Meeting on the MUCHACHA campaign

(Multiple Chamber Aerosol Chemistry and Ageing)

Forschungszentrum Karlsruhe, December 5, 2008

PSI

GÖTEBORG UNIVERSITY

Leibniz-Institut für Troposphärenforschung e.V.

Carnegie Mellon

Forschungszentrum Jülich
in der Helmholtz-Gemeinschaft

Forschungszentrum Karlsruhe
Institute for Meteorology and Climate Research
Atmospheric Aerosol Research Division

SOA08

Forschungszentrum Karlsruhe
in der Helmholtz-Gemeinschaft

Universität Karlsruhe (TH)
Research University · founded 1825

Agenda for today

- 11:30 - 12:30 Lunch
- 12:30 – 14:30 First results and discussion of the chemical ageing experiments in AIDA (SOA08)
  - ~15 Min presentations by the participants
- 14:30-15:00 Coffee break
- 15:00 Discussion of possible experiments in the PSI chamber and in SAPHIR
  - Definition of possible goals and requirements
  - Set the time frame for the upcoming campaigns
- 17:00 End of the meeting

List of individual experiments

Date	Exp. #	T/°C	Activity/Comment
2008-11-06	SOA08-01	20	Test of dark OH source at 20°C, high background of VOC
2008-11-07	SOA08-02	20	Test of dark OH source at 20°C, lower background of VOC
2008-11-10	SOA08-1	20	Ageing of SOA from α-pinene with OH from TME at 20°C
2008-11-11	SOA08-2	20	Ageing of SOA from α-pinene with OH from TME at 20°C
2008-11-12	SOA08-3	0	Ageing of SOA from α-pinene with OH from TME at 0°C
2008-11-13	SOA08-4	-20	Ageing of SOA from α-pinene with OH from TME at -20°C
2008-11-14	SOA08-5	-20	Ageing of SOA from α-pinene with OH from TME at -20°C (low SOA conc.)
2008-11-17	SOA08-6	40	Ageing of SOA from α-pinene with OH from TME at 40°C
2008-11-18	SOA08-7	40	Ageing of Pinic and Pinonic acid with OH from TME at 40°C
2008-11-19	SOA08-8	30	Formation of SOA from Isoprene + OH (TME at 30°C)
2008-11-20	SOA08-9	10	Ageing of Pinic and Pinonic acid with OH from TME at 10°C
2008-11-21	SOA08-10	0	Formation of SOA from Isoprene + OH (TME at 0°C)
2008-11-24	SOA08-11	40	Ageing of SOA from limonene with OH from TME at 40°C
2008-11-25	SOA08-12	20	Ageing of SOA from limonene with OH from TME at 20°C
2008-11-26	SOA08-13	0	Ageing of SOA from limonene with OH from TME at 0°C
2008-11-27	SOA08-14	20	Ageing of SOA from α-pinene with OH from TME at 20°C (long term)
2008-11-28	SOA08-14	20	Ageing of SOA from α-pinene with OH from TME at 20°C (long term)

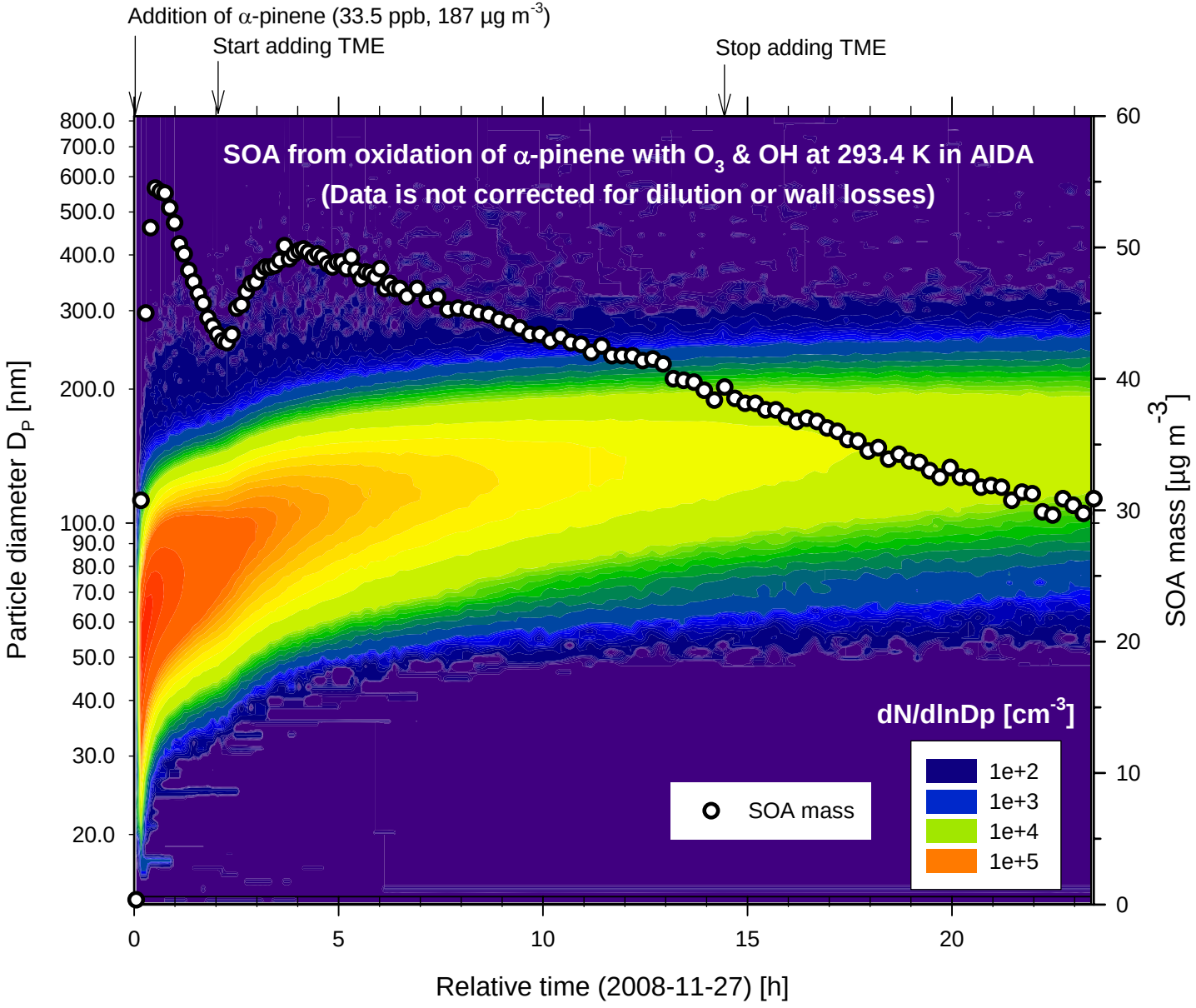
List of individual experiments

Exp. No.	T °C	r.h. %	Ref. Time	Exp. Start Time	Exp. End Time
1	20	39	2008-11-10 10:32:00	2008-11-10 09:50:00	2008-11-10 19:33:00
2	20	40	2008-11-11 09:19:00	2008-11-11 08:50:00	2008-11-11 17:30:00
3	0.8	35	2008-11-12 09:33:00	2008-11-12 09:00:00	2008-11-12 16:45:00
4	-20	37	2008-11-13 09:35:30	2008-11-13 09:00:00	2008-11-13 18:11:00
5	-20	40	2008-11-14 09:35:00	2008-11-14 09:00:00	2008-11-14 19:02:00
6	40	20	2008-11-17 10:12:00	2008-11-17 09:45:00	2008-11-17 19:07:00
7	40	19	2008-11-18 11:24:00	2008-11-18 09:00:00	2008-11-18 19:55:00
8	30	35	2008-11-19 10:01:00	2008-11-19 09:00:00	2008-11-19 17:10:00
9	10	36	2008-11-20 09:50:00	2008-11-20 09:30:00	2008-11-20 17:55:00
10	0	36	2008-11-21 10:29:00	2008-11-21 10:00:00	2008-11-21 19:53:00
11	40	21	2008-11-24 10:38:00	2008-11-24 10:00:00	2008-11-24 20:00:00
12	20	37	2008-11-25 09:58:00	2008-11-25 09:00:00	2008-11-25 18:30:00
13	0	36	2008-11-26 10:03:00	2008-11-26 09:30:00	2008-11-26 19:32:00
14	20	42	2008-11-27 10:19:00	2008-11-27 09:30:00	2008-11-28 11:30:00

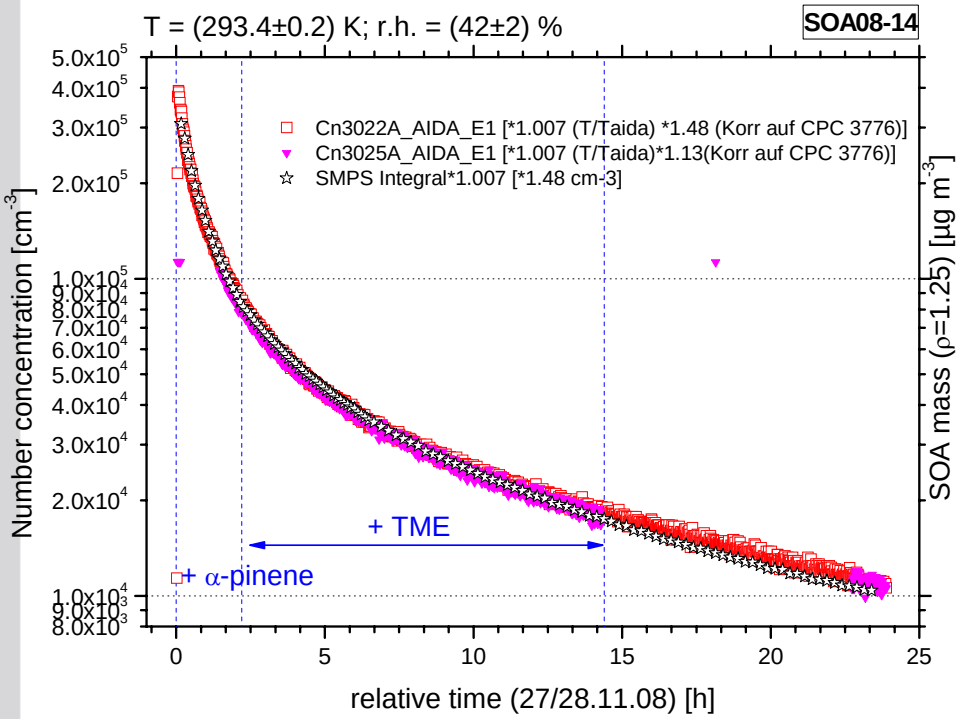
Experimental data provided from AIDA

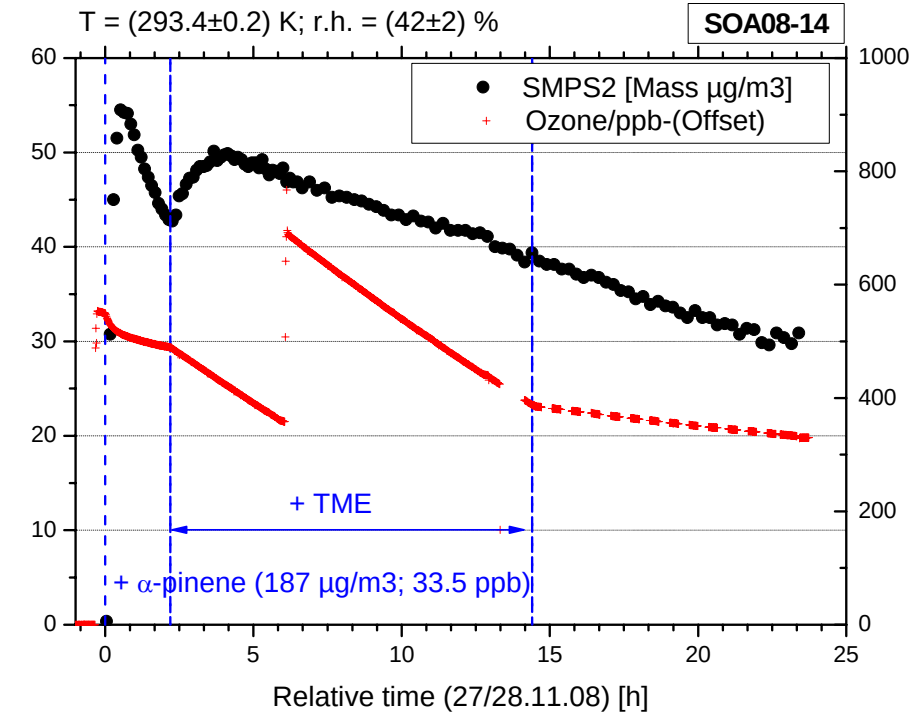
1. **Particle number concentrations measured with 4 different CPC's**
   - **3022A, 3022A, 3025A, 3776 (Reference), and 3786 (FZJ)**
2. **Particle size distributions measured with SMPS and DMPS**
   - **SMPS (14-820 nm) with 7-10 min time resolution**
   - **DMPS (1-3 reference measurements at AIDA temperature per experiment)**
3. **Ozone concentrations measured by UV absorption or FTIR**
4. **Sulphate concentrations from ion chromatographic analysis of filter samples or FTIR**
5. **Water concentrations measured with dew point mirror and TDL**
6. **AIDA temperature and pressure**

SOA08-14 size distribution

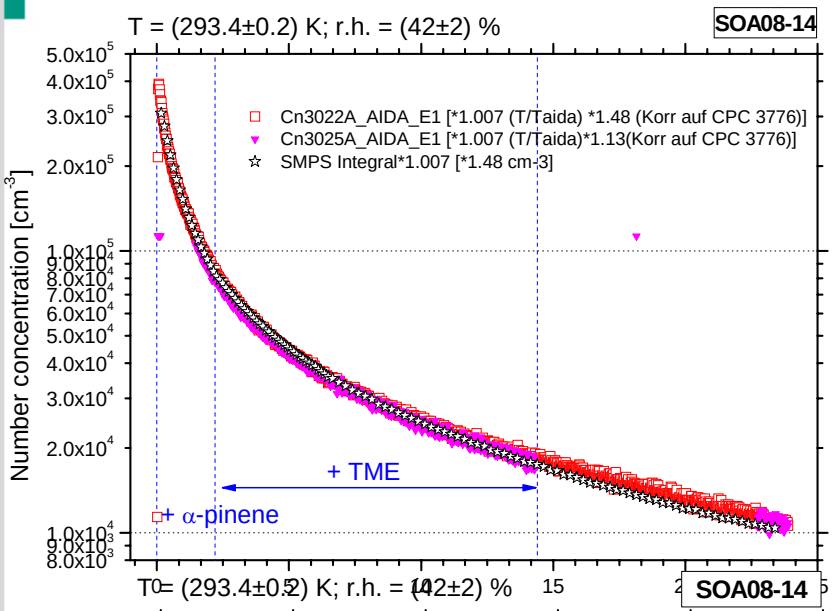


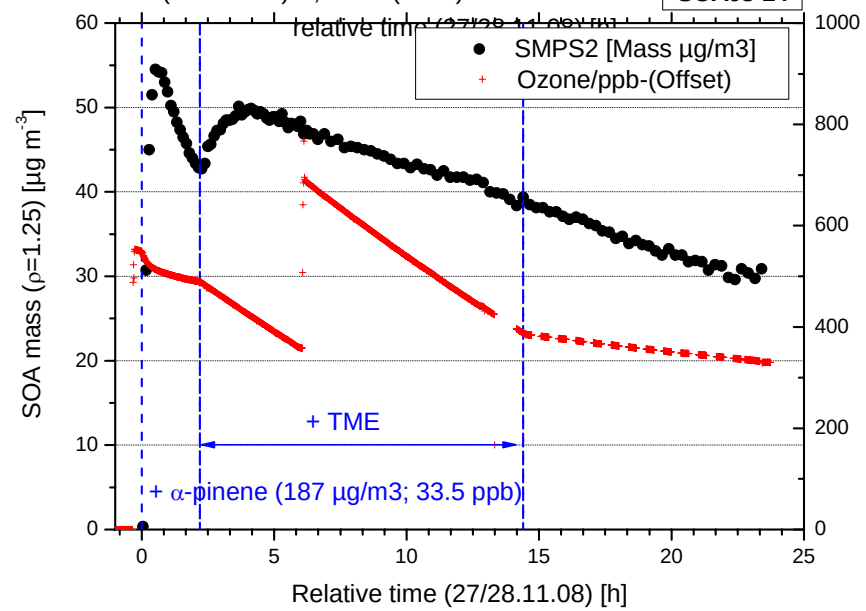
SOA08-14 particle number & mass

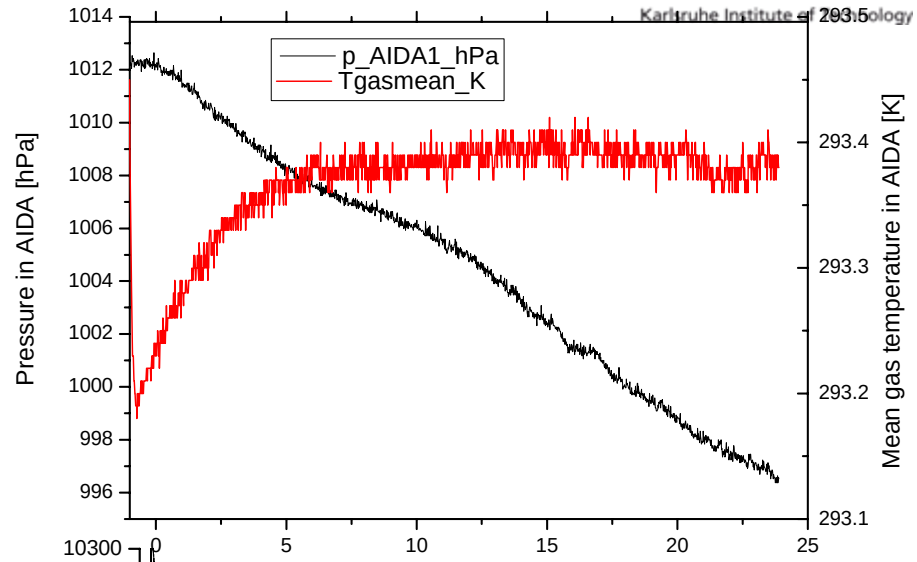


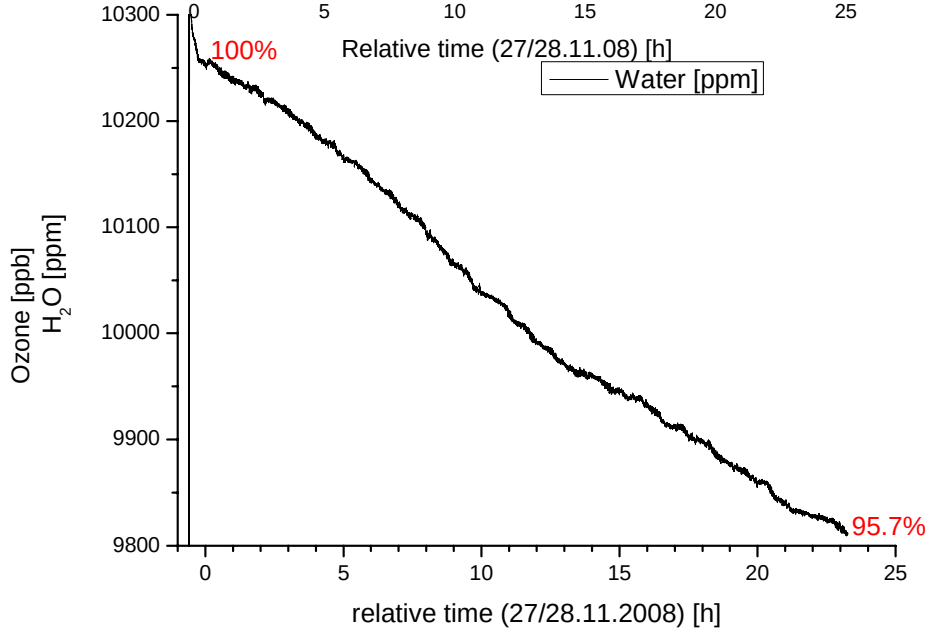


SOA08-14 number, mass, O_3, p, T









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Preliminary conclusions

- OH-radicals can be formed in AIDA using TME and ozone
  - OH-levels should have been around some times 10^6 cm^{-3}
  - OH-levels can be calculated from the decay of 3-Pentanol
- Adding OH radicals to SOA from ozonolysis of α-pinene and limonene resulted in additional formation of SOA mass in the order of 10-20%
  - The additional mass formed is smaller for lower temperatures
  - The additional mass is formed typically within one hour
- Pinic acid seems to have a lower vapour pressure than cis-pinonic acid
- Oxidation of cis-pinonic acid with OH radicals seems to results in formation 3-methyl -1,2,3-butanetricarboxylic acid (MW 204)
- Reaction of OH radicals with methacrolein or MVK did not lead to significant additional SOA formation at 30°C and 0°C