COMPREHENSIVE TWO-DIMENSIONAL GAS CHROMATOGRAPHY (GC X GC)

Separation of analytes using two capillary columns with different separation mechanism (different polarity)

1. dimension

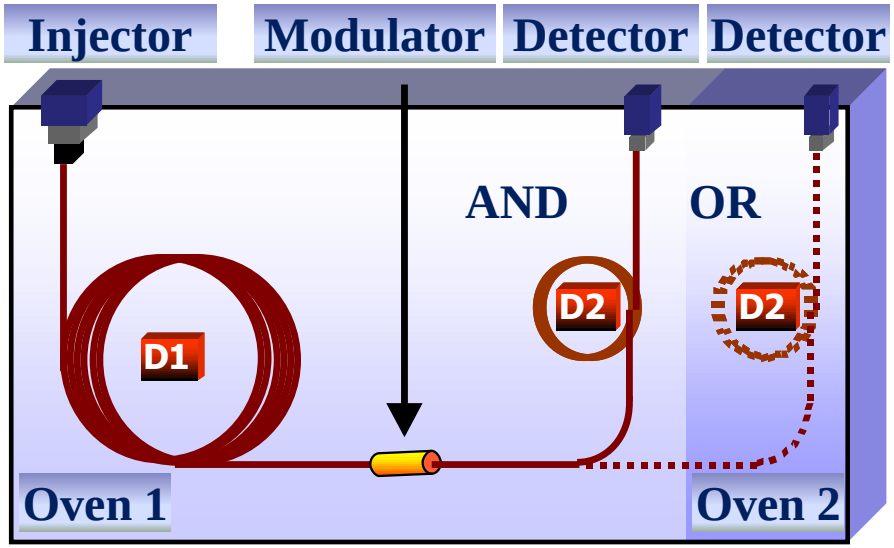
- conventional GC separation
- a long nonpolar column

separation: ***vapour pressure***

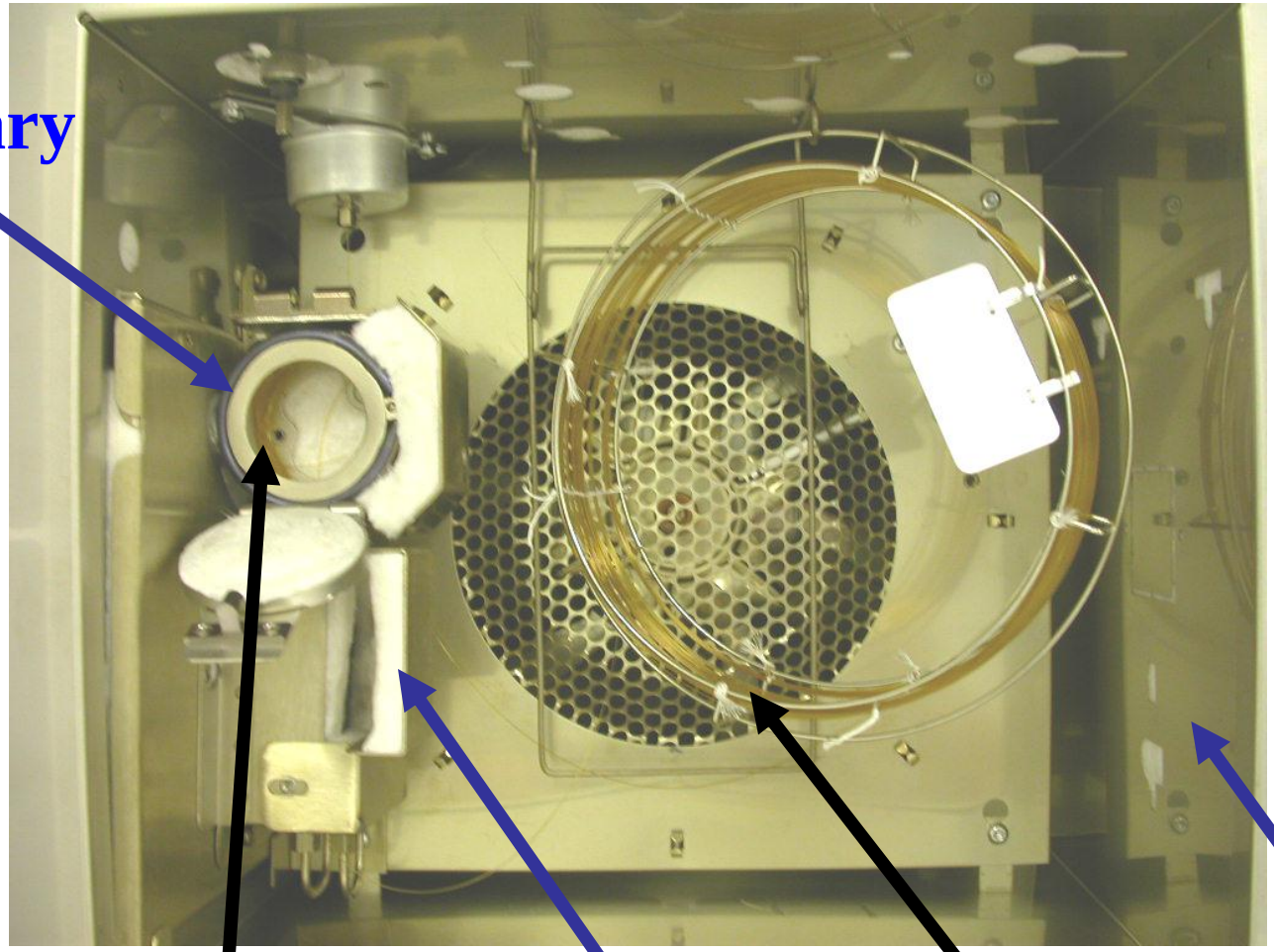
2. dimension

- „flash“ separation
- a narrow polar column

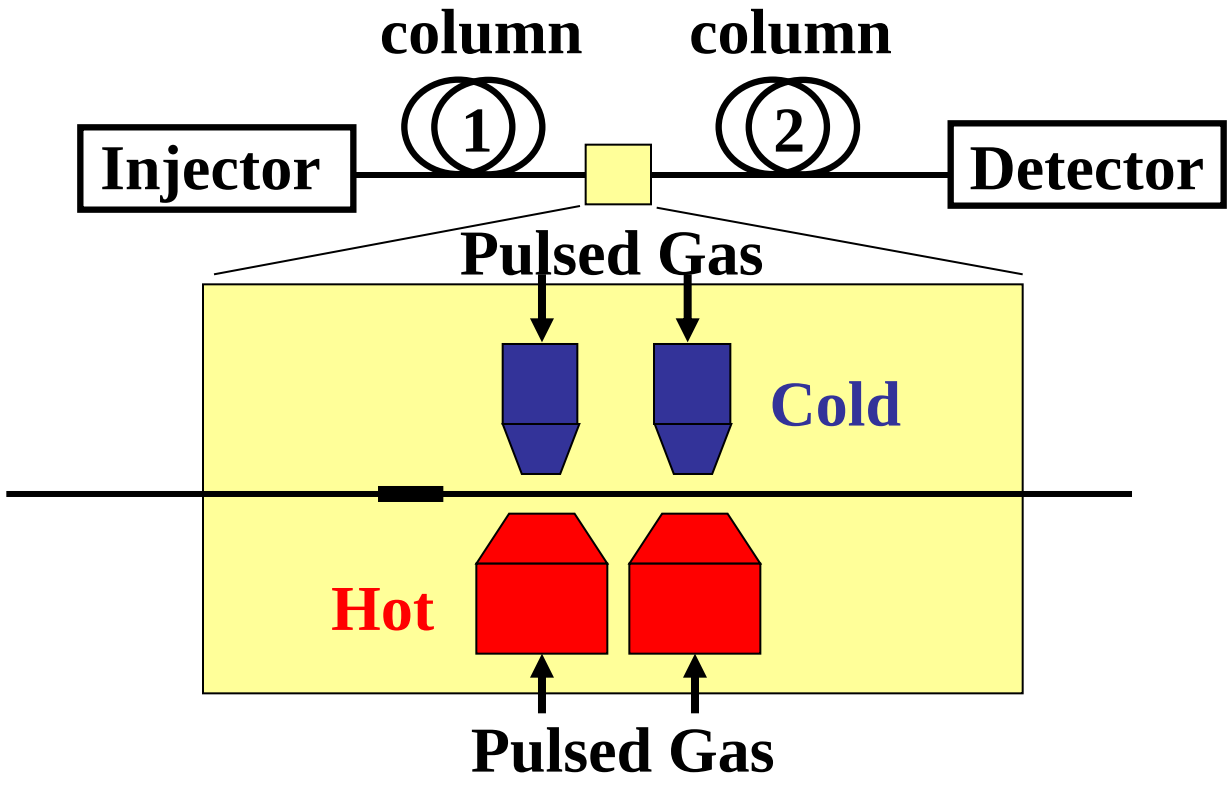
separation: ***polarity***



„GC x GC“

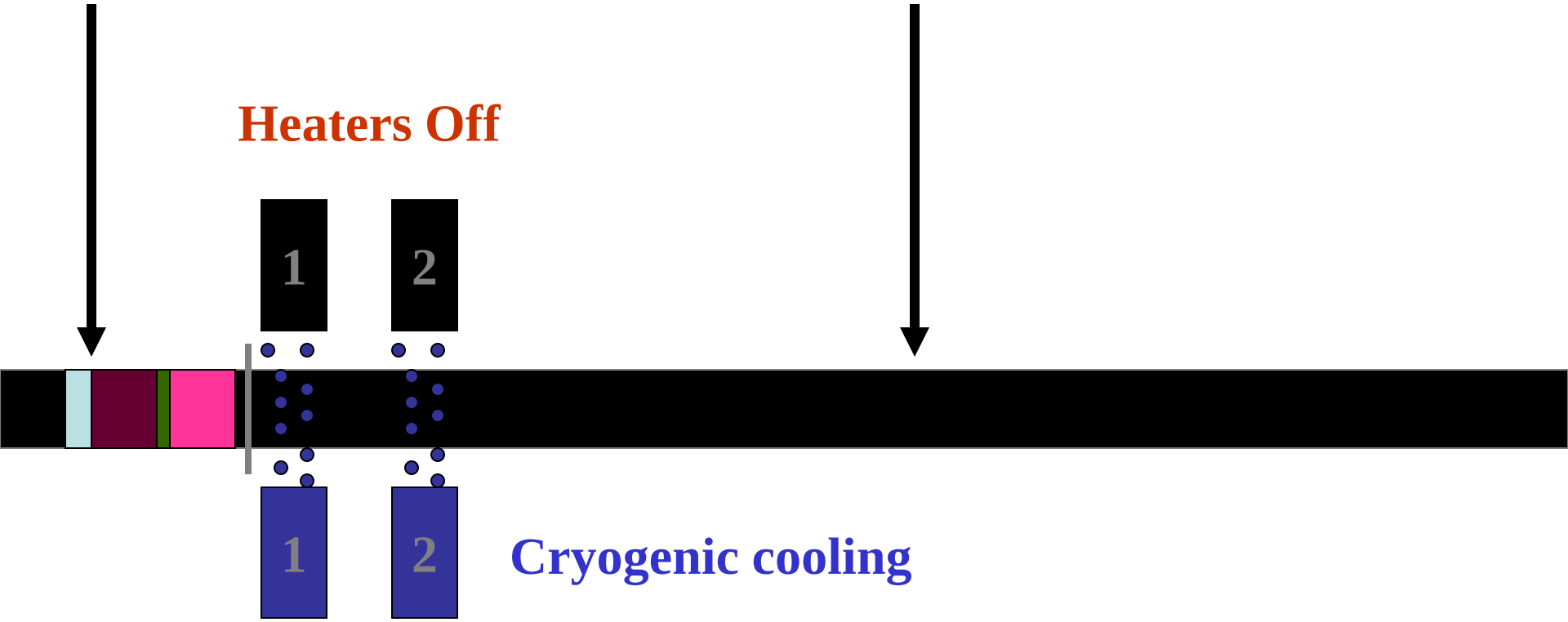

Secondary oven
Primary oven
Secondary column
Modulator
Primary column

„GC x GC“ - MODULATOR



Comprehensive GCxGC

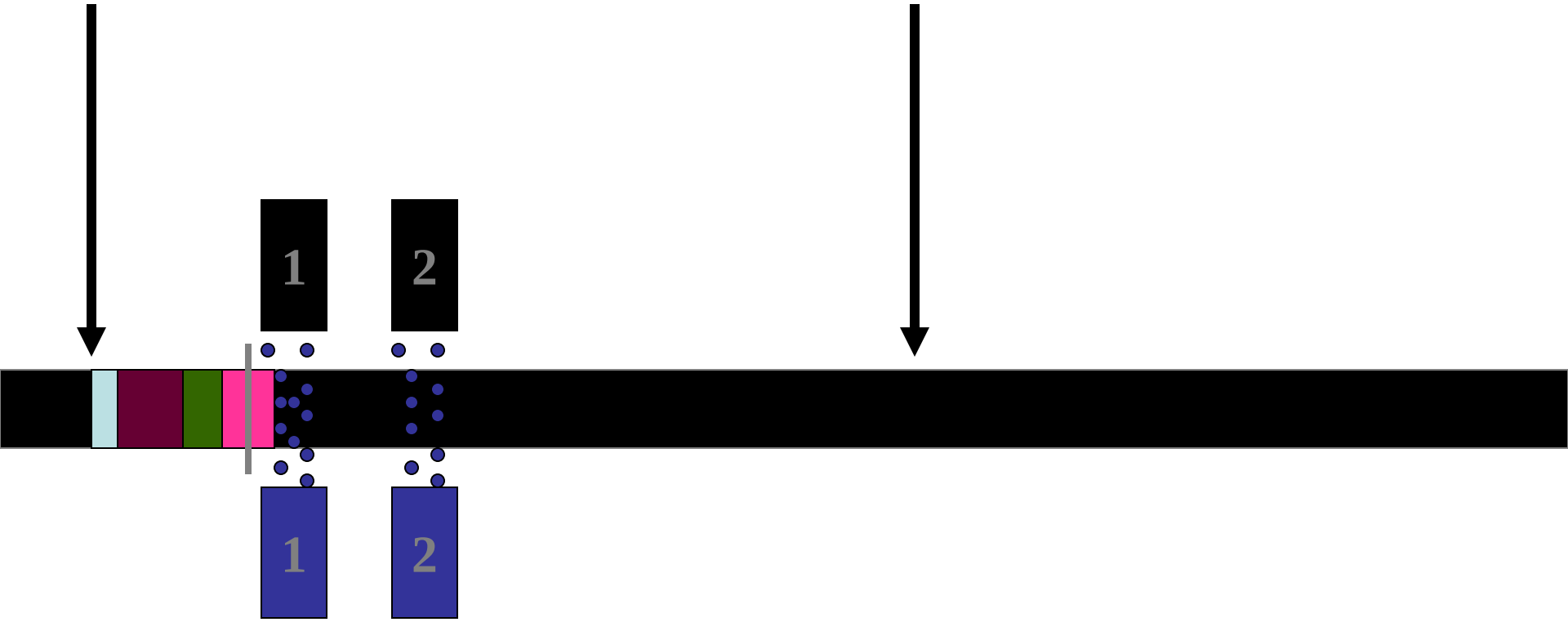
Column 1: nonpolar phase **Column 2: polar phase**



Partial separation on column 1

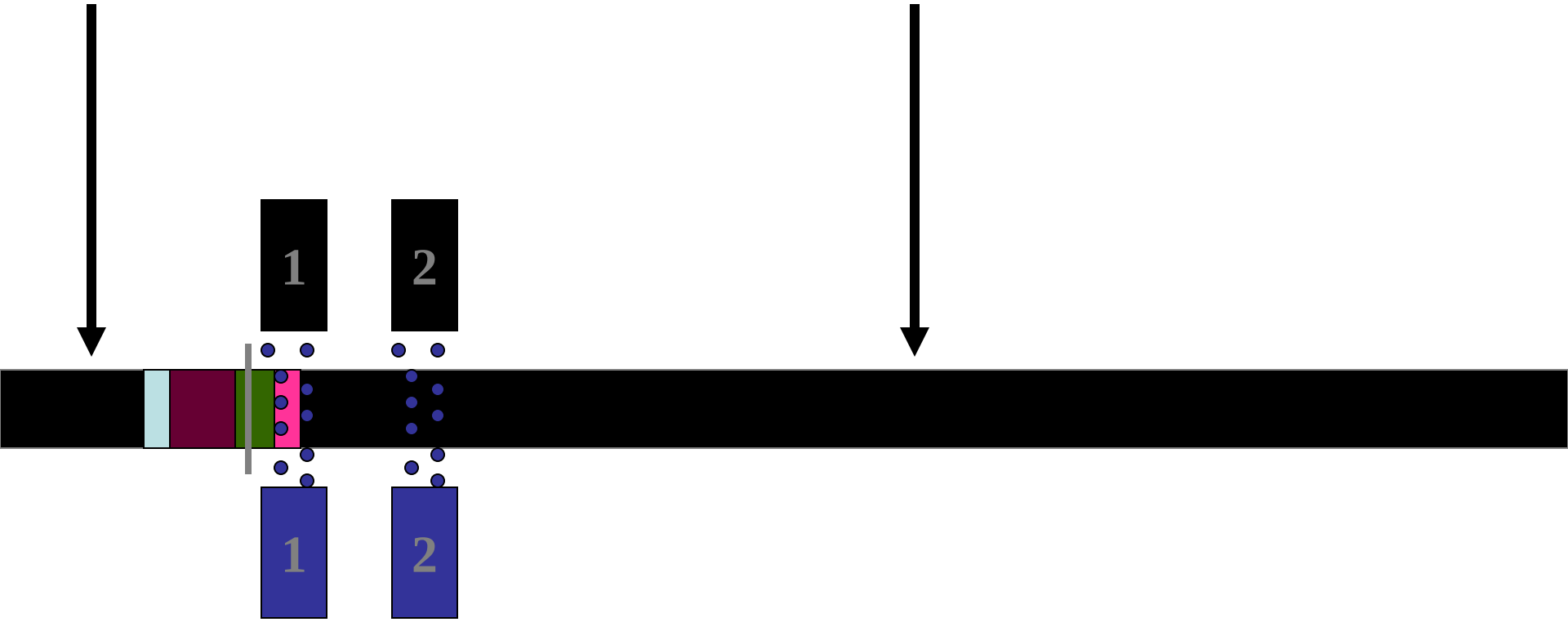
Comprehensive GCxGC

Column 1: nonpolar phase **Column 2: polar phase**



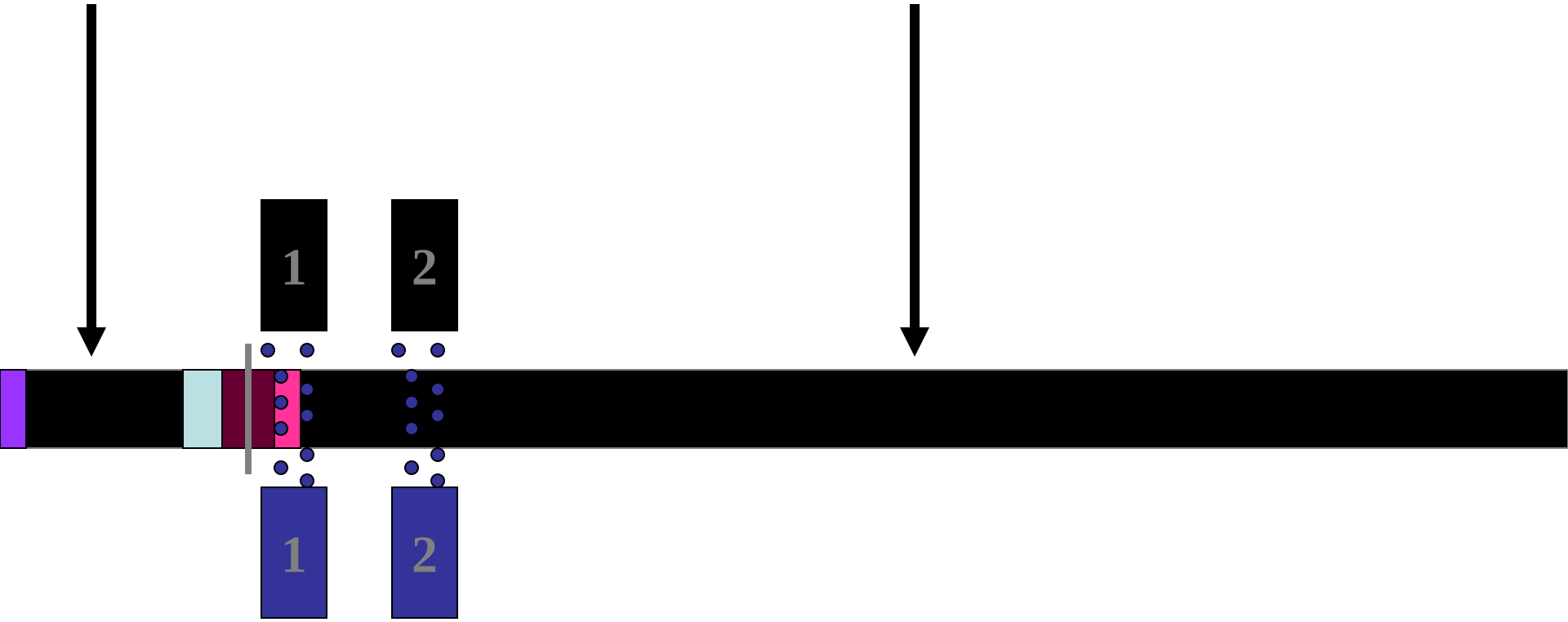
Comprehensive GCxGC

Column 1: nonpolar phase **Column 2: polar phase**



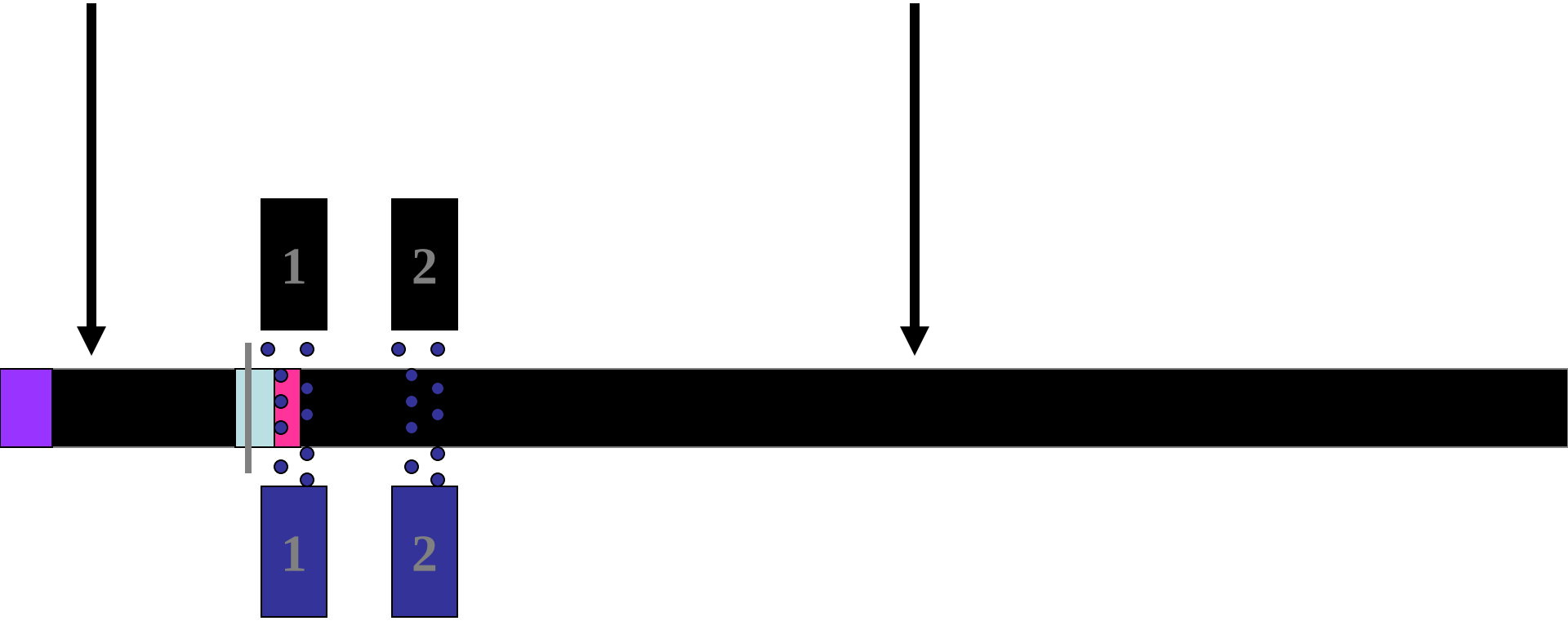
Comprehensive GCxGC

Column 1: nonpolar phase **Column 2: polar phase**



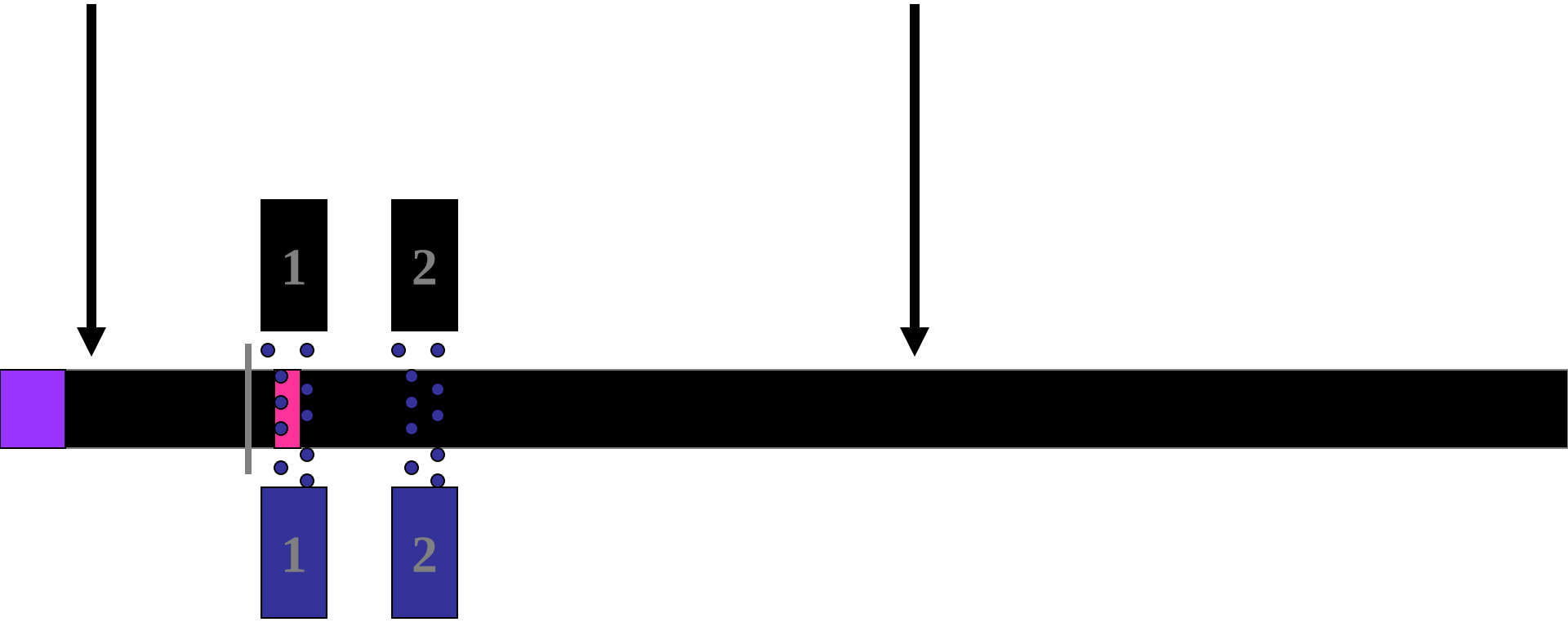
Comprehensive GCxGC

Column 1: nonpolar phase **Column 2: polar phase**



Comprehensive GCxGC

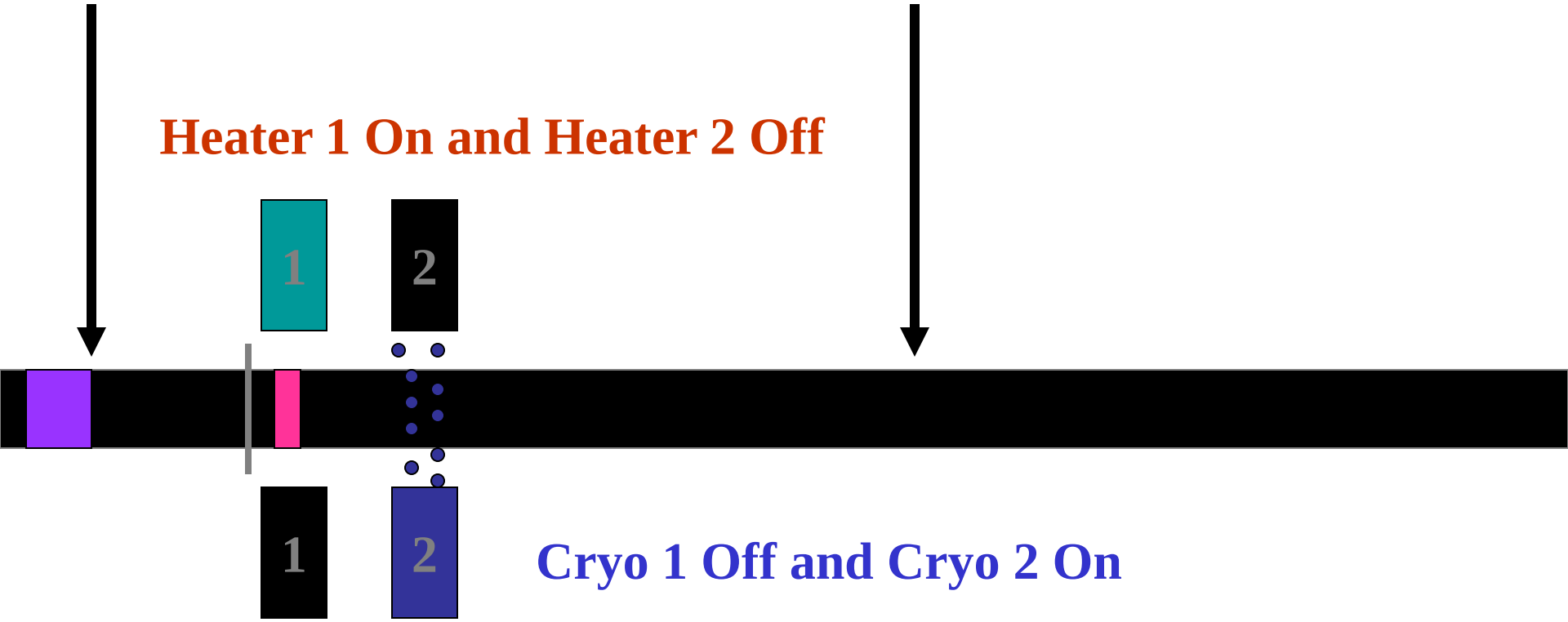
Column 1: nonpolar phase **Column 2: polar phase**



Analytes trapped in part 1 of modulator

Comprehensive GCxGC

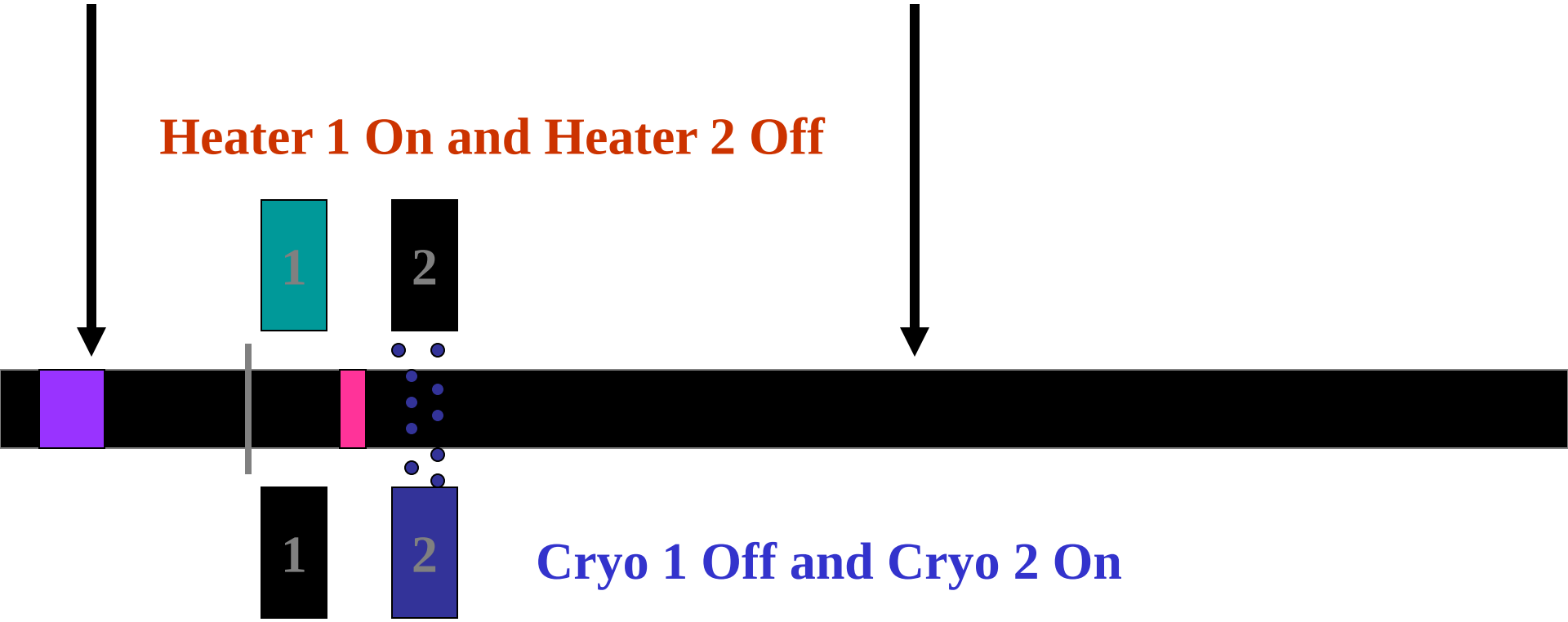
Column 1: nonpolar phase **Column 2: polar phase**



Analytes released to part 2 of modulator

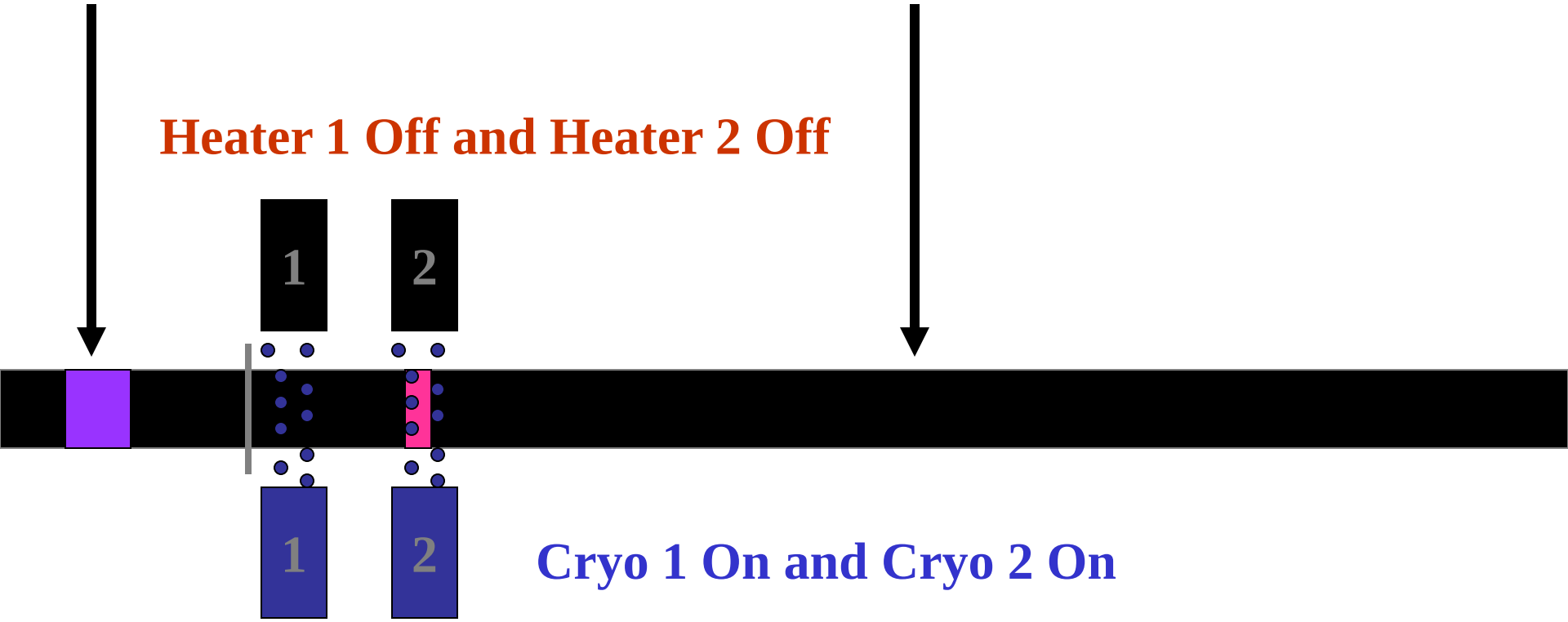
Comprehensive GCxGC

Column 1: nonpolar phase **Column 2: polar phase**



Comprehensive GCxGC

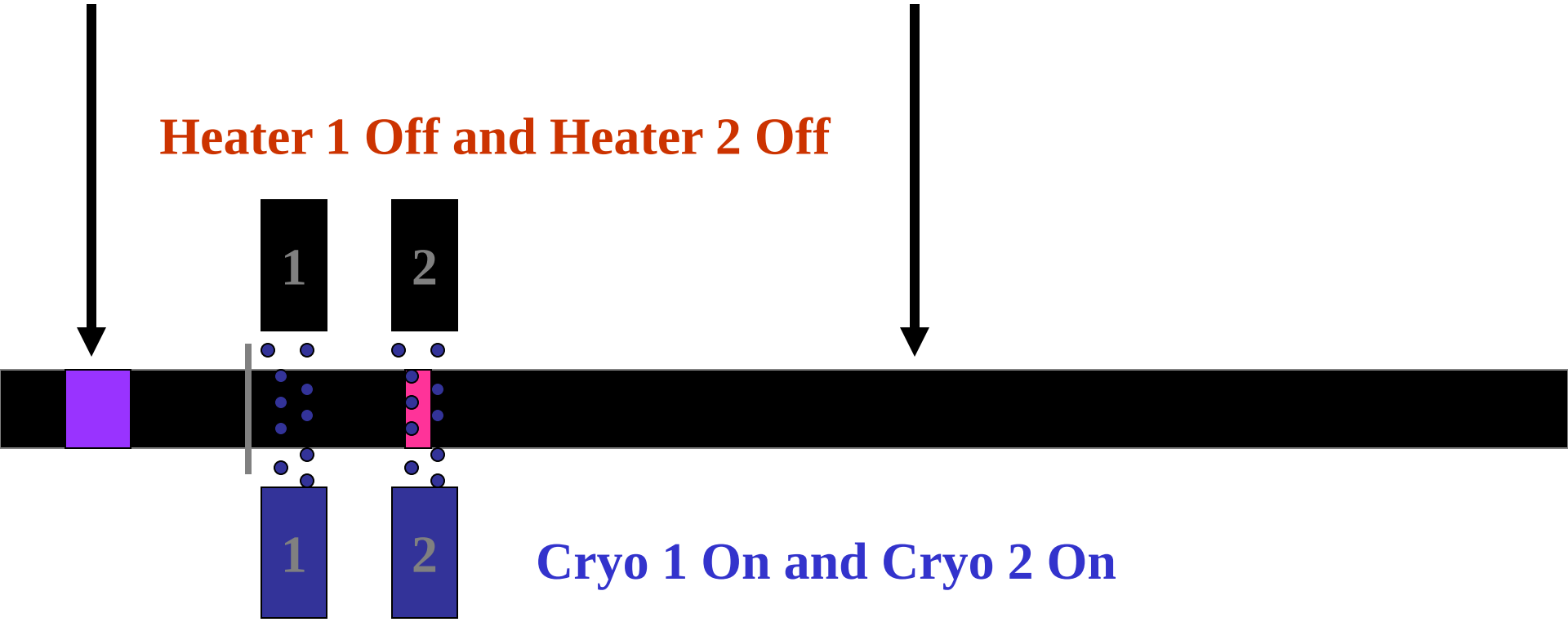
Column 1: nonpolar phase **Column 2: polar phase**



Part 1 is coming back to the mode of analytes trapping

Comprehensive GCxGC

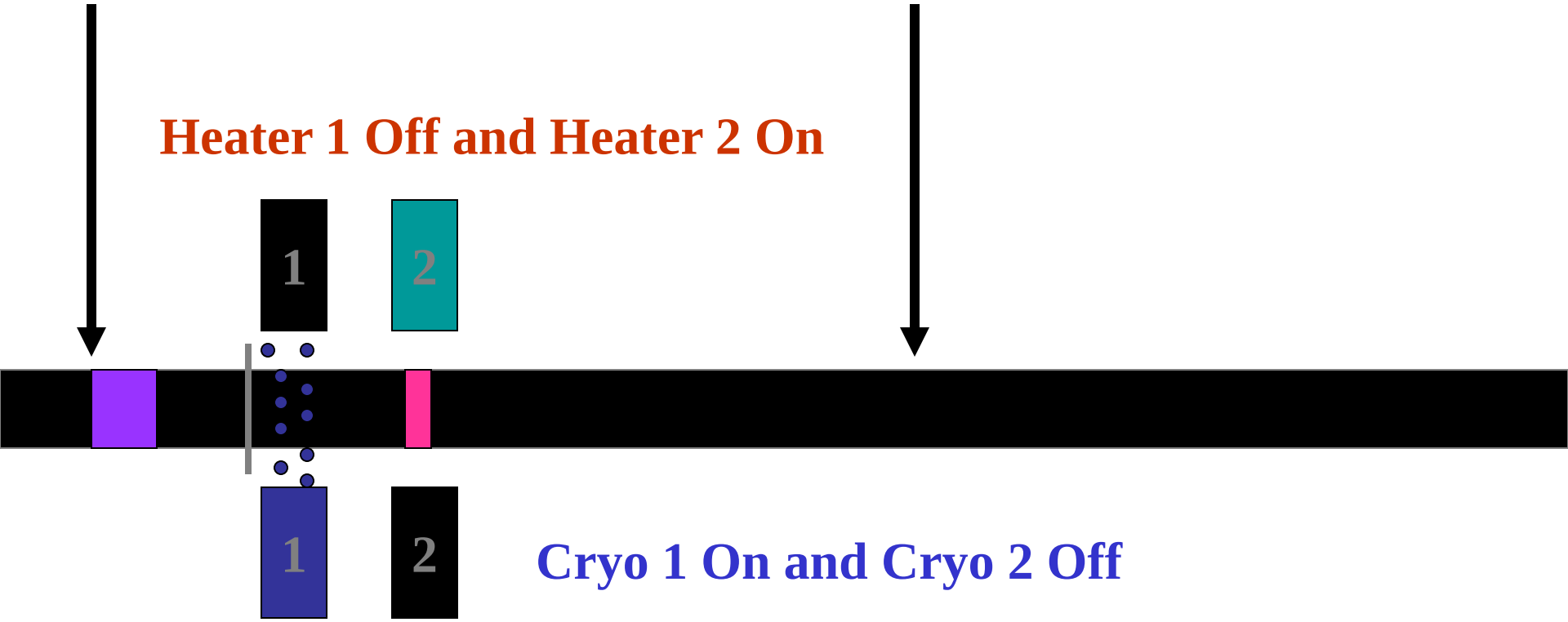
Column 1: nonpolar phase **Column 2: polar phase**



Analytes trapped in part 2 of modulator

Comprehensive GCxGC

Column 1: nonpolar phase **Column 2: polar phase**

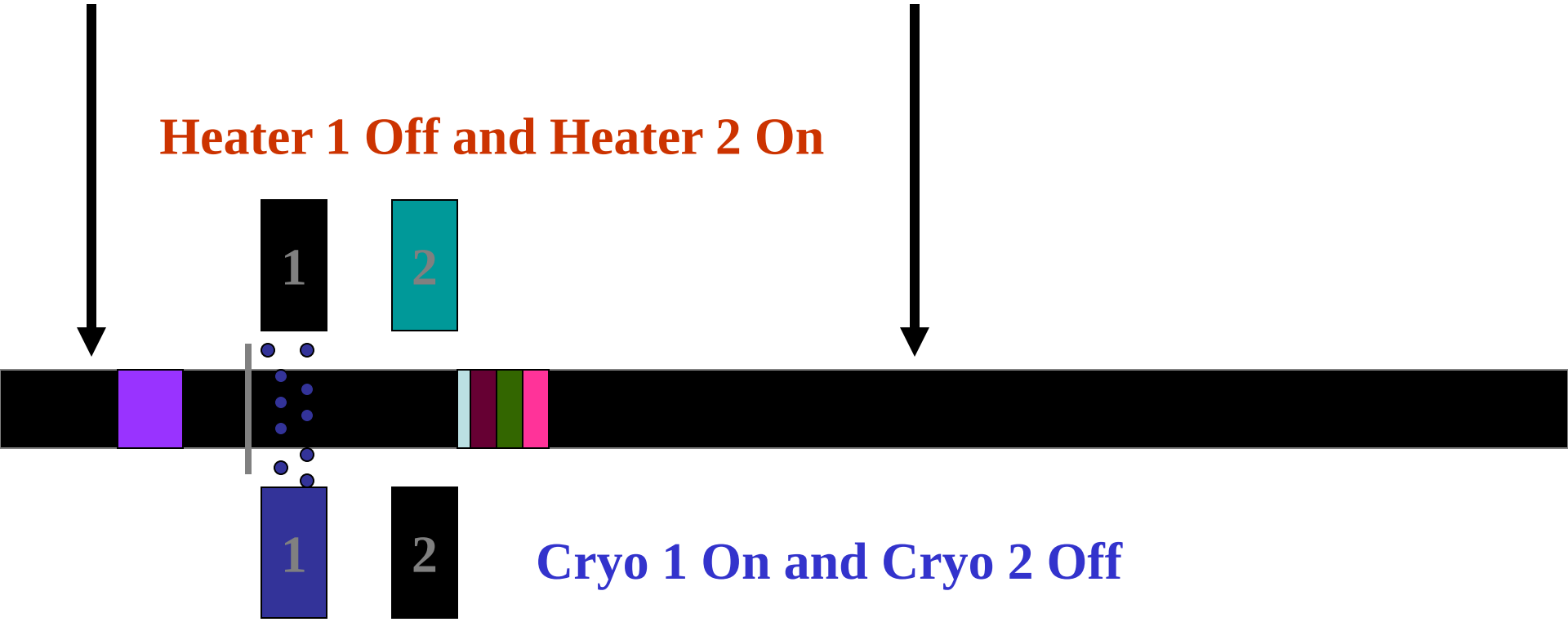


Analytes released to column 2

Comprehensive GCxGC

Column 1: nonpolar phase **Column 2: polar phase**

Heater 1 Off and Heater 2 On

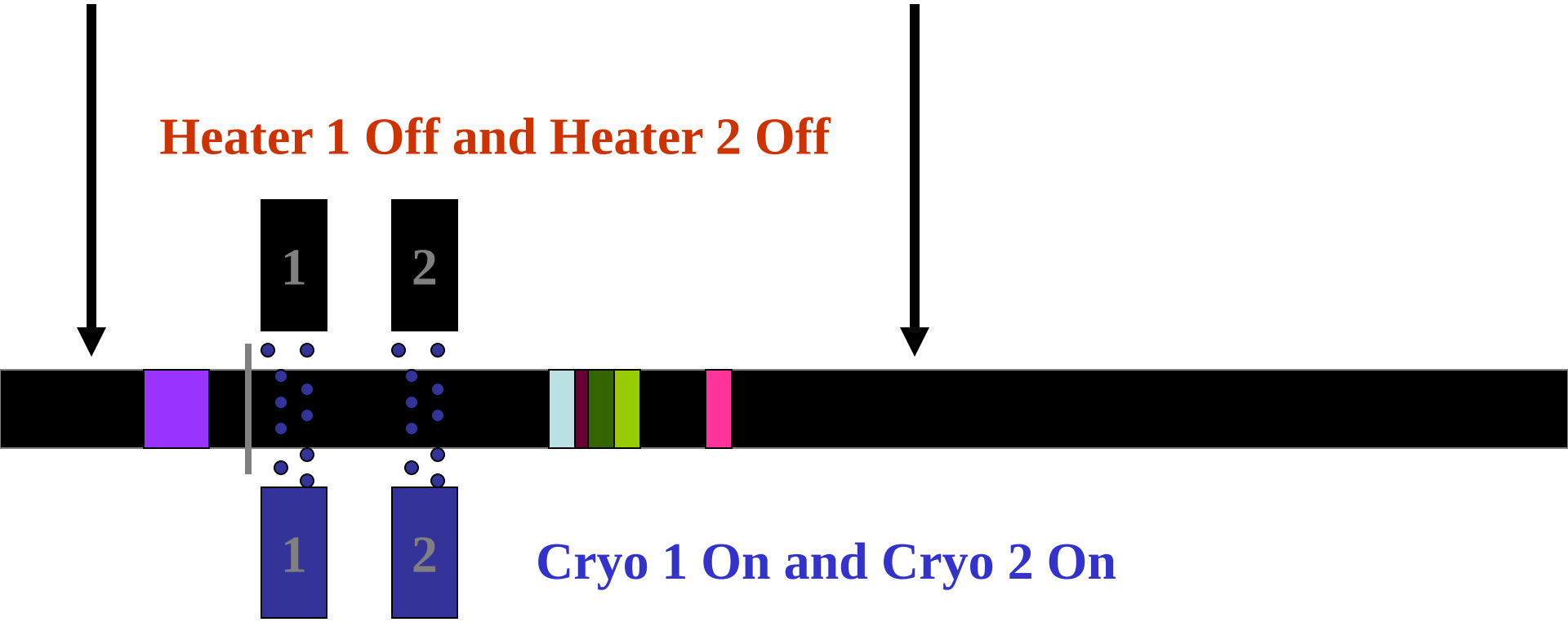


Cryo 1 On and Cryo 2 Off

Separation of analytes on column 2

Comprehensive GCxGC

Column 1: nonpolar phase **Column 2: polar phase**

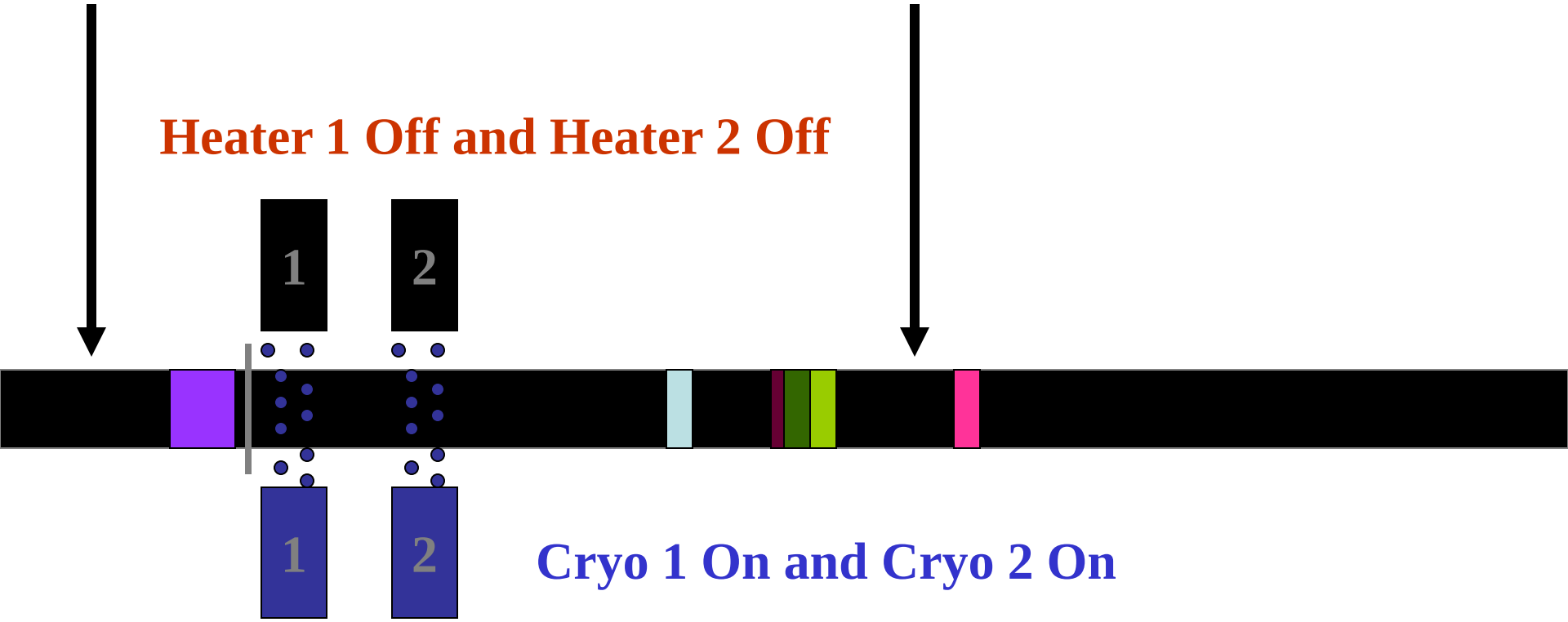


Separation of analytes on column 2

Next band of analytes is entering into modulator

Comprehensive GCxGC

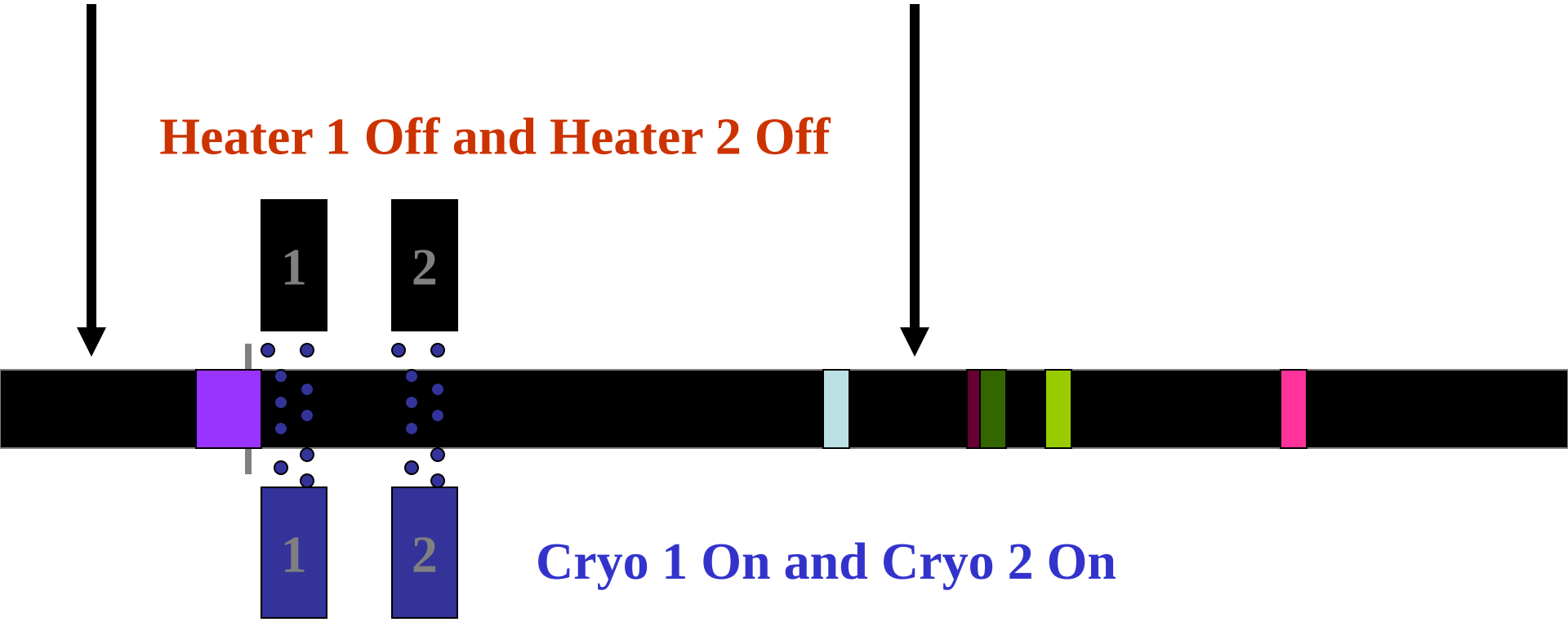
Column 1: nonpolar phase **Column 2: polar phase**



Separation of analytes on column 2

Comprehensive GCxGC

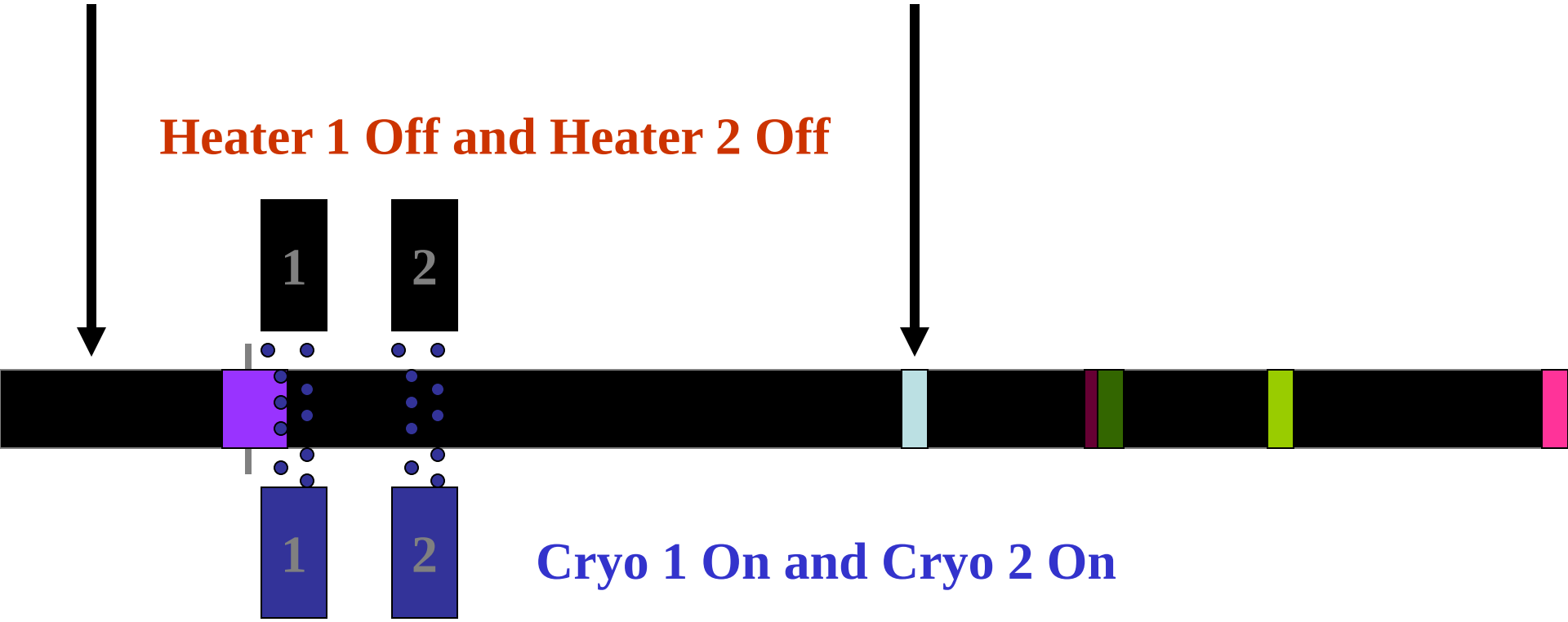
Column 1: nonpolar phase **Column 2: polar phase**



Separation of analytes on column 2

Comprehensive GCxGC

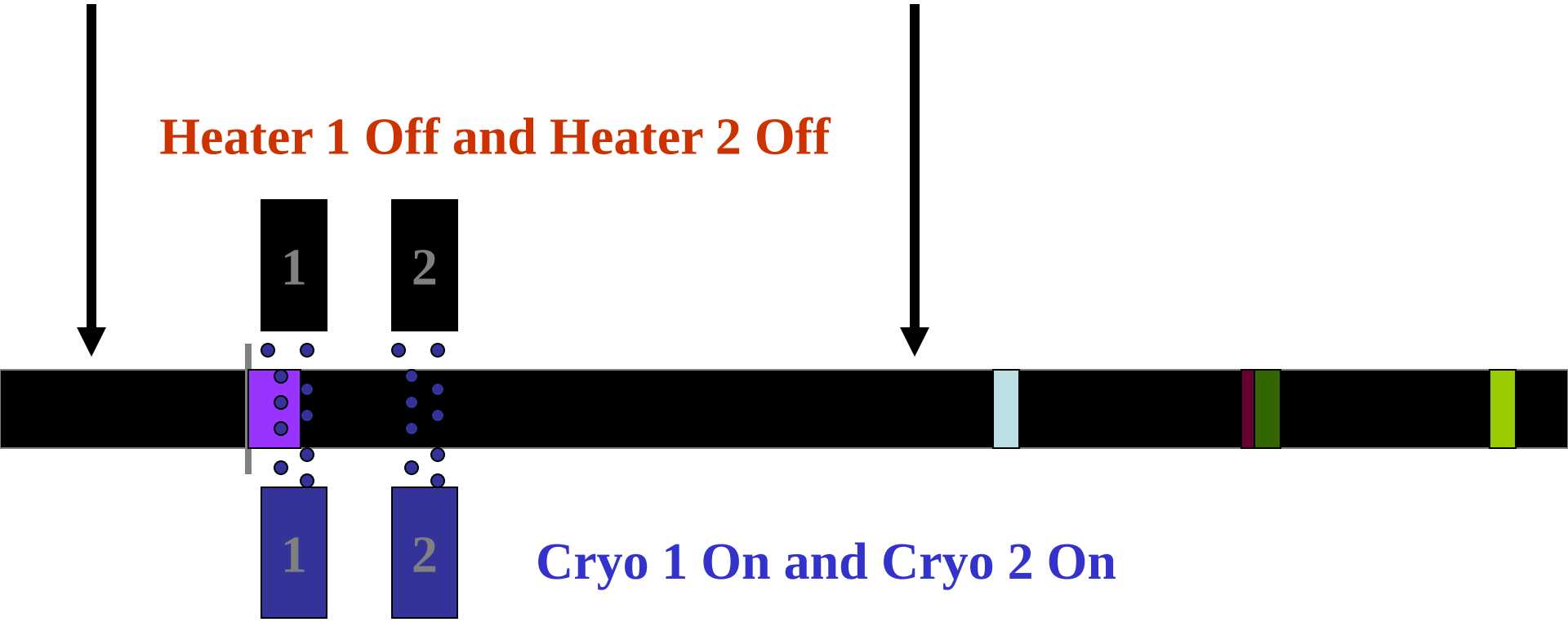
Column 1: nonpolar phase **Column 2: polar phase**



Separation of analytes on column 2

Comprehensive GCxGC

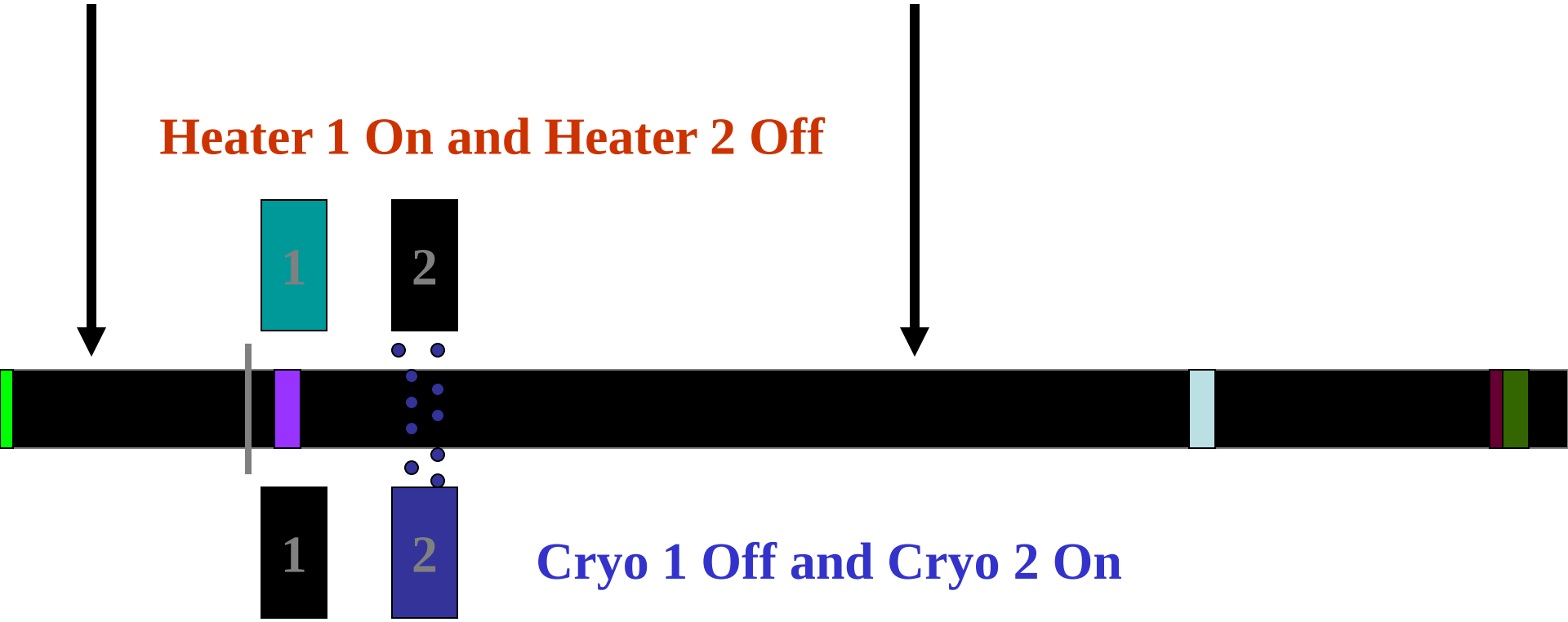
Column 1: nonpolar phase **Column 2: polar phase**



Separation of analytes on column 2

Comprehensive GCxGC

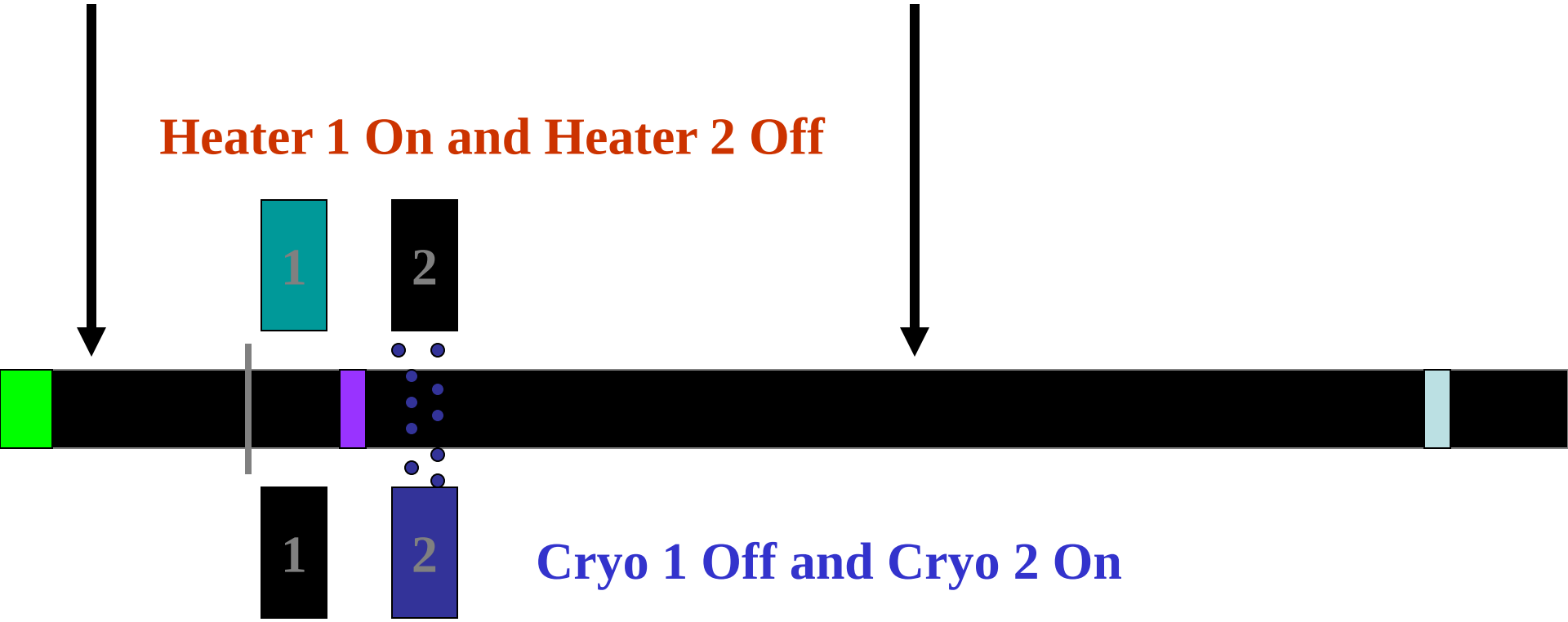
Column 1: nonpolar phase **Column 2: polar phase**



Separation of analytes on column 2

Comprehensive GCxGC

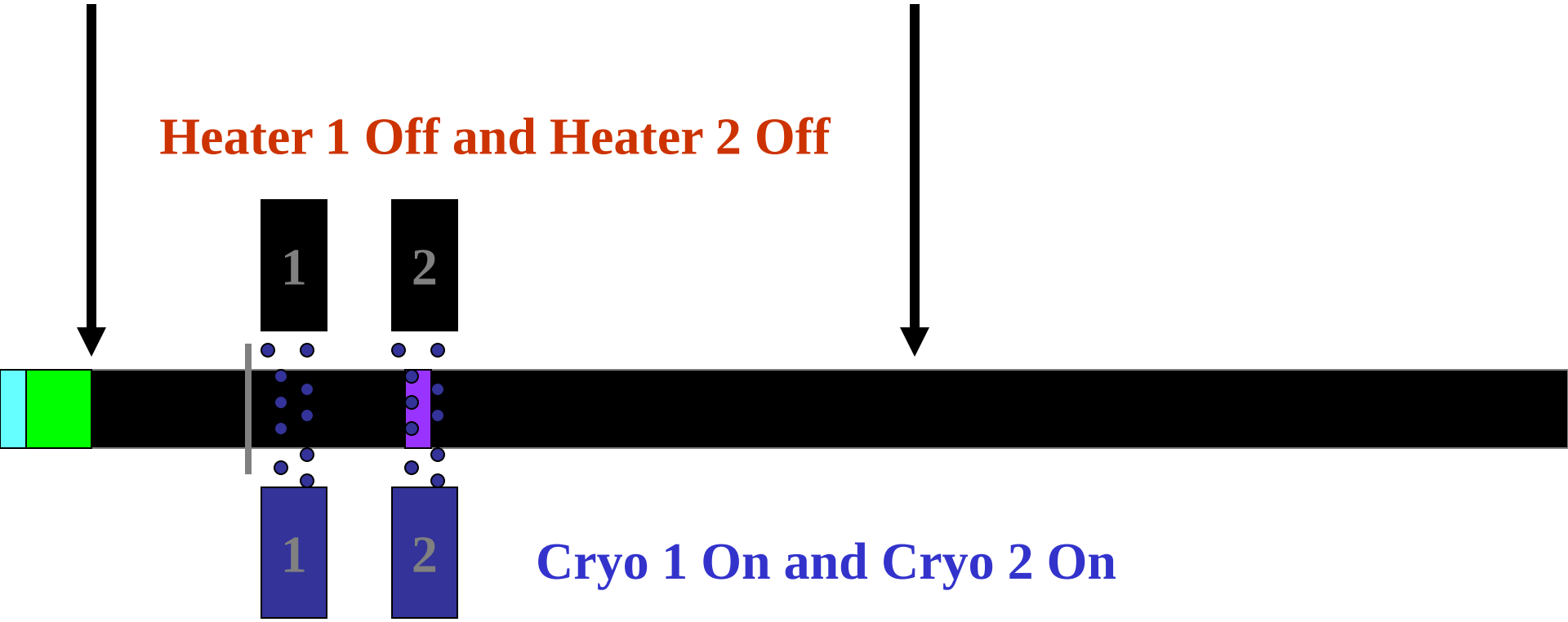
Column 1: nonpolar phase **Column 2: polar phase**



Separation of analytes on column 2

Comprehensive GCxGC

Column 1: nonpolar phase **Column 2: polar phase**

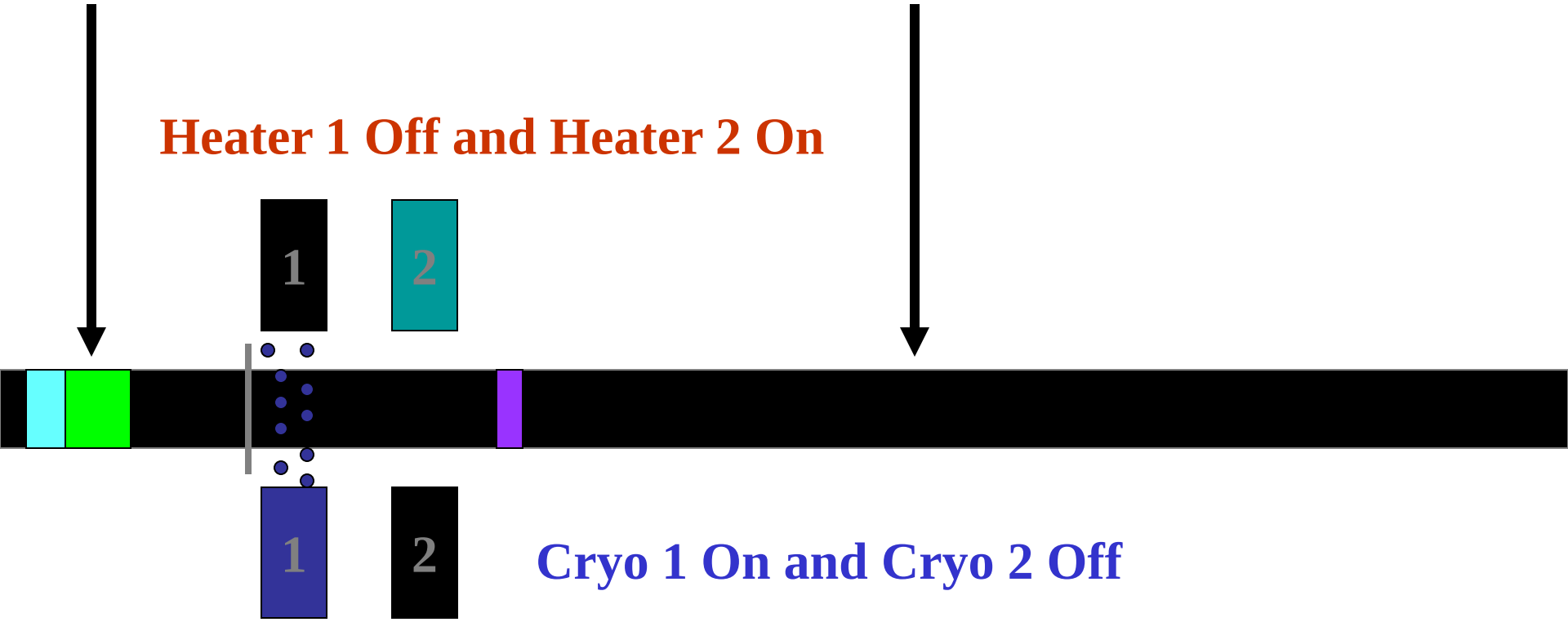


Next separation in 2. dimension can start

Comprehensive GCxGC

Column 1: nonpolar phase **Column 2: polar phase**

Heater 1 Off and Heater 2 On

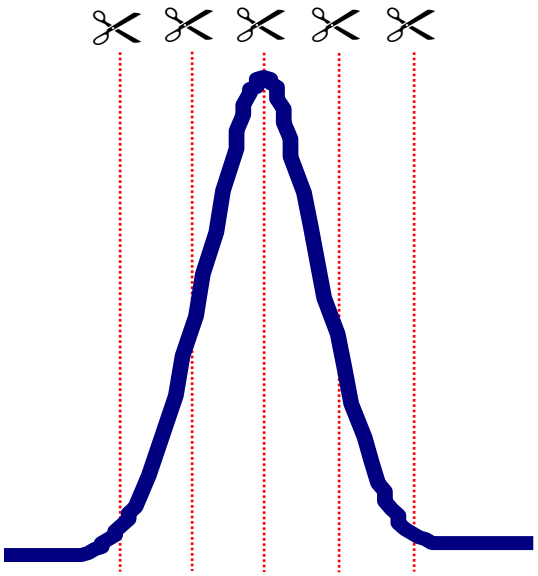


Cryo 1 On and Cryo 2 Off

Next separation in 2. dimension started

„GC x GC“ - MODULATOR

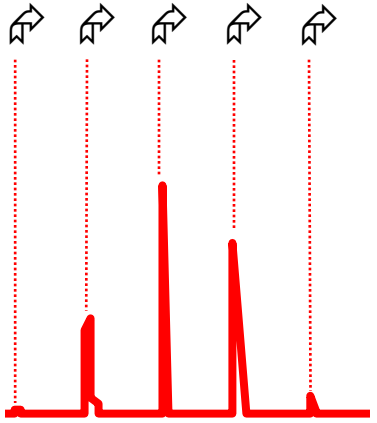
1. Modulator transfers portions of effluent from 1. column in defined periods
2. Cryo-concentrated portions are transferred to 2. column
3. Fast separation on 2. column



Effluent from 1. column

Modulation

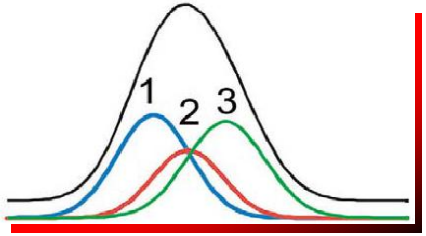
(cryo-concentration)



Effluent from 2. column

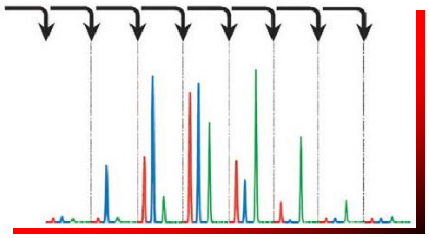
GC x GC CHROMATOGRAM - creation

1D chromatogram
(1. column output)



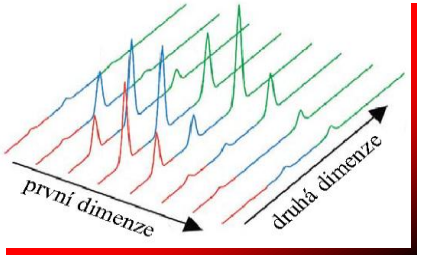
MODULATION

2D chromatogram basic
(2. column output)



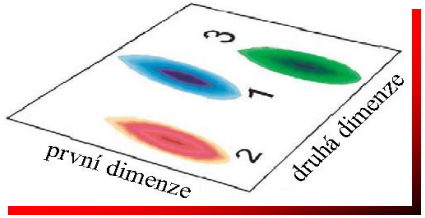
TRANSFORMATION

2D chromatograms
composed in parallel

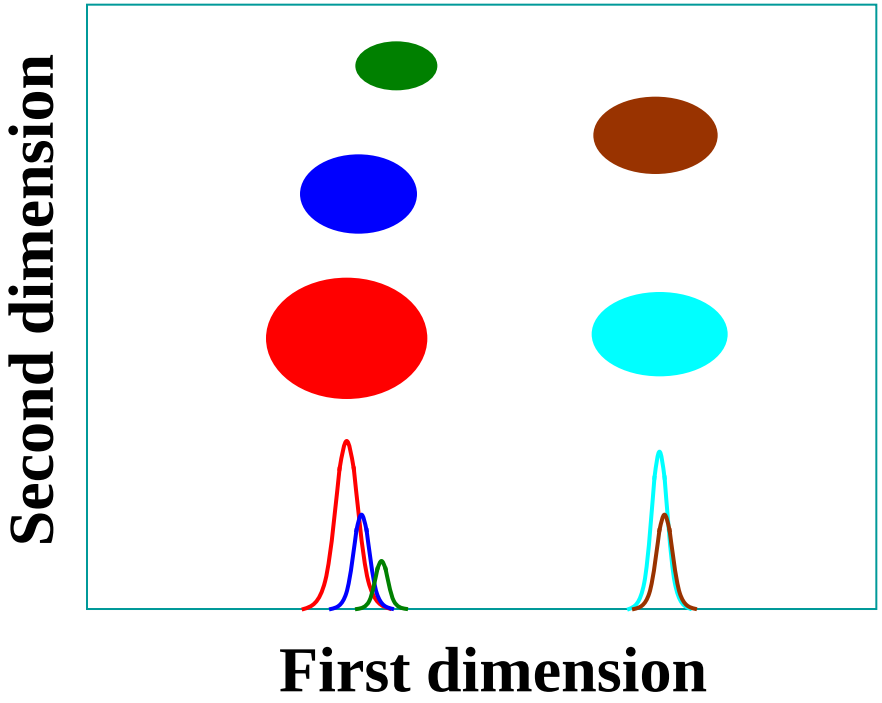


VIZUALISATION

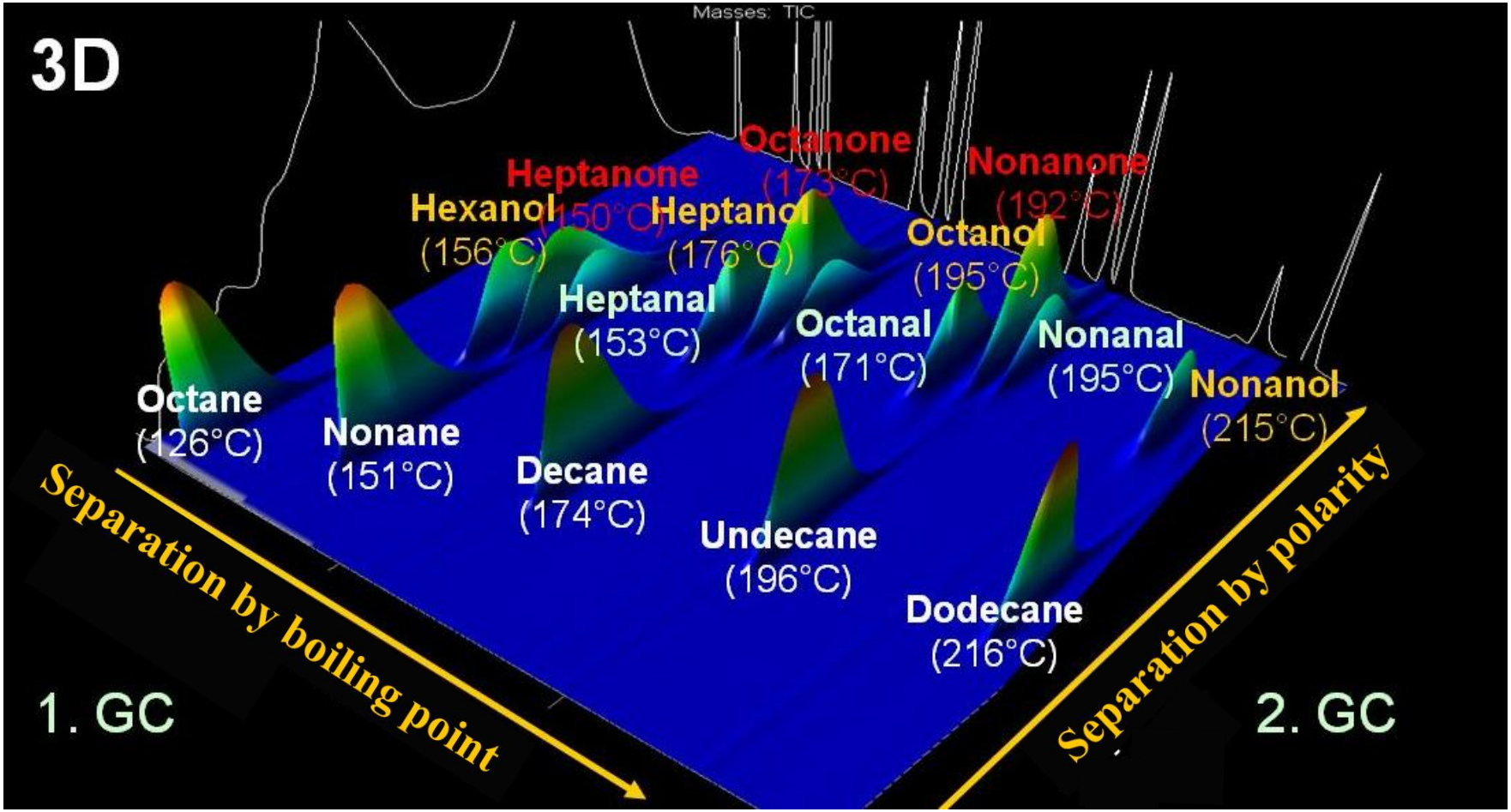
2D contour plot of chromatogram



GC x GC CHROMATOGRAM - creation



GC x GC CHROMATOGRAM - creation



GC x GC CHROMATOGRAM - creation