

And what about air quality inside a car?

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And what about air quality inside a car?

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“Tackling Tomorrow’s Air Pollution Today”
Leicester, 22 June 2014

Background

Driving on busy roads → exposure of car passengers?

9th ETH Conference on Combustion generated Nanoparticles (2009):

Jean Morin →

“car cabin does not protect from traffic generated pollution”

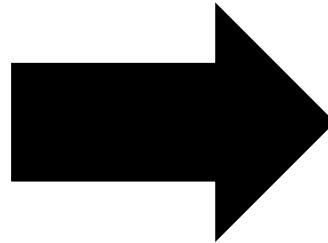
Questions Ministry of Environment:

- What about vehicle air quality?
- Influence of ventilation, filtration, recirculation?
- Exposure in the car's cabin?



Experimental setup

Volkswagen Touran



Experimental setup (2)

Instruments:

- 2xNO_x → chemoluminescence (Ecophysics)
- 2xCondensation Particle Counter (3007 TSI)
- GPS
- Inlets at the front (grill) and near driver's head

Ventilation:

- Different ventilation modes and recirculation;
windows always closed

Traject:

- Alkmaar City ring, Motorway Alkmaar- Amsterdam

Limitation:

- Mixing of air in the cabin unknown ...



Ventilation system

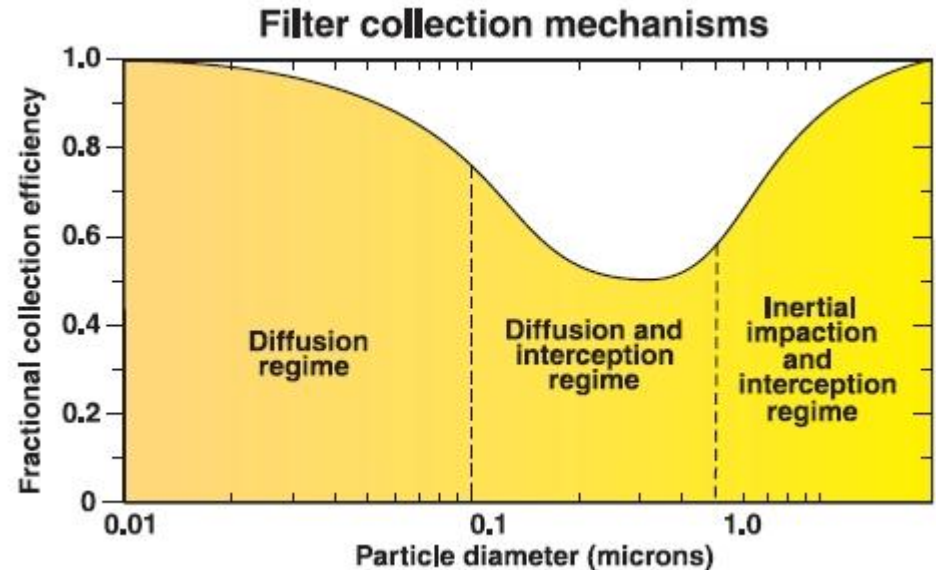


HVAC system = Integrated Heating, Ventilation and Air Conditioning system

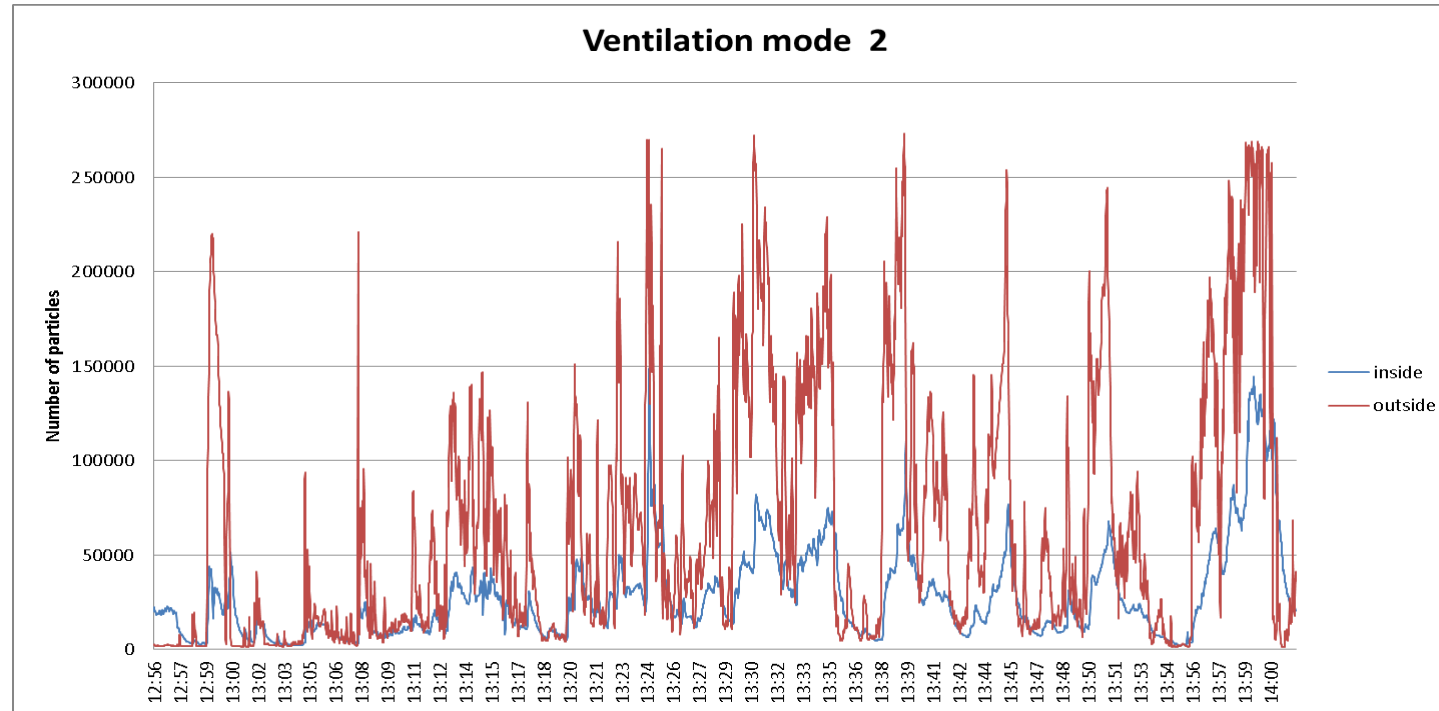
**Air cabin filter = dust pollen filter
no specification of efficiency**



*“eliminates most pollutant particles s
bacteria, pollen and dust that come in*

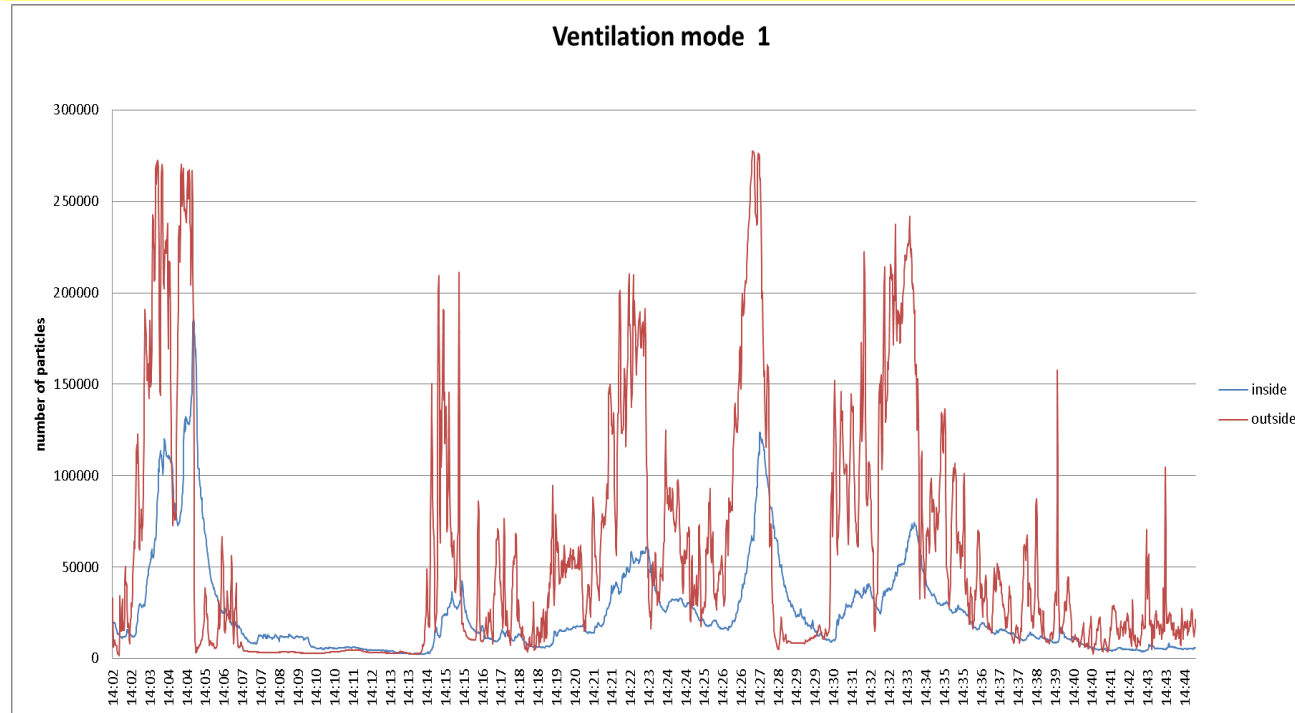


Day 1: particle number



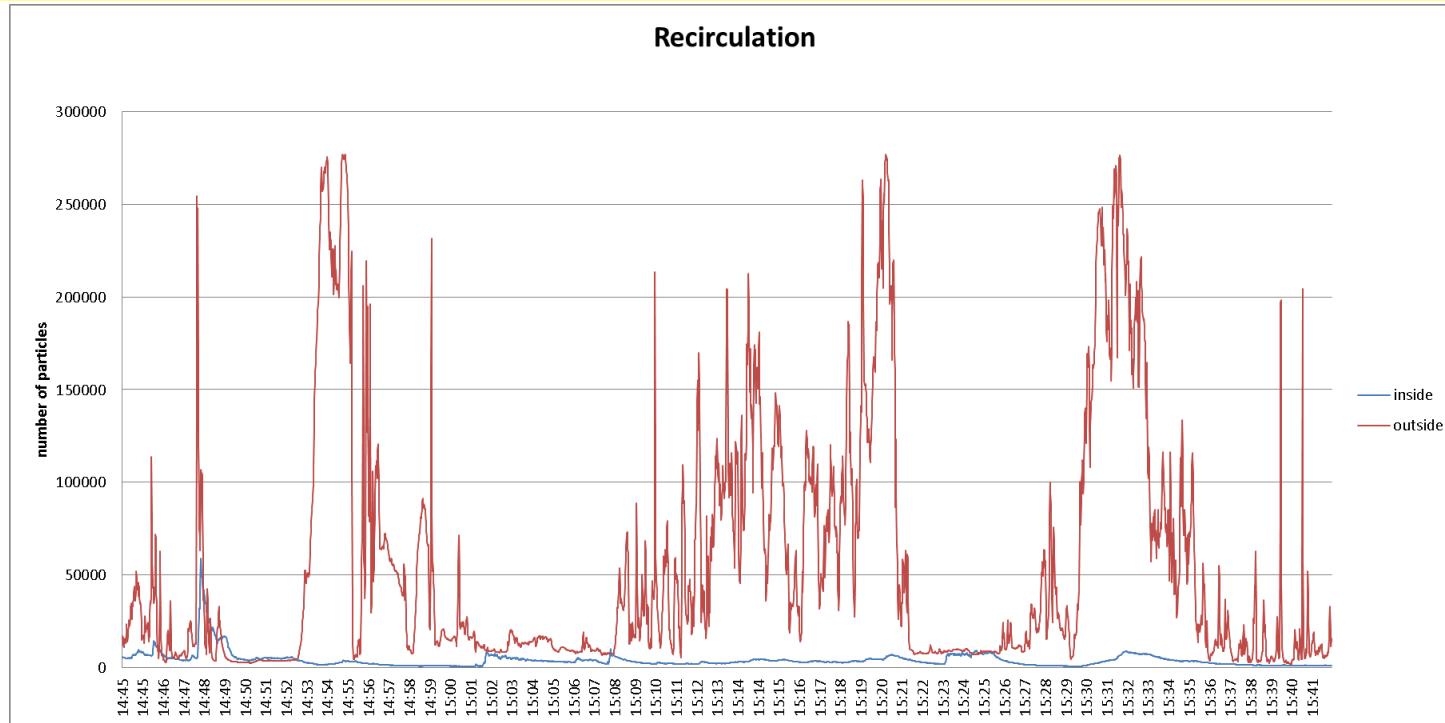
- Lower particle numbers inside
- Correspondence in variation
- Peak values outside not observed in the cabin

Day 1: particle number



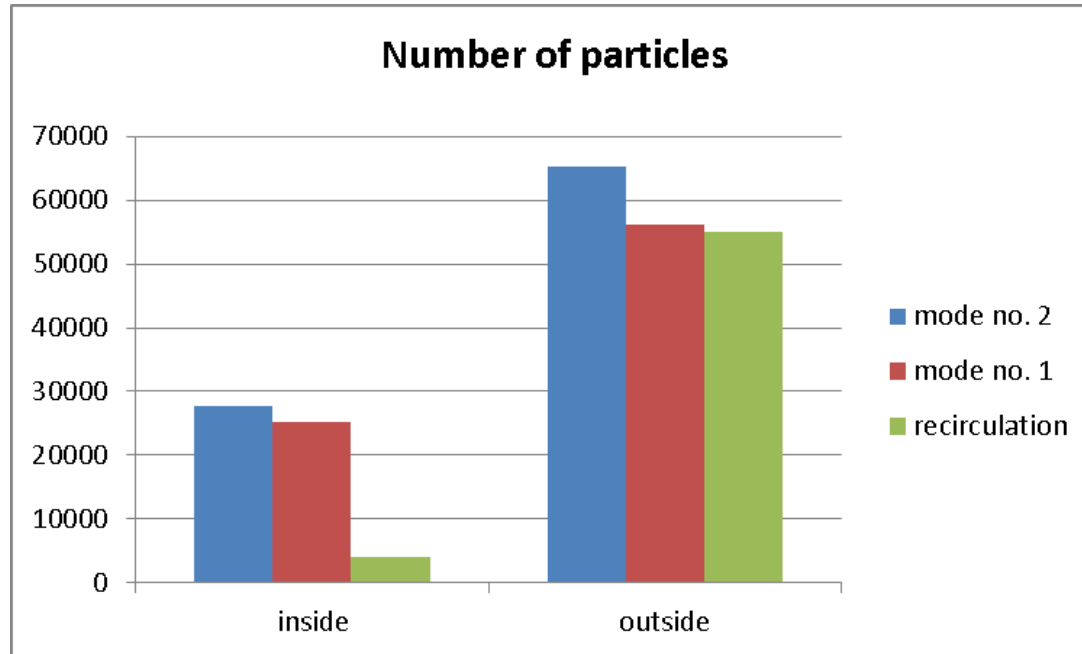
- Again: correspondence with what happens outside
- Delay time visible

Day 1: particle number



- Very low numbers inside the car
- Decoupling inside-outside

averages and ratios

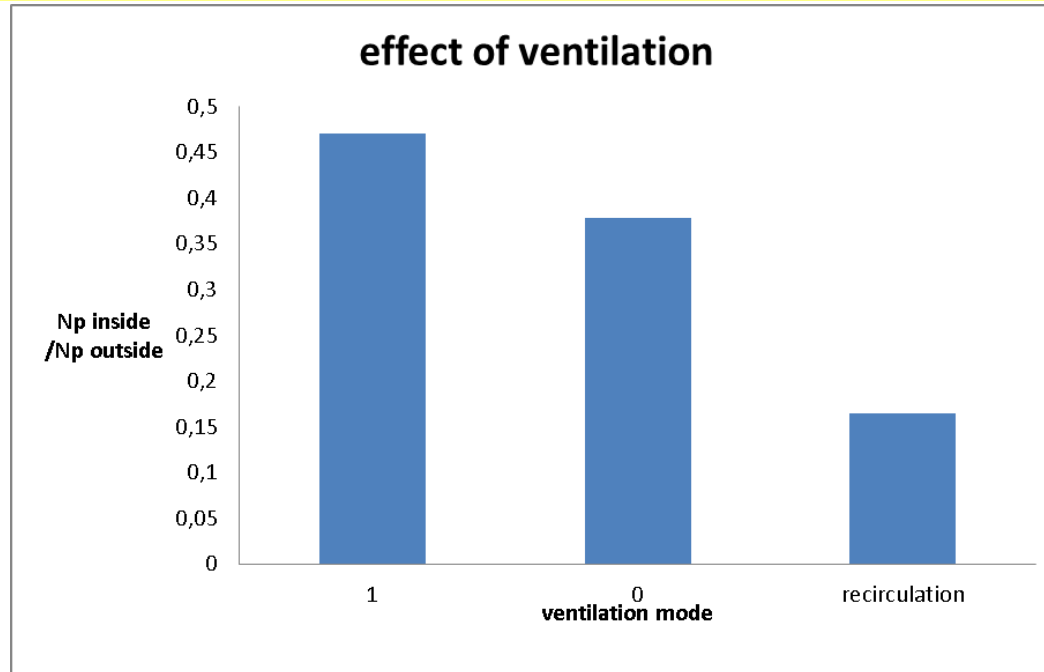


	inside	outside	ratio
mode no. 2	27828	65358	0,43
mode no. 1	25186	56210	0,45
recirculation	4027	55058	0,07



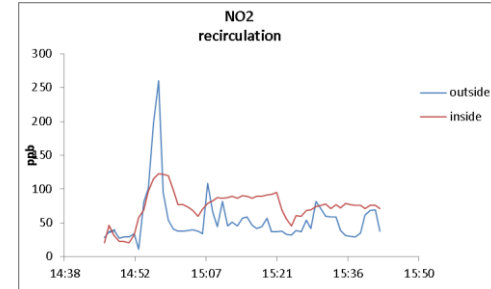
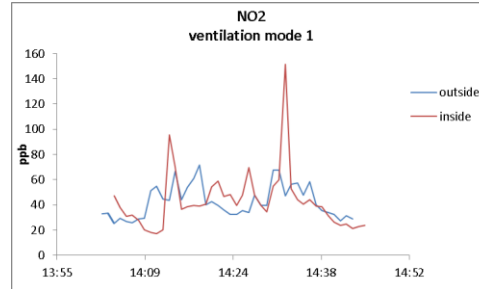
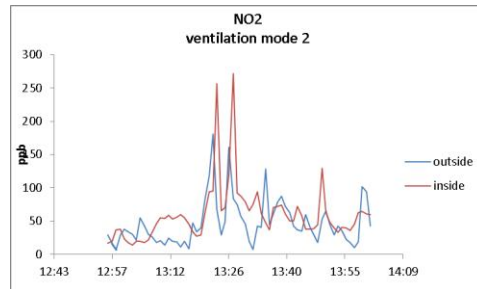
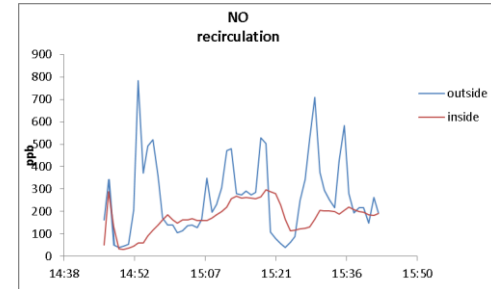
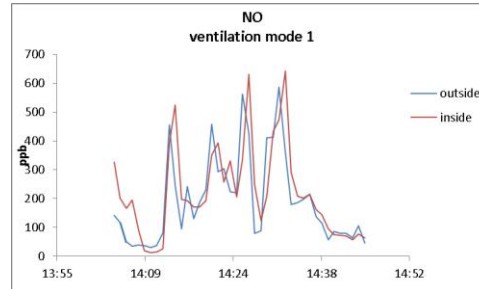
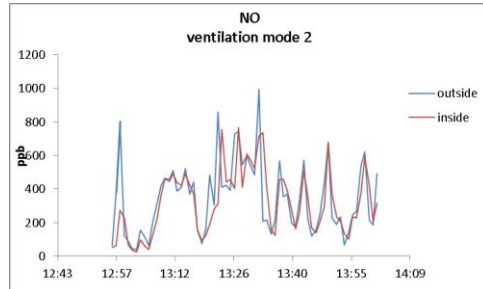
Levels inside 50-60% lower during ventilation

Day 2: ratios



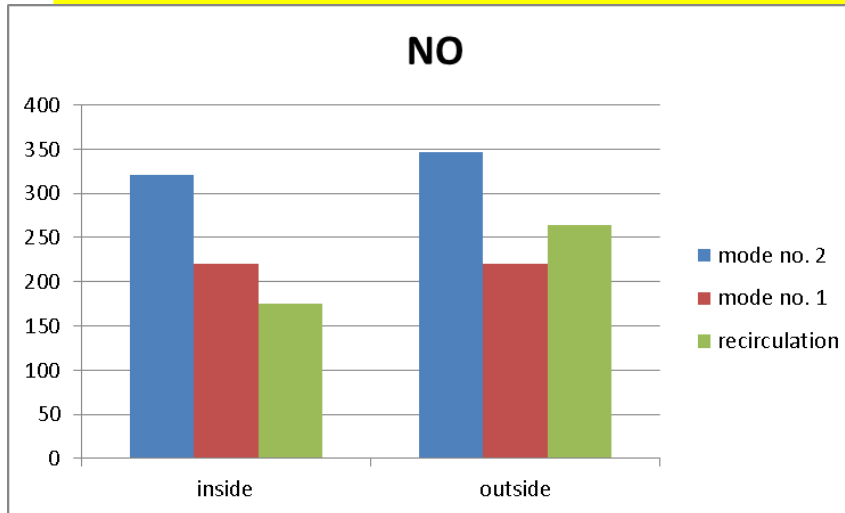
Motorway

NO&NO₂ (1-min averages)



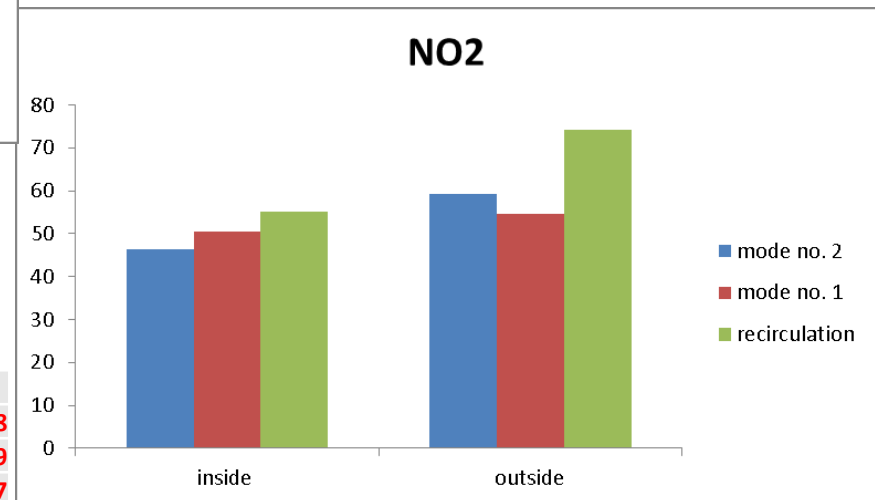
- Ventilation: hardly any change in NO, small time delay;
less correspondence for NO₂
- Recirculation: decoupling

averages NO and NO₂



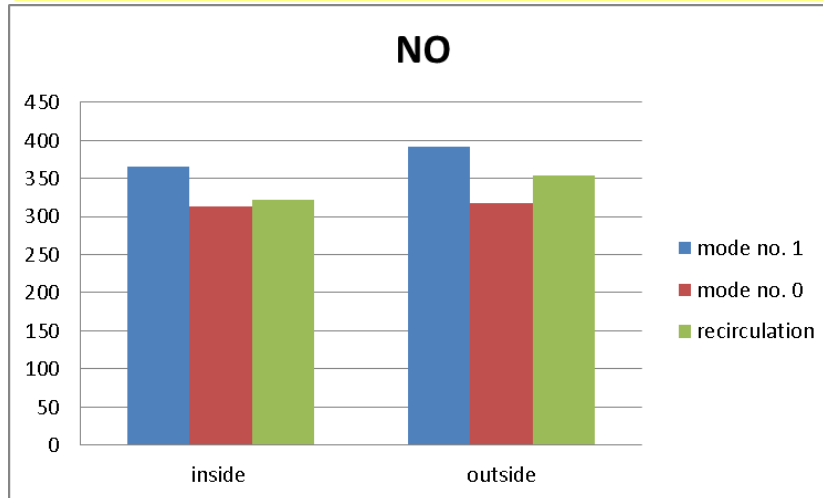
- Ventilation: ratio in-vehicle to on-road close to 1
- Ring road

NO	inside	outside	ratio
mode no. 2	321	347	0,9
mode no. 1	221	220	1,0
recirculation	175	264	0,7



NO ₂	inside	outside	ratio
mode no. 2	46	59	0,8
mode no. 1	50	55	0,9
recirculation	55	74	0,7

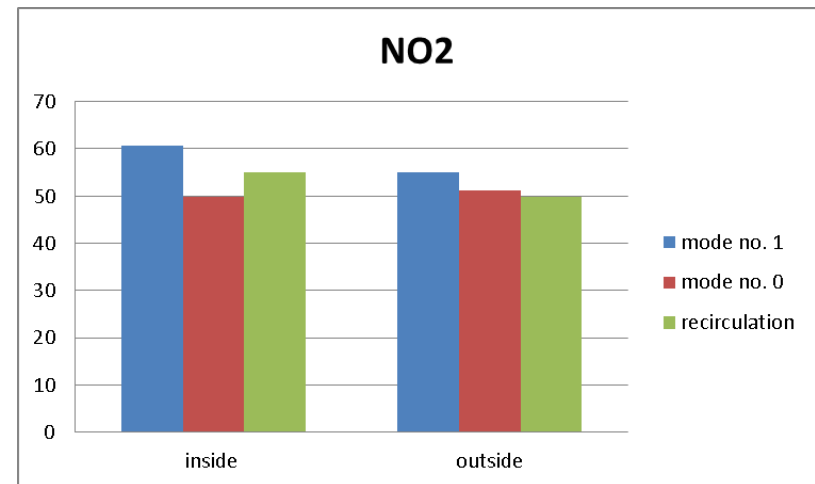
Day 2:



NO	inside	outside	ratio
mode no. 1	365	391	0,9
mode no. 0	314	317	1,0
recirculation	321	354	0,9

NO2	inside	outside	ratio
mode no. 1	61	55	1,1
mode no. 0	50	51	1,0
recirculation	55	50	1,1

- Ventilation: ratio in-vehicle to on-road close to 1
- Motorway



Summarizing remarks (1)

Effect of ventilation

- Particle number concentrations in vehicle air roughly 45% of on-road levels
- NO/NO₂: no clear difference during ventilation

Effect of recirculation

- Drastic decrease in number concentration in vehicle air (<15% of on road level)
- NO/NO₂: no difference; steady level?

Summarizing remarks (2)

Exposure:

- NO and NO₂: similar as on the road
- Particle number: less but still above urban background while ventilating
- Car's cabin does (indeed) not protect against traffic pollution
- Setting a car's ventilation system to "recirculate"
is the best way to reduce exposure
to particulate pollution
- But not so effective as cutting back
driving time ...





We need more ventilation ...

Thanks for your attention

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