

Mobile Air Toxics Monitoring Project

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Air Quality Branch Manager

Photo:
Air Monitoring Station
Mayo Clinic site



A NEW DAY.

City of Jacksonville, Florida

Donna Deegan, Mayor

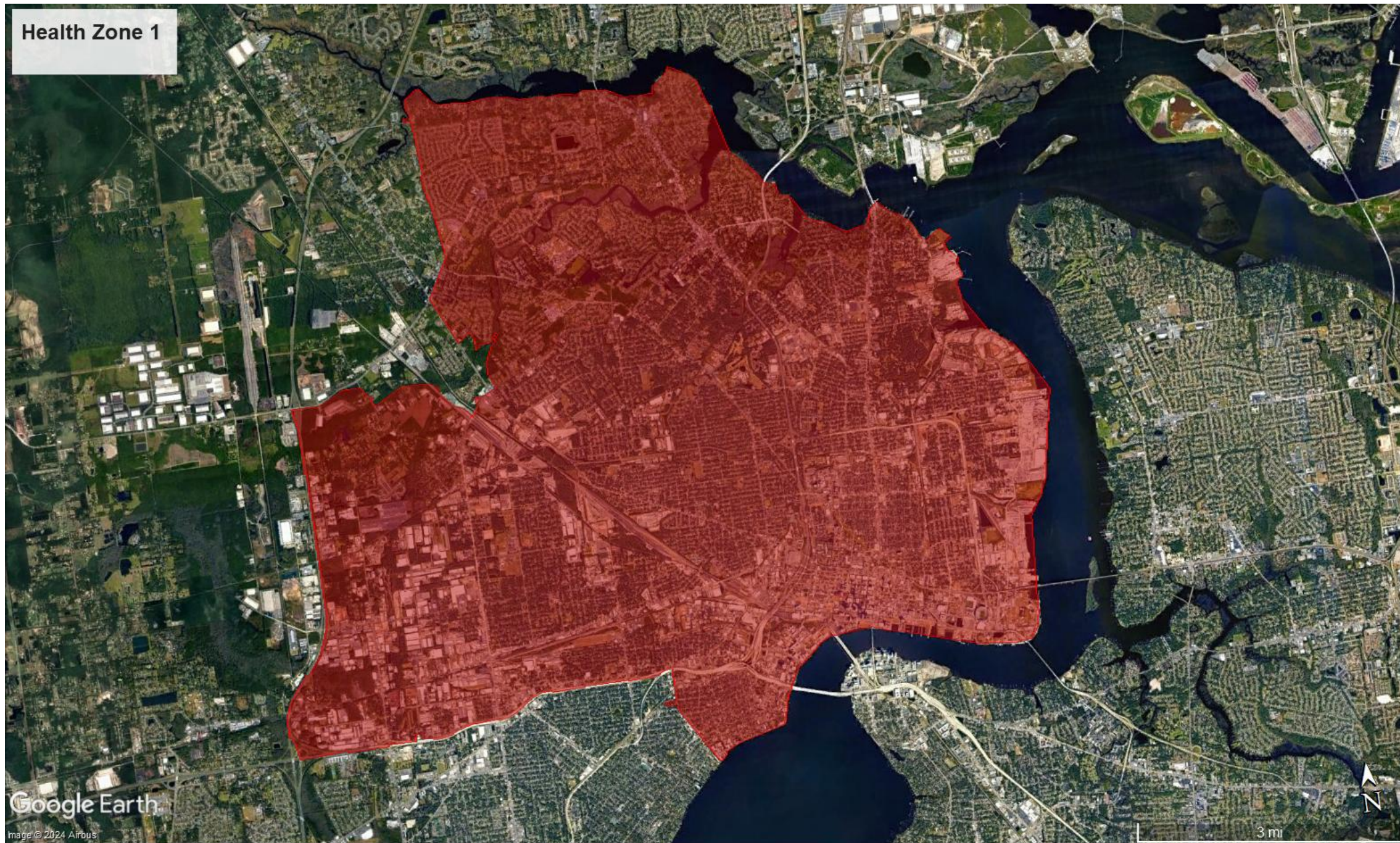
Environmental Quality Division
Ed Ball Building
214 N. Hogan Street, 5th Floor
Jacksonville, Florida 32202

Project Overview

The total project budget is \$750,000, of which \$300,000 is from the EPA under the IRA 60105a-b grant and \$450,000 from the Jacksonville Environmental Protection Board (JEPB). We are outfitting a Ford Transit van with instruments to:

1. Conduct monthly mobile surveys to identify air toxic hotspots, primarily in Health Zone 1, but elsewhere as well. Two-year commitment in EPA grant workplan.
2. Publish data on a website for public access. We are planning to publish the data in a format compatible with EPA's Real Time Geospatial Data Viewer (RETIGO), which will allow the user to upload data to the RETIGO website and view the geospatial data on a map.
3. Implement follow-up actions based on survey results, including further analysis, source investigations, and potential enforcement actions.
4. Use the mobile monitoring system for secondary purposes such as odor complaint investigations and ethylene oxide (EtO) monitoring around Jacksonville's medical sterilization facility.

Health Zone 1

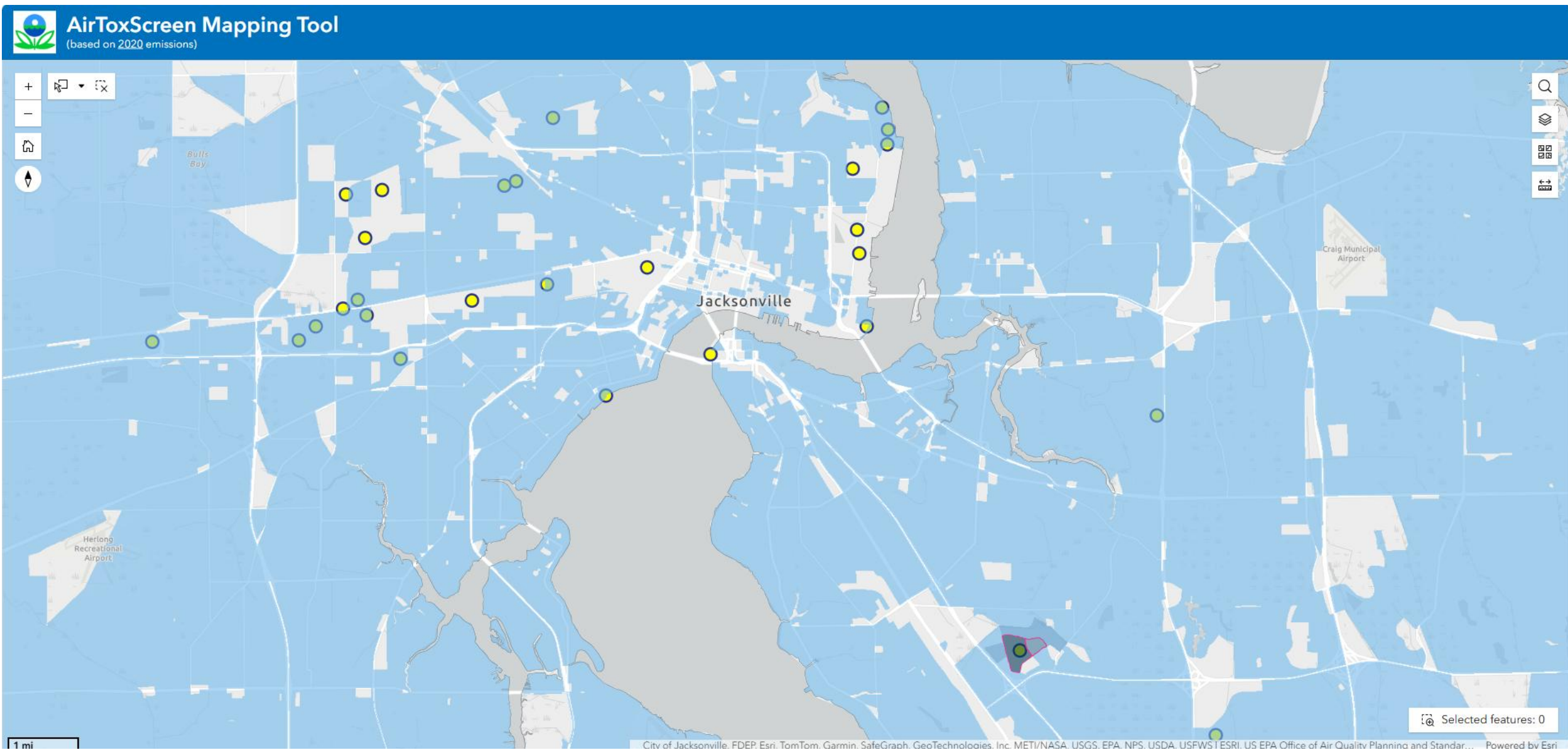


Google Earth

Image © 2024 Airbus

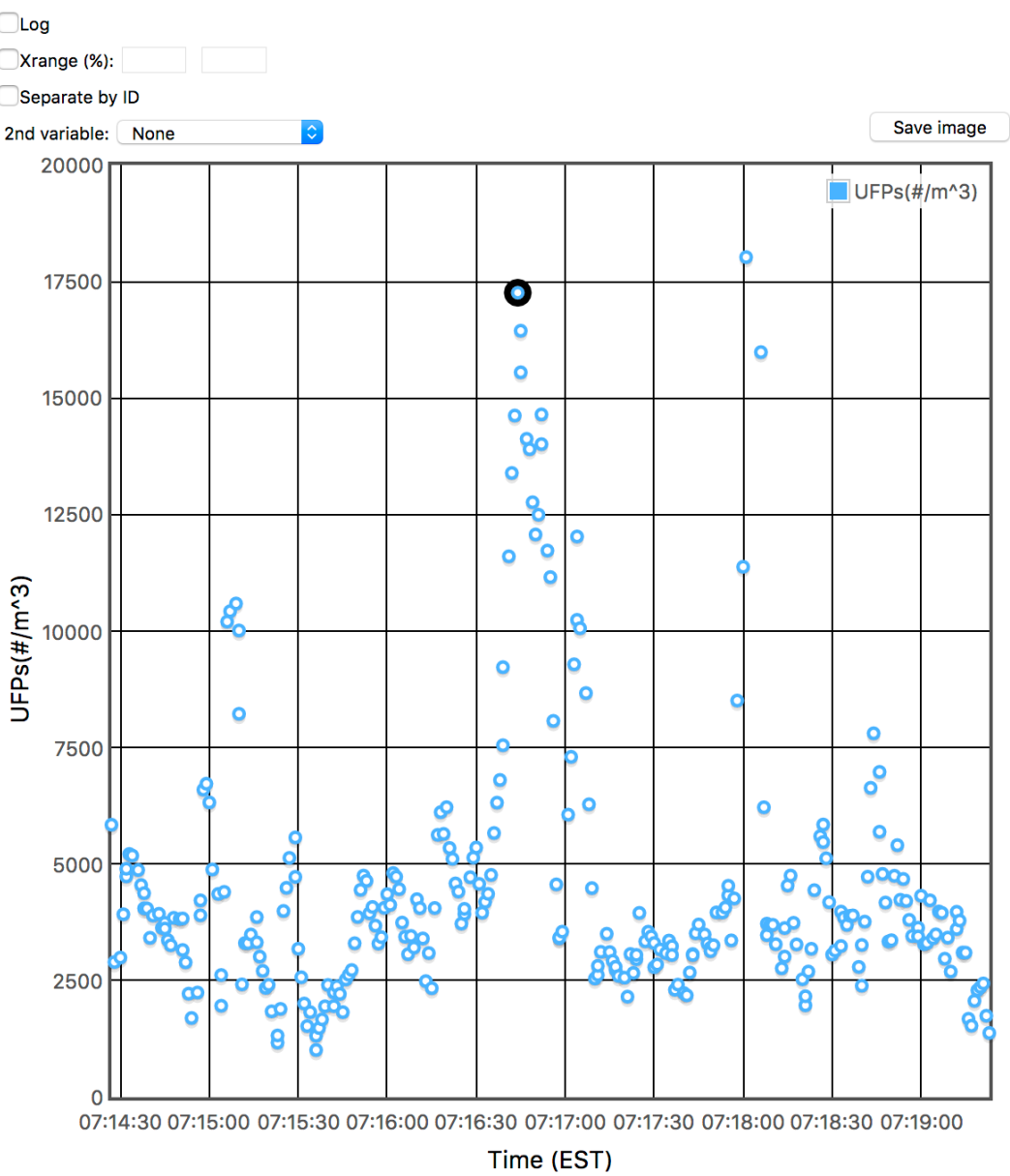
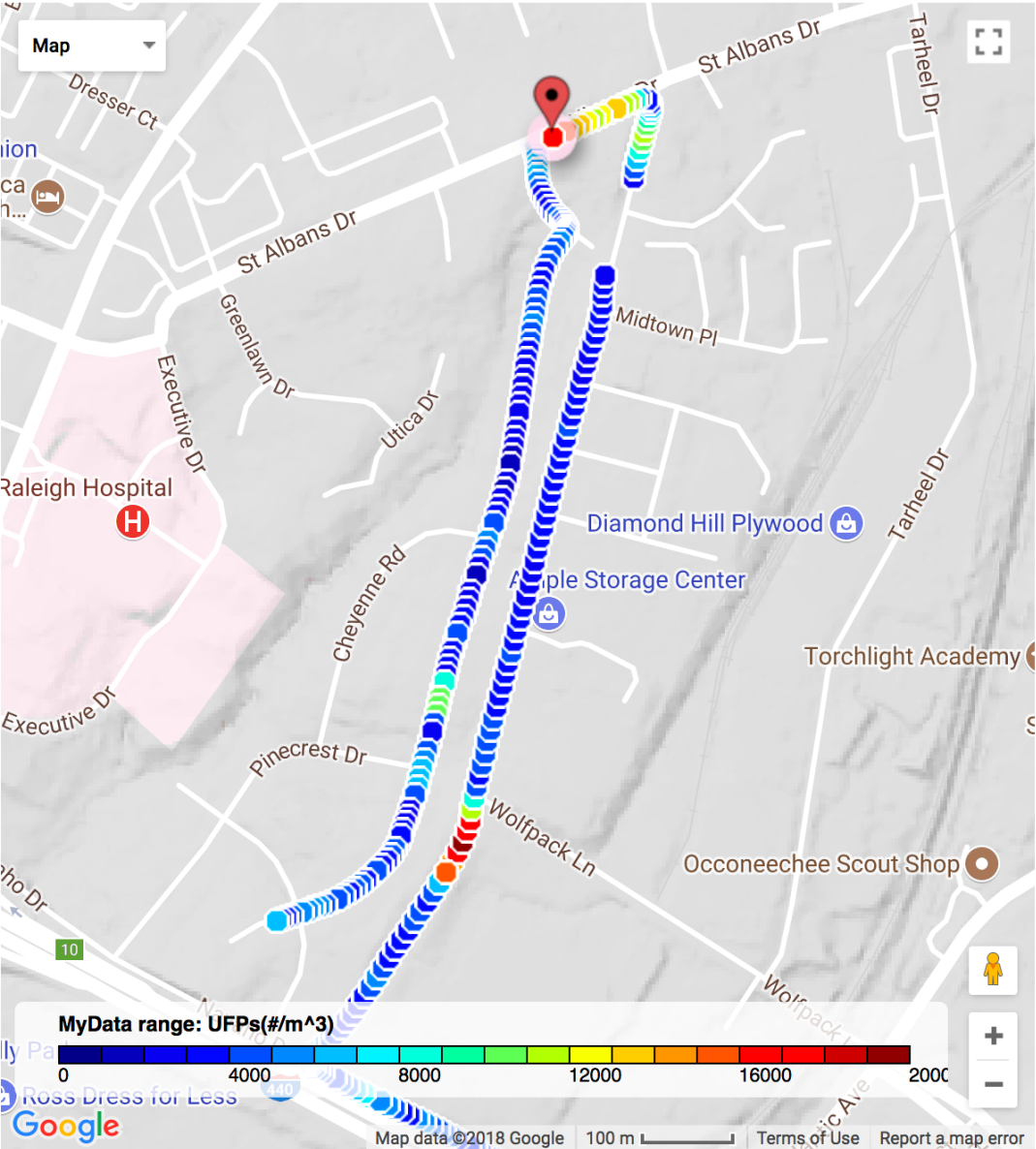
3 mi

<https://experience.arcgis.com/experience/a0deb771dbcd40d0a46fbe83adc51747/0>



Display time in: EST Time: Wed, 05 Nov 2008 07:16:44.00 EST

MyData: UFPs(#/m^3) = 17259.0000



MyDataMerge

☒ Show map

☐ Show analysis plot

☒ Show timeseries plot

☐ Show wind-pollution plot

☐ Show connecting line

☒ Show map marker

☒ Show all points on map

☐ Single point on map

Map size:

Identifier: AllNone

☒ Raleigh

☒ Raleigh-track2

☒ Raleigh-track3

☒ Raleigh-track4

☒ Raleigh-track5

Time range: ☒ Avg ☐ Block

☐ Extend blocks: 2

☒ 2008-11-05T07:14:00

Data range: 0 to 20000

Select variable to display:

☐ speed(mph)

☒ UFPs(#/m^3)

☐ PM(ug/m^3)

☐ O3(ppb)

☐ wind_vector(m/s)

EPA GMAP Van



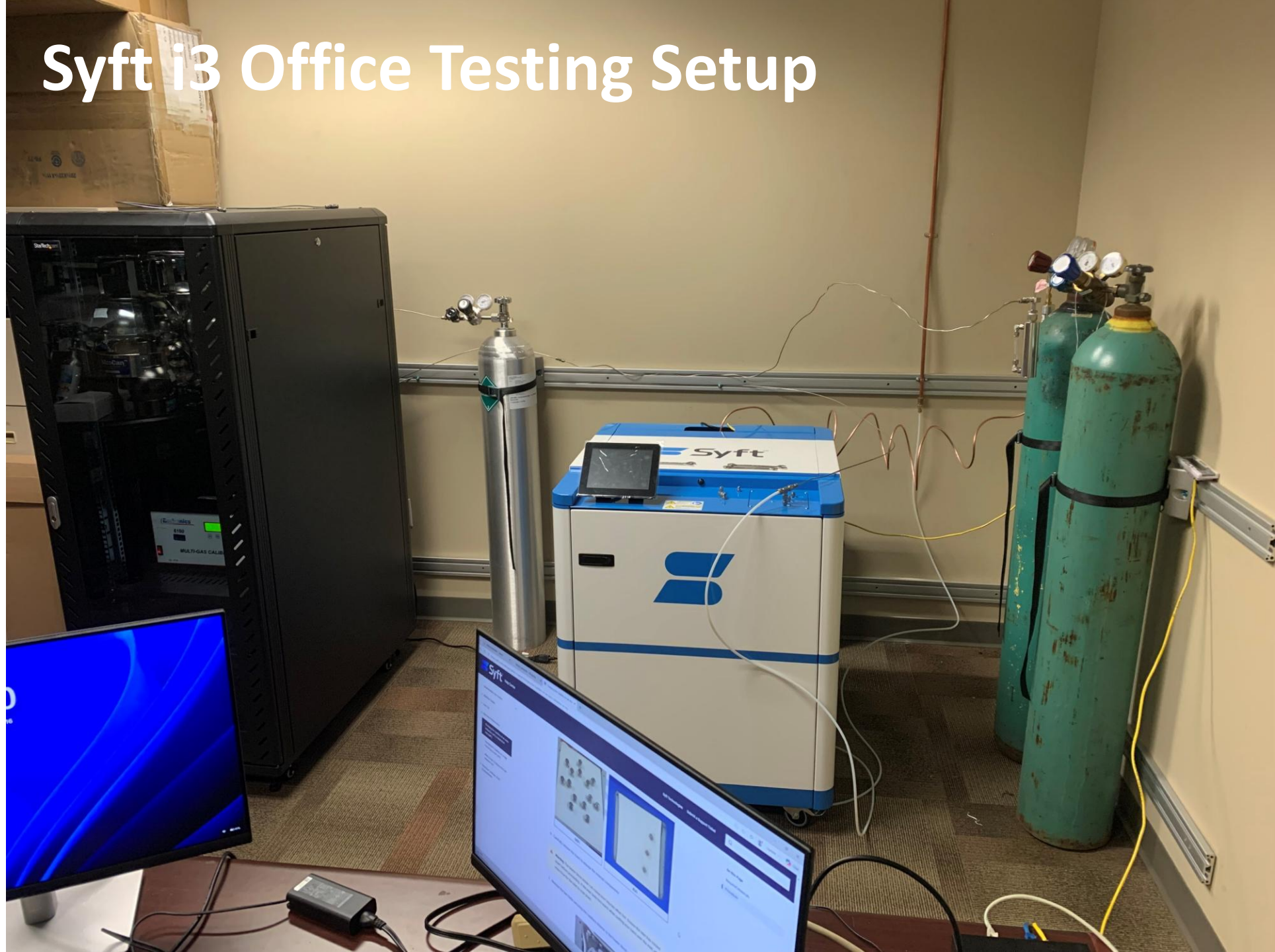
Mobile Air Monitoring Van Features

- Sample inlet no. 1 instrumentation:
 - Syft i3 Selective Ion Flow Tube Mass Spectrometer (SIFT MS): TO-15 air toxics; H₂S, odorous non-toxic speciated VOCs, ammonia
 - Falco 2 pumped PID: total VOC
 - LiCor CO₂, H₂O instrument: CO₂ as indicator that we are sampling vehicle exhaust
- Sample inlet no. 2 instrumentation (initial configuration):
 - SO₂ monitors (2) and tube furnace: aggregate reduce sulfur per JEPB Rule 2.901
- Other instrumentation and accessories:
 - AirMar 200 WX: dynamic wind speed and direction, gps location
 - Zero air generator and Syft gas dilution system: calibration
 - Nitrogen cylinder and sampling standard cylinders (TO-15, BTEX, EtO, SO₂, odor mix)

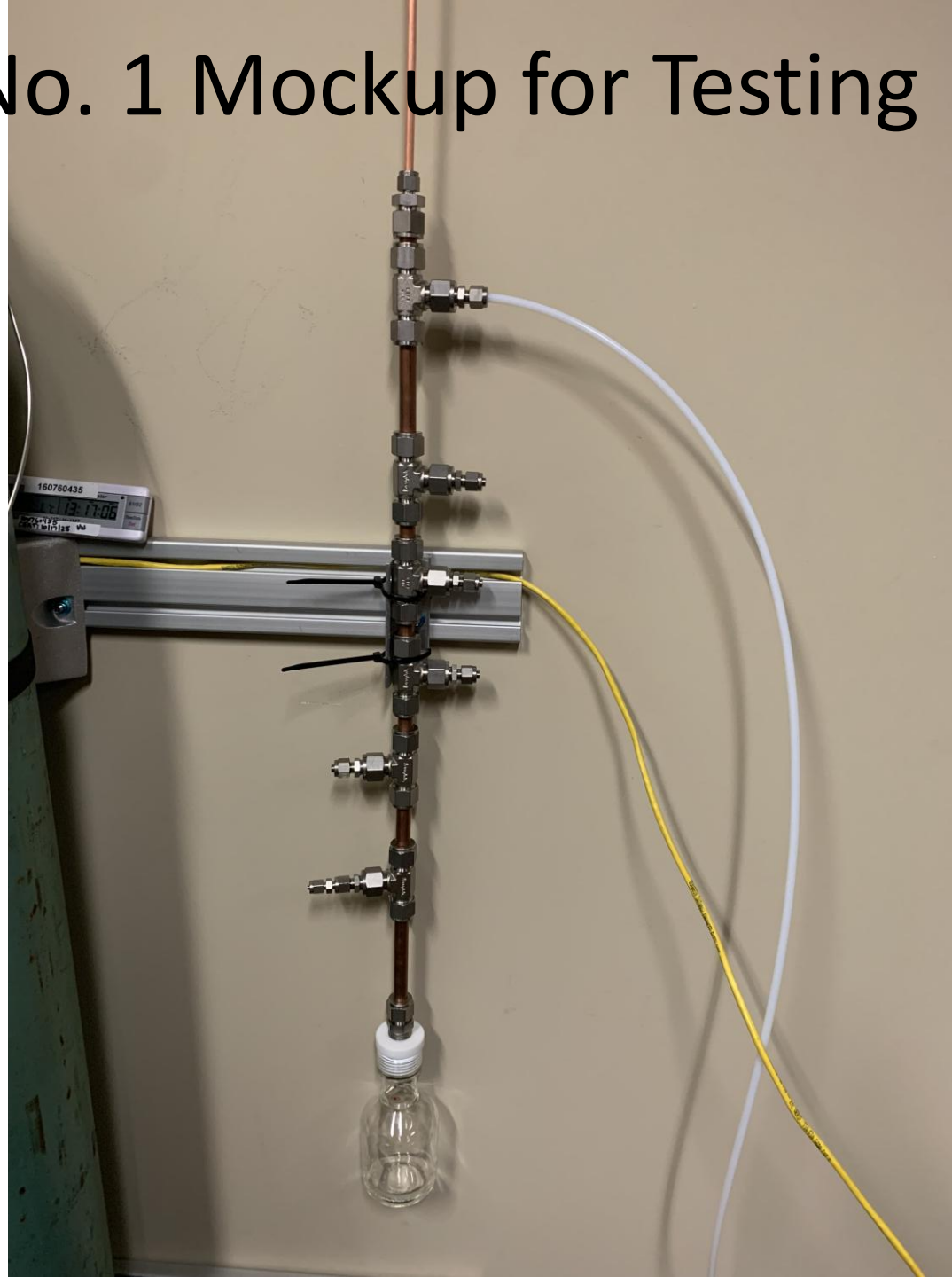
Mobile Air Monitoring Van Features

- Powering the instruments:
 - Cummins Onan 10kW RV generator or equivalent
 - Lithium-ion backup capable of running all instruments, ACs, lighting for 2 hours
 - 50-amp shore power while parked overnight

Syft i3 Office Testing Setup

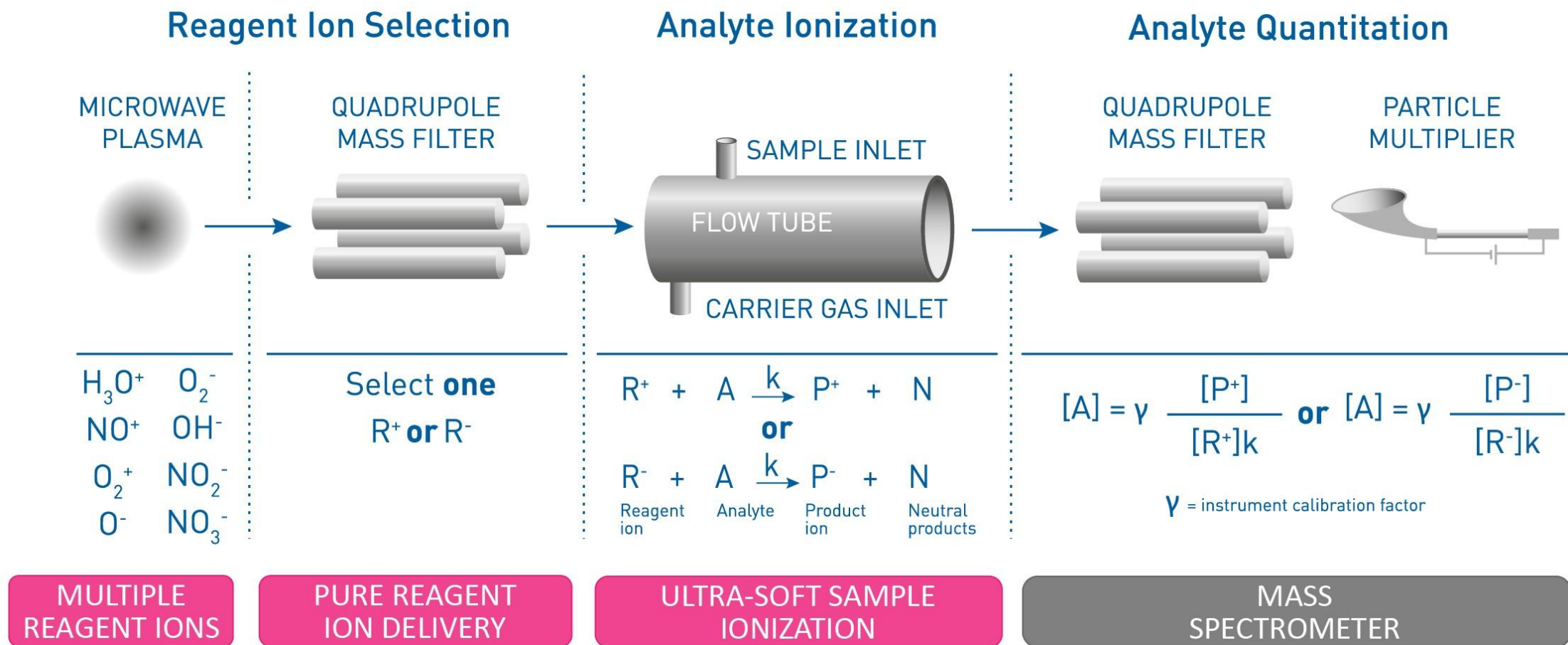


Inlet Manifold No. 1 Mockup for Testing



SIFT-MS: How it works

https://syft.com/sift-ms-technology/wed330_eto_silva.pdf



Positive Ion Reaction Mechanisms

- Proton transfer examples: $\text{H}_3\text{O}^+ + \text{C}_7\text{H}_8 \rightarrow \text{C}_7\text{H}_9^+ + \text{H}_2\text{O}$ and $\text{H}_3\text{O}^+ + \text{CH}_3\text{CH}(\text{CH}_3)\text{CH}_2\text{OH} \rightarrow \text{CH}_3\text{CH}(\text{CH}_3)\text{CH}_2^+ + 2\text{H}_2\text{O}$ (there are others)
- Electron transfer examples: $\text{O}_2^{+\bullet} + \text{C}_8\text{H}_8\text{O}_3 \rightarrow \text{C}_8\text{H}_8\text{O}_3^{+\bullet} + \text{O}_2$ and $\text{NO}^+ + \text{CH}_3\text{N}(\text{NO})\text{CH}_3 \rightarrow \text{CH}_3\text{N}(\text{NO})\text{CH}_3^{+\bullet} + \text{NO}^\bullet$
- Dissociative electron transfer examples: $\text{O}_2^{+\bullet} + \text{CH}_3\text{SCH}_3 \rightarrow \text{CH}_3\text{S}^+ + \text{CH}_3^\bullet + \text{O}_2$ and $\text{NO}^+ + \text{CH}_3\text{C}(\text{O})\text{C}(\text{O})\text{CH}_3 \rightarrow \text{CH}_3\text{CO}^+ + \text{CH}_3\text{CO}^\bullet + \text{NO}^\bullet$
- Association (collision of reagent ion, analyte, and a non-reactive species) example: $\text{NO}^+ + \text{C}_2\text{H}_4\text{O}_2 \xrightarrow{\text{g}} \text{NO}^+\text{C}_2\text{H}_4\text{O}_2$
- Hydride (removal of H^-) abstraction example: $\text{NO}^+ + (\text{CH}_3)_3\text{CH} \rightarrow (\text{CH}_3)_3\text{C}^+ + \text{HNO}$

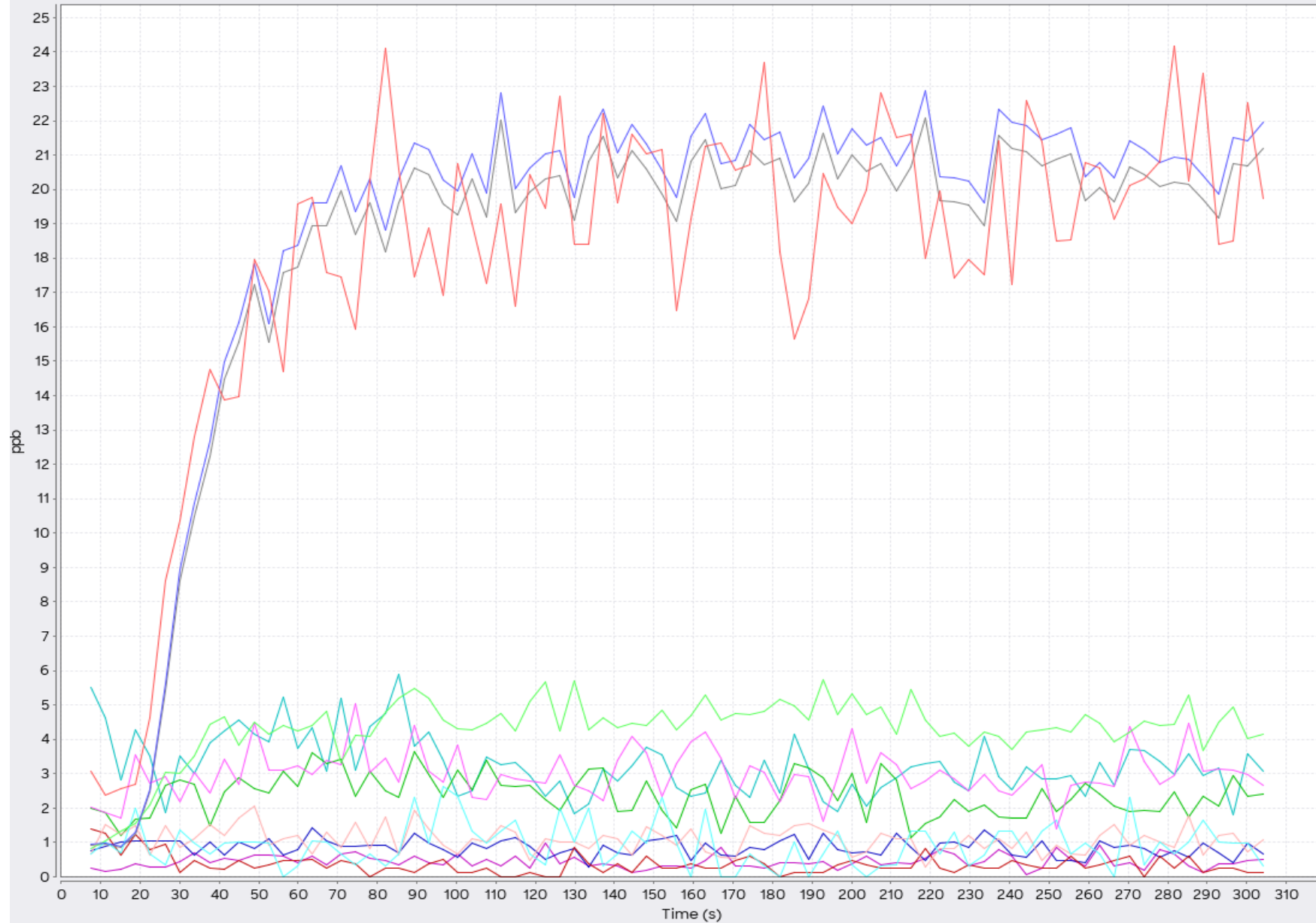
APPENDIX

CAS Number	Name	Molecular Weight (g mol ⁻¹)	Reagent Ion	Product Ion Formula	Branching ratio (%)	Product Ion m/z (Secondary Ion m/z)
463-58-1	carbonyl sulfide	60.07	O ₂ ⁺	COS ⁺	100	60
107-03-9	1-propanethiol	76.16	H ₃ O ⁺	C ₃ H ₈ S.H ⁺	100	77
			NO ⁺	C ₃ H ₈ S ⁺	40	76
			NO ⁺	C ₃ H ₈ S.NO ⁺	60	106
			O ₂ ⁺	C ₃ H ₈ S ⁺	40	76
3658-80-8	dimethyl trisulfide	126.26	H ₃ O ⁺	C ₂ H ₆ S ₃ .H ⁺	100	127 (145)
			NO ⁺	C ₂ H ₆ S ₃ ⁺	100	126
			O ₂ ⁺	C ₂ H ₆ S ₃ ⁺	45	126
110-02-1	thiophene	84.14	H ₃ O ⁺	C ₄ H ₄ S.H ⁺	100	85
			NO ⁺	C ₄ H ₄ S ⁺	100	84
			O ₂ ⁺	C ₄ H ₄ S ⁺	100	84
78-83-1	isobutyl alcohol	74.12	NO ⁺	C ₄ H ₉ O ⁺	95	73
			O ₂ ⁺	C ₄ H ₉ ⁺	25	57
123-38-6	propanal	58.08	H ₃ O ⁺	C ₃ H ₇ O ⁺	100	59 (77)
			NO ⁺	C ₃ H ₅ O ⁺	100	57
123-72-8	butanal	72.11	NO ⁺	C ₄ H ₇ O ⁺	100	71
			O ₂ ⁺	C ₂ H ₄ O ⁺	65	44
			O ₂ ⁺	C ₄ H ₈ O ⁺	35	72
78-84-2	2-methylpropanal	72.11	NO ⁺	C ₄ H ₇ O ⁺	100	71
			O ₂ ⁺	C ₄ H ₈ O ⁺	70	72
123-73-9	2-butenal	70.09	H ₃ O ⁺	C ₄ H ₇ O ⁺	100	71 (89)
			NO ⁺	C ₄ H ₅ O ⁺	100	69
			O ₂ ⁺	C ₄ H ₅ O ⁺	65	69
590-86-3	3-methylbutanal	86.13	H ₃ O ⁺	C ₅ H ₉ ⁺	30	69
			H ₃ O ⁺	C ₅ H ₁₁ O ⁺	70	87 (105)
			NO ⁺	C ₅ H ₉ O ⁺	100	85
78-93-3	methyl ethyl ketone (MEK)	72.11	NO ⁺	C ₄ H ₈ O.NO ⁺	100	102
			O ₂ ⁺	C ₄ H ₈ O ⁺	35	72
108-10-1	methyl isobutyl ketone (MIBK)	100.16	H ₃ O ⁺	C ₆ H ₁₂ OH ⁺	100	101 (119)
			NO ⁺	C ₆ H ₁₂ O.NO ⁺	100	130
			O ₂ ⁺	C ₆ H ₁₂ O ⁺	25	100
64-19-7	acetic acid	60.05	H ₃ O ⁺	CH ₃ COOH ₂ ⁺	100	61 (79)
			NO ⁺	CH ₃ COOH.NO ⁺	100	90
79-09-4	propanoic acid	74.08	H ₃ O ⁺	C ₂ H ₅ COOH ₂ ⁺	90	75 (93)
			NO ⁺	C ₂ H ₅ COOH.NO ⁺	70	104
			O ₂ ⁺	C ₂ H ₅ COOH ⁺	80	74
107-92-6	butanoic acid	88.11	H ₃ O ⁺	C ₃ H ₇ COOH ₂ ⁺	95	89 (107)
			NO ⁺	C ₃ H ₇ COOH.NO ⁺	80	118
109-52-4	pentanoic acid	102.13	H ₃ O ⁺	C ₄ H ₉ COOH ₂ ⁺	90	103 (121)
			NO ⁺	C ₄ H ₉ CO ⁺	60	85
			NO ⁺	C ₄ H ₉ COOH.NO ⁺	40	132
503-74-2	3-methylbutanoic acid	102.13	H ₃ O ⁺	CH ₃ C ₃ H ₆ COOH ₂ ⁺	95	103 (121)
			NO ⁺	CH ₃ C ₃ H ₆ CO ⁺	30	85
			NO ⁺	CH ₃ C ₃ H ₆ COOH.NO ⁺	70	132
141-78-6	ethyl acetate	88.11	H ₃ O ⁺	CH ₃ COOC ₂ H ₅ .H ⁺	100	89 (107)
			NO ⁺	CH ₃ COOC ₂ H ₅ .NO ⁺	100	118

<https://syft.com/sift-ms-technology/Odor-Pollution-2025-v3.0.pdf>

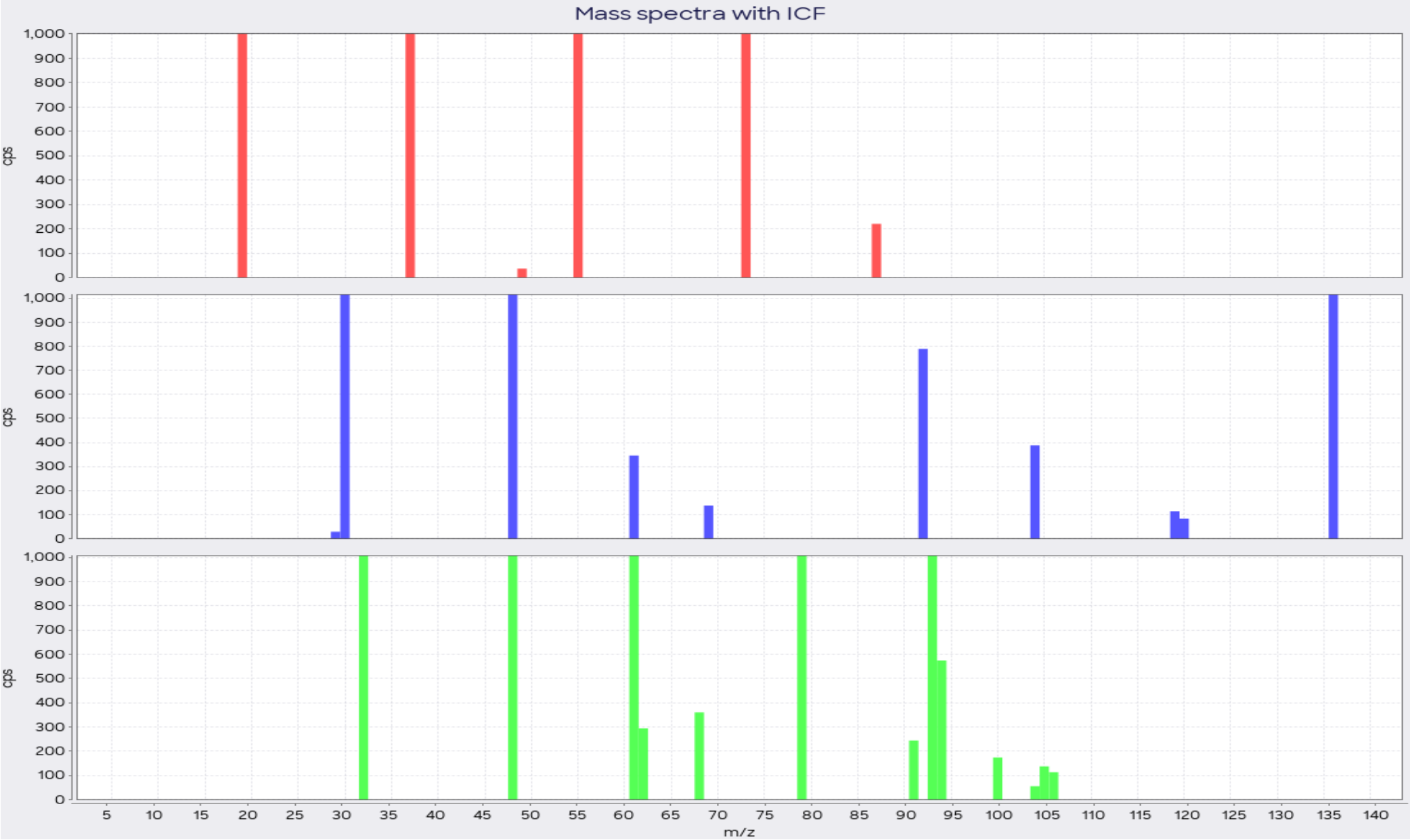
Syft SIM Scan Sample A

Time series: Analyte concentrations



- ☒ alpha-pinene (80-56-8; 2437-95-8)
- ☒ beta-pinene (127-91-3)
- ☒ dimethyl disulfide (624-92-0)
- ☒ dimethyl sulfide (75-18-3)
- ☒ ethyl mercaptan (75-08-1)
- ☒ isopropyl benzene (98-82-8)
- ☒ limonene (138-86-3; 7705-14-8)
- ☒ methyl mercaptan (74-93-1)
- ☒ methyl methacrylate (80-62-6)
- ☒ o-xylene (95-47-6)
- ☒ styrene (100-42-5)
- ☒ vinyl acetate (108-05-4)

Syft SIM Scan Sample A



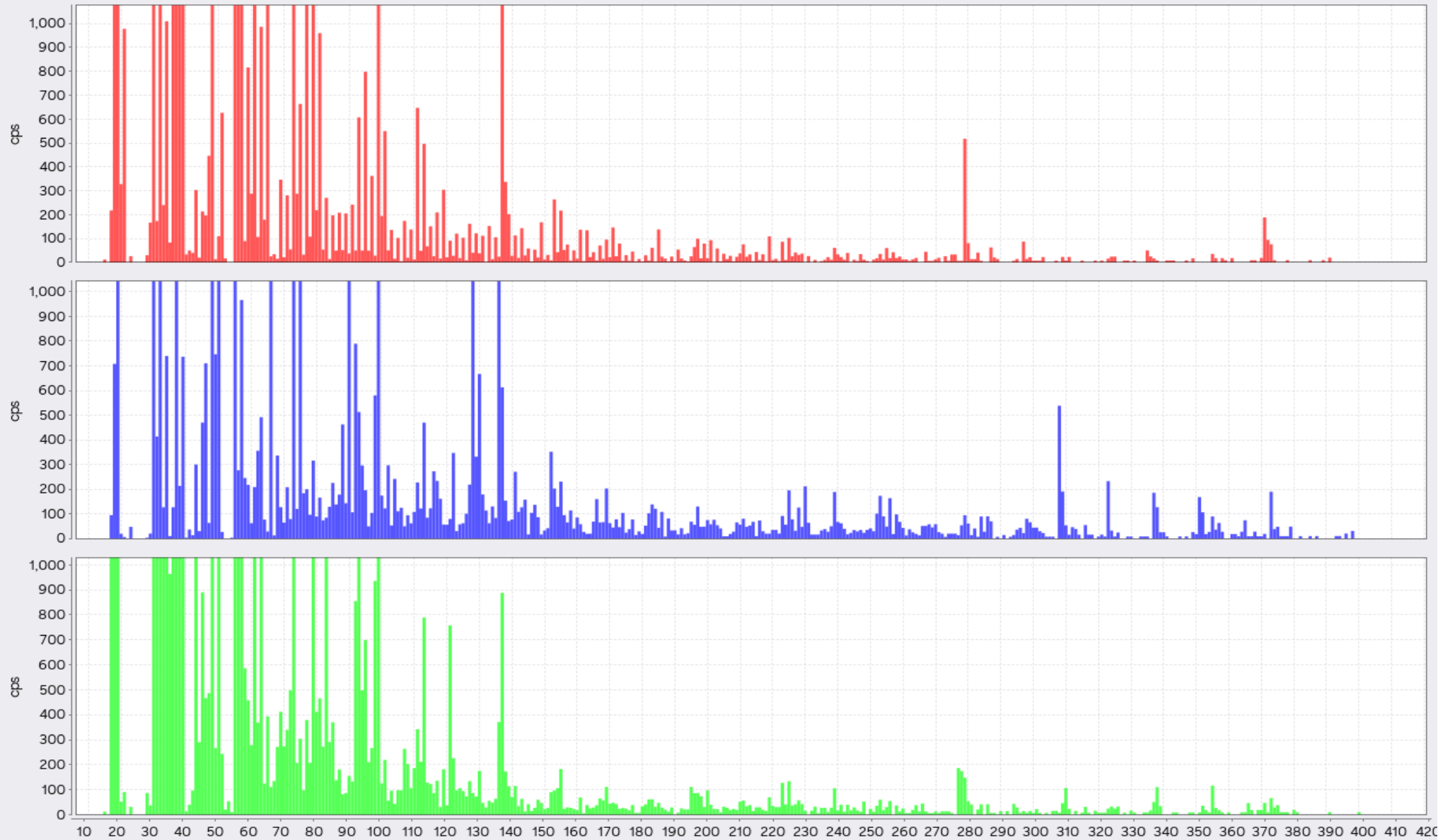
In SIM (Single Ion Monitoring) mode, these are the only ions used to identify individual compounds. This allows for faster scanning because only the ions in the method are scanned.

Reagent Ions

- ☒ H3O+
- ☒ NO+
- ☒ O2+

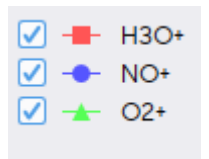
Syft Total Mass Scan Sample A

Mass spectra with ICF

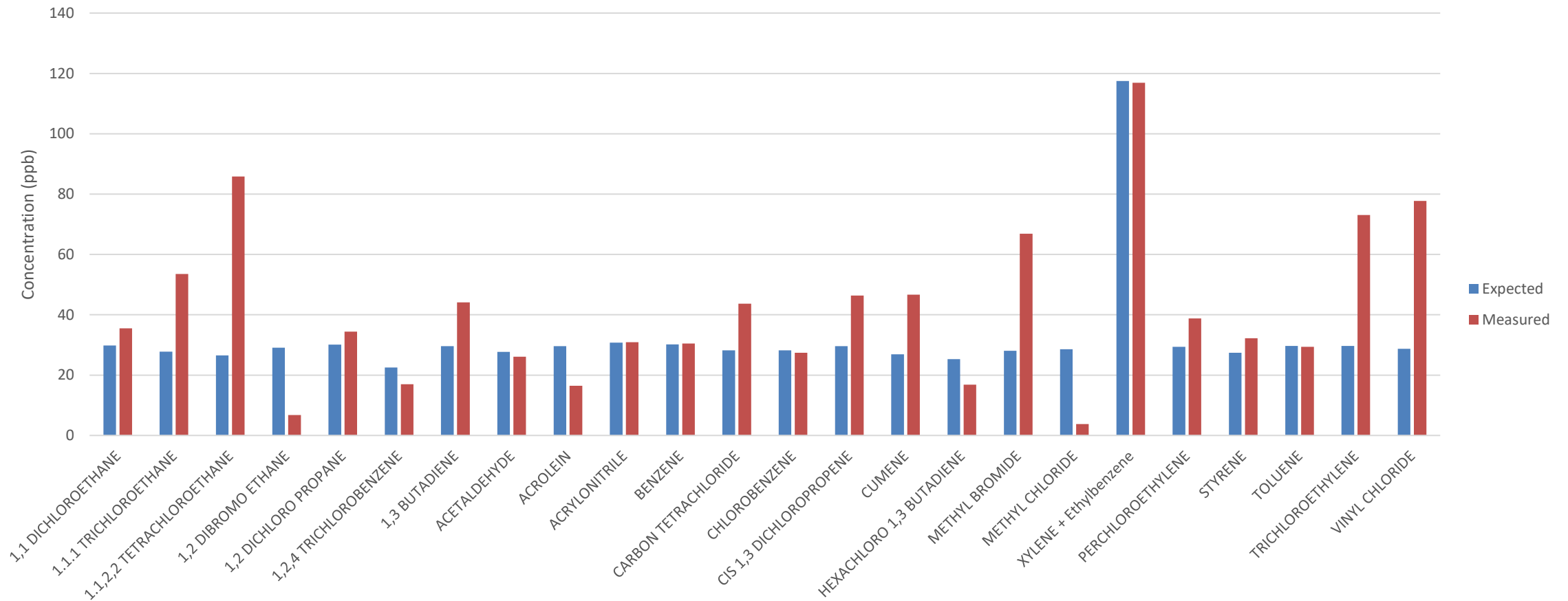


In mass scan mode, all ions in the selected range are scanned. In this method, m/z from 15 through 400 are scanned and reported.

Reagent Ions



TO-15 Standard Analyzed on SYFT I3



The only compounds calibrated on this I3 are Benzene, Toluene and the Xylenes + Ethylbenzene. The other compounds used the SYFT Library entries for their k values; some were for Helium carrier gas instead of the Nitrogen carrier gas used