



An optical neuro-monitor of cerebral oxygen metabolism and blood flow for neonatal research

The goal is to reduce the risk of brain lesions in extremely preterm babies and eventually decrease the number of children with disabilities.

The BabyLux device can be brought to the bedside, measurements can be done in a few minutes (<2 min) and continuously, both under critical and non-critical conditions.

The system is based on near-infrared diffuse correlation spectroscopy (DCS) and time-resolved reflectance spectroscopy (TRS). Both technologies work in a wavelength range called the “physiological window” (600nm-900nm) which allows to reach deeper tissue layers, sampling at the depth of the cerebral cortex. DCS provides tissue hemodynamic information, the local micro-vascular cerebral blood flow (CBF), and TRS measures locally the optical tissue properties allowing to deduce information on oxygen saturation and total hemoglobin concentration. By this innovative combination of an accurate state-of-the-art TRS and DCS for the first time in a single instrument, a set of information for monitoring the local cerebral oxygen metabolism becomes accessible.

Preclinical testing - the clinical protocol has been authorized by the Danish Medical Agency and by the Italian Ministry of Health: two demonstrators have been tested at the Rigshospitalet in Copenhagen (Denmark) and the Mangiagalli Hospital in Milan (Italy) for at least 6 months.



About the BabyLux Project

Funded by the European Union under the Competitiveness and Innovation Framework Programme 2007-2013, BabyLux has been a challenging project led by

- **9 scientific and technical partners:** Politecnico di Milano, Fondazione Politecnico di Milano, ICFO-Institute of Photonic Sciences, Fraunhofer Institute for Production Technology IPT, Hemophotonics SL, PicoQuant GmbH, Loop, Capital Region of Denmark and Fondazione IRCCS Ca' Granda Ospedale Maggiore Policlinico
- **in 4 different countries:** Italy, Spain, Germany and Denmark
- **for more than 3 years**, from January 2014 to April 2017

BabyLux has taken up complete R&D works and has extended already tested prototypes to the level of demonstrator, bridging the gap between research and development, and the market.

To know more, visit the website <http://www.babylux-project.eu>



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Essential features



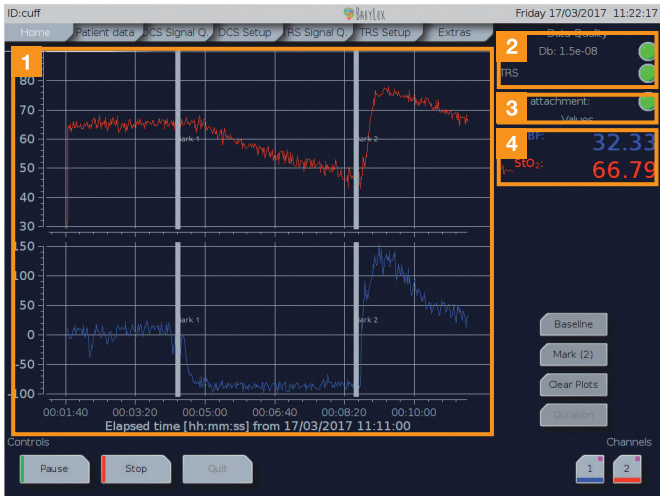
With its bottom trolley, the device is **easily movable** by means of the rear handle. For final placement, the two wheel lock system assures stable positioning in the ICU room.



- Three wavelengths for TRS, one for DCS
- Time resolution up to 1 s

1. Time chart updated online
2. Online evaluation of data quality
3. Safety measures employed
4. Online results shown

The graphical user interface and data representation is designed for two principal application scenarios. First, as an **easy control monitor** with large number representation of main parameters and second, as continuous monitor providing **graphical representation of the parameter evolution over time**. Furthermore, additional information is offered on demand by changing between the main window and secondary windows.



Technical data

Medical Applications

Monitoring of brain hemodynamics in neonates: cerebral blood flow (CBF) and cerebral tissue oxygenation (StO₂)

Estimation of cerebrovascular reactivity in response to different treatments

Measurement Specifications

<i>Optical data</i>	Absorption μ_a & scattering μ_s coefficients (cm ⁻¹), photon intensities (s ⁻¹), For expert users: full DCS autocorrelation curve, TRS photon time of flight distribution
<i>Hemodynamics</i>	Concentration of de-, oxygenated and total hemoglobin (μM), StO ₂ (%), CBF (cm ² /s), relative cerebral metabolic rate of oxygen (CMRO ₂)
<i>Max. acquisition rate</i>	1 s
<i>Data collection rate</i>	1-3 s
<i>Data storage</i>	>50 days of uninterrupted measurement
<i>Tissue penetration depth</i>	~ 1 cm

Technical Specifications

<i>Dimensions & Weight (screen folded)</i>	672 x 1372 x 673 mm; 100 kg
<i>Lasers</i>	1 x DCS CW laser 3 x TRS pulsed lasers
<i>Detector</i>	DCS: 2 x single APDs TRS: PMA hybrid photomultiplier detector
<i>Acquisition electronics</i>	DCS: custom-made hardware correlator, 2-channels TRS: Time-correlated SPC board
<i>Sensor</i>	34 x 20 x 5 mm 1 light emitting window and 2 light collecting windows 2 source/detector separations (0.5 and 1.5 cm) 7 fibers and connectors integrated in a 3 m shielded cable (Ø 175 mm) fiber connectors: 1 x SMA, 3x FC/APC (TRS), 3 x FC/PC (DCS)
<i>PC</i>	Touch screen monitor 15", 250 GB HDD
<i>OS</i>	Linux
<i>Power requirements</i>	UPS: 110-240 V, 200 W; operation time while battery supplied >30