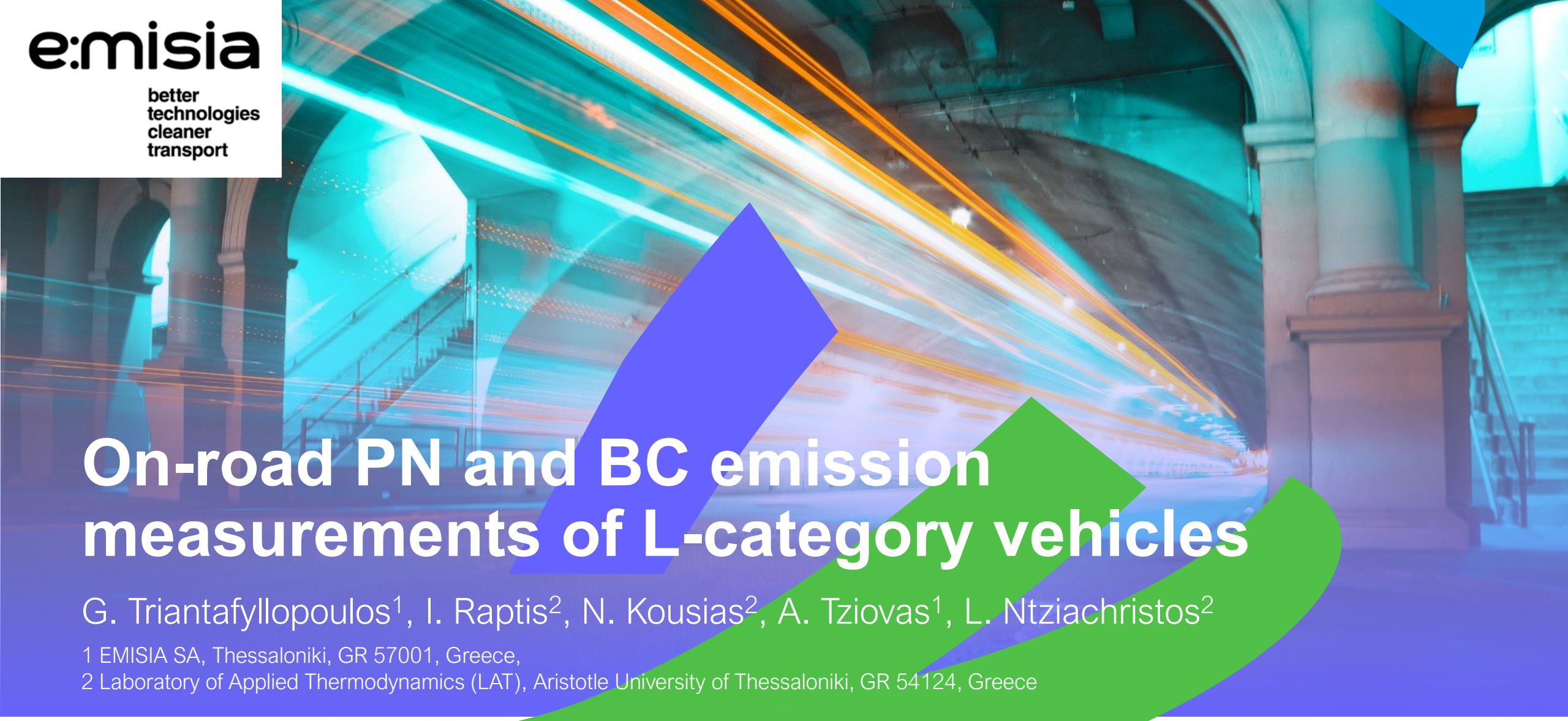

On-road PN and BC emission measurements of L-category vehicles

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This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101056777

L-vehicles Emissions and Noise mitigation Solutions

LENS Project: L-vehicles Emissions and Noise mitigation Solutions

- “L” category vehicles (LVs)
- Mainly Motorcycles, but also:
  - Mopeds
  - Enduro
  - 3-wheelers
  - Quads
  - Mini-cars
  - Buggy



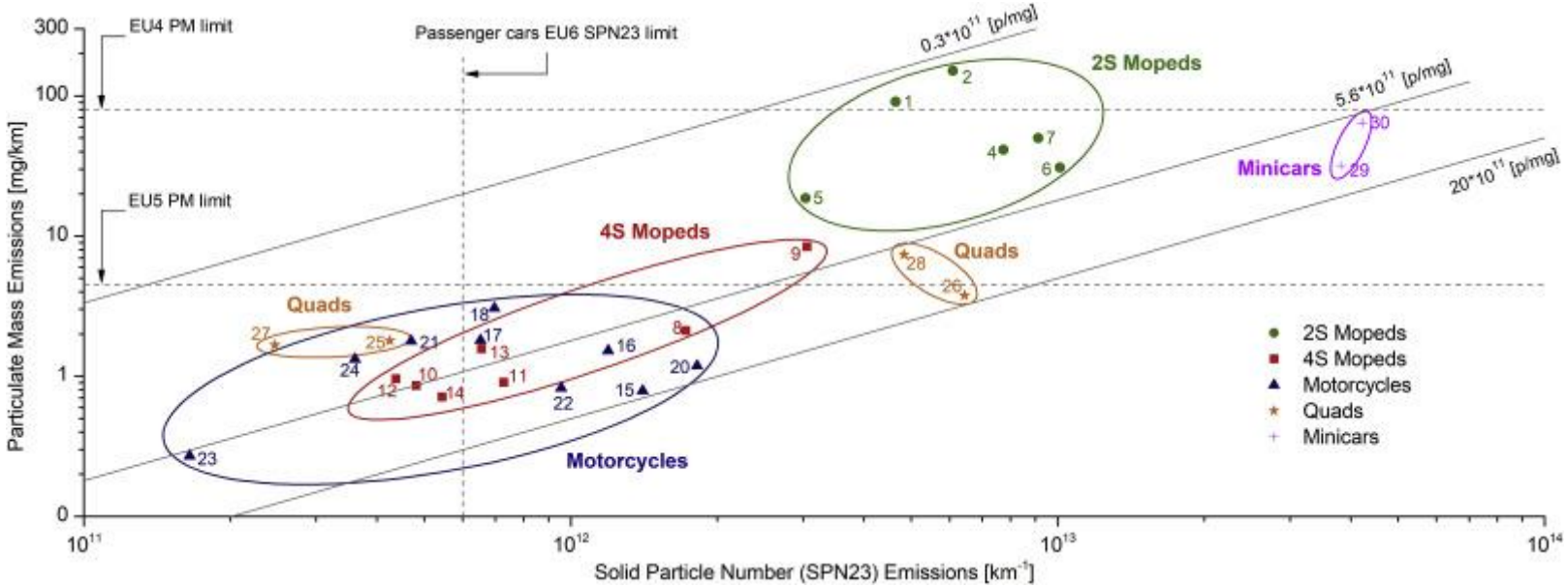





LENS L-vehicles Emissions and Noise mitigation Solutions

LENS Project: L-vehicles Emissions and Noise mitigation Solutions

- [1]LVs are a major contributor to vehicular particulate emissions.
- [1]Particulate emissions of latest technology vehicles much higher than passenger cars.

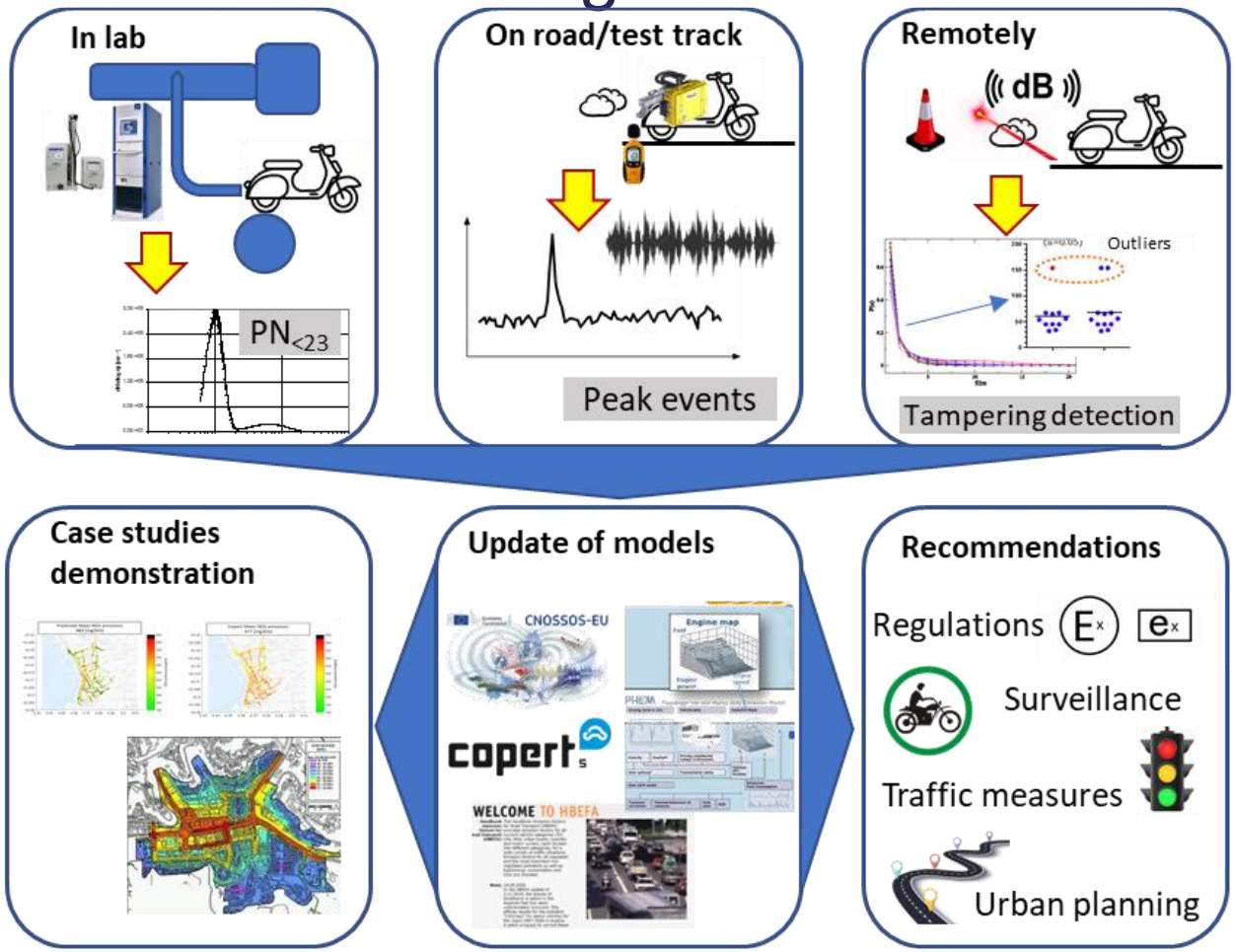


- Further research on real-world emissions of LVs necessary for applying appropriate emission reduction policies.

1 Kontses et al, “Particulate emissions from L-Category vehicles towards Euro 5”, Environmental Research, Volume 182, March 2020

LENS Project: L-vehicles Emissions and Noise mitigation Solutions

- Horizon Europe project
- 15 partners
- Emissions measurements (lab & road) 150 LVs
- Noise measurements (track & road) 164 LVs
- Remote sensing and tampering detection
- Emissions and noise simulations
- Recommendations for pollutants & noise reduction



- https://www.lens-horizoneurope.eu/

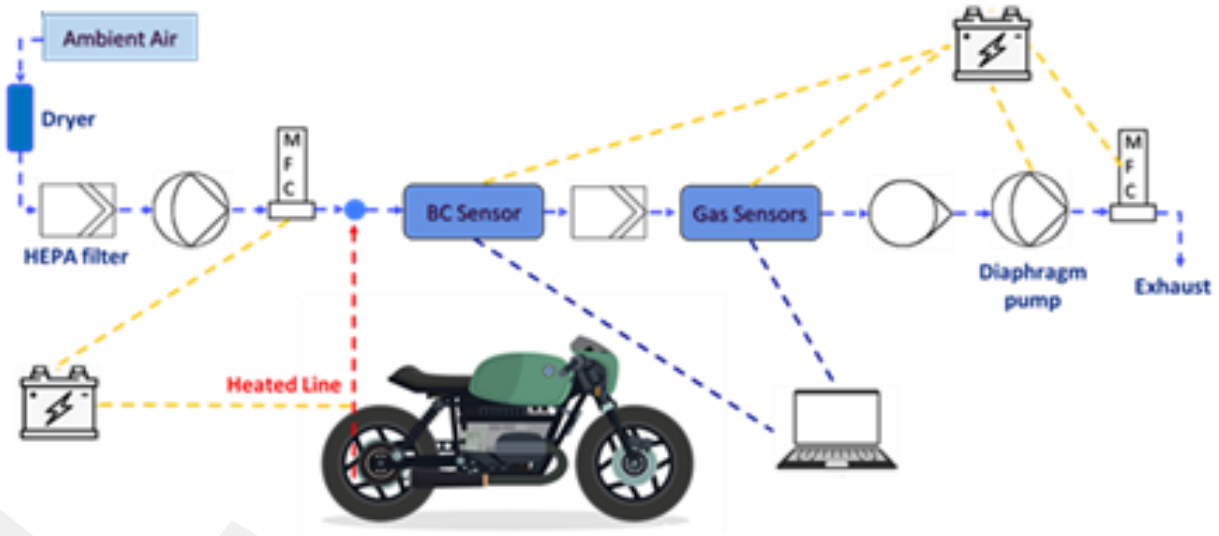
emisia CONSCIOUS OF TRANSPORT'S IMPACT · Applus IDIADA · TU Graz · ivl Swedish Environmental Research Institute · ika RWTH AACHEN UNIVERSITY · KU LEUVEN · CZU Czech University of Life Sciences Prague

TNO innovation for life · ifp Energies nouvelles · KTM · BMW GROUP · PIAGGIO GROUP · DUCATI · HORIBA · POLIS CITIES AND REGIONS FOR TRANSPORT INNOVATION

On-road testing

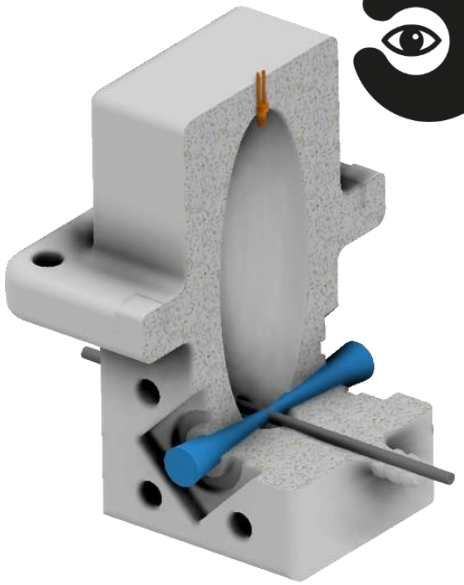
- Commercial PEMS used only for big motorcycles and 4-wheeler LVs
- Smaller sensor-based equipment commercial & prototype used for all LVs

Maurus sensor for BC measurement

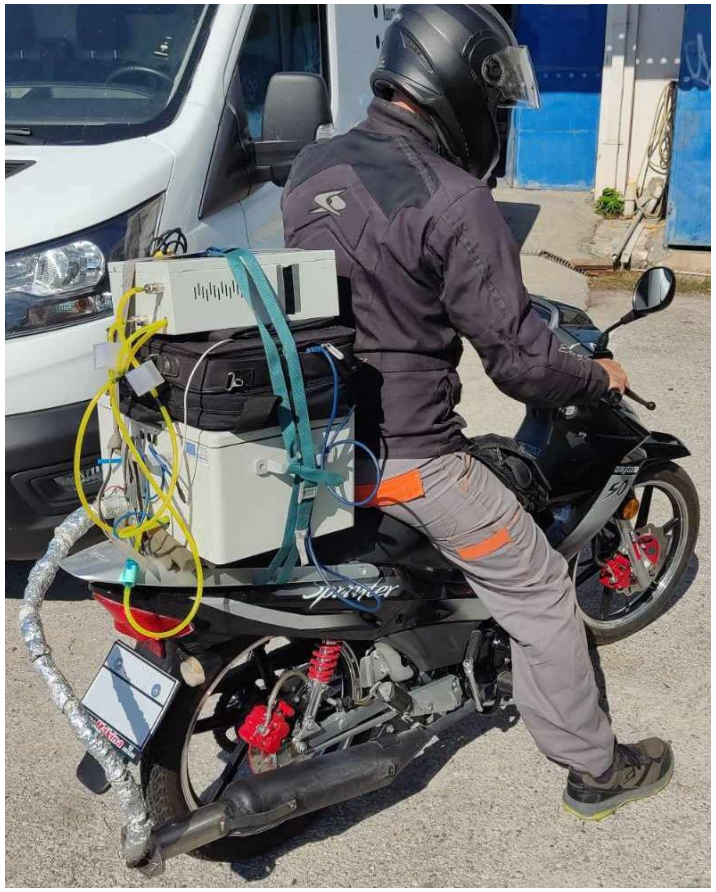


- Maurus BC prototype optoacoustic sensor
- CO & NO (electrochemical)
- CO_2 (NDIR)
- Dilution 10:1
- Compact & Lightweight

maurus



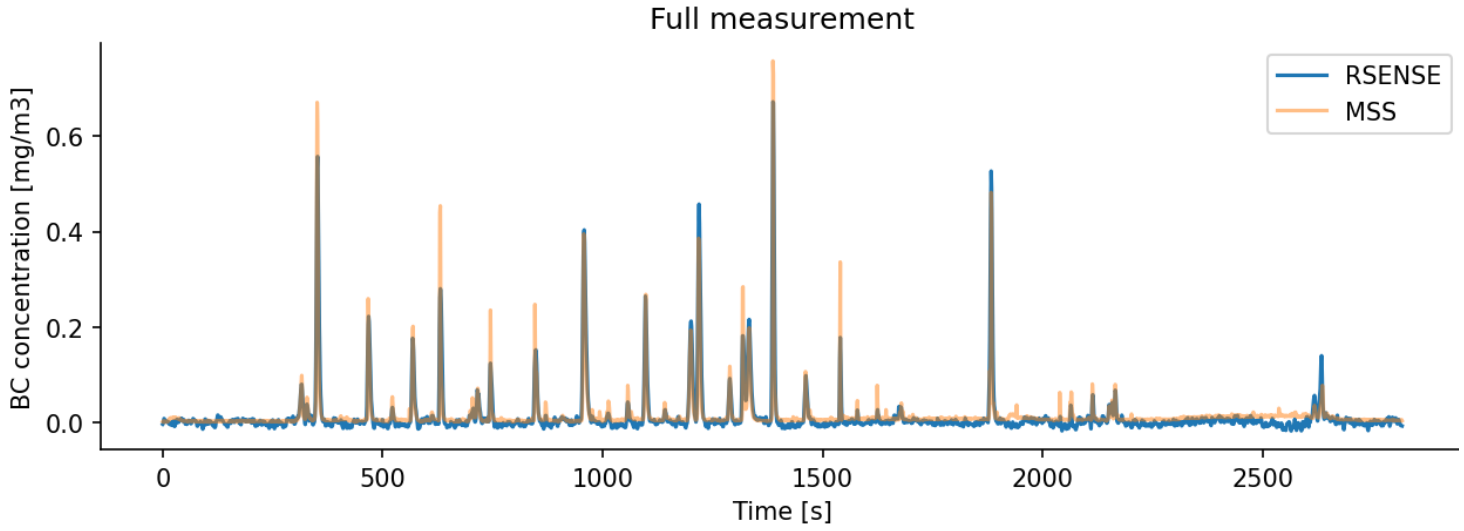
Installed on 50cc moped

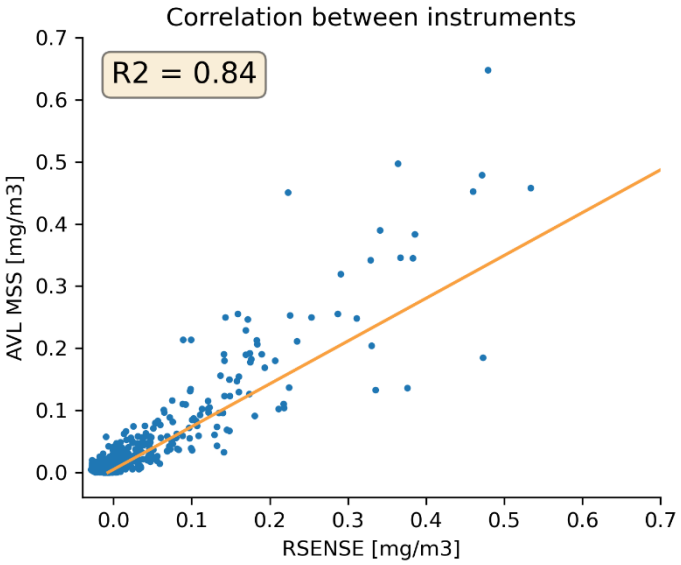


Maurus sensor for BC measurement

- Maurus sensor against commercial laboratory BC optoacoustic sensor in laboratory conditions
- Satisfactory correlation

BC





Pegasor Mini PPS & Horiba mini-PEMS for PM & PN measurement

- Prototype Horiba mini-PEMS
  - CO_2, CO, HC (NDIR)
  - NO_x (electrochemical)
  - Exhaust flow (pitot)
- Pegasor mini PPS
  - PM &PN (Diffusion charger)
- Bulky and heavy

Installed on 2-wheel and 3-wheel mopeds

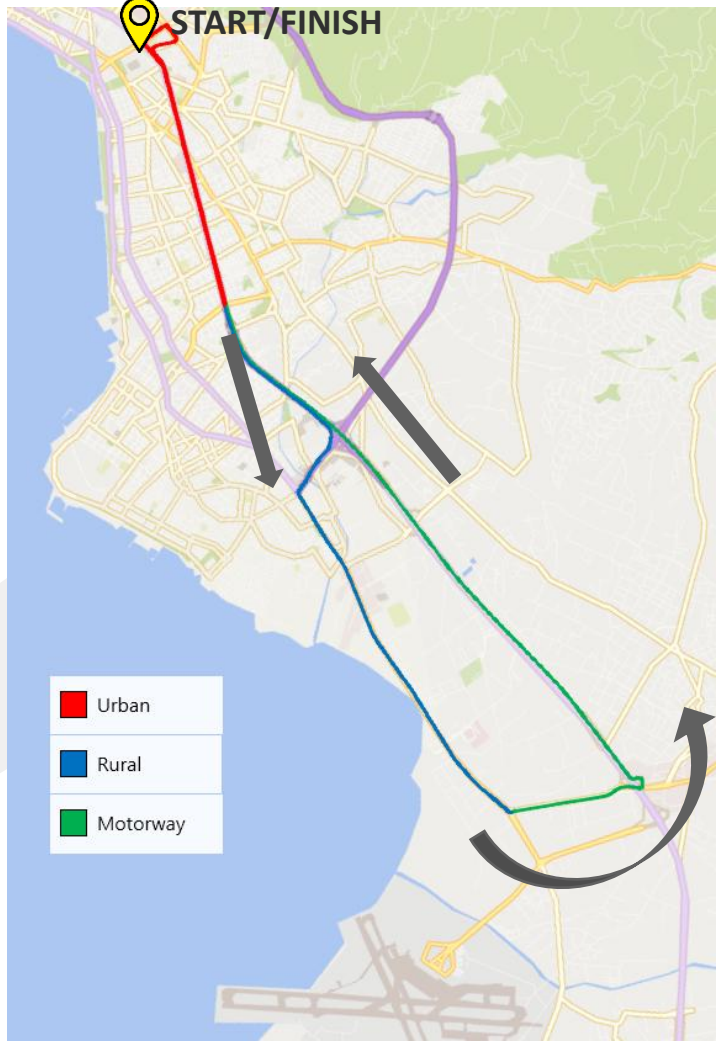
Vehicles tested

- BC measured on:
  - EU5 Scooter <250cc
  - EU5 Moped 50cc
  - EU5 Scooter <250cc
  - EU5 Scooter >250cc

- PM & PN measured on:
  - EU5 Motorcycle >250cc
  - EU1 Moped 3-wheel 50cc (2-stroke)
  - EU3 Moped 50cc, modified to 75cc

Routes tested

Regular RDE

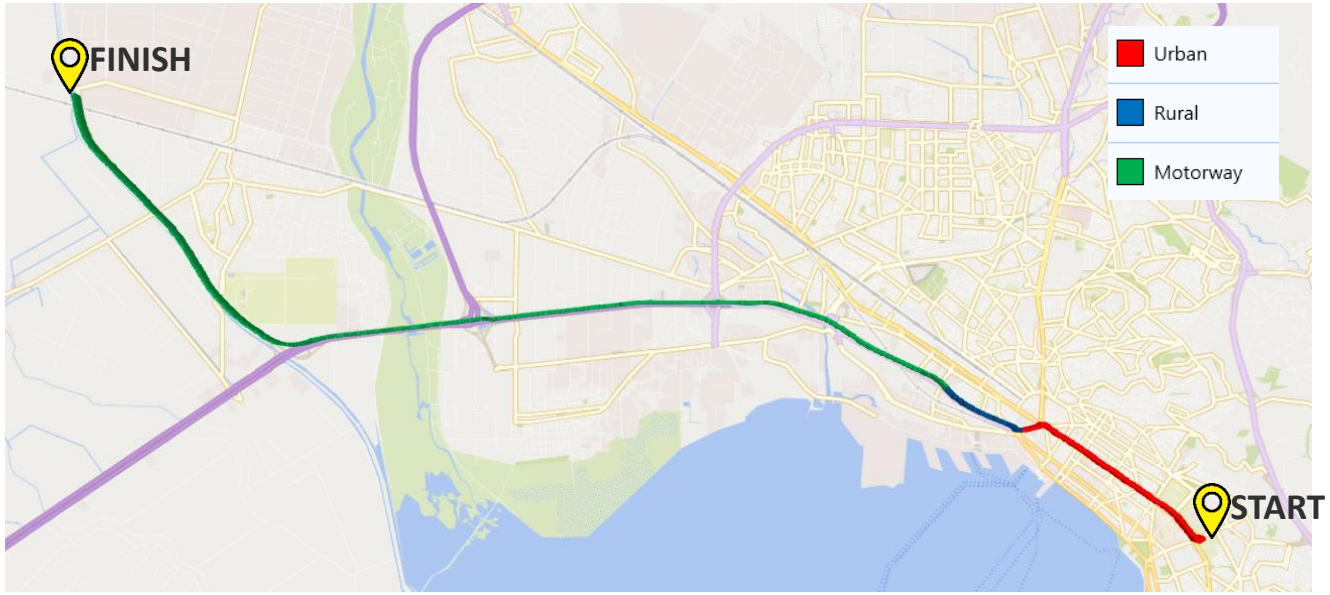


- Regular RDE trip
  - Cold starting
  - Casual driving
  - Urban, Rural & Motorway
  - Urban only for mopeds

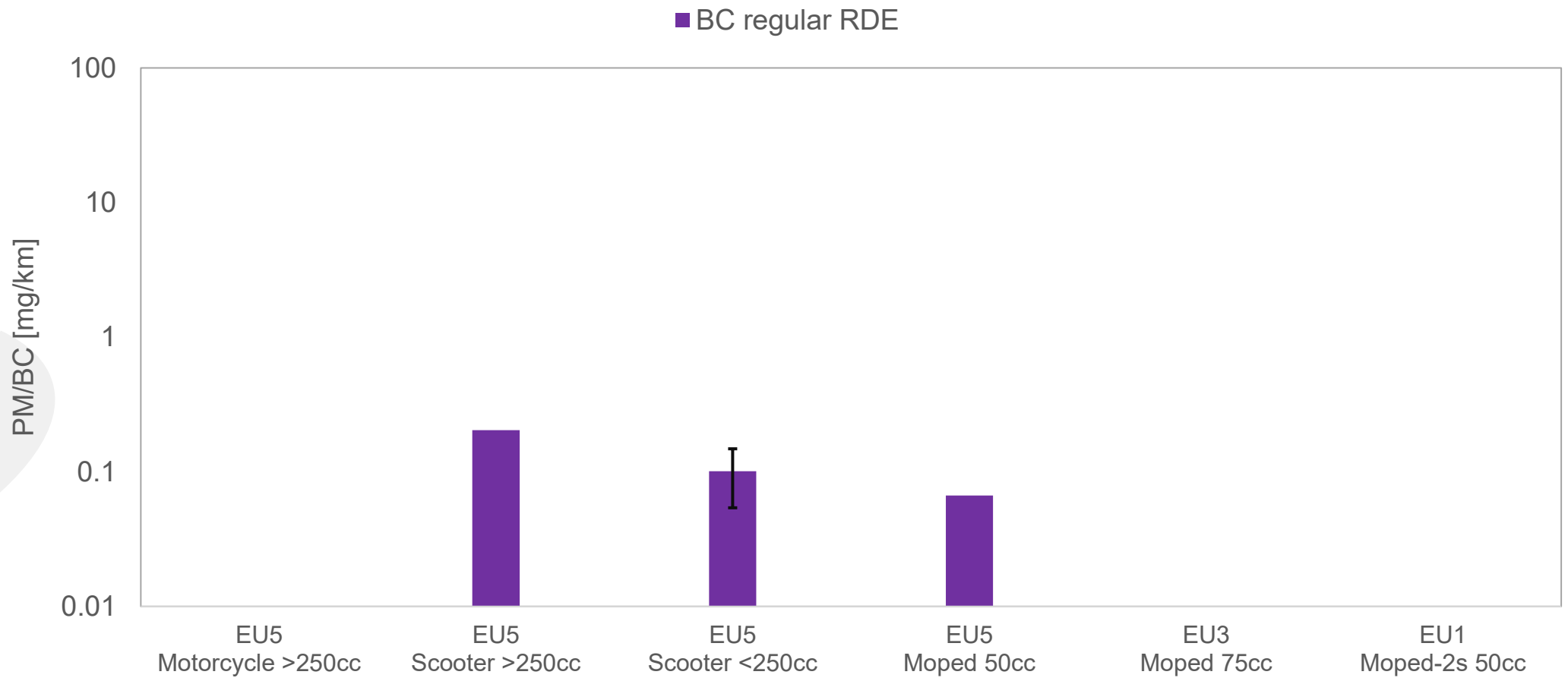
- Extreme RDE trip
  - Cold starting
  - Aggressive driving
  - Backfire
  - Strong accelerations
  - Engine revving
  - Acceleration – deceleration transition
  - Frequent gear changes

Tested only with EU5 Motorcycle >250cc

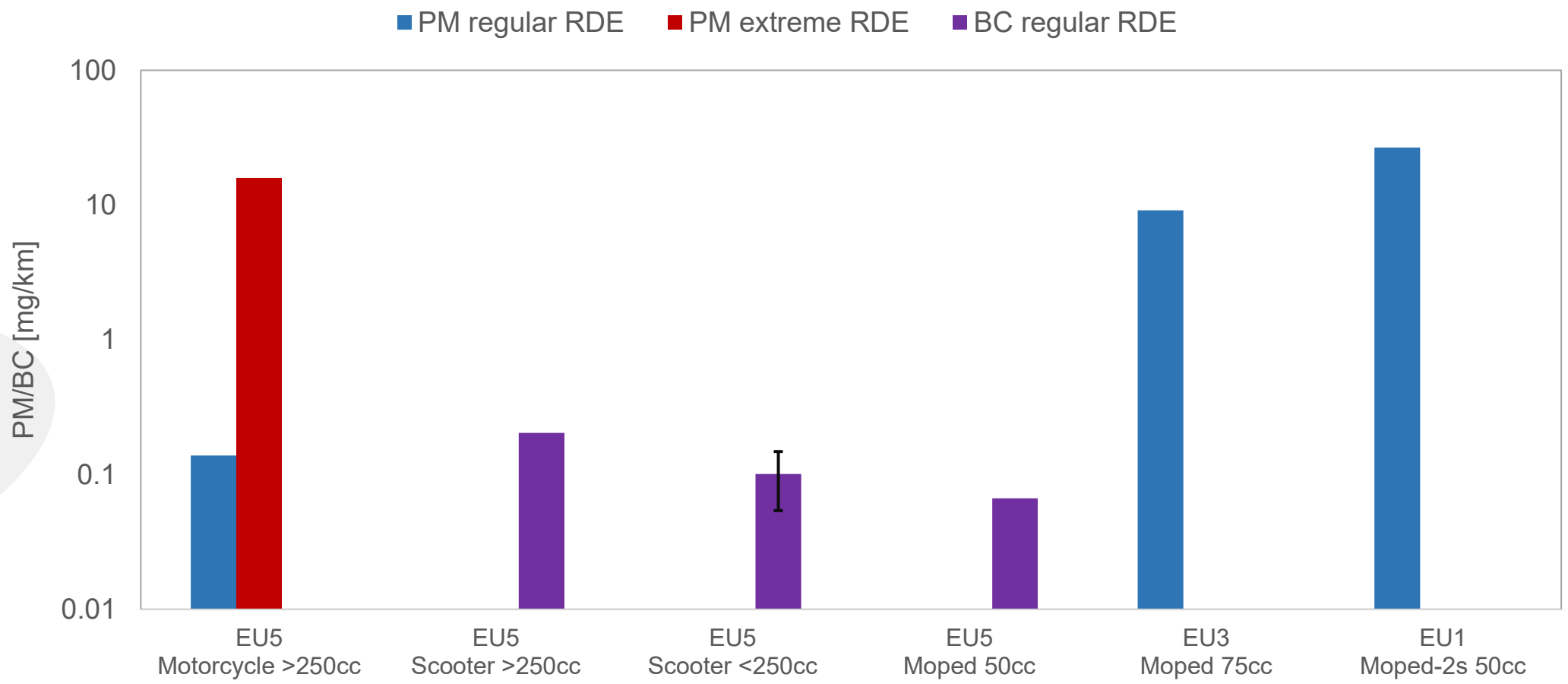
Extreme RDE



PM & BC Results



PM & BC Results



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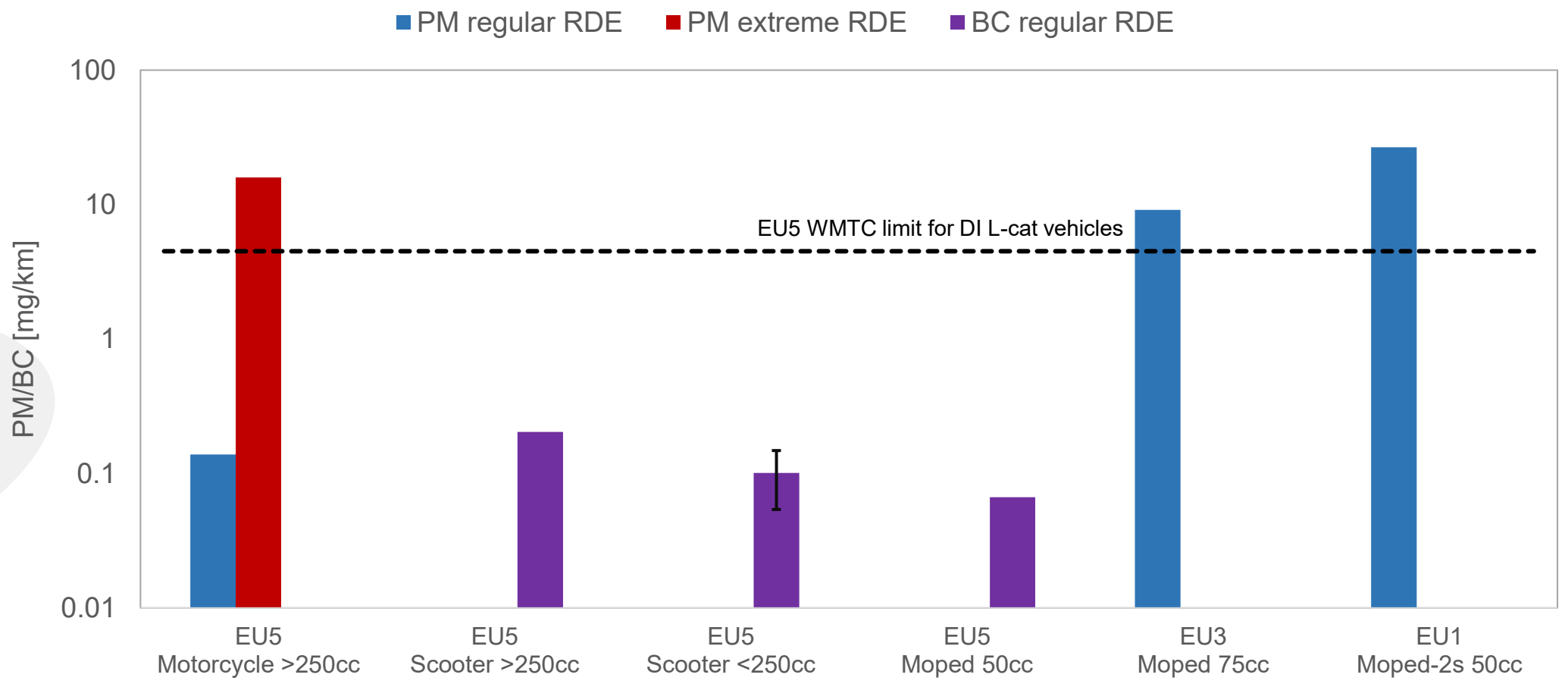
PM & BC Results



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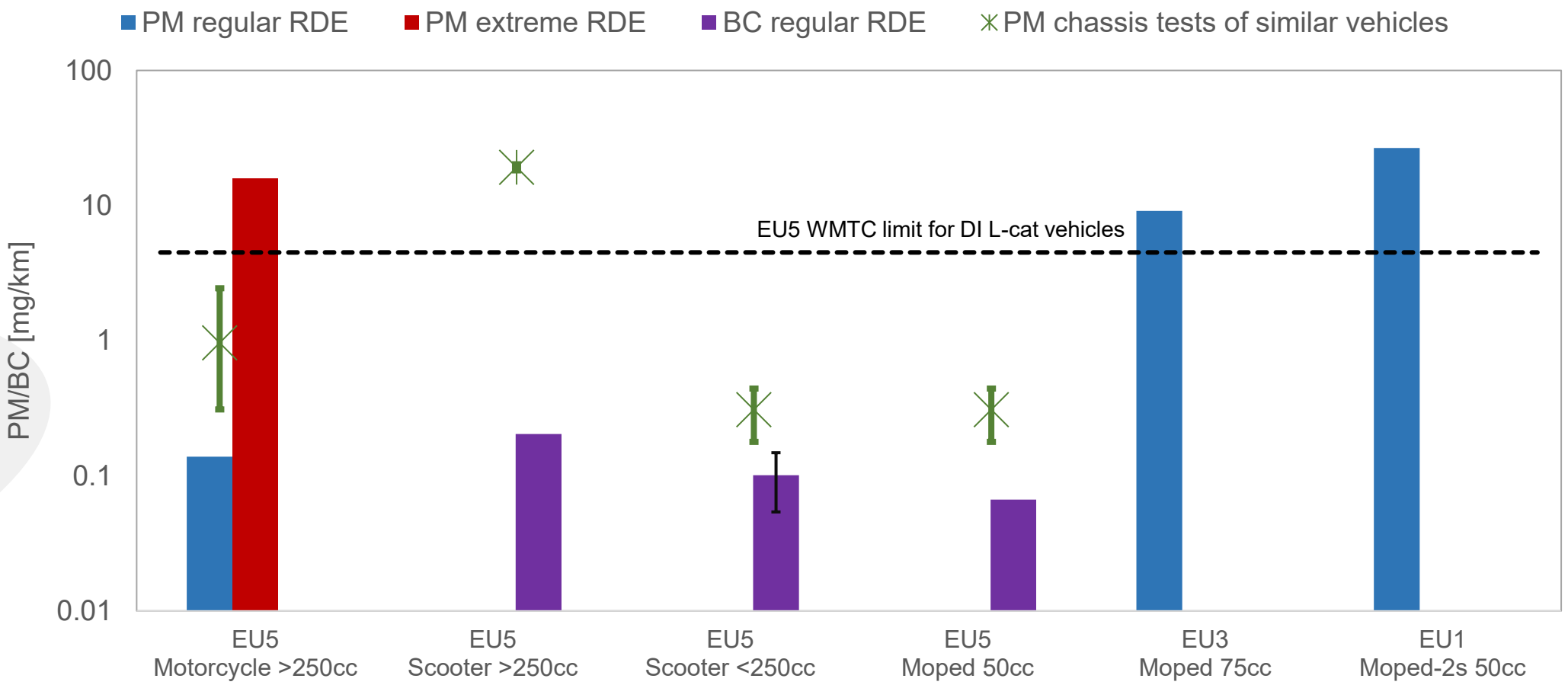
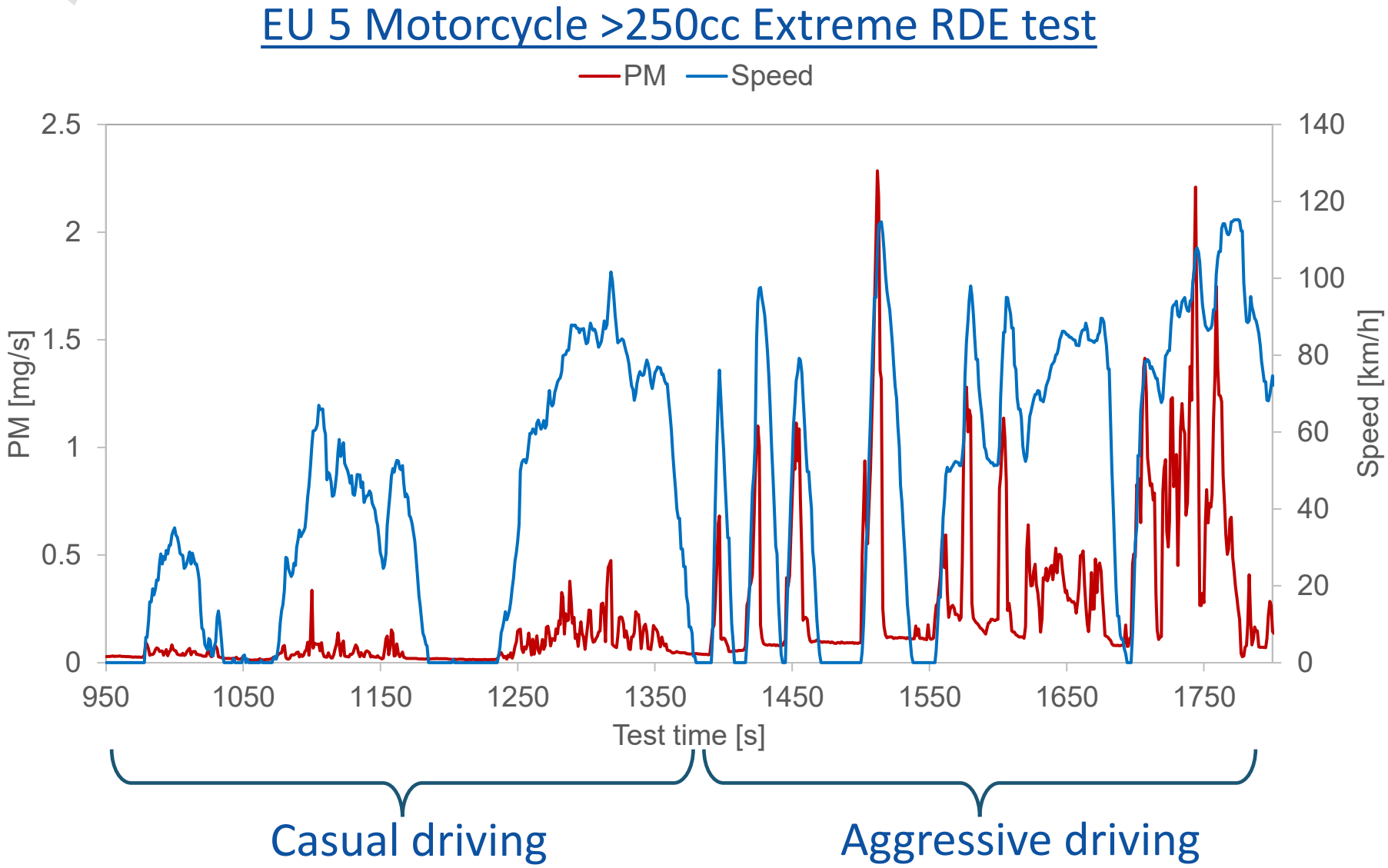
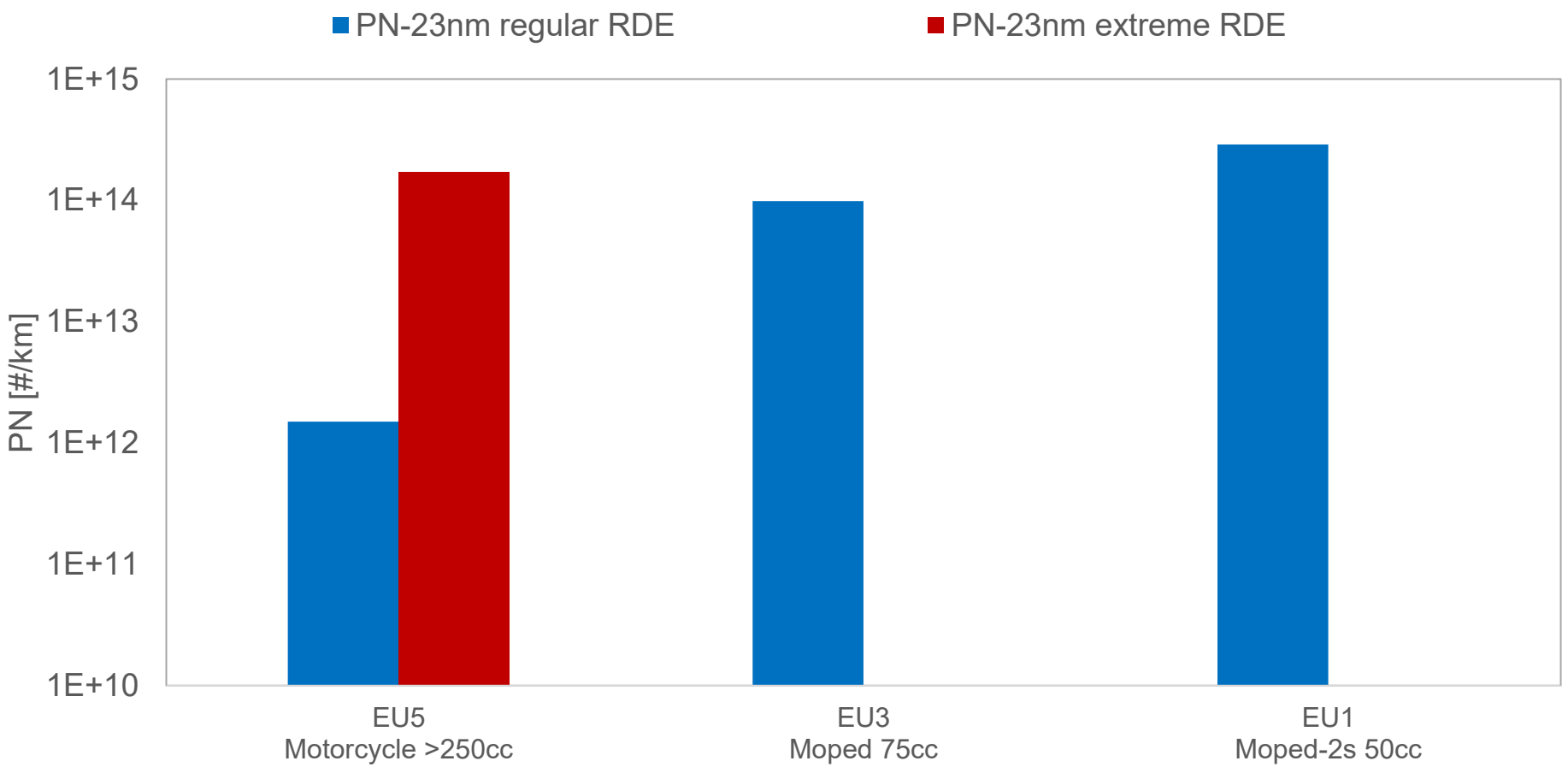
PM & BC Results



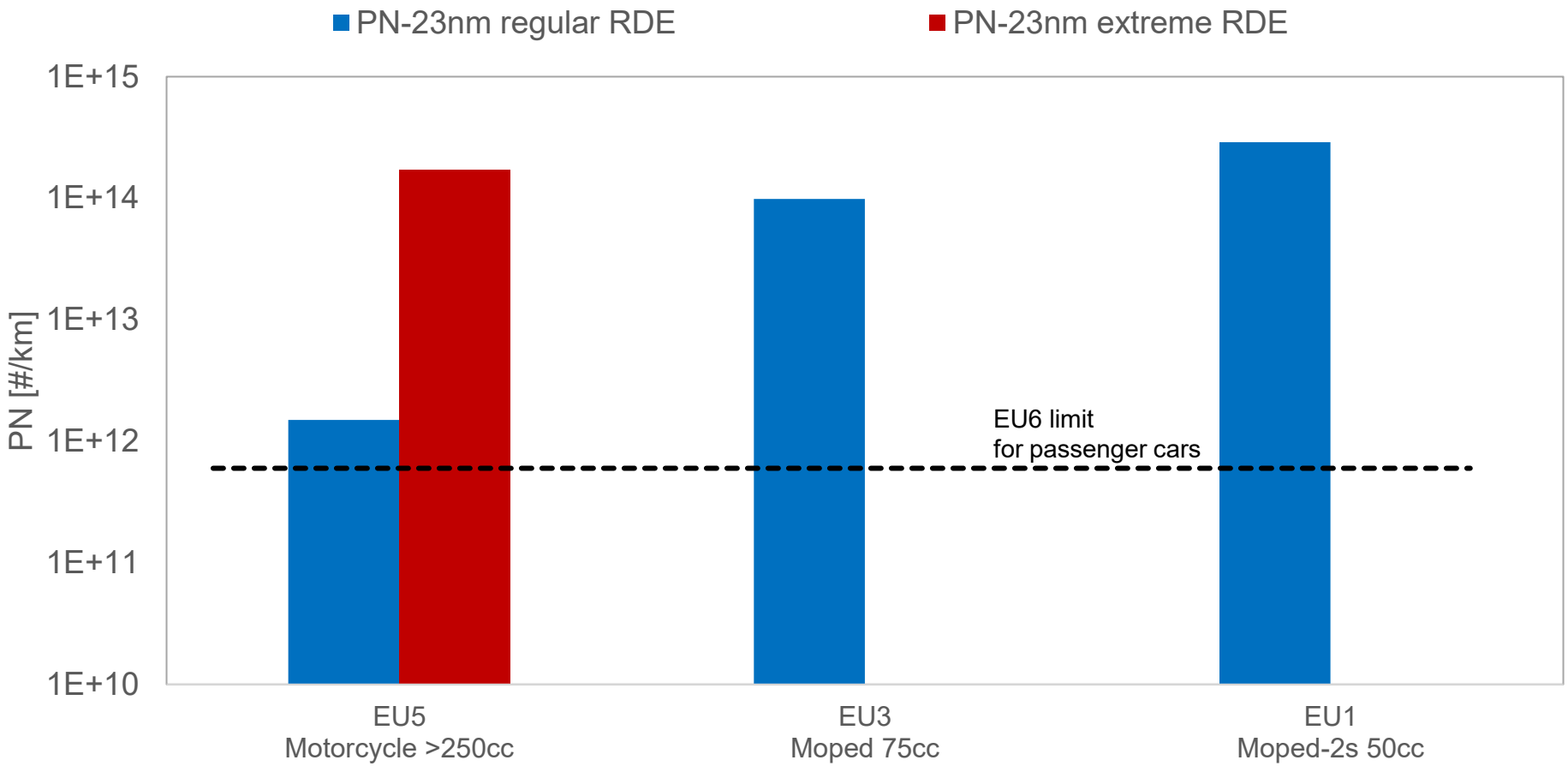
PM & BC Results



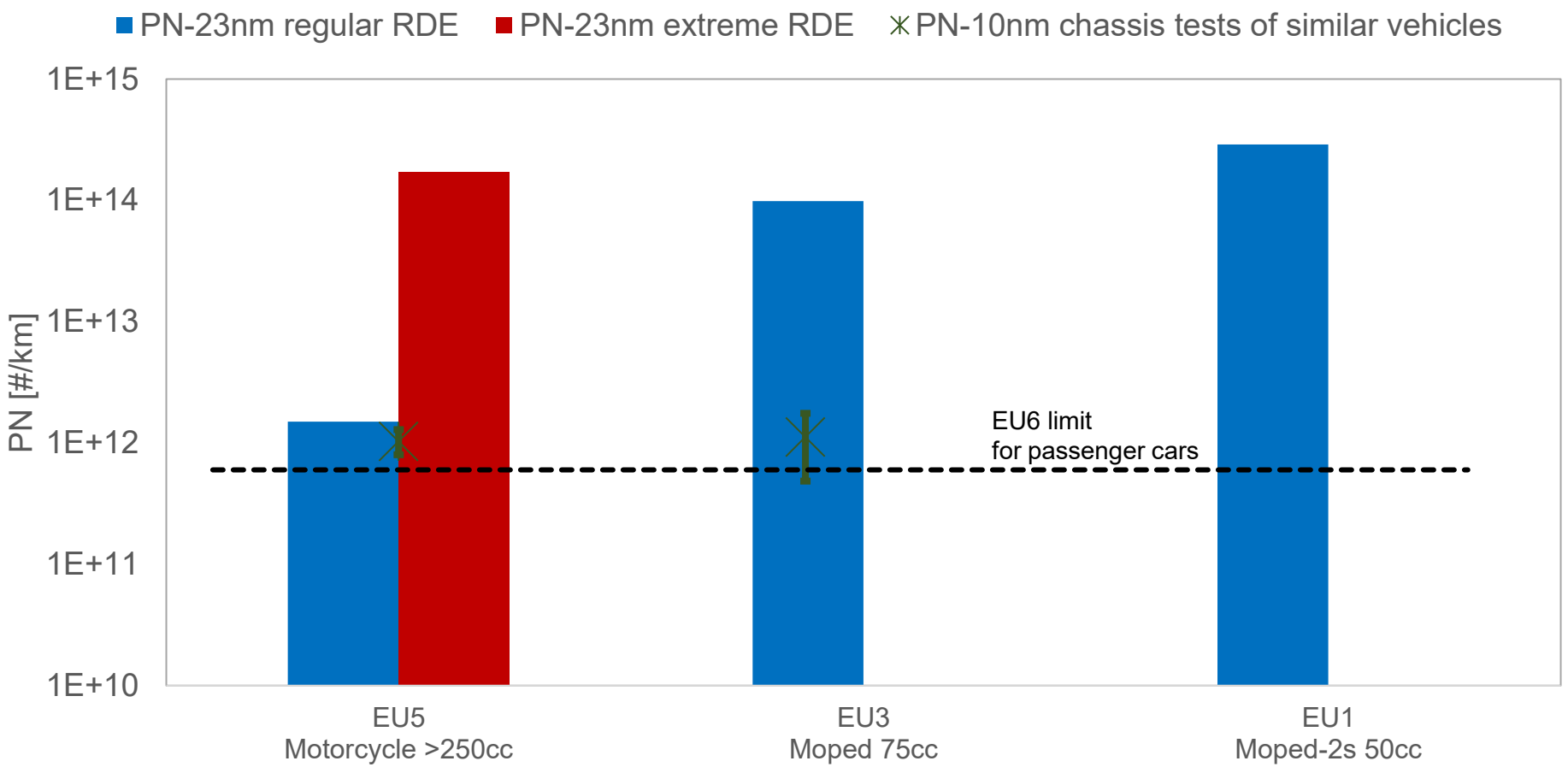
PN results



PN results

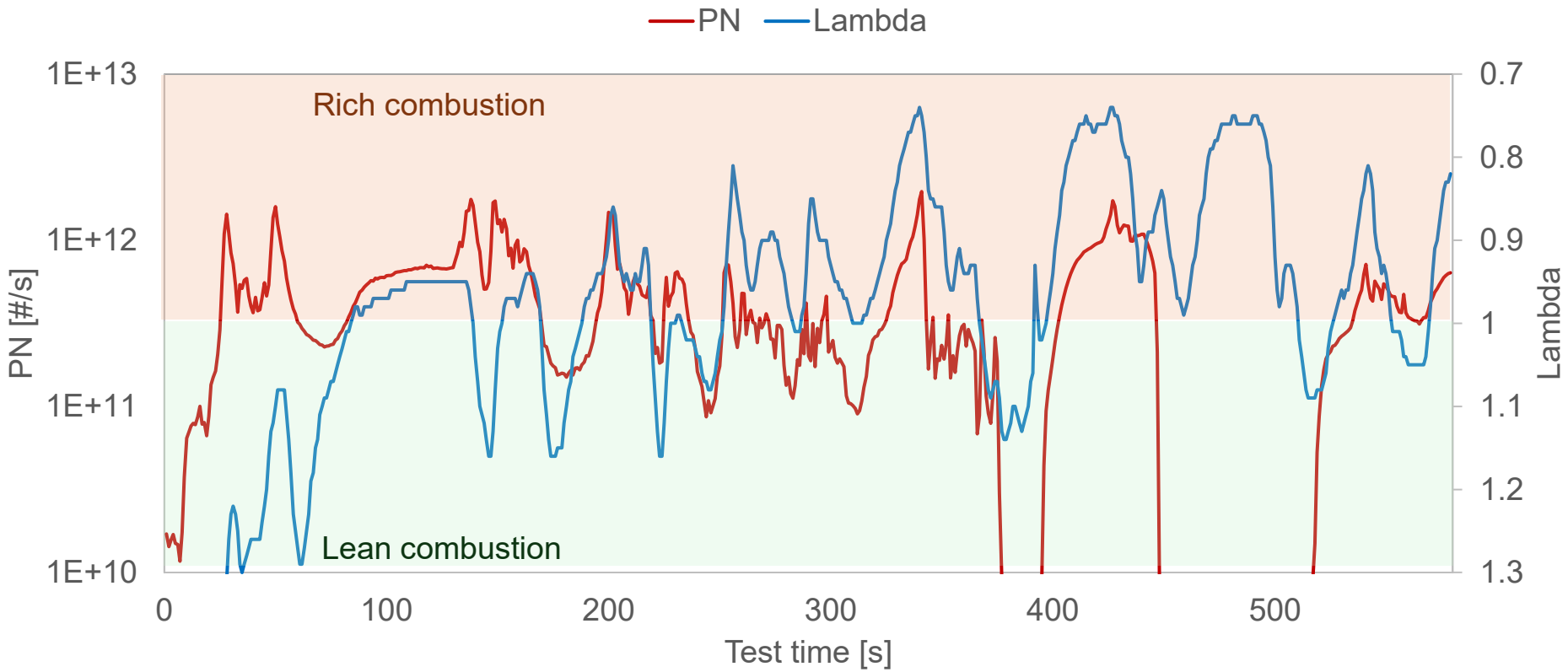


PN results



PN results

EU 3 Moped, modified to 75cc Regular RDE test



Conclusions

- Maurus prototype BC sensor operational & accurate.
- CO_2, CO, NO_x and BC measurements achievable for all LVs.
- PN & PM measurement possible with Pegasor, but not an option for small vehicles.
- LVs PN & PM levels vary greatly. Very high levels measured in some cases.
  - From 1 LV: Driving behavior has significant effect on PN & PM emissions.
  - Higher PN & PM levels during cold starting
  - Higher PN & PM levels during fuel rich combustion
    - On-road RDE is necessary for assessing the real-world emissions performance.

Thank you!

Contacts

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This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101056777

L-vehicles Emissions and Noise mitigation Solutions

Backup slides

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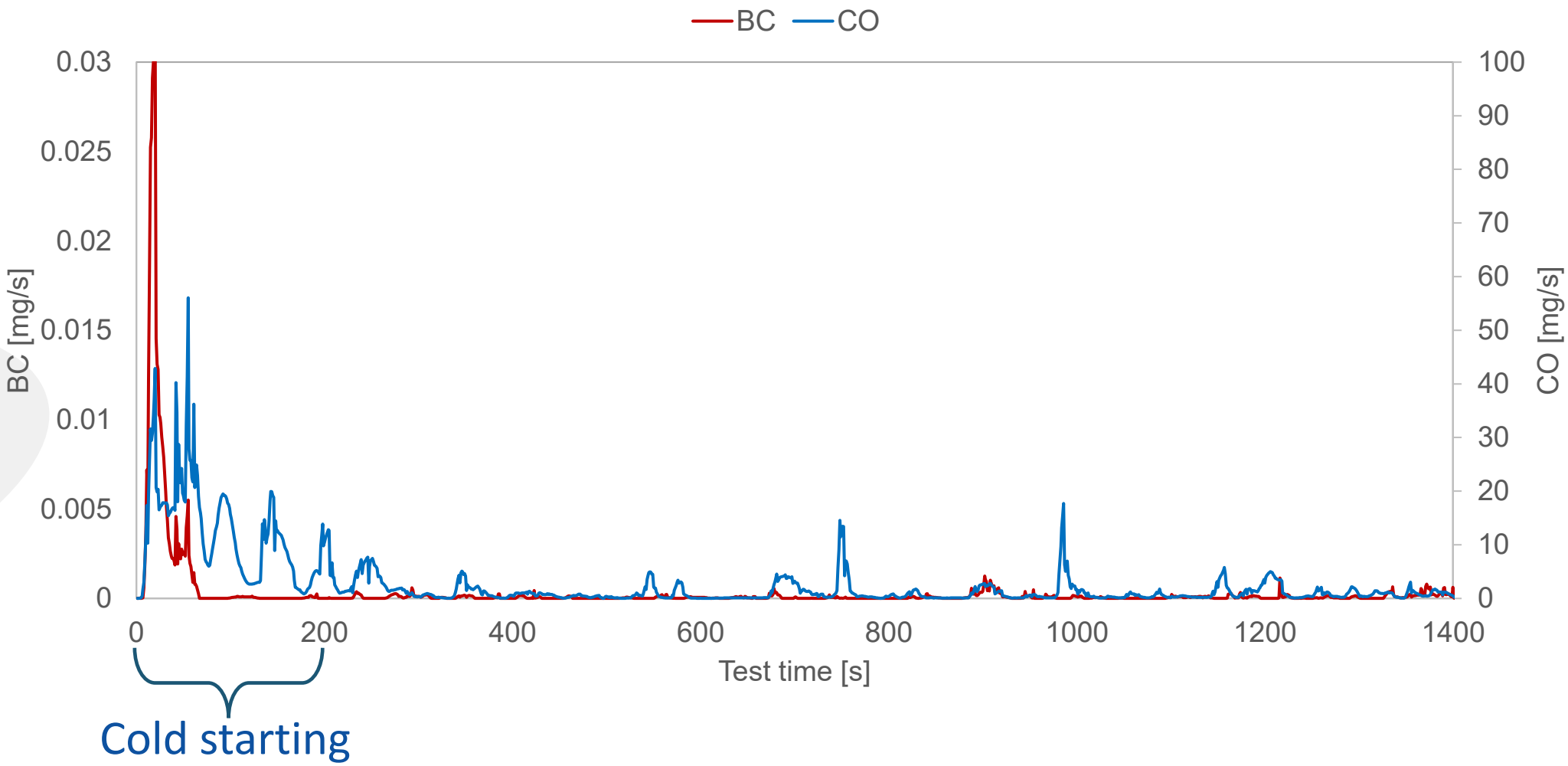
PM & BC Results

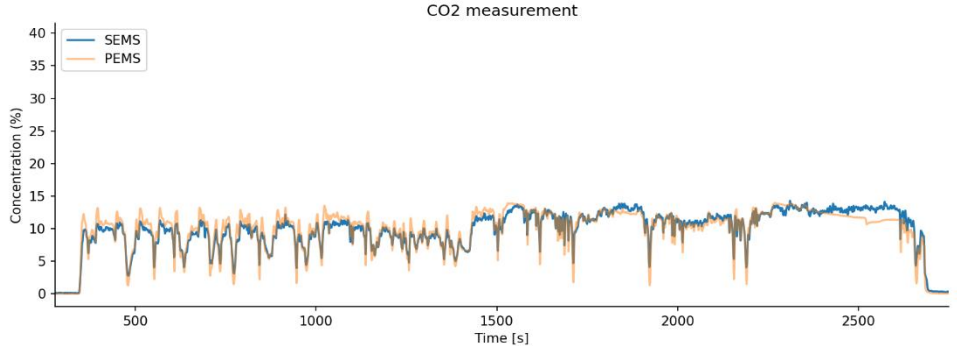
EU 5 Moped 50cc Regular RDE test

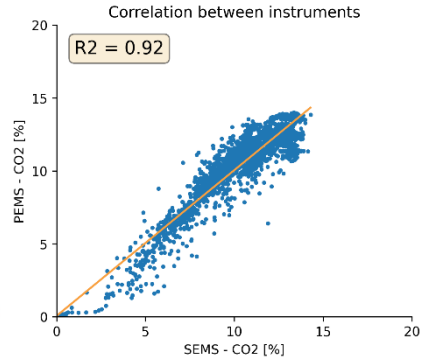


EMISIA ReTEMS prototype used with Maurus sensor for CO, CO_2 & NO

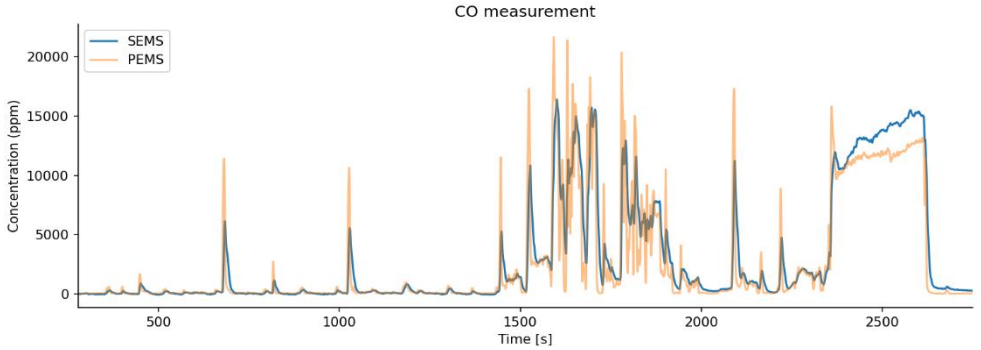
- ReTEMS (Real Time Emisisons Measurement System) for gaseous CO, CO_2 & NO emissions.
- EMISIA developed
- CO & NO (electrochemical)
- CO_2 (NDIR)
- ReTEMS against commercial PEMS in laboratory conditions
- Satisfactory correlation

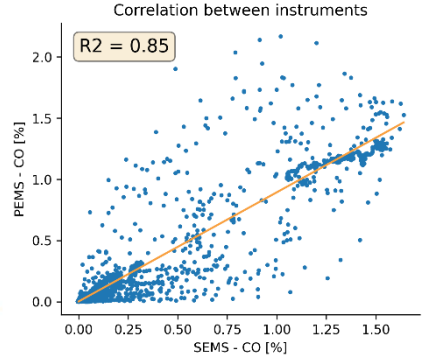
CO_2



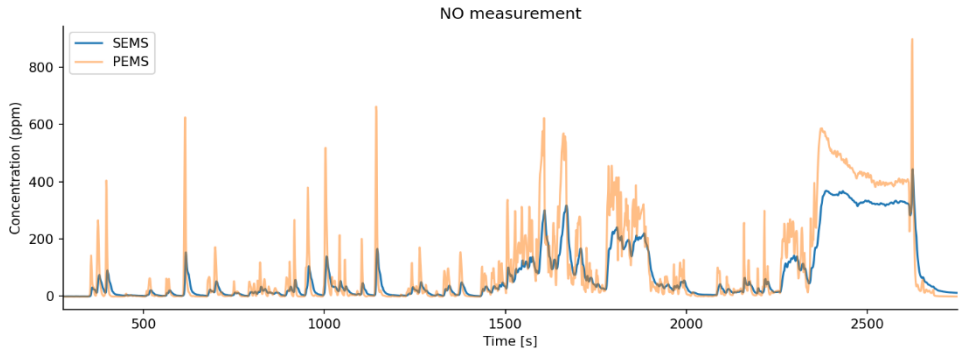


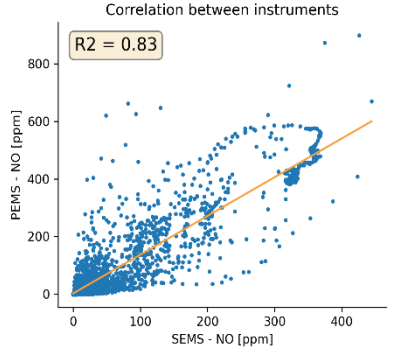
CO





NO





L-vehicles Emissions and Noise mitigation Solutions

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