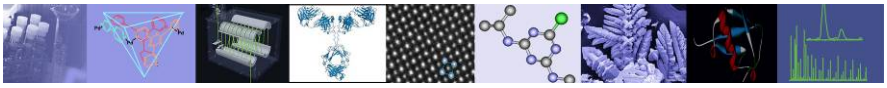

Applications Note

# AccuTOF-GCv Series

## GC x GC/EI and GC x GC/FI Measurements Using the EI/FI Combination Ion Source

**Introduction**

Comprehensive 2-dimensional GC (GC x GC) provides higher-separation capabilities for complex mixtures than the typical 1-dimensional GC measurements. However, this technique requires high speed data acquisition, e. g. > 20 Hz, for the GC detectors due to the shorter 2nd GC column (comparable to those used for the ultra-fast GC measurements) which elutes samples within just a few seconds.

Recently, JEOL has developed a new generation GC-HRTOFMS system called the "AccuTOF GCv 4G". The AccuTOF GCv 4G has high sensitivity, high resolution, high mass accuracy and high speed data acquisition, all simultaneously. Also JEOL has developed a unique EI/FI combination ion source for this system which provides the capabilities of GC/EI and GC/FI measurements without having to break vacuum in order to switch between each ionization mode. Additionally, this combination is particularly powerful in that it provides library searchable fragmentation information by using EI and high mass accuracy molecular ion information by using FI.

In this work, we measured diesel fuel using both the GC x GC/EI and GC x GC/FI techniques on the AccuTOF GCv 4G.

**Experimental**

Sample information and measurement conditions are shown in Table 1.

**Results**

The GC x GC/EI and GC x GC/FI total ion chromatograms (TICs) for the diesel fuel sample are shown in Figures 1 and 2, respectively. Both chromatograms showed the presence of a wide variety of components in the sample.

Several EI and FI mass spectra for this sample are shown in Figure 3. The FI mass spectra (Right side) showed that the molecular ions were the dominant peaks observed in the mass spectra. Additionally, the mass accuracy was less than 2 mDa for the molecular ions measured by both EI and FI using the external one-point calibration method.

| Condition | GC x GC/EI | GC x GC/FI |
|---|---|---|
| Sample | Diesel Fuel | |
| Concentration | 1/100 (Hexane) | |
| GCxGC system | ZX2 thermal modulator (ZOEX) | |
| 1st column | Rxi-5SilMS, 30 m x 0.25 mm, 0.25 um | |
| 2nd column | Rxi-17SilMS, 2 m x 0.15 mm, 0.15 um | |
| Modulator | Deactivated fused silica, 1.5 m x 0.15 mm | |
| Modulator period | 8 sec | |
| Modulator duration | 400 msec | |
| Hot jet temp. | 270 C | |
| Hot jet gas pressure | 40 psi | |
| Cold jet flow | 18 L/min | |
| Inlet pressure | 200 kPa (Out flow: 2mL/min) | |
| Inlet mode | Split 10:1 | Splitless |
| Oven temp. | 5 0C(1 min) -> 3 C/min -> 300 C(6 min) | |
| GC-TOFMS system | AccuTOF GCv 4G (JEOL) | |
| Ion source | EI/FI combination | |
| Ionization mode | EI+ | FI+ |
| *m/z* range | *m/z* 35-500 | |
| Acquisition speed | 50Hz | 33Hz |
| External calibrant | *m/z* 207.0329 ($C_5H_{15}O_3Si_3^+$) | *m/z* 226.2661 ($C_{16}H_{34}^+$) |

Table 1. Measurement Conditions

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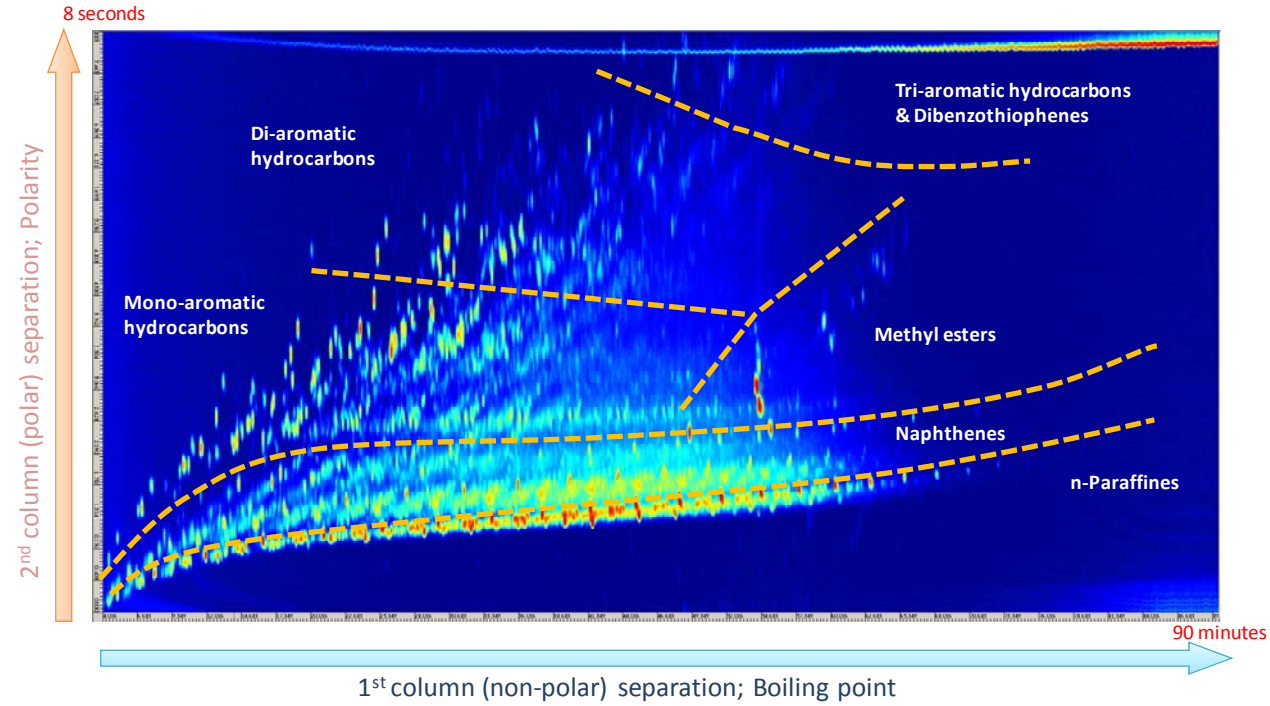



Figure 1. GCxGC/EI TIC for diesel fuel

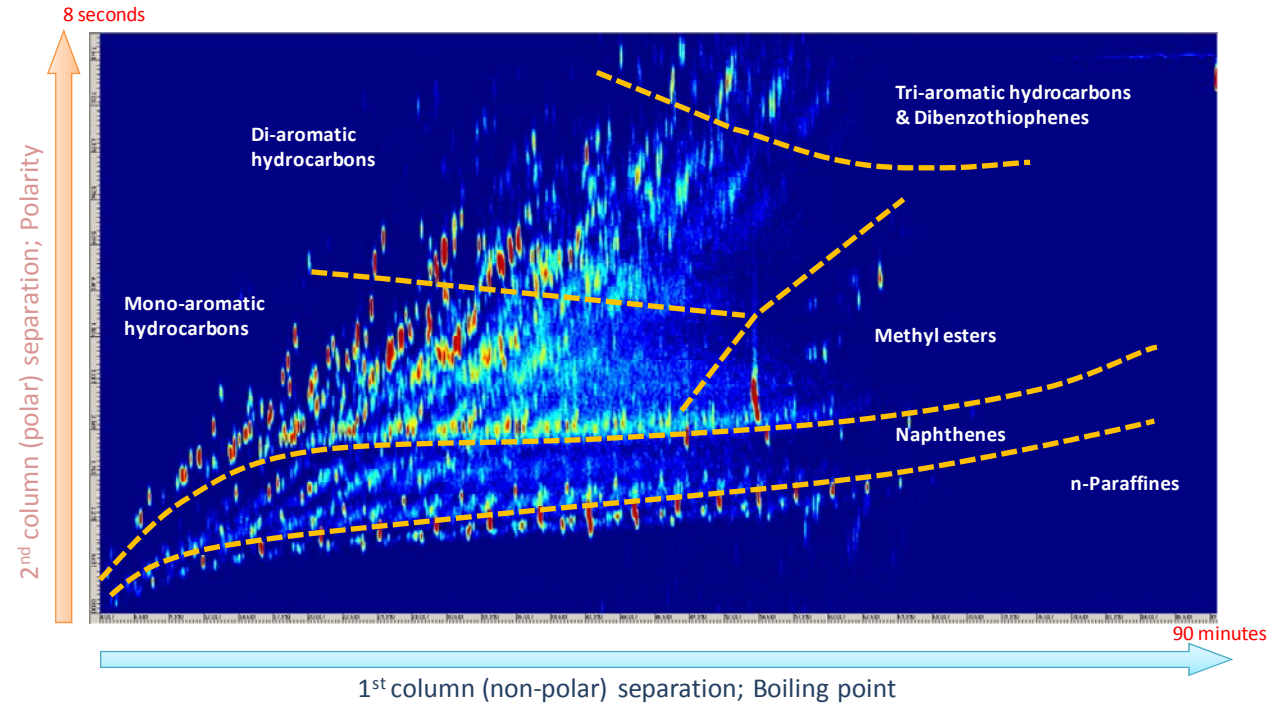
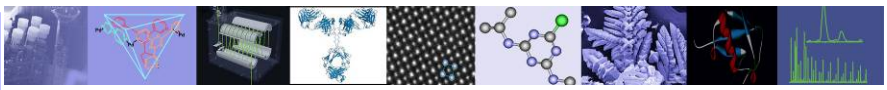



Figure 2. GCxGC/FI TIC for diesel fuel



JEOL

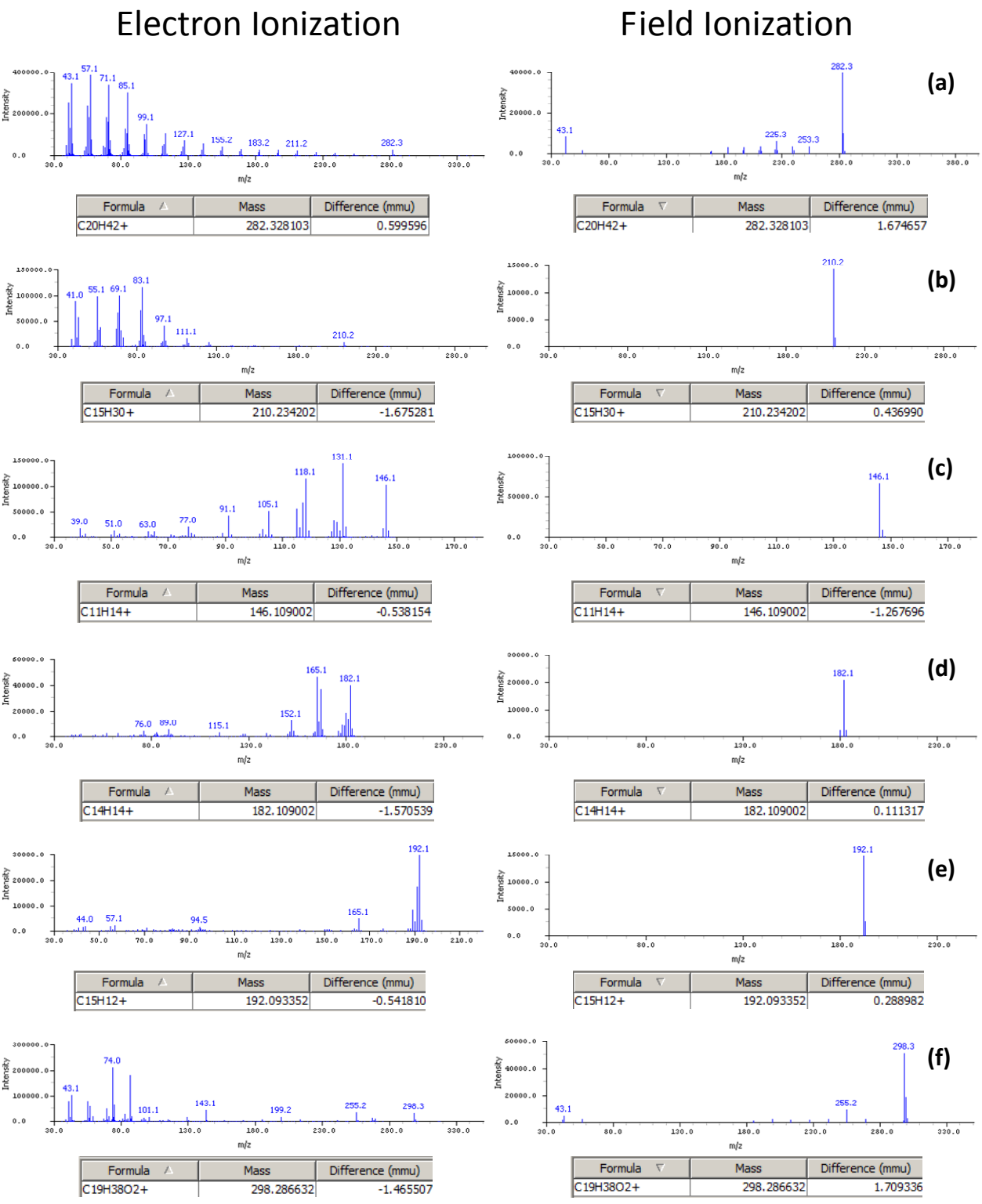
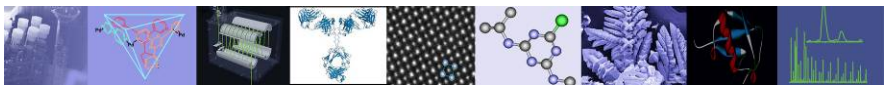



Figure 3. EI and FI mass spectra for **(a)** n-parafin ($C_{20}H_{42}$), **(b)** naphthenes ($C_{15}H_{30}$), **(c)** monoaromatic hydrocarbon ($C_{11}H_{14}$), **(d)** diaromatic hydrocarbon ($C_{14}H_{14}$), **(e)** triaromatic hydrocarbon ($C_{15}H_{12}$), **(f)** ethyl esters ($C_{19}H_{38}O_2$).





**Conclusion**

The AccuTOF GCv 4G has a unique EI/FI combination ion source which does not require breaking vacuum in order to switch between each ionization mode. Consequently, this system was able to easily measure the GC x GC/EI and GC x GC/FI data for diesel fuel. The resulting data provided structural information for the chemical components using EI (hard ionization) and accurate mass molecular weight information using FI (soft ionization). The AccuTOF GCv 4G is a powerful tool for measuring both GC x GC/EI and GC x GC/FI mass spectra for very complex samples.



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Figure 2. 2-dimensional and 3-dimensional ma
result and accurate mass measurement re