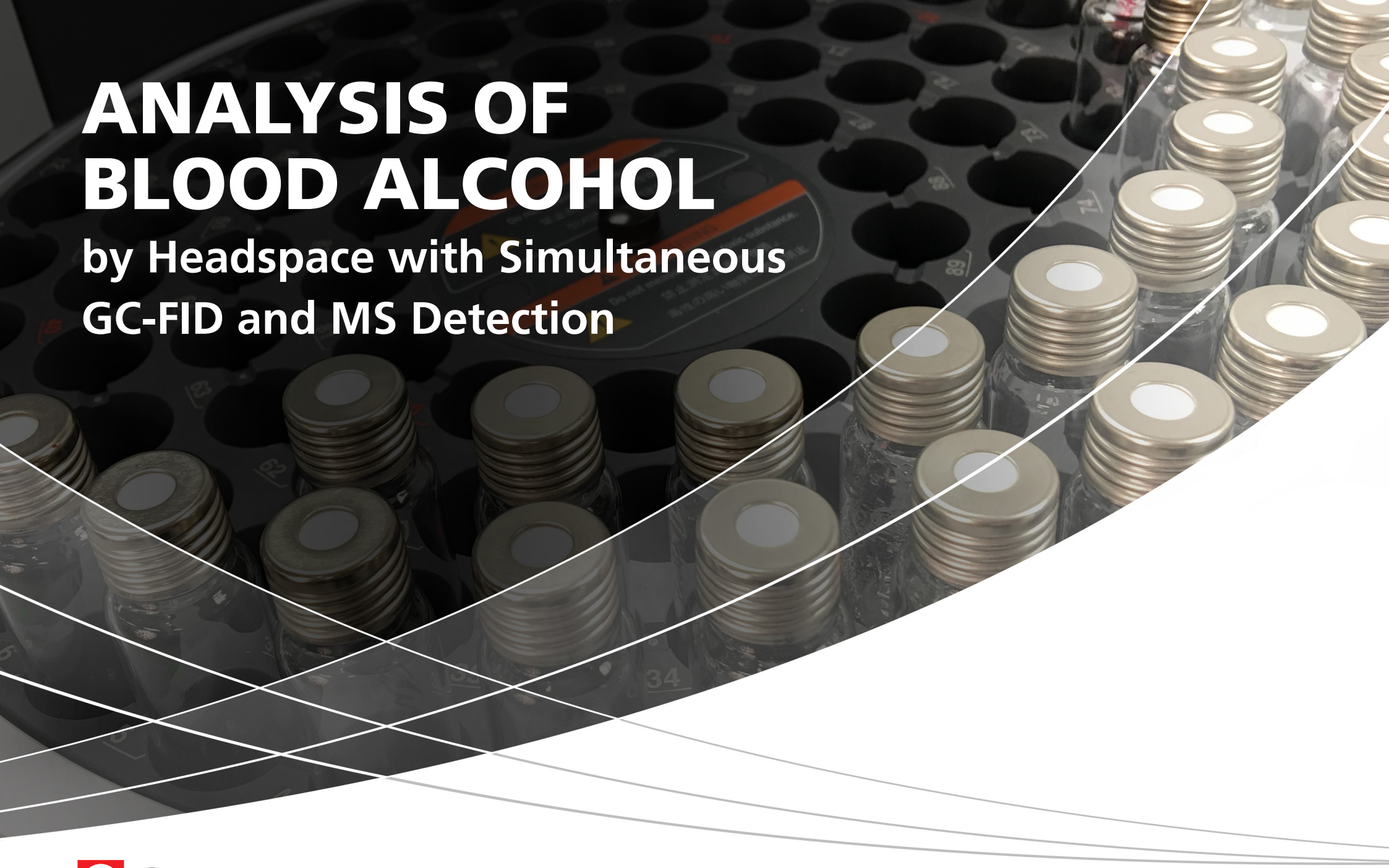
ANALYSIS OF BLOOD ALCOHOL

by Headspace with Simultaneous GC-FID and MS Detection



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Excellence in Science

Every day in America, 29 people die in drunk driving accidents

…according to the National Highway Traffic Safety Administration. To prevent future incidents and ensure appropriate legal action is taken, forensic laboratories must be able to effectively analyze ethanol in blood samples. One of the most widely used methods is blood alcohol testing.

Using blood alcohol testing, forensic toxicologists can determine the amount of alcohol that is in a person's blood at the ***time the sample is taken***. However, without the right instrumentation, performing this type of analysis can be time-consuming and challenging.

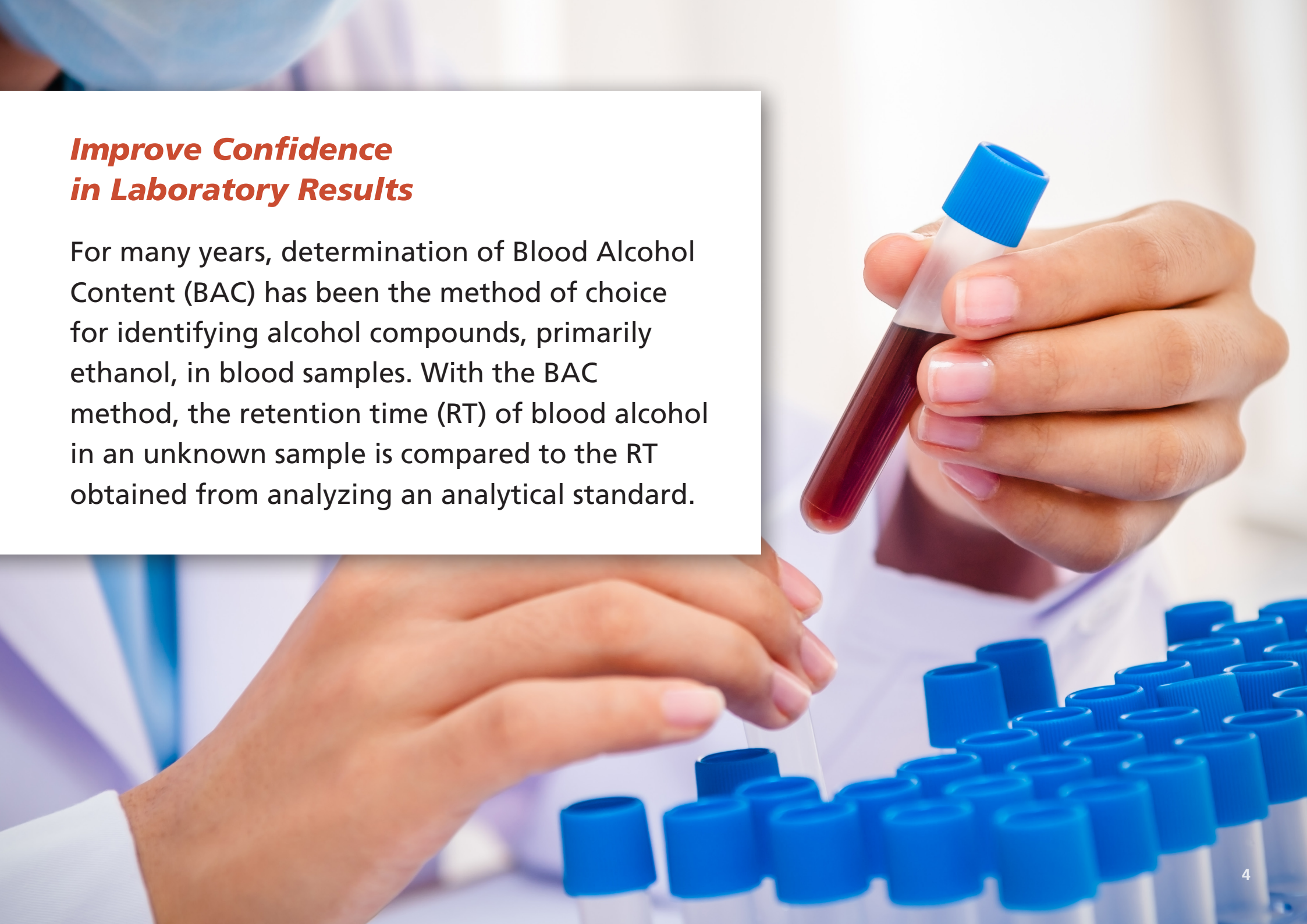
To address this, Shimadzu offers the

HS-20 Loop Headspace Sampler

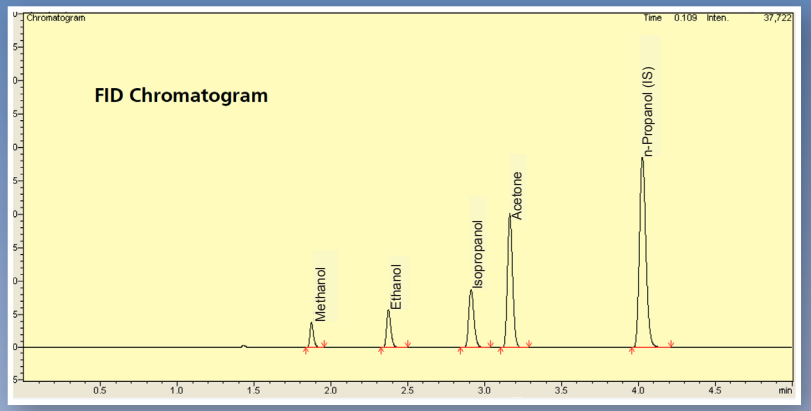
- Provides superior performance and a user-friendly design, so you can generate ***high-accuracy*** results that are critical to your lab.
- Offers high throughput and ***high-speed*** analysis by accommodating up to 90 samples.
- Enables fast, ***reliable blood alcohol analysis***, when combined with gas chromatography mass spectrometry (GCMS).

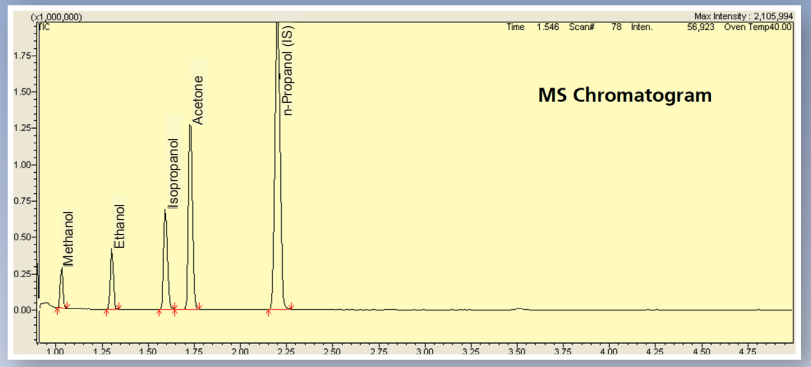
Improve Confidence in Laboratory Results

For many years, determination of Blood Alcohol Content (BAC) has been the method of choice for identifying alcohol compounds, primarily ethanol, in blood samples. With the BAC method, the retention time (RT) of blood alcohol in an unknown sample is compared to the RT obtained from analyzing an analytical standard.



Chromatograms from the FID and MS with Compound Peaks Labeled



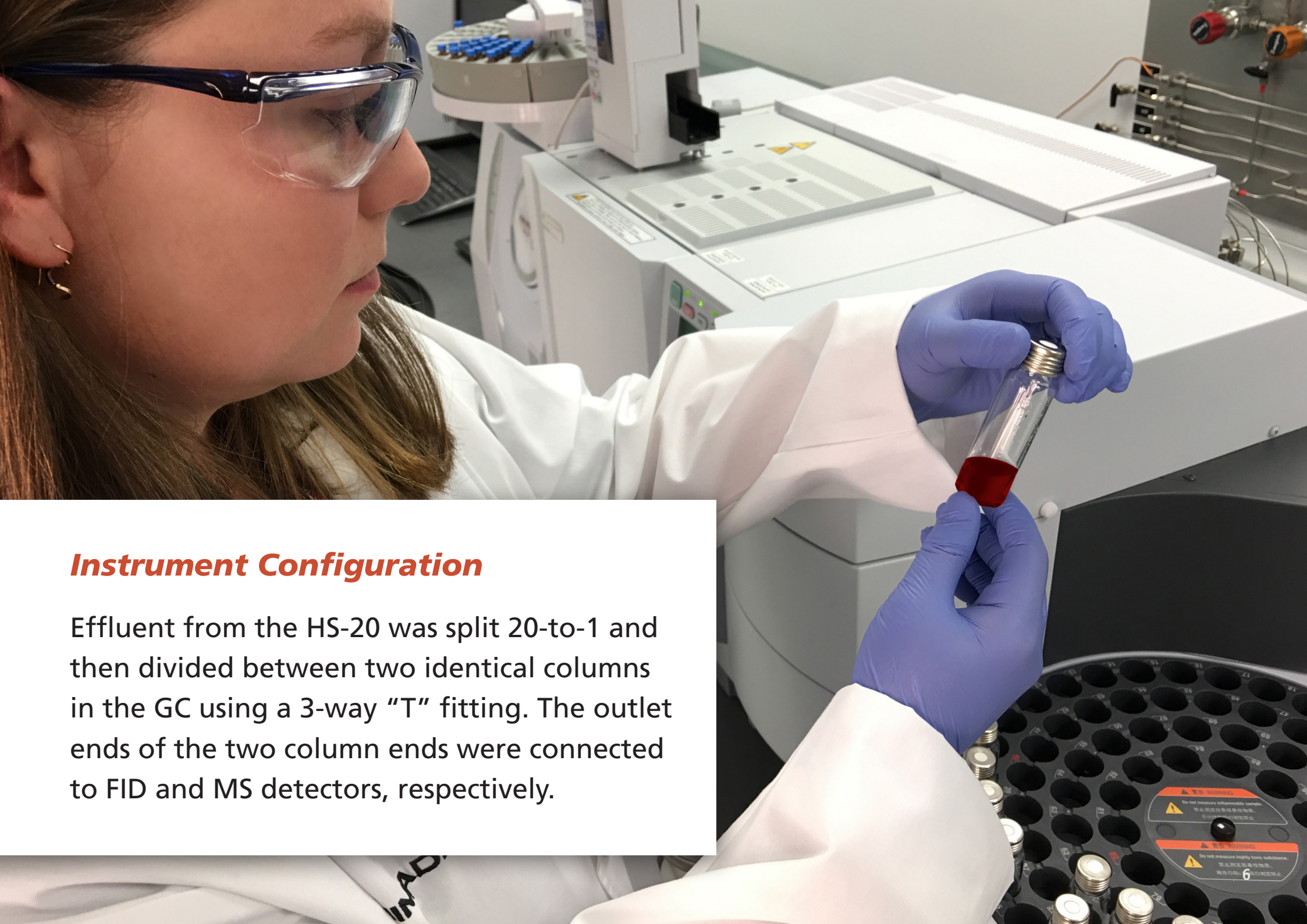


In addition, labs have been adding another step to provide a more confident level of confirmation. They not only compare retention time, but also match the ethanol mass spectrum from the sample to a library spectrum from the known standard.

Using the HS-20 Loop headspace sampler, we developed a method for the detection and quantification of ethanol in blood samples. To test this method, we combined the ***HS-20*** with a Shimadzu ***single quadrupole GCMS***.

The Shimadzu HS-20 Loop headspace sampler was used in the static-loop headspace mode for sample introduction. Separation was accomplished using gas chromatography, and a flame ionization detector (FID) and single quadrupole mass spectrometer were used for detection and quantitation.

A mass spectrometer (MS) combined with an FID detector allows for positive compound identification. The FID, or an MS and FID, can ***obtain two sets of data simultaneously***. The quantitative results can then be compared for confirmation of the reported BAC levels.



Instrument Configuration

Effluent from the HS-20 was split 20-to-1 and then divided between two identical columns in the GC using a 3-way “T” fitting. The outlet ends of the two column ends were connected to FID and MS detectors, respectively.

Sample Preparation

First, we prepared an internal standard (IS) solution of n-Propanol at 0.2 g/dL in total organic carbon (TOC)-grade water. Then, we prepared a control standard (CS) by mixing methanol, ethanol, acetone, and isopropanol in TOC-grade water.

Aliquots for analysis were prepared by mixing 1.0 mL of the IS solution with 100 µL of the individual calibration or control standard in a 10 mL headspace vial. The aliquots were then immediately sealed with a crimper before analysis.

Results

To confirm the identity of ethanol in the FID or MS chromatogram, we matched the mass spectrum for the ethanol peak to the standard spectrum in the National Institute of Standard and Technology (NIST) library. In all cases, the identity of ethanol was confirmed with a ***similarity index of 98 or better***.

Calibration over the target concentration range was linear on both detectors. Additionally, precision was below 2% for analysis of six replicate standards at the concentration range of interest.

Linearity of Calibration Compounds on the FID and MS Detectors Over Range of 0.01 to 0.4 g/dL

Compound	R^2 on FID	R^2 on MS
Methanol	0.9999	0.9995
Ethanol	0.9999	0.9998
Isopropanol	0.9999	0.9991
Acetone	0.9999	0.9992

Precision Results for Six Replicate Analyses of the Control Standard at 0.06 g/dL

Compound	RSD on FID *(n=6)*	RSD on MS *(n=6)*
Methanol	1.6%	1.0%
Ethanol	1.4%	0.9%
Isopropanol	1.1%	1.5%
Acetone	0.8%	1.7%

Fast, Reliable Ethanol Confirmation for BAC Analysis

Shimadzu's HS-20 headspace sampler ensures fast, repeatable analysis of blood alcohol content. When combined with a GC-FID and MS, it offers the perfect solution for volatile drug confirmation.

Shimadzu provides a wide range of high-quality analytical and measuring instruments for the forensics industry. Training is offered with any system, ensuring that every forensics lab is able to complete BAC analysis quickly and with confidence.

To learn more about how Shimadzu can help you optimize your forensic analysis, visit *www.InvestigateYourLab.com*.

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