



Isotope Ratio Measurements by IRMS Instrument in TUBITAK UME



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10th October 2019
Bern / Switzerland

- EA-IRMS ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Measurements)
- TCEA-IRMS ($\delta^{18}\text{O}$ and $\delta^2\text{H}$ Measurements)
- GC-IRMS ($\delta^{13}\text{C}$, $\delta^{18}\text{O}$ and $\delta^2\text{H}$ Measurements)
- Infrastructure of Gas Metrology Laboratory
- Project and Comparisons

EA-IRMS ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Measurements)

$\delta^{13}\text{C}$ Measurements:

Bulk honey, molasses, juice, sugar and sugary products, biofuels, biodiesel, vegetarian oil, seed samples



Allows the precise measurements of mixture of stable isotopes

ThermoFinnigan MAT 253 IRMS



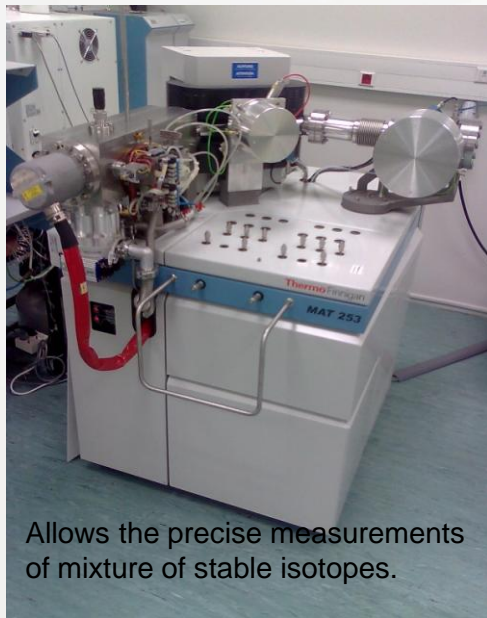
Elemental Analyzer (EA)



Continuous flow III

$\delta^{15}\text{N}$ Measurements:

Fish muscle, wheat, leaf samples



ThermoFinnigan MAT 253 IRMS



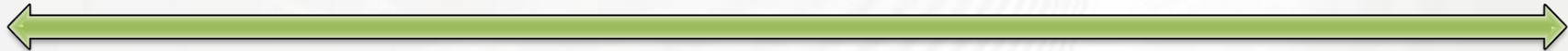
Elemental Analyzer (EA)



Continuous flow III

$\delta^{18}\text{O}$ Measurements:

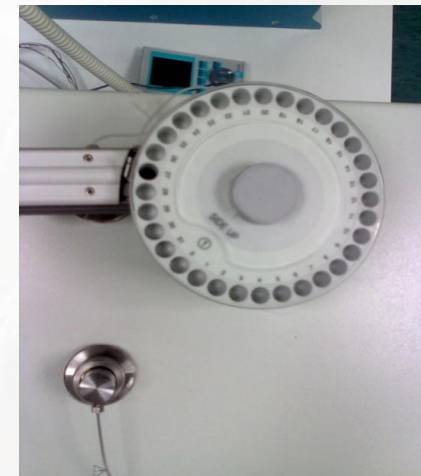
Underground water, biofuels, vegetarian oil, seeds, clay, juice samples



Thermo Finnigan MAT 253 IRMS



Temperature Conversion
Elemental Analyzer (TC/EA)

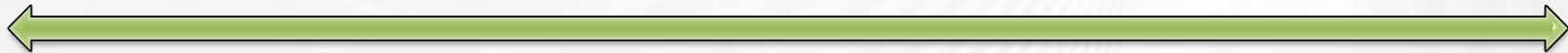


Solid autosampler unit

Solid / liquid autosampler units for TCEA

$\delta^2\text{H}$ Measurements:

Underground water, biofuels, vegetarian oil, seeds, clay samples



Thermo Finnigan MAT 253 IRMS



Temperature Conversion
Elemental Analyzer (TC/EA)

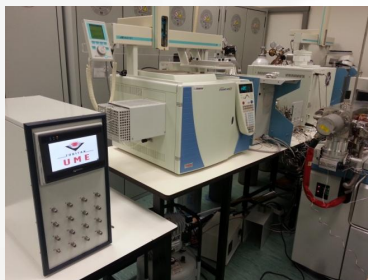


Solid autosampler unit

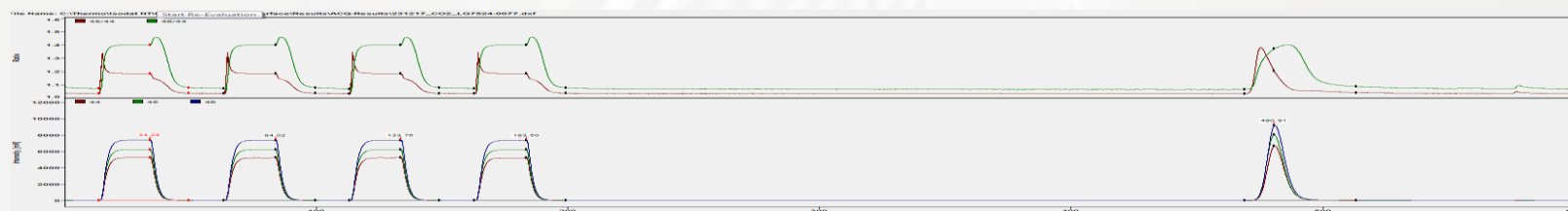
We have solid and liquid autosampler units for TCEA.

$\delta^{13}\text{C}$ Measurements:

Methyl mercury in fish samples, pure and 400 ppm CO_2 and CH_4 gas samples



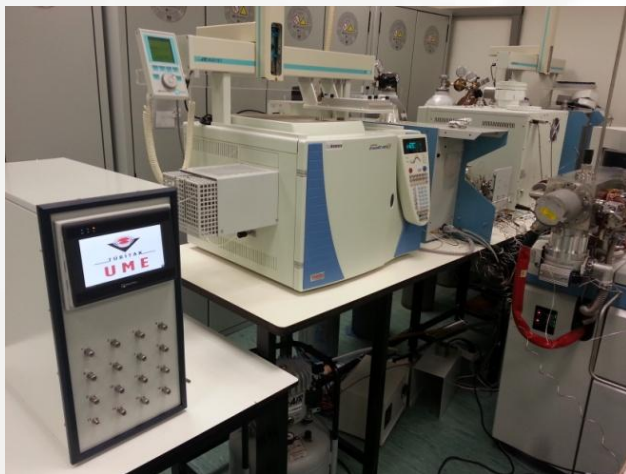
Gas autosampler unit coupled to GC-IRMS Thermo Finnigan MAT 253



Sample chromatogram for pure CO_2 by GC-IRMS

$\delta^{18}\text{O}$ Measurements:

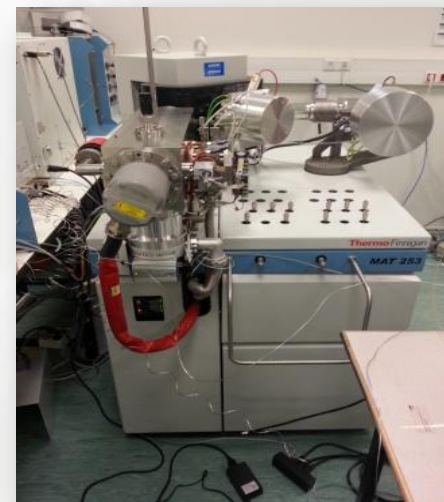
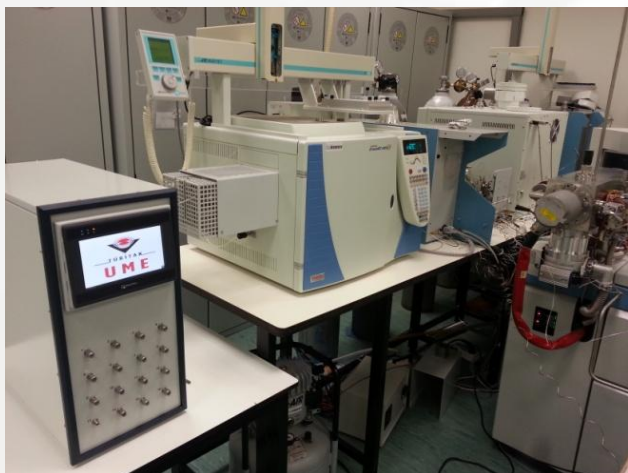
Pure and 400 ppm CO_2 gas samples



Gas autosampler unit coupled to GC-IRMS Thermo Finnigan MAT 253

$\delta^2\text{H}$ Measurements:

CH_4 gas samples



Gas autosampler unit coupled to GC-IRMS Thermo Finnigan MAT 253

Gas Mixture Preparation



Turbomolecular vacuum pump system



Gas filling station

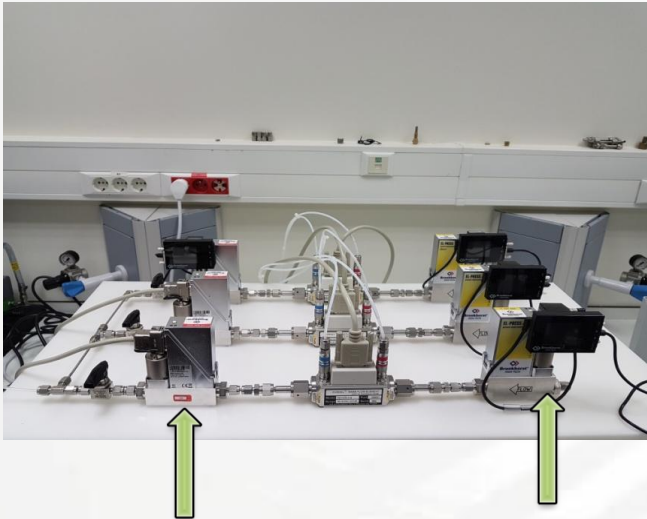


Cylinder weighing system



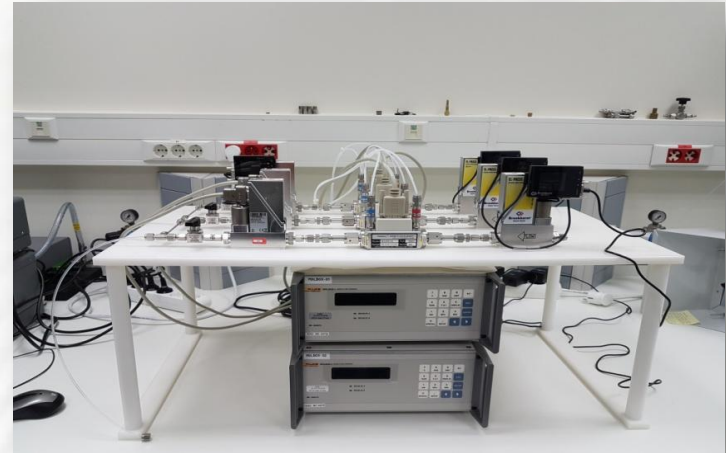
Cylinder roller (for homogenization)

Gas Mixture Preparation (diluting system)



MF (mass flow controller) PC (pressure controller)

Molbloc-L flow element PC



Molbox Units



CRDS

Gas Analysis



CRDS: Picarro G2401 CO/CO₂/CH₄/H₂O Analyzer
equipped with 16-Port Distribution Manifold

ENG09-Metrology for Biofuels Project (2010-2013)

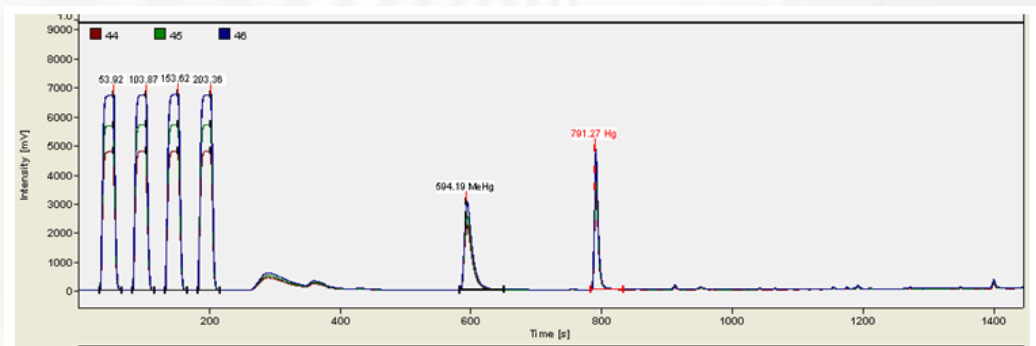
$\delta^{13}\text{C}$, $\delta^{18}\text{O}$ and $\delta^2\text{H}$ Measurements (TCEA-IRMS):

Biofuels, biodiesel, oil and seed samples



ENV51-Traceability for Mercury Measurements (Metra project, 2014-2017)

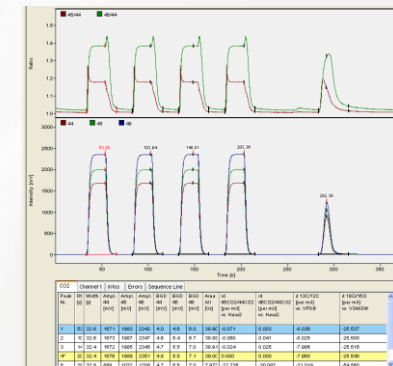
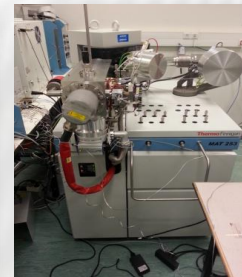
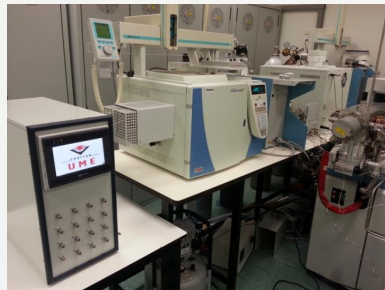
$\delta^{13}\text{C}$ Measurements (GC-IRMS): Fish samples



ENV52-Metrology for high-impact greenhouse gases (highgas project, 2014-2017)

$\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ Measurements (GC-IRMS):

Pure and 400 ppm CO_2 gas samples



Gas autosampler unit coupled to GC-IRMS Thermo Finnigan MAT 253

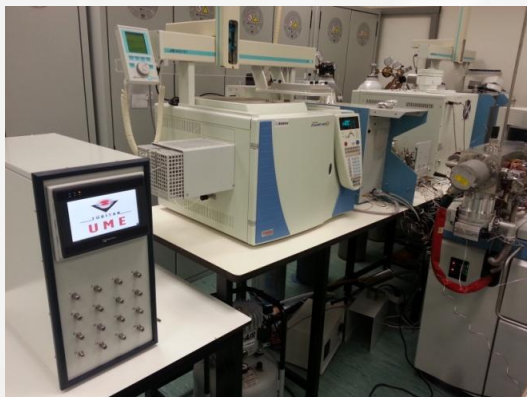
Sample chromatogram for 400 ppm CO_2 in air measured by GC-IRMS

ENG54-Metrology for Biogas (biogas project, 2014-2017)

$\delta^{13}\text{C}$ and $\delta^2\text{H}$ Measurements (GC-IRMS): CH_4 gas samples



METROLOGY for
BIOGAS

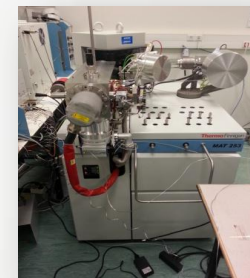
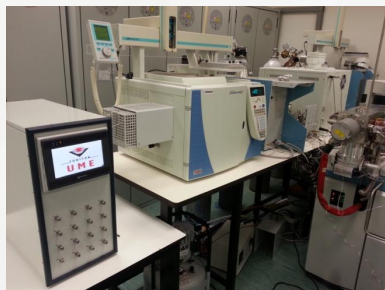


Gas autosampler unit coupled to GC-IRMS Thermo Finnigan MAT 253

16ENV06-Stable isotope reference standards (SIRS project)

$\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ Measurements (GC-IRMS): pure and 400 ppm CO_2 gas samples

Preperation of pure and 400 ppm CO_2 gas mixtures



Gas autosampler unit coupled to GC-IRMS Thermo Finnigan MAT 253

Key Comparison: Carbon stable isotope ratio delta values in honey (CCQM-K140)

$\delta^{13}\text{C}$ Measurements (EA-IRMS): Honey CRM 1312

KEY COMPARISON

CCQM-K140: carbon stable isotope ratio delta values in honey

P J H Dunn¹, H Goenaga-Infante¹, A C Goren², A Şimşek², M Bilsel², N Ogrinc³, P Armishaw⁴ and L Hai⁵

[Metrologia](#), [Volume 54](#), [Technical Supplement](#)

Participants to CCQM-K140

- IJS
- LGC
- NIM
- NMIA
- UME



ThermoFinnigan MAT 253
Isotope Ratio Mass Spectrometer (IRMS)



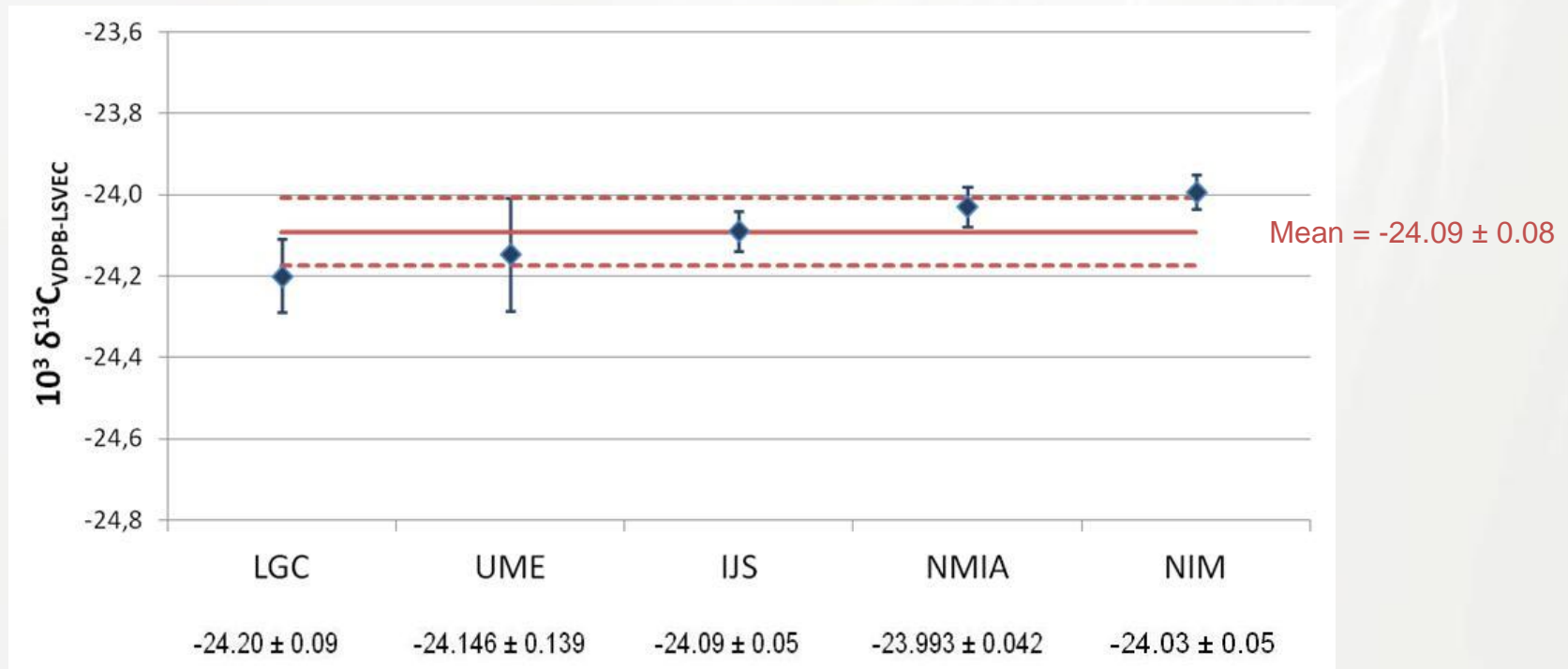
Elemental Analyzer
(EA)



Continuous flow

Key Comparison: (CCQM-K140)

K140 Results



Standart uncertainties, k=1

Key Comparison CCQM-P204

Key Comparison: CO₂ Isotope Ratios ($\delta^{13}\text{C}$ and $\delta^{18}\text{O}$) in pure CO₂ CCQM-P204

We purchased the cylinders and valves for the comparison of CCQM-P204

Description	Quantity
Part No.: SS-600-P Description: 316 Stainless Steel Plug for 3/8 in. Swagelok Tube Fitting	10
Part No.: SS-4CS-TW-50 Description: 316 Stainless Steel Single Ended Miniature Sample Cylinder, 50 cm ³ , 1000 psig (68.9bar)	10
Part No.: SS-6BW Description: Stainless Steel Bellows Sealed Valve, Welded, Spherical Stem Tip, 3/8 in. Swagelok Tube Fitting	10



Thank you



for your attention

