

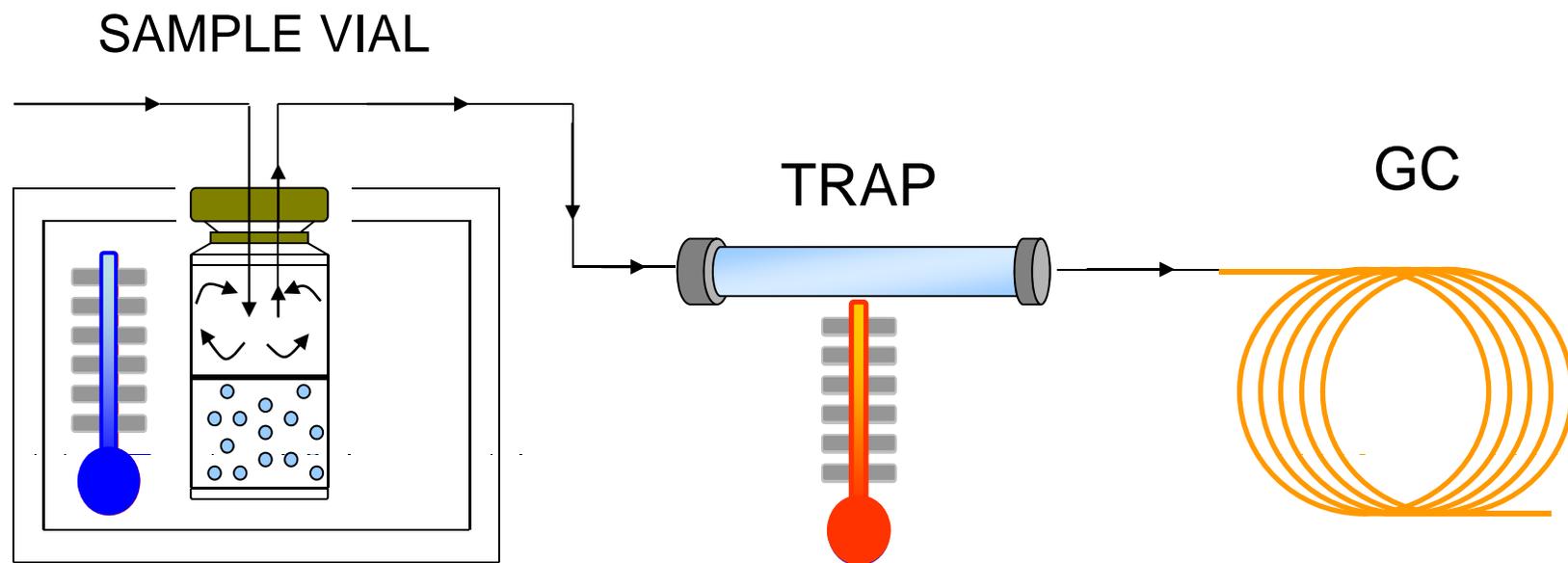


# **Dynamic Headspace Determination of Volatile Organic Compounds in a Tar Sample from the Gulf of Mexico**

**August 2011  
ITT | OI Analytical**

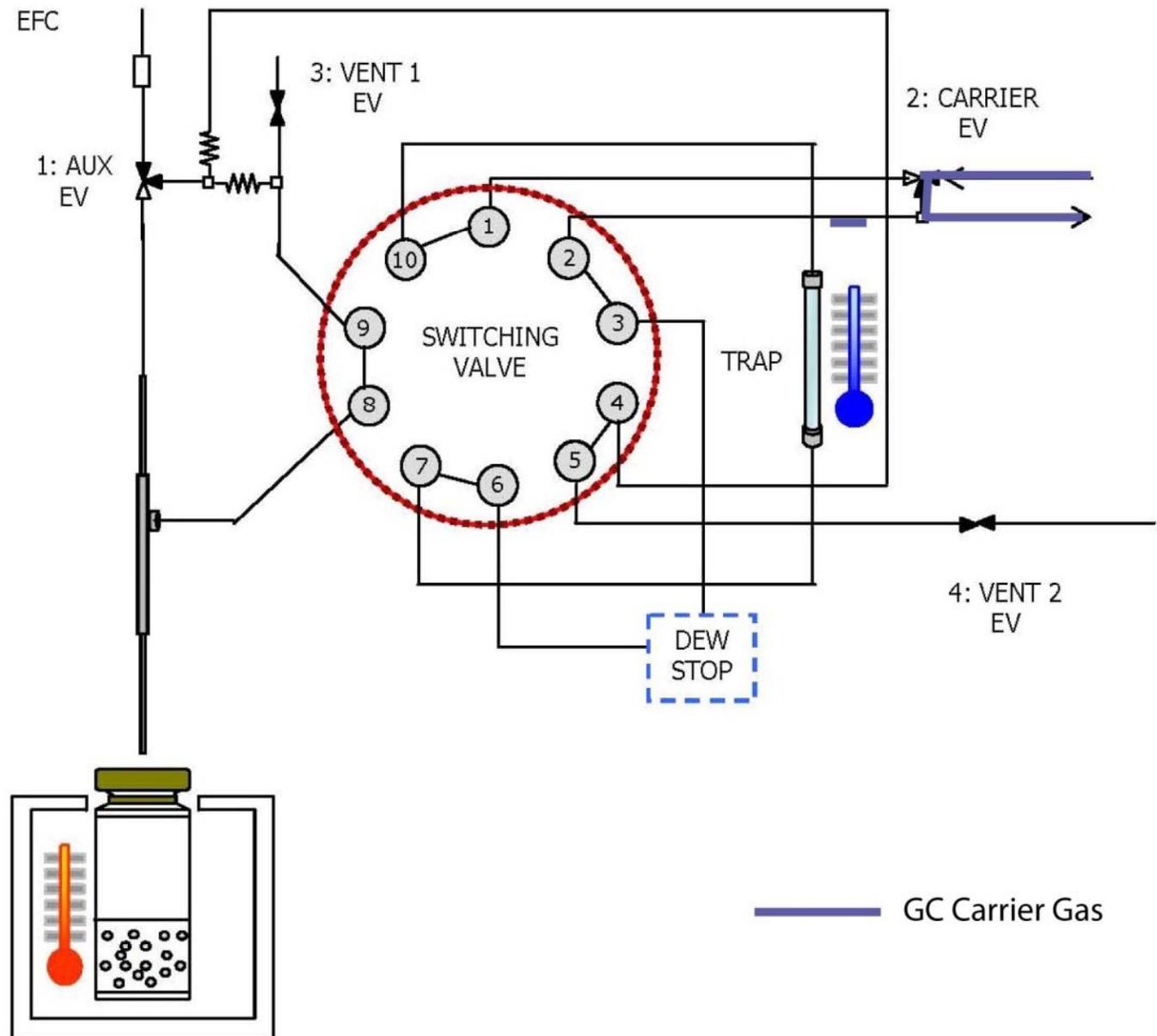
- **Sensitive at low parts per billion**
- **Complex matrices**
- **Little or no carryover**
- **Minimal sample preparation**
- **Rapid**

# Static vs. Dynamic Headspace

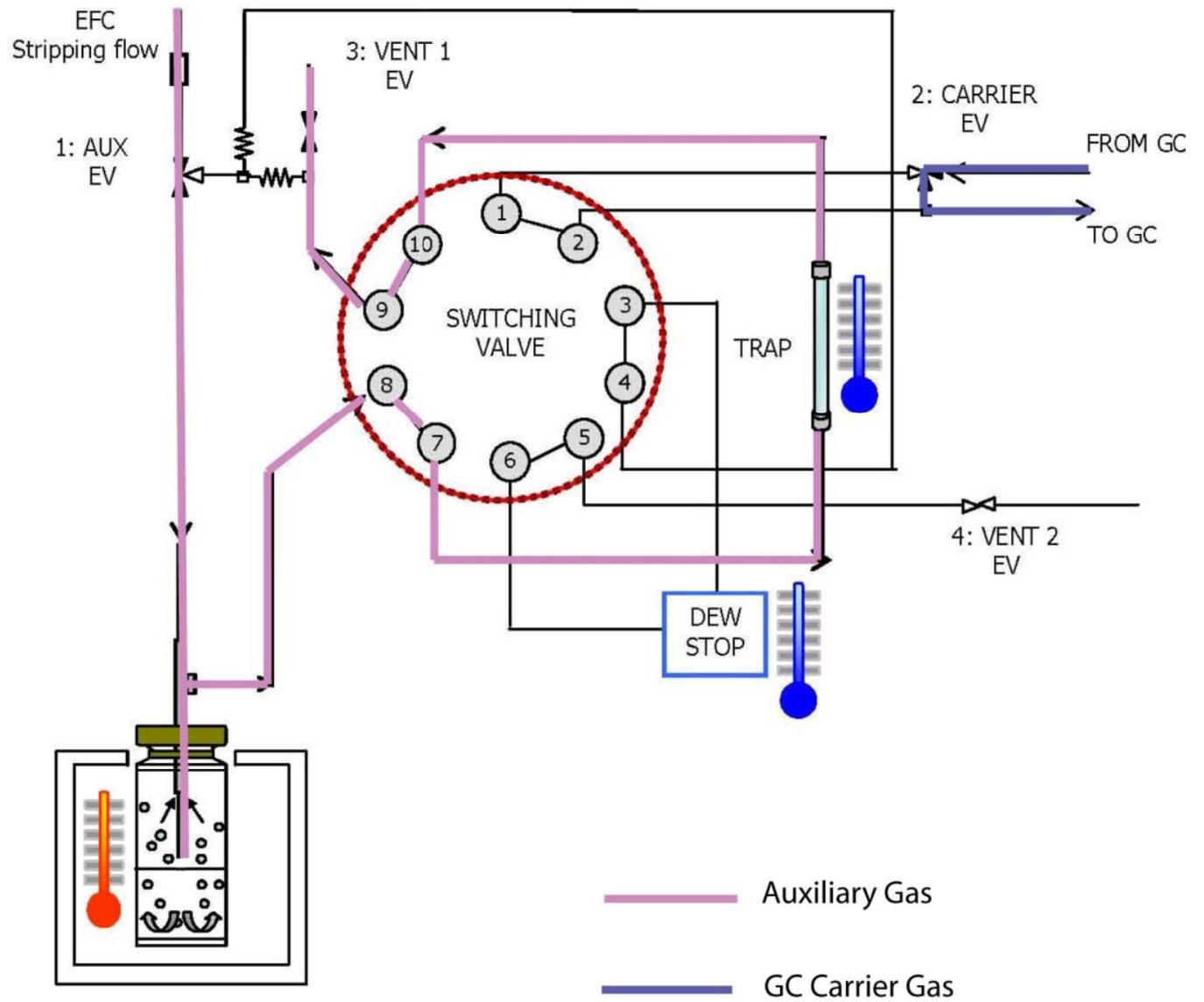


Dynamic Headspace

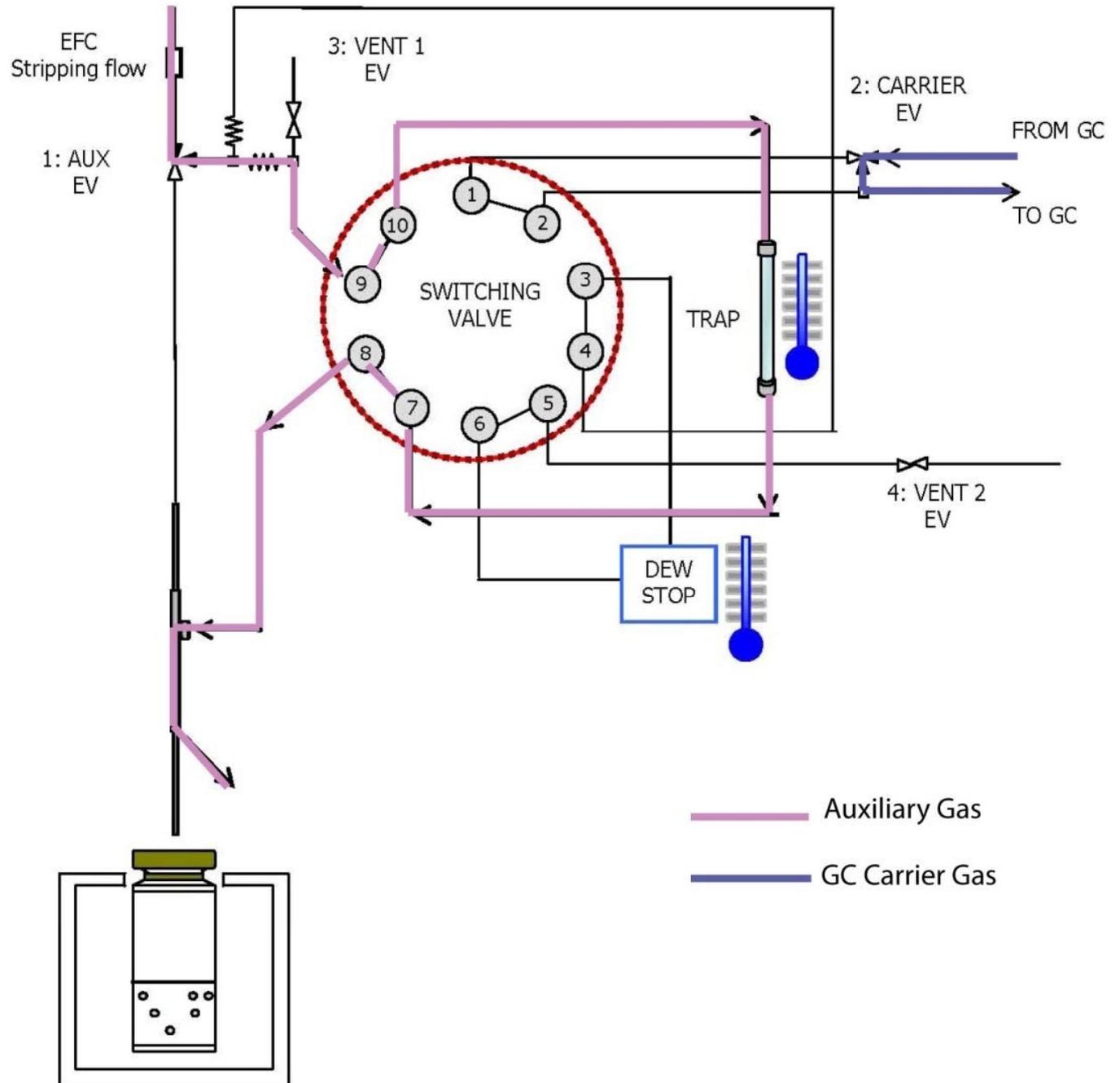
# Equilibration



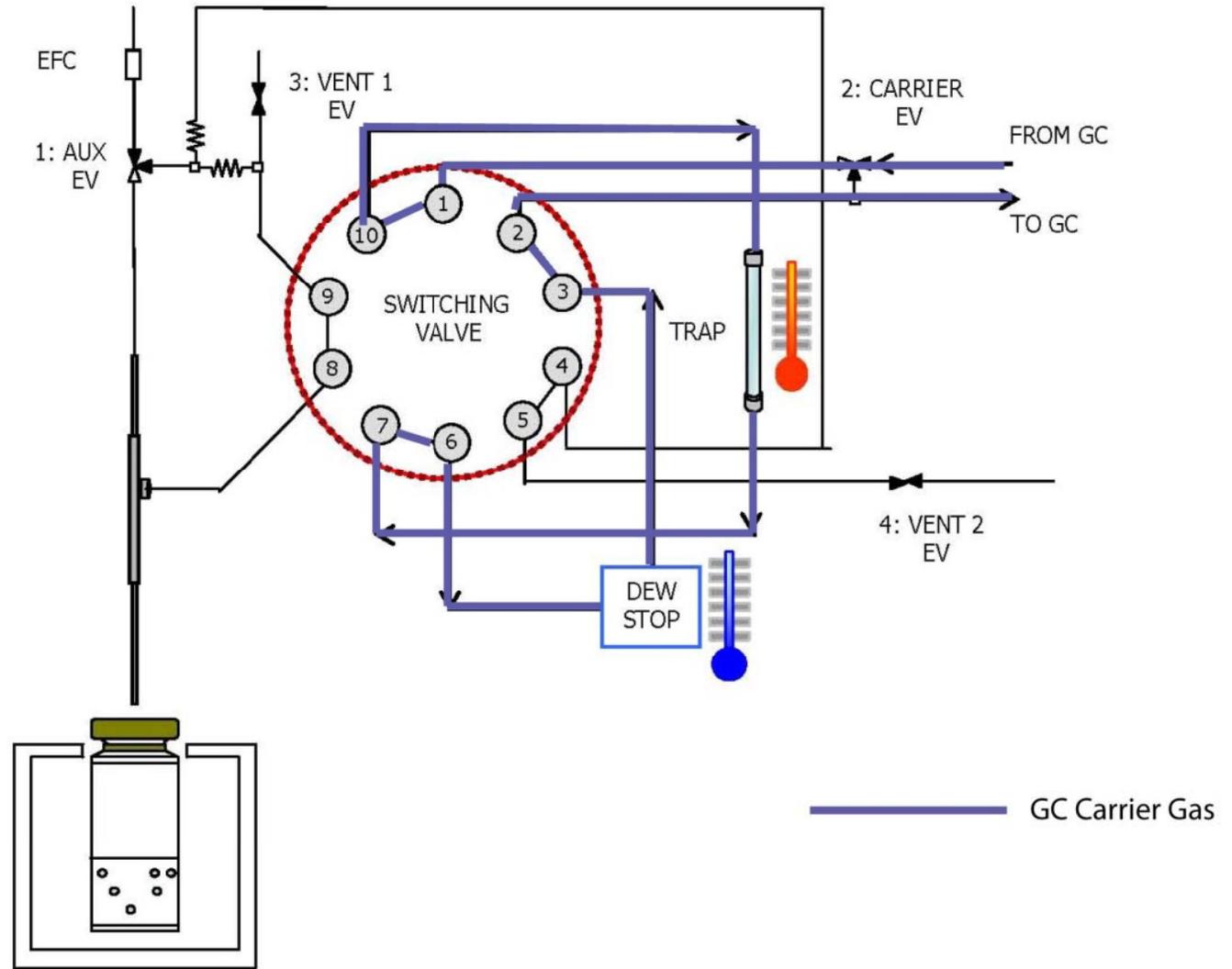
# Stripping



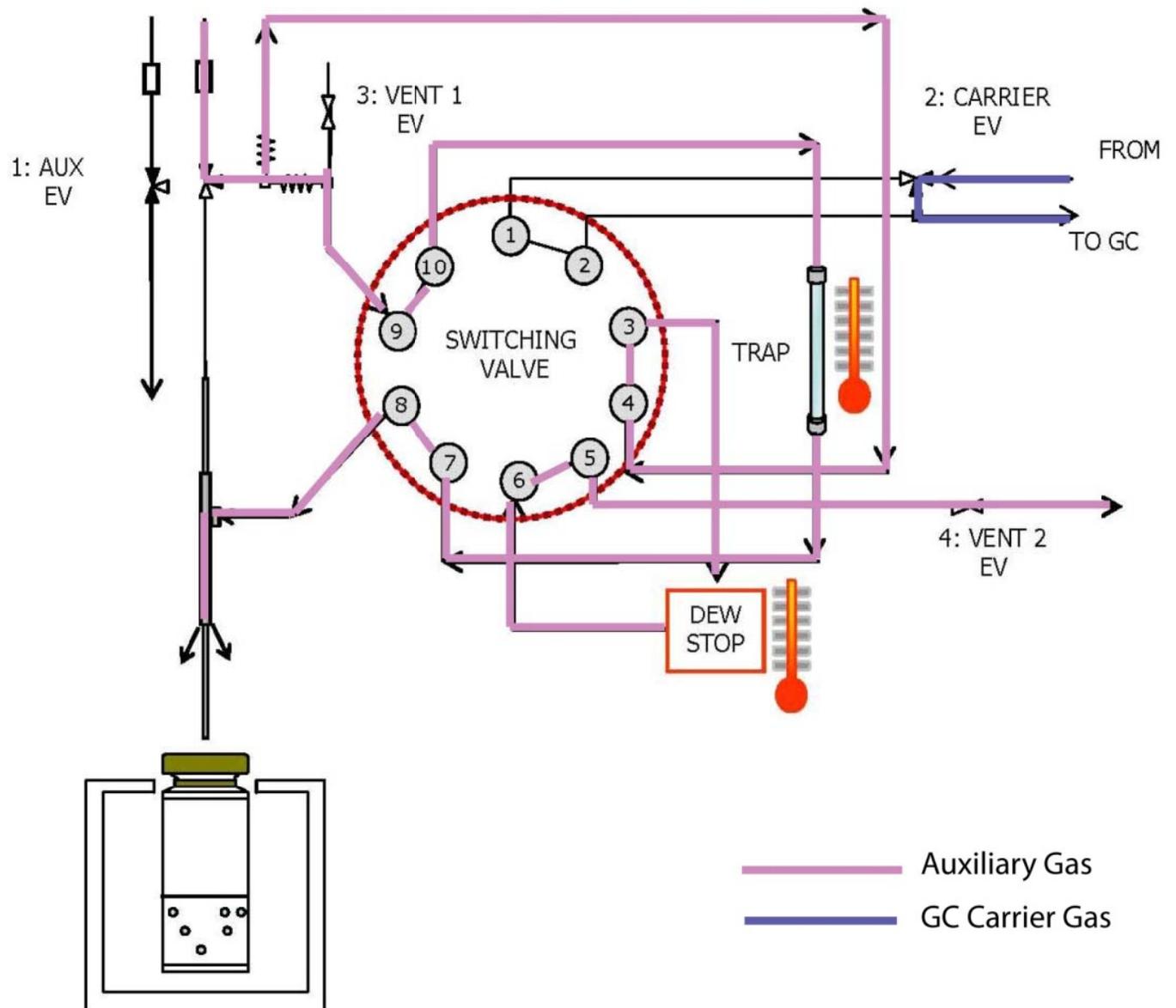
# Drying



# Injection



# Baking



# Sample preparation time

**10 minute equilibration**

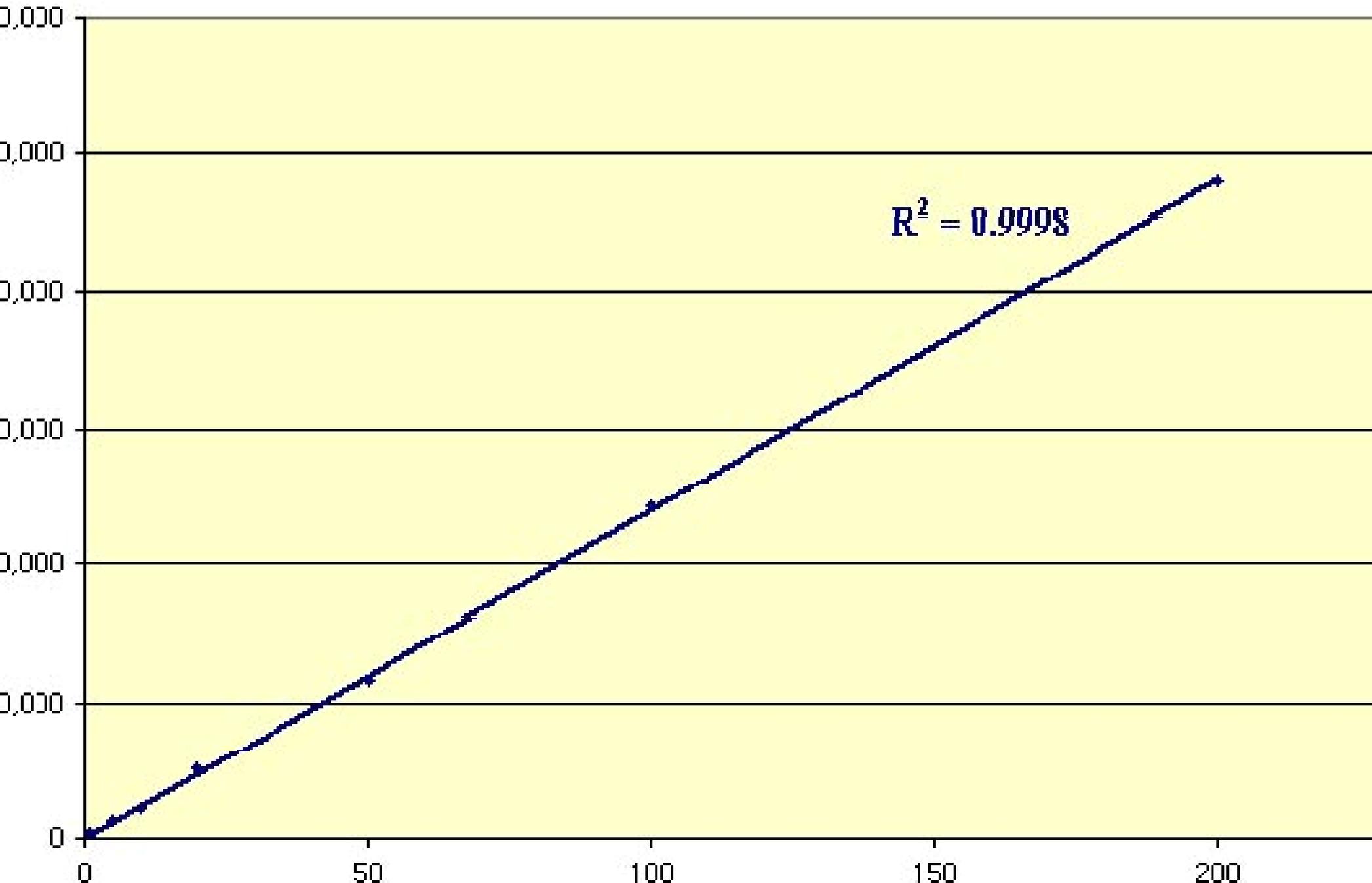
**11 minute stripping**

**1 minute dry**

**1 minute injection**

**23 minutes total**

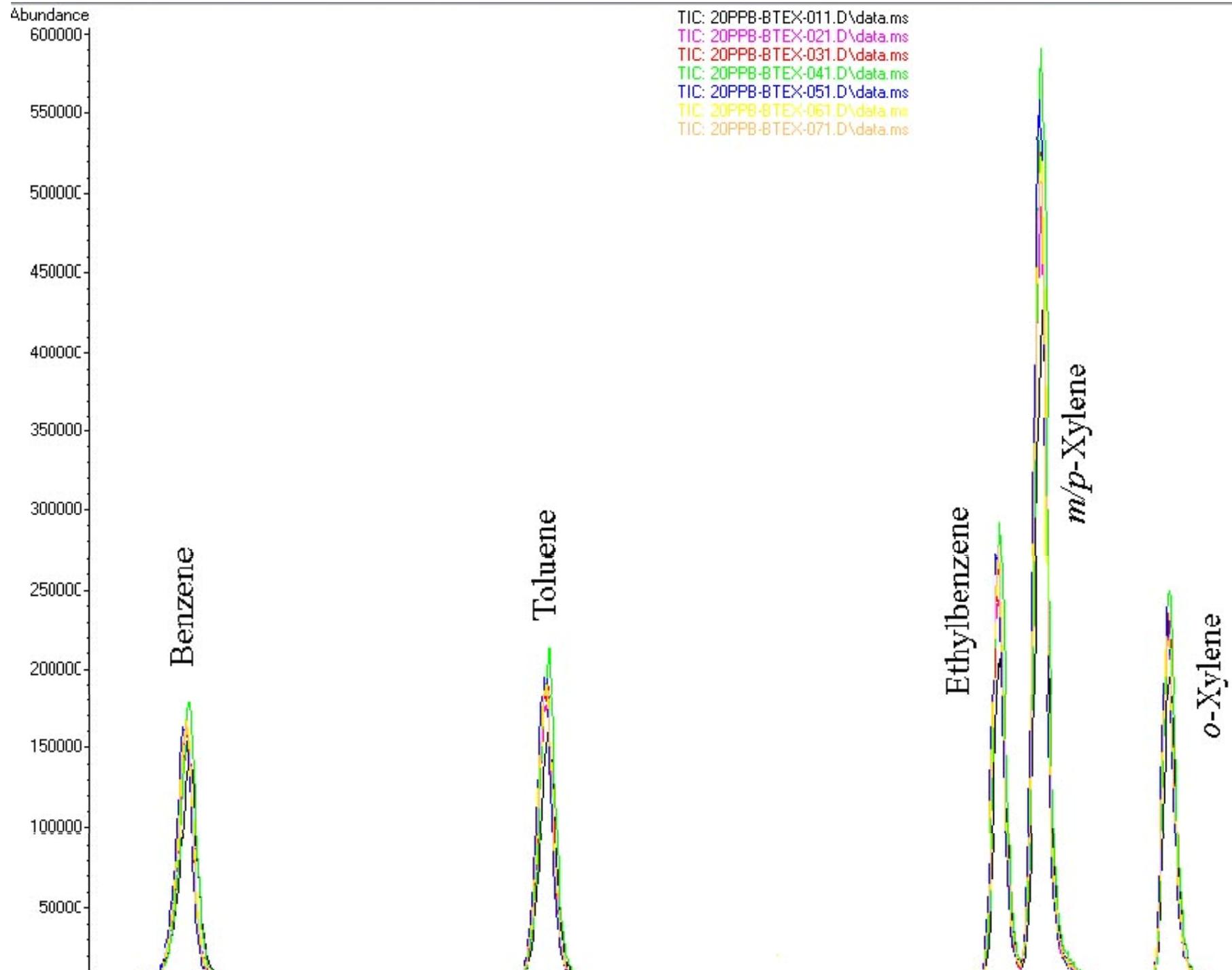
# Calibration



# Calibration Correlation

<b>Compound</b>	<b>1 to 200 ppb</b>
<b>Benzene</b>	<b>0.9998</b>
<b>Toluene</b>	<b>0.9995</b>
<b>Ethylbenzene</b>	<b>0.9985</b>
<b><i>m/p</i>-Xylene</b>	<b>0.9993</b>
<b><i>o</i>-Xylene</b>	<b>0.9994</b>

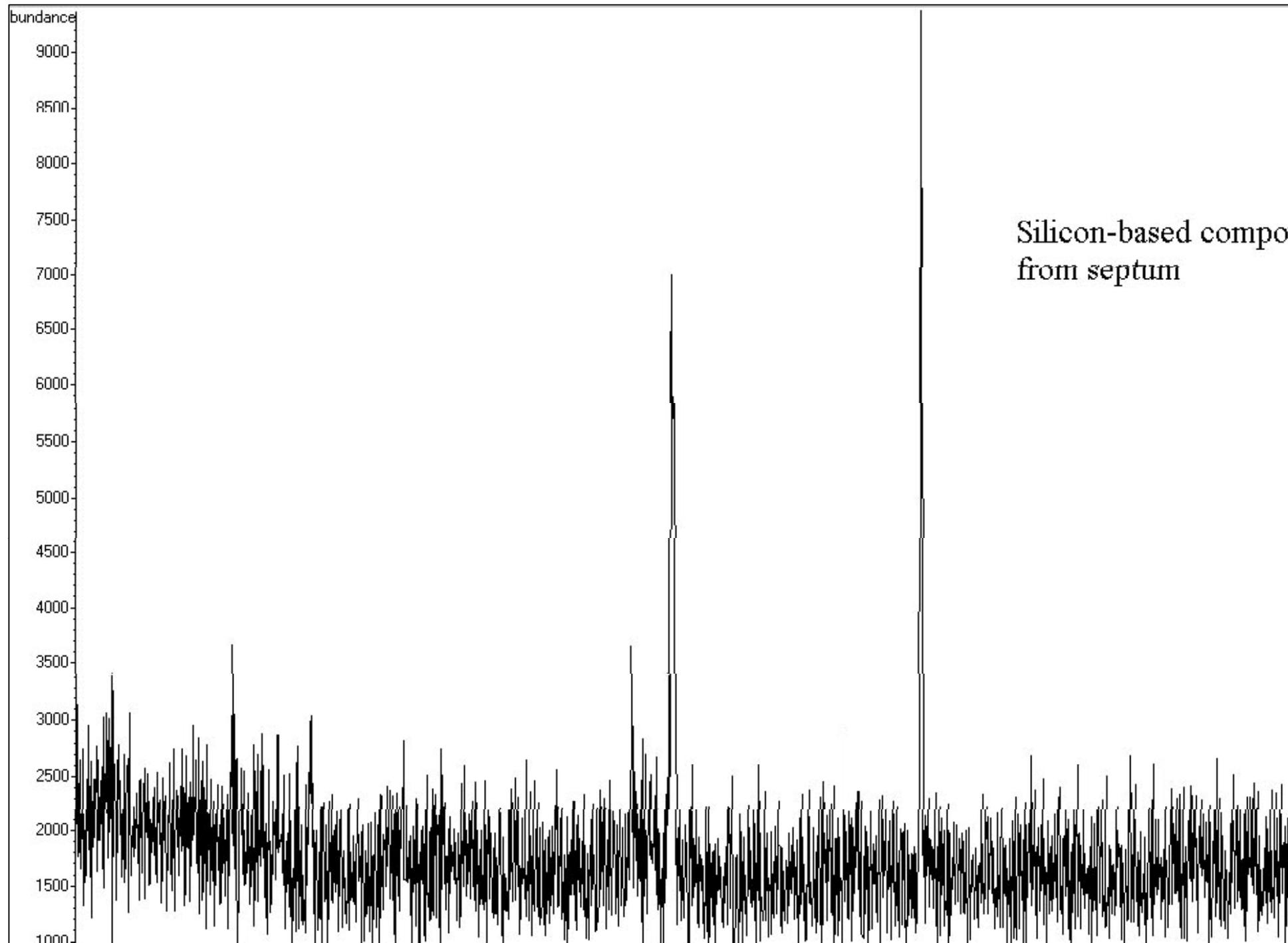
# Overlaid Chromatograms



# Repeatability At 20 ppb

<b>Compound</b>	<b>%RSD n = 7</b>
<b>Benzene</b>	<b>7.7</b>
<b>Toluene</b>	<b>9.1</b>
<b>Ethylbenzene</b>	<b>10.0</b>
<b><i>m/p</i>-Xylene</b>	<b>10.2</b>
<b><i>o</i>-Xylene</b>	<b>7.0</b>

# No carryover

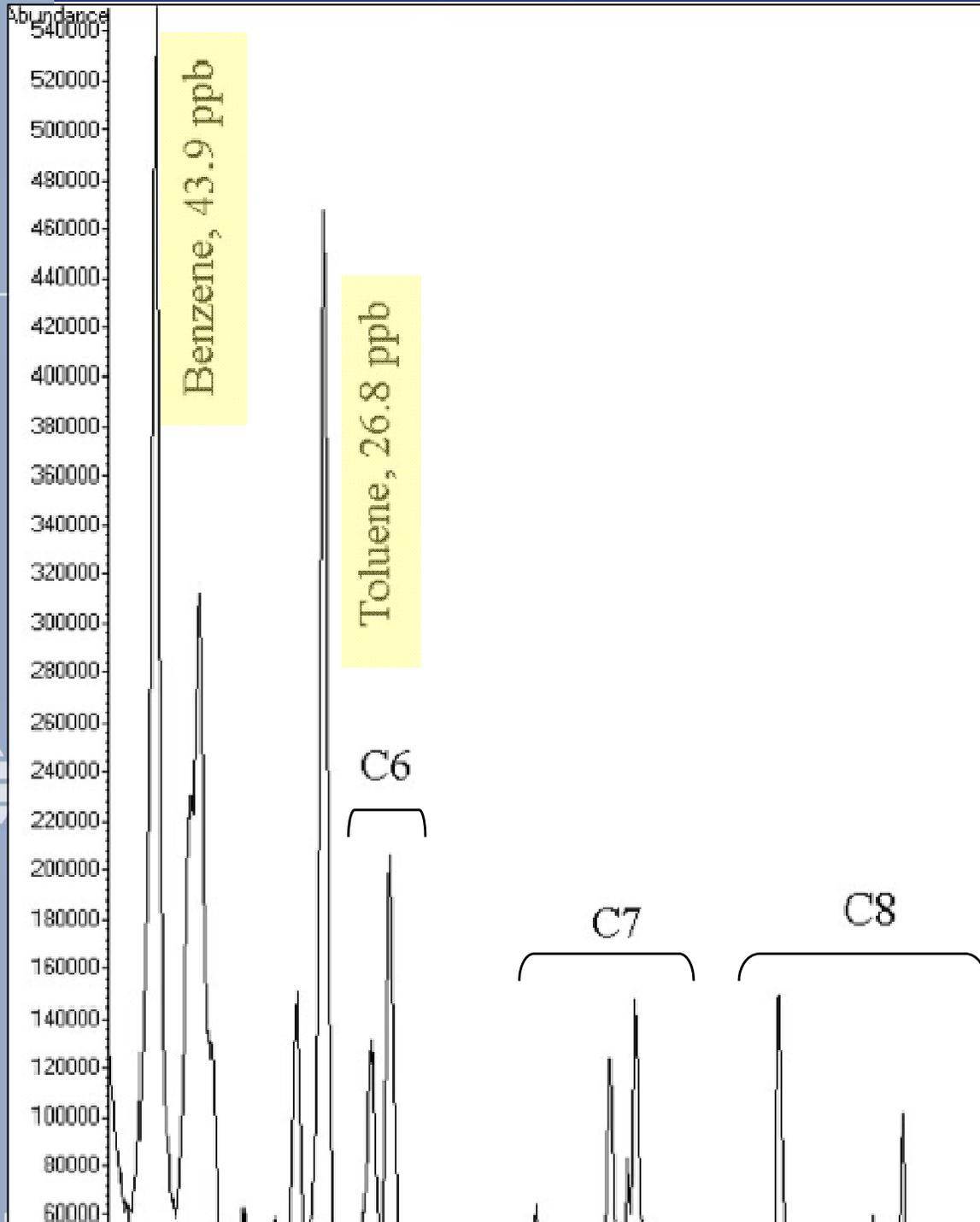


- **Difficult samples**
- **Can't run by P&T**
- **Low Concentrations**

# Only sand



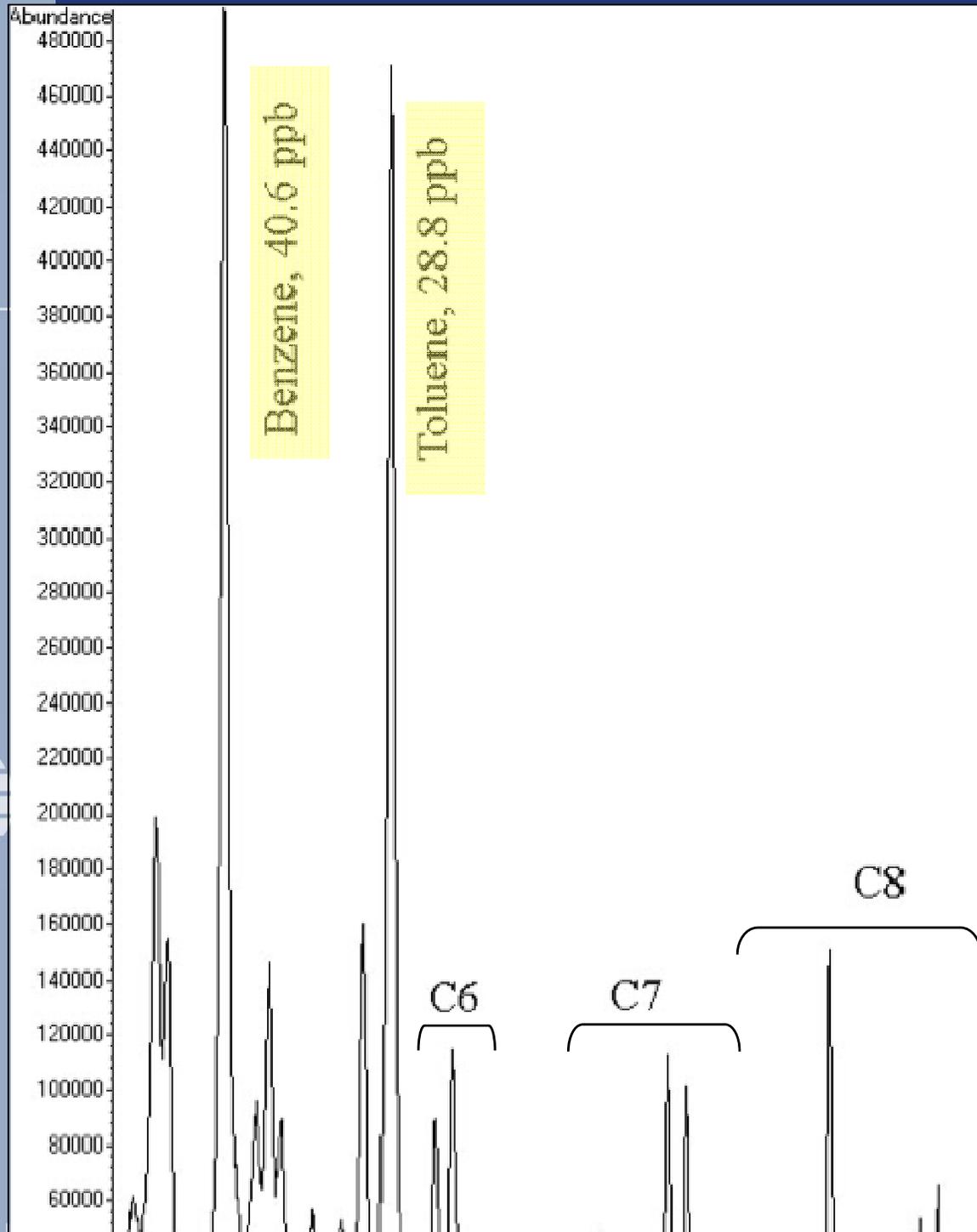
# BTEX in City Sand



# Tar Ball



# DTEX III Tar Ball



# Conclusions

- **Low Concentration VOA**
- **Fully automated**
- **Simple to operate**
- **No carryover**
- **Rapid**

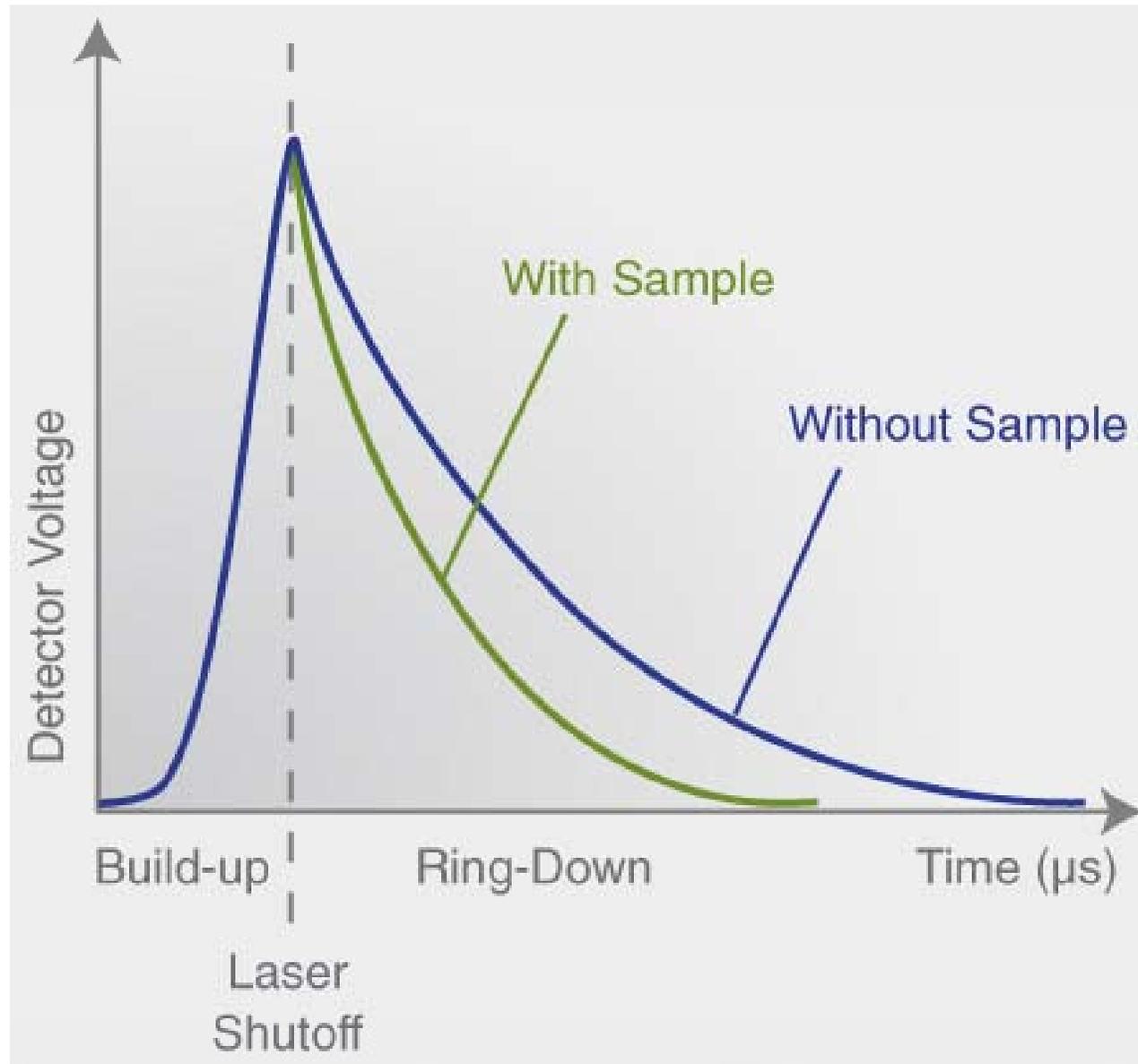
# **$\delta$ TOC-CRDS**

**Isotopic Fingerprinting of  
Tar Ball Carbon Content**

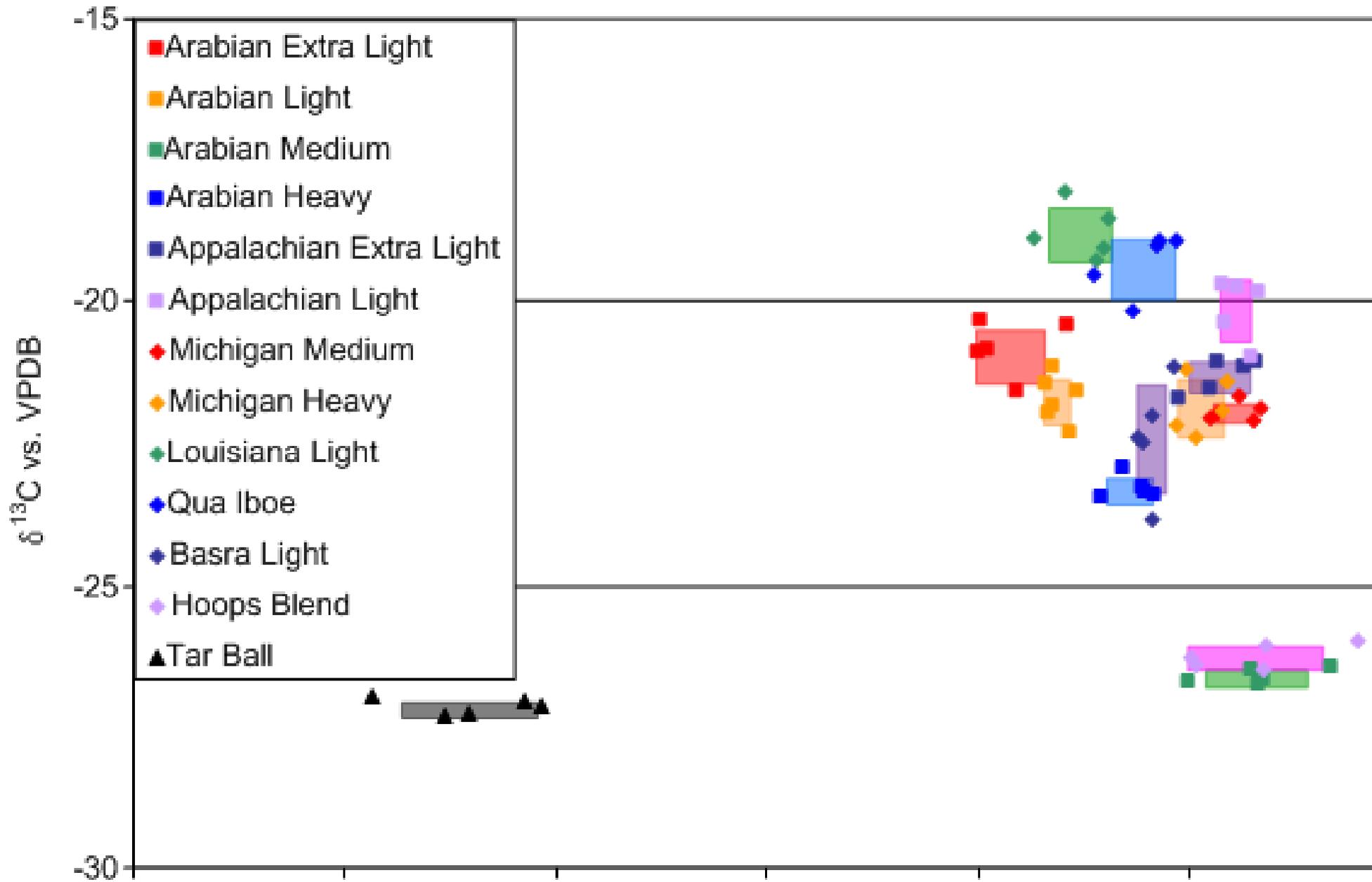
# Isotopic fingerprinting

- **Combust entire contents of tar ball**
- **Combustion products mixed into a reservoir**
- **Analyze collected CO<sub>2</sub> with CRDS for <sup>12</sup>C/<sup>13</sup>C**
- **Compare with reference library**
- **Determine source of tar ball**

# Cavity Ring Down Spectroscopy

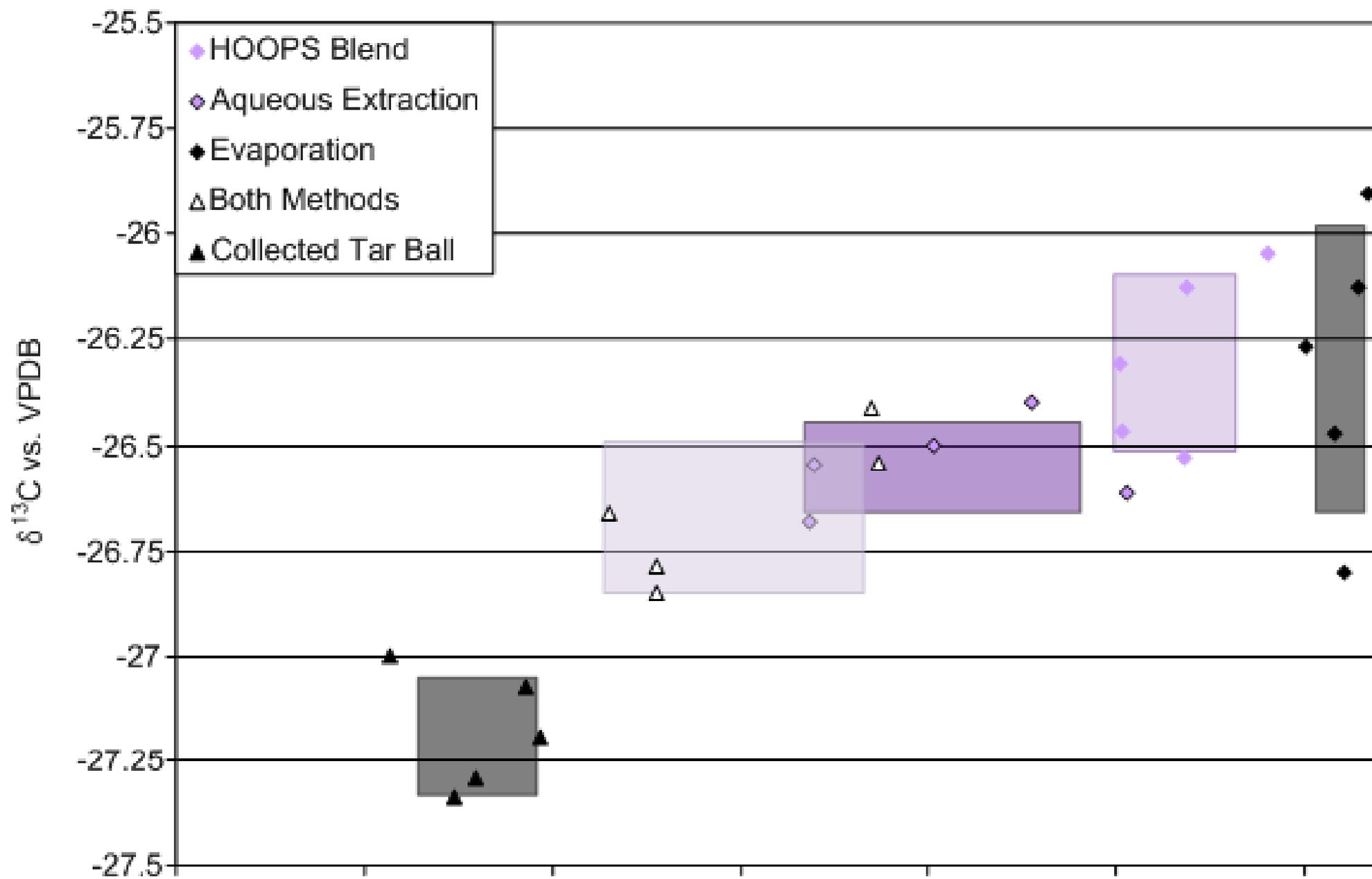


# Petroleum Fingerprint Data



# Lab weathered tar ball

## Petroleum Weathering Data



- **Cost effective isotope ratio**
- **Estimate source of organic pollution**
- **Low cost,**
- **Low maintenance**
- **Easy to use**

**[www.oico.com](http://www.oico.com)**