

# Investigation of road traffic and wood burning emissions in Switzerland using a mobile laboratory

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On occasion of the project Aerowood (Aerosols from wood burning versus other sources) the spatial and temporal variation of selected aerosol parameters were assessed for two valleys in Southern Switzerland using a mobile laboratory. Results showed that the number concentration for smaller particle diameter (< 30 nm) increased with the proximity to the highway whereas larger particles played the dominant role in villages.

An IVECO Turbo Daily Transporter was selected as a rolling platform for the measuring equipment. The instruments inside the mobile laboratory included a Condensation Particle Counter (CPC 3010; TSI), a Scanning Mobility Particle Sizer (SMPS; DMA, CPC 3010; TSI), a Diffusion Charger (DC; Matter Engineering LQ1-DC), a Fast Mobility Particle Sizer (FMPS; TSI) as well as a CO<sub>2</sub> (CO<sub>2</sub> monitor; LI-COR) and a NO<sub>x</sub> (ML 9841A) gas analyzer.

In winter 2005/06 mobile measurements were performed in Roveredo in the Mesolcina Valley alongside the San Bernadino route and in the Riviera Valley alongside the San Gotthardo route. Both highways are the main transit route of the Swiss Alps. From November 30<sup>th</sup> 2005 until December 14<sup>th</sup> 2005 specific routes were selected including highways, rural roads and residential areas in villages. Using the geographical information (GPS, Garmin Iplus) the data could be assigned to the specific area. Since the measurements were performed in winter time the average ambient temperature was around -5 °C.

Comparison of SMPS and FMPS data yielded quite good agreement between the instruments, although the values for the FMPS data were higher compared to SMPS and CPC data.

Average values for number and volume concentrations were calculated by assigning parts of the driven routes to “rural”, “highway” and “village”. It indicated that highest number concentrations are detected for highways whereas the lowest concentrations are measured for the village. Comparing total concentration of FMPS and FMPS (> 10 nm) demonstrates that the number concentration is dominated by small particle diameters mainly on the highway. For the volume concentration one can observe that the concentration is higher for the village compared to rural road and highway. It seems that mass emissions are higher in villages. Measured number size distribution in the Riviera Valley showed a distinctive mode at a particle diameter around 10 nm for the highway. An additional mode is found at around 80 nm particle diameter and seen for both the villages and the highways. However, the volume size distribution indicates a mode at around 150 nm particle diameter. The “village” volume size distribution exceeds the volume distribution for the highway.

With distance from the highway the nucleation mode disappears in the number size distribution and an accumulation mode dominates the volume distribution while approaching villages. The investigations demonstrated that wood burning in villages are more important for the aerosol mass emissions in these valleys than the road traffic emissions.

But the road traffic emissions play the dominant role for the number concentration, especially for smaller particles around 10 nm.

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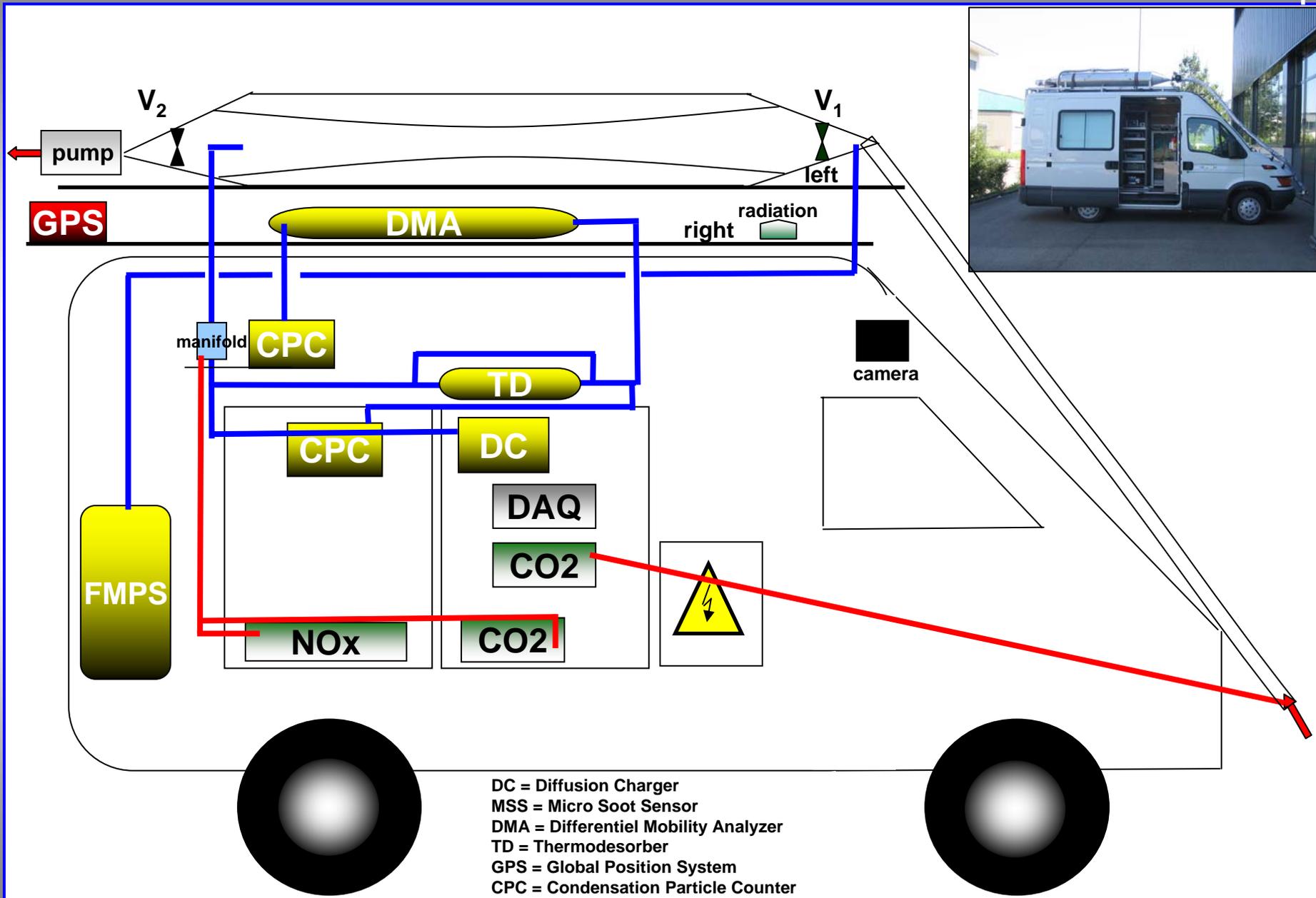
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**Conference on Combustion Generated Nanoparticles**

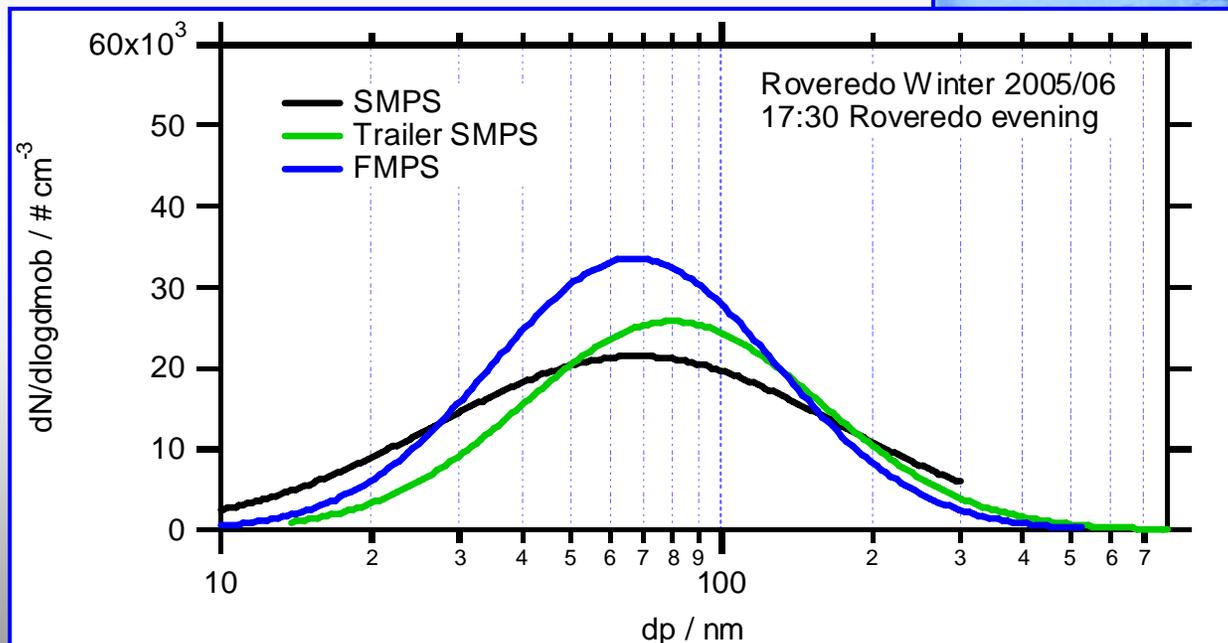
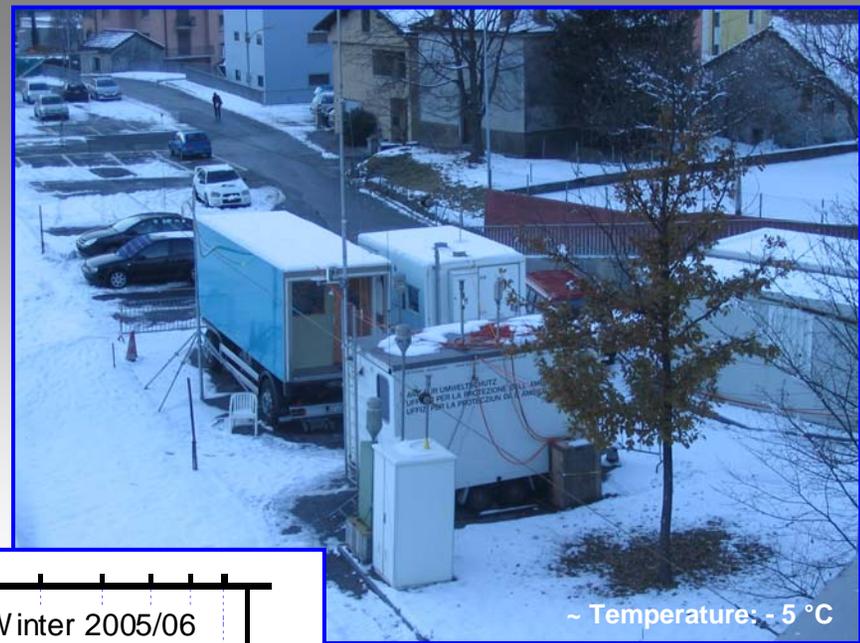
**ETH, Zürich**

**21.08. – 23.08.2006**



DC = Diffusion Charger  
 MSS = Micro Soot Sensor  
 DMA = Differential Mobility Analyzer  
 TD = Thermodesorber  
 GPS = Global Position System  
 CPC = Condensation Particle Counter

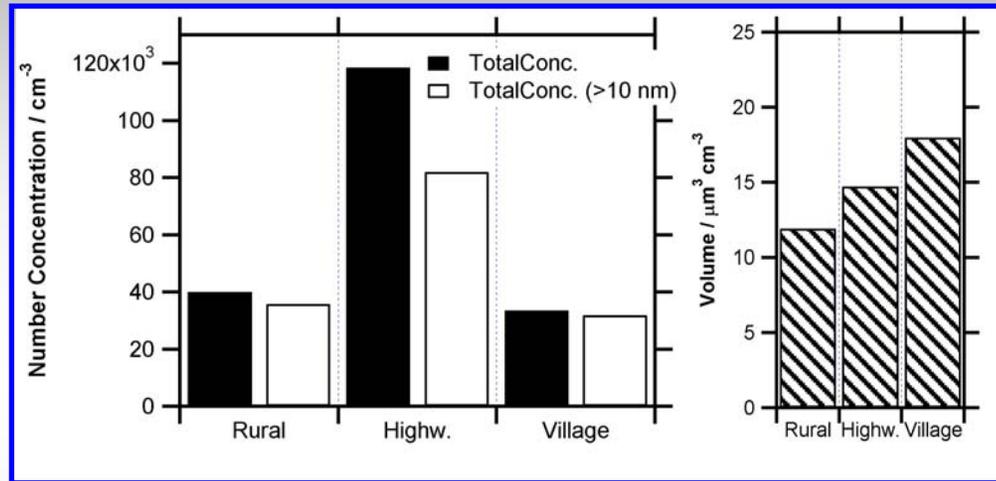
# Instrument Comparison: FMPS and SMPS



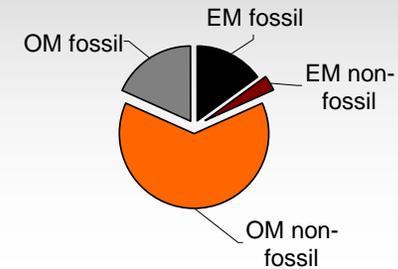
- ❖ agreement between SMPS, FMPS quite good
- ❖ FMPS values higher compared to SMPS and CPC data

# Average number and volume concentrations in different areas on the routes in the Riviera and Mesolcina valleys

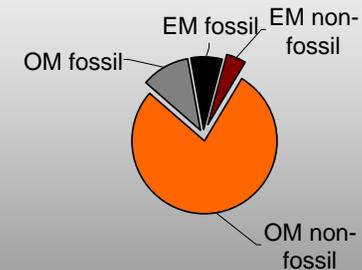
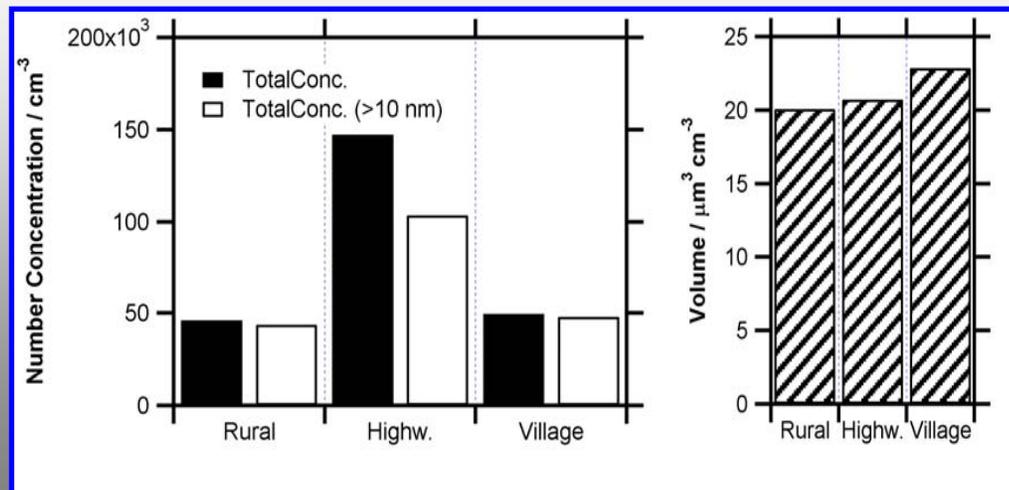
## Riviera Valley



## <sup>14</sup>C analysis



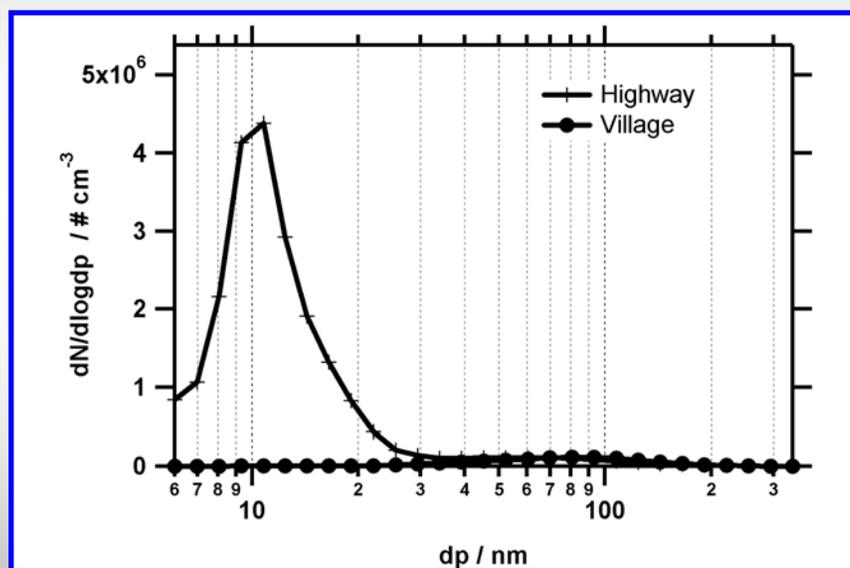
## Mesolcina Valley



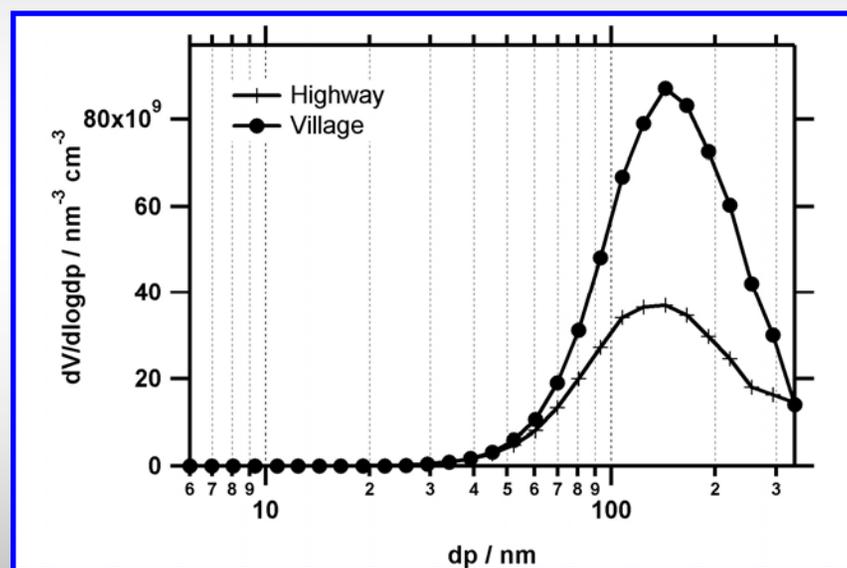
done by Sönke Szidat, Jisca Sandradewi

# Size distribution for village and highway in the Riviera Valley

## Number Size Distribution



## Volume Size Distribution



- ❖ Road traffic emission study in winter 2005/06
  - ❖ nucleation mode observed on highway for colder temperatures, disappears with distance from highway, accumulation mode increases in towns



**It seems that wood burning in villages are more important for the aerosol mass emissions in these valleys than the road traffic emissions.**

**But the road traffic emissions play the dominant role for the number concentration, especially for smaller particles (~ 10 nm).**