



2021 IEEE INTERNATIONAL WORKSHOP ON

# METROLOGY FOR AGRICULTURE AND FORESTRY

TRENTO - BOLZANO, ITALY / NOVEMBER 3-5, 2021

## WORKSHOP PROGRAM



**MetroAgriFor**  
TRENTO-BOLZANO *2021*

For further information, visit the website  
[www.metroagrifor.org](http://www.metroagrifor.org)

2021 IEEE INTERNATIONAL WORKSHOP ON

# METROLOGY FOR AGRICULTURE AND FORESTRY

TRENTO - BOLZANO, ITALY / NOVEMBER 3-5, 2021



MetroAgriFor  
TRENTO-BOLZANO 2021

**JAE** Journal of Agricultural Engineering



**sensors**  
an Open Access Journal by MDPI



**agriculture**  
an Open Access Journal by MDPI



*def-tech*  
Technologies  
Defence

**mipaaf**

ministero delle politiche  
agricole alimentari e forestali



UNIVERSITÀ  
DI TRENTO

**unibz**

## TABLE OF CONTENTS

Welcome Message from the General Chairs .....	2
Message from the Technical Program Chairs.....	5
IEEE MetroAgriFor 2021 Committe.....	7
IEEE MetroAgriFor 2021 Plenary Speakers .....	10
Plenary Thursday, November 4, 2021 - H 09:30.....	10
Plenary Friday, November 5, 2021 - H 09:40.....	11
IEEE MetroAgriFor 2021 Tutorial .....	12
Thursday, November 4, 2021 - H 17:10.....	12
IEEE MetroAgriFor 2021 Workshop Venue .....	13
IEEE MetroAgriFor 2021 Social Events.....	15
IEEE MetroAgriFor 2021 Patronages .....	16
IEEE MetroAgriFor 2021 Sponsors .....	17
Program Schedule - November 3, Trento .....	18
Program Schedule - November 4, Trento .....	19
Program Schedule - November 5, Bolzano.....	20
Technical Sessions - Wednesday, November 3 .....	21
Technical Sessions - Thursday, November 4 .....	33
Technical Sessions - Friday, November 5 .....	41

## Welcome Message from the General Chairs

On behalf of the Organizing Committee, we cordially welcome you to the 2021 IEEE International Workshop on Metrology for the Agriculture and Forestry (*MetroAgriFor 2021*).

*MetroAgriFor 2021* intends to create an active and stimulating forum where academics, researchers, and industry experts in measurement and data processing techniques for Agriculture, Forestry, and Food can meet and share new advances and research results.

Attention is paid, but not limited to, new technologies for agriculture and forestry environment monitoring, food quality monitoring, metrology-assisted production in agriculture, forestry and food industries, sensors and associated signal conditioning for agriculture and forestry, calibration methods for electronic test and measurement for environmental and food applications.

The first edition of *MetroAgriFor* was hosted by Polytechnic University of Marche, Italy, from an insightful and brilliant idea of Professor Enrico Primo Tomasini. He served as the first General Chair of this adventure. The Department of Agricultural Sciences, University of Naples "Federico II", Italy, hosted the second edition of the Workshop, with Leopoldo Angrisani, Pasquale Daponte and Matteo Lorito as General Chairs. The 3<sup>rd</sup> edition of *MetroAgriFor* was originally planned to be held in Trento (Italy), hosted by the University of Trento. However, due to the COVID-19 emergency, we were forced to organize this edition as a virtual conference. The virtual Workshop was planned to make an online conference, with a virtual environment where the attendees could present their papers, and could be engaged interacting in all sessions and activities. A special thanks to the organizing team, who professionally addressed this issue.

This year our expectation to have another chance to host you all in Trentino-Alto Adige and its world-famous Dolomites had success!! The programme is arranged to offer the possibility of visiting Trento during the first two days, and Bozen/Bolzano on the last day, thanks to a fruitful collaboration between the University of Trento and the Free University of Bozen-Bolzano. Such collaboration is constantly growing, especially on research topics of

agricultural engineering, actively carried out in both locations, which in Bozen/Bolzano also see the participation of the NOI-Techpark, which will host the final part of the event. At the end of the last day, it will also be possible to visit the new research laboratories of the NOI, where many of the topics addressed in the various sessions of the Conference are applied.

The *MetroAgriFor* Technical Program consists of 98 oral presentations scheduled over three days. Presentations are organized in a General Session and 15 Special Sessions. Special Sessions aim to create a focus on specific topics, where researchers can make knowledge, familiarize, exchange ideas, and build cooperation.

The received extended abstracts were submitted to a peer-review process. Relevance, quality, significance, and novelty of the scientific contribution were the main attributes taken into consideration for acceptance and publication in the Proceedings. The Proceedings are going to be submitted for publication in the IEEEExplore Digital Library. We would like to thank all the reviewers who actively contributed to the selection and quality improvement of the presented works.

Technically extended versions of presented papers can be submitted to:

- JAE (Journal of Agricultural Engineering), the official journal of the Italian Association of Agricultural Engineering (AIIA). JAE is supporting the *MetroAgriFor* Conference with two main initiatives; (i) a JAE *MetroAgriFor* Special Mention & Award will be assigned by an international evaluation board to the best paper on topics related to agricultural and forestry engineering among those presented by young researchers (<30 yrs old), the Award will consist on a bonus for a free-charge publication on JAE within the next 2 years; (ii) the same international evaluation board will select a set of 12 papers to be potentially included, after a regular review process, in a JAE Special Issues on *"Matching metrology and management issues in agricultural and forestry engineering applications"*.
- Special Issue on MDPI Agriculture, the topics of interest for this Special Issue include but are not limited to precision agriculture, precision horticulture, smart agriculture, metrology for farm pest control, Smart water management in agriculture, smart farm, and so on.

During the Workshop, attendees have the possibility to follow a tutorial on *"Present and future of sensors for the food industry"*, held by Annachiara Berardinelli, University of Trento.



*MetroAgriFor 2021* is honored to have experts in smart agriculture and forestry as Invited Speakers.

- Prof. Javier Tardaguila of Televisis Research Group, University of La Rioja. Logroño, Spain, will open *MetroAgriFor 2021* with a lecture on *"Non-invasive technologies and smart applications in viticulture"*.
- Prof. Maurizio Righetti, University of Bozen, Italy, will open the second day of works with a talk about *"Metrology challenges in the field of fluid dynamics applied to the control of agri-environmental and hydro-geological risks in the climate change era"*.

We are grateful to the Invited Speakers for joining the Workshop.

To recognize the most outstanding paper presented at the annual *IEEE International Workshop on Metrology for Agriculture and Forestry*, the Best Conference Paper Award sponsored by Sensors Journal will be assigned. Other awards will be assigned to the Best Paper presented by a Young Researcher sponsored by MDPI Agriculture Journal, and to the Best Paper Presented by a Woman, this last sponsored by IEEE Women in Engineering, to recognize the full engagement of women in all aspects of the Metrology in Agriculture and Forestry. We sincerely want to thank all the sponsors and the patronages who made this event possible.

The *2021 IEEE International Workshop on Metrology for Agriculture and Forestry* is about to begin. Metrologists, agriculture, forestry, food experts, and engineers, enjoy the Workshop!

November 2021

*Davide Brunelli, University of Trento, Italy*  
*Pasquale Daponte, University of Sannio, Italy*  
*Fabrizio Mazzetto, University of Bolzano, Italy*  
**MetroAgriFor2021 General Chairs**

## Message from the Technical Program Chairs

Welcome to the *2021 IEEE International Workshop on Metrology for Agriculture and Forestry (MetroAgriFor 2021)*, organized by the University of Trento and Free University of Bozen-Bolzano (Italy). *MetroAgriFor* previous editions were held in Ancona (2018), Portici (2019), and due to the COVID-19 pandemic on line (2020). *MetroAgriFor* established itself as an important world forum for discussing the latest advances in metrology for agriculture and forestry.

The Technical Program of *MetroAgriFor 2021* has 98 papers divided into 21 sessions distributed over the three days of the workshop, among which a general session, and 13 special sessions on specific themes. The general session has three parts and five special sessions have two parts. Special sessions aim at creating mini-workshops on specific topics where researchers working on the same area can be aware with each other's contributions to the creation of knowledge beyond the current state of the art. *MetroAgriFor* launched a call for special sessions and received a variety of different proposals from the session chairs.

1. General Session (2.3, 5.1, and 6.2)
2. Smart electronics and sustainable systems as key enabling technology in precision agriculture (1.1 and 2.1)
3. Smart technologies and digital infrastructure in agricultural, livestock and food-processing facilities (1.2 and 5.2)
4. Smart systems for land monitoring, analysis, management and planning (1.3)
5. Precision horticulture (2.2 and 4.1)
6. Emerging instrumentation for in-situ monitoring of physiological and soil parameters related to water-stress (3.1)
7. Livestock gaseous emissions, measurement and modelling techniques from barn to field (3.2)
8. Measurement and sensing techniques for estimating soil hydraulic characteristics and monitoring soil water dynamics (4.2)
9. Sensing hydrological processes at different spatial and temporal scales for sustainable use of water resources (5.3)

10. Advances in software tools for smart agriculture measurement (6.1)
11. Metrology for farm pests control: what contributions meeting technical efficacy, environmental sustainability and certification requirements (7.1)
12. Robotics for agro-forestry applications (7.2 and 8.2)
13. The role of digitization in agricultural sustainability (7.3 and 8.3)
14. Measuring methods for assessing biomass valorization routes in the agriforestry sector (8.1)

The Technical Program ends with a Technical Visit at NOI-TechPark of Bolzano and a Closing Drink Together.

We gratefully acknowledge the hard work of the Technical Program and Organizing Committees in the process of reviewing the papers and helping to shape the program and other activities, such as keynotes and tutorials. The International Program Committee is composed of dozens internal experts in the area of agriculture and forestry measurements. Also, we thank the dozens of reviewers who accepted to review papers in their specific expertise. Finally, we especially thank authors who honored the 4<sup>th</sup> edition of *MetroAgriFor*, submitting high-quality contributions with their research results. All these people played an important role in making this Workshop to come through.

We wish all participants a very enjoyable and professionally fruitful experience at *MetroAgriFor 2021*, where finally we have the opportunity to meet you all in person!!

Thanks to you all for your participation.

November 2021

Annachiara Berardinelli, *University of Trento, Italy*  
Carlos Alberto Kamienski, *Federal University of ABC (UFABC) - Brazil*  
Nunzio Isidoro, *Polytechnic University of Marche, Italy*  
***MetroAgriFor2021 Technical Program Chairs***



# IEEE MetroAgriFor 2021 Committe

## HONORARY CHAIR

Enrico Primo Tomasini, *Polytechnic University of Marche, Italy*

## GENERAL CHAIRS

Davide Brunelli, *University of Trento, Italy*

Pasquale Daponte, *University of Sannio, Italy*

Fabrizio Mazzetto, *University of Bolzano, Italy*

## TECHNICAL PROGRAM CHAIRS

Annachiara Berardinelli, *University of Trento, Italy*

Carlos Alberto Kamienski, *Federal University of ABC (UFABC) - Brazil*

Nunzio Isidoro, *Polytechnic University of Marche, Italy*

## PUBLICATION CHAIRS

Dinko Oletić, *University of Zagreb, Croatia*

Matteo Nardello, *University of Trento, Italy*

Claudio Gandolfi, *University of Milano, Italy*

## TREASURY CHAIR

Sergio Rapuano, *University of Sannio, Italy*

## WIE ACTIVITIES CHAIR

Cristina Costa, *Fondazione Bruno Kessler, Italy*

## INTERNATIONAL PROGRAM COMMITTEE

Rita Acquistucci, *CREA, Italy*

Matt Aitkenhead, *James Hutton Institute, Scotland UK*

Leopoldo Angrisani, *University of Naples Federico II, Italy*

Alfonso Jose Calera Belmonte, *University of Castilla La Mancha, Spain*

Giuliano Bonanomi, *University of Naples Federico II, Italy*

Jose Blasco Valencian, *Valencian Inst. for Agricultural Research, Spain*

Gerardo Caja, *University of Barcelona, Spain*

Maria Grazia Cappai, *University of Sassari, Italy*

Raffaele Casa, *University of Tuscina, Italy*

Paolo Castiglione, *METER Group inc., USA*

Chiara Cevoli, *University of Bologna, Italy*

André Chanzy, *INRA, Avignon*

Gherardo Chirici, *University of Florence, Italy*

Concetta Conduurso, *University of Messina, Italy*

Simona Consoli, *University of Catania*  
Antonio Coppola, *University of Basilicata, Italy*  
Elena Sara Crotti, *University of Milan, Italy*  
Quirijn de Jong van Lier, *University of São Paulo, Brasil*  
Maria Teresa dell'Abate, *CREA, Italy*  
J.A.M. Demattê, *University of São Paulo, Brazil*  
Veronica De Micco, *University of Naples Federico II, Italy*  
Annie Deslauriers, *Université du Québec à Chicoutimi, Canada*  
Guido D'Urso, *University of Naples Federico II, Ariespace srl, Italy*  
Massimo Faccoli, *University of Padova, Italy*  
Giannino Francesco, *University of Naples Federico II, Italy*  
Emanuele Frontoni, *Polytechnic University of Marche, Italy*  
Marco Fusi, *King Abdullah Univ. of Science and Technology, Saudi Arabia*  
Paolo Gay, *University of Torino, Italy*  
Emilio Gil, *Polytechnic University of Catalonia, Spain*  
José Manuel Gonçalves, *Instituto Politécnico de Coimbra, Portugal*  
Alfred Hartemink, *University of Wisconsin- Madison, USA*  
Jon Hempel, *Natural Resources Conservation Service, USA*  
Gerard Heuvelink, *ISRIC-Wageningen, The Netherlands*  
Naftali Lazarovitch, *Ben-Gurion University of the Negev, Israel*  
Craig Lobsey, *University of Southern Queensland, Australia*  
Otoniel Lopez, *Miguel Hernández University of Elche, Spain*  
Matteo Lorito, *University of Naples Federico II, Italy*  
Anne-Katrin Mahlein, *University of Bonn, Germany*  
Paolo Menesatti, *CREA-IT, Italy*  
Mario Minacapilli, *University of Palermo, Italy*  
Budiman Minasny, *University of Sydney, Australia*  
Giovanni Molari, *University of Bologna, Italy*  
Rosario Napoli, *CREA-AA, Italy*  
Anna Pelosi, *Università degli Studi di Salerno, Italy*  
Andrea Petroselli, *University of Tuscia, Italy*  
Stefania Pindozi, *University of Naples Federico II, Italy*  
Andrea Pitacco, *University of Padova, Italy*  
Simone Priori, *CRA-ABP-Crea, Italy*  
Amauri Rosenthal, *University of Campinas, Brazil*  
Federica Rossi, *IBIMET, Italy*  
Vittorio Rossi, *University of the Sacred Heart, Italy*  
Youssef Roupheal, *University of Naples Federico II, Italy*  
Fabrizio Sarghini, *University of Naples Federico II, Italy*  
Gerardo Severino, *University of Naples Federico II, Italy*  
Zhou Shi, *Zhejiang University, China*  
Oliver K. Shluter, *ATB, Postdam, Germany*

Markus Steffens, *Technical University of Munich, Germany*  
Da-Wen Sun, *University College Dublin, Ireland*  
Di Tian, *Auburn University, USA*  
Marco Trevisan, *University of the Sacred Heart, Italy*  
Antonella Verzera, *University of Messina, Italy*  
Francesco Vuolo, *Boku, Austria*  
David C. Weindorf, *Texas Tech University, USA*  
Pablo J. Zarco-Tejada, *The University of Melbourne, Australia*

# IEEE MetroAgriFor 2021 Plenary Speakers

Plenary Thursday, November 4, 2021 - H 09:30

## Non-invasive technologies and smart applications in viticulture

Javier Tardaguila

*Televitis Research Group. University of La Rioja. Logroño, Spain*

### ABSTRACT

Emerging non-invasive technologies are being developed and applied in viticulture to improve grape production and to produce quality wines in a manner that is both environmentally and economically sustainable. In this work, we describe several of these non-invasive technologies as computer vision, chlorophyll fluorescence, thermography, spectroscopy and hyperspectral imaging for proximal or remote monitoring of the vineyards. The main objective of these new technologies is to obtain and supply data and information to grape growers and wine producers as a basis for improving decision-making process. The smart applications of these technologies in viticulture are discussed in relation nutrient and water status, pests and diseases, yield components and fruit composition.

### SPEAKER BIO

Dr. **Javier Tardaguila** is Full Professor of Precision Viticulture at the University of La Rioja (Spain). Prof. Tardaguila works in precision viticulture, robotics and emerging technologies in agriculture. He was the Coordinator of VineRobot European project. Currently, he is working in NoPest H2020 project that develops non-destructive techniques of detecting plant diseases. He was involved in several European and national research projects in precision viticulture. He also is the author of over 90 publications in indexed journals (h index =30) and 3294 citations. He has been keynote speaker in several international conferences. Prof. Tardaguila has been actively involved in the technological transfer to the wine industry in collaboration to several national and international companies. He is Associate Editor of "Australian Journal of Grape and Wine Research". Prof. Tardaguila has been ViceChancellor of Research and Knowledge Transfer at the University of La Rioja.



Plenary Friday, November 5, 2021 - H 09:40

## **Metrology challenges in the field of fluid dynamics applied to the control of agri-environmental and hydro-geological risks in the climate change era**

**Maurizio Righetti**

*Free University of Bozen-Bolzano, Italy*



### **ABSTRACT**

Water and agriculture are inextricably linked, both as regards the problems of the use of water resources and those of defense against hydrogeological instability. Climate change induces significant changes in the water-agriculture relationship, accentuating problems and increasing the risks of agricultural operators. Increasingly intense events of instability (floods, landslides, mudslides and debris) affect the agro-forestry sector more and more frequently and with greater intensity. The agricultural sector, as it is closely linked to land and water, is increasingly called upon to carry out the functions of safeguarding the territory, actively contributing to the maintenance of minor waterways and mountain areas. A better knowledge of the dynamics of instability and the hydrodynamic behavior of "traditional" techniques for the arrangement of water courses, such as naturalistic engineering, can help in the fight against hydrogeological instability. In this presentation I will introduce some research results for understanding the dynamics of mud and debris flows and the hydraulic behavior of the arrangement of water courses with naturalistic engineering techniques, with particular attention to the methodologies and laboratory techniques used.

# IEEE MetroAgriFor 2021 Tutorial

Thursday, November 4, 2021 - H 17:10

## Present and future of sensors for the food industry

**Annachiara Berardinelli**

*University of Trento, Italy*

### ABSTRACT

The talk will focus on off-line and on-line sensors for the rapid assessment of the chemical and physical properties and the microbial status of raw materials, process streams and end products.

Complex and variable samples in terms of chemical composition and physical structure in addition to hostile conditions and hygiene requirements represent challenging conditions for these sensors. The development and implementation of successful tools require a multidisciplinary approach focusing on the relationship between food properties and environment, on the transducer and electronics characteristics and on the statistical procedures.

### SPEAKER BIO

**Annachiara Berardinelli** received the degree in Food Science and Technologies from the University of Bologna and the doctoral degree in Agricultural Engineering from University of Bologna. She is currently Assistant Professor at the University of Trento (Center of Agriculture, Food and Environment C3A and Department of Industrial Engineering). She is in charge to teach "Mechanization and precision viticulture" and "Innovative plants and automation for the agri-food production and transformation" courses.

She works on the assessment of physical and mechanical properties of agricultural products and on the development of systems for non-destructive determinations of biological product qualitative attributes, based on their optical, electric and dielectric properties and on the combination with multivariate and machine learning tools. Another area of work is the study of innovative solutions for non-thermal treatments of food products.





## IEEE MetroAgriFor 2021 Workshop Venue

### TRENTO - DAY 1 - NOVEMBER 3, 2021

#### **VENUE 1 - Lunch, Welcome Party**

Trento EXPO - Via Di Briamasco, 2

#### **VENUE 2 – Registration, Opening Ceremony, Session 1.1, Session 1.2, Session 2.1, Session 2.2, Session 3.2, Session 4.2**

Department of Economics and Management, University of Trento, Via Vigilio Inama, 5  
Conference Hall - Seminar Room

#### **VENUE 3 - Session 1.3, Session 2.3**

Department of Sociology and Social Research, University of Trento, Via Verdi, 26  
Room 7

#### **VENUE 4 - Session 3.1**

Faculty of Humanities, via Tommaso Gar, 14  
Room 007

### TRENTO - DAY 2 - NOVEMBER 4, 2021

#### **VENUE 1 - Lunch**

Trento EXPO - Via Di Briamasco, 2

#### **VENUE 2 – Registration, Plenary Session, Session 5.1, Session 5.2, Tutorial**

Department of Economics and Management, University of Trento, Via Vigilio Inama, 5  
Conference Hall - Seminar Room

#### **VENUE 3 - Session 5.3**

Department of Sociology and Social Research, University of Trento, Via Verdi, 26  
Kessler Room

#### **VENUE 4 - Session 6.1**

Faculty of Humanities, via Tommaso Gar, 14  
Room 004

#### **GALA DINNER**

Forsterbräu Trento - Via Paolo Oss-Mazzurana, 38, Trento

### BOLZANO - DAY 3 - NOVEMBER 5, 2021

#### **TRANSFER TRENTO - BOLZANO**

Meeting Point - Piazza Dante, Trento

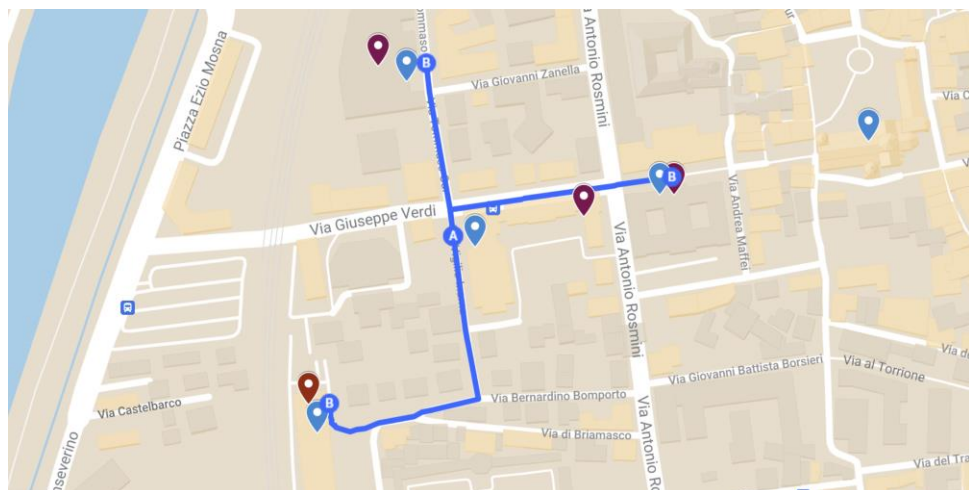
#### **VENUE**

NOI Techpark Alto Adige - Via Alessandro Volta, 13  
Auditorium - Hall 1 - Hall 3 - Noisteria

## TRENTO - MAP



Use the QR Code on the left to see the venue map on Google with your mobile device.



## IEEE MetroAgriFor 2021 Social Events

### WELCOME PARTY

**Wednesday, November 3, 2021**

18:40 - 20:30

The MetroAgriFor 2021 Welcome Party will be held at Trento EXPO

Address: Via Di Briamasco, 2 - Trento

### GALA DINNER

**Thursday, November 4, 2021**

20:00 - 22:30

The MetroAgriFor 2021 Gala Dinner will be held at Restaurant Forsterbräu Trento

Address: Via Paolo Oss-Mazzurana, 38 - Trento



**RISTORANTE BIRRERIA  
FORSTERBRÄU TRENTO**

## IEEE MetroAgriFor 2021 Patronages

**mipaaf**

ministero delle politiche  
agricole alimentari e forestali



**UNIVERSITÀ  
DI TRENTO**



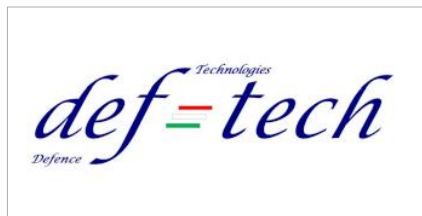
**UNIVERSITÀ  
DEGLI STUDI  
DEL  
SANNIO**  
Benevento



associazione italiana **e**  
**gme**  
gruppo misure  
elettriche ed elettroniche



## IEEE MetroAgriFor 2021 Sponsors



## Program Schedule - November 3, Trento

WEDNESDAY, NOVEMBER 3 - TRENTO			
09:00 - 09:30	Opening Ceremony - Welcome Addresses Conference Hall - Faculty of Economics		
09:30 - 11:10	<b>Session 1.1</b> Smart electronics and sustainable systems as key enabling technology in precision agriculture - Part 1 Conference Hall - Faculty of Economics	<b>Session 1.2</b> Smart technologies and digital infrastructure in agricultural, livestock and food-processing facilities - Part 1 Seminar Room - Faculty of Economics	<b>Session 1.3</b> Smart systems for land monitoring, analysis, management and planning Room 7 - Faculty of Sociology
11:10 - 11:40	Coffee Break		
11:40 - 13:00	<b>Session 2.1</b> Smart electronics and sustainable systems as key enabling technology in precision agriculture - Part 2 Conference Hall - Faculty of Economics	<b>Session 2.2</b> Precision horticulture - Part 1 Seminar Room - Faculty of Economics	<b>Session 2.3</b> General Session - Part 1 Room 7 - Faculty of Sociology
13:00 - 14:45	Lunch		
15:00 - 16:40	<b>Session 3.1</b> Emerging instrumentation for in-situ monitoring of physiological and soil parameters related to water-stress Room 007 - Faculty of Humanities	<b>Session 3.2</b> Livestock gaseous emissions, measurement and modelling techniques from barn to field Conference Hall - Faculty of Economics	
16:40 - 17:10	Coffee Break		
17:10 - 18:30	<b>Session 4.1</b> Precision horticulture - Part 2 Room 007 - Faculty of Humanities	<b>Session 4.2</b> Measurement and sensing techniques for estimating soil hydraulic characteristics and monitoring soil water dynamics Conference Hall - Faculty of Economics	
18:40 - 20:30	Welcome Party		



## Program Schedule - November 4, Trento

THURSDAY, NOVEMBER 4 - TRENTO			
09:30 - 10:30	<b>Plenary Talk - Non-invasive technologies and smart applications in viticulture</b> <i>Javier Tardaguila</i> Conference Hall - Faculty of Economics		
10:30 - 11:00	Coffee Break		
11:00 - 12:40	<b>Session 5.1</b> General Session <b>Seminar Room - Faculty of Economics</b>	<b>Session 5.2</b> Smart technologies and digital infrastructure in agricultural, livestock and food-processing facilities - Part 2 <b>Conference Hall - Faculty of Economics</b>	<b>Session 5.3</b> Sensing hydrological processes at different spatial and temporal scales for sustainable use of water resources <b>Kessler Hall - Faculty of Sociology</b>
13:00 - 14:45	Lunch		
15:00 - 16:40	<b>Session 6.1</b> Advances in software tools for smart agriculture measurement <b>Room 004 - Faculty of Humanities</b>	<b>Session 6.2</b> General Session <b>Conference Hall - Faculty of Economics</b>	
16:40 - 17:10	Coffee Break		
17:10 - 18:00	<b>Tutorial - Present and future of sensors for the food industry</b> Annachiara Berardinelli, University of Trento <b>Conference Hall - Faculty of Economics</b>		
20:00	Gala Dinner		

## Program Schedule - November 5, Bolzano

FRIDAY, NOVEMBER 5 - BOLZANO			
08:15 - 09:15	<b>Bus Transfer Trento --&gt; Bolzano</b> (meeting point P.zza Dante, Trento)		
09:30 - 09:40	Welcome Addresses <b>Hall 1 - NOI Techpark Alto Adige</b>		
09:40 - 10:30	<b>Plenary Talk - Metrology challenges in the field of fluid dynamics applied to the control of agri-environmental and hydro-geological risks in the climate change era</b> <i>Maurizio Righetti</i> <b>Hall 1 - NOI Techpark Alto Adige</b>		
10:30 - 10:50	Coffee Break		
11:50 - 12:30	<b>Session 7.1</b> Metrology for farm pests control: what contributions meeting technical efficacy, environmental sustainability and certification requirements <b>Auditorium - NOI Techpark Alto Adige</b>	<b>Session 7.2</b> Robotics for agro-forestry applications - Part 1 <b>Hall 1 - NOI Techpark Alto Adige</b>	<b>Session 7.3</b> The role of digitization in agricultural sustainability - Part 1 <b>Hall 3 - NOI Techpark Alto Adige</b>
12:30 - 13:50	Lunch		
13:50 - 15:30	<b>Session 8.1</b> Measuring methods for assessing biomass valorization routes in the agriforestry sector <b>Auditorium - NOI Techpark Alto Adige</b>	<b>Session 8.2</b> Robotics for agro-forestry applications - Part 2 <b>Hall 1 - NOI Techpark Alto Adige</b>	<b>Session 8.3</b> The role of digitization in agricultural sustainability - Part 2 <b>Hall 3 - NOI Techpark Alto Adige</b>
15:30 - 16:00	Closing and Award Ceremony <b>Auditorium - NOI Techpark Alto Adige</b>		
16:00 - 17:00	<b>Technical Visit at NOI-Techpark Alto Adige</b>		
17:00 - 17:40	Closing Drink Together		

## Technical Sessions - Wednesday, November 3

**09:00 - 18:30**

**REGISTRATION**

**Room:** Conference Hall (Faculty of Economics, via Vigilio Inama 5)

**09:00 - 09:30**

**OPENING SESSION - WELCOME ADDRESSES**

**Room:** Conference Hall (Faculty of Economics, via Vigilio Inama 5)

**09:30 - 11:10**

**SESSION 1.1**

**Special Session - Smart electronics and sustainable systems as key enabling technology in precision agriculture - Part 1**

**Room:** Conference Hall (Faculty of Economics, via Vigilio Inama 5)

**Chairs:** Luca Maiolo, *CNR-IMM, Italy*  
Francesco Maita, *CNR-IMM, Italy*

**09:30 Preliminary results from beehive activity monitoring using a 77 GHz FMCW radar sensor**

Luca Dall'Asta, Fraunhofer Italia Research Innovation Engineering Center, Italy  
Georg Egger, Fraunhofer Italia Research Innovation Engineering Center, Italy

**09:50 A THz Imaging Scanner to Monitor Leaf Water Content**

Manuel Greco, Università degli Studi "Roma Tre", Italy  
Emilio Giovenale, ENEA, Fusion and Nuclear Dept, Italy  
Fabio Leccese, Università degli Studi "Roma Tre", Italy  
Andrea Doria, ENEA, Fusion and Nuclear Dept, Italy  
Eduardo De Francesco, SeteL s.r.l, Italy  
Gian Piero Gallerano, ENEA, Fusion and Nuclear Dept, Italy

**10:10 droneONtrap project – Integration of IoT technologies and drones for health status and pests monitoring of orchards**

Gianluca Ristorto, MAVTech srl, Italy  
Alex Bojeri, MAVTech srl, Italy  
Gabriele Scarton, Gruppo FOS SpA, Italy  
Giovanni Giannotta, Gruppo FOS SpA, Italy  
Giorgio Guglieri, Politecnico di Torino, Italy

**10:30 Smart Monitoring Technologies for Defining Variability in Vineyard Microclimate, and Vinegrape Performances**

Mauro Maesano, University of Tuscia, Italy  
Federico Valerio Moresi, University of Tuscia, Italy  
Manuel Greco, Università degli Studi "Roma Tre", Italy  
Fabio Leccese, Università degli Studi "Roma Tre", Italy  
Mariagrazia Leccisi, Università degli Studi "Roma Tre", Italy  
Eduardo De Francesco, SeTeL s.r.l., Italy  
Elena Brunori, University of Tuscia, Italy  
Rita Biasi, University of Tuscia, Italy  
Giuseppe Scarascia Mugnozza, University of Tuscia, Italy

**10:50 Measure of the deflections from linear trajectory of a skid-steer gantry tractor during its motion**

Volodymyr Bulgakov, National University of Life and Environmental Sciences of Ukraine  
Simone Pascuzzi, University of Bari Aldo Moro, Italy  
Semjons Ivanovs, Latvia University of Life Sciences and Technologies, Latvia  
Volodymyr Kuvachov, Tavria State Agrotechnological University, Ukraine  
Hryhoriy Kaletnik, Vinnytsia National Agrarian University of Ukraine, Ukraine  
Janusz Nowak, University of Life Sciences in Lublin, Poland

**09:30 - 11:10**

**SESSION 1.2**

**Special Session - Smart technologies and digital infrastructure in agricultural, livestock and food-processing facilities - Part 1**

**Room:** Seminar Room (Faculty of Economics, via Vigilio Inama 5)

**Chairs:** Carlo Bibbiani, *University of Pisa, Italy*

Andrea Pezzuolo, *University of Padua, Italy*

**09:30 Automatic heart girth measurement for cattle based on deep learning**

Ao Du, China Agricultural University, China  
Hao Guo, China Agricultural University, China  
Jie Lu, China Agricultural University, China  
Yang Su, China Agricultural University, China  
Alexey Ruchay, Russian Academy of Sciences, Russia  
Andrea Pezzuolo, University of Padova, Italy

**09:50 A cascaded model based on EfficientDet and YOLACT++ for instance segmentation of cow's collar ID tag in image**

Kaixuan Zhao, Henan University of Science and Technology, China  
Ruihong Zhang, Henan University of Science and Technology, China  
Jiangtao Ji, Henan University of Science and Technology, China

**10:10 Live weight prediction of cattle using deep image regression**

Alexey Ruchay, Russian Academy of Sciences, Chelyabinsk State University, South Ural State University, Russia  
Konstantin Dorofeev, Russian Academy of Sciences, Russia  
Vsevolod Kalschikov, Russian Academy of Sciences, Russia  
Vladimir Kolpakov, Russian Academy of Sciences, Russia  
Kinispay Dzhulamanov, Russian Academy of Sciences, Russia  
Hao Guo, China Agricultural University, China

**10:30 Body Condition Score for Dairy Cows Method Based on Vision Transformer**

Yufeng Wu, China Agricultural University, China  
Hao Guo, China Agricultural University, China  
Zhenbo Li, China Agricultural University, China  
Qin Ma, China Agricultural University, China  
Yuanyang Zhao, China Agricultural University, China  
Andrea Pezzuolo, University of Padova, Italy

**10:50 Research on denoising and segmentation algorithm application of pigs' point cloud based on DBSCAN and PointNet**

Runheng Lin, China Agricultural University, China  
Hao Hu, China Agricultural University, China  
Zhikun Wen, China Agricultural University, China  
Ling Yin, China Agricultural University, China

**09:30 - 10:30**

**SESSION 1.3**

**Special Session - Smart systems for land monitoring, analysis, management and planning**

**Room:** Room 7 (Faculty of Sociology, via Verdi 26)

**Chairs:** Daniele Torreggiani, *University of Bologna, Italy*

Maria Nicolina Ripa, *Tuscia University, Italy*

**09:30 Assessing landscape fragmentation in Sardinia (Italy): A Comparative Analysis**

Andrea De Montis, *University of Sassari, Italy*

Vittorio Serra, *University of Sassari, Italy*

Giovanna Calia, *University of Cagliari, Italy*

Maria Grazia Gavina Ruiu, *University of Sassari, Italy*

Antonio Ledda, *University of Sassari, Italy*

**09:50 GIS based-model to locate and quantify agricultural wastes for sustainable building components: plastic films and sheep wool fibers**

Monica C.M. Parlato, *University of Catania, Italy*

Simona M.C. Porto, *University of Catania, Italy*

Francesca Valenti, *University of Catania, Italy*

**10:10 The impacts of Nature Based Solutions (NBS) on vegetated flows' dynamics in urban areas**

Giuseppe Francesco Cesare Lama, *University of Naples Federico II, Italy*

Matteo Rillo Migliorini Giovannini, *University of Florence, Italy*

Alessandro Errico, *University of Florence, Italy*

Sajjad Mirzaei, *Tarbiat Modares University, Iran*

Giovanni Battista Chirico, *University of Naples Federico II, Italy*

Federico Preti, *University of Florence, Italy*

**11:10 - 11:40**

**COFFEE BREAK**

**Room:** Conference Hall (Faculty of Economics, via Vigilio Inama 5)



**11:40 - 13:00**

**SESSION 2.1**

**Special Session - Smart electronics and sustainable systems as key enabling technology in precision agriculture - Part 2**

**Room:** Conference Hall (Faculty of Economics, via Vigilio Inama 5)

**Chairs:** Luca Maiolo, *CNR-IMM, Italy*

Francesco Maita, *CNR-IMM, Italy*

**11:40 Some Metrological Observations on the Use of the Exhaust Gas Temperature for the Indirect Measurement of the Torque in Agricultural Engines**

Marco Bietresato, Free University of Bolzano, Italy

Francesco Selmo, Free University of Bolzano, Italy

Massimiliano Renzi, Free University of Bolzano, Italy

Fabrizio Mazzetto, Free University of Bolzano, Italy

**12:00 Transistor-based plant sensors for agriculture 4.0 measurements**

Saleh Hamed, Free University of Bolzano, Italy

Pietro Ibba, Free University of Bolzano, Italy

Mattia Petrelli, Free University of Bolzano, Italy

Manuela Ciocca, Free University of Bolzano, Italy

Paolo Lugli, Free University of Bolzano, Italy

Luisa Petti, Free University of Bolzano, Italy

**12:20 Low power Wireless Sensor Network for precision agriculture: a battery-less operation scenario**

Francesco Maita, Consiglio Nazionale delle Ricerche, Italy

Luca Maiolo, Consiglio Nazionale delle Ricerche, Italy

**12:40 Comparing Routing Protocols for WSN in Agricultural Scenario**

Mariagrazia Leccisi, Università degli Studi "Roma Tre", Italy

Marco Cagnetti, Università degli Studi "Roma Tre", Italy

Fabio Leccese, Università degli Studi "Roma Tre", Italy

Giuseppe Schirripa Spagnolo, Università degli Studi "Roma Tre", Italy

**11:40 - 13:00**

**SESSION 2.2**

**Special Session - Precision horticulture - Part 1**

**Room:** Seminar Room (Faculty of Economics, via Vigilio Inama 5)

**Chairs:** Lav Ramchandra Khot, *Washington State University, USA*

Luigi Manfrini, *University of Bologna, Italy*

Manuela Zude-Sasse, *Leibniz Institute for Agricultural Engineering and Bioeconomy*

**11:40    Kiwifruit absorption and scattering properties obtained through postharvest shelf life using a laser backscattering imaging system**

Zhuo Yang, MAF Digital Lab, Massey University, New Zealand

Mo Li, MAF Digital Lab, Massey University, New Zealand

Andrew East, MAF Digital Lab, Massey University, New Zealand

Manuela Zude-Sasse, Leibniz Institute for Agricultural Engineering and Bioeconomy (ATB), Germany

**12:00    Anomaly detection in plant growth in a controlled environment using 3D scanning techniques and deep learning**

Iva Xhimitiku, University of Padua, Italy

Federico Bianchi, Idea-Re Srl, Italy

Massimiliano Proietti, Idea-Re Srl, Italy

Tommaso Tocci, University of Perugia, Italy

Andrea Marini, Idea-Re Srl, Italy

Lorenzo Menculini, Idea-Re Srl, Italy

Loris Francesco Termite, K-Digitale Srl, Italy

Edvige Pucci, Idea-Re Srl, Italy

Alberto Garinei, Guglielmo Marconi University, Italy

Marcello Marconi, Guglielmo Marconi University, Italy

Gianluca Rossi, University of Perugia, Italy

**12:20    Apple orchard flower clusters density mapping by unmanned aerial vehicle RGB acquisitions**

Mirko Piani, University of Bologna, Italy

Gianmarco Bortolotti, University of Bologna, Italy

Luigi Manfrini, University of Bologna, Italy

**12:40 Comparison of various methods for estimation of reference evapotranspiration under four different precision farming structures**

Chitra Shukla, Indian Institute of Technology Kharagpur, India

Debaditya Gupta, Indian Institute of Technology Guwahati, Assam

S. R. Bhakar, Maharana Pratap University of Agriculture & Technology Udaipur, Rajasthan

---

**11:40 - 13:00**

**SESSION 2.3**

**General Session - Part 1**

**Room:** Room 7 (Faculty of Sociology, via Verdi 26)

**Chair:** Matteo Nardello, *University of Trento, Italy*

---

**11:40 Field-effect-transistor based biosensors: a review of their use in environmental monitoring applications**

Giulia Elli, Free University of Bolzano, Italy

Manuela Ciocca, Free University of Bolzano, Italy

Paolo Lugli, Free University of Bolzano, Italy

Luisa Petti, Free University of Bolzano, Italy

**12:00 Automatic inspection of baked goods based on costeffective RGB-D camera**

Lorenzo Comba, Università degli Studi di Torino, Italy

Alessandro Biglia, Università degli Studi di Torino, Italy

Davide Riccauda Aimonino, Università degli Studi di Torino, Italy

Paolo Barge, Università degli Studi di Torino, Italy

Cristina Tortia, Università degli Studi di Torino, Italy

Paolo Gay, Università degli Studi di Torino, Italy

**12:20 Evaluation of seeding unit equipped with shock absorber suspension on corn and sunflower**

Kaihua Liu, University of Padova, Italy

Alessandro Zanchin, University of Padova, Italy

Marco Sozzi, University of Padova, Italy

Franco Gasparini, University of Padova, Italy

Marco Benetti, University of Padova, Italy

Luigi Sartori, University of Padova, Italy

**12:40 2D tree crops training system improve computer vision application in field: a case study**

Gianmarco Bortolotti, University of Bologna, Italy

Kushtrim Bresilla, Wageningen University & Research, Netherlands

Mirko Piani, University of Bologna, Italy

Luca Corelli Grappadelli, University of Bologna, Italy

Luigi Manfrini, University of Bologna, Italy

**13:00 - 14:45**

**LUNCH**

**Room:** Trento Expo (Via di Briamasco 2)

**15:00 - 16:40**

**SESSION 3.1**

**Special Session - Emerging instrumentation for in-situ monitoring of physiological and soil parameters related to water-stress**

**Room:** Room 007 (Faculty of Humanities, via Tommaso Gar 14)

**Chairs:** Dinko Oletić, *University of Zagreb, Croatia*

Sabine Rosner, *BOKU University, Institute of Botany, Austria*

Guillaume Charrier, *INRAE, PIAF laboratory, Clermont-Ferrand, France*

**15:00 Verifying sensitivity of a sensor system for logging xylem's acoustic emissions related to drought stress**

Dinko Oletic, University of Zagreb, Croatia

Sabine Rosner, Universität für Bodenkultur Wien, Austria

Vedran Bilas, University of Zagreb, Croatia

**15:20 A low cost harmonically modulated chlorophyll fluorescence imaging system and frequency domain analysis of chlorophyll fluorescence**

Dingle Jose, University of Manchester, UK

**15:40 Non-contact Assessment of Apple Condition using Magnetic Induction Spectroscopy: Preliminary Results and Indications**

Michael D. O'Toole, The University of Manchester, UK

Richard J. Colgan, University of Greenwich, UK

Alma Anvar, The University of Manchester, UK

Anthony J. Peyton, The University of Manchester, UK

**16:00 Advanced monitoring system for agroecosystems threatened by salinisation and pollution**

Marko Reljic, University of Zagreb, Croatia  
Marina Bubalo Kovačić, University of Zagreb, Croatia  
Gordon Gilja, University of Zagreb, Croatia  
Monika Zovko, University of Zagreb, Croatia

**16:20 Detecting cellular damages in freezing plants: are acoustic emissions useful?**

Guillaume Charrier, PIAF - INRAE, France  
Thierry Améglio, PIAF - INRAE, France  
Stéphane Herbette, PIAF - INRAE, France  
Lia Lamacque, PIAF - INRAE, France  
Florian Sabin, PIAF - INRAE, France  
Christophe Serre, PIAF - INRAE, France  
Anna Wielemans, PIAF - INRAE, France

**15:00 - 16:40**

**SESSION 3.2**

**Special Session - Livestock gaseous emissions, measurement and modelling techniques from barn to field**

**Room:** Conference Hall (Faculty of Economics, via Vigilio Inama 5)

**Chairs:** Alberto Finzi, *University of Milan, Italy*  
Marco Bovo, *University of Bologna, Italy*

**15:00 Uncertainty in determining ammonia and methane emissions at different sampling locations in an open-sided dairy barn**

Provvidenza Rita D'Urso, University of Catania, Italy  
Claudia Arcidiacono, University of Catania, Italy  
Giovanni Cascone, University of Catania, Italy

**15:20 The landscape approach as support to the livestock manure management. The buffalo herds case-study in Sele plain, Campania region**

Elena Cervelli, University of Naples Federico II, Italy  
Ester Scotto di Pertà, University of Naples Federico II, Italy  
Antonio Mautone, University of Naples Federico II, Italy  
Stefania Pindozi, University of Naples Federico II, Italy

**15:40 Testing the Efficiency of a Passive Sampler for Ammonia Monitoring and Comparison with Alpha-Samplers**

Jacopo Maffia, University of Turin, Italy

Simone Pelisetti, UptoFarm s.r.l., Italy

Paolo Balsari, University of Turin, Italy

Elio Dinuccio, University of Turin, Italy

Dario Sacco, University of Turin, Italy

**16:00 Ammonia concentration and recommended threshold values in pig farming: a review**

Cecilia Conti, University of Milan, Italy

Federica Borgonovo, University of Milan, Italy

Marcella Guarino, University of Milan, Italy

**16:20 Rapid and continuous monitoring of air ammonia concentration in dairy milking parlors**

Andrea Pigni, University of Milan, Italy

Alessio Tugnolo, University of Milan, Italy

Roberto Beghi, University of Milan, Italy

Giacomo Cocetta, University of Milan, Italy

Alberto Finzi, University of Milan, Italy

---

**16:40 - 17:10**

**COFFEE BREAK**

**Room:** Conference Hall (Faculty of Economics, via Vigilio Inama 5)

---

---

**17:10 - 18:30**

**SESSION 4.1**

**Special Session - Precision horticulture - Part 2**

**Room:** Room 007 (Faculty of Humanities, via Tommaso Gar 14)

**Chairs:** Lav Ramchandra Khot, *Washington State University, USA*

Luigi Manfrini, *University of Bologna, Italy*

Manuela Zude-Sasse, *Leibniz Institute for Agricultural Engineering and Bioeconomy*

---



**17:10 Improving accuracy and efficiency in plant detection on a novel, benchmarking real-world dataset**

Laurenz Ohnemuller, Maastricht University, Netherlands

Alexia Briassouli, Maastricht University, Netherlands

**17:30 High throughput canopy characterization of a commercial apple orchard using aerial RGB imagery**

Gajanan S. Kothawade, Washington State University, United States

Abhilash K. Chandel, Washington State University, United States

M. Jacob Schrader, Washington State University, United States

Anura P. Rathnayake, Washington State University, United States

Lav R. Khot, Washington State University, United States

**17:50 Geospatial apple canopy transpiration mapping: effect of in-field and open-field weather**

Abhilash K. Chandel, Washington State University, United States

Lav R. Khot, Washington State University, United States

David J. Brown, Washington State University, United States

Claudio O. Stöckle, Washington State University, United States

R. Troy Peters, Washington State University, United States

Steve Mantle, innov8.ag, United States

**18:10 Non-destructive Leaf Area Estimation of Tomato Using Mobile LiDAR Laser Scanner**

Kowshik Kumar Saha, Technische Universität Berlin, Leibniz Institute for Agricultural Engineering and Bioeconomy, Germany

Cornelia Weltzien, Technische Universität Berlin, Leibniz Institute for Agricultural Engineering and Bioeconomy, Germany

Manuela Zude-Sasse, Leibniz Institute for Agricultural Engineering and Bioeconomy, Germany

**17:10 - 18:10**

**SESSION 4.2**

**Special Session - Measurement and sensing techniques for estimating soil hydraulic characteristics and monitoring soil water dynamics**

**Room:** Conference Hall (Faculty of Economics, via Vigilio Inama 5)

**Chair:** Luca Santoro, *University of Trento, Italy*

**17:10 A Sensing-without-Sensors System for Soil Moisture Estimation**

Riccardo Marini, WiLab, CNIT, University of Bologna, Italy  
Enrico Testi, WiLab, CNIT, University of Bologna, Italy  
Chiara Buratti, WiLab, CNIT, University of Bologna, Italy  
Andrea Giorgetti, WiLab, CNIT, University of Bologna, Italy  
Roberto Verdone, WiLab, CNIT, University of Bologna, Italy

**17:30 The effects of management practices and fires on soil water dynamics at three locations across Europe**

Jakub Jerabek, Czech technical university in Prague, Czech Republic  
David Zumr, Czech technical university in Prague, Czech Republic  
Tomas Dostal, Czech technical university in Prague, Czech Republic  
Tomas R. Tenreiro, Institute for Sustainable Agriculture, Spain  
Peter Strauss, Federal Agency for Water Management, Austria  
Magdalena D. Vaverkova, Mendel University in Brno, Czech Republic

**17:50 CRNS-based monitoring technologies for a weather and climate-resilient agriculture: realization by the ADAPTER project**

Patrizia Ney, Forschungszentrum Julich GmbH, Germany  
Markus Kohli, Heidelberg University, Germany  
Heye Bogena, Forschungszentrum Julich GmbH, Germany  
Klaus Goergen, Forschungszentrum Julich GmbH, Germany

---

**18:40 - 20:30**

**WELCOME PARTY**

**Room:** Trento Expo (Via di Briamasco 2)

---

## Technical Sessions - Thursday, November 4

**09:00 - 15:00**

### **REGISTRATION**

**Room:** Conference Hall (Faculty of Economics, via Vigilio Inama 5)

**09:30 - 10:30**

### **PLENARY SESSION**

**Room:** Conference Hall (Faculty of Economics, via Vigilio Inama 5)

**Chair:** Annachiara Berardinelli, *University of Trento, Italy*

### **Non-invasive technologies and smart applications in viticulture**

Javier Tardaguila, *Televis Research Group, University of La Rioja, Logroño, Spain*

**10:30 - 11:00**

### **COFFEE BREAK**

**Room:** Conference Hall (Faculty of Economics, via Vigilio Inama 5)

**11:00 - 12:40**

### **SESSION 5.1**

#### **General Session - Part 2**

**Room:** Seminar Room (Faculty of Economics, via Vigilio Inama 5)

**Chair:** Matteo Nardello, *University of Trento, Italy*

### **11:00 Faster R-CNN and EfficientNet for Accurate Insect Identification in a Relabeled Yellow Sticky Traps Dataset**

Maurice Deserno, *Maastricht University, The Netherlands*

Alexia Briassouli, *Maastricht University, The Netherlands*

**11:20 Measurement of soil properties and surface hydrology parameters to assess the variation induced by different plantations**

Chitra Shukla, Indian Institute of Technology Kharagpur, India

K. N. Tiwari, Indian Institute of Technology Kharagpur, India

Gurjeet Singh, NASA Jet Propulsion Laboratory, USA

**11:40 High-Resolution Soil Moisture Retrieval Using C-Band Radar Sentinel-1 and Cosmic-ray Neutron Sensor Data**

Hami Said, Joint FAO/IAEA Centre of Nuclear Techniques in Food and Agriculture, Austria

Modou Mbaye, CERAAS - ISRA, Sénégal

Lee Kheng Heng, Joint FAO/IAEA Centre of Nuclear Techniques in Food and Agriculture, Austria

Georg Weltin, Joint FAO/IAEA Centre of Nuclear Techniques in Food and Agriculture, Austria

Trenton Franz, University of Nebraska, USA

Gerd Dercon, Joint FAO/IAEA Centre of Nuclear Techniques in Food and Agriculture, Austria

Arsenio Toloza, Joint FAO/IAEA Centre of Nuclear Techniques in Food and Agriculture, Austria

Peter Strauss, Federal Agency for Water Management, Austria

Gerhard Rab, Federal Agency for Water Management, Austria

**12:00 A data-driven framework for identifying productivity zones and the impact of agricultural droughts in sugarcane using SPI and unsupervised learning**

Roberto Fray da Silva, University of São Paulo, Brazil

Gabriela Chiquito Gesualdo, University of São Paulo, Brazil

Marcos Roberto Benso, University of São Paulo, Brazil

Maria Clara Fava, Federal University of Viçosa, Brazil

Eduardo Mario Mendiondo, University of São Paulo, Brazil

Antonio Mauro Saraiva, University of São Paulo, Brazil

**12:20 Automatic Spatial Rainfall Estimation on Limited Coverage Areas**

Maria Clara Fava, Federal University of Viçosa, Brazil

Roberto Fray da Silva, University of São Paulo, Brazil

Gabriela Chiquito Gesualdo, University of São Paulo, Brazil

Marcos Roberto Benso, University of São Paulo, Brazil

Eduardo Mario Mendiondo, University of São Paulo, Brazil

Antonio Mauro Saraiva, University of São Paulo, Brazil

Alexandre Cláudio Botazzo Delbem, University of São Paulo, Brazil

Carlos Roberto Padovani, Brazilian Agricultural Research Corporation, Brazil

**11:00 - 13:00**

**SESSION 5.2**

**Special Session - Smart technologies and digital infrastructure in agricultural, livestock and food-processing facilities - Part 2**

**Room:** Conference Hall (Faculty of Economics, via Vigilio Inama 5)

**Chair:** Alberto Barbaresi, *University of Bologna, Italy*

**11:00 Methodology for sensor calibration in agro-industrial facilities**

Alberto Barbaresi, University of Bologna, Italy  
Mattia Ceccarelli, University of Bologna, Italy  
Miki Agrusti, University of Bologna, Italy  
Marco Bovo, University of Bologna, Italy  
Enrica Santolini, University of Bologna, Italy  
Patrizia Tassinari, University of Bologna, Italy  
Daniele Torreggiani, University of Bologna, Italy

**11:20 A Low Power GPS-based device to develop KDE analyses for managing herd in extensive livestock systems**

Simona M.C. Porto, University of Catania, Italy  
Francesca Valenti, University of Catania, Italy  
Giulia Castagnolo, University of Catania, Italy  
Giovanni Cascone, University of Catania, Italy

**11:40 Application of a smart dynamic scale for measuring live-fish biomass in aquaculture**

Lorenzo Rossi, University of Pisa, Italy  
Carlo Bibbiani, University of Pisa, Italy  
Baldassare Fronte, University of Pisa, Italy  
Eugenio Damiano, MEGA Materials s.r.l., Italy  
Alberto Di Lieto, University of Pisa, Italy

**12:00 Portable Photometer for Procyanidins Quantitation in Red Wine**

Eleonora Iaccheri, University of Bologna, Italy  
Arianna Ricci, University of Bologna, Italy  
Giuseppina P. Parpinello, University of Bologna, Italy  
Andrea Versari, University of Bologna, Italy  
Luigi Ragni, University of Bologna, Italy

## **12:20 Digital Technologies and Automation in Livestock Production Systems: a Digital Footprint from Multisource Data**

Andrea Pezzuolo, University of Padova, Italy  
 Hao Guo, China Agricultural University, China  
 Giorgio Marchesini, University of Padova, Italy  
 Marta Brscic, University of Padova, Italy  
 Stefano Guercini, University of Padova, Italy  
 Francesco Marinello, University of Padova, Italy

## **12:40 An IoT-based beer fermentation monitoring system**

Daniele Buonocore, Spring Off s.r.l., Italy  
 Giuseppe Ciavolino, Spring Off s.r.l., Italy  
 Domenico Di Caro, Birring start-up innovativa s.r.l., Italy  
 Consolatina Liguori, University of Salerno, Italy

**11:00 - 12:40**

### **SESSION 5.3**

**Special Session - Sensing hydrological processes at different spatial and temporal scales for sustainable use of water resources**

**Room:** Kessler Hall (Faculty of Sociology, via Verdi 26)

**Chair:** Gabriele Baroni, *University of Bologna, Italy*

## **11:00 A comparison between satellite- and model-based approaches developed in the ESA Irrigation+ project framework to estimate irrigation quantities**

Sara Modanesi, National Research Council, Italy  
 Jacopo Dari, National Research Council, University of Perugia, Italy  
 Christian Massari, National Research Council, Italy  
 Angelica Tarpanelli, National Research Council, Italy  
 Silvia Barbetta, National Research Council, Italy  
 Gabriëlle De Lannoy, KU Leuven, Heverlee, Belgium  
 Alexander Gruber, KU Leuven, Heverlee, Belgium  
 Hans Lievens, KU Leuven, Heverlee, Belgium  
 Michel Bechtold, KU Leuven, Heverlee, Belgium  
 Raphael Quast, Research Unit Remote Sensing, TU Wien, Austria  
 Mariette Vreugdenhil, Research Unit Remote Sensing, TU Wien, Austria  
 Mehrez Zribi, CESBIO, France  
 Michel Le Page, CESBIO, France  
 Luca Brocca, National Research Council, Italy

## **11:20 Eco-hydrodynamic characterization of vegetated flows derived by UAV-based imagery**

Giuseppe Francesco Cesare Lama, University of Naples Federico II, Italy  
Mariano Crimaldi, University of Naples Federico II, Italy  
Angela De Vivo, University of Naples Federico II, Italy  
Giovanni Battista Chirico, University of Naples Federico II, Italy  
Fabrizio Sarghini, University of Naples Federico II, Italy

## **11:40 Assessing spatial soil moisture patterns at a small agricultural catchment**

Tailin Li, Czech Technical University in Prague, Czech Republic  
Jakub Jeřábek, Czech Technical University in Prague, Czech Republic  
David Zumr, Czech Technical University in Prague, Czech Republic  
Nina Noreika, Czech Technical University in Prague, Czech Republic  
Tomáš Dostál, Czech Technical University in Prague, Czech Republic

## **12:00 Assessing crop evapotranspiration by combining ERA5-Land meteorological reanalysis data and visible and near-infrared satellite imagery**

Anna Pelosi, University of Salerno, Italy  
Salvatore Falanga Bolognesi, Ariespace s.r.l., Italy  
Guido D'Urso, University of Naples Federico II, Italy  
Giovanni Battista Chirico, University of Naples Federico II, Italy

## **12:20 Assessment of a new non-invasive soil moisture sensor based on cosmic-ray neutrons**

Stefano Gianessi, University of Bologna, Italy  
Matteo Polo, FINAPP s.r.l, Italy  
Luca Stevanato, FINAPP s.r.l, Italy  
Marcello Lunardon, University of Padova, Italy  
Hami Said Ahmed, Joint FAO/IAEA Centre of Nuclear Techniques in Food and Agriculture  
Georg Weltin, Joint FAO/IAEA Centre of Nuclear Techniques in Food and Agriculture, Austria  
Arsenio Toloza, Joint FAO/IAEA Centre of Nuclear Techniques in Food and Agriculture, Austria  
Christian Budach, University of Potsdam, Germany  
Peter Bíró, University of Potsdam, Germany  
Till Francke, University of Potsdam, Germany  
Maik Heistermann, University of Potsdam, Germany  
Sascha E. Oswald, University of Potsdam, Germany  
Emil Fulajtar, Joint FAO/IAEA Centre of Nuclear Techniques in Food and Agriculture, Austria  
Gerd Dercon, Joint FAO/IAEA Centre of Nuclear Techniques in Food and Agriculture, Austria  
Lee Kheng Heng, Joint FAO/IAEA Centre of Nuclear Techniques in Food and Agriculture  
Gabriele Baroni, University of Bologna, Italy

**13:00 - 14:45**

**LUNCH**

**Room:** Trento Expo (Via di Briamasco 2)

**15:00 - 16:40**

**SESSION 6.1**

**Special Session - Advances in software tools for smart agriculture measurement**

**Room:** Room 004 (Faculty of Humanities, via Tommaso Gar 14)

**Chairs:** Carlos Kamienski, *Federal University of ABC, Brazil*

Gabriele Baroni, *University of Bologna, Italy*

**15:00 Data Value Extraction Mechanism in a Resilient Fog-based IoT System for Smart Irrigation**

Franklin M. Ribeiro Junior, *Federal University of ABC, Brazil*

Carlos A. Kamienski, *Federal University of ABC, Brazil*

**15:20 Irrigation water saving estimation using soil moisture forecast simulation**

Juha-Pekka Soininen, *VTT Technical Research Centre of Finland, Finland*

Kari Kolehmainen, *VTT Technical Research Centre of Finland, Finland*

Hannu Tanner, *VTT Technical Research Centre of Finland, Finland*

Jafar Golnabi, *Intercrop Iberica, Spain*

Ramade Augusto Sales Dantas, *Instituto Federal de Pernambuco, Brazil*

Gilberto Souza, *FEI University Center, Brazil*

**15:40 IrrigaSim: An Irrigation Simulation, Processing, and Animation Environment**

Ronaldo C. Prati, *Federal University of ABC, Brazil*

Fabrizio Borelli, *Federal University of ABC, Brazil*

Ivan Dimitry Zyrianoff, *University of Bologna, Italy*

Dener Silva, *Federal University of ABC, Brazil*

Rodrigo Togneri, *Federal University of ABC, Brazil*

Carlos Kamienski, *Federal University of ABC, Brazil*

**16:00 Managing Smart Agriculture: the IoT Entity Management System (IoTEMS)**

Fabrizio Borelli, *Federal University of ABC, Brazil*

Gabriela Biondi, *Federal University of ABC, Brazil*

Dener Silva, *Federal University of ABC, Brazil*

Carlos Kamienski, *Federal University of ABC, Brazil*



## **16:20 A Soil Moisture Calibration Service for IoT-based Smart Irrigation**

Ivan Dimitry Zyrianoff, University of Bologna, Italy

André Torre Neto, EMBRAPA, Brazil

Dener Silva, Federal University of ABC, Brazil

Tullio Salmon Cinotti, University of Bologna, Italy

Marco Di Felice, University of Bologna, Italy

Carlos Kamienski, Federal University of ABC, Brazil

**15:00 - 16:40**

### **SESSION 6.2**

#### **General Session - Part 3**

**Room:** Conference Hall (Faculty of Economics, via Vigilio Inama 5)

**Chairs:** Chiara Cevoli, *University of Bologna, Italy*

Luca Roffia, *University of Bologna, Italy*

## **15:00 CFD modelling of gaseous emissions and dispersion from pig barn to surrounding areas**

Enrica Santolini, University of Bologna, Italy

Marco Bovo, University of Bologna, Italy

Alberto Barbaresi, University of Bologna, Italy

Shahad Hasan Flayyih Al-Rikabi, University of Bologna, Italy

Daniele Torreggiani, University of Bologna, Italy

Patrizia Tassinari, University of Bologna, Italy

## **15:20 Process-oriented simulation and observations of N2O emission from intensively managed agricultural cropping system**

Terenzio Zenone, National Research Council, Italy

Lucia Ottaiano, University of Naples Federico II, Italy

Antonio Manco, National Research Council, Italy

Luca Vitale, National Research Council, Italy

Daniela Famulari, National Research Council, Italy

## **15:40 Predict soil moisture into the future: on the integration of CRITERIA-1D into ZENTRA cloud**

Brenno Tondato de Faria, VAIMEE srl, Italy

Cristiano Aguzzi, VAIMEE srl, Italy

Travis Bates, METER Group, Inc., USA

Colin Campbell, METER Group, Inc., USA

Fausto Tomei, ARPAE Hydro-Meteo-Climate Service, Italy

Marco Bittelli, University of Bologna, Italy

Luca Roffia, VAIMEE srl, University of Bologna, Italy

**16:00 Preliminary exploration of potential ponding impact on crop vigour using remote sensing techniques**

Eugenio Straffellini, University of Padova, Italy

Anton Pijl, University of Padova, Italy

Fabio Turco, University of Padova, Italy

Paolo Tarolli, University of Padova, Italy

**16:20 Potential of in-field Vis/NIR hyperspectral imaging to monitor quality parameters of alfalfa**

Chiara Cevoli, University of Bologna, Italy

Luca Di Cecilia, CNH Industrial Italia SpA, Italy

Luca Ferrari, CNH Industrial Italia SpA, Italy

Angelo Fabbri, University of Bologna, Italy

Giovanni Molari, University of Bologna, Italy

**16:40 - 17:10**

**COFFEE BREAK**

**Room:** Conference Hall (Faculty of Economics, via Vigilio Inama 5)

**17:10 - 18:05**

**TUTORIAL SESSION**

**Room:** Conference Hall (Faculty of Economics, via Vigilio Inama 5)

**Chair:** Davide Brunelli, *University of Trento, Italy*

**Present and future of sensors for the food industry**

*Annachiara Berardinelli, University of Trento, Italy*

**20:00 - 22:30**

**GALA DINNER**

Ristorante Birreria Forsterbräu Trento - Via Paolo Oss-Mazzurana, 38, Trento

## Technical Sessions - Friday, November 5

---

**08:15 - 09:15**

**TRANSFER TRENTO - BOLZANO**

**Meeting Point:** Piazza Dante, Trento

---

One ticket for the bus shuttle transfer from Trento to Bolzano is included in the registration fee.  
The bus will depart at 08:15 - Meeting Point Piazza Dante, Trento.

---

**09:15 - 12:00**

**REGISTRATION**

**Room:** NOI Techpark Alto Adige (Via Alessandro Volta, 13 - Bolzano)

---

---

**09:30 - 09:40**

**WELCOME ADDRESSES**

**Room:** Hall 1 - NOI Techpark Alto Adige

---

---

**09:40 - 10:30**

**PLENARY SESSION**

**Room:** Hall 1 - NOI Techpark Alto Adige

**Chair:** Fabrizio Mazzetto, *Free University of Bozen-Bolzano, Italy*

---

**Metrology challenges in the field of fluid dynamics applied to the control of  
agri-environmental and hydro-geological risks in the climate change era**

Maurizio Righetti, *Free University of Bozen-Bolzano, Italy*

---

**10:30 - 10:50**

**COFFEE BREAK**

**Place:** Noisteria Café e Restaurant (Via Alessandro Volta, 15)

---

**10:50 - 12:30**

**SESSION 7.1**

**Special Session - Metrology for farm pests control: what contributions meeting technical efficacy, environmental sustainability and certification requirements**

**Room:** Auditorium - NOI Techpark Alto Adige

**Chairs:** Fabrizio Mazzetto, *Free University of Bozen-Bolzano, Italy*  
Simone Pascuzzi, *University of Bari, Italy*

**10:50 Spray Drop Size Measurement via Image Analysis**

Emanuele Cerruto, University of Catania, Italy

Giuseppe Manetto, University of Catania, Italy

Domenico Longo, University of Catania, Italy

Rita Papa, University of Catania, Italy

**11:10 A Brief Review of Nozzle Spray Drop Size Measurement Techniques**

Simone Pascuzzi, University of Bari Aldo Moro, Italy

Giuseppe Manetto, University of Catania, Italy

Francesco Santoro, University of Bari Aldo Moro, Italy

Emanuele Cerruto, University of Catania, Italy

**11:30 Indoor test bench measurements of potential spray drift generated by multi-row sprayers**

Marco Grella, University of Turin, Italy

Paolo Marucco, University of Turin, Italy

Marco Manzone, University of Turin, Italy

Raimondo Gallo, Free University of Bozen, Italy

Fabrizio Mazzetto, Free University of Bozen, Italy

Paolo Balsari, University of Turin, Italy

**11:50 Check and calibration of spraying machinery in Lombardy: activity results from 1999**

Davide Facchinetti, University of Milan, Italy

Lavinia Eleonora Galli, University of Milan, Italy

Domenico Pessina, University of Milan, Italy

**12:10 Feasibility study of using laser technology for calibrating orchard sprayer machinery. First results**

Simone Pascuzzi, University of Bari Aldo Moro, Italy

Fabrizio Mazzetto, Free University of Bozen, Italy

---

**10:50 - 12:30**

**SESSION 7.2**

**Special Session - Robotics for agro-forestry applications - Part 1**

**Room:** Hall 1 - NOI Techpark Alto Adige

**Chairs:** Renato Vidoni, *Free University of Bozen-Bolzano, Italy*

Karl von Ellenrieder, *Free University of Bozen-Bolzano, Italy*

Dario Mengoli, *University of Bologna, Italy*

---

**10:50 Improving agricultural drone localization using georeferenced low-complexity maps**

Cesare Donati, Politecnico di Torino, Italy

Martina Mammarella, National Research Council, Italy

Lorenzo Comba, University of Torino, National Research Council, Italy

Alessandro Biglia, University of Torino, Italy

Fabrizio Dabbene, National Research Council, Italy

Paolo Gay, University of Torino, Italy

**11:10 Wind Tunnel Testing of Remotely Piloted Aircraft Systems for Precision Crop-Spraying Applications**

Nicoletta Bloise, Politecnico di Torino, Italy

Manuel Carreno Ruiz, Politecnico di Torino, Italy

Domenic D'Ambrosio, Politecnico di Torino, Italy

Giorgio Guglieri, Politecnico di Torino, Italy

**11:30 Trajectory Planning ROS Service for an Autonomous Agricultural Robot**

Lorenzo Gentilini, University of Bologna, Italy

Simone Rossi, University of Bologna, Italy

Dario Mengoli, University of Bologna, Italy

Andrea Eusebi, University of Bologna, Italy

Lorenzo Marconi, University of Bologna, Italy

**11:50 Robust autonomous row-change maneuvers for agricultural robotic platform**

Dario Mengoli, University of Bologna, Italy

Andrea Eusebi, University of Bologna, Italy

Simone Rossi, University of Bologna, Italy  
Roberto Tazzari, University of Bologna, Italy  
Lorenzo Marconi, University of Bologna, Italy

## **12:10 MAR - Multipurpose Amphibious Rover**

Eduardo De Francesco, SeTeL Group, Italy

**10:50 - 12:30**

### **SESSION 7.3**

#### **Special Session - The role of digitization in agricultural sustainability - Part 1**

**Room:** Hall 3 - NOI Techpark Alto Adige

**Chairs:** Pasqualina Sacco, *Fraunhofer Italia IEC, Italy*

Francesco Marinello, *University of Padova, Italy*

## **10:50 A Blockchain implemented App for forestry nursery management**

Simone Figorilli, CREA - Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria, Italy

Stefano Bruzzese, University of Torino, Italy

Andrea Rosario Proto, University of Reggio Calabria, Italy

Corrado Costa, CREA - Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria, Italy

Lavinia Moscovini, CREA - Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria, Italy

Simone Blanc, University of Torino, Italy

Filippo Brun, University of Torino, Italy

## **11:10 Italian Speech Commands for Forestry applications**

Luciano Ortenzi, CREA - Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria, Italy

Giacomo Colle, Effetreszero Srl, Italy

Corrado Costa, CREA - Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria, Italy

Lavinia Moscovini, CREA - Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria, Italy

## **11:30 Assessing the Digitalization Footprint from Agricultural Fields on Required Data Storage Space**

Ahmed Kayad, University of Padova, Italy

Marco Sozzi, University of Padova, Italy

Andrea Pezzuolo, University of Padova, Italy

Stefano Grigolato, University of Padova, Italy  
Francesco Marinello, University of Padova, Italy

### **11:50 farMAS: Multi-Agent based farm activity planning and execution system**

Georg Egger, Fraunhofer Italia, Italy  
Pasqualina Sacco, Fraunhofer Italia, Italy  
Dmitry Chaltsev, Fraunhofer Italia, Italy  
Fabrizio Mazzetto, Free University of Bozen, Italy

### **12:10 Life Cycle Assessment of Fertilization – Precision Soil Modeling Combined with Precision Agriculture**

Francisco Medel Jimenez, BOKU - University of Natural Resources and Life Sciences Vienna, Austria  
Iris Kral, BOKU - University of Natural Resources and Life Sciences Vienna, Austria  
Andreas Gronauer, BOKU - University of Natural Resources and Life Sciences Vienna, Austria  
Theresa Krexner, BOKU - University of Natural Resources and Life Sciences Vienna, Austria  
Norbert Barta, BOKU - University of Natural Resources and Life Sciences Vienna, Austria  
Gerhard Piringer, BOKU - University of Natural Resources and Life Sciences Vienna, Austria

**12:30 - 14:00**

**LUNCH**

**Place:** Noisteria Cafè e Restaurant (Via Alessandro Volta, 15)

**14:00 - 15:20**

**SESSION 8.1**

**Special Session - Measuring methods for assessing biomass valorization routes in the agriforestry sector**

**Room:** Auditorium - NOI Techpark Alto Adige

**Chairs:** Marco Baratieri, *Free University of Bozen-Bolzano, Italy*

Giuseppe Toscano, *Università Politecnica delle Marche, Italy*

### **14:00 Preliminary study on the application of a commercial LAI ceptometer for estimation of leaf production on low vigour mulberry trees**

Domenico Giora, University of Padova, Italy  
Federico Masin, University of Padova, Italy  
Giuditta Marchetti, University of Padova, Italy  
Alberto Assirelli, CREA - Council for Agricultural Research and Economics, Italy

Silvia Cappellozza, CREA - Council for Agricultural Research and Economics, Italy  
Alessio Saviane, CREA - Council for Agricultural Research and Economics, Italy  
Francesco Marinello, University of Padova, Italy  
Luigi Sartori, University of Padova, Italy

**14:20 Development of a method for determining the charcoal calorific value variability as integration of the UNI EN ISO 18125:2018 standard**

Alessio Mencarelli, University of Padova, Italy  
Raffaele Cavalli, University of Padova, Italy  
Rosa Greco, University of Padova, Italy

**14:40 Investigating biomass pyrolysis through intra-particle gas measurements**

Francesco Patuzzi, Free University of Bozen, Italy  
Simona Ciuta, City College of New York, USA  
Frederic Marias, Universite de Pau et des Pays de l'Adour, France  
Naomi Klinghoffer, Western University, Canada  
Marco Baratieri, Free University of Bozen, Italy  
Marco J. Castaldi, City College of New York, USA

**15:00 Quality control of woodchip energy parameters using near infrared spectroscopy coupled with chemometrics**

Manuela Mancini, University of Copenhagen, Denmark  
Elena Leoni, Università Politecnica delle Marche, Italy  
Giuseppe Toscano, Università Politecnica delle Marche, Italy

**14:00 - 15:20**

**SESSION 8.2**

**Special Session - Robotics for agro-forestry applications - Part 2**

**Room:** Hall 1 - NOI Techpark Alto Adige

**Chairs:** Renato Vidoni, *Free University of Bozen-Bolzano, Italy*

Karl von Ellenrieder, *Free University of Bozen-Bolzano, Italy*

Dario Mengoli, *University of Bologna, Italy*

**14:00 Generating maneuverable trajectories for a reconfigurable underactuated agricultural robot**

Helen Henninger, Free University of Bozen-Bolzano, Italy  
Karl von Ellenrieder, Free University of Bozen-Bolzano, Italy



**14:20 Increasing autonomy in agricultural robots: unevenness estimation of the terrain ahead**

Antonio Leanza, Polytechnic of Bari, Italy  
Rocco Galati, Polytechnic of Bari, Italy  
Giulio Reina, Polytechnic of Bari, Italy  
Annalisa Milella, National Research Council, Italy

**14:40 Metrology-aware Path Planning for Agricultural Mobile Robots in Dynamic Environments**

R. A. Saeed, Free University of Bozen-Bolzano, Italy  
Giacomo Tomasi, Free University of Bozen-Bolzano, Italy  
Ganesh Govindarajan, Free University of Bozen-Bolzano, Italy  
Renato Vidoni, Free University of Bozen-Bolzano, Italy  
Karl D. von Ellenrieder, Free University of Bozen-Bolzano, Italy

**15:00 Design and evaluation of a brach sensing system for a climbing and pruning robot**

Giovanni Carabin, Free University of Bozen-Bolzano, Italy  
Fabrizio Mazzetto, Free University of Bozen-Bolzano, Italy  
Renato Vidoni, Free University of Bozen-Bolzano, Italy

**14:00 - 15:20**

**SESSION 8.3**

**Special Session - The role of digitization in agricultural sustainability - Part 2**

**Room:** Hall 3 - NOI Techpark Alto Adige

**Chairs:** Pasqualina Sacco, *Fraunhofer Italia IEC, Italy*  
Jacopo Bacenetti, *University of Milano, Italy*

**14:00 Evaluation of Tracer dyes for spray deposit assessment in the vineyard**

Rino Gubiani, University of Udine, Italy  
Gianfranco Pergher, University of Udine, Italy  
Nicola Zucchiatti, University of Udine, Italy

**14:20 Connectivity in rural areas: a case study on internet connection in the Italian agricultural areas**

Marco Sozzi, University of Padova, Italy  
Ahmed Kayad, University of Padova, Italy  
Giovanni Ferrari, University of Padova, Italy

Alessandro Zanchin, University of Padova, Italy  
Stefano Grigolato, University of Padova, Italy  
Francesco Marinello, University of Padova, Italy

**14:40 Digital sustainability in smart agriculture**

Pasqualina Sacco, Fraunhofer Italia, Italy  
Elena Rangoni Gargano, Fraunhofer Italia, Italy  
Alessia Cornella, Fraunhofer Italia, Italy  
Davide Don, Fraunhofer Italia, Italy  
Fabrizio Mazzetto, Free University of Bolzano, Italy

**15:00 Can PocketNNI, a new smart app for Nitrogen Nutrition Index estimation, reduce the environmental impact of rice?**

Livia Paleari, Università degli Studi di Milano, Italy  
Michele Zoli, Università degli Studi di Milano, Italy  
Jacopo Bacenetti, Università degli Studi di Milano, Italy  
Roberto Confalonieri, Università degli Studi di Milano, Italy

**15:20 - 15:50**

**CLOSING AND AWARD CEREMONY**

**Room:** Hall 1 - NOI Techpark Alto Adige

**15:50 - 17:00**

**TECHNICAL VISIT at NOI Techpark Alto Adige**

**17:00 - 17:30**

**CLOSING DRINK TOGETHER**

**Place:** Noisteria Café e Restaurant (Via Alessandro Volta, 15)