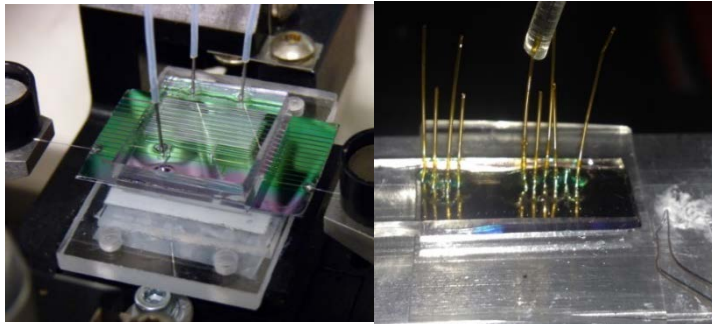


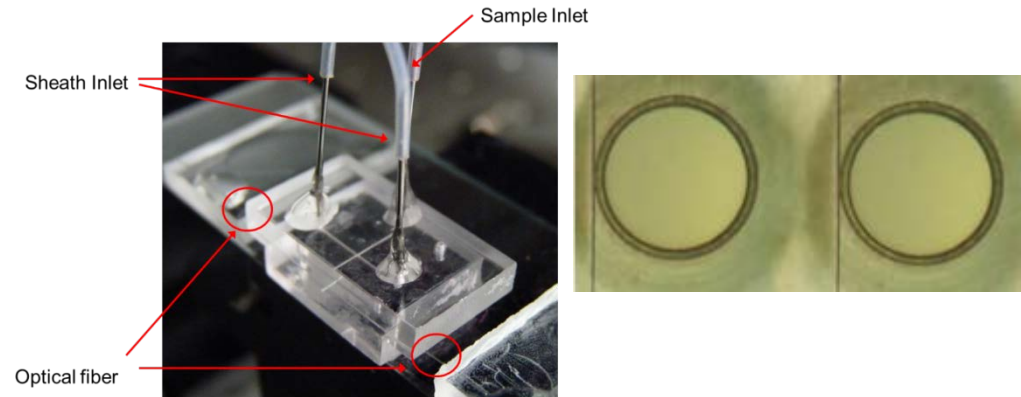
Topic 1 Photonics

Subtopic 1.1 and subtopic 1.3 - Optofluidic and Fiber optics distributed Sensors

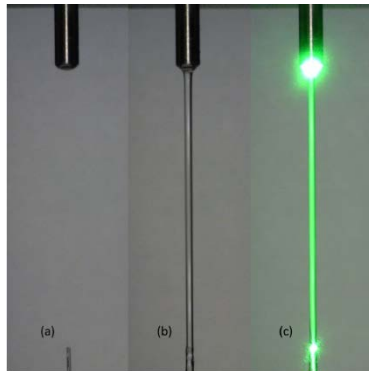
Contact: R. Bernini (bernini.r@irea.cnr.it)



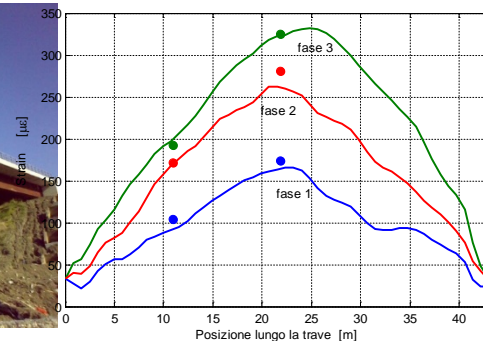
Silicon integrated optofluidic sensors for fluorescence or label-free analysis



Polymeric microfluidic sensor for molecular biosensing and single cell counting and analysis



Optofluidic Fluorescence/Raman spectroscopy platform for on line/real time liquid analysis and monitoring

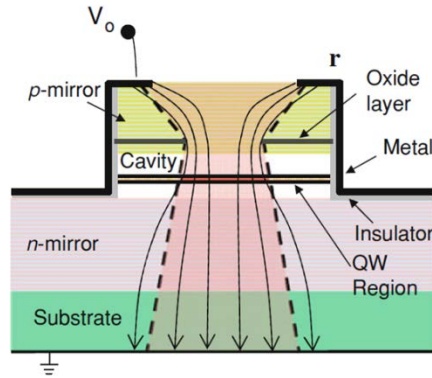


Distributed fiber optic sensors for temperature and/or structural health monitoring of civil infrastructure or aeronautical structures

Topic 1 Photonics

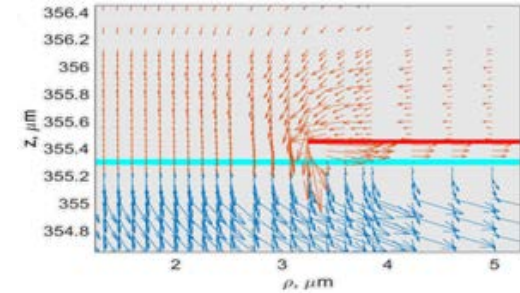
Subtopic 1.2 - Vertical cavity surface emitting lasers (VCSEL)

Contact: Pierluigi Debernardi (pierluigi.debernardi@ieiit.cnr.it)

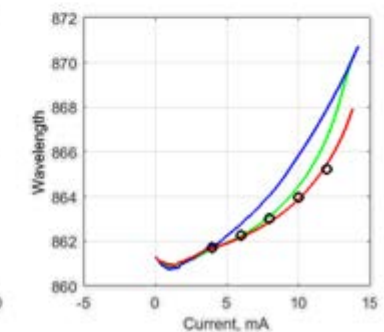
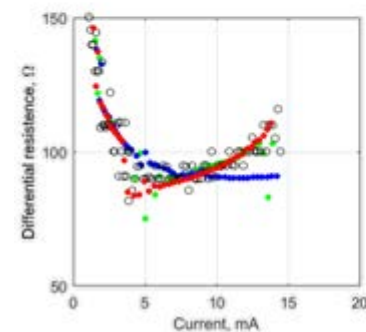
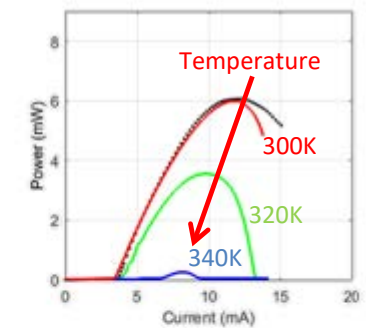
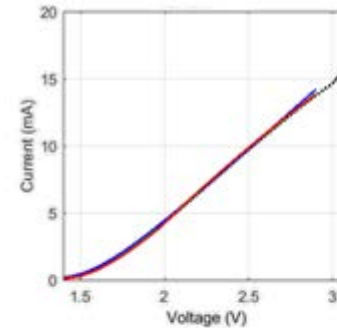


Typical VCSEL schematic

Top view of a VCSEL.

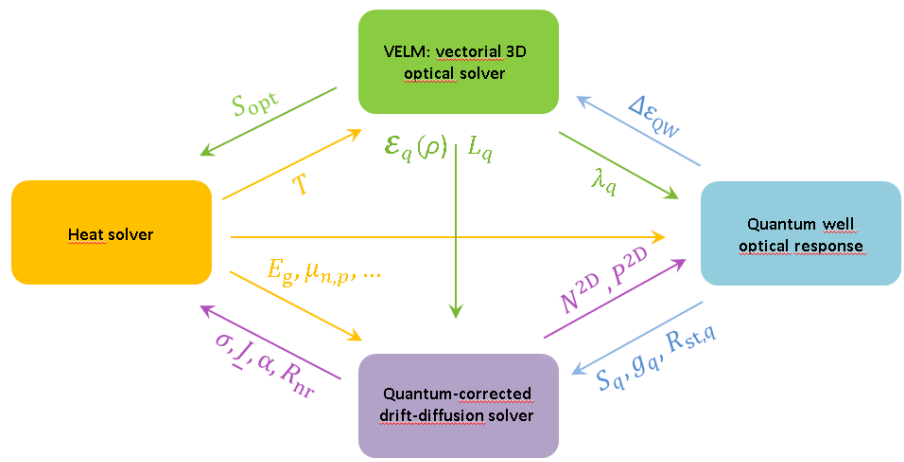


Example of simulated current density vector map



VCSEL Simulation result chart:

comparison with experiment (dots)



Workflow of our in-house VCSEL NUMerical Simulator (VENUS)



Project Area 1: Devices and Systems for ICT

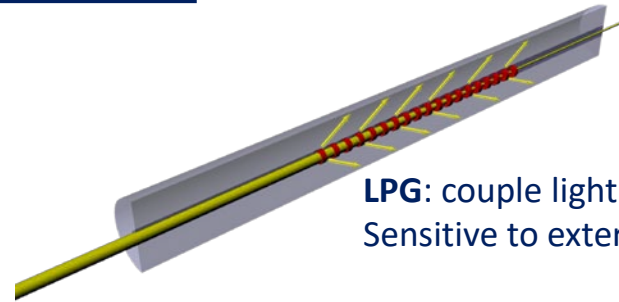
Topic 1 Photonics

Subtopic 1.4 - Fiber gratings

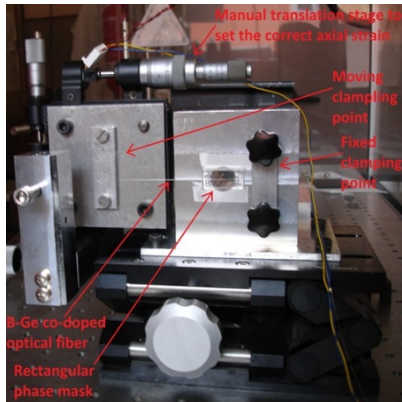
Contact: Cosimo Trono (c.trono@ifac.cnr.it)



FBG: back-couple light in the core
Sensitive to strain and temperature



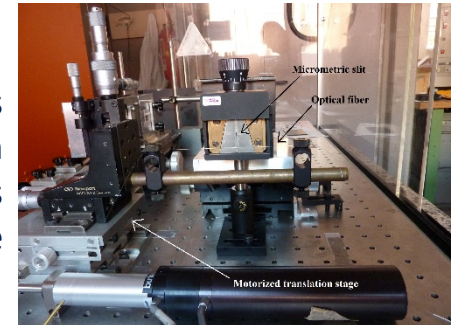
LPG: couple light in the clad
Sensitive to external refractive index



FBG writing apparatus:
Excimer source @248 nm
Photosensitive fibers
Phase mask technique

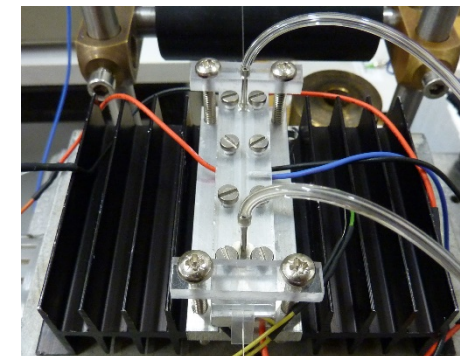
Design and development

LPG writing apparatus
Excimer source @248 nm
Photosensitive fibers
Point by point technique



FBG
Deformation monitoring
Cars windshield

Examples of applications



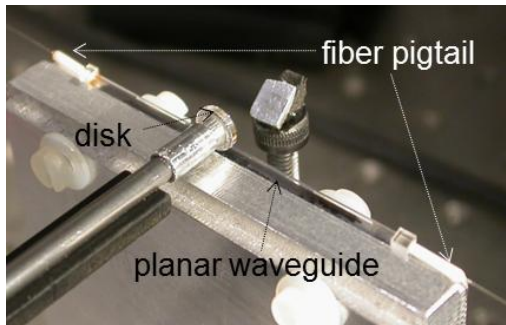
LPG
Label free biosensing

Topic 1 Photonics

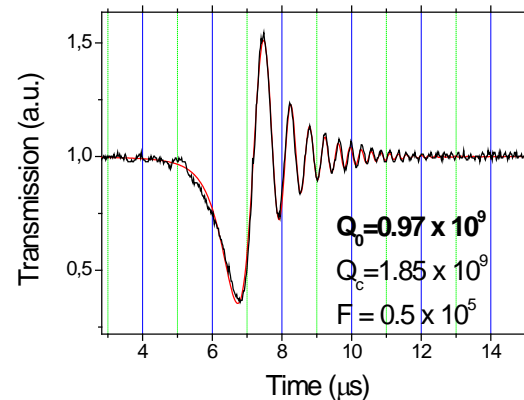
Subtopic 1.6 - High-Q optical micro-resonators

Contact: Gualtiero Nunzi Conti (g.nunziconti@ifac.cnr.it)

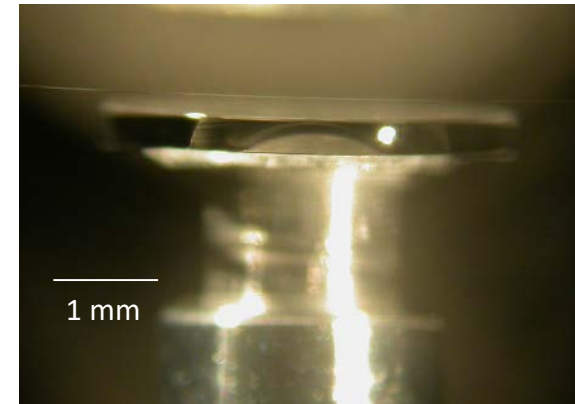
Ultra-high Q optical micro-resonators in crystals for ultra-compact low noise optoelectronic oscillators and frequency combs



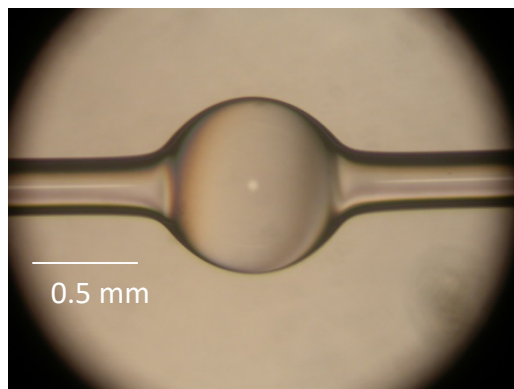
Lithium niobate disk uniquely coupled to a fiber pigtailed lithium niobate waveguide



Cavity ringdown measurement showing a Q factor of one billion in a MgF₂ disk

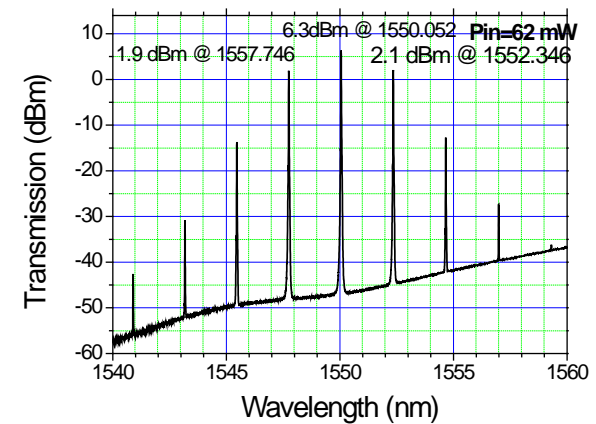


MgF₂ disk supporting ultra-high Q Whispering Gallery Modes



Hollow silica resonators or microbubble made from silica capillary

Hollow silica based micro-resonators for biomedical applications and ultra-broadband photoacoustic microscopy



Primary comb with separation of 26 FSR obtained from a magnesium fluoride disk

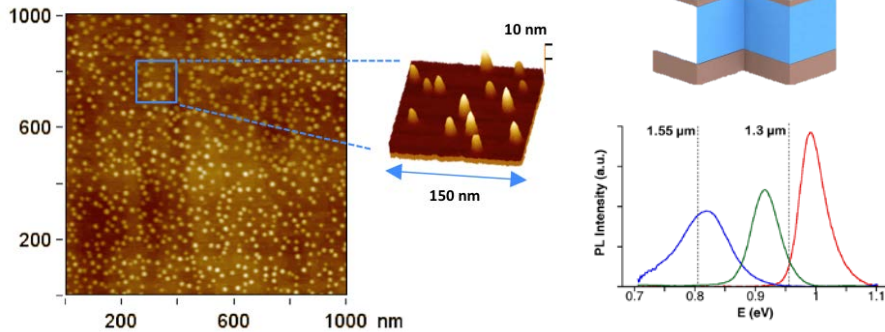
Topic 1 Photonics

Subtopic 1.9 - Quantum Dot nanostructures for photon emission at telecom wavelengths

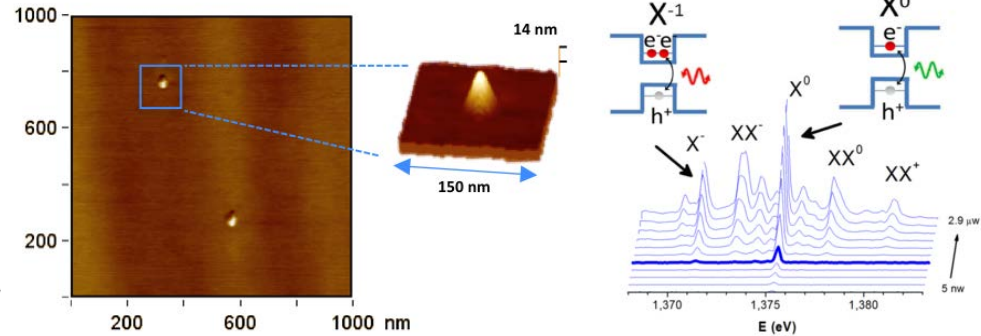
Contact Person: Paola Frigeri (paola.frigeri@imem.cnr.it)

Epitaxial Quantum Dots compact, integrable and efficient photon sources:

InAs/GaAs-based QDs for high-performance QD lasers.



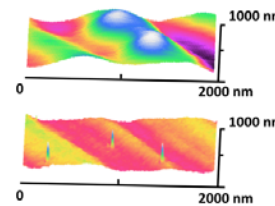
Metamorphic QD nanostructures: single-photon sources for quantum information technology.



Molecular Beam Epitaxy system for the deposition of III-V semiconductors



Bottom-up, site-controlled nanostructures.



Laboratory for Micro- and Nano-Fabrication equipped with a FESEM-FIB





Project Area 1: Devices and Systems for ICT

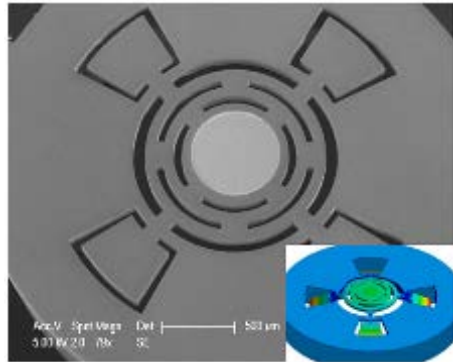
Topic 1 Photonics

Subtopic 1.10 - Micro/nano optomechanical oscillators with low optical and mechanical loss

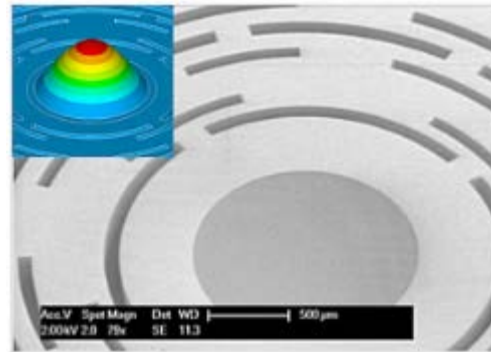
Contact: Michele Bonaldi (mbonaldi@fbk.eu)

MEMS mechanical oscillator for quantum optomechanics

- Silicon based devices -

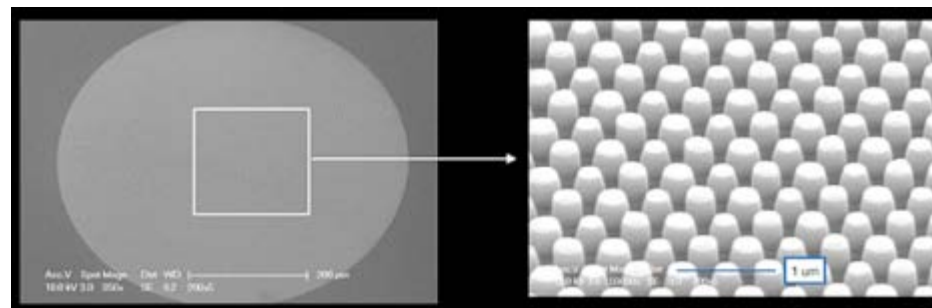


- SiN based devices -



Michelson interferometric setup
for device characterization

Photonic metamaterial to
improve reflectivity of the
oscillator





Project Area 1: Devices and Systems for ICT

Topic 2 Microwave and Millimeter-Wave Technologies and Devices

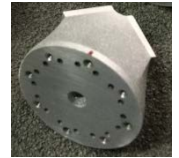
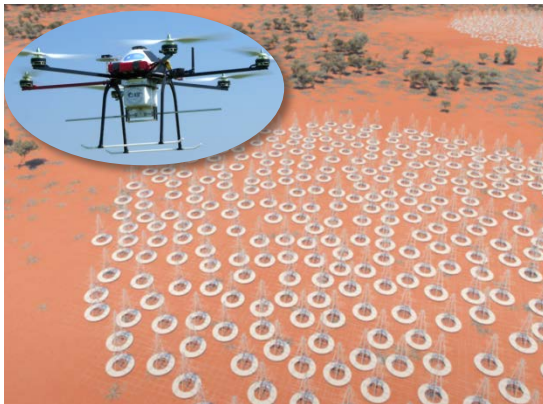
Subtopic 2.1 - Microwave and millimeter-wave passive systems and antennas

Contact persons: G. Virone (giuseppe.virone@ieiit.cnr.it)

Q-band (40-50 GHz)
multi-beam receiver for
astrophysical surveys



Unmanned Aerial Vehicle (UAV)
integrated with Tx sources for
radio-telescope calibration



Microwave components
developed by 3D- printing



Microwave/millimeter-wave
laboratory equipped up to
110 GHz



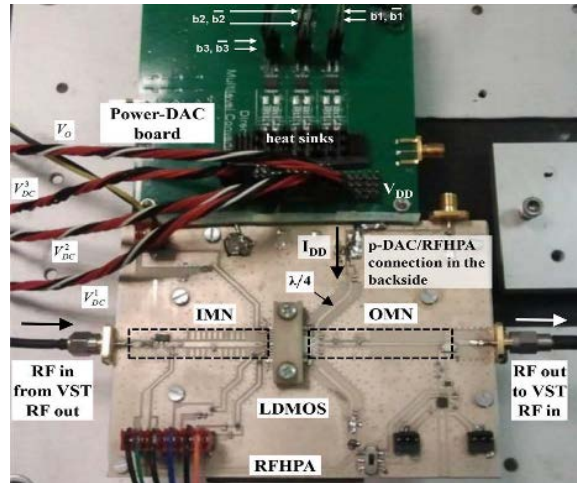


Project Area 1: Devices and Systems for ICT

Topic 2 Microwave and Millimeter-Wave Technologies and Devices

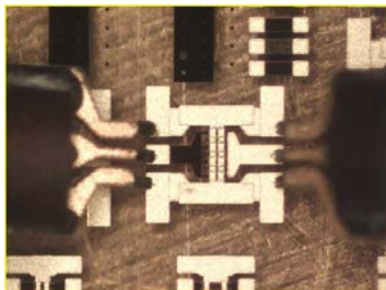
Subtopic 2.2 - Active circuits for wireless-communication systems

Contact persons: R. P. Paganelli (rudi.paganelli@ieiit.cnr.it)

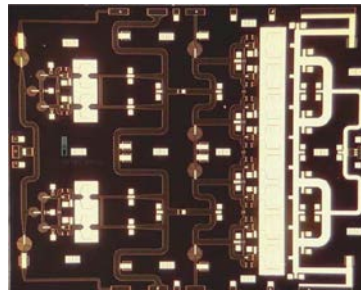


**Envelope-Tracking
Voltage-Supply**
Power-DAC supply
(on top) enhances
RF-Transmitter
efficiency in
Radars and
Base-Stations

Active Device Characterization
and Modelling



MMIC Amplifier
and Circuit Design

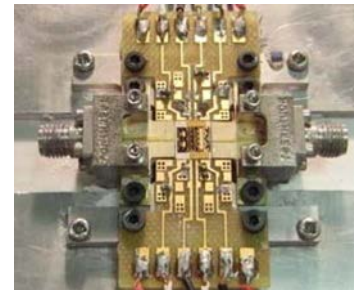


Resonant Wireless Power Transfer (WPT) System

Two Linear Motors work with the Energy gathered by
a Resonant Coil of a [150 Watt – 6.78 MHz] WPT-Link



Circuit Assembly
and Prototyping





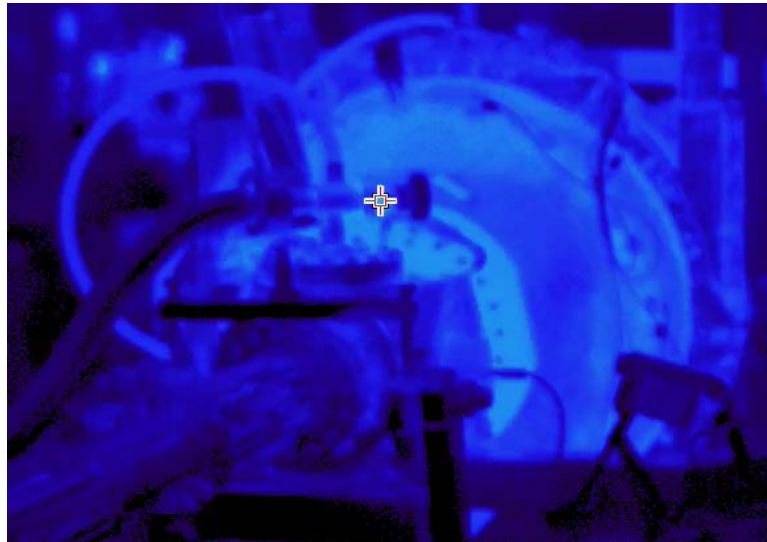
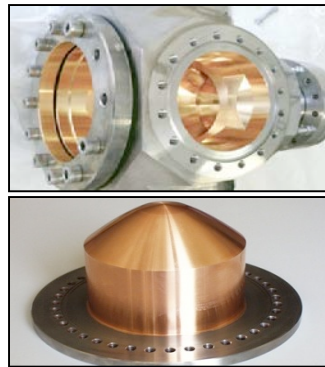
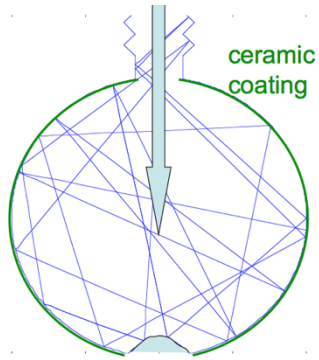
Project Area 1: Devices and Systems for ICT

Topic 2 Microwave and Millimeter-Wave Technologies and Devices

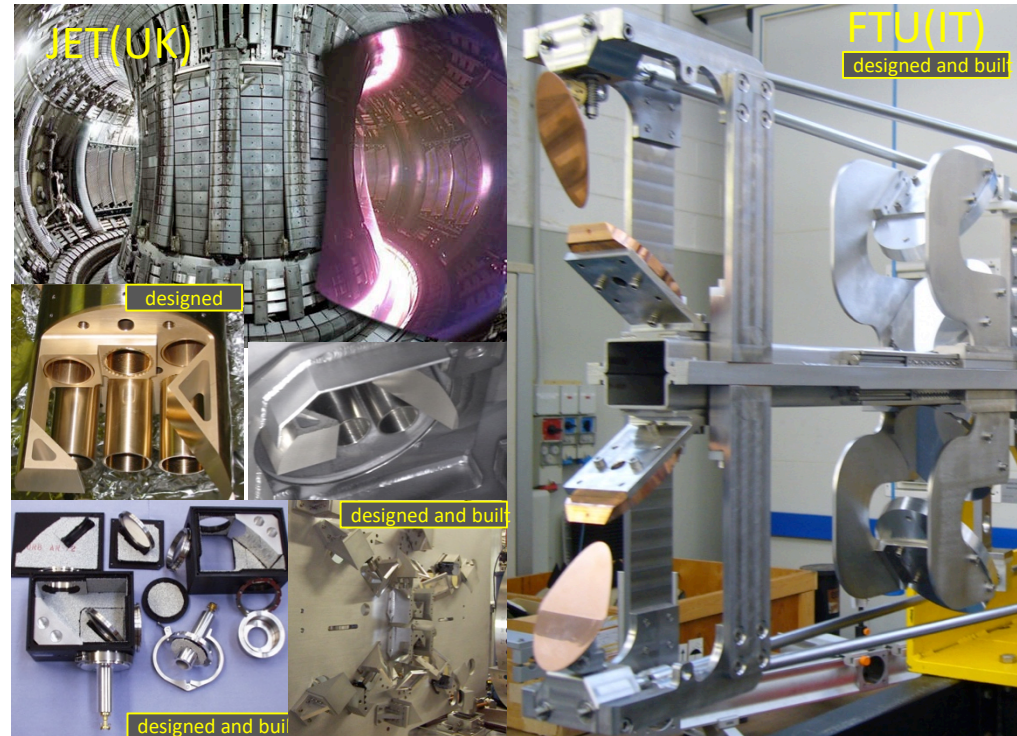
Subtopic 2.3 - RF technologies for nuclear fusion research

Contact persons: A. Simonetto (simonetto@ifp.cnr.it) and A. Bruschi (bruschi@ifp.cnr.it)

Design & tests of a 2 MW long-pulse millimeter-wave load at 170 GHz for the European Gyrotron for ITER



Design of millimeter-wave quasi-optical systems and antennas



<- IR image of the load during a 5 s,
0.5 MW pulse at QST lab. (Naka, JP)

mm-wave lab equipped
to 220 GHz ->





Project Area 1: Devices and Systems for ICT

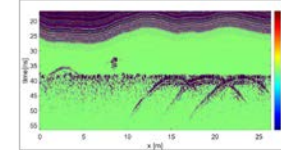
Topic 2 Microwave and Millimeter-Wave Technologies and Devices

Subtopic 2.4 Electromagnetic diagnostics systems and technologies

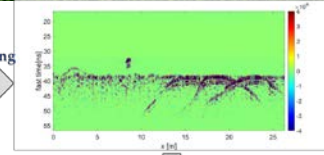
Contact Person: Ilaria Catapano (catapano.i@irea.cnr.it)



Portion of altitude compensated radargram

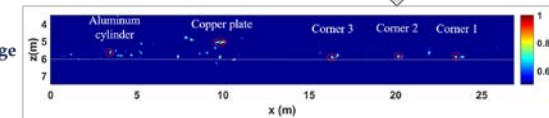


SVD denoising



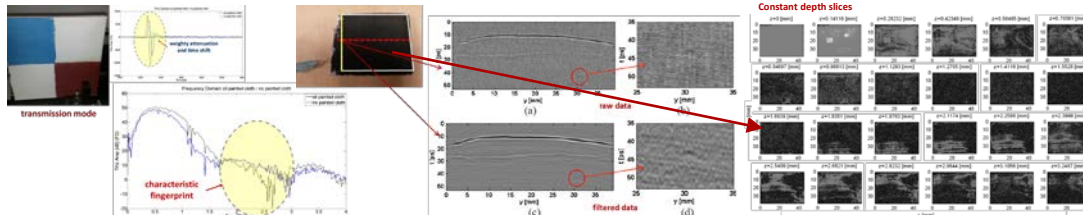
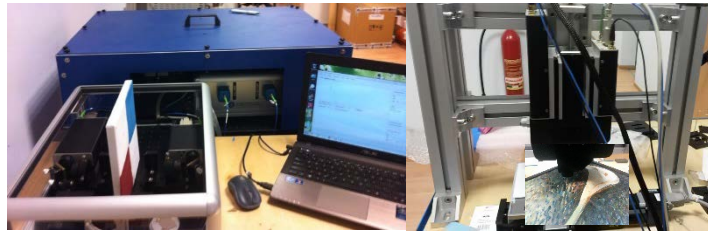
Microwave tomography

Focused image



Subsurface radar equipment improved by microwave tomographic approaches for 2D and 3D imaging via user friendly interfaces

Radar imaging via novel (MIMO / forward-looking) systems and unconventional (contactless, airborne, UAV) platforms



Time domain THz system equipped with proprietary data processing strategies combining noise filters with model based approaches for spectroscopy and imaging



Radar prototypes for through the wall imaging and vital signal monitoring

Topic 3 Micro and Nano-Electronics Technologies

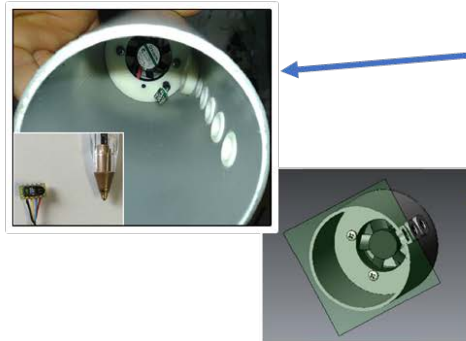
Subtopic 3.1 Hardware/software platforms for gas analysis

Contact Person: Davide Moroni (davide.moroni@isti.cnr.it)

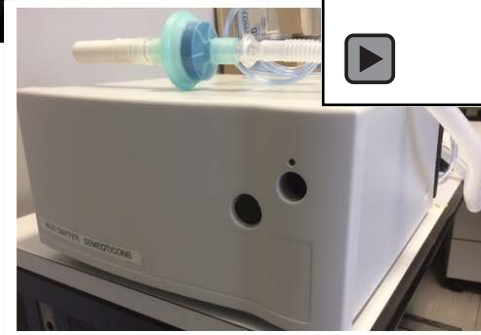
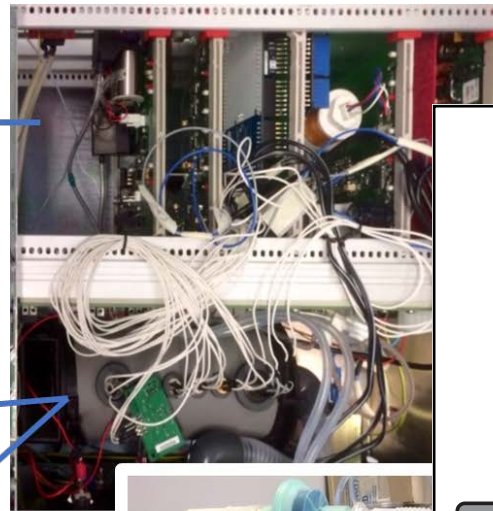
The Wize Sniffer



The sampling pump and the oxygen and carbon dioxide sensors

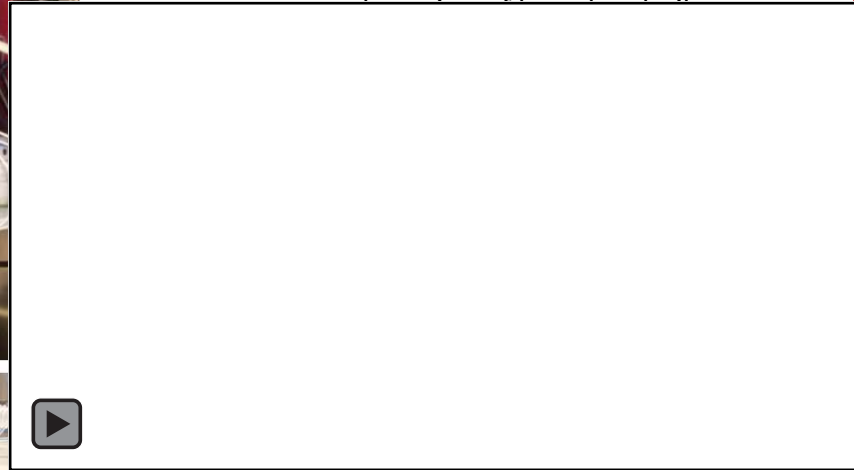


A Sensirion SHT11 monitors temperature and relative humidity values into the gas sampling chamber. A fan is switched on to purge the gas sampling chamber with ambient air after each breath test



Applications:

A) SEMEOTICONS <http://www.semeoticons.eu>



VIDEOS - See the Wize Sniffer in action:

- <https://youtu.be/Hq4eWteMIU0> (EN)
- <https://youtu.be/JkoDoQGR5DM> (EN)
- <https://youtu.be/S9dpeh0bjs0> (ITA)

Contacts:

- sara.colantonio@isti.cnr.it
- danila.germanese@isti.cnr.it



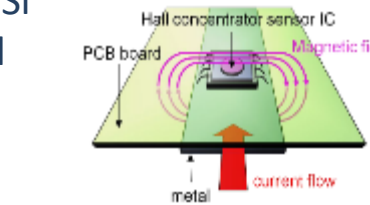
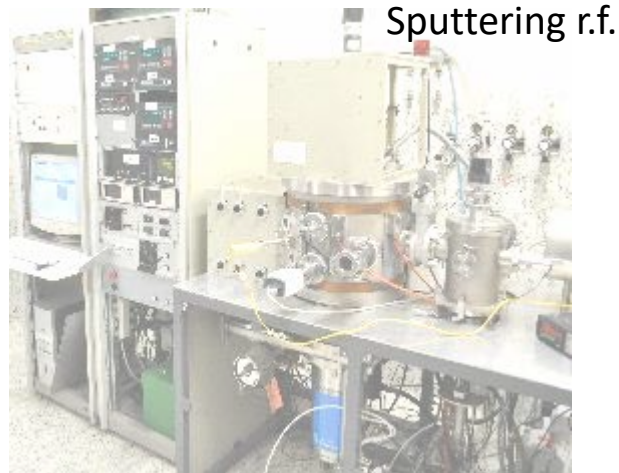
Project Area 1: Devices and Systems for ICT

Topic 3 Micro and Nano-Electronics Technologies

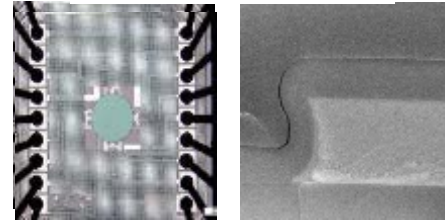
Subtopic 3.2 Si-integrated magnetic and magneto-optical sensors and devices

Contact Person: F. Albertini (franca.albertini@imem.cnr.it)

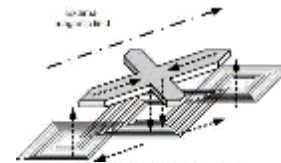
- Growth of magnetic and magneto-optical materials on Si
- Study of the interplay between growth parameters and functional properties
- Technological transfer
- Reliability tests of materials and devices



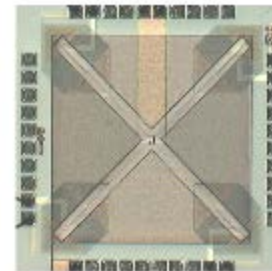
Hall current/magnetic field sensor



cross section of the magnetic concentrator



E3car-H2020 ENIAC-JU



Flux gate current/magnetic field integrated sensor

Application fields: current/magnetic field sensors, biosensors, magnetic MEMS, integrated inductors

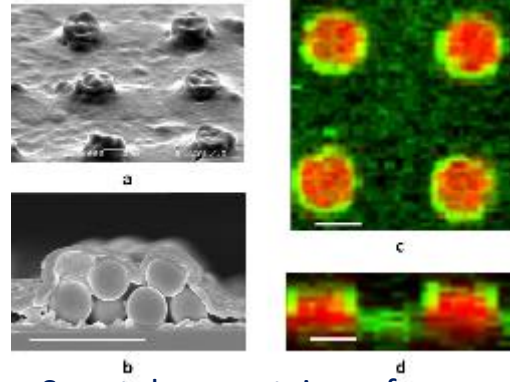
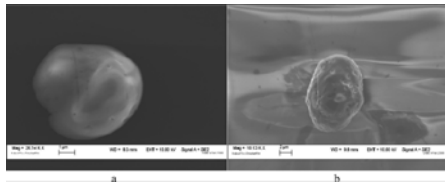


Project Area 1: Devices and Systems for ICT

Topic 3 Micro and Nano-Electronics Technologies

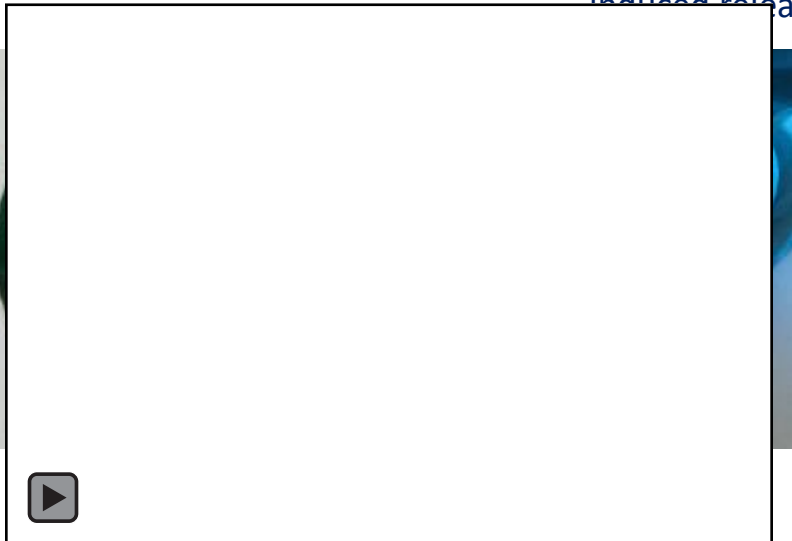
Subtopic 3.3 Electronic and electrochemical devices for sensing, radiation detection, unconventional computing and bioelectronics

Contact Person: Victor Erokhin (victor.erokhin@fis.unipr.it)

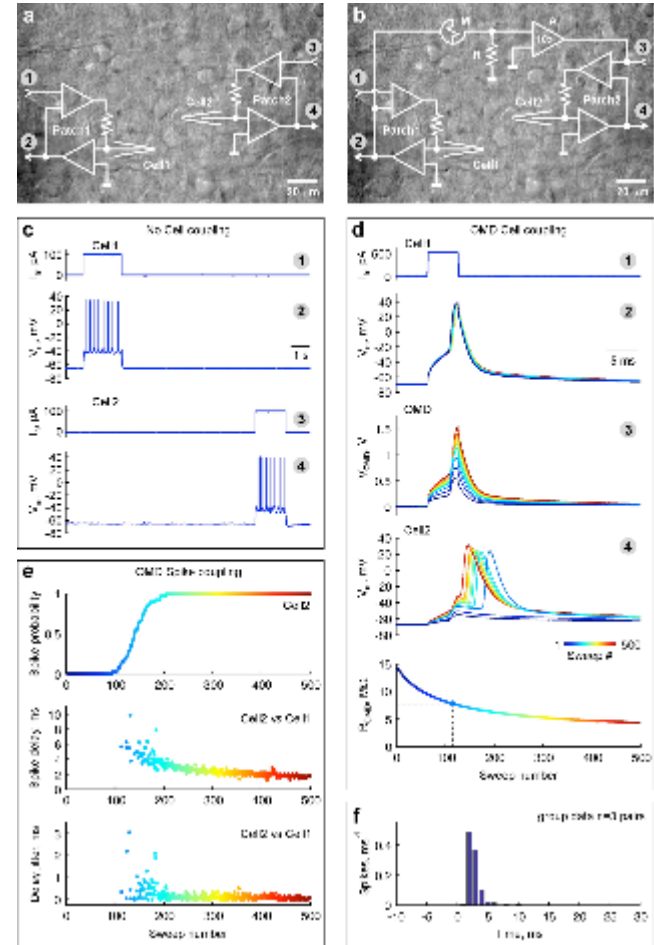


Smart drug containers for targeted delivery and induced release

Smart drug containers for induced release



flexible (kapton) substrates



First step towards synapse prosthesis: live neuron cells are synaptically connected through organic memristive device



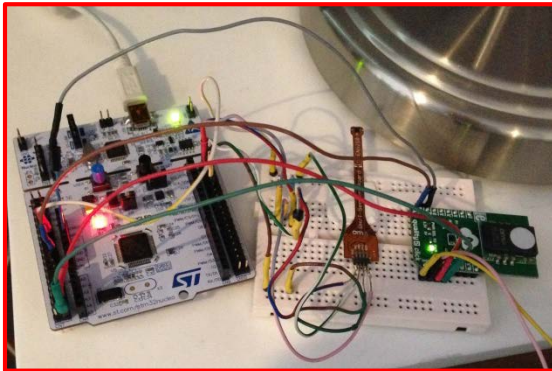
Project Area 1: Devices and Systems for ICT

Topic 3 Micro and Nano-Electronics Technologies

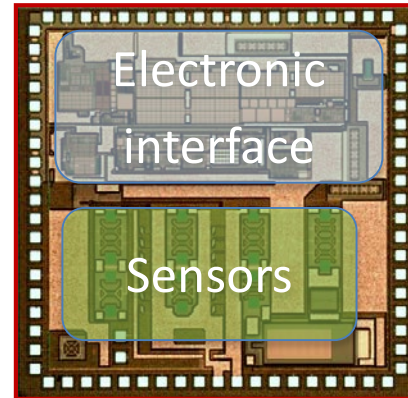
Subtopic 3.4 MEMS and smart sensors based on thermal principles and micro/nano-structured materials

Contact Person: Lucanos Strambini (lucanos.strambini@ieiit.cnr.it)

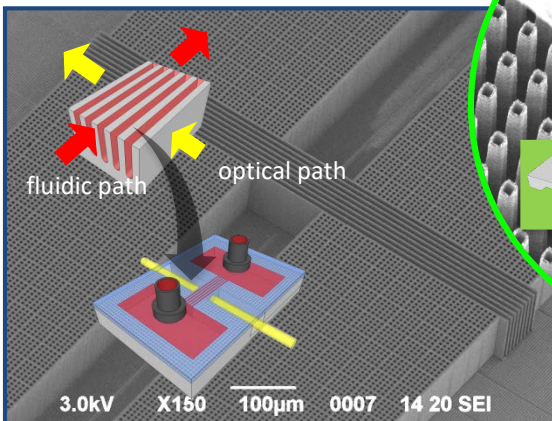
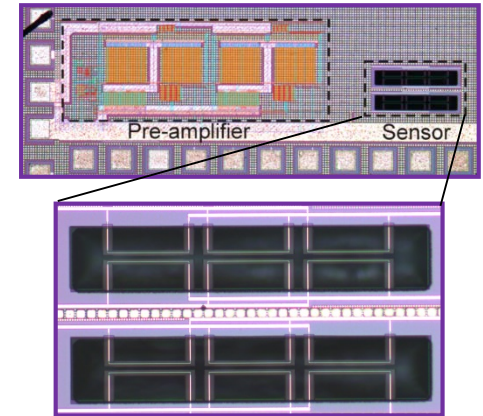
Indoor Air-Quality monitoring



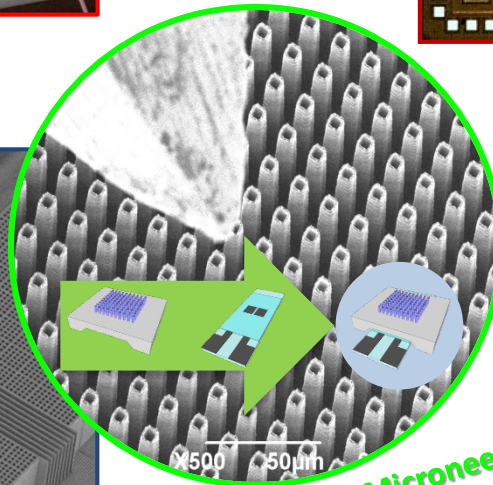
Smart Air Flow Sensor



CMOS Acoustic Particle Velocity Sensor



1D-PhC Microsystems For (Bio)sensing



Self-Powered Microneedles
For Pain-Free Transdermal
Glucose Sensing



Consiglio Nazionale delle Ricerche
Istituto di Elettronica e di Ingegneria dell'Informazione e delle Telecomunicazioni
**MEMS
&
Smart Sensors**
Laboratorio congiunto