Potential use of FAIMS for the detection of potato storage diseases

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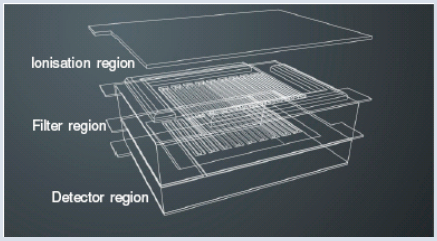
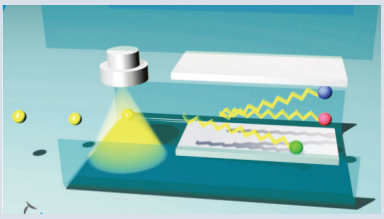
FAIMS instrumentation

A Field Asymmetric Ion Mobility Spectrometer (FAIMS) consists of three main functional units:

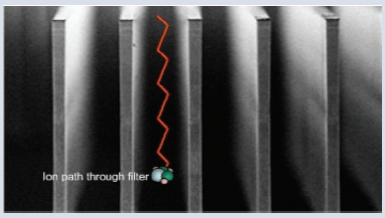
1. A gas ionisation source ionises volatile chemicals extracted from a head space. This allows them to move under the influence of an electric field.



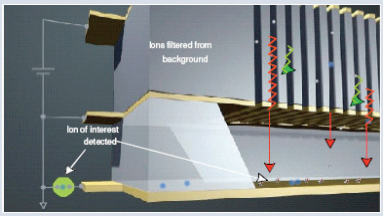
2. An ion filter separates ionised gases according to their mobility. A time varying electric field is applied across multiple channels. Only the ions with the right mobility (depending on mass and shape) can pass through the channel.
3. An ion detector measures the amplitude of the current generated by the ions reaching the detector. The ion current is an indicator of number of ions and therefore concentration.



Gas atoms enter the sensor and are ionised with a radioactive source



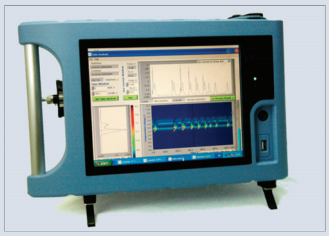
Ions inside filter channels move on saw-like trajectories



Ions with the correct mobility 'fingerprint' pass through the ion channels and are detected

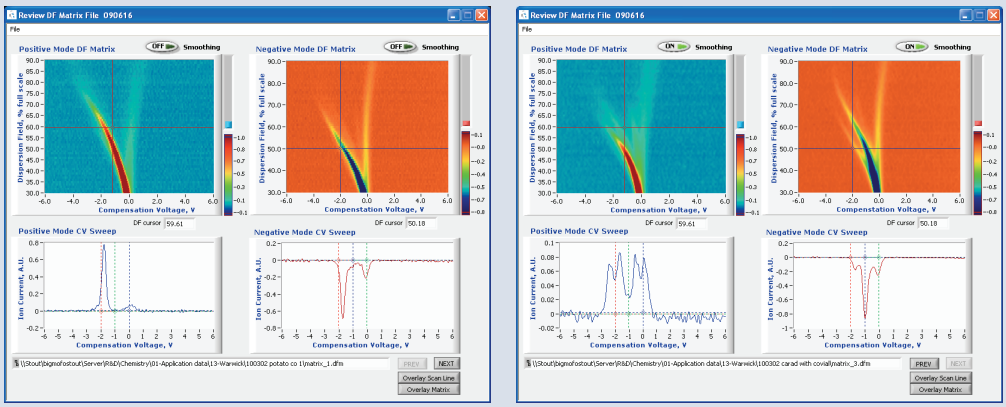
Detection of *Pectobacterium atrosepticum*

- The bacterium *Pectobacterium atrosepticum* causes blackleg disease of potatoes in the field and can also result in soft rot of stored tubers.
- Soft-rotted tubers are known to be associated with the release of volatiles which could potentially be detected by FAIMS.
- A FAIMS Lonestar™ unit (Owlstone Nanotech Ltd.) was used to compare the volatile fingerprints of the headspace above healthy tubers and those artificially infected with *P. atrosepticum.*
- The FAIMS fingerprint for the infected tuber was quite different from the healthy one and suggests that this technology can be useful in detecting soft rot and perhaps other potato diseases in store.



The FAIMS Lonestar™ unit is a complete self-contained stand-alone system. It has a detection limit of parts per billion and can be trained for volatile fingerprint recognition.

Healthy tuber **FAIMS fingerprints** **Infected with *Pectobacterium***



The FAIMS Lonestar™ unit rapidly creates a fingerprint for all the ionising volatiles present in the headspace. The fingerprint consists of a colour coded matrix of data points, e.g. positive (blue display)/negative (red display) DF matrix, or a single line of measurement. Software analyses the fingerprints and compares number of peaks, peak positions and values. For ion current values in positive mode for a dispersion field of 60%, two peaks were observed for the uninfected potato (left) while four peaks were obtained for the tuber infected with *Pectobacterium* (right).