Developing New Detection and Verification Methods for Oxidized Mercury

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New Oxidized Mercury Instrumentation is Needed to Break Through Barriers

1. **Automated field-deployable calibrator**
   - For verification of measurements in field conditions using multiple mercury compounds
2. **Cryofocusing/GC-MS system**
   - For identification and quantification of ambient mercury compounds

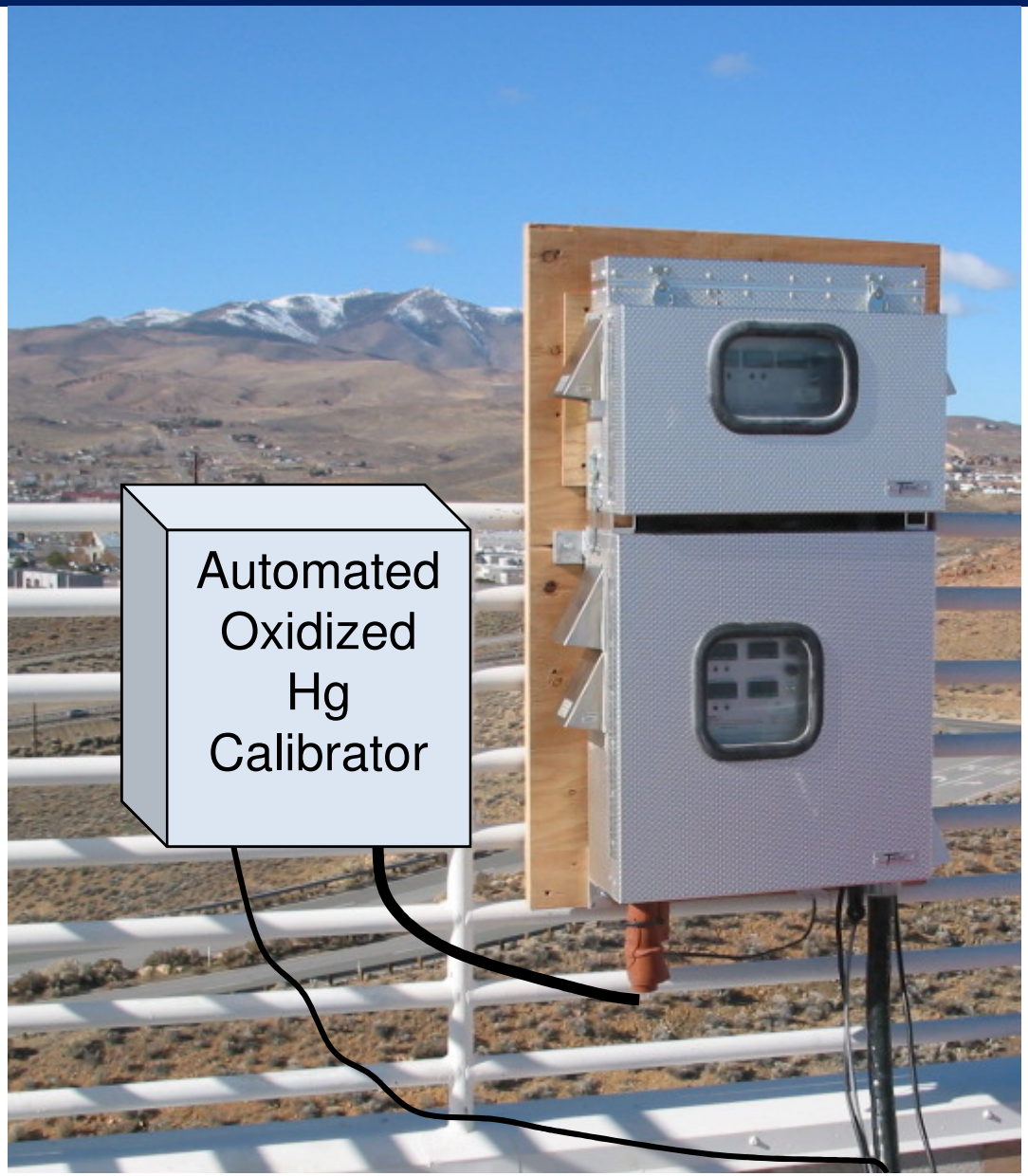
Calibrators for Oxidized Mercury Have Been Successfully Deployed

- **Lab permeation of mercury compounds**
  - Landis et al., 2002, Environ. Sci. Tech. 36, 3000-3009
  - Lyman et al., 2010, Atmos. Chem. Phys. 10, 8197-8204
  - Huang et al., 2013, Environ. Sci. Tech. 47, 7307-7316
  - And Several Others

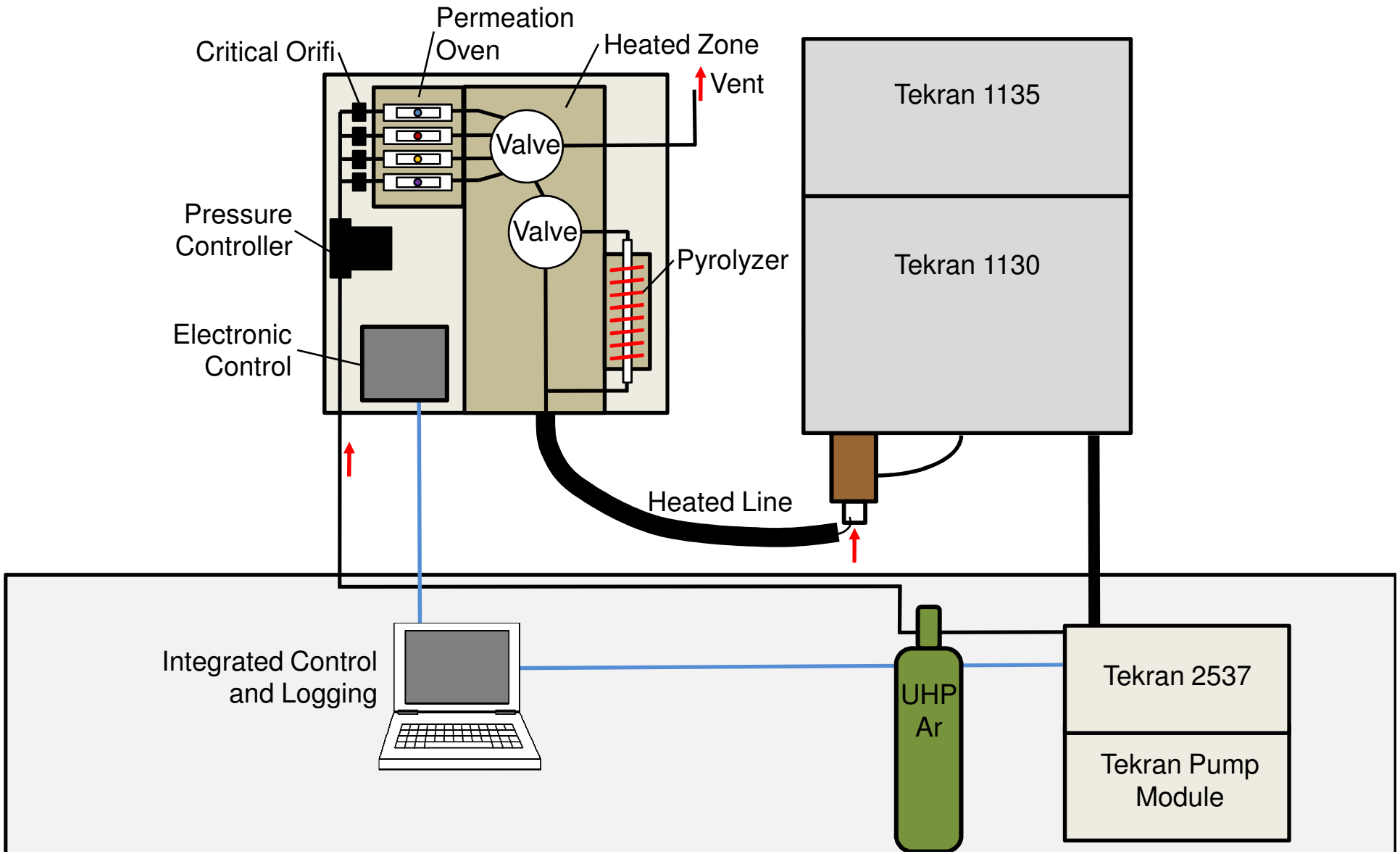
- **Field permeation to test oxidized mercury instruments**
  - Finley et al., 2013, Environ. Sci. Tech. 47, 7277-7284

- **Advantages: Certainty, simplicity**
- **Disadvantages: Unstable permeation rate (sometimes)**

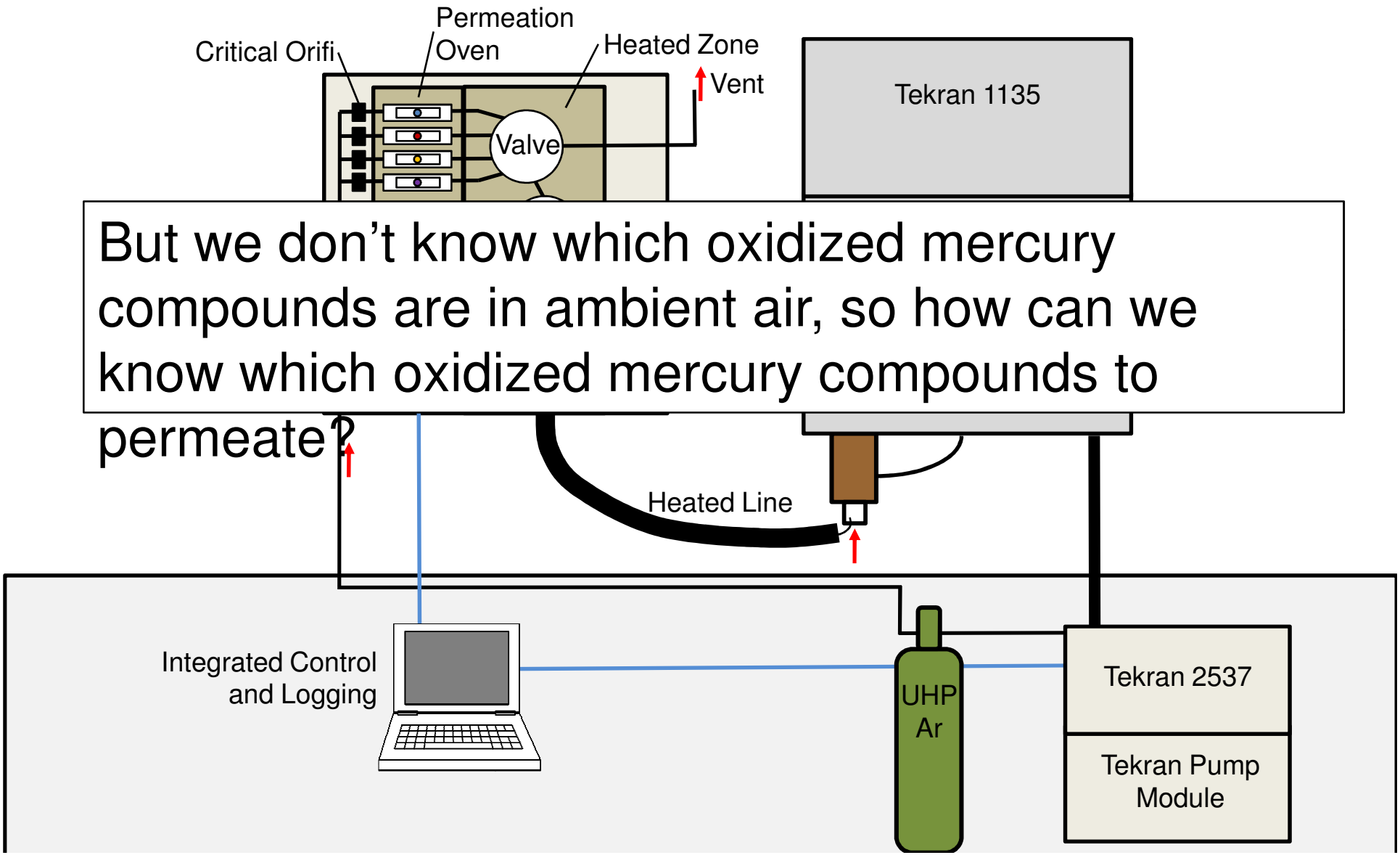
Automated Field Calibrator to Verify Ambient measurements



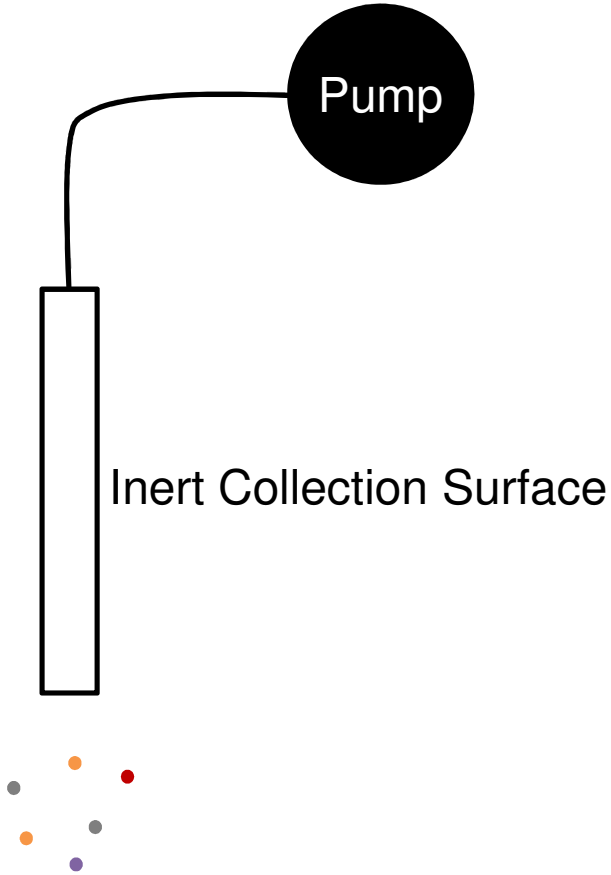
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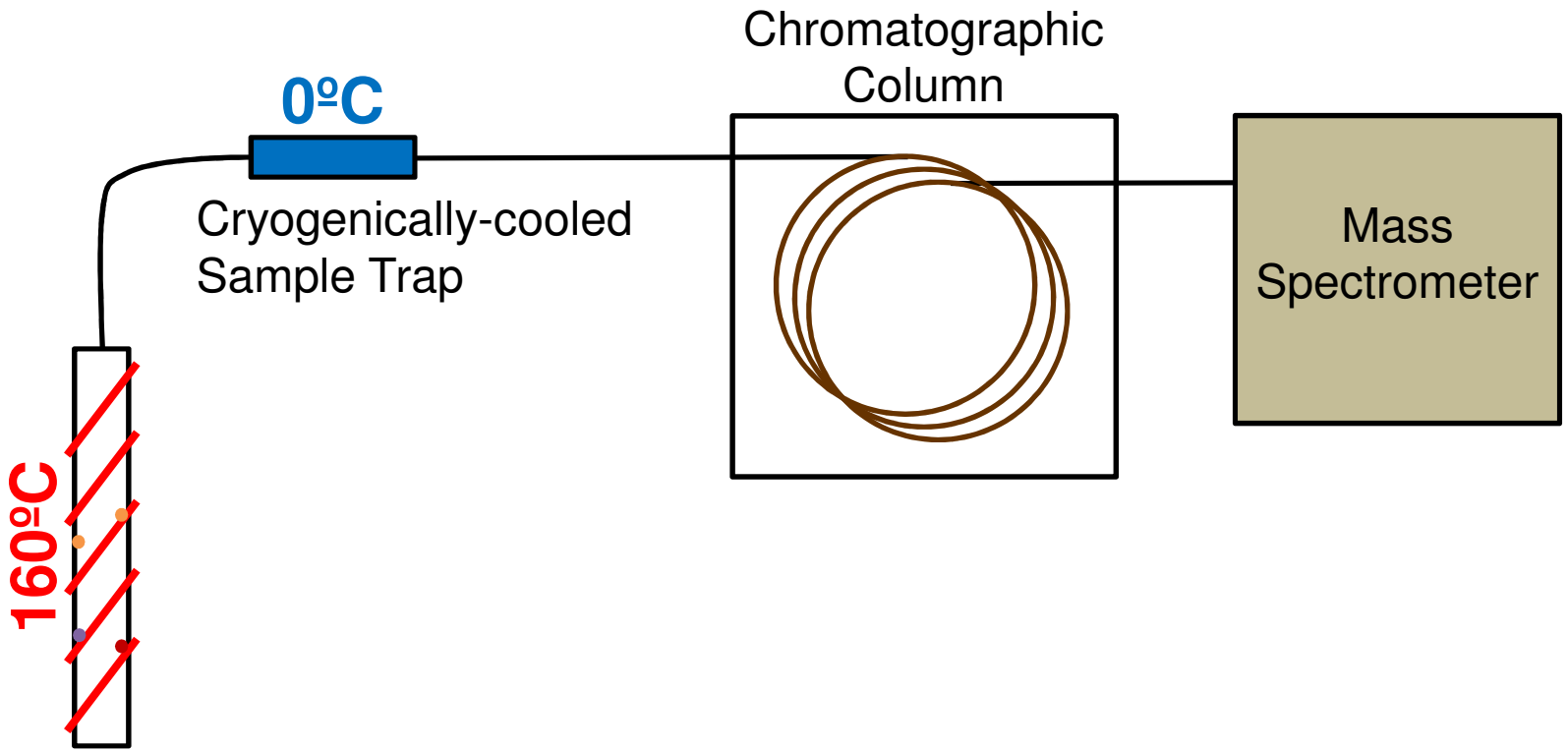
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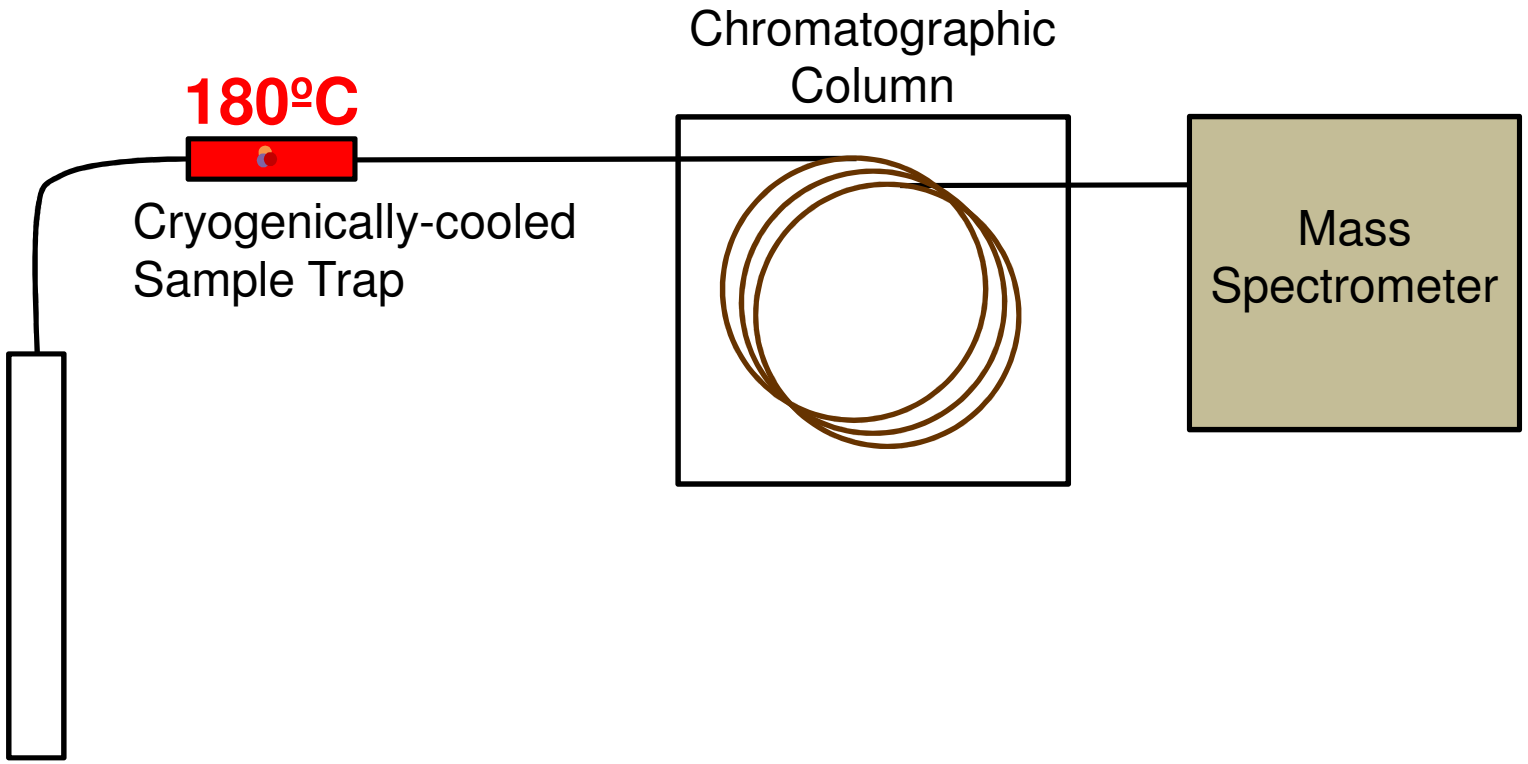
GC/MS System to Identify Individual Mercury Compounds: Sample Collection



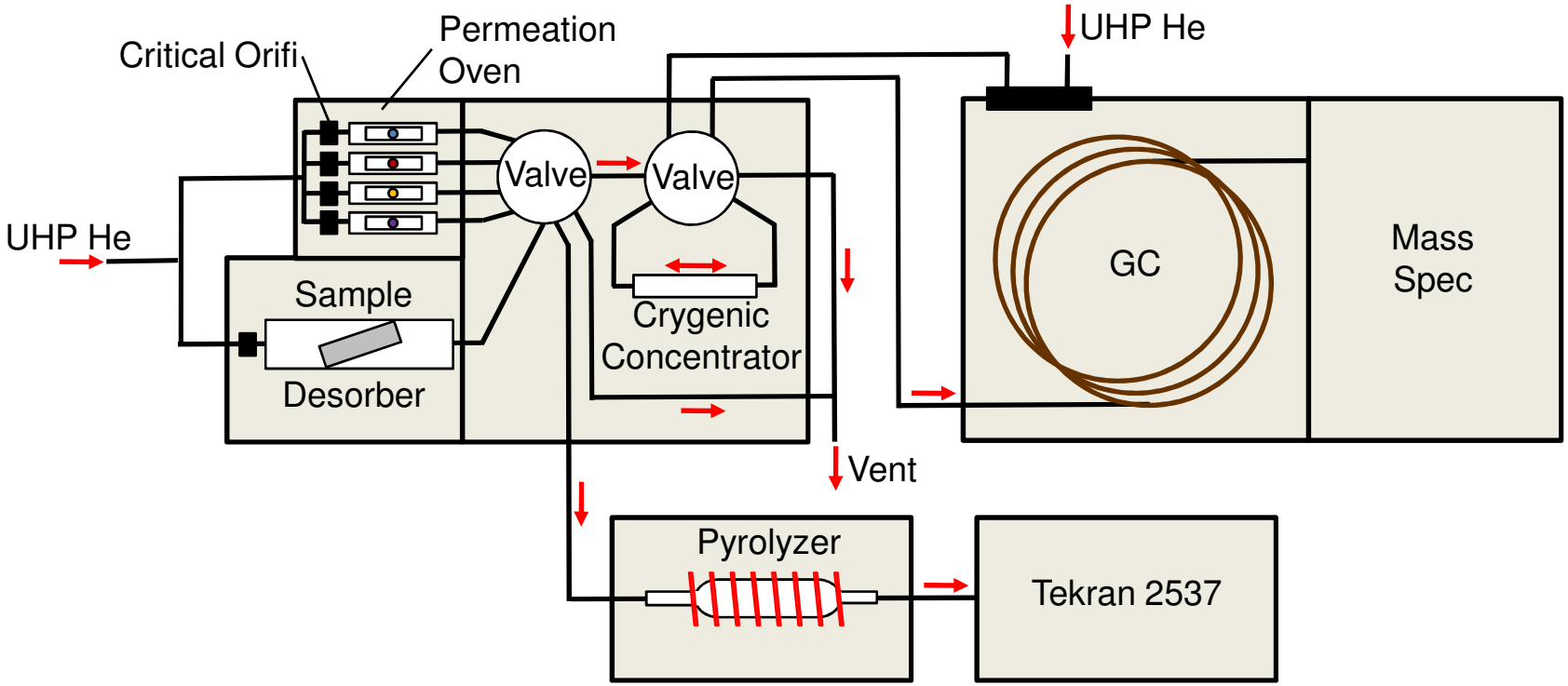
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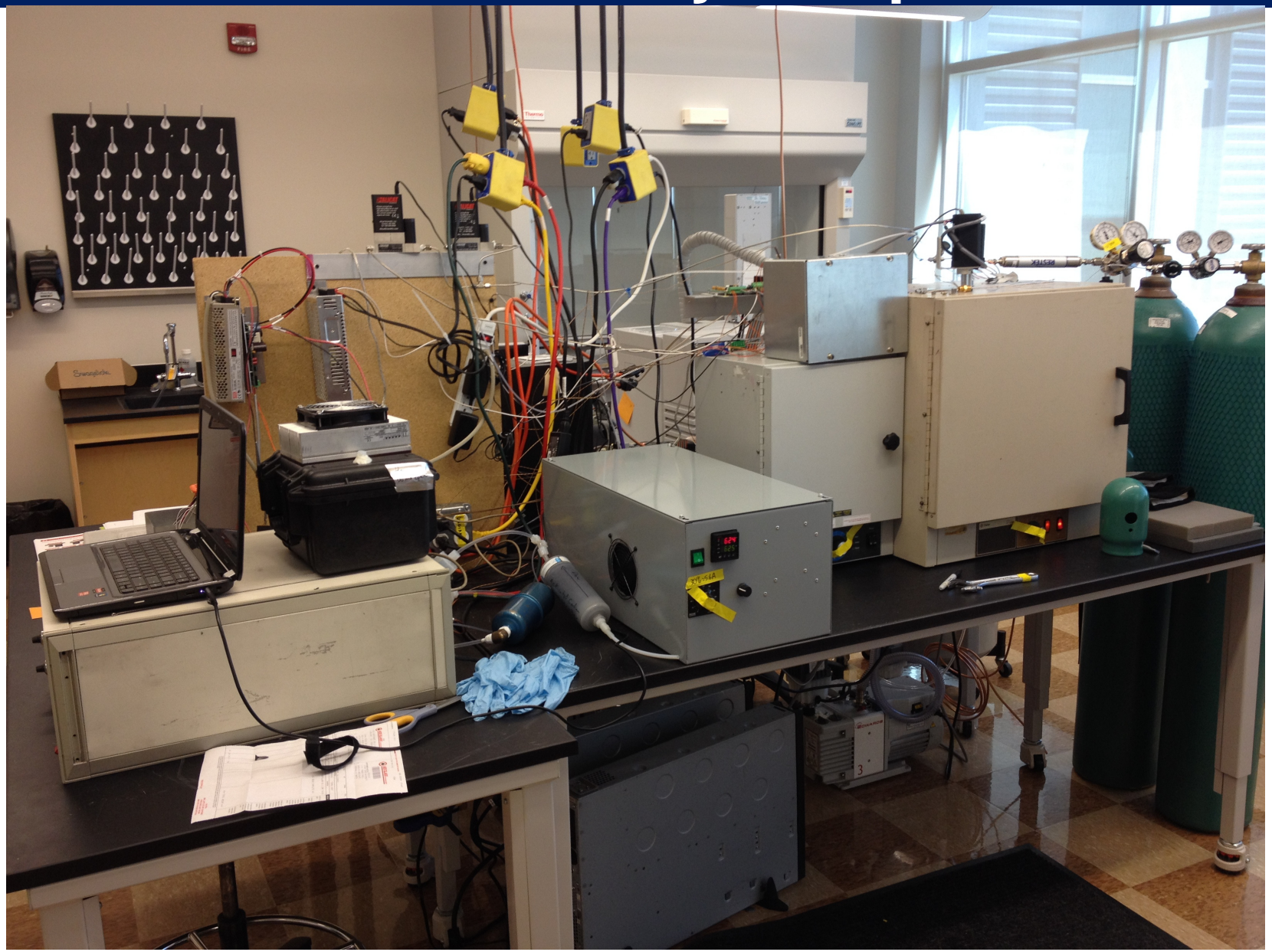
GC/MS System to Identify Individual Mercury Compounds: Flow diagram



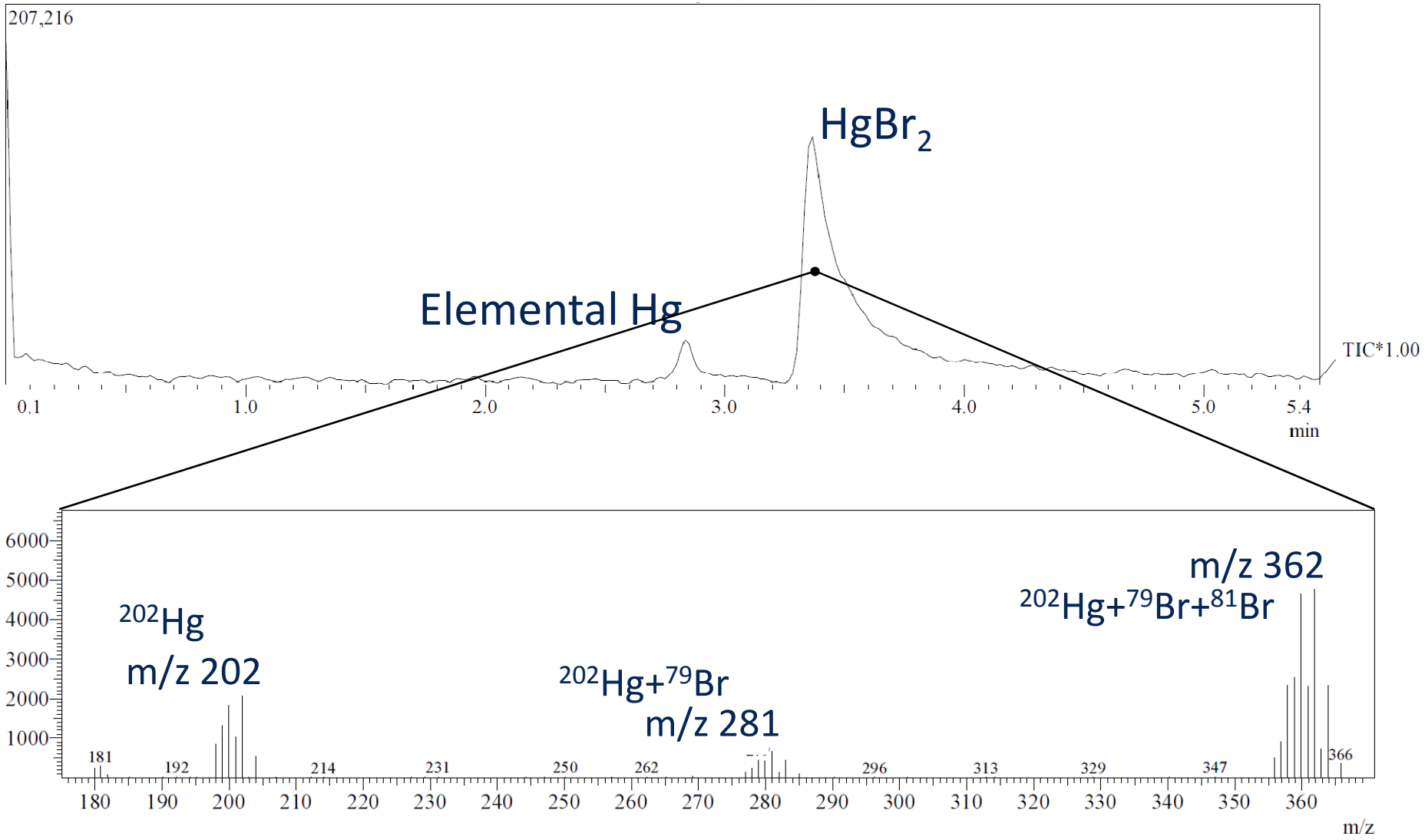
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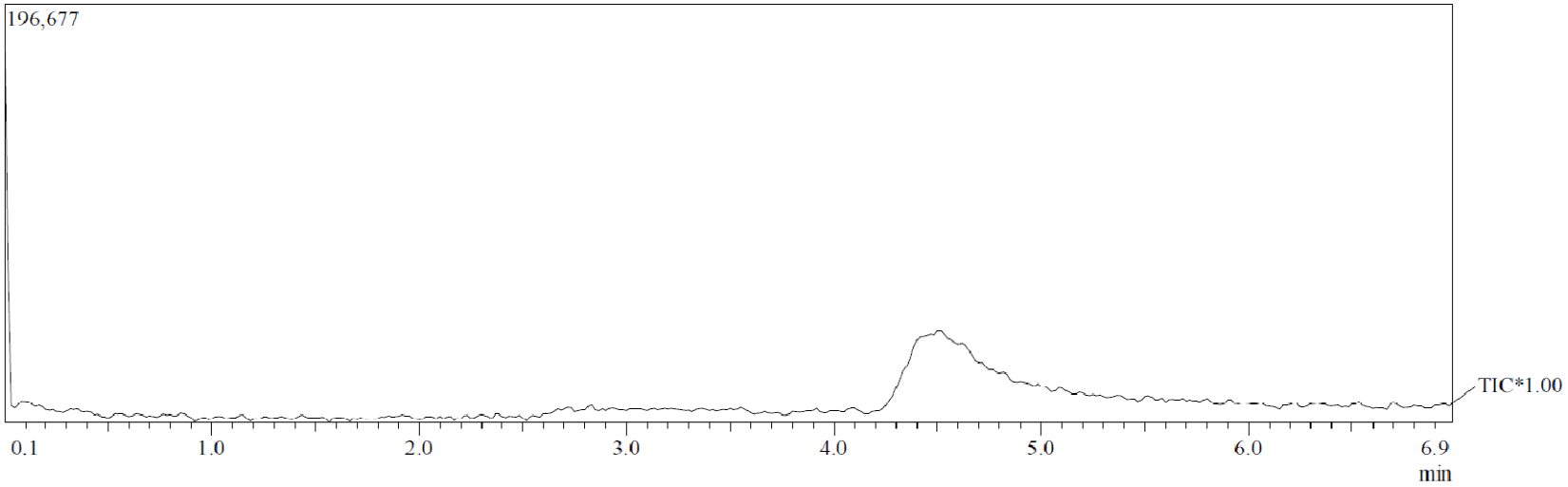


Clear Identification of $HgBr_2$ by MS

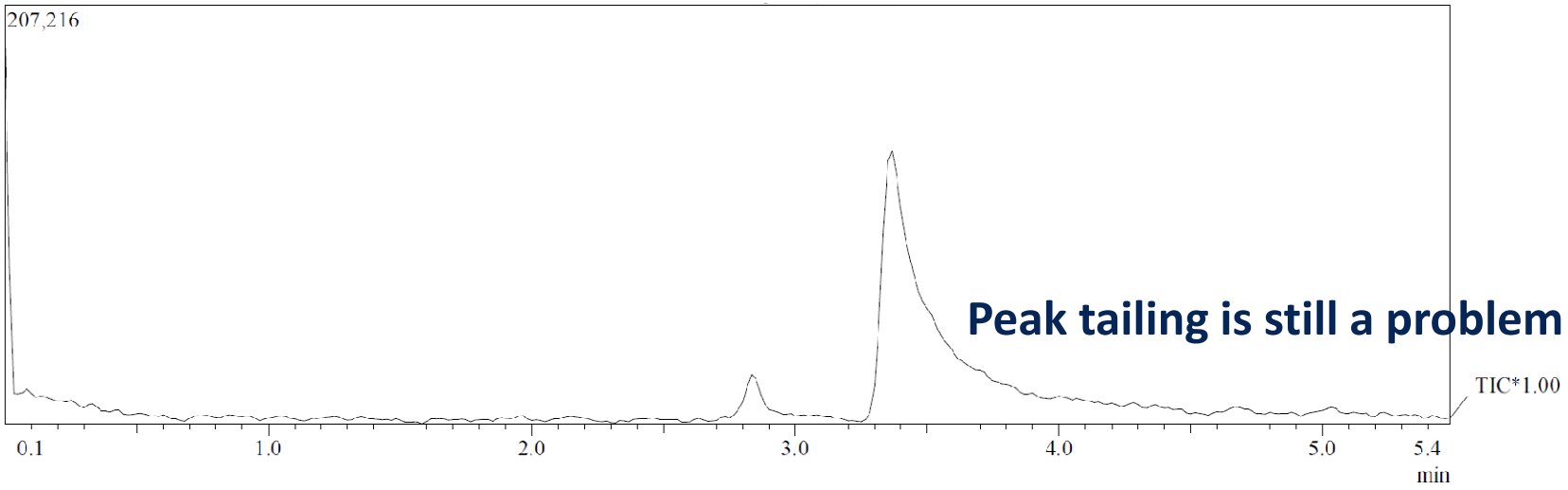


System Optimization is Improving Detection

Temperatures at 160ºC, detector not optimized, cryotrap collection at -25ºC

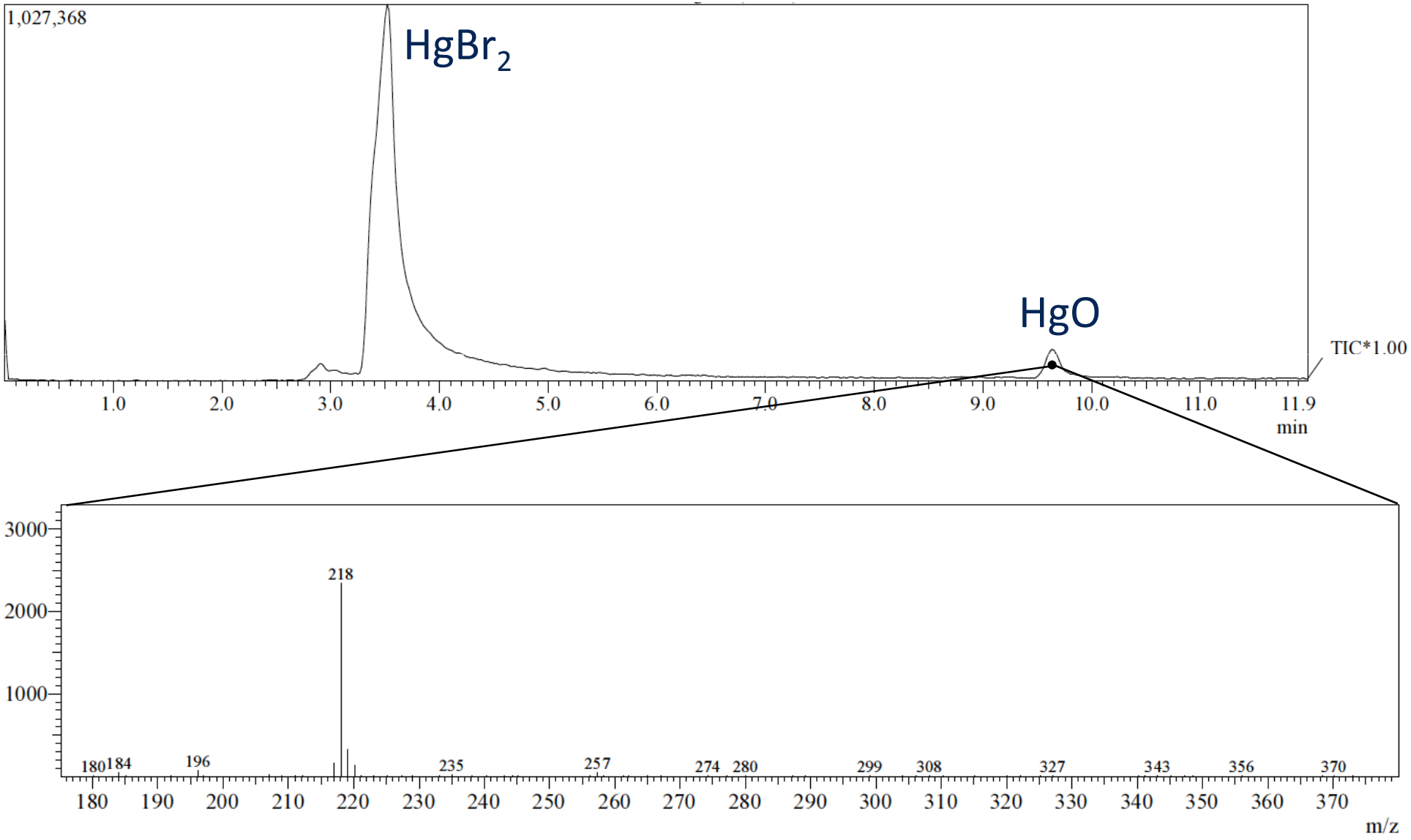


Temperatures at 200ºC, sensitivity optimized, cryotrap collection at 0ºC

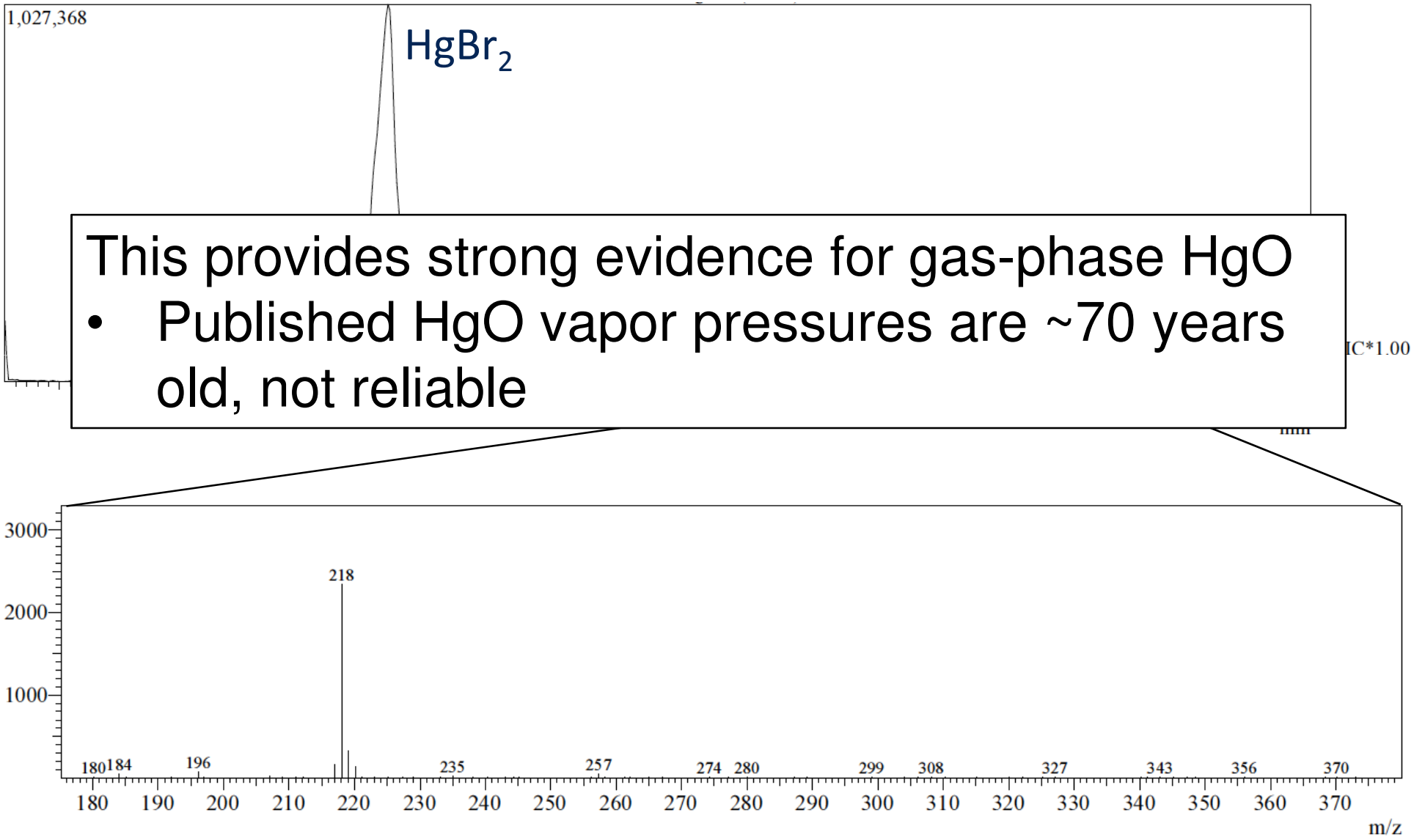


Peak tailing is still a problem

GC-MS can Separate Different Mercury Compounds



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This provides strong evidence for gas-phase HgO

- Published HgO vapor pressures are ~70 years old, not reliable

Worries

- **What about chemical transformation/decomposition during ambient air collection?** (from Jerry Lin)
- **What if ambient air oxidized Hg is some compound(s) we don't know about yet?**
  - **What if whatever it is is too reactive to make it through the GC/MS system?**
- **Will semivolatile organics interfere with oxidized mercury cryotrapping or detection?**
- **Won't we have to sample a boatload of ambient air to overcome detection limits?**

Thank You

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