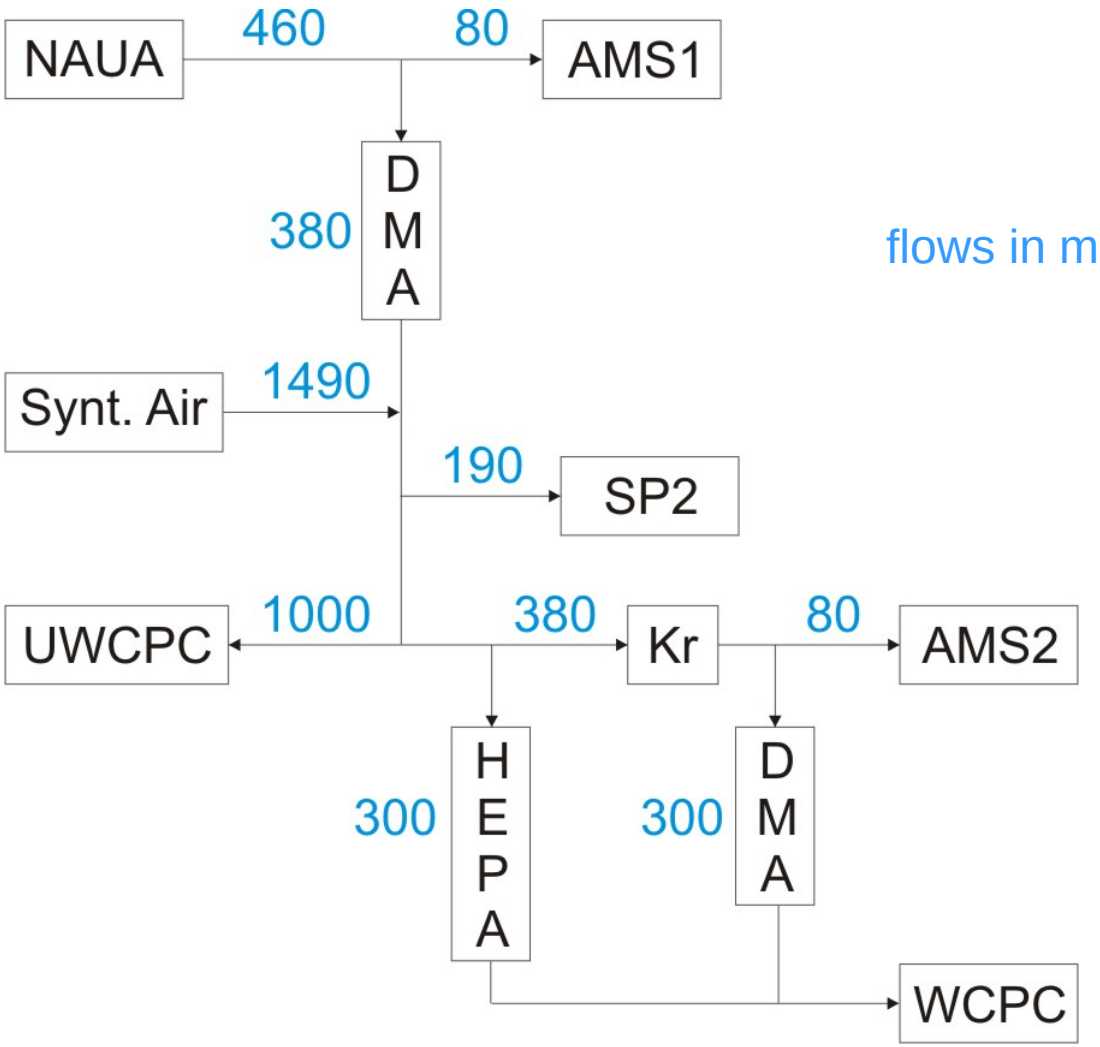
# AMS Results

## from Vi-ACI Campaign AIDA NI-11

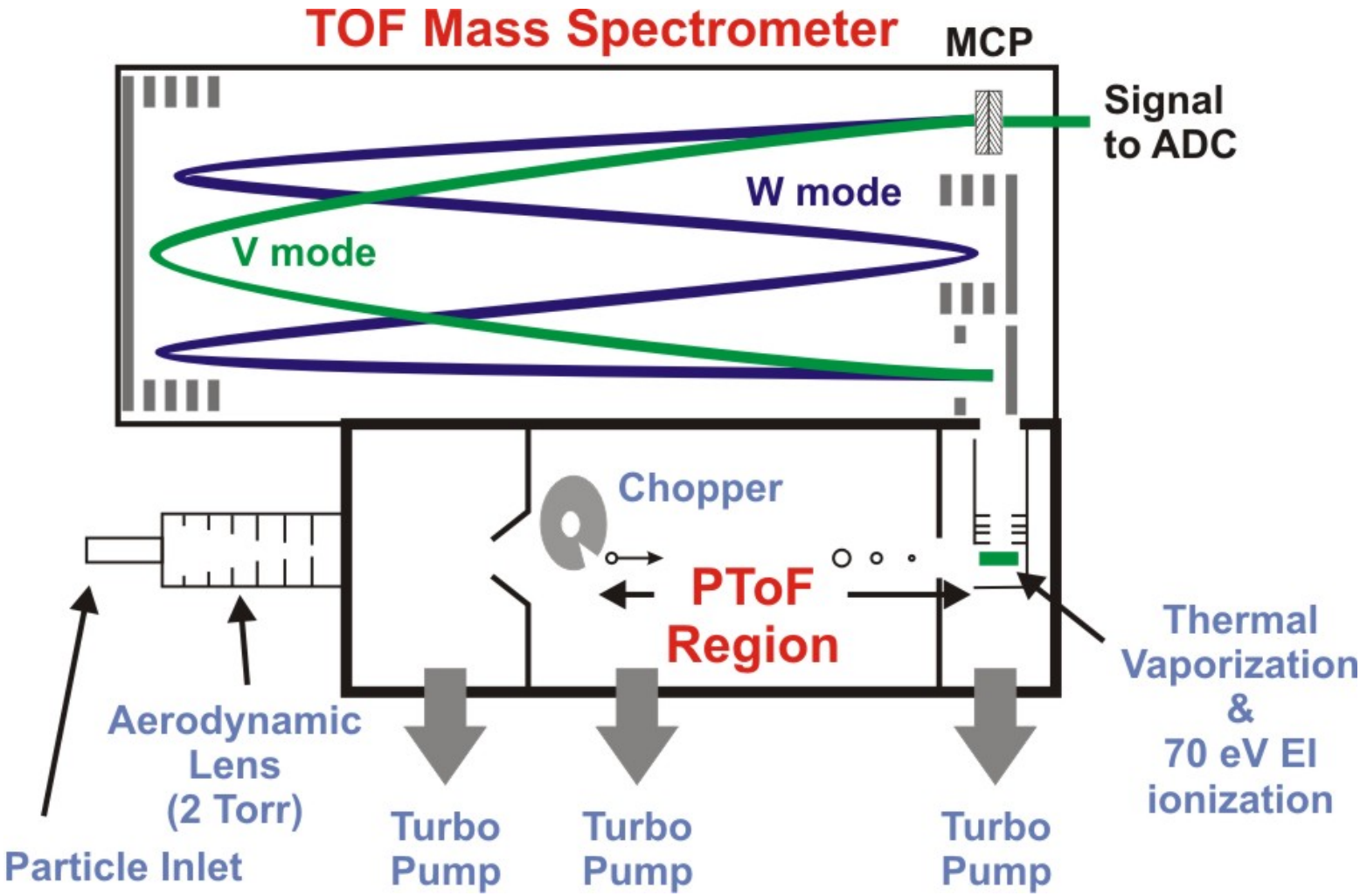
## Karlsruhe, Nov. 2007

06. Oktober 2008 | Christian Spindler

# Setup in VI-ACI Campaign AIDA NI-11



# Aerodyne Aerosol Mass Spectrometer



# Goals and Challanges

Task:
- Trace analysis of non-refractory coatings on refractory cores

Goals:
- "quality control" of aerosol generation
- coating mass
- water soluble mass
- aerodynamic $D_{va}$ – effective densities
- multiple charged particles

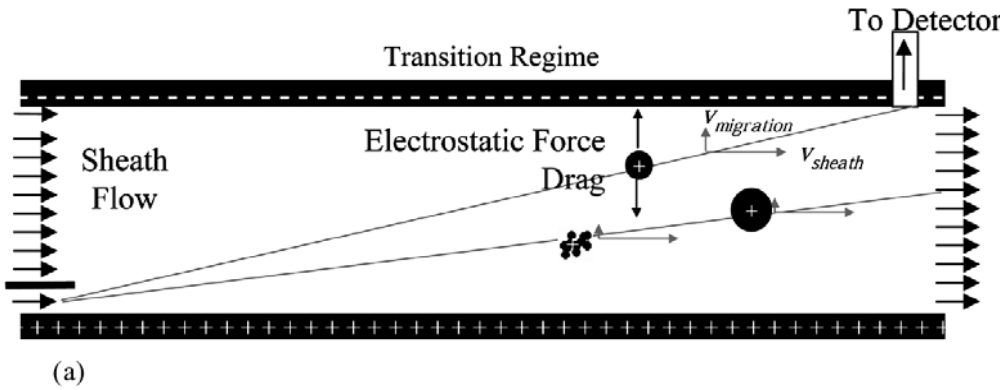
Challanges:
- Even uncoated soot contains detectable organic mass
- Effective densities strongly depend on morphology

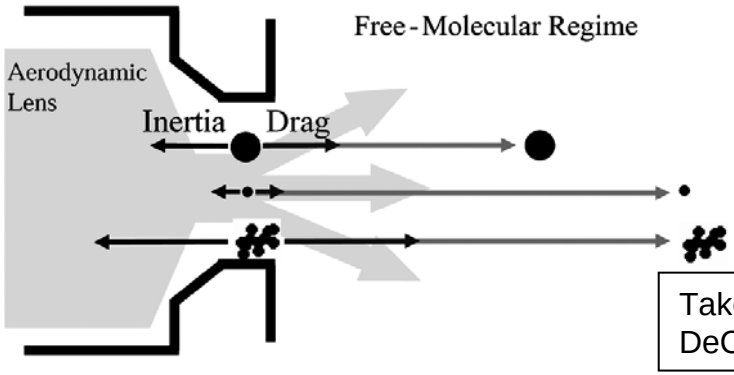
# „Size“ in SMPS and AMS

$$d_m = d_{ve} \frac{C_c(d_m)}{C_c(d_{ve})} \chi_m$$

$$d_{va} = \frac{\rho_p}{\rho_0} \frac{d_{ve}}{\chi_{va}}$$

$$d_{va} \approx \overline{\rho} \frac{d_m}{\chi^2} \frac{C_c(d_{ve})}{C_c(d_m)}$$



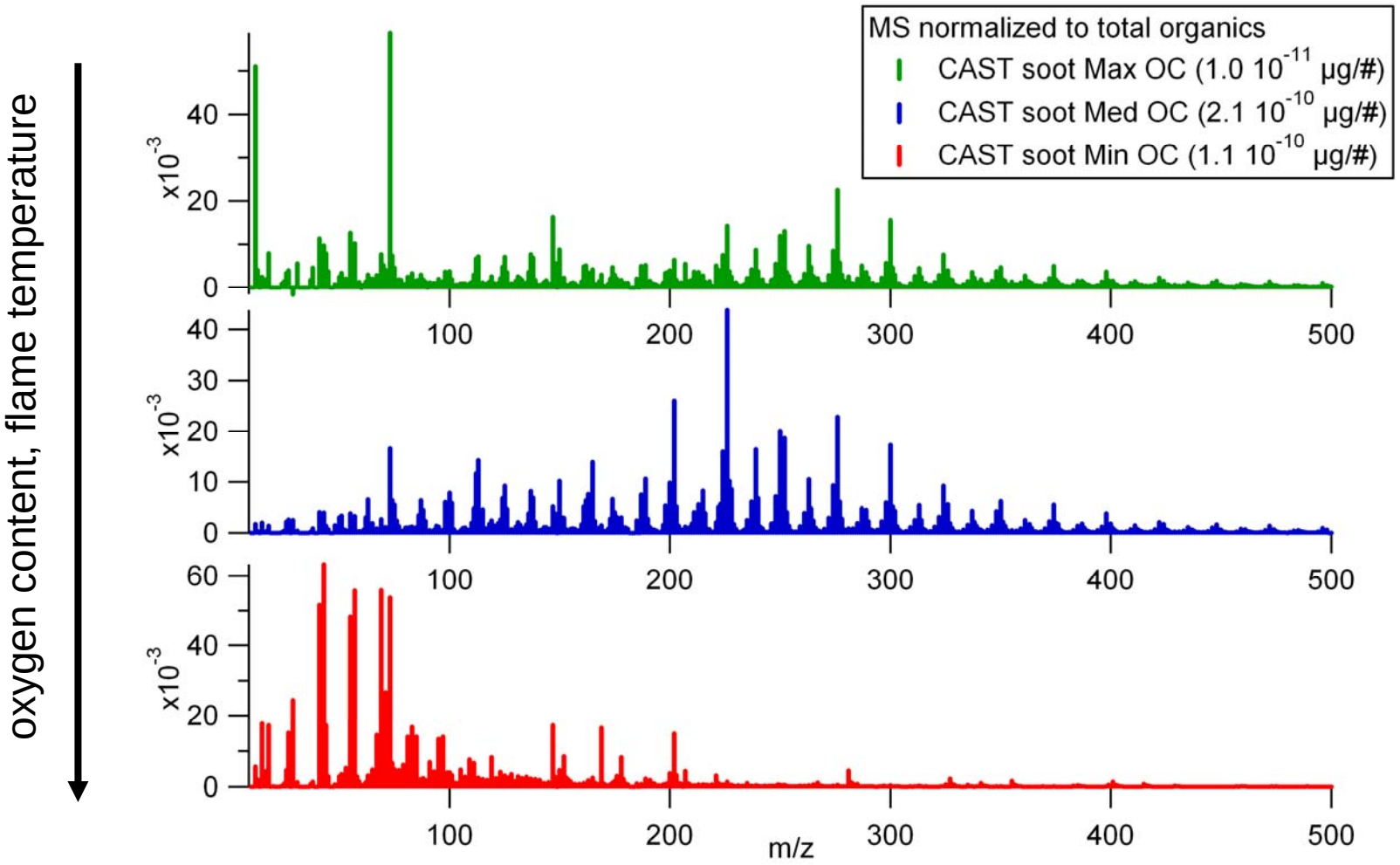




Taken from
DeCarlo, AST 38, 2004

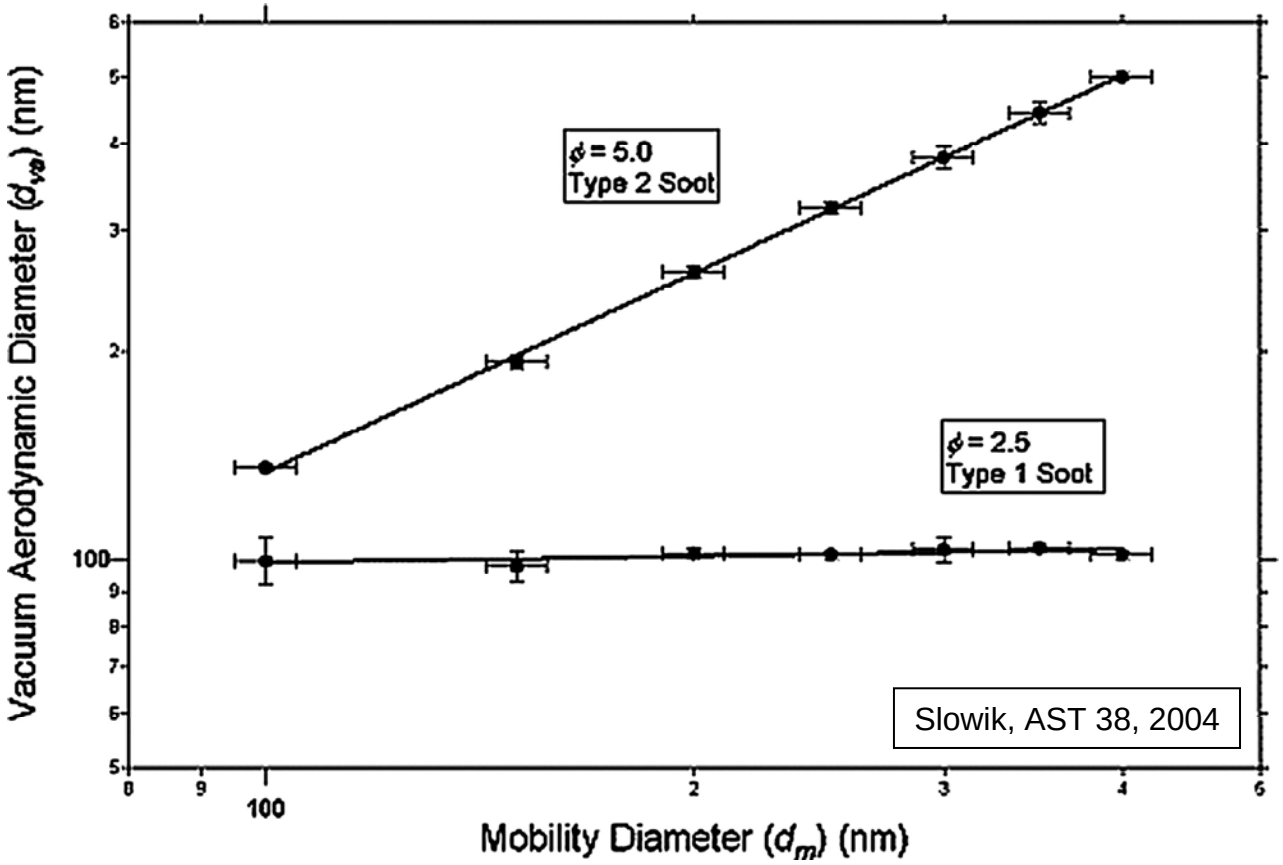
+ fractal ➔ - $d_{va}$
+ compact ➔ + $d_{va}$
coating w/o changes in shape ➔ + $d_{va}$

coating w/ compaction ➔ ++ $d_{va}$

# Uncoated CAST-soot

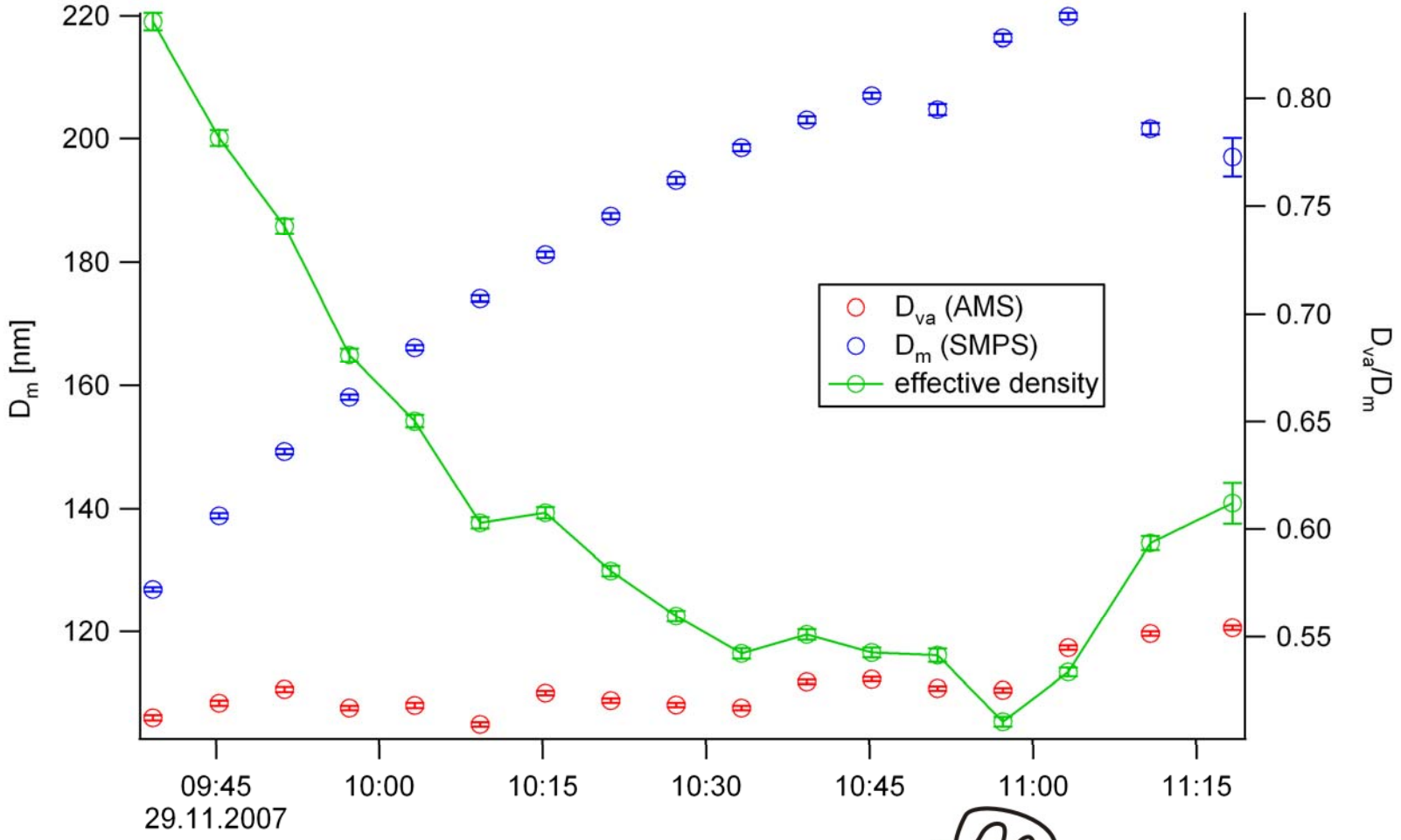


# Uncoated CAST-soot MedOC

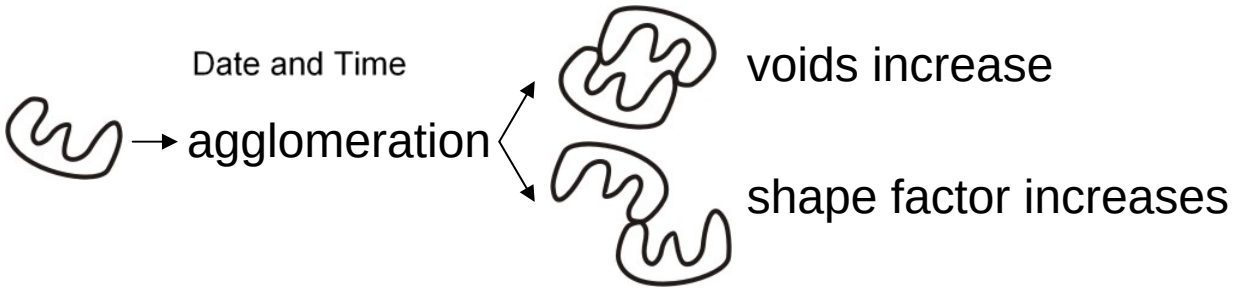



$\phi$ = fuel/$O_{2\ (actual)}$ / fuel/$O_{2\ (stoichiometric)}$

# Uncoated CAST-soot MedOC




$$d_{va} \approx \overline{\rho} \frac{d_m}{\chi^2} \frac{C_c(d_{ve})}{C_c(d_m)}$$



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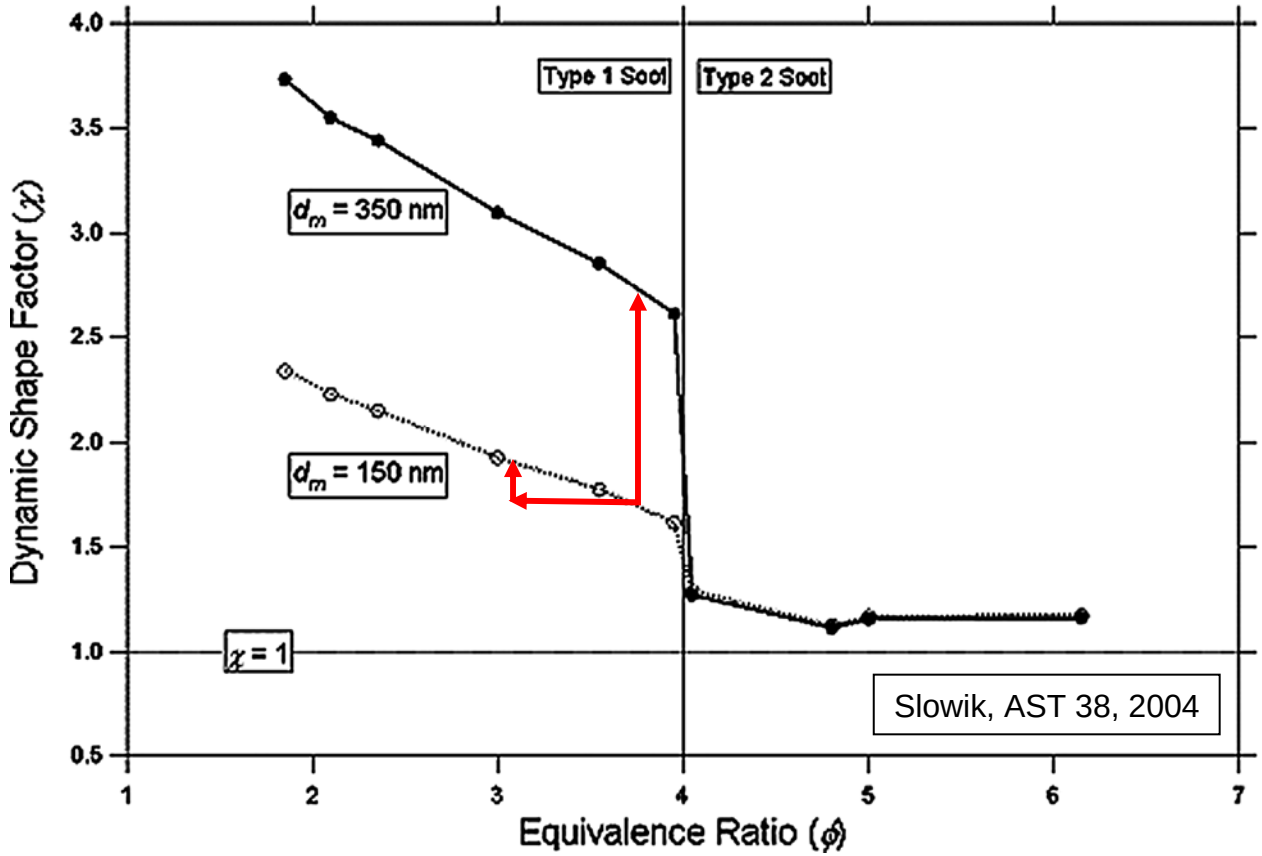
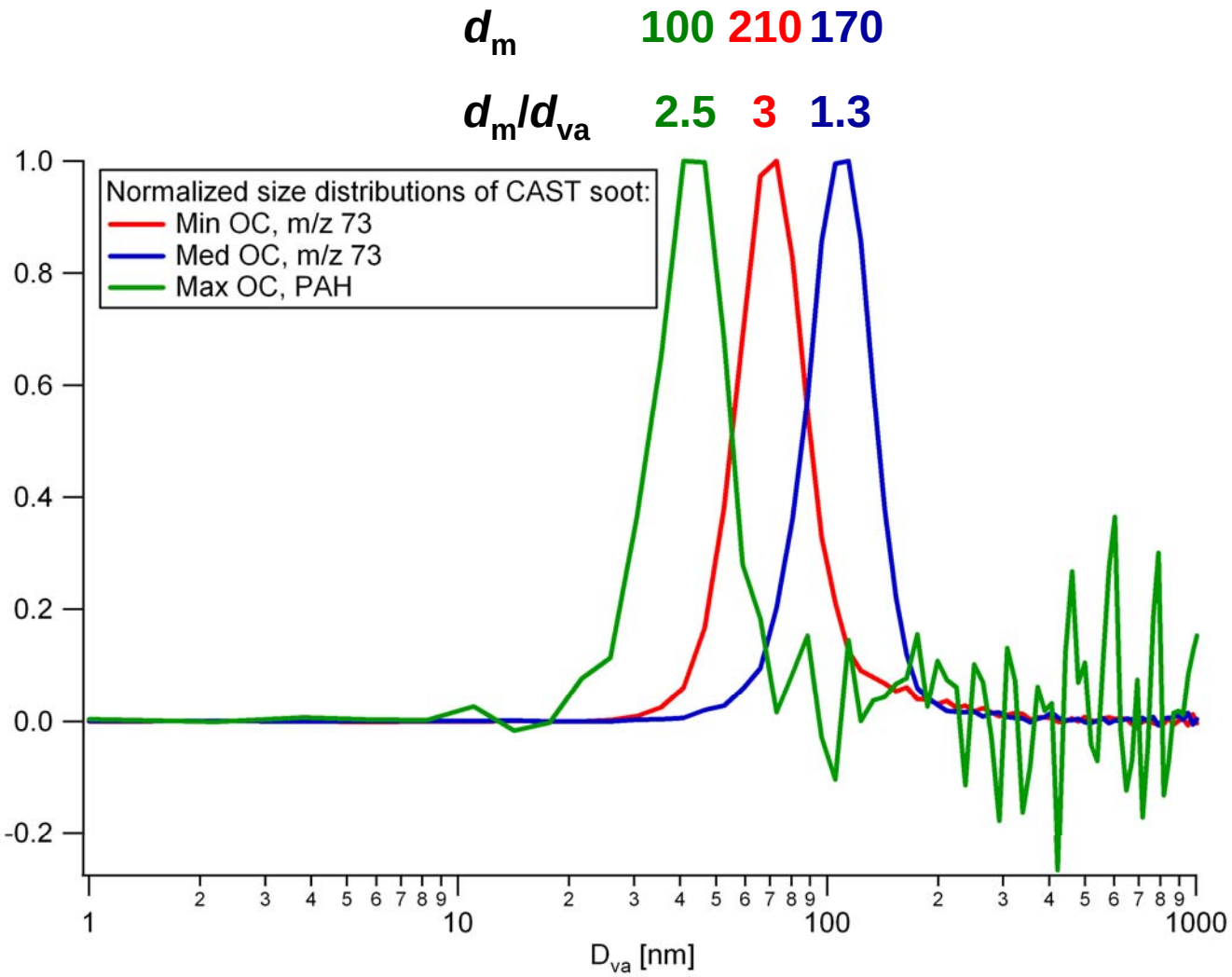



$\phi$ = fuel/$O_{2\ (actual)}$ / fuel/$O_{2\ (stoichiometric)}$

Both increase of $d_m$ and $O_2$ leads to increase of $\chi$

# Uncoated CAST-soot MedOC




$$\frac{d_m}{d_{va}} \sim \frac{\chi^2}{\overline{\rho}}$$

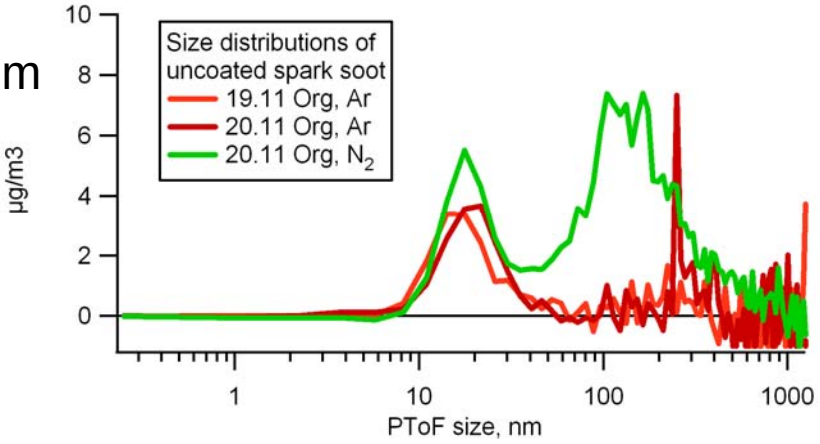
Max OC – trace does not fit ← small loading?

# Coated (Succ. ac.) and uncoated spark-soot

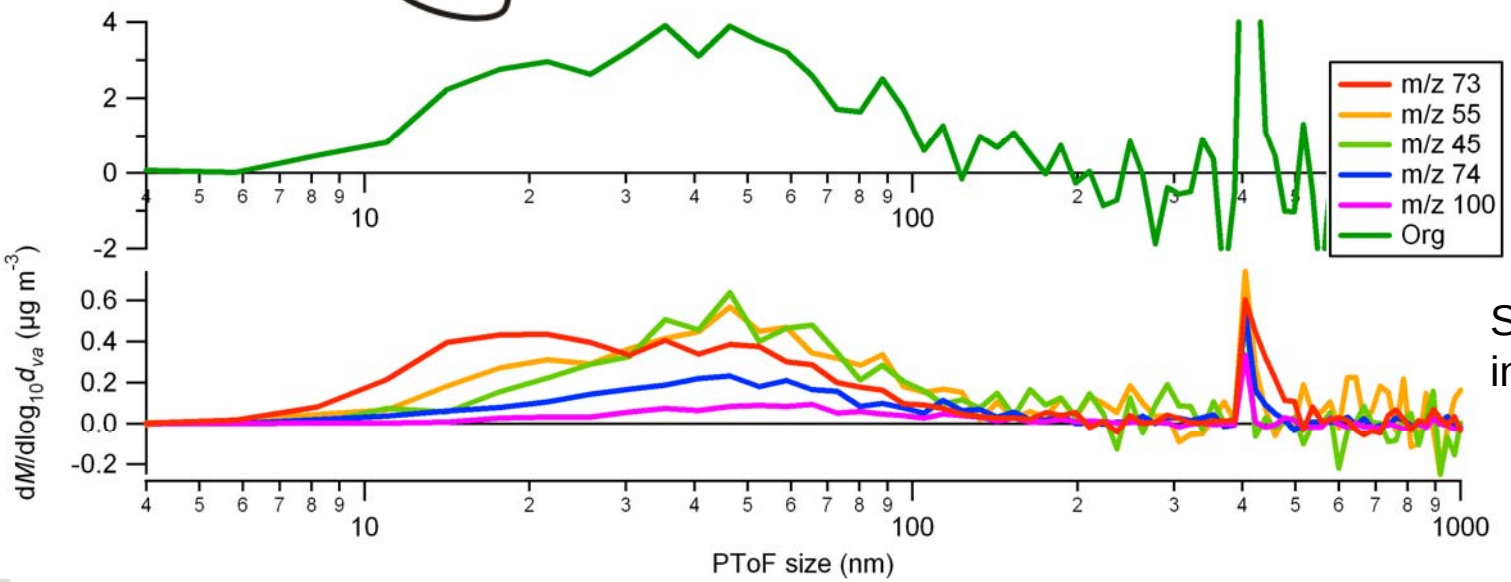
$$\frac{d_m}{d_{va}} \sim \frac{\chi^2}{\overline{\rho}}$$

$d_m$ ~ 220 nm, $d_{va\ (soot\ core)}$ ~ 20 nm
➔ Factor 11?

ρ = const → $\chi$ = 3.1 is realistic



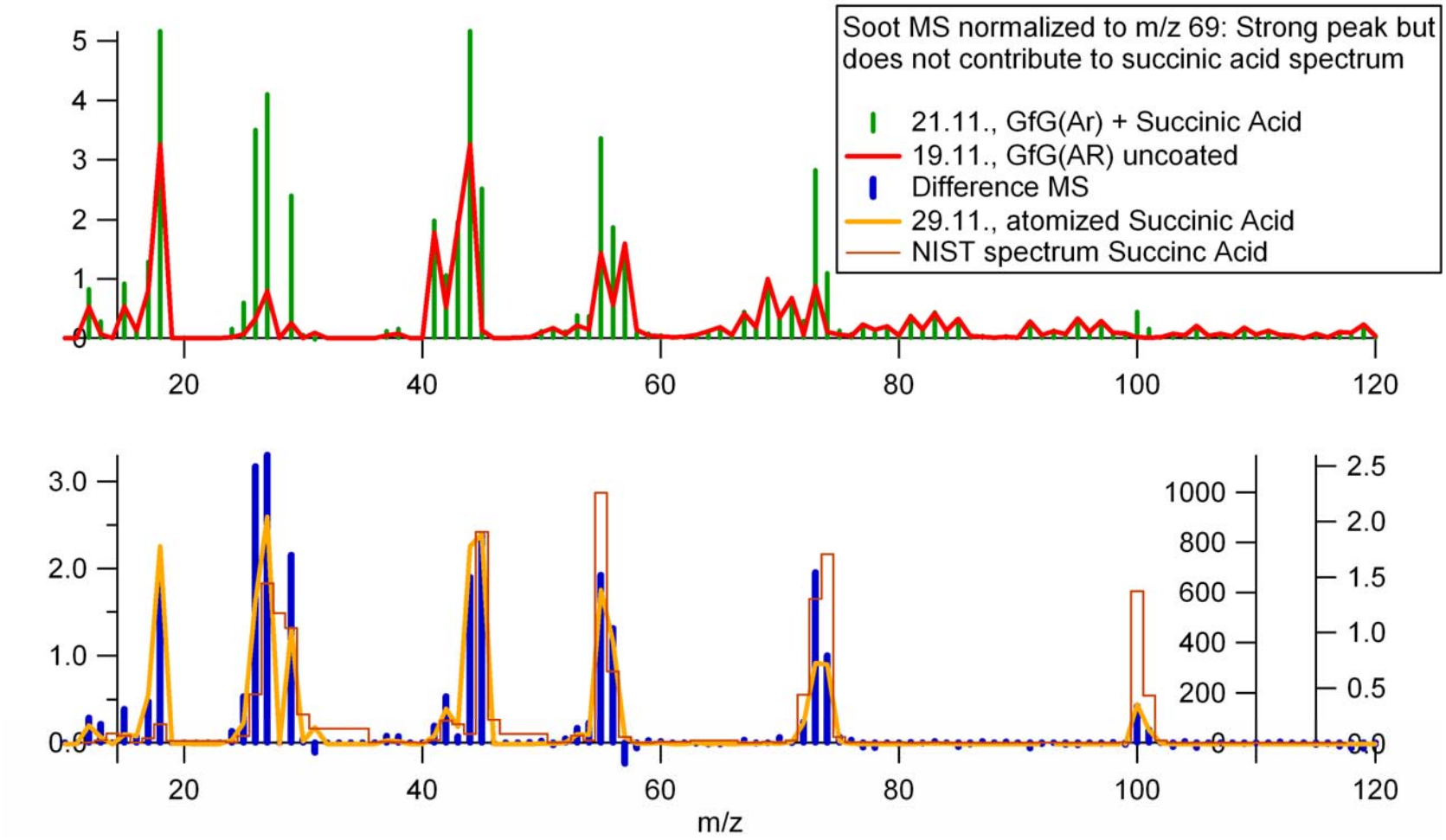

coating: + $d_{va}$




Strongest peaks in succinic acid MS

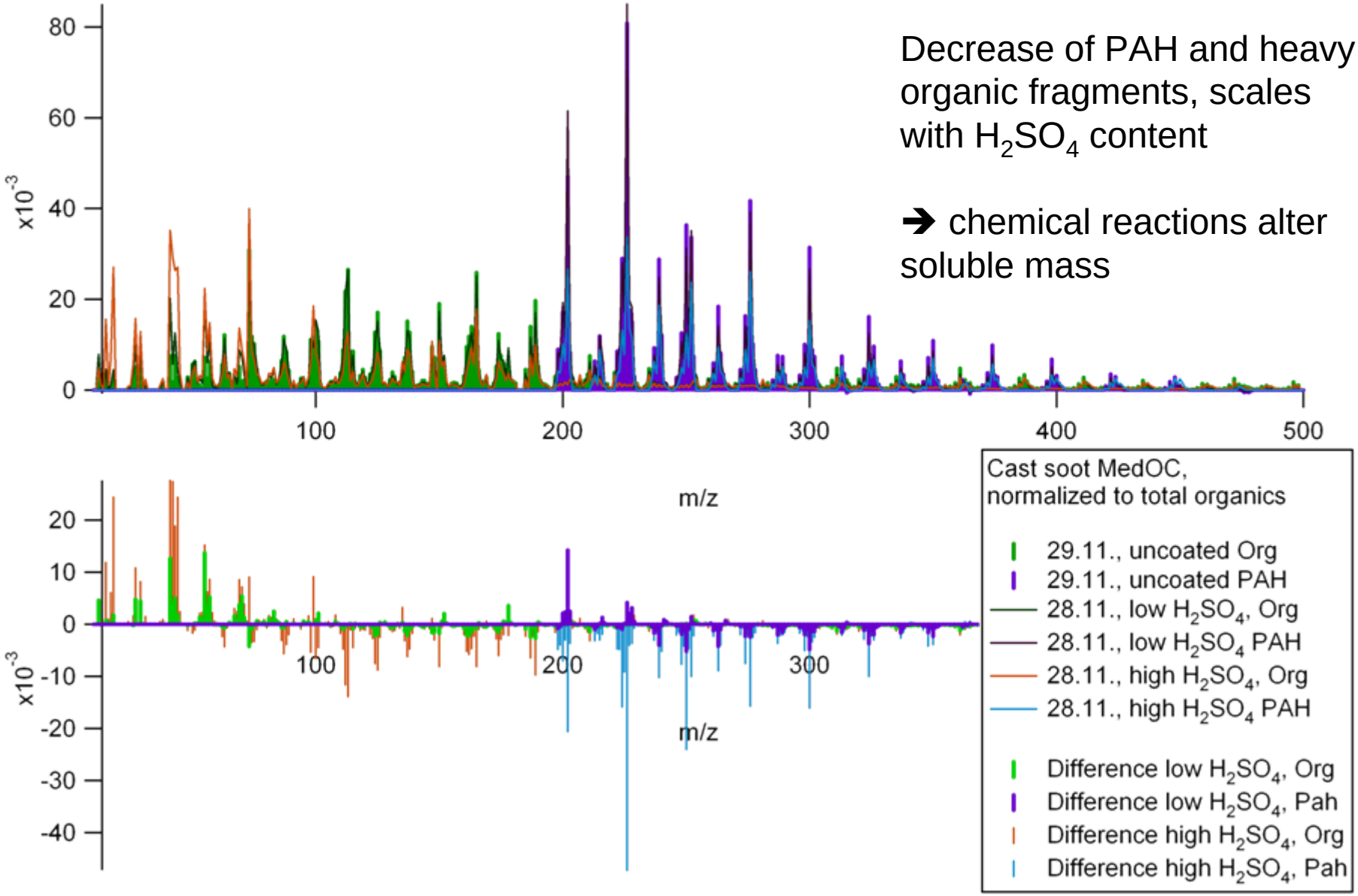
➔ Small peaks in PToF can be explained.

# Quantification of coatings (Succinic Acid)




Difficult to obtain precise amount of coating.
Above: m/z 69 used as reference peak: Only contribution in soot.
Look for such internal tracers to quantify coatings.

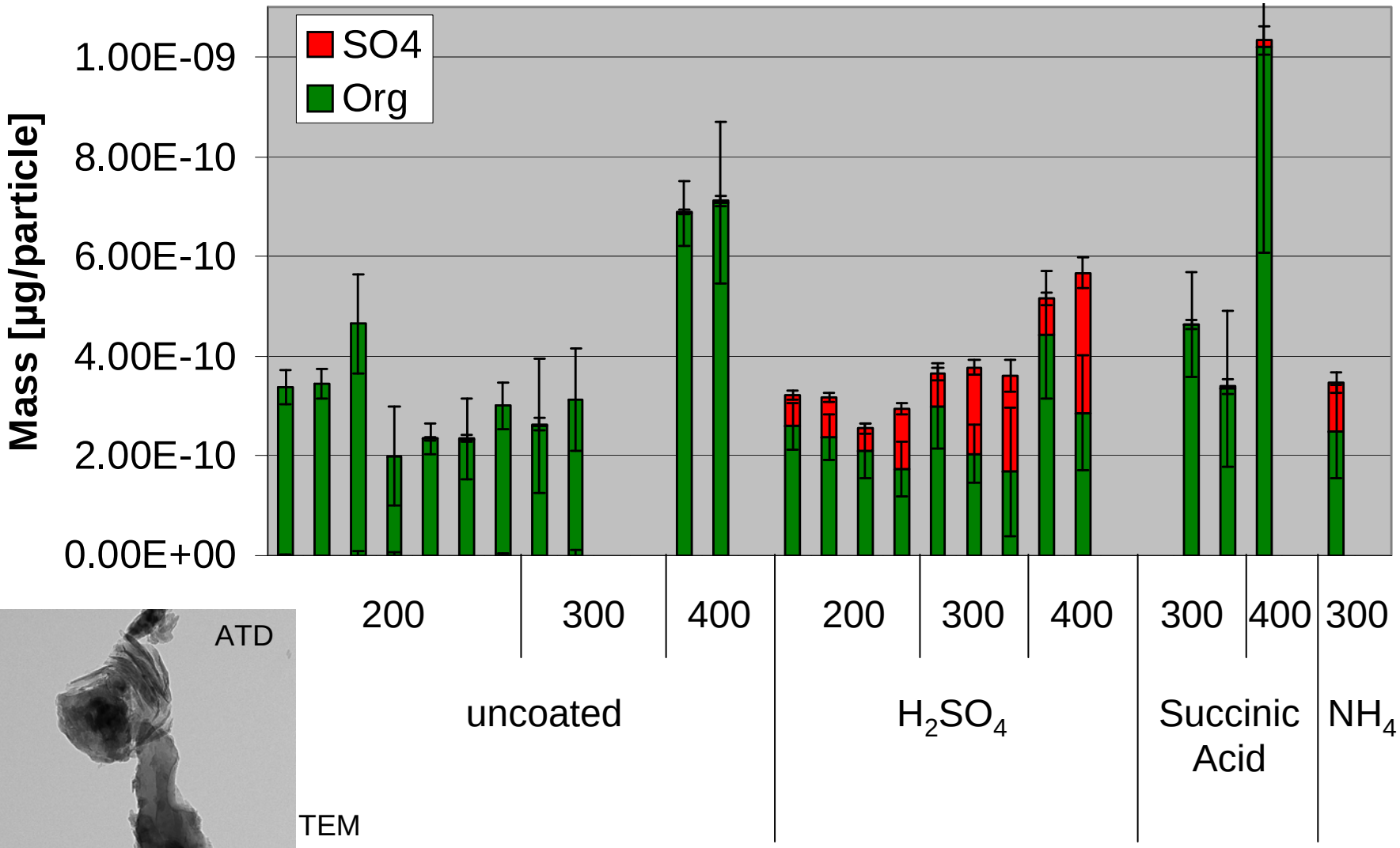
# Quantification of coatings (Sulfuric Acid)




Decrease of PAH and heavy organic fragments, scales with $H_2SO_4$ content

➔ chemical reactions alter soluble mass

# Measurements of ATD (IfT Leipzig)

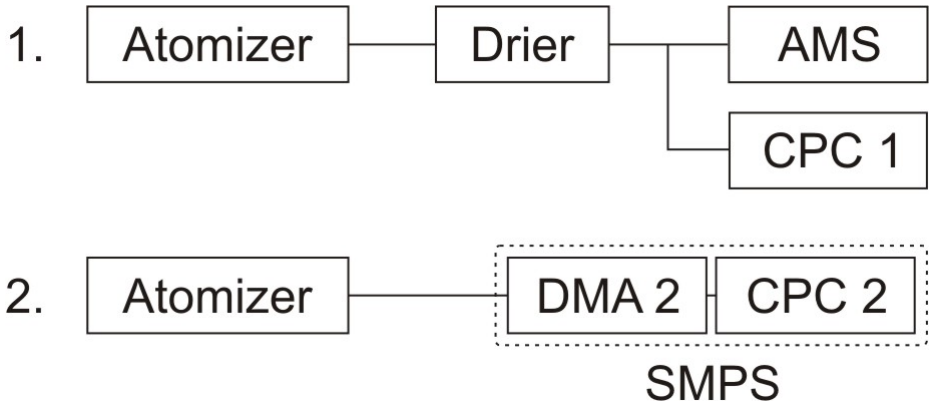


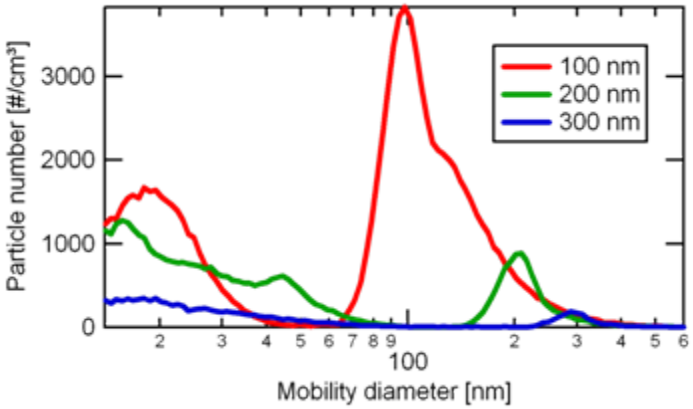


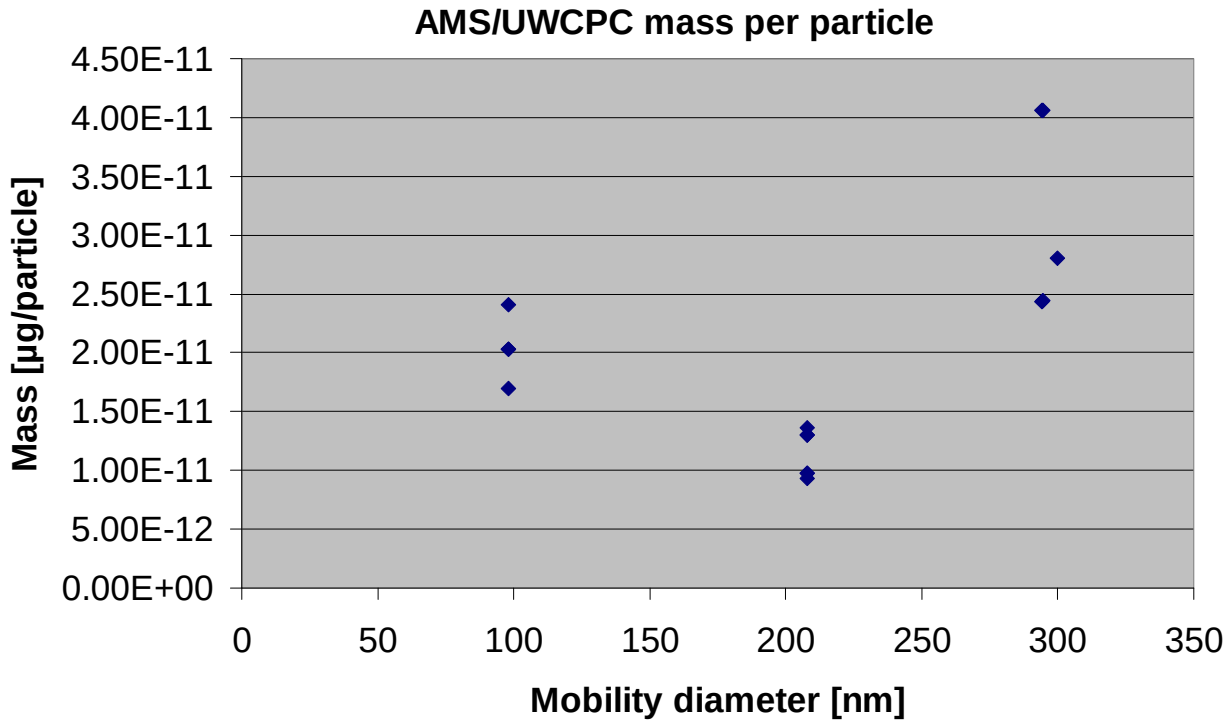


TEM
(A. Kiselev, IfT;
I. Lieberwirth, MPI-P)

# Measurements of silica spheres



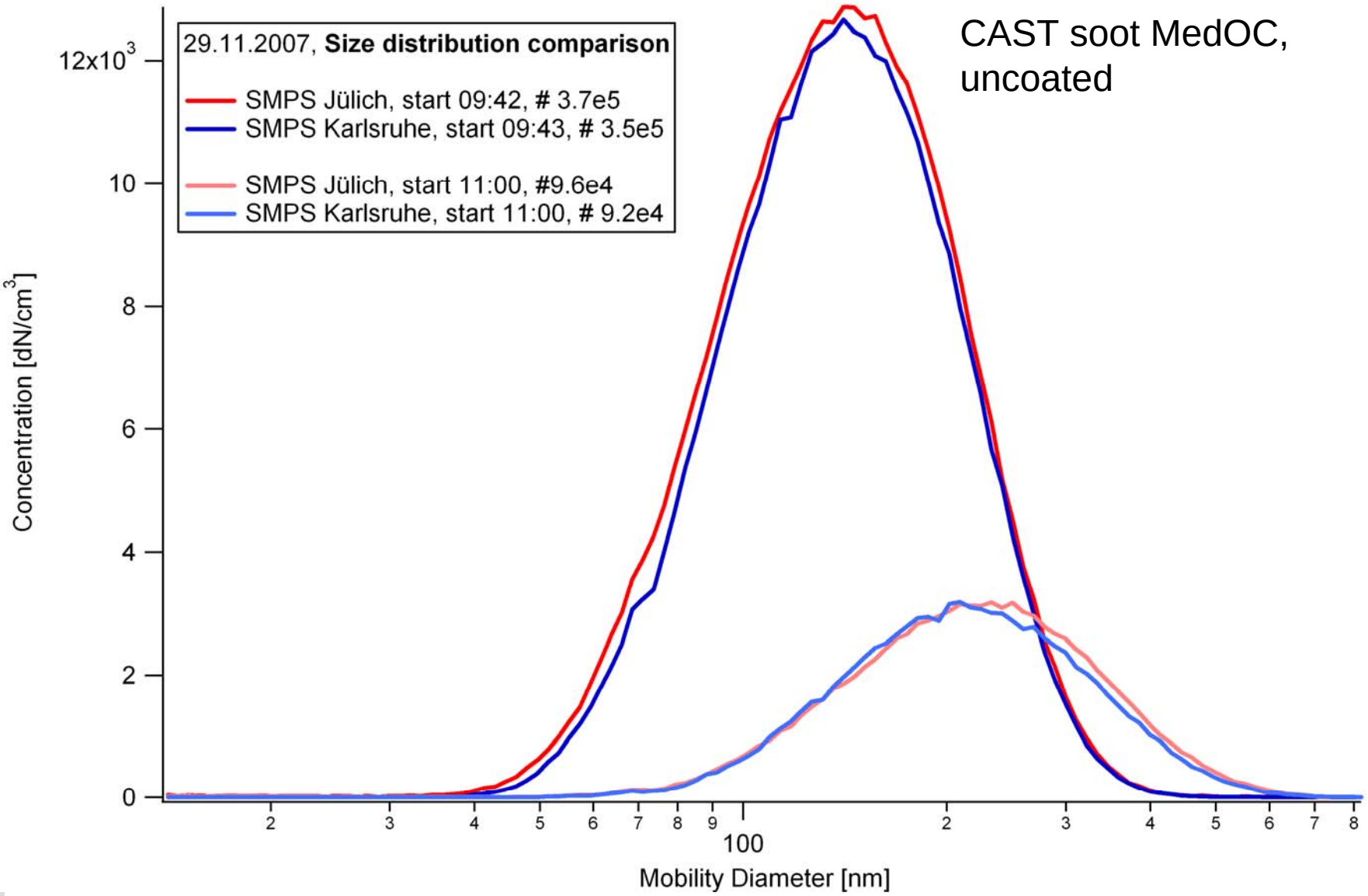



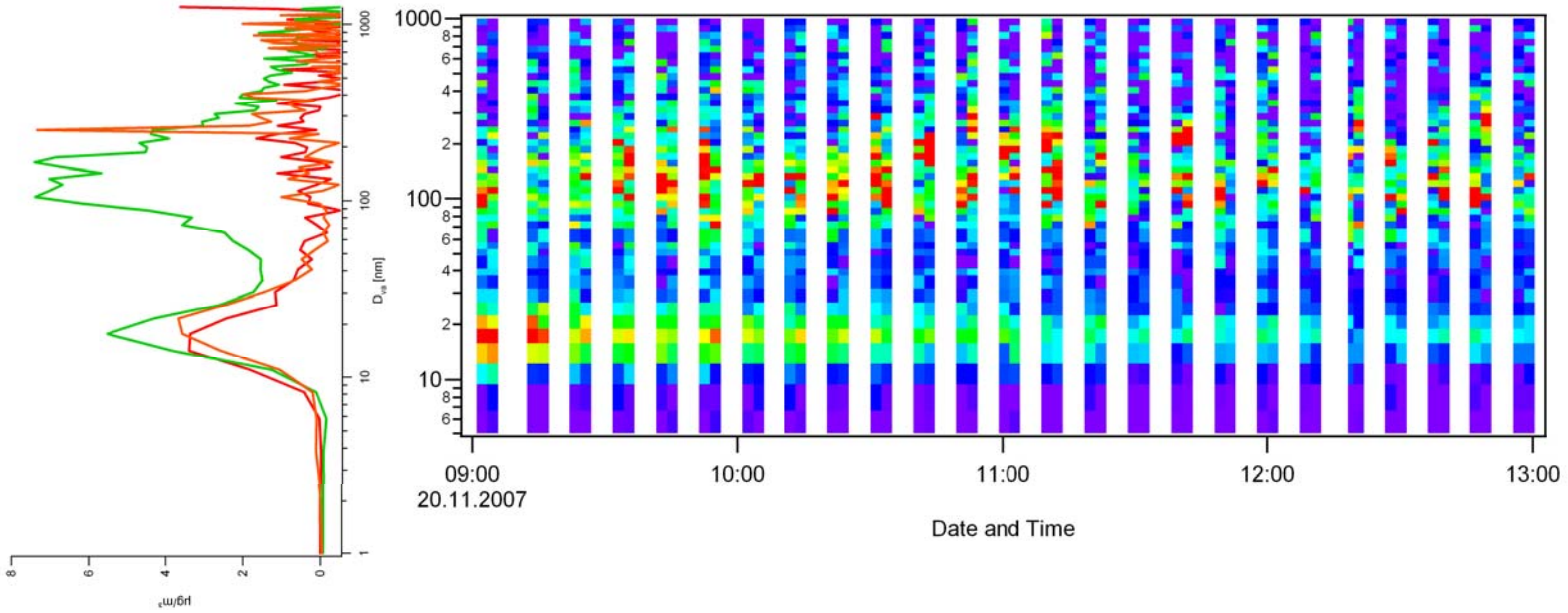
# Proposals for upcoming measurements

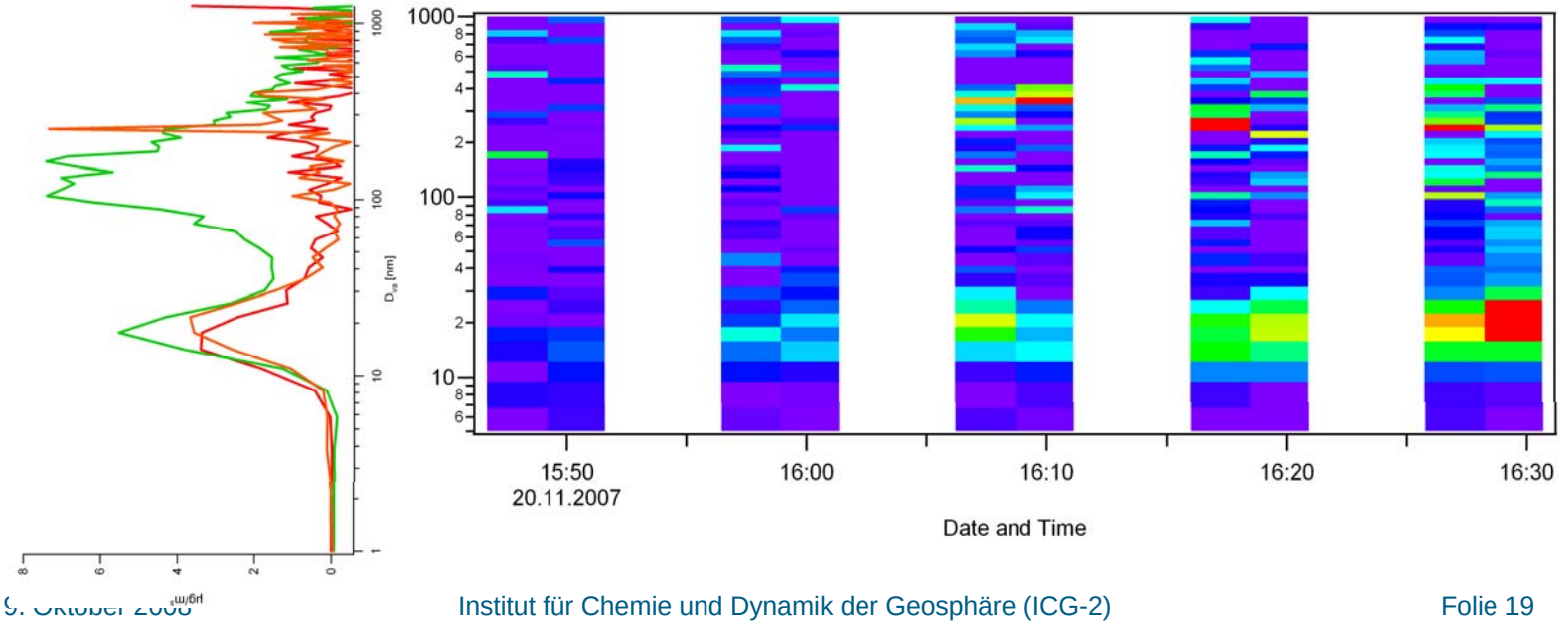
- Scan continuously size distribution with the SMPS
- Make reference measurements of bare soot in advance of each experiment
- Use single particle measurement mode (BFSP) of AMS to count particles
- Use only PToF-Mode to count particles

# AMS-SMPS size distribution comparison

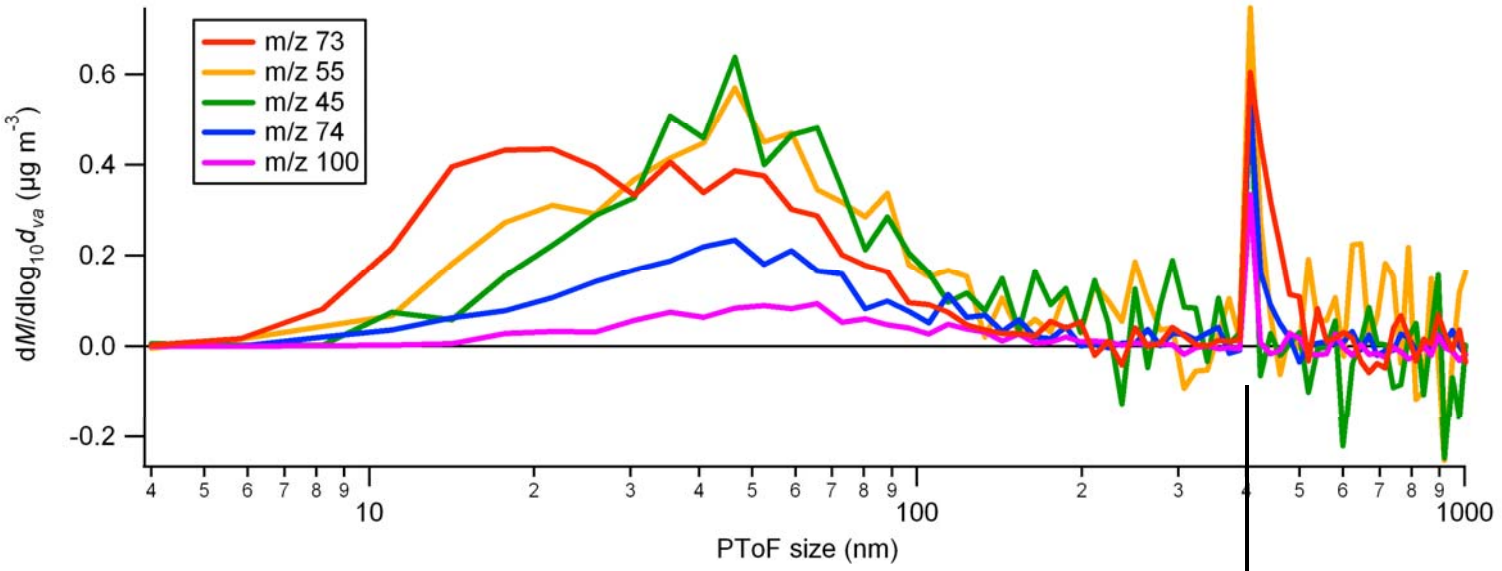


# Unbeschichteter GfG-Ruß

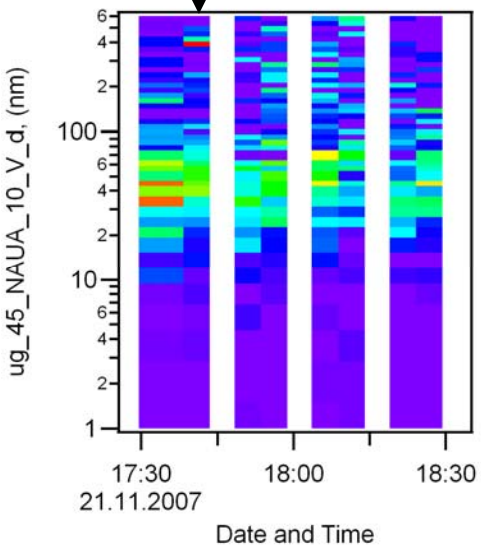


# Uncoated spark-soot




Strongest peaks in succinic acid



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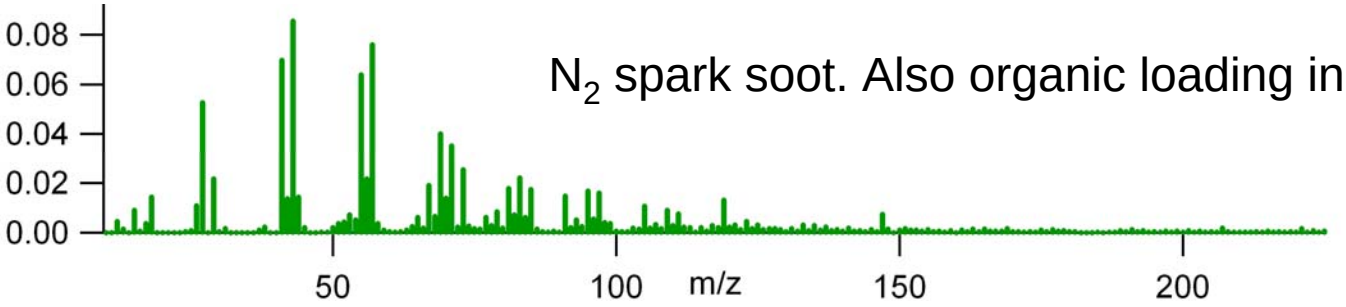
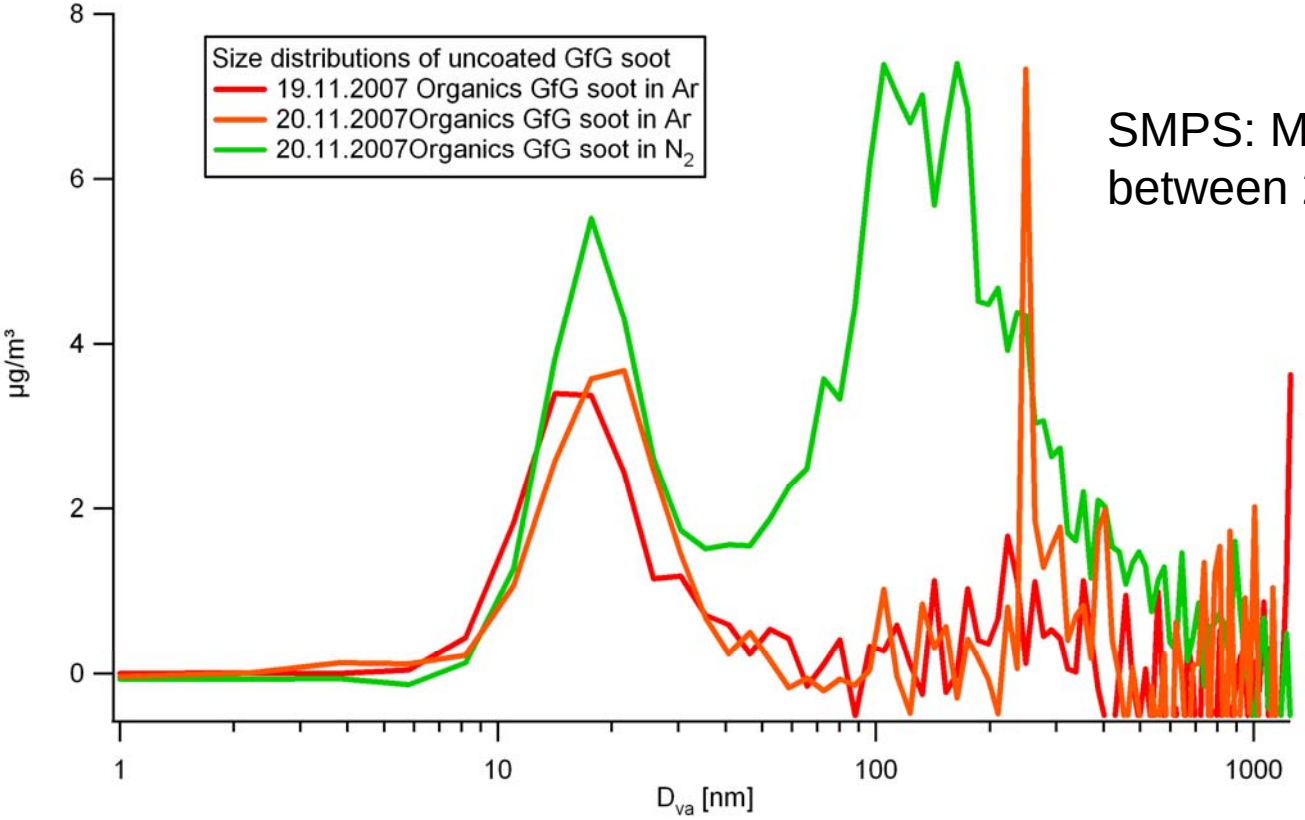



$N_2$ spark soot. Also organic loading in Ar case




SMPS: Mode grows between 200 and 270 nm