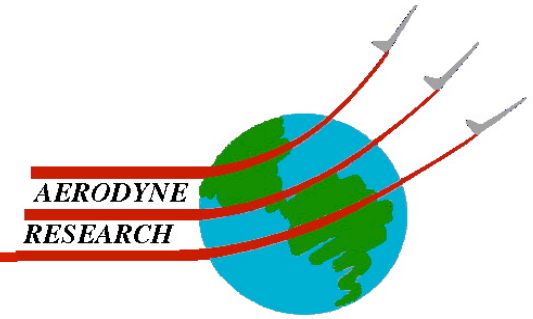


***AERODYNE RESEARCH, INC.***



# **Aerodyne Mobile Laboratory Deployment MCMA-2006, MAX-MEX, MILAGRO**

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**Prepared for:**

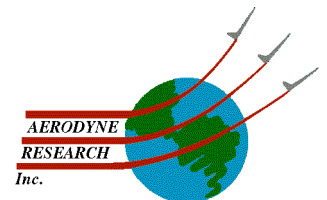
**MILAGRO Science Meeting  
Millennium Hotel  
Boulder, CO**

**October 23, 2006**

# Aerodyne's MILAGRO Objectives

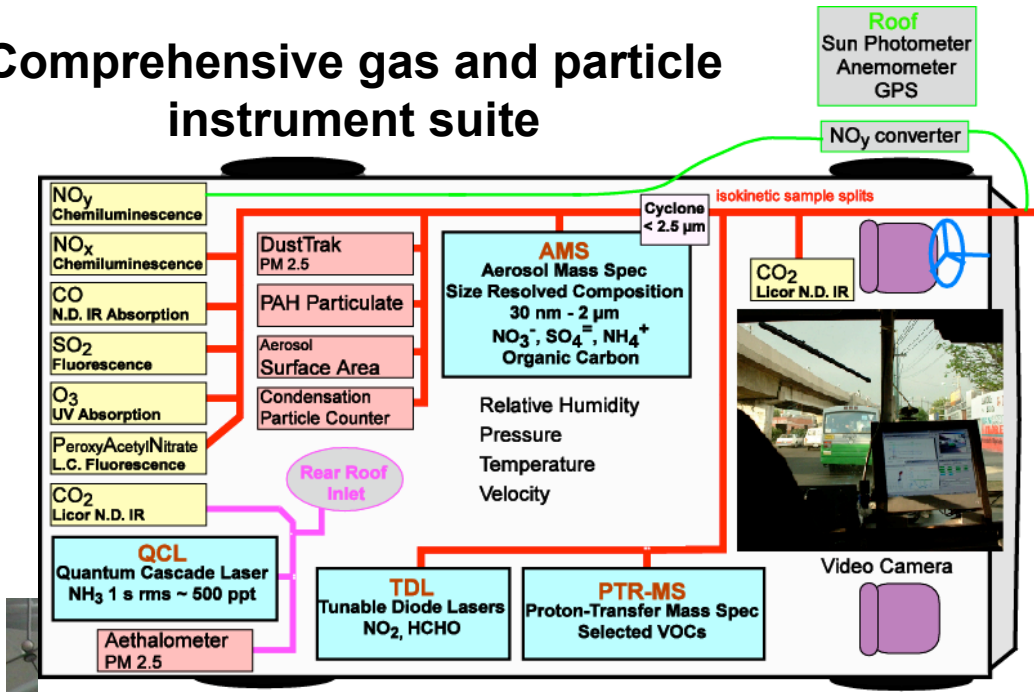
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- **Investigate sources and photochemical processing of gases and particles**
  - **Processing of emissions and secondary oxidant and aerosol formation**
- **Characterize on-road traffic emissions**
  - **For comparison with studies in 2003, 2002, and emission inventories**
- **Collaborate with other scientists through co-located sampling**



# Aerodyne Mobile Laboratory

## Comprehensive gas and particle instrument suite



### Gas phase measurements:

CO<sub>2</sub>, CO, NO<sub>2</sub>, HNO<sub>3</sub>, NH<sub>3</sub>, O<sub>3</sub>, NO, NO<sub>2</sub>, NO<sub>y</sub> VOCs

### Particulate measurements:

Composition, mass loadings, size distributions, black carbon, number concentrations, absorption, scattering, surface area, PAH concentration

### Meteorological measurements:

Wind speed and direction, temperature, pressure, relative humidity

### Offline methods:

- canister sampling
- filter sampling



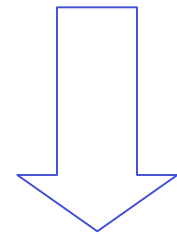
# Modes of Deployment

- **STATIONARY SAMPLING**

- Multiple site deployment during intensive study
  - High time resolution point sampling
  - Locate at hard to access sites
- Co-located sampling with other researchers



Specific source emissions



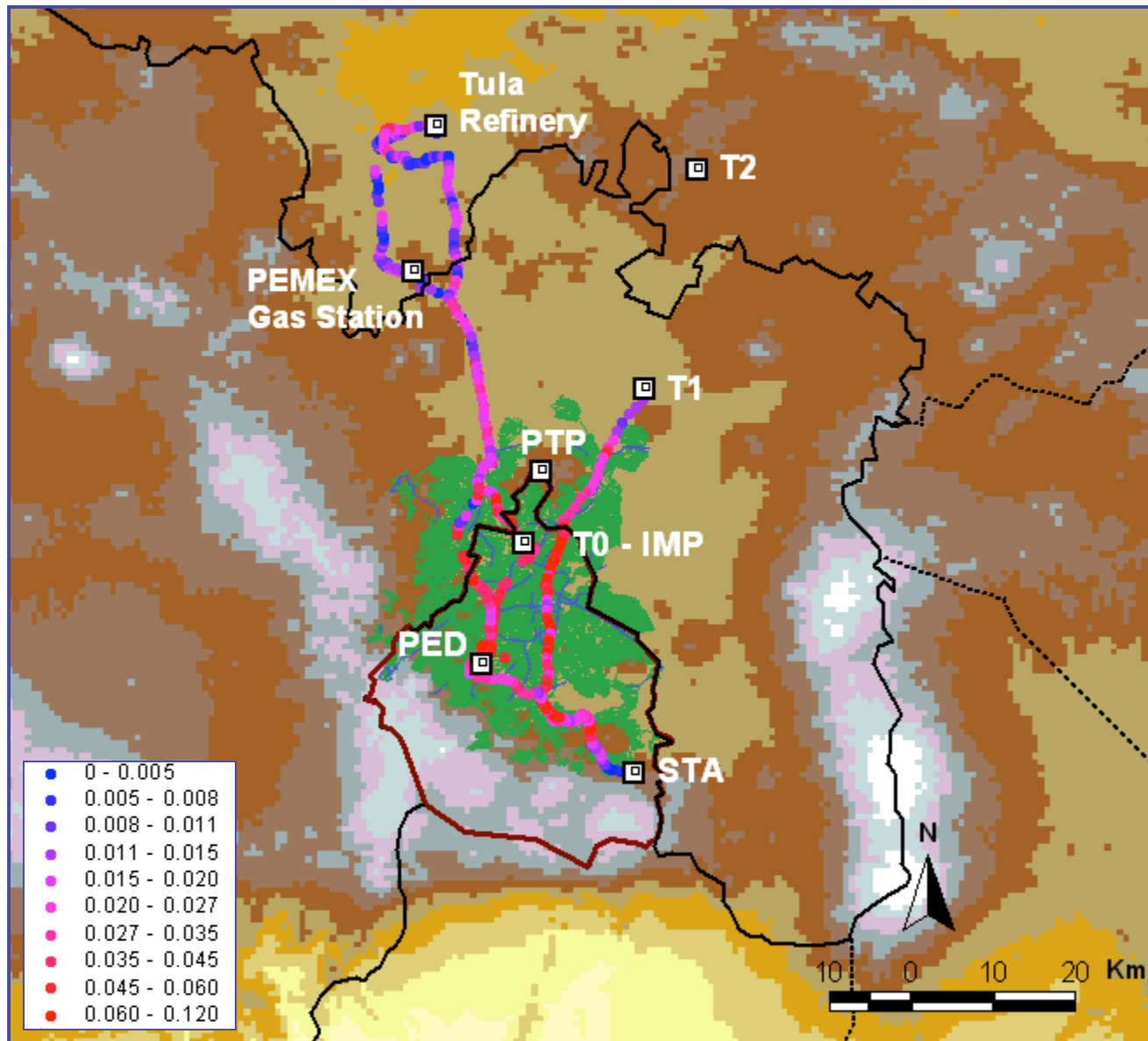
MCMA basin and regional pollution

- **ON-ROAD SAMPLING**

- On-road vehicle emissions quantification by vehicle and operating condition
- Aggregate (fleet) motor vehicle pollutant emission ratios
- Point and area emission plume source location & dispersion measurement



# Fixed Mobile Laboratory MILAGRO Monitoring Sites (On-road Ratios of H<sub>2</sub>CO/CO<sub>2</sub> [ppb/ppm])



# Stationary Sampling

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- Objectives:
  - (1) understand photochemical processing
  - (2) correlate pollution sources with wind direction and speed
  - (3) co-located sampling for instrument comparison



# Pico Tres Padres

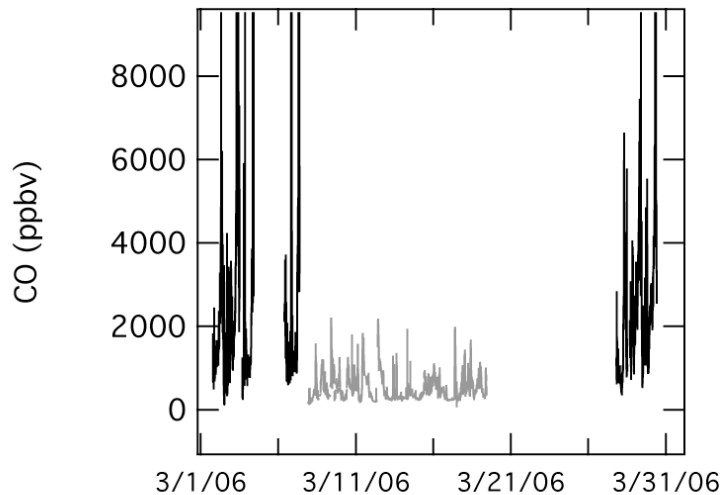
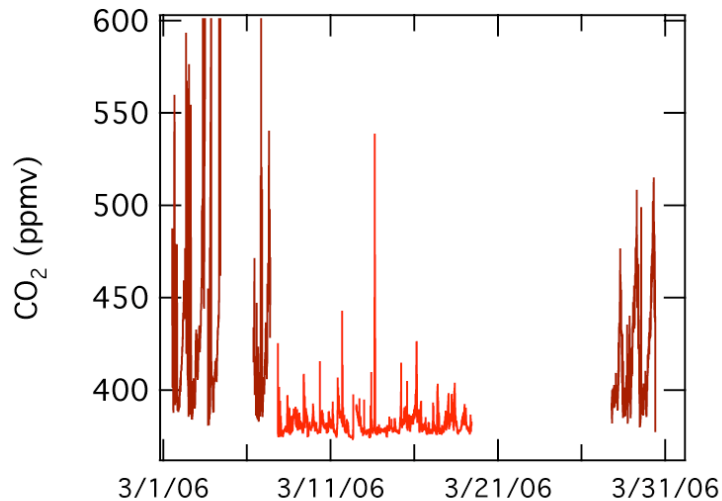


- Photochemical processing of city emissions and secondary aerosol generation
- Source-specific wind-advected plumes and particle nucleation and growth

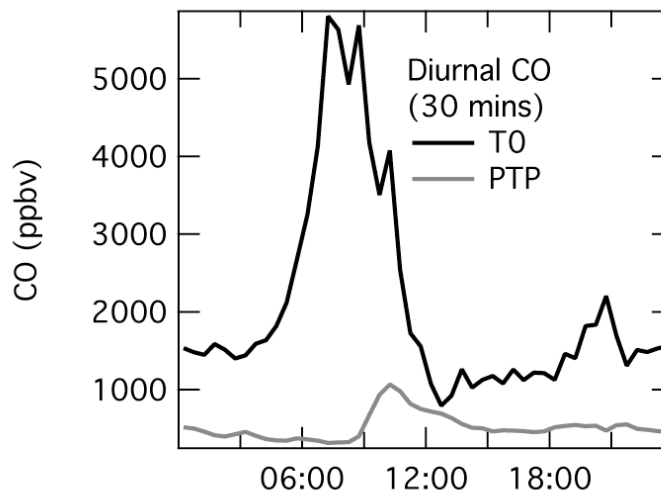
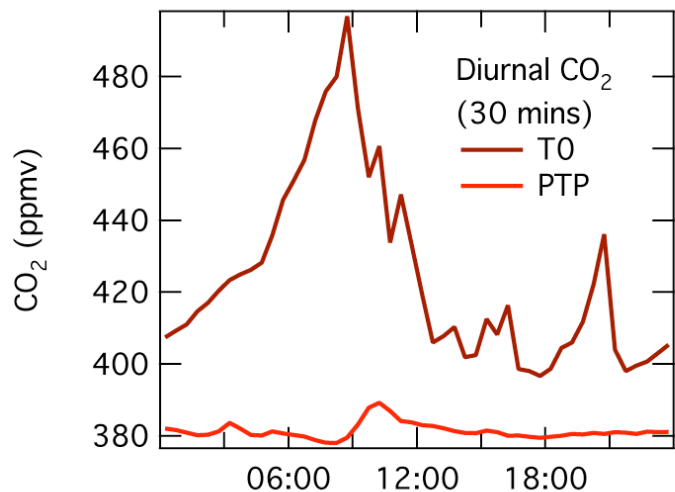
# MCMA Air Pollution







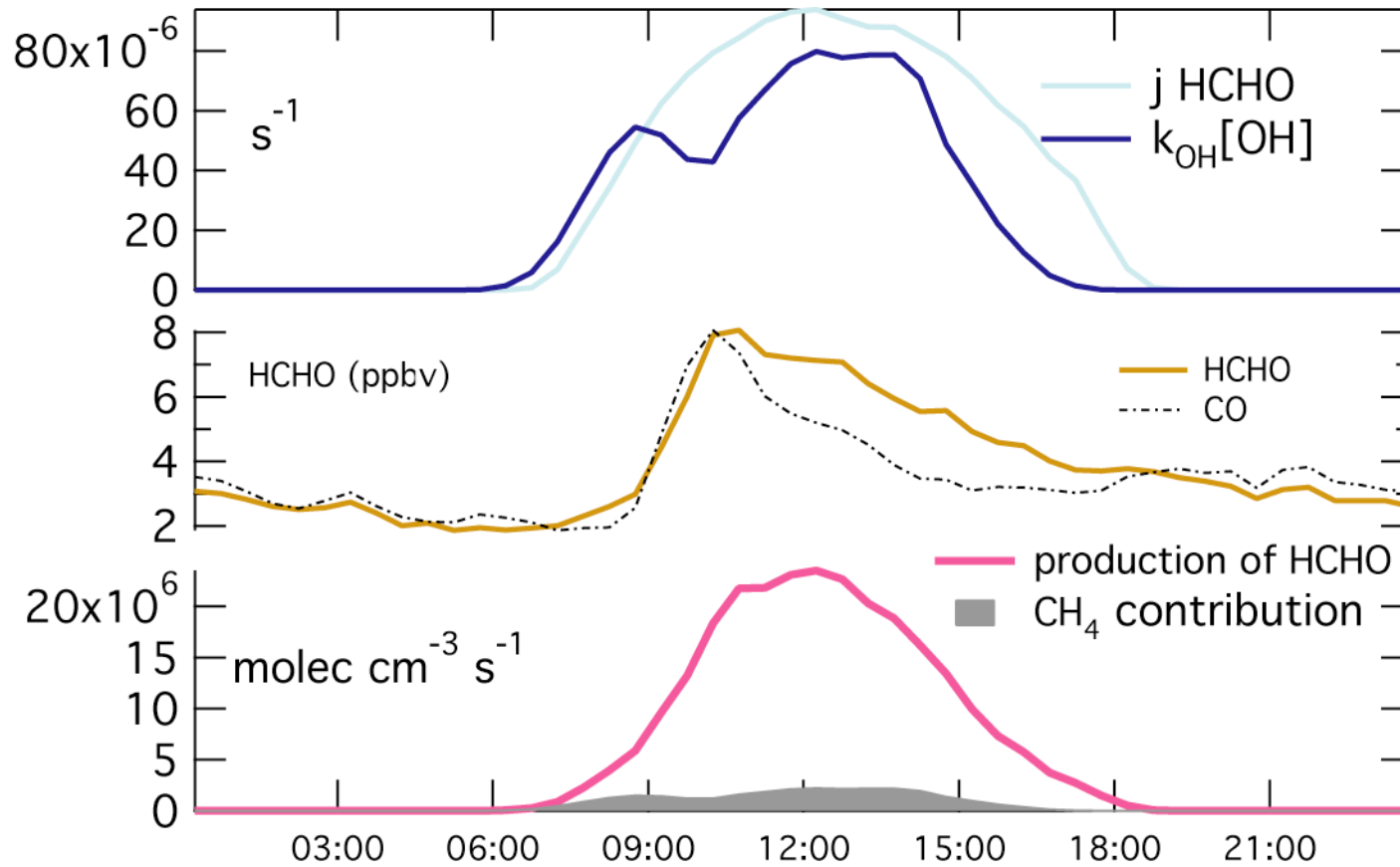
Primary Combustion Traces, CO<sub>2</sub> and CO exhibit very different temporal profiles at the two sites



CO Emission Ratio ~ 0.048 - 0.065 or 15-20 CO<sub>2</sub> per CO  
 2003 Result ~ 0.052-0.085 on-road and at CENICA

Is the penetration of new automobiles into the MCMA fleet 2003->2006 making a difference in fleet average CO ER?

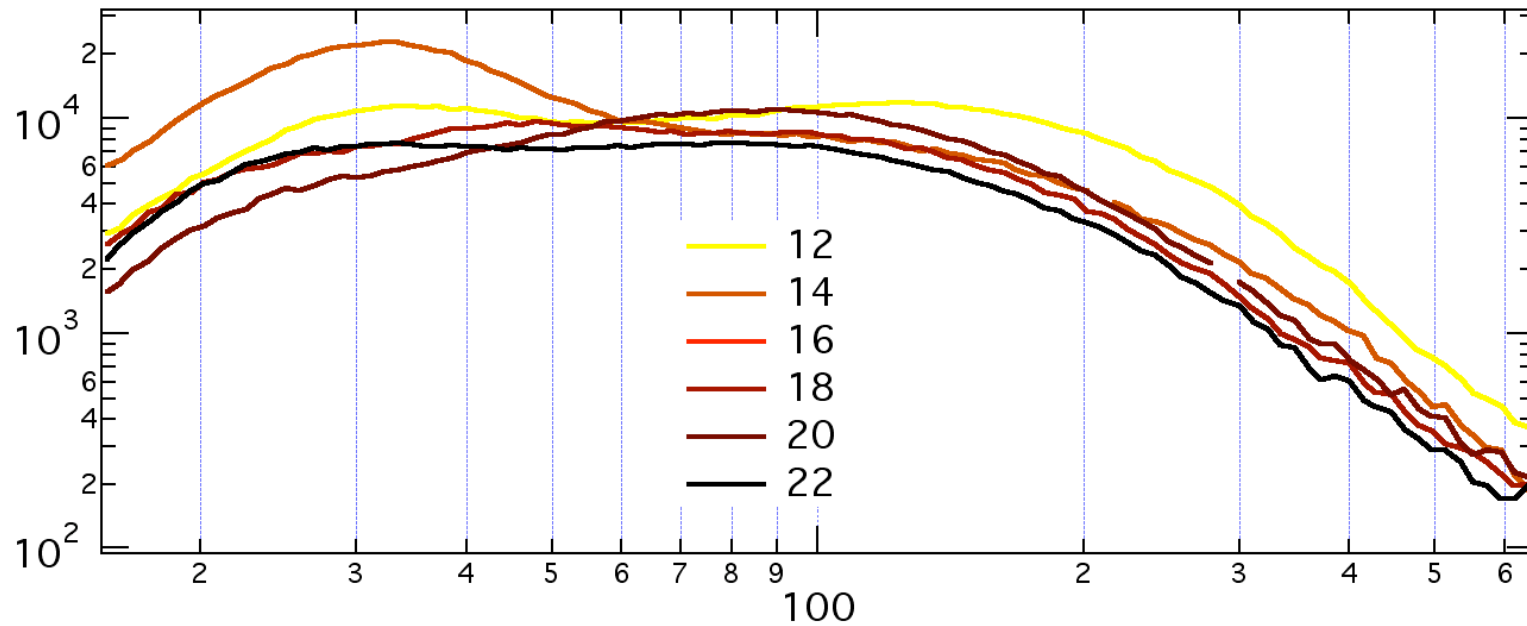
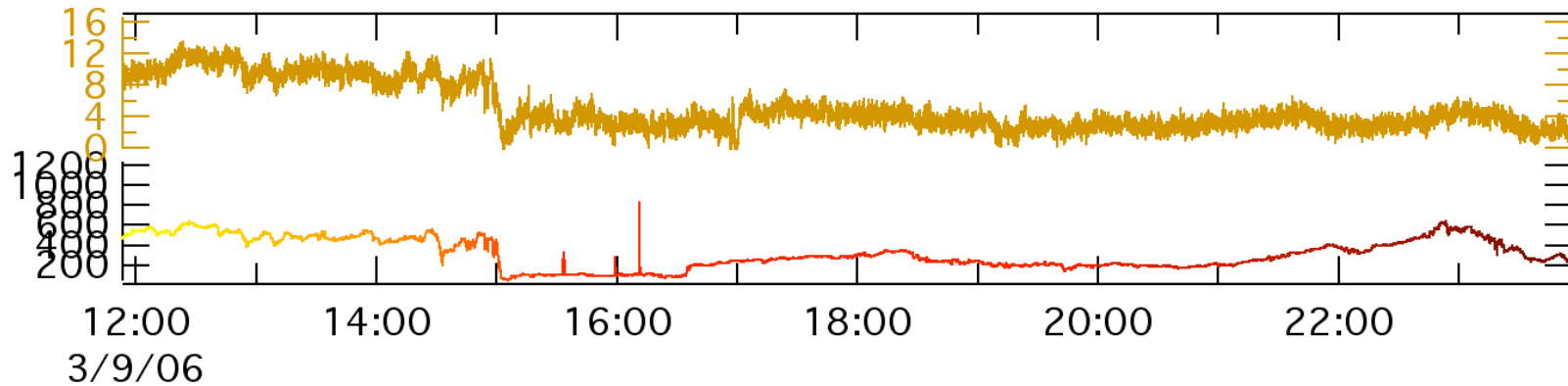
Fraction of cars with emissions control			
2000	2002	2004	2006
61%	65%	74%	?

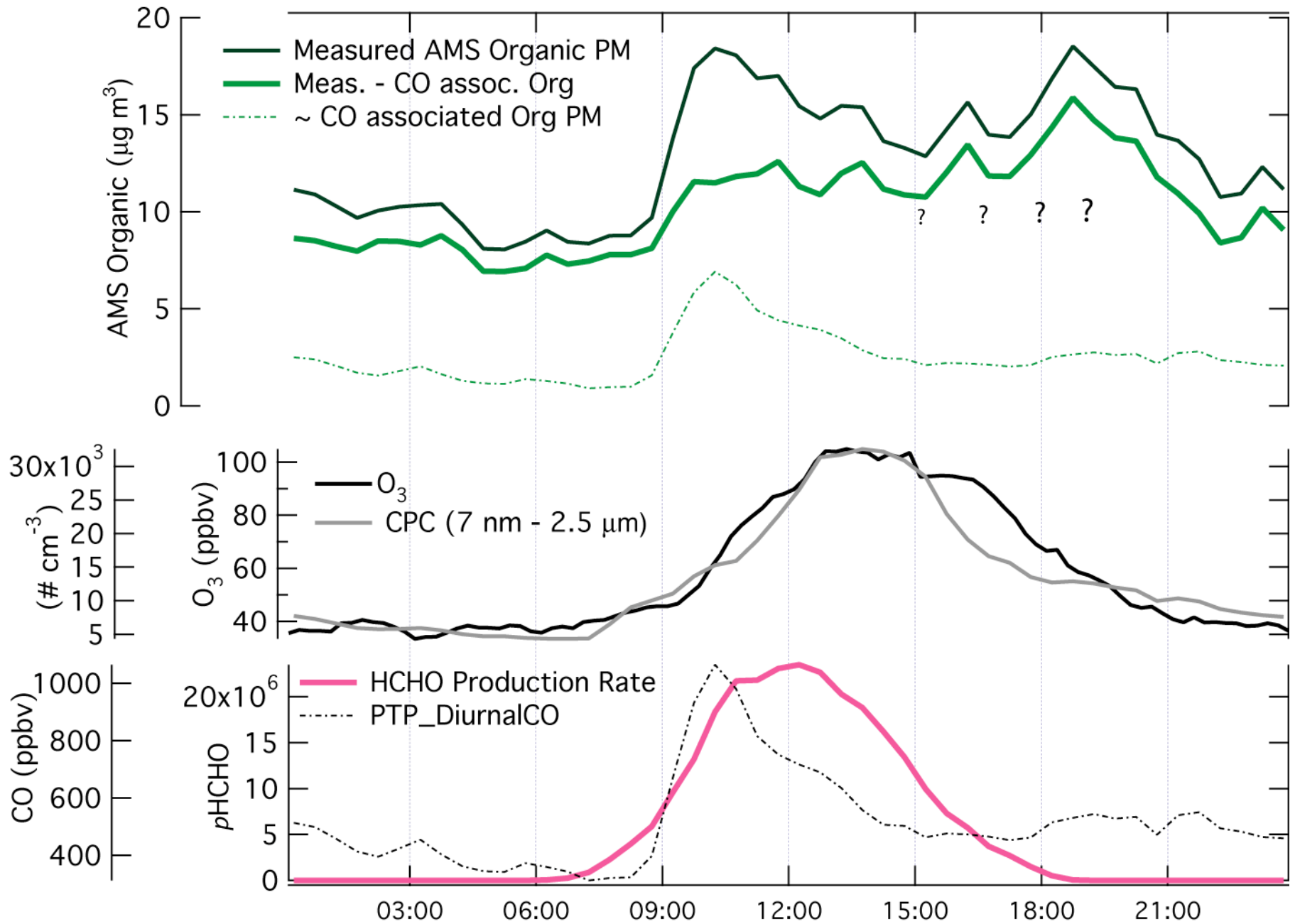


Using the Ehhalt parameterization for OH and the 'shade-scaled' clear sky  $j$  HCHO the production of HCHO is estimated assuming the measured value is in photochemical steady state

$$p(HCHO) = [HCHO]_{ss} * \{ k_{OH}[OH] + j(HCHO) \}$$

# Size dependence of the particle production (2/2)





HCHO production peaks at noon;

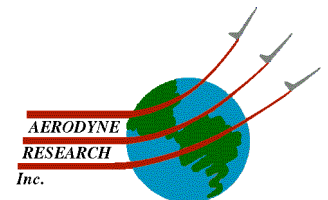
O<sub>3</sub> concentration peaks mid afternoon, along with the CPC number count

If a fraction of the measured AMS Organic mass is attributed to direct emissions & prompt SOA

# Summary

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- Successfully deployed the Aerodyne Mobile Laboratory as part of MILAGRO/MAX-MEX/MCMA-2006
- Characterized on-road vehicle “fleet” emissions during multiple trips through Mexico City
- Obtained high quality data sets on the photochemical processing of gas and particle emissions at six different locations in MCMA
- Collaborations established with many scientists and institutions during MILAGRO that will continue as the data are further analyzed
- See posters by Zavala et al., Herndon et al., Knighton et al., and Onasch et al.



# Acknowledgements

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## MCMA Logistics and Guidance

Rafael Ramos, Armando Retama – RAMA

Andrian Fernandez, Ana Patricia Martínez,

Eduardo Destúa, Franciso Lopaz – INE

Miguel Zacarias – Televisa

Benjamin de Foy, Luisa Molina – Molina Center/MIT

## Funding

DOE Atmospheric Sciences Program

NSF Atmospheric Chemistry Program

