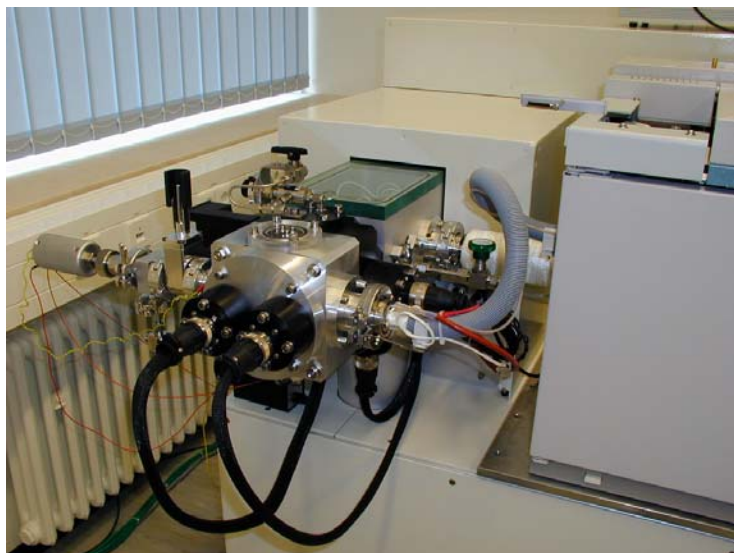


Module	Description
CI-UDIC	CI/EI ion sources in Unique Dual Ionization Configuration

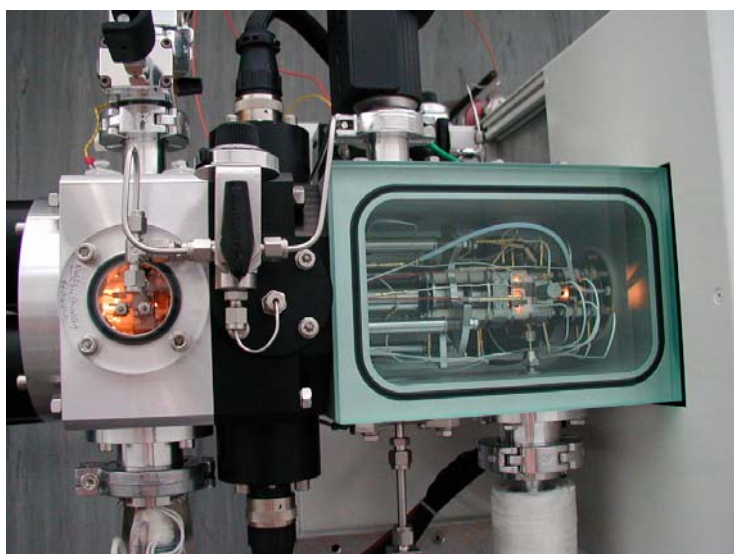


**Simultaneous or alternating recording of ions** from independent CI and standard EI ion source in GC/MS mode allows to combine the information content of EI spectra and CI spectra in one GC/MS run. This **unique and new methodology enhances the effectiveness of GC/MS significantly.**

The CI-UDIC module consists of a flange with EI ion source structure, additional auxiliary ion source supply, MICS extension, movable CI ionization volume, shut-off and regulation valve for reagent gas, high vacuum lock

Both ion sources are coupled to the gas chromatograph via independent GC/MS transfer lines. The GC flow is splitted, accordingly.

Module	Description
TRANSFER	CI and EI ion sources “in axis” with AMD UDIC transfer ion optics



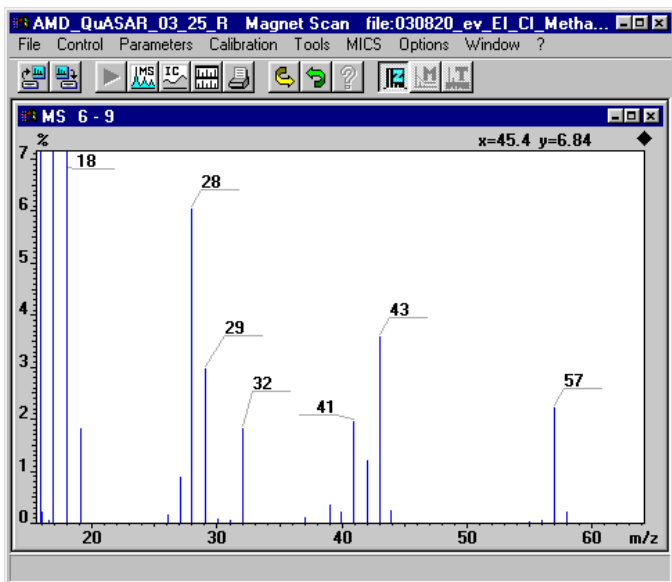
**Top view on independent EI and CI ion sources in simultaneous operation**

CI ions are produced in source S2 (left hand side, view through round transparent flange), accelerated through transfer optics, decelerated for passing the standard EI source S1 (right hand side, view through glass cover), re-accelerated and focussed to the entrance slit of the mass spectrometer.

EI ions are produced in the standard EI source S1, accelerated and focussed to the entrance slit of the mass spectrometer simultaneously for production **super-imposed EI-CI** spectra for unequivocal identification of quasi-molecular ions.

Module Description

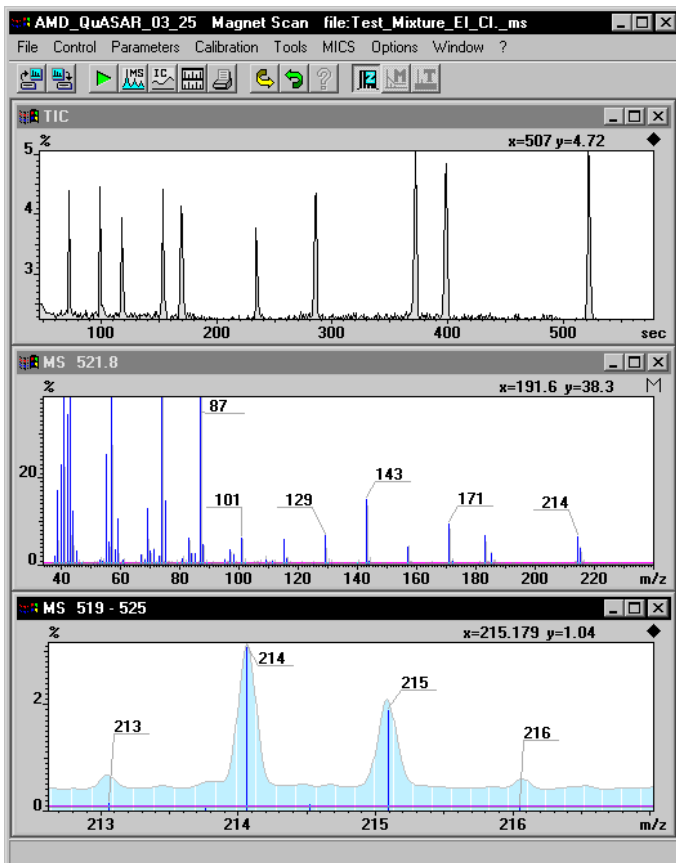
CI-UDIC CI/EI ion sources in Unique Dual Ionization Configuration



A **superimposed EI – CI** mass spectrum has been produced in preparation for an analytical GC/MS run.

**Methane** has been introduced as **reagent gas** for CI, **water** and **air** are existing as background and **Isobutane** has been added as a **trace gas**.

The spectrum contains **EI** ions from all components and also **CI** cluster ions from the reagent gas as well as the significant M-H ion of the Isobutane trace



**Superimposed EI – CI** mass spectra have been produced in **GC/MS mode** by **simultaneous recording** of ions arising from independent CI and standard EI ion source

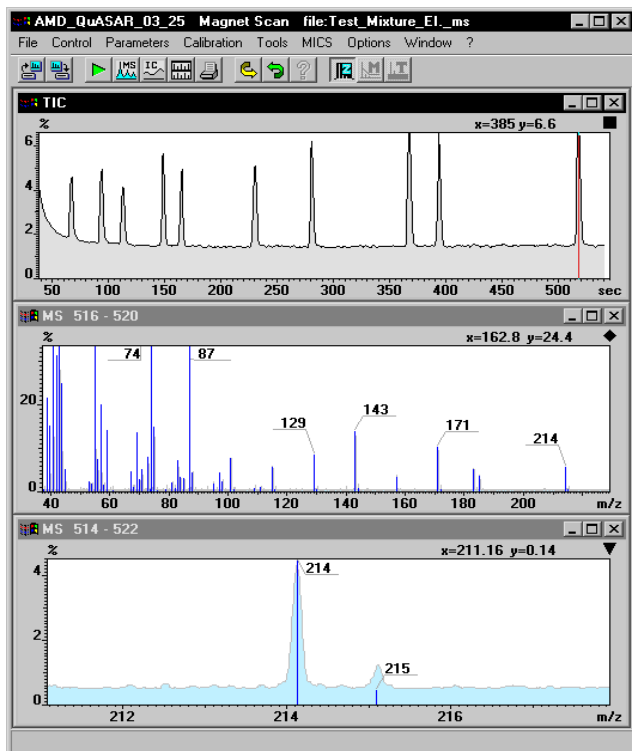
The **gas chromatogram** represents a **test mixture** for optimization of the GC/MS conditions. The last peak in the chromatogram represents the compound **dodecane acid methylester**.

The complete **superimposed EI - CI** mass spectrum of this compound is shown in the middle part of the picture. The **molecular ion at mass 214 produced by EI** is of significant intensity and all relevant fragment ions are also existing. Therefore, the **protonated quasi-molecular ion at mass 215 produced by CI** confirms the existence of the molecular ion at mass 214. The details of the molecular ion group are shown in the lower part of the picture.

**Independent GC/MS runs in EI and CI** modes are shown in the pictures below. **Alternating recording of ions from CI and EI** ion sources in **GC/MS mode** will be demonstrated elsewhere.

Module Description

CI-UDIC CI/EI ion sources in Unique Dual Ionization Configuration

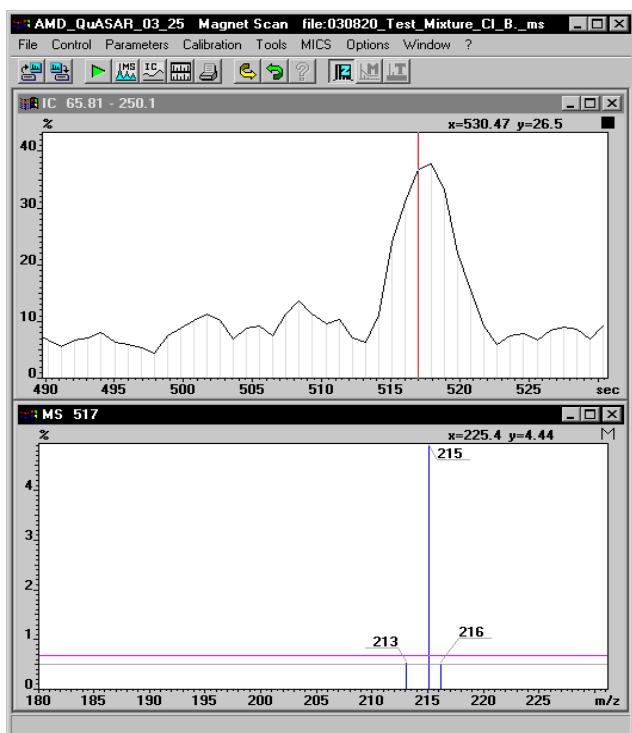


The **gas chromatogram** represents the same **test mixture** for optimization of the GC/MS conditions as above but produced here in **EI only** mode. Again, the last peak in the chromatogram represents the compound **dodecane acid methyl-ester**.

The complete **EI** mass spectrum of this compound is shown in the middle part of the picture. It confirms that the molecular ion at mass 214 produced by EI is of significant intensity and it shows all relevant fragment ions.

The intensity of the isotopic peak at mass 215 corresponds to the <sup>13</sup>C contribution. The details of the molecular ion group are shown in the lower part of the picture.

The deviation of the **intensity distribution** of the molecular ion group in **EI** mode compared to the superimposed EI-CI spectrum (see above) is clearly recognizable.



The **gas chromatogram** of the same **test mixture** has also been produced in **CI only** mode. A section of the ion chromatogram (masses 65-250) is shown in the upper part of the picture, representing the last peak in the chromatogram of **dodecane acid methyl-ester**.

The **CI** mass spectrum of this compound contains no fragment ions but practically yields only the **quasi-molecular ion at mass 215** of the compound (the reagent gas ions in the low mass range are not shown). The lower part of the picture shows the details (centroided peaks). Both, pure EI and CI spectra confirm the result and the conclusions drawn from the superimposed EI-CI spectra.

**Alternating recording of ions from CI and EI ion sources in GC/MS mode** is in preparation. Very fast scanning in multi-channel mode will be demonstrated in this context and even more instructive results of the **unique ionization combination** will be expected.