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**EU-Program "Particulates"**

## Introduction

Within the current database there are limited data on particulate size, and future measurements of different size fraction of ambient particulate may complicate both the assessment of environmental impact and the identification of relevant emission standards for motor vehicles. Therefore, it is necessary to collect and analyse information regarding the characterisation of motor vehicle emitted particulates in a scientifically and technically sound manner. The characterisation should include parameters already introduced by the air quality standards, but also other components to help towards the investigation of particulate fate and provide useful input to studies on health effects. On this basis, a consistent methodology should be established to measure automotive particle emissions and to establish a relationship of the automotive particle contribution to the ambient particulate matter.

The following main tasks are envisaged:

- a) Definition of the exhaust aerosol properties which will be examined and evaluation of the available measurement instruments and techniques.
- b) Development and introduction of a harmonised protocol for the measurement of exhaust aerosol.
- c) Examination of the particulate emission of current light duty vehicles and heavy duty vehicles and engines.
- d) Investigation of the influence of engine technology, fuel quality and after-treatment on particulate emissions.

The product of this activity will include:

- a detailed framework for a future vehicle particulate sampling and measurement methodology
- input to emissions modelling tools, in relation to existing knowledge, in terms of usable emission factors for current vehicles
- assessment of the effectiveness of the technical measures for reducing particulate emissions
- useful input to studies of health effects

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# PARTICULATES

Characterisation of Exhaust Particulate Emissions  
from Road Vehicles

European commission DG TREN Project  
within the 5<sup>th</sup> Framework Programme

**Urs Mathis, EMPA**

# DG TREN Particulate Consortium

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- Launched in April 2000
- Duration of 3 years
- Consisting of 21 contractors in the field of:
  - aerosol physics
  - analytical chemistry
  - mechanical engineering
  - engine, vehicle, fuel and emissions tests
  - automotive manufacture
  - epidemiology and toxicology

# Objectives

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- Selection of adequate instruments for measuring accumulation and nucleation mode particles under transient conditions
- Definition of harmonised protocol for sampling conditions
- Investigation of engine technology, fuel quality and after-treatment systems on particle emissions

# Next steps

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- Revision of the experimental results by all partners and consultants
- Round robin test (7 laboratories) to verify proposed harmonised sampling conditions
- Performance of the measurement matrix

# Measurement matrix

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- Vehicles/Engines
  - more than 40 vehicles/engines, 12 laboratories
  - Euro I to V
- Fuels
  - conventional gasoline and diesel fuel
  - alternative fuel (RSME, oxygenated fuels, natural gas)

# Measurement matrix

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- Exhaust after-treatment
  - oxidation catalyst
  - CRT, particulate trap
  - SCR, SiNO<sub>x</sub>, plasma system
- Sub-zero start effects
- Effect of lube oil consumption
- Roadside measurements
- Non exhaust particulate measurements



# Completed tasks

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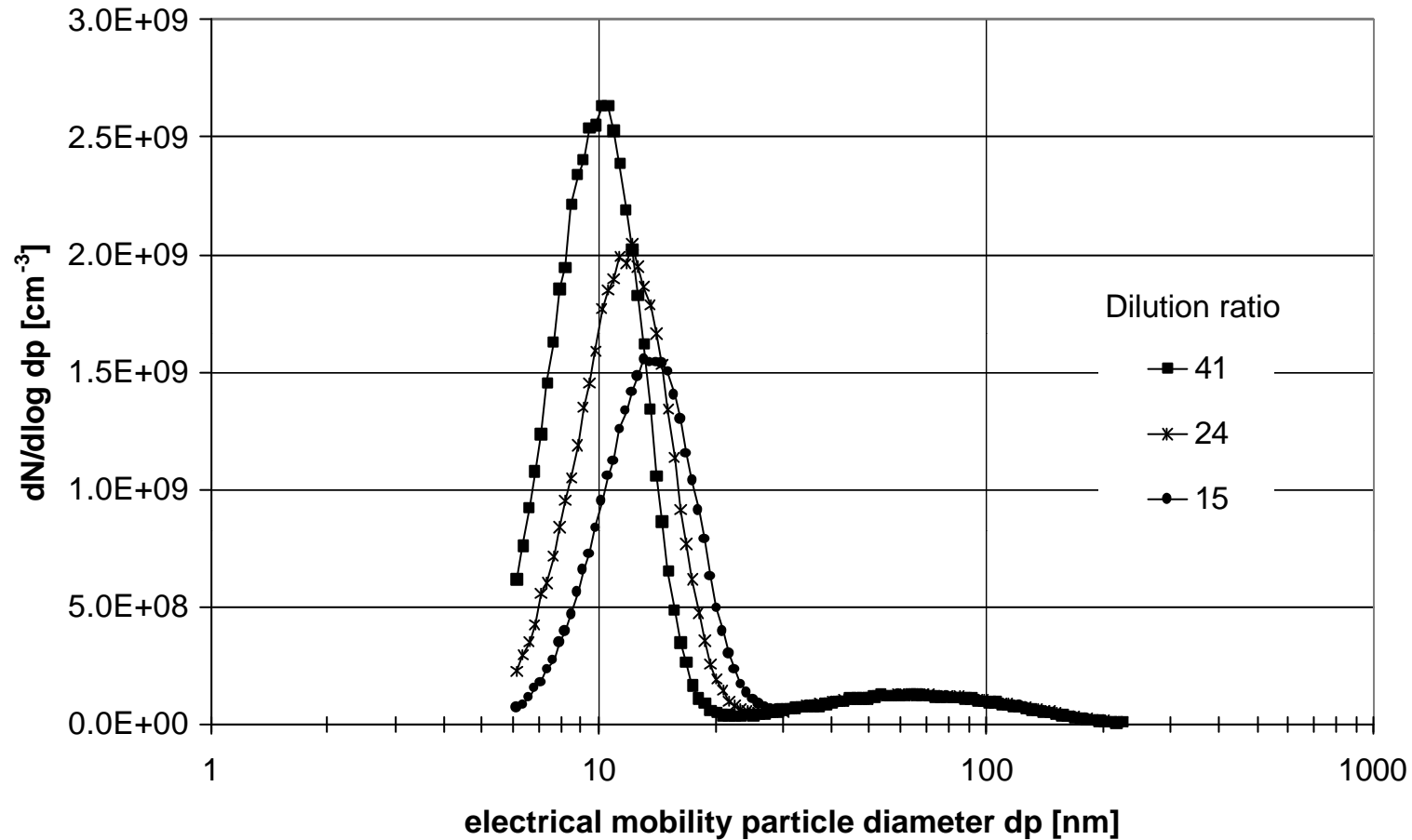
- Literature study on health effects, formation and sampling conditions of particles
- Definition of instrumentation and measurement techniques
- Development and construction of a partial flow diluter as primary dilution stage
- Definition of vehicle/engine technologies, fuels and test procedure
- Experimental investigations on sampling conditions
- First definition of harmonised sampling conditions

# Sampling conditions

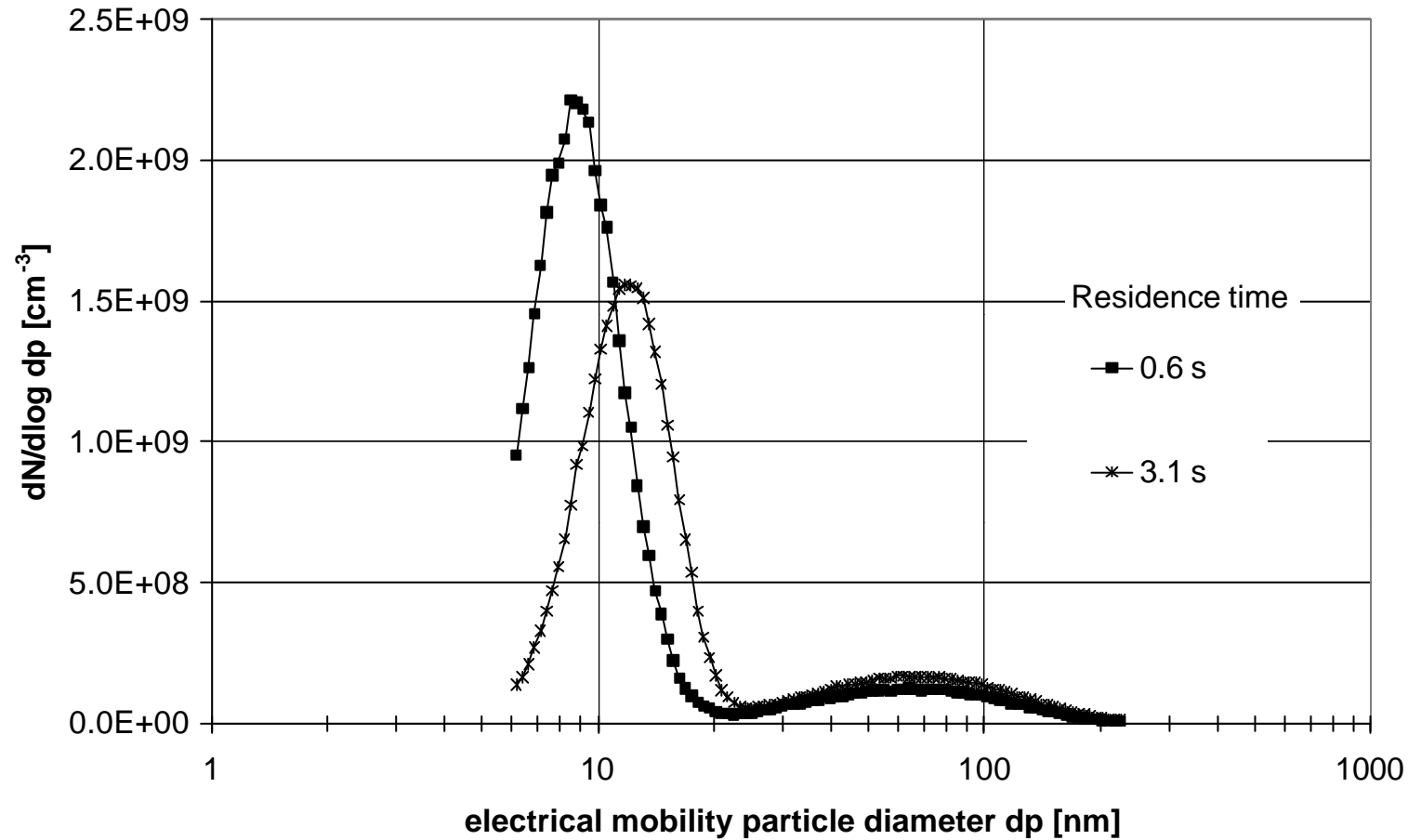
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- Main challenge
  - reproducibility of accumulation and nucleation mode particles
- Used instrumentation
  - ELPI, DMA, CPC, DC, TEOM, impactors
  - TEM, soxhlet extraction, PGAA
  - thermodesorber
- Investigated parameters for nucleation mode
  - dilution air temperature and humidity
  - dilution ratio of the primary dilution stage
  - residence time

# Dilution ratio (EMPA/TUT)



# Residence time (EMPA/TUT)



# Summary

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- Increase of nucleation mode by:
  - dilution air humidity ↑
  - dilution air temperature ↓
  - dilution ratio of the primary dilution stage ↑
  - residence time ↓ ↑

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Thank you for your attention

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