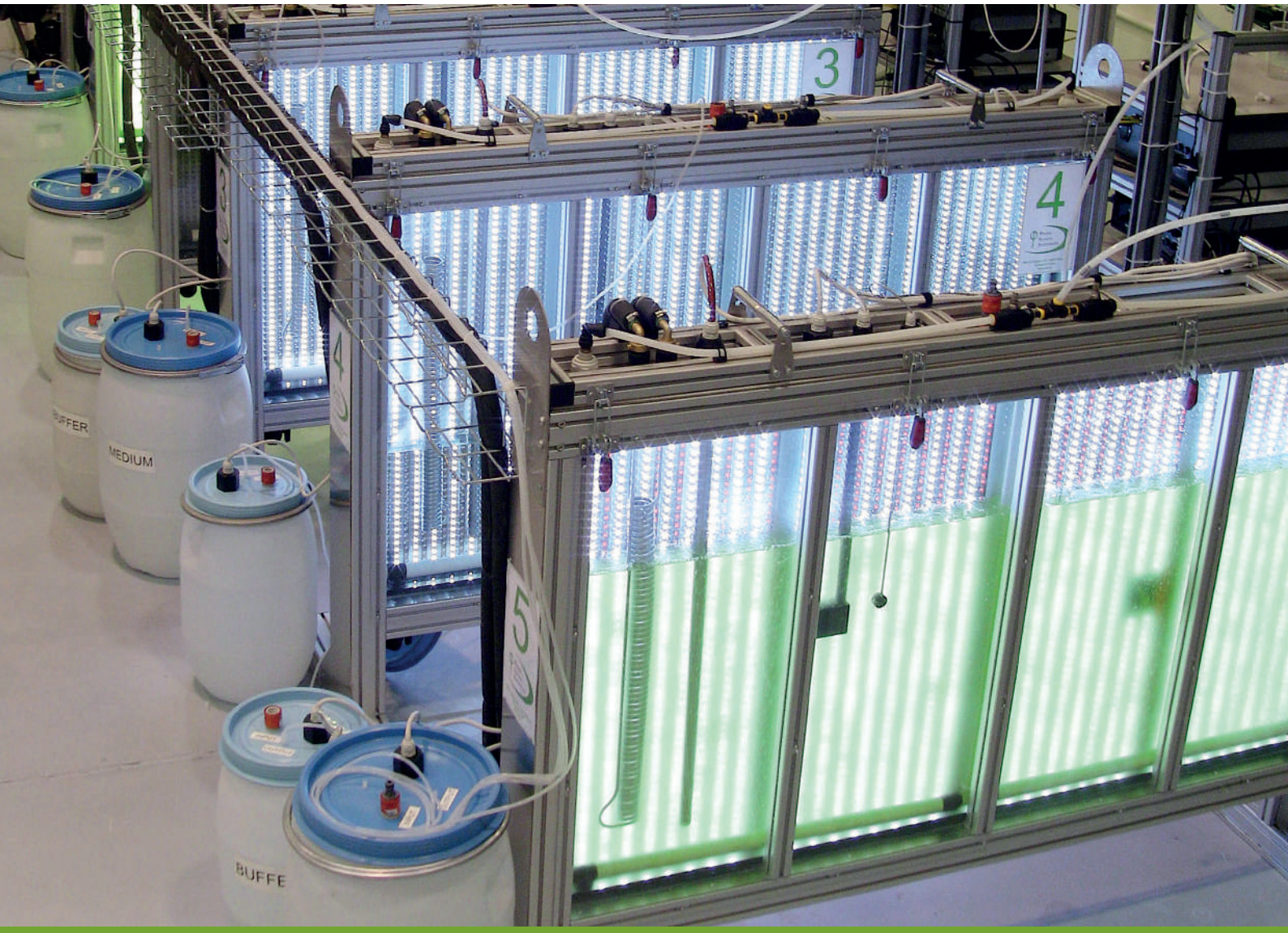

Large-Scale Photobioreactors

PSI **Large-Scale Photobioreactors** are systems that create a controlled artificial environment for large-scale monitored growing and harvesting of photosynthetic organisms, mostly algae and cyanobacteria. The core of the standard Photobioreactor system is a flat glass cultivation tank (25 l or 100 l in volume) with an integrated temperature regulation and bubble stirring system for the aeration of the culture. The cultivation tanks may be cascaded to increase the total volume up to 1,000 l. Illumination is provided by flat LED panel that generates a highly uniform irradiance flux. Continuous-flow turbidostatic cultivation can be used for the stabilization of the biomass suspensions via optical density control. Programmable light, temperature, gas, and medium regime can oscillate with various amplitudes and frequencies according to user-defined experimental protocols.

The growth of the cultures is monitored by the integrated densitometer (OD720, 680 nm). The instantaneous physiological state of the culture is measured by the Photosystem II quantum yield F_V/F_M with integrated PAM Fluorometer. Supplementary sensors for monitoring and control of pH/T, O_2, CO_2 are available.

Photobioreactor function can be enhanced by the additional gas module Gas Mixing System GMS 150 providing optimal control of input gas concentration and flow rate.

The entire Photobioreactor system is connected to an external Control unit with a computer running control software that defines and controls experimental conditions and also enables remote control via internet.

Regard to a broad experience concerning the development and production of diverse Photobioreactors systems, PSI offers also development and manufacturing of **customized Large-Scale Photobioreactors** comprising of various cultivation tanks and other accessories.

03 / Photobioreactors

CULTIVATION VESSEL

- Flat construction with light path of 6.5 cm
- Working volume of 25 l or 100 l per one unit
- Glass cultivation tank with stainless steel frame. Cultivation tank is not autoclavable
- Gas-tight vessel lid with gas and electronics fittings
- Gas sparging system

LIGHT MODULE: LED-BASED ILLUMINATION

- Bi-color white-red LED panel with separately controllable colors. Other color combination on request
- 25 l PBR: PPFD up to 500 $\mu mol.m^{-2}.s^{-1}$ for white and up to 200 $\mu mol.m^{-2}.s^{-1}$ for red light channel (standard)
- 25 l PBR: light intensity up to 2,000 $\mu mol.m^{-2}.s^{-1}$ for both light channel together (optionally)
- Both static and fluctuating light regime. Day/night cycles
- Solar simulation

ADDITIONAL MODULES

- Optical module: PAM fluorometer with blue and red-orange excitation; Turbidometer 680 and 720 nm (OD680, 720)
- Electrode module for connection of pH/T, dO_2, CO_2 probes
- Fluidic modules: Turbidostat module, Chemostat module, pH-stat module
- Cooling module widens the range of cultivating temperature to 15–60 °C (ambient temperature not exceeding 30 °C)
- Gas module: Gas Mixing System GMS 150

CONTROL SOFTWARE

- User defined protocol writing
- Real time data visualization and analyses in graphs
- Remote control of the experiment via internet

CUSTOMIZED LARGE-SCALE PHOTOBIOREACTORS

- Vertical Tubular Airlift Photobioreactor is a modular system scalable between 100 – 1,000 l. Ambient or artificial LED illumination. Monitoring of OD680, 720 and chlorophyll fluorescence. Additional probes: pH/T, dO_2, CO_2
- Stainless 1,000 l Photobioreactor. Temperature controlled cultivation tank with the immersed LED lighting and integrated sparging system. Monitoring of OD680, 720 and chlorophyll fluorescence. Additional probes:pH/T, dO_2, CO_2
- Modular Helical Tubular Photobioreactor (250 l per one unit) with a degassing system. Ambient or artificial LED illumination. Monitoring of OD680, 720 and chlorophyll fluorescence. Additional probes: pH/T, dO_2, CO_2