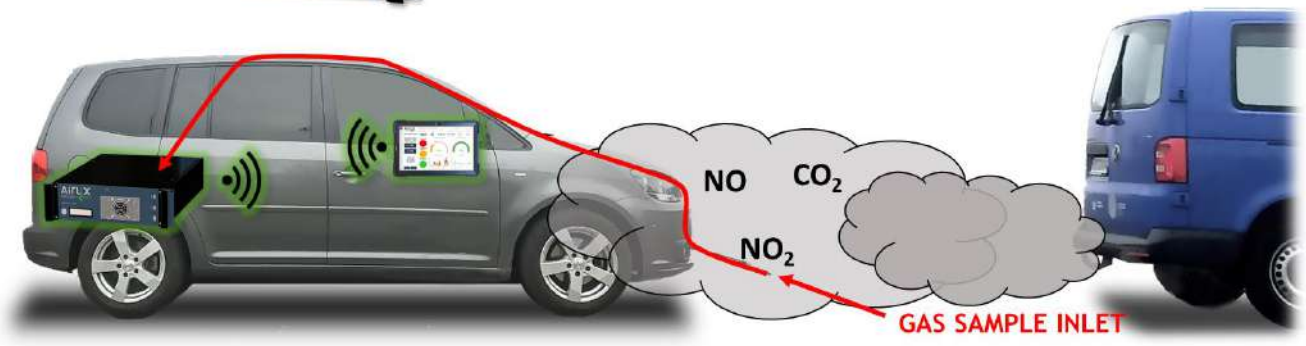
Enviro Technology Services Ltd
part of CuraTerrae

AirUX
DIFFERENT THINKING. BETTER MEASURING.

REAL-TIME ON-ROAD NO_X EMISSION MEASUREMENTS

FAST, SIMPLE AND PRECISE ON-ROAD NO_X EMISSION MEASUREMENTS OF LIGHT- AND HEAVY-DUTY VEHICLES USING THE PLUME CHASING METHOD

- ❑ PRECISE MEASURMENTS OF NO, NO_2, CO_2
- ❑ LIGHTWEIGHT, COMPACT SETUP
- ❑ SIMPLE OPERATION
- ❑ FAST AND RELIABLE HIGH EMITTER IDENTIFICATION
- ❑ REAL-TIME NO_x EMISSION FACTORS (EURO CLASSES)



WHY PLUME CHASING?

The Plume Chasing (PC) method provides determination of **NO_x emission factors** from single vehicles **under real driving conditions** by sampling exhaust plume gases. In contrast to stationary measurements, PC does not capture snapshot like measurements but instead **representative** averages over seconds to minutes respecting variable engine loads of the target vehicle.

By **measuring both NO_x and CO_2**, the exhaust plume can easily be identified by increased CO_2 signals and emission factors can precisely be determined by the ratio of NO_x and CO_2 which is independent from dilution. With CO_2 being equivalent to fuel consumption and engine load, the current driving situation (e.g., downhill or uphill) is taken into account.

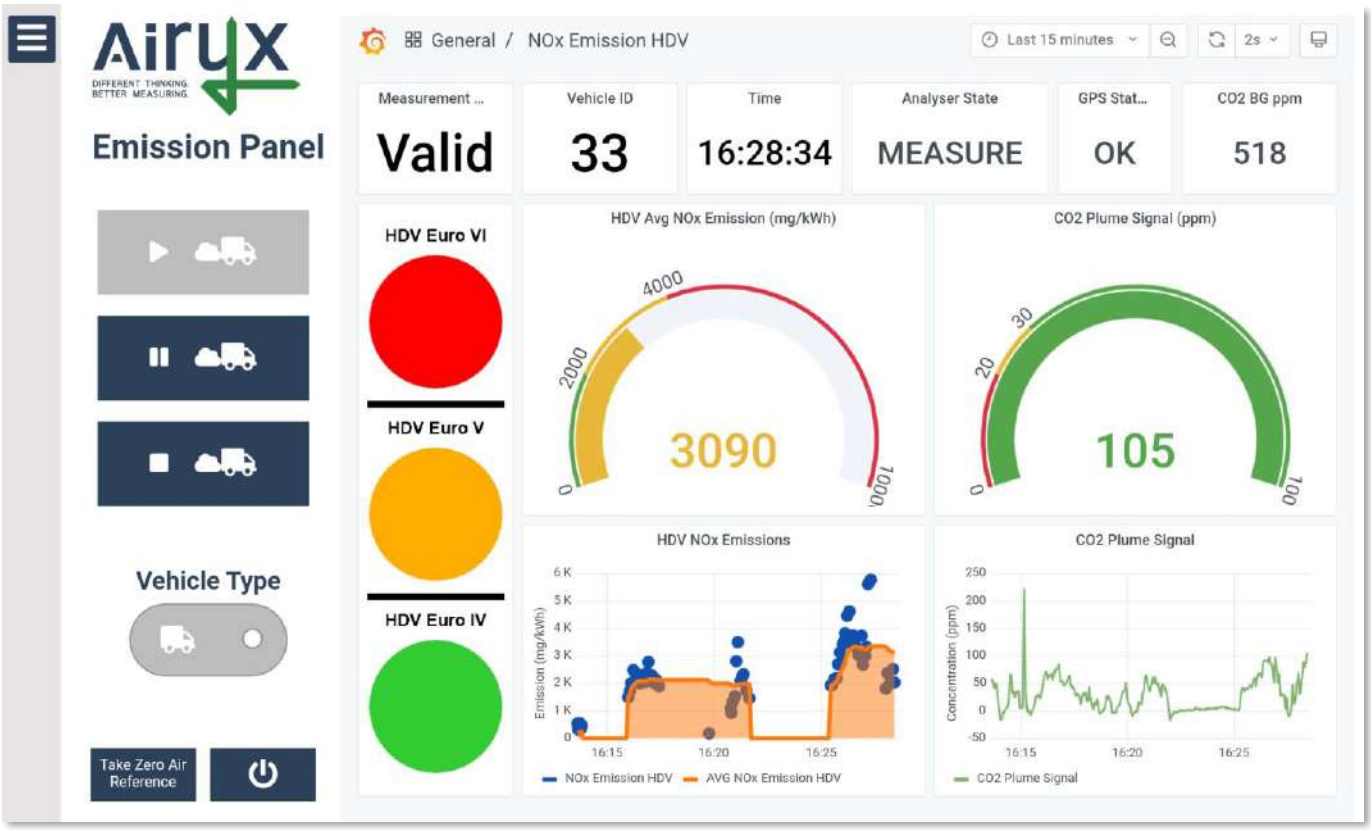
Plume Chasing allows fast, precise and economic identification of distinct high emitters on highways or in inner cities.

WHY USING ICAD ANALYSERS FOR PLUME CHASING?

The **compact** form factor (19" Rack, 3HU), **low power** consumption and **insensitivity to vibrations** enables mobile applications especially in cars. The **fast** response and **precise** measurement of **NO and NO_2** allows real-time detection and assignment of NO_x emission signatures to single vehicles within seconds. The **integrated CO_2 sensor** provides precise data to identify emission plumes and to calculate the emission factor NO_x/CO_2 with respect the current engine load of the target vehicle, independent from plume signal dilution.

SIMPLE AND FAST OPERATION

The Plume Chasing instrument is **operated by a wireless tablet** and a **simple graphical user interface** which enables a data acquisition within a few clicks. Among other details, the user interface provides **feedback about the current plume signal strength** as well as the **assigned emission class** (EURO class). Logfiles are created automatically and are provided for final reports of measured target vehicles.



Graphical User Interface for operation and monitoring of Plume Chasing measurements.

PLUME CHASING SPECIFICATIONS

Operation and data monitoring	WiFi; Tablet mounted in car cockpit	**Calibration**	Target calibration gas not needed[*2]
Emission class identification	LDV Euro 4,5,6 / HDV EURO IV,V,VI	**Consumable gases**	No gases needed for operation
Emission calculation	In Realtime, from NO_x/CO_2 ratio	**Cross sensitivity**	No significant cross sensitivity[*3]
Measurement duration per target vehicle	15 seconds (preliminary screening) to 1 minute (valid measurement)	**Data communication**	LAN/WiFi/RS232/M2M/OPCUA; Bayern-Hessen Protocol; Voltage/Current Output[*4]
Detection of NO_2	Direct spectroscopic measurement	**Power consumption**	Less than 40 W at 12 V (typ.)
Detection of NO (NO_x)	By conversion to NO_2	**Start-up time**	Less than 1 min (typ.)
Detection of CO_2	Internal NDIR CO_2 sensor	**Instrument Weight**	< 12 kg
Plume sampling line	Mounted at front car bumper	**Instrument Size (WDH)**	48.26 x 41.0 x 13.3 cm^3, 19" Rack, 3HU
Response Time (10% to 90%)	2s at 1 l/min or 1s at 2 l/min	**Mechanical stability**	Insensitive to vibrations
Zero Drift	Less than 0.1 ppb/month[*1]	**Temp. operation range**	-10 to +40°C

(*1) Upper limit. Drift is negligible due to regularly automated reference measurements. (*2) Literature absorption data for target gas is used for gas quantification. (*3) No significant spectroscopic cross sensitivity found: Water, Ozone, Glyoxal, Carbon Oxides, Methane, Formaldehyde, Hydrogen, Sulphide, Sulphur Dioxide, Chlorine, Chlorine Dioxide, Hydrogen Cyanide, Hydrogen Chloride, Phosphine, Hydrogen, Ammonia, Acetylene, Nitromethane, Ethylene, Ethanol, Methyl Mercaptan, Ethyl Mercaptan. (*4) Voltage and Current output on request.

HIGHLIGHTS

BENEFITS	INNOVATION
Simple and low costs operation	• Easy installation on any kind of vehicle • Easy operation with graphical user interface • Online calculation of emissions in mg/km or mg/kWh within a few seconds • NO_x measurement (with ozone titration converter) • No calibration with target gas (NO_2, CO_2) required • No consumable gases needed • Robust setup, long lifetime
High measurement accuracy	• Direct spectroscopic gas measurement of NO_x • Integrated CO_2 measurement to respect engine load of target vehicle • Fast measurement response • No zero-point or calibration drift, 100 % reproducibility • No interferences from other gas species
Flexible application	• Fast and reliable identification of single high emitting vehicles • High stability (not sensitive to shocks, vibration, temperature) • Compact design, mobile application • Low power consumption and 12 V operation • Data Interfaces: WiFi, LAN, Machine2Machine, RS232, Analogue Volt./Cur. • Internal memory for up to 2 years of data

Patents: DE102015000423; EP3329251; US15/748,923; China ZL201680057099.6

OTHER AIRYX PRODUCTS
SkySpec Instrument Series

ACCURATE AND FLEXIBLE SPECTRAL OBSERVATIONS OF SCATTERED AND DIRECT SUN LIGHT

SkySpec Compact

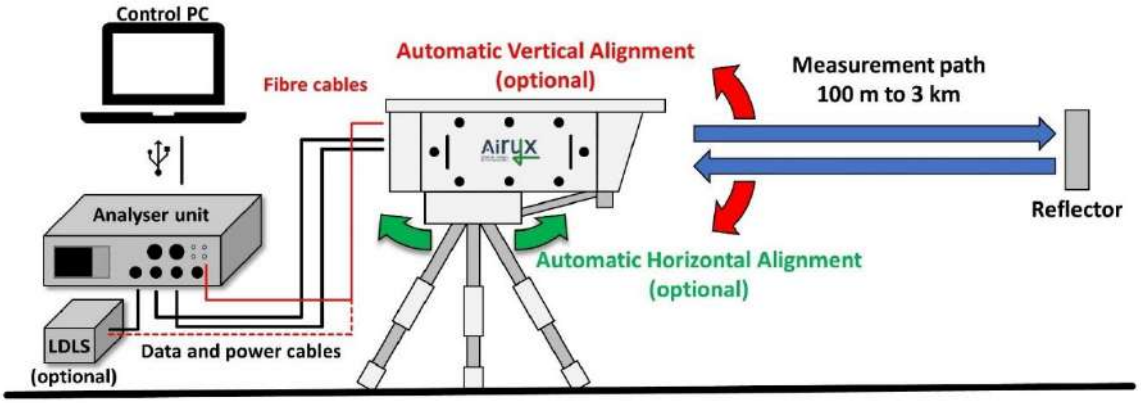
SkySpec 1D

SkySpec 2D

The SkySpec instrument series performs fast, flexible and reliable atmospheric observations with the passive DOAS (Differential Optical Absorption Spectroscopy) method; according to VDI standard 4212. Ultra violet and visible radiation spectra of direct and scattered sunlight in multiple viewing directions are acquired and analysed to obtain information on the spatial distributions of various trace gases (e.g., NO_2, O_3, SO_2, formaladehyd, H_2O, HONO, IO, BrO, Glyoxal) and aerosols in the troposphere as well as the stratosphere. Also, other high precision spectroscopic applications are possible (e.g., surface reflection spectroscopy).

Open-path active remote sensing instrument

FAST AND ACCURATE SPECTRAL TRACE GAS MEASUREMENTS USING ACTIVE SPECTROSCOPY



Scheme of the Open-path instrument setup. Besides standard high Power LEDs, a broadband Laser-Driven Light Source (Xe-lamp) is available.

The Airyx open-path remote sensing instrument allows to monitor a wide range of atmospheric trace gases (NO_2, SO_2, O_3, HCHO, HONO, H_2O, BrO, OClO) based on the method of Differential Optical Absorption Spectroscopy (DOAS). Light emitted by high power LEDs (centered at 280, 325, and 365 nm wavelength) covering the UV/VIS range from 280 to 380 nm are coupled into a telescope and sent through the atmosphere along light paths of lengths between several 100 m and several km. Optionally, a high-power broadband light source (LDLS) is available extending the spectral range and the maximum measurement path length. The instrument measures the average concentration along the path with high precision (sub ppb range, depending on path length) and high time resolution of a few seconds.

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