DOTS

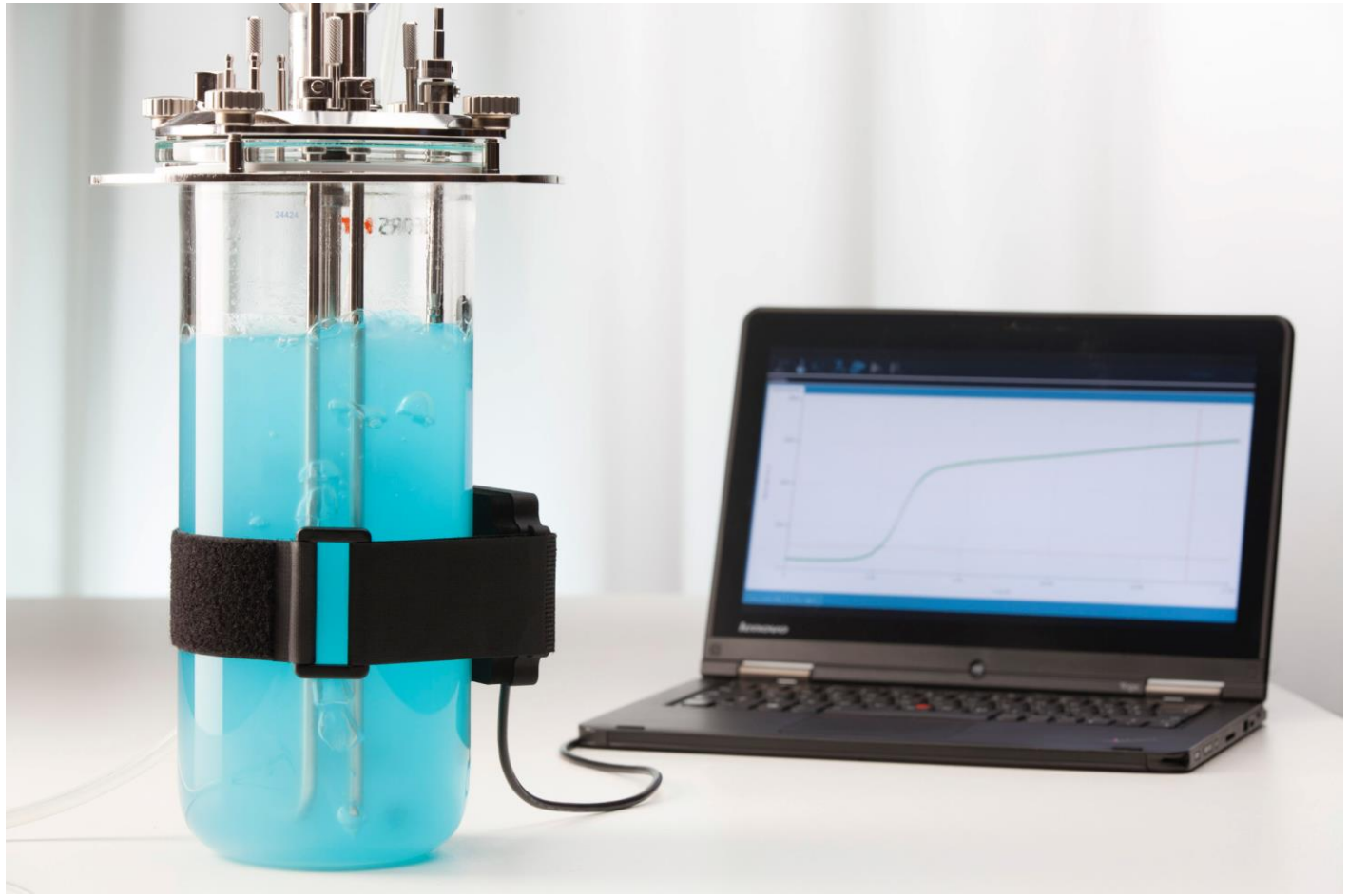
sbi SCIENTIFIC BIOPROCESSING

Cell Growth Quantifier (CGQ) BioR

ONLINE BIOMASS MONITORING FOR BIOREACTORS

The CGQ BioR is a sensor-based technology for non-invasive online biomass monitoring in various types/scales of bioreactors.

Cell Growth Quantifier BioR (CGQ BioR)



A CGQ BioR system consists of three components:
he CGQ BioR sensor, the base station and the DOTS Software.

Hardware & Software Components

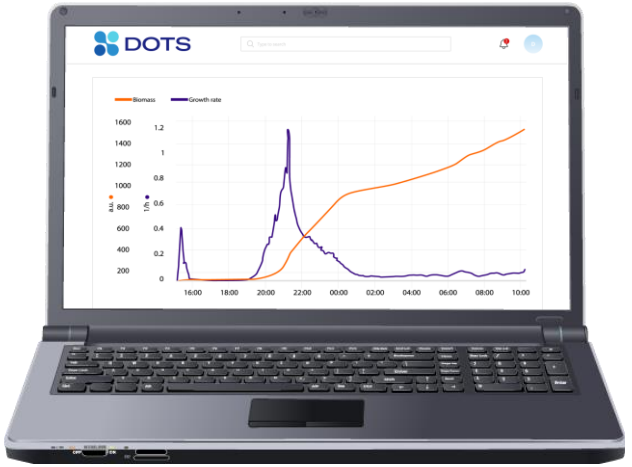
CGQ BioR Sensor

The sensor is positioned to the outside wall of the bioreactor and measures the biomass non-invasively.

Base Station

The base station bundles the data from all monitored bioreactors and sends it to the DOTS Software.

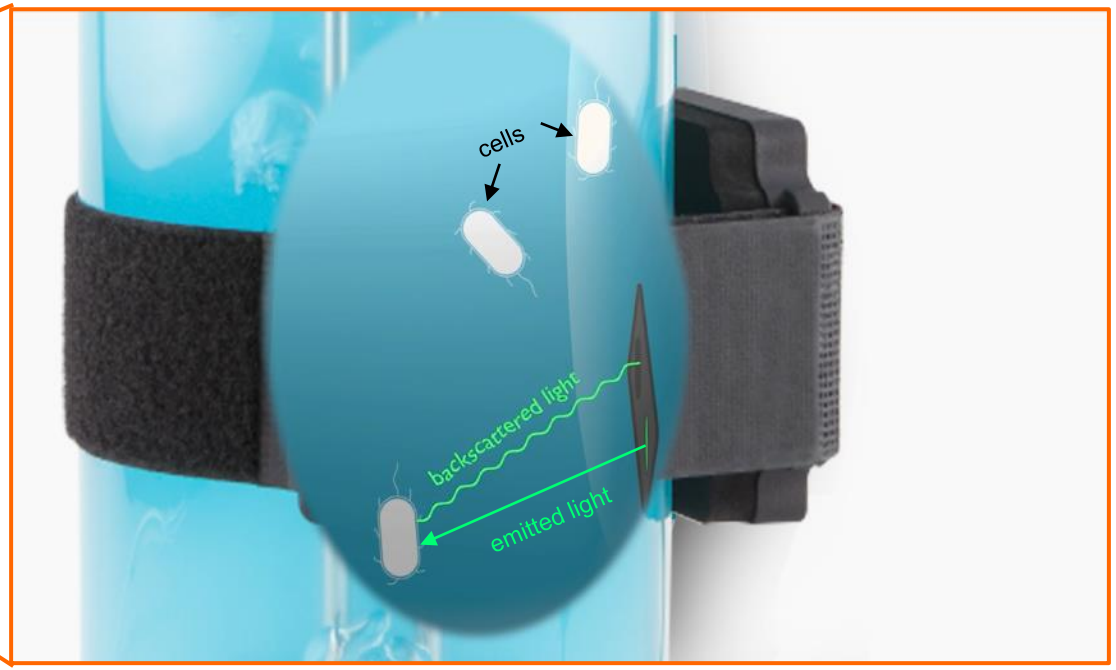
DOTS Software



DOTS Software enables a simplified control of sensors and visualizes the received data from all monitored bioreactors in real-time.

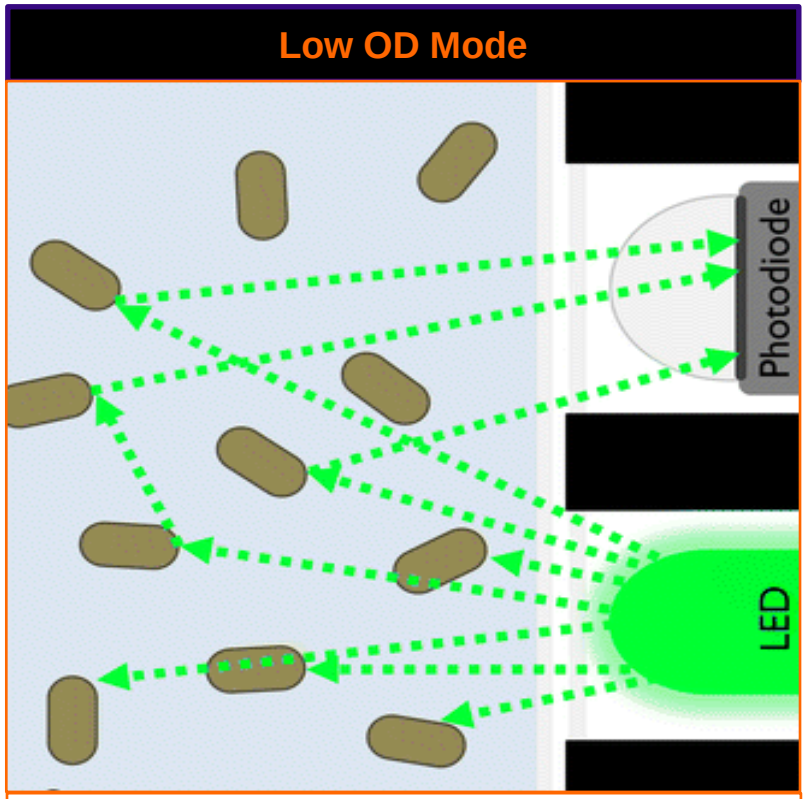
Backscatter measurements are used to monitor the biomass optically and non-invasively through the wall of the bioreactor.

Measurement Principle

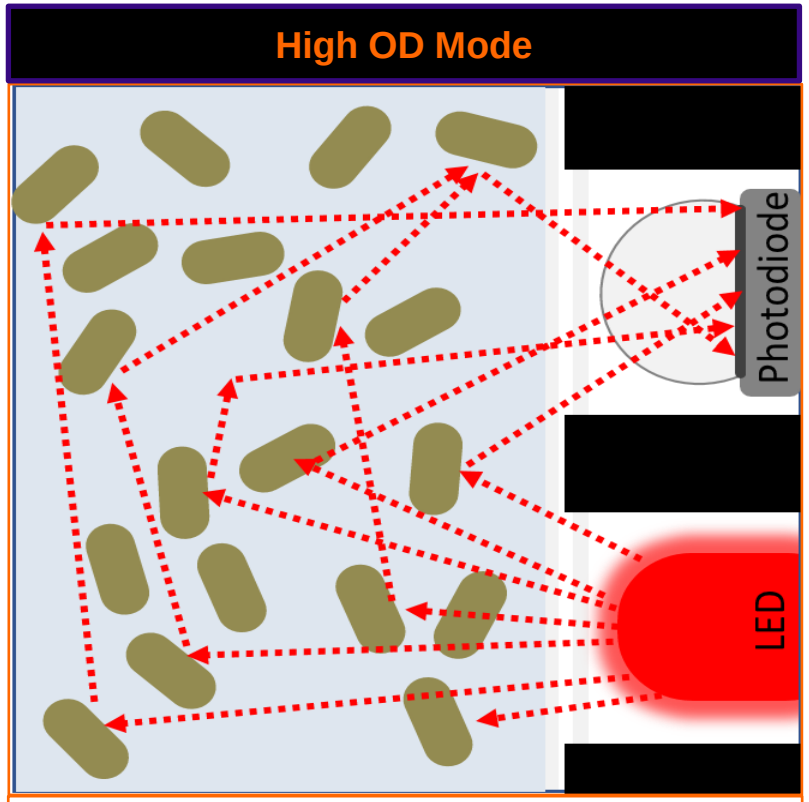


With two built-in LEDs (green and red), a broad range of cell densities can be covered.

Low vs. High OD Measurement Modes



Green LED, 521 nm: Low cell density mode
→ OD 0.5-50



IR LED, 940 nm: High cell density mode
→ OD 15-300

The CGQ BioR creates significant value by saving time & costs as well as creating detailed bioprocess understanding.

CGQ BioR Key Facts

Key Facts

Non-invasive quick-start technology
No cleaning or autoclaving, no ports blocked, quickly install/uninstall at any time

Compatible with various scales of bioreactors
Mini bioreactor systems, benchtop bioreactors, production scale and more

Detailed microbial growth kinetics in real-time
Real-time analysis of biomass with highest precision

One sensor for all needs
Covers the OD range from 0.5 to 300 in two measurement modes with one sensor

Flexible integration
Integration of biomass data into other software (e.g., analog, OPC,…)

Powerful DOTS Software
Simplified sensor control and data visualization for improved comparability

The CGQ BioR has several clear advantages over currently used invasive biomass probes for bioreactors.

Comparison: CGQ BioR vs. Invasive Biomass Probes

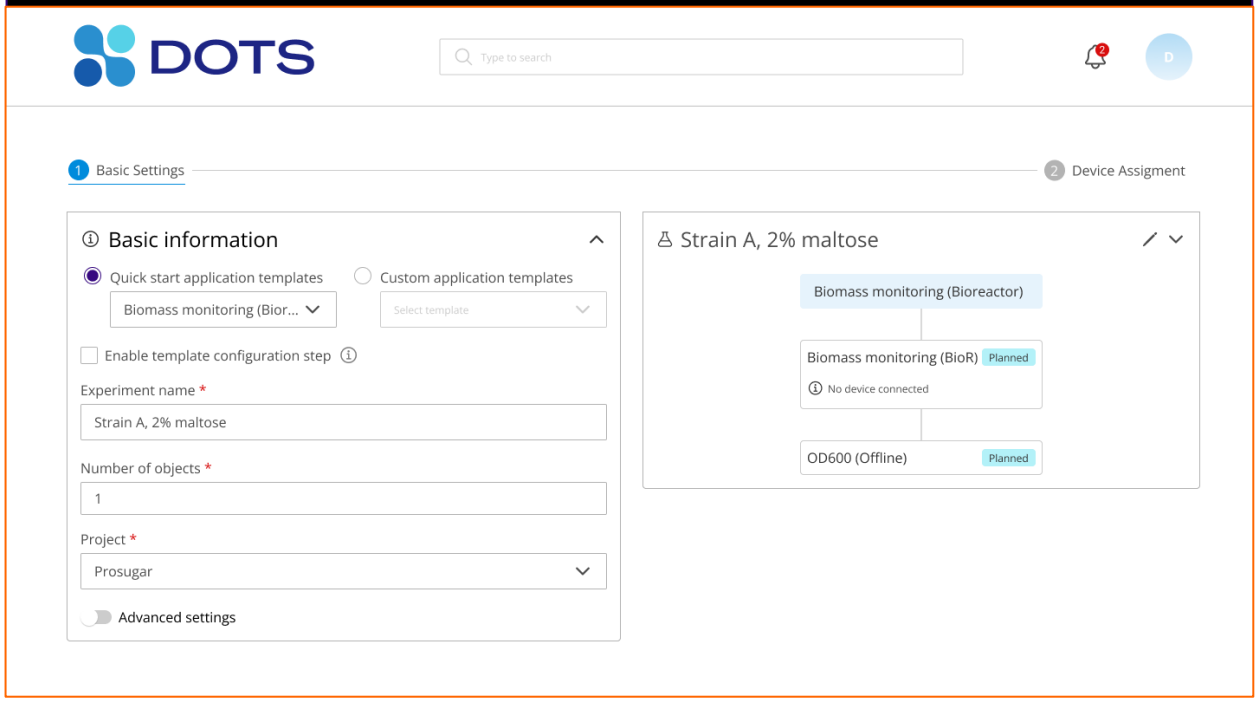
	CGQ BioR	Invasive Biomass Probes
Cleaning & Autoclaving	– Non-invasive sensor that does not need to be autoclaved or cleaned	– Needs to be cleaned and autoclaved with the vessel after every use
Available Ports	– No ports blocked since the BioR is attached to the outside of the glass vessel	– Requires a port
Flexibility	– Can be installed/uninstalled at any given time during the fermentation (quick-start)	– Must be installed before the experiment is started
Vessel Compatibility	– Compatible with most vessel types/sizes – Simply attach to the glass wall or a glass window	– Can often only be used for one vessel size (limited by probe length)
OD Range	– Standard Mode (521 nm): OD 0.5-50* – High Cell Density Mode (940 nm): OD 15-300*	– Usually limited to a specific OD range, various probes needed for different biomass ranges

**Depending on vessel type/size, media, organism and other factors*

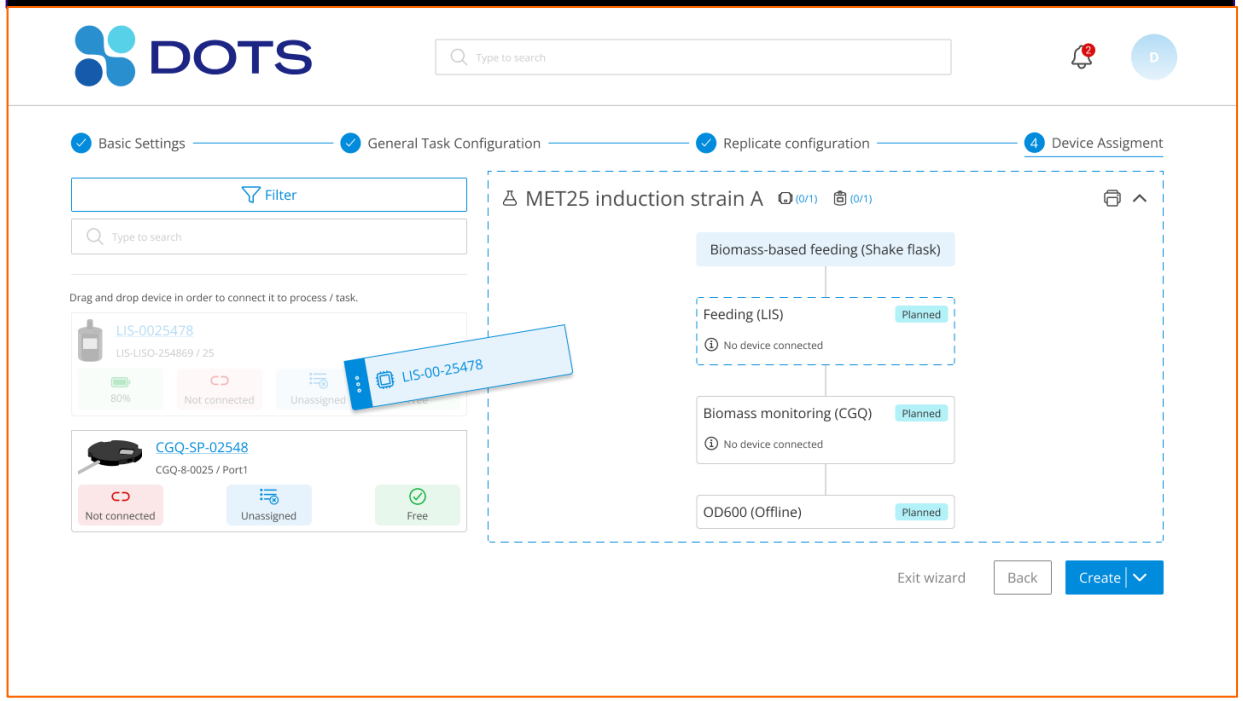
The DOTS Software enables easy sensor handling and experiment set up.

Exemplary Screenshots

Create an experiment with pre-defined application templates



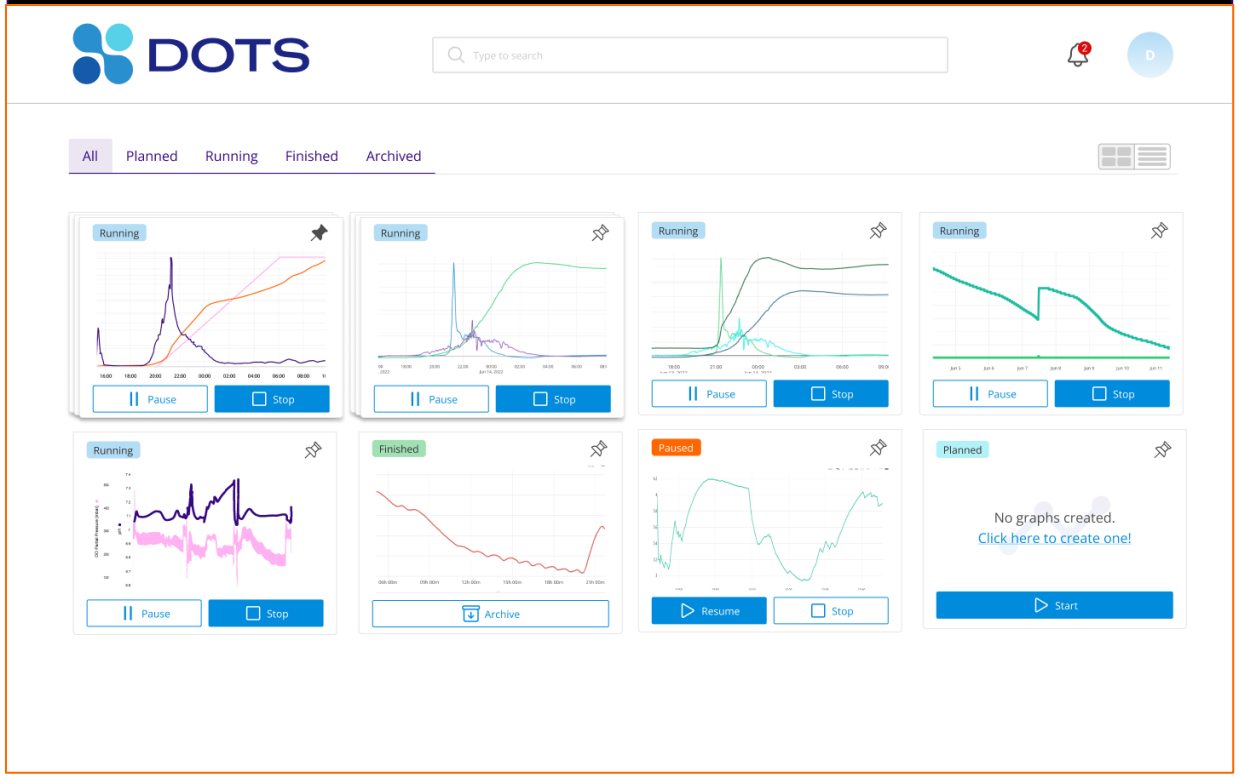
Assign sensors to planned experiments via drag and drop



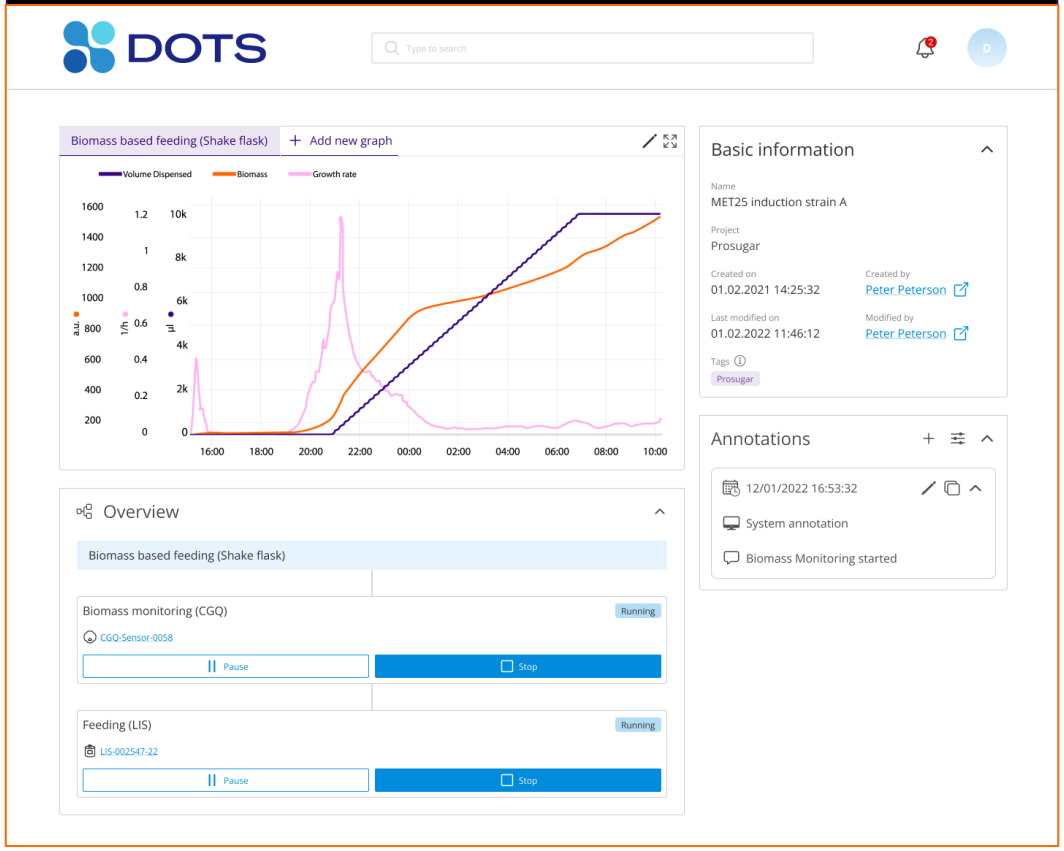
The DOTS Software provides a comprehensive overview of your experiments and visualizes your data in real-time.

DOTS Software Modules for Data Visualization

The dashboard schema provides an overview over all running, planned, or finished experiments

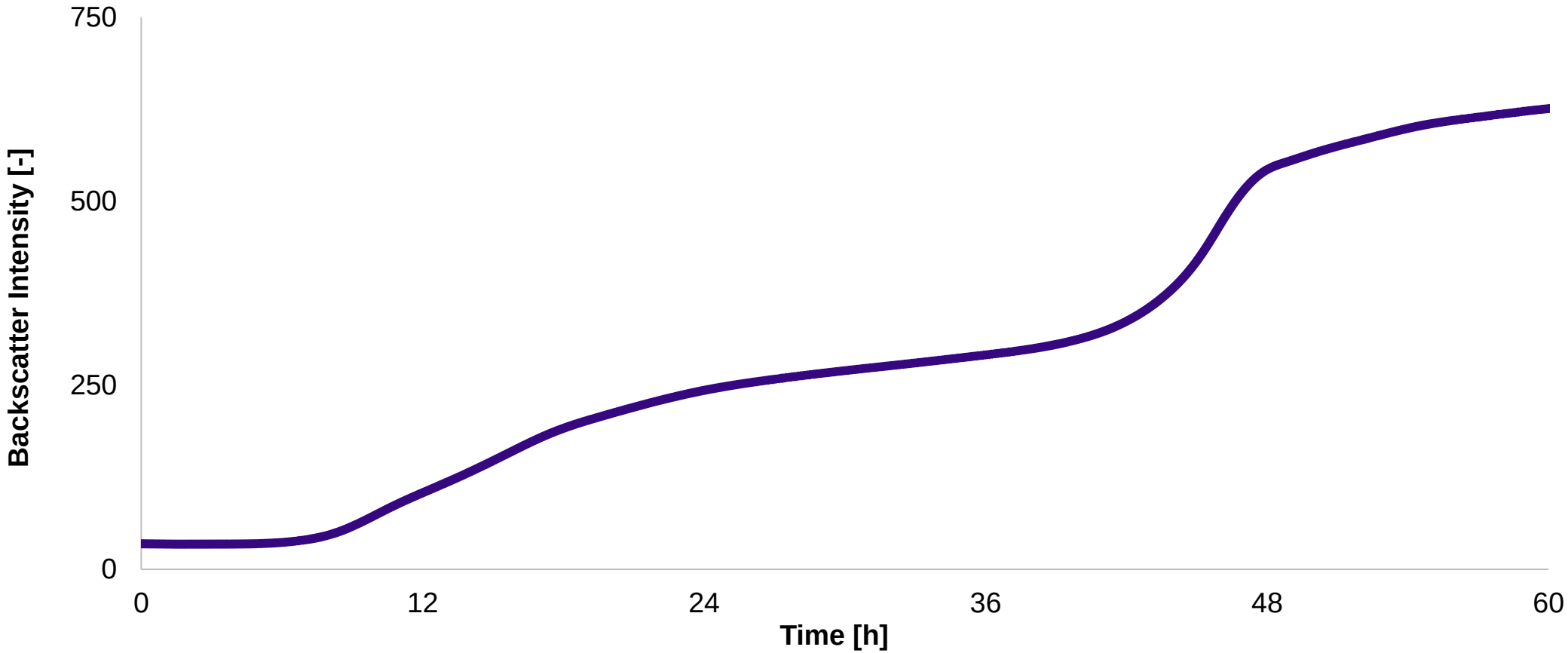


Data visualization tools enable a customized display of data in real-time



The high data density of CGQ BioR measurements allows you to detect and visualize process events like metabolic shifts.

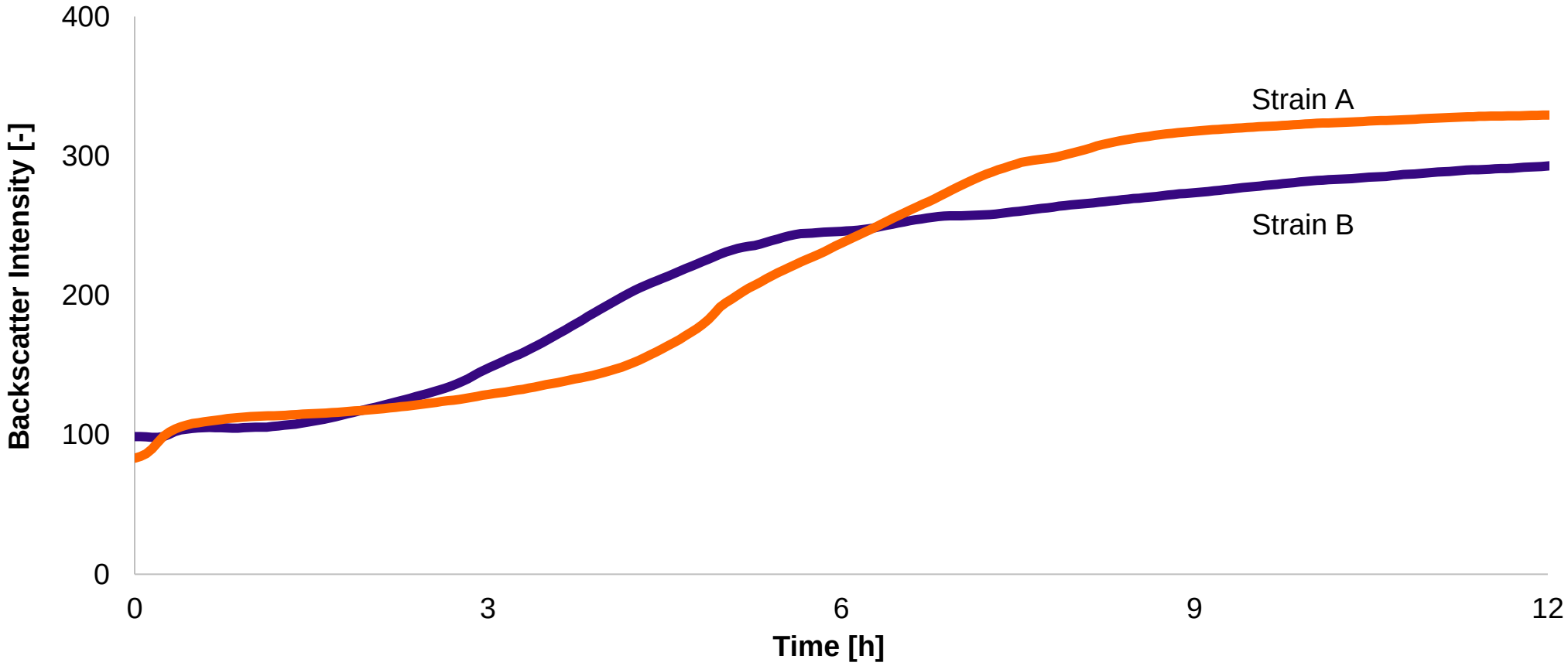
CGQ BioR Measurement: *Saccharomyces cerevisiae* (Diauxic Growth)



Saccharomyces cerevisiae, YPD Media, Applikon Glass Bioreactor (7.5 L), Room Temperature

The CGQ BioR is ideal for screening experiments in bioreactors such as strain or media comparisons.

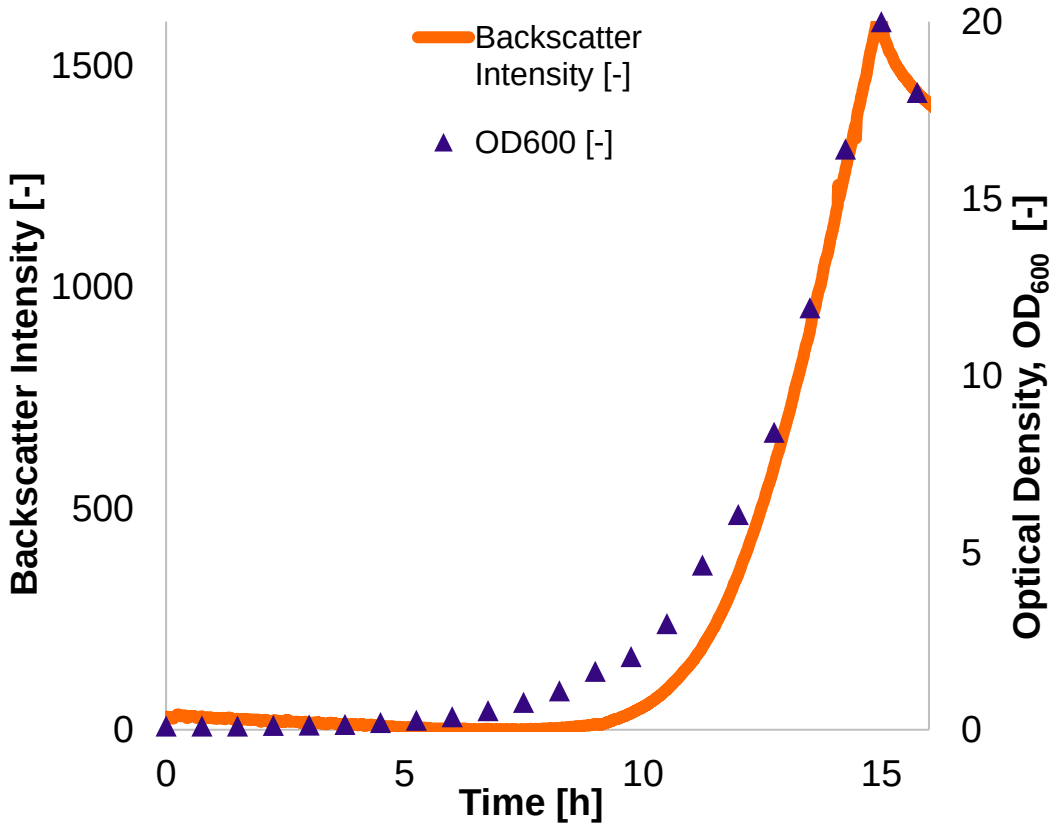
CGQ BioR Measurement: Different *Escherichia coli* Strains

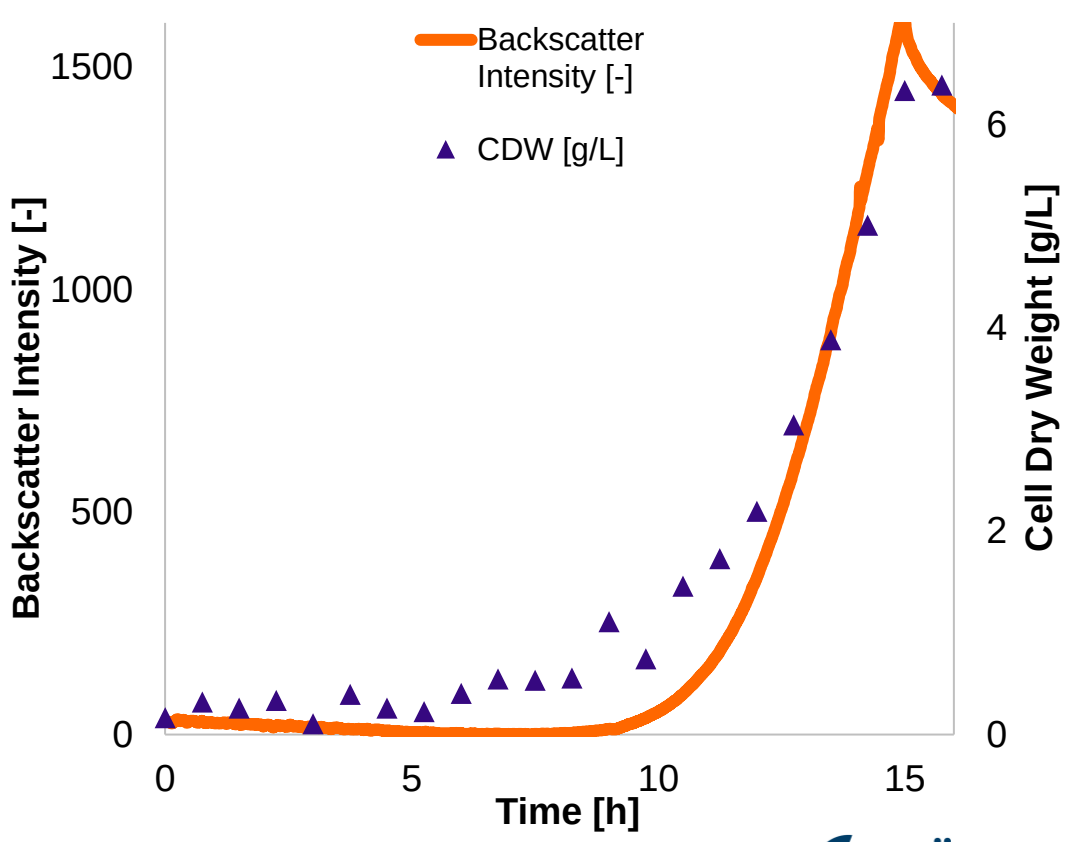


Escherichia coli, HCDC Media, Infors Labfors (7.5 L), 37 °C

The CGQ BioR shows good correlation with offline biomass data such as OD_{600} and Cell Dry Weight.

CGQ BioR & Offline Biomass Measurements (1/2): *Corynebacterium glutamicum*

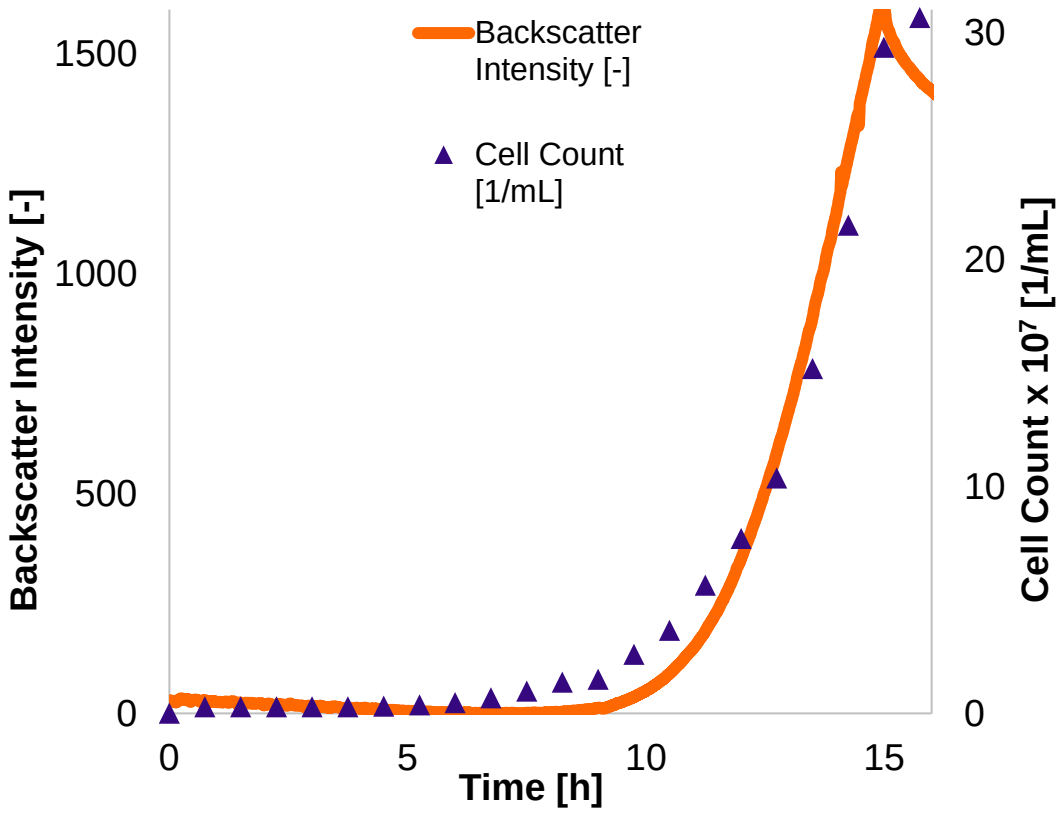


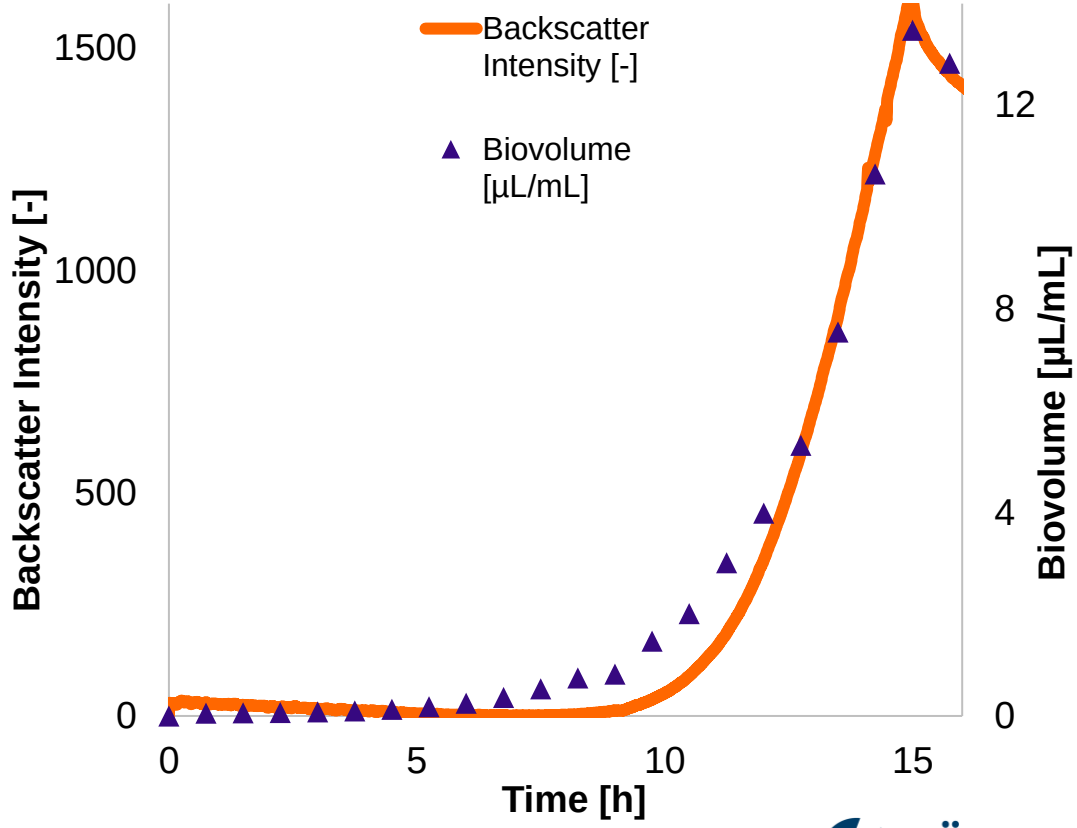


Corynebacterium glutamicum, CGXII Medium, DASGIP Bioblock (1.8 L), 30 °C

The CGQ BioR shows good correlation with offline biomass data such as Cell Count and Biovolume.

CGQ BioR & Offline Biomass Measurements (2/2): *Corynebacterium glutamicum*

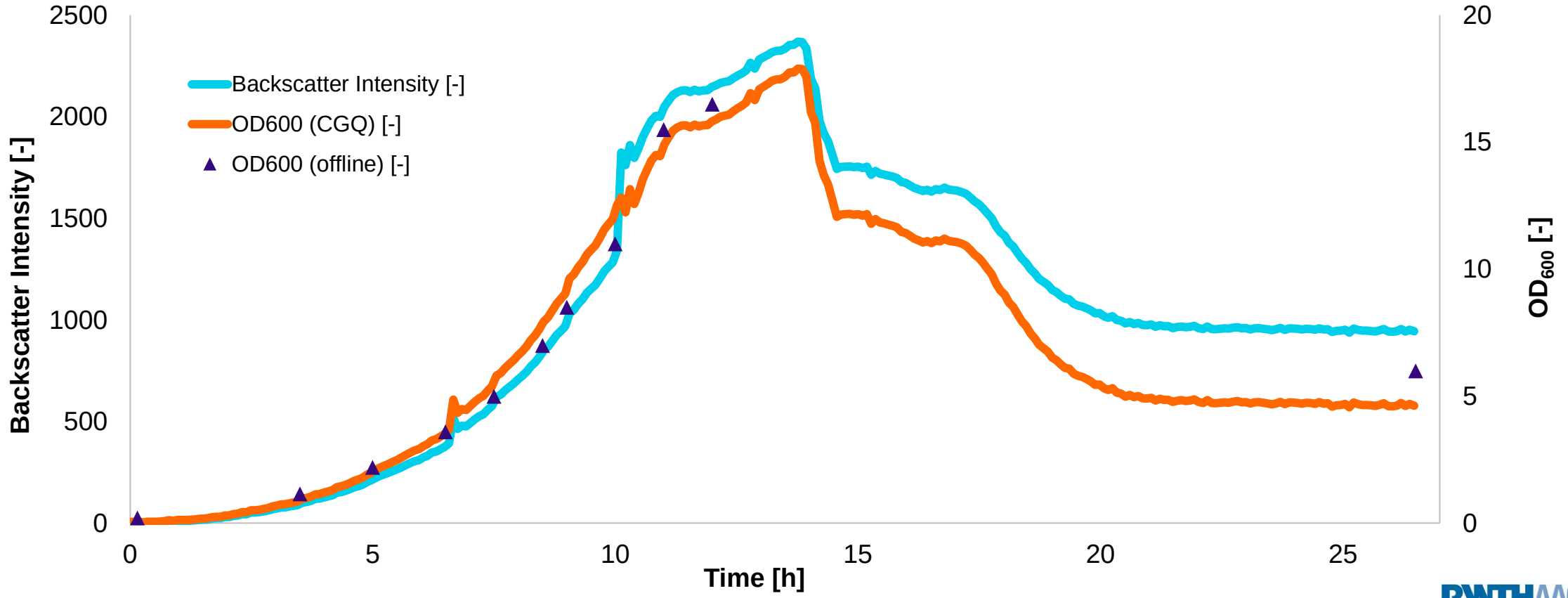




Corynebacterium glutamicum, CGXII Medium, DASGIP Bioblock (1.8 L), 30 °C

Using a calibration file, the CGQ BioR is able to directly convert backscatter intensities to OD values.

CGQ BioR and Offline OD Measurements: *Bacillus subtillis*



Bacillus subtilis, Minimal Medium, New Brunswick Glass Bioreactor (3 L), 37 °C

Our products and our service are highly valued by our global customer base.

Customer Feedback

For the first time, **we were able to generate high-quality growth curves** of photosynthetic *S. elongatus* without necessarily relying on classical manual measurements like OD_{750} or cell dry weight,(…). Thus, we don't face the omnipotent risk of contamination anymore.

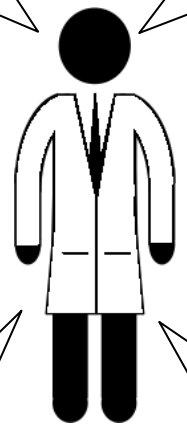
Prof. Dr. Ilka Maria Axmann

hhu Heinrich Heine Universität Düsseldorf

The CGQ provided **accurate growth curves with a very dense sampling interval** and gave us the opportunity to identify differences in the growth behaviors. The **CGQ (…) had a big impact in** understanding the organisms and, eventually, **the finalization of the publication.**"

Prof. Dr. Lars Blank

RWTH AACHEN UNIVERSITY



"The CGQ made it possible for us to observe growth dynamics in real time (…). This has very much **improved performance and reproducibility of our experiments, and it has increased our throughput considerably."**

Dr. Andrea Sass

GHENT UNIVERSITY

" (…) We are also **very satisfied about the customer service**: they really thought along with us to adapt the system for monitoring the growth of (hyper)thermophiles."

Prof. Dr. E. Peeters

Vrije Universiteit Brussel

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