

***DEVELOPMENTS IN REAL TIME, TRACE  
AIR TOXIC MONITORING: Jet REMPI***

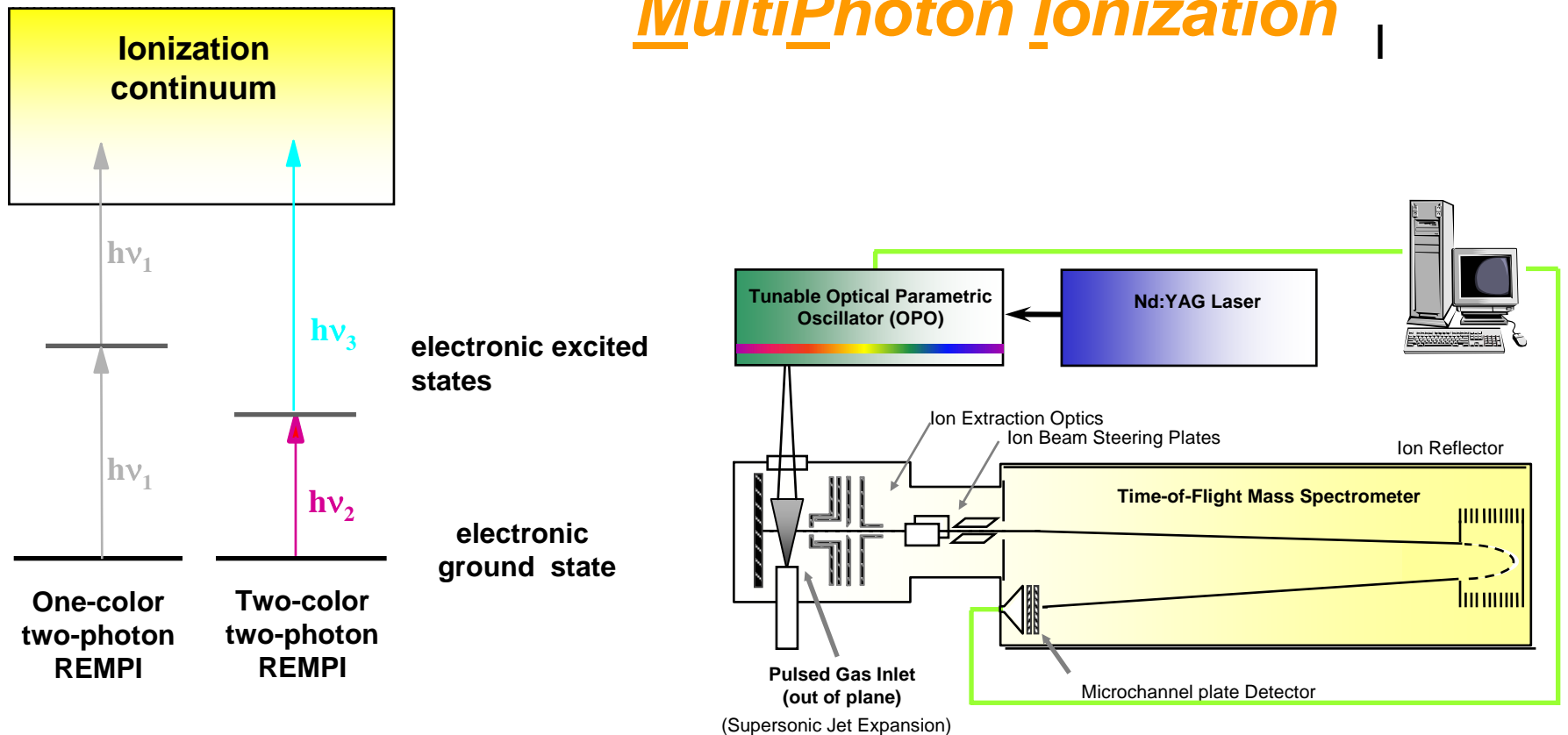
***Air Toxics Monitoring Data Analysis  
Workshop  
September 27-28, 2005***

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U.S. EPA/Office of Research & Development



# Jet Resonance Enhanced MultiPhoton Ionization



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# Jet Resonance Enhanced MultiPhoton Ionization



Jet REMPI system in EPA's RTP laboratories

- Measures a broad array of aromatics, including halogenated organics and PAHs
- Real time to near-real-time
- Sensitive (ppt to ppb)
  - Concentration to ppq
- Selective (can distinguish isotopomers)
- Source or ambient monitor

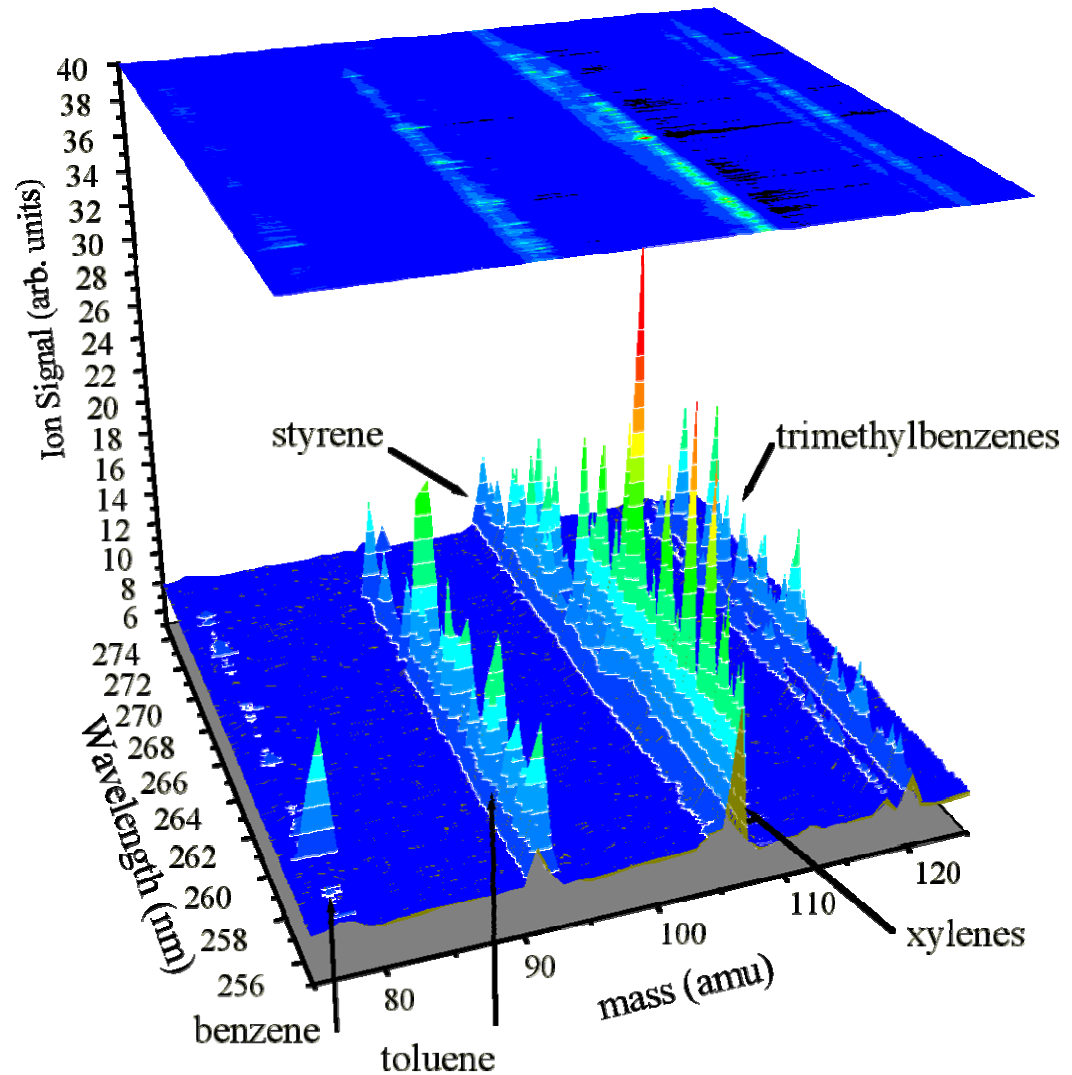


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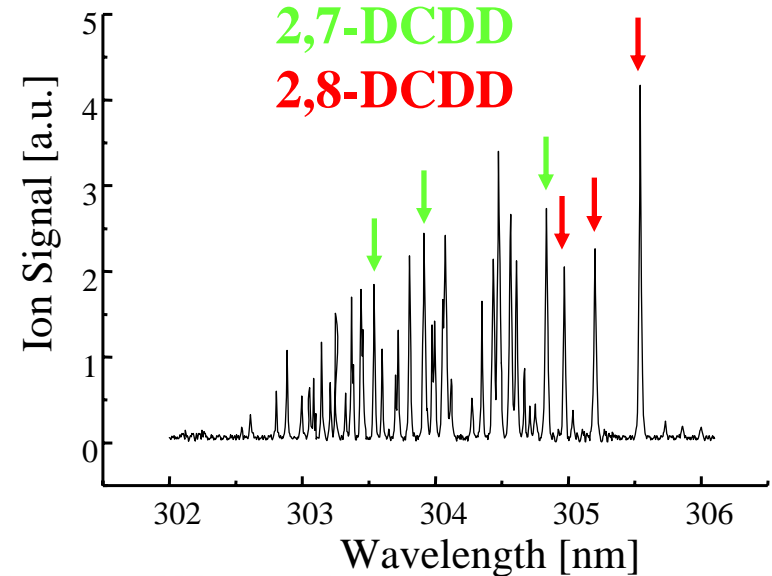
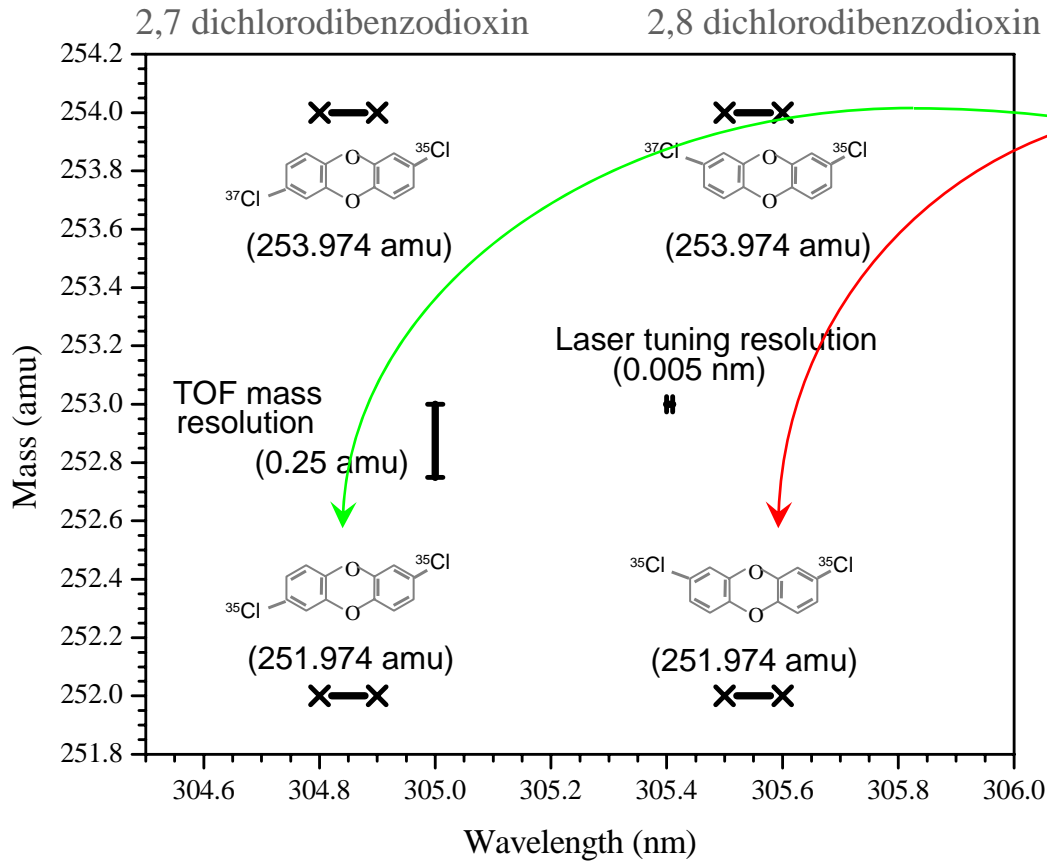
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## High Selectivity: Mass and Wavelength

Test of an aromatic mix (100 ppb each)

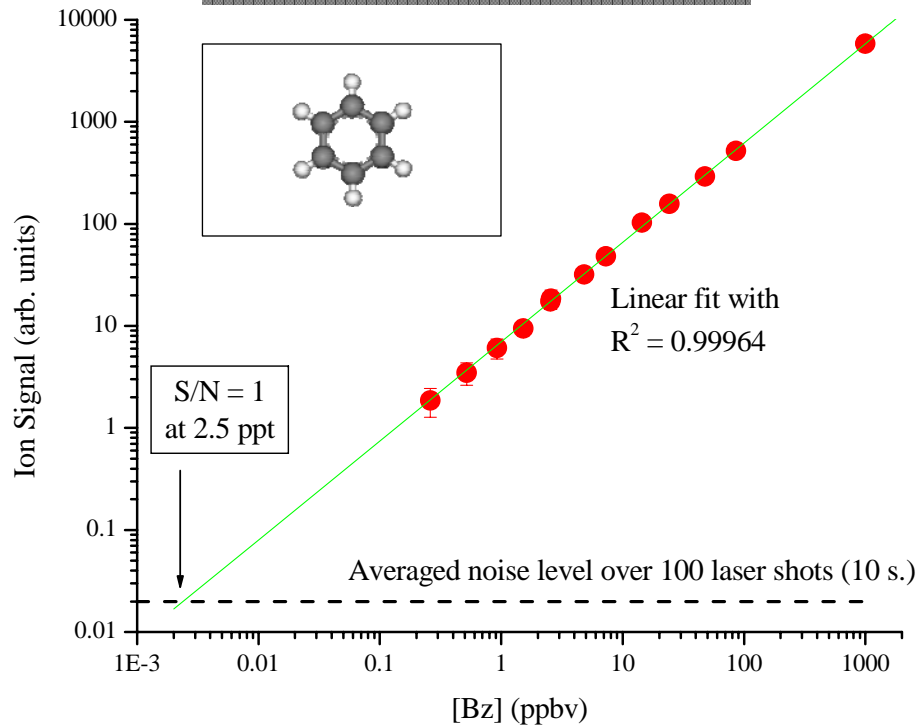


# High Selectivity: Dioxin Isomer-specific

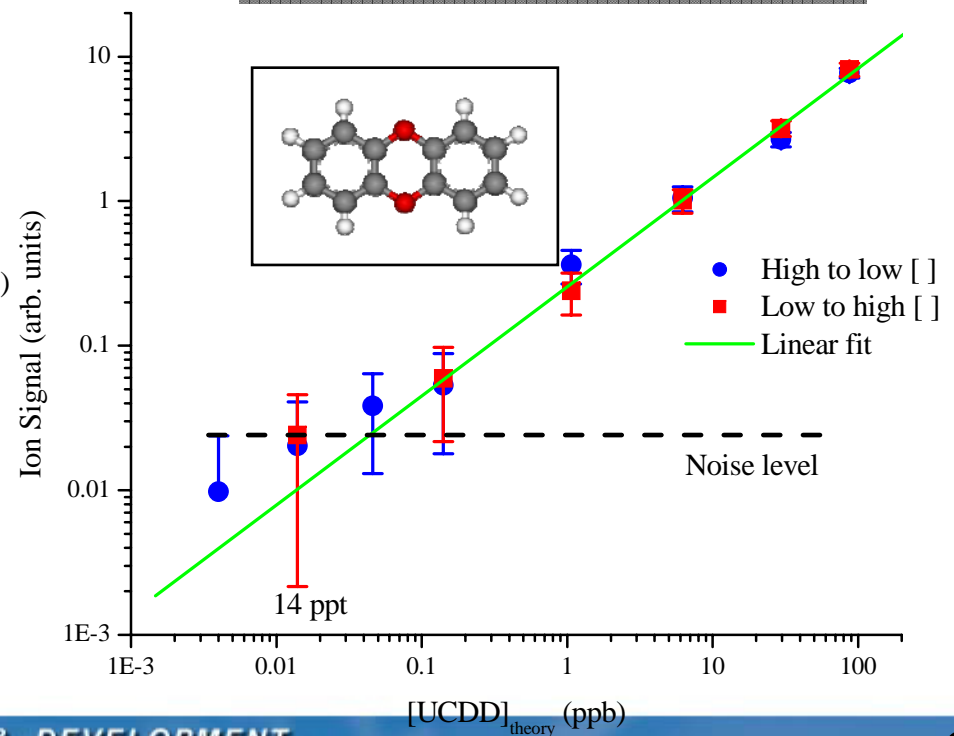


# Very High Sensitivity: Benzene and dibenzo-p-dioxin

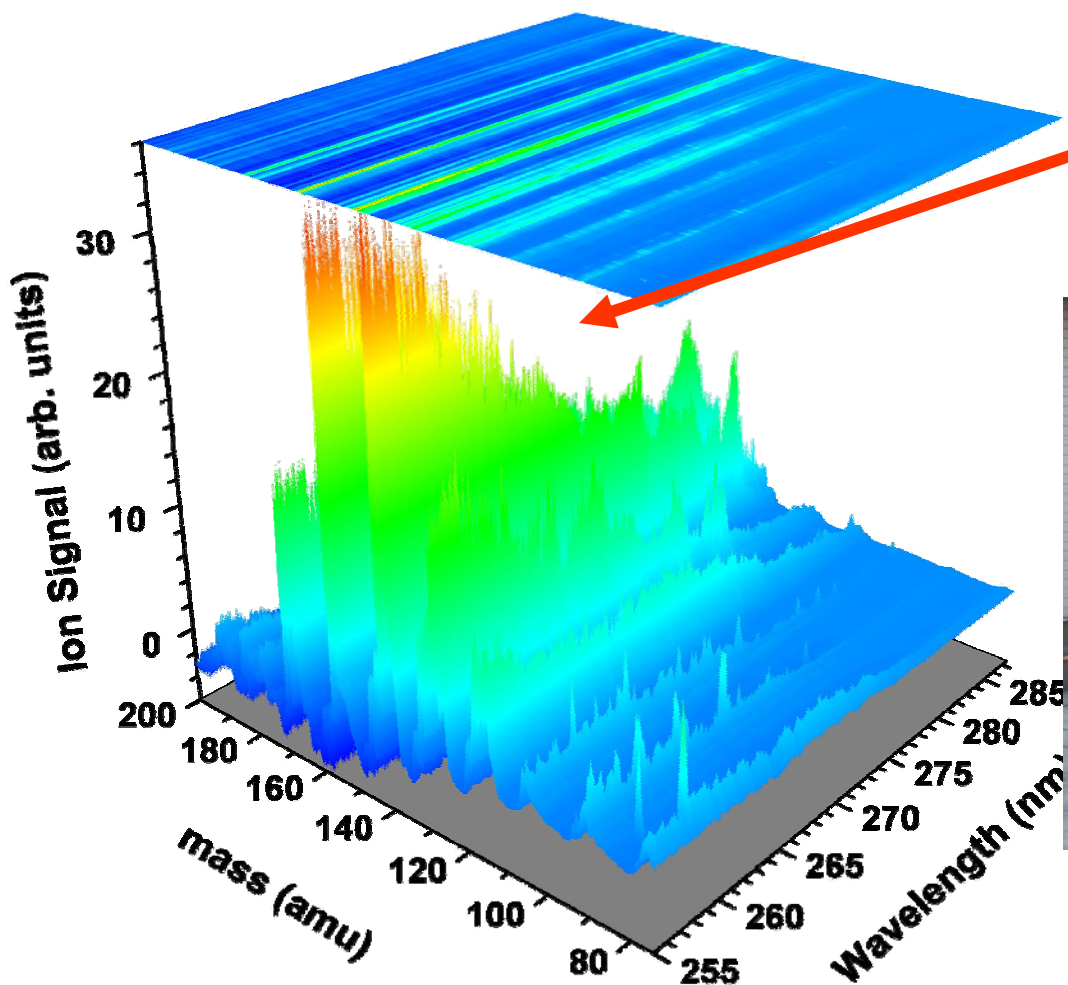
*Derived* detection limit for benzene of 2.5 ppt



*Observed* detection limit for dibenzodioxin of 14 ppt



# Applications of Jet REMPI: Air Toxics from DoD Diesel Generator Exhaust



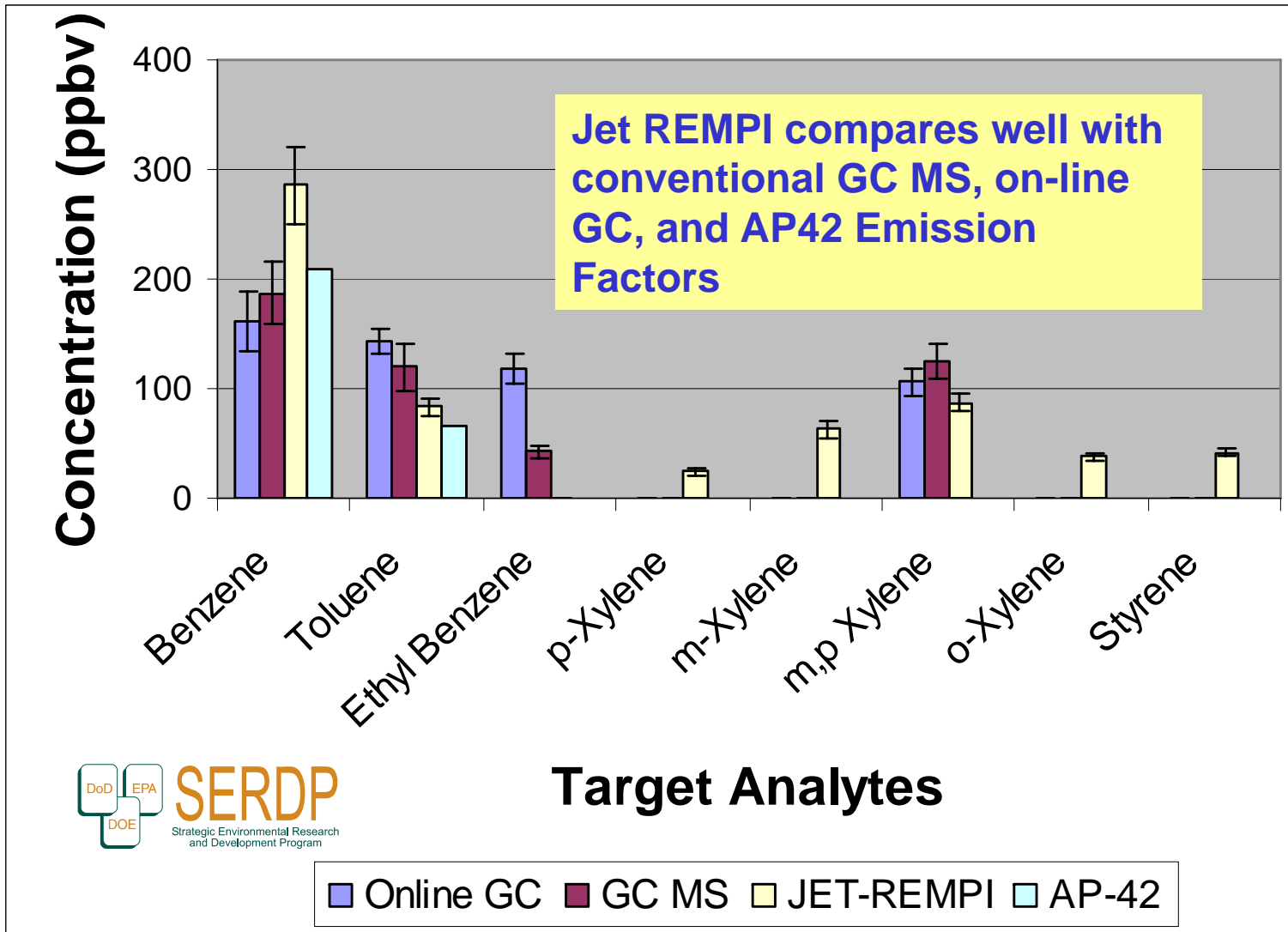
**Methylated PAHs during start-ups**



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# Applications of Jet REMPI: Air Toxics from DoD Diesel Generator Exhaust



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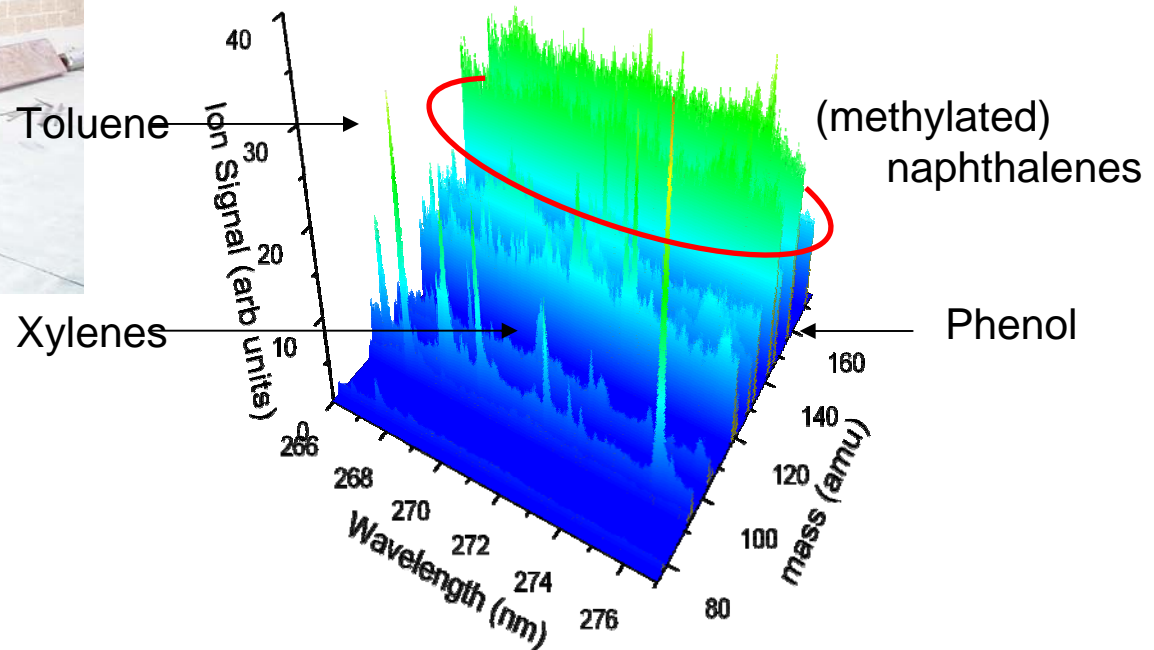
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# Applications of Jet REMPI: Air Toxics from USAF Jet Compressor



Turbine Engine Compressor, USAF type A/M32A-95, JP8. Compressor furnishes pneumatic power for ground support of aircraft systems.



**Turbine engine emits more (aromatic) pollutants at low load than at high load.**



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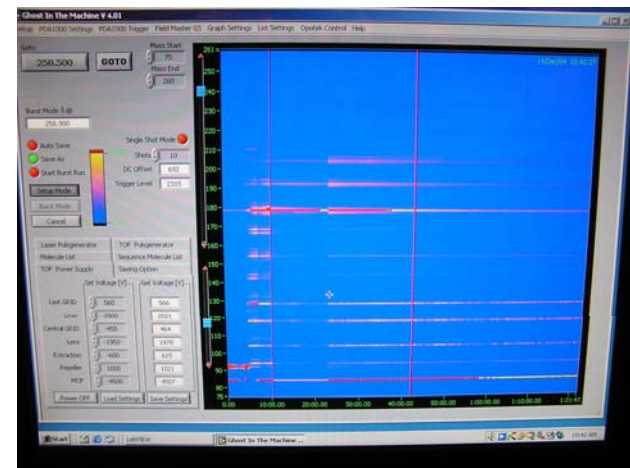
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# Applications of Jet REMPI: Air Toxics from a Waste Combustor.

## Focus on Chlorinated Dioxins/Furans.



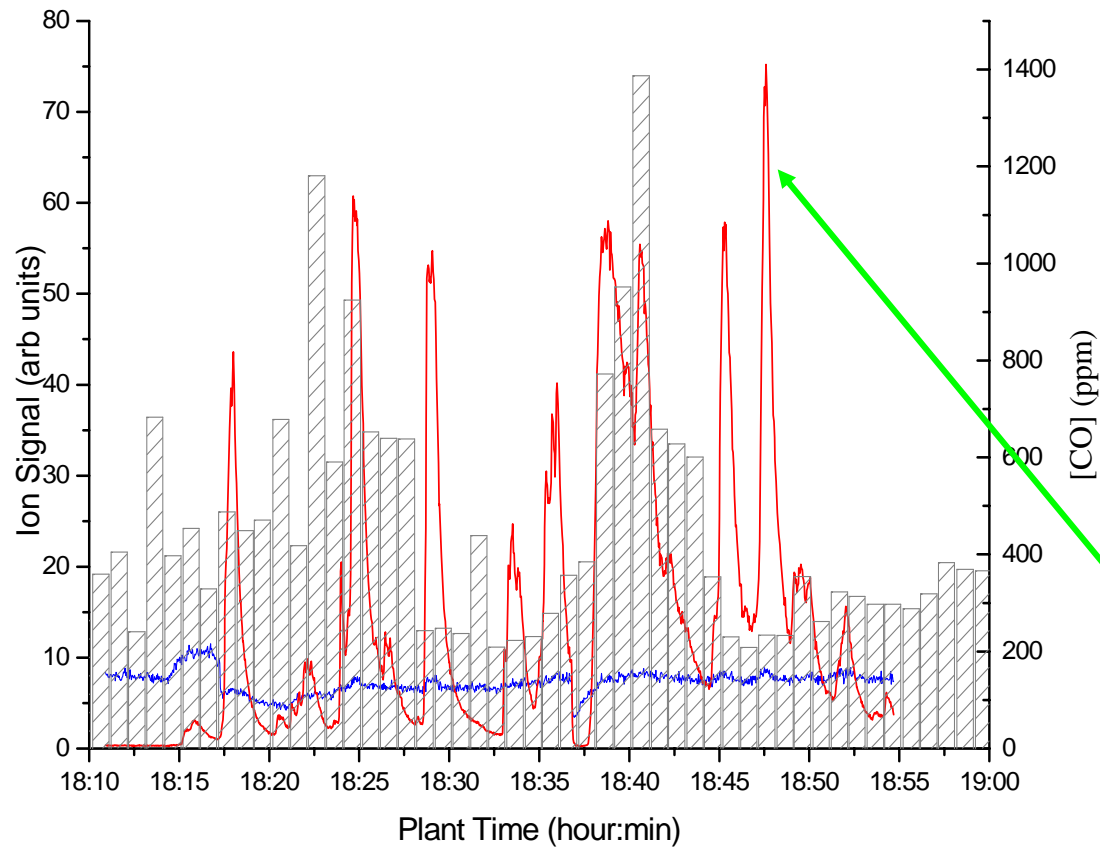
**Dec., 2004  
Testing**  
(results pending  
analysis)



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# Applications of Jet REMPI: Air Toxics from a Waste Combustor. Focus on Chlorinated Dioxins/Furans.



**Method: correlation of indicator or precursor compounds with more trace concentration dioxins**

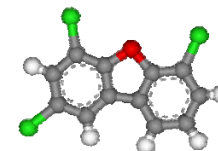


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## TEST: Dioxin Emission Monitoring Systems – 9/12-23/05



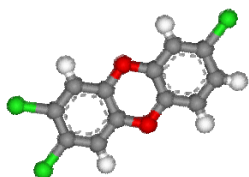
### Verification Test Design:

- Boiler cofiring #2 oil and 1,2 dichlorobenzene
- Four EMSs operated simultaneously.
- Collect reference samples using Method 23.
- Range of sampling periods, 4 to 16 h.
- Range of dioxin concentrations.
- Performance parameters evaluated:
  - Accuracy vs. Method 23
  - Ease of use, reliability, maintenance, etc.



### Dioxin EMS Technologies

- Automated, long term sampling systems with laboratory analysis
  - AMESA (Becker-Messtechnik, GmbH)
  - Dioxin Monitoring System (MonitoringSystems, GmbH)
- Real and near-real-time analysis with laser ionization and mass spectrometric detection
  - RIMMPA-TOFMS (IDX Technologies, Inc.)
  - JET-REMPI (EPA/SRI International)



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# *Jet REMPI Summary*

- Real-time to near-real-time measurement
  - start-ups, load changes, temporal air toxic changes, process monitor/feedback
- Source or ambient monitor
- Highly sensitive
  - ppt to ppb in real time, ppq with concentra.
- Measures broad array of aromatics
- Highly selective
  - isotopomer-specific
- 4 field demonstrations to date
  - Including waste combustor, ETV test of dioxin monitors



# ***DEVELOPMENTS IN REAL TIME, TRACE AIR TOXIC MONITORING:***

## ***Jet REMPI***



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