Real-time “interactive storage” quality control in fresh agro products (QCAP)

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Project summary:

In the North-west region, the agri food sector has a high economic and social value. A significant part of the crops is lost because of spoilage or the decreasing quality during handling or storage. The Radbound University develops a prototype of an interactive storage system (ISS) which is able to measure volatile compounds in storage air. These substances will be traced back to the occurrence of certain storage diseases.
An early recognition of the problems enables timely action so that an early sale can be carried out and big losses of food can be prevented.
The new technology will be tested under commercial storage conditions in the following crops: Apples, pears, potatoes and blueberries.

Concept and approach underpinning the project and methods:

A block diagram of the technical layout of the system is shown in Fig. 1.
The general working principle is the following: a broad spectrum generated by a specially designed supercontinuum laser (A) will propagate in a multipass cell (D) filled with storage room gas samples via a dedicated gas handling (pump) system (E). The pressure within the multipass cell will be maintained low (~50-100 mbar) in order to reduce pressure broadening of the absorption lines and thus minimize spectral overlap with interfering gases. The output spectrum, containing absorption patterns from different interrogated species, is dispersed by a 2D spectrometer (C) based on the combination of a Virtually Imaged Phased Array (VIPA) and a conventional grating. The resulting 2D absorption spectrum will be imaged onto the detector array. Imaging optics (C) and deconvolution algorithms (F) will optimize the signal molecular energy transitions in the spectral range of interest, i.e. 2.5-4 micrometer. contrast either for a full spectrum (~2.5-4 µm) or for a smaller spectral window with higher resolution in a single shot measurement. From the obtained absorption spectrum, a data processing algorithm (F) will provide information on the levels of markers present in the storage room, allowing the end-user to adjust parameters like O_2-CO_2 levels or to make further decisions in order to maintain food quality and safety at high standards and avoid or mitigate losses.

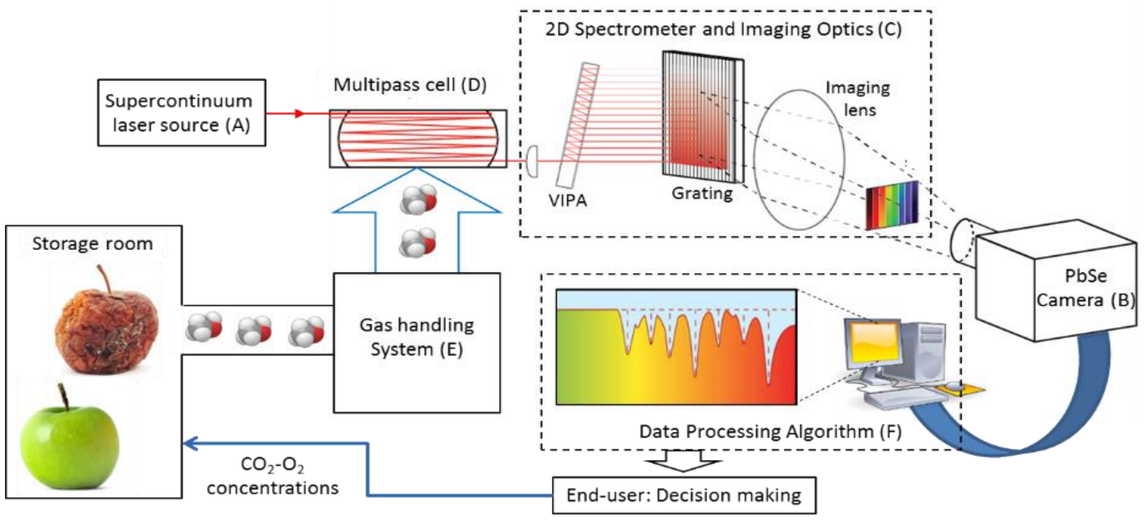


Fig. 1: Technical layout of the system

Hypothesis:

The ISS measures special volatile compounds in the air of storage rooms, which are produced by the apples because of low O_2 or high CO_2 levels. If the storage diseases, which are influenced by these compounds, are reversible, the crop can be secured by changing the storage conditions.

Volatile compounds (in ppm) to measure in apples:

<u>O_2-dificiency → Fermentation</u>
- Ethanol (0-1000 ppm)

<u>CO_2-excess → depending on variety 0 -3,5 % CO_2</u>
- Acetaldehyde (0-50 ppm)
- Ethyl acetate (0-50 ppm)

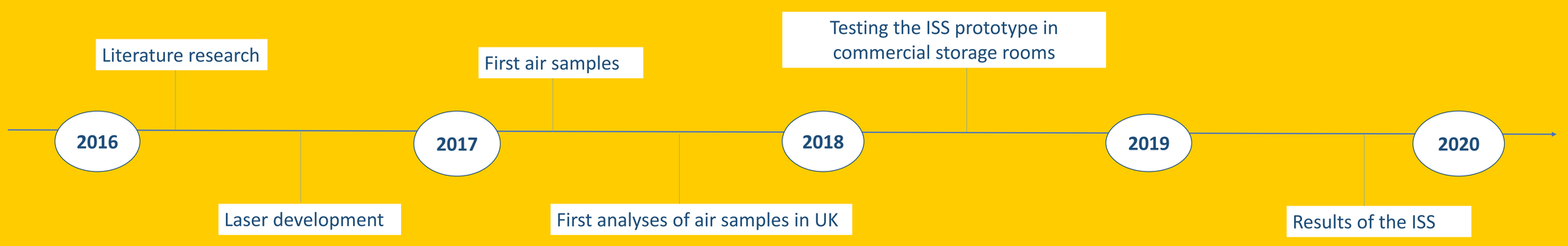
- Ethylen (0-500 ppm)

Volatile compounds (in ppm) to measure in blueberries:

<u>O_2- dificiency → Fermentation</u>
- Ethanol (0- 1000 ppm)

<u>CO_2-excess → at least 15 % CO_2 to have an effect against decay</u>
- Acetaldehyde (0-50 ppm)
- Ethyl acetate (0-50 ppm)

- Ethylen (0-100 ppm)



Participants
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