SEVENTH FRAMEWORK PROGRAMME

- EU STREP Project -
Bloch electromagnetic surface wave biosensors for early cancer diagnosis

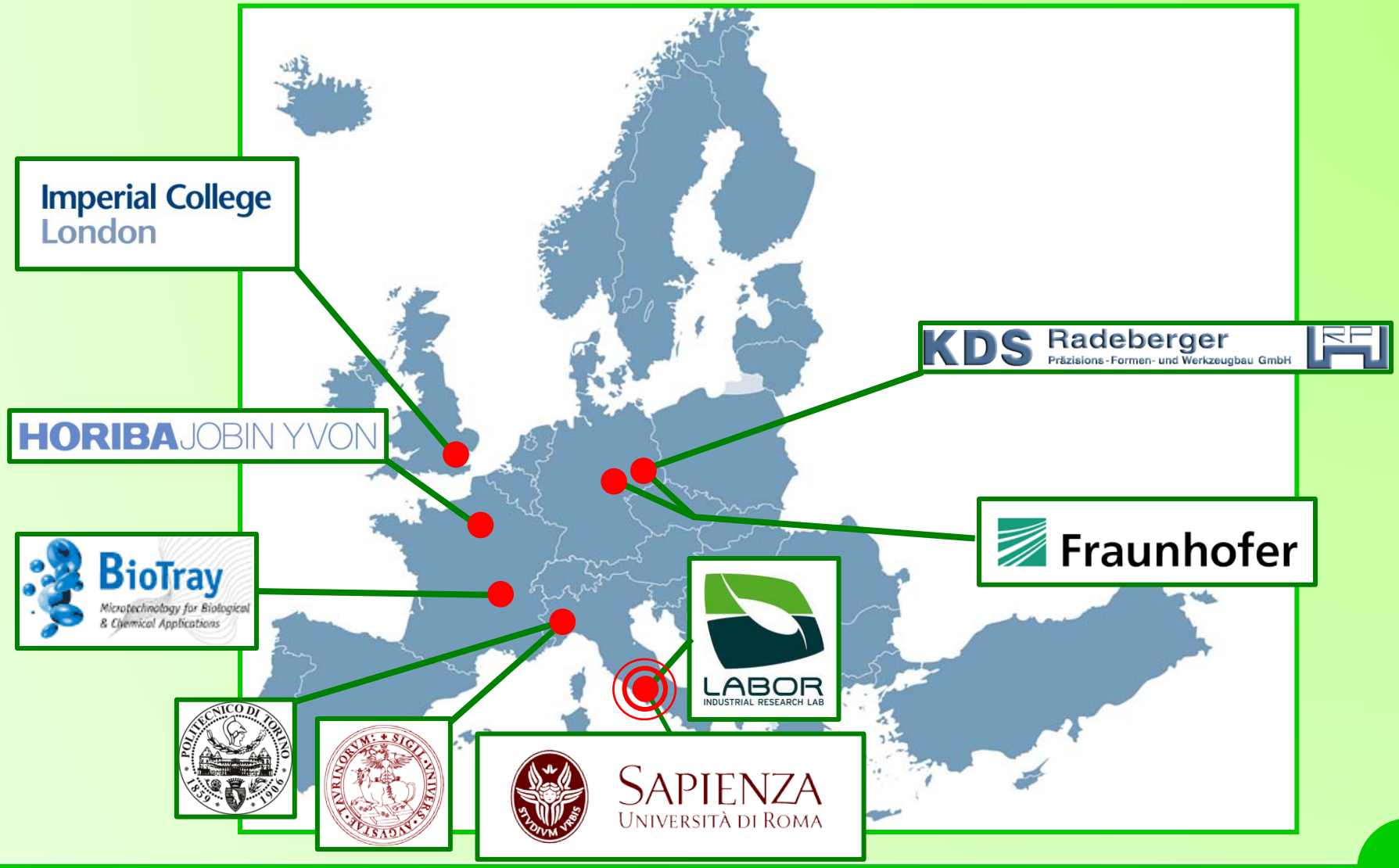
Project ID Card

- Funded under: EU 7th Seventh Framework Programme
- Topic: ICT 2011.3.5.a Core Photonic Technologies
  Subtopic (2) Biophotonics for early, fast and reliable medical diagnosis
- Reference: 318035
- Total cost: 4.73 M€
- EU contribution: 3.60 M€
- Start Date: October 1st 2012
- Duration: 36 months
- Contact: Prof. F.Michelotti (Project Coordinator)
  francesco.michelotti@uniroma1.it

Partnership

- Università degli Studi di Roma “La Sapienza”
  Department of Basic and Applied Sciences for Engineering
- Politecnico di Torino
  Department of Applied Sciences and Technology
- Fraunhofer Gesellschaft zur Förderung der Angewandten Forschung
  Unit a - IOF - Institut für Angewandte Optik und Feinmechanik
  Unit b - IWS - Institut für Werkstoff-und Strahltechnik
- Imperial College London
  Department of Materials
- Università degli Studi di Torino
  Department of Oncology
- Labor, Srl
- Biotray, SAS
- Horiba Jobin Yvon, SAS
- KDS Radeberg, GmbH

European Dimension



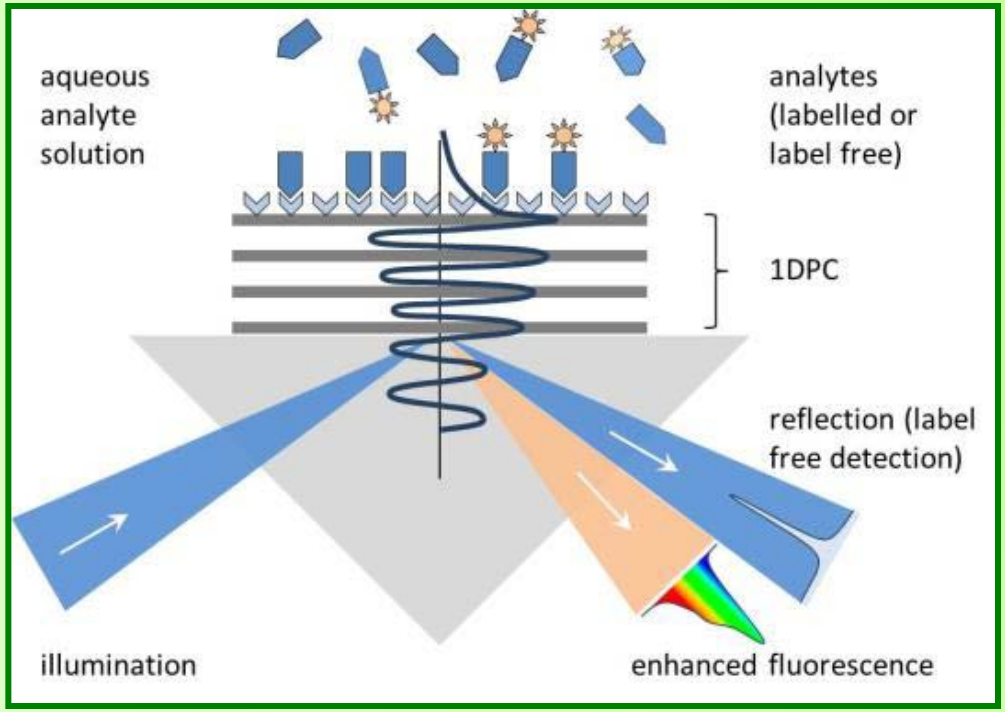
Objectives

- Developing a compact and multifunctional point-of-care platform performing real-time cancer biomarker detection in a tandem label-free and fluorescence configuration.

- The bio-sensing platform will consist of:
  - Disposable and low cost dielectric 1D photonic crystal biochips
  - Reading device

- Validating at pre-clinical stage the platform by the detection at a very low concentration of Angiopoietins -1 and -2 which have been identified as tumor inducers.

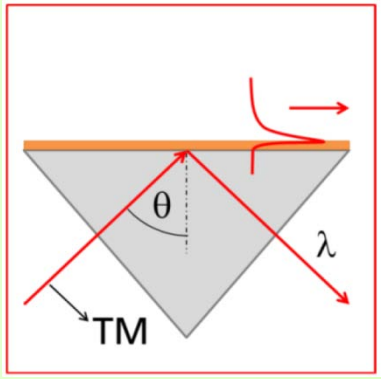
Concept



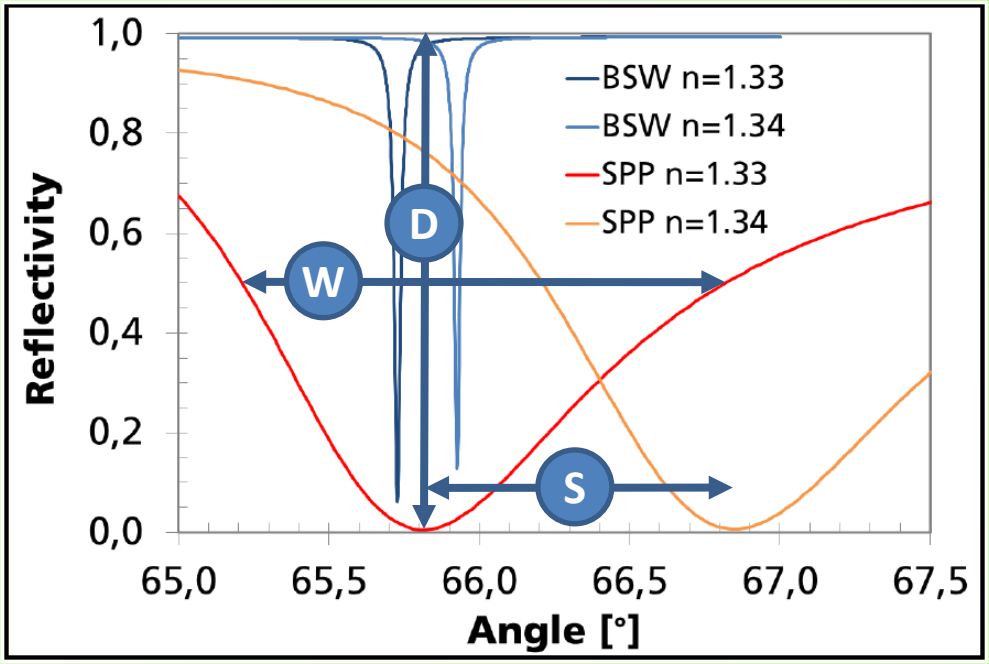
Properly designed 1DPC can sustain Bloch electromagnetic Surface Waves (BSW) at the interface, whose peculiar properties can be exploited for overcoming the limitations to sensitivity, selectivity, and resolution of present point-of-care cancer diagnostic tools and thus lead to a new class of advanced industrial products.

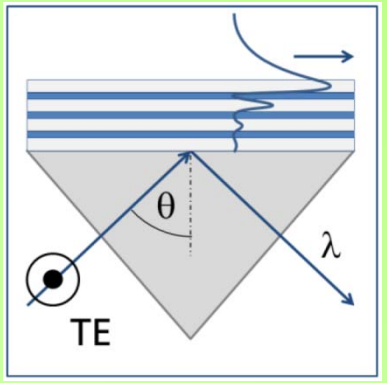
Concept

Enhancement of the label-free operation performance



- S=100°/RIU
- W=1.7°
- D=1





- S=20°/RIU
- W=0.02°
- D=1

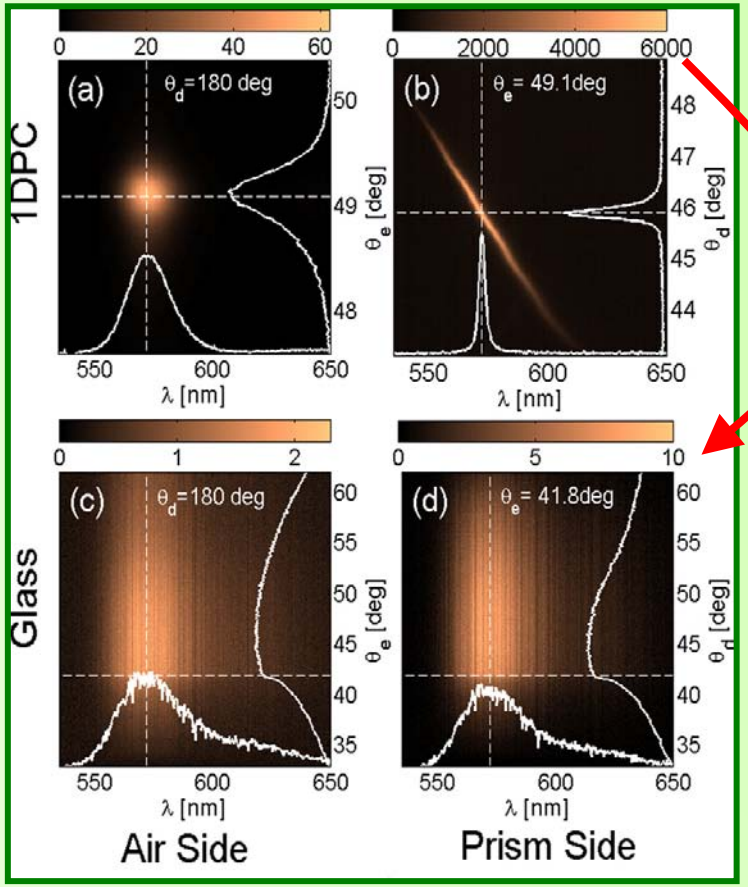
$$FOM = S \times \frac{D}{W}$$

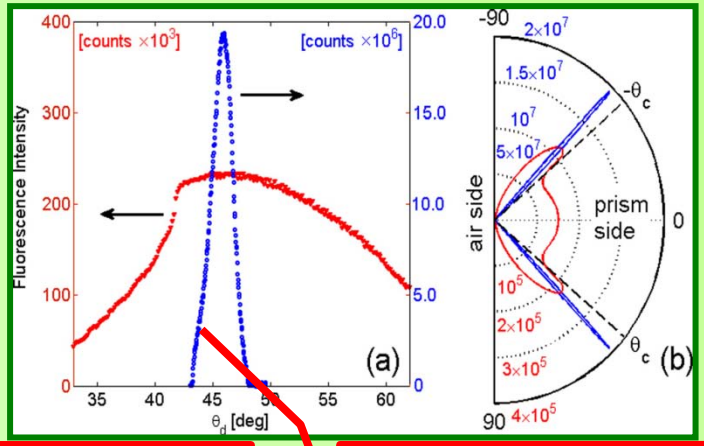
FOM=60 RIU^{-1} @ 804nm

FOM=1000 RIU^{-1} @ 804nm

Concept

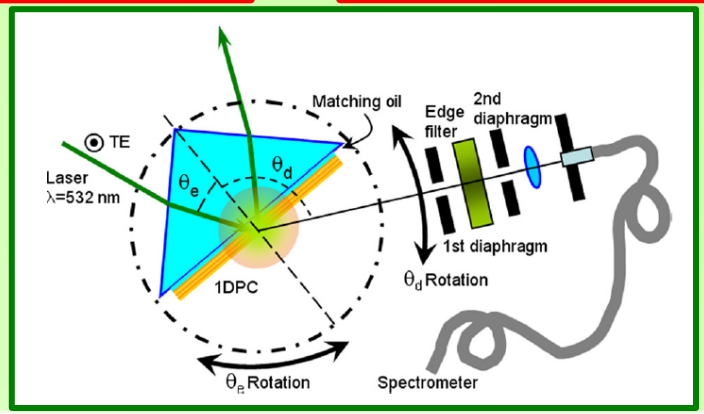
Enhancement of the fluorescence operation performance





Single λ enhancement 560

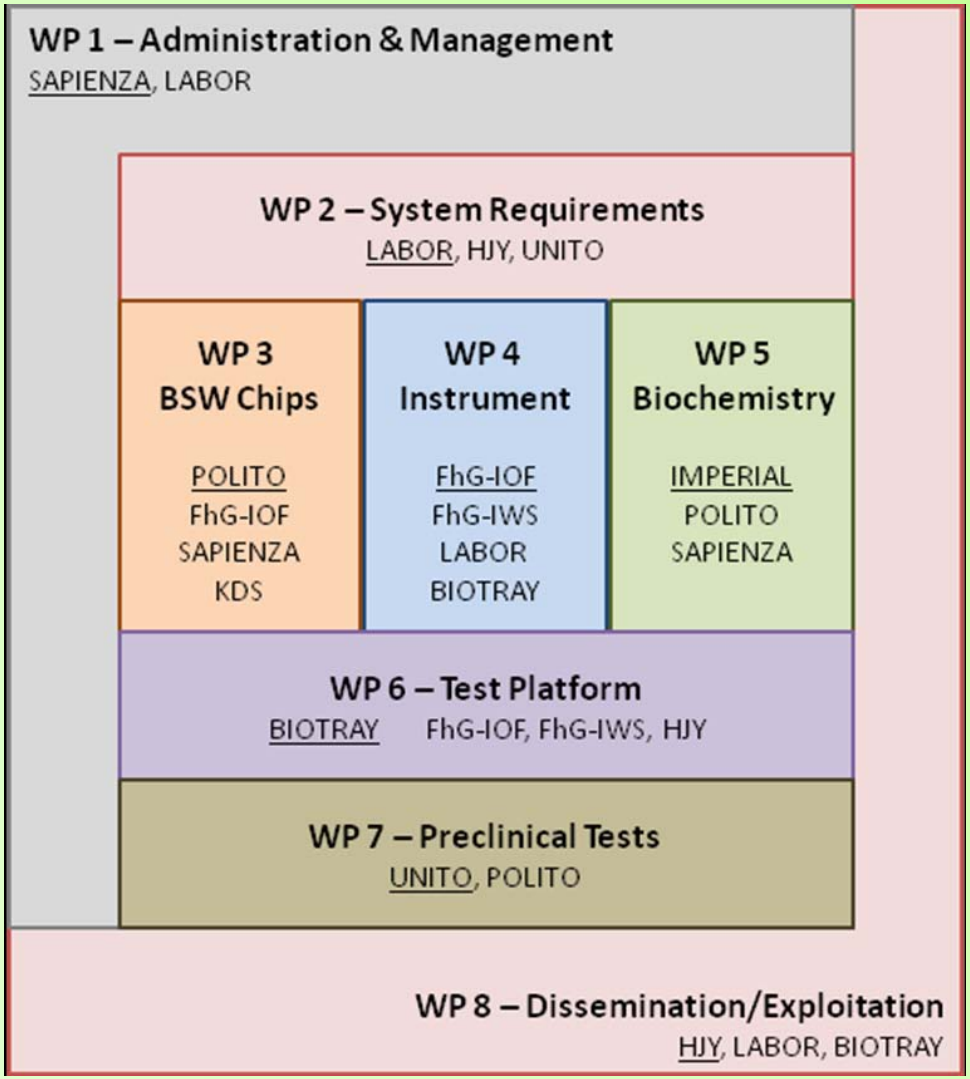
Integral enhancement 100



Objectives

Objective	Target value	Value of state of the art SPR platforms
Sensitivity of amplitude-based sensors to refractive index changes	30 RIU^{-1}	150 RIU^{-1}
Resolution for refractive index changes	$\Delta n < 5 \cdot 10^{-8}$ RIU	$\Delta n \sim 2 \cdot 10^{-7}$ RIU
Field enhancement factor for improving fluorescence intensity	5000	100
Integration of label-free and enhanced fluorescence detection	YES	NOT EXISTING
Resolution for detectable cancer biomarkers concentration	10ng/mL (label-free) <0.1ng/ml (fluo)	10ng/mL for Prostate Specific Antigen biomarkers
		64 ng/mL for activated leukocyte cell adhesion molecule biomarkers

Workplan


WP 1 – Administration & Management
SAPIENZA, LABOR
WP 2 – System Requirements
LABOR, HJY, UNITO
WP 3
BSW Chips
POLITO
FhG-IOF
SAPIENZA
KDS
WP 4
Instrument
FhG-IOF
FhG-IWS
LABOR
BIOTRAY
WP 5
Biochemistry
IMPERIAL
POLITO
SAPIENZA
WP 6 – Test Platform
BIOTRAY FhG-IOF, FhG-IWS, HJY
WP 7 – Preclinical Tests
UNITO, POLITO
WP 8 – Dissemination/Exploitation
HJY, LABOR, BIOTRAY

Exploitation potential

- The BILOBA platform represents a breakthrough in ultra-sensitive photonic systems for non invasive and point of care early diagnosis of cancer.
- BILOBA can potentially outperform conventional approaches and set a new standard for early recognition of malignancies.
- The increased performance of the BSW biochips will have a tremendous impact on the medical community, allowing cancer diagnosis at a very early stage with consequent increase of quality of life for the patients, increase of lifetime, and decrease of treatment costs.
- Horiba Jobin Yvon is leading the exploitation activities as it is well placed in the market which can directly exploit the BILOBA technology.

Contact

Sapienza Università di Roma	**Francesco Michelotti**	francesco.michelotti@uniroma1.it
Politecnico di Torino	**Emiliano Descrovi**	emiliano.descrovi@polito.it
Fraunhofer	**Norbert Danz**	norbert.danz@iof.fraunhofer.de
Imperial College London	**Molly Stevens**	m.stevens@imperial.ac.uk
Istituto di Ricerche Chimiche e Biochimiche "G. Ronzoni"	**Federico Bussolino**	federico.bussolino@ircc.it
LABOR Industrial Research Lab	**Paolo De Stefanis**	p.destefanis@labor-roma.it
BioTray Microtechnology for Biological & Chemical Applications	**Raphael Anastase**	r.anasthase@biotray.fr
HORIBA JOBIN YVON	**Chiraz Frydman**	chiraz.frydman@horiba.com
KDS Radeberger Präzisions-Formen- und Werkzeugbau GmbH	**Thomas Schubert**	schubert@kds-werkzeugbau.de