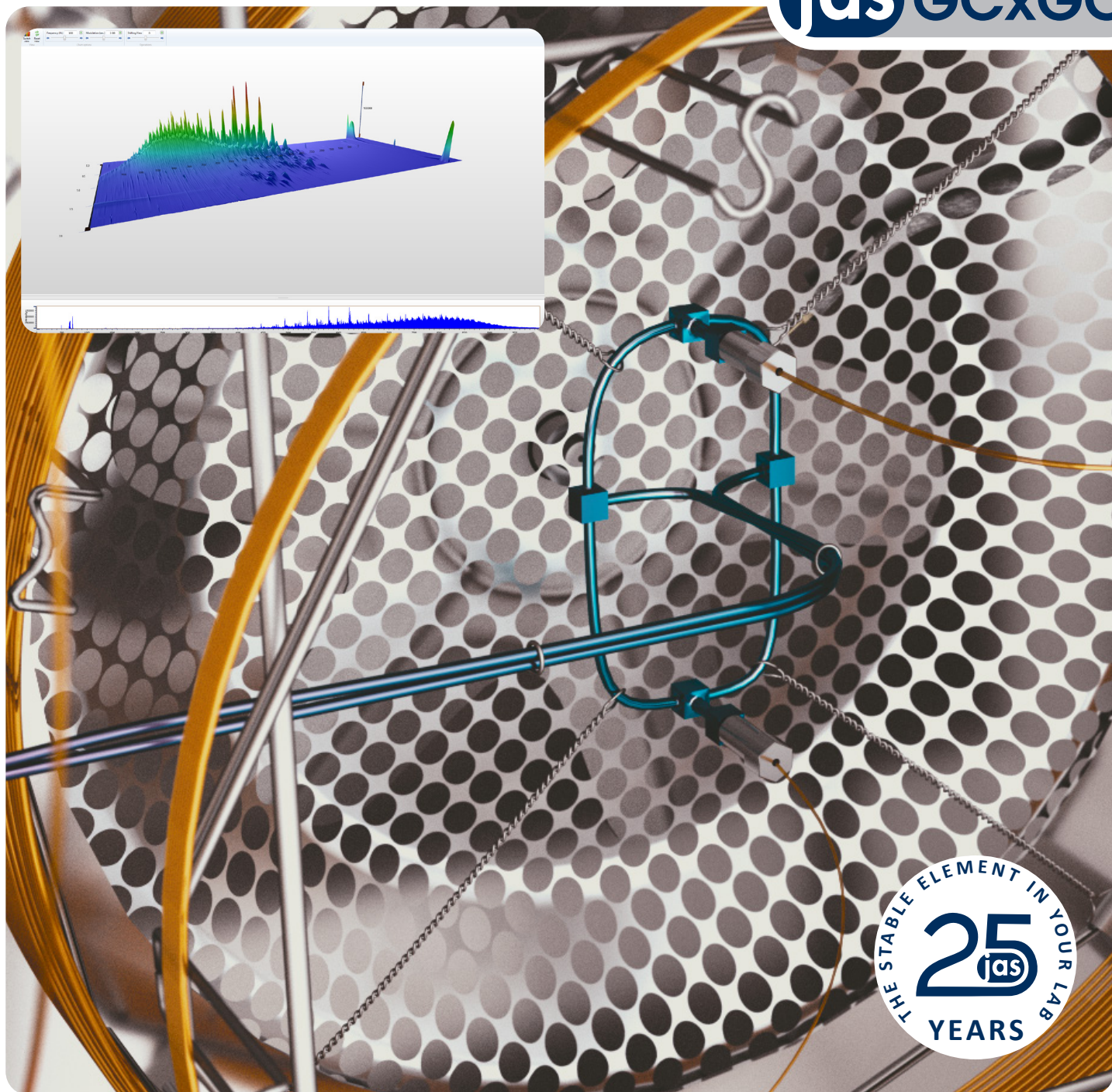
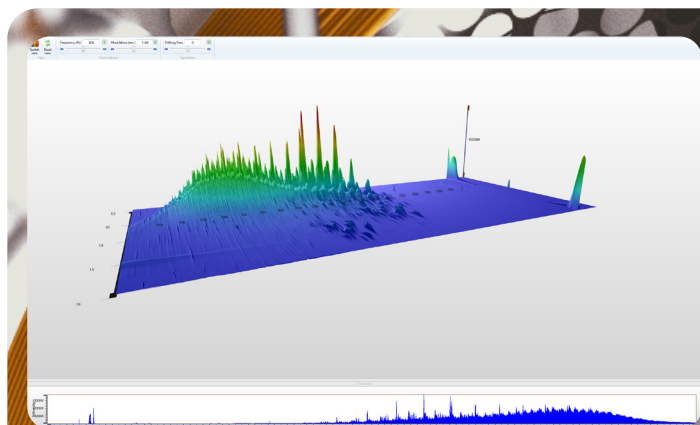


JAS GCxGC

JAS Solutions for GCxGC Comprehensive Chromatography

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Qualitative and quantitative analysis of complex samples, such as diesel, is a challenging task. Comprehensive two-dimensional gas chromatography (GCxGC) is a powerful tool to analyze organic compounds even in complex matrices. The advantage of GCxGC compared to conventional GC is a vastly-expanded separation space. For this purpose two analytical columns with different separation properties (non-polar and polar) are used in series. The technique is based on continuous collection of the effluent from the primary analytical column and periodic reinjection of small portions of this effluent to a second column. Typically the first one is a non-polar column and compounds are separated depending on their boiling points. The second one is a polar column and separation mechanism based on polarity. As a result, chromatographic resolution and sensitivity are strongly improved. Comprehensive chromatography means that the sample is completely transferred to the second column, therefore even compounds of low concentrations or impurities can be found. Typical application areas are petrochemicals, flavor and fragrances, environmental and forensic samples as well as clinical and biological samples.

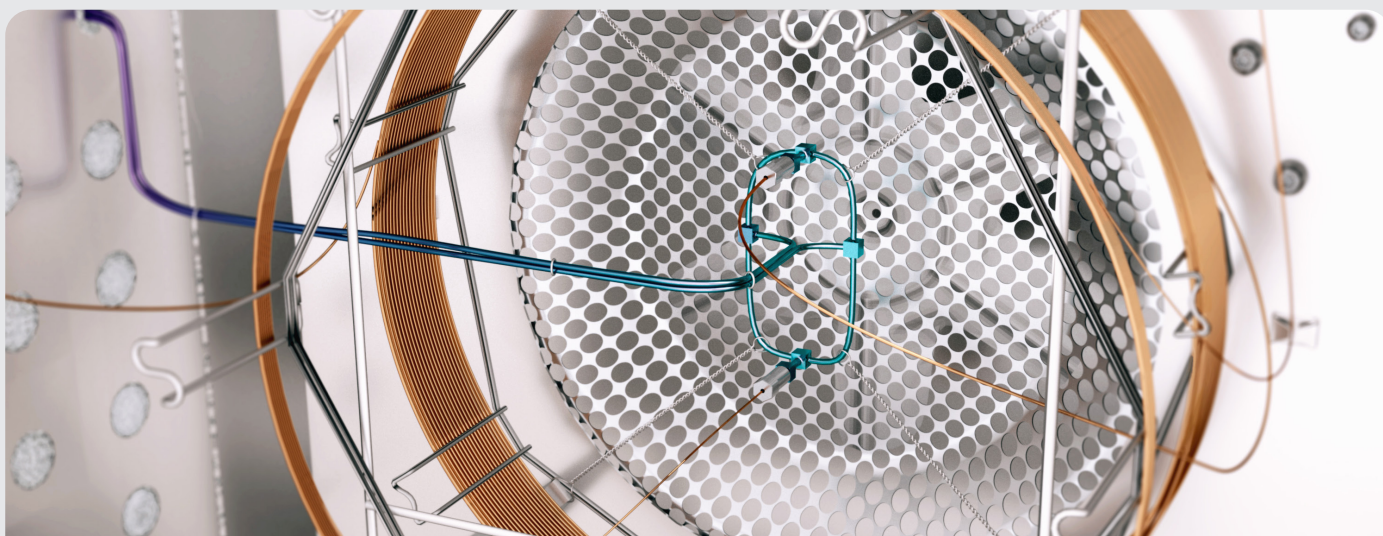


Figure 1: GCxGC solution installed in a GC oven

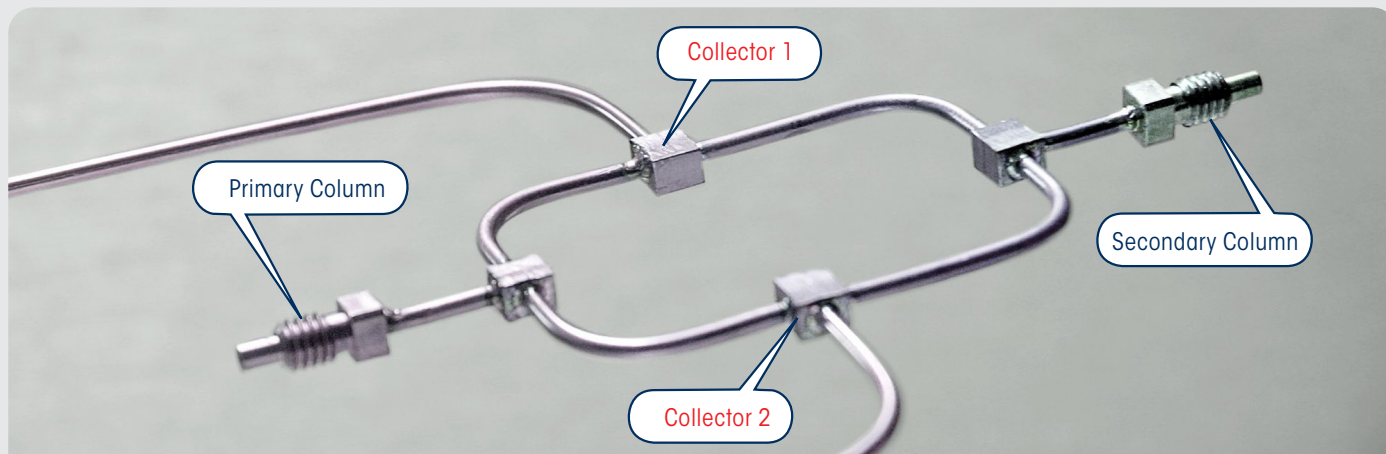


Figure 2: JAS GCxGC system includes two alternately operating collectors

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JAS offers a patented solution of GCxGC Comprehensive Chromatography (Figure 1). The heart of a GCxGC system is a special interface between the two columns (modulator). Effluent of the first column is collected for a certain period of time and periodically injected at a selected time interval into the second column by means of this modulator device. Thus, the main functions of the modulator are (I) collecting/trapping, (II) refocusing, and (III) rapidly release of the collected fragments. Without periodically sampling of the first column effluent by means of a modulator, fragments might recombine in the second column and co-elute at the detector.

Numerous GCxGC systems include thermal modulators which require a cooling as well as a heating device. JAS GCxGC solution works with a pneumatic controlled flow modulator to transfer eluted analytes from column 1 to column 2 with high precision and reproducibility. This kind of modulator is able to switch very fast and produce narrow injection bands which improve resolution and detection limit. Main advantages of using a flow modulator based on a valve are:

- Costly coolant for cryogenic trapping is not necessary,
- No extreme temperature differences has to be created,
- No possibility of breakthrough, even for high volatile compounds
- Enables very fast second-dimension separations in a time period < 1 sec
- Positioning the valve outside the GC oven makes it insusceptible for high temperature problems

Furthermore, JAS GCxGC solution includes two collectors operating alternately. Figure 2 illustrates the functional principle. While collector 2 is loaded with separated sample fragments eluted from column 1, collector 1 is purged with a high flow rate of carrier gas in order to transfer the trapped sample fragments to the second analytical column. The main gas stream flows through collector 1, but a small portion runs through the restricted column and makes sure that the eluted fragments from column 1 find the way to collector 2. Then the flow modulator changes gas directions (Figure 3) and the high flow rate runs through collector 2 for transferring the trapped sample fragments to the second analytical column. Meanwhile collector 1 is loaded with sample fragments.

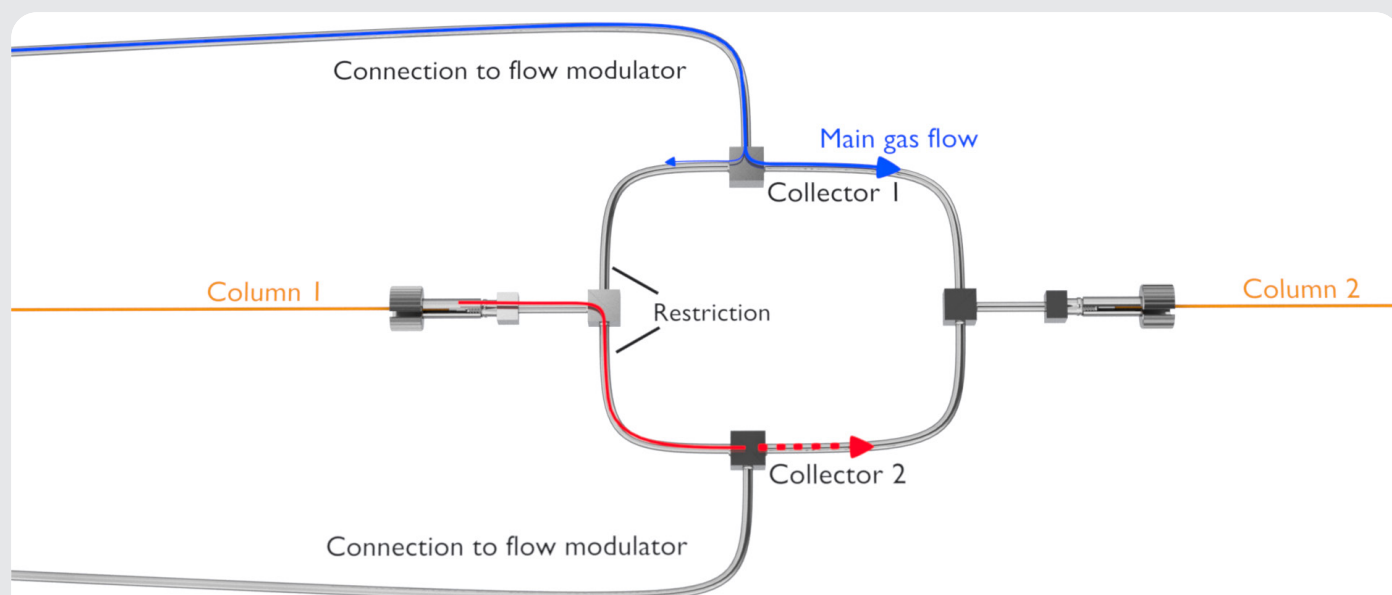


Figure 2: Gas flow directions while loading collector 2

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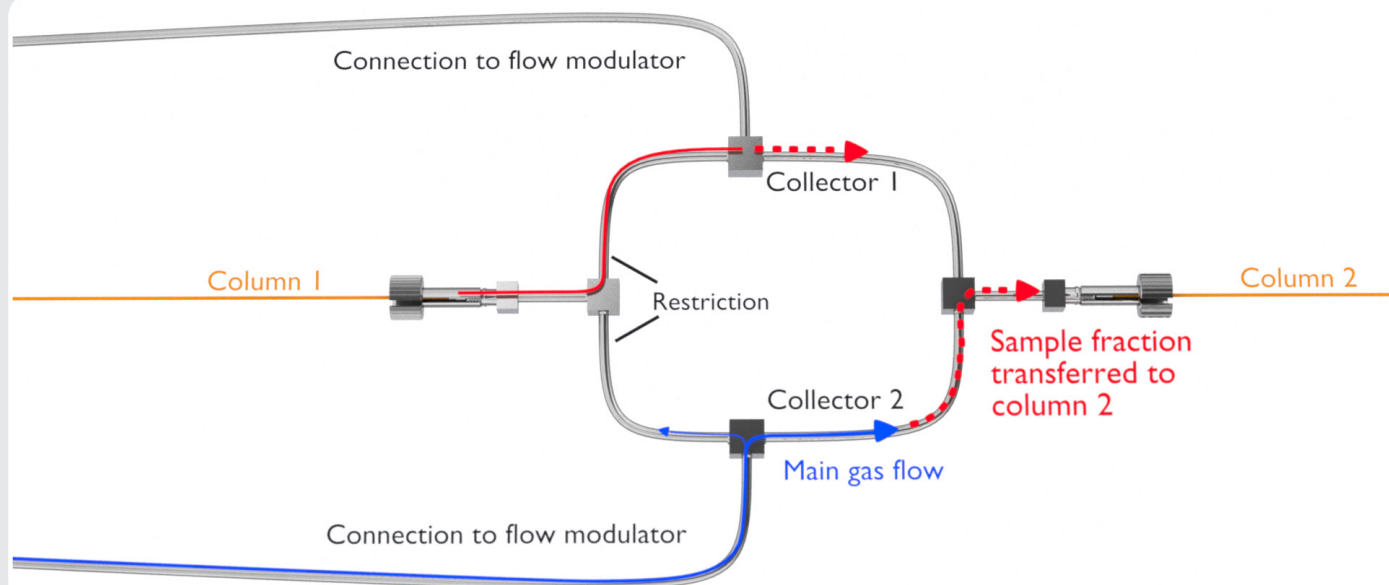


Figure 3: Gas flow directions while loading collector 1 and the simultaneous transfer of sample fraction from collector 2 to the second analytical column

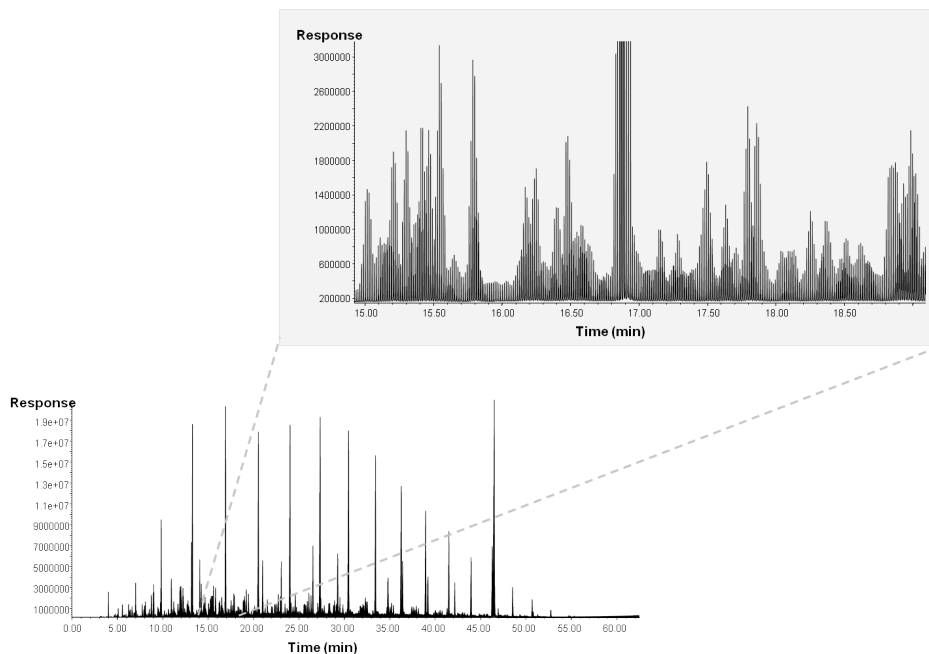
The second analytical column has to be short for high speed operation in order to ensure the complete separation of one injected fraction before the next collected sample fraction is injected. For this reason the use of H₂ as carrier gas is strongly recommended. H₂ provides high separation efficiency even at high flow rates and complex matrices.

Since the second separation is very fast and the occurring peaks extremely narrow the detector has to record data with a high rate. Commonly used detectors for GCxGC are flame ionization detector (FID), electron capture detector (ECD) or time-of-flight mass spectrometer (TOFMS).

Petrochemical samples are perfect candidates to demonstrate the applicability of GCxGC method for highly complex mixtures showing numerous co-elutions in a one-dimensional chromatography. In Figure 4 a chromatogram of diesel analysis is illustrated. The detail shows narrow peaks in the retention time 15 – 19 min as an example. Accurate peak identification and quantification is not possible.

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By means of GCxGC hydrocarbon class separation can be visualized the FID signal in a two-dimensional contour plot. Figure 5 illustrates a contour plot of a diesel sample with the X-axis representing the retention time on column 1 and Y-axis representing the retention time on column 2. Signal intensity is illustrated on a color scale (blue represents the base line and red represents the highest peak intensity). Peak identification and quantitative evaluation are provided by special JAS GCxGC software.

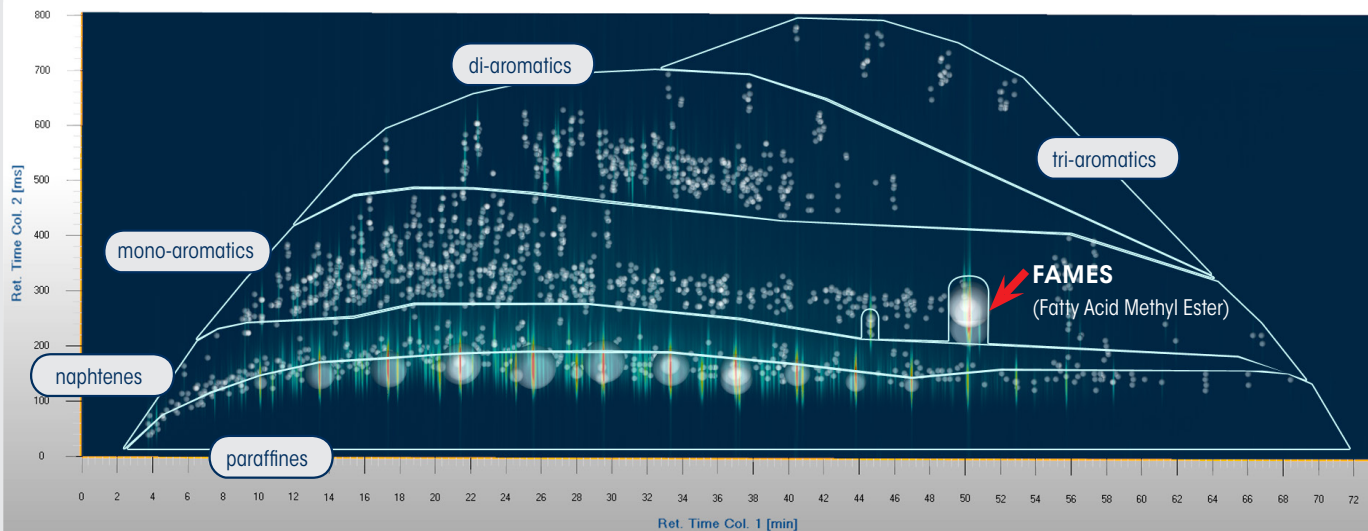


Figure 5: 2-dimensional contour plot showing the FID signals of diesel constituents

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Figure 6 shows results of diesel analysis in a 3-dimensional format. This kind of presentation gives an overview of the relative intensity of numerous components present in the diesel sample. By using the mouse the analyst is able to rotate this 3-dimensional plot to look at the results from any angle. Additionally, obtained results are listed in a peak table including retention time, peak area and peak area percentage for each located peak.

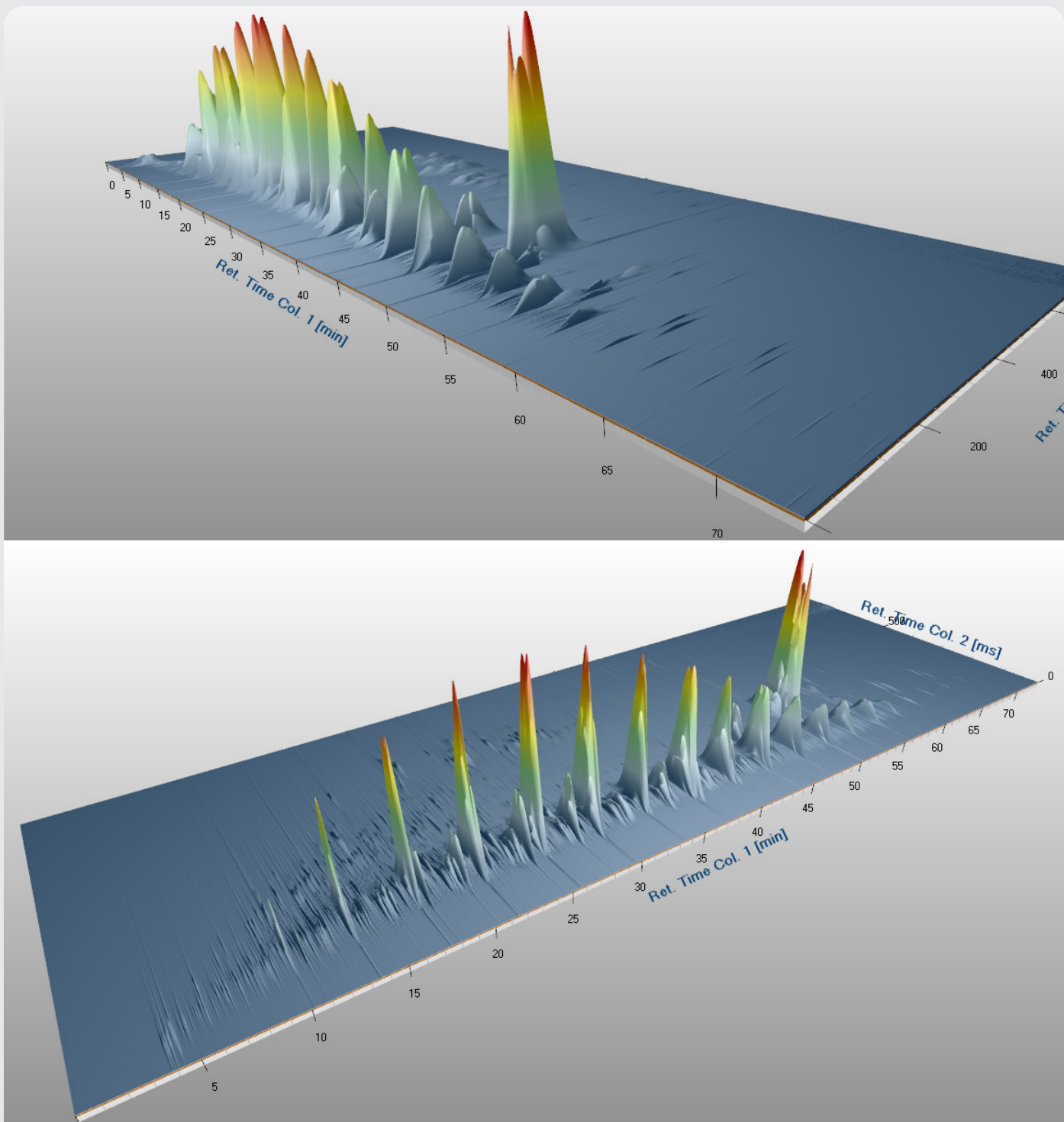


Figure 6: 3-dimensional presentation of GCxGC fragment pattern of diesel from different points of view

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Benefits of JAS GCxGC Comprehensive Chromatography are:

- two collectors for efficient effluent separation
- variable collector volumes
- pneumatic controlled flow modulator – no cooling and heating device
- no cryogenic trapping
- no temperature limitation of the modulator
- special JAS GCxGC software for qualitative and quantitative evaluation

Order numbers:

JAS GCxGC	JAS 16900
JAS GCxGC software	JAS 16901



About Joint Analytical Systems

Since 1995 JAS has been a Premier Solution Partner and Value Added Reseller of Agilent Technologies. We are an innovative-driven organization that offers customized solutions for GC, GCxGC, μ GC, GC-AED, GC-MS, GC-QQQ, LC, LC-MS, LC-QQQ and Q-TOF LC-MS applications.

JAS serves key industries such as

- Chemical
- Petrochemical/HPI
- Environmental
- Food & Flavor
- Forensic

JAS Products for GC

- Atomic Emission Detector
- UNIS Inlet Systems
- Automatic Gas Samplers
- CryoTrap
- Customized Valving Systems
- EzPrep - Preparative Fraction Collector
- Olfactometer
- GICU - Gas Injection Control Unit

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