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Basic Chromatography

Basic Chromatography

- A chromatograph is a computerized machine that analyzes hydrocarbons, chemicals, and permanent gases.
- During one analysis cycle a lot of components are separated and analyzed individually
- The information from the chromatograph includes the mole percent or liquid volume percent of the components and/or parts per million of the components that make up the sample.
- The goal of an online process gas chromatograph is to supply quantitative and qualitative information.
- The information is used to not only monitor and control the process but to optimize its use of energy, time and raw materials.
- PGC (Process GC) : Online but discontinous

Basic Chromatography

A basic Gas Chromatograph (GC) consists of the following parts:

- Carrier Gas
- Carrier Regulator
- Sample Valve
- Column
- Detector
- Sample Conditioning Systems
- System Controller

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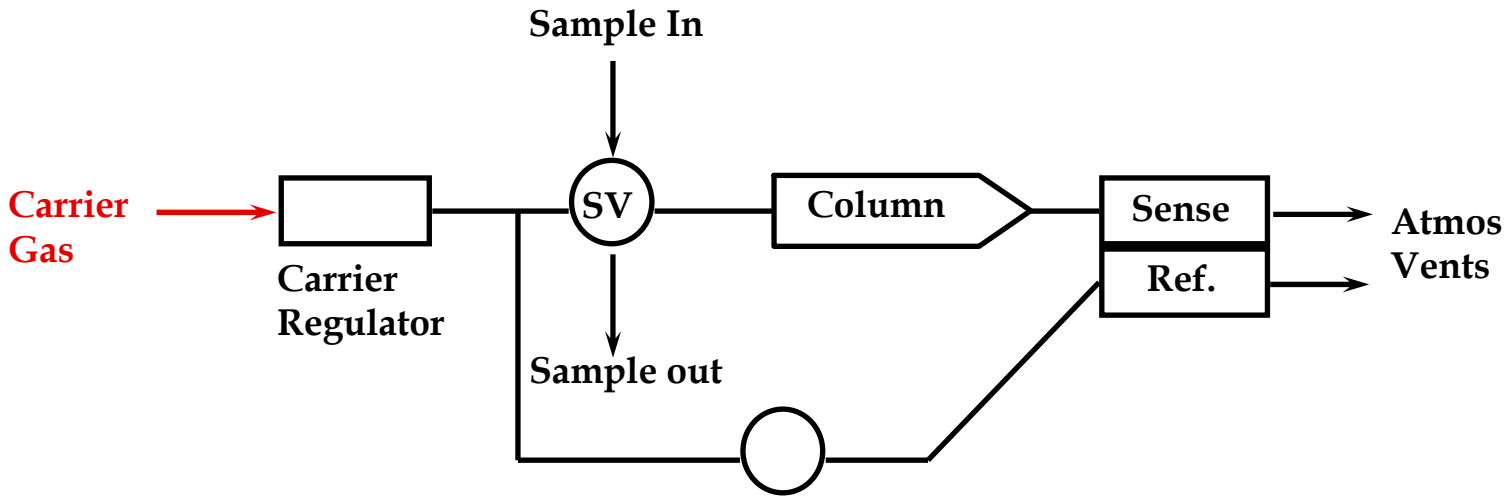
- Sample Conditioning Systems
  - Sample probe
  - Sample Transport Tubing
  - Sample Phase Consistency
    - Filtration
    - Liquid Coalescing
    - Heat Tracing
- Speed Loops
- Automatic Stream switching
  - Calibration Standards
  - Multiple Sample Streams

Basic Chromatography

- A basic Gas Chromatograph (GC) consists of the following parts:
  - Carrier Gas

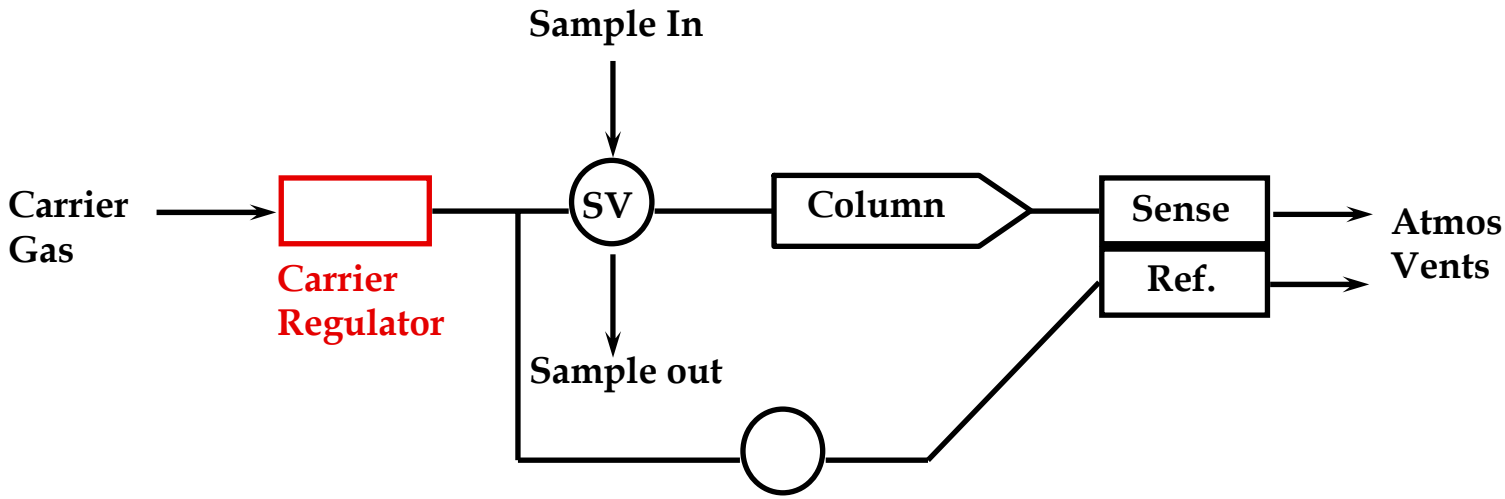
Carries the sample through the column and detector to an atmospheric vent.



Basic Chromatography

- A basic Gas Chromatograph (GC) consists of the following parts:
  - Carrier Regulator

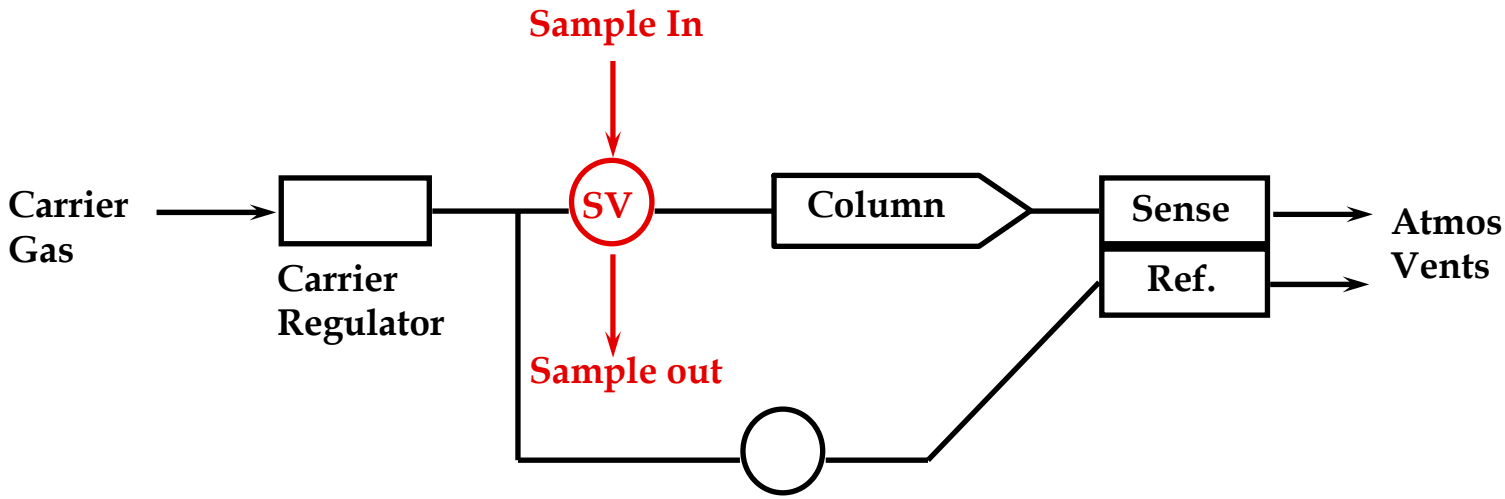
Maintains a constant pressure of carrier gas which results in a constant carrier flow rate.



Basic Chromatography

- A basic Gas Chromatograph (GC) consists of the following parts:
  - Sample Valve

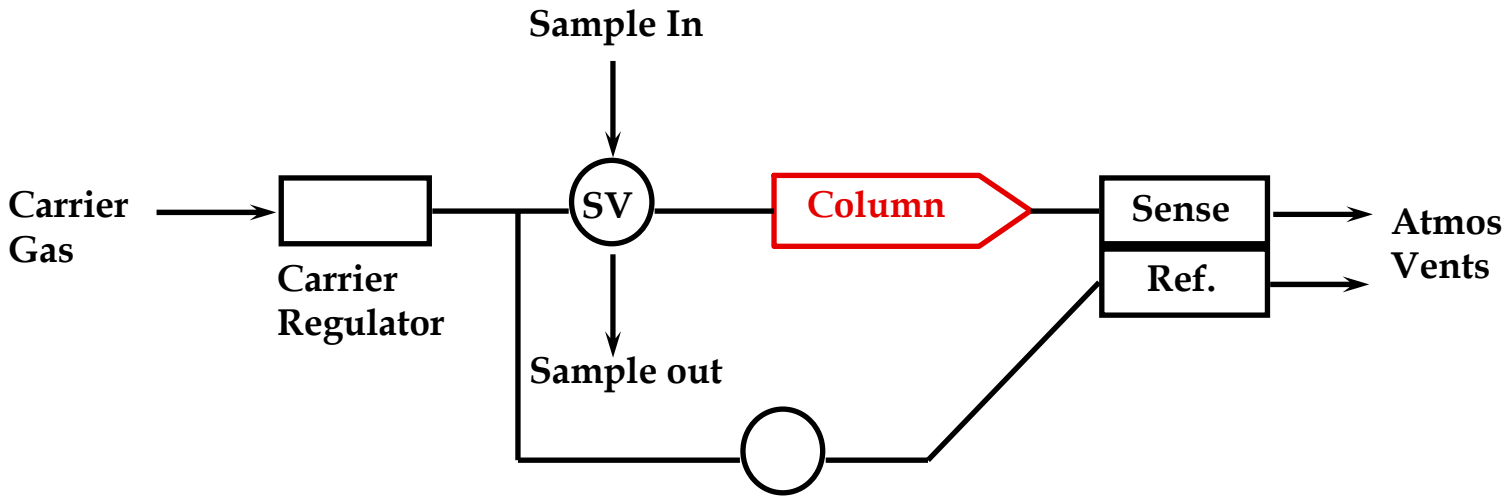
Injects a measured amount of sample.



Basic Chromatography

- A basic Gas Chromatograph (GC) consists of the following parts:
  - Column

Separates the sample into individual components.



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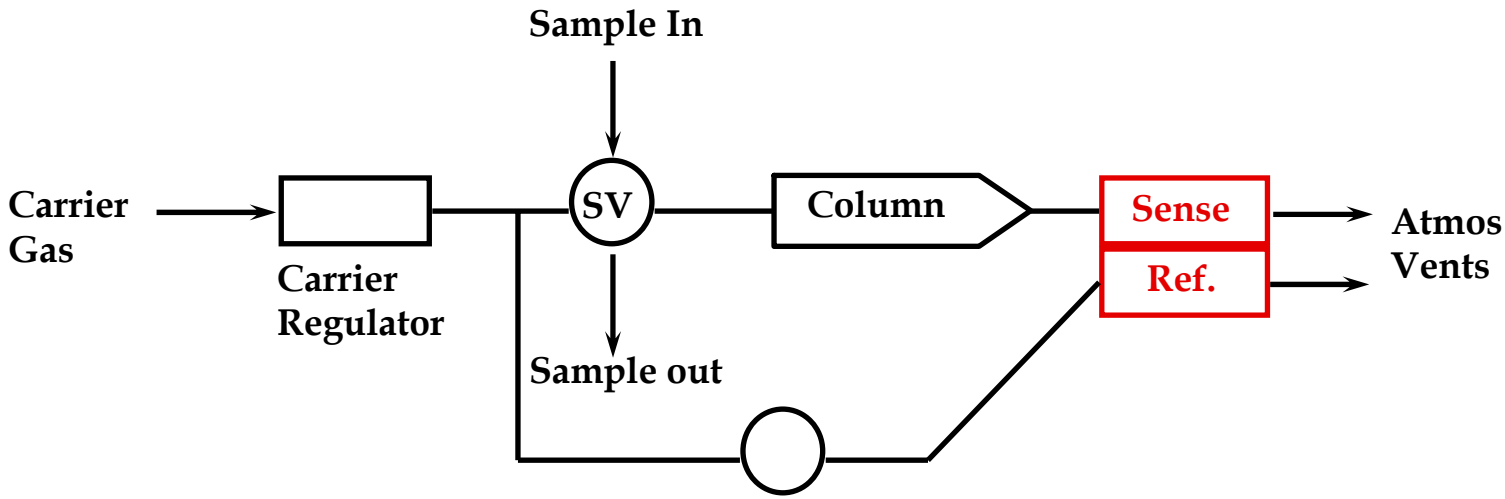
Basic Chromatography

- A basic Gas Chromatograph (GC) consists of the following parts:
  - Detector

Senses the individual components as they elute off the column.



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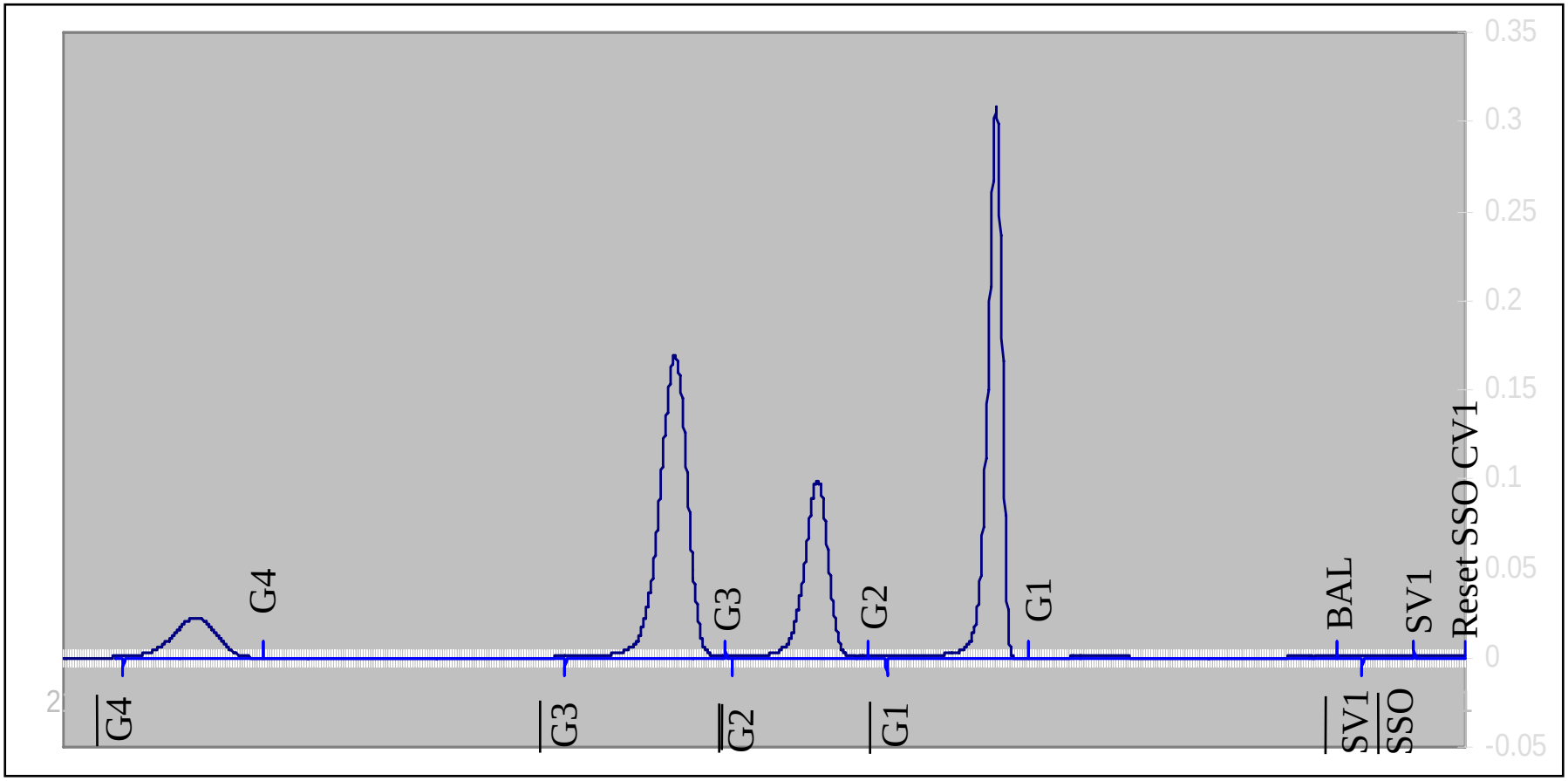
Gas Chromatogram:

- The trace of the detector signal drawn on a recorder.



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Two Important laws in chromatography

- Peak area is directly proportional to the concentration of the component.

  Peak Area / Response Factor = Concentration of the Component

- Retention time for each component is always the same.

  Retention time is the time from sample inject to the top of the peak.

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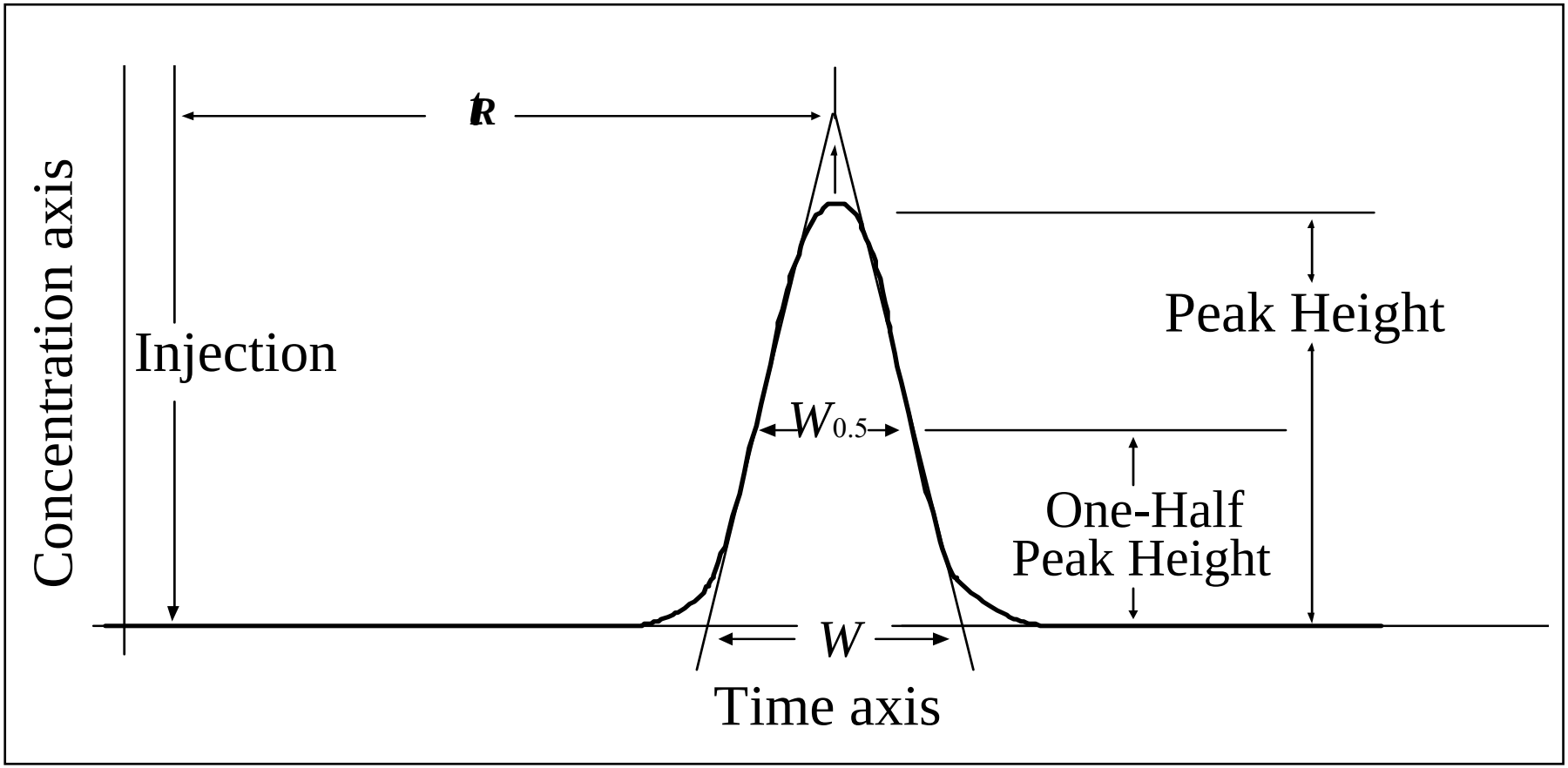
Retention time:



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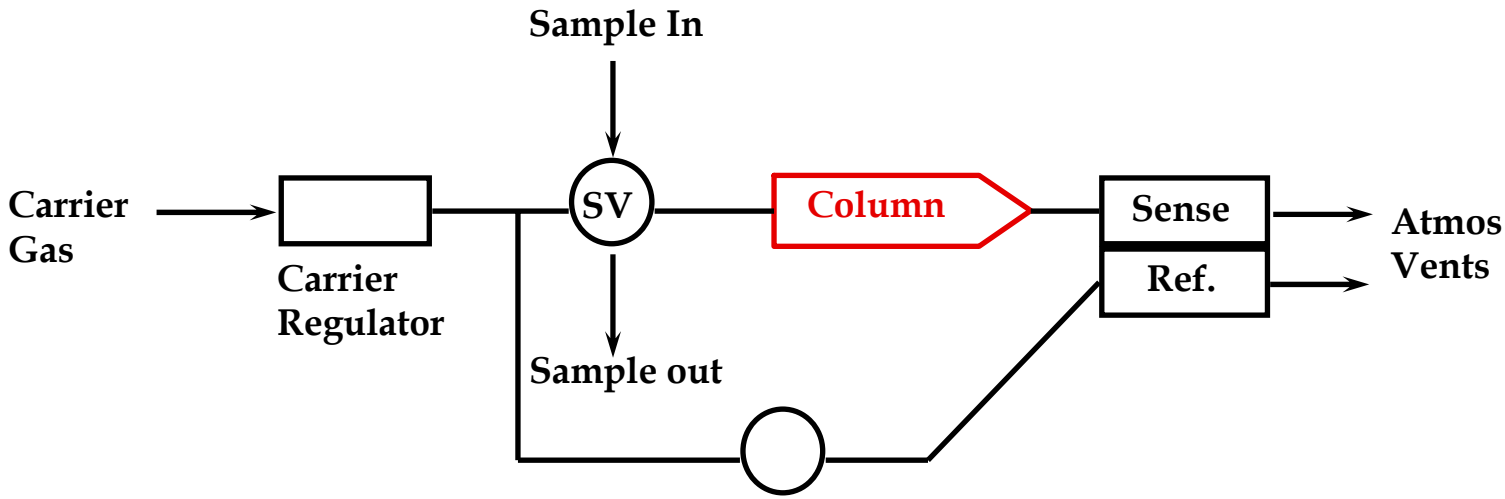
Three things that can cause the retention time of the peak to change.

- Change in carrier flow rate.
- Change in oven temperature
- Degrading columns

Basic Chromatography

- A basic Gas Chromatograph (GC) consists of the following parts:
  - Column



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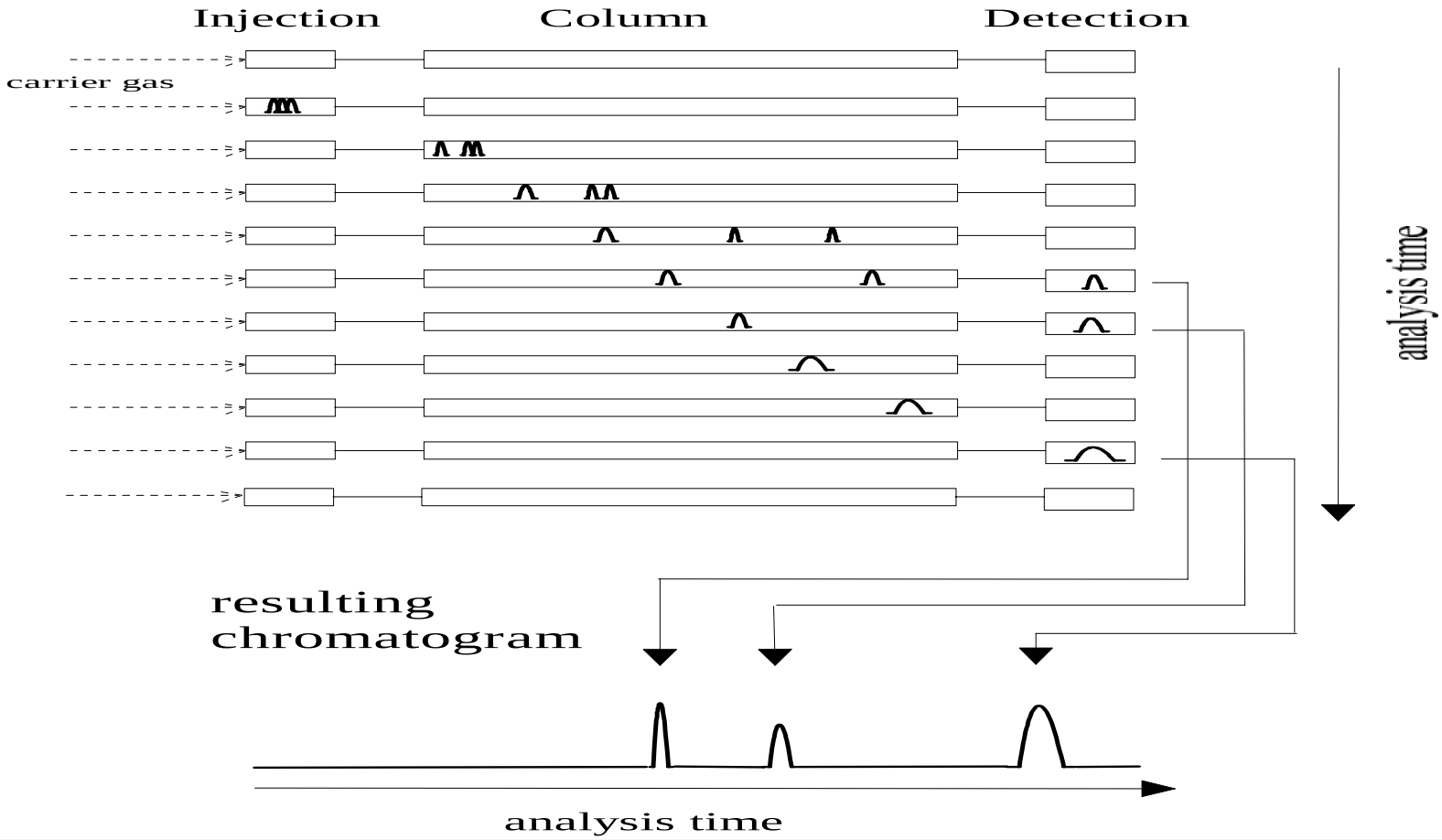
Separation on column



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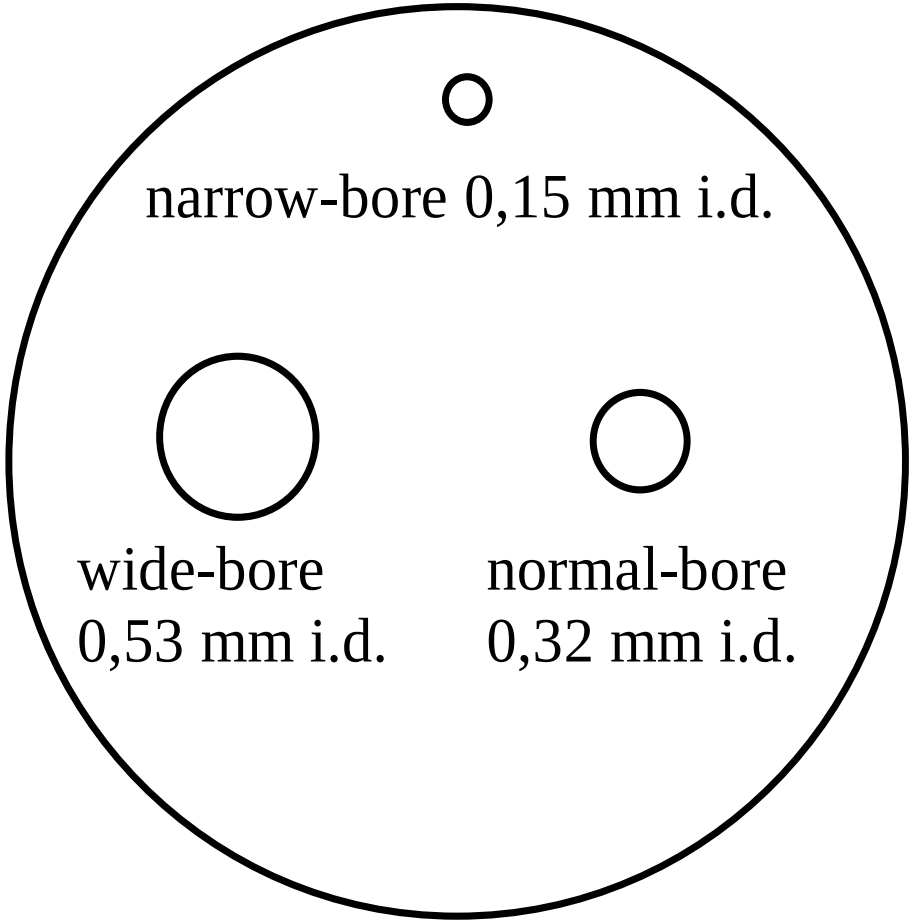
Types of columns



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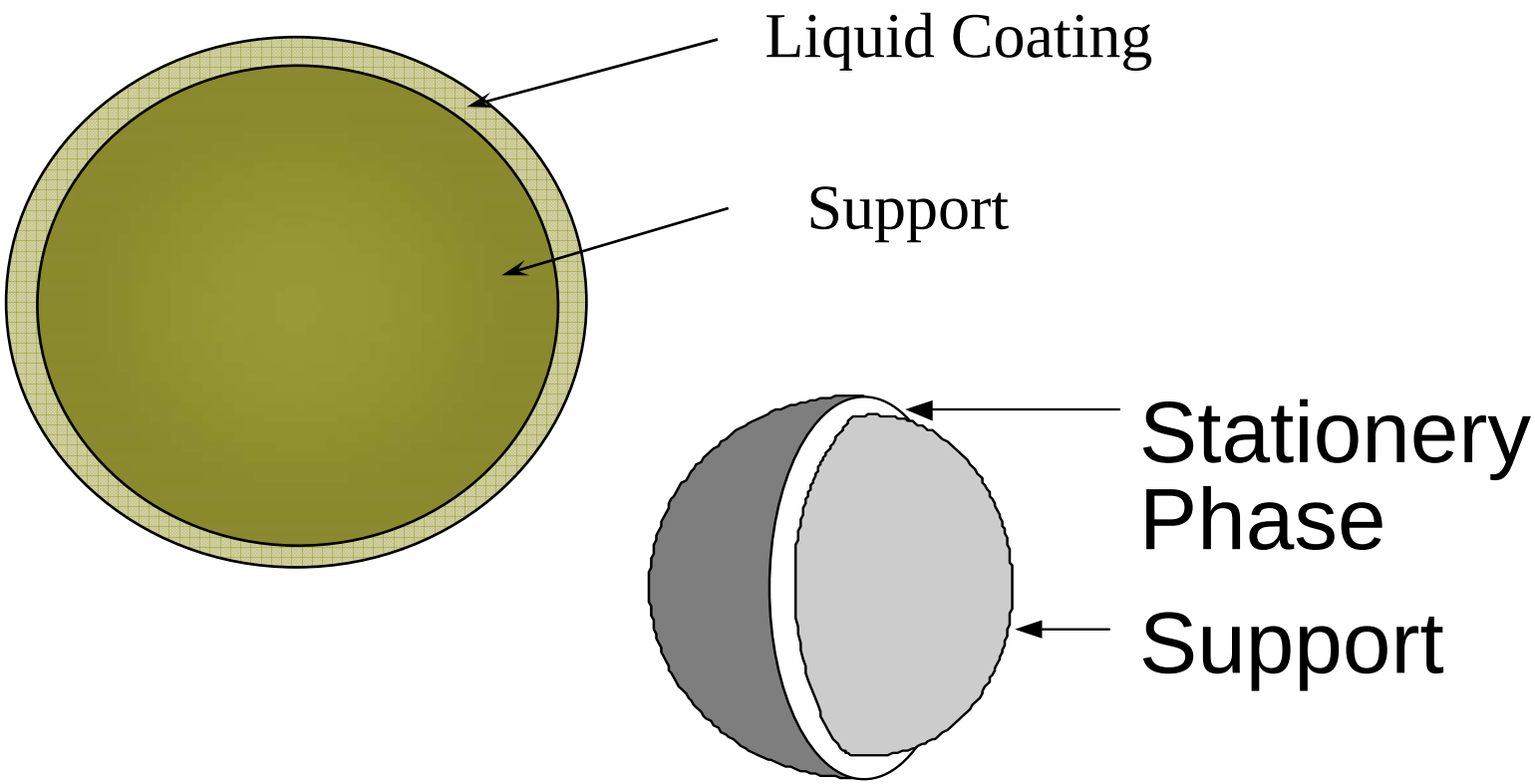
Packed Column Material



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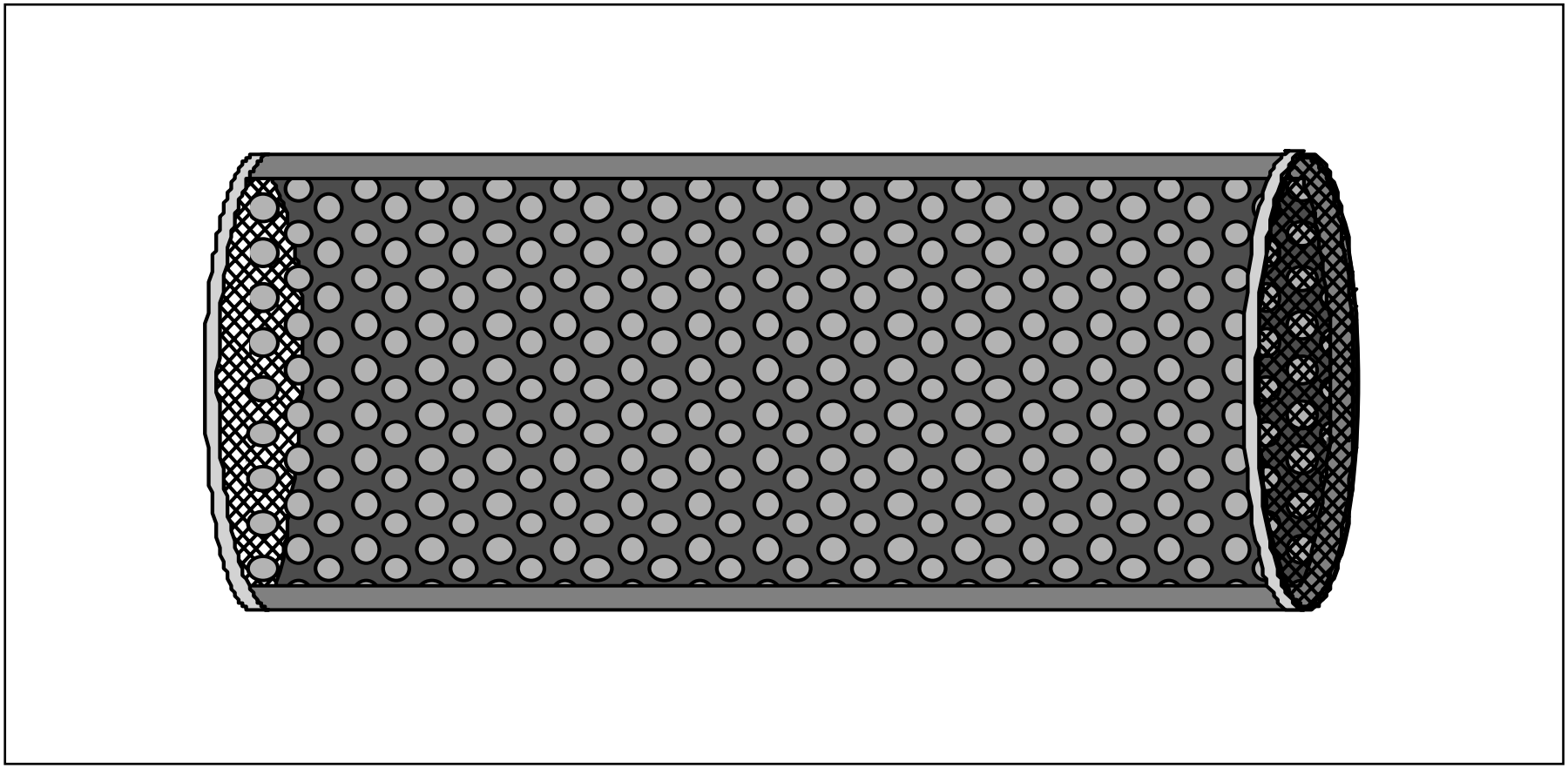
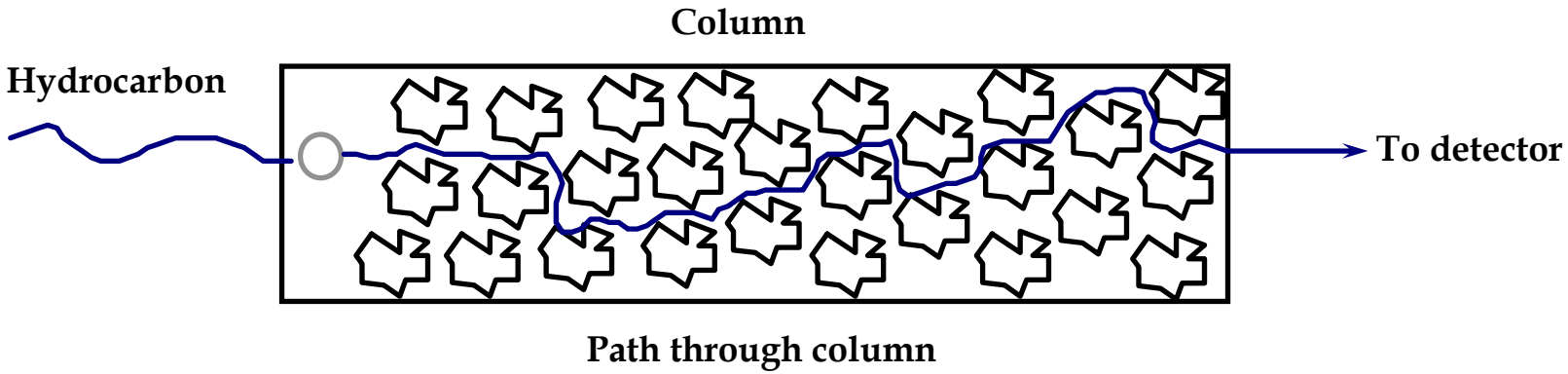
Packed Column - Principal operation



Basic Chromatography

- A basic Gas Chromatograph (GC) consists of the following parts:
  - Column



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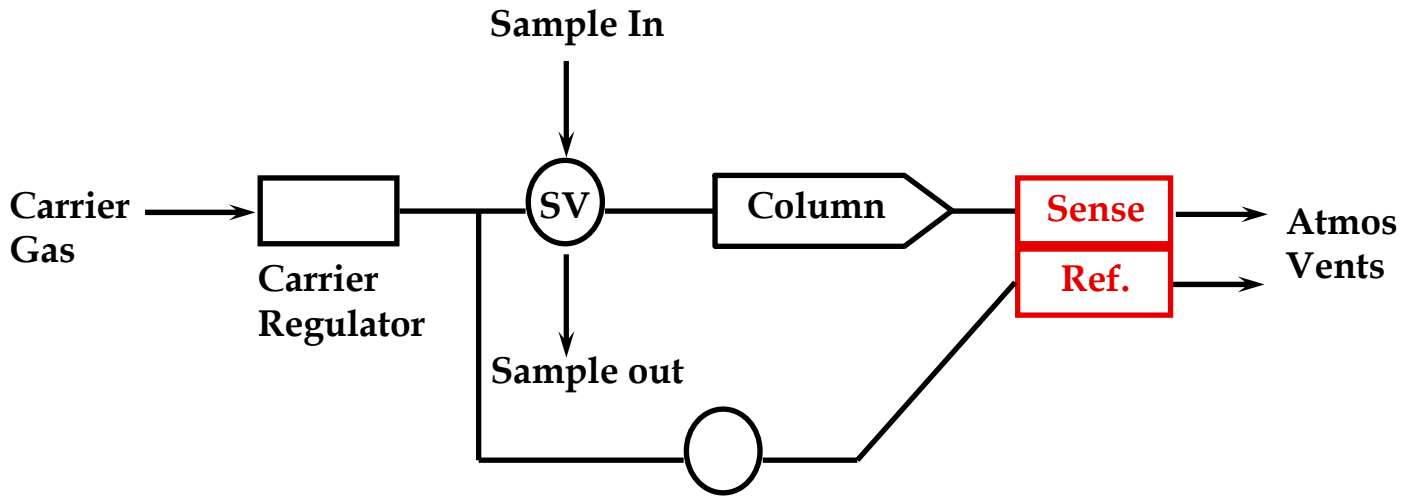
- A basic Gas Chromatograph (GC) consists of the following parts:
  - Detector



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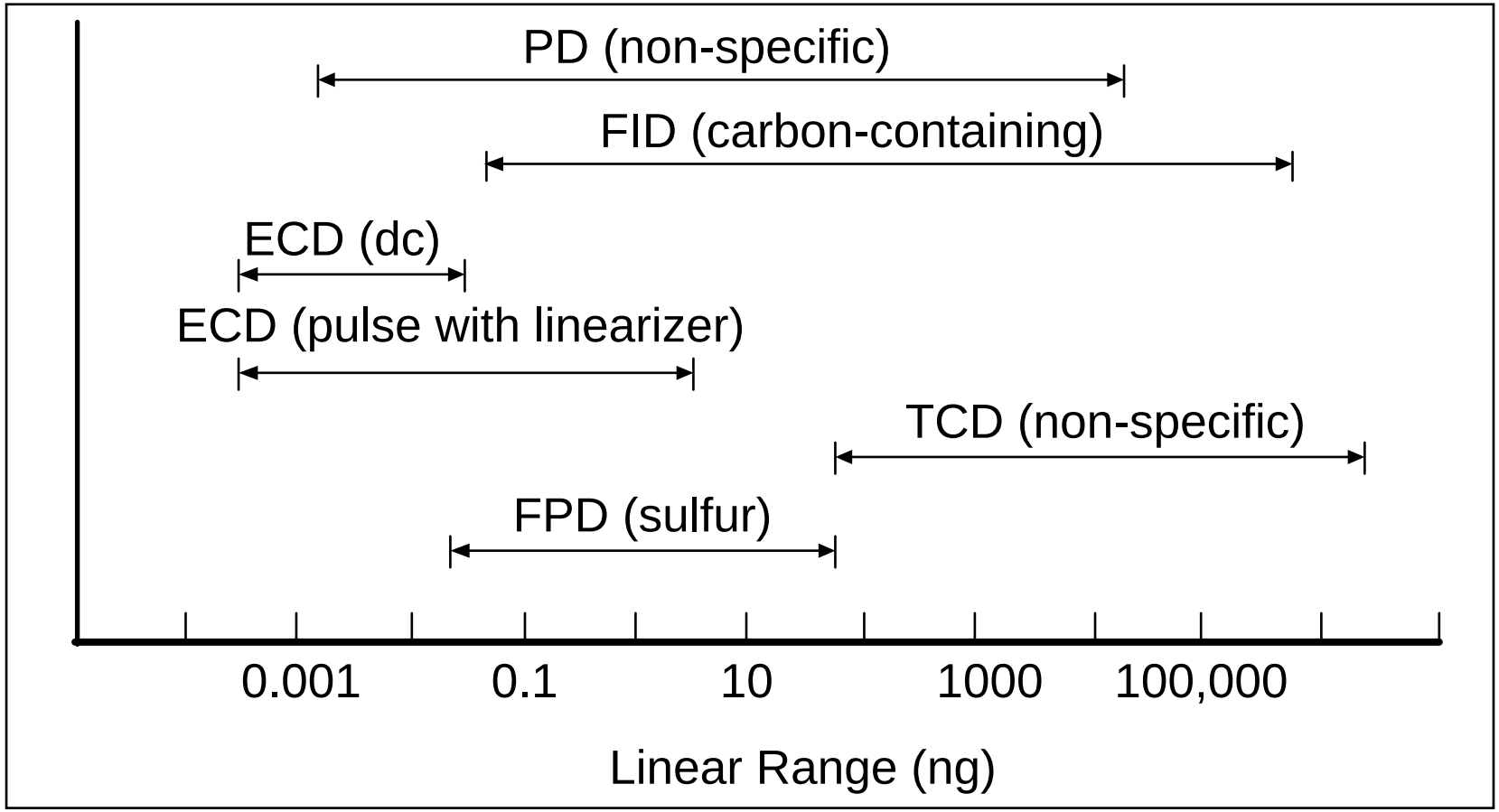
Detector Ranges



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Thermal conductivity: the ability of a substance to transmit heat by conduction.

- Thermal Conductivity Detectors
  - Non-specific
  - Measures the differance in thermal conductivity
  - Two types
    - hot wire
    - thermistor bead

- Advantages
  - Broad applications
  - low cost
  - high repeatability
  - low maintenance

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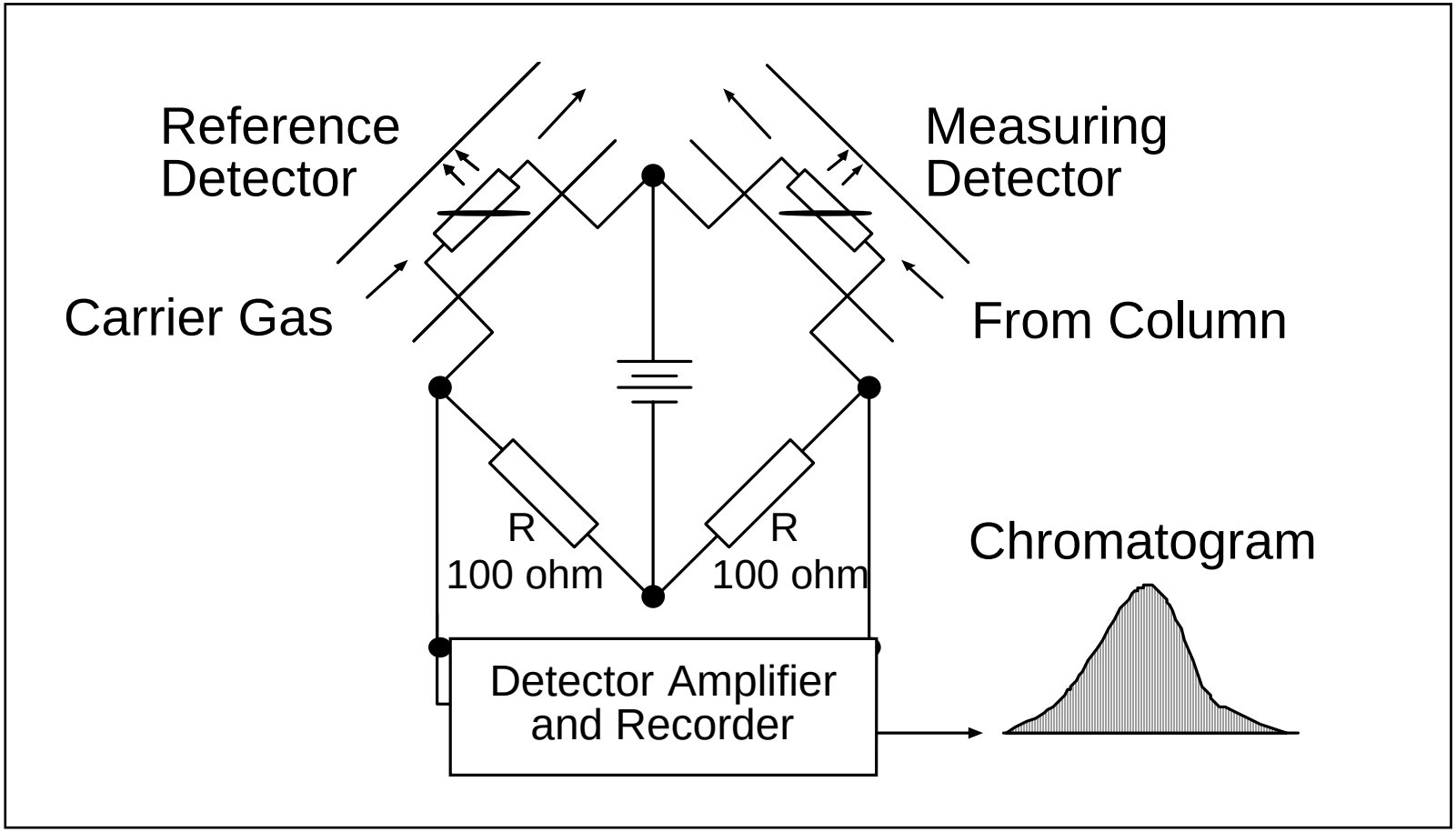
TCD



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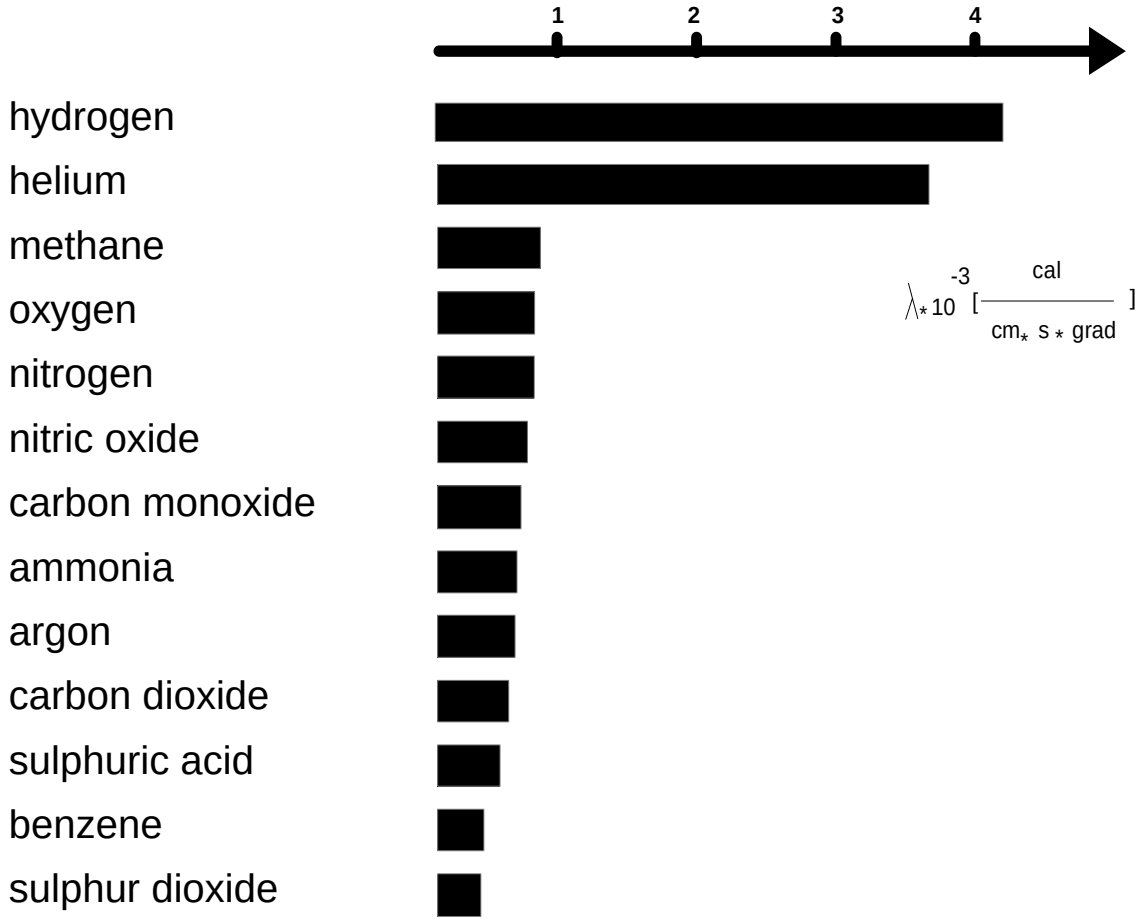
Thermal Conductivity of some gases



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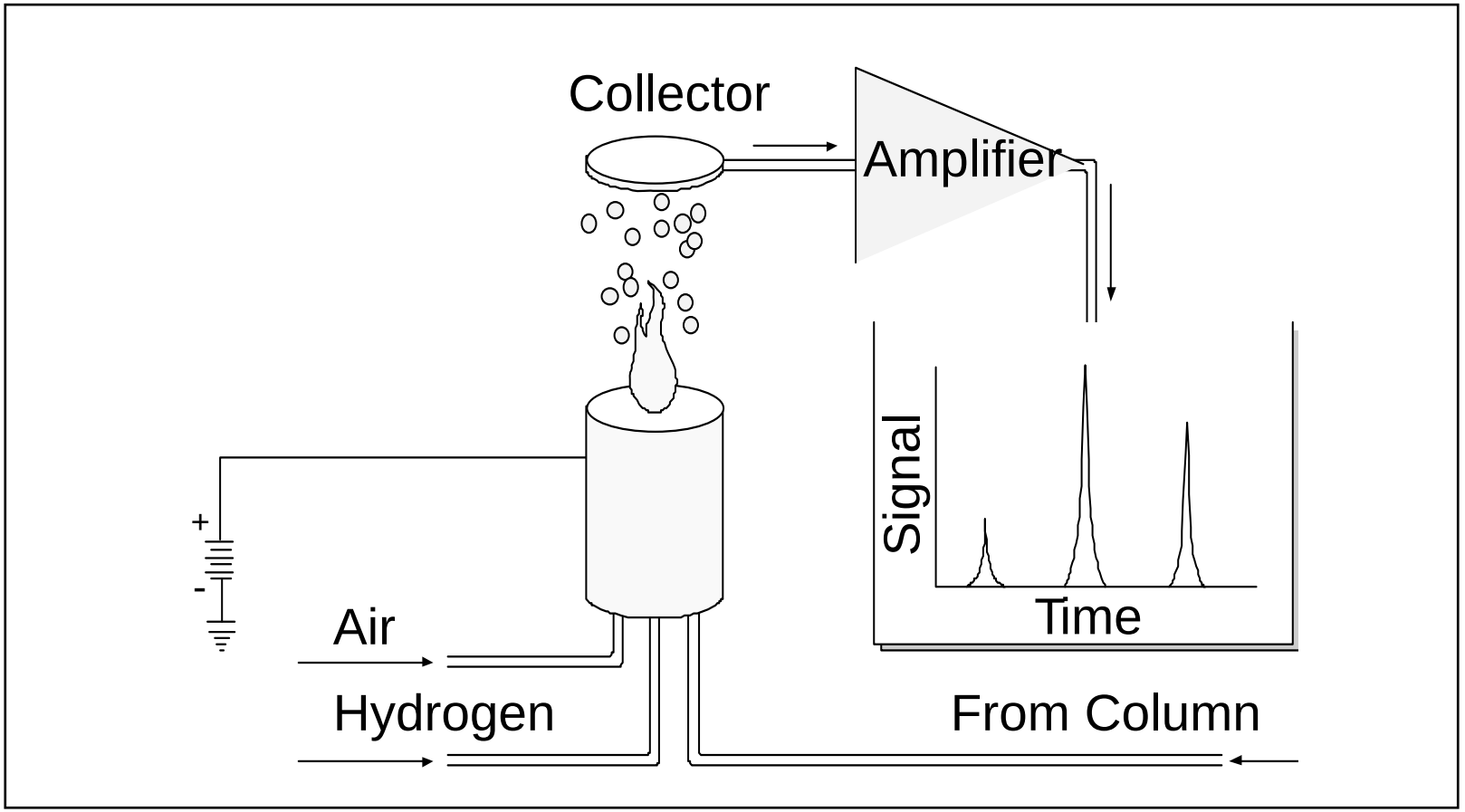
Flame Ionisation detector



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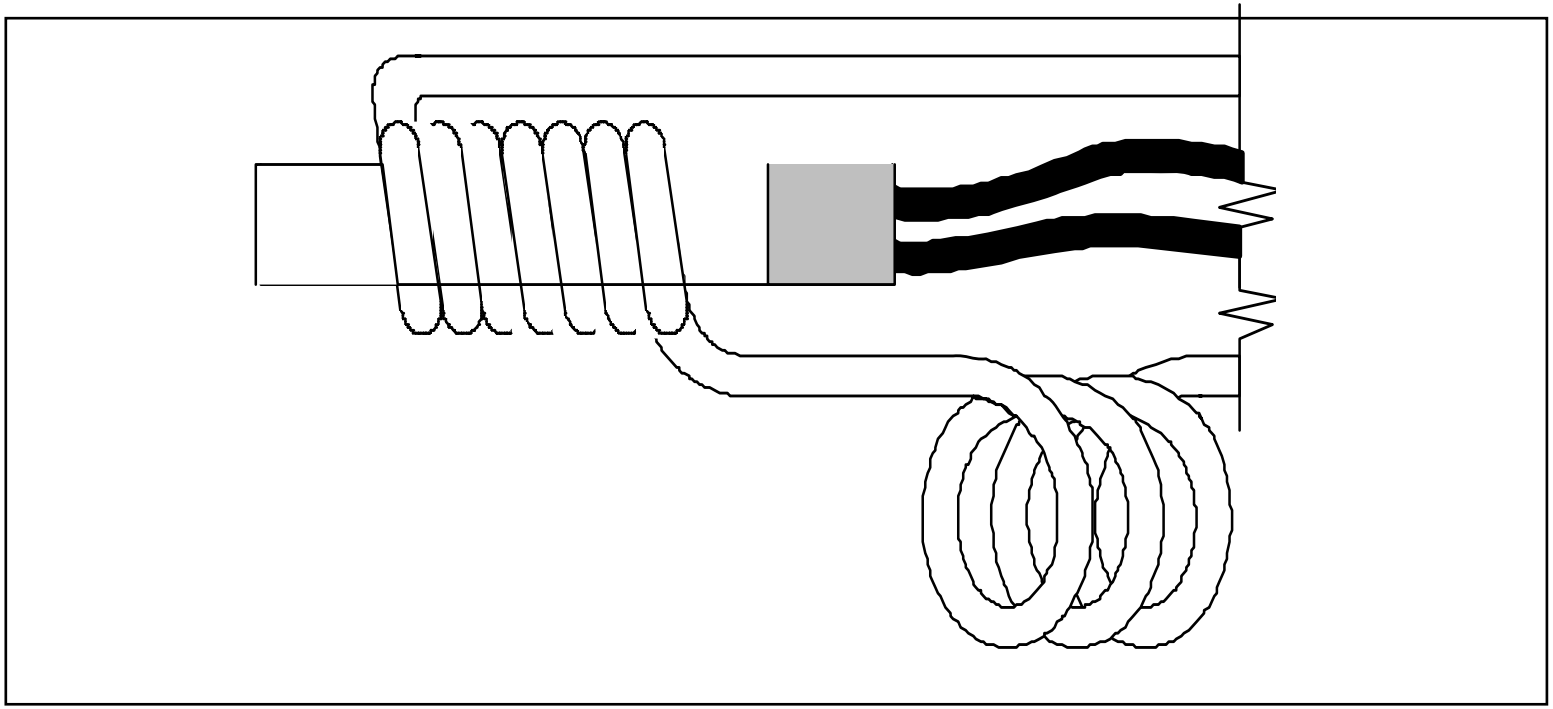
Air Treater: Converts trace hydrocarbons in the instrument to carbon dioxide. They are converted by passing the air over a heated catalyst.



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Methanator: used with flame ionization detectors.
Converts inorganic molecules to methane by passing them through heated nickel catalyst in the presence of hydrogen.