



Regione Toscana



Consiglio  
Nazionale delle  
Ricerche



Institute for Applied Physics "Nello Carrara"  
of the Italian National Research Council



Consiglio Nazionale delle Ricerche  
Istituto per la BioEconomia

# Managing Innovation In Tuscany

## *The Photonics Perspective*

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WORKSHOP

Tech4Food  
in Paris



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OCT



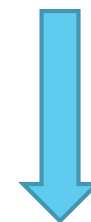
# Photonics Industry 4.0 in Tuscany



**Toscana Open Research**



- ✓ 121 Companies participating in H2020 projects
- ✓ 4.142 Researchers



**53.9M € Funds H2020**



PIATTAFORMA TOSCANA  
**INDUSTRIA 4.0** DIH  
Digital Innovation Hub

**POLO DI INNOVAZIONE TOSCANO**



**OPTOELETTRONICA E SPAZIO**



POLO DI INNOVAZIONE TOSCANO DI OPTOELETTRONICA E SPAZIO



- ✓ 91 Companies: 1.2B € Turnover and 4.000 Employees
- ✓ 16 Research Organisations
- ✓ 4 other Partners



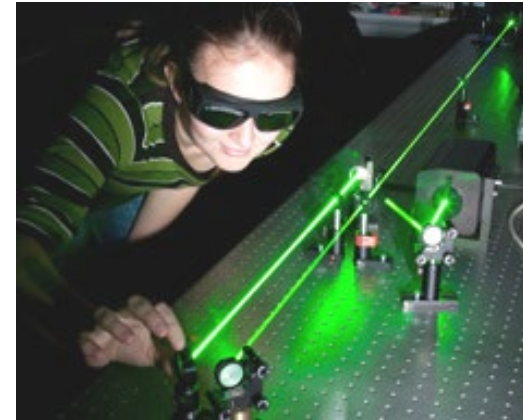
**IFAC** Institute for Applied Physics "Nello Carrara"  
of the Italian National Research Council

# IFAC - CNR

## *Institute of Applied Physics «Nello Carrara»*

### People:

- ▶ 70 Researchers and Technologists
- ▶ 21 Technicians and Administrative
- ▶ 75 Collaborators



### Sectors:

- ▶ Space, Aerospace and Earth Observation
- ▶ Health, NanoMedicine and Safety
- ▶ Cultural heritage
- ▶ Environment and Food Quality Monitoring

# Methodologies used by IFAC - CNR

## Laser



Laser alignment on optical bench for generation of non-linear effects

## Microoptics



Photolithographic and thin film deposition techniques in class 1000 clean room.

## Biophotonics



Fluorescence sensor for monitoring the phenolic maturity of wine grapes

## Sensors



Various types of alimentary and lubricant oils classified by optical microsensors.

## Microwaves



Microwave radiometer for experimental observation of natural surfaces (crops, vegetation, forests, snow).

## Diagnostics



Portable fibre optics sensors applied on paintings for pigments analysis.

## And ...

- Conservation;
- Remote sensing: Surface and Atmosphere;
- ICT (Processing and Access)

# CENTRE RESEARCH & INDUSTRY (CRI)

## Technology department Office - Industrial Liason Office



Multidisciplinary team offering Technological and Administrative Services

### Technological Services:

- ▶ Optics and Photonics: Design and Production in Cleanroom
- ▶ Laser processing: laser cutting / drilling / welding optimization studies
- ▶ Safety Measures and Electromagnetic Compatibility (EM): EM field measurements in the field and in anechoic chamber
- ▶ Services for Cultural Heritage: Laser Instruments and analysis
- ▶ Agrifood: data acquisition, analysis and tests with spectroscopic sensors on food and crops

### Administrative Services:

- ▶ Design support for European, national and local calls
- ▶ Business network services
- ▶ Technology consulting (E.g. Patents)



# Funded Sample Project: Fresh Fruit Pilot Project



High Tech Farming pilot action on photonics technology applied to table grapes and kiwis:

- ▶ to focus on commercialisation and scale-up
- ▶ to attract private investment
- ▶ to explore and strengthen synergies

## Technologies:

- ▶ Photonics for fruit ripening management, Italy (IFAC)
- ▶ Photonics for DNA identification, Portugal (private firm)
- ▶ Other Technologies implemented by other Public Research Organisations and Start-ups from Portugal, France and Greece.

Implemented in 5 geographical locations across Northern Greece

- ▶ Involving 4 producers groups as well as individual farmers
- ▶ Coordinators: American Farm School (Thessaloniki) and Central Macedonia
- ▶ Other regions involved: Tuscany, Bretagne, Extremadura



# Working in progress Sample Project:

## Sustainable phytochemicals enhancement in ready-to-eat vegetables (SUPERVEG)

### SUPERVEG Goals:

- ▶ To enhance the phytochemical content of ready-to-eat (RTE) vegs using short-term low-dosage postharvest ultraviolet and light radiation (UV/light) treatments
- ▶ To enrich the phytochemicals of RTE vegs waste coming from wholesalers and retailers, by defining specific UV/ light treatments



### Main Outcomes:

- ▶ add health values to RTE vegs;
- ▶ improve shelf life of RTE vegs by increasing natural plant defences against spoilage and pathogenic microorganisms;
- ▶ reduce veg waste by increasing quality and extended shelf life of products.

### Innovative aspects:

- ▶ Optimising bioactive composition in fresh production and Light Emitting Diodes treatments
- ▶ Use of optical sensors
- ▶ Post-packaging treatments and storage conditions: Improvements of the quality and shelf life of RTE veg
- ▶ Waste valorisation



CNR - IBIMET  
Institute of Biometeorology



CNR - IVALSA  
Trees and Timber Institute



 National Research Council of Italy  
Institute of BioEconomy



Biology - Agriculture and Food Sciences Department



It was created to respond to the ongoing process of reordering the scientific network of the institution and to the enhancement of a strategic sector for the future

The European Commission's Bioeconomy Strategy is at the heart of **Horizon Europe**

**10 billion €**



The next National Research Programme 2020-2025 includes a strategic area Bioeconomy, food and blue growth

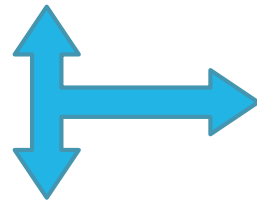
1 June 2019

 Consiglio Nazionale delle Ricerche  
Istituto per la BioEconomia



# The European Bioeconomy

Provides about 2.3 trillion euros per year

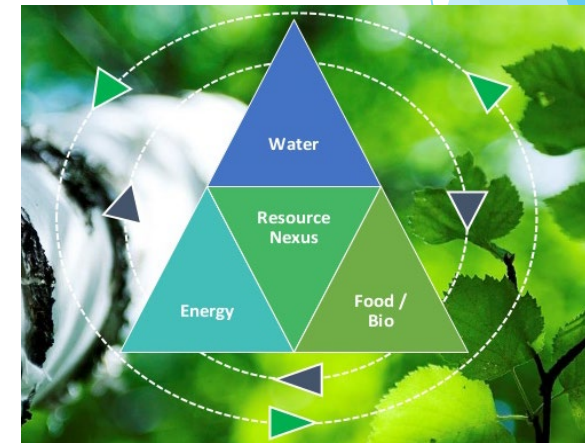


The Italian economy has almost two million jobs and about 330 billion annual turnover.

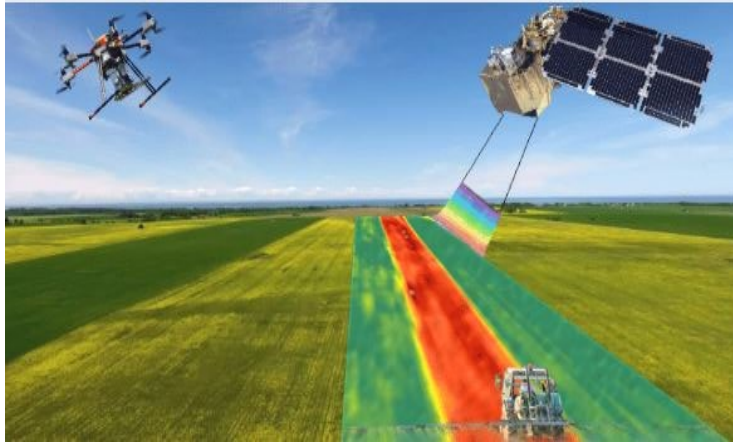
52 million are related to the agricultural production

The sector is expected to increase turnover and employment by 20% by 2030, particularly in industrial food production

This represents a major leap forward for agricultural companies and a major challenge with a cost reduction of at least 20% and a reduction in the use of pesticides from 50% to peaks of 70%.



# AGROSAT: A RESOURCE MANAGEMENT SUPPORT



A platform created to allow even small businesses to grow in terms of efficiency competitiveness



Provides a detailed picture of biomass time variability in the field by developing prescription maps

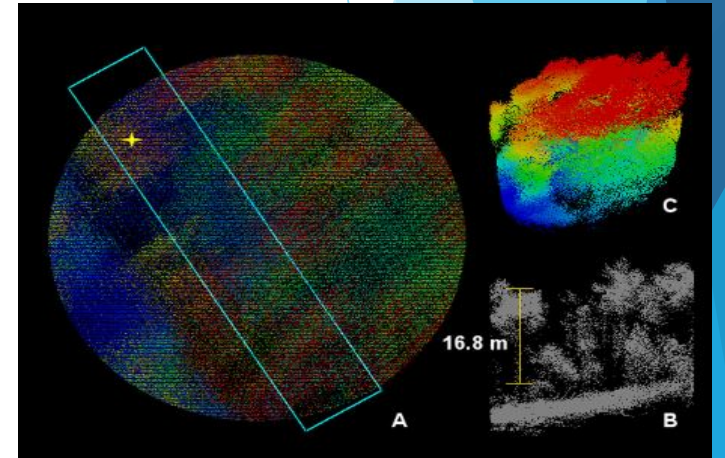
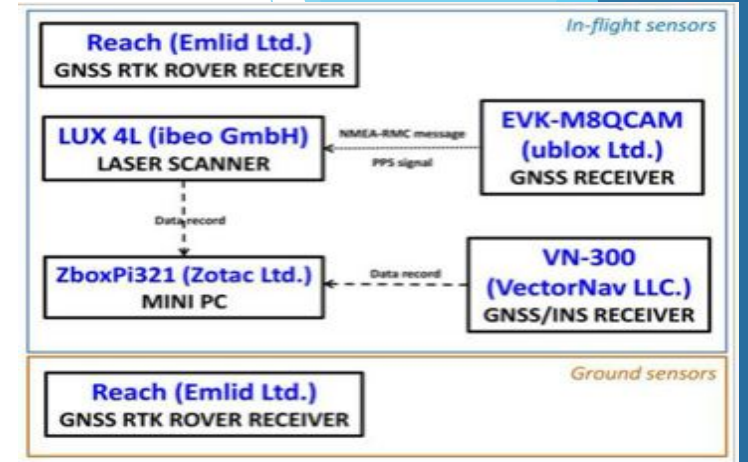
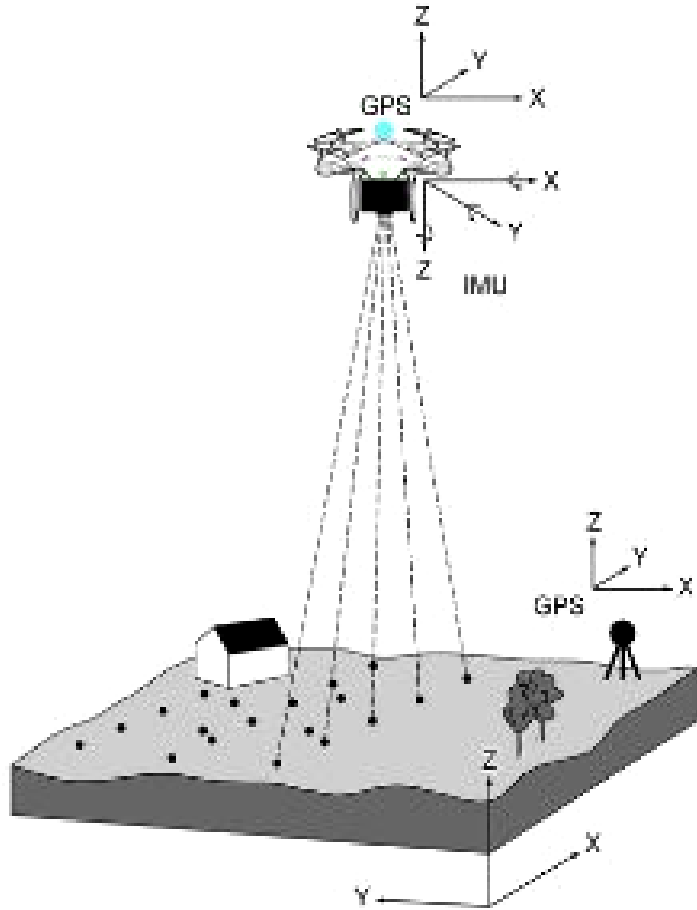
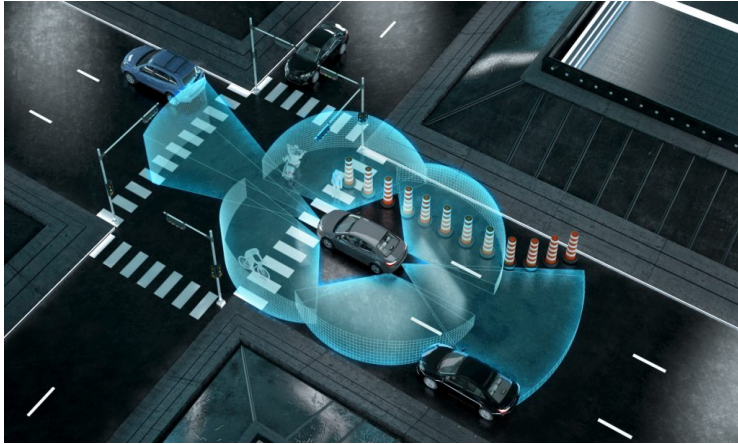


Using these products will save time, fuel, water and money by giving fertilizers only in the areas of the field that actually need it.





# SPIRIT PROJECT TO DEVELOP PRECISION FORESTRY APPLICATION



Funded Project by Regione Toscana.  
POR FESR 2014-2020

# E-CROPS TECHNOLOGIES FOR SUSTAINABLE DIGITAL AGRICULTURE



E-crops will employ an infrastructure for HTP phenotyping in a controlled environment to evaluate:

- ▶ The efficiency of photosynthetic conversion in biomass;
- ▶ Tolerance/adaptation/resilience to biotic and abiotic stresses;
- ▶ Sustainable exploitation of plant and microbial biodiversity;
- ▶ The adoption of resilient farming systems;
- ▶ The diversification of production into marginal areas.



Decision support tools will be developed, through the close interaction between business needs and monitoring and analysis methodologies, which allow to manage field spatial variability and to increase the quality of the final product (on high-value-added supply chains), and for sustainability optimization (on industrial supply chains).



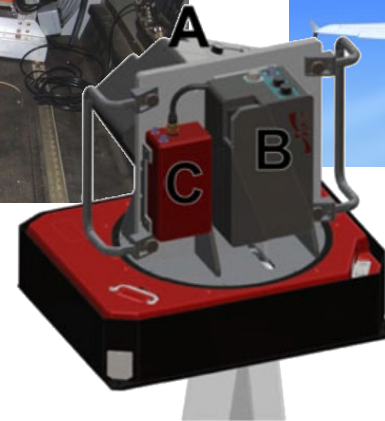
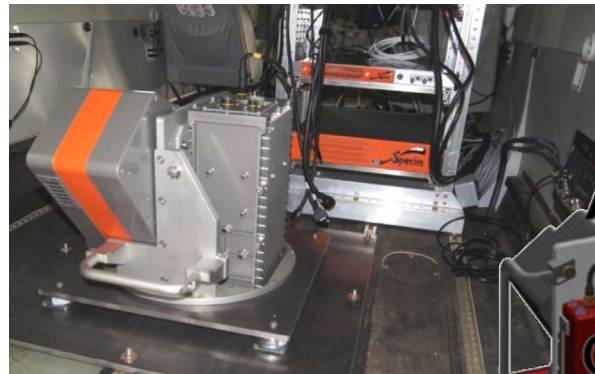


# PRISCAV: ACTIVITIES OF CAL/ VAL OF PRISMA MISSION



PRISCAV is a calibration/validation project for a recent ASI high-resolution hyperspectral satellite → **PRISMA**

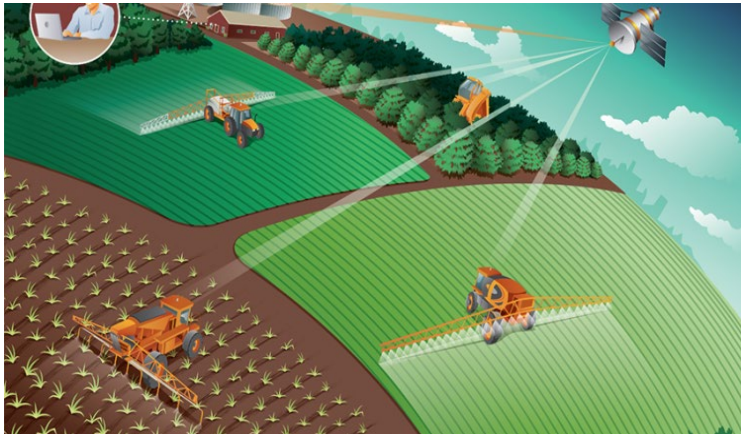
Activities of the project include ground truthing and airborne measurements with a state of the art hyperspectral sensor → **HYPLANT**



The satellite is still in a test phase, once operational it will make a fundamental contribution to monitoring pollution and environmental changes and will support the management of natural resources and emergencies.

# CONCLUSIONS

Advance the scientific and technological knowledge useful for the development and enhancement of a sustainable and innovative agri-food system.



Improving crop yield and sustainability, production quality and working conditions to ferry agriculture into evolving and experiencing a digital revolution.



In order to

Working with all stakeholders and implementing the innovative ideas of our field of action in a design and effective way, combining different sectors, disciplines and technologies



# THANK YOU



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