



# Dissolved Oxygen (DO) Sensor Pills

**DISSOLVED OXYGEN MONITORING IN SHAKE FLASKS**

# The Dissolved Oxygen (DO) Sensor Pill is the first pill-based optical sensor for online DO monitoring in shake flasks.

## DO Sensor Pills



# The DO Sensor Pill is part of the DOTS Platform and works in tandem with the Multiparameter Sensor and the DOTS Software.

## Hardware & Software Components

### DO Sensor Pill



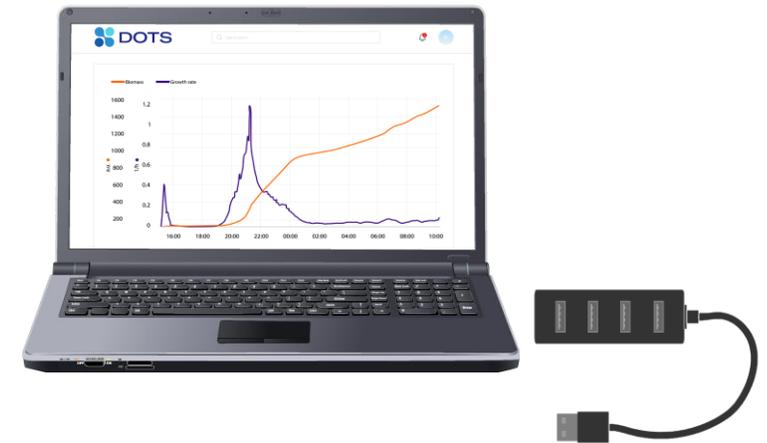
The single-use, factory-calibrated pill is simply dropped into the shake flask culture. Circulating with the medium, it measures dissolved oxygen continuously.

### Multiparameter Sensor & Adapter



The MPS is positioned in the adapter, underneath the shake flask and optically reads out the DO signal, transmitted by the DO Sensor Pill.

### DOTS Software and USB Hub



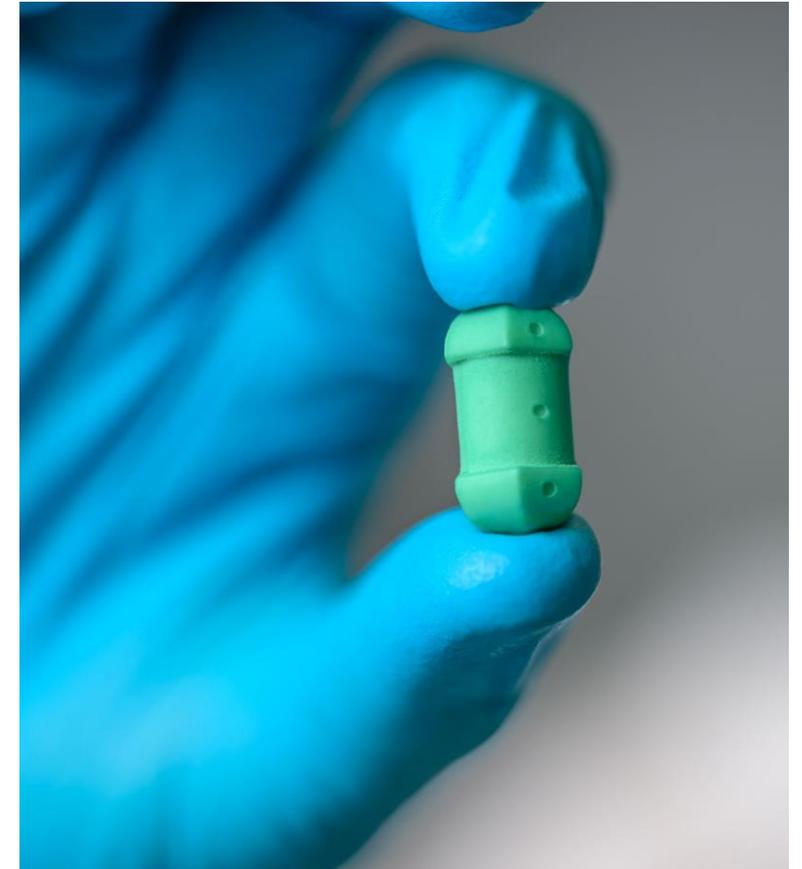
The data from multiple MPS is bundled with the USB Hub and forwarded to the DOTS Software which visualizes the DO data in real-time.

# The DO Sensor Pills are single-use and come pre-sterilized and factory-calibrated. They were designed for easy handling.

## DO Sensor Pills Key Facts

### Key Facts

- Sensor Pills are **injection-molded polyamid cores, coated with a luminescent dye** that is sensitive to the specific analyte (here: DO).
- End caps are designed to **optimize pill orbit** under recommended shaking conditions.
- End caps contain **luminescent markers that enable pill identification** and thus allow for parallel readout of different pill types in the same shake flask.
- Pills are a **single-use product and come pre-sterilized**. Re-sterilization is not recommended, as it may negatively influence data accuracy.
- Pills are **factory-calibrated and come with a calibration code** that should be input in the DOTS Software for experiments.



# Drop & Go: The single-use DO pills are simply dropped into the culture and circulate with the medium.

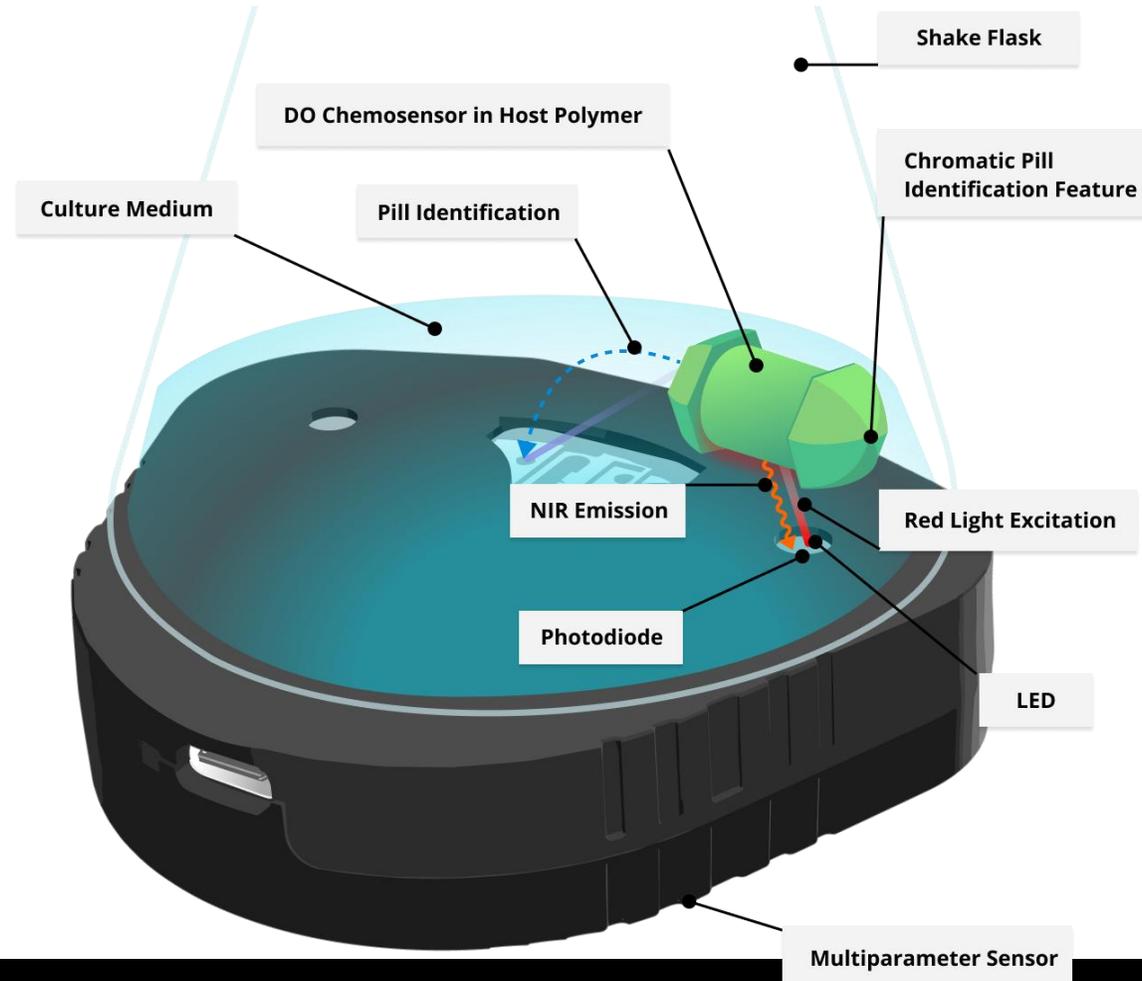
## DO Sensor Pills

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# The Multiparameter Sensor (MPS) contains an LED that reads out the DO signal emitted by the DO Sensor Pill.

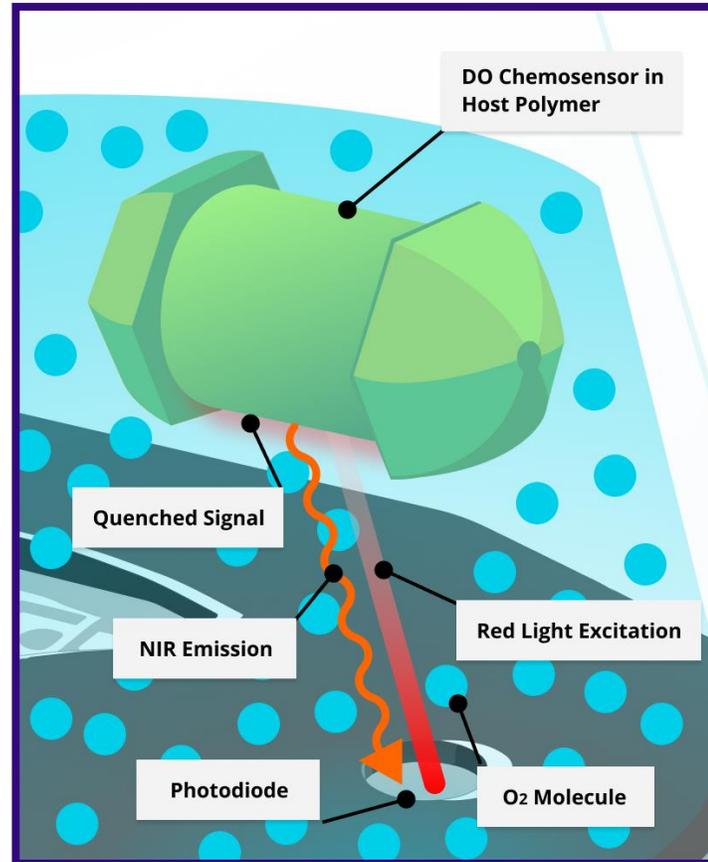
## DO Measurement Principle and Set-up



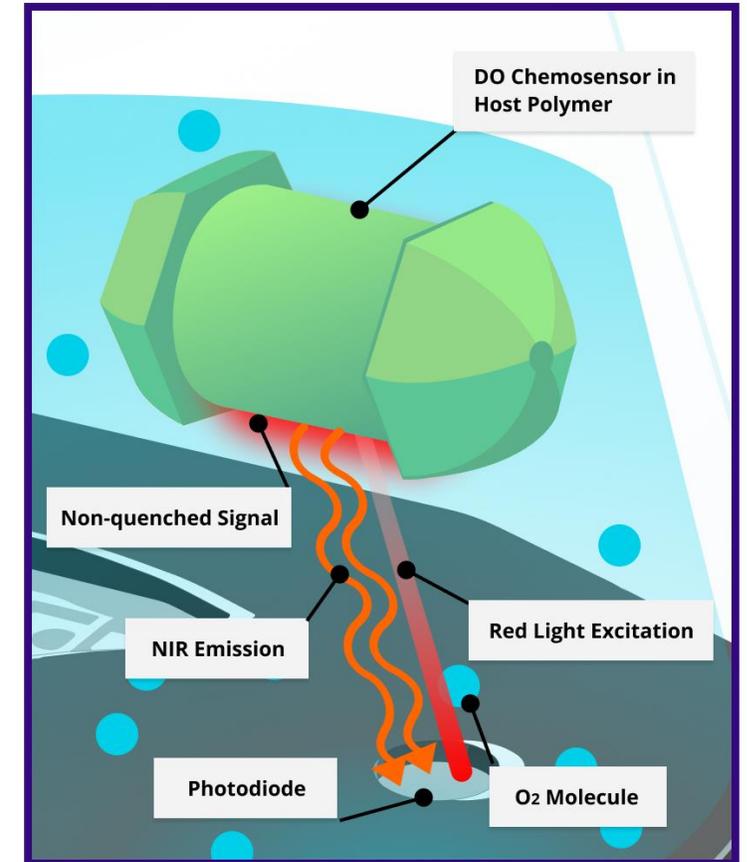
# The DO Sensor Pill is built with an integrated chemosensor, containing a luminescent dye indicator suitable for dissolved oxygen (DO) sensing.

## DO Measurement Principle

The indicator is excitable with red light (at a wavelength of 610-630 nm) and shows luminescence in the near-infrared (NIR) region (760-790 nm). Depending on the level of oxygen present in the solution, the amount of luminescence changes.



High Oxygen



Low Oxygen

# sbi's MPS enables monitoring of various parameters like dissolved oxygen, backscatter (biomass), and fluorescence in shake flasks.

## The Multiparameter Sensor (MPS)

### Ambient Sensors

- Temperature
- Shaking speed
- Humidity
- Pressure

### Sensor Pill Read Out

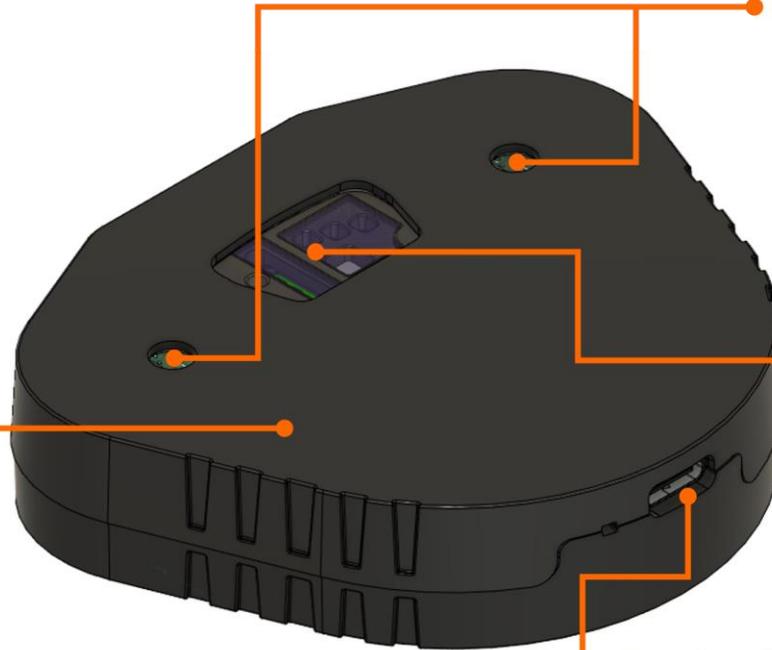
- DO
- pH (*future edition*)

### Optical Read Out

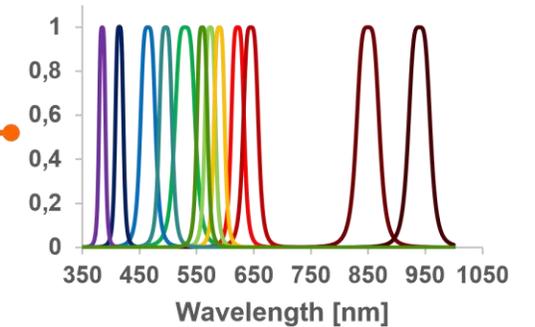
- Backscatter
- Fluorescence
- Marker detection

### USB-C Port

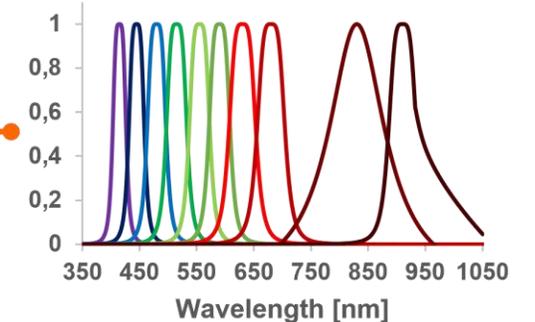
- USB Connection
- Charging
- External Interfaces



### Excitation Spectra



### Detection Spectra



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

## Exemplary Screenshots

### Create an experiment with pre-defined application templates

The screenshot shows 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-based feeding (S...)', a checkbox for 'Enable template configuration step', and input fields for 'Experiment name \*' (MET25 induction strain A), 'Number of objects \*' (1), and 'Project \*' (Prosugar). The right panel, titled 'MET25 induction strain A', displays a hierarchical task diagram with four tasks: 'Biomass-based feeding (Shake flask)', 'Feeding (LIS)', 'Biomass monitoring (CGQ)', and 'OD600 (Offline)'. Each task has a 'Planned' status and a 'No device connected' warning icon.

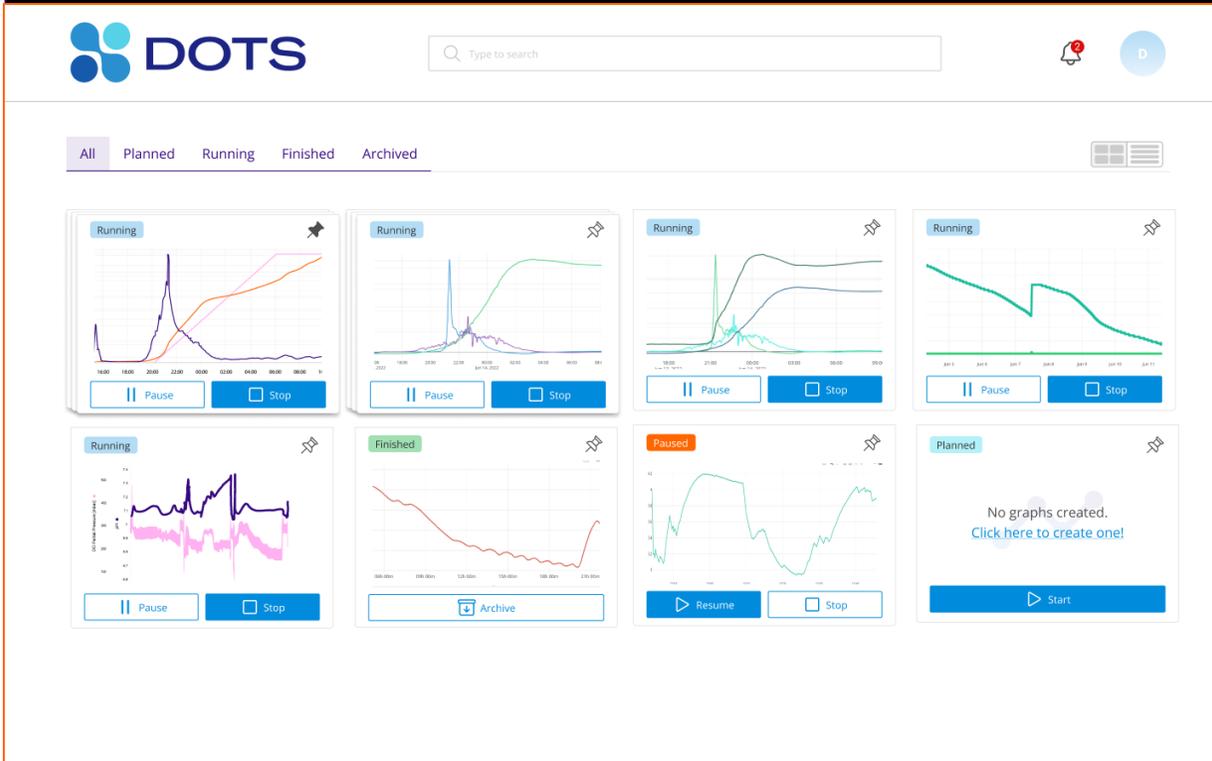
### Assign sensors to planned experiments via drag and drop

The screenshot shows 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', displays a hierarchical task diagram with four tasks: 'Biomass-based feeding (Shake flask)', 'Feeding (LIS)', 'Biomass monitoring (CGQ)', and 'OD600 (Offline)'. Each task has a 'Planned' status and a 'No device connected' warning icon. The right panel, titled 'MET25 induction strain A', displays a list of devices available for assignment. The devices are: 'LIS-0025478' (LIS-LISO-254869 / 25, 80% battery, Not connected), 'LIS-00-25478' (Unassigned), 'CGQ-SP-02548' (CGQ-8-0025 / Port1, Not connected), and 'Free' (Free). A blue callout box highlights the 'LIS-00-25478' device. The bottom right corner of the interface includes an 'Exit wizard' button, a 'Back' button, and a 'Create' button.

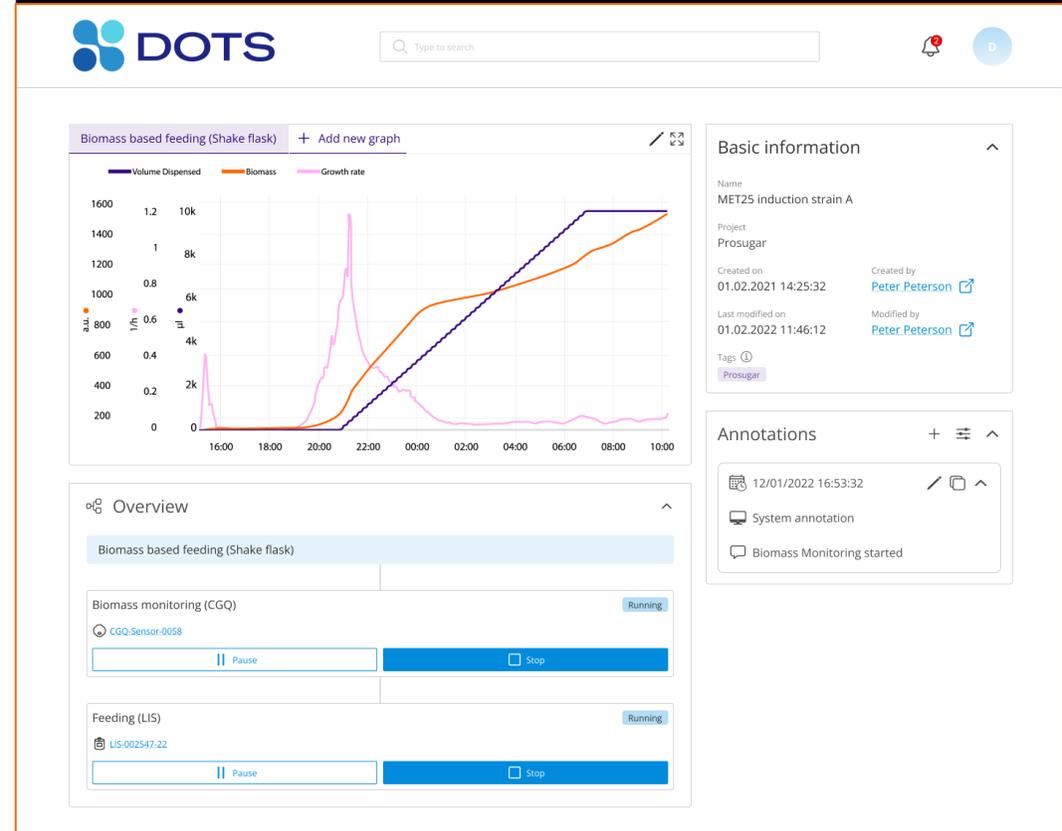
# The DOTS Software provides a comprehensive overview of your experiments and visualizes your data in real-time.

## DOTS Software Modules for Data Visualization

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

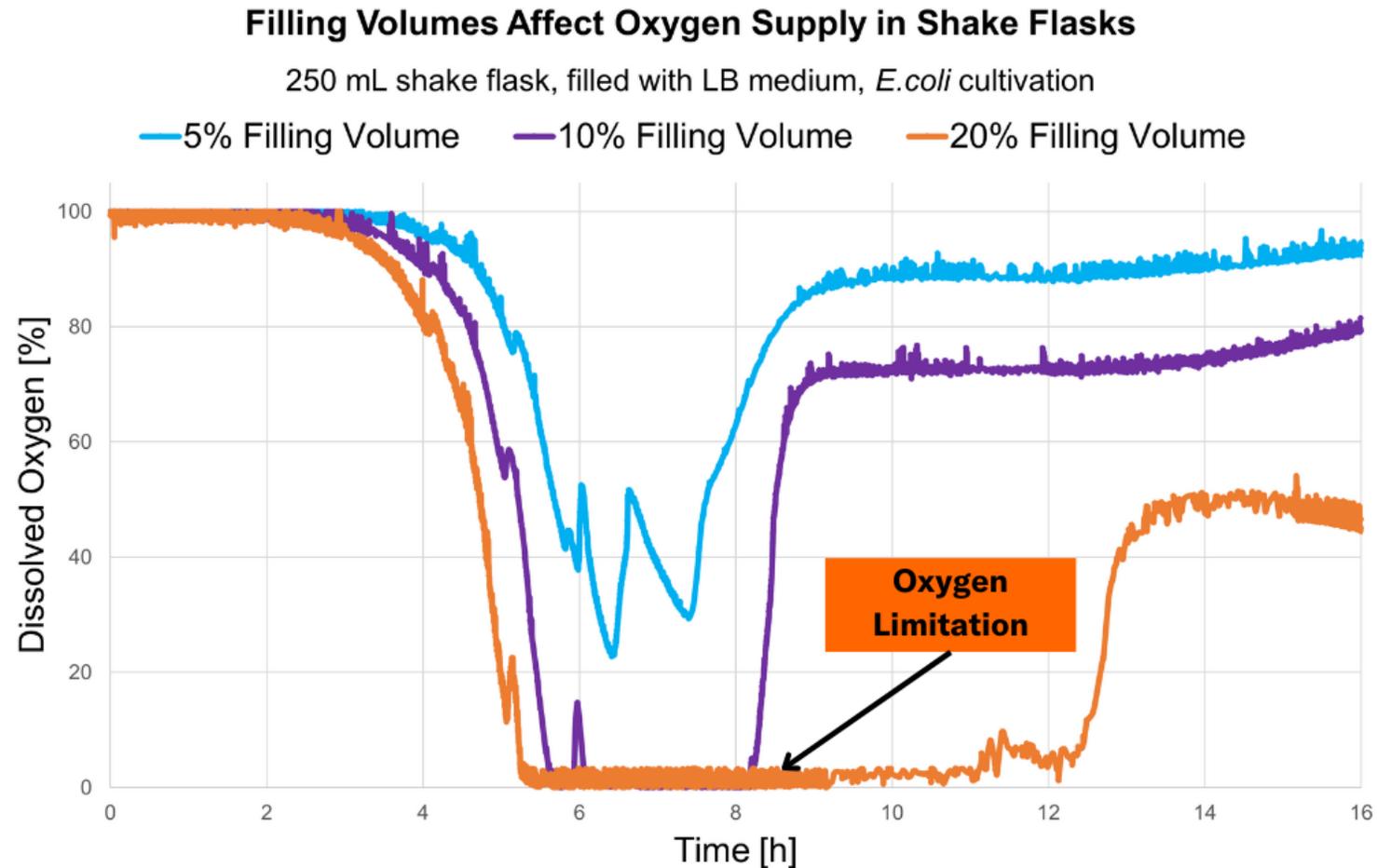


Data visualization tools enable a customized display of data in real-time



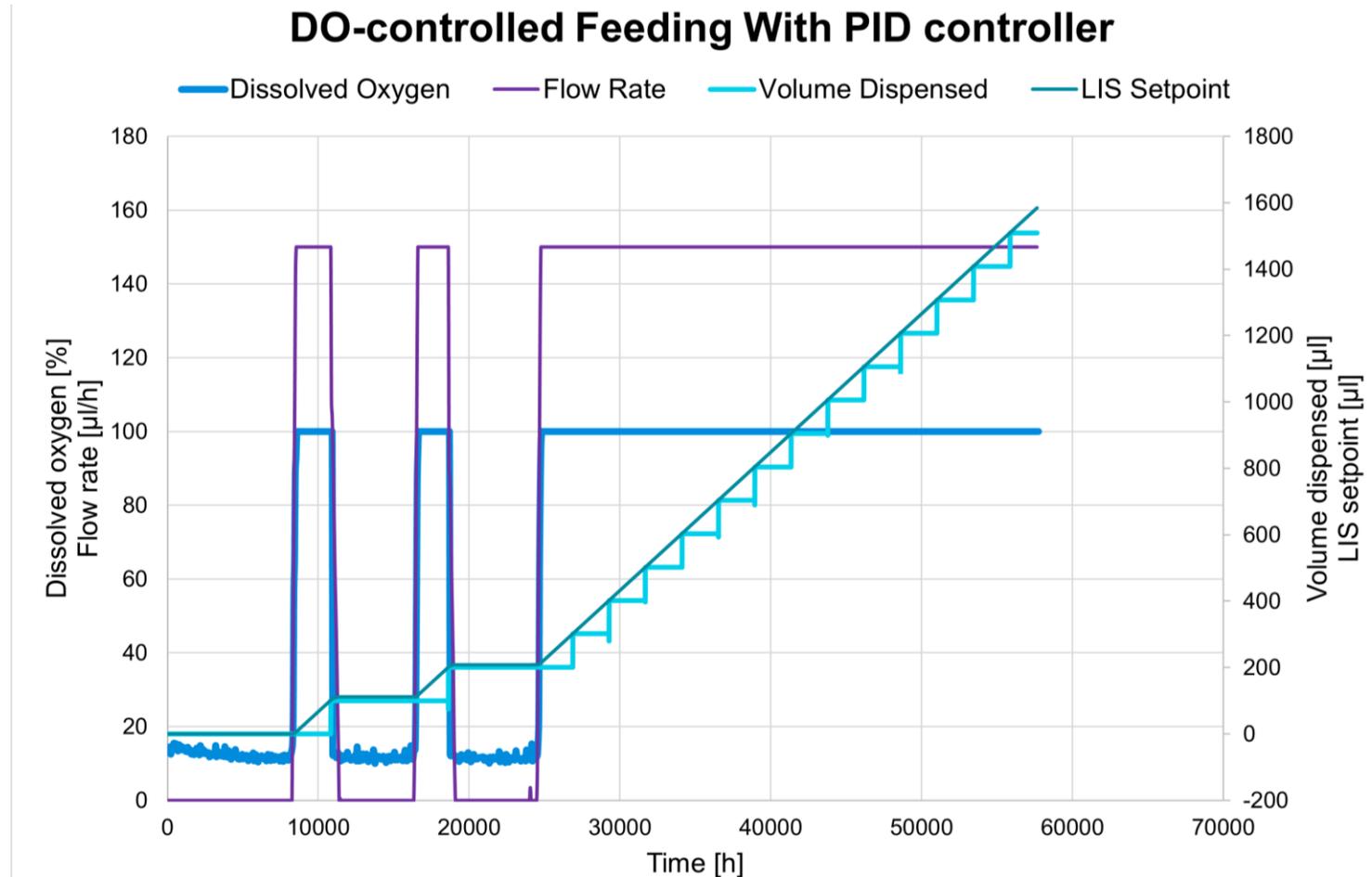
# Exemplary data: Oxygen limitations can be detected with high sensitivity.

## DO Pills Measure Oxygen Availability In *E.coli* Cultivations With Three Different Filling Volumes



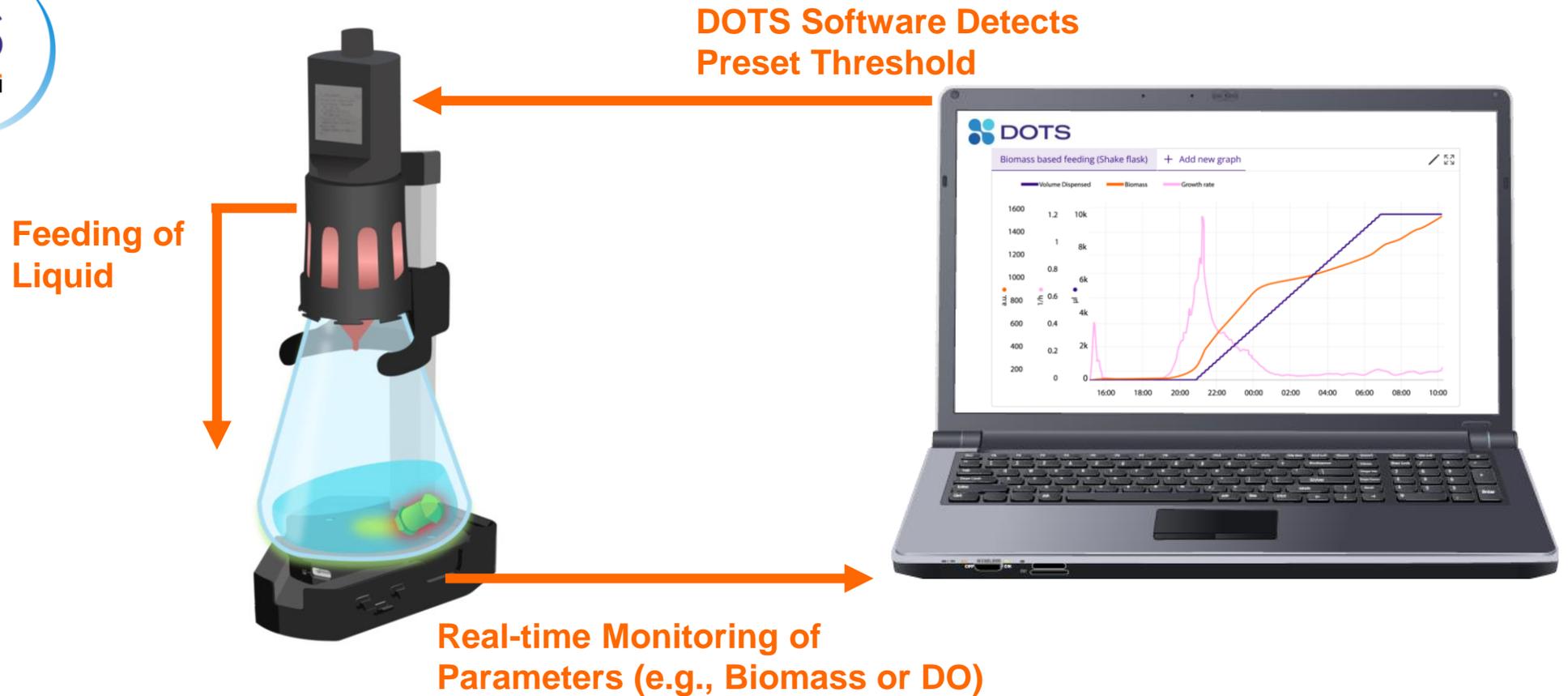
# A DOTS-integrated controller allows for an immediate feeding response for fine-tuned experiment control.

DOTS-adjusted Feeding: The Liquid Injection System (LIS) Starts Feeding at High DO Levels



# The DOTS Platform enables communication between sensors and actuators, realizing advanced bioprocess options.

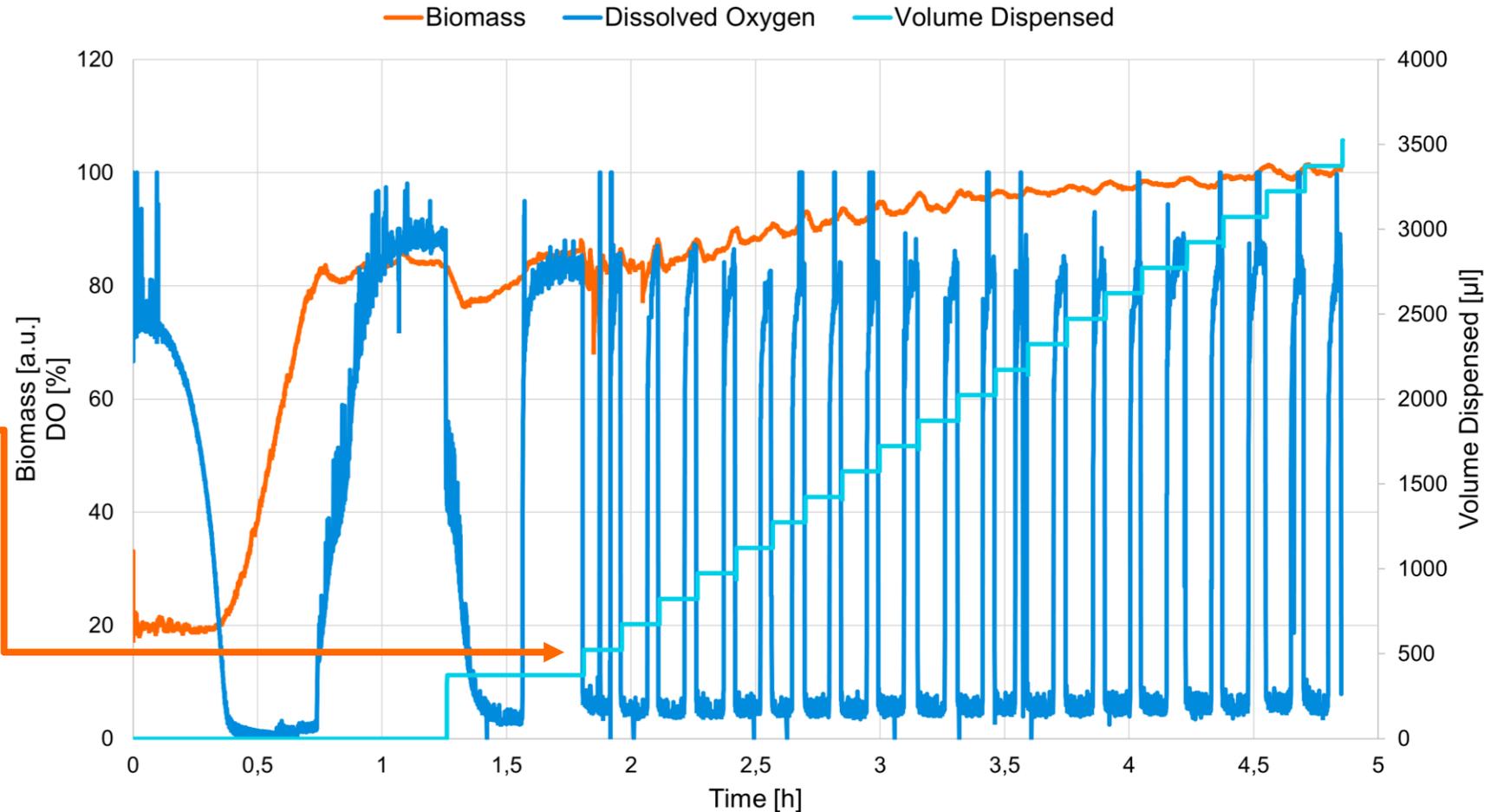
## Parameter-based Feeding With The DOTS Platform



# Exemplary data: Feeding with the Liquid Injection System starts when a preset DO-threshold, measured with DO Sensor Pills, is reached.

## DO-based Methanol Feed to *Pichia pastoris* Cultures to Keep Promotor Activity Constant

- With a DOTS-integrated controller, methanol feed is adjusted
- As soon as the DO of the culture has recovered (>80% DO) the Liquid Injection System (LIS) starts feeding
- This enables ideal cell viability while keeping promotor activity constant



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