VUV

Vacuum Ultraviolet Detector

A New and Worthy Alternative

YOUNG IN Chromass

CONTENTS

01

What is VUV?

01

What is VUV?

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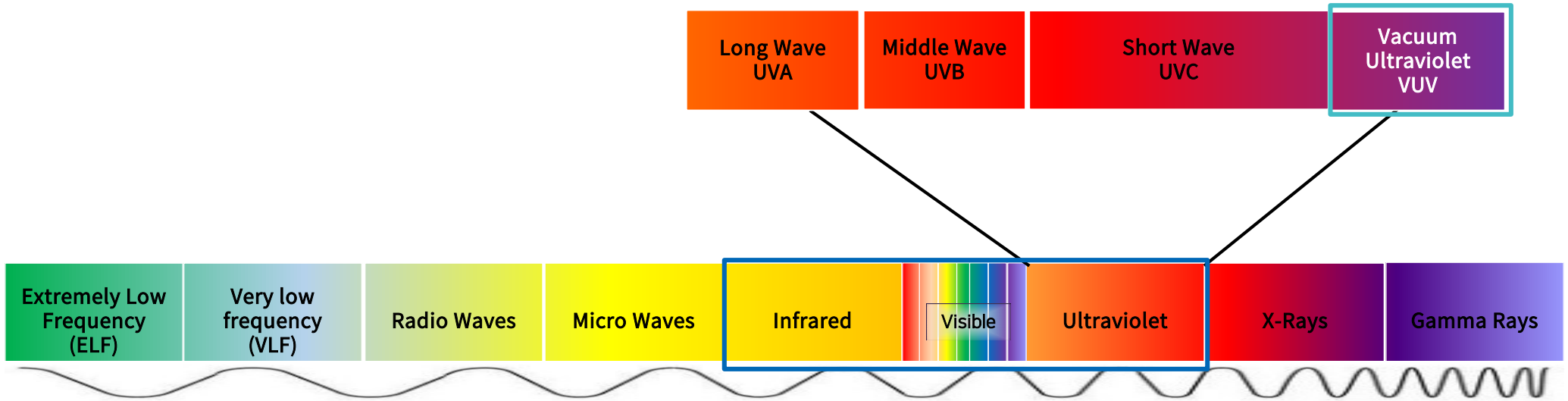
Absorption spectroscopy is a well-understood analytical detection technique offering a wide range of uses. Measured wavelength ranges from the ultraviolet through the infrared are commonly used for gas and solution phase applications.



01

What is VUV?

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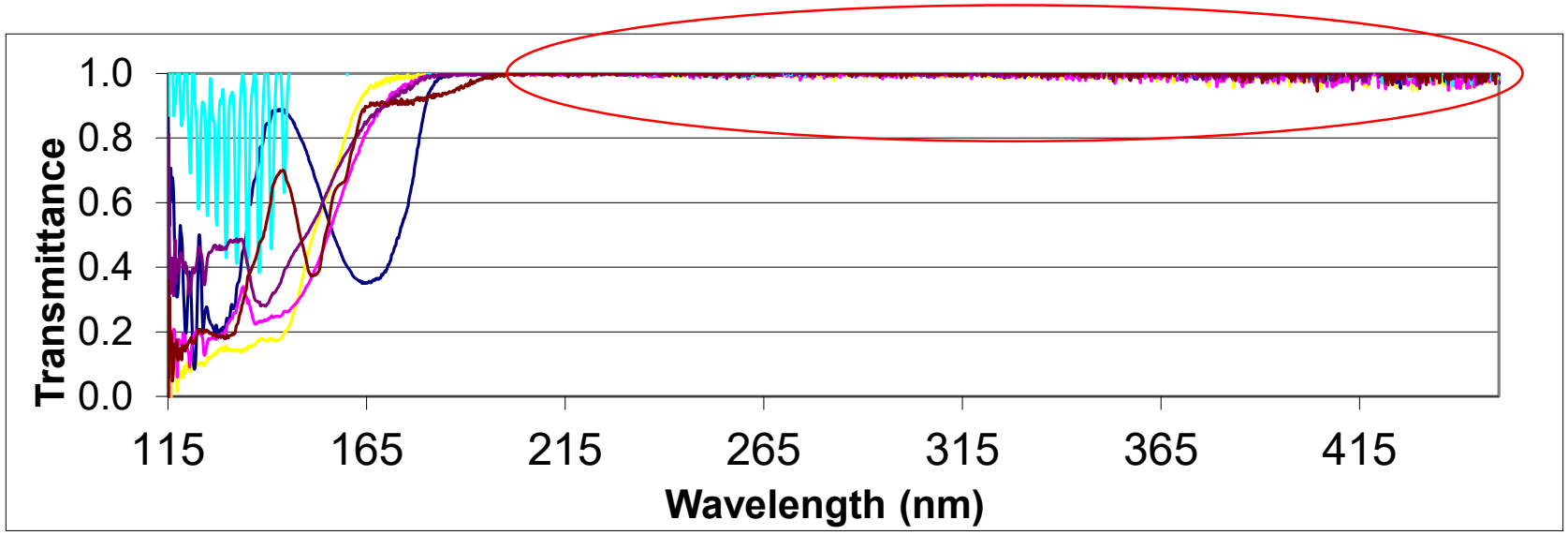
Absorption Detection in Chromatography

- LC-UV market share ~70%
- GC-UV market share <<1%

Why? Gases don't absorb in UV region



What is VUV?

Gas Chromatography detection in a whole new light

ChroZen GC-VUV

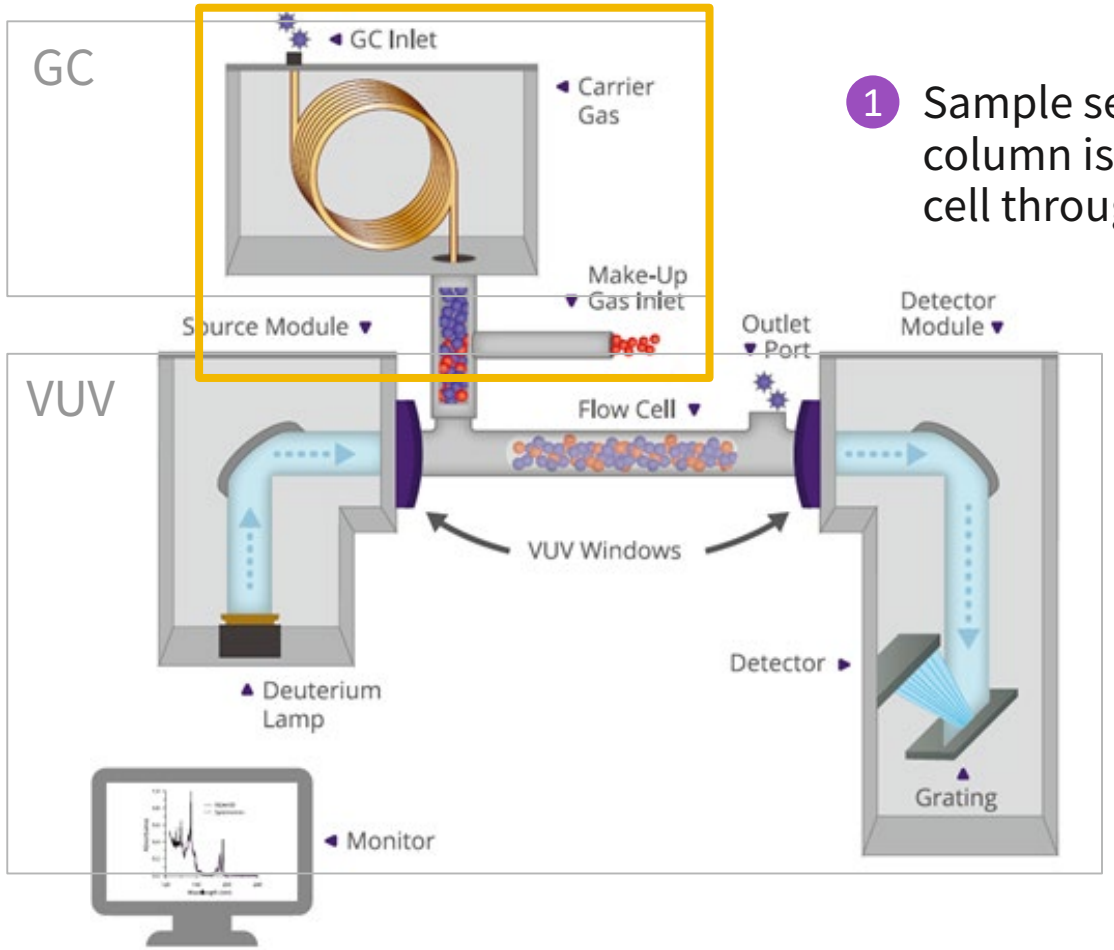
What is VUV detector?

- The latest developed universal detector for gas chromatography
- VUV absorption ranges from 120 -240 nm
- Strong and unique absorption spectra of most gaseous molecules in the VUV region, including many isomers.
- The measured spectra can be matched VUV library to rapidly identify the compounds.

02

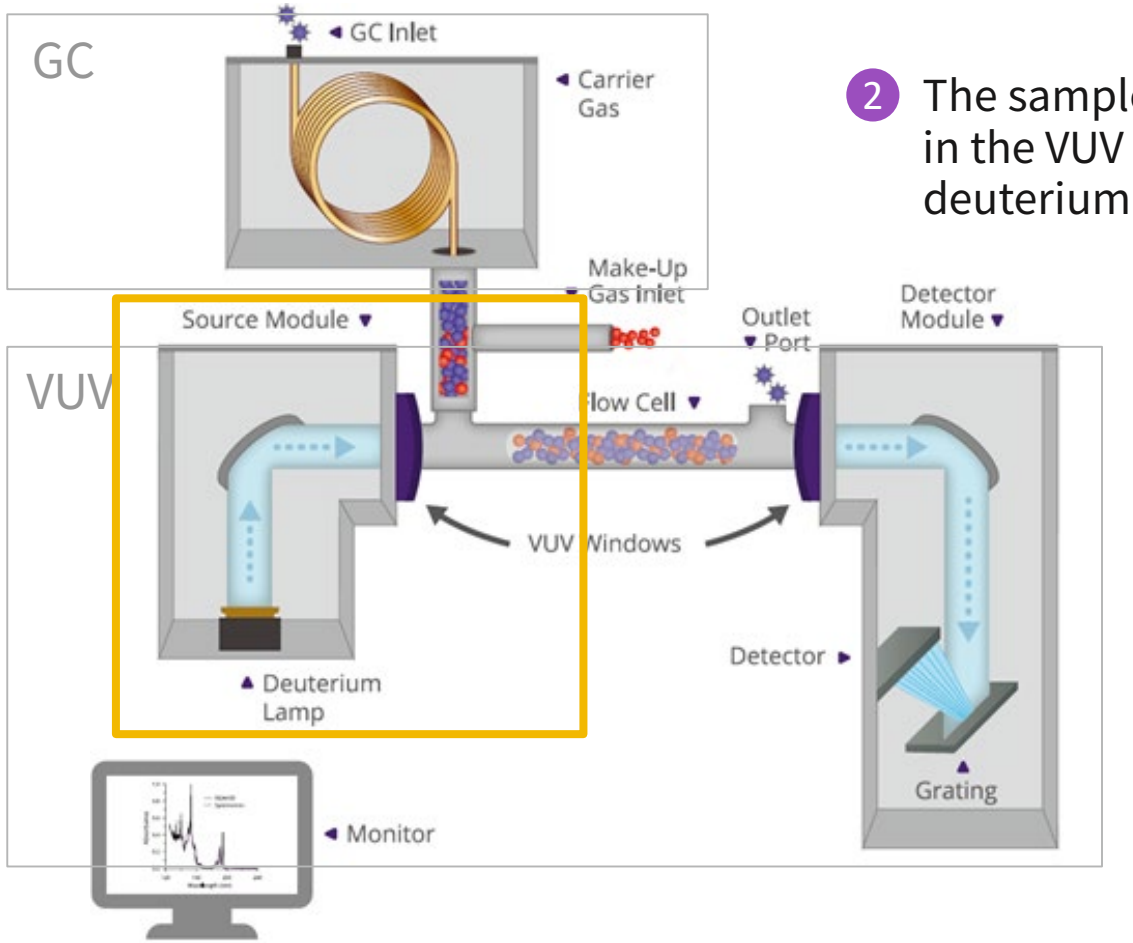
How it works

How it works



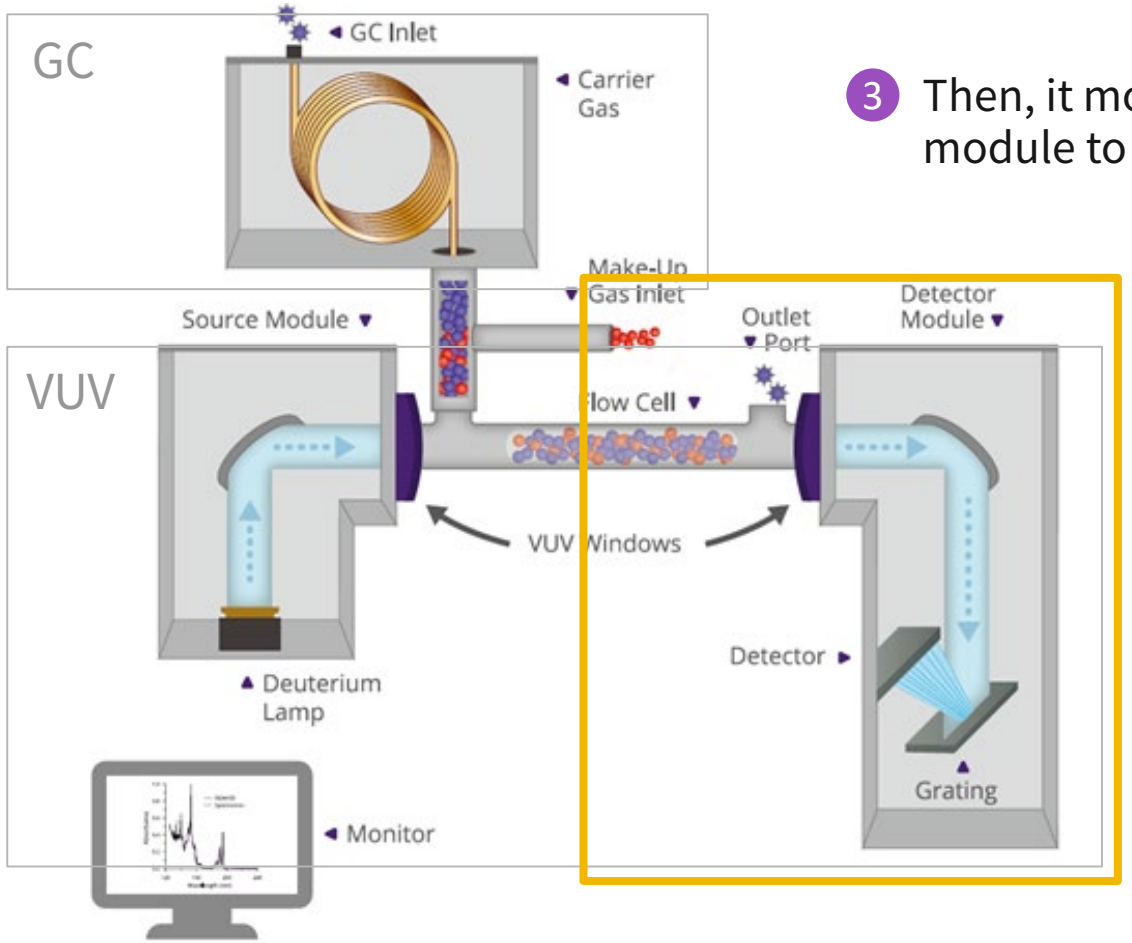
1 Sample separated in GC column is transferred to flow cell through transfer line.

How it works



2 The sample strongly absorbs in the VUV wavelength from the deuterium lamp of source module.

How it works



3 Then, it moves to the detector module to be detected.

03

VUV Detector Features

VUV Detector Features

The World's First VUV Absorption Detector

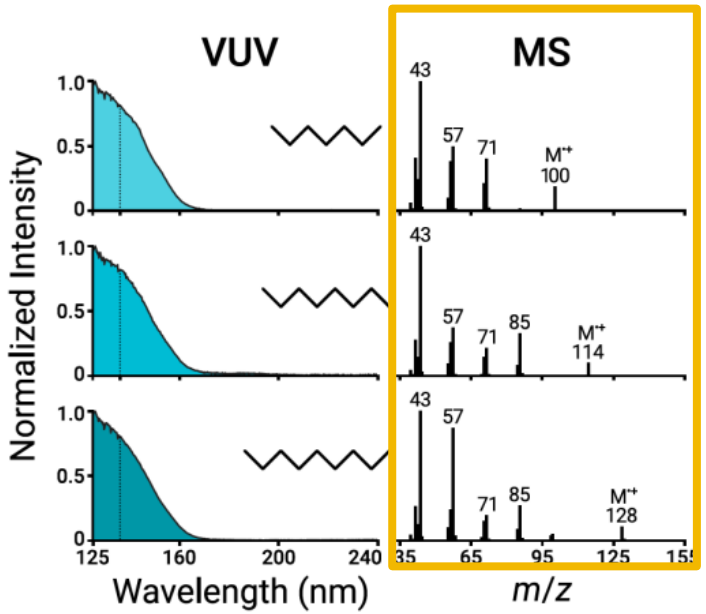
- A "PDA" for your GC, but much better

- Unique Selectivity
- Excellent Sensitivity (up to picograms)
- Non-destructive Detector
- Reliable & Easy to Use System

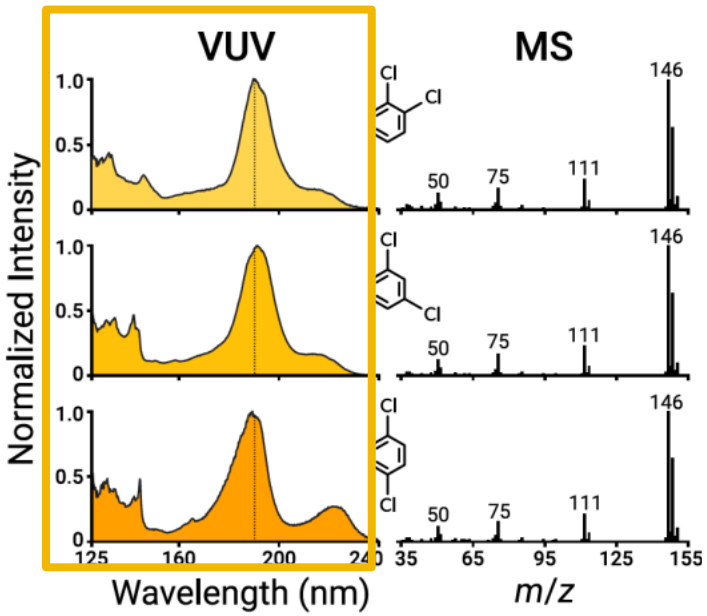
  (No routine maintenance necessary, no vacuum pumps, Minimized instrument downtime)

VUV Detector Features···Unique Selectivity

- Identification and quantitation of unambiguous compound



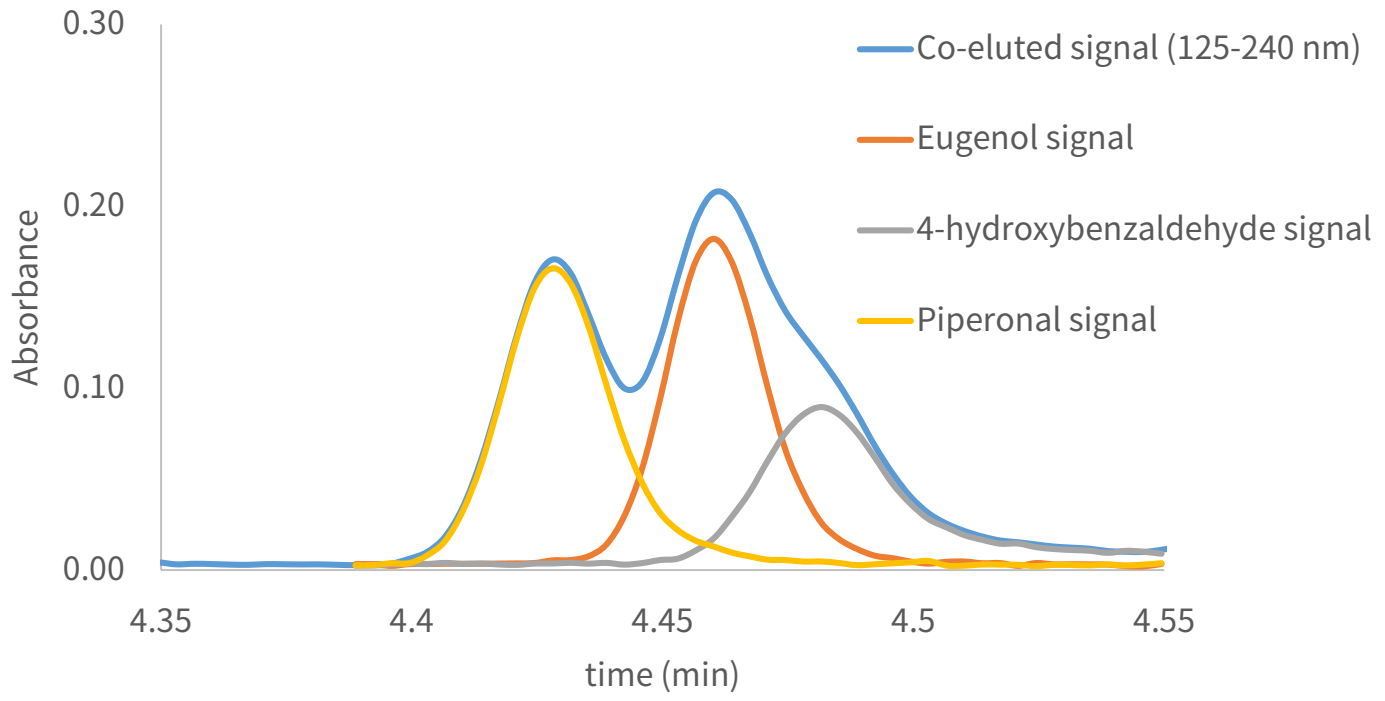
VUV and MS spectrum comparison of alkanes



VUV and MS spectrum comparison of structural isomers

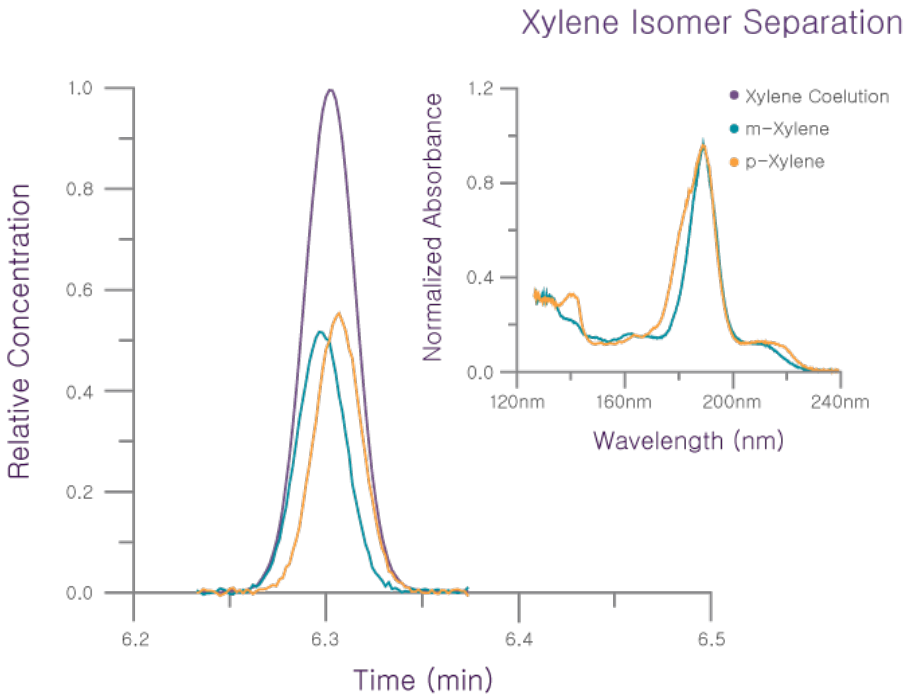
VUV Detector Features···Unique Selectivity

- Deconvolution of co-eluting peaks

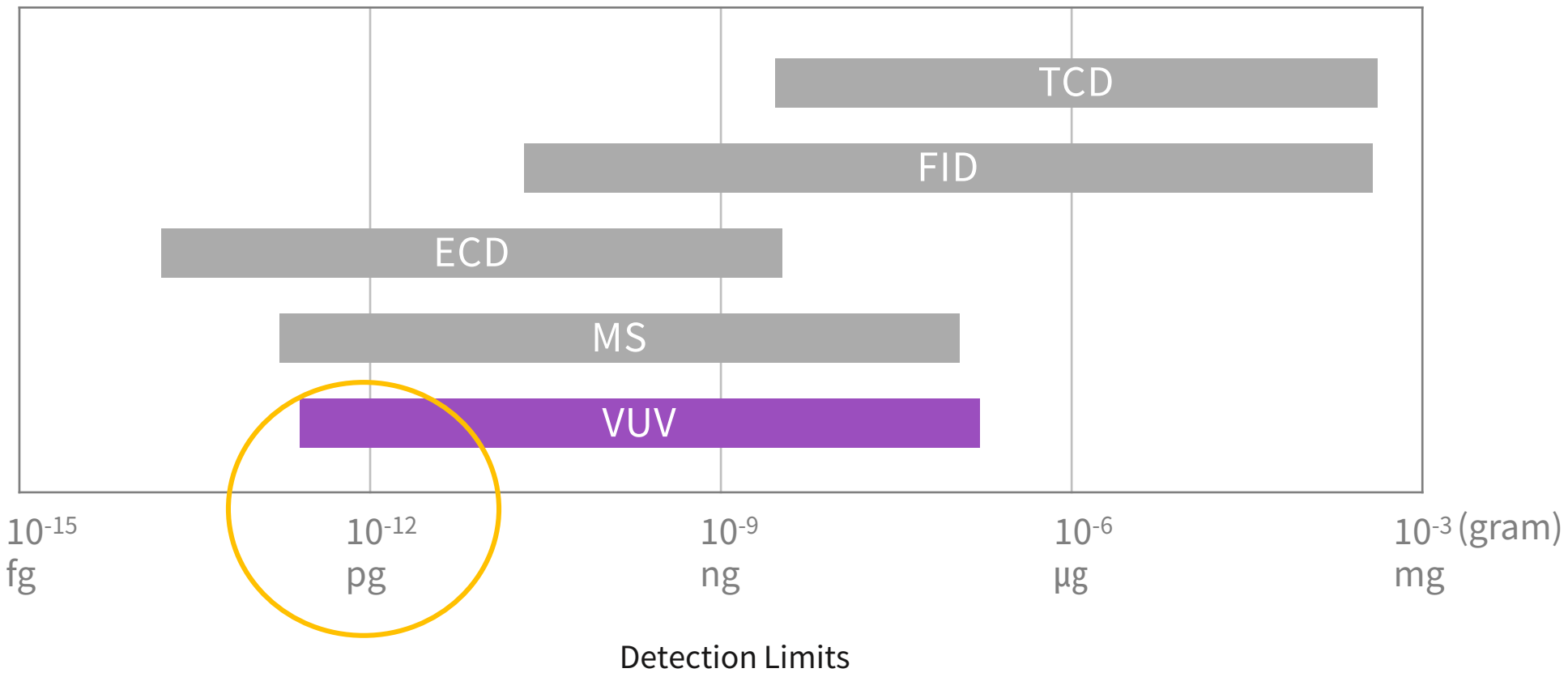


VUV Detector Features···Unique Selectivity

- Isomer differentiation



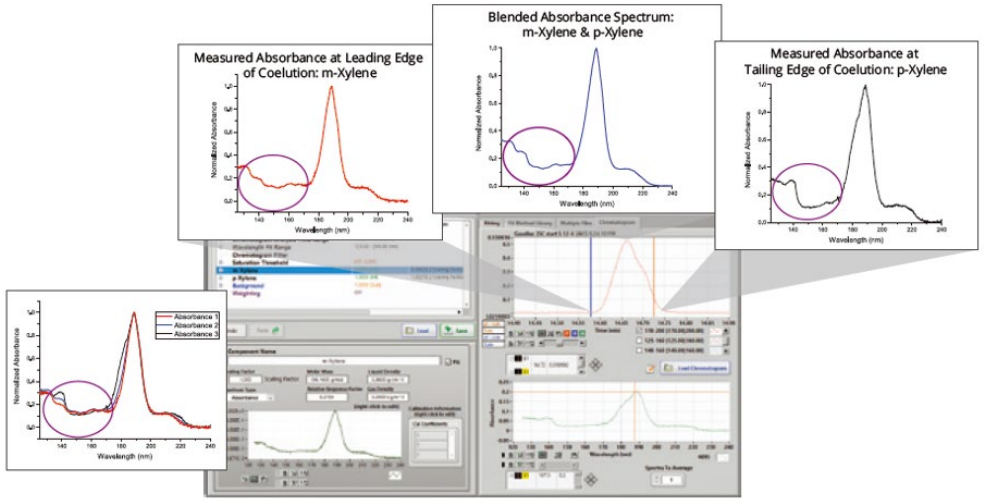
VUV Detector Features···Excellent Sensitivity



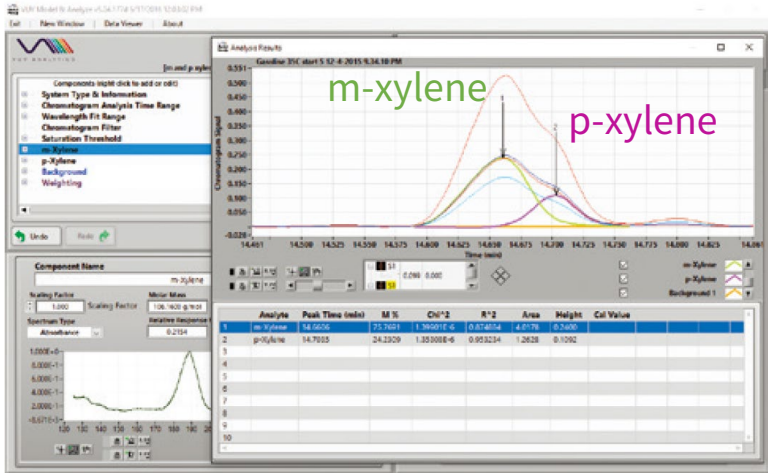
VUV Detector Features···Non-destructive Detector

Detector	Applicable Samples	Destructive	Response Characteristic	Detection Limits
FID	Hydrocarbons	Yes	Mass	1 pg C/s
TCD	Universal	No	Concentration	500 pg/ml
ECD	Halogenated, peroxides and Nitro Groups	Yes	Concentration	5 fg/s
FPD	Sulfur & Phosphorous containing compounds	Yes	Mass	1.0 pg S/s 0.1 pg P/s
FTIR	Organic Compounds	No	Concentration	0.2-40 ng/ml
MS	Universal	Yes	Mass	0.25-100 pg
VUV	Universal	No	Mass/Concentration	5-250 pg

VUV Detector Features···Powerful Software

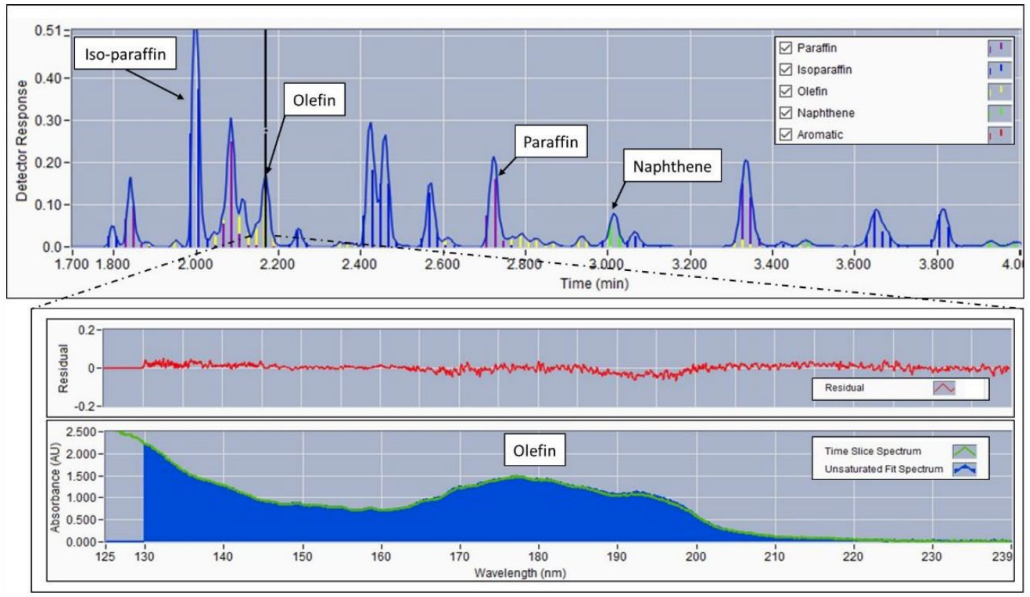


Matching the peaks of interest to compounds in the VUV absorbance library
Every data point in the sum absorbance peak has a unique spectrum reflecting the contribution of known compounds at a given retention time.



Deconvolution of m- and p-xylene allows quantitation of each isomer

VUV Detector Features···Powerful Software



- Allows for automated and rapid (<1)post-run analysis of compound classes and carbon numbers.
- Following applications are available for all VUV Analyzer solutions:
  - Finished gasoline Analysis (ASTM D8071)
  - Jet Fuel Analysis (ASTM D8267)
  - Diesel Analysis (ASTM D8368)
  - VHA™ (ASTM method in process)
- VUV Analyze Software in included with all VUV Analyzer platforms
  - VUV Analyzer™ for Fuels
  - Verified Hydrocarbon Analyzer™
  - VUV Analyzer for Feedstock Characterization

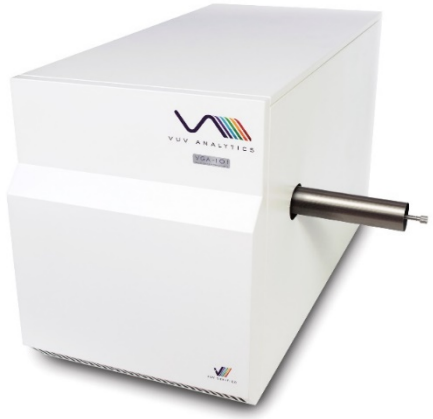
VUV Detector Features

Universal and selective detector

Fast detector response

First-principal technique drastically reduces calibration issues

Easy to operate and maintain (No vacuum pumps required)



Everything you need in one GC detector

Identification and quantitation of ambiguous compounds including isomers

No need of ionization

Excellent resolution

Solution for co-eluting analytes

04

Products

Product Overview

VGA-100 Detector

VGA-101 Detector

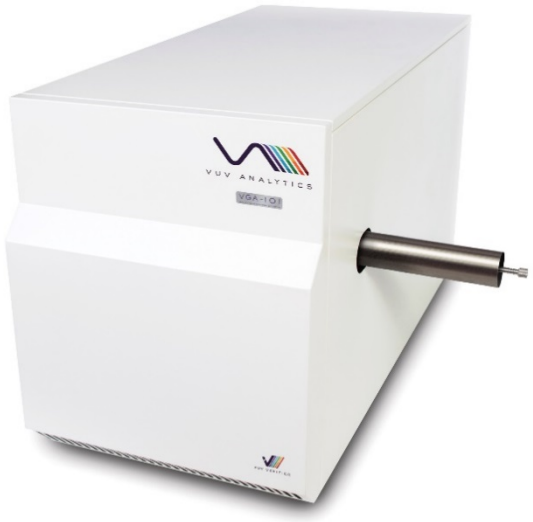
04 Products···VGA-100

VGA-100

Features

- Universal mass-sensitive gas chromatography detector
- High performance detectors by versatile applications
- No ionization – minimal sample degradation
- Overcome co-elution of analytes
- Wavelength range : 125 – 240 nm
- Temperature range : ambient - 300°C
- 80 ㎛ of flow cell

04 Products···VGA-101



VGA-101

Features

- Broader wavelength range : 125 – 430 nm
- Operating temperature heating up to 450°C
  - Enables high boiling point applications
- Improved sensitivity by reduced flow cell volume (40 ㎛)
  - Over 3-10 times improvement in LOD
- In-series integration with other detectors
  - MS, TCD···

05

Application

05 Application

Environmental research

Oil & gas

Specialty gas

Forensics

Petrochemical

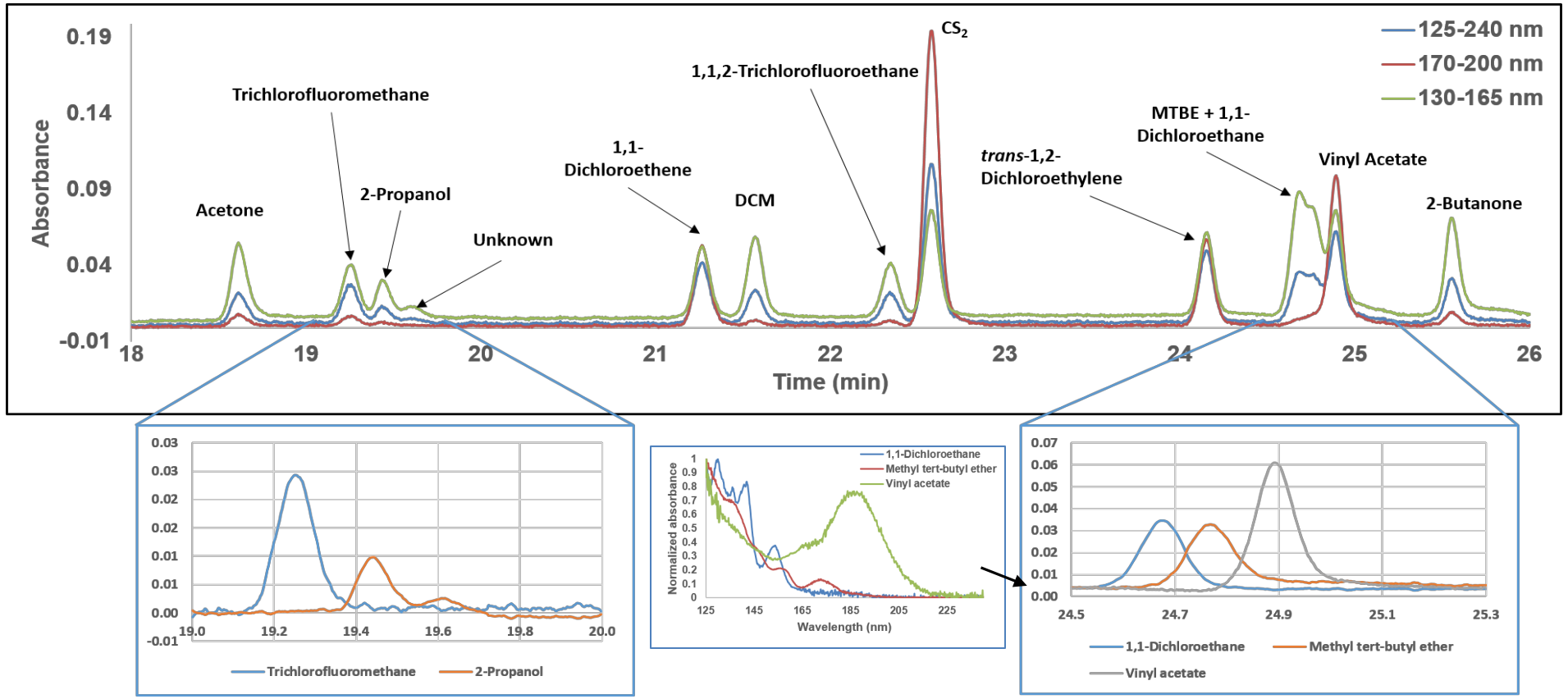
Food safety

Agrochemical

Fragrances & flavors

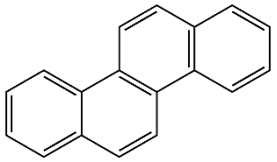
Application

Environmental research – VOCs in Air (EPA TO-15) Analysis

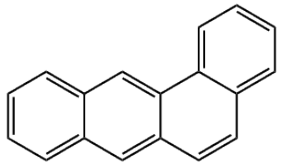


Application

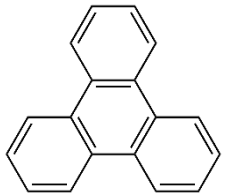
Environmental research – PAH Analysis



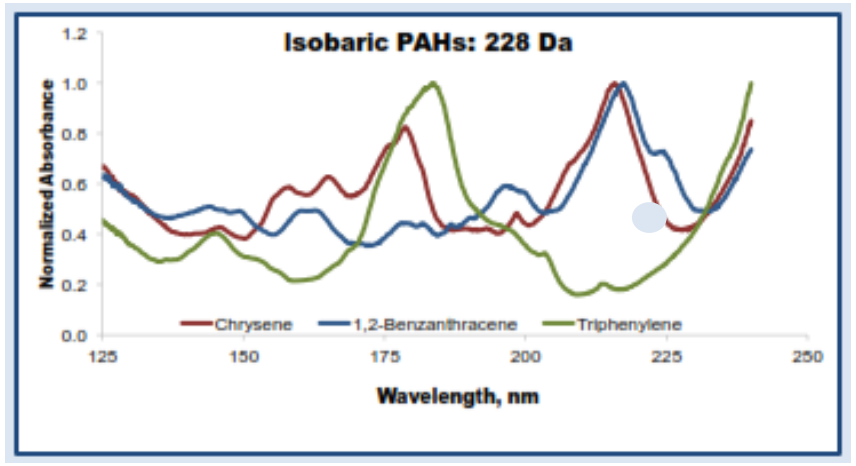
Chrysene

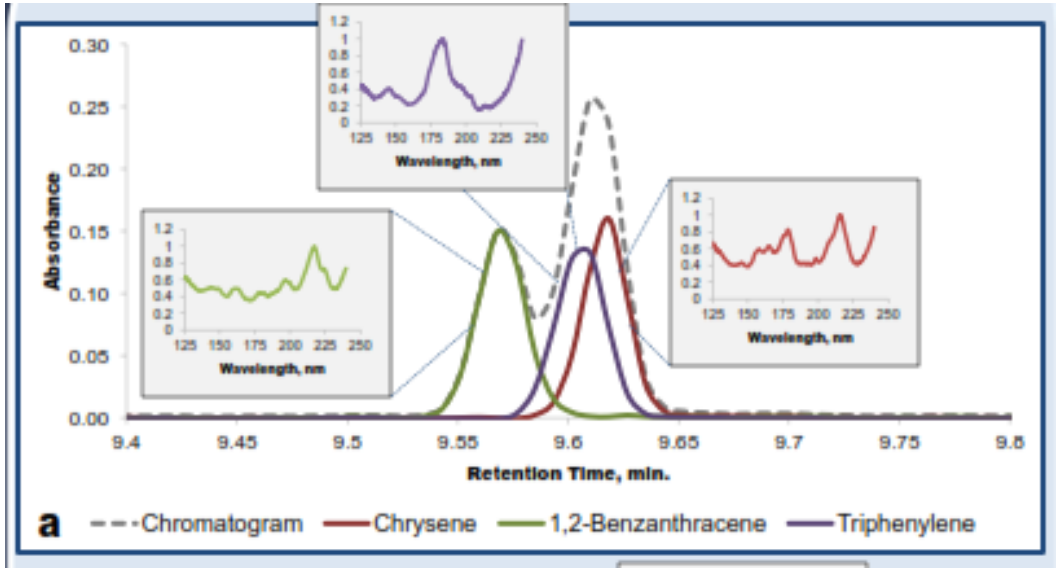


1,2-benzanthracene



Triphenylene





Application

Oil & gas – Transformer Oil Gas Analysis (TOGA) using GC-VUV

VUV Spectra of Gas Standards

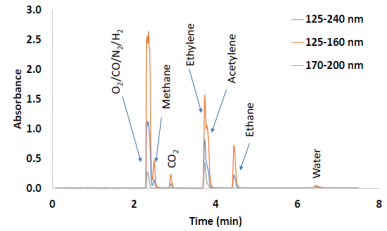


Fig. 1 Analysis of TOGA gas standard on GC VUV. Note, N_2 and H_2 are transparent in VUV (125 – 240 nm).

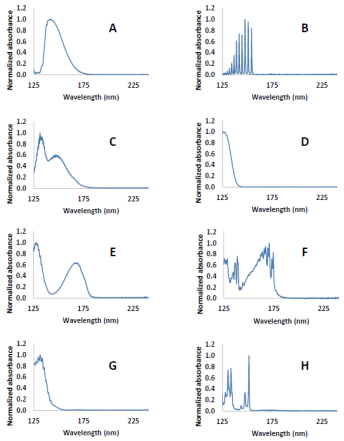


Fig. 2 VUV spectra of A) oxygen, B) carbon monoxide, C) carbon dioxide, D) methane, E) water, F) ethylene, G) ethane and H) acetylene.

Deconvolution

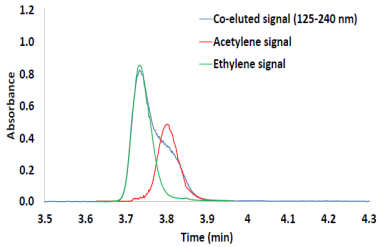


Fig. 3 Deconvolution of the acetylene and ethylene co-elution in Fig. 1 using the 125-240 nm spectral filter. The VUV spectra for these two analytes (see Fig. 2F and 2H) are significantly distinct to afford good deconvolution.

Real TOGA samples

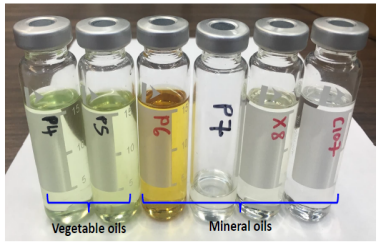


Fig. 4 Six TOGA samples were analyzed by introducing 15 mL of oil in a sealed, argon-flushed headspace vial using a syringe (needle flushed with oil) and an argon-flushed vent line. Samples were heated to 70°C for 10 minutes and then sonicated for 2 – 3 minutes. Thereafter, 1 mL of the headspace was drawn up in a gas tight syringe and 0.25 mL was injected manually on a Shimadzu GC 2010 (see experimental). Note, P7 is a residual sample, not the original sample analyzed.

Qualitative results

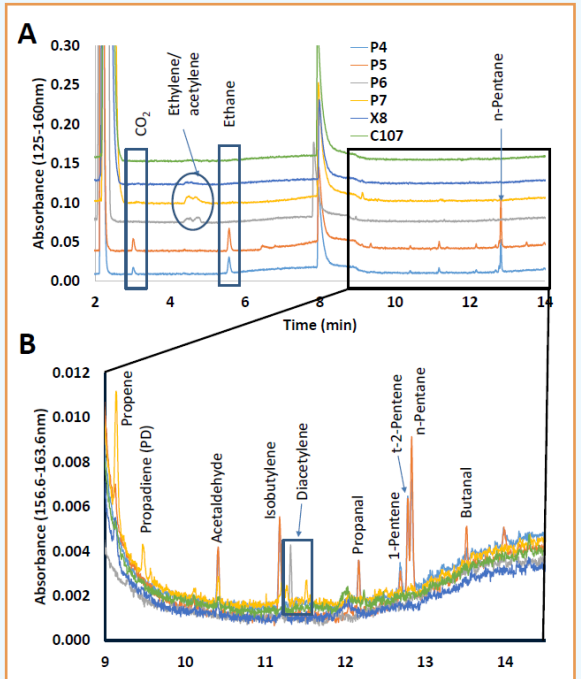
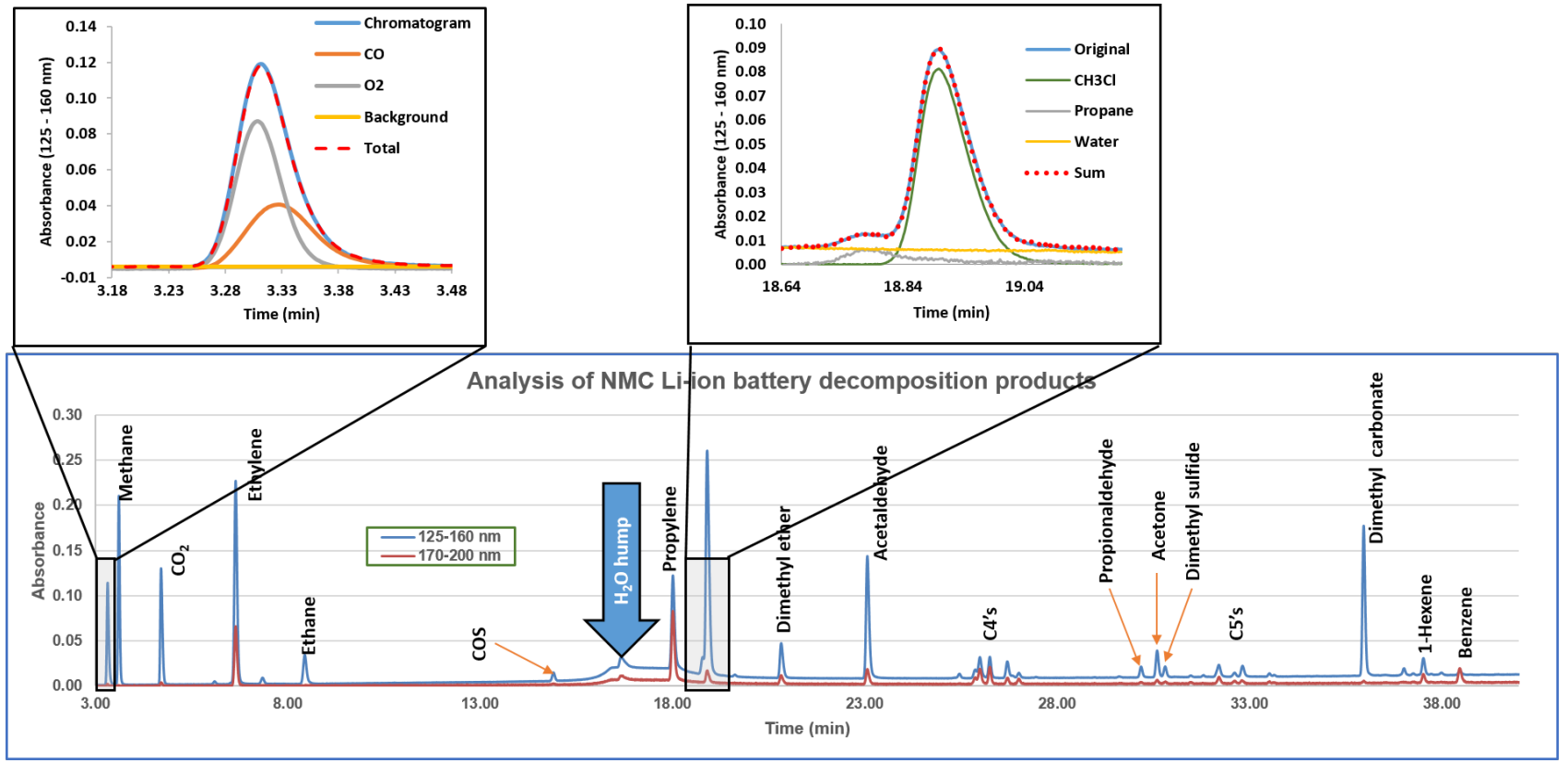


Fig. 5A An overlay of six TOGA samples using the 125-160 nm spectral filter (see experimental for GC details). 5B A zoom-in of the 9 – 14 min region using a low-noise spectral filter (156.6 – 163.6 nm) to highlight the trace-level peaks.

Application

Specialty gas – Evolved Gas Analysis



Petrochemical – ASTM D8071

VUV Analytics Receives Approval of First ASTM Method, D8071 for Finished Gasoline Analysis

PRESS RELEASE UPDATED: MAR 3, 2017

GC-VUV PIONA+TM Method Characterizes the Bulk Composition of Hydrocarbon Groups and Select Individual Compounds in Gasoline

"The setup procedure is easy and requires no pre-column tuning or valve timing adjustments," says ASTM member Dan Wispinski, laboratory manager at InnoTech Alberta. "The standard allows for faster run times because of the test method's ability to handle co-elution among various species and hydrocarbon classes. It is a testament to the ASTM process that enables new technology to be quickly incorporated into mainstream use" says Wispinski.

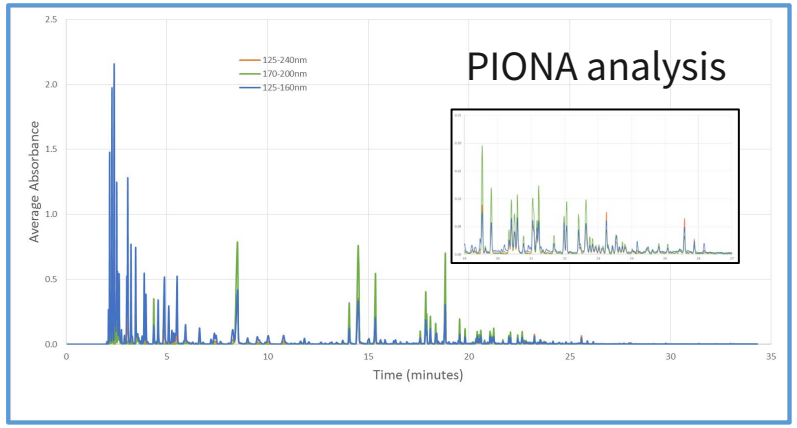
Method D8071, available commercially as VUV PIONA+, uses straightforward instrumentation: a gas chromatograph, a standard 30m nonpolar column, and a VGA detector. Bulk concentrations of the hydrocarbon classes of paraffins, isoparaffins, olefins, naphthenes, and aromatics (PIONA) are determined. Specific analytes can also be singled out for further characterization.

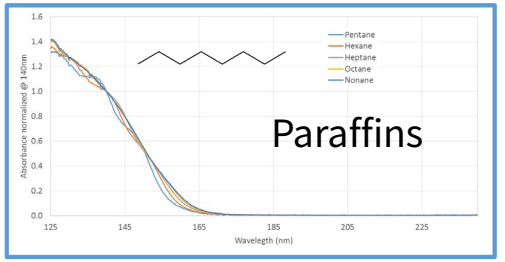
" The rapid approval process by ASTM demonstrates the great support we've received from our lead customers and the D02 committee," said Sean Jameson, Senior Vice President of Business Development at VUV Analytics. He added, "Our thanks to the many people who helped make it happen."

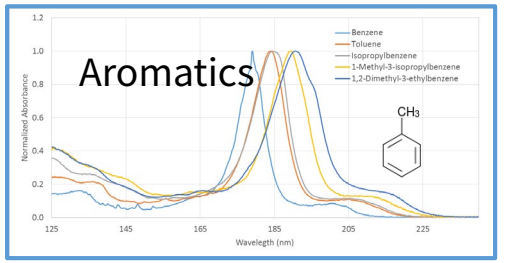
Application

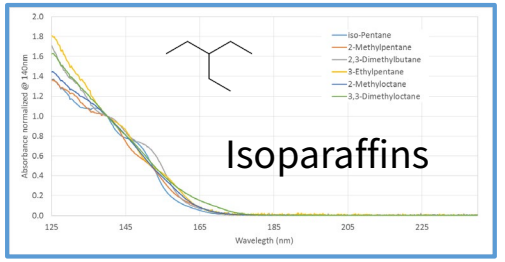
Petrochemical – Gasoline Analysis

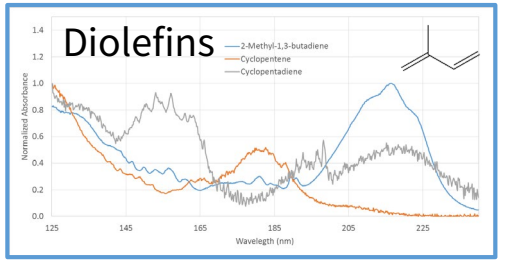
VUV Analytics Receives Approval of First ASTM Method, D8071 for Finished Gasoline Analysis

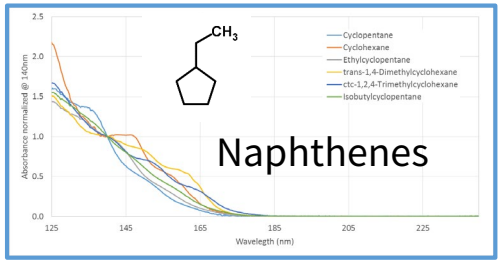


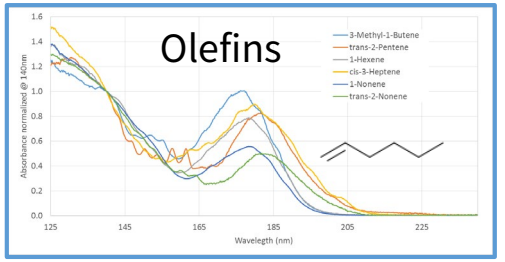


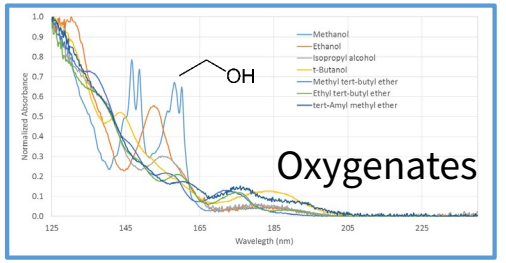








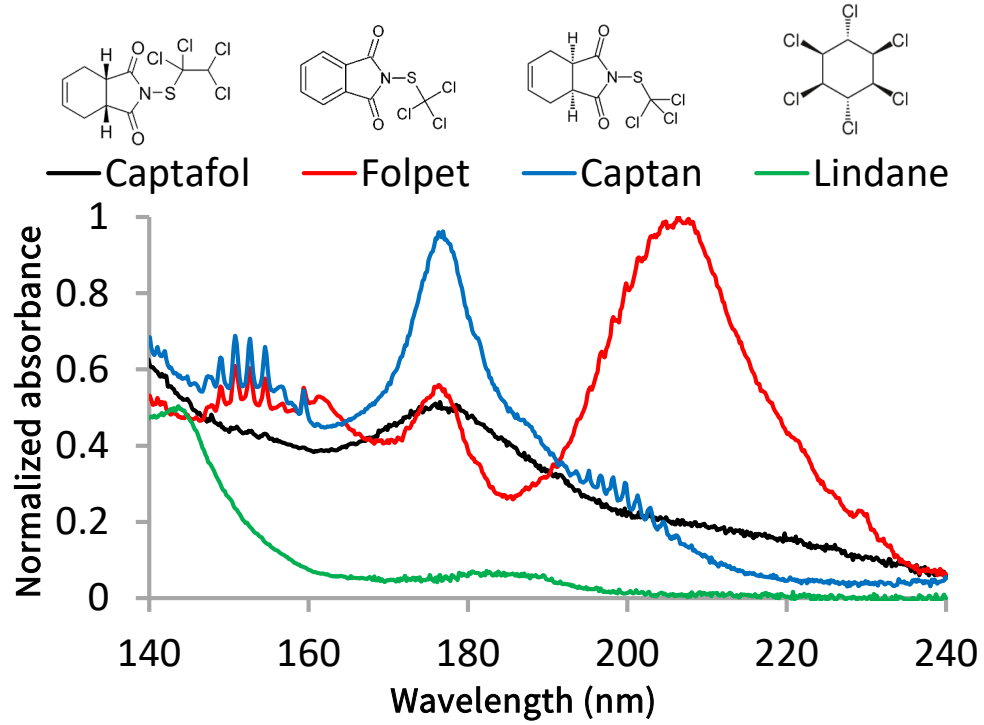




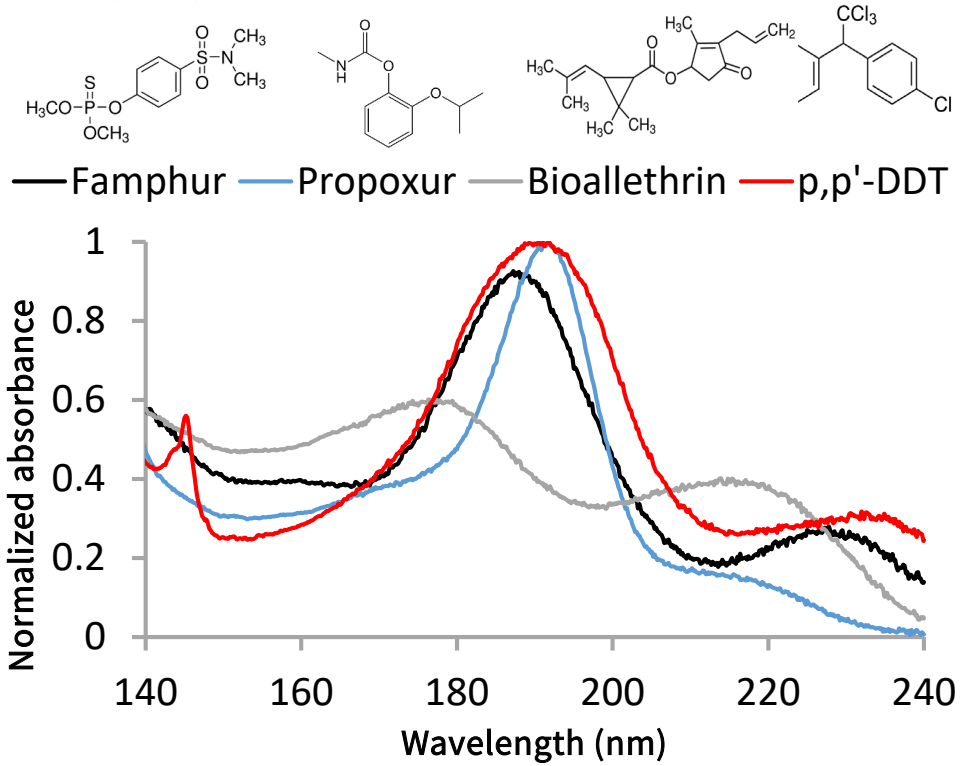
Application

Food & beverage safety – Pesticides Analysis

Within-class



Multiclass



Application

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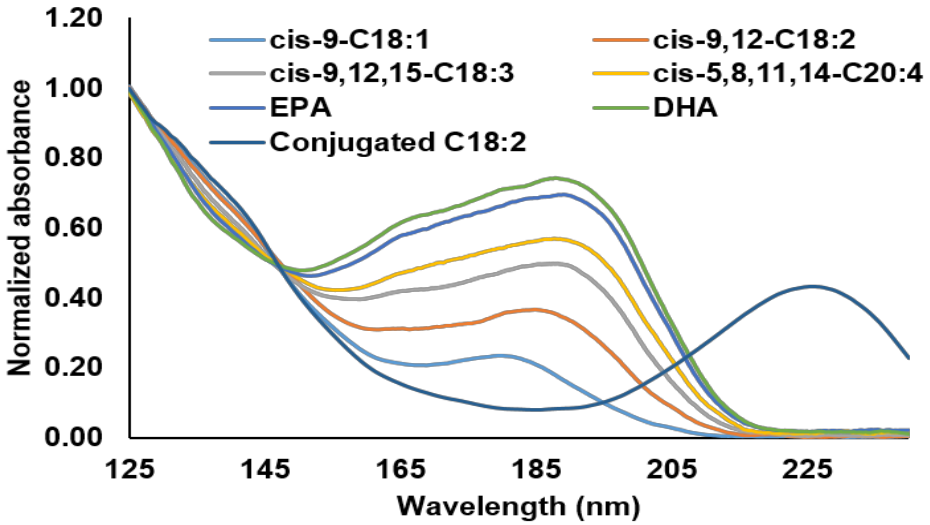
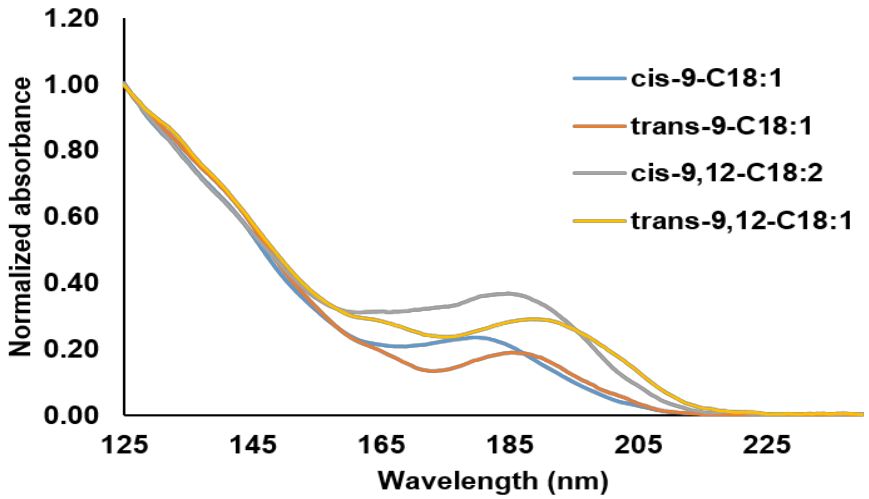
Food & beverage safety – FAMEs(Fatty Acid Methyl Esters) Analysis

Polyunsaturated FAMEs



Cis-/trans- FAMEs



*Characterization of FAMEs is important in food nutrition, food chemistry, detergent production, and biodiesel applications