



Laboratory software

Intelligent data analytics solutions

Providing clarity to take decisive action

Labs generate vast amounts of data in various forms—from sample analyses and test results to information about lab personnel, instruments and equipment. To unlock the full potential of this data, it must be contextualized and presented in a format that enables informed decision making. Thermo Scientific™ SampleManager™ LIMS Software offers three powerful data analytics solutions designed to do just that: the Autonomous Test Revisor (ATR) Solution, the Data Analytics AI Solution and the Data Analytics Business Intelligence (BI) Solution for SampleManager LIMS.



The Autonomous Test Revisor (ATR) Solution

The ATR Solution creates personalized quality control analyst AI agents that will automatically review samples and test results to rapidly identify anomalies. This solution enhances and automates the quality control process, supporting “review-by-exception” to improve laboratory efficiency by employing advanced AI models. The ATR not only identifies anomalies but also provides valuable insights through dashboards, helping you understand data distributions, trends and potential causes.

Benefits of the ATR Solution:

- **Improved quality control:** By leveraging AI to detect anomalies in test results and samples, helping to ensure only the most accurate and reliable data.
- **Speed:** Accelerates the review process by automatically flagging irregularities, enabling quicker decision making.
- **Cost savings:** Reduces manual labor and minimizes errors, leading to lower operational costs.

Key features:

- **Automated:** The AI agent is integrated within the sample lifecycle and autonomously analyses the quality without user intervention.
- **Personalized:** Learns the characteristics of the laboratory’s samples and builds personalized agents for each type of sample.
- **Multivariate:** Adds an advanced method of anomaly detection that considers complex relationships in a set of results.

The ATR Solution includes both univariate and multivariate capabilities, providing a dual-layer anomaly detection system that identifies anomalies at different stages and helps elevate your data integrity.



Univariate anomaly detection capability

The ATR Solution’s univariate capability pinpoints anomalies at the moment of result entry. By leveraging statistical models built from historical laboratory data, it establishes precise upper and lower limits within the SampleManager LIMS framework. Each new result is immediately scrutinized for univariate anomalies, helping to ensure robust quality control.

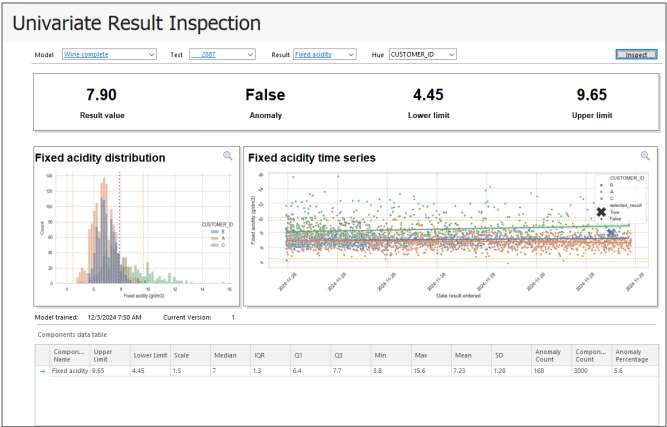


Figure 1. Univariate result inspection data

Multivariate anomaly detection capability

The ATR Solution’s advanced multivariate capability takes anomaly detection to the next level. Once a complete set of results is available, an autoencoder neural network model, trained on historical data, takes a closer look at the data. It identifies anomalous samples by analyzing complex interrelationships among results, spotting patterns that might elude even the most seasoned experts.

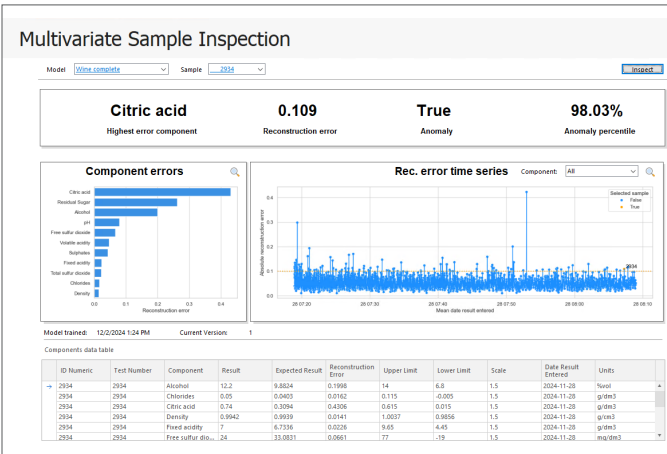


Figure 2. Multivariate sample inspection results

The AI Solution for SampleManager LIMS

Elevate your data capabilities with this cutting-edge AI solution, designed to integrate advanced AI-driven predictive analytics seamlessly. This comprehensive software solution offers tools for exploratory data analysis, robust machine learning capabilities to predict test outcomes, and sophisticated forecasting features to anticipate future samples and resource needs.

The AI Solution empowers you to:

- Conduct in-depth statistical analyses to uncover deeper insights
- Use machine learning to anticipate test results or failures, enabling proactive planning, early issue identification, and optimized testing procedures
- Anticipate and mitigate issues before they impact lab operations
- Forecast future sample volumes and associated resource requirements to help ensure optimal lab resource allocation

Key features of the AI Solution:

- **No-code, user-friendly interface:** Effortlessly navigate and use powerful AI tools without the need for coding expertise.
- **Accurate predictions:** Leverage precise machine learning models for reliable forecasting.
- **Seamless integration:** Fully compatible with SampleManager LIMS and its data for a cohesive user experience.
- **Proactive lab management:** Use predictive analytics to stay ahead of lab processes and enhance operational efficiency.



Featured dashboards from the AI Solution

Exploratory data analysis capability

The Exploratory Data Analysis (EDA) capability for SampleManager LIMS software is designed to elevate your laboratory data insights. Our EDA tool leverages powerful statistical techniques such as Univariate Analysis, Bivariate Analysis, Linear Regression, and Principal Component Analysis (PCA) to provide a comprehensive understanding of your datasets. Univariate Analysis helps you summarize and visualize the distribution of individual variables, while Bivariate Analysis examines the relationships between two variables to uncover hidden patterns. Linear Regression offers predictive insights by modeling the relationship between dependent and independent variables, and PCA reduces data dimensionality, enhancing interpretability without significant information loss. Together, these methods help you gain a holistic view of your data, so that any subsequent AI and machine learning is successfully applied.

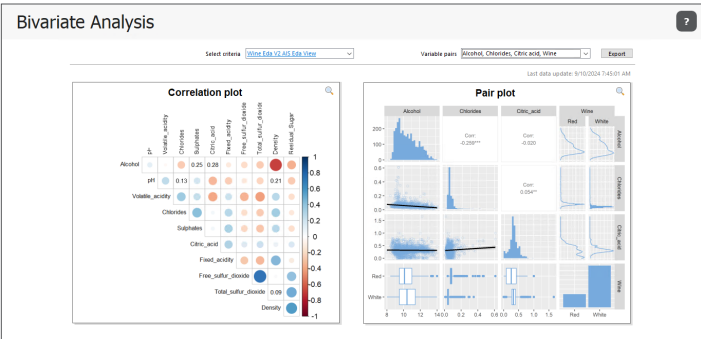


Figure 3. Bivariate Analysis applied to a set of samples

Profiling capability

The profiling capability for SampleManager LIMS uses advanced machine learning (ML) techniques to estimate the outcome of unexecuted tests based on historical data. By utilizing ML algorithms such as XGBoost and neural networks, SampleManager LIMS creates an ML pipeline that examines previous test results and data from similar samples to develop a predictive model. This technology can aid laboratories in predicting potential test results, which may provide valuable insights during the testing process.

The benefits of this innovative feature are multifold. Laboratories can identify and eliminate redundant tests, reduce the number of samples tested, and save on costs associated with expensive reagents and consumables. Additionally, predictions can be generated for all eligible samples without extra cost or time, allowing labs to take proactive measures based on anticipated test outcomes and fail early samples that would not pass.

The no-code, user-friendly framework of the [machine learning capability](#) empowers users to explore data within SampleManager LIMS, apply novel ML techniques, and derive insightful predictions and analyses, significantly enhancing operational efficiency and decision-making processes.

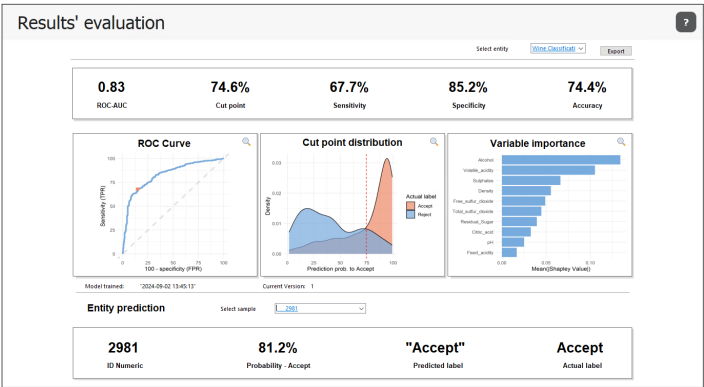


Figure 4. Profiling results applied to a classification problem



Forecasting capability

This innovative feature leverages advanced ML techniques and historical data to accurately predict the number of samples your laboratory will receive for both the current and upcoming months. By using a powerful forecasting algorithm, SampleManager LIMS forecasts sample influx and then calculates detailed estimates for the expected tests, instrument category runs, and stock usage.

Harnessing the power of predictive analytics, your laboratory can now make informed decisions to stay ahead of demand. Anticipate future sample volumes, optimize personnel allocation through timely hiring, training, or relocation, and manage your inventory by knowing exactly when to replenish or halt stock purchases. Additionally, this capability allows your lab to restructure operations based on incoming sample types and set strategic goals for future sales, workflow durations, and more.

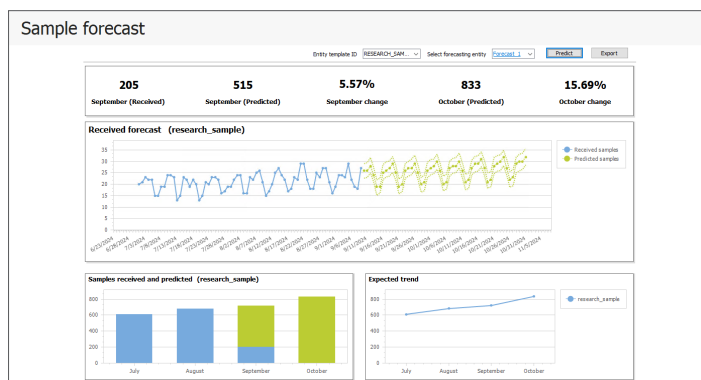


Figure 5. Forecasting of upcoming samples

The Business Intelligence (BI) Solution

The BI Solution oversees lab processes with pre-configured dashboards that deliver instant, deeper insights. These intuitive dashboards display key business and laboratory metrics such as resource availability, stock information, location status, and lab performance in a clear, interactive format. Users can drill down for further details and results, enabling quick and effective decision making.

The BI Solution allows labs to:

- **Optimize resources:** Visualize and manage lab capacity and utilization.
- **Streamline inventory management:** Real-time tracking of stock levels and usage.
- **Enhance lab performance:** Monitor key metrics and identify areas for improvement.

Key features of the BI Solution:

- **Pre-configured dashboards:** Immediate insights without the need for additional software.

- **Interactive data displays:** Easy drill down and exploration.
- **Real-time data integration:** Eliminate delays from data transfers.

Featured dashboards from the BI Solution

Managing laboratory resources

The instrument dashboard generates an up-to-date picture of the lab's overall instrument usage. The identification of underutilized instruments can lead to space optimization, energy savings, and eventual recuperation costs if correctly identified. The instruments dashboard will help laboratories in identifying the key metrics on instrument usage.

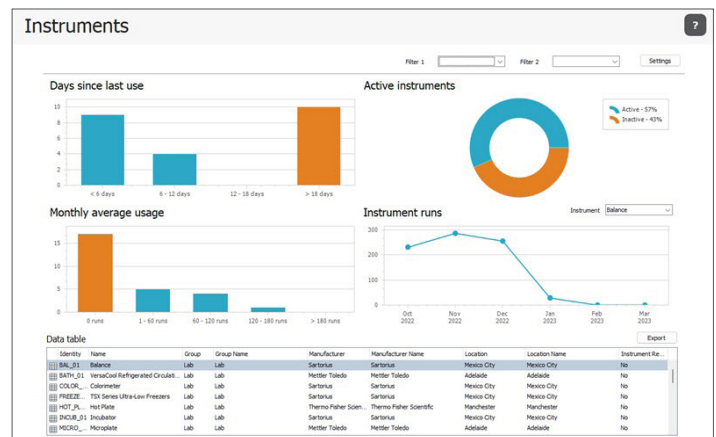


Figure 6. Instruments dashboard

Laboratory compliance

The laboratory compliance dashboard provides users with updated information about the instruments, stocks and personnel status. It facilitates the timely maintenance and calibration of the laboratory equipment, the efficient usage of the stock batches by monitoring the expiration dates, and aids in the compliance of scheduled personnel trainings.

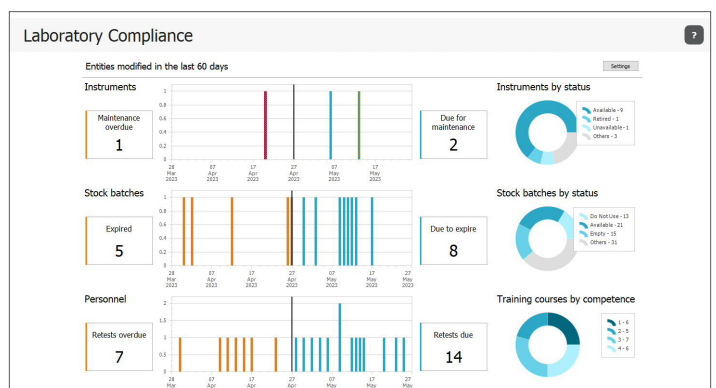


Figure 7. Laboratory compliance dashboard

Reagent and consumable management

The BI Solution features enhanced stock management capabilities. The stock overview dashboard displays resource availability, including reagents and consumables. For larger sites, the stock overview dashboard can show stock levels in each location. This visibility helps staff intelligently source and reallocate supplies as needed. Tracking supplies using the stock overview dashboard supports improved understanding of stock usage and distribution, resulting in better equipped labs. An effective stock overview dashboard drives advanced procurement, enabling the business to accurately plan and spend only on resources that are required when and where they are needed.

Location insights

A majority of the dashboards have the capability to filter the data at the location level. They provide the visualization of key statistics and indicators per site, specifically the location and their associated test results. For a selected location or sampling point, the location is displayed and the user is provided with interactive views to:

- Show updated results as each location is selected
- View multiple analyte results by a sampling point
- Filter to show results over a specified time period

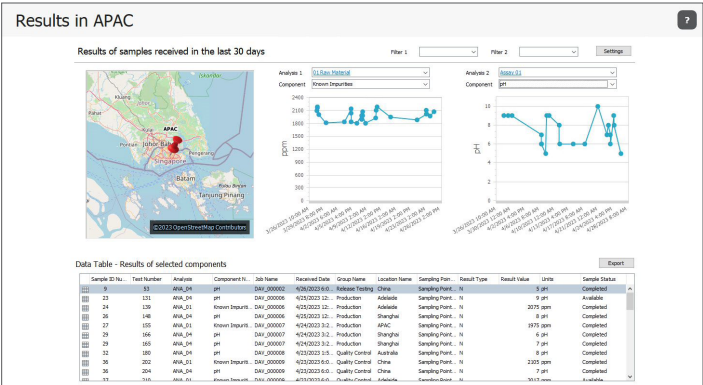


Figure 8. Results in APAC dashboard

Performance dashboards

Lab performance dashboards in the BI Solution display key performance indicators such as the volume of samples at different stages of a process, percentage of on-time analyses, or average time taken at each stage. The volume of incoming samples can also be used to enable resource planning and allocation as new work comes into the lab. This information helps instantly identify process bottlenecks, so issues can be investigated and resolved quickly.



Sample times dashboard

The sample times dashboard provides a breakdown of cycle time by laboratory group over the specified number of days (e.g., last 60 days). At a glance, a laboratory manager can determine how efficiently each lab group is functioning. This dashboard provides the data necessary to determine whether lab resource adjustments are needed to meet the testing demand. Knowing the number of samples that the department tested in a quarter aids in planning of both resources and materials. Using the sample time dashboard ensures staffing is adequate for routine operations and helps predict bandwidth for upcoming projects and volume fluctuations.

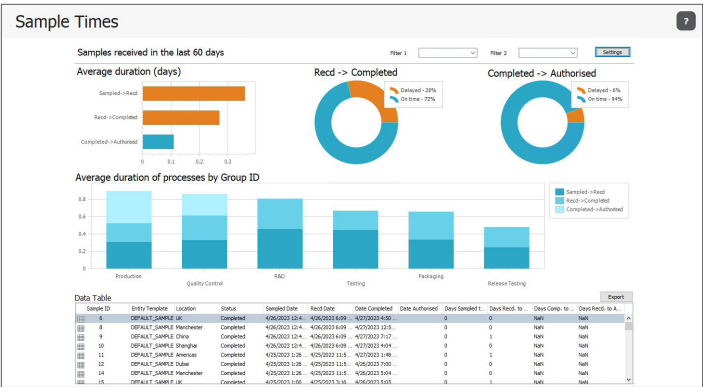


Figure 9. Sample times dashboard

Job backlog dashboard

The job backlog dashboard identifies jobs where all associated samples and testing have not been completed and authorized within the laboratory’s expected timeframe. Adhering to these expected times enables the removal of systemic roadblocks and facilitates the completion of investigations, thereby supporting the timely delivery of processes.

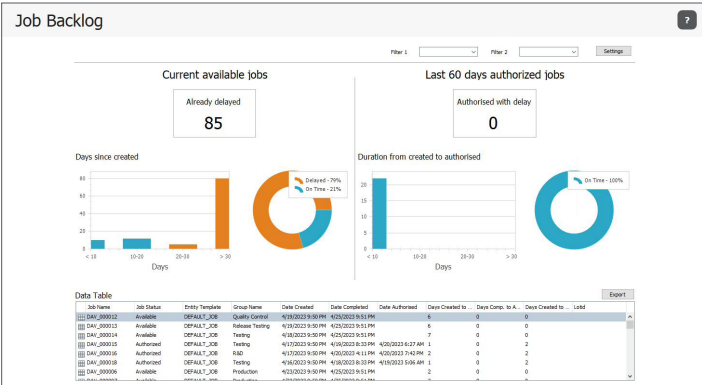


Figure 10. Job backlog dashboard

Sample status dashboard

The sample status dashboard provides a breakdown of the samples within the laboratory and their current status (received, completed or authorized). These metrics showcase the efficiency and predictability of the laboratory while highlighting opportunities for improvement within the laboratory testing and approval process.

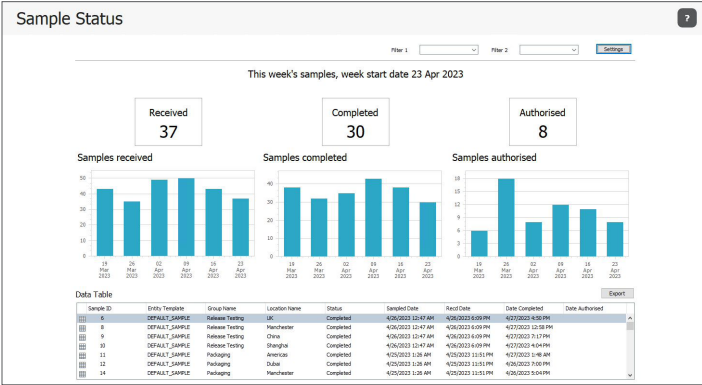


Figure 11. Sample status dashboard

Retests dashboard

The retests dashboard allows the laboratory to follow important metrics and disaggregate them by different groups such as analysis, personnel, and instruments, providing information that can point to the cause of the retest and thus lead to an efficient retest process. Maintaining an efficient retest process ensures accurate results, streamlining operations and enhancing productivity. Retests are a cause for inefficiency in the lab as each test incurs an increase in the overall costs.

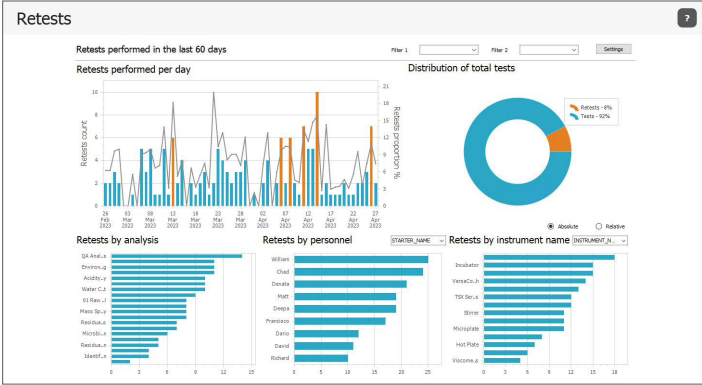


Figure 12. Retests dashboard

Incident control dashboard

The incidents dashboard offers comprehensive analytics about incidents occurring in the lab. This enables users to identify recurring issues, pinpoint root causes, and implement proactive measures to prevent similar incidents from taking place again in the future. This data-driven approach can help improve the overall quality and safety of laboratory procedures, fostering a culture of continuous improvement.

Clarity to take decisive action

By integrating these powerful tools within SampleManager LIMS software, you can transform your lab's data into actionable intelligence, driving efficiency and insight. Whether you need

to gain quick insights with the BI Solution, perform predictive analysis with the AI Solution or build AI quality specialist agents, SampleManager LIMS provides the clarity you need to take decisive action.

 Learn more at thermofisher.com/dataanalytics

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