

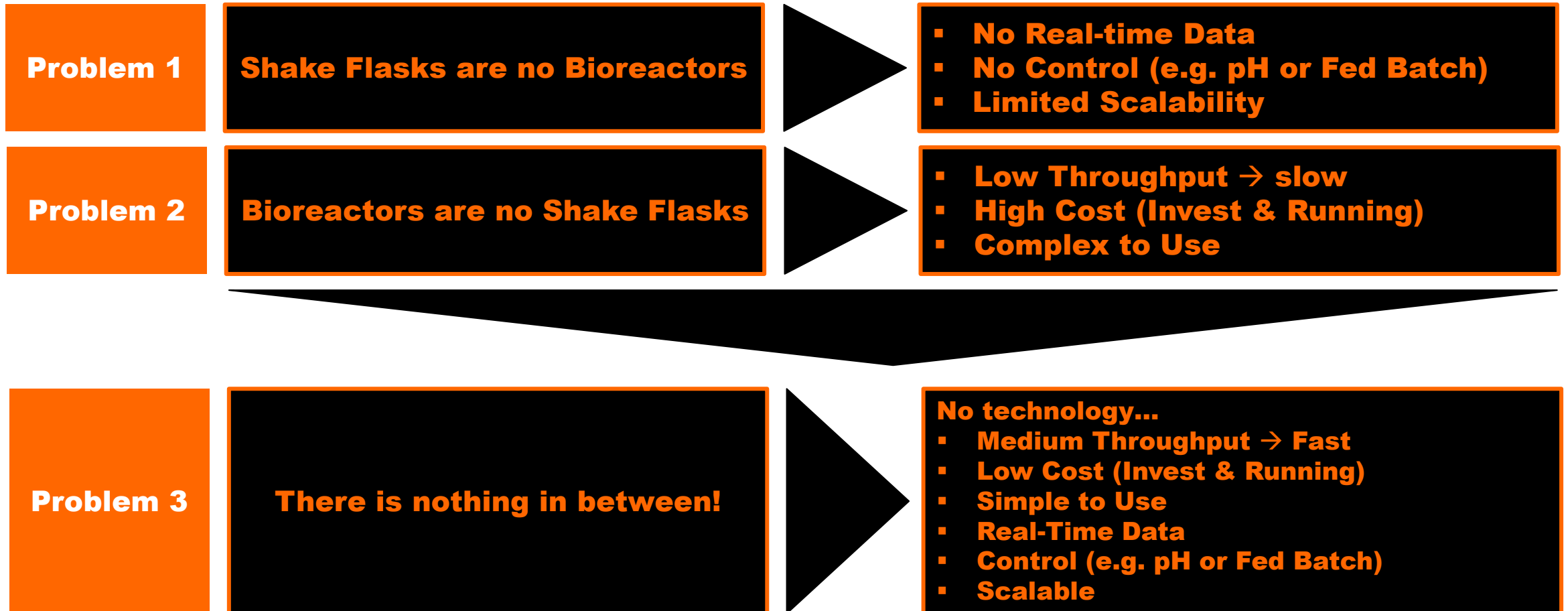


DOTS Platform for Shake Flask

Product Presentation

Scientists are forced to choose between bioreactors or flasks. There is no solution that combines the advantages of both.

What Problems does the DOTS Platform solve?



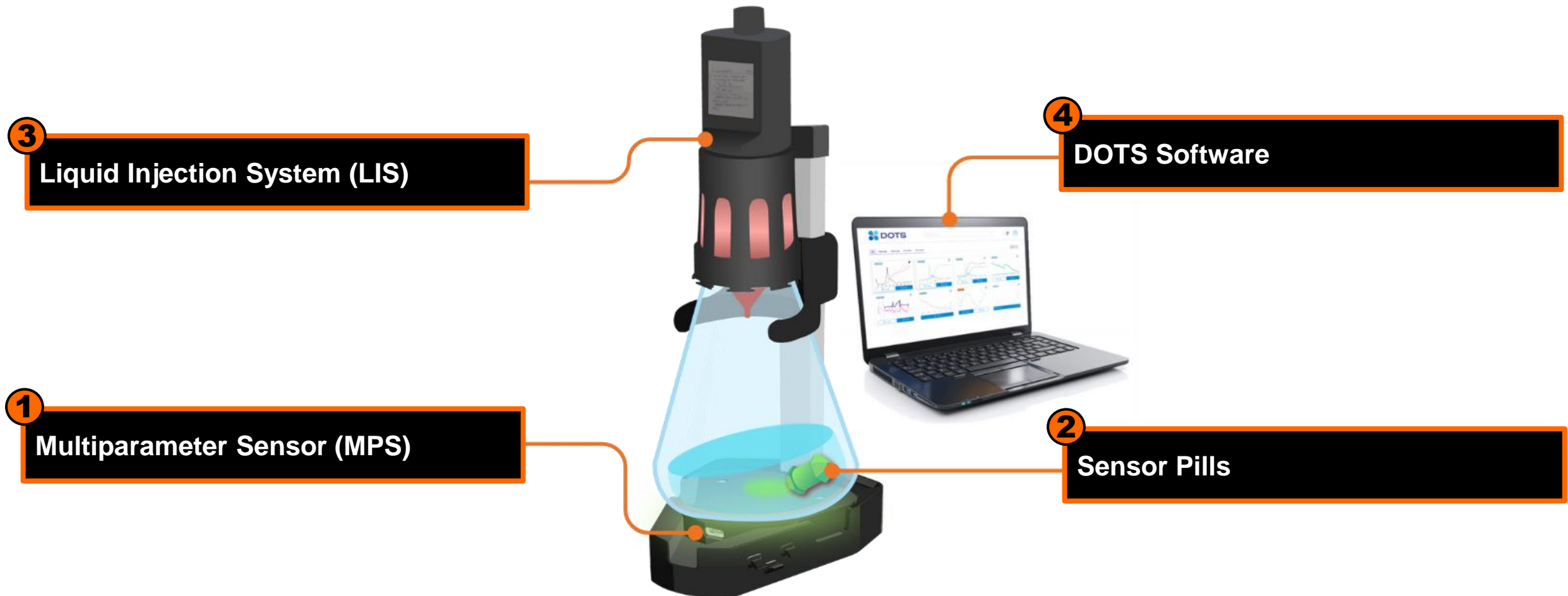
Our **DOTS Shake Flask Platform allows you to run typical bioreactor experiments while offering the advantages of shake flasks.**

The Solution



The DOTS Platform consists of 4 components: LIS, MPS, Sensor Pills & DOTS Software.

DOTS Platform: Components



The **MPS** is an optical sensor technology for the monitoring of multiple parameters in shake flasks.

Multiparameter Sensor (MPS)



1

Multiparameter Sensor (MPS)

What?

- Non-invasive Sensing (Biomass, Fluorescence, Read Out of Sensor Pills)
- Up to 100 Shake Flasks in parallel
- For all Shakers
- Various flask Sizes: 100ml to 2000ml Flasks
- Single Use & Glass Flasks, Serum Bottles
- Microbial (Bacteria, Yeast, Fungi) & Cell Culture (CHO)

How?

- Mount the sensor and holder on your tray
- Put the flask on the sensor
- Set-Up Experiment in Software
- Start monitoring your culture

Sensor Pills are chemosensors, read out optically by the MPS, for e.g. online dissolved oxygen (DO) monitoring in shake flasks.

Dissolved Oxygen (DO) Sensor Pills



2

Sensor Pills

What?

- Chemosensor in Pill Form
- Variety of Parameters (e.g. Dissolved Oxygen)
- Pre-calibrated, Sterile & Single Use
- Various flask Sizes: 100ml to 2000ml Flasks
- Different Flask Types: Single Use and Glass
- Microbial (Bacteria, Yeast, Funghi) & Cell Culture (CHO)

How?

- Drop sensor pill into flask
- Install flask on MPS sensor
- Set-Up Experiment in Software
- Pill swirls around with liquid and is constantly read out by MPS

LIS enables automated liquid feeding into shake flasks for e.g. Fed Batch, Induction or pH control.

Liquid Injection System (LIS)



3

Liquid Injection System (LIS)

What?

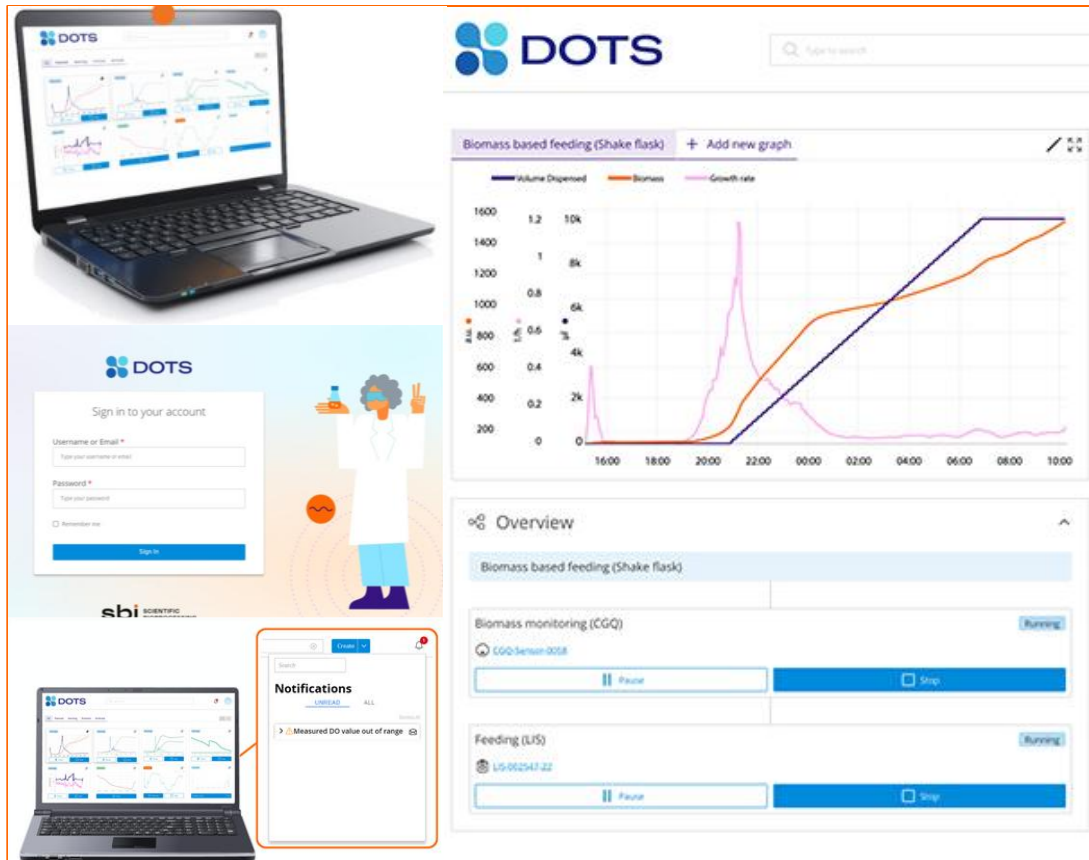
- Automated Feeding (Fed Batch, pH Control, Induction)
- Feedback Control (PID) → e.g. DO-based feeding
- 1 Liquid (25ml)
- Feeding Rate: from 100ul to 1ml/min
- Various Liquids (e.g., methanol, sugars, acids)
- Diverse feeding profiles (e.g. exponential, or constant)

How?

- Fill the sterile cartridge
- Mount on Flask
- Set-Up Experiment in Software
- Start feeding your culture

DOTS Software is your tool control all sensors and actuators and get a real-time actionable insights from your flasks.

DOTS Software



4

DOTS Software

What?

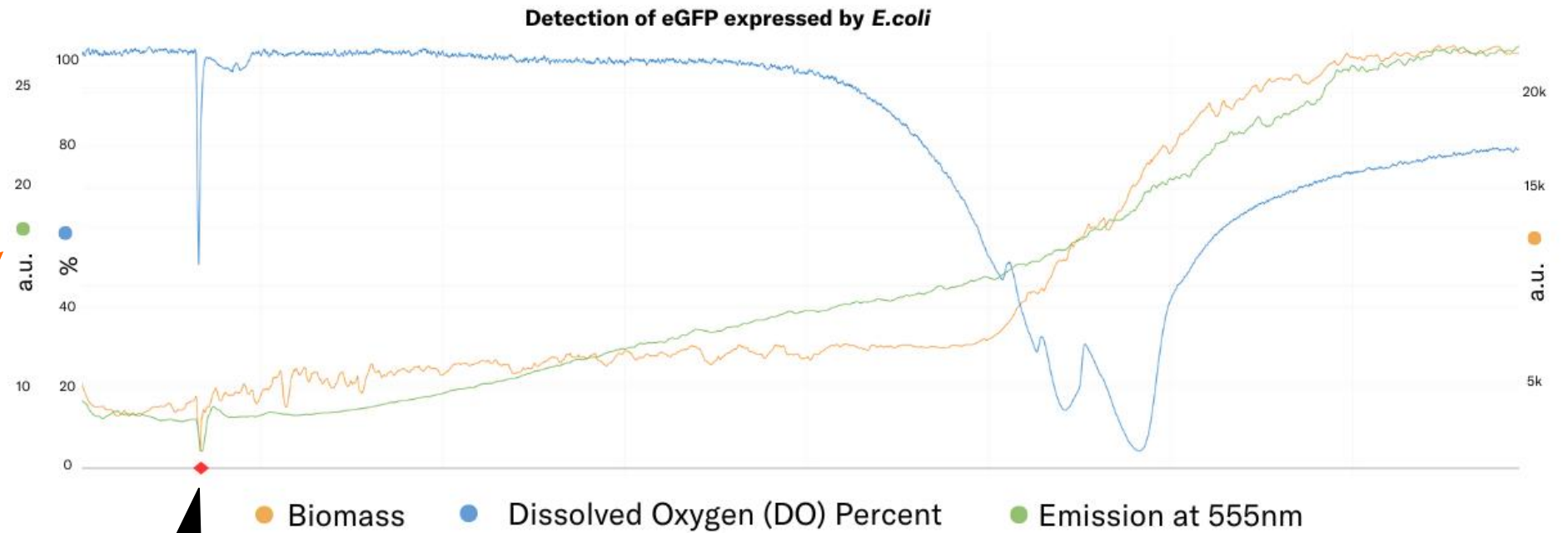
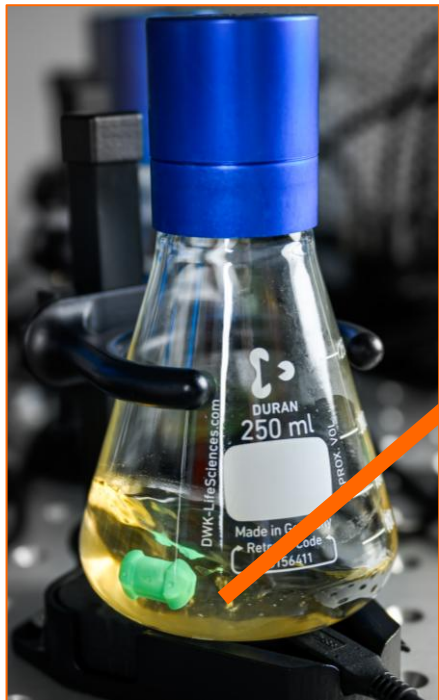
- Our Software for Control and Monitoring
- Windows 10 or newer
- Locally installed and browser-based
- Application templates for quick set-up
- Perpetual Licenses or Subscription Licenses

How?

- Laptop with DOTS Software in proximity of shaker
- USB cable connects DOTS software with LIS/MPS Hub on shaker
- Hub transfers data/instructions between DOTS Software and devices

What DOTS delivers: Real-time biomass, dissolved oxygen and fluorescence data for up to 100 shake flasks in parallel.

DOTS in Action (1/3) – Monitoring *E. coli* during eGFP expression in shake Flasks



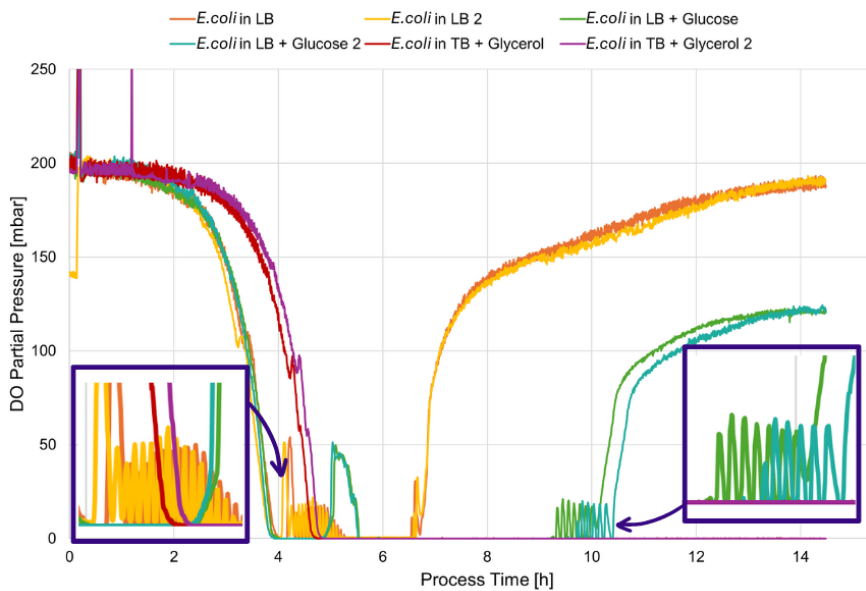
Induction
with IPTG

Exemplary Applications: Growth Characterizations, Screenings and Process Optimizations in shake flasks, even for complex organisms.

DOTS in Action (2/3)

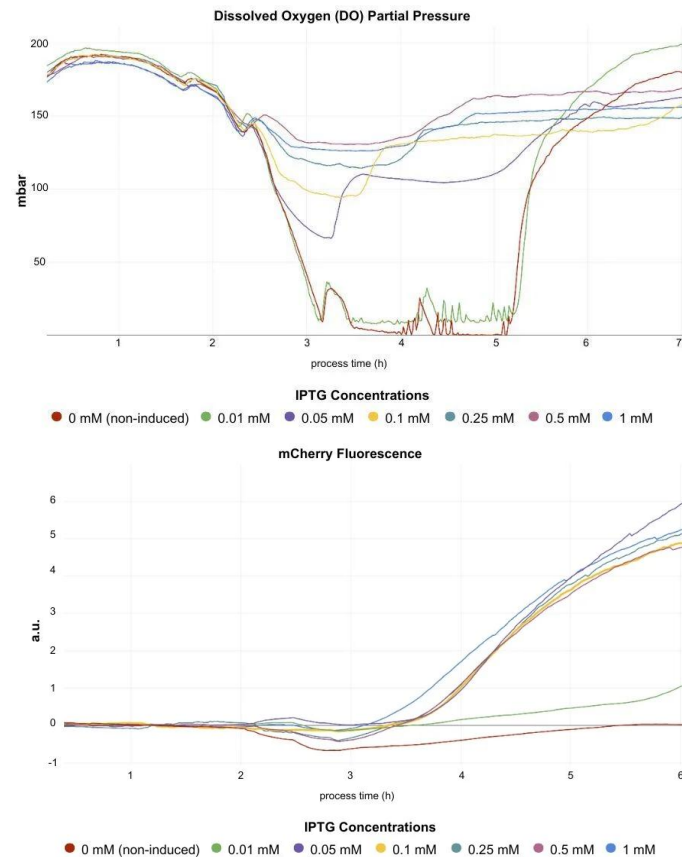
1

Growth Characterization & Metabolic Event Detection



2

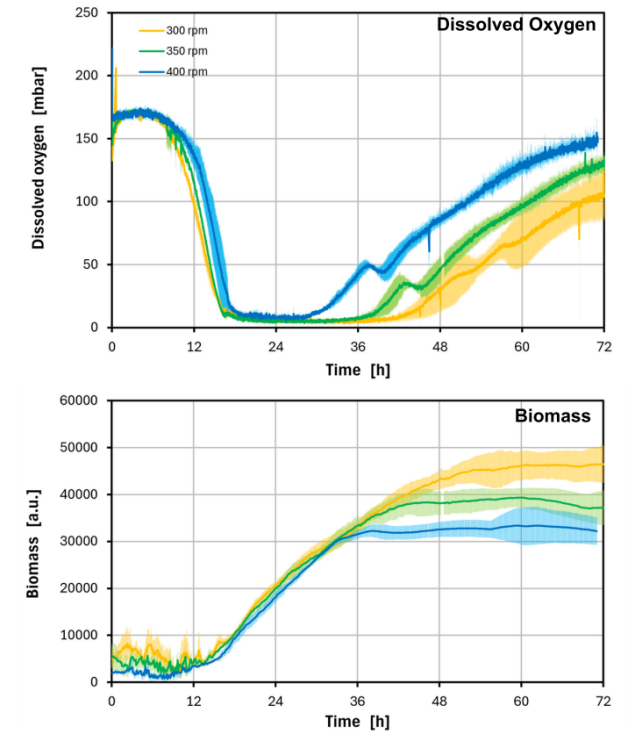
Optimizing Protein Expression with DO-Based Smart Feeding



3

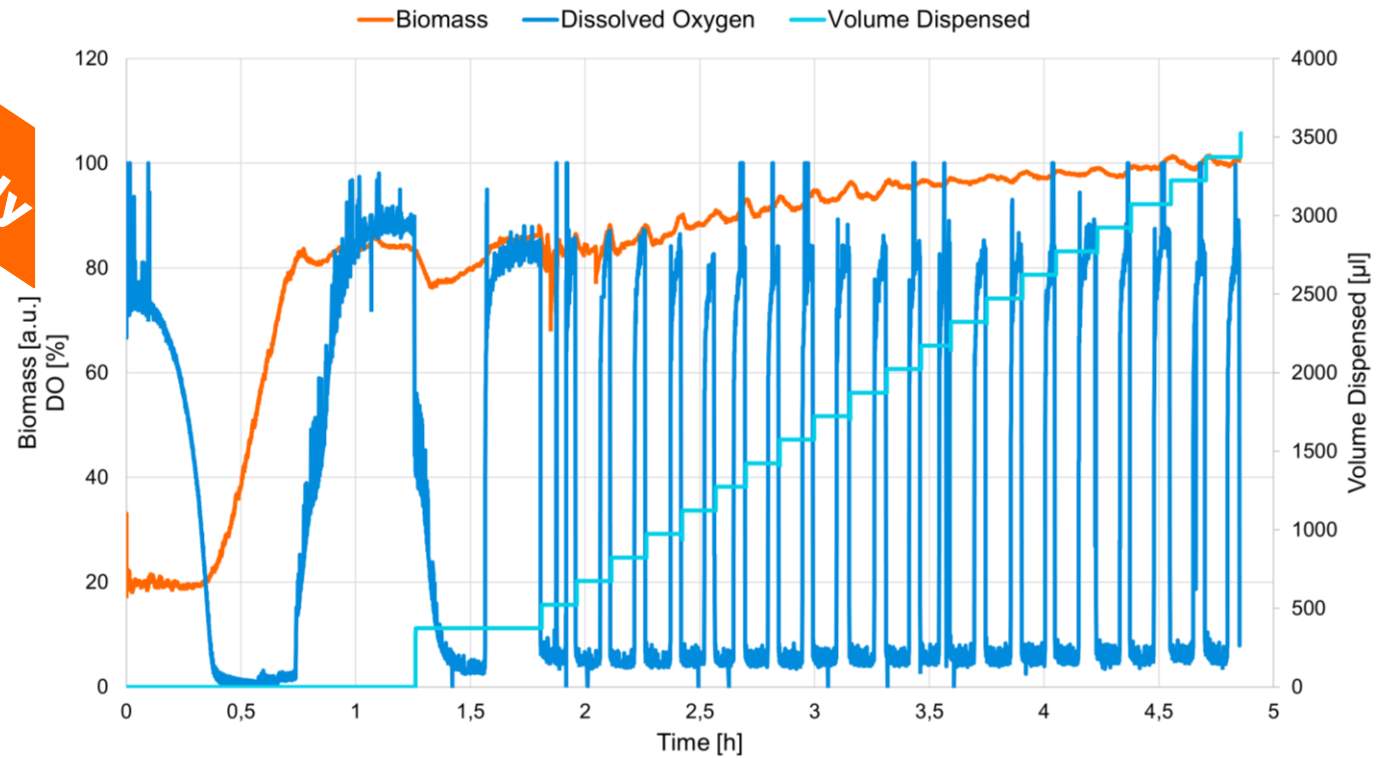
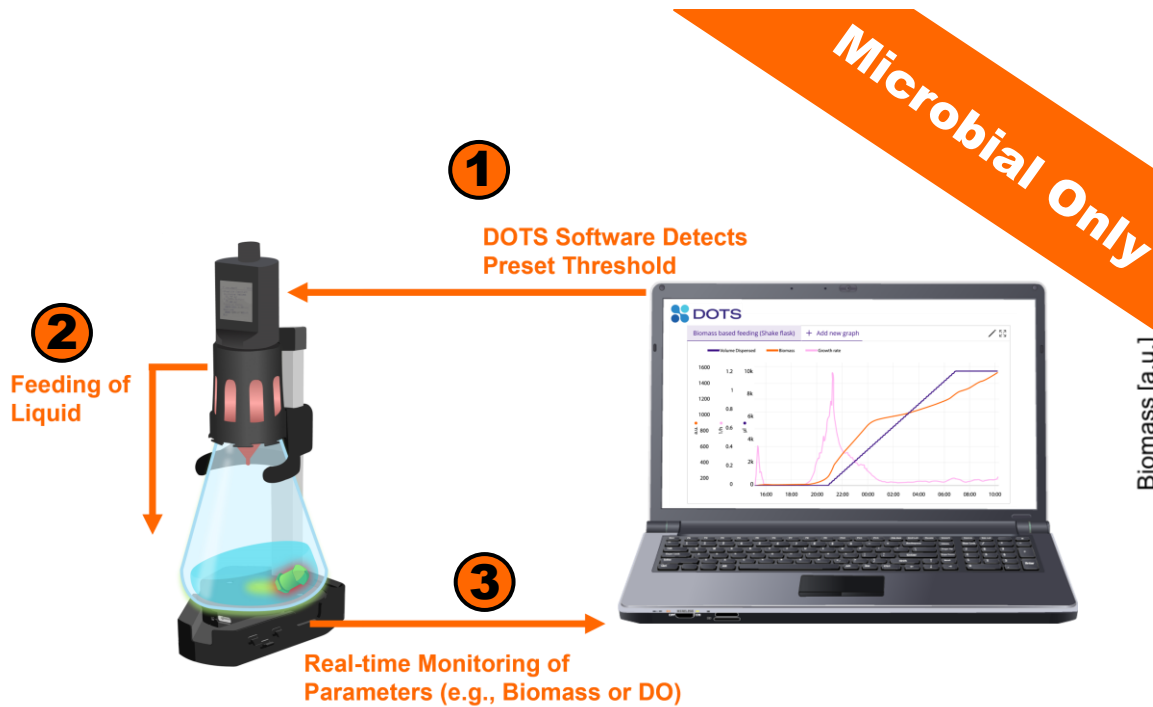
Screening Bioprocess Conditions

Influence of Different Shaking Frequencies on *Aspergillus oryzae*



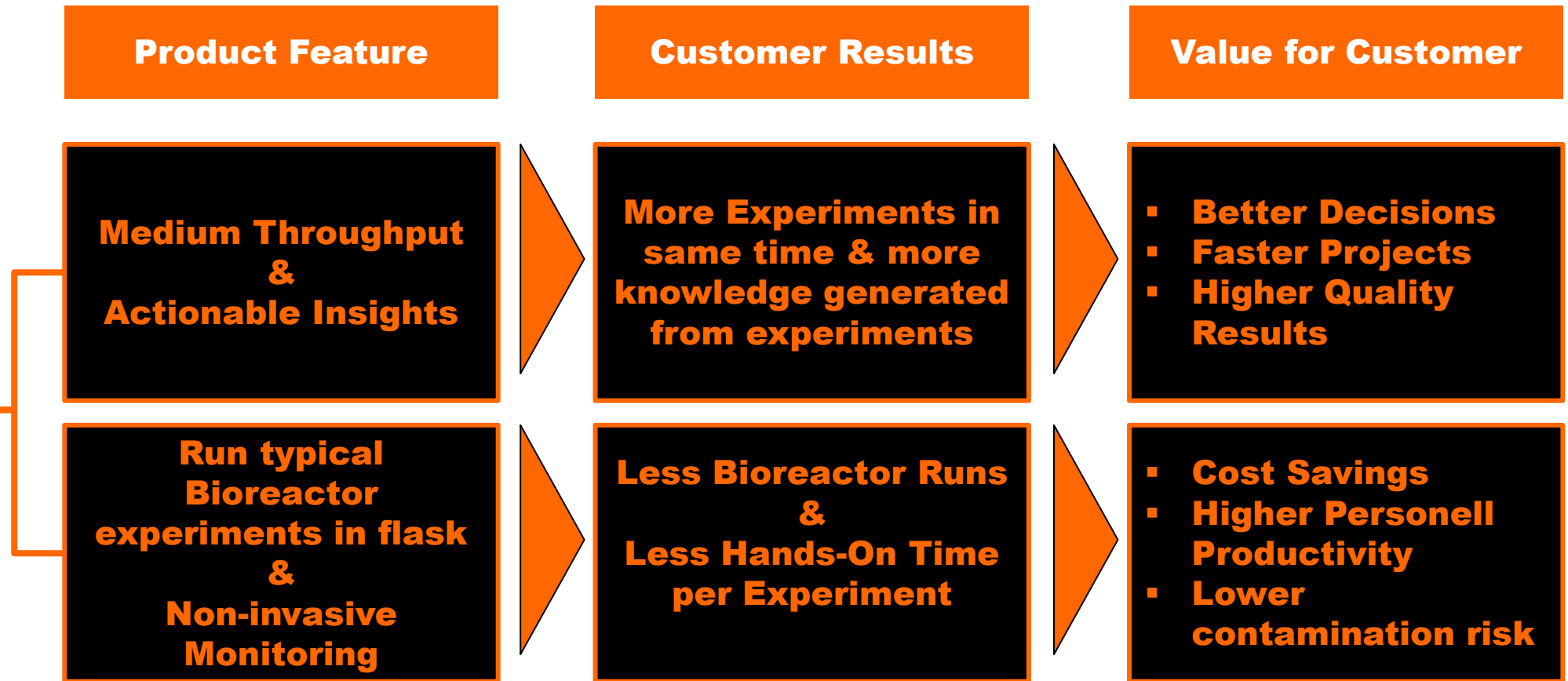
Exemplary Applications: Fed Batch based on online dissolved oxygen data for bioreactor-like control in shake flasks.

DOTS in Action (3/3)



Better and faster bioprocessing decisions/projects while saving costs and creating more time for other tasks.

Value of DOTS





Technical Details

The **MPS** contains three read out windows for different parameters and communicates with the DOTS Software via wired connections.

Multiparameter Sensor (MPS)

1 Multiparameter Sensor (MPS)

Ambient Sensors

- Temperature
- Shaking speed
- Humidity
- Pressure

Sensor Pill Read Out

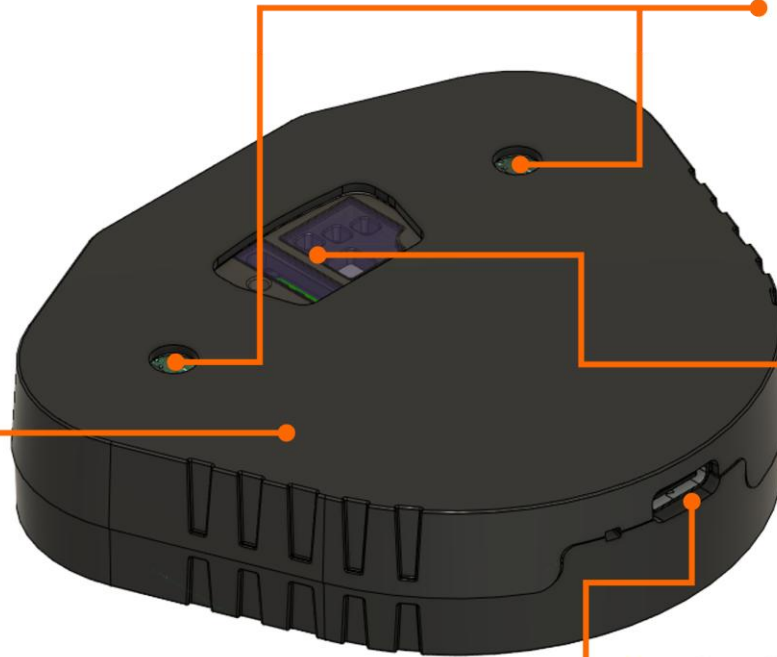
- DO
- pH (*future edition*)

Optical Read Out

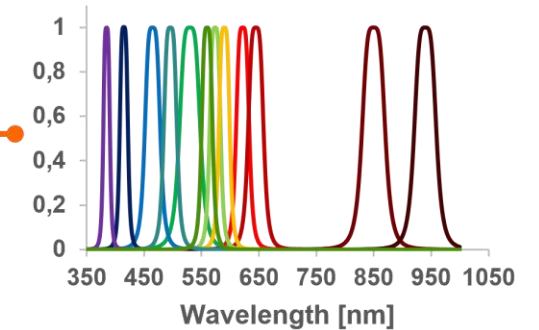
- Backscatter
- Fluorescence
- Marker detection

USB-C Port

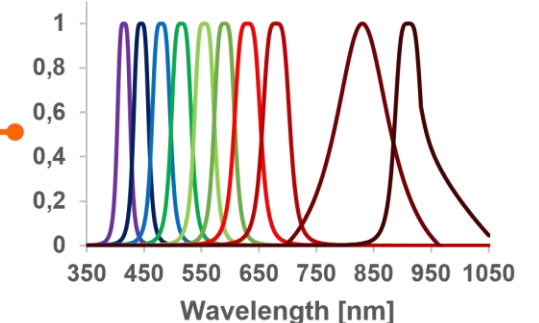
- USB Connection
- Charging
- External Interfaces



Excitation Spectra



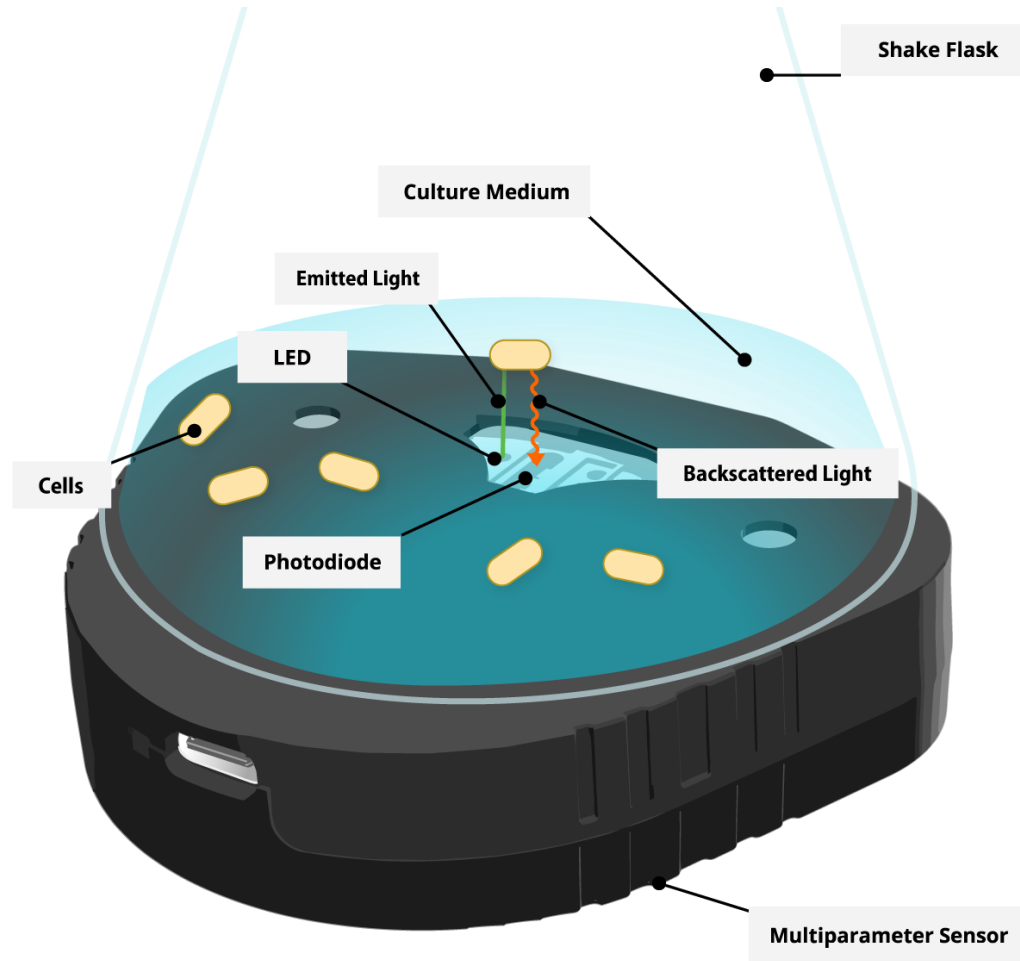
Detection Spectra



The MPS measures **biomass** via the **backscattered light** method, allowing for continuous, non-invasive growth monitoring.

Multiparameter Sensor (MPS)

1 Multiparameter Sensor (MPS)

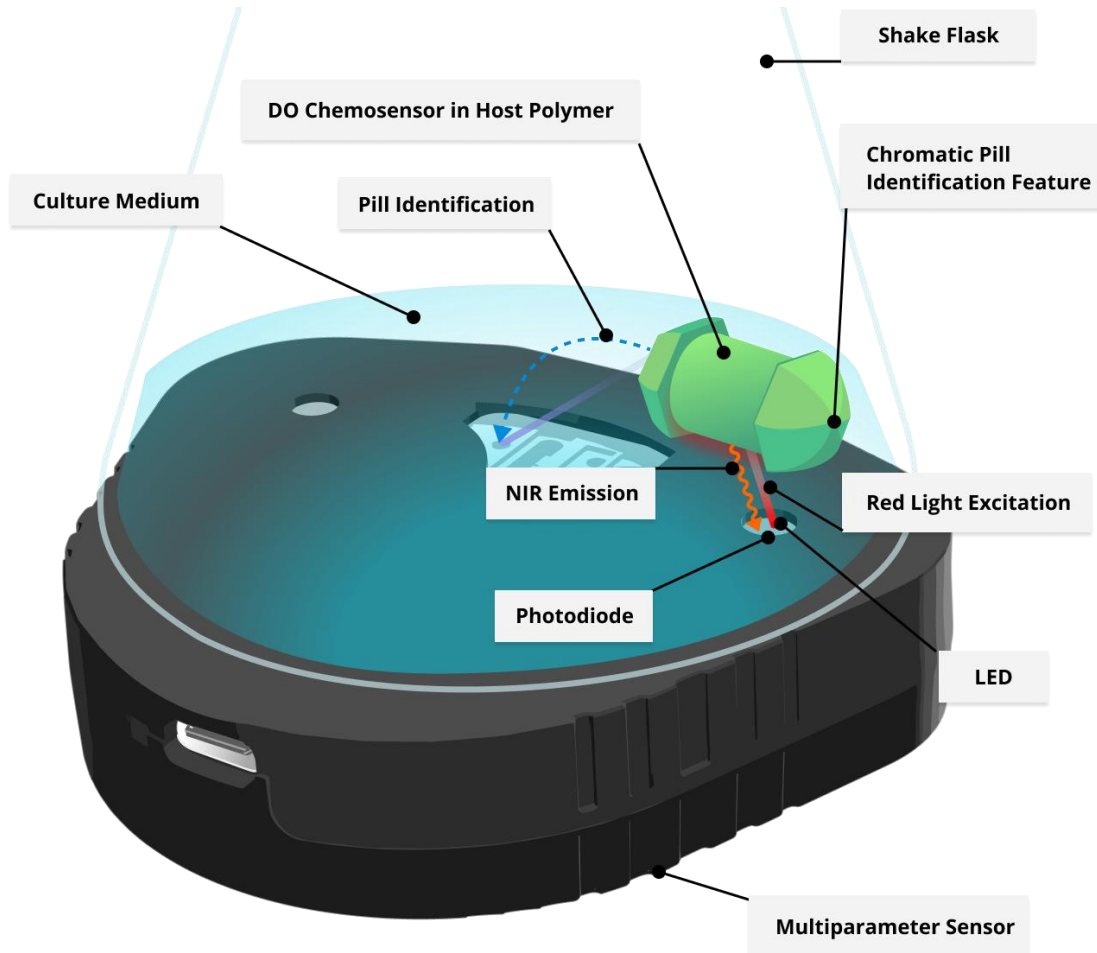


- The LED source emits light in a preset wavelength.
- Cells in the medium scatter some of the light back, which is detected by the photodiode.
- The more cells present in the medium, the higher the backscatter signal.

Together with the **Dissolved Oxygen (DO) Sensor Pill**, the MPS measures DO continuously and online.

Multiparameter Sensor (MPS)

1 Multiparameter Sensor (MPS)



- The DO Sensor Pill is coated with a luminescent dye capable of detecting changes in DO.
- The pill identification algorithm allows the MPS to take measurements as the pill circulates in the media.
- The sensor emits a red light, exciting the DO Sensor Pill which shows luminescence in the near-infrared region.
- Depending on the level of DO present in the solution, the amount of luminescence changes, which is detected by the MPS.

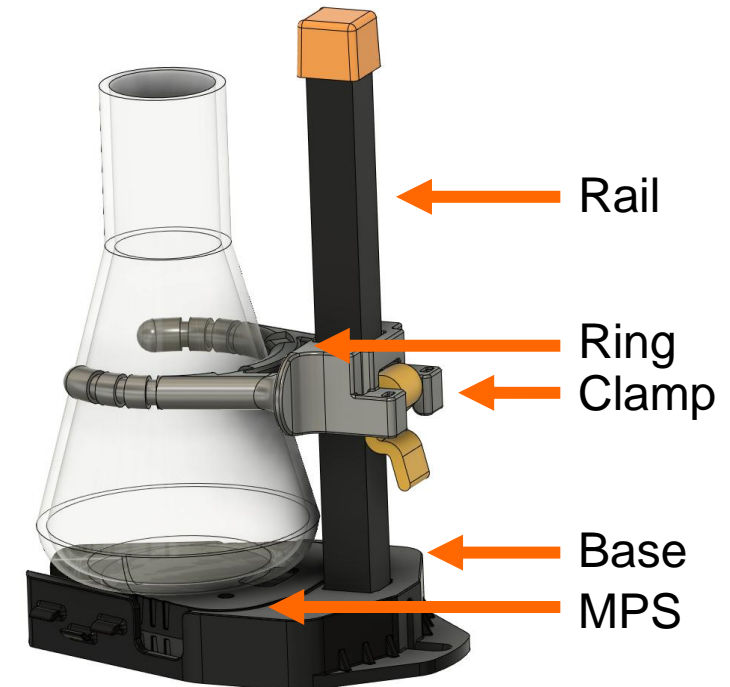
The **MPS Adapter** keeps the sensor in place and secures the shake flask, for increased stability.

Multiparameter Sensor (MPS)

- Available for **all common shake flask sizes**
 - 100 mL, 250 mL, 500 mL, 1000 mL, 2000 mL
- Compatible with **every shaking incubator**
 - Screws and Sticky Mats
- **Avoids shake flask rotation for ideal shaker to sensor alignment**
- **Increases stability for extreme shaking speeds and larger shaking diameters*** even with top-heavy flasks (e.g., when carrying a LIS)
- Easy insertion or removal of shake flasks with no clamp hassle



1 Multiparameter Sensor (MPS)

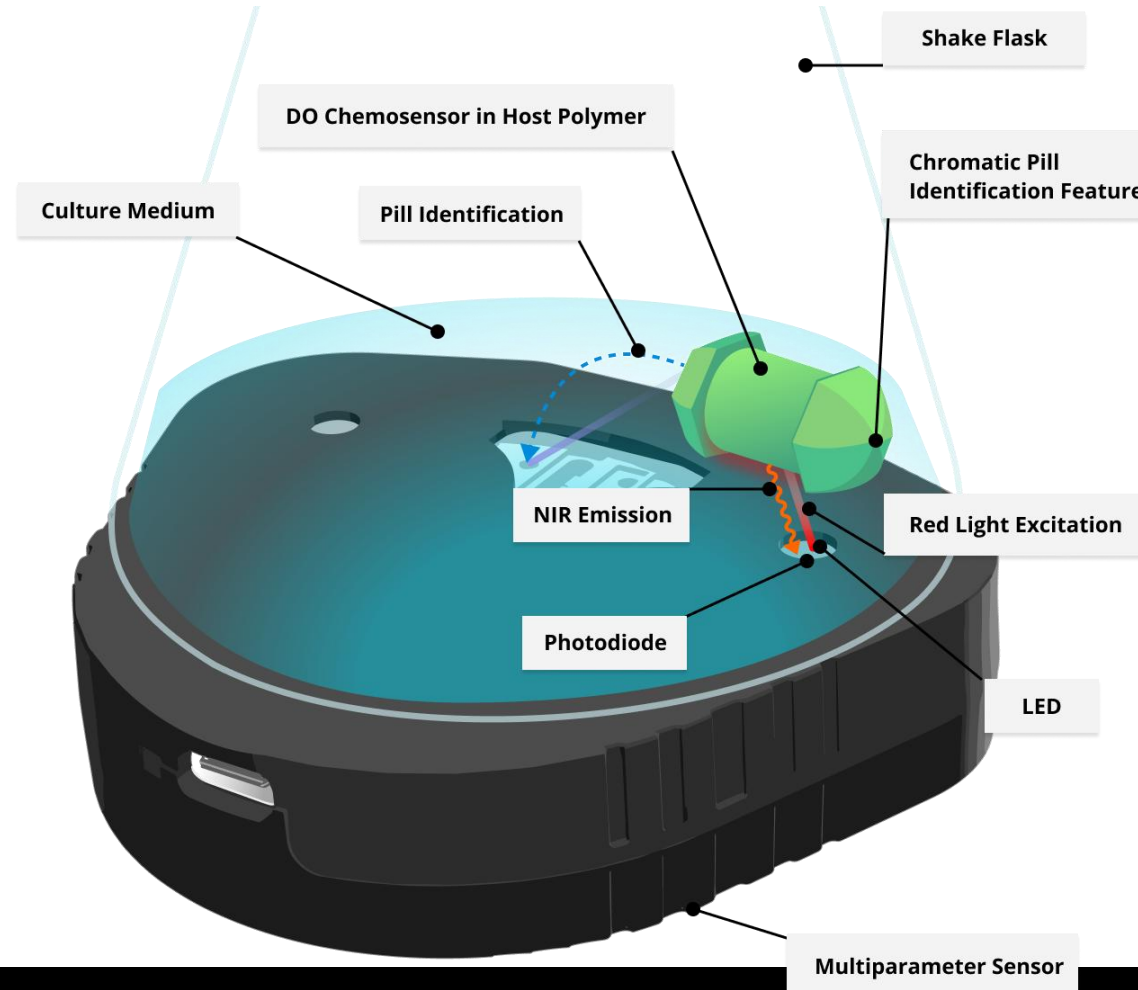


*Tested with 350 rpm at a 50 mm shaking diameter

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

Sensor Pills

2 Sensor Pills

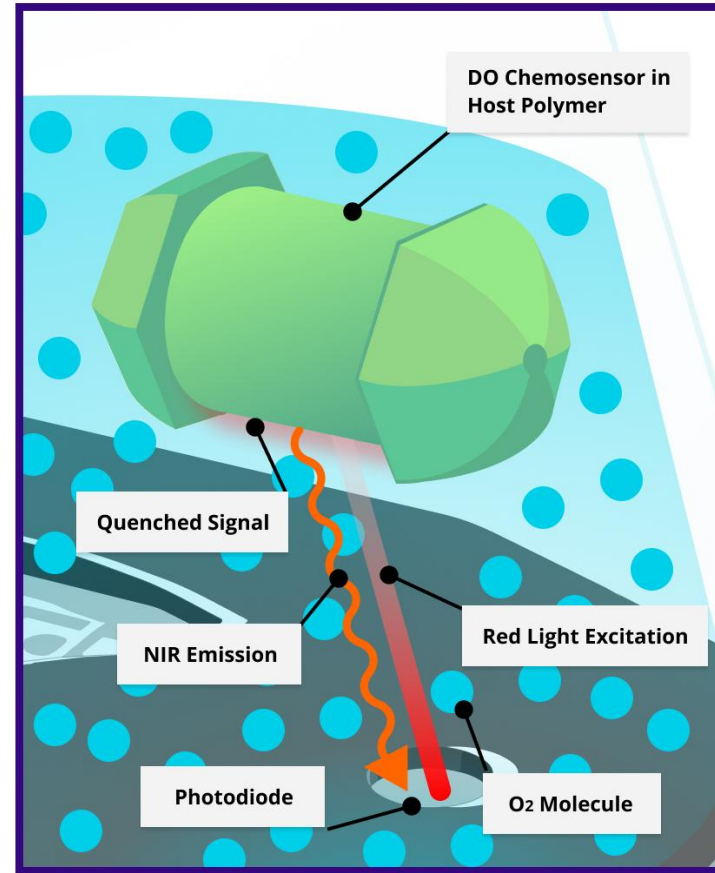


The **DO Sensor Pill** is built with an integrated chemosensor, containing a luminescent dye indicator suitable for dissolved oxygen (DO) sensing.

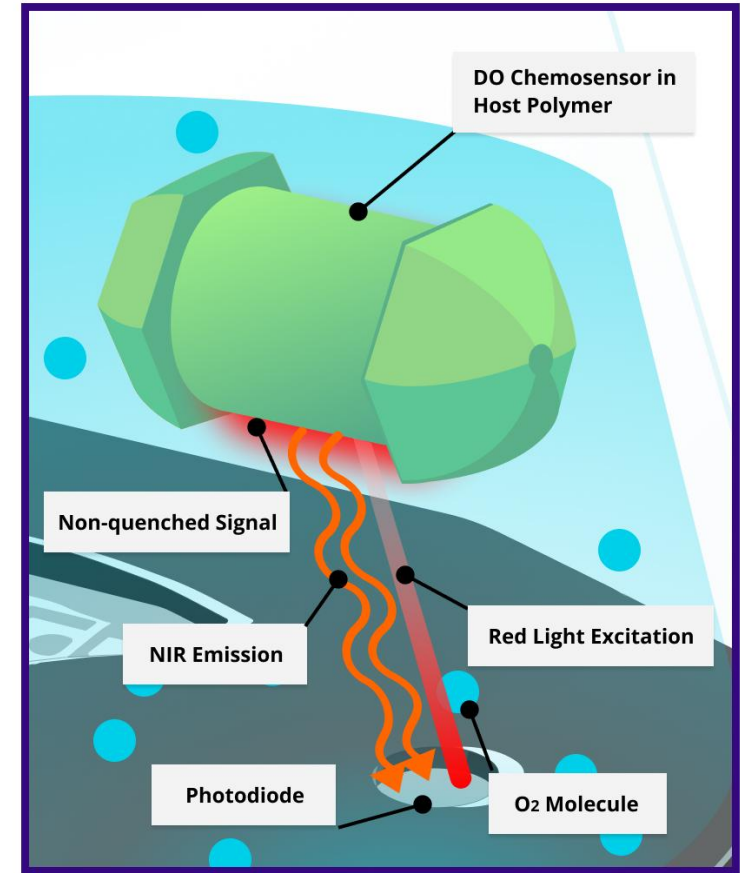
Sensor Pills

2 Sensor Pills

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

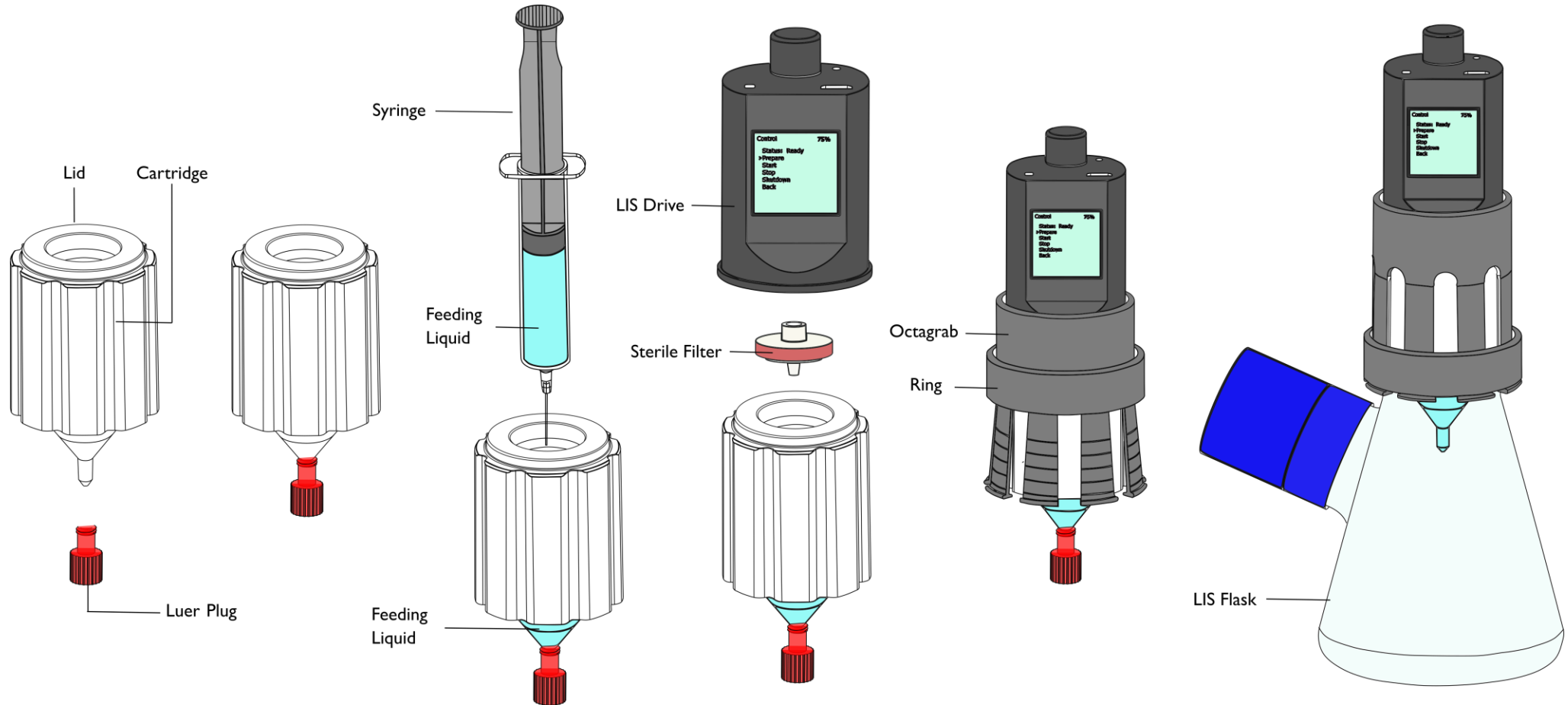


Low Oxygen

LIS is **easy to assemble**: Fill the cartridge with the feeding liquid, connect the LIS drive to the cartridge and start feeding.

Liquid Injection System (LIS)

3 Liquid Injection System



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