Roadside measurements of L-vehicle emissions

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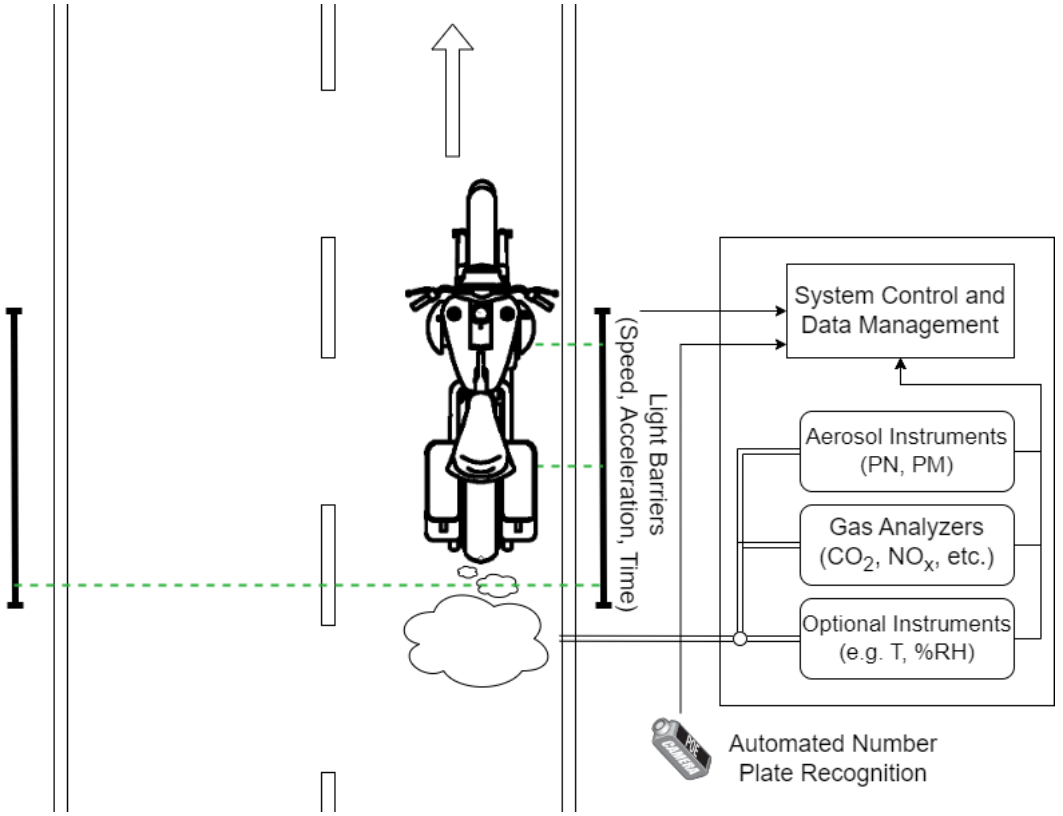
L-vehicles Emissions and Noise mitigation Solutions

Contents

Roadside Emission Measurement by Point Sampling (PS)

- Sample extraction via tube, analyzers in PS bus
- Vehicle detection, speed and acceleration measurement via light barriers
- AI-based Automated Number Plate Recognition
- Logging vast amounts of data
- Battery powered operation

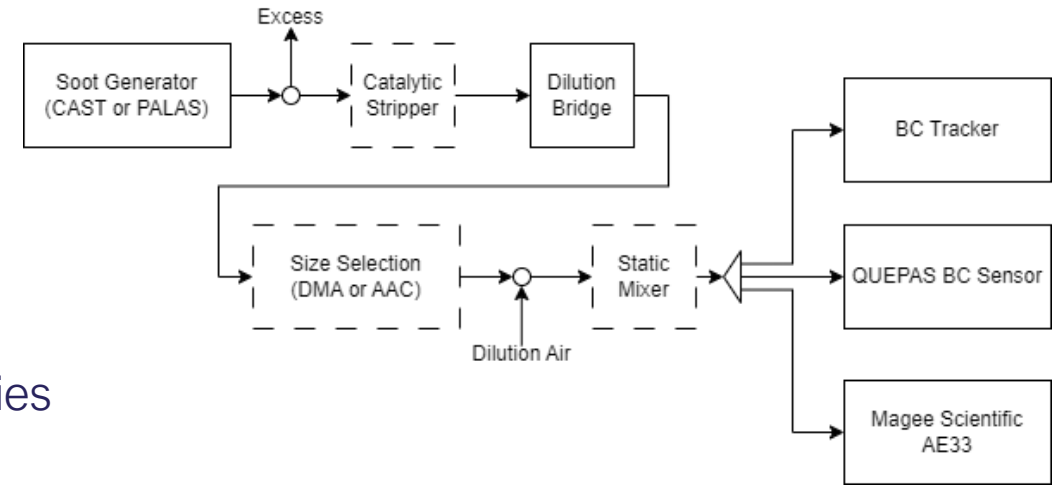


LENS L-vehicles Emissions and Noise mitigation Solutions

Roadside Point Sampling (PS) Setup

Device Validation Campaign

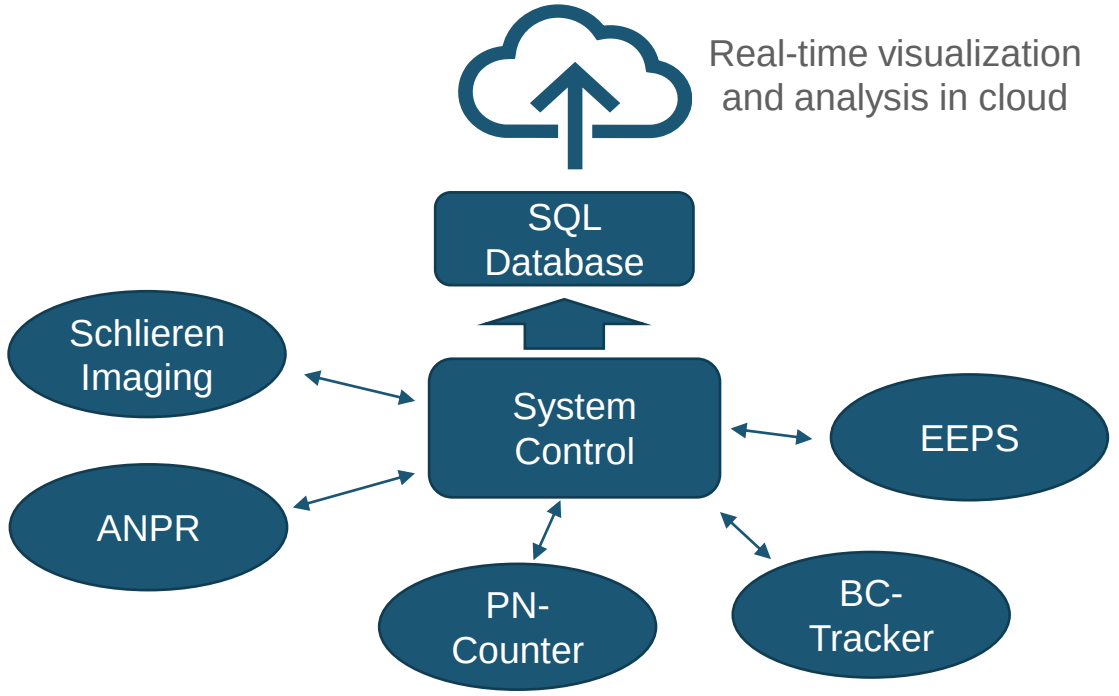
- In-lab sensor calibration
  - Calibration of black-carbon sensors for different EC/OC ratios
  - Particle number (PN) - Sensor calibration
  - CO2-sensor and NOx-sensor factory calibrated
  - Engine exhaust particle sizer (EEPS) calibrated
- Point Sampling Exercise
  - Around 150 passes of L-vehicles with different categories
  - Validation of all sensors with PS



Data Management

COMMUNITY
THE DIGITAL GOVERNMENT EXPERTS

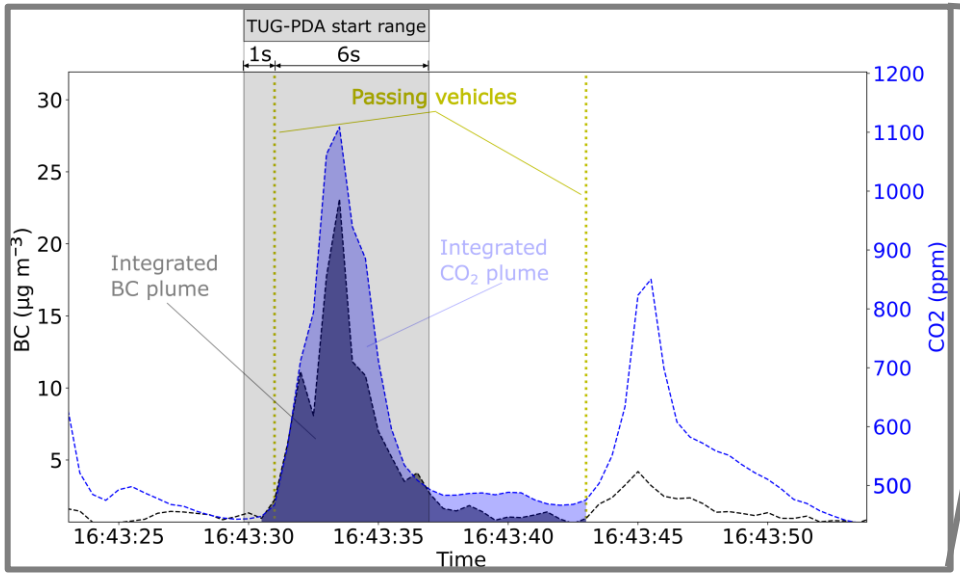
- Point sampling data management
  - PS shelter equipped with central system control
  - Instrument time alignment
  - Sampling time correction
  - Data logging and storage → local SQL database
- Optional cloud uplink
  - Link SQL database to cloud
  - Real-time visualization hub
    - publicly visible data stream (e.g. post link on webpage)
    - log-in protected data stream (e.g. for project partners)
    - log-in protected alarm page (e.g. for authorities)
  - Cloud real-time data analysis possible – option for future campaigns

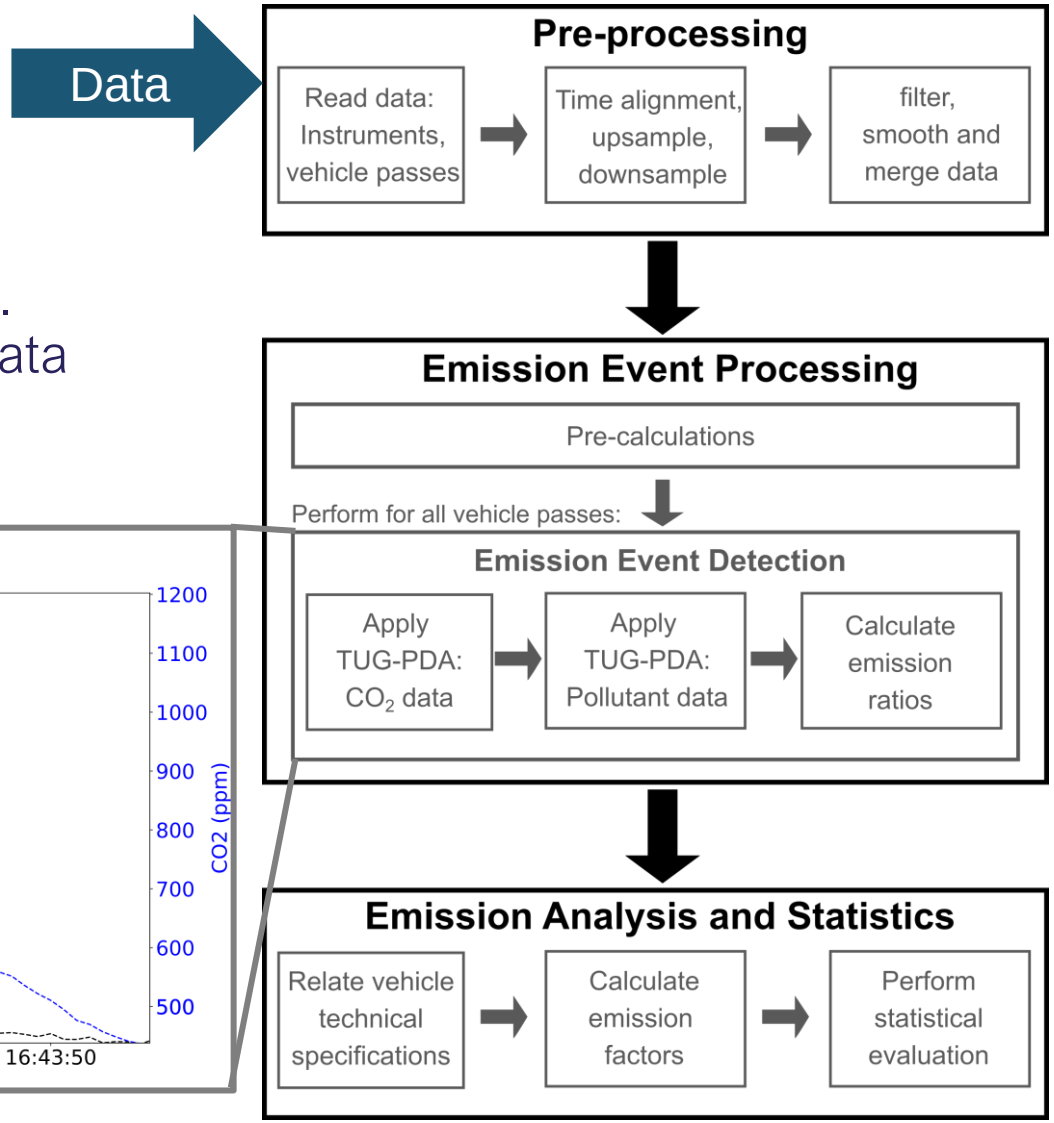


Data Analysis

- Based on [Knoll et al. Large-scale automated emission measurement of individual vehicles with point sampling. Pre-print. EGUsphere. 2023.] – approach for CARES data
- Automated post-processing
  - Peak detection
  - Alignment
  - Pollution data
  - Obtain Efs
- Emission Factors
  (Emission Ratio ER)

$$ER = \frac{\int_{t_1}^{t_2}([P]_t - [P]_{t_0})dt}{\int_{t_1}^{t_2}([CO_2]_t - [CO_2]_{t_0})dt}$$





L-vehicles Emissions and Noise mitigation Solutions

Schlieren Imaging Technique

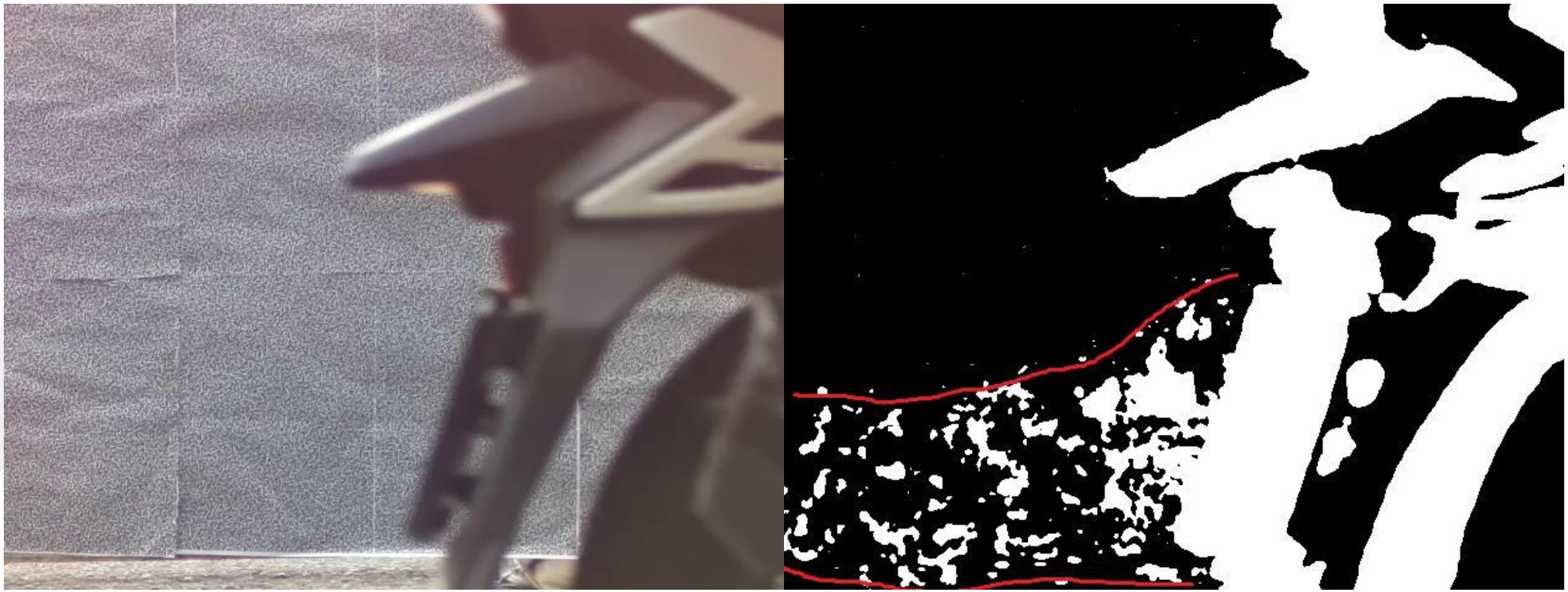
Car – Leuven – Donkerstraat 37 - 2024-05-13 15:41:28

Original image

Schlieren image

Schlieren Imaging Technique

Scooter – Leuven – Donkerstraat 37 - 2024-05-13 17:20:41



Original image

Schlieren image

L-vehicles Emissions and Noise mitigation Solutions

Schlieren Imaging Technique

Heavy Bike – Leuven – Donkerstraat 37 - 2024-05-13 16:14:25

Original image

Schlieren image

L-vehicles Emissions and Noise mitigation Solutions

Conclusion

- Point sampling setup with all the sensing devices have been setup in Leuven
- More than 100 L-vehicles have been tested in Leuven in last two days
- Detection of high emitters will be done after post processing of data from all the devices
- Detection of high emitters in real time by PS in general possible when thresholds are defined, possibly by combining the analyzed LENS emission data

Thank you!

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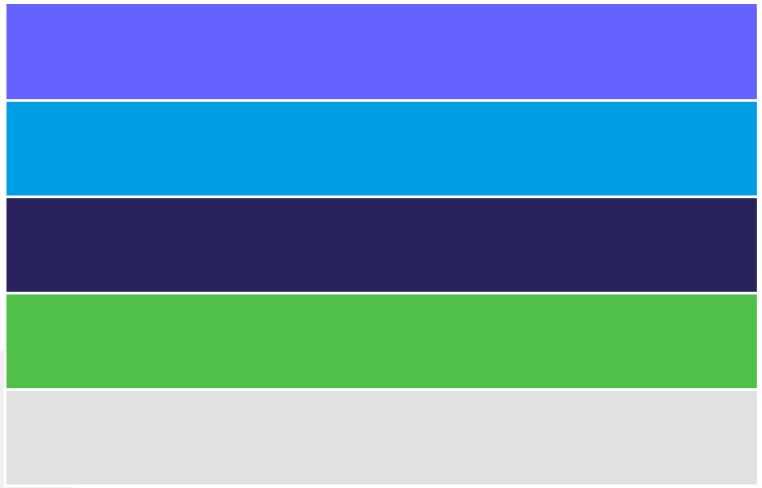
Colour palette



RGB	HEX
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0/159/227	009fe3
40/35/93	28235d
81/192/72	51c048
225/225/225	E1E1E1