



SELSUSTAINED CROSS-BORDER CUSTOMIZED
CYBERPHYSICAL SYSTEM EXPERIMENTS
FOR CAPACITY BUILDING AMONG EUROPEAN STAKEHOLDERS

NIR sensor & tracking platform for daily diary processing

Presenter: Maurangelo Petruzzella, MantiSpectra BV



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of the European Union

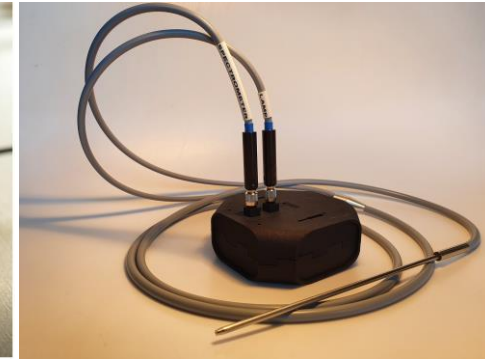
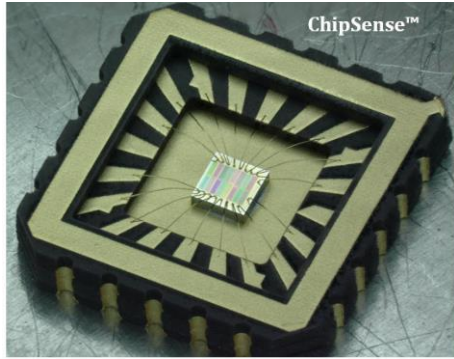
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Smart Anything Everywhere Area 2

www.smart4all-project.eu
Grant Agreement: 872614

NIR sensor & tracking platform for daily dairy processing



Goal: Provide real-time data to **dairy farmers** and **distributors** about the key properties of **milk**



MantiSpectra, a spinoff from **Eindhoven University of Technology**, is commercializing Breakthrough, **Miniaturized Photonic Spectral Chips for Fast, Cost-Effective, and Non-invasive testing** of Product Properties, offering great Scalability and Customization for a wide range of applications in Real-Time Near-Infrared Analysis.

As **the ultimate Industry 4.0 solution for Material Sensing**, for applications in the fields of Industrial Process Control, Product Recycling & Circularity, Pharmaceuticals, and Smart Agriculture.

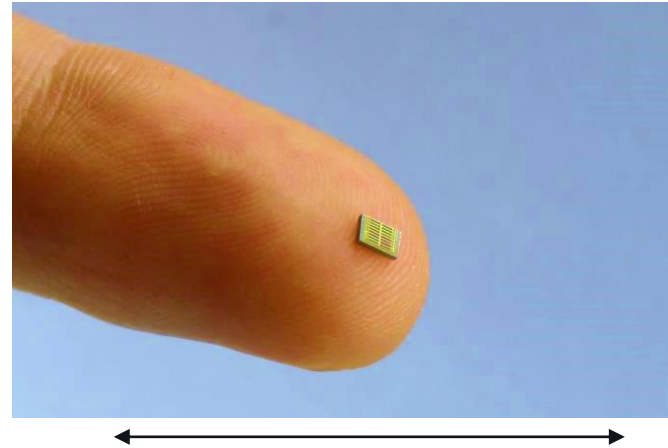
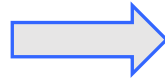
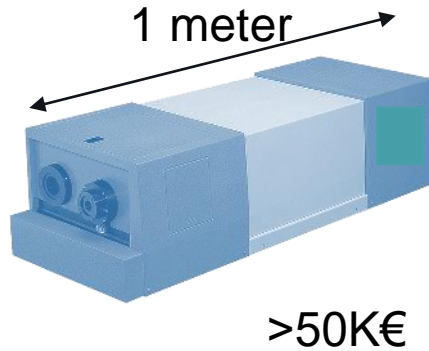


A spin-off of



**EINDHOVEN
UNIVERSITY OF
TECHNOLOGY**

- The only **fully-integrated** solution in the near-IR ⇒ **Smaller**
- Measure only the wavelengths you need ⇒ **Faster**
- No mechanical movements ⇒ **Robust**
- Scaling to **large-volume** production ⇒ **Low-cost**



Agritrack is an **innovative software startup** offering **food process automation** platform utilizing IoT, Immutable Ledger and Artificial Intelligence

We help Food companies **reduce food losses and costs** by **securely tracking food's quality** as well as showcasing the foods story to consumers

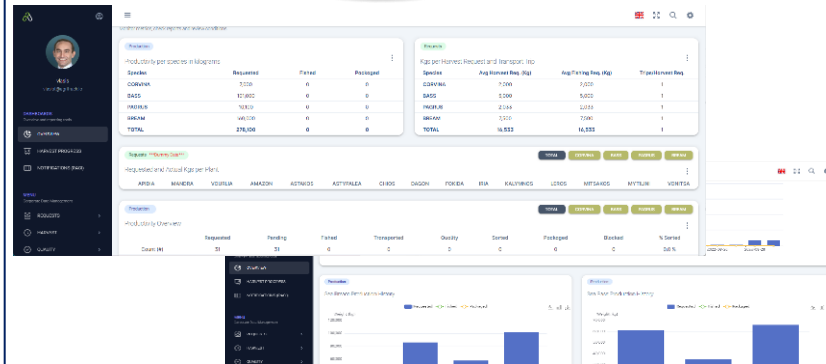
Welcome to Food Value Chain Intelligence!

IoT & LEDGER TECHNOLOGIES

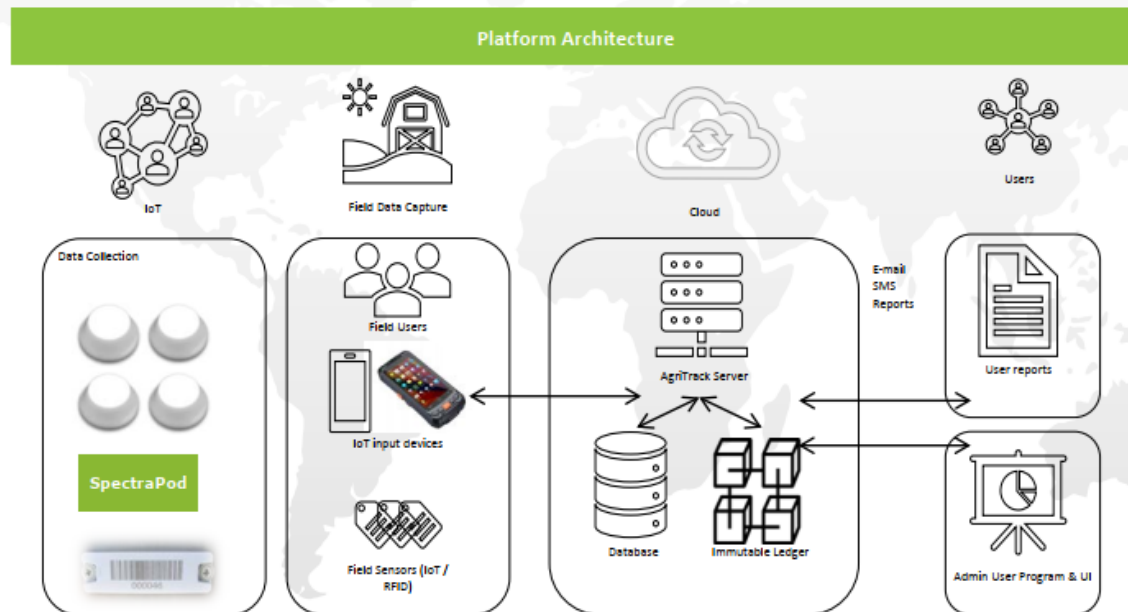
FOOD SCIENCE



ARTIFICIAL INTELLIGENCE



Agritrack, since September 2020 we have been piloting our **Traceability Automation** solution for the Greek milk supply chain (c. **200 milk farms, averaging daily 35 tons of cow milk and 10 tons of goat milk**).

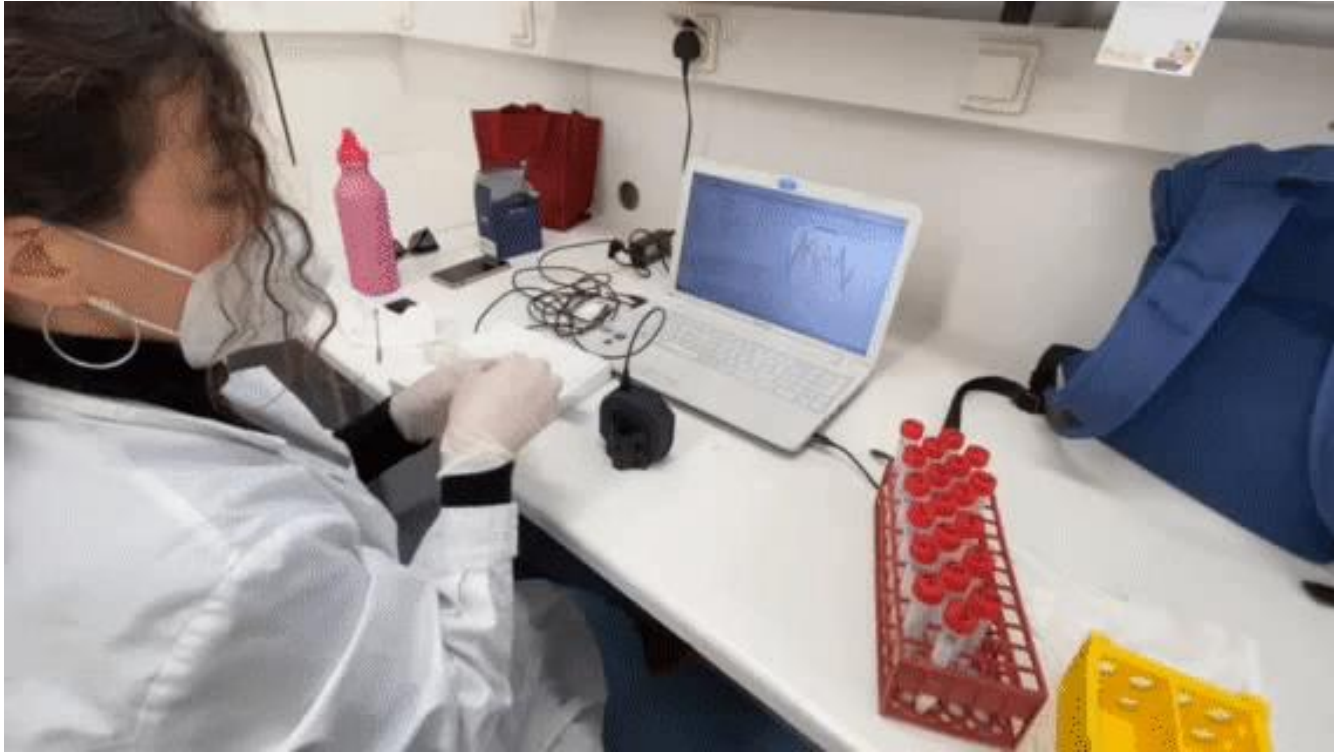




SpectraPod in Action

Workplan:

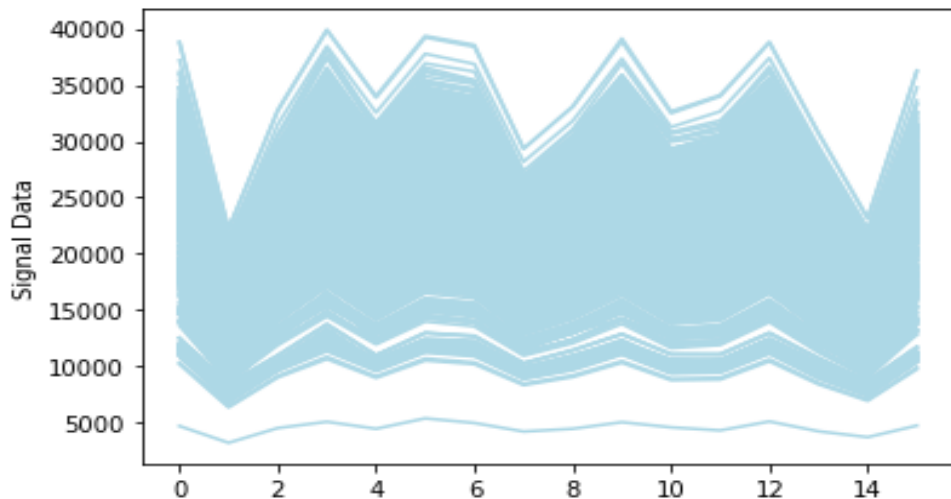
- MS: Spectral module design/develop
- MS: Pre-characterization module for liquid
- MS: Delivers module to AT
- AT: Data collection on pre-calibrated samples (LAB)
- AT: Sw-Hw integration within platform
- AT/MS: experiments with milk farmers and real samples
- AT/MS: Iterate (if needed)
- Final reports including feedback of early-adopters



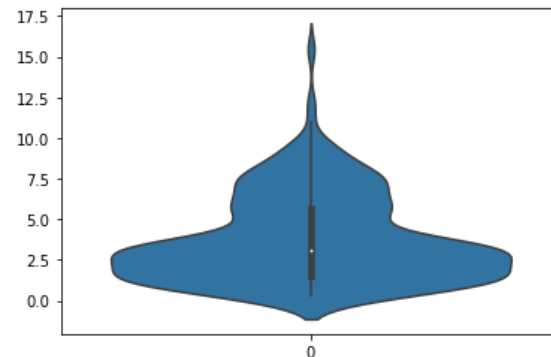
Spectra Dairy Fat regression-767 sheep samples

Fat

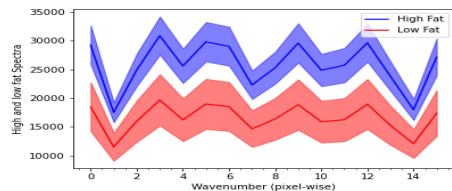
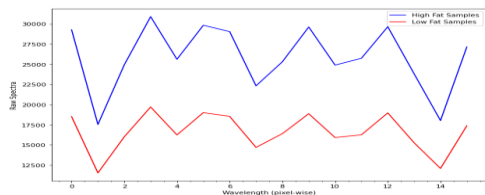
Raw spectra



Distribution of fat values across samples



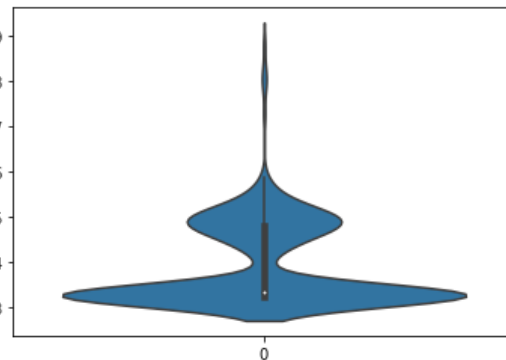
High fat (>7) vs. Low fat (<2) samples



Mean values

Mean values & STDs

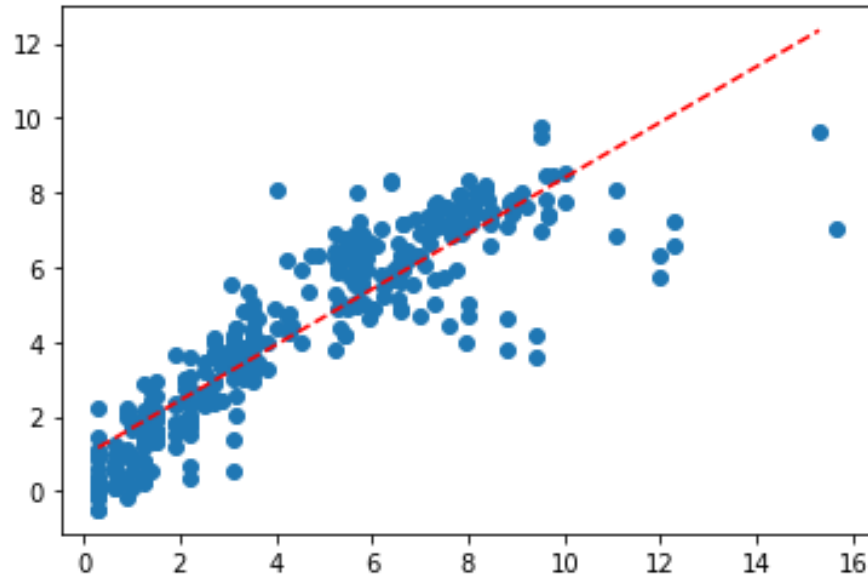
Distribution of protein values across samples



Test-model

Fat

slope (a)	Offset (b)	R2	RMSE
0.75	0.95	0.80	1.60

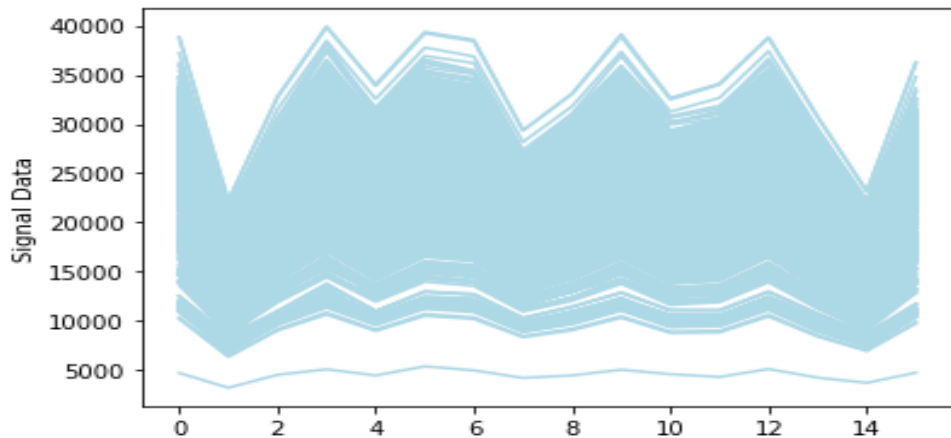


slope	Ideal = 1
offset	Ideal = 1
R2	Goodness of fit
RMSE	Root mean square error

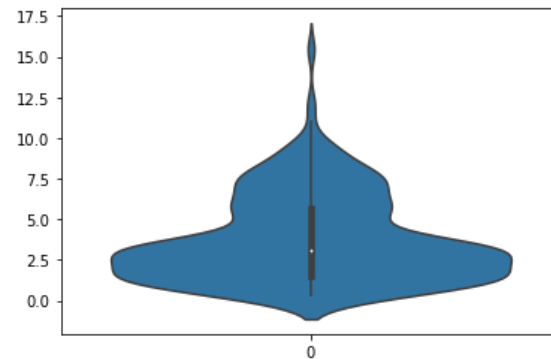
SpectraPod Protein regression-800 sheep samples

Protein

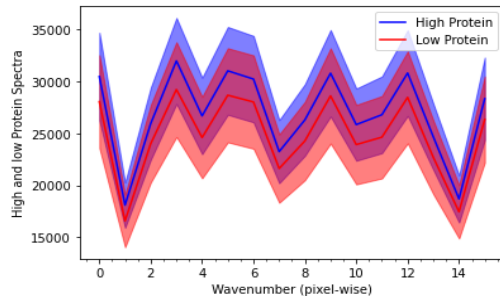
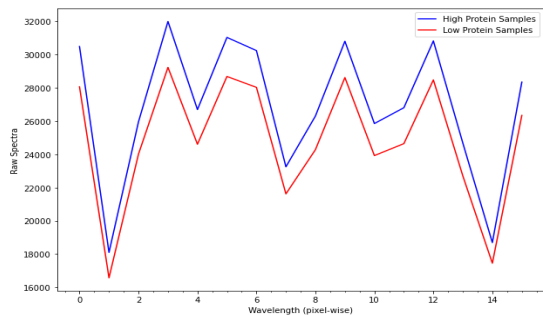
Raw spectra



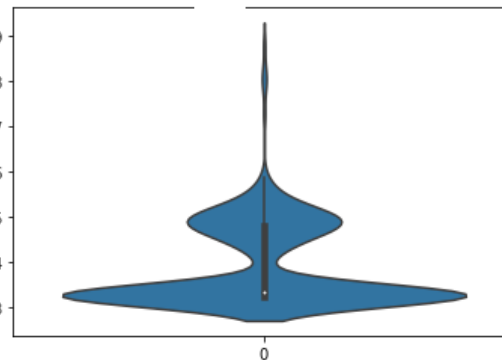
Distribution of fat values across samples



Low protein (<3.2) vs. High Protein (>5.4) samples



Distribution of protein values across samples



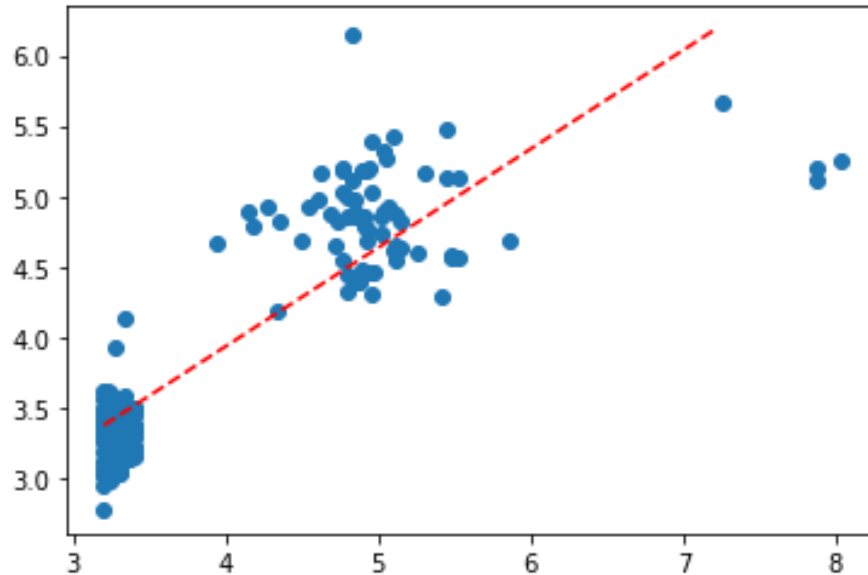
Mean values

Mean values & STDs

Testing-model validation

Protein

slope (a)	Offset (b)	R2	RMSE
0.70	1.13	0.76	0.57



slope	Ideal = 1
offset	Ideal = 1
R2	Goodness of fit
RMSE	Root mean square error



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Summary

- *First Successful Demonstration of Key quality testing on milk samples on a large sample set*
- *Promising results for determination of fat and protein content for quality control at farms*
- *Validation using external laboratories*

Next Steps

- *Ruggedized, certified, and interconnected device for in-field deployment*
- *Deployment in farms and logistic points in Greece*

