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# Gas Analysis Capabilities

**Jayeshkumar Das, Ph.D.**

Operations Manager (Thermal & Gas analysis) & Senior Principal Scientist

April 26, 2023



[www.eag.com](http://www.eag.com)



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EAG  
Laboratories

# Eurofins EAG Laboratories

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600+  
HIGHLY EDUCATED EMPLOYEES



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IN 50 COUNTRIES



20+  
LOCATIONS

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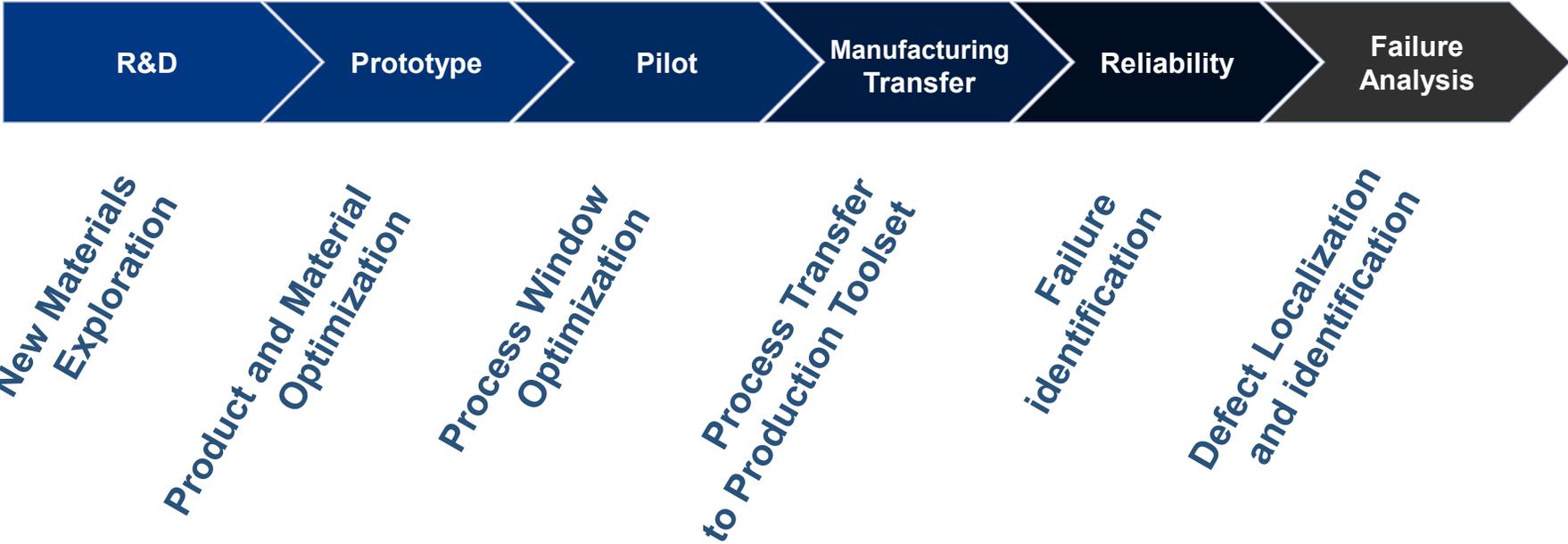
## ASIA

<b>FRANCE</b> Toulouse	<b>CHINA</b> Shanghai	<b>JAPAN</b> Tokyo
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<b>UNITED KINGDOM</b> London	<b>KOREA</b> Seoul	<b>AUSTRALIA</b> Sydney

Syracuse gas analysis capability after consolidating our RGA operations at Fort Collins, CO

# Solving Commercial Challenges from Concept through Commercialization

Client success requires control & optimization at all stages of a product's life cycle



**EAG provides the knowledge & appropriate tools to help clients *Faster and Better***

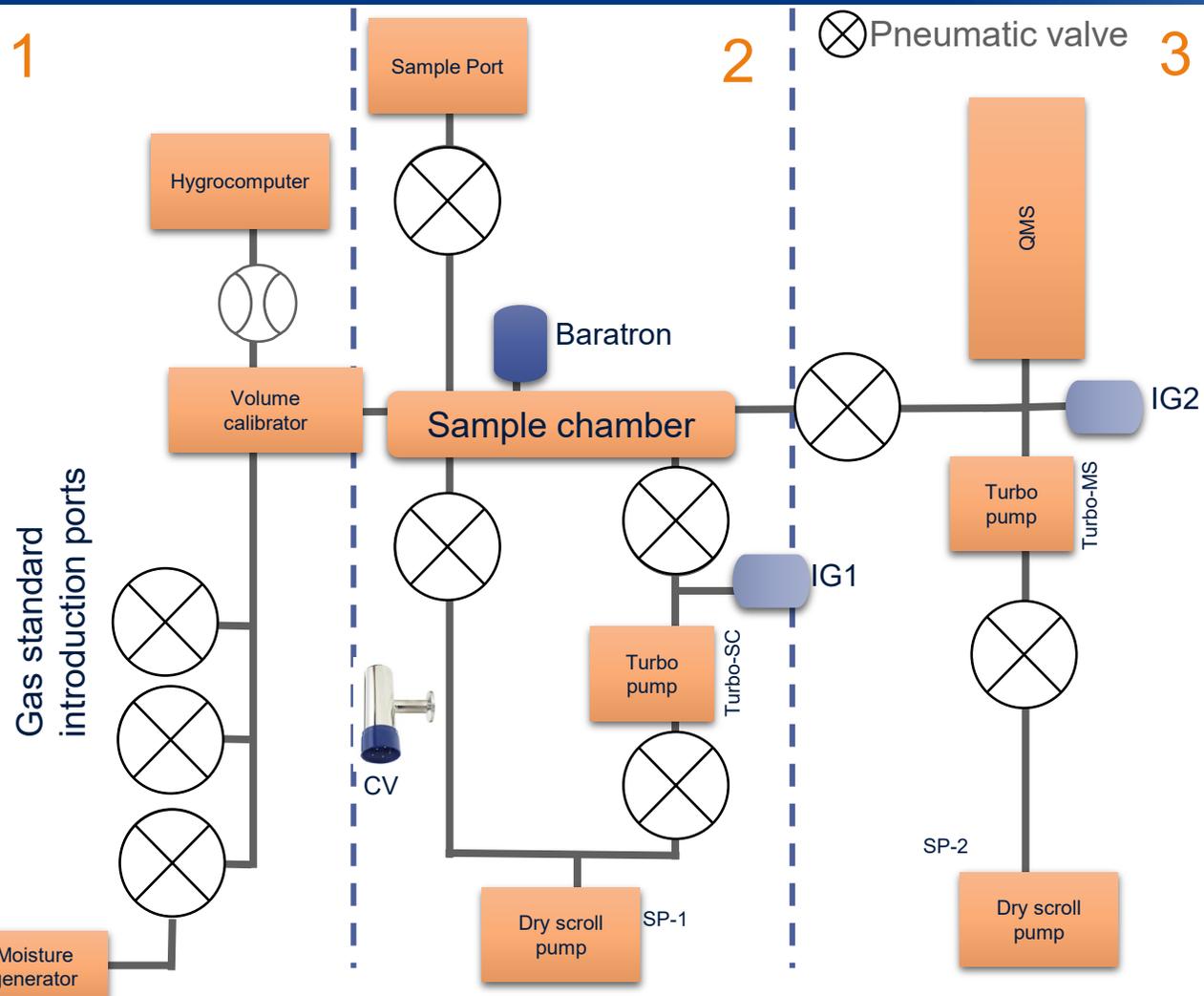
# History of RGA and Pernicka Test Methodology

- Late-70's - Residual Gas Analysis (RGA) method developed for high reliability, hermetically sealed devices in defense, aerospace and medical
- 1979 - Pernicka Corporation (John Pernicka) designs & builds first Mass Spectrometer for RGA testing
- Test method known today as MIL-STD 883/750 Test Method 1018
- 2018 - EAG Laboratories acquires Pernicka Corp and IP
- 2021 - Eurofins EAG Materials Science re-launches RGA testing laboratory in Liverpool, NY offering a full suite of gas analysis testing
- 2022 - DLA suitability to perform MIL-STD883/750 TM 1018 granted to EAG in NY; commercial testing now underway



**What are the components of RGA system?**

**What is the function of each component in RGA testing?**



(1) Calibration

(2) Sample loading and gas extraction

(3) Mass spectrometer

## RGA Software: MS control and DAQ

Automated valve control

Residual Gas Analysis Software (aar-guhs)

File Edit View Project Operate Tools Window Help

**System** Calibration Tools

Manual valve control

Baratron (Torr)	0.000	<input type="checkbox"/>
IG1 (Torr)	0.00E+0	<input type="checkbox"/>
IG2 (Torr)	2.07E-9	<input type="checkbox"/>
Fixture Temp (°C)	100	<input type="checkbox"/>
Chamber Temp (°C)	98	<input type="checkbox"/>

Load sample

Pump down

Scanning

- 2
- 3
- 4
- 14
- 16
- 17
- 18
- 20
- 22
- 28
- 29
- 31
- 32
- 34
- 36
- 40
- 41
- 43
- 44
- 50
- 55
- 57
- 67
- 69
- 78
- 84
- 119
- 131
- 132
- 134
- BT
- IG1
- IG2
- FT
- ST

700 RGA-166 SEM 1398 5/20 cycles completed, Next: full scan (1 to 140 amu)...

Logged in as: Jayeshkumar Das

Windows login

Is this a new RGA system for EAG or is it the same PERNICKA RGA system that EAG acquired a few years ago?

RGA-166 1.0 (Built in Mar 1996)	RGA-166 2.0 ( upgrading completed on Jan 2022)	Advantages & details
Mass analyzer controller QMG 422	Mass analyzer controller QMG 700	<ul style="list-style-type: none"> <li>QMG-422: Obsolete</li> <li>QMG-700: latest technology with higher stability and software functionality</li> </ul>
Hygrocomputer: General Eastern Hygro-M3	Hygrocomputer: EdgeTech DewMaster	<ul style="list-style-type: none"> <li>Hygro-M3: obsolete, no technical support</li> <li>DewMaster: new generation, higher stability and software functionality, US based technical support</li> </ul>
Moisture generation: Manual mixing of dry and wet room air	Moisture generation: KinTek automated moisture generator (moisture + nitrogen balance)	<ul style="list-style-type: none"> <li>Precise moisture generation within short time</li> <li>Higher reproducibility &amp; reliability</li> </ul>
Software: Quadstar: MS control Excel: data analysis & reporting	Indigenously built LabVIEW software for (1) MS control, (2) data analysis and reporting	<ul style="list-style-type: none"> <li>Total software control for testing and data processing, integrated with EAG's job management software for data handling and reporting.</li> </ul>
Two oil pumps for turbo pumps & bypass line	Two scroll pumps for backing turbo pumps and bypass line	<ul style="list-style-type: none"> <li>Complete oil free vacuum system</li> <li>Easier maintenance</li> </ul>
Two water cooled turbo pumps	Two air cooled new generation turbo pumps	<ul style="list-style-type: none"> <li>No need of water chiller</li> <li>Turbo control through software</li> <li>Easier maintenance</li> </ul>
Valve control: Solenoid manual/auto control	New generation solenoid control	<ul style="list-style-type: none"> <li>New solenoid controlled by software</li> <li>Consistent valve operation, independent of users</li> </ul>
Vacuum line: stainless bellow tubes	Vacuum line: ¼" stainless tubing	<ul style="list-style-type: none"> <li>Substantially reduce volume and surface area, enhance vacuum quality</li> </ul>
Old temperature controllers	Omega high performance, sensitive temperature controller	<ul style="list-style-type: none"> <li>Higher stability and controlled through software</li> </ul>

**What is the minimum volume of sample needed for RGA?  
What size of cavity is minimal needed to measure the gas  
content?**



DEFENSE LOGISTICS AGENCY  
LAND AND MARITIME  
POST OFFICE BOX 3990  
COLUMBUS, OH 43218-3990

November 1, 2022

Ms. Frona Wilson  
General Manager  
EAG  
Eurofins Material Science  
103 Commerce Blvd.  
Liverpool, NY 13088

Dear Ms. Wilson:

Re: Commercial Laboratory Suitability Status, MIL-STD-883/MIL-STD-750, FSC 5962/5961, VQE-23-037427, CAGE Code: 75V79, Control Number: 082377

As a result of our audit during the week of August 22, 2022, your facility at the above address is considered suitably equipped to perform testing on military devices for the following test methods of MIL-STD-883 and MIL-STD-750:

<u>TEST</u>	<u>METHOD (883/750)</u>	<u>CONDITION (883/750)</u>
Stabilization Bake	1008/ n/a	C
Internal Water Vapor Content	1018/1018	(volumes listed below)
<u>System Serial Number</u>	<u>Volume</u>	
0166	.01 to 20cm <sup>3</sup>	

Our current suitability range for volume is between 20 cc to 0.01 cc.

**How do you read/understand the typical RGA test report?**

Client Name:	<b>Client information</b>
Contact Name:	
EAG job#:	
PO#:	
Qty of Parts:	

Date of analysis	08/23/22 14:16:30
Analysis method	RMIL
Sample ID (EAG)	S220822125
Part #	RA
	2
Serial #	10110060
Date Code	na
Inlet Pressure (Torr)	2.8680
Inlet Temp (°C)	9.9378E+1
Instrument ID	S-RGA166
Analyst	JD
<b>Gases Analyzed (Vol%)</b>	
Hydrogen	b.d.
Helium	b.d.
Methane	b.d.
Moisture	<b>0.6258</b>
Nitrogen	78.2050
Carbon Monoxide	b.d.
Oxygen	<b>20.1281</b>
Argon	0.8180
Carbon Dioxide	0.2179
Total HC. & Org.	b.d.
Fluorocarbons	<b>b.d.</b>
Ammonia	b.d.
Neon	b.d.
Krypton	b.d.
Xenon	b.d.
IG2 (Torr)	3.807E-6

1 vol% = 10,000 ppmv, b.d.: below detection (Fluorocarbons: <50 ppmv, other gases: <100 ppmv)  
Report Date: 9/9/2022 6:30 PM

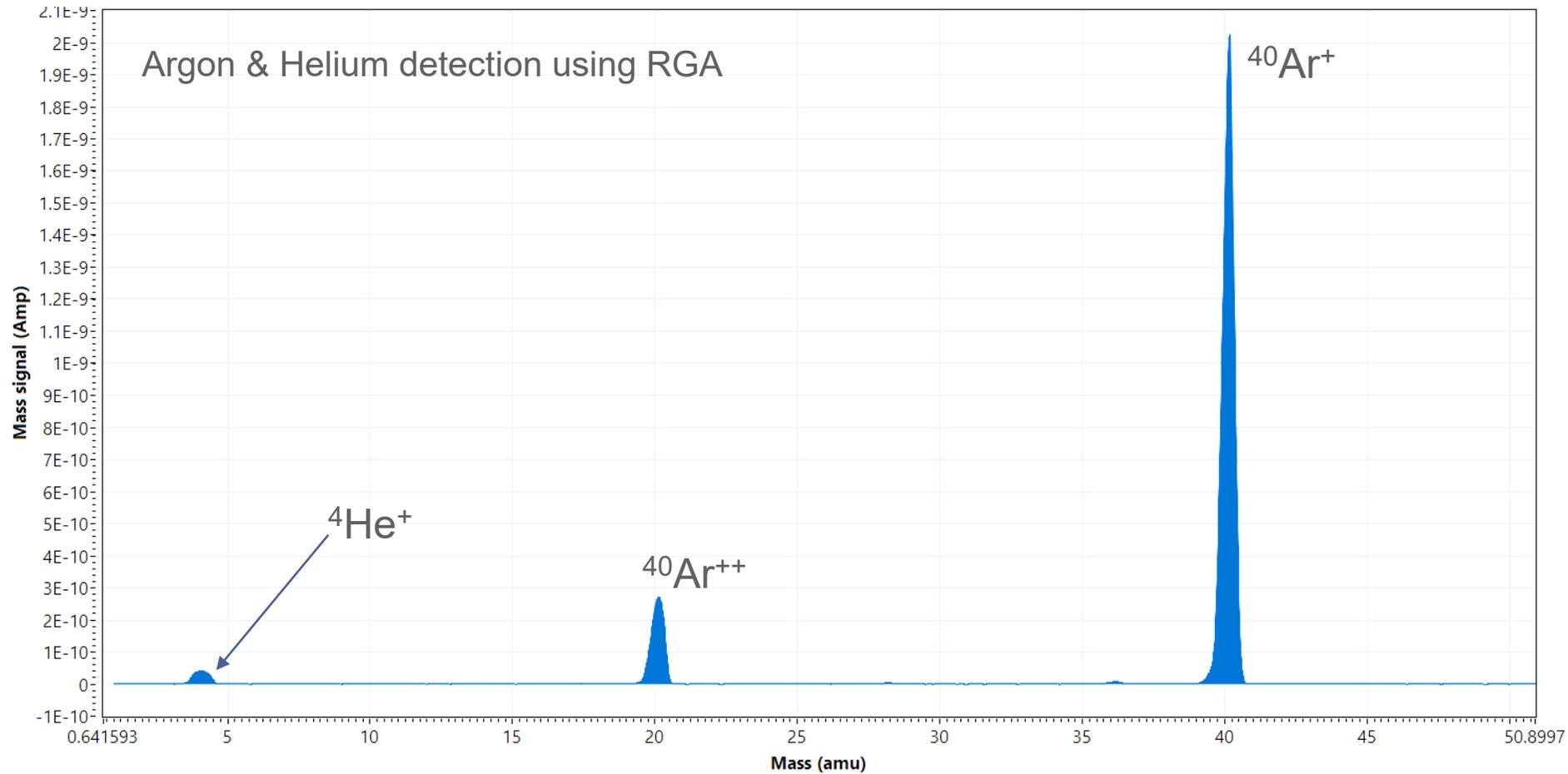
Reviewed by: (Jayeshkumar Das)  
Comment: MIL-STD 750/883--Internal Water Vapor Content Analysis-TM1018  
Prebake : 100°C (16-24 hr)

Measurement uncertainty: Based on SPC for moisture deviation, the general uncertainty is < 2%. Results relate only to the items tested.  
Eurofins EAG Materials Science, LLC does not perform sampling. Analysis was performed on samples and sample locations specified and agreed upon by the client prior to analysis.  
This report shall not be reproduced except in full without written approval of the laboratory.

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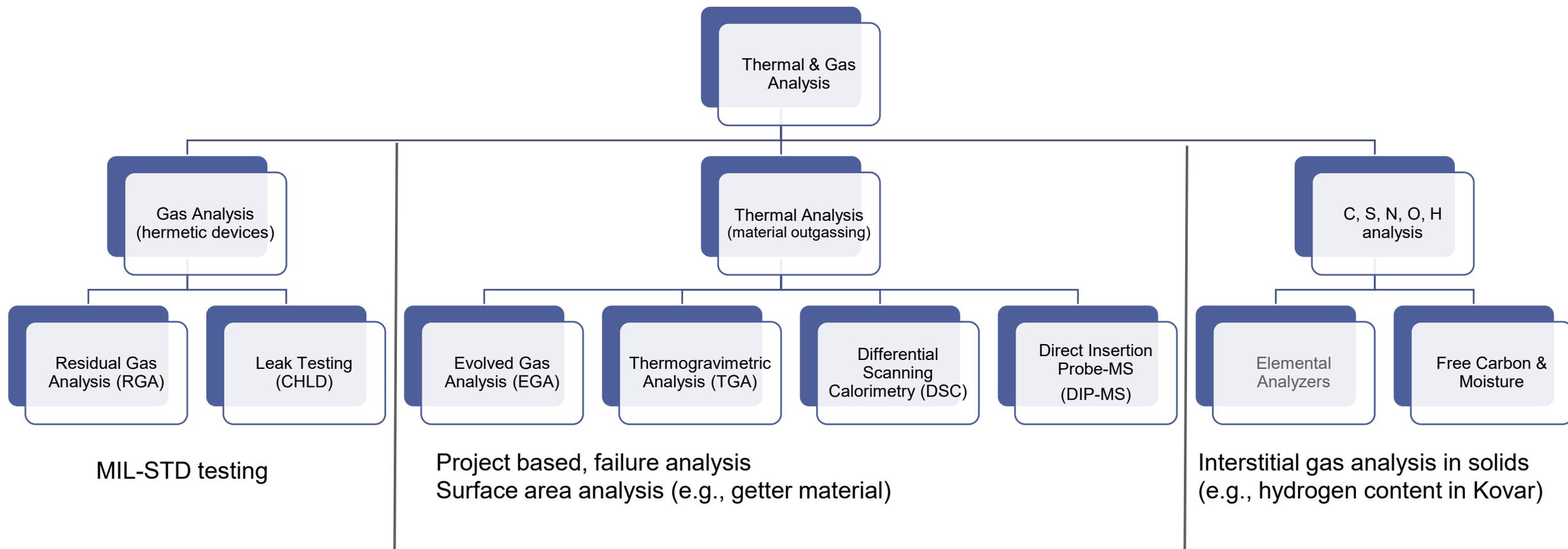
<b>Gases Analyzed (Vol%)</b>	
Hydrogen	b.d.
Helium	b.d.
Methane	b.d.
Moisture	<b>0.6258</b>
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Oxygen	<b>20.1281</b>
Argon	0.8180
Carbon Dioxide	0.2179
Total HC. & Org.	b.d.
Fluorocarbons	<b>b.d.</b>
Ammonia	b.d.
Neon	b.d.
Krypton	b.d.
Xenon	b.d.
IG2 (Torr)	3.807E-6

# New feature: Analog scan from 1-140 amu



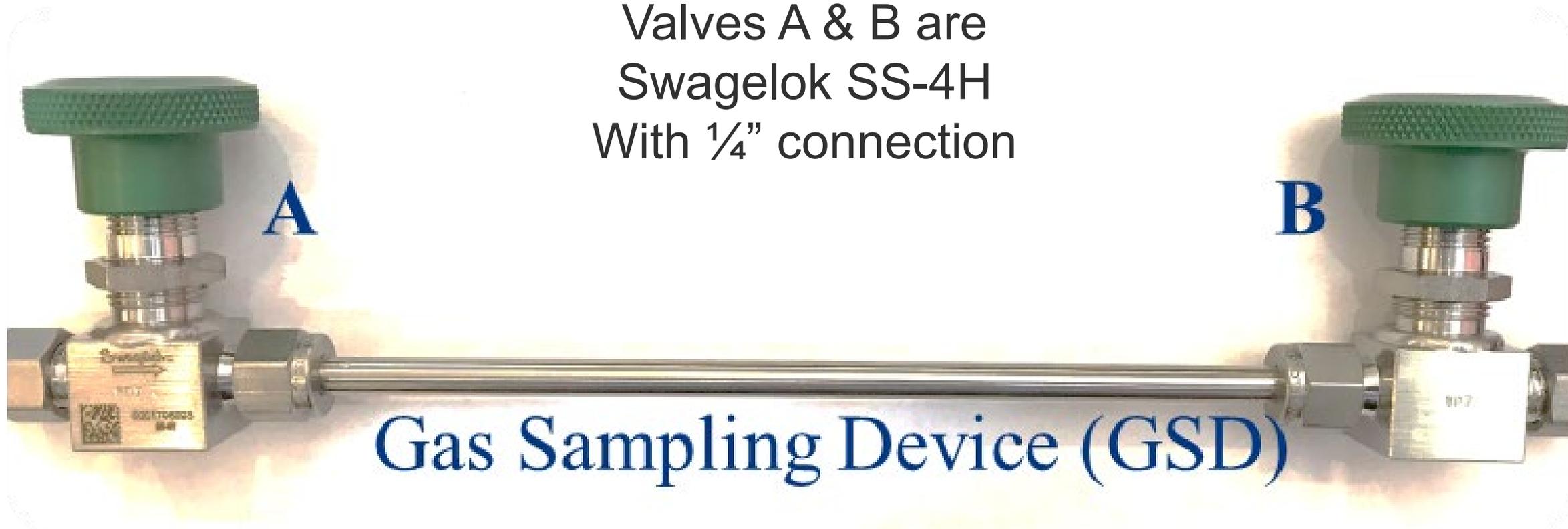
Example for mass scan performed on Ar-He gas by RGA

**What other gas analysis capabilities do you offer at EAG?**



What are the options for in-line continuous hydrogen purity monitoring?

Valves A & B are  
Swagelok SS-4H  
With 1/4" connection



**Gas Sampling Device (GSD)**

# Why Choose Eurofins EAG Laboratories?

- Client confidentiality is core to our business
- We are established thought leaders in investigative science
- We have an extensive knowledge base and skilled expertise
- We can offer a multi-disciplinary approach to support you
- We can scale with your demand and meet your time constraints
- We own more than 2,500 instruments worldwide
- We are a global leader for materials testing services
- ISO 9001 and 17025 quality accreditations

**We can help solve your materials and engineering related product problems!**