AMS Users Community
Annual Meeting Attendance

680+ Published Articles to date
Overview of Aerosol Instrument Developments

AMS Family and Aerosol Collectors

TAG and FIGAERO

Sat 9:19 AM
Instruments and Developments

AMS, mini AMS
QACSM, ToF ACSM
CIMS and Aerosol CIMS
IMS TOF
LAAPTOF
TAG AMS
Capture Vaporizer
Particle Lens
ePTOF Multiplex chopper
Something we may have delivered to the Manchester Group!

s/n: 255-002
June 2000
The Quad AMS

The work horse

Where the fundamental hardware and software ideas evolved.

Zhang et al, GRL 2007
Geneology and Chronology of AMS systems

<table>
<thead>
<tr>
<th>System</th>
<th>Year</th>
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</thead>
<tbody>
<tr>
<td>QAMS</td>
<td>1995 – 2000+</td>
</tr>
<tr>
<td>CTOF AMS</td>
<td>2001</td>
</tr>
<tr>
<td>HTOF AMS</td>
<td>2002</td>
</tr>
<tr>
<td>QACSM</td>
<td>2004 – 2009+</td>
</tr>
<tr>
<td>SP HTOF AMS</td>
<td>2007</td>
</tr>
<tr>
<td>eTOF ACSM</td>
<td>2010</td>
</tr>
<tr>
<td>CTOF mAMS</td>
<td>2011</td>
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<tr>
<td>HTOF mAMS</td>
<td>TBD</td>
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</tbody>
</table>

Different colors are different vacuum systems
What’s the Difference between an AMS, mini-AMS and an ACSM

If it has a chopper its an AMS
    -can do pTOF sizing

If it doesn’t have a chopper its an ACSM
    -no pTOF sizing, mass spectra only

A mini-AMS is just a smaller AMS
    -a different vacuum system
All AMS and ACSM Systems Share a Few Common Features

• Particle aerodynamic lens
• A differentially pumped high vacuum system, *efficient gas-particle separation*
• Particle vaporizer
• Electron impact ionization source
• *Mass spectrometer ➤ performance/Cost*
Aerosol Mass Spectrometer

Particle Beam Generation

Aerodynamic Sizing

Particle Composition

Research grade TOF mass spectrometer

Beam Chopper

Particle TOF Region

Aerodynamic Lens

Pumps (x5)

Fast Data System
Timers
DACs
Full PC

Thermal Vaporization & Electron Impact Ionization
Aerosol Chemical Speciation Monitor

Particle Beam Generation

Aerodynamic Lens 40-1000 nm

Particle Inlet (1 atm)

No Sizing

Particle Composition

Laptop Computer

Smaller/lower cost Q- or TOF- Mass Spec

Thermal Vaporization & Electron Impact Ionization

Pumps (x3)
Two Different Vacuum System Designs

QACSM
discrete turbos

TOF ACSM and mAMS
Split flow turbo

Pumping speeds (L/s)

300  80  300

40  170  135  160
Key Difference Between the mAMS/ACSM and AMS Systems is Pumping at the First Stage

Reduced particle transmission at small size end
Recent mAMS and ACSM Systems

Differences between ACSM and mAMS are the chopper and the DAQ system.
The new TOF ACSM and mAMS systems have a new generation of electronics and TPS systems.

- Giraffe
- TPS2

Size: 23”H x 25”W x 19”D
Weight: 160 pounds
Power: ~300W

Is this the next generation AMS system?
Can we put a mini-Vacuum system on an HTOF?

Overall length
28.2” (720 mm)

31.4” (800 mm)
Some Open Issues to be Addressed with mAMS System

• Software development of AMS DAQ system

  Different sw paths to support AP240, ADQ1600, TPS 1&2, Giraffe, different analog and digital I/O systems.

• Performance Evaluations

  Particle transmission, reduced pumping speed at lens exit leads to collisional defocusing of sub 100 nm particles.

  Shorter pTOF flight path, is the trade off with size resolution acceptable.

• Vacuum chamber compatibility for optional modules

  mini-chamber does not currently support light scattering, soot particle laser module, beam width probe. Use with HTOF mass spectrometer.
Aerosol composition with the CIMS instrument
Particle collection and thermal vaporization


FIGAERO – new collector module. Aerosol collection by filtration. Separate sampling lines for gas and aerosol

EyeOn - A hardware and software control system for the collector module

UW - Joel Thornton, Claudia, Felipe
TAG-AMS
Thermal Desorption Aerosol GC/MS

Thermal Desorption Aerosol Gas Chromatograph (TAG)

High Resolution Time of Flight Aerosol Mass Spectrometer (HR-ToF-AMS)

Tag inlet
Auto Injector
Collection & Thermal Desorption Cell (CTD)

Gas Phase Denuder
Sample Loop
He
vent
Quad PC
Filter
Heated Transfer Line
Valveless Manifold
Resistively Heated GC Column

V-Mode
W-Mode

Beam Chopper
Thermal Vaporization & EI Ionization

(Isaacman, AMT, 2011)

September 4, 2010

Williams et al. 2006 (UCB)
TAG-CIMS

Thermal Desorption Aerosol Gas Chromatograph (TAG)

Tag inlet
Auto Injector
Denuder
Sample Loop
He
Heater Loop
PC
Heated Transfer Line
Valveless Manifold
Resistively Heated GC Column

Collection & Thermal Desorption Cell (CTD)
(Isaacman, AMT, 2011)

GC Interface kept at 250°C