



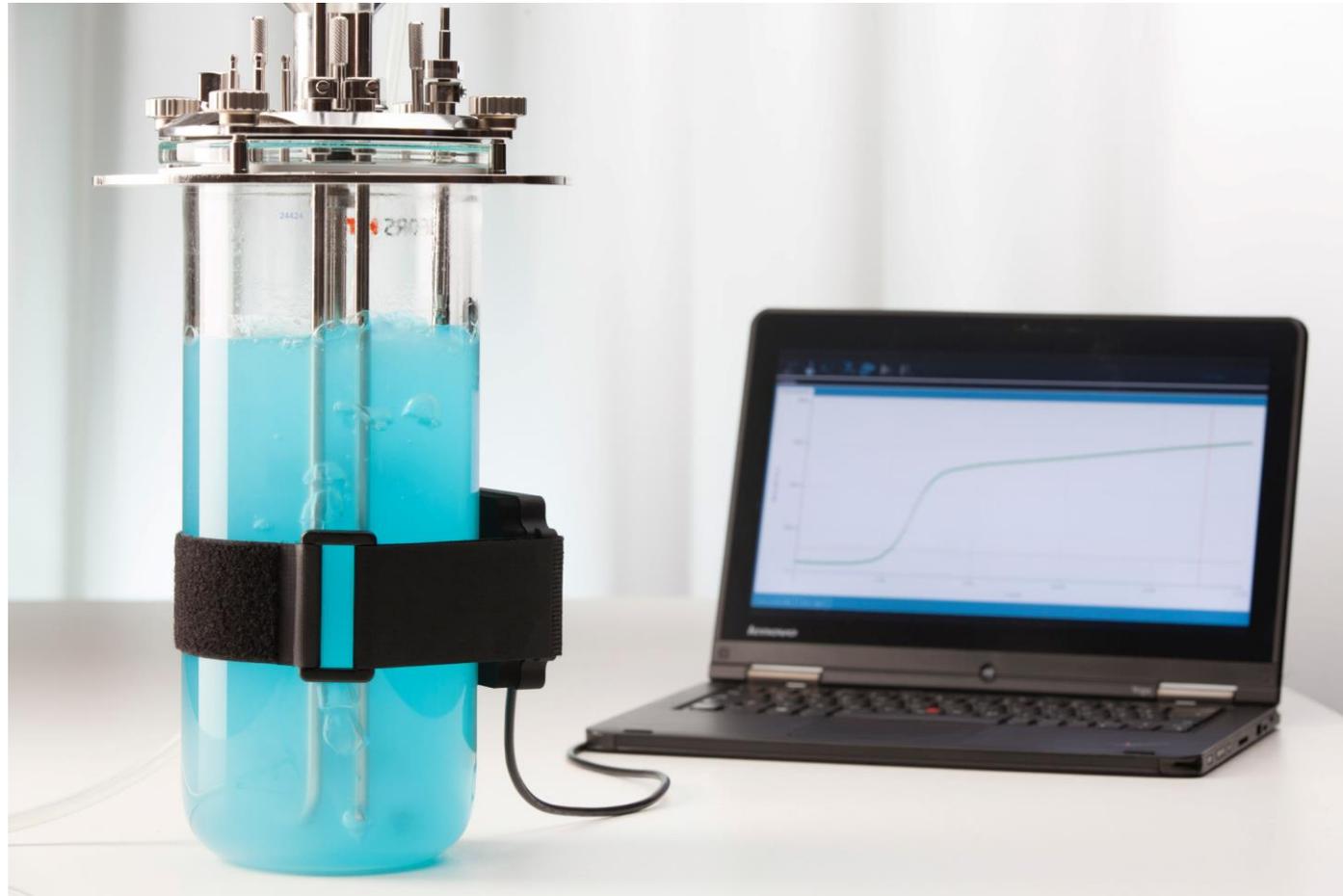
# Cell Growth Quantifier (CGQ) BioR

**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)

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# A CGQ BioR system consists of three components: the CGQ BioR sensor, the BioR hub and the DOTS Software.

## Hardware & Software Components

### CGQ BioR Sensor



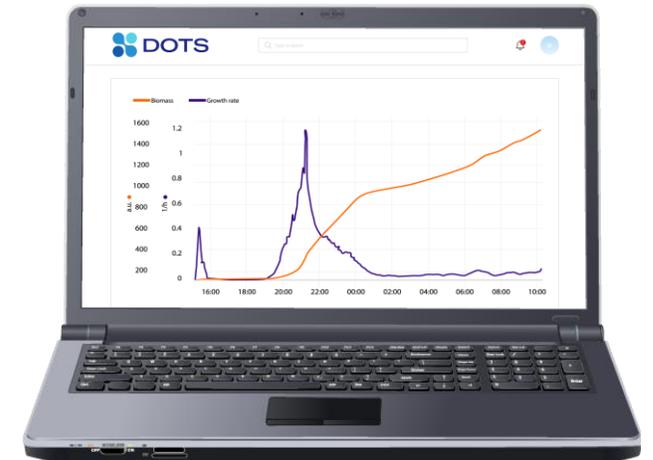
The sensor is positioned to the outside wall of the bioreactor and measures the biomass non-invasively.

### BioR Hub



The BioR hub bundles the data from all monitored bioreactors and sends it to the DOTS Software.

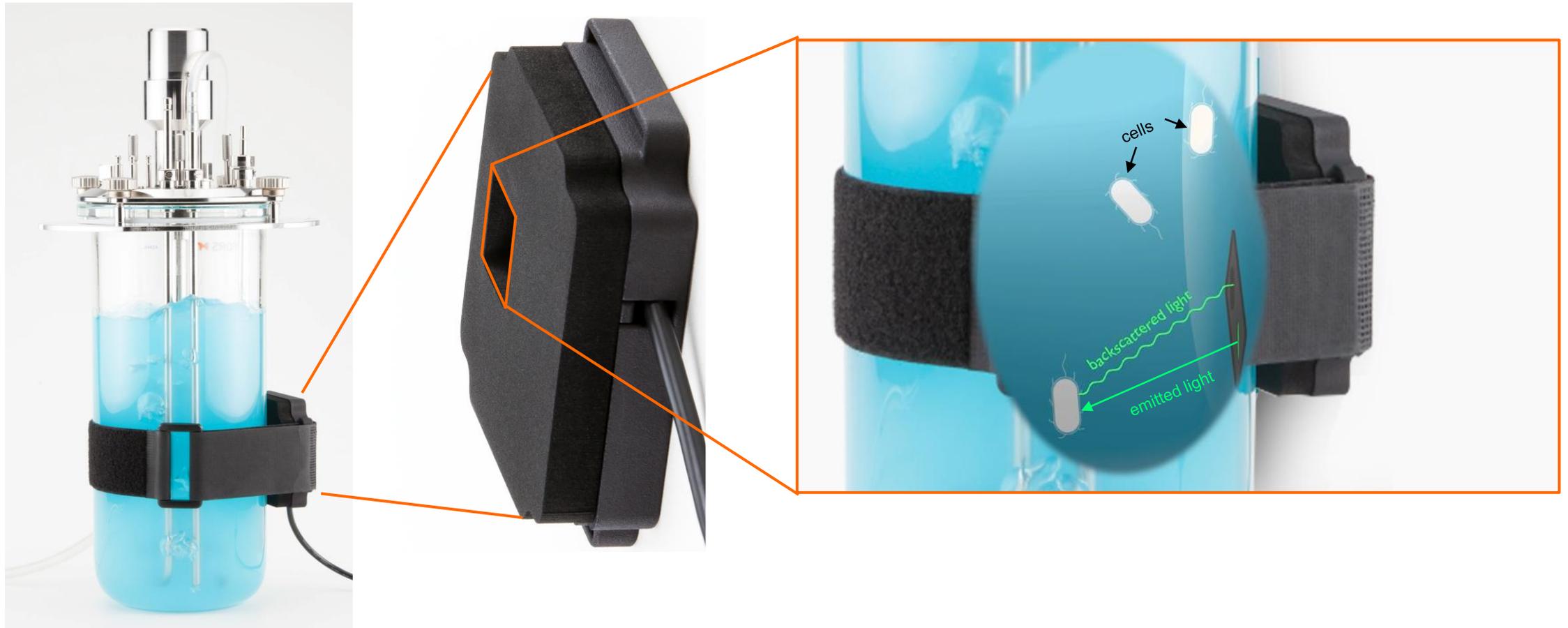
### DOTS Software



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

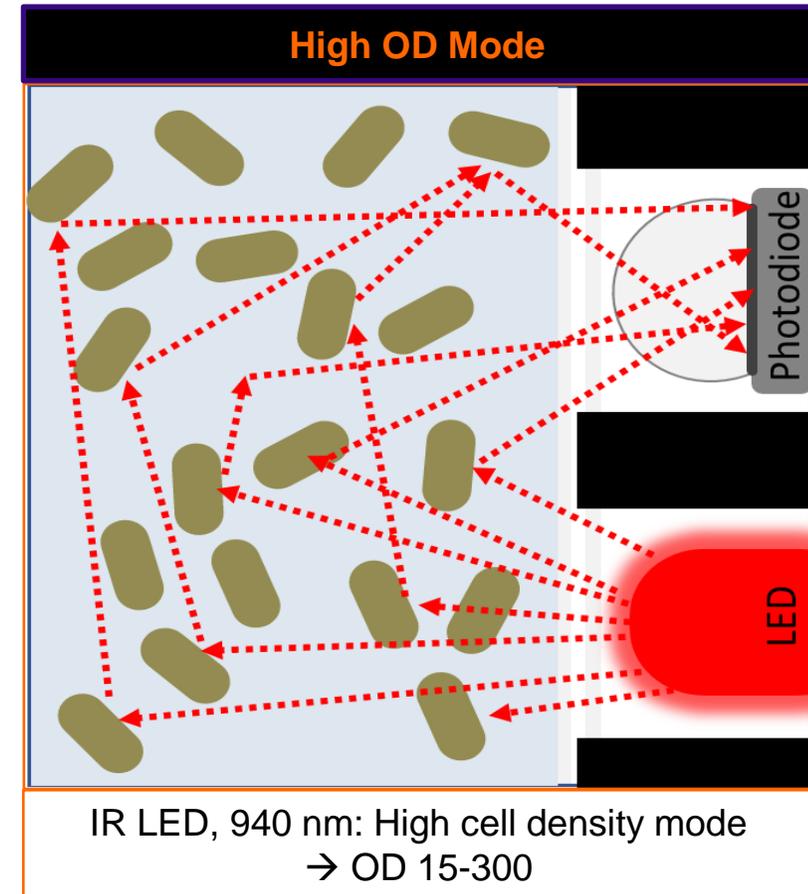
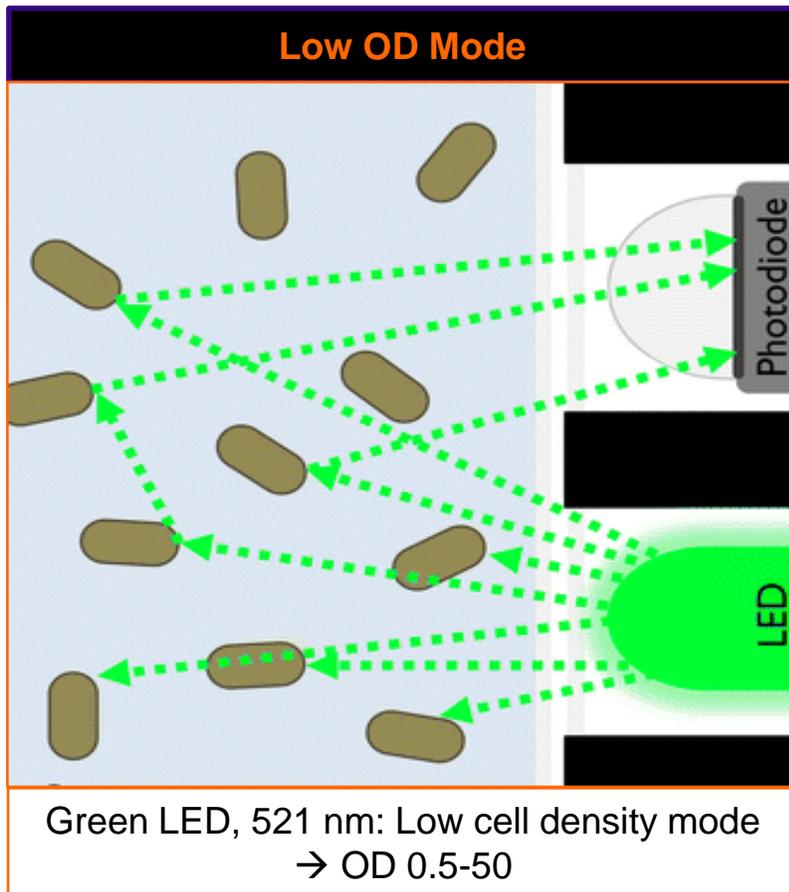
# Backscatter measurements are used to monitor the biomass optically and non-invasively through the wall of the bioreactor.

## 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



# 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	<ul style="list-style-type: none"><li>– Non-invasive sensor that <b>does not need to be autoclaved or cleaned</b></li></ul>	<ul style="list-style-type: none"><li>– <b>Needs to be cleaned and autoclaved</b> with the vessel after every use</li></ul>
Available Ports	<ul style="list-style-type: none"><li>– <b>No ports blocked</b> since the BioR is attached to the outside of the glass vessel</li></ul>	<ul style="list-style-type: none"><li>– <b>Requires a port</b></li></ul>
Flexibility	<ul style="list-style-type: none"><li>– <b>Can be installed/uninstalled at any given time</b> during the fermentation (<b>quick-start</b>)</li></ul>	<ul style="list-style-type: none"><li>– <b>Must be installed before the experiment</b> is started</li></ul>
Vessel Compatibility	<ul style="list-style-type: none"><li>– <b>Compatible with most vessel types/sizes</b></li><li>– Simply attach to the glass wall or a glass window</li></ul>	<ul style="list-style-type: none"><li>– Can often only be used <b>for one vessel size</b> (limited by probe length)</li></ul>
OD Range	<ul style="list-style-type: none"><li>– Standard Mode (521 nm): OD 0.5-50*</li><li>– High Cell Density Mode (940 nm): OD 15-300*</li></ul>	<ul style="list-style-type: none"><li>– Usually <b>limited to a specific OD range, various probes needed for different biomass ranges</b></li></ul>

*\*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

The screenshot displays the DOTS software interface during the 'Basic Settings' step of experiment creation. The interface includes a search bar, a notification bell, and a user profile icon. The main content area is divided into two panels. The left panel, titled 'Basic information', contains options for 'Quick start application templates' (selected) and 'Custom application templates'. It also includes a dropdown menu for 'Biomass monitoring (BioR...)', a checkbox for 'Enable template configuration step', and fields for 'Experiment name \*' (Strain A, 2% maltose), 'Number of objects \*' (1), and 'Project \*' (Prosugar). The right panel, titled 'Strain A, 2% maltose', shows a hierarchical diagram of the experiment setup. It includes 'Biomass monitoring (Bioreactor)' at the top, which is connected to 'Biomass monitoring (BioR)' (Planned) and 'OD600 (Offline)' (Planned). A 'No device connected' warning is present under the BioR component.

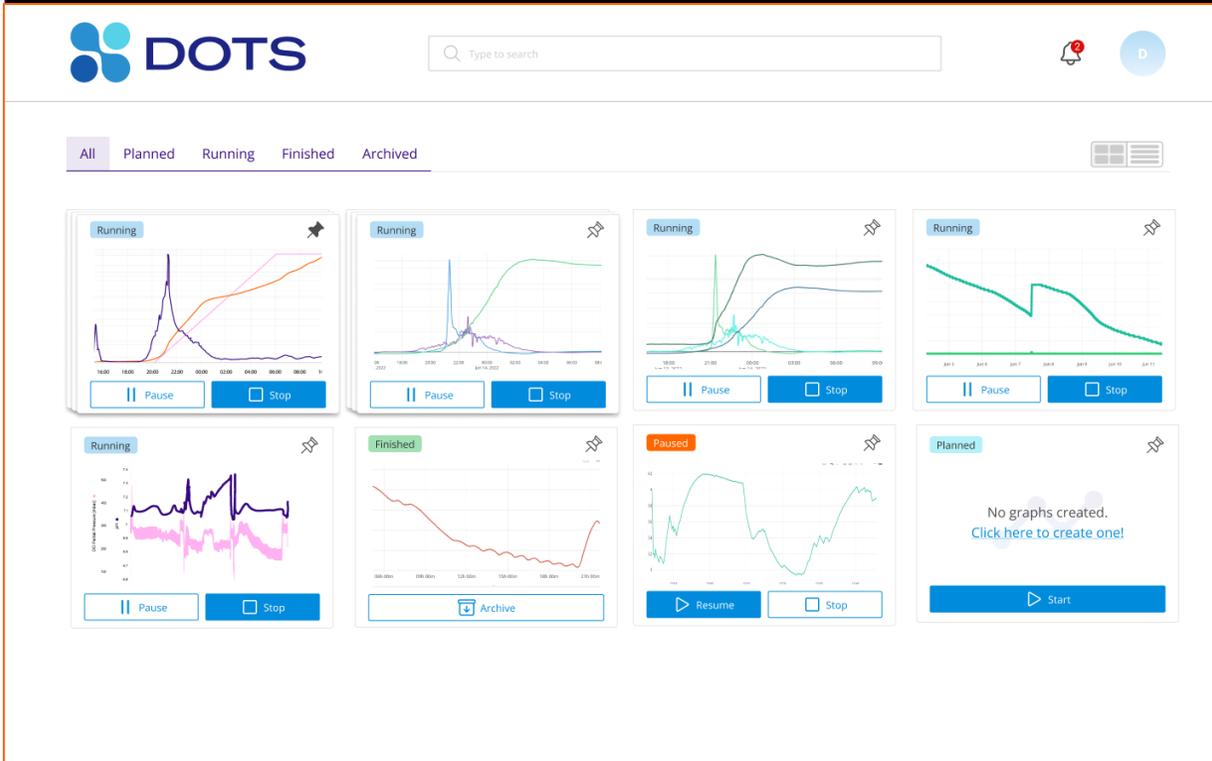
### Assign sensors to planned experiments via drag and drop

The screenshot displays the DOTS software interface during the 'Device Assignment' step of experiment creation. The interface includes a search bar, a notification bell, and a user profile icon. The main content area is divided into two panels. The left panel, titled 'MET25 induction strain A', shows a list of devices available for assignment. The devices are: LIS-0025478 (LIS-LIS0-254869 / 25, 80% battery, Not connected), LIS-00-25478 (Unassigned), and CGQ-SP-02548 (CGQ-8-0025 / Port1, Not connected). A blue callout box highlights the LIS-00-25478 device, with a mouse cursor pointing to it. The right panel, titled 'Biomass-based feeding (Shake flask)', shows a hierarchical diagram of the experiment setup. It includes 'Feeding (LIS)' (Planned) with a 'No device connected' warning, 'Biomass monitoring (CGQ)' (Planned) with a 'No device connected' warning, and 'OD600 (Offline)' (Planned). The 'Create' button is visible at the bottom right.

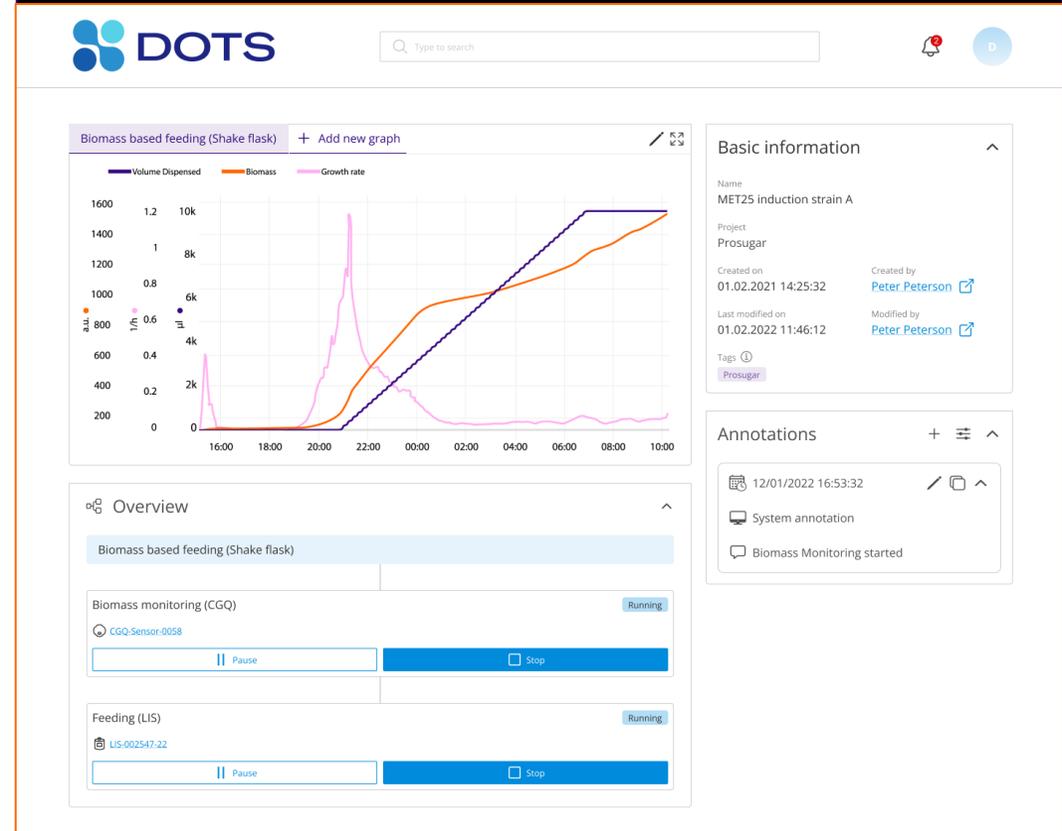
# The DOTS Software provides a comprehensive overview of your experiments and visualizes your data in real-time.

## DOTS Software Modules for Data Visualization

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

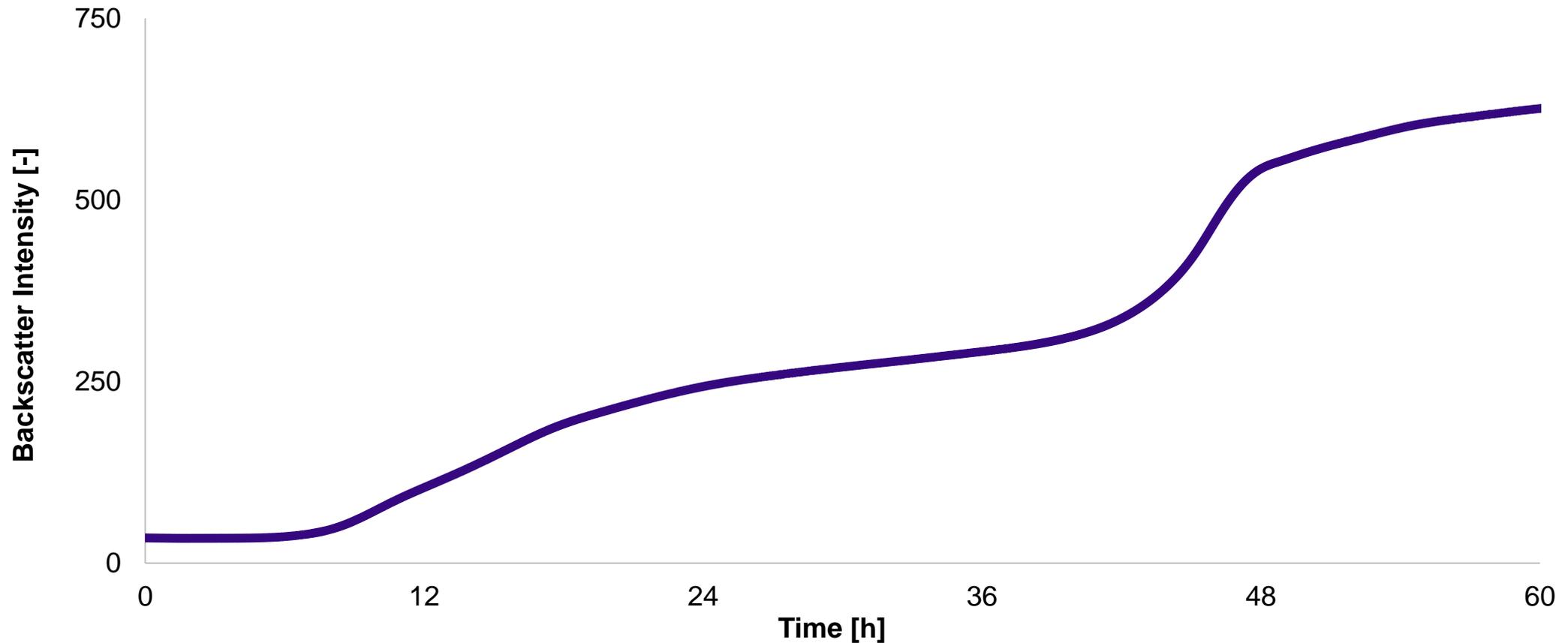


Data visualization tools enable a customized display of data in real-time



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

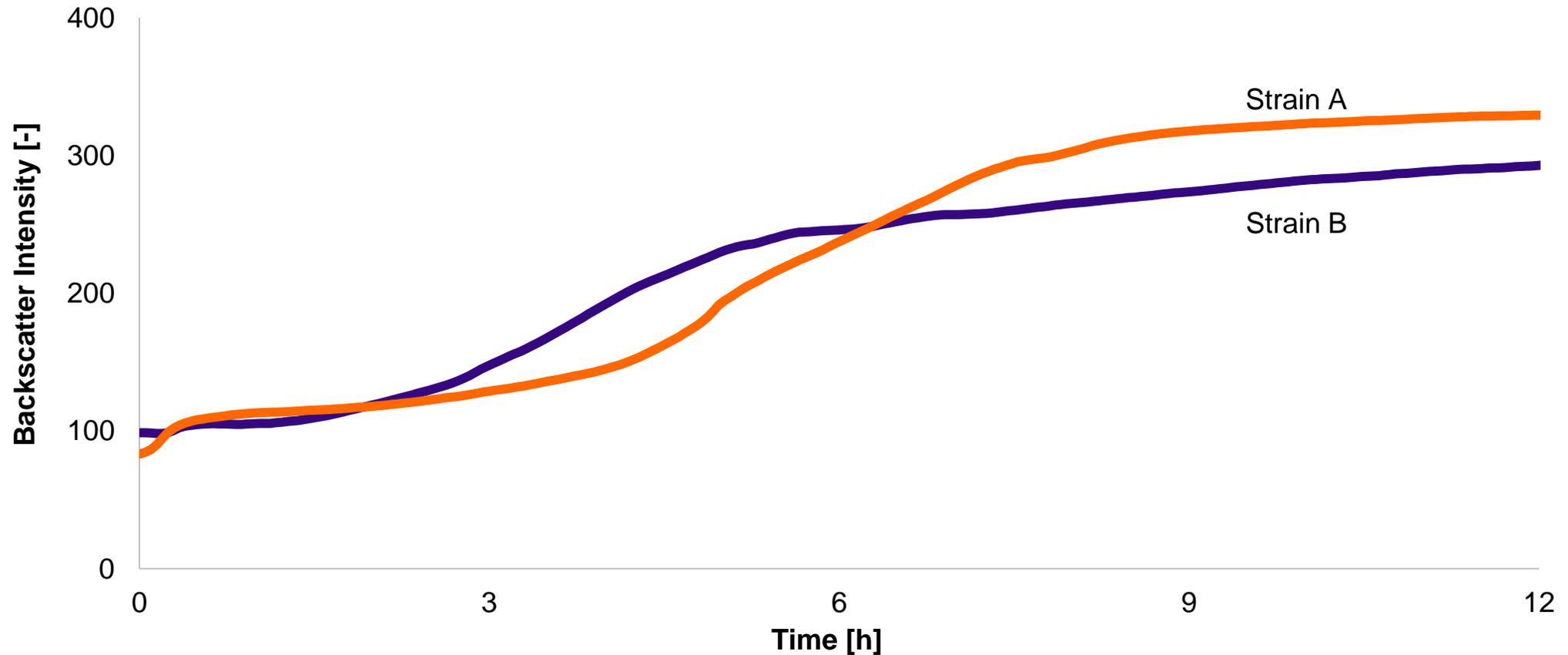
## CGQ BioR Measurement: *Saccharomyces cerevisiae* (Diauxic Growth)



*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.

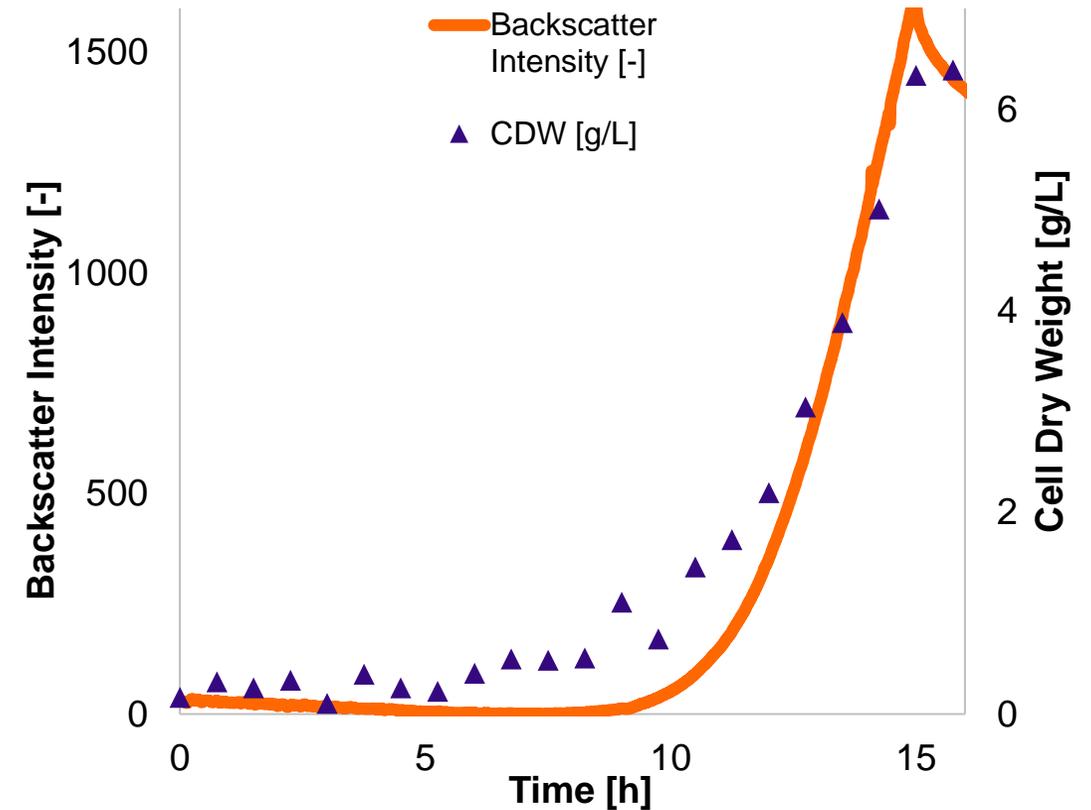
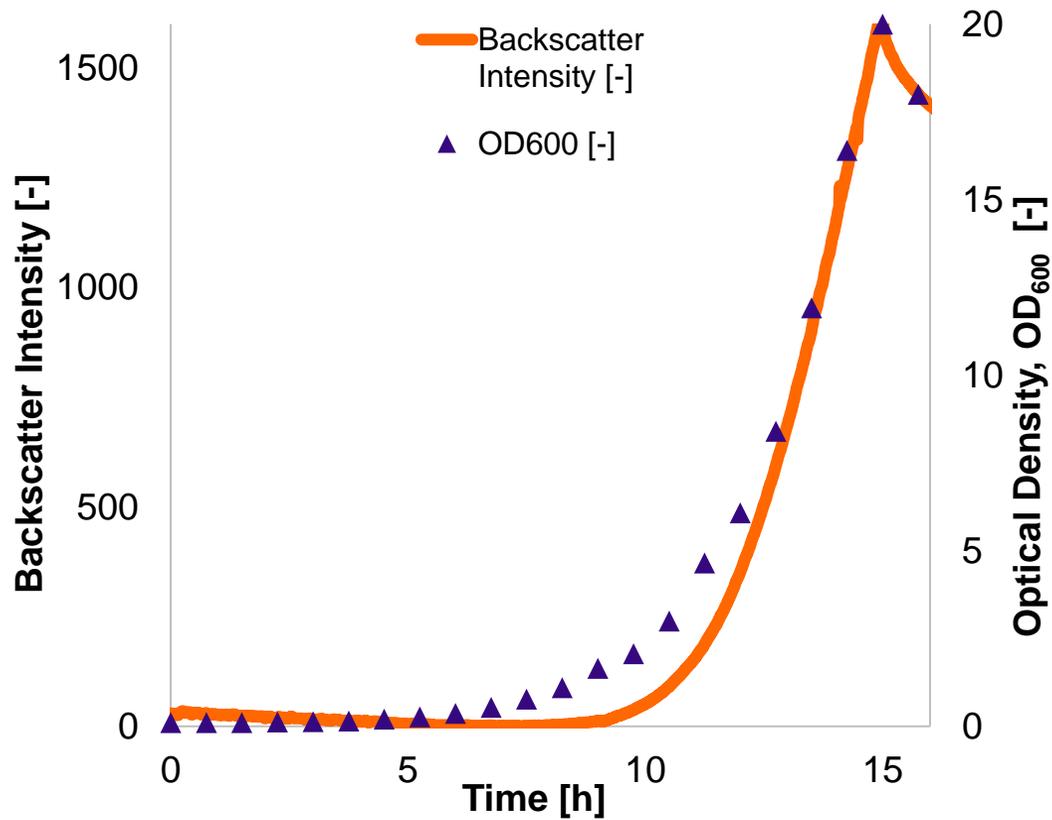
## CGQ BioR Measurement: Different *Escherichia coli* Strains



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

# The CGQ BioR shows good correlation with offline biomass data such as OD<sub>600</sub> and Cell Dry Weight.

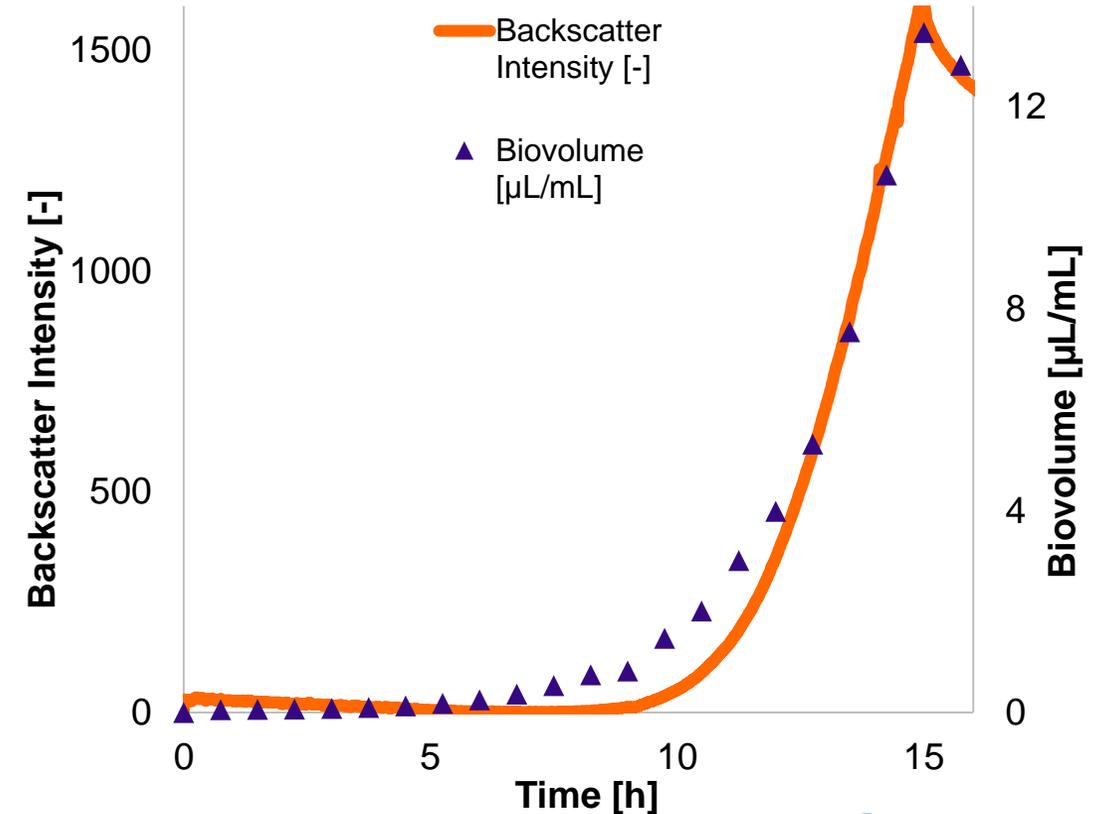
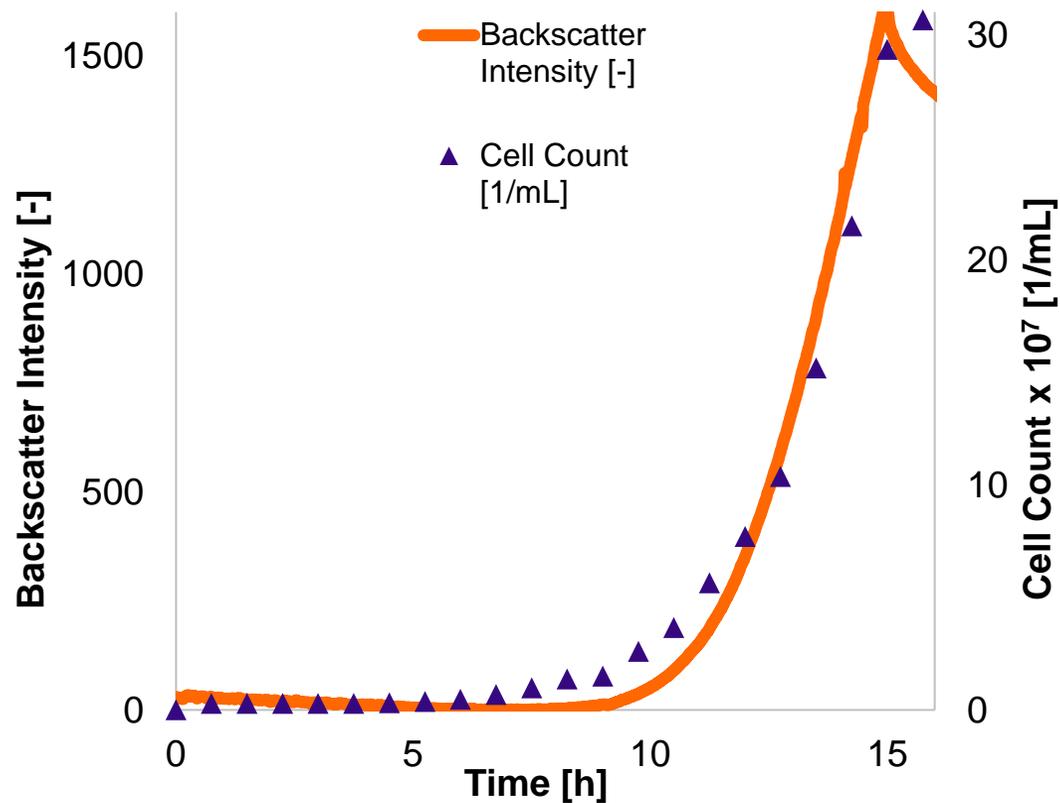
## CGQ BioR & Offline Biomass Measurements (1/2): *Corynebacterium glutamicum*



*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.

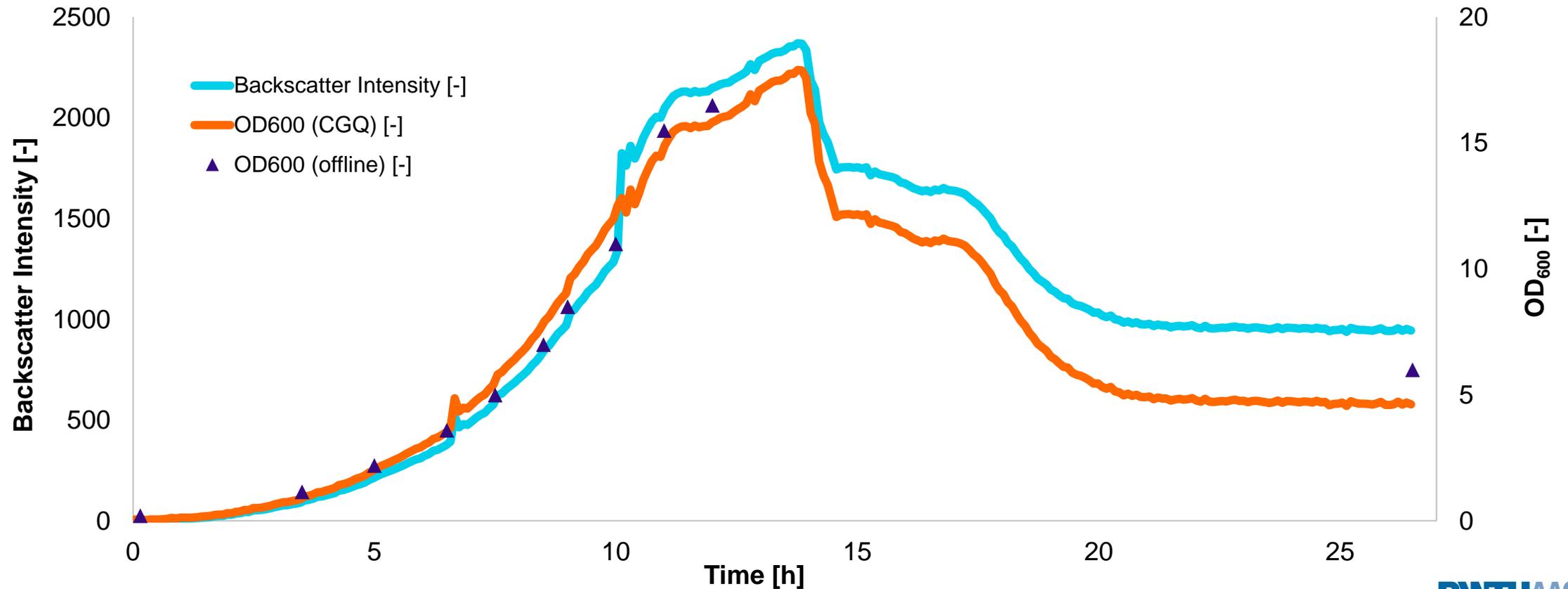
## CGQ BioR & Offline Biomass Measurements (2/2): *Corynebacterium glutamicum*



*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 subtilis*



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

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