



POLITECNICO  
DI MILANO



**nEUROpt**

**Non-invasive imaging of brain function and  
disease by pulsed near infrared light**



## SEVENTH FRAMEWORK PROGRAMME HEALTH

### HEALTH-2007-1.2-2

#### Novel optical methodologies for detection, diagnosis and monitoring of disease or disease-related processes

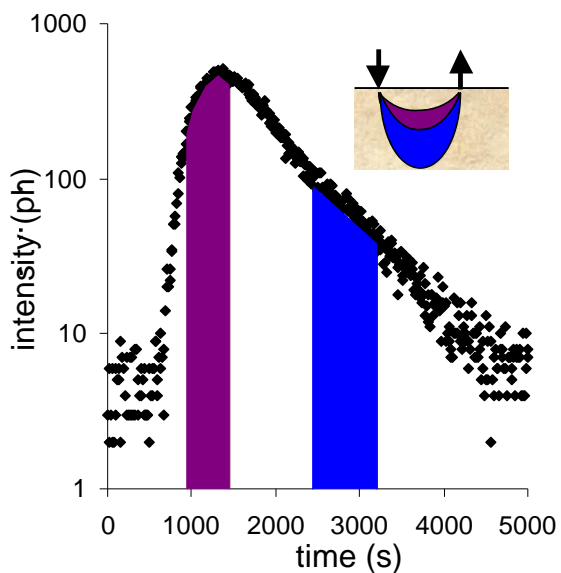
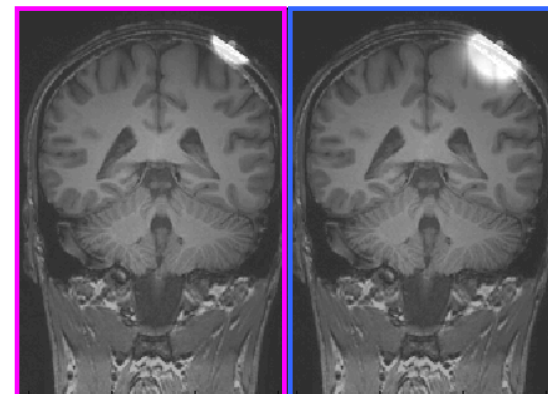
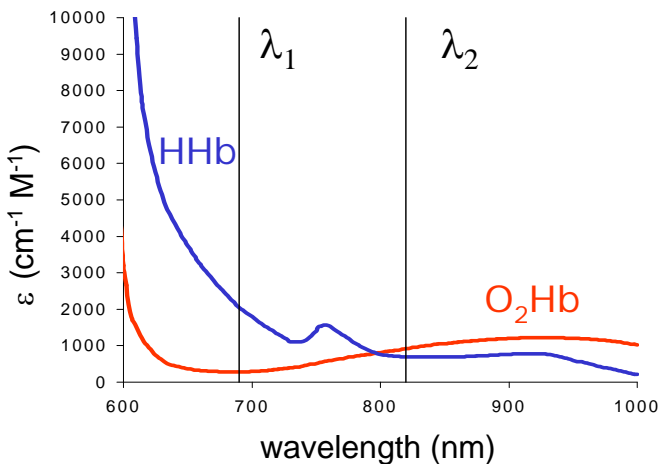
**Title: Non-invasive imaging of brain function and disease by pulsed near infrared light**

- Grant Agreement n.201076
- Project Duration: April 1, 2008 - March 31, 2012
- Funding: Total cost 7.529.109 € - EU contribution 5.738.653 €
- Participants: 17 Partners in 14 Centers
- Project coordinator: Rinaldo Cubeddu, Physics Dept. Politecnico di Milano



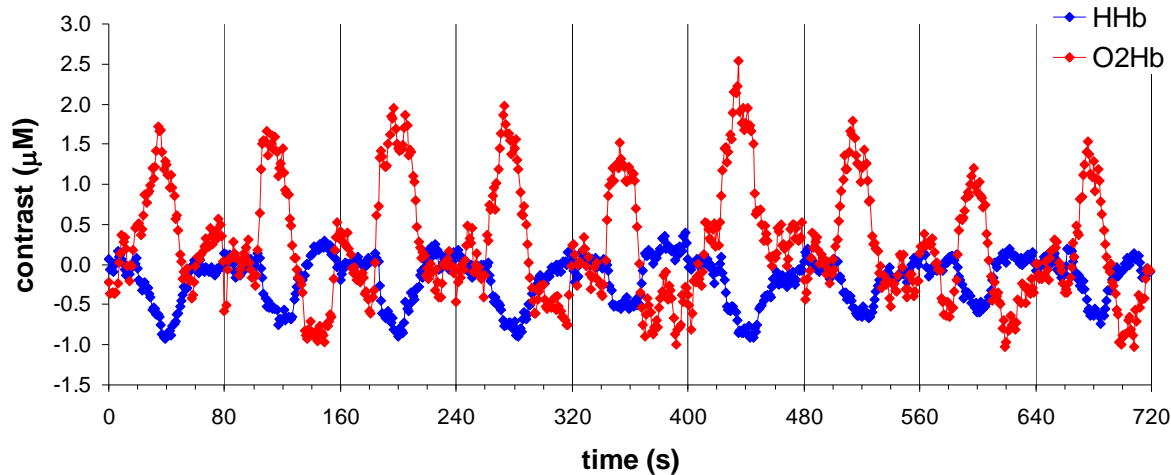
# DOI – Time domain Functional near-infrared spectroscopy

Time-resolved:  
Depth sensitivity



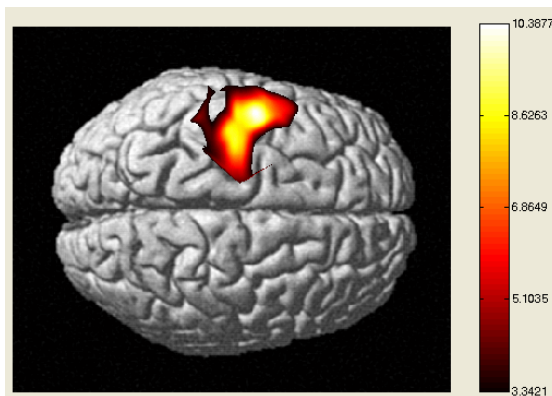


# DOI – fNIRS : Brain activation monitoring during a motor task Haemodynamic changes

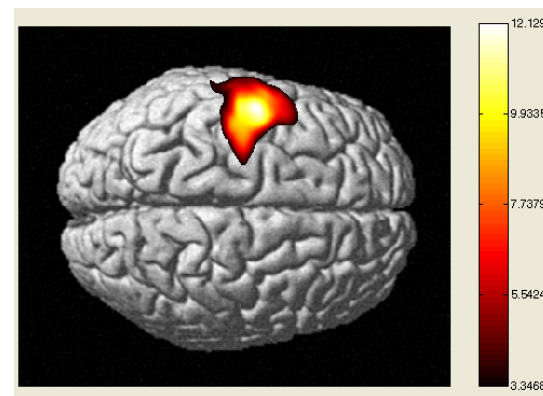


**Protocol:** 20 s baseline, 20 s task (finger tapping with right hand at  $\approx 2\text{Hz}$ ), 40 s recovery, 9 repetitions, acquisition time 1s

**O<sub>2</sub>Hb**  
(p-val < 0.05)



**HHb**  
(p-val < 0.05)



*Development and clinical validation of advanced non-invasive optical methodologies based on Diffuse Optical Imaging by pulsed near infrared light for in vivo diagnosis, monitoring and prognosis of major neurological diseases as stroke, brain haemorrhage, epilepsy and hypoxic-ischaemic encephalopathy.*

## Objectives

- **Development of novel methodologies** for optical imaging of the brain, yielding improved spatial resolution, widespread coverage of the head, optimum selectivity to signals from the brain, and absolute quantification of physiological data
- **Modelling of pulsed near-infrared light propagation** in the brain. Solving the inverse problem
- **Development of new time-domain systems** for diffuse optical imaging of the brain (clinical prototypes)
- **Characterisation of performance of instruments** together with basic methods of data analysis. Definition and implementation of standardised protocols for the quality assessment of the instruments
- **Assessment of the diagnostic value** of time-domain brain imaging by **clinical pilot studies**

## ***RTD activities:***

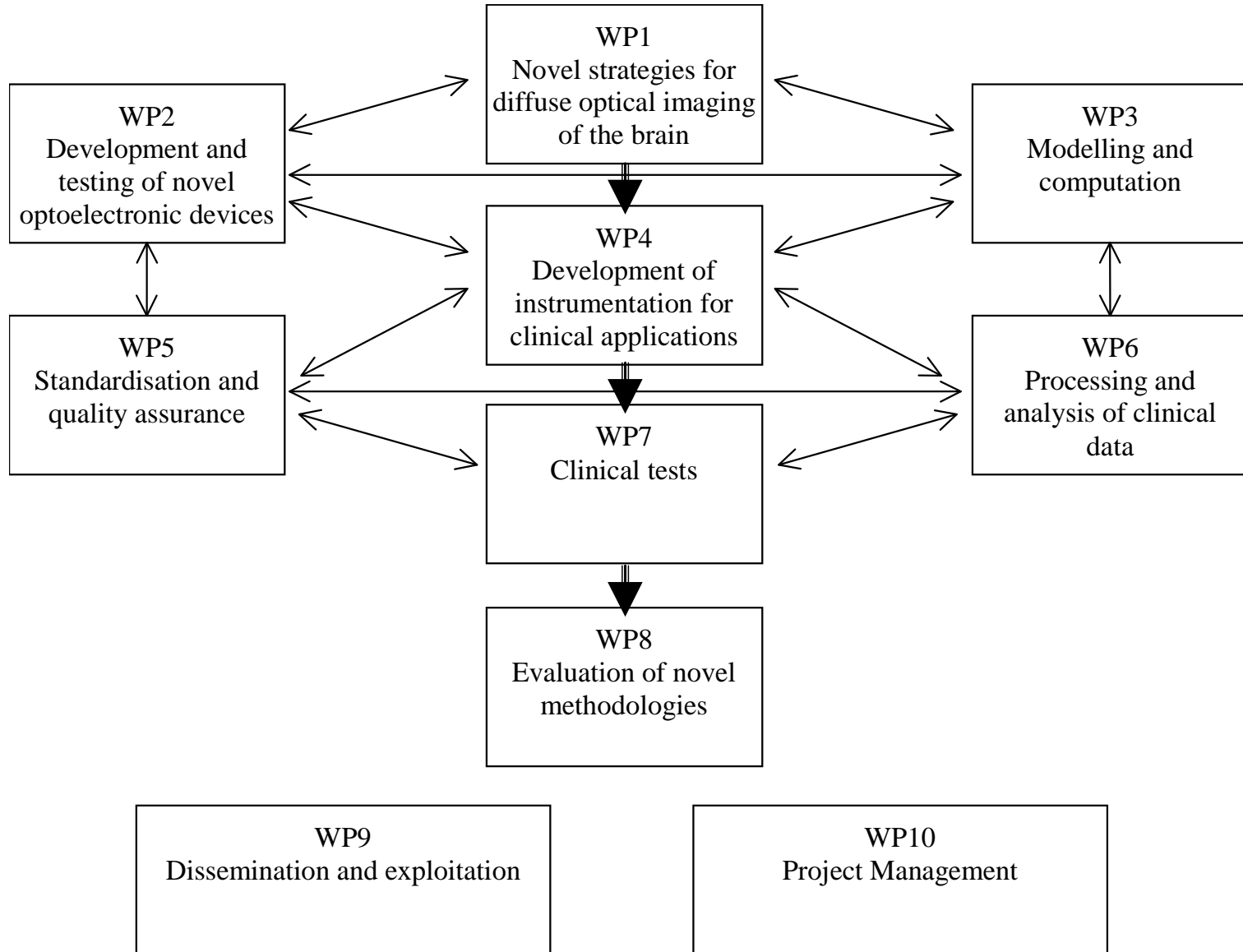
- WP 1: Novel strategies for time-domain diffuse optical imaging of the brain
- WP 2: Development and testing of novel photonic devices
- WP 3: Modelling and computation
- WP 4: Development of instrumentation for clinical applications
- WP 5: Standardisation and quality assurance
- WP 6: Processing and analysis of clinical data
- WP 7: Clinical tests
- WP 8: Evaluation of novel methodologies

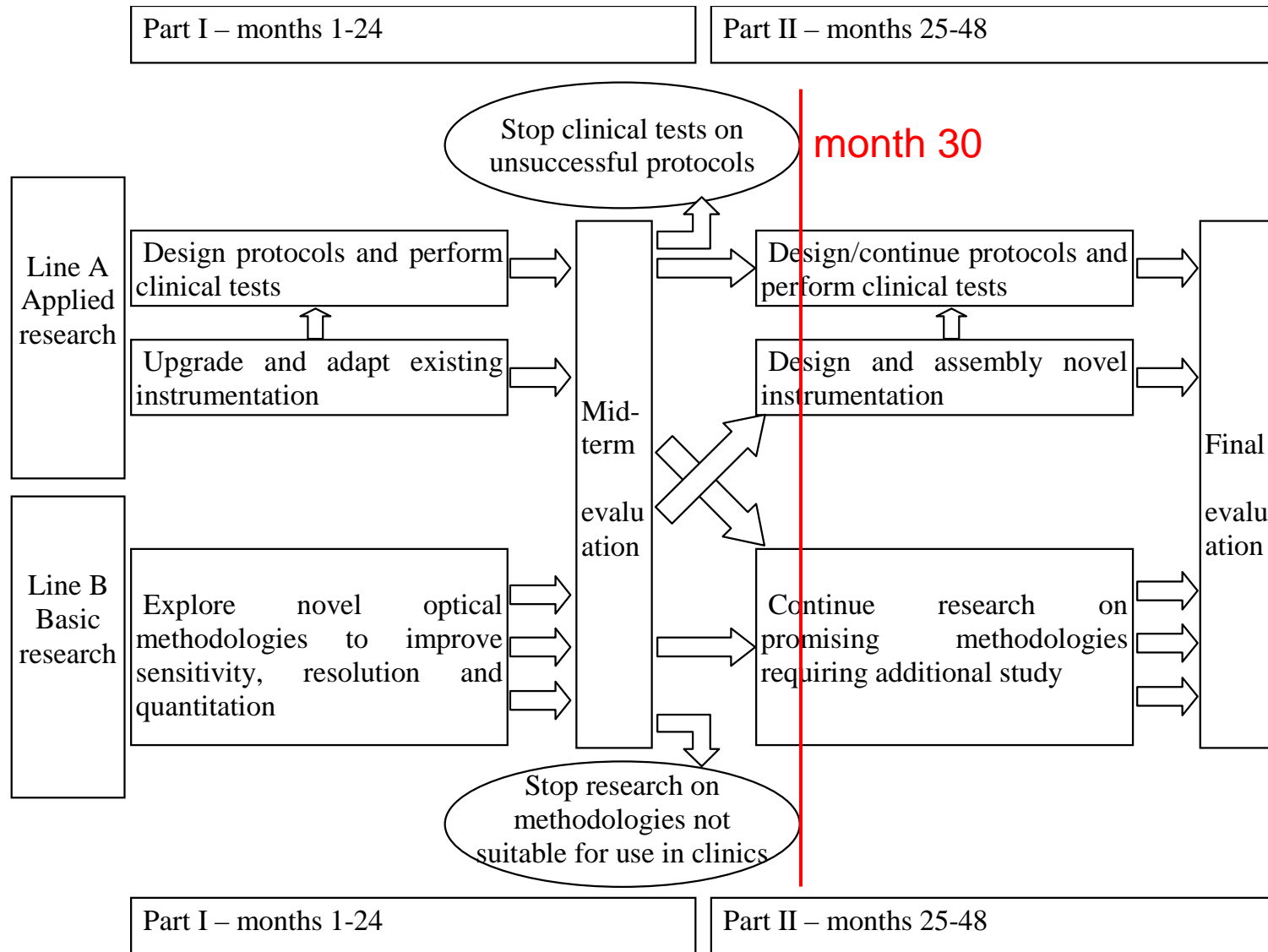
## ***OTH activities:***

- WP 9: Dissemination and exploitation

## ***MGT activities:***

- WP 10: Project management







## Physics and Engineering

- *Politecnico di Milano – Dipartimento di Fisica (Coordinator)*
- University College London - Medical Physics & Bioengineering- BORL
- University I Inzynierii Biomedycznej Polskiej Akademii Nauk – Warsaw – I
- Physikalisch-Technische Bundesanstalt - Berlin
- CPPM - University of Bath

## Clinical

- University College London – Institute of Women’s Health
- Fondazione IRCCS Istituto Neurologico Carlo Besta - Milan
- Charité Universitätsmedizin Berlin
- Akademia Medyczna w Warszawie

hypoxic-ischaemic brain injury in newborn infants

photosensitive epilepsy and movement disorders (myoclonus)

acute stroke

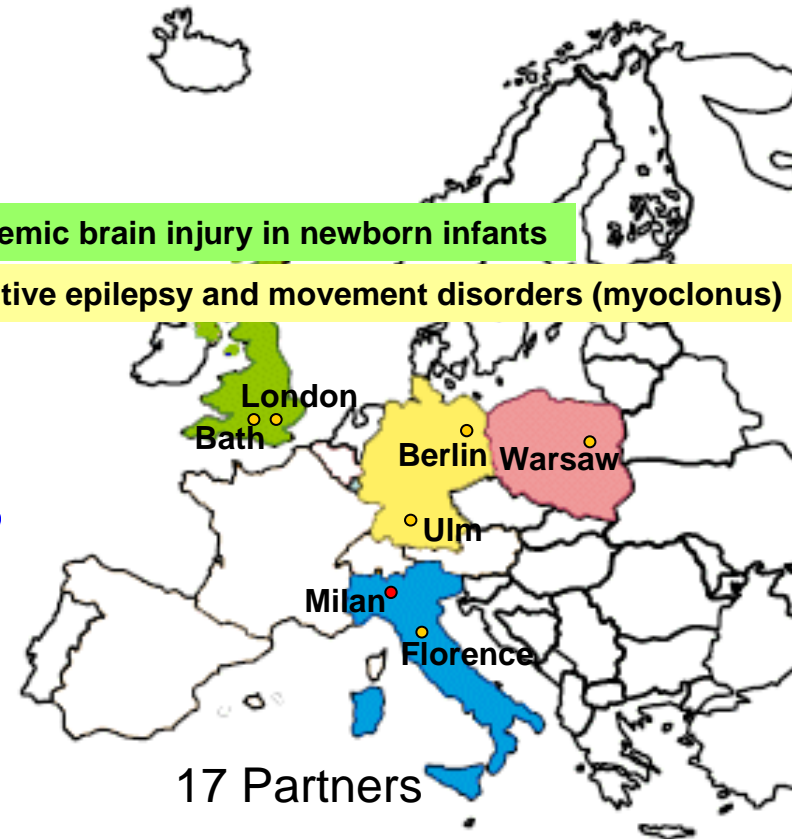
brain haemorrhage

## Modelling and Data Analysis

- University College London – Computer Science
- Stiftung für Lasertechnologien in der Medizin und Meßtechnik an der Univ
- Università degli Studi di Firenze
- Politecnico di Milano-Dipartimento di Bioingegneria

## SME

- Fianium Ltd
- Micro Photon Devices S.r.l.
- Becker & Hickl GmbH
- CF Consulting Finanziamenti Unione europea S.r.l





## Physics and Engineering

**Politecnico di Milano,**  
Dipartimento di Fisica  
Milan, Italy  
Prof. Rinaldo Cubeddu (PA1)



## **Institute of Biocybernetics and Biomedical Engineering**

Polish Academy of Sciences  
Department of Biophysical  
Measurements and Biomedical Imaging  
Laboratory of Biomedical Optics  
Warsaw, Poland  
Prof. Adam Liebert (P4)



**Physikalisch-Technische Bundesanstalt**  
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Berlin, Germany  
Dr. Heidrun Wabnitz (P2)



## **University of Bath**

Department of Physics  
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Prof. William J Wadsworth (P13)



**University College London**  
Department of Medical Physics  
Biomedical Optics Res. Lab.  
London, UK  
Prof. Jem Hebden (P3A)





## Medical Clinics

**University College London**  
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Department of Paediatrics  
London, UK  
Prof. Judith Meek (P3B)



**Charité Universitätsmedizin**  
Berlin, Germany  
Prof. Hellmuth Obrig (P6)



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Neurologico Carlo Besta**  
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Prof. Silvana Franceschetti (P5)



**The Medical University of Warsaw**  
The Department of Anesthesiology  
and Intensive Care  
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Prof. Ewa Mayzner-Zawadzka (P8)





## Modelling and Data Analysis

**University College London**  
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Prof. Giovanni Zaccanti (P11)



**Stiftung für  
Lasertechnologien in der  
Medizin und Meßtechnik** an  
der Universität Ulm  
Ulm, Germany  
Prof. Alwin Kienle (P9)



**Politecnico di Milano**  
Dipartimento di Bioingegneria  
Milano, Italy  
Prof. Sergio Cerutti (P1B)





## SME

### **Fianium Ltd**

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Dr. John Clowes (P14)



### **Micro Photon Devices S.r.l.**

Bolzano, Italy

Prof. Franco Zappa (P15)



### **Becker & Hickl GmbH**

Berlin, Germany

Dr. Wolfgang Becker (P16)



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Milan, Italy

Dr. Carla Finocchiaro (P17)

