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GC results to your online analytics with the
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ECLIPSE - WELCOME TO THE FUTURE OF PROCESS GAS CHROMATOGRAPHY

Typical process gas chromatographs (PGCs) monitor 2-3 analytes isothermally from one process stream. Eclipse PGCs can monitor dozens of analytes by using up to 8 capillary columns sampling up to 16 sample streams. Eclipse chromatographs offer MS, VUV, PDHID, TCD and FID detector combinations controlled by dedicated electronic pressure and flow controllers. The result is an online PGC that can finally deliver lab-quality performance.

Figure 1: Close up of Wasson-ECE patented Micro-Convection Oven for capillary columns.

Eclipse Technology

- Online MSD, VUV, PDHID, TCD and FID
- Capacity for up to 8 capillary columns
- Full electronic pressure programming
- Two programmable micro-convection ovens
- Two isothermal ovens
- Local 19" touchscreen interface
- MODBUS RTU, TCP and REST automation
- Wasson-ECE's new chromatography data system
- Sample systems with multiplexing for up to 16 sample streams
- Rated Class I, Division 2 and ATEX Zone 2 for hazardous locations

Table 1: Key features enabling lab-quality capillary column chromatography on a process GC.

The efficiency, and thus the value, of a PGC is maximized when the analyses provide as much data as possible in the shortest amount of time. In laboratory settings, this is achieved with the use of high-resolution capillary columns that utilize temperature and pressure programming to produce extensive chromatograms showing the separation and quantification of complex mixtures. Typical PGCs rely on low-resolution packed columns and isothermal ovens which limits their utility in monitoring complex sample streams.

Eclipse is a new generation of PGC. The objective in the design of this instrument was to deliver laboratory-caliber capillary column chromatography in an online PGC. To meet this goal, the Wasson-ECE engineering teams combined electronic pressure and flow controls with high-performance convection ovens. Eclipse has two independent, patented Micro-Convection Ovens (MCOs) which provide two unique temperature programmed environments (Fig. 1). There are also two isothermal ovens, each with a separate temperature assignment. This configuration, two independent programmable ovens and two isothermal ovens, delivers the most flexibility and analytical capability available on the PGC market today.

Super RGA: An example of Eclipse's comprehensive capabilities

The Super RGA (refinery gas analyzer) addresses gas, pressurized liquid, or liquid samples that range from hydrogen to C20. The Super RGA uses four ovens – two temperature programmable and two isothermal – and four detectors – two flame ionization (FID) and two thermal conductivity (TCD). One TCD uses nitrogen carrier gas and quantifies hydrogen. The other TCD uses helium, or hydrogen carrier gas and quantifies carbon dioxide, carbon monoxide, oxygen, nitrogen and hydrogen sulfide. The two TCD signals are summed together so that the resulting single TCD chromatogram encompasses the full range of the TCD analytes (Fig. 2).

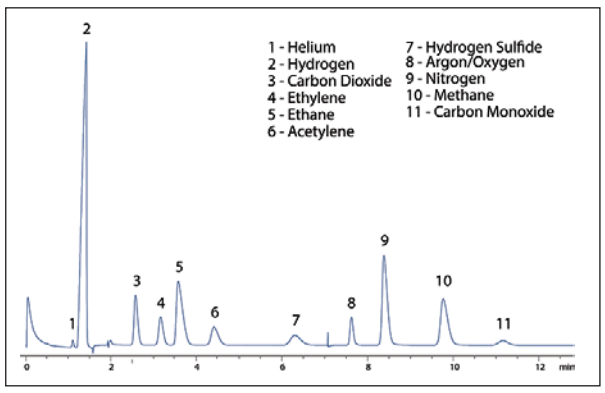

Figure 2: Eclipse TCD chromatogram showing separation of common permanent gases and H2S.

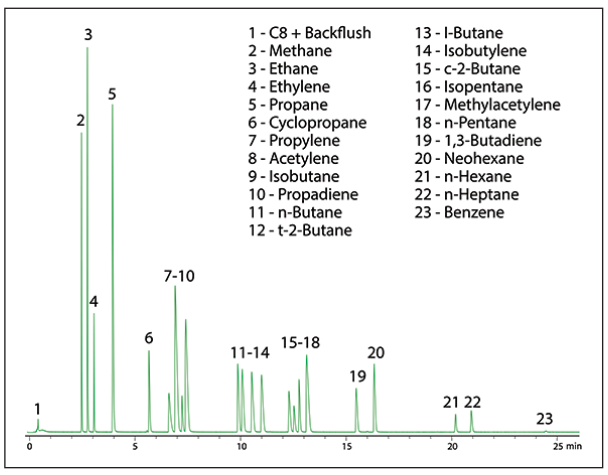

Figure 3: Eclipse FID1 chromatogram showing separation of C1-C7 hydrocarbons and backflush of heavier species.

Both temperature programmable MCOs house capillary columns. One oven has two columns and is connected to one of the FIDs to produce a chromatogram of C1-C7 paraffins and olefins plus a C8+ composite peak (Fig. 3). The second MCO has a capillary column which specifically separates the C8-C20 hydrocarbons (Fig. 4). The two FIDs each produce their own chromatogram and these chromatograms occur at the same time the combined TCDs chromatogram occurs. This comprehensive system produces three chromatograms simultaneously: one combined TCDs and two FID chromatograms. The extensive analyte range covered by this single analyzer makes it the broadest ranging PGC in the world.

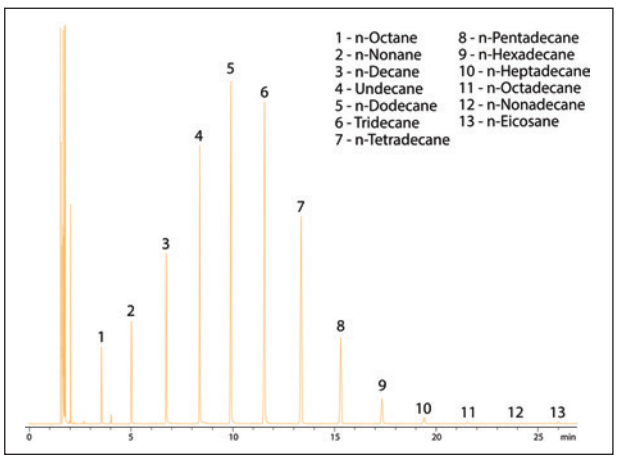

Figure 4: Eclipse FID2 chromatogram showing speciation of C8-C20 hydrocarbons.

Thus, four aliquots of the same sample are injected down parallel paths, each aliquot being directed to the column of choice with its own temperature and pressure program. Simultaneous chromatograms are combined into a single digital report and transmitted as needed. Since this one Super RGA analyzer interrogates a single sample flow, the resulting multidetector data provides greater accuracy and with overall reduced analysis time.

Wasson-ECE Instrumentation has 35 years of experience designing, building and applicating the most sophisticated GC systems in the field. With Eclipse, Wasson-ECE is leading a revolution in process gas chromatography.

The Eclipse suite of fully applicated PGC analyzers are ready to transform your HPI processes.

More information online: ilmt.co/PL/4Qzl

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Eclipse Process Gas Chromatographs:
Maximizing efficiencies in monomer process control

Competition in the monomer market is increasingly fierce and the quality of the final product is critical to maintaining and increasing market share. Premium product requires sophisticated process monitoring and control at every stage of development. Eclipse process gas chromatographs couple MS, VUV, PDHID, TCD and FID detector combinations to characterize an extremely broad range of analytes from fixed gases to C20+. These sensitive analyzers can quickly detect ppm-ppb levels of impurities and catalyst poisons; ultimately improving product quality and saving time and money.

Capillary Chromatography in an Online Gas Chromatograph: Eclipse process gas chromatographs (PGCs) are the most sensitive and capable online analyzers available to the hydrocarbon processing industry. Our patented micro-convection ovens (MCOs, Fig. 1) enable the precise temperature controls required for capillary column chromatography. Low sensitivity analysis (ppm to ppb) is achieved by combining the precision of the MCOs with electronic pressure programming. Interfacing between the Eclipse PGC and the plant data communication systems allows for rapid responses to changing stream conditions.

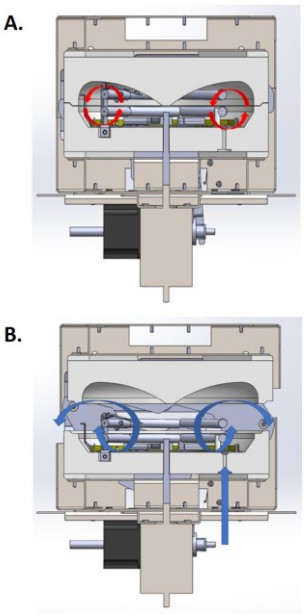

Figure 1. Eclipse MCO capillary column ovens enable rapid and precise temperature programming with convection heating (A) and cooling (B).

Impurities in ethylene and propylene product streams are costly in at least two respects. First, the purity of the monomer product, and the price which can be demanded for it, is directly impacted by trace impurities such as heavy hydrocarbons, sulfurs, arsine, phosphine or oxygenates. Additionally, the catalyst required to produce the monomer is poisoned by common by-products such as hydrogen sulfide, acid gases or methanol which reduce catalyst efficiency and shorten the life of the catalyst bed. Consequently, careful control of monomer process streams is required at multiple stages of product development.

Eclipse Monomer Analyzers: Measuring impurities in ethylene and propylene streams

The Eclipse Monomer Analyzer described here, designed for one of the largest O&G companies in North America, identifies C1-C6 hydrocarbons and common catalyst poisons (H2S, COS, methyl mercaptan, ethyl mercaptan, methanol, arsine and phosphine) in an ethylene matrix. To resolve and quantify such diverse analytes, the PGC is configured with 7 capillary columns housed in 2 temperature programmable MCOs and 1 isothermal oven. Two chromatography methods direct eluates to three multiplexed detectors (FID, PDHID and MSD) for unambiguous compound identification and quantification in just over 30 minutes.

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In the first method, 200 ppm hydrocarbons in an ethylene stream were resolved on a 50-meter column in MCO1 and speciated by FID (Fig.2A). The minimum detectable limit (MDL) was determined to be 2 ppm for this mixture.

Simultaneously, another 50-meter column in MCO2 resolved methanol, methyl mercaptan and ethyl mercaptan which were then detected by an Agilent 5977B mass spectrometer (Fig. 2B). The compounds were detected in select ion mode at MDLs of 50, 30 and 40 ppb, respectively.

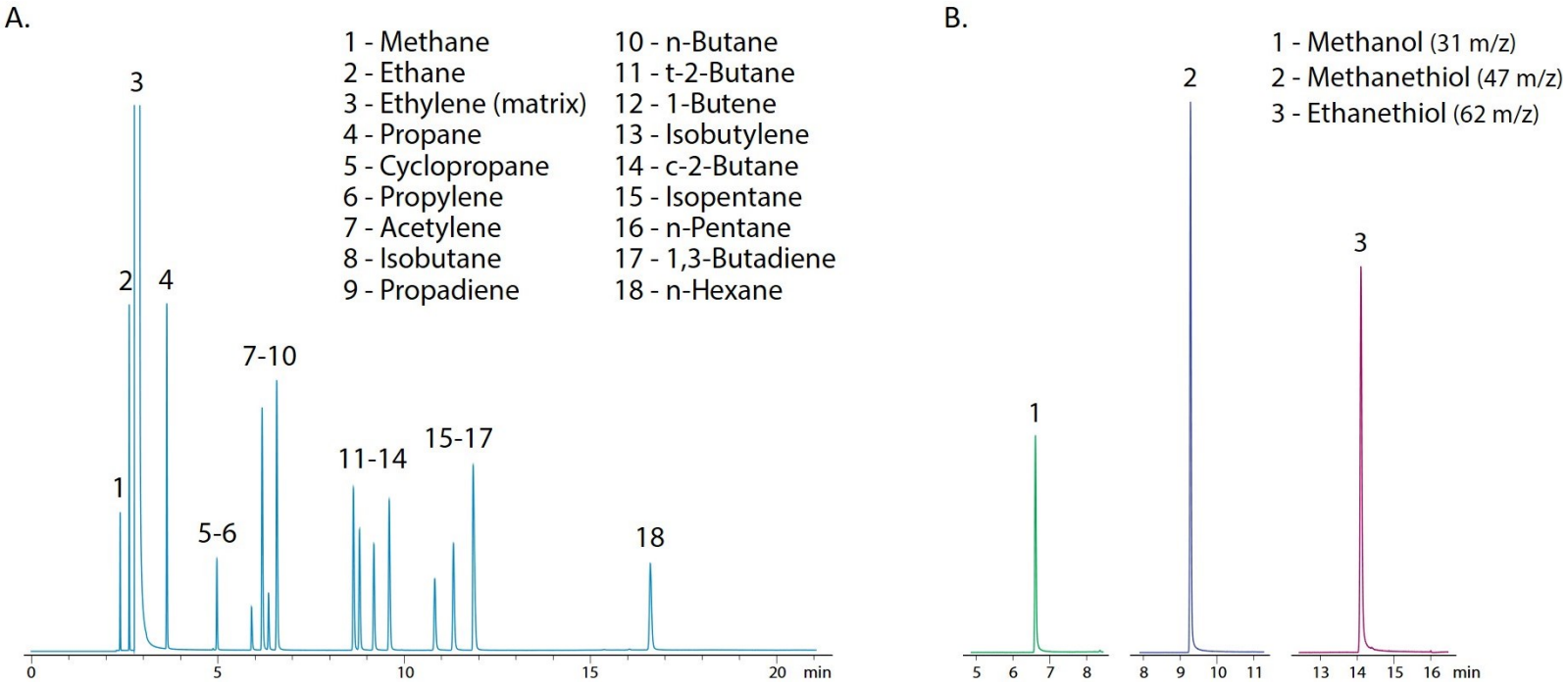

Figure 2. Method 1 analytes. FID chromatogram of C1-C6 hydrocarbons (A) and MSD select ion peaks for methanol, methyl mercaptan and ethyl mercaptan (B).

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The second method utilized 4 columns in the isothermal oven to separate hydrogen, oxygen/argon, nitrogen, carbon monoxide and carbon dioxide fixed gases (10ppm each). Eluates were detected by a Valco PDHID (Fig. 3A). The MDL for these analytes was 0.7 ppm.

The second method also used the columns in MCO2 and the MSD to detect H_2S and COS (10 ppm each) (Fig. 3B). The MDL for COS was 10 ppb while that of H_2S was 40 ppb. Arsine and phosphine were also examined using this approach (10 ppm each) (Fig. 3B) and found to have MDLs of 15 ppb and 30 ppb respectively.

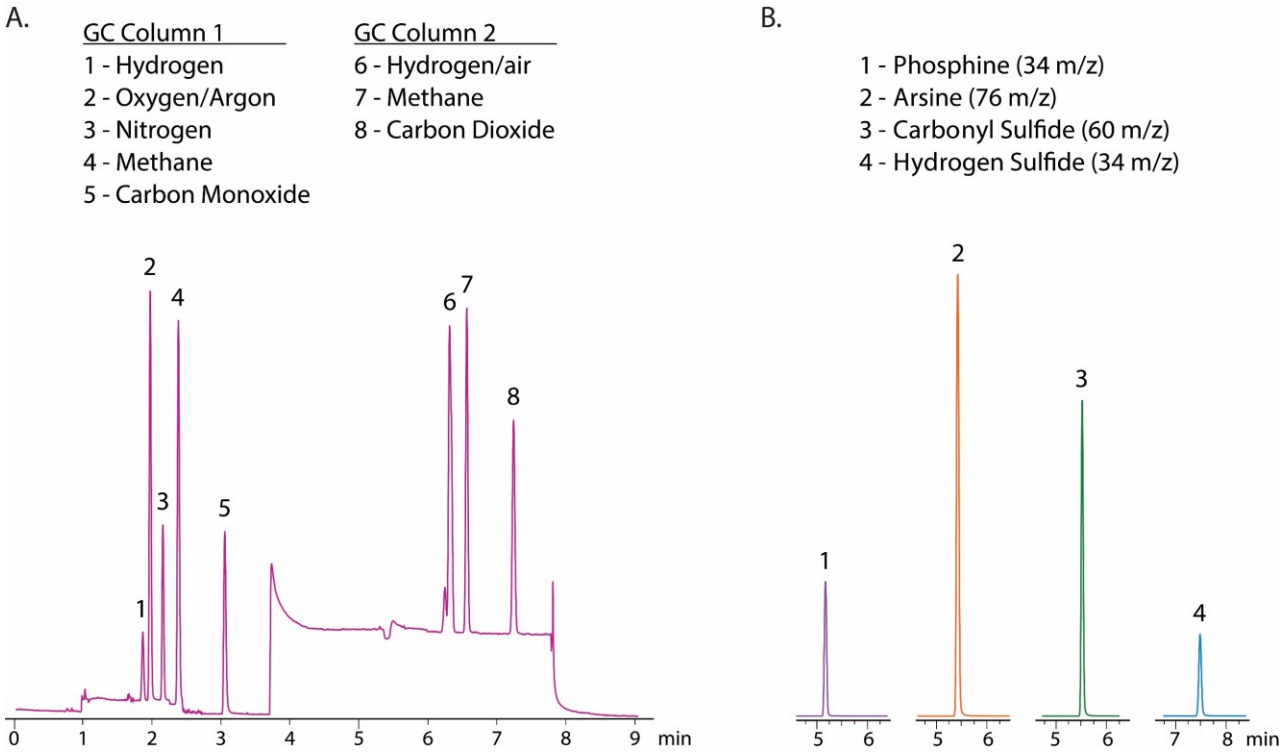

Figure 3. Method 2 analytes. PDHID chromatogram of common fixed gases (A), and MSD select ion peaks for phosphine, arsine, carbonyl sulfide and hydrogen sulfide (B).

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The Eclipse Monomer Analyzer provides online, lab-quality analysis of monomer streams in a fraction of the time required to complete these analyses by traditional methods.

Reproducibility studies, performed on an Eclipse Super RGA system, examined the precision of Eclipse temperature and electronic pressure controls. Figure 4 demonstrates highly reproducible retention times and peak areas, results rivaling those obtained on laboratory GCs and unparalleled in online PGCs.

A. Retention Times

	Methane	Pentane	Hexane	Heptane	Octane	Nonane	Decane	Undecane
Day 1	2.744	3.619	4.687	6.645	9.581	13.197	17.099	21.035
	2.775	3.653	4.723	6.683	9.613	13.225	17.118	21.038
	2.746	3.625	4.696	6.66	9.603	13.223	17.12	21.047
	2.747	3.626	4.697	6.663	9.604	13.223	17.118	21.049
	2.747	3.626	4.698	6.666	9.606	13.224	17.121	21.049
Day 2	2.747	3.625	4.694	6.659	9.598	13.213	17.108	21.036
	2.747	3.627	4.698	6.665	9.603	13.217	17.111	21.029
	2.745	3.624	4.694	6.662	9.601	13.215	17.106	21.033
Retention Time								
Avg.	2.750	3.628	4.698	6.663	9.601	13.217	17.113	21.040
StDev	0.010	0.010	0.011	0.010	0.009	0.009	0.008	0.008
RSD%	0.373	0.285	0.225	0.157	0.096	0.070	0.046	0.037

Data from 8 injections of Hydrocarbon blend over 2 days

B. Peak Areas

	Methane	
Peak Areas	83767	83886
	84037	84020
	83813	83891
	83992	83966
	83727	83806
	83880	83859
Peak Area		
Avg.	83887	
StDev	100.155	
RSD%	0.119	

Data from 12 injections of 5% Methane in Argon

Figure 4. Eclipse retention times and peak areas show excellent RSD %. **A.** Highly reproducible hydrocarbon retention times are a function of temperature, pressure and backpressure control. **B.** Reproducible methane peak areas are a function of split inlet performance and mass flow control.

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Wasson-ECE Instrumentation has 35 years of experience designing, building and applicating the most sophisticated GC systems in the field. With Eclipse, Wasson-ECE is leading the revolution in process gas chromatography. Eclipse analyzers are fully customizable to meet the needs of the most challenging processes (Fig. 5, Table 1) and are ready to transform your monomer processes.

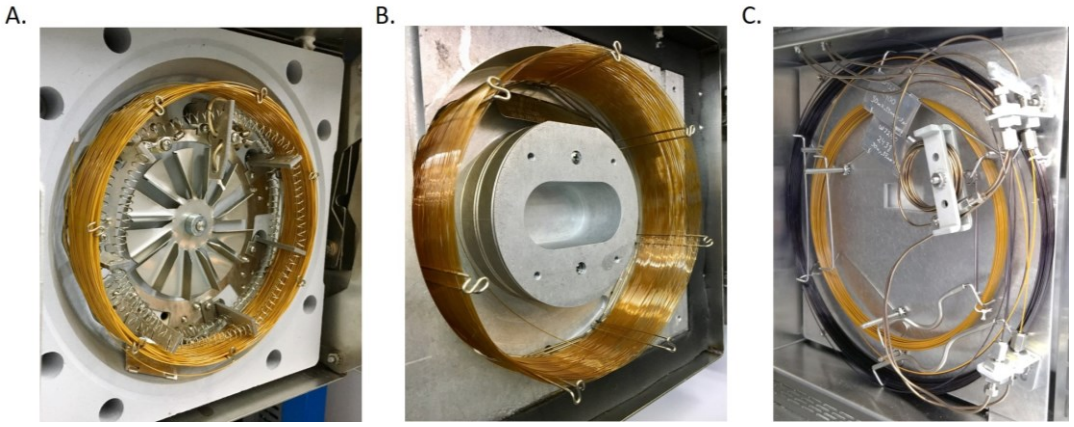

Figure 5. Eclipse capillary column MCOs deliver precisely controlled temperatures up to 225°C (A) and Peltier cooled to -20°C (B). Isothermal ovens are also available.

Table 1. Key features enabling lab-quality capillary column chromatography on a process GC.

Eclipse Technology
• Online MSD, VUV, PDHID, TCD and FID
• Capacity for up to 6 capillary columns
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• Two programmable micro-convection ovens
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• Local 19" touchscreen interface
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Eclipse

Welcome to the future of Process Gas Chromatography

In industry today, especially the hydrocarbon processing industry, the process gas chromatograph (PGC) is an indispensable tool. These fully automated online GC's draw in samples, analyze them for chemical composition and then transmit the results to a plant control computer. Programmed to cycle through several streams, these systems constantly update control systems with respect to process composition objectives and quality specifications.

The efficiency, and thus the value, of a PGC is maximized when the analyses provide as much data as possible. In the laboratory, this is done with the use of high-resolution capillary columns that utilize temperature and pressure programming to produce extensive chromatograms showing the separation, and quantification of complex mixtures.

Figure 1: Wasson-ECE patented Micro-Convection Ovens provide lab-quality temperature control and highly reproducible retention times.

Eclipse is a new generation of PGC. The objective in the design of this instrument was the use of true convection ovens, along with electronic pressure programming, to enable the reproduction of laboratory-caliber capillary column chromatography in an on-line chromatograph. Eclipse has two independent, patented Micro-Convection Ovens (MCOs) which provide two unique temperature programmed environments (Fig. 1). There are also two isothermal ovens, each with a separate temperature assignment. This configuration, two independent programmable ovens, and two isothermal ovens, delivers the most flexibility and analytical capability available on the PGC market today.

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Super RGA: An example of Eclipse's comprehensive capabilities

The Super RGA (refinery gas analyzer) addresses gas, pressurized liquid, or liquid samples that range from hydrogen to C20. The Super RGA uses four ovens – two temperature programmable and two isothermal – and four detectors – two flame ionization (FID) and two thermal conductivity (TCD). One TCD uses nitrogen carrier gas and quantifies hydrogen. The other TCD uses helium, or hydrogen carrier gas and quantifies carbon dioxide, carbon monoxide, oxygen, nitrogen and hydrogen sulfide. The two TCD signals are summed together so that the resulting single TCD chromatogram encompassing the full range of the TCD analytes (Fig. 2).

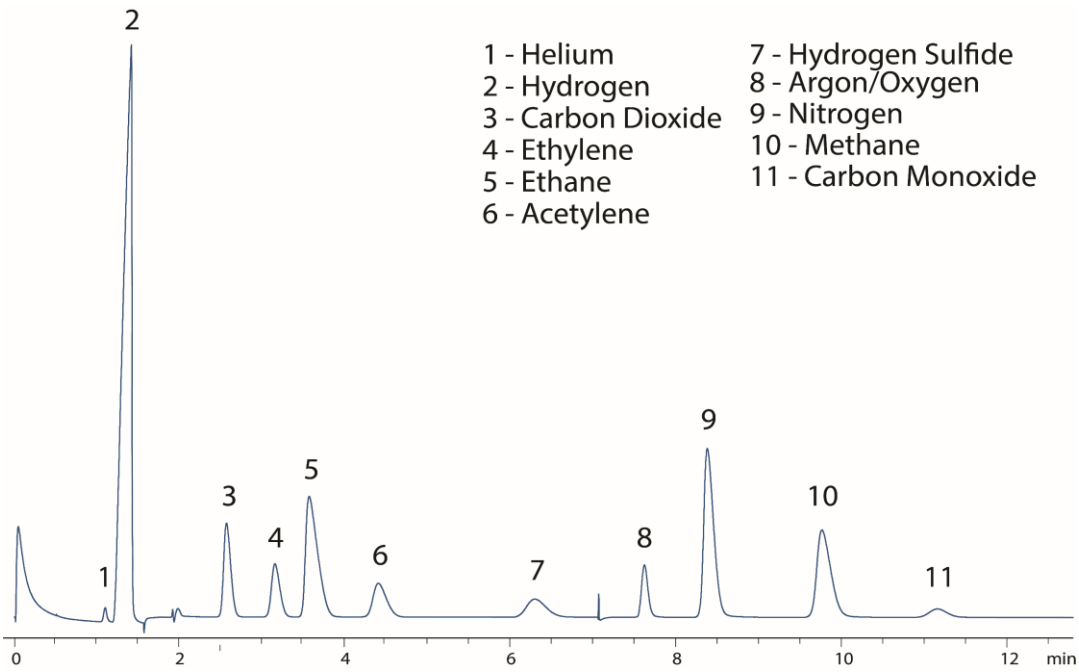

Figure 2: Eclipse TCD chromatogram showing separation of common permanent gases and H_2S.

The two temperature programmable MCO's each have capillary columns. One oven has two columns and is connected to one of the FID's to produce a chromatogram of C1-C7 paraffins and olefins plus a C8+ composite peak (Fig. 3). The second MCO has a capillary column which specifically separates the C8-C20 hydrocarbons (Fig. 4). The two FID's each produce their own chromatogram, and these chromatograms occur at the same time the combined TCD's chromatogram occurs. This comprehensive system produces three chromatograms simultaneously: one combined TCD's and two FID chromatograms. The extensive analyte range covered by this single analyzer makes it the broadest ranging PGC in the world.

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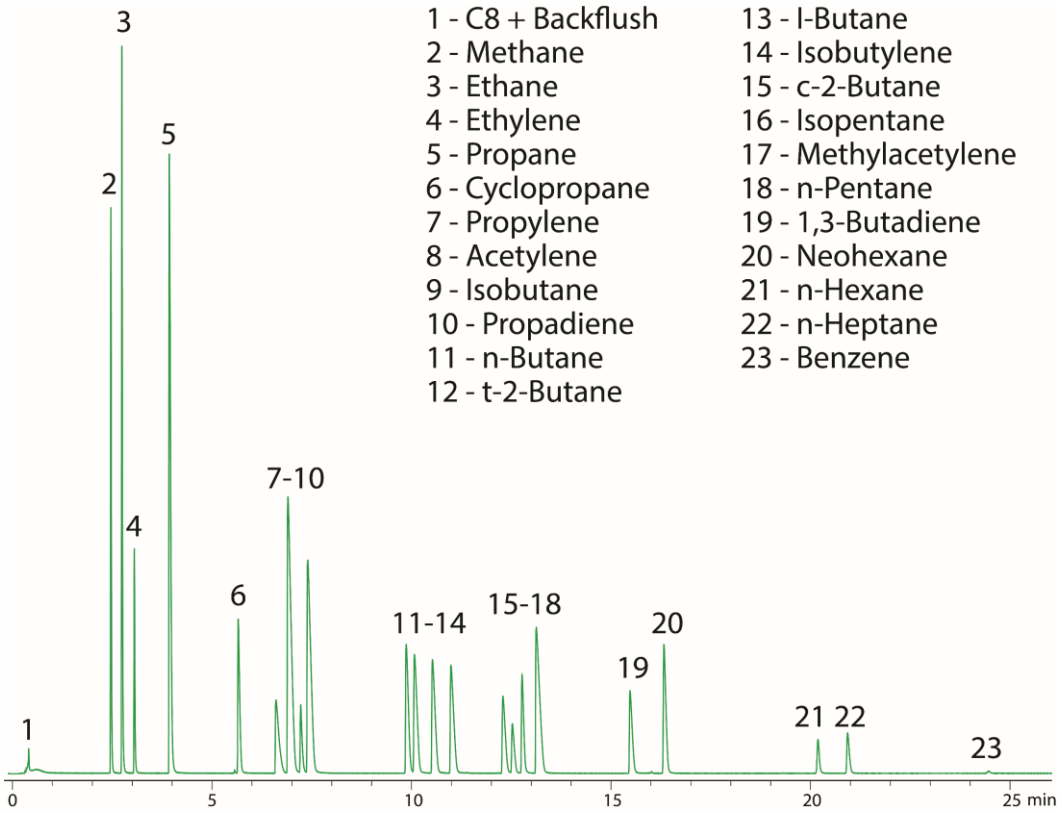

Figure 3: Eclipse FID1 chromatogram showing separation of C1-C7 hydrocarbons and backflush of heavier species.

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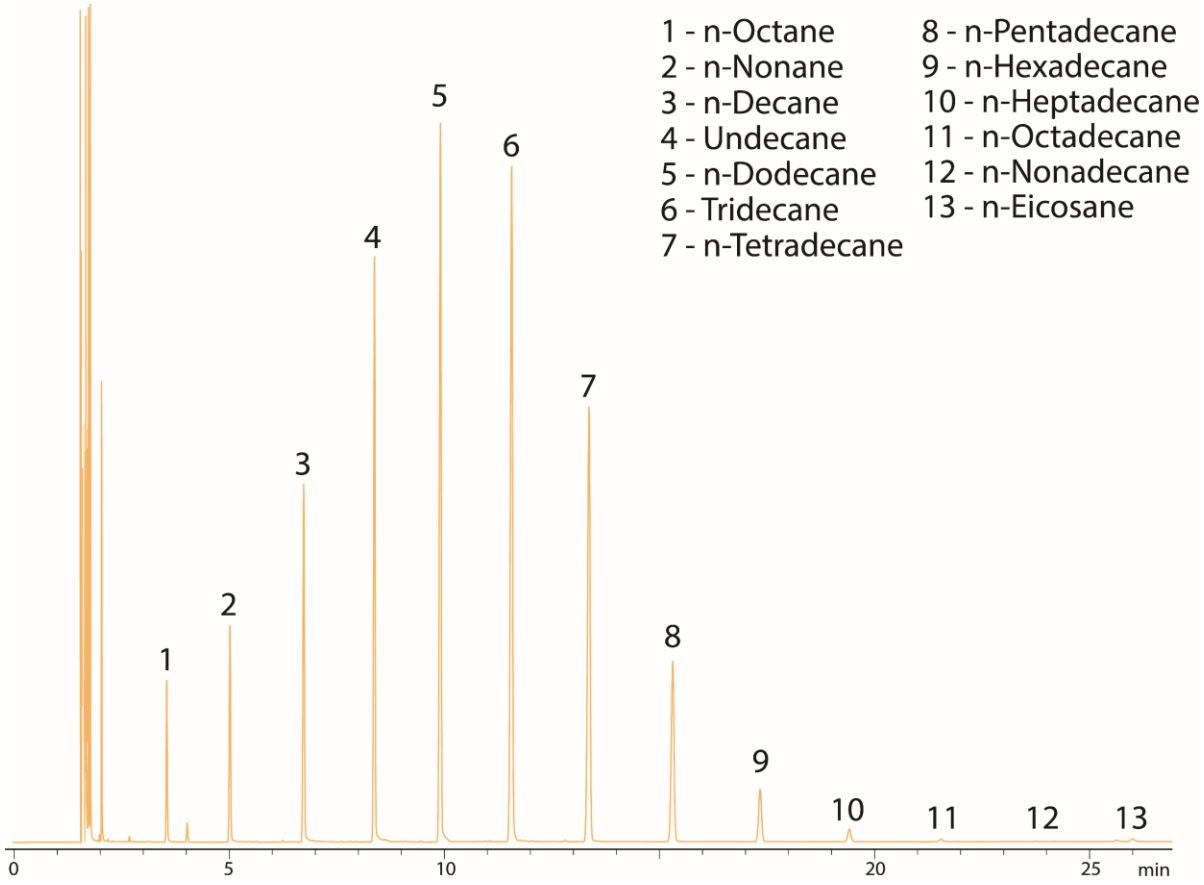

Figure 4: Eclipse FID2 chromatogram showing speciation of C8-C20 hydrocarbons.

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Thus, four aliquots of the same sample are injected down parallel paths, each aliquot being directed to the column of choice with its own temperature and pressure program. Simultaneous chromatograms are combined into a single digital report and transmitted as needed. Since this one analyzer addresses a single sample flow, the resulting **multidetector data provides greater accuracy, greater reproducibility (Fig. 5) and with overall reduced analysis time.**

A.

	Methane	Pentane	Hexane	Heptane	Octane	Nonane	Decane	Undecane
Day 1	2.744	3.619	4.687	6.645	9.581	13.197	17.099	21.035
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Retention Time								
Avg.	2.750	3.628	4.698	6.663	9.601	13.217	17.113	21.040
StDev	0.010	0.010	0.011	0.010	0.009	0.009	0.008	0.008
RSD%	**0.3733**	**0.2851**	**0.2249**	**0.1567**	**0.0960**	**0.0703**	**0.0461**	**0.0370**

Data from 8 injections of Hydrocarbon blend over 2 days

B.

	Methane	
Peak Areas	83767	83886
	84037	84020
	83813	83891
	83992	83966
	83727	83806
	83880	83859
Peak Area		
Avg.	83887	
StDev	100.155	
RSD%	**0.1194**	

Data from 12 injections of 5% Methane in Argon

Figure 5. Eclipse analyzers yield laboratory-quality retention times and peak areas showing excellent RSD %. **A.** Highly reproducible retention times are a function of temperature, pressure and backpressure control. **B.** Reproducible peak areas are a function of split inlet performance and mass flow control.

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Eclipse is, quite simply, the bright new future of process gas chromatography. Typical PGCs monitor 2-3 analytes isothermally from one process stream. Eclipse PGCs can monitor 20 analytes or more by using up to 6 capillary columns interrogating up to 16 sample streams. Moreover, Eclipse chromatographs offer MS, VUV, PDHID, TCD and FID detector combinations, all controlled by dedicated electronic pressure and flow controllers. The result is an online PGC that can finally do what it once took numerous lab GCs to do (Table 1).

The Eclipse suite of fully applicated PGC analyzers are ready to transform your online HPI processes.

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• Online MSD, VUV, PDHID, TCD and FID
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