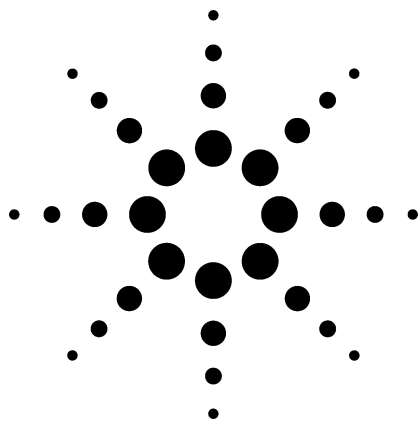


Retention Time Reproducibility of the Agilent 6890 Plus GC



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Abstract

Agilent Technologies tested a large number of 6890 Plus gas chromatographs (GCs) over a 10-month period to characterize analytical performance. A sequence of ten runs was performed on each GC to measure retention time reproducibility. The results for retention time reproducibility show that a given peak typically falls within a very tight range of 0.002 to 0.003 min. The average standard deviation for all GCs tested was 0.001 min. This represents a relative standard deviation of less than 0.02 percent.

Key Words

Retention time reproducibility; retention time locking; RTL; capillary gas chromatography; electronic pneumatics control; EPC; 6890 GC; 6890 performance

Introduction

The retention time of an analyte within a given GC method is the most important qualitative measurement in capillary GC. Retention time is the

primary means of compound identification and usually dictates critical integration windows for analyte quantitation. Instruments and methodologies that yield good retention-time reproducibility improve confidence in results and boost overall laboratory productivity. Retention-time stability usually is affected by small variations in column flow, oven temperature, or changes in the chemical composition of the stationary phase. Enhancements to fused-silica capillary columns have improved chemical stability and increased operating life. Precise electronic control of the gas flows and temperatures within GC instrumentation greatly improves retention-time reproducibility. The 6890 and Agilent 6850 GCs employ real-time, ambient pressure- and temperature-compensation to maximize the control and reproducibility of column flow. This advancement has led to the development and growing practice of retention time locking (RTL). This technical note describes a simple method for measuring retention-time reproducibility and presents the results of using this method to characterize the retention-time reproducibility of the 6890 Plus GC.

Experimental

During a 10-month period, thirty-two 6890 Plus GCs were randomly

selected from Agilent's production line. All instruments evaluated were equipped with at least one capillary split/splitless inlet and at least one flame ionization detector (FID). Sample injections were accomplished with G1513A (7673C) autoinjectors. An Agilent 3396C integrator was used for data acquisition. The GC method conditions can be found in table 1. The method includes a single-ramp, oven temperature program to test

Table 1. Method Conditions for Measuring Retention-Time Reproducibility.

Sample:	FID hydrocarbon check-out (part number 18710-60170)
Column:	30 m x 0.32 mm x 0.25 μ m, HP-5 (part number 19091J-413)
Agilent 7673C Autoinjector	
Injection speed:	Fast
Injection volume:	0.5 μ L
Split/Splitless Inlet	
Temperature:	250 $^{\circ}$ C
Pressure:	25 psi (constant)
Mode:	Split 10:1
FID	
Temperature:	300 $^{\circ}$ C
H ₂ Flow:	30 mL/min
Air Flow:	400 mL/min
N ₂ Make-up:	25 mL/min
Offset:	< 20 pA
Oven Program	
Initial Temperature:	90 $^{\circ}$ C
Initial Time:	0 min
Rate 1:	15 $^{\circ}$ C/min
Final Temperature:	170 $^{\circ}$ C
Final Time:	2 min



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possible variations in the instrument's thermal profile from run to run. The hydrocarbon checkout sample was repeatedly injected in an automated sequence of 10 runs. The retention times of the three hydrocarbon peaks were recorded and analyzed.

Results and Discussion

Figure 1 shows an overlay of 10 runs for the hydrocarbon standard. Table 2 lists the 10 retention times of the C16 peak in a typical run. For each instrument, the retention time of each peak typically fell within a narrow range of 0.002 to 0.003 min. For each

Table 2. Retention Times of C16 (10 runs from GC 11).

Run	Time
1	6.910
2	6.910
3	6.911
4	6.911
5	6.911
6	6.911
7	6.911
8	6.910
9	6.910
10	6.910
Avg.	6.911
STD	0.00065
RSD%	0.009%

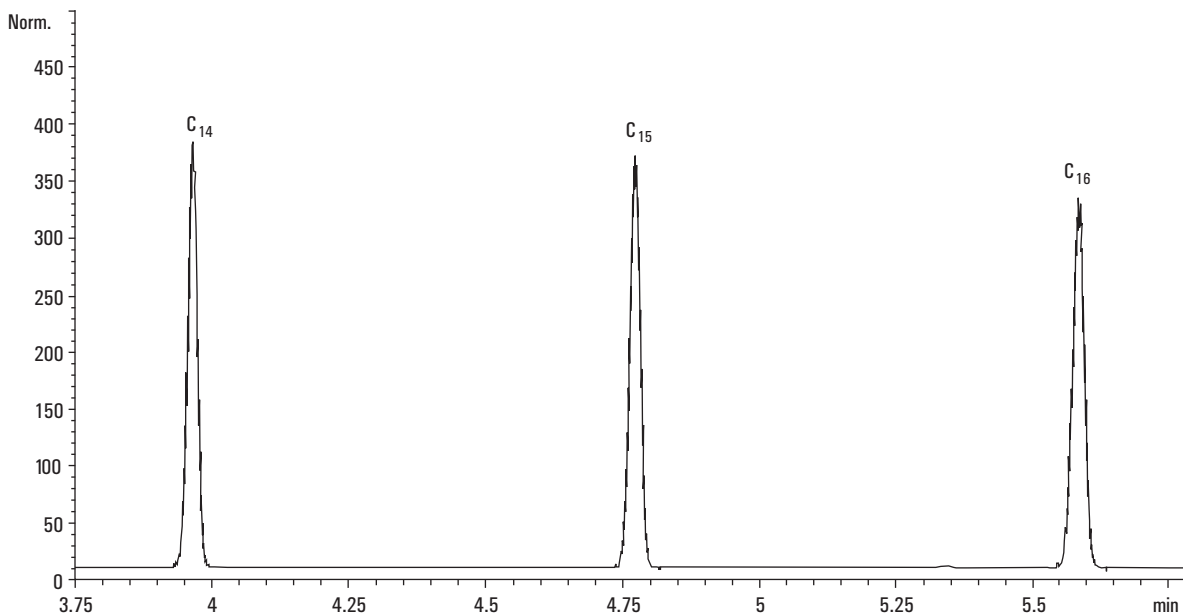


Figure 1. Typical chromatogram showing the results of 10 runs of the hydrocarbon checkout sample.

peak, the average retention time and standard deviation was calculated. The standard deviation for the C₁₆ peak ranged from 0.0003 min to 0.0045 min. About two-thirds of the instruments had a standard deviation of less than 0.0007 min. This corresponds to a relative standard deviation of less than 0.01 percent. Figure 2 contains a histogram displaying the standard deviation for all 32 instruments. Three instruments had a standard deviation much higher than

typical. Unfortunately, the experiment did not allow for repeat measurements to confirm or explain these aberrations. It should be noted that even the largest standard deviation represents an exceptional RSD of less than 0.1 percent.

Conclusion

The introduction of electronic pneumatics control with real-time ambient

pressure and temperature compensation has resulted in unprecedented retention-time reproducibility. A sample of 32 Agilent 6890 Plus GCs consistently demonstrated an RSD of less than 0.1 percent, with some lower than 0.01 percent. This retention-time stability is critical to the successful application of new chromatographic techniques such as retention time locking.

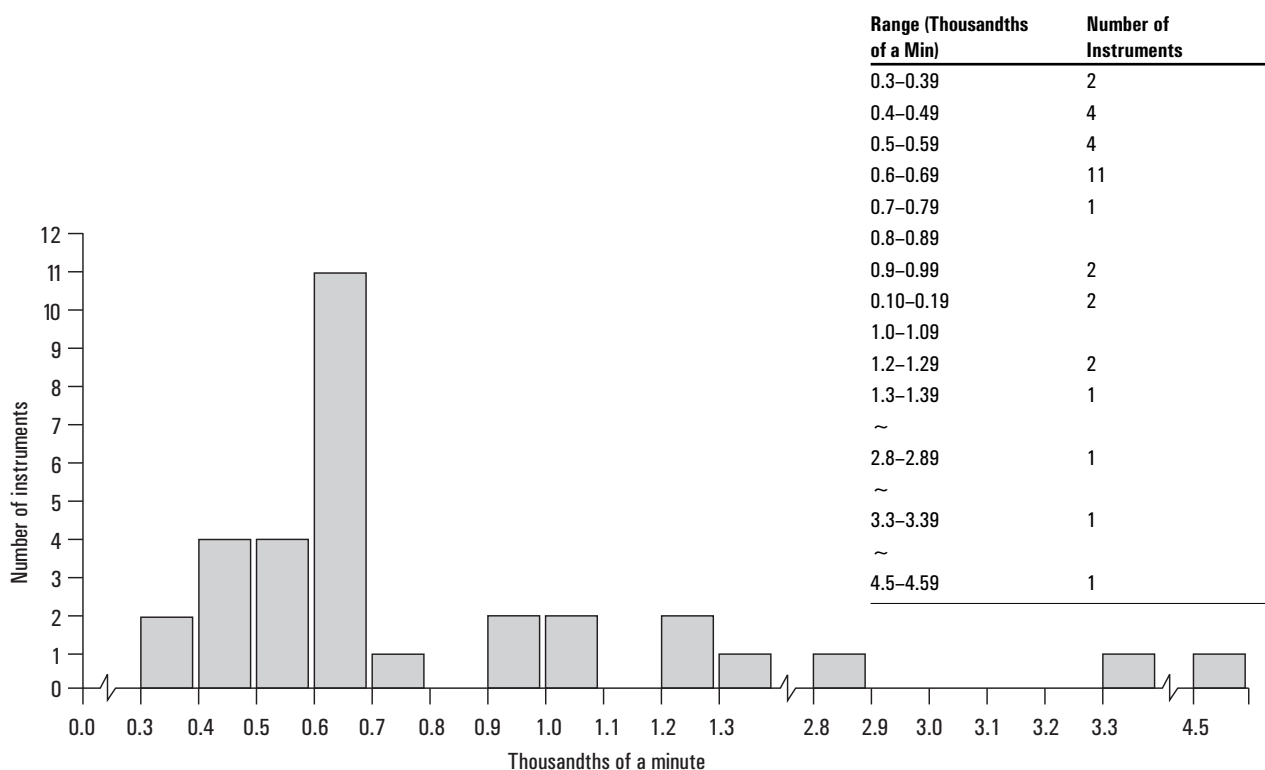


Figure 2. This experiment tested thirty-two 6890 Plus GCs randomly selected from the production line. The FID checkout sample was run on each instrument 10 times. Each data point on this histogram represents the standard deviation of the C16 retention time for one instrument. The average standard deviation for all 32 GCs was 0.001 min. Two-thirds of the instruments had a standard deviation less than 0.0007 min.

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