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**IONER**  
Aerosol & Volatile Analysis Technology

# Aerosol Instrumentation



## HIGH RESOLUTION MOBILITY SPECTROMETER

**A NEW FIELD ANALYTICAL TECHNIQUE**

# HIGH RESOLUTION MOBILITY SPECTROMETER

Ion Mobility Spectrometry (IMS) is an emerging technique in field analysis. IONER has developed a new concept IMS based on space classification of ions (Differential Mobility Analysis) with a high flow sheath gas that allows for higher sensitivity and resolving power than drift time IMS.



IONER High Resolution MS is a new instrument based on space classification of ions at ambient pressure and electrical detection of ions. This active separation allows for higher resolving power than traditional IMS.

Measurement of ion mobility in gas phase gives a fingerprint of the chemical nature of a mixture of vapors that can be used in fields such as security, food inspection, environment, diagnosis or fundamental ion research. Additionally, the novel determination of ion size can be achieved.

Moreover, the IONER High Resolution MS includes a multivariate analysis software that allows for specific training and the generation of custom-made libraries for signal recognition and quantification. Default library includes standards.

Several non-radiative ionization methods can be used depending on the chemical family of the analyte and matrix. Photoionization, Corona Discharge and Electrospray.

## SPECIFICATIONS

|                        |   |
|------------------------|---|
| Measuring principle    | Ion Mobility  |
| Mobility range         | 0.6 & 3 cm <sup>2</sup> v <sup>-1</sup> s <sup>-1</sup>           |
| Ionization             | Non-radiative<br>Photoionization 10.6eV<br>Electrospray<br>Corona |
| Sampling               | Direct or with membrane   |
| Sensitivity            | PPB   |
| Detection              | Electrical current  |
| Dynamic range          | 3 decades   |
| Sample flow rate       | From 0.1 to 3 Lmin <sup>-1</sup>                                  |
| Sheath flow rate       | From 170 to 900 Lmin <sup>-1</sup>                                |
| Voltage                | Up to 7,5 kV  |
| Resolving power        | 50  |
| Ion polarity           | Positive/negative   |
| Measurement time lapse | 2-5min  |
| Communications         | Ethernet  |
| Powering               | 110-220 VAC 50-60 Hz  |
| Max. Consumption       | 700W  |
| Working temp. range    | 5 – 40 °C *2  |
| Storage temp. range    | -20 – 60 °C *2  |
| Humidity working range | 5 – 80 % *2   |
| Weight                 | 25Kg  |
| Dimensions:            | 90x40x40 cm   |

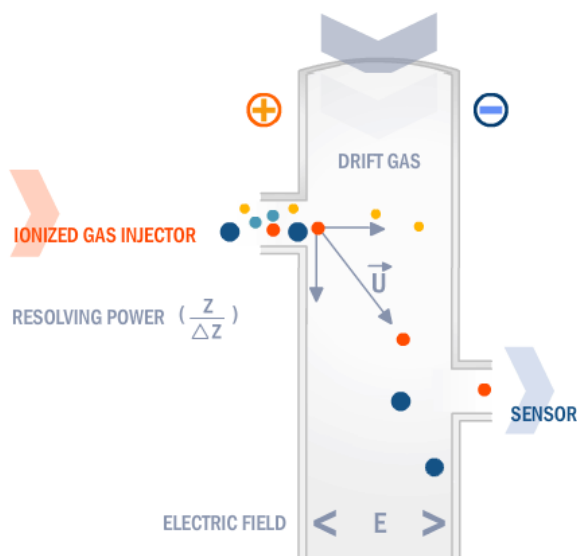
\*1 Standard Litres Per Minute at 20 °C and 1 Atm.

\*2 Non-condensing



## HIGH RESOLUTION MOBILITY SPECTROMETER

### Working principle



DMA is a particular type of Ion Mobility Spectrometer in which ions are actively separated by a sheath gas at a high flow speed (tens of m/s). An electric field is superimposed in a perpendicular direction so that ions are driven by the combination of the electrical force and fluid drift. More mobile (smaller) ions are less deflected by the sheath gas than less mobile (bigger) ions. Every field-flow combination results in the classification of a current of ions all with the same mobility that flow through a slit and are detected by an electrometer. Scanning the electric field allows a complete spectrum ions with mobility between  $0.6$  and  $2 \text{ cm}^2\text{V}^{-1}\text{s}^{-1}$ .

Careful design results in limited losses and high sensitivity (ppb level).

It is capable to offer excellent repeatability and reproducibility working on continuous out-flow of mobility-classified ions. Ideal for long-time laboratory or field measuring.

The versatility of the High Resolution MS enable it to work with several inter-chargeable ion sources for several chemical families. This way, the High Resolution MS detects most of the chemicals that you would expect from this kind of measuring systems.

### Applications

#### Security

Detection of explosive (Nitro-glycerine, PETN, RDX, TNT, TATP, HMTD), TICs, aggressive chemical compounds.

#### Environment

Detection of VOCs (acetone, diethylether, formaldehyde, BTX).

#### Diagnosis

Breath analysis.

#### Food Chemistry

Quality Control, anti-counterfeit.

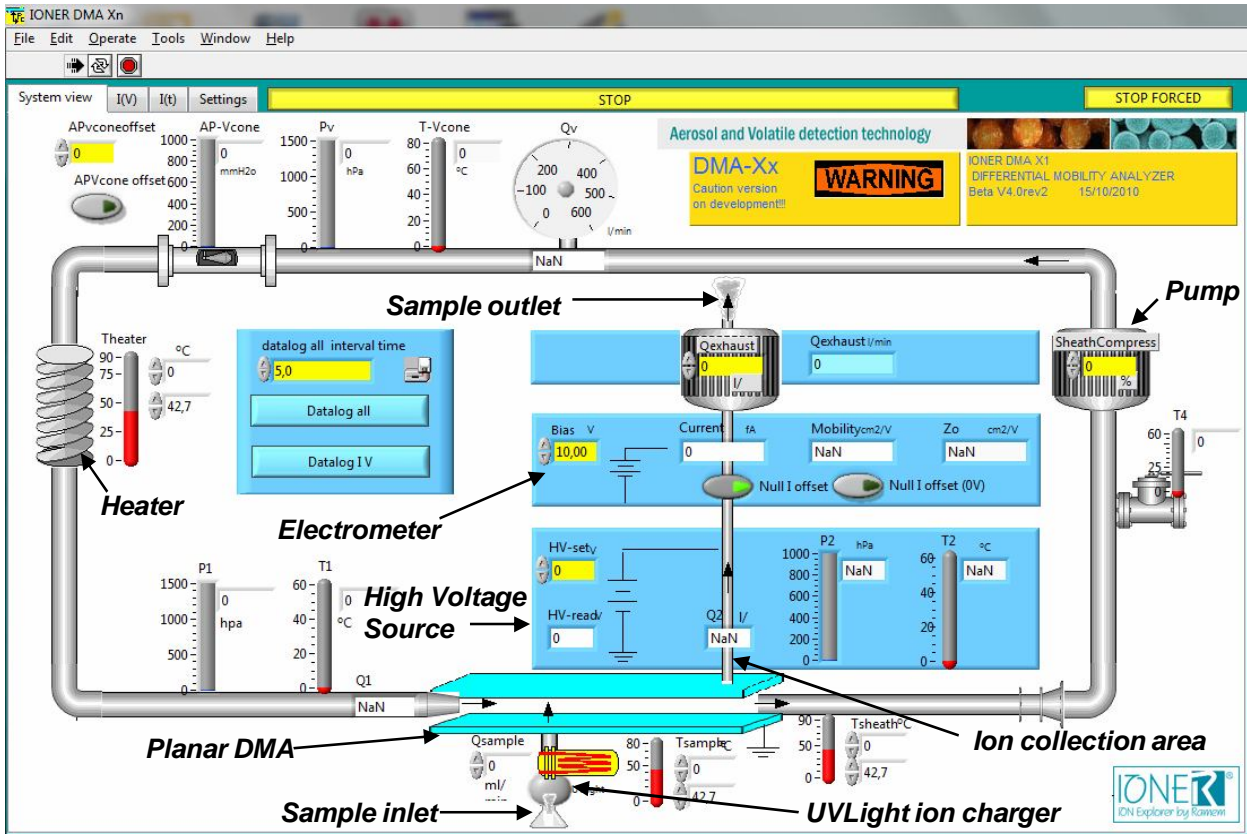
#### Fundamental research

Gas-aerosol nucleation studies, generation of aerosols by electrical discharges, studies of size determination.



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### Features



IONER High Resolution MS system scheme

#### Sheath gas circuit (closed loop)

- Sheath air flow is generated controlled by the pump.
- Temperature, pressure and flow rate are measured.
- A heater can be used to set the air temperature as convenient.
- The flow is laminarized to avoid turbulence in the classification region.
- Data analysis is also made by the multivariate software.
- Humidity and particles filters are provided to ensure cleanness of the sheath gas.

#### Ion circuit (open loop)

- Sample is introduced at a variable flow rate.
- Temperature control of the sample can be chosen.
- Analytes are ionized by a UV light source.
- Ions are injected into the classification volume and separated by the combination of electric field and sheath flow.
- Mobility-classified ions are drawn through the outlet slit.
- An electrometer detects the current of ions.
- Scanning the voltage results in a full ion mobility spectrum.



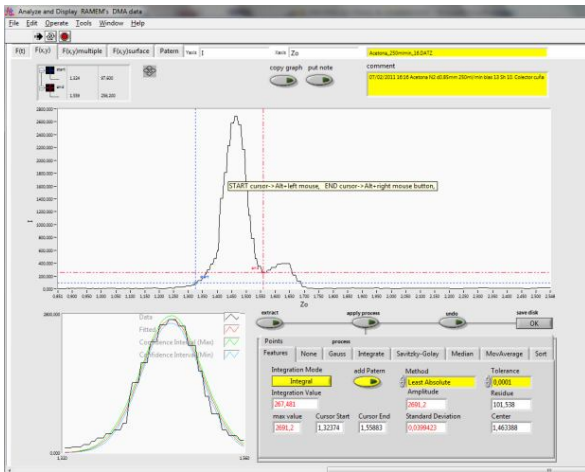
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### Software

IONER High Resolution MS is equipped with a user-friendly software allowing for data acquisition, data analysis and substance qualitative and quantitative analysis.

#### Data acquisition software

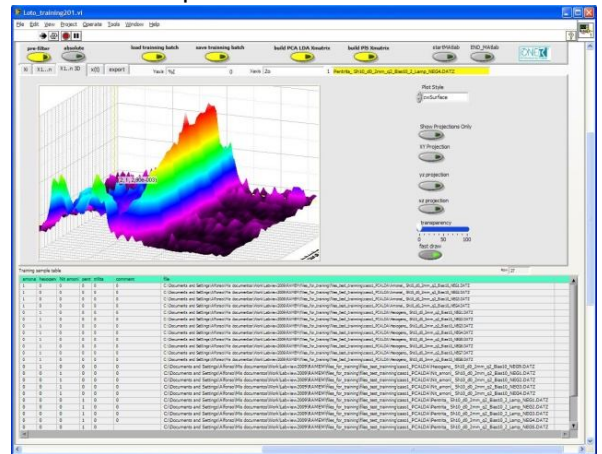
- Programming of measurements to allow unmanned operation.
- Time tracking of spectral peaks.
- Real time substance identification and quantification.



IONER High Resolution MS data analysis software

#### Data analysis software:

- Peak identification.
- Peak integration .
- Gaussian fit and deconvolution.
- Savitzky-Golay filtering.
- Construction of time series.
- 3D plots.
- Contour plots.
- Export to text and Excel files.

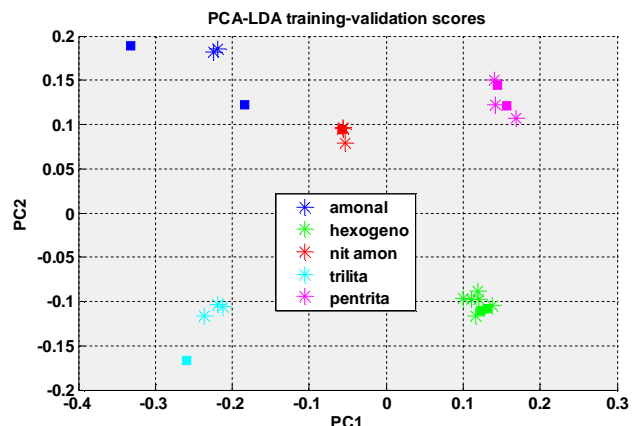


High Resolution MS off-line software to build a training set

#### Multivariate analysis Software

Multivariate analysis software allows for qualitative and quantitative analysis. Programmed algorithms include Principal Component Analysis-Linear Discriminant Analysis for qualitative classification and Partial Least Squares for quantitative analysis.

Default configuration includes model for lab standards. The user can construct specific training models for a given application.



PCA-LDA results for the classification of some explosives

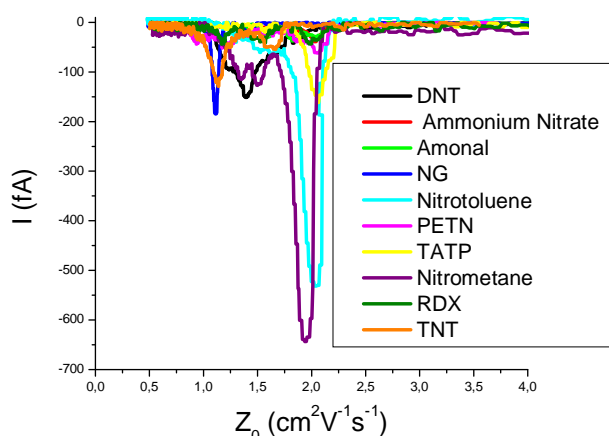
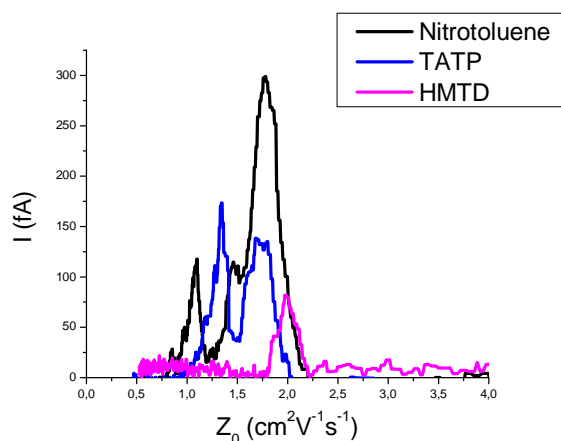
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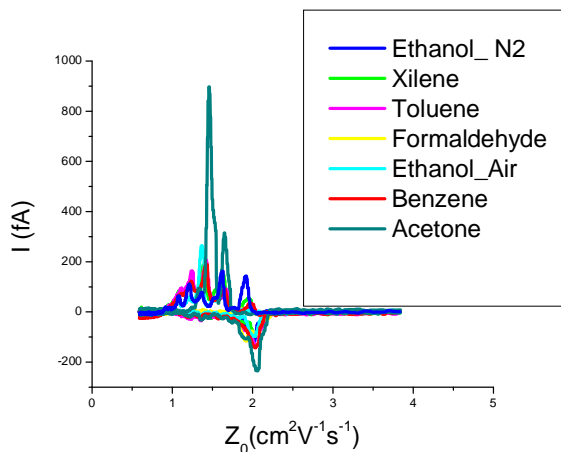
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**Examples**

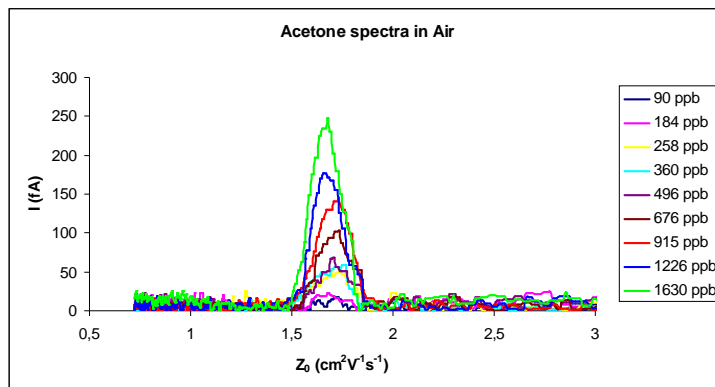
**Explosives detection in positive and negative mode**



**VOCs detection**



**Quantitative example for acetone**



**Publications**

- Santos, J.P., Hontañón, E., Alonso, M. & Ramiro, E. 2009. *Atmospheric Chemistry and Physics* 9, 2419-2429
- Alonso, M., Santos, J.P., Hontañón, E. & Ramiro, E. 2009. *Air and Aerosol Quality Research* 9, 453-457



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