

Introduction to FIGAERO Filter Inlet for Gases and AEROsols

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Canagaratna, John Jayne, Douglas Worsnop

Outline

- Background
- How it works
- Application examples

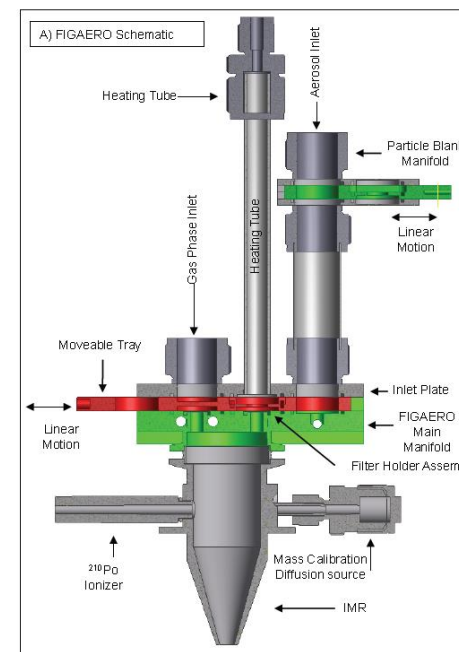
Development of FIGAERO

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Atmospheric
Measurement
Techniques

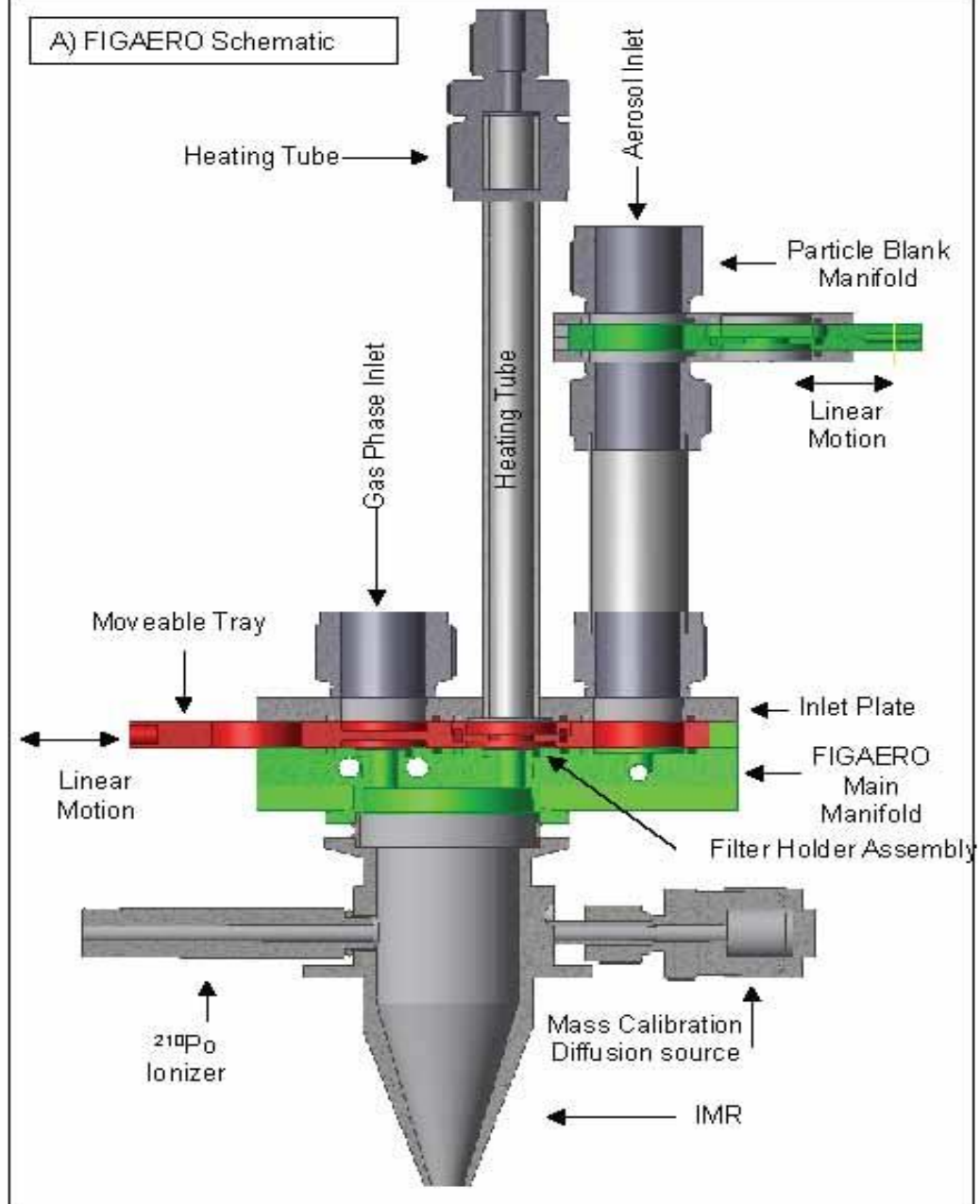
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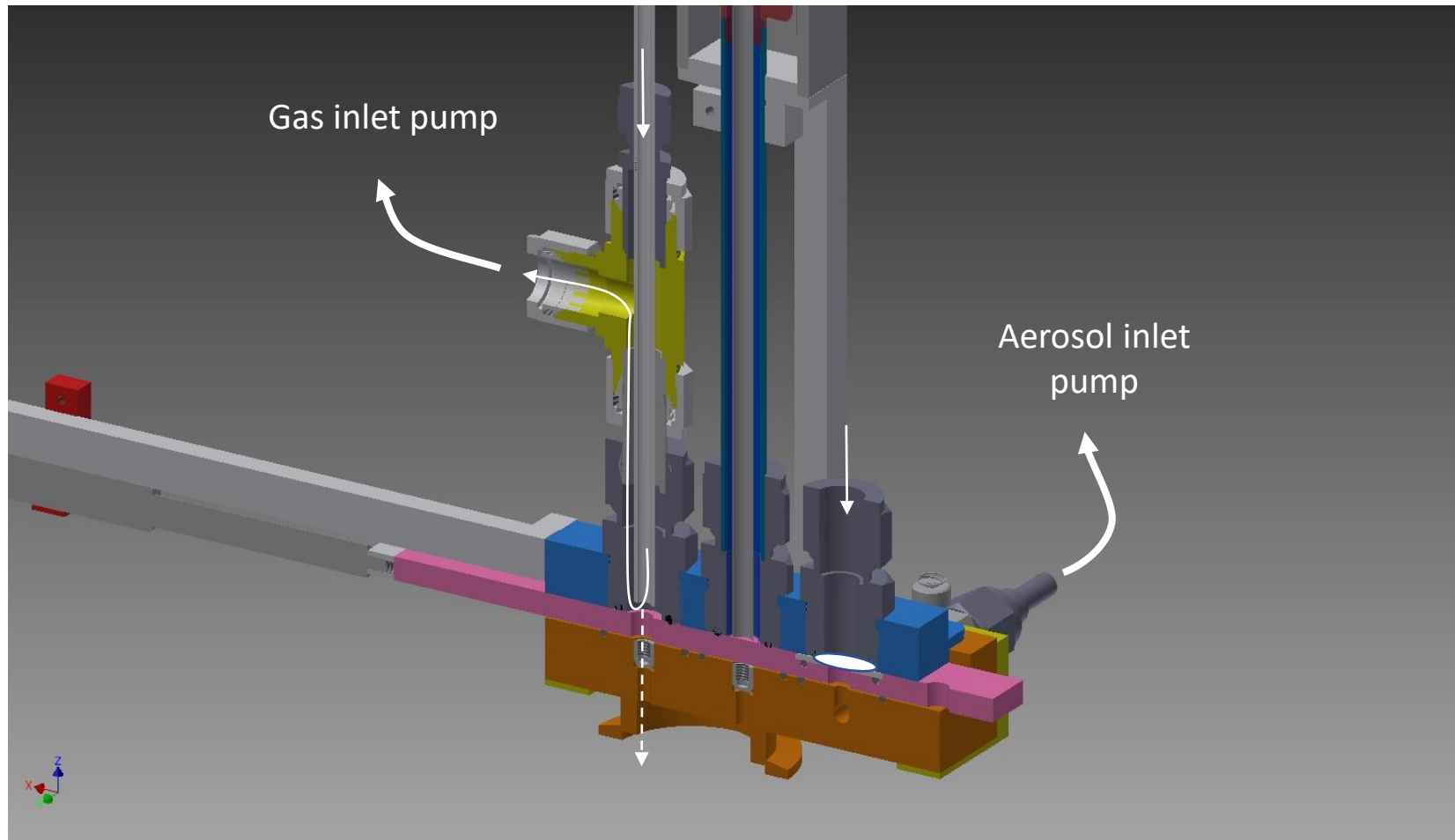
**A novel method for online analysis of gas and particle composition:
description and evaluation of a Filter Inlet for Gases and AEROsols
(FIGAERO)**

F. D. Lopez-Hilfiker¹, C. Mohr¹, M. Ehn^{2,3}, F. Rubach³, E. Kleist⁴, J. Wildt⁴, Th. F. Mentel³, A. Lutz⁵, M. Hallquist⁵,
D. Worsnop^{2,6}, and J. A. Thornton^{1,2,3}

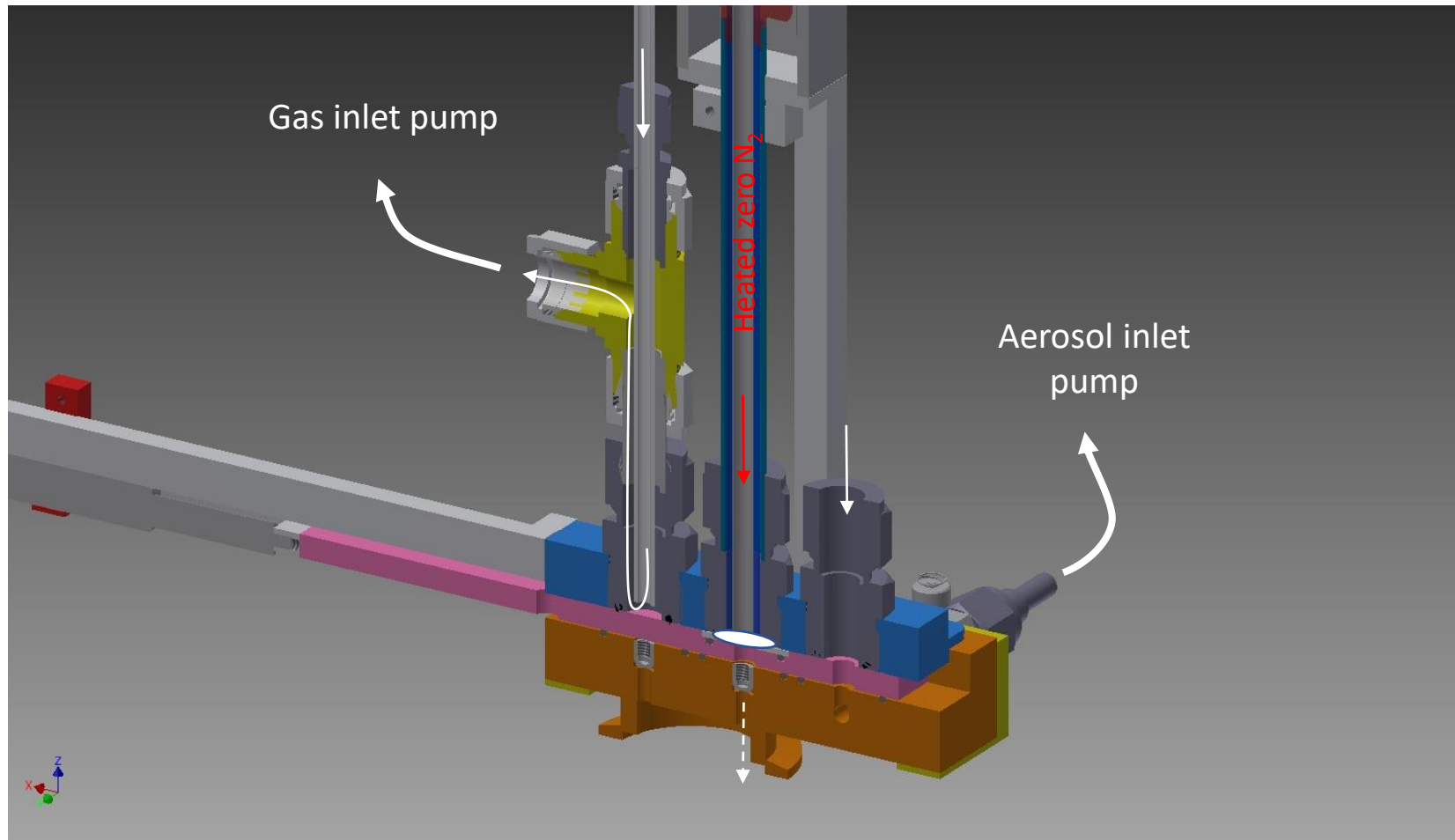
A) FIGAERO Schematic



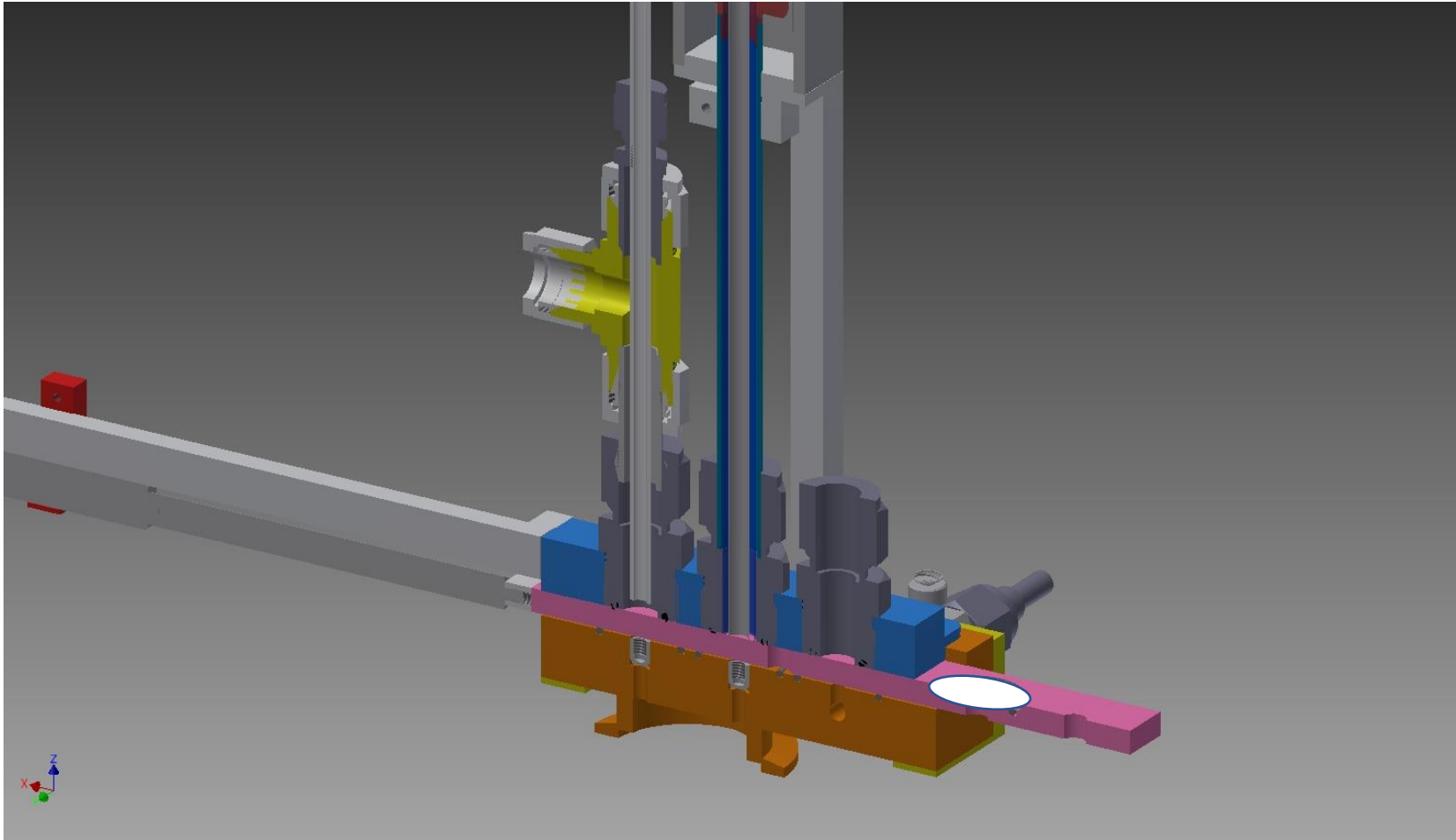
Gas Sampling & Filter Loading



Filter Desorption



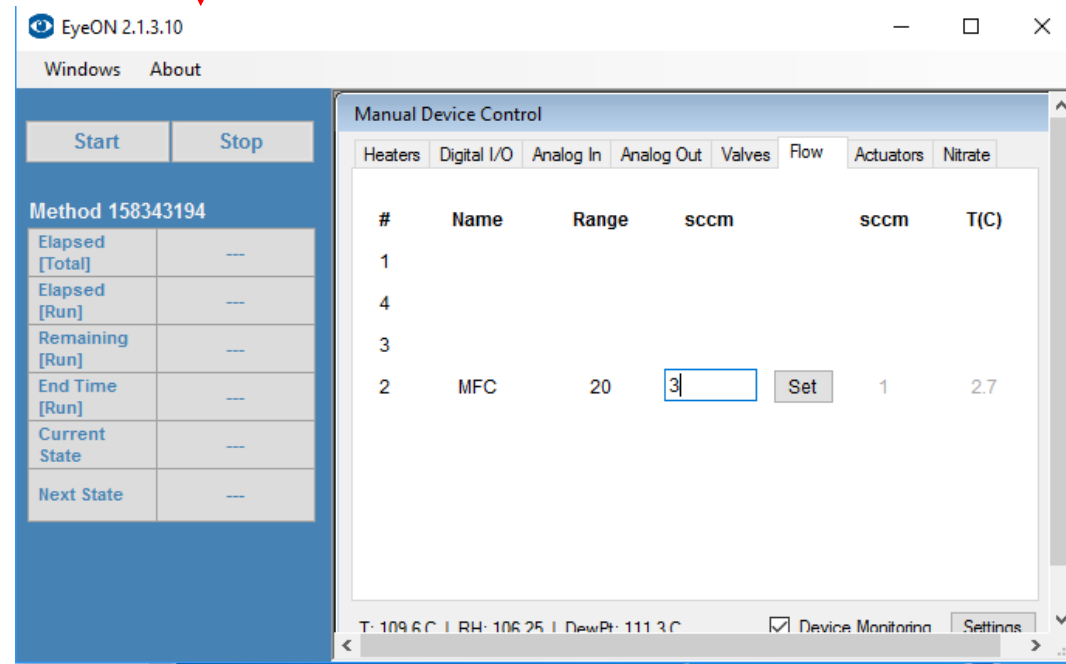
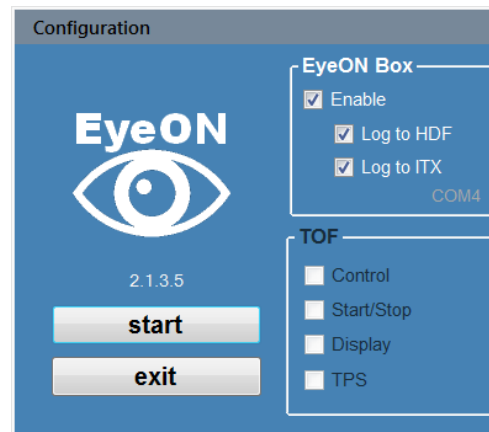
Filter Replacement



Pall, Zeflour 2 um pore size, p/n 60048

EyeOn Control System

General Purpose Sequencing and Peripheral Controller and Logger
Writes data into HDF files



What basic information can we get with FIGAERO?

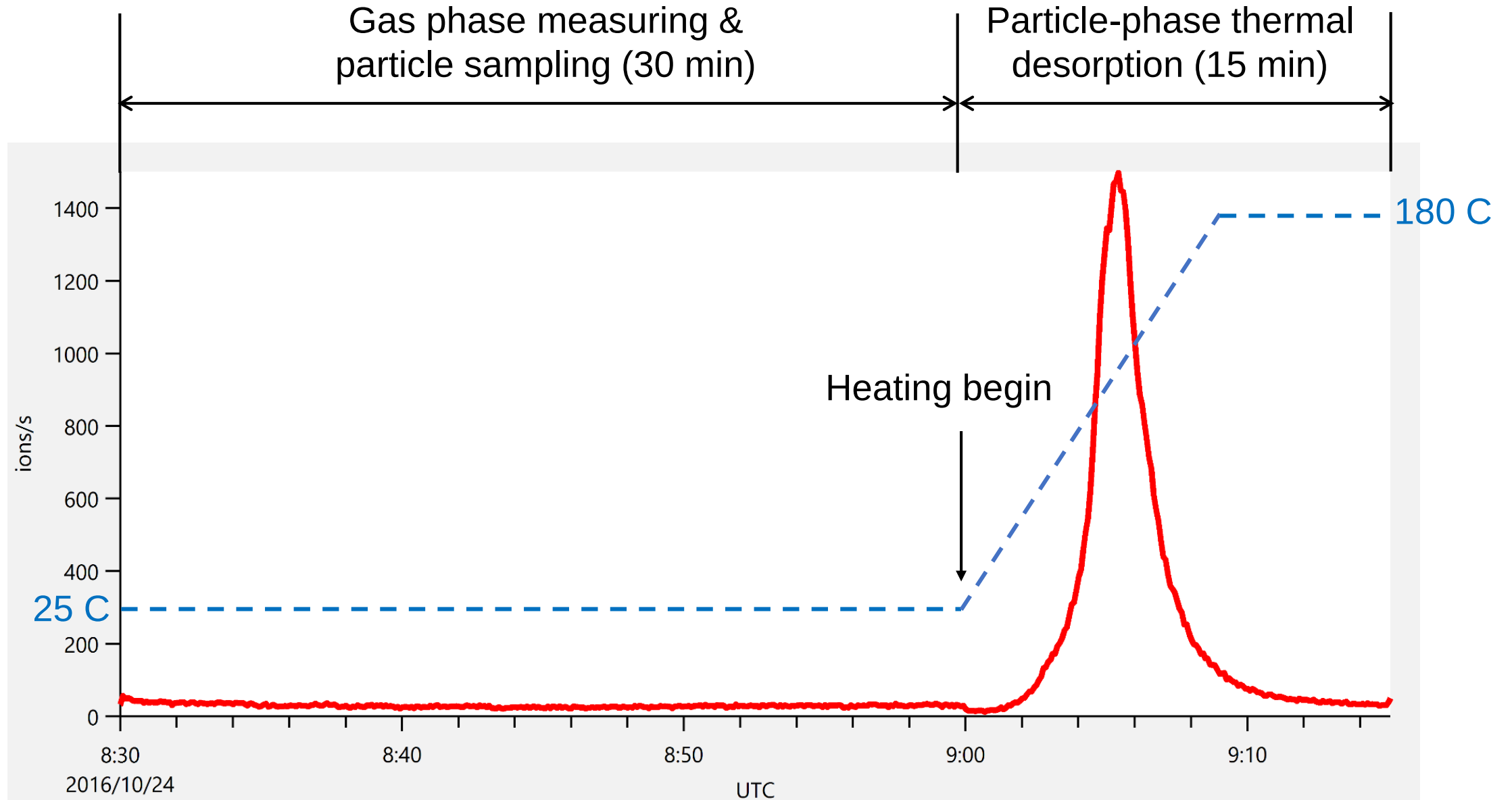
Gas phase

- 1. Traditional CIMS measurement, **compositions, concentrations.....**

Particle phase

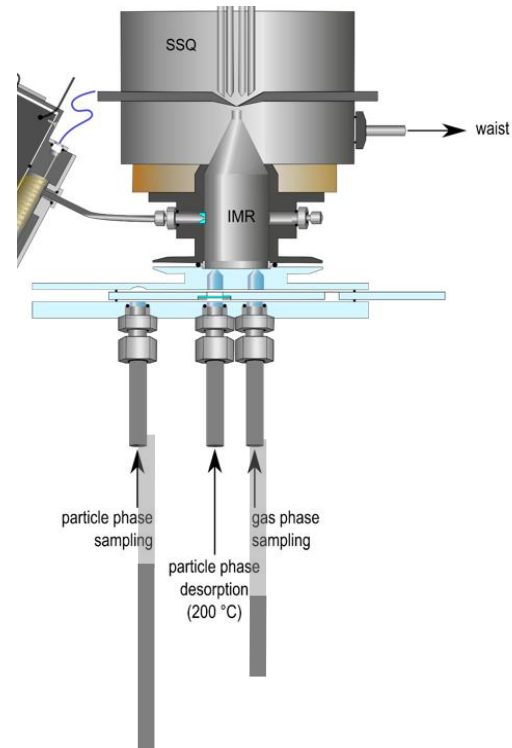
- 2. Vaporization. **Particle phase chemical information.**
- 3. Thermogram. **Volatility**

A typical gas sampling-thermal desorption cycle

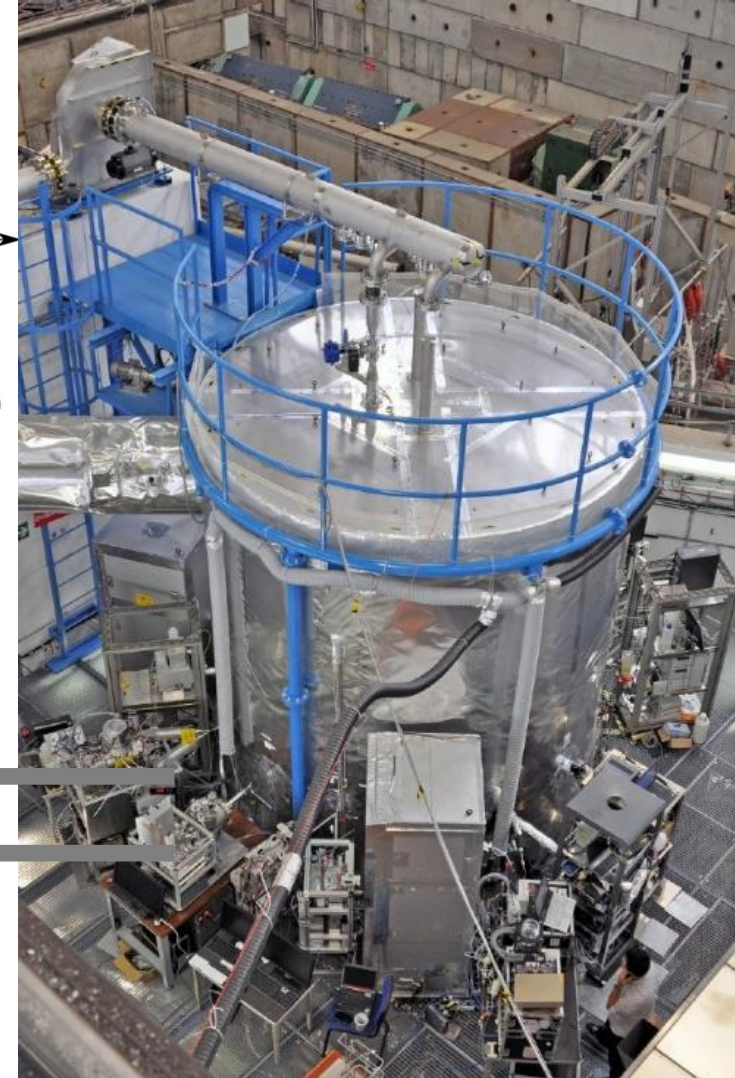
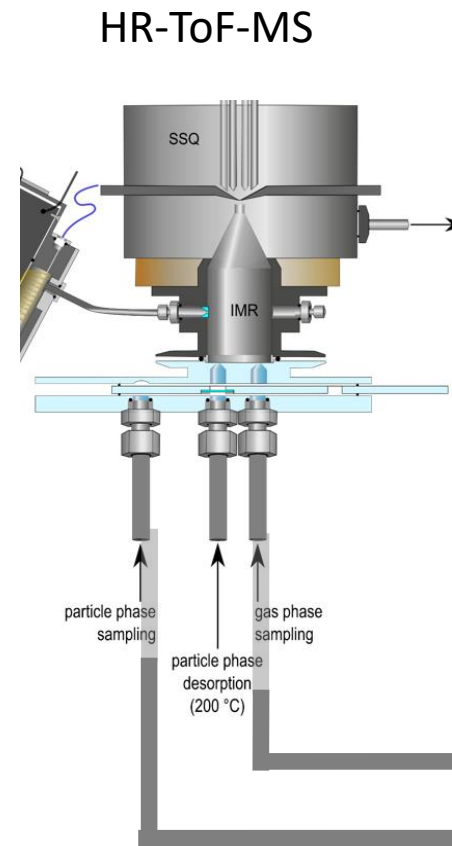


FIGAERO Application, ambient

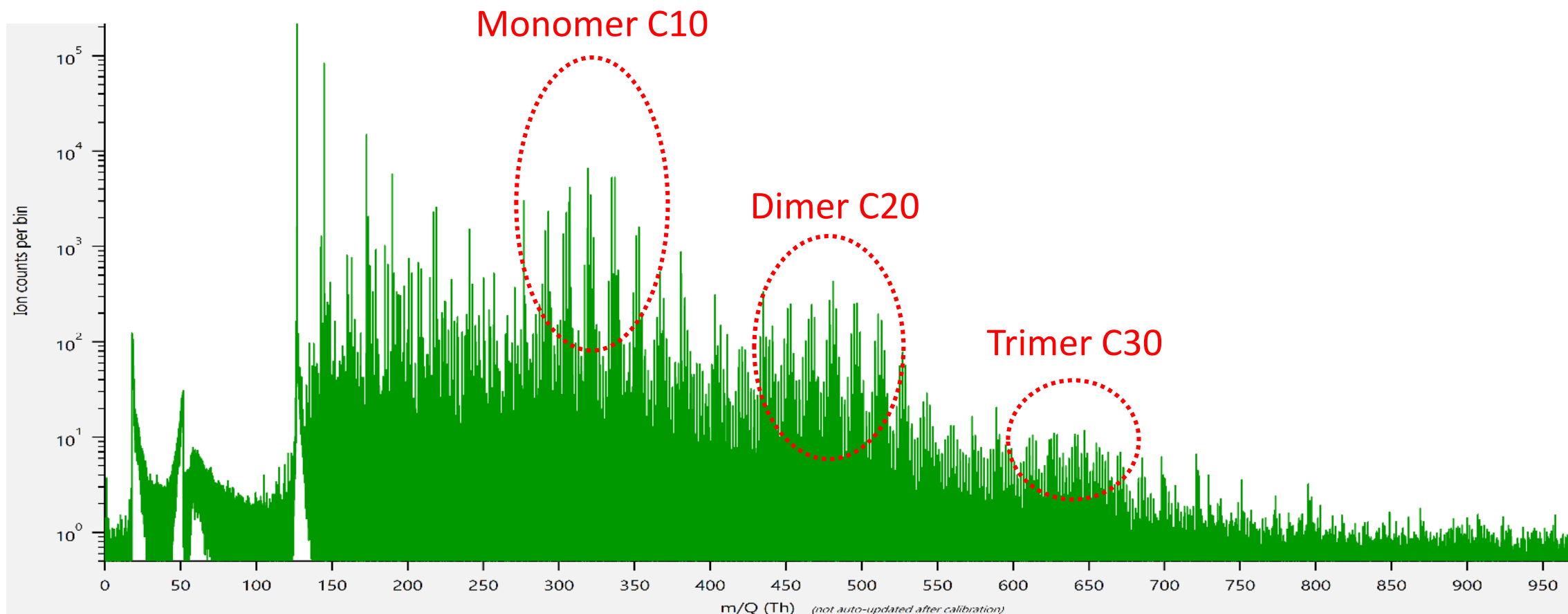
HR-ToF-MS



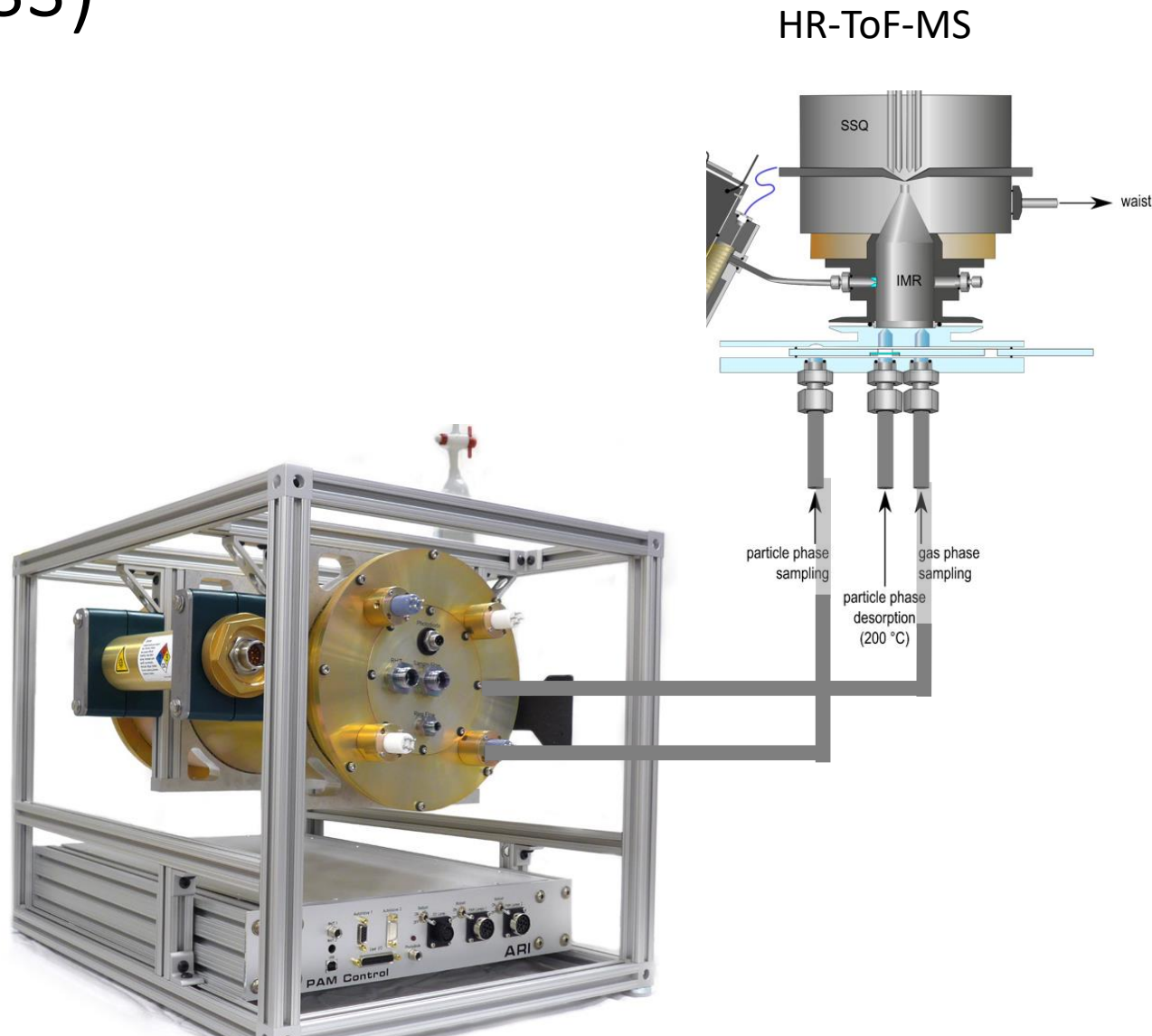
FIGAERO Application, chamber



Particle-phase MS of oxidation products from Naphthalene+OH

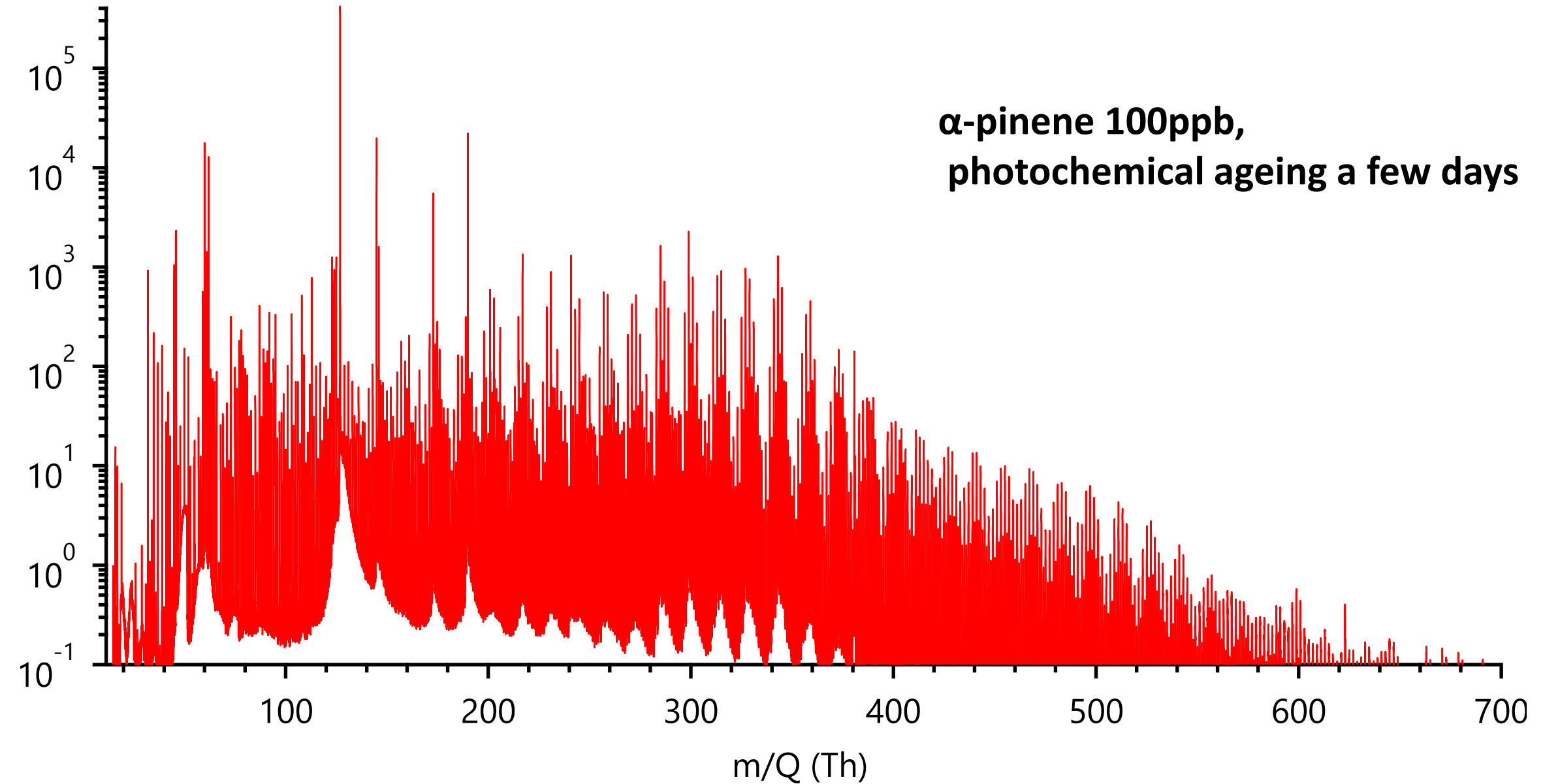


FIGAERO Application, PAM (Potential Aerosol Mass)

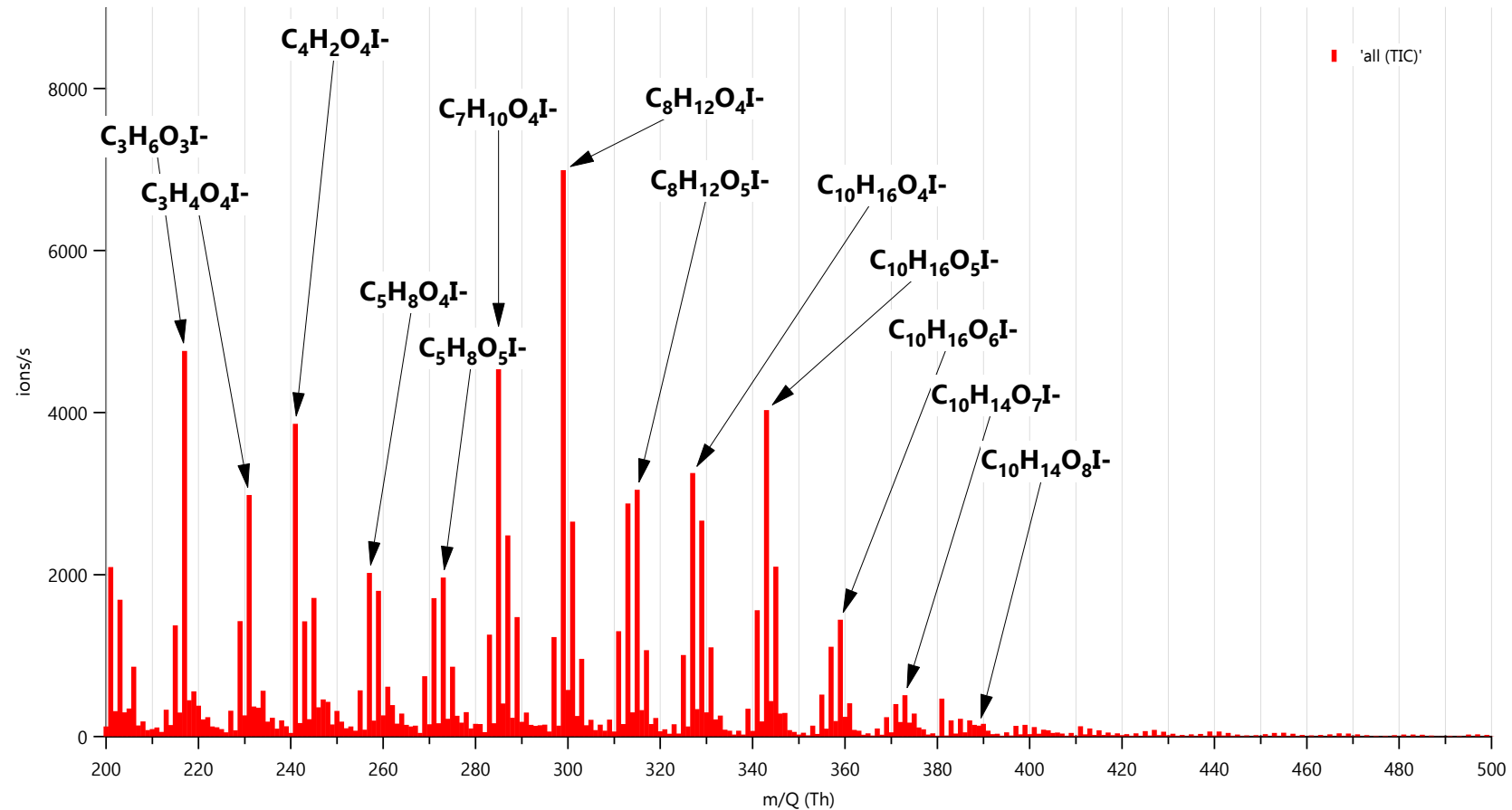


α -pinene + OH , particle phase

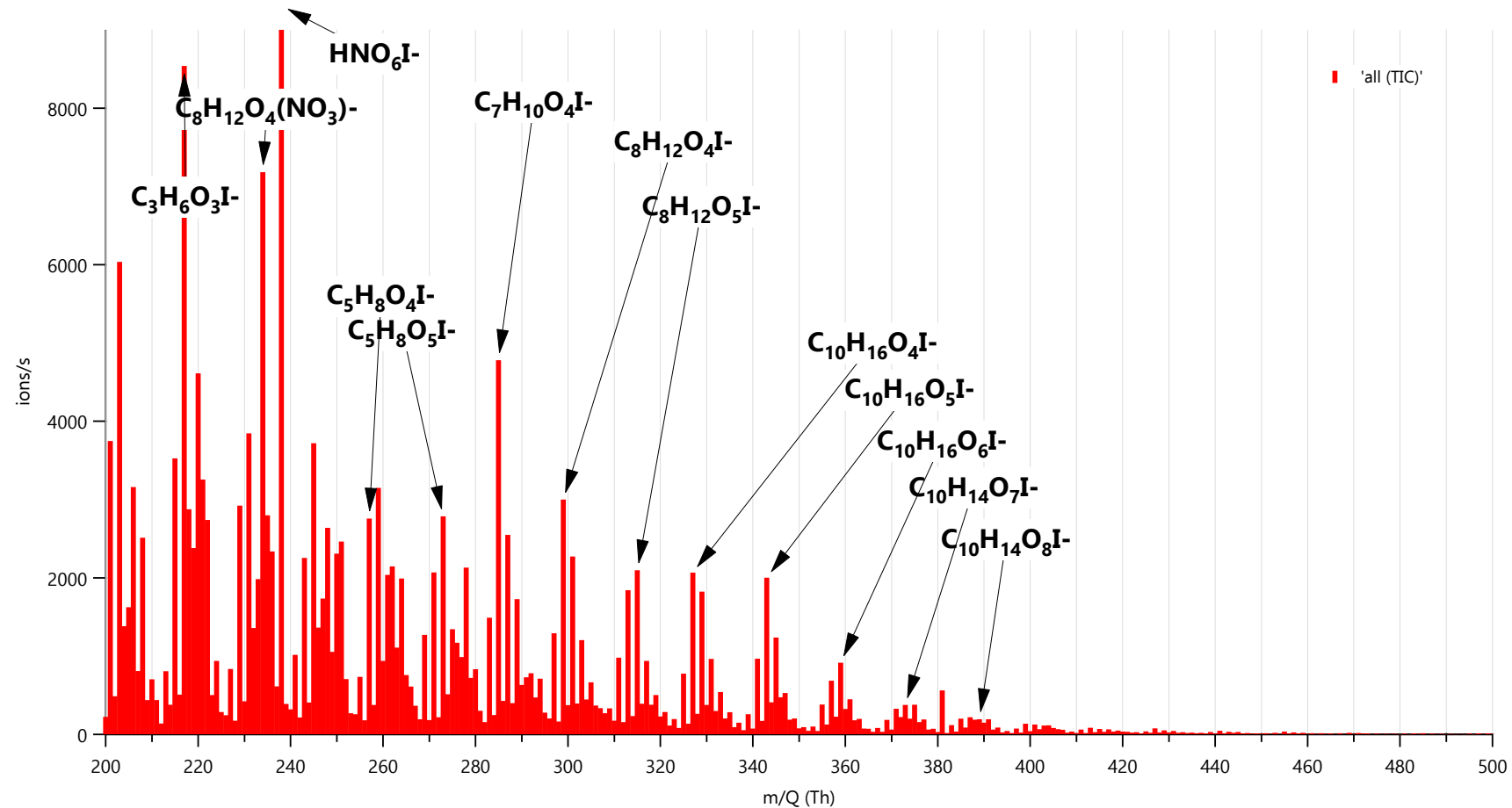
**α -pinene 100ppb,
photochemical ageing a few days**



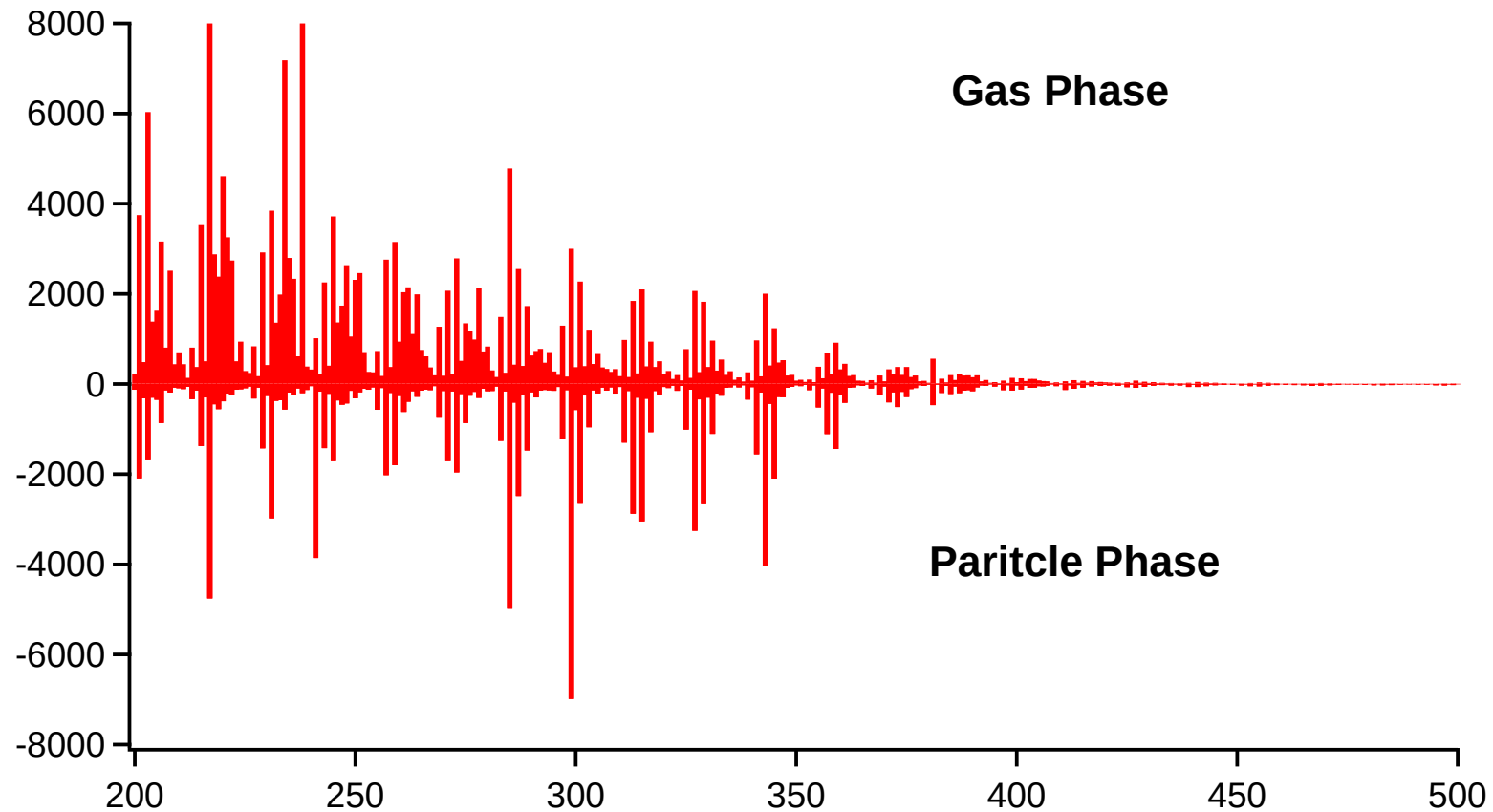
Major oxidation products in particle phase



α -pinene + OH , gas phase

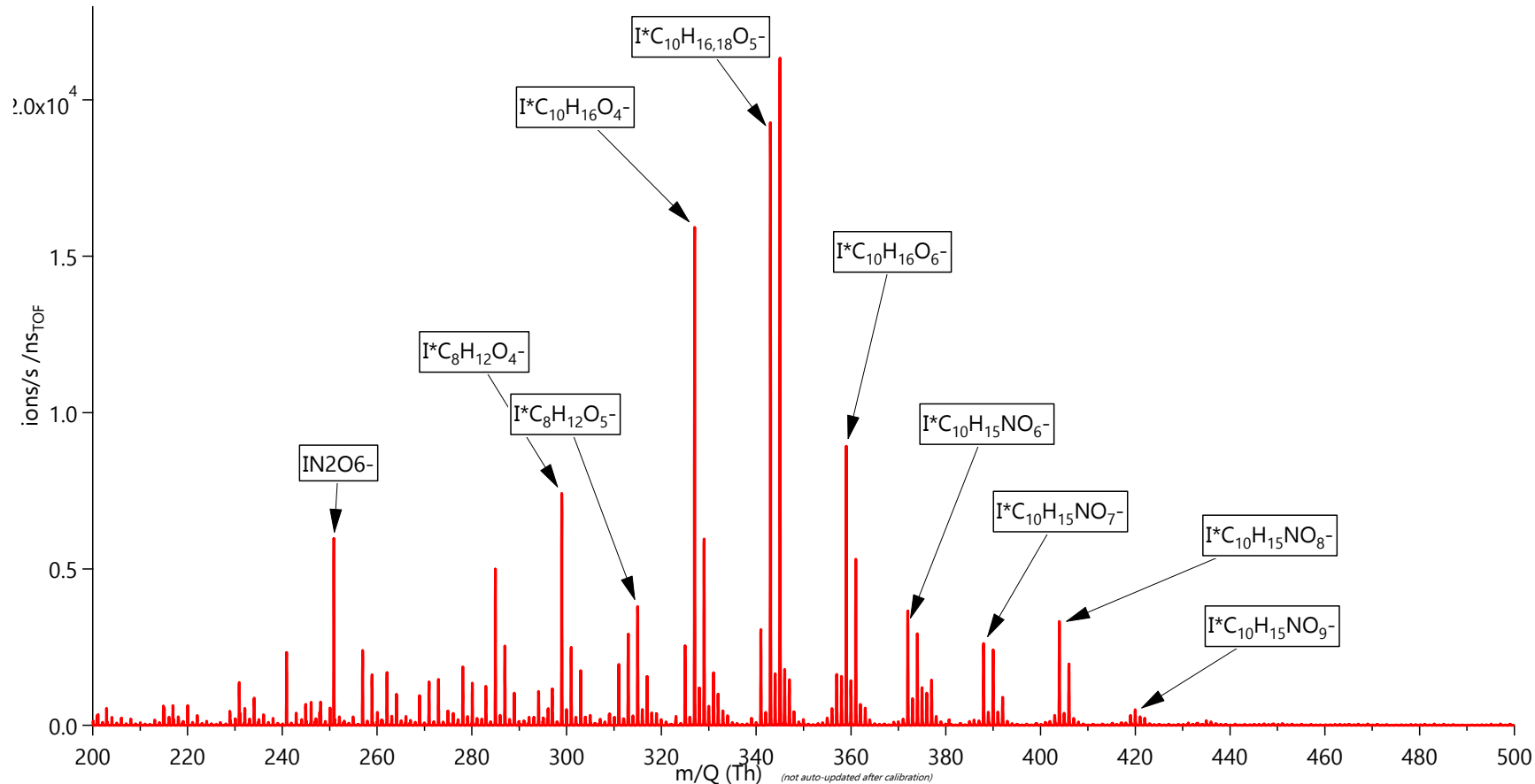


Comparing the MS of the gas and particle phase



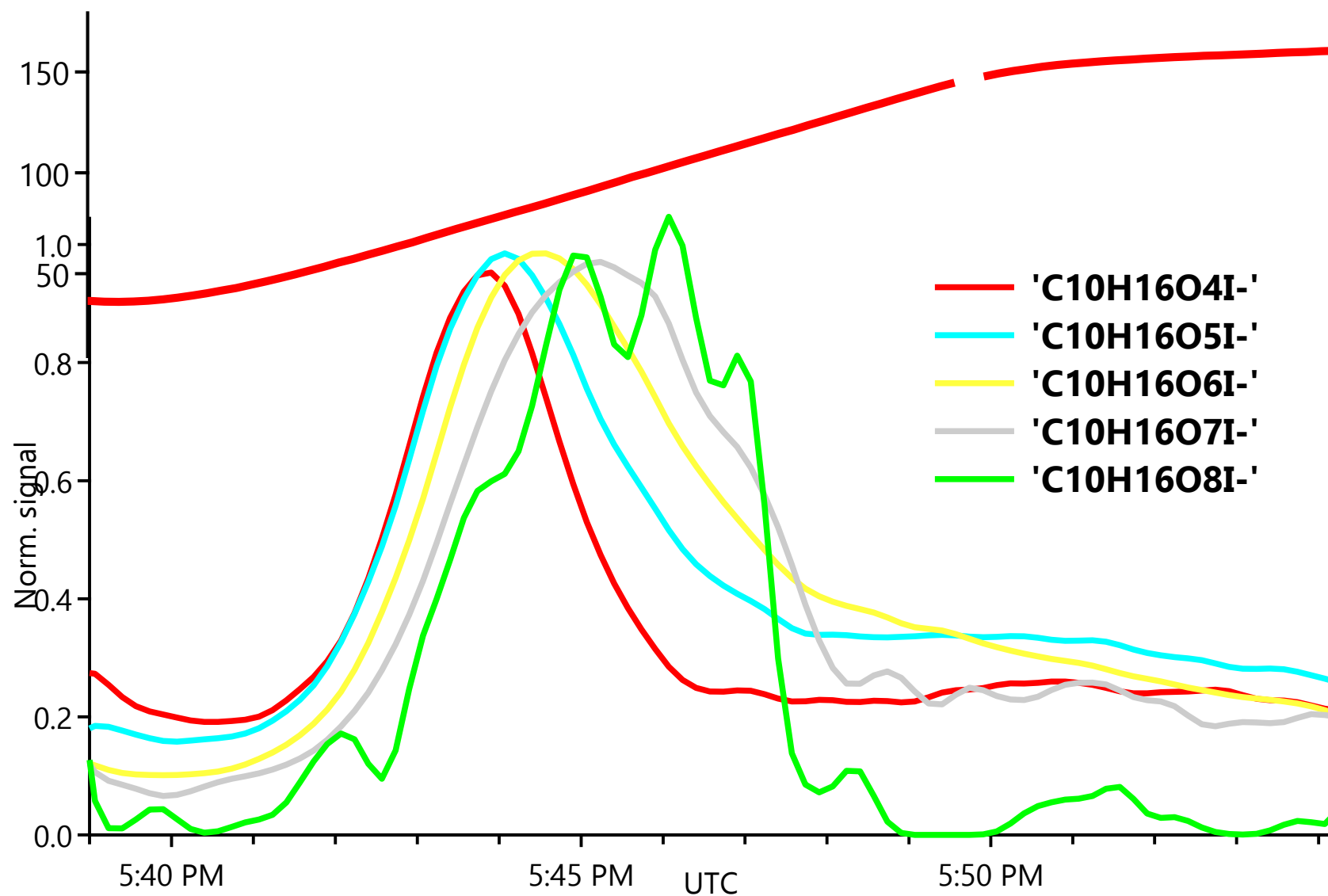
apinene + OH + NO

Average MS during FIGAERO desorption, $m/Q = 200 - 500$



- $\text{C}_8\text{H}_{12}\text{O}_{4-5}$ and $\text{C}_{10}\text{H}_{16,18}\text{O}_{4-6}$
- $\text{C}_{10}\text{H}_{15,17}\text{NO}_{6-9}$ organic nitrates

Thermogram of the oxidation products



Summary

1. FIGAERO can provide compositions, concentrations and other chemical information of the organics in both gas phase and particle phase.
2. The desorption sequence of the oxidation products demonstrate the volatility difference.