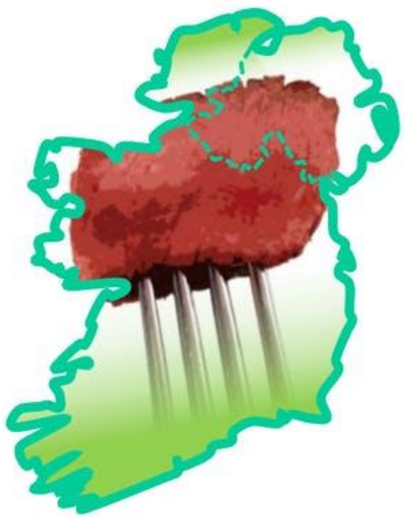
REIMS – a new method for authenticity



ALL-IRELAND MEAT SCIENCE CONFERENCE 2019

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Waters
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1st March 2019

@njbirse

What is a mass spectrometer ?

A mass spectrometer is an instrument we use in the laboratory to weigh and then identify molecules.

These molecules can be man-made products like pesticides and plasticisers, or they can be naturally occurring products like the lipids found in cells.

Mass spectrometers can also break apart the molecules they're weighing in a process known as 'fragmentation'.

Molecules break at known weak points, by weighing these fragments we can determine the structure of these molecules, confirming their identities.

So what is REIMS then ?

- REIMS stands for Rapid Evaporative Ionisation Mass Spectrometry.

- It eliminates the complex preparation steps needed to get our samples ready for analysis, so no freeze-drying or extraction steps to undertake first.

- It also eliminates the need for chromatography, removing the cost and complexity of running a liquid or gas chromatography system.

- Just direct sampling - straight from the sample to be analysed with no preparation.


Waters G2-XS QTof mass spectrometer
Diathermy generator
Fume Hood
BioMAT1 Class 1 biosafety cabinet
Windows PC
BioMAT 1
Waters
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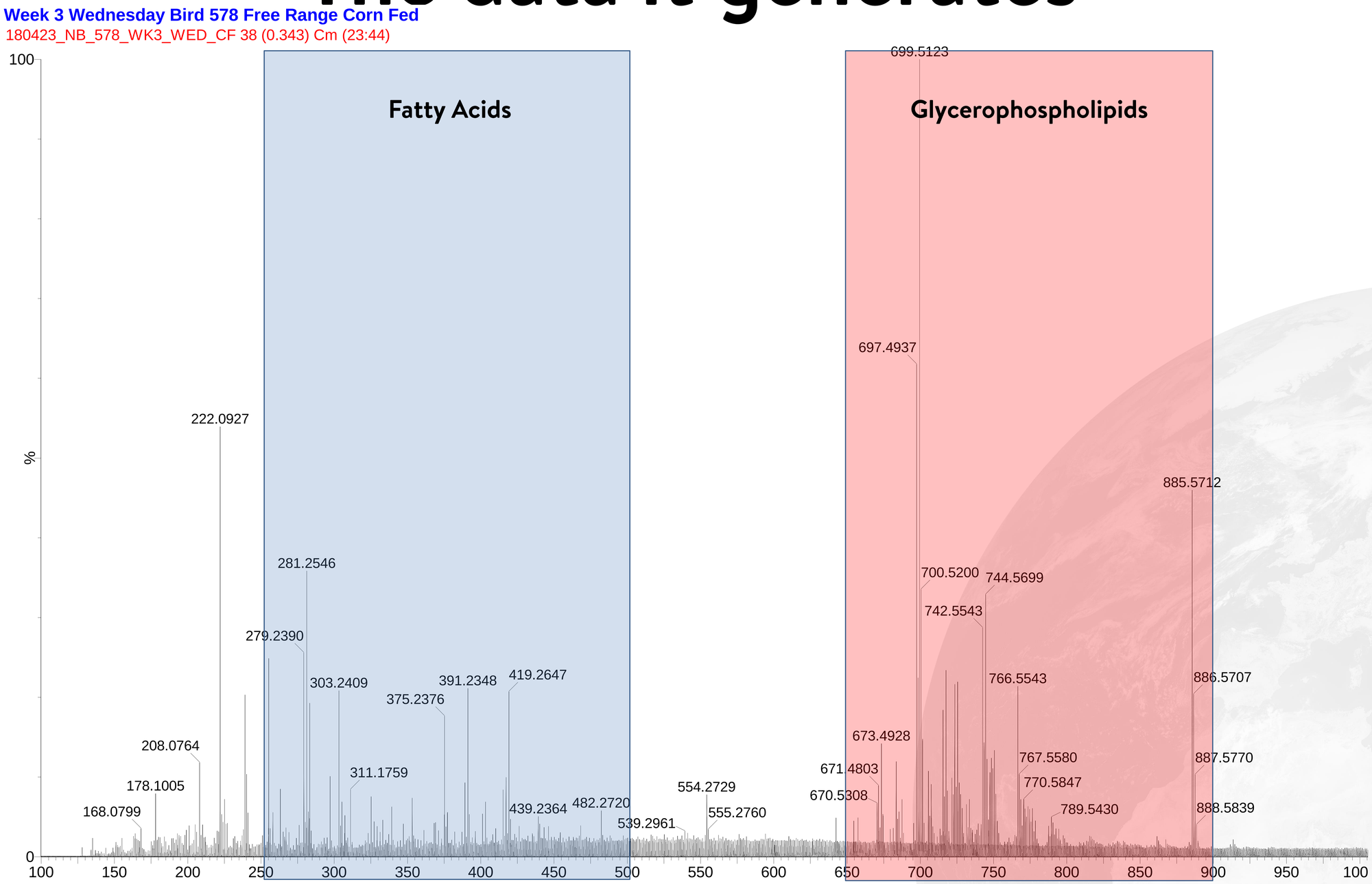
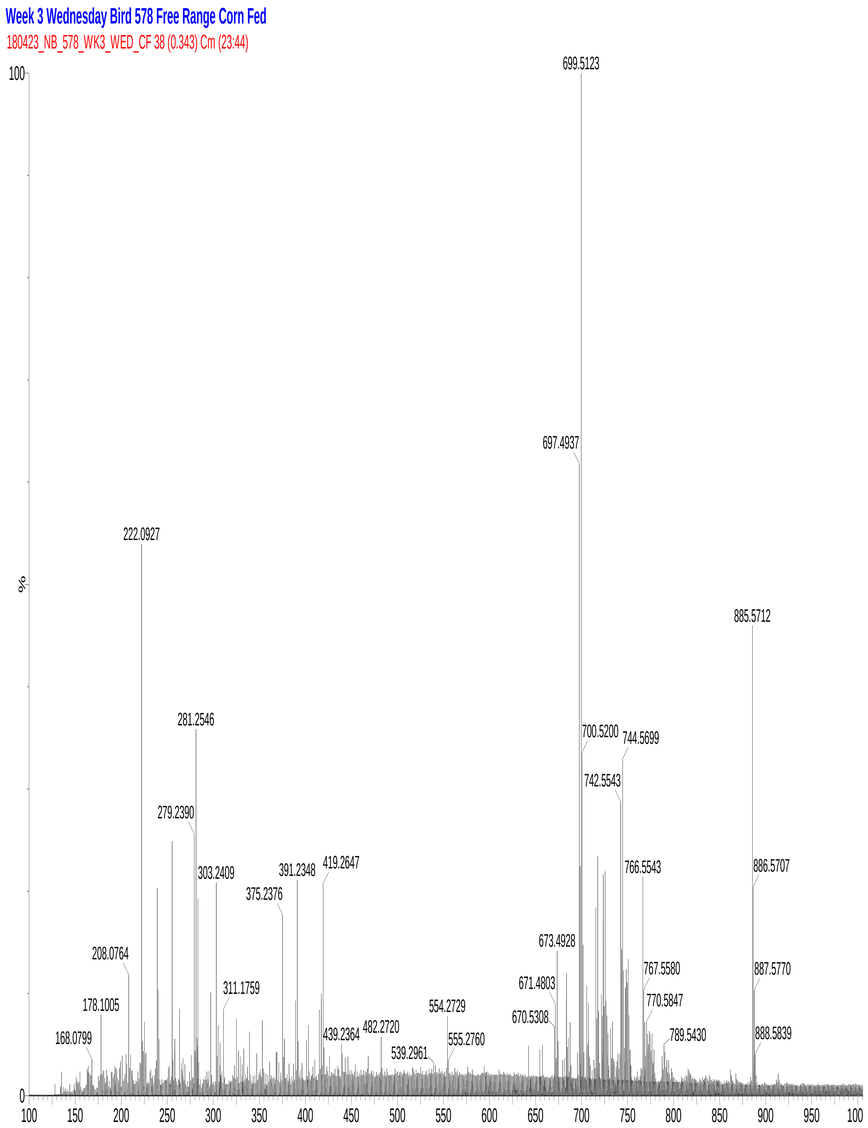
How does it work ?

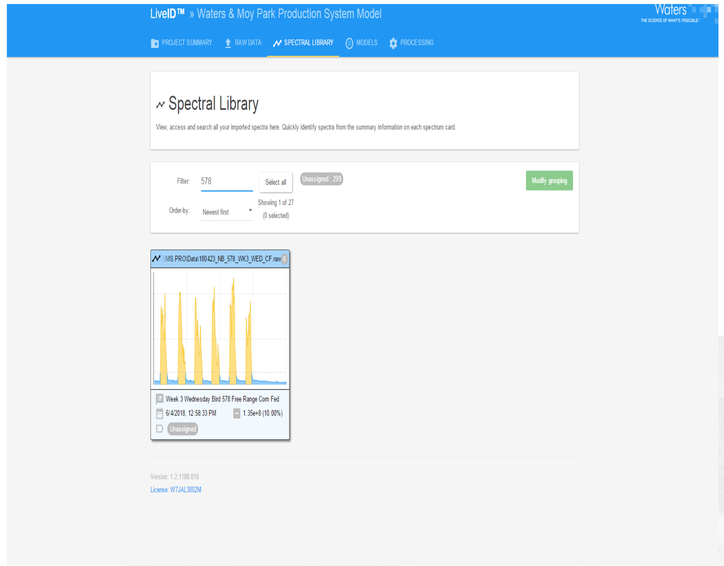
- Smoke is generated by the iKnife or a comparable source (lasers and bi-polar probes can be used).
- The smoke is rich in chemical compounds which are characteristic of the sample being analysed – for meat we are most interested in cell membrane lipids.
- Ionisation and analysis of the components of the smoke results in a spectra being generated. This spectra shows the composition of the smoke.
- The relative abundance of each component is also measured, allowing us to determine not only what is present in the smoke, but the quantities present.

The data it generates

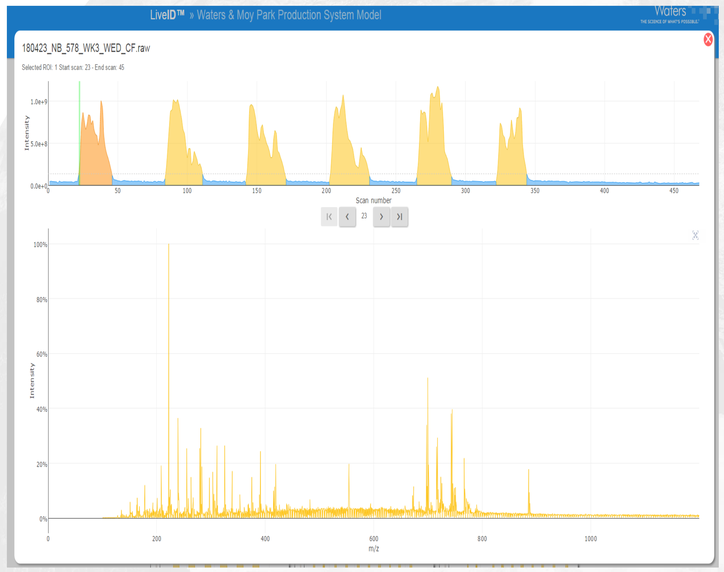


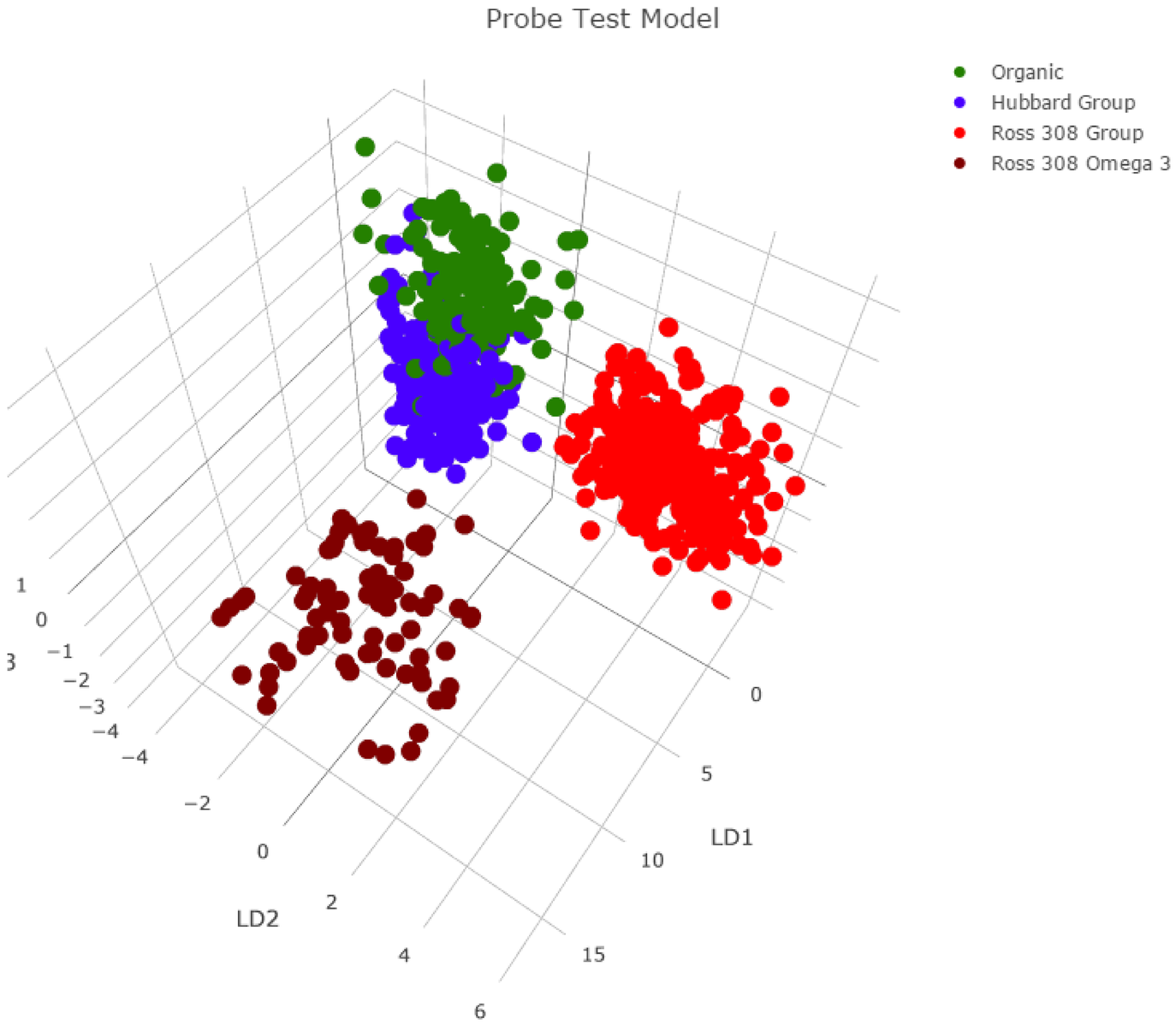
Chemometric modelling

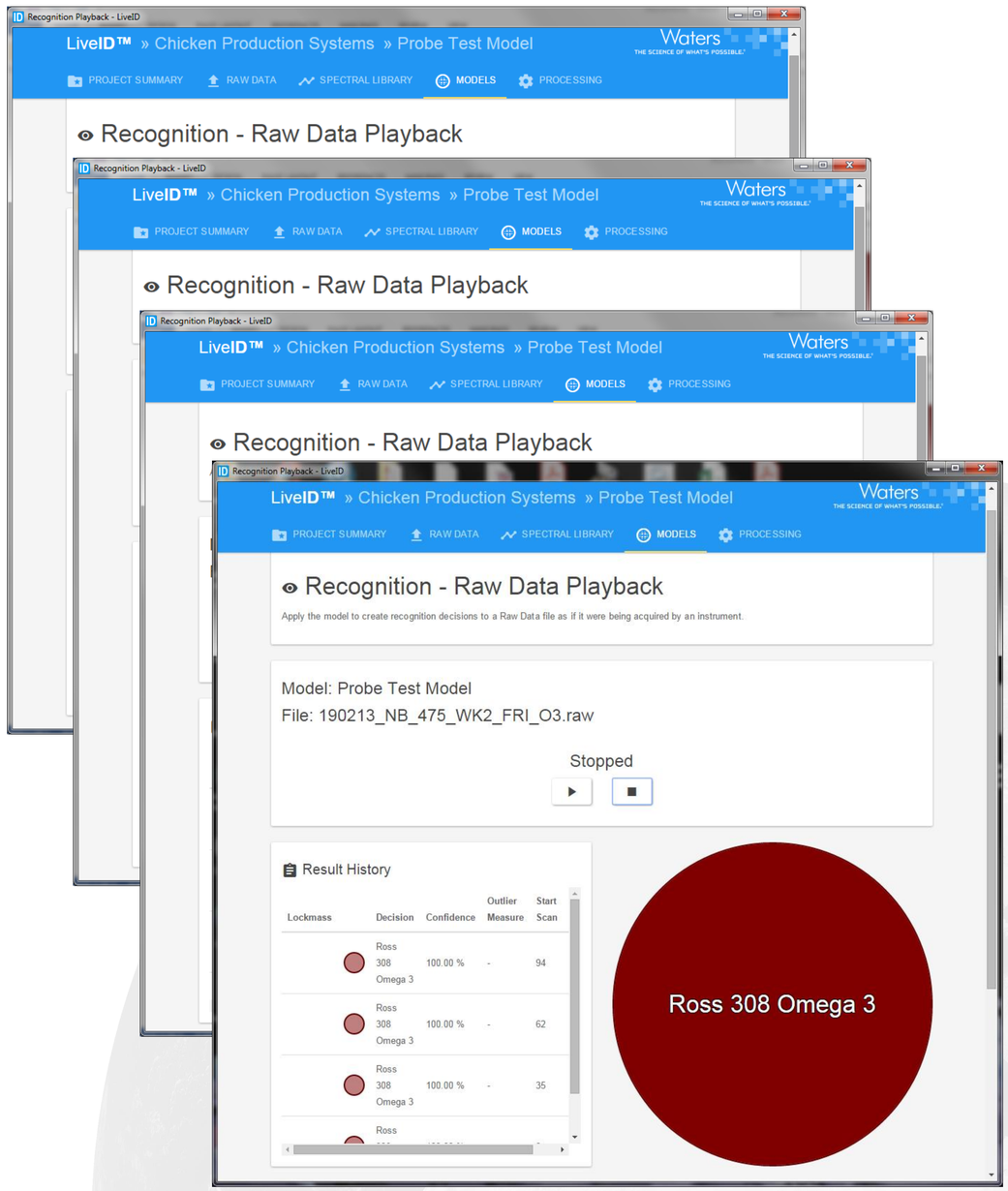




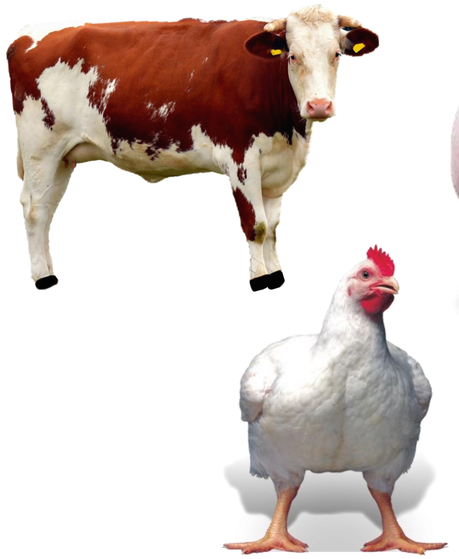
Spectral data curated and then imported into Waters LiveID software – spectral data compared using PCA, LDA and PCA-LDA models




Probe Test Model
Organic
Hubbard Group
Ross 308 Group
Ross 308 Omega 3
LD1
LD2
1
0
−1
−2
−3
−4
−4
−2
0
2
4
6
0
5
10
15


Recognition Playback - LiveID
LiveID™ » Chicken Production Systems » Probe Test Model
Waters
PROJECT SUMMARY
RAW DATA
SPECTRAL LIBRARY
MODELS
PROCESSING
Recognition - Raw Data Playback
Recognition - Raw Data Playback
Apply the model to create recognition decisions to a Raw Data file as if it were being acquired by an instrument.
Model: Probe Test Model
File: 190213_NB_475_WK2_FRI_O3.raw
Stopped
Result History
Lockmass
Decision
Confidence
Outlier Measure
Start Scan
Ross 308 Omega 3
100.00 %
94
62
35
Ross 308 Omega 3

What can it do ?



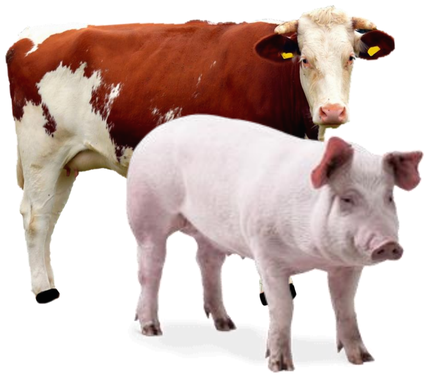
Species and breeds

Production Systems

Product quality

Geographic origin

REIMS at Queen's



Species and breeds

Identification of species and breed of meat or fish present in an unknown sample.

Production Systems

Identifying catch methods for fish or differentiating between free range and barn chickens.

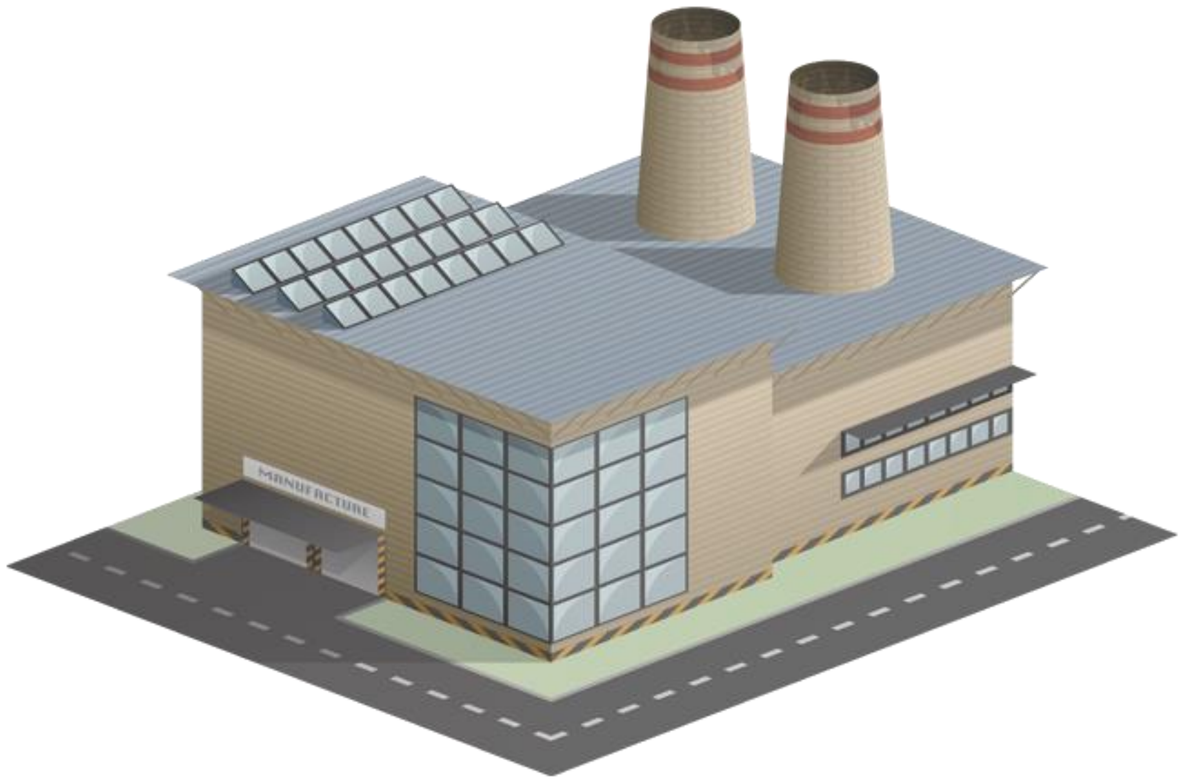
Geographic origin

Determining the production location of seafood products such as farmed shrimp.

Product quality

Adulterants in samples such as animal by-products can also be detected by REIMS analysis.

Where next ?



On the factory floor

A trial factory development using Waters REIMS technology is now underway in Denmark.

REIMS is being used for at-line identification of pigs carcasses suffering from the testosterone related 'boar taint' issues, allowing their removal from the cutting line.

It is hoped that by using REIMS, it will be possible to better detect tainted meat, reducing customer complaints and costs. The technology should also allow cutting plants to reduce the amount of carcasses they reject through more accurate analysis.

Thanks

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Chris Elliott and Olivier Chevallier (my supervisors)
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Sara Stead, Steven Pringle and Simon Hird

Moy park

Stewart Blair, Eleanor Paisley, Ursula Lavery and Rachel Gawn

afbi Agri-Food and Biosciences Institute ®

Linda Farmer and all at AFBI involved with AIMSC 2019

Questions

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http://www.waters.com/reims
for detailed technical information