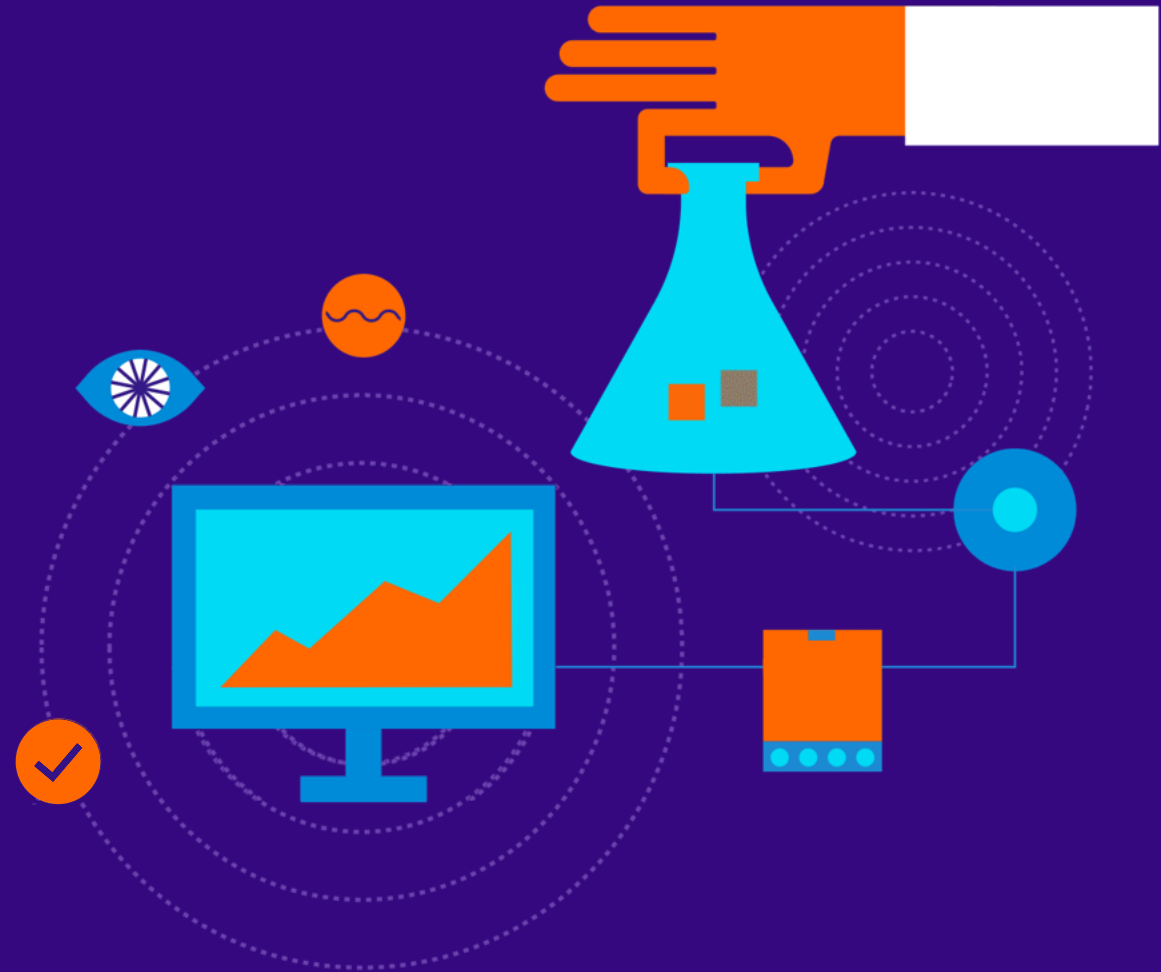


# Cell Growth Quantifier (CGQ) BioR

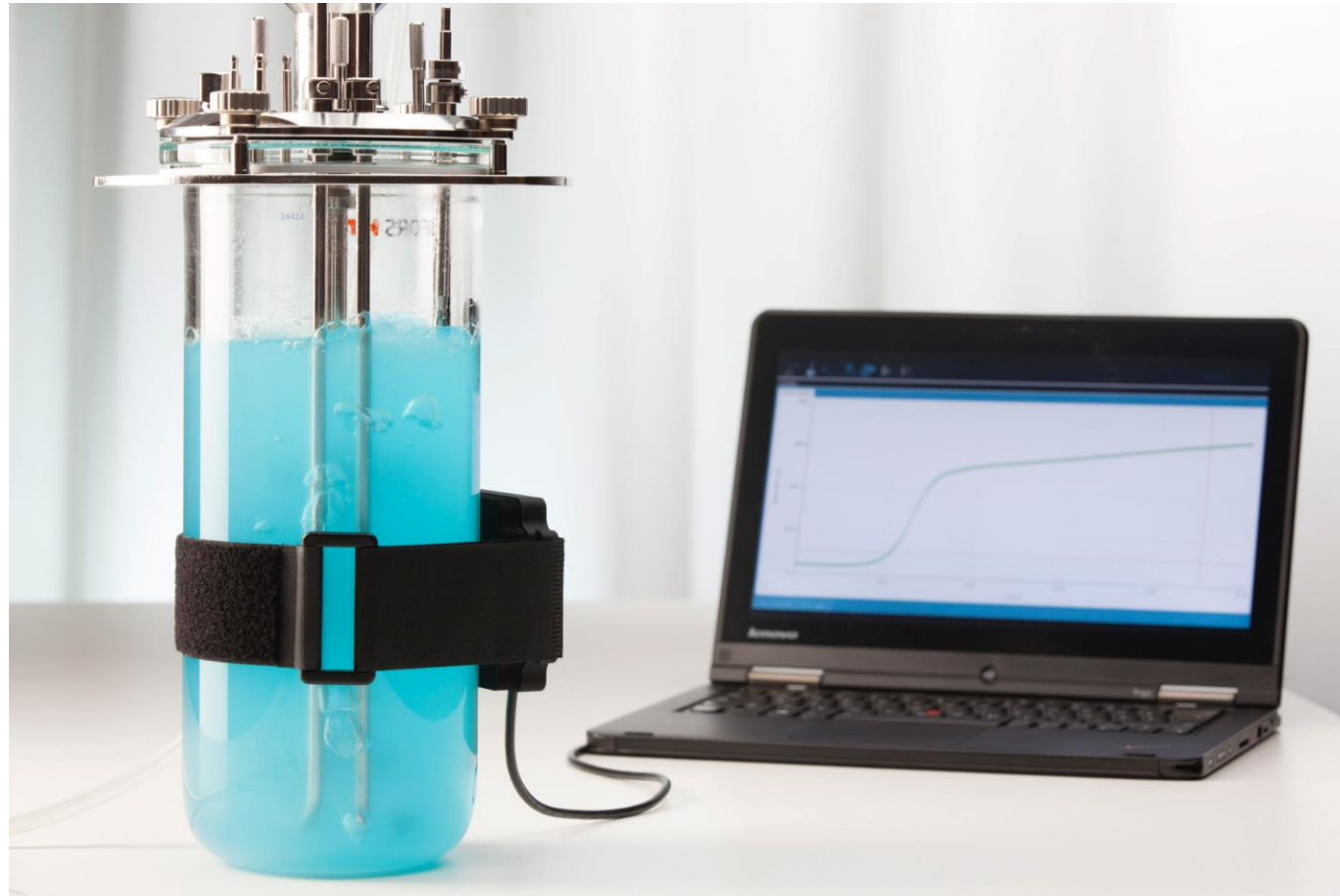
ONLINE BIOMASS MONITORING IN BIOREACTORS



# 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 base station and the CGQuant software.

## Hardware & Software Components

### CGQ BioR Sensor



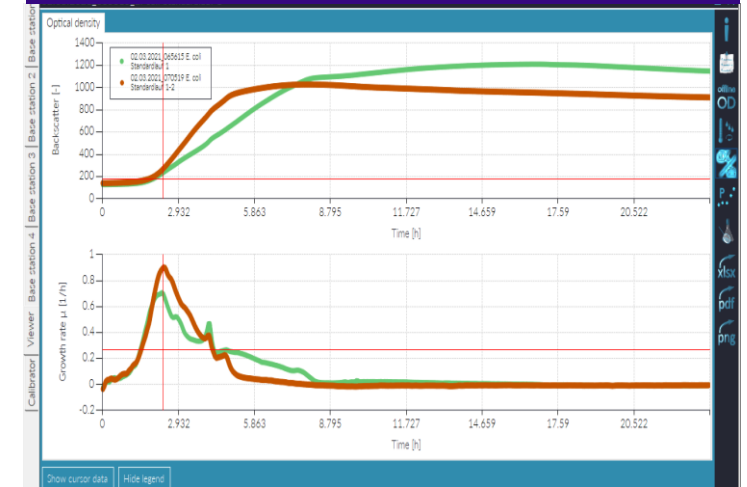
The sensor is positioned to the outside wall of the bioreactor and measures the biomass non-invasively.

### Base Station



The base station bundles the data from all monitored bioreactors and sends it to the CGQuant software.

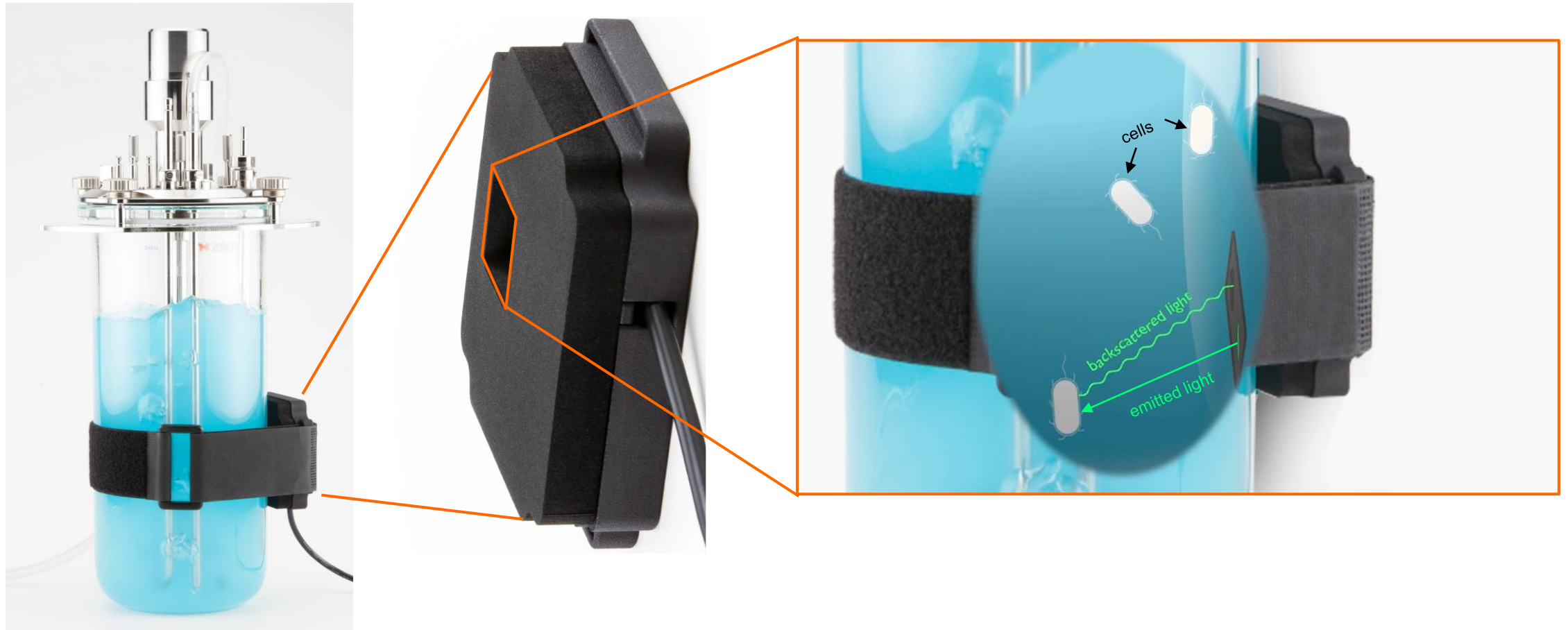
### CGQuant Software



CGQuant analyzes and visualizes the biomass signal from all monitored bioreactors and can be used for advanced data analytics.

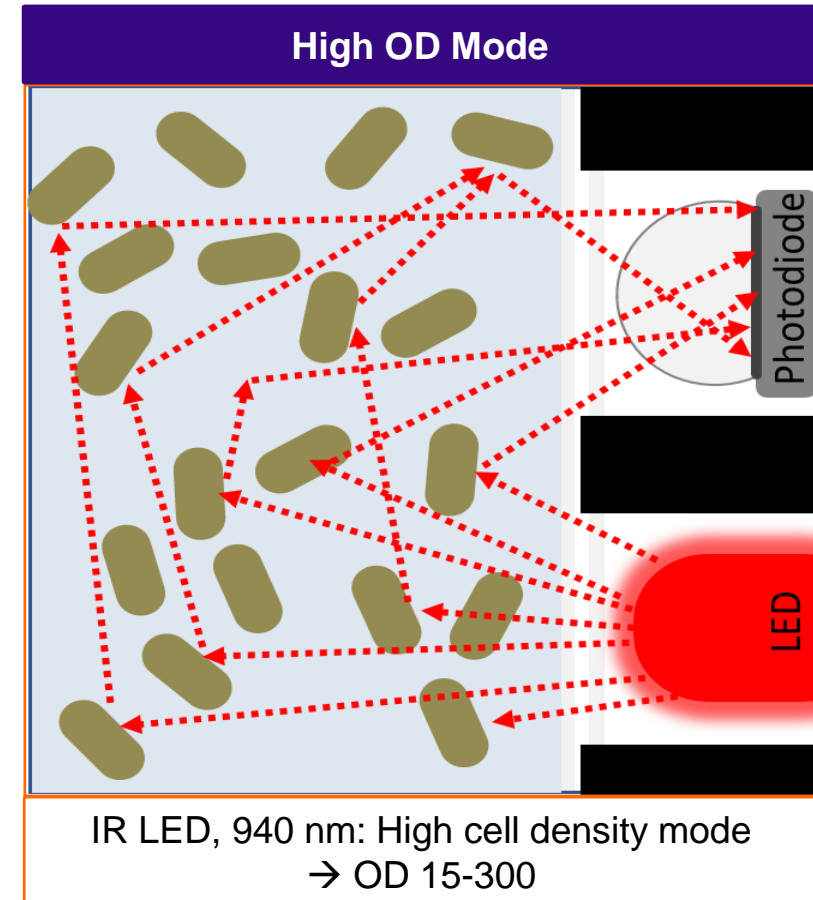
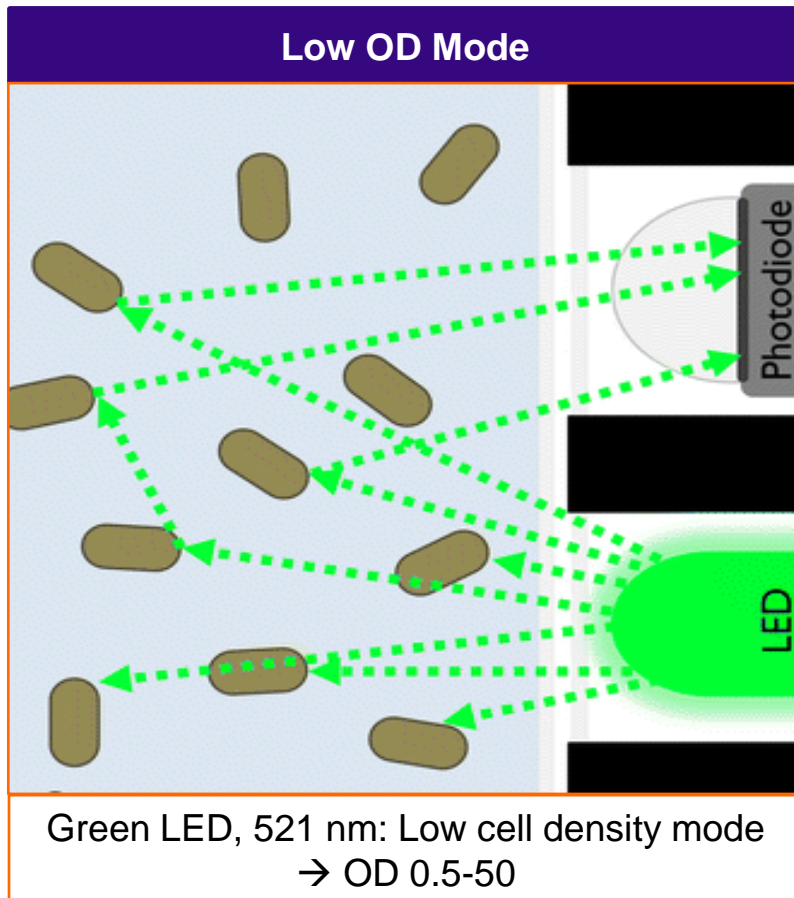
# Backscatter measurements are used to monitor the biomass optically and non-invasively through the wall of the bioreactor.

## Principle of Measurement



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

## Low vs. high OD Measurement Mode



# 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 plug & play 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 software**

*CGQuant software for advanced data analytics*



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

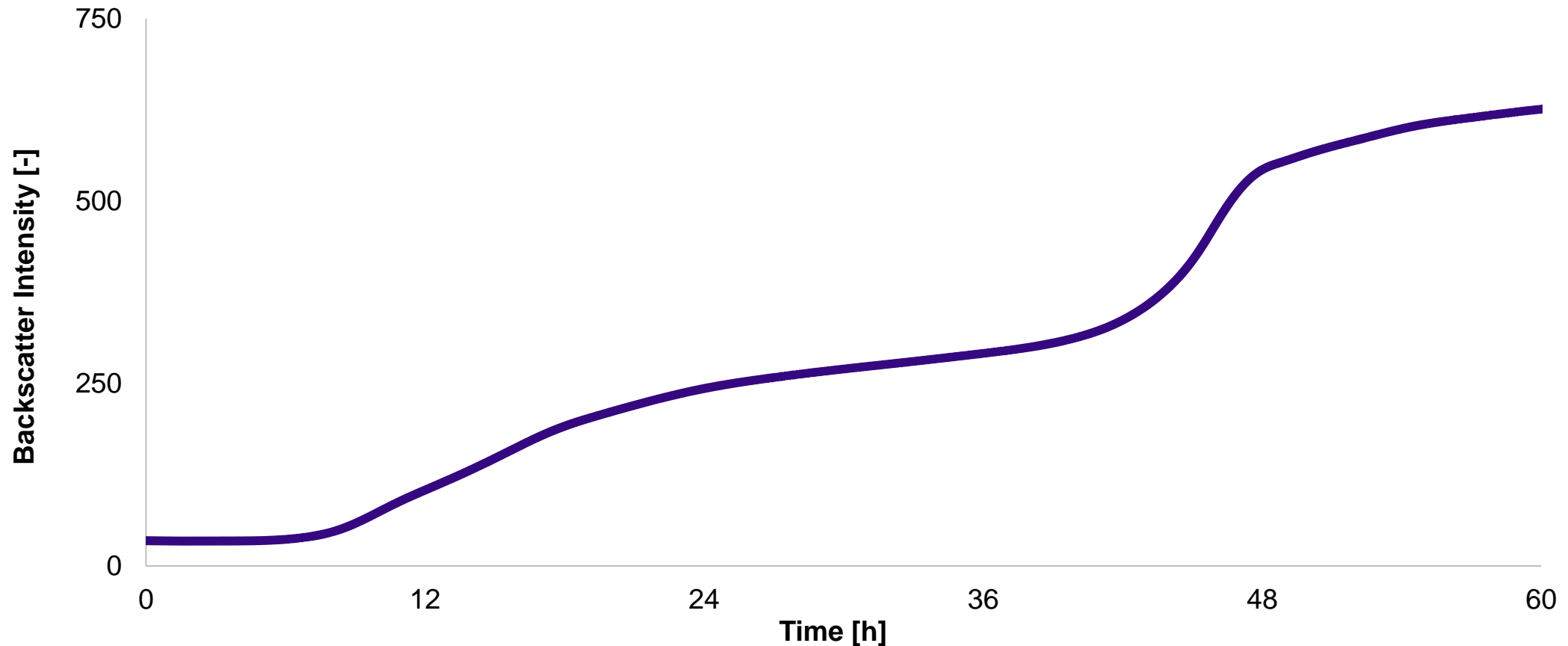
## Comparison: CGQ BioR vs. Invasive Biomass Probes

	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>plug and play</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</b>, <b>various probes needed for different biomass ranges</b></li></ul>

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

# 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)

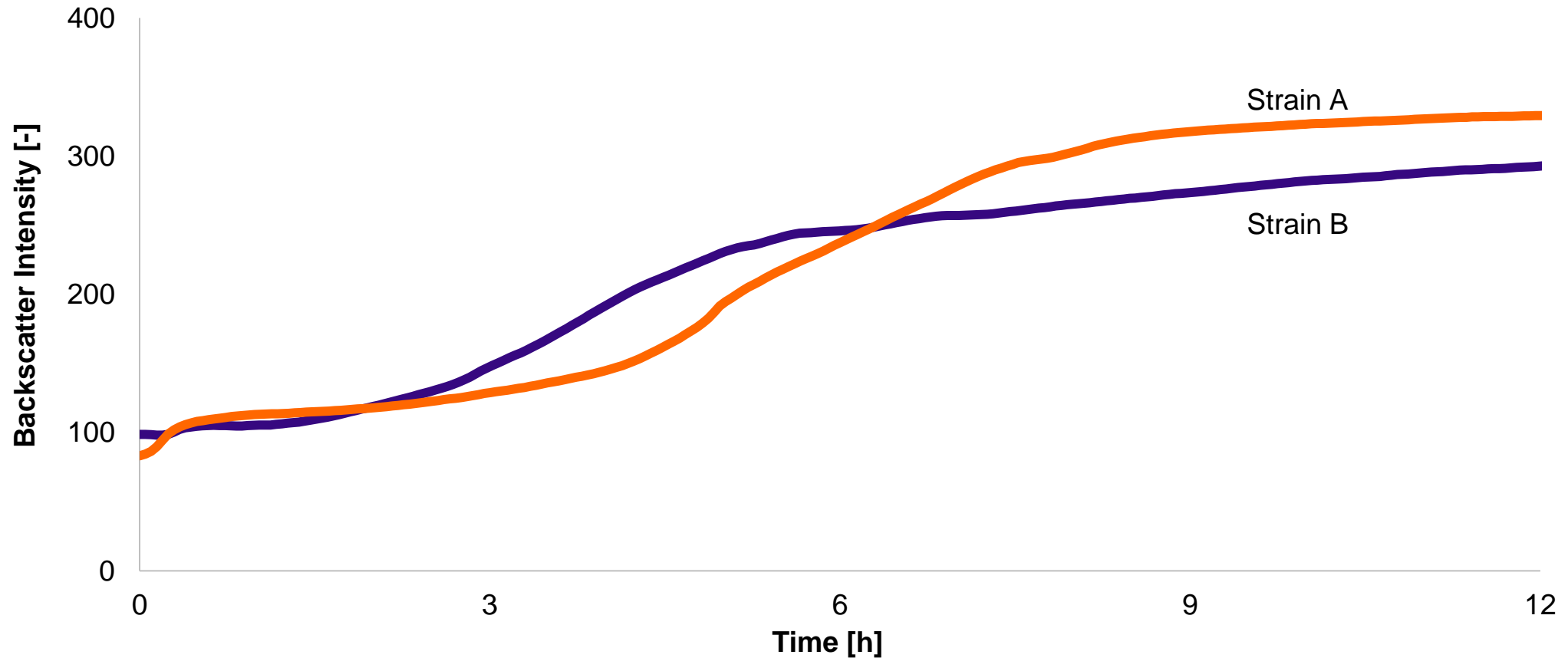


*Saccharomyces cerevisiae*, YPD Media, Applikon Glass Bioreactor (7.5 L), Room Temperature



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

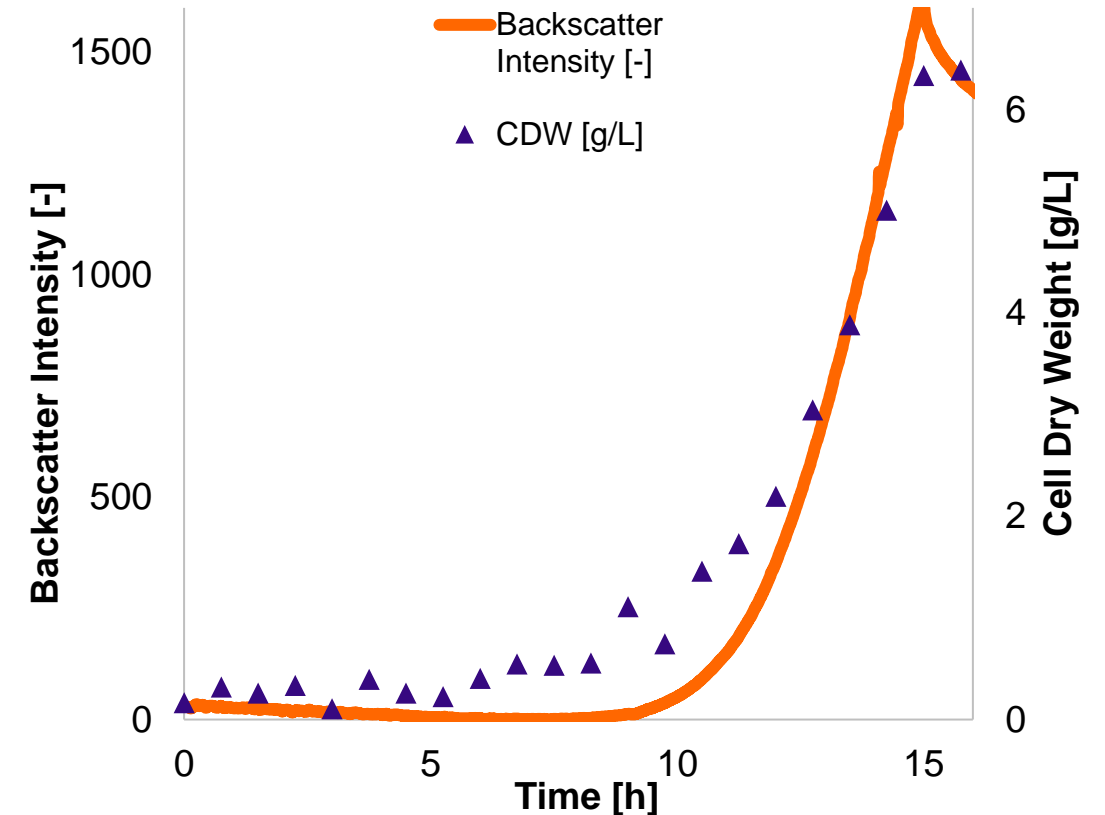
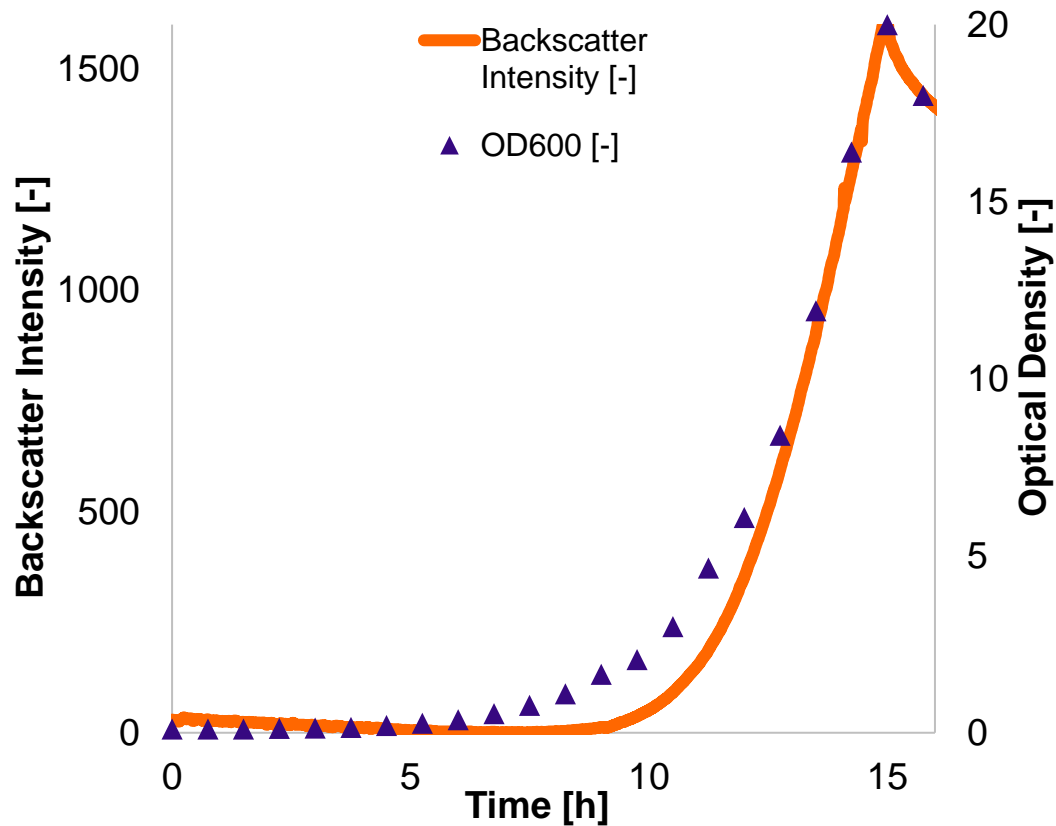
## CGQ BioR Measurement: Different *Escherichia coli* Strains



*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.

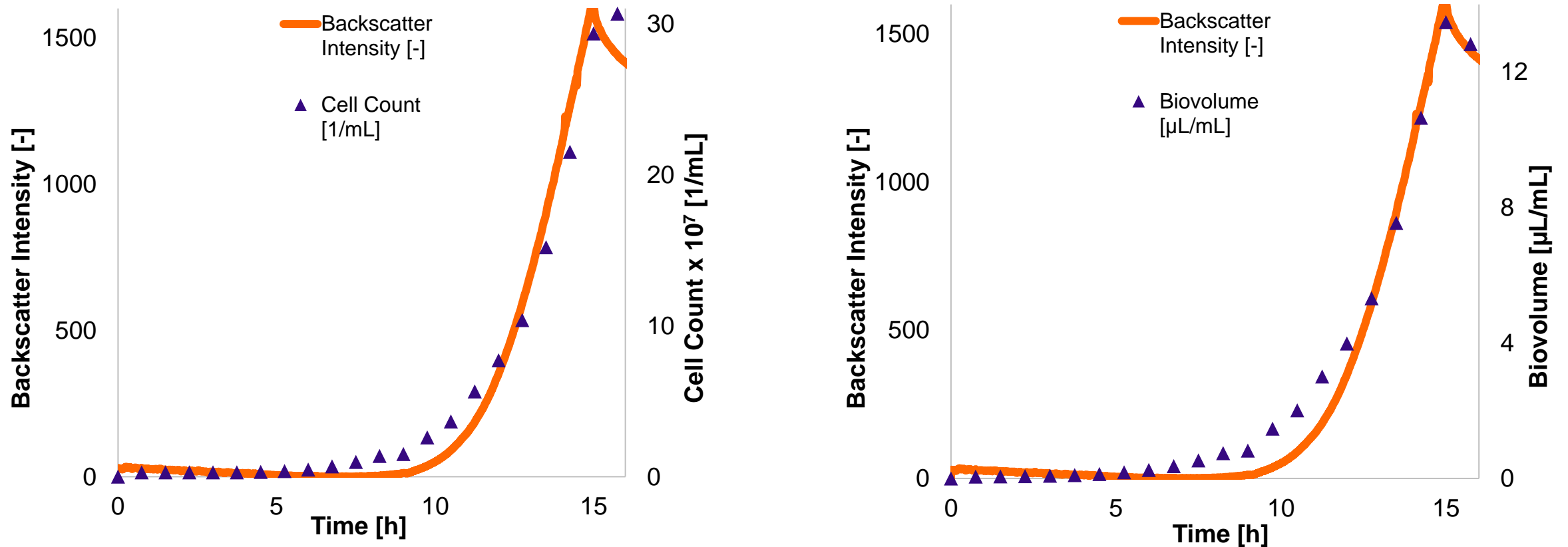
## CGQ BioR & Offline Biomass Measurements (1/2): *Corynebacterium glutamicum*



*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.

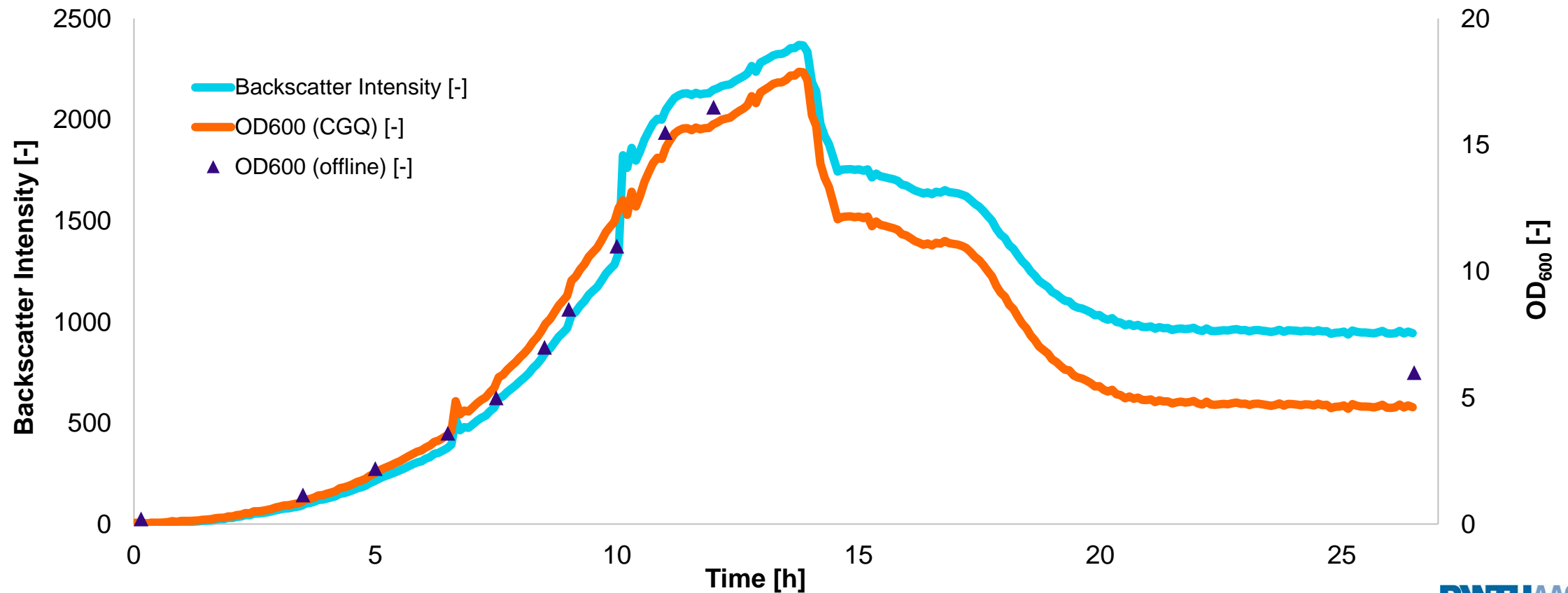
## CGQ BioR & Offline Biomass Measurements (2/2): *Corynebacterium glutamicum*



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

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

## CGQ BioR and Offline OD Measurements: *Bacillus subtilis*



*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 OD750 or cell dry weight, (...)*. Thus, we don't face the omnipotent risk of contamination anymore.

Prof. Dr. Ilka Maria Axmann



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



"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



" (...) 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



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