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23

**The Measurement of Number, Size and Mass
of Automotive Particulate Emissions
A CONCAWE Study**

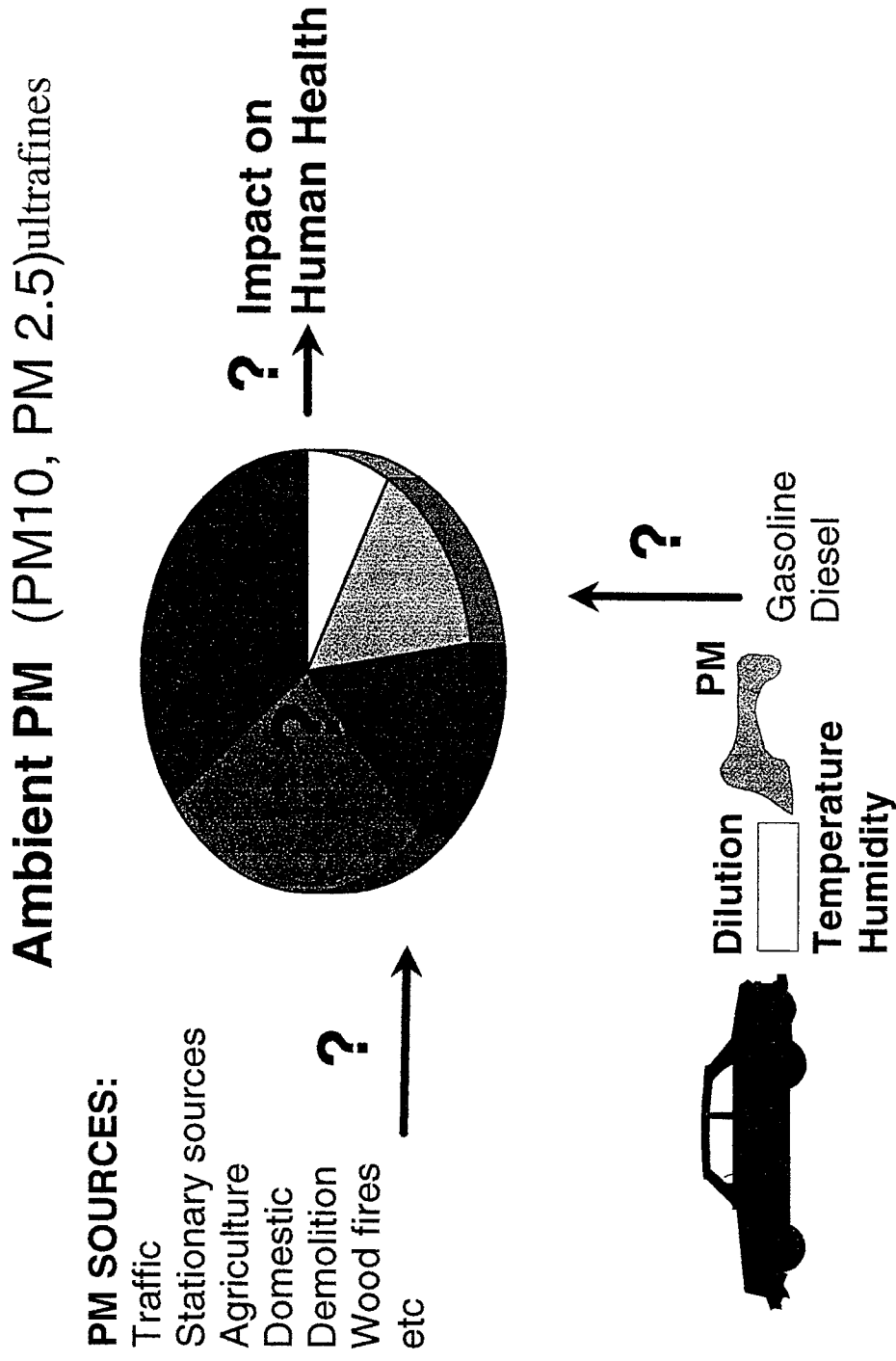
**2nd ETH Workshop - 'Nanoparticle
Measurement'**

August 7th 1998
Zurich

*The Measurement of Number, Size and Mass
of Automotive Particulate Emissions
A CONCAWE Study*

Diane Hall

The Measurement of Number, Size and Mass of Automotive Particulate Emissions



Source: CONCAWE

The Measurement of Number, Size and Mass of Automotive Particulate Emissions

- literature study identified best available test methods for particulate emissions sizing (CONCAWE report no 96/56)
 - electrical mobility analysers for size distribution
 - impactors for mass distribution
- objectives
 - develop information on particulate size, number and mass distribution from current LD Diesel and LD gasoline engines
 - compare results from currently available measurement techniques
 - compare results from different laboratories

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TEST PROGRAMME

- detailed structured test procedures/methodology to provide a sound technical documentation
 - importance of back to back repeats
 - essential to check baseline recovery
- in co-operation with recognised outside experts
- validation of complex test results
 - regulated emissions checked against EPEFE protocol
 - detailed investigation of robustness of sizing equipment

(CONCAWE report 98/51)

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TEST FUELS

Diesel

D1 - Summergrade

D2 - Wintergrade

D3 - Swedish Class I

Gasoline

G1 - low S/low aromatics

G2 - high S/high aromatics

TEST VEHICLES

Diesel

V1 1.9l IDI/OX

V2 1.9l DI/OX

V3 2.5l DI

V4 1.9l DI/OX

Gasoline

V5 1.8l MPI

V6 1.0l SPI/TWC

V7 1.9l MPI/TWC

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TEST PROTOCOL

- **daily test procedure (for single vehicle/fuel combination)**
 - cold start MVEG cycle
 - 3 x 'hot' start MVEG cycles (oil temperature control)
 - steady state testing (idle, 30km/h, 50km/h, 70km/h, 120km/h)
 - vehicle pre-con for next day
- **repeat of daily test procedure**
 - day 1 (fuel A); day 2 (fuel A)
 - day 3 (fuel B); day 4 (fuel B)
 - day 5 (fuel A)
 - repeated as required

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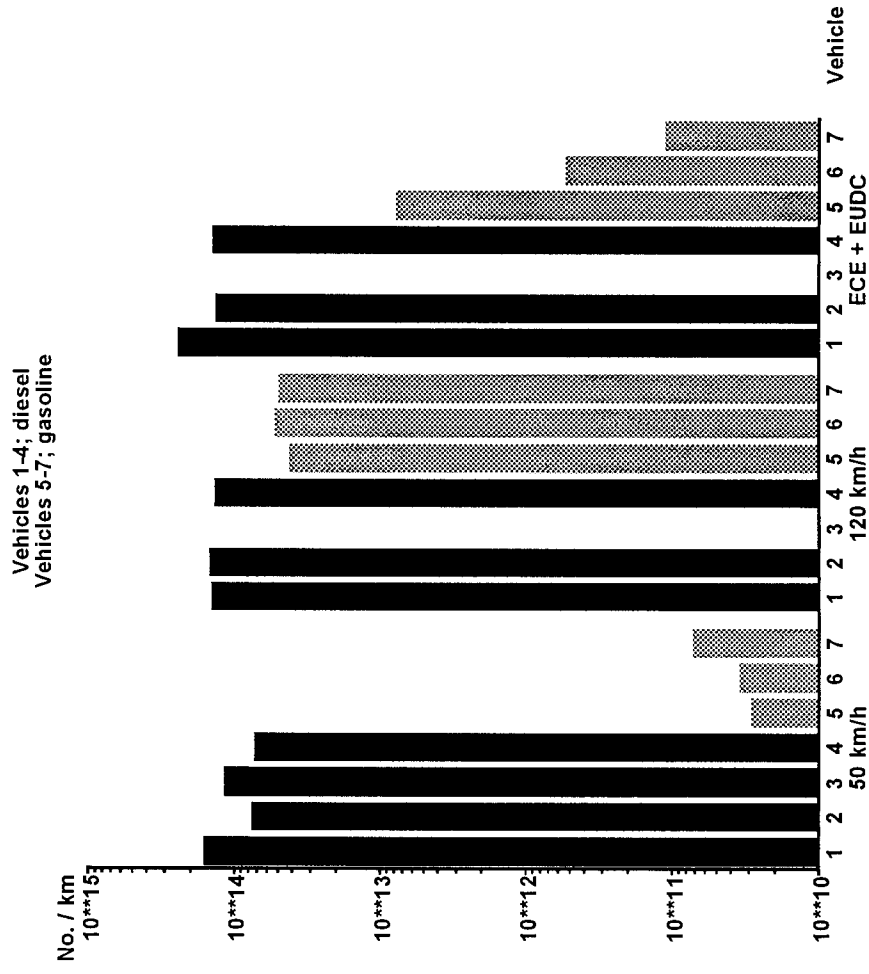
Measurement of particle sizes

- steady state testing
 - complete scan across size capability of instrument
- transient testing
 - individual sizes monitored across each cycle

SMPS:- 25, 60, 100nm

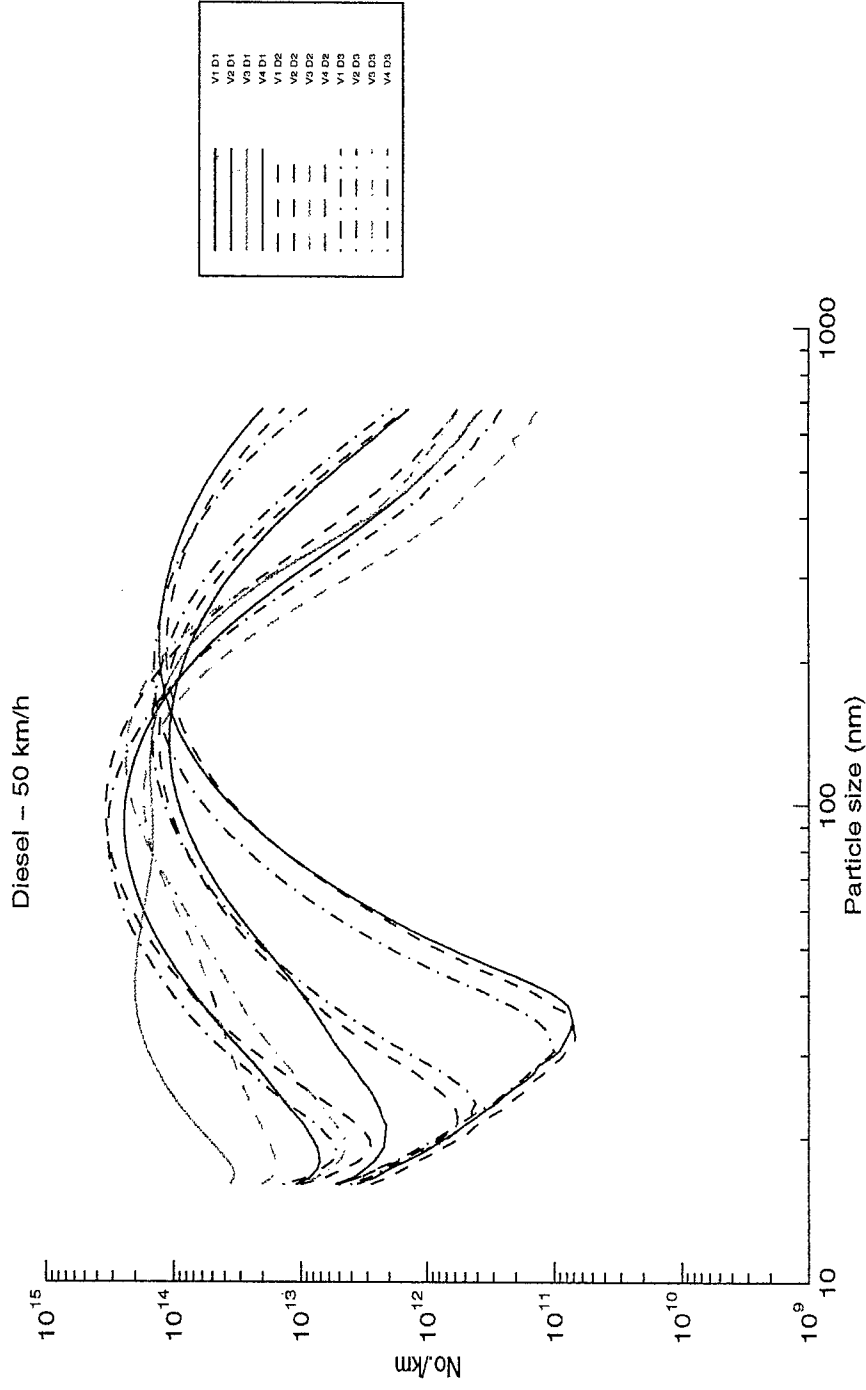
DMPS:- 100, 200, 400nm

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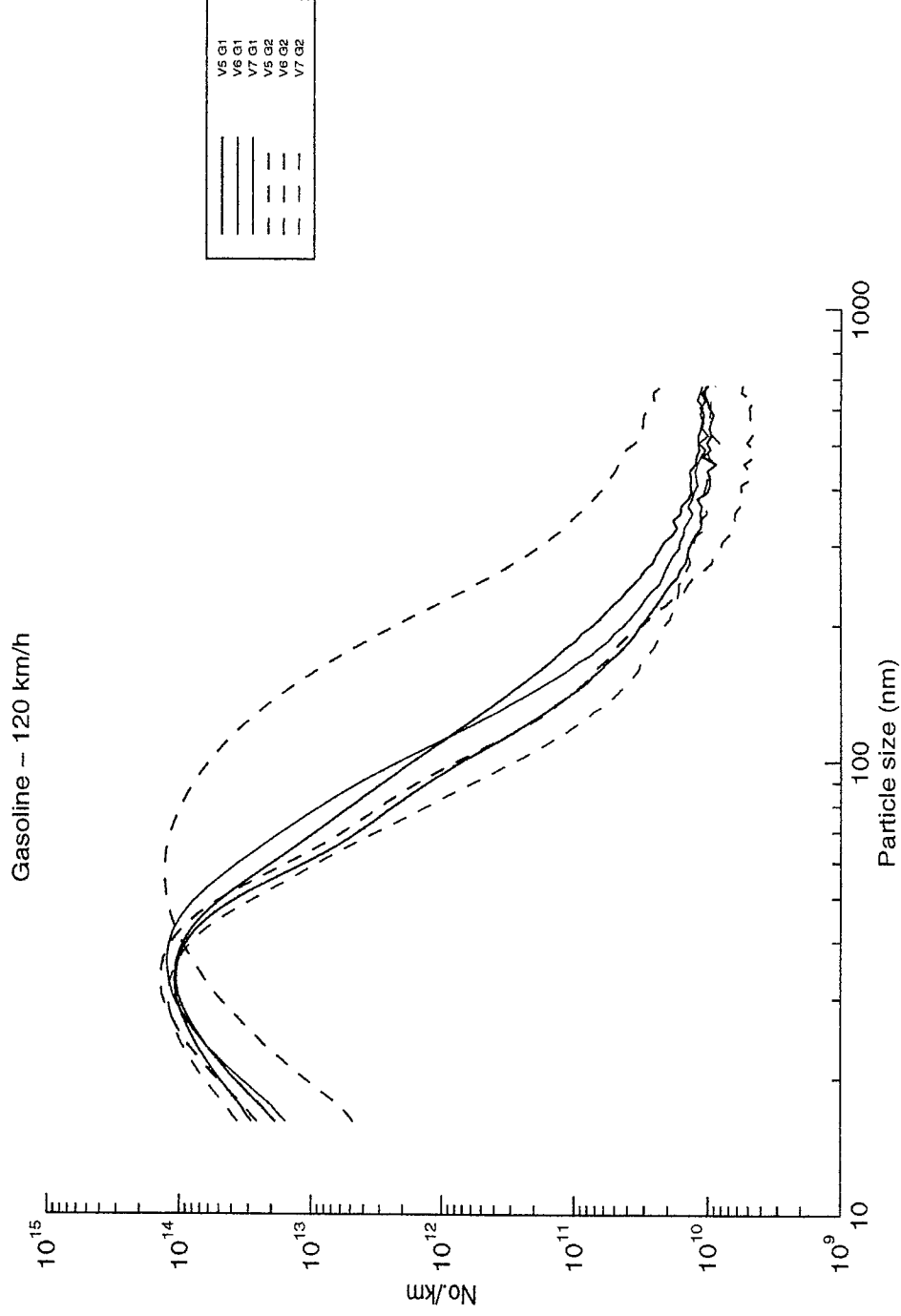


(total number of particles emitted per kilometre, averaged over all fuels)

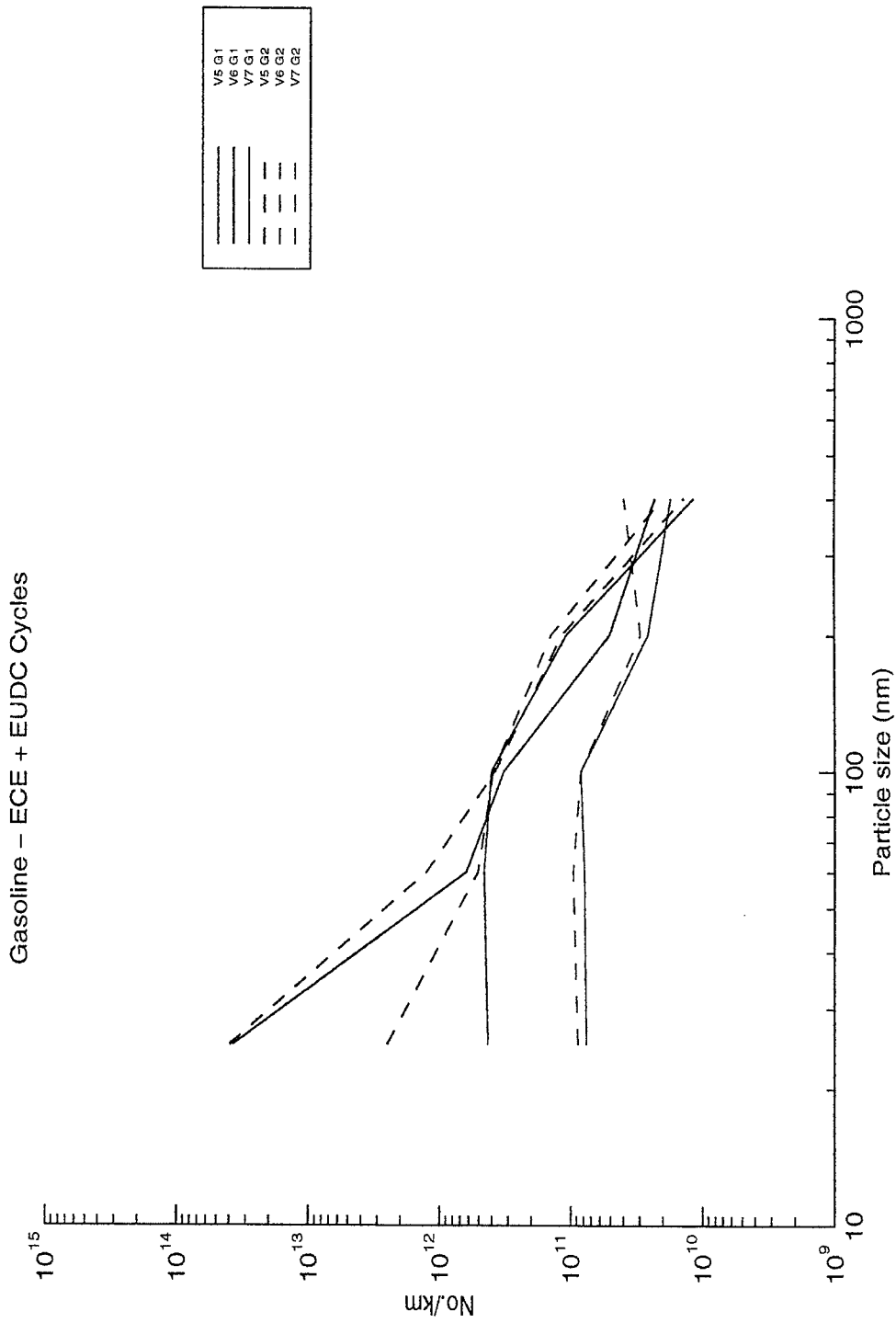
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The Future??

- for automotive:
 - mass measurement more accurate and gives better discrimination across a wide range
 - number measurement less accurate and appears to show less discrimination between current LD Diesel technology
- need to identify species to be measured
- need to prepare standard procedures and establish reference methods

COMMUNICATION ACROSS DISCIPLINES ESSENTIAL