LUCULLUS

COMPREHENSIVE SOFTWARE FOR BIOPROCESS DIGITALIZATION


AUTOMATE
DIGITALIZE

Lucullus® enables automation and digitalization across divers bioprocessing environments, integrating workflow elements into a single intelligent suite on a digital platform. The over-arching software solutions pro-motes industry 4.0 standards, ensuring data integrity and full process transparency.

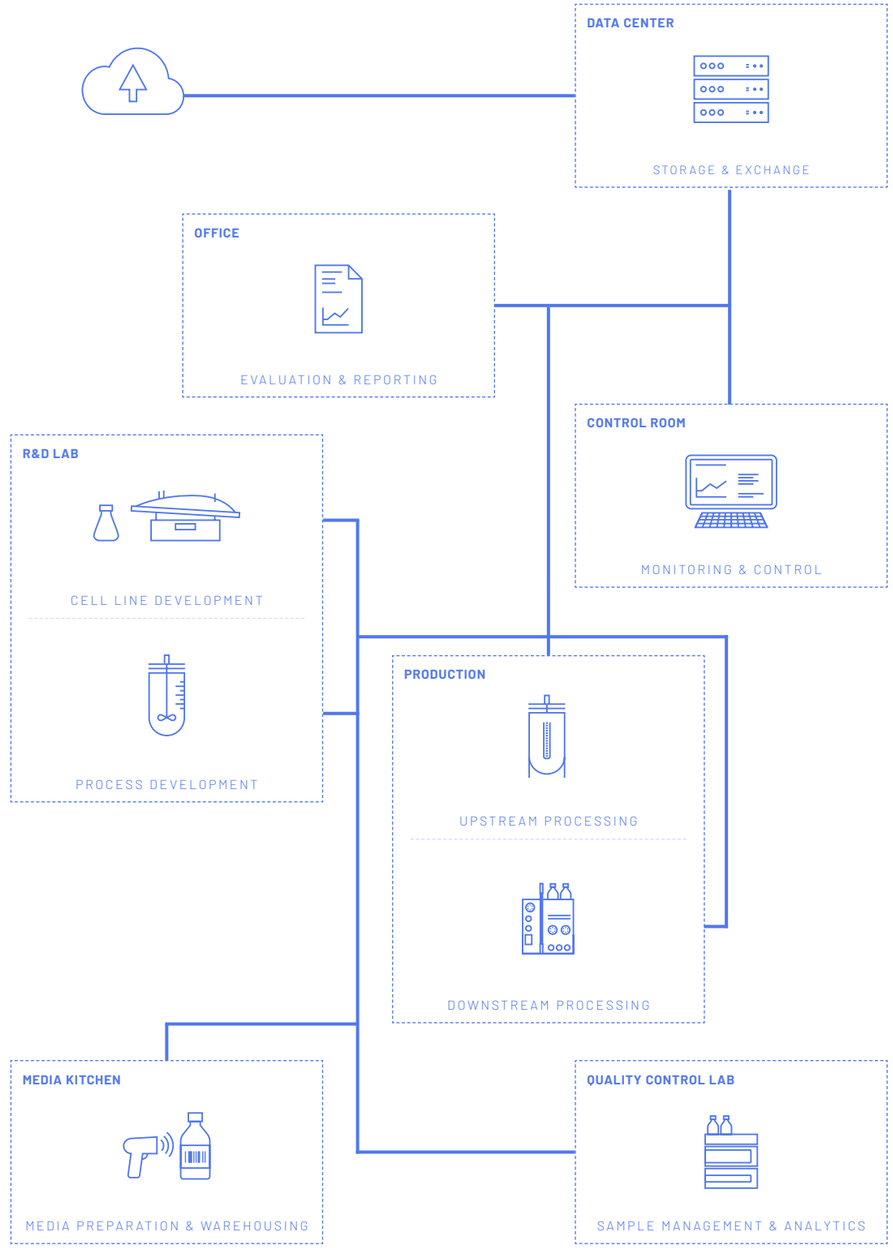
CONTENT

BIOPROCESS DIGITALIZATION

The biopharmaceutical industry is moving towards increased digitization and the interconnection of products, supply chains, and business models aiming to lower costs and expand access to lifesaving biotherapeutics. The digital transformation of the biopharmaceutical industry – referred to as "Bioprocessing 4.0", is driven by cutting-edge technologies supporting the thorough revolution of bioprocessing workflows.

The Lucullus® software is the ultimate tool to facilitate and advance Bioprocessing 4.0. Through its vendor agnosticism, Lucullus® integrates and communicates to all players of a typical bioprocessing workflow ensuring utmost data integrity and workflow automation.

Lucullus® efficiently manages all process data, including raw materials, media compositions, process parameters, equipment, samples, and analytics. With its broad functionality, Lucullus® offers a complete solution for bioprocess planning, preparation, monitoring, control, evaluation, storage, and data exchange.



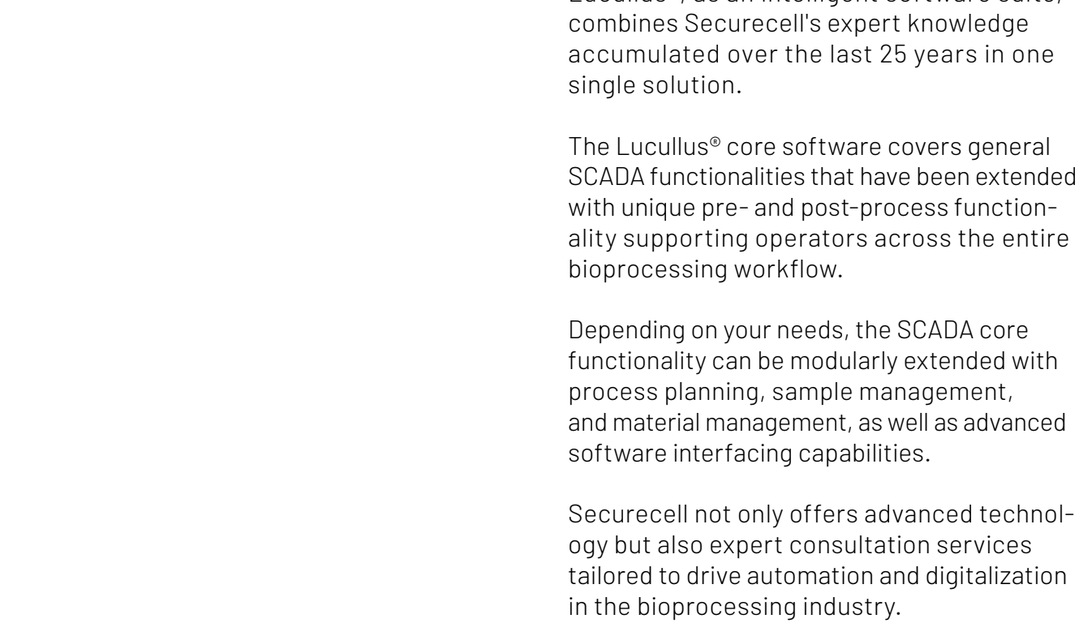
Lucullus® acts as the central orchestrator and brain of the whole bioprocessing workflow. Through the software, bioreactors, other process-associated devices, and connected sensors can be monitored and controlled. An built-in sample management workflow allows barcode-assisted sampling, automated data retrieval after analysis, and real-time process alignment. Raw-material information can be registered in a raw material database, media preparation digitalized with electronic protocols, and raw-material lots assigned to the corresponding process. With the genealogy function predecessor and successor processes can be linked ensuring complete information traceability throughout the whole process chain. All captured data can be securely stored in a central database and can be analyzed and evaluated as well as exported via state-of-the-art interfaces to 3rd party analysis software.

Lucullus®, as an intelligent software suite, combines Securecell's expert knowledge accumulated over the last 25 years in one single solution.

The Lucullus® core software covers general SCADA functionalities that have been extended with unique pre- and post-process functionality supporting operators across the entire bioprocessing workflow.

Depending on your needs, the SCADA core functionality can be modularly extended with process planning, sample management, and material management, as well as advanced software interfacing capabilities.

Securecell not only offers advanced technology but also expert consultation services tailored to drive automation and digitalization in the bioprocessing industry.



Screen shown is from the upcoming Lucullus® V.24 update (2024)

More than SCADA

CORE SCADA

BASIC

DATA ACQUISITION + PROCESS MONITORING

INFORMATION MANAGEMENT + EVALUATION + REPORTING

CONTROL

PROCESS CONTROL + AUTOMATION

EXTENSIONS

PROCESS PLANNING

SAMPLE MANAGEMENT

MATERIAL MANAGEMENT + MEDIA PREPARATION

"Securecell's support goes beyond the simple supplier-customer relationship. With Securecell we chose a partner that is actively supporting us in our mission of automating and digitalizing our laboratory environment."

NICK WIERCKX
Professor at Institute of Bio- and Geosciences Forschungszentrum Jülich

MAIN BENEFITS

Comprehensive solution: A single bioprocess software for monitoring, controlling, and managing data, planning samples, and handling raw materials

Overarching integration: A wide range of control units, PAT sensors, analyzers and more are supported

Increased productivity: Structured and automated workflows throughout the entire process chain, from planning to evaluation

Scalable architecture: Customizable implementation from single facilities to the whole enterprise

Efficient collaboration: Simplified data and tech transfer between laboratories, departments and sites

Data integrity: Secured, structured and traceable stored data from various sources

Unlimited access: Exchange of harmonized data with the existing software landscape / 3rd party software, through OPC-UA and REST-API interfaces

KEY FEATURES

Parallel process monitoring and comparison of real-time and historical data

Process control, automation and real-time calculation

Data evaluation and 3rd party analysis software integration (MATLAB, Python, DataHowLab, ...)

Process planning including equipment, procedures, parameters, sampling events and materials

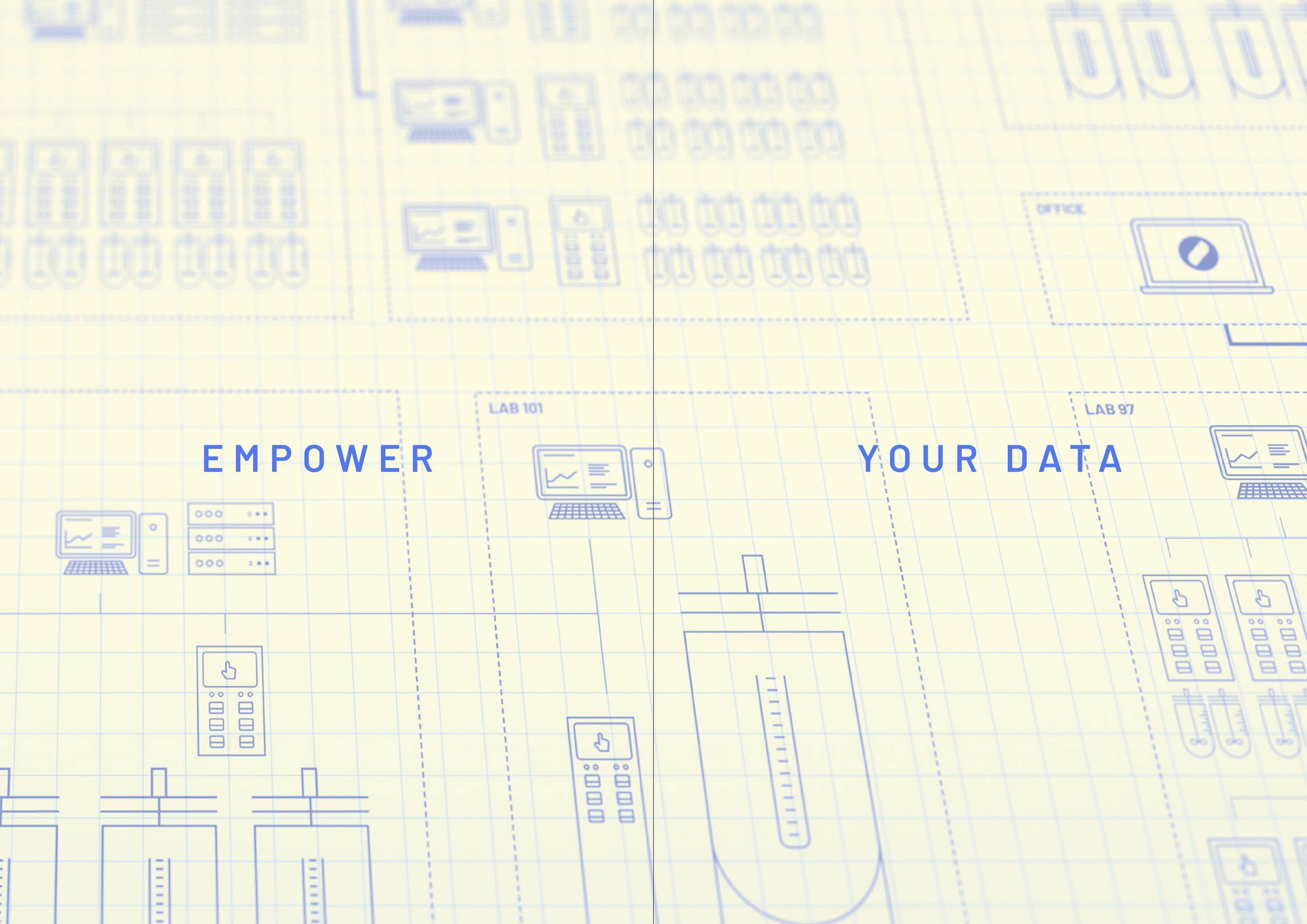
Media and warehouse management with electronic recipes and guided media preparation

Multi-user access and role management

Meets **regulatory compliance** regarding 21CFR Part 11

EMPOWER

YOUR DATA



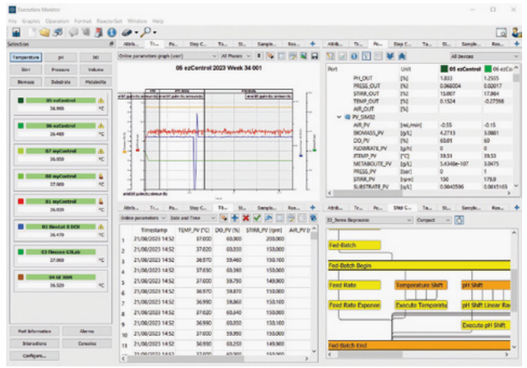
See securecell.ch/lucullus for full list of supported systems.

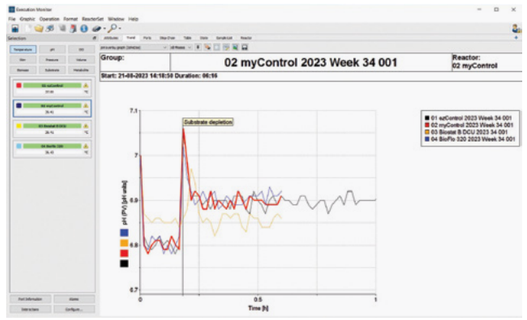
DATA ACQUISITION + PROCESS MONITORING

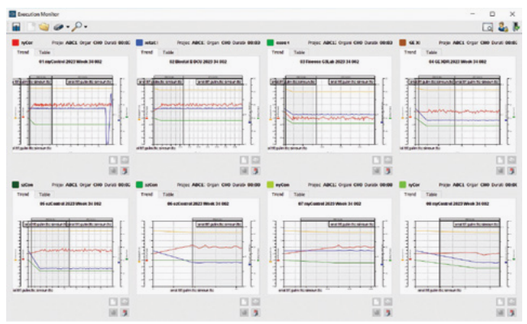
In modern bioprocessing, collecting data from diverse sources is essential to gain a comprehensive understanding and valuable insights into the process. With Lucullus®, this is realized through seamless connectivity and vendor-agnostic integration of various equipment. The data is centrally stored in a structured and harmonized manner serving as a hub for consolidating the aggregated data. These foundations enable the subsequent application of process knowledge in advanced control strategies for automation.

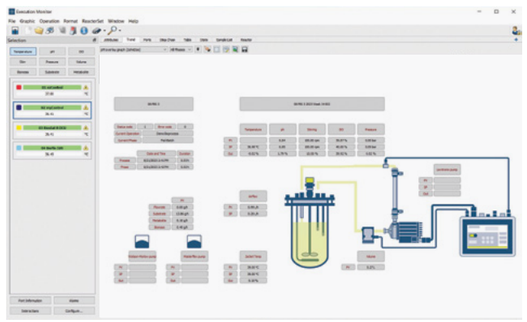
Benefits

- **Gain Overview**
  Be on top of your running processes with centralized real-time monitoring.
- **Oversee Data**
  Supervise your processes with easy access to all relevant information on site and remote.
- **Compare Processes**
  Evaluate performance with comparison of running and historical processes of different scales.
- **Get Notified**
  Receive SMS and / or e-mail notifications on alarms and process events.









Lucullus® Version 3.11

Data Collection

The acquisition of information is at the core of Lucullus®. All relevant data is centralized and stored for subsequent use in process control and evaluation:

- Real-time process data
- Off-line, at-line, on-line and in-line analytical data
- Process parameters, Media components, equipment, project information, seed train
- Events, comments, user interactions and alarms
- Audit trail records

Monitoring and Visualization

Lucullus® provides a clear visualization of current and historical process data and all relevant information. Whether presented as a diagram, table, or P&ID, the adaptable interface ensures a comprehensive overview of your processes.

- Single and parallel experiments
- User interactions, events, alarms
- Comparison analysis / overlay graphics
- Realtime calculation of key process parameters / soft sensors
- Interactive piping and instrumentation diagrams (P&ID)
- Configurable user interface / pre-defined buttons for quick access to specific parameters

"Lucullus® allows us to compare the data of running processes with data from historic processes to evaluate process performance in real-time and to establish our complex fermentation processes during upscaling."

DR. MIRIAM GROSSE
Head of Fermentation at Helmoltz Center for Infection Research

INFORMATION MANAGEMENT

In biomanufacturing, multiple stakeholders play critical roles, including lab technicians, engineers, data scientists, and managers. Each user has distinct responsibilities and requires access to specific tools and information. Lucullus® was purposefully developed to support to the unique needs of each user, offering manageable access and a harmonized interface. It ensures that all users have the necessary tools and information at their disposal, facilitating seamless collaboration and optimizing workflow efficiency.

- **User Management**
  Define users, groups and permissions via Lucullus® or existing LDAP
- **Remote Access**
  Secure data access from everywhere in the network
- **Audit Trail**
  Recording of all the user interactions during the process and projects
- **Information Transfer**
  Seamless and harmonized data exchange between laboratories, departments and sites

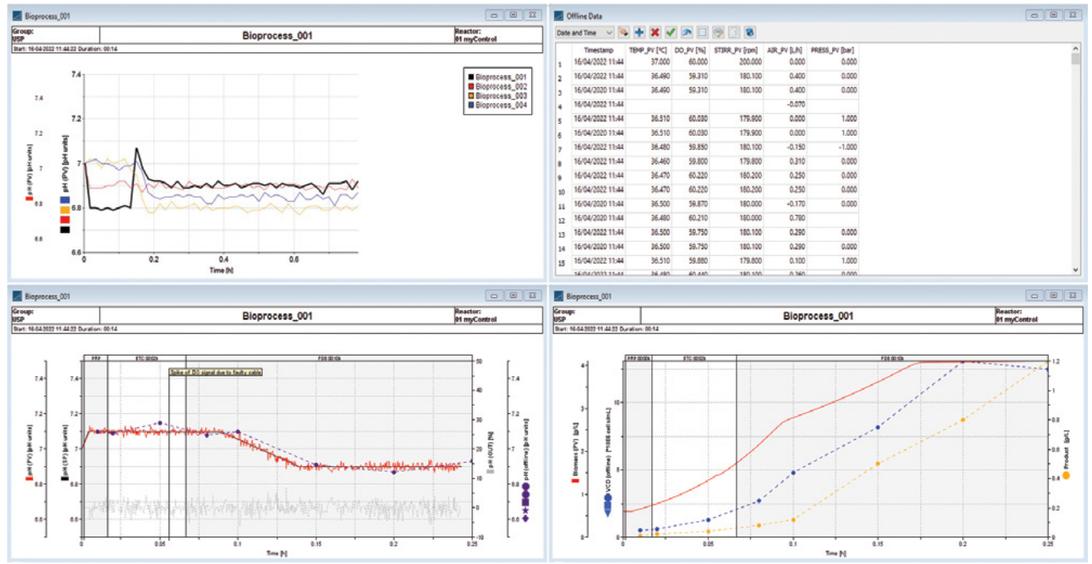
Web Interface, Lucullus® Version 3.11

EVALUATION + REPORTING

Lucullus® collects data from various sources across the entire bioprocess environment, storing them securely in one central location. All process information is accessible for automated visualization, evaluation and batch reporting. Lucullus® provides efficient database search options, analysis tools, data export features, and automated paperless documentation to support your needs.

Features

- **Efficient filtering options** to easy access all the historical process data
- **Customized visualization** of data in graphs or tables
- **Advanced real-time processes evaluation** with integrated tools (e.g., smoothing, regression, integration)
- **Programmable sequential evaluation** for standardized process analysis and reporting
- **Data export options** for selected data sets and graphs in various formats
- **Automatically generated reports** with customized templates
- **Data integration** with 3rd party software such as databases and mathematical, statistical, and machine-learning tools




CONTROL
YOUR PROCESS

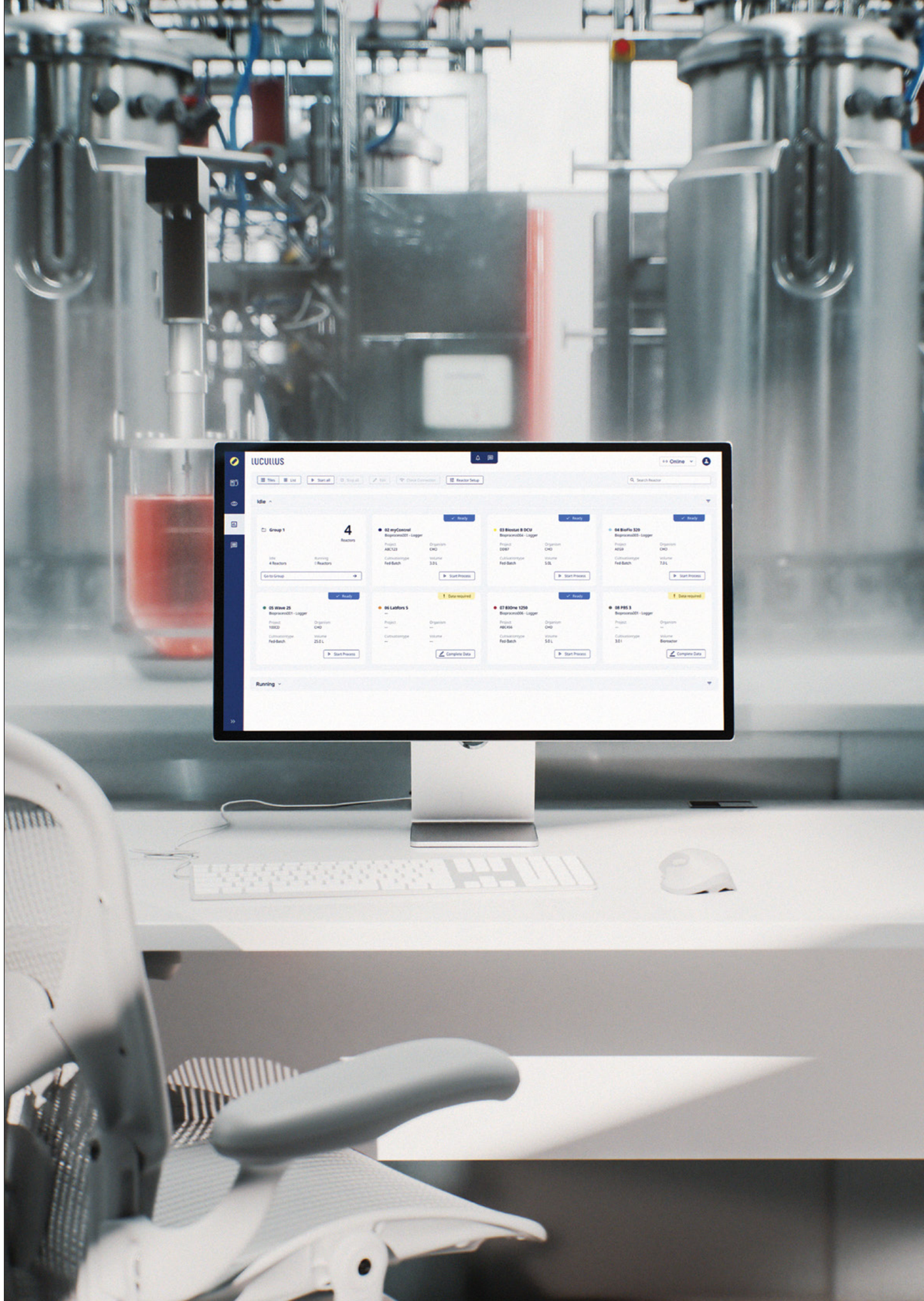
PROCESS CONTROL + AUTOMATION

Process control plays a pivotal role in bio-process development and production. With Lucullus®, you can implement both basic and advanced control mechanisms to ensure the precise execution of process commands across all connected reactor systems.

Lucullus® seamlessly collecting standalone devices by leveraging its powerful data integration capabilities, providing comprehensive real-time information for control purposes. The process step-chains dictate the timely sequence of events, whether control actions are automated or manually executed by operators. With incorporated control sequences and event-based decisions, Lucullus® enables implementation and execution of process designs without any limitations.

Benefits

- **Facilitate the simultaneous launch** of several experiments with variable recipes
- **Increase efficiency and robustness** through pre-designed process strategies and supervision
- **Ensure product quality** by controlling critical process parameters and critical quality attributes
- **Improve batch-to-batch consistency** Decrease risk of human errors and failing processes
- **Save operator time** by unattended process execution and full automation
- **Easy tech transfer** from R&D to production

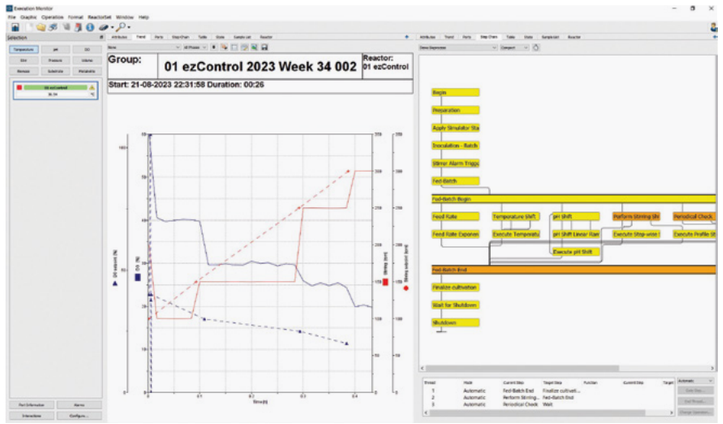


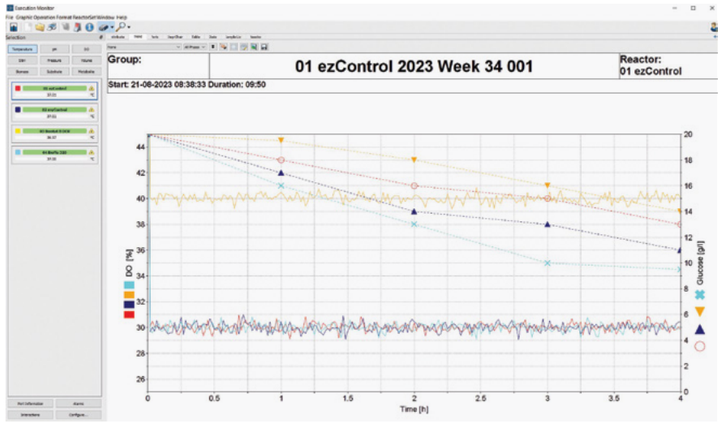
Basic Control

The basic process control functionalities of Lucullus® include effortless process loading, initiation, and termination, alongside the ability to modify setpoints and parameters. Additionally, it provides a comprehensive visualization of process states, alarms, and events, offering a holistic overview.

Centralized, uniform interface for overarching process control:

- Start and stop processes on selected bioreactors
- Adapt process setpoints and parameters during the process
- Apply predefined control strategies to single processes or process groups
- Configure customized notifications for alarms, process conditions, or events



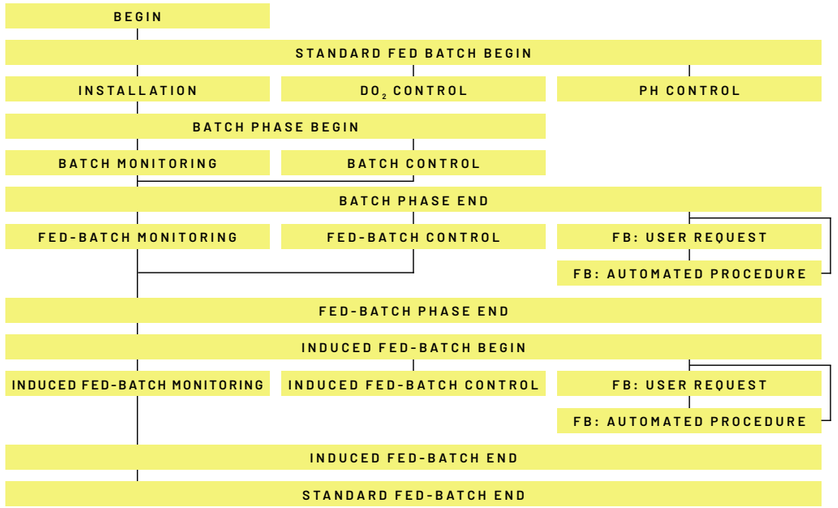


Advanced Control

Advanced process control enables the development of automated process control strategies. This encompasses a wide array of actions based on events and timing, such as initiating feeds, parameter shifts, phase changes, and a variety of other possibilities. The system offers prepared modules designed for calculations, user interactions, feed profiles, and other functions, simplifying the programming of processes with an intuitive approach.

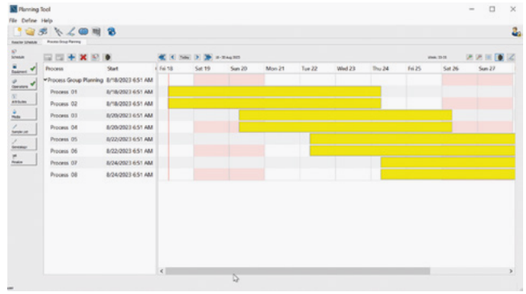
Process control strategies for supervisory control and process automation:

- Step-chain programming with alternative branching and parallel steps
- Defined event and time-based user interactions
- Integrated alarms and operator notifications (e.g., e-mail and SMS alarms)
- Ready-to-use software programming modules (e.g., calculator, interactive user console, profiler, exponential and linear ramp function, PID controller, etc.)
- Advanced script-based process programming
- Built-in utilities / tools to go beyond predefined modules and code advanced calculations for process control



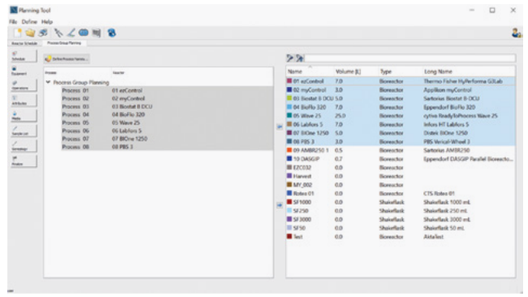
PROCESS PLANNING

The Lucullus® Planning tool empowers users to design future bioprocesses using a guided workflow. Operators can pre-define and schedule reactors and associated equipment, specify attributes, and select control step-chains and alarms. This structured planning approach for future processes or process groups ensures smooth process starts and seamless knowledge transfer, facilitating efficient operations and effective process implementation.



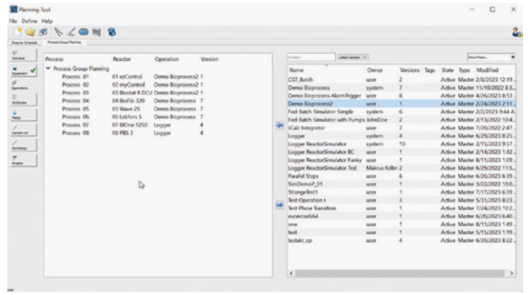
1 Define process groups

- Create single processes and process groups
- Assign unique process names
- Import DoE data (if desired)



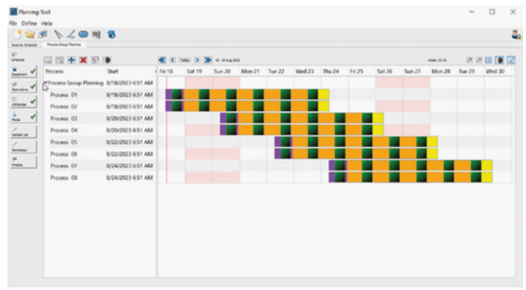
2 Select devices and define attributes

- Select the bioreactors and assign the processes
- Define process attributes and set-points



3 Assign operations and media

- Assign process control step-chains (operations)
- Choose the medium



4 Schedule processes and sampling events

- Define phases and durations
- Schedule processes
- Optional: add sampling plan

SAMPLE MANAGEMENT

Lucullus® revolutionizes sample management and the associated data assignment to respective processes. While reactor sampling and sample processing are still performed manually, the samples are now stored in tubes labeled with barcodes. Lucullus® automatically creates unique barcodes for each sample, which are subsequently scanned at the off-line analyzer. By generating a unique barcode ID, Lucullus® automatically imports the sample results upon completion of the analysis and assigns them to the corresponding process and process time, streamlining data integration and ensuring accurate tracking of sample information.

Benefits

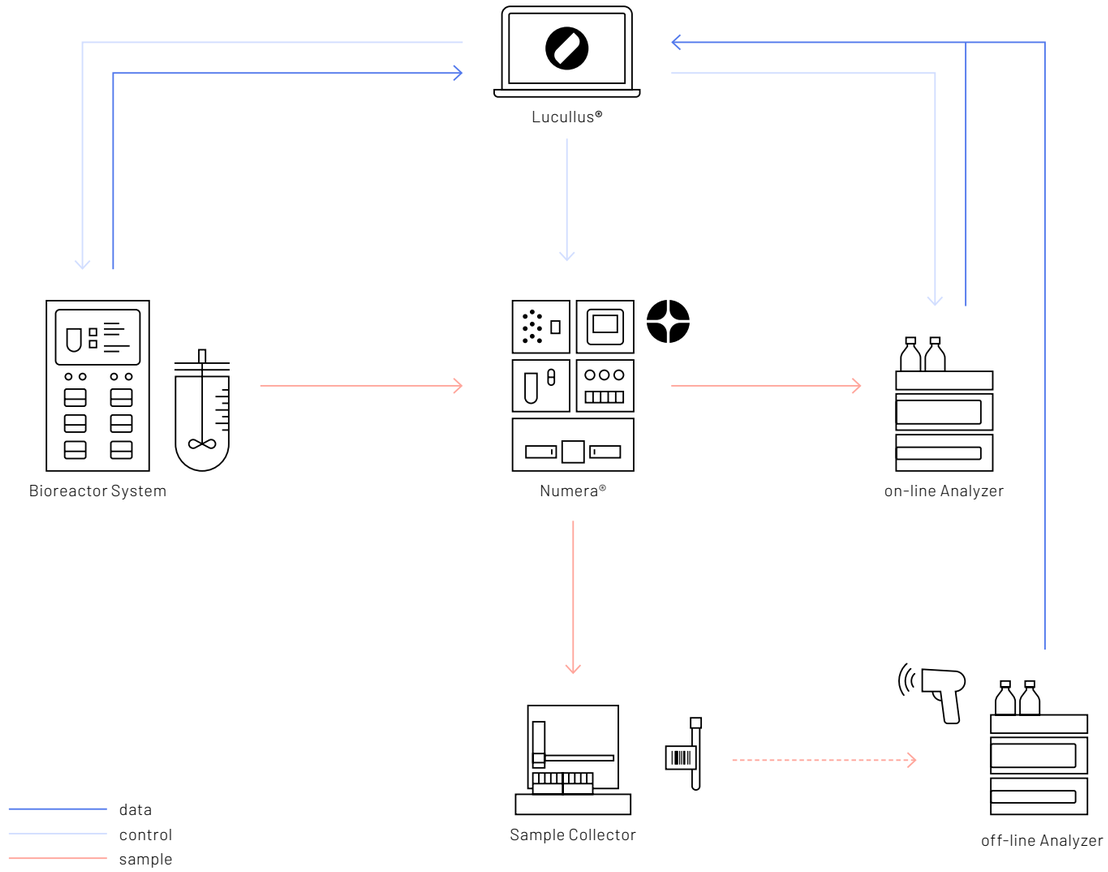
- **Manage samples efficiently** by applying sampling strategies, defining methods and preparing tubes with barcode labels
- **Be reminded** during process execution to take a sample at predefined sampling intervals
- **Record exact timing of sampling** to align on-line and off-line data
- **Retrieve data automatically** from at-line analyzers
- **Automate sampling** and sample processing even further with the Numera® PAT system
- **Use sample data** for advanced process control

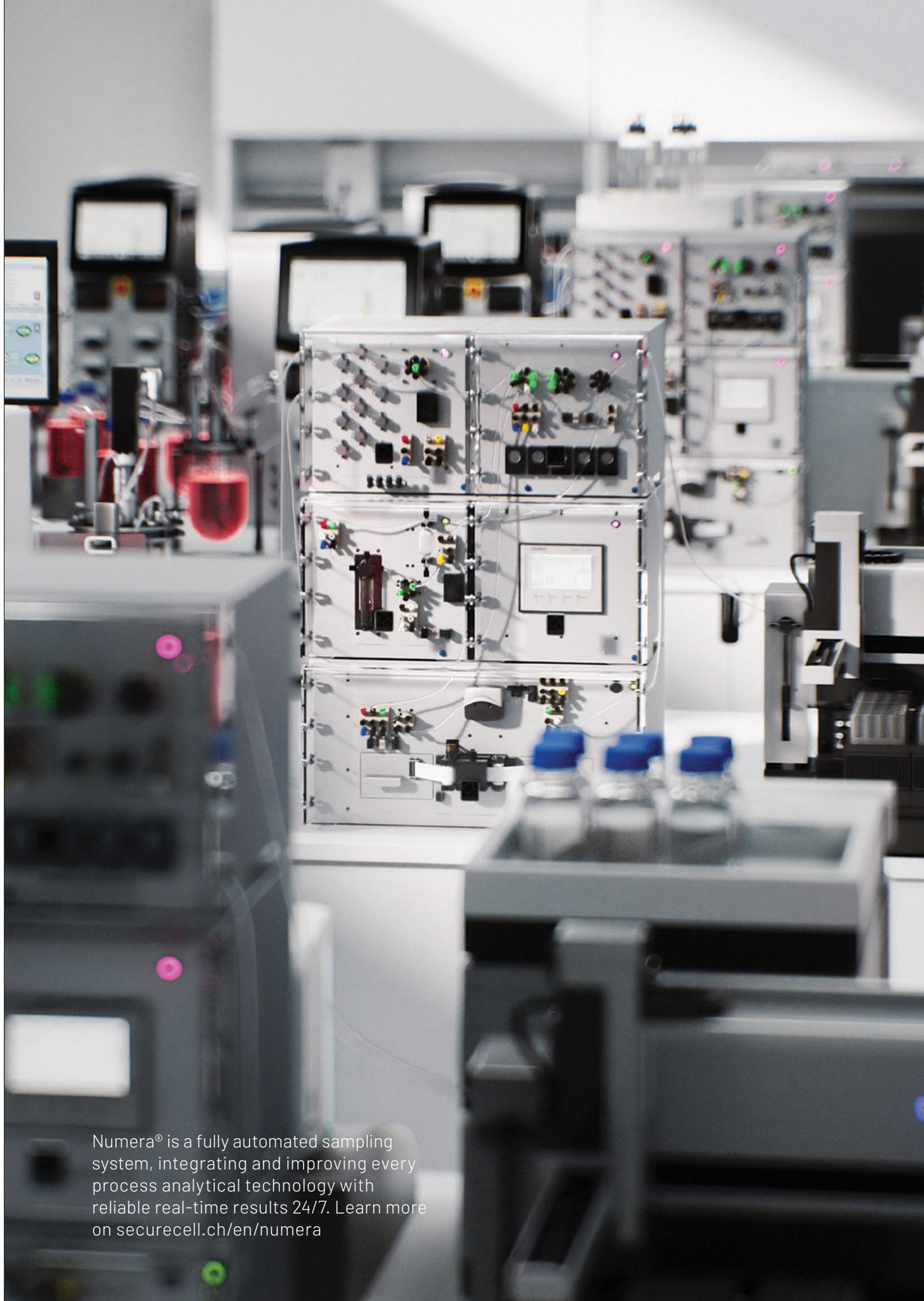
AUTOMATED SAMPLING

The integration of Lucullus® with the automated sampling system Numera® enables end-to-end workflow automation, encompassing sampling, measurement, process monitoring, and control. Together, Lucullus® and Numera® streamline the entire process, enhancing efficiency and accuracy throughout.

Features

- Sample planning (time and event based)
- Analytical methods for all analyzers
- Automated sample triggering during process
- Sample preparation and sample storage
- Automated on-line measurements
- Centralized data management and process monitoring
- Advanced process control and feedback loops





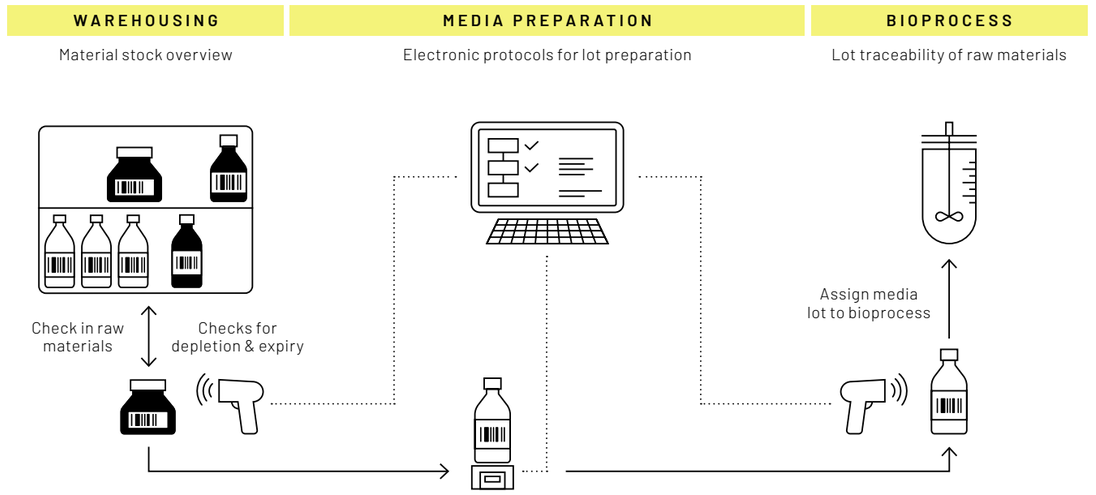
Numera® is a fully automated sampling system, integrating and improving every process analytical technology with reliable real-time results 24/7. Learn more on securecell.ch/en/numera

MATERIAL MANAGEMENT + MEDIA PREPARATION

Lucullus® offers digital assistance for media lot preparation and seamless integration of raw material information. Lucullus® facilitates a streamlined workflow from media planning to media optimization through guided media preparation using electronic protocols. Lucullus® also enables efficient warehousing and ensuring traceability of components throughout the process, enhancing overall efficiency and quality control.

Benefits

- **Check and monitor** the availability and the usage of compounds from storage
- **Reduce human errors** for material handling due to guided workflows and barcode technology
- **Manage your media recipes** in a structured library
- **Automatically record data** in your media kitchen with integrated devices (e.g., pH meter, scales, etc.)
- **Link media lots and compounds** to experiments
- **Use the information** gained during experiments for media optimization, comparison, calculation and reporting
- **Identify and monitor** critical material attributes



"Different control units at various scales made the overarching operation a challenging task. Thus, we chose Lucullus® which flexibly integrates an unmatched 100 laboratory devices allowing the complete digitalization of our GMP manufacturing environment."

NAVJYOT WAGHMARE
Automation Expert at IDT Biologika

LUCULLUS® 21CFR PART 11 COMPLIANCY

Lucullus® is designed to fulfill the requirements for electronic records and electronic signatures for GMP applications. It is compliant with the FDA 21CFR Part 11 guideline.

Access Security	The Access Security includes features such as the use of a unique combination of user ID and password, customizable password security settings, comprehensive logging of access security actions in an audit trail, and extensive user management capabilities for roles and groups.
Electronic Signature	Lucullus® enforces the authorization of defined interactions by a user with the appropriate authorization. Confirmation of changes is requested with pop-up windows. The following information is stored in the audit trail: reason, timestamp, and printed username.
Audit Trail	Lucullus® provides a continuous audit trail that is protected against deactivation and tampering. It tracks the user interactions and all events during a process. A second audit trail on the database level logs all changes in system configuration.
Archiving and Retrieval	The Lucullus® interface is designed to prevent process deletion and raw data modification to ensure data integrity. A robust data integrity checking mechanism prevents the deletion of resources associated with active processes and serves as an additional layer of protection to ensure data consistency and reliability.

Validation documents and detailed statements are available.
Please contact us for further information.

LUCULLUS® LICENSING

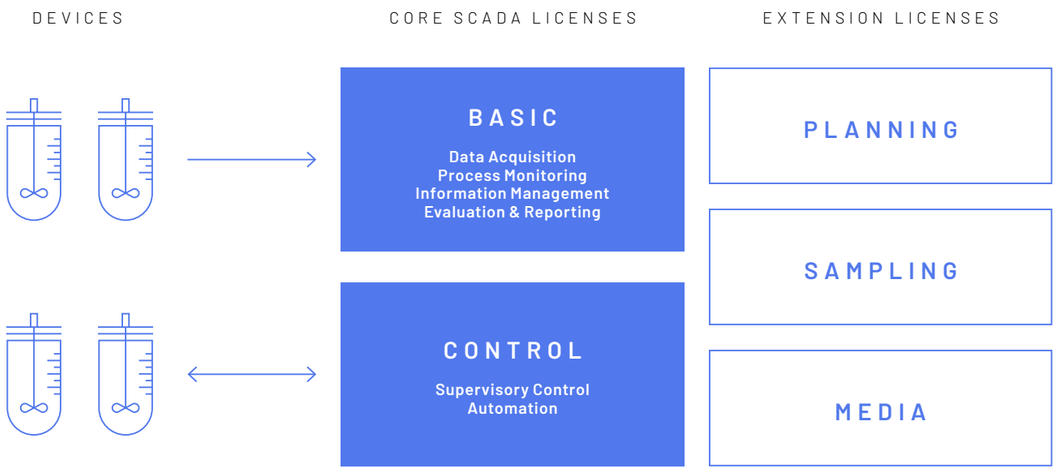
We offer a versatile licensing model, customized to align perfectly with your unique needs. Licenses are procured for each bioreactor and its associated devices. The pricing model varies, dictated by the intricacy of the equipment and the scale of installation.

The Lucullus® core SCADA software encompasses two types of licenses: Basic and Control. The Basic License facilitates a unidirectional connection to devices for seamless data acquisition and process monitoring. The Control License establishes a bidirectional connection for process control and automation.

To extend beyond the standard SCADA functionality, you can enhance the Lucullus® core software. The extensions provide advanced capabilities for process planning, sample management, and media management.

Lucullus® also offers additional license as for example GMP license, REST API license, LDAP license, OPC DA license, and DBI license.

Lucullus® can be deployed in various architectures – either as a stand-alone system or a client-server model. The choice is dictated by the number of devices in use and the complexity of the integration.



CORE SCADA SOFTWARE

LICENSES	FUNCTIONALITY
Basic License	Data Acquisition & Process Monitoring
	Information Management & Evaluation & Reporting
Control License	Process Control & Automation

EXTENSIONS

LICENSES	FUNCTIONALITY
Planning License	Process Planning
Sampling License	Sample Management
Media License	Warehouse & Media Management

OPTIONS

LICENSES	FUNCTIONALITY
GMP License	CFR 21 Part 11
REST API License	REST API & Web Interface
LDAP License	Lightweight Directory Access Protocol
Device License	Device integration for additional equipment
OPCUA License	OPC Driver

SOFTWARE ARCHITECTURE

LICENSES	FUNCTIONALITY
Client-server	Network Architecture
Workstation	Stand-Alone Installation
Oracle DB	Oracle Processor & Named User Plus

SERVICES

OPTIONS	DESCRIPTION
Installation	Installation, Configuration & Commissioning
Training	Basic and Expert Training Lessons
Support	Software Update and Support based on Agreement

TECHNICAL DATA

Integrate all Standalone Devices

Lucullus® efficiently aligns and consolidates data from diverse sources within the bioprocess environment, providing a centralized storage solution. The integration process is simplified through integrated workflows and a high level of automation. All information is securely recorded, ensuring traceability, and easily accessible for direct utilization.

Lucullus® integrates a comprehensive catalog of bioreactors, devices, and sensors:

- Bioreactor control units
- Incubators and shakers
- DSP devices
- On-line and off-line analyzers, gas analyzers
- Pumps, scales, mass flow controllers, sensors
- Control systems (PLC and DCS)
- Fieldbus devices
- Printers, barcode scanners

See securecell.ch/lucullus for full list of supported systems.

Integrate Data with 3rd Party Software

Lucullus® supports data exchange with various 3rd-party software (e.g., DataHowLab, Matlab, Excel, Ois PI, ...) through common interfaces and communication standards, such as OPC, XML, SQL or REST API for:

- Data analytics and evaluation
- Machine learning and modeling
- Design of experiments (DoE)
- Statistics and calculations
- Data storage

INSTALLATION + SUPPORT

Installation and Hardware Requirements

For small installations (up to 8 bioreactors) all components can be installed on a single workstation (Windows).

For medium- and large-scale installations, Lucullus® has distributed architecture (client / server), including:

- Online clients with or without replication (Windows or Linux)
- Application server (Windows or Linux)
- Database server (Oracle)
- Backup servers / historian

Consultancy and Support

Securecell supports you in planning and implementing Lucullus® installations, integrating all devices involved, and configuring the system for your needs. We support you in the implementation of advanced process automation and digitalization of your data flows. Our experts provide comprehensive training and support you with technical assistance.

- Planning and implementation
- Installation and integration
- Configuration of users and devices
- Step-chain programming
- Validation
- Training
- Support

Contact our experts today for a live demo.

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