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Evaluation of the impact of bad storage (temperature) on the chicken meat quality by Raman Spectroscopy

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REAMIT Networking Symposium

9th January 2020
Crowne Plaza Nottingham, UK

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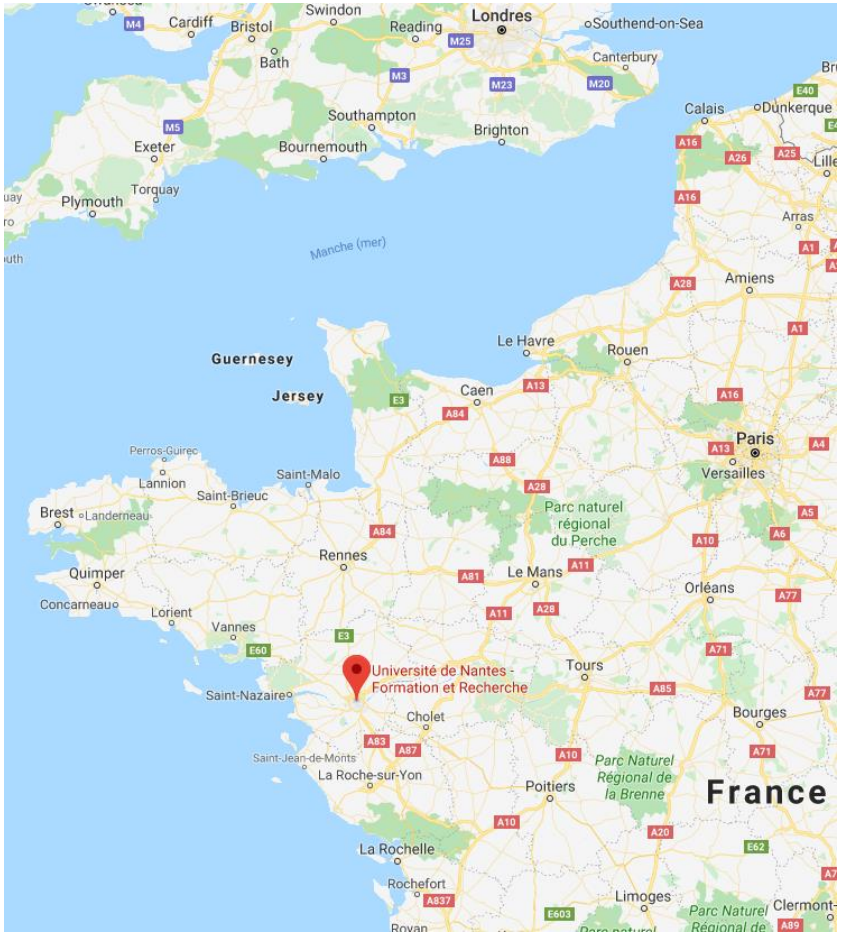
Nantes University: A leading of higher education & research center in Western France

38 000 students

64 Research Units

3 754 staff members (2 118 *assistant, associate and full professors and researchers +* ***1 636*** *administrative and technical staff)*



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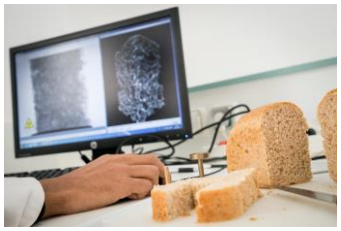
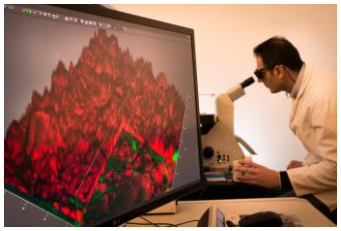
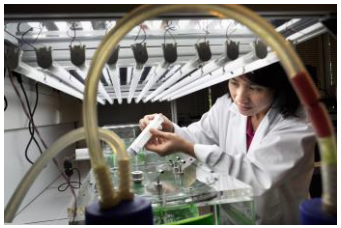
GEPEA: process engineering for environment and food

220 members (*associate and full professors, researchers + administrative and technical staff****)***

5 research topics				
Bioprocess applied on microalgae	Matrices & Food : Processes / Properties / Structure - Sensory	Water Treatment- Air- Metrology	Matrices & Optimization - System - Energy	Energy/Residuals and Emission Treatment


https://www.gepea.fr/

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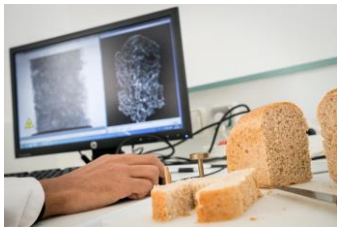
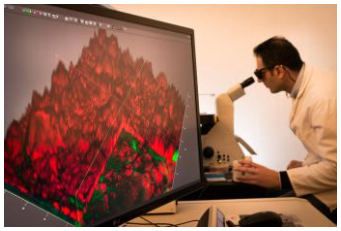
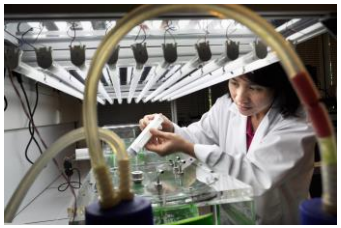


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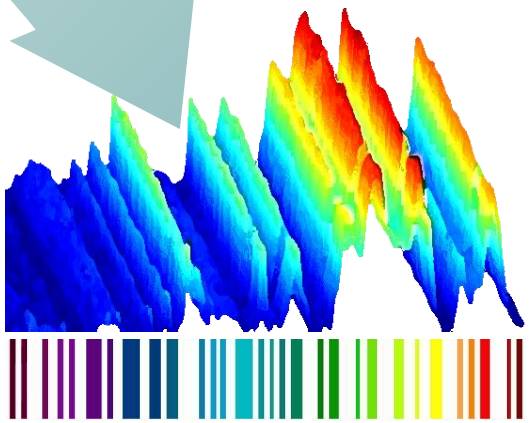
Optical methods
Raman,
Fluorescence, …



Molecular fingerprint

Different field of applications

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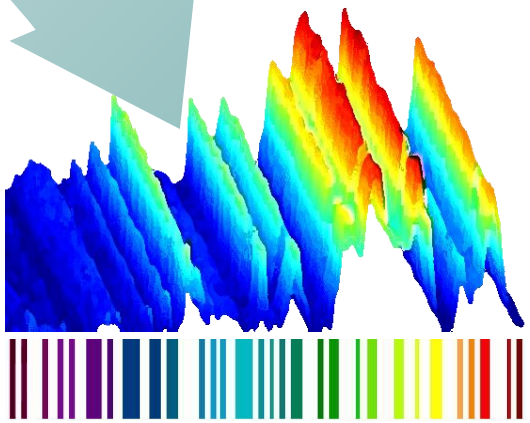

Molecular fingerprint

Optical methods
Raman,
Fluorescence, …

Pollution fingerprints, toxicity, biodegradation

Microalgae process monitoring

Microorganism's detection

Food characterization

+ other applications

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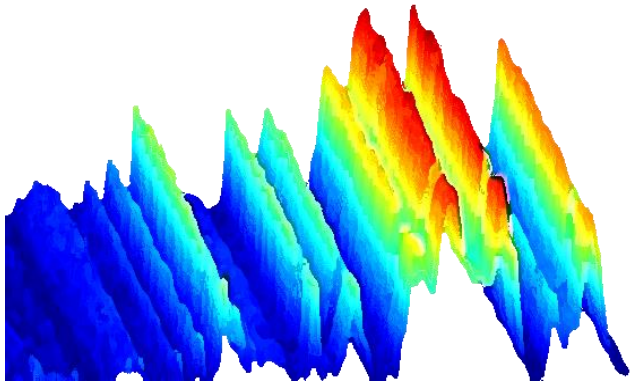
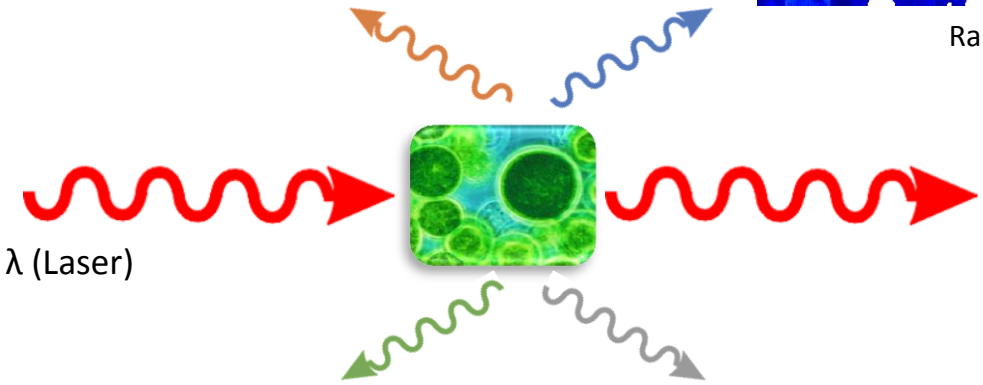
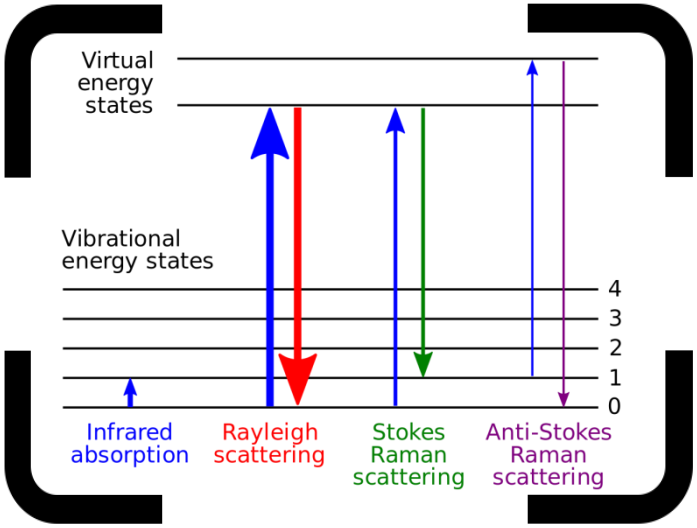
Raman scattering (1/10^9 photons)



Raman spectra



+ other radiative emissions or not
(Fluorescence, phosphorescence, ….)



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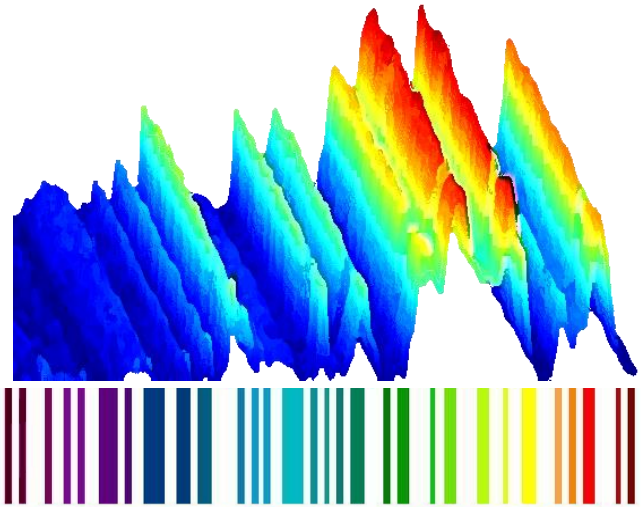

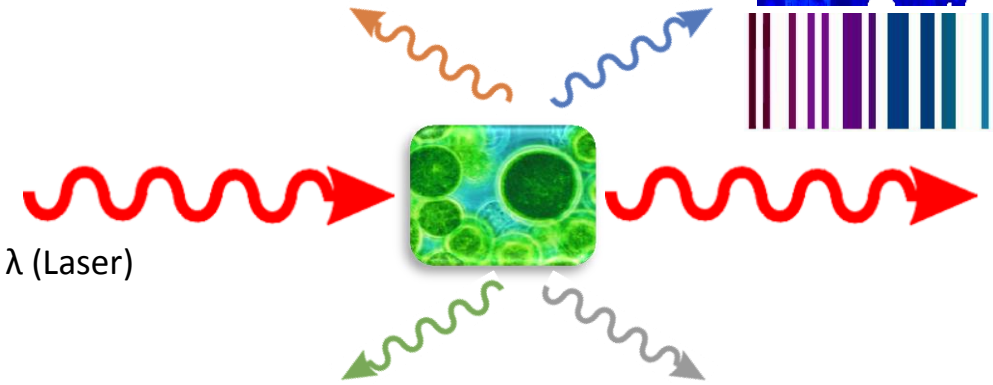

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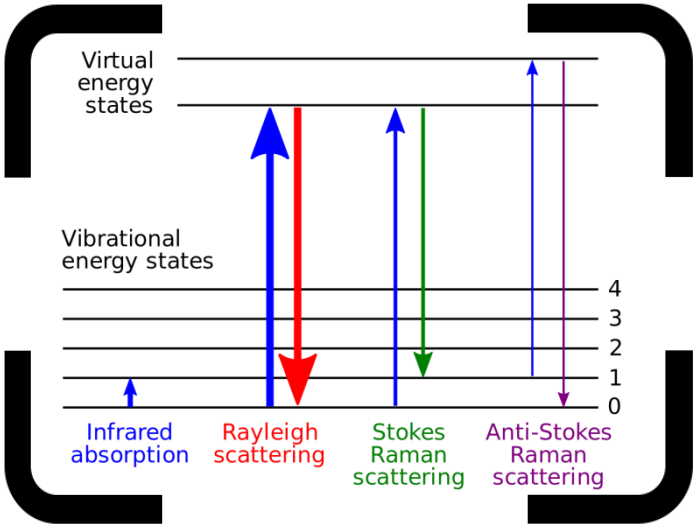

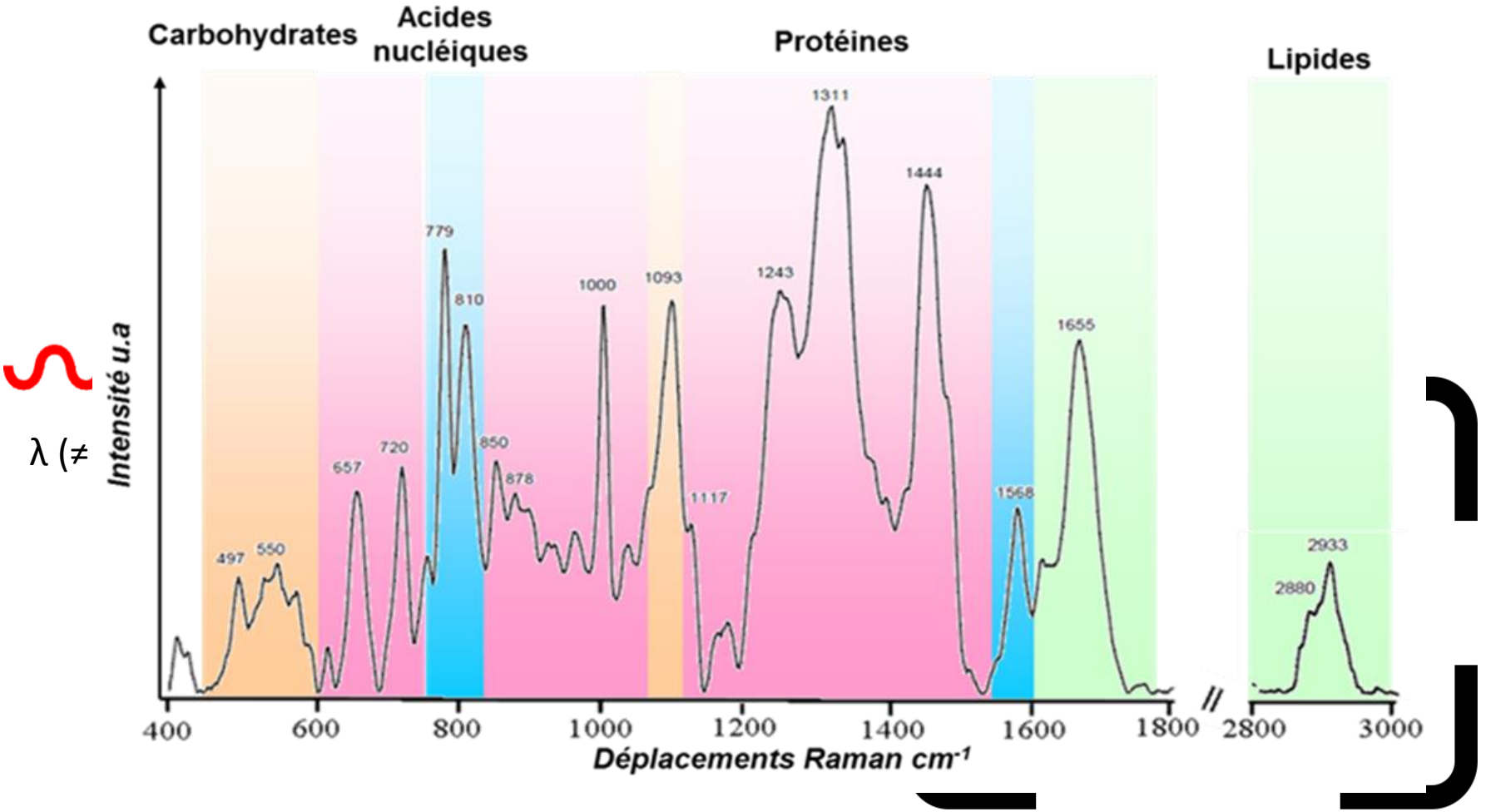
Carbohydrates
Acides nucléiques
Protéines
Lipides
Intensité u.a
λ (≠
497
550
657
720
779
810
850
878
1000
1093
1117
1243
1311
1444
1568
1655
2880
2933
400
600
800
1000
1200
1400
1600
1800
2800
3000
Déplacements Raman cm-1

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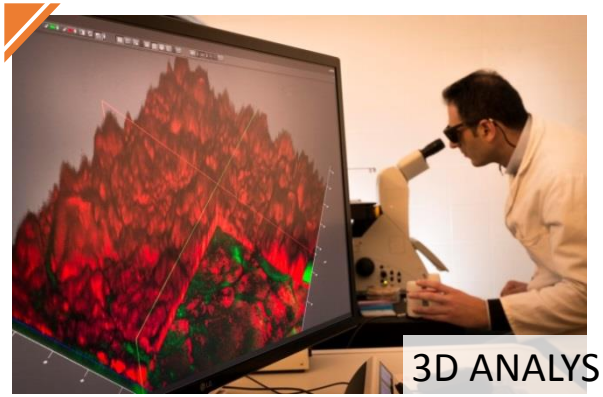
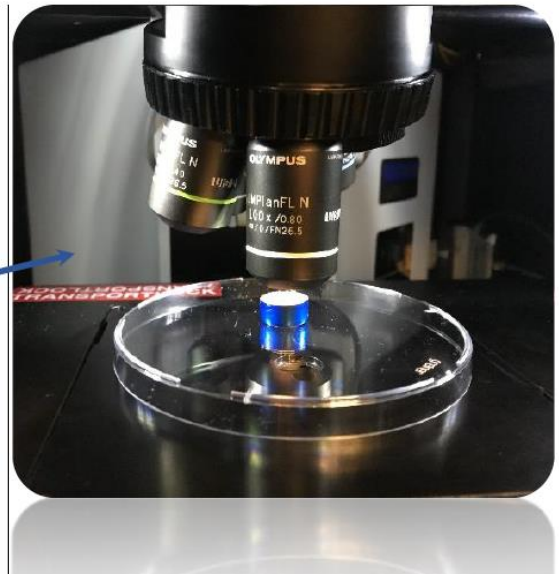
- Non-invasive and non-destructive analysis: **no sample preparation required**
- A **small quantity** of sample is sufficient
- **Very fast** analysis
- One shot = **simultaneous verification**
  The presence/absence of pathogens
  Lipid/protein/carbohydrate,…


NON DESTRUCTIVE


3D ANALYSIS

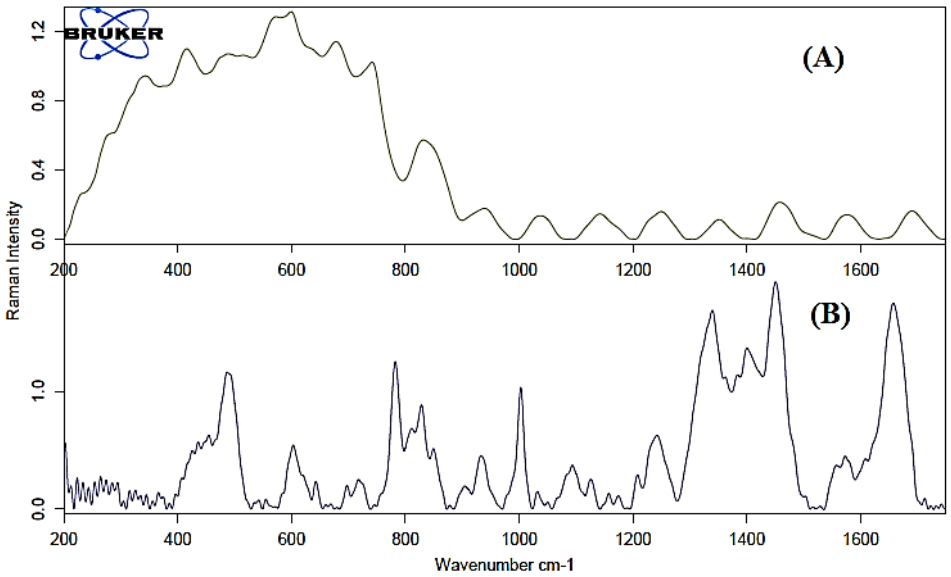


Optimization of optical parameters

- Laser: λ, P, t, R, …
- Biology: high variability of living samples
- Statistics: nb of spectra, data, model reliability

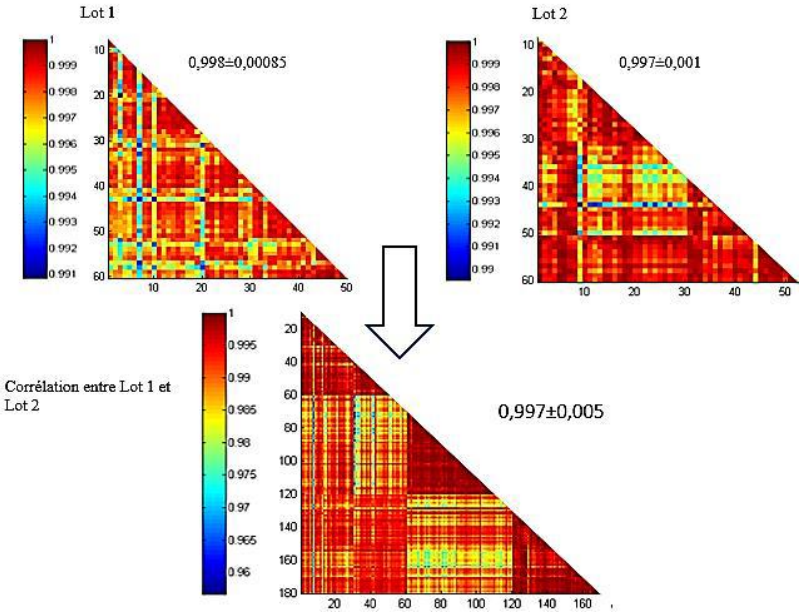
All of these parameter should be examined to provide reliable data

Selection of the best wavelength



Raman spectra done on chicken matrices with 2 different wavelength **(A) 532 nm** & **(B) 785 nm**.

Variability between batches



Correlation between 2 batches of chicken

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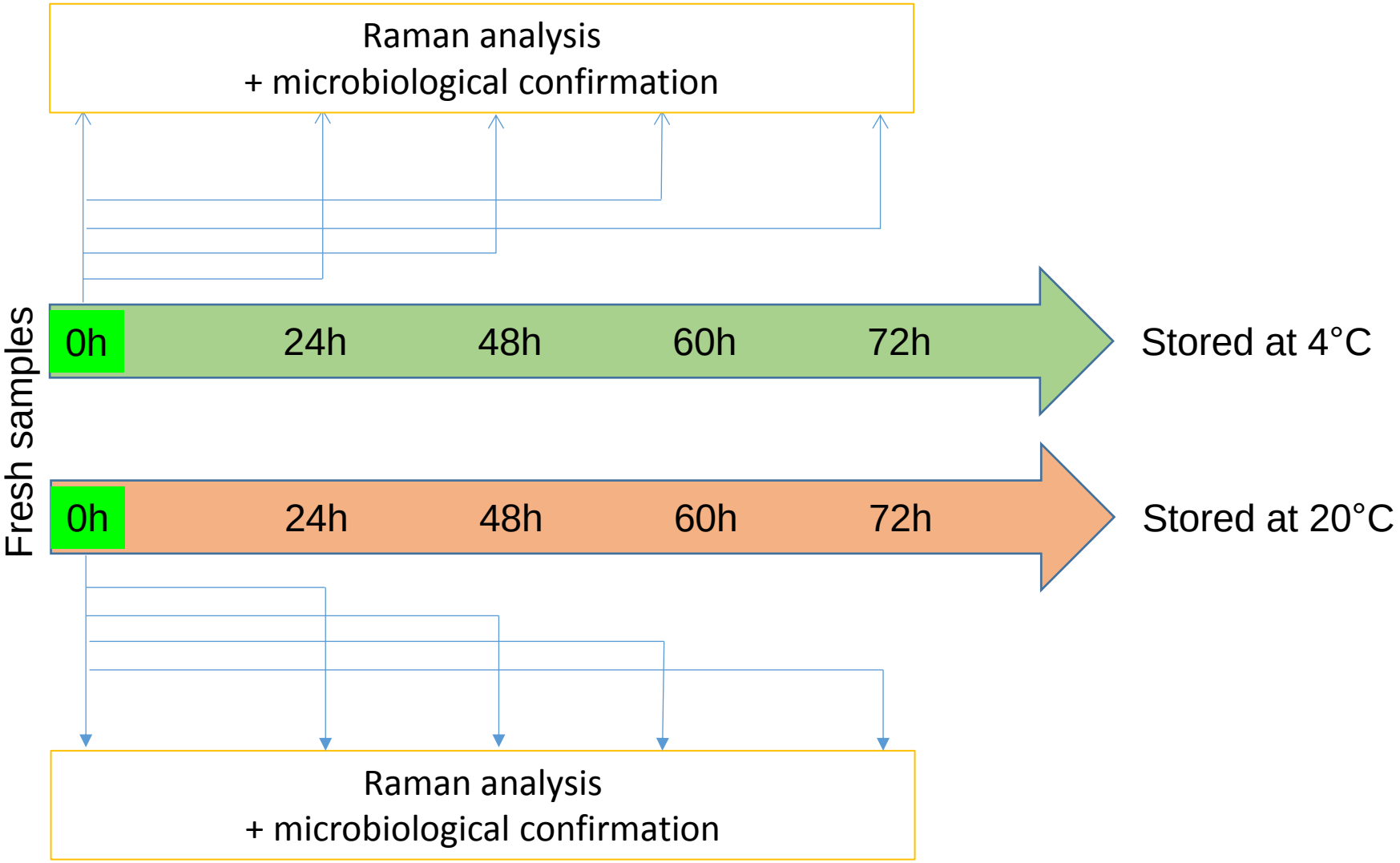

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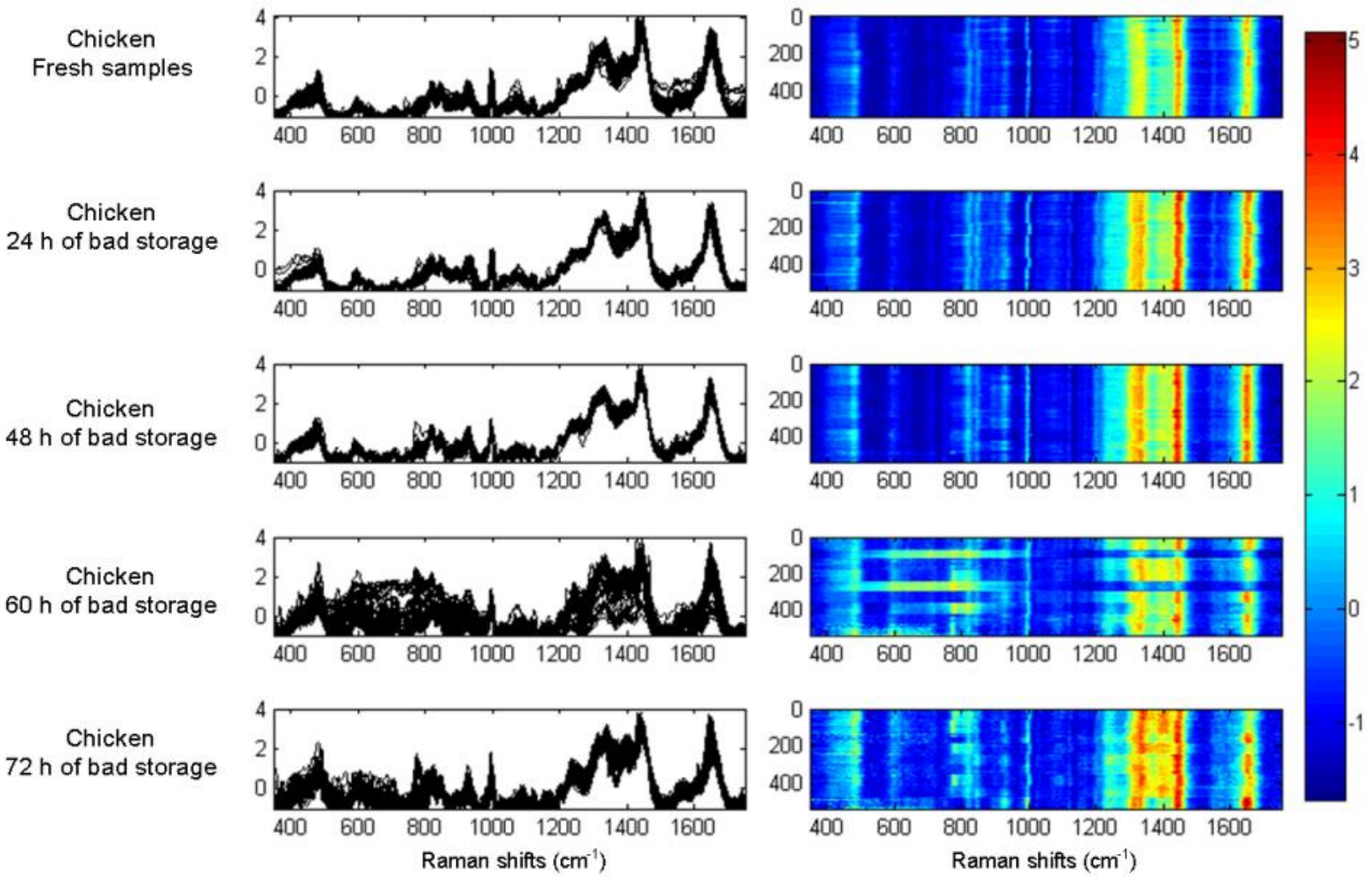
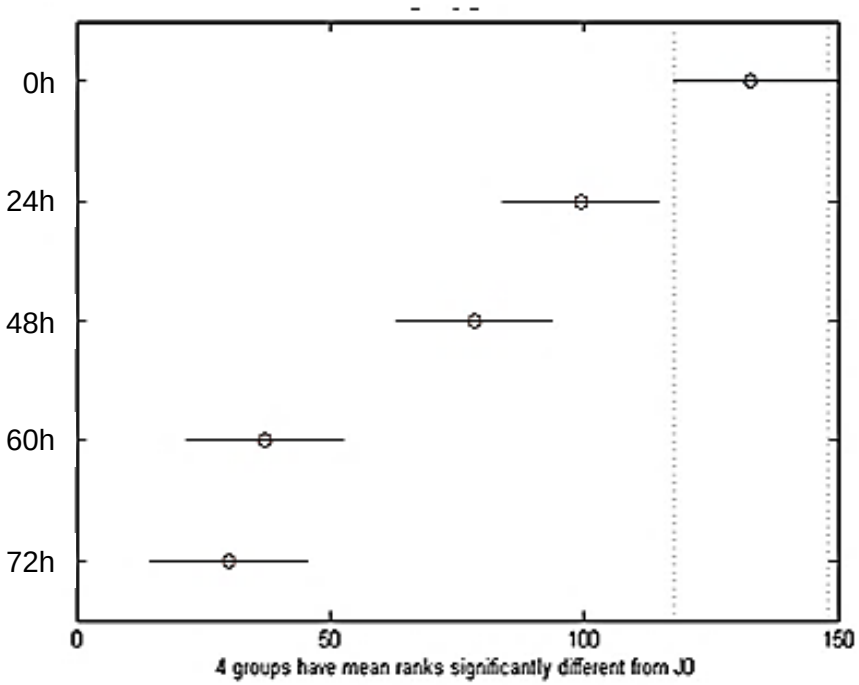
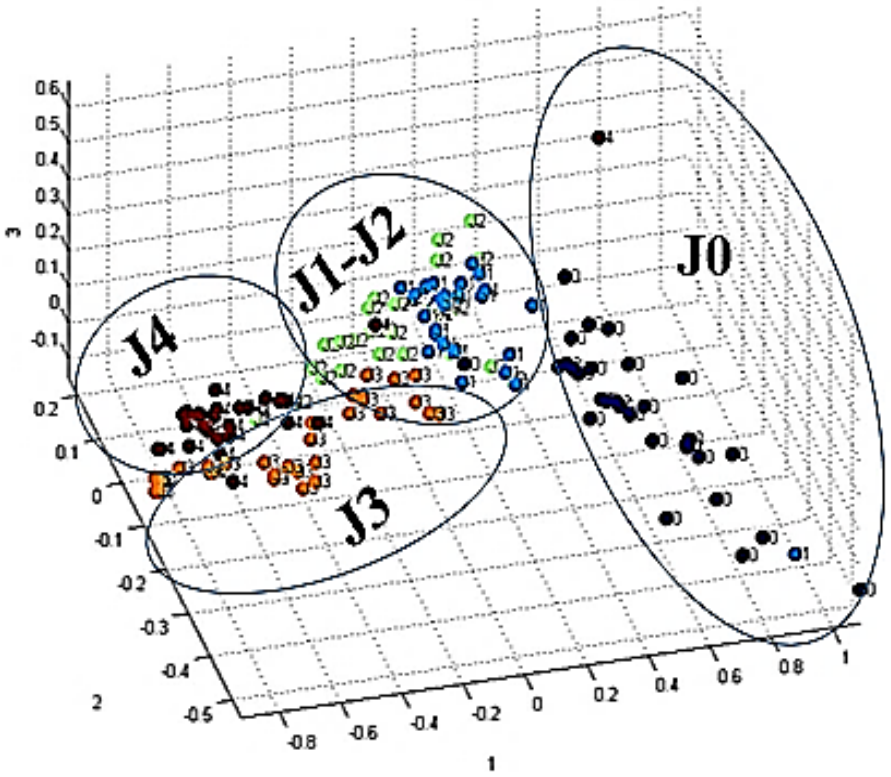
Raman spectra of chicken samples (left side) and 2D plots of spectra showing the Raman shift and the intensity differences between the studied samples (right side)

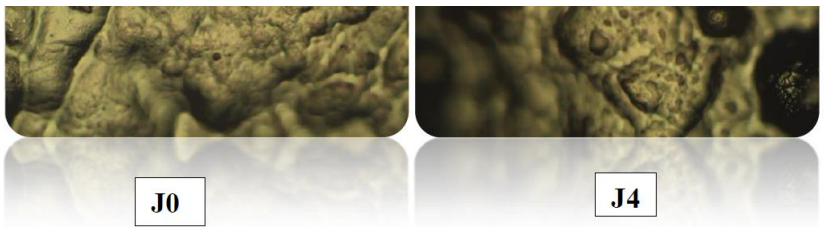




Kruskal-Wallis ANOVA Table

Source	SS	df	MS	Chi-sq	Prob>Chi-sq
Groups	221917.7	4	55479.4	117.57	1.7624e-24
Error	59319.8	145	409.1		
Total	281237.5	149			





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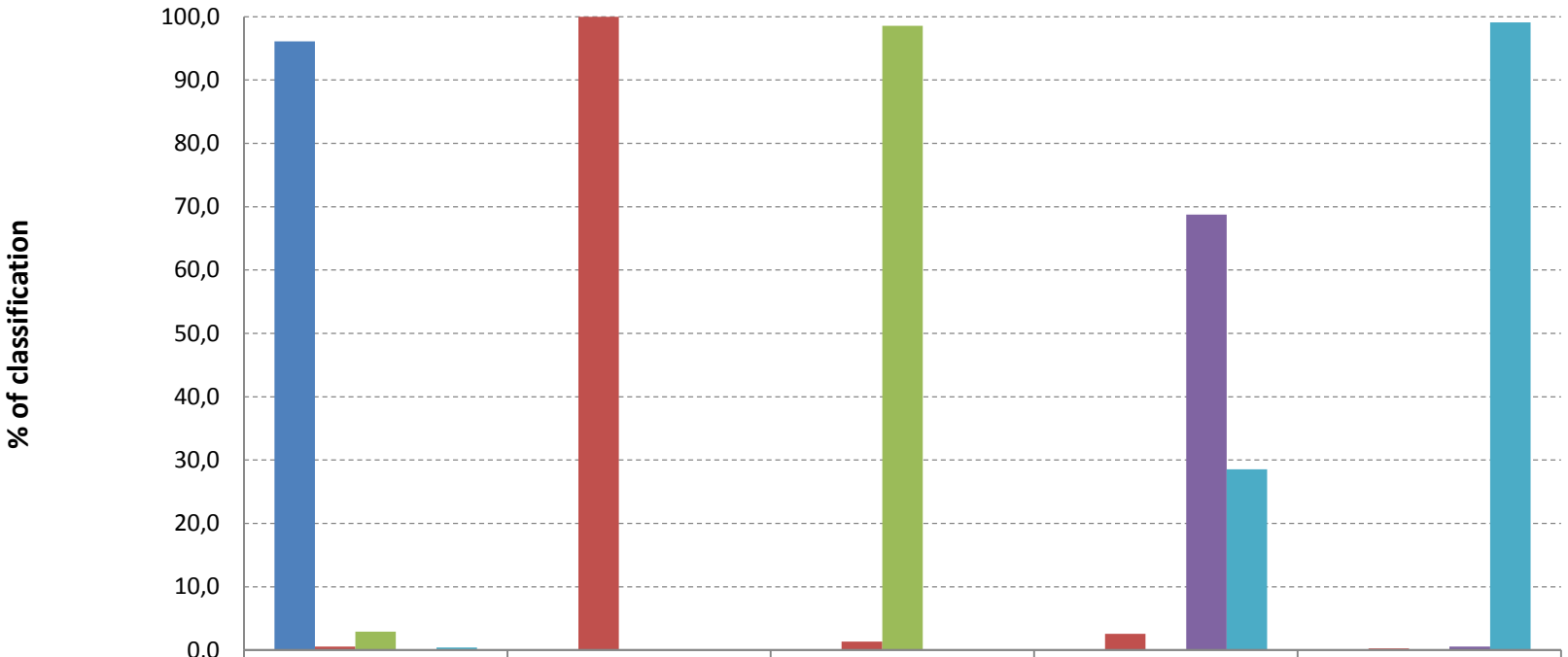
Classification of the Raman spectra done on chicken samples according to their storage conditions



	Fresh	24h	48h	60h	72h
Fresh samples	96,1	0,0	0,1	0,0	0,0
24h of bad storage	0,5	100,0	1,3	2,6	0,3
48h of bad storage	2,9	0,0	98,6	0,1	0,1
60h of bad storage	0,1	0,0	0,0	68,8	0,5
72h of bad storage	0,4	0,0	0,0	28,6	99,1

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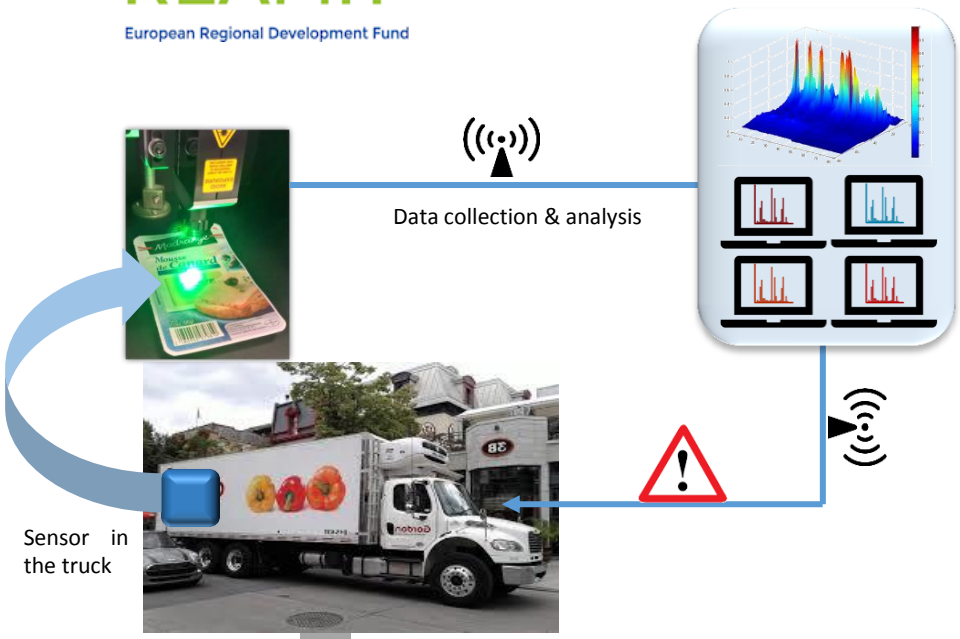


UoN will perform the following activities in REAMIT

(i) Raman Spectroscopy technology for monitoring food quality in the supply chain

(ii) Send the sensor data to Big data platforms for further analytics

(iii) Conduct technology testing and piloting

(iv) Help in project evaluation, risk assessment, monitoring and dissemination.

○ **Nearest welcome point**

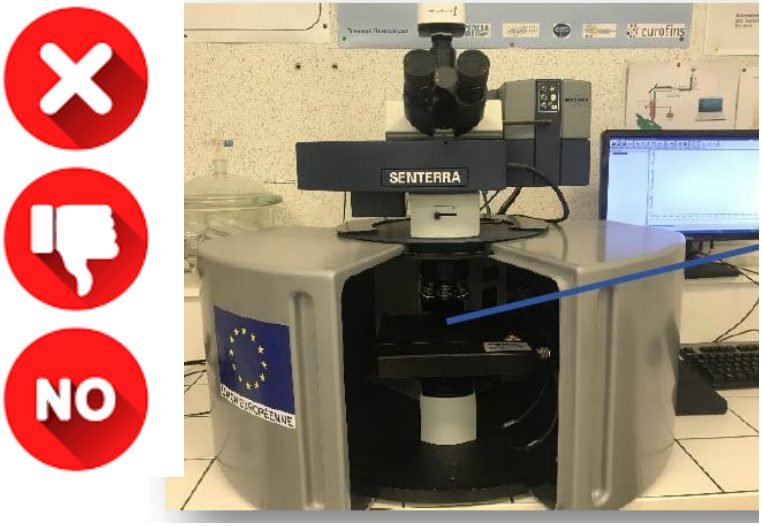
yes problem

No problem

○ **Safety arriving at destination**

Raman spectroscopy is a powerful technique to monitor the quality of food matrices

Challenges for REAMIT project



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Thank you for your attention