

## **ONE-PAGE ABSTRACT TEMPLATE AND GUIDELINES –TITLE CENTERED AND ALL CAPS**

Gernot John, PreSens Precision Sensing  
g.john@presens.de  
Christian Ude, University of Hannover

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Shake flasks have been the work horse for microbial small-scale fermentations for decades. Recently, single use versions are becoming more and more popular -for both microbial and cell cultivation.

Typically, these vessels are still used as black boxes because no online measurement is integrated. The non-invasive measurement of oxygen and pH using chemical-optical sensors has already been commercially available for several years. With the recently added ability to measure biomass online, the metabolism is even more visible. This presentation discusses the use of a multitude of sensors in the small scale of shake flasks. It also presents a prototype sensor for the online measurement of CO<sub>2</sub> that was developed recently and integrated into a multi-parameter platform. Applications are various: Although the CO<sub>2</sub> sensor is only a prototype it is possible to follow a diauxie of *E. coli* cultivations online, while small changes in the growth curve detected by the biomass sensor indicate the exact time of limitations which was shown for different organisms.

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