Project:

Fluorescence Lifetime Multiplex Flow Cytometry System (FLiMFlow)

Technological key words:

fluorescence lifetime, flow cytometry, particles, multiplex bead assay, Bead Coding, lab-on-bead, biochemical analysis, microparticles

Industrial sectors addressed:

Diagnostics and Research in Life Sciences

Total cost: 939267 Euros

Partners' descriptions:

- **Quantum Analysis GmbH, Münster (QA)** Quantum Analysis (QA) develops and produces innovative biophotonic analytical instrumentation and applications for microscopic single particle analysis, especially based on flow cytometry (FCM) and scanning cytometry (SCM). QA coordinates the FLiMFlow consortium and project activities. QA will extend and combine its own experience in the field of instrumentation, including sensitive fast optical detection and signal processing with the contributions of the project consortium to a new instrument, allowing rapid and sensitive, yet affordable lab-on-bead multiplex biochemical analysis applications.
  Web: www.quantum-analysis.com

Quantum Analysis

Co-funded by the 7th Framework Programme of the European Union

0 **PolyAn GmbH, Berlin (POLYAN)** PolyAn is a nanotechnology company specialized in the modification of surfaces using Molecular Surface Engineering (MSE). Since 1996 we develop and manufacture functionalised consumables used in molecular diagnostics and LifeScience research. For fluorescence microscopy and flow cytometry PolyAn has developed a range of monodisperse PMMA microparticles for multiplex bead assays and calibration. Within the FLiMFlow project, PolyAn is responsible for the development and functionalization of new life-time beads.

Web: www.poly-an.de

0 **Bundesanstalt für Materialforschung, Berlin (BAM)** BAM Biophotonics is one of the internationally leading groups in fluorescence spectroscopy. Expertise: design and spectroscopic characterization of functional dyes for e.g. biomarker and surface group analysis, multiplexing and signal enhancement strategies, absolute fluorometry and standards. BAM was the first to suggest fluorescence lifetime multiplexing with lifetime pattern, meanwhile extended to first applications in biomarker analysis and cell studies. Expertise in optical characterization of fluorescent particles with custom-designed spheres. BAM successfully cooperated with POLYAN in characterizing surface functionalities on beads. BAM will dedicate its unique research and development expertise to FLiMFlow.

WEB: http://www.bam.de/de/index.htm

0 **Consiglio Nazionale delle Ricerche, Pisa (CNR)** The group of Prof. Bizzarri at IBF-CNR is a leading research entity in the field of microscopic luminescence lifetime analysis and its medico-biological applications. Different microscopic methods have been developed and characterized in a range of scientific publications. CNR will contribute excellent theoretical and practical luminescence lifetime analysis expertise to the FLiMFlow project.

Web: http://www.pi.ibf.cnr.it/

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o **Seco s.r.l., Arrezzo (SECO)** SECO is one of the worldwide most innovative and leading companies in the field of industrial computer electronics. SECO has specialized on compact and power-efficient computer module platforms and established the computer board standard Q7 ideally suited for digital signal processing specifically useful for powerful compact analytical devices. SECO will contribute its expertise in digital electronics development, including platforms for digital signal processing for nanosecond fluorescence lifetime analysis. ***Web:*** www.seco.it

Project abstract:

Flow Cytometry (FCM) is an established biophotonic technology for detection, analysis and sorting of biological cells and other microscopic particles. Within a flow cell, suspended particles are forced to cross a small light spot in a narrow sample stream, one-by-one. By their photonic interaction with the light spot, optical scatter light and specific fluorescence signals are generated. By FCM, physical and biochemical properties of thousands of particles can be analyzed per second. Due to its universality, FCM has evolved to a standard tool in medical diagnostics (health disorders, immune- status, leukemia) and more recently for industrial applications (rapid microbial control of pharmaceutics, food and cosmetics, plant breeding quality control). Among upcoming applications are environmental and nanomaterial particle uptake studies within the context of product safety and toxicity.

One of the developments with most rapidly growing applications in FCM is the use of polymer-microspheres (beads; with e.g. 0.1…5 µm of diameter), functionalized with various biochemical active surfaces (e.g. DNA/oligonucleotides, proteins and peptides, acting as target-specific ligands e.g. for health-related biomarkers) which allow specific biochemical analysis e.g. towards DNA/RNA, proteins and antibodies by biophotonic means.

FLiMFlow will establish a new and innovative flow cytometric method for analyzing biochemical targets and significantly increase the sensitivity towards lower target molecule concentrations by a new bead technology based on fluorescence lifetime analysis (FLA).

Expected results and exploitation plan:

The world-wide market for flow cytometry instruments (FCM), according to recent market studies, was 1400 Mio US$ in 2010.In addition, the world marked for reagents used for FCM applications reached a total volume of 800 Mio US$. With new FCM systems, applications and associated regents, based on the FLiMFlow technology, Quantum Analysis will access existing and new global markets for rapid and sensitive biochemical and cell analysis in the field of life sciences, and extend its global market participation as one of the few European flow cytometry companies.

PolyAn The development of new high performance reagents for multiplex diagnostics and research applications in the life sciences, which will be a key result of the FLiMFlow project for PolyAn, will broaden the product portfolio of PolyAn. The new products will efficiently complement PolyAn's already existing range of beads for multiplex applications.

PolyAn will address a segment of the overall reagents market for FCM applications. Major competitors are producers of monodisperse beads for multiplex applications. Additionally, there are integrated providers like Luminex that offer a bundle comprised of both instruments and reagents. PolyAn estimates the relevant market segment for beads to have a size of 150 Mio. US$ in 2011 with an annual growth rate of 5-8%.

SECO As a leading European technological company in the field of innovative embedded computer technology, being key promoter of several standards, standardization consortiums and communities, including Q7 and UDOO, Seco technology will play a key role for the systems based on the FLiMFlow technology. In addition to specific supply of components for this, the project will also serve as a valuable and well recognized reference for other application specific high-speed data acquisition requirements opening opportunities and emerging life science instrumentation marke.

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