



**SENSORS  
AND DEVICES**



**NQSTI**

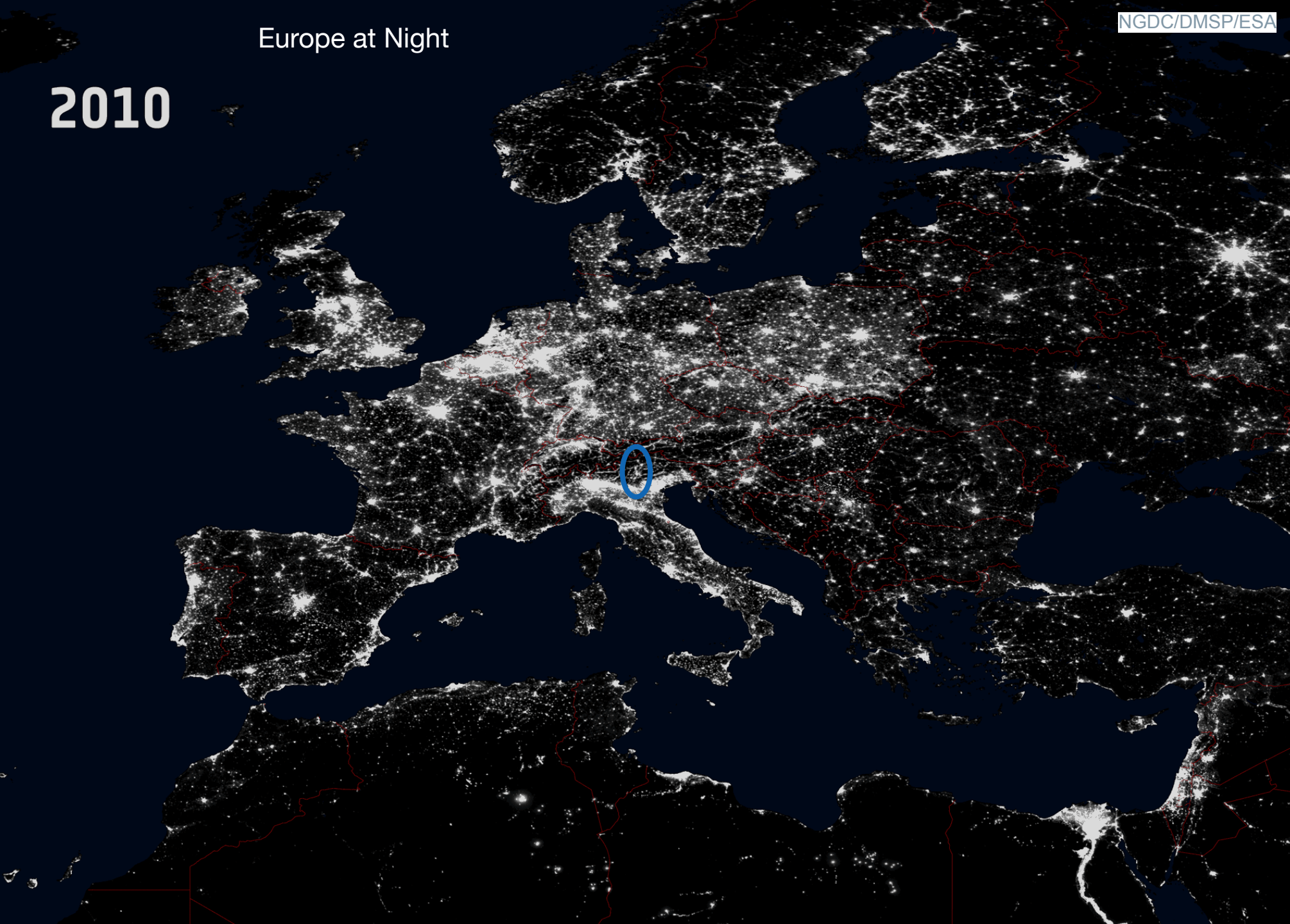
National Quantum Science  
and Technology Institute

# Welcome to the INFN Quantum Architectures for Analogues and Theory Applications Workshop

Prof. Richard Hall-Wilton

*FBK-Sensors&Devices Centre director*

2010



- Trento is on one of the main north-south Europe routes
- Region close to Austria and Switzerland

Trade routes and borders are drivers of ideas and creativity



**sensors**

**a device that is used to record that something is present or that there are changes in something**



**devices**

**an object or machine that has been invented for a particular purpose: an electronic device**

*Cambridge English dictionary*

**SD Centre**  
**Scientific Pillars**

Quantum Technology

Industry

Space Industry & Big Science

*Training*

Health & Environment

*Dissemination*

## Q@TN - A joint laboratory

- Q@TN is a joint laboratory of **University of Trento, Fondazione Bruno Kessler, INFN** and **CNR** on Quantum Science and Technology  
→ leverages on human resources and state of the art infrastructures of the partners
- Q@TN promotes
  - basic & applied research,
  - technological transfer & innovation,
  - education & training
- Q@TN is rooted in Trentino with a European outlook



Finanziato  
dall'Unione europea  
NextGenerationEU



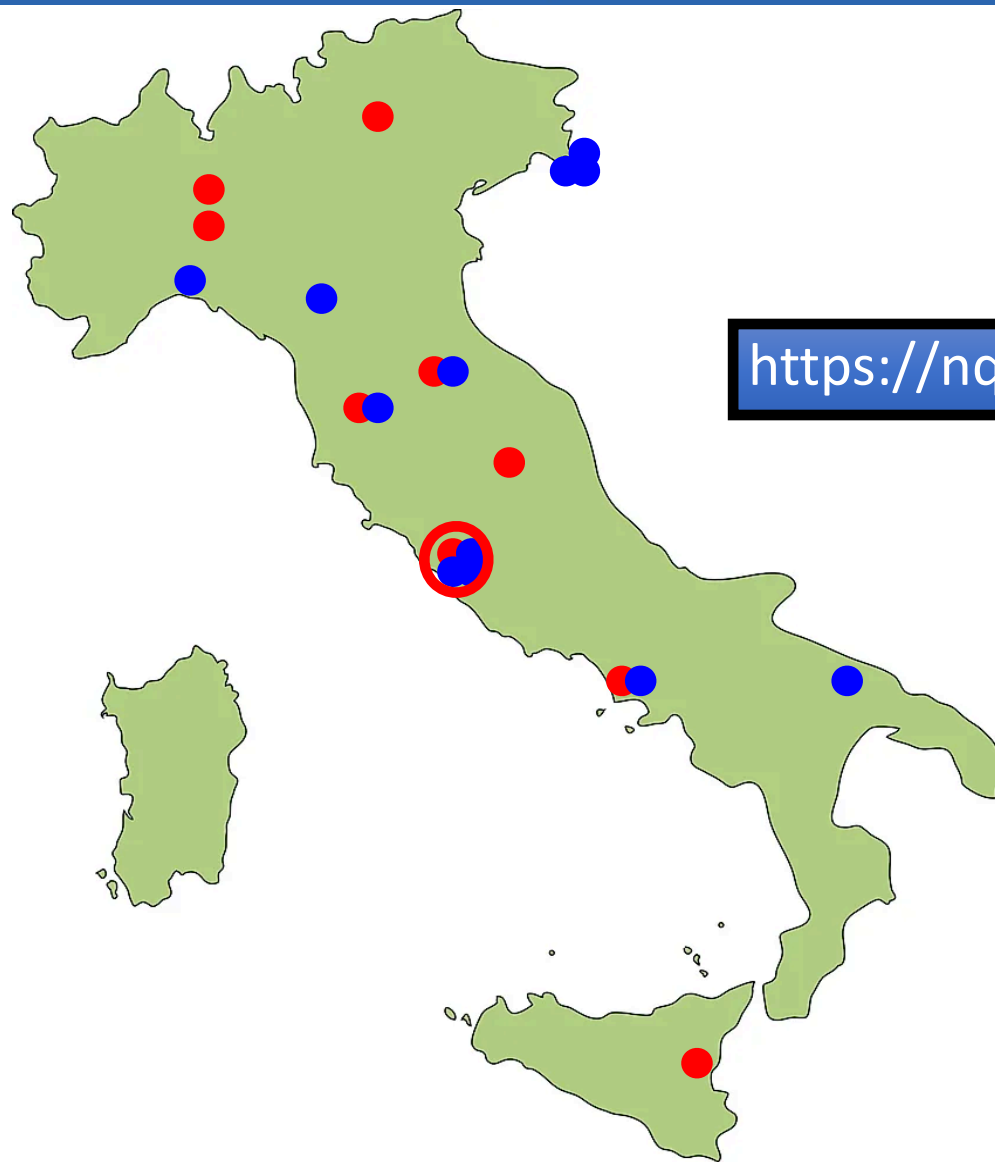
Ministero  
dell'Università  
e della Ricerca



Italiadomani  
PIANO NAZIONALE  
DI RIPRESA E RESILIENZA



NQSTI  
National Quantum Science  
and Technology Institute



**20 Institutions**



**Researchers  
322**



**MUR funding  
116 MEuro**

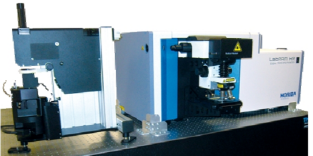
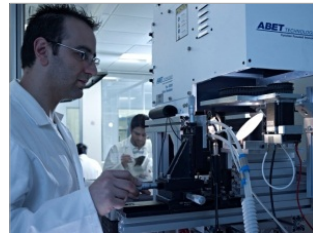


**New RTD  
104**

**Italian National Quantum Science and Technology Institute**

# FBK Sensors&Devices Centre: Micro and Nano Fabrication Facility

## IPCEI1: 1200m<sup>2</sup> moving to >2000m<sup>2</sup> semiconductor ISO4-6 cleanrooms



### 6" Microfabrication Area

#### Clean Room Detectors

700 m<sup>2</sup>; Class 10/100 0,8 um CMOS pilot line: Ion Implantation, Oxidation, Diffusion, RIE, Deep RIE (silicon and oxide), Lithography (stepper 0.35 um and mask aligner), metal sputtering, optical profilometry

#### Clean Room MEMS

500 m<sup>2</sup> Class 100/1000 diffusion, lithography (mask aligner), wafer bonding, electroplating, Si bulk micromachining, metal evaporation, RIE, mechanical and optical profilometry,

#### Clean Room 3D

towards 3D integration with through silicon vias (sensor + readout chip), thinning.

#### Testing Area

300 m<sup>2</sup> manual parametric testing, automatic parametric/functional testing, optical testing (spectral responsivity, quantum efficiency), solar cells efficiency characterization, gas and pressure sensors test benches

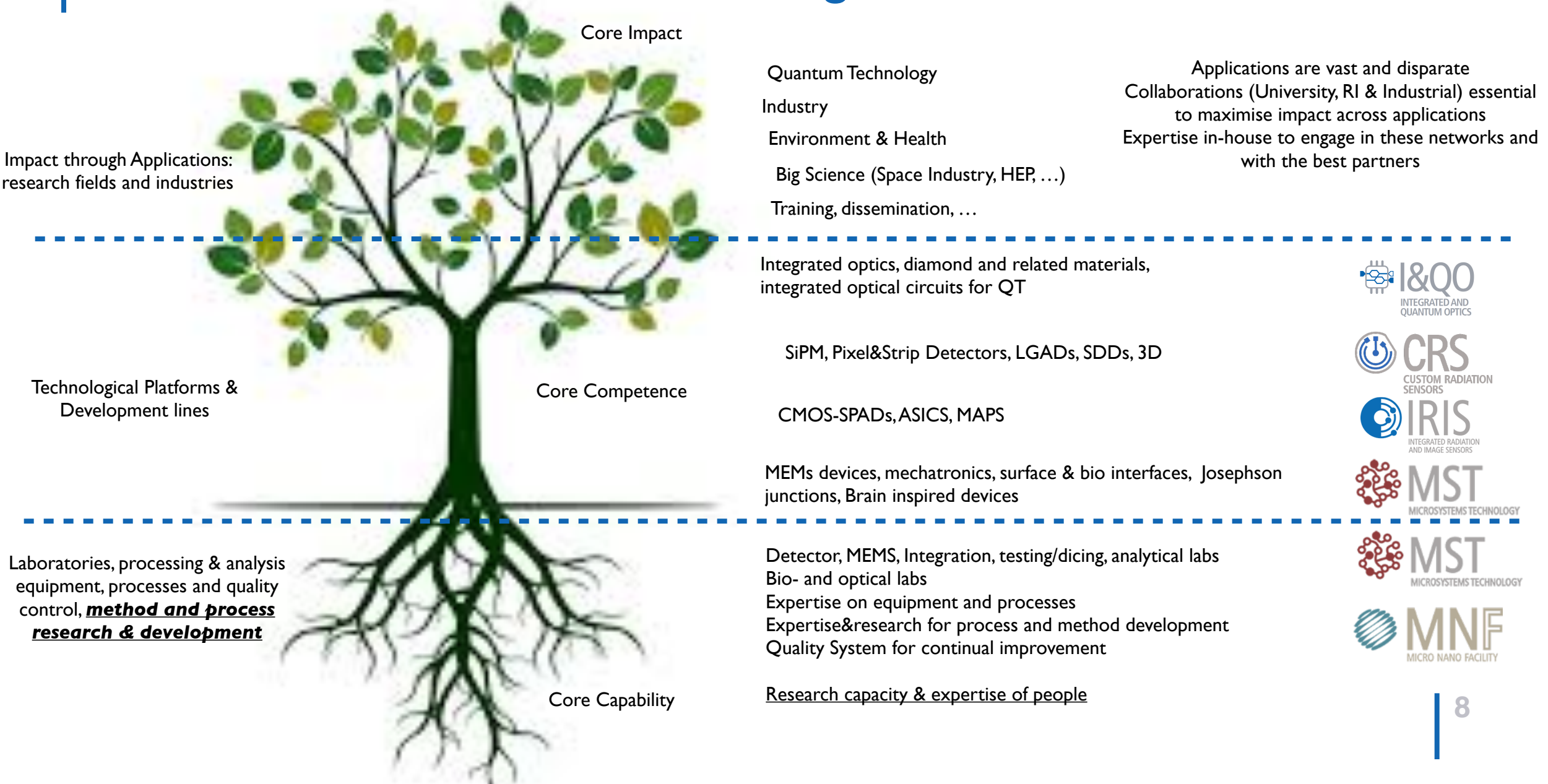
#### Integration Area

100 m<sup>2</sup> clean room Class 1000 Microassembly station; screen printing, bonding (ball & wedge bonder), Shear-Pull Tester, reflow oven, CNC micro-mill, pick and place

#### Nano- and Micro- Analytical Facility

Nano Ramen, FIB-SEM-EDX-EBSD, D-SIMS, TOF-SIMS, XPS, AFS, XRD/XRF

# FBK-SD Centre - How does it fit together?





Twofold role:

- Provide technologies to industrial and academic partners
- Participate in excellent research
- Contribute to Quantum Science

4 main areas/platforms :

- Single photon detectors
- Integrated photonics
- Superconducting devices
- Colour centres in diamond and related materials

# Quantum Technology is Horizontal / Cross Unit Activity



Integrated optical circuit platform

CMOS-SPADs

Hybrid SPAD array

Josephson Parametric Amplifiers

Defects in Diamond, Silicon, SiC, ... Single Photon Sources

Integrated quantum photonics

Quantum RNG

SiPMs

Superconducting Qubits

Core Processing and Production Capability

Dielectric materials

Quantum and ghost imaging

Fund. Physics. Applications

Superconducting Devices

Single ion implantation

Diamond

ASICs

LiNbO3

A/D design & readout

**Maximal impact from generating synergy from cross-unit activity**

**Aim:**

- Enjoy the Workshop!
- Enjoy the location!
- Looking forward to continuing excellent collaboration!