Single particle measurement of black carbon using LS-SP-AMS in downtown Toronto – Preliminary results

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LS-SP-AMS = SP-AMS + light scattering module

Cross et al, ACP, 2009
Background information

- **Location**: Toronto (Downtown campus of University of Toronto)
- **Study Period**: 18-22 Sep, 2012 (5 days)
- **Instrument**: SP-AMS + light scattering module (LS-SP-AMS)
  - Laser on: MS, PToF
  - Laser on: LS
  - Laser off: MS, PToF
  - Laser off: LS

The thermal vaporizer was always on.
Aerosol composition (Laser on)

- Ammonium
- Nitrate
- Sulfate
- Chloride
- Organic

- Black carbon

Average Org MS
- SO4: 13.1%
- BC: 4.8%
- 0.4% Chl
- 6.8% NH4
- 7.2% NO3

H:C
O:C

Date and Time:
- 9/19/12
- 9/20/12
- 9/21/12
- 9/22/12
Ambient black carbon

Average BC MS

Nitrate equivalent mass (μg/m³)

Organic 67.2%
BC 4.8%
NO₃ 7.7%
NH₄ 6.8%

Regal Black

Size distribution (Laser on)

Fresh mode?
Light scattering data analysis

m/z 36: HCl or C3?

HCl or Black carbon (C3)?
**Light scattering signals**

![Graph with Laser ON and Laser OFF signals]

**Light scattering signals – Sulfate**

![Graphs showing Laser OFF and Laser ON signals with sulfuric acid (SO4) levels]
Light scattering signals – Black carbon

Light scattering signals – Organic
Single particle mass spectra - Inorganic

Ammonium sulfate
Dva = 341 nm

Ammonium nitrate
Dva = 337 nm

Single particle mass spectra – HOA like

HOA
Dva = 446 nm

HOA
Dva = 345 nm
Single particle mass spectra – BC

BC
Dva = 227 nm

BC + HOA
Dva = 163 nm

BC + OOA + AS
Dva = 567 nm

BC + OOA + AS
Dva = 548 nm

BC + OOA
Dva = 559 nm
We have some single particle mass spectra of ambient black carbon now!!