Biologics. Our system demonstrates high precision and reproducibility, enabled by barcode tracking, timestamping, and assay step recording. It supports high-capacity screening of up **to 210 plates in the 384-well format**. This automation has significantly improved efficiency, reducing the required **FTE time from 5 workdays to just 2 workdays**.

One key application of our platform is testing the immunogenicity profile of biotherapeutics and gene therapy products, taking into account pre-existing antibody levels. Understanding the impact of these antibodies is crucial for designing molecules with lower immunogenicity and optimizing treatment efficacy. Moreover, our system enables robust investigation of the full antibody repertoire, with the ability to analyze various peripheral responses like IgG, IgM, and IgA by utilizing multiple secondary antibodies.

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