Reimagining ELISA with Rayo

How Compact Design and Automation-Ready Innovation are Redefining Precision and Performance

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Executive Summary

Today's lab environment isn't for the faint of heart. It's a place where precision meets pressure—where scientists performing high-sensitivity assays like ELISA are expected to accelerate discovery while cutting costs and increasing throughput. Despite its reliability and sensitivity, the Enzyme-Linked Immunosorbent Assay (ELISA) remains a **labor** intensive process. Automation was supposed to simplify it, yet many workflows remain fragmented—leaving researchers balancing accuracy, reproducibility, and cost efficiency under constant pressure.

Scientists face ongoing challenges to:

Run more ELISA plates with fewer resources

Reduce cost per assay while maintaining precision

Deliver reproducible, compliant results at industrial pace

Meanwhile, OEMs are tasked with designing compact, reliable systems that integrate seamlessly into automation workflows without sacrificing the precision and reproducibility scientists need.

This white paper explores:

The challenges scientists face in conventional ELISA workflows

How Rayo enhances reproducibility, cost efficiency, and space **utilization** in benchtop and hybrid ELISA environments

The OEM opportunity to automate ELISA with maximum impact

How Rayo's compact, compliance-ready, automation-friendly design bridges both worlds

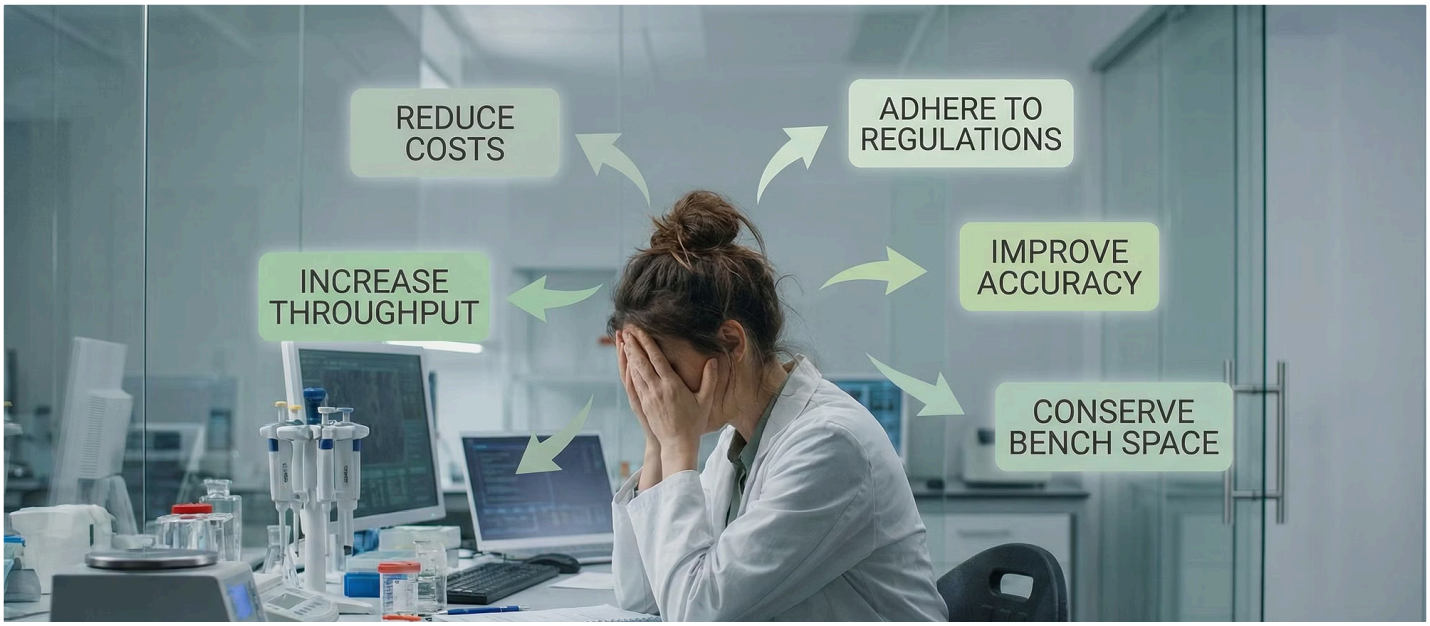
The Scientist's Burden — Conventional ELISA Workflows Under Pressure

ELISA remains one of the most trusted assays for quantifying proteins, peptides, and antibodies. Yet, it is also one of the most time-consuming and error sensitive. Every pipetting step introduces the potential for human error, and each wash or incubation requires precise timing. As laboratories increase throughput, the cumulative effect of these small inefficiencies leads to rising costs, inconsistent results, and reduced reproducibility.

Common Conventional ELISA Challenges

1. Labor-intensive processes that consume technician time
2. Variable results caused by timing or temperature deviations
3. High cost per assay due to inefficiencies and repeat testing
4. Space constraints caused by bulky benchtop readers

The result is a scientific environment defined by complexity, constraint, and cost pressure. To remain competitive, labs must find solutions that improve throughput and accuracy without expanding physical or financial resources.



Not Every Lab Can Fully Automate — But Every Lab Can Advance

While automation delivers major advantages, many ELISA laboratories operate using conventional or benchtop workflows. These stand-alone setups remain essential for thousands of scientists worldwide. For these teams, the focus isn't on full automation, it's on achieving cost-effective precision, reproducibility, and space efficiency within existing infrastructure.

Compact. Reliable. Powerful. Meet Rayo

Rayo: The Most Compact ELISA Reader on the Market

Rayo enables every ELISA laboratory to modernize its workflow, and delivers the precision and reliability of automation in a device compact enough to fit anywhere in the research process. Measuring approximately **9 × 15 × 6 cm,** Rayo is the most compact full-performance ELISA reader available today.

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Engineered to fit within a single **SBS deck position**, Rayo occupies just one footprint slot in automated layouts while maintaining full compatibility with SBS-standard microplate coordinates—a true SBS-position instrument that fits directly on deck, inside incubators, or within controlled environments.

Rayo's compact size does not come at the cost of performance. It delivers the same precision, wavelength range, and compliance capabilities as larger readers while consuming a fraction of the space and operational overhead.

Explore the RAYO Models: Precision Options for Every Workflow

RAYO S600 – 600 nm

Essential functionality for single/multi-wavelength OD600 and absorbance, built for core microbial and plant growth monitoring.

RAYO (M-Series) – 405 nm, 450 nm, 590 nm, 740 nm

A versatile multiwavelength reader offering kinetic + endpoint measurements and compatibility with proteomics, microbial growth, plant studies, environmental workflows, and general absorbance analytics.

RAYO (ELISA) – 405 nm, 450 nm, 490 nm, 590 nm

A precision multi-wavelength system featuring ELISA-optimized wavelengths and workflow-driven performance for high-sensitivity absorbance assays.

Rayo's Solution for Conventional ELISA Workflows

Even in benchtop operation, Rayo delivers measurable gains in efficiency, precision, and reproducibility. It accelerates plate processing by minimizing setup demands and delivering rapid access to reliable data. It maintains tightly aligned measurement performance across every well and wavelength, and provides consistent and trustworthy results. The platform produces dependable outcomes from plate to plate and user to user, giving laboratories renewed confidence in their daily ELISA workflows. This elevated speed, consistency, and reliability strengthen overall laboratory performance without requiring any changes to established processes.

Key Advantages for Conventional ELISA Users

Rayo provides scientists with automation-level precision in a compact, cost-effective form factor—offering a clear advantage over bulkier, less flexible systems. Designed to fit into any workflow, it delivers reliable ELISA performance while ensuring compliance and data integrity.

- Rayo (M-Series) and ELISA will come with automation friendly features/versions.

1	**Compact, space-saving design** True SBS-position footprint (≈9 × 15 × 6 cm), eliminating the need for adapters or large benchtop units. Frees valuable workspace and reduces infrastructure costs.
2	**High precision and reproducibility** ±0.005 OD accuracy across all wavelengths ensures dependable, consistent ELISA results, even under variable lab conditions.
3	**Cost-effective ownership** Competitively priced, offering lower total cost of operation through reduced bench-space demand, enhanced reliability, and full compliance readiness.
4	**Standalone, PC-free operation** Onboard storage and USB connectivity allow ELISA data capture without dedicated PCs or software dependencies.
5	**Compliance-ready assurance** Includes 21 CFR Part 11–aligned data management, audit trails, and traceability for regulated environments.
6	**Automation-ready flexibility** Native API and single-deck footprint allow seamless transition from benchtop to automated workflows, supporting future scalability.
7	**Fast read performance** Rayo reads a full 96-well plate in seconds using one independent optical path per well. The microplate never moves, removing the mechanical drift seen in legacy systems that rely on a single emitter and detector scanning well-to-well. With no moving parts, calibration is rapid and robust. A single snapshot captures all 96 wells at once, and delivers stable references and superior repeatability.

With Rayo, scientists gain both precision and peace of mind—achieving ELISA excellence while reducing operational costs.

Four wavelengths. One Superior ELISA Platform.

RAYO is engineered to deliver unmatched ELISA performance. Each wavelength is purpose-built to align with the most widely used chromogenic substrates and assay chemistries—giving researchers superior sensitivity, cleaner separation, and greater assay flexibility. With both endpoint and kinetic measurement capability, RAYO empowers labs to generate high-confidence data with exceptional reproducibility, run after run.

Benefits of RAYO ELISA Four-Wavelength Design

Wavelength (nm)	ELISA Application	Benefit
405 nm	Early-phase enzyme activity assays; phosphatase-based ELISA; kinetic color development	**Stronger early detection:** Provides high sensitivity for initial enzyme reactions and low signal conditions, enabling unmatched visibility into early color development.
450 nm	HRP-based ELISA using TMB (primary readout)	**Gold-standard accuracy:** Delivers industry standard quantification with strong reproducibility for TMB-based absorbance measurements.
490 nm	Alternative HRP/TMB chemistries; OPD assays; confirmation wavelengths	**Broader assay compatibility:** Supports dual wavelength normalization and additional chemistries that conventional readers cannot accommodate.
590 nm	Dual-enzyme or multiplex ELISA requiring secondary absorbance peaks	**Cleaner signal separation:** Enables advanced multiplexing and higher-confidence secondary readouts for complex workflows.

Together, these wavelengths give Rayo the flexibility to support a wide range of ELISA formats—from single-analyte diagnostics to high-throughput screening—without requiring custom filter configurations or optical retooling.

Bench Space: The Hidden Cost of Operation

Laboratory bench space represents one of the largest recurring costs in research operations. Recent industry analyses show that wet lab space costs between **700 and 1,300 dollars per square foot annually**, depending on facility type and region (Thermo Fisher Scientific, 2021; CBRE, 2022; Lab Manager, 2021). Even small instruments contribute significantly to these operational expenses when multiplied across multiple workstations.

Rayo's Compact Advantage

Rayo's compact form directly addresses this challenge. Measuring approximately 9×15×6 centimeters, Rayo's actual footprint is just **0.16 square feet**, and with standard operational clearance, its effective workstation allocation is only about **0.3 square feet**. In contrast, most conventional benchtop microplate readers occupy 1.5 to 2.0 square feet of usable bench space. This reduction represents an **80 to 85 percent decrease in spatial demand**, freeing valuable real estate for other essential equipment or workflows.

Annual Cost Savings

Thermo Fisher Scientific (2019) estimates that a single eight-foot bench section costs between 15,000 and 25,000 dollars per year in space, utilities, and service—equivalent to approximately 750 to 1,250 dollars per square foot annually. Applying these values, the annual bench space cost of operating a Rayo reader is approximately **120 to 200 dollars**, compared to **1,100 to 2,500 dollars** for a conventional reader. This efficiency translates into an estimated savings of **1,000 to 2,300 dollars per reader per year** solely through bench space optimization.

For multi-instrument facilities or OEM-integrated systems, these savings scale dramatically, reducing total infrastructure requirements and long-term operational costs.

By minimizing its spatial footprint while maintaining full optical and analytical performance, Rayo reduces both upfront purchase costs and long-term operational expenses, lowering the total cost of ownership for modern laboratories.

The OEM's Opportunity — Automating ELISA with Impact

For OEMs, automating ELISA represents both a technical and strategic challenge. Each stage—from sample addition to plate reading—affects precision and throughput. The key is determining which steps to automate first to deliver the greatest impact.

OEMs must also decide which components drive the highest return on automation balancing footprint, cost, and performance. This is where Rayo's compact, automation-ready design offers clear value.

OEM Automation Area	ELISA Challenge	Rayo Solution	Value Delivered
Workflow efficiency	Integration bottlenecks slow throughput	True SBS-position fit + native API control	Faster time-to-market; reduced validation complexity
Compact footprint	Limited deck real estate	Single SBS-position design	Maximizes throughput per footprint
Reliability and reproducibility	Reader variability affects accuracy	±0.005 OD reproducibility	Consistent, high quality ELISA data
Compliance	21 CFR Part 11 requirements	Audit-ready onboard traceability	Simplified regulatory compliance
Scalability	Need modular, scalable design	Parallel multi-reader operation	Expandable automation architecture
Cost optimization	High total system cost	Reduced footprint lowers overall system BOM	Better ROI for OEM platforms

For OEMs striving to optimize ELISA automation, Rayo delivers clear advantages across every dimension of system design and performance. Its true SBS-position footprint and native, automation-ready API eliminate common integration bottlenecks, accelerating time-to-market and reducing validation effort. Whether your workflow is driven by Rayo, by the robot, or by a centralized software controller, Rayo adapts to the automation strategy and ensures flexibility across a system architecture.

The compact, single-deck design maximizes throughput per square inch of deck space—an essential factor in high-efficiency automation environments where every position counts. Rayo's exceptional ±0.005 OD reproducibility ensures precise, consistent data across every assay, improves overall accuracy and reduces variability.

Beyond its precision, Rayo is engineered for scalability, compliance, and operational efficiency. With audit-ready traceability and 21 CFR Part 11–aligned data management, it simplifies regulatory alignment for OEMs and end users alike. Its modular architecture supports parallel multi-reader operation, allowing systems to expand capacity seamlessly without increasing footprint or cost. By minimizing spatial demand and reducing the total bill of materials, Rayo achieves a lower total cost of ownership—delivering a superior return on investment and a proven path to building smarter, more reliable automated ELISA platforms.

Rayo's native API and single-deck design make it a drop-in solution for OEM platforms—accelerating development and simplifying integration without sacrificing optical performance.

Traditional vs. Automated ELISA Workflows: Quantifying the Time Savings

While traditional ELISA workflows have long been a cornerstone of biomolecular quantification, they remain time-consuming and prone to human variability. Every pipetting, washing, and incubation step requires precise timing and manual handling processes that become significant bottlenecks as throughput increases. Automation transforms this reality by standardizing timing, eliminating manual delays, and improving overall data quality.

By minimizing human intervention and eliminating idle time between steps, automation delivers a consistent and accelerated workflow. Compact, automation-ready readers like Rayo further amplify these gains—offering rapid read times, real-time data export, and effortless integration with liquid handlers or incubation systems. The result is faster, more reproducible ELISA data, reduced variability, and lower per-assay cost—all without increasing footprint or complexity.

Representative comparison illustrating how automation—and integration with compact, automation-ready Rayo—can dramatically reduce total assay time and hands-on effort.

Step	Traditional Workflow	Automated Workflow	Time Saved
Plate Coating	1–2 hours	Automated incubation	—
Blocking	1 hour	Automated reagent addition	—
Sample Addition	1–2 hours	Robotic pipetting	45–60 minutes
Wash Cycles	10–15 minutes	Integrated washer	5–10 minutes
Detection/Conjugate	1–2 hours	Automated addition & incubation	—
Substrate Reaction	30 minutes	Controlled incubation	—
Plate Reading	12–25 minutes	Automated, in-situ readout	12–25 minutes
Data Export	10–15 minutes	Automated transfer	10–15 minutes

Total Workflow Comparison:

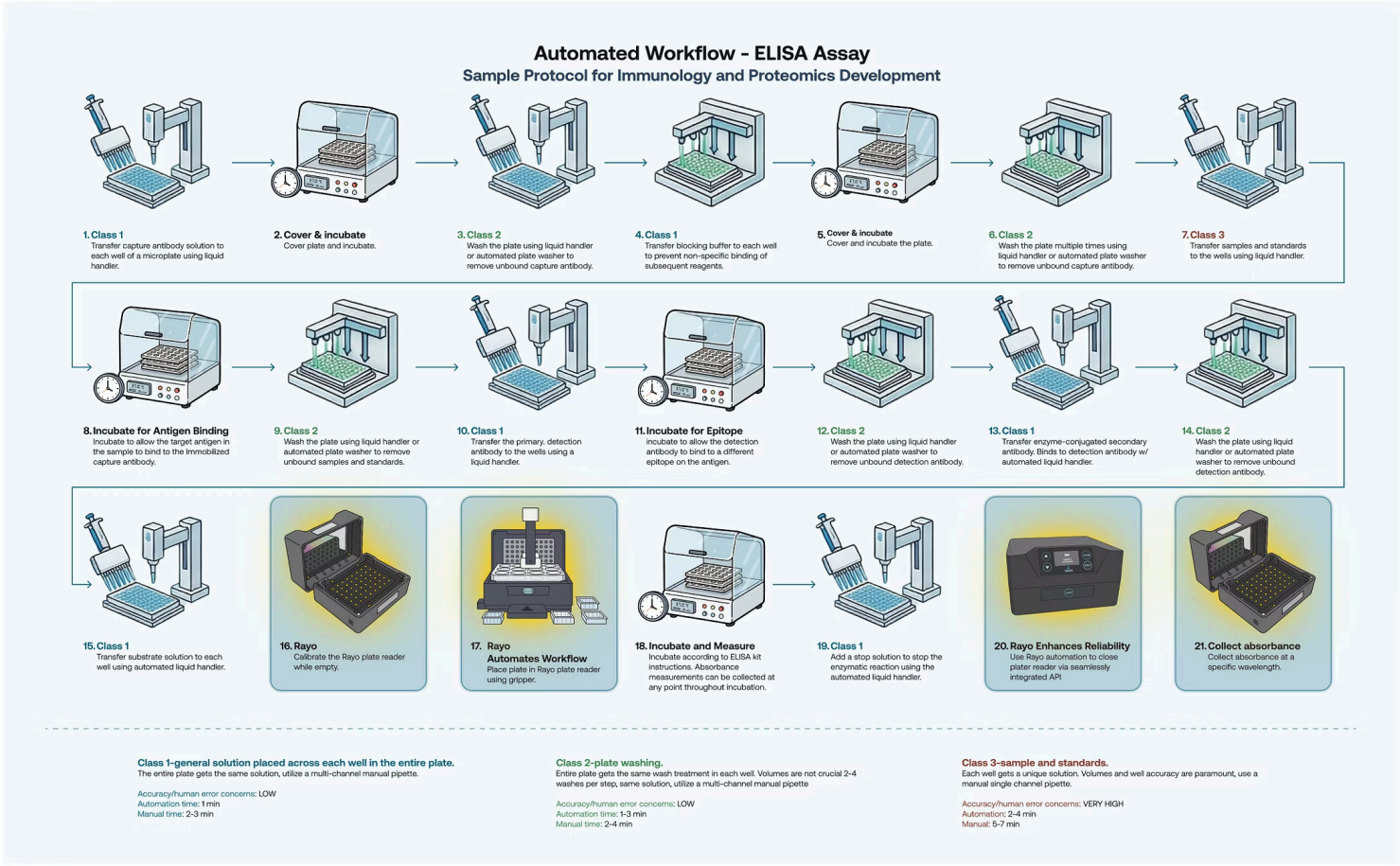
Traditional Total Hours
2.5–3.5 hours hands-on

Automated Total Hours
~30–45 minutes hands-on

Hours Saved Per Plate
1.5–2.5 hours time saved

Daily Efficiency Gain
+40–50% throughput increase

Example:



Why Rayo Excels in ELISA

When precision, speed, and efficiency define success, Rayo delivers.

For Scientists

For scientists, Rayo brings automation-level performance to conventional ELISA workflows, reducing human error, improving reproducibility, and maximizing bench space efficiency. Its ultra-compact, true SBS-position footprint requires no adapter, allowing direct placement in incubators, anaerobic chambers, or automation decks.

For OEMs

For OEMs, Rayo eliminates integration barriers. Its native API, SBS-position footprint, and compliance-ready design make it the clear choice for labs and OEMs seeking performance, efficiency, and scalability—whether for a single ELISA plate or a fully automated workflow.

> **Rayo doesn't just read ELISA plates—it redefines how ELISA is performed.**

Conclusion

ELISA remains a cornerstone of modern research and diagnostics—but its success depends on precision, consistency, and efficiency. Rayo bridges the gap between conventional reliability and automation scalability. It empowers scientists to improve reproducibility and save space while enabling OEMs to integrate seamlessly into automation platforms.

Compact, compliant, and cost-effective, Rayo is built for the demands of today's laboratory—and ready for tomorrow's automation. Because in a lab environment that isn't for the faint of heart, success belongs to those who innovate with precision, speed, and versatility—whether advancing ELISA assays through traditional workflows or driving discovery through full automation.

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