The composition and analyses of oil fractions present in food

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Workshop MOCRINIS
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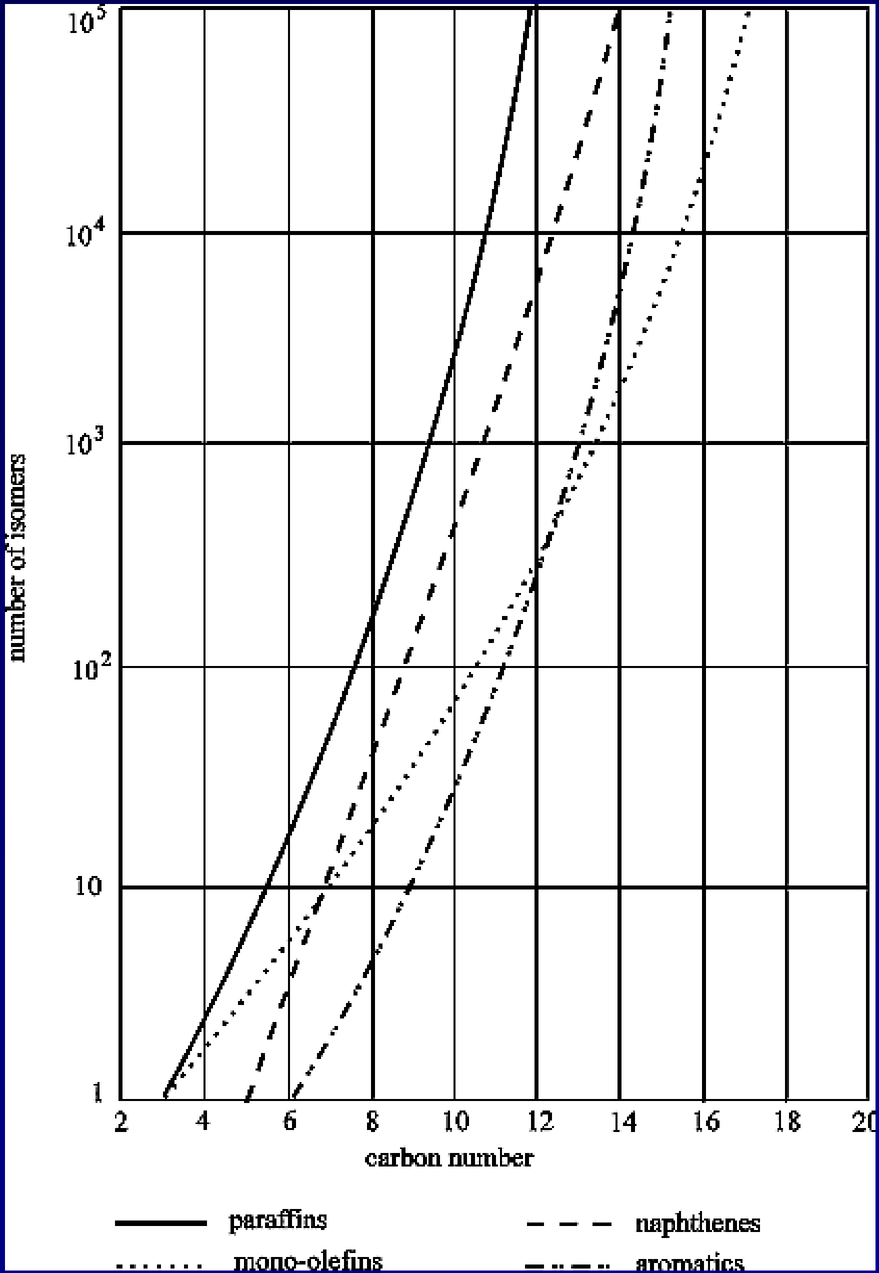
The anlayses of oil fractions

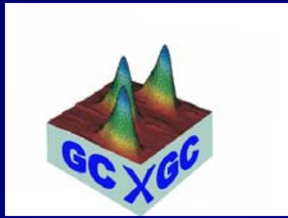
Different from GC analyses in general : The complete matrix composition has to be determined.

Advantage: in general, contain only hydrocarbons

Disadvantage: contain enormous amounts of isomeric compounds

The number of possible hydrocarbon isomers





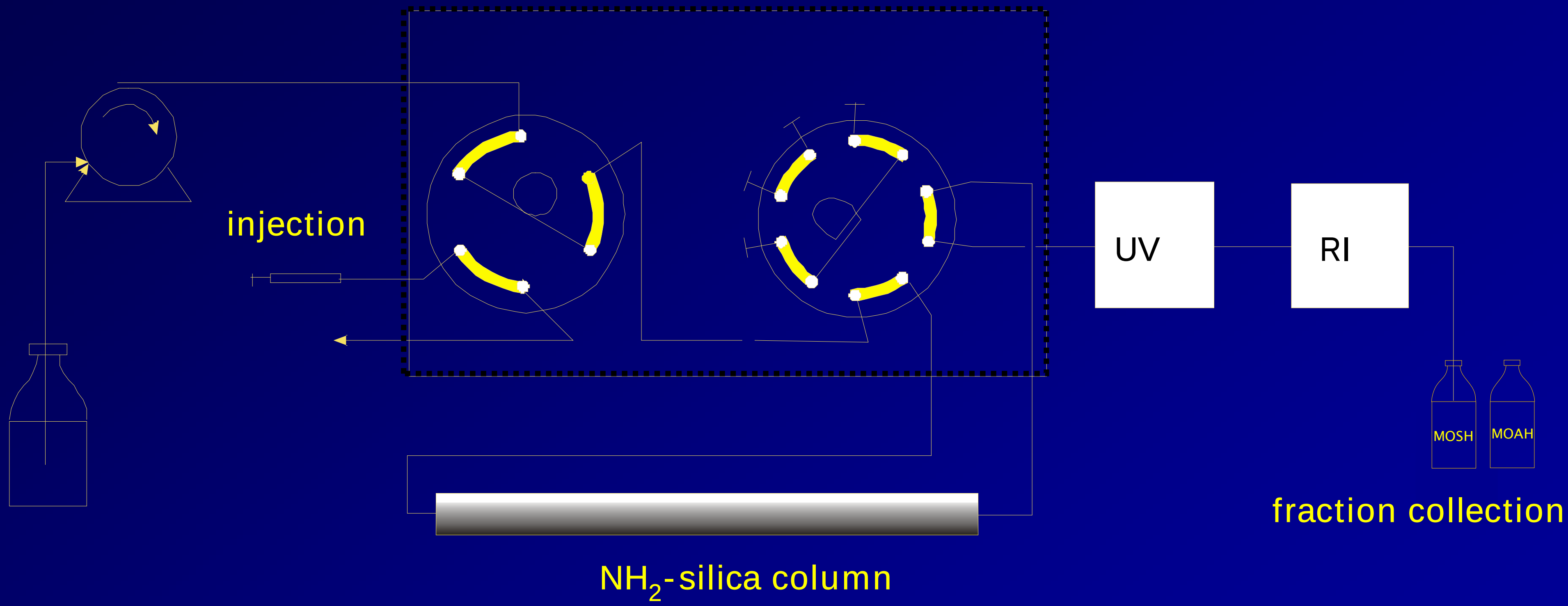
The composition of oil fractions

1. Saturates (MOSH)
   - → Straight chain alkanes
   - → Branched alkanes
   - → Cyclic alkanes

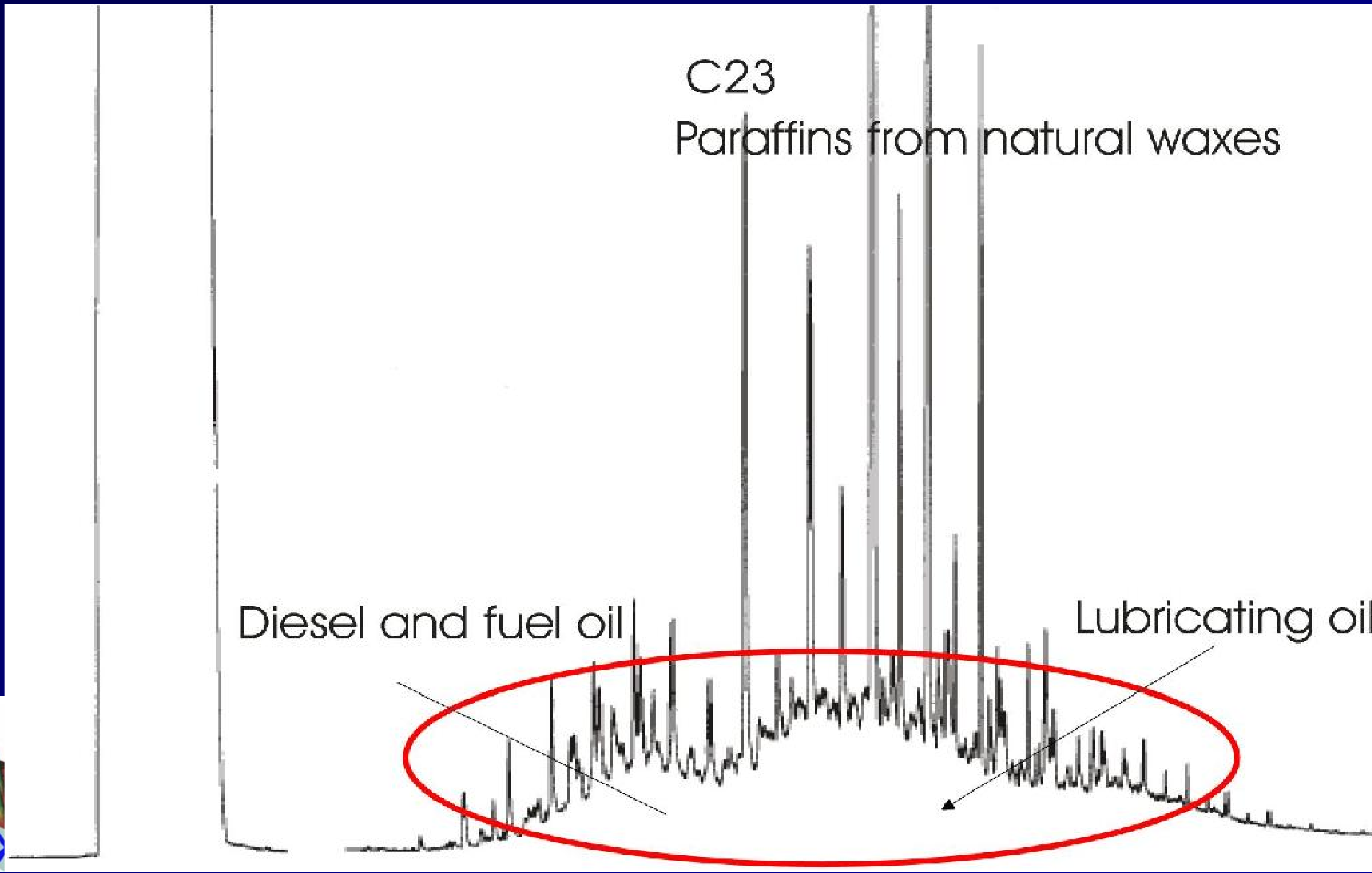
2. Aromatics (MOAH)
   - → Mono-aromatics
   - → Higher ringsystems

(3. Sulphur compounds)

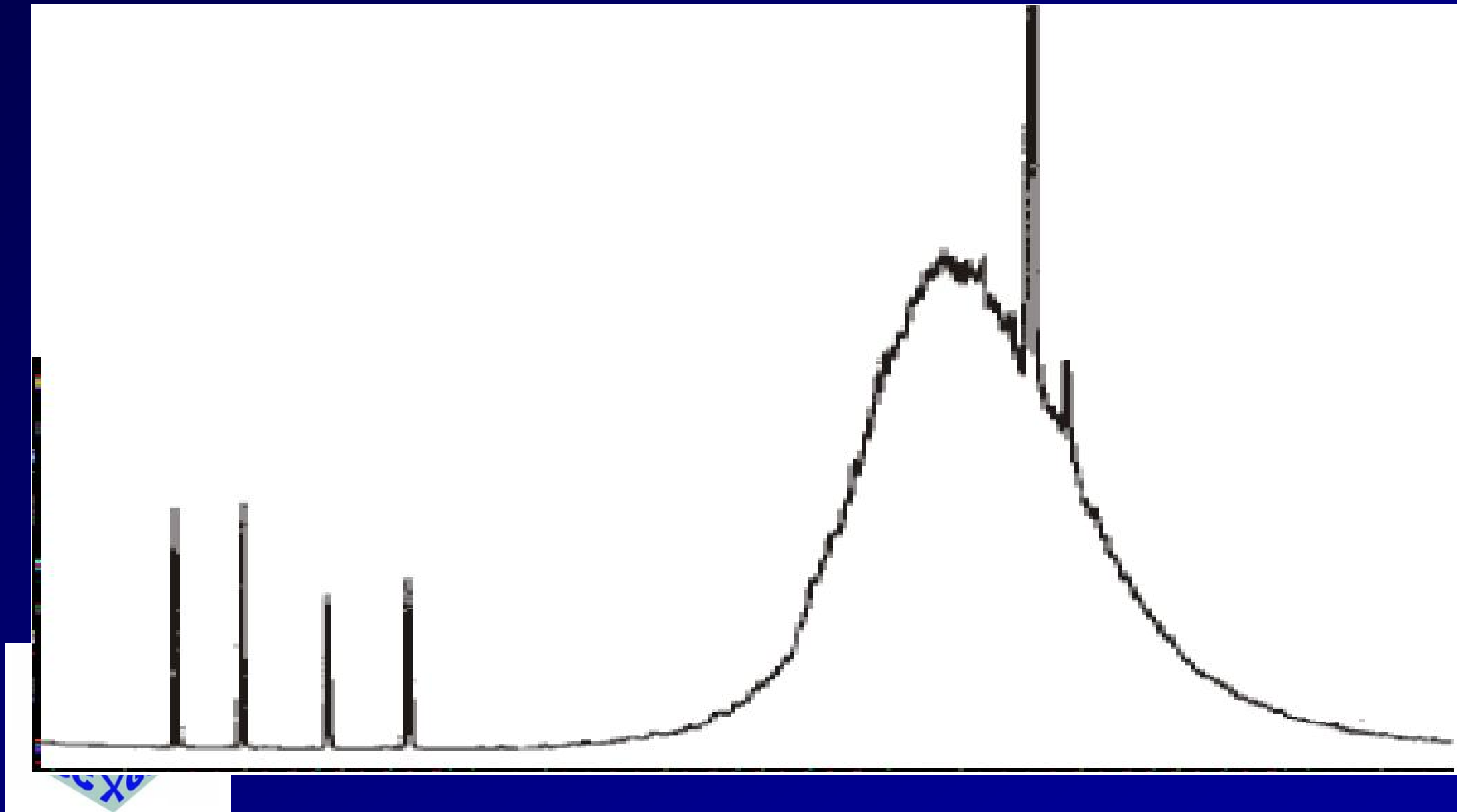
Pre-separation of MOSH and MOAH



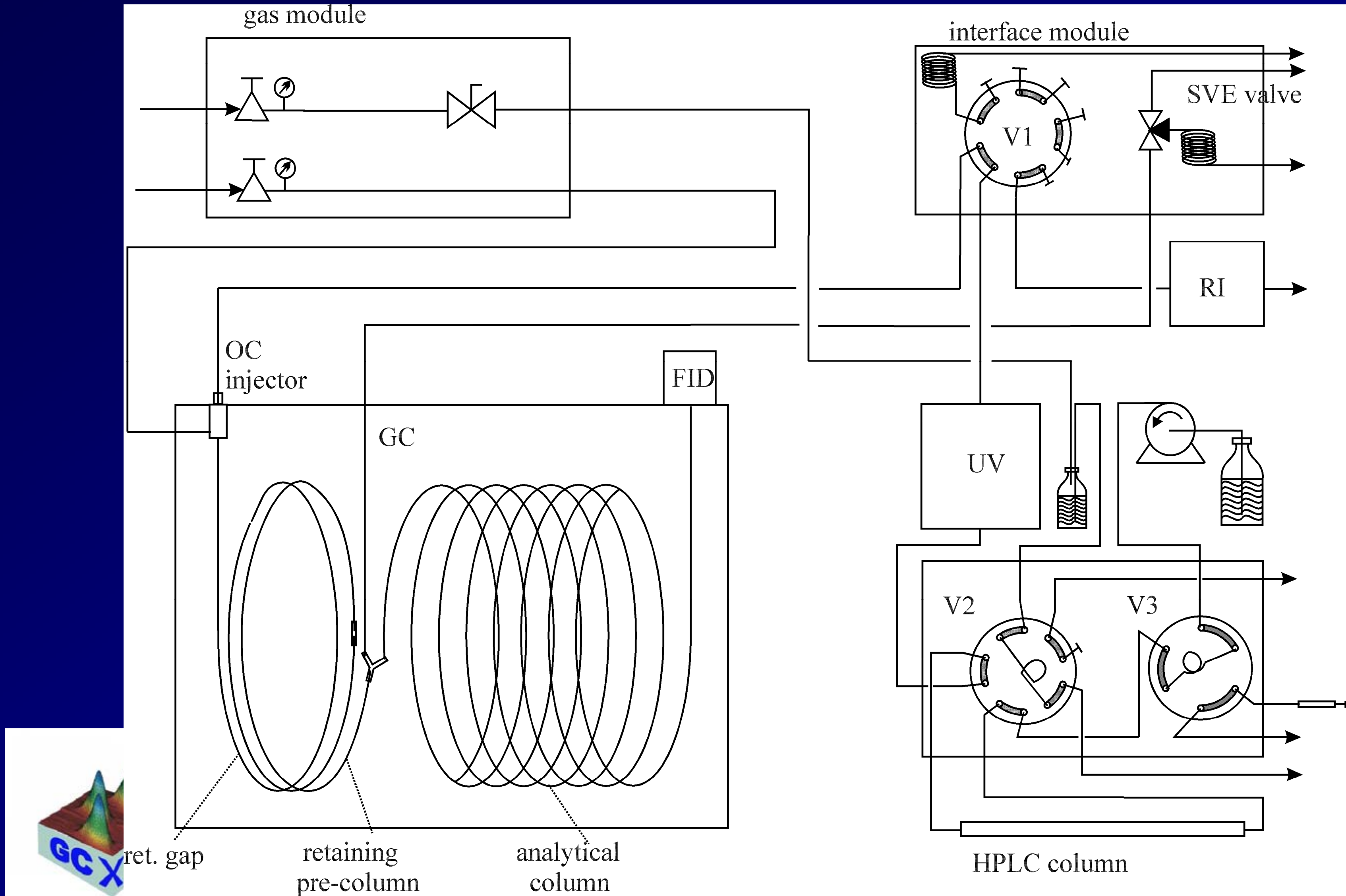
GC-analyses of the two fractions
1. MOSH



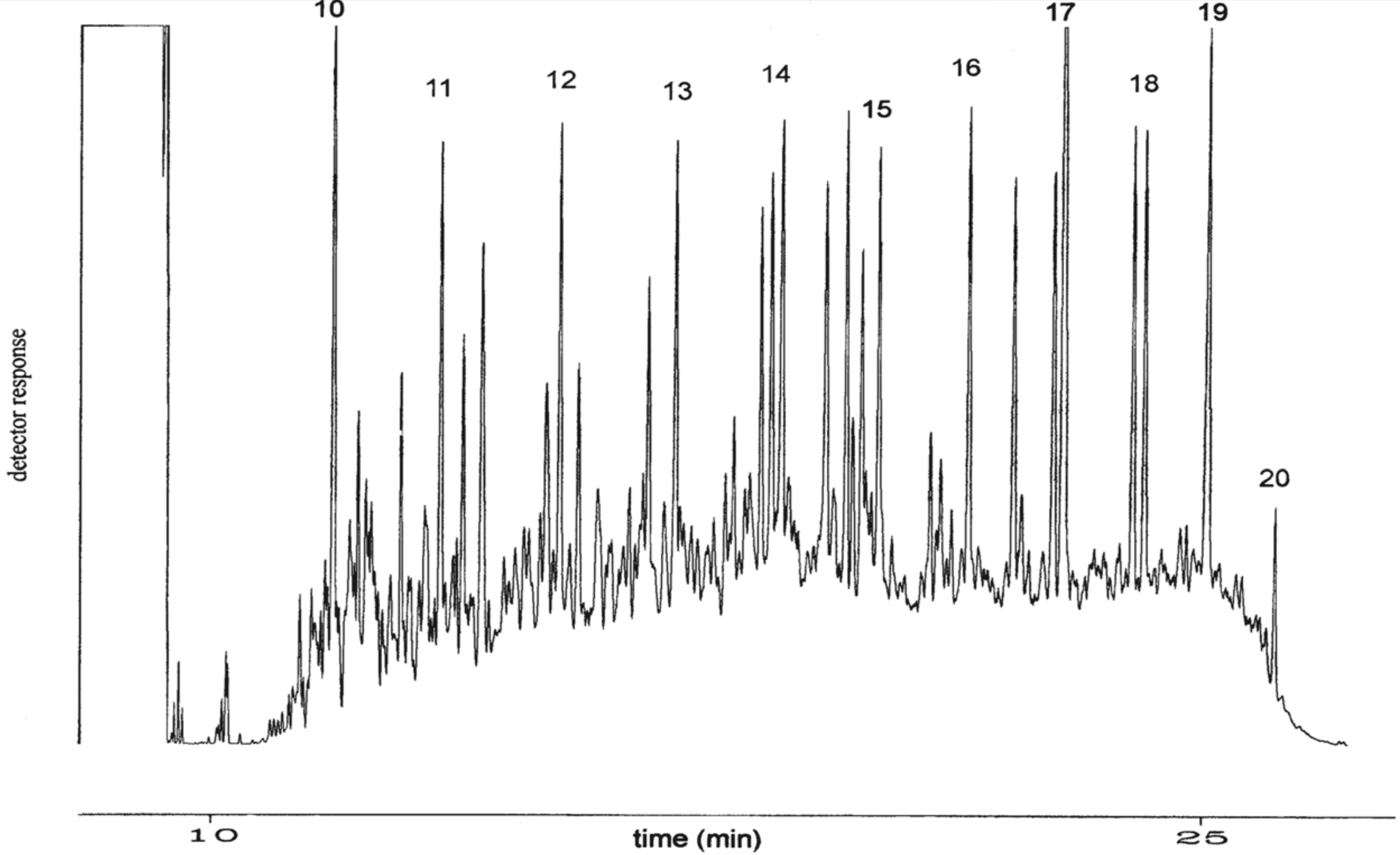
GC-analyses of the two fractions
2. MOAH



On-line LC-GC analyses of MOSH and MOAH

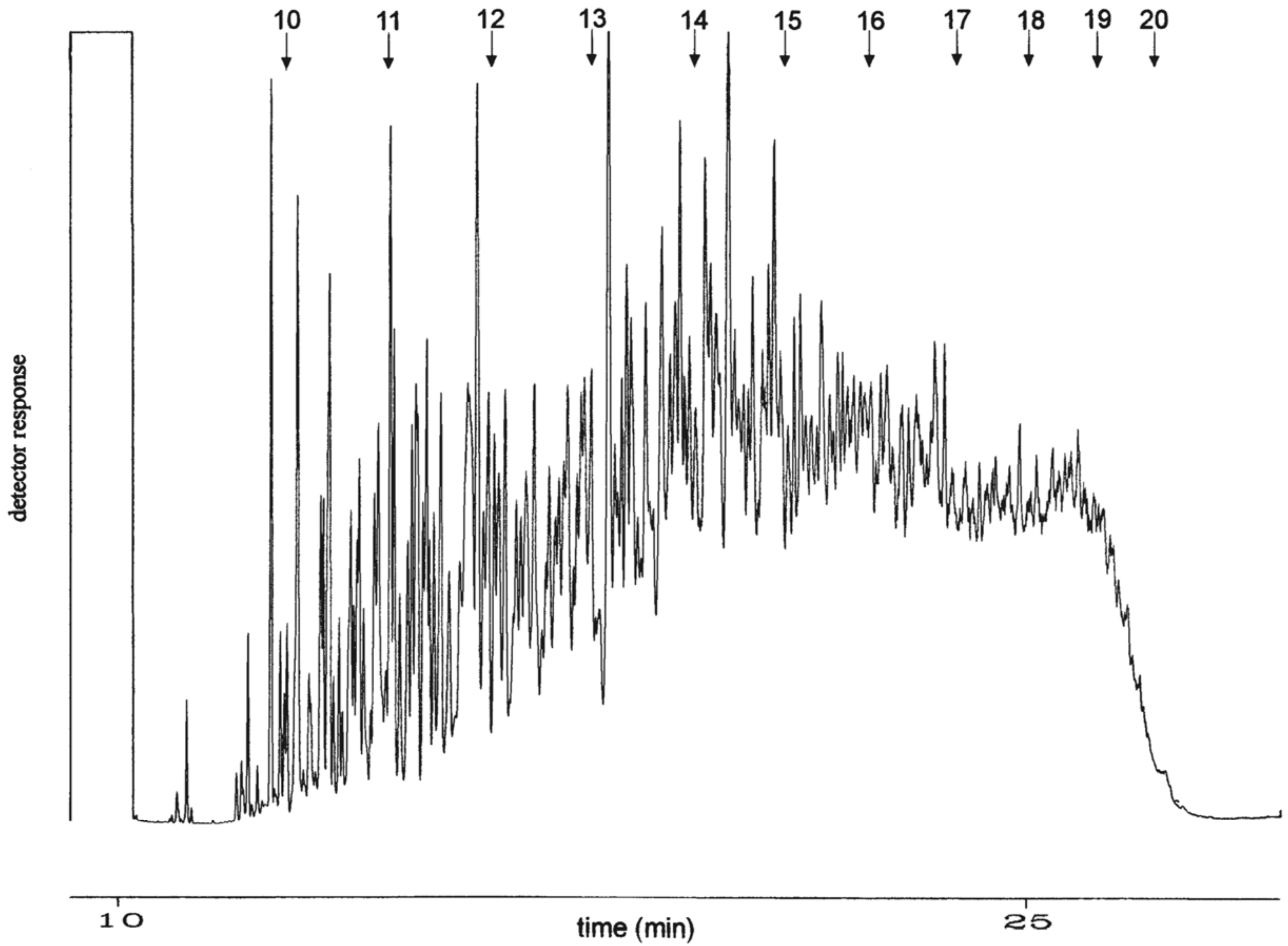


GC analysis of the different fractions
1. MOSH



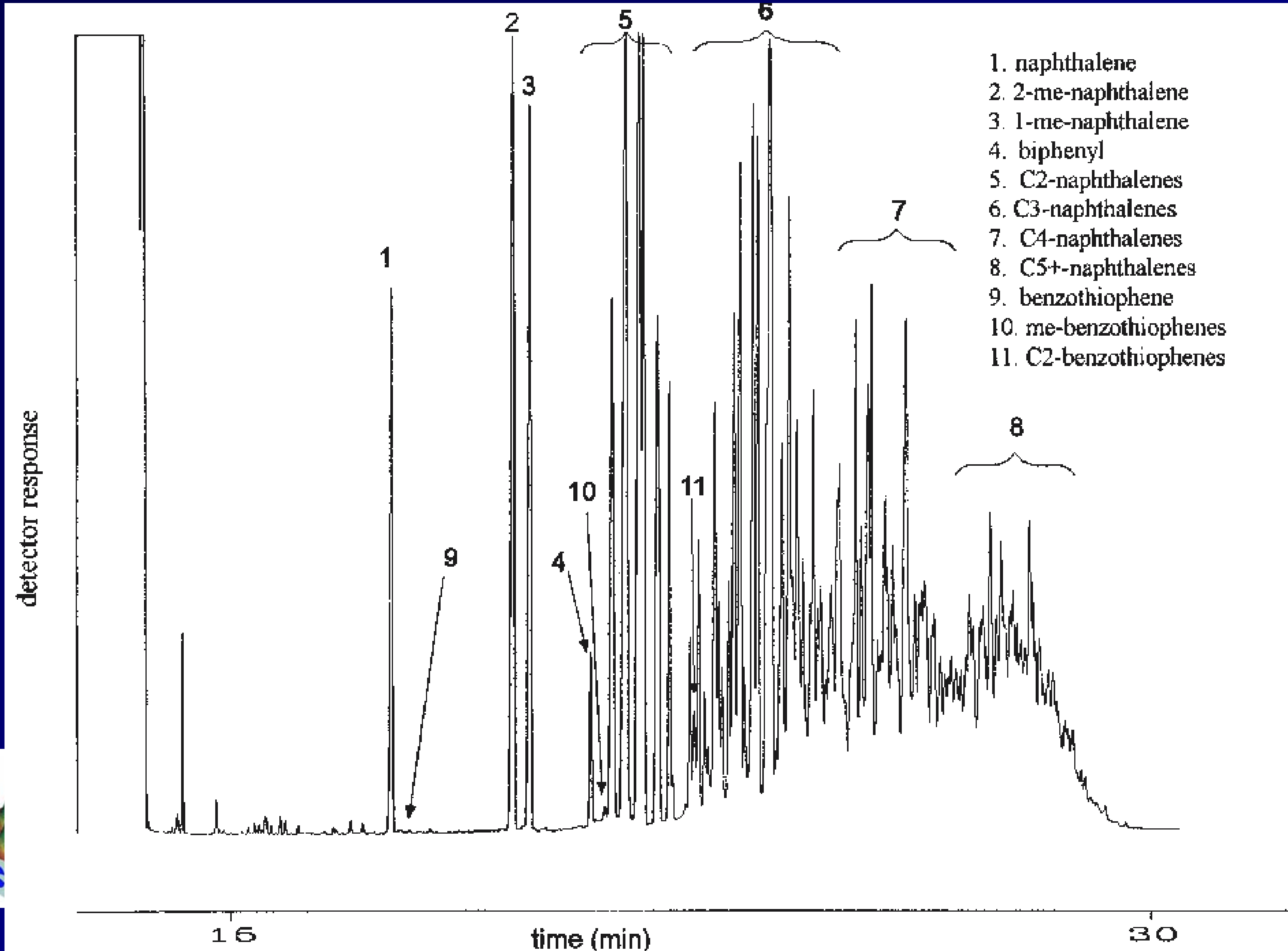
The numbers indicate the n-alkanes

GC analysis of the different fractions
2. Mono-aromatics (MOAH-1)

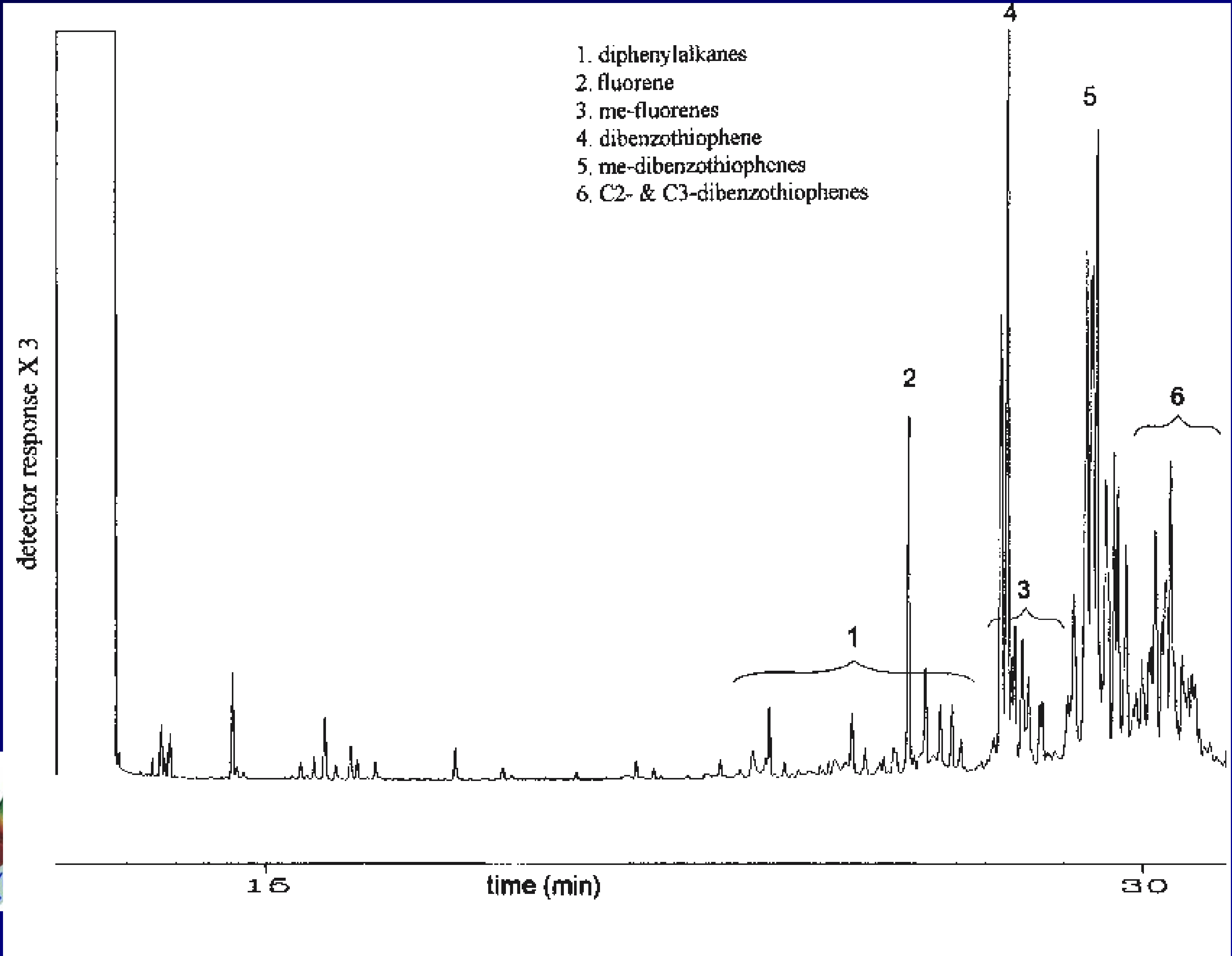


The numbers indicate the retention time of the n-alkanes

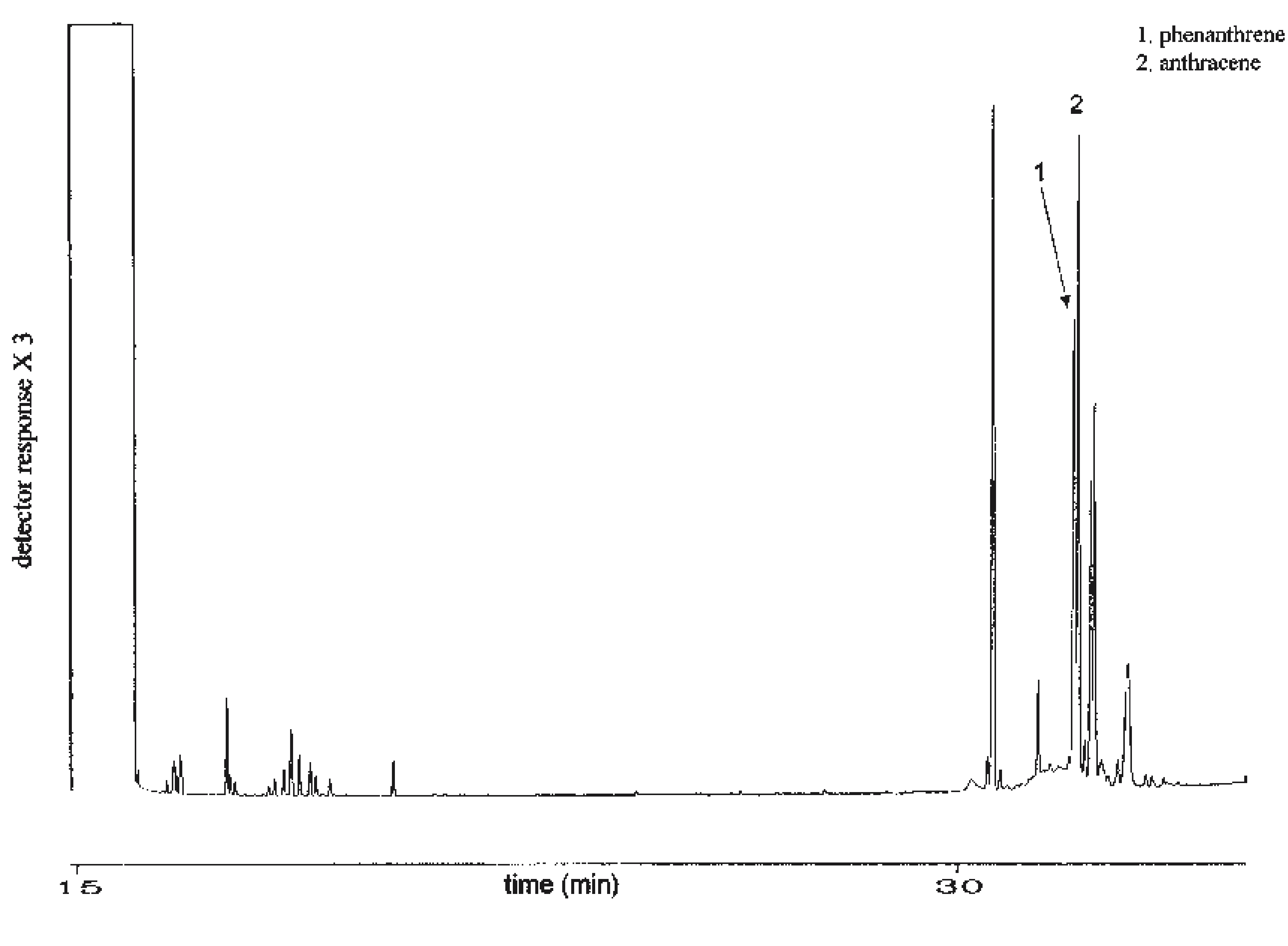
GC analysis of the different fractions
3. Naphthalenes (MOAH-2)



GC analysis of the different fractions
4. Other di-aromatics (MOAH-2)



GC analysis of the different fractions
5. Tri-aromatics (MOAH-3)



Comprehensive two-dimensional gas chromatogrpay (GCXGC)

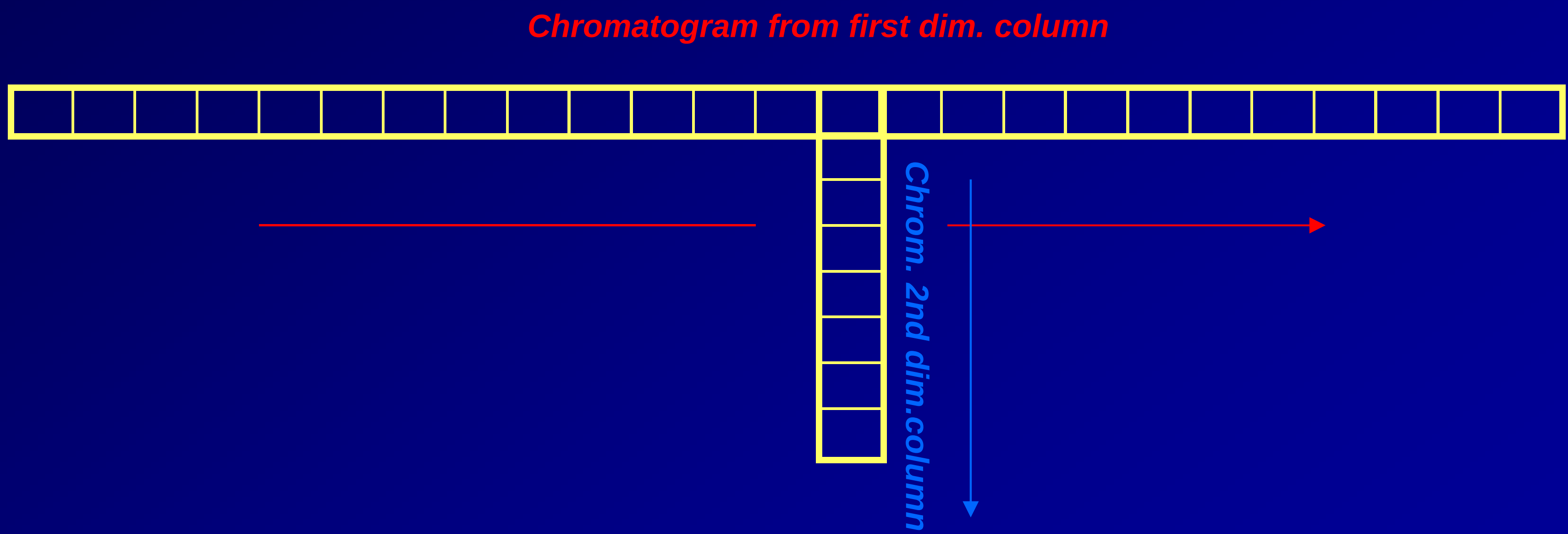
GC–GC (Or 2D-GC)

- Typical heart-cut technique, target compounds
- Characterization of the whole sample:
  many, many heart-cuts

Comprehensive 2D-GC → **GCxGC**

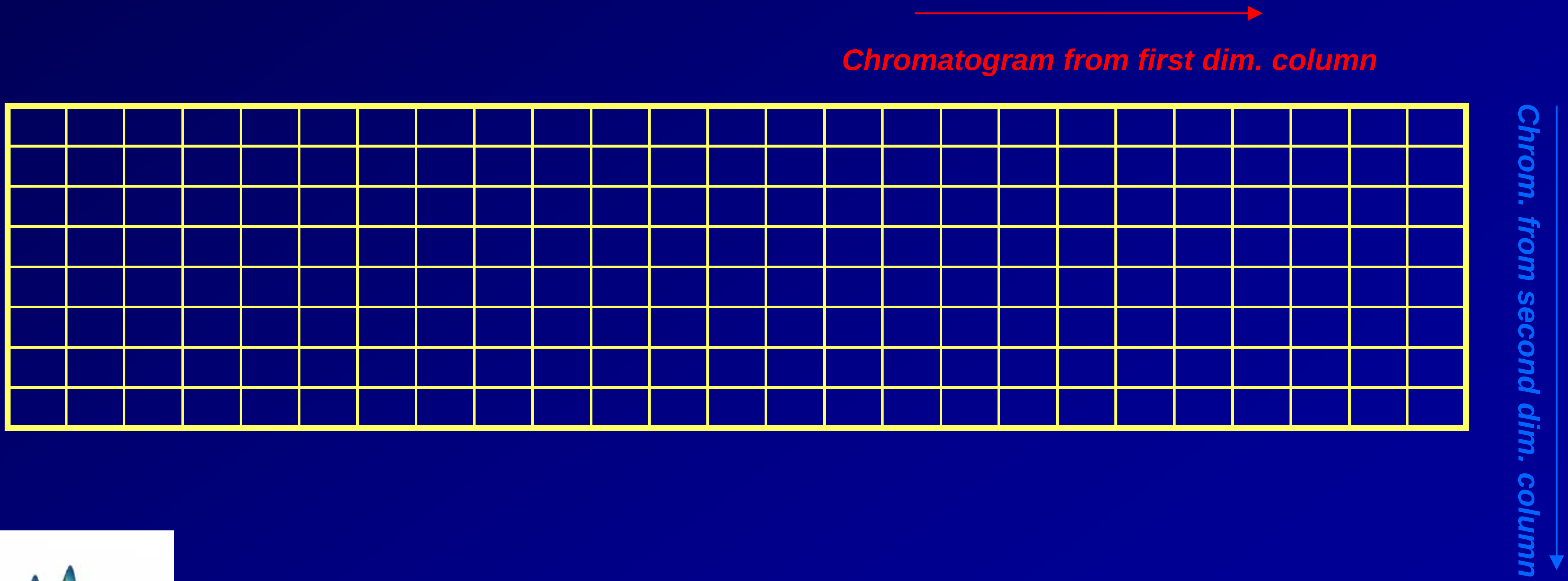
Two-dimensional gas chromatography

Heart-cut 2D-chromatography (2D-GC or GC-GC)

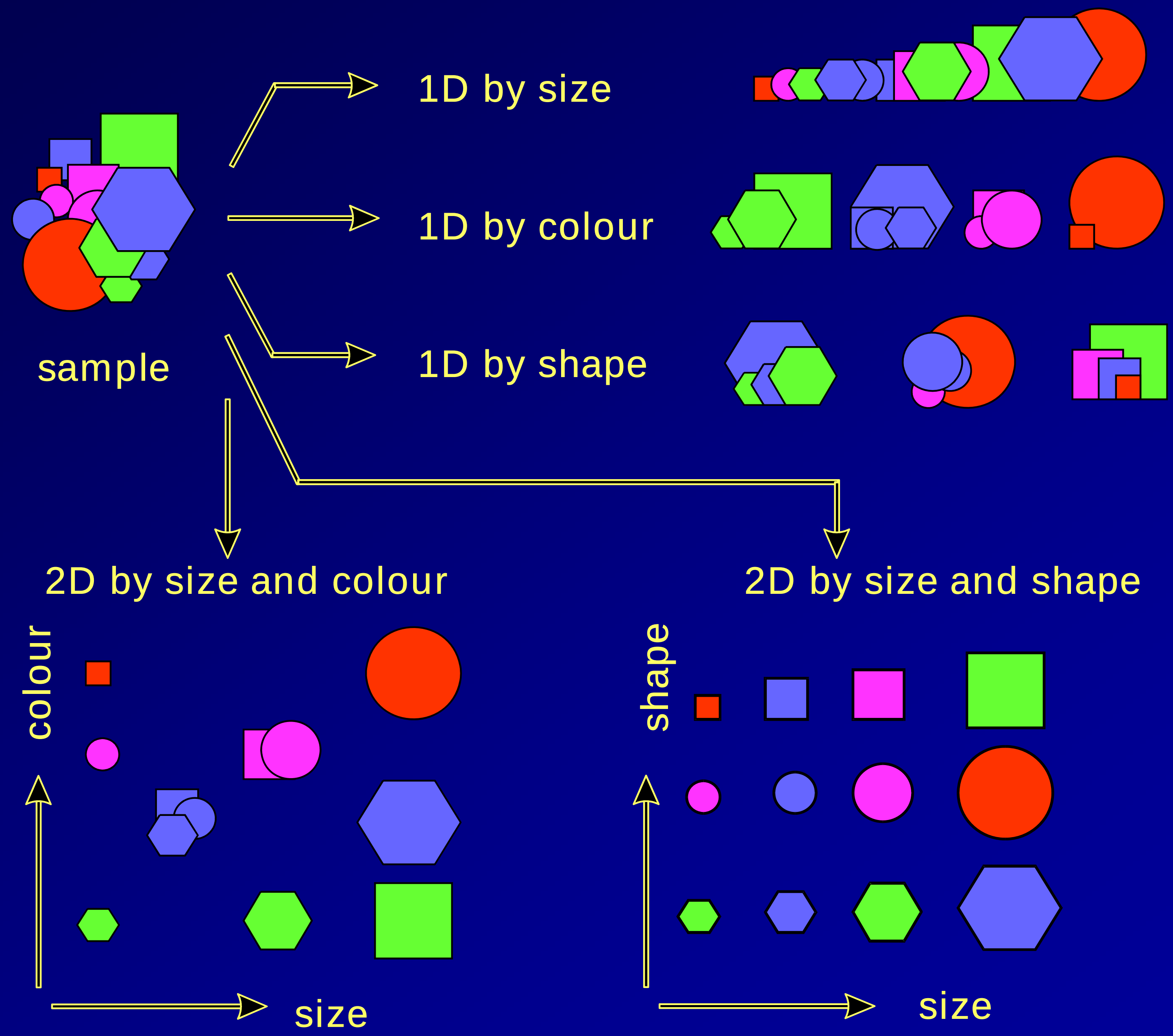


Comprehensive two-dimensional gas chromatography

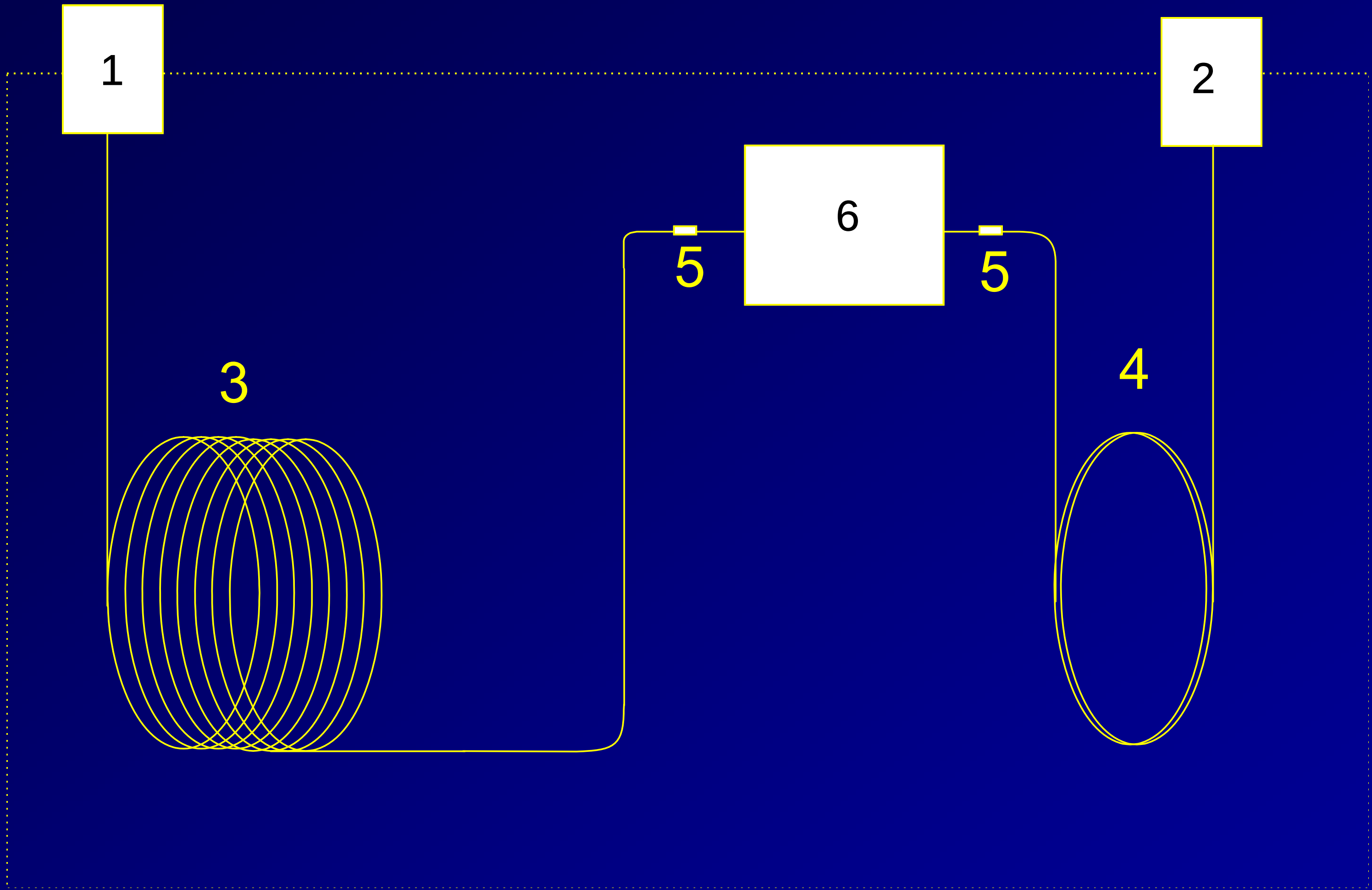
Comprehensive 2D-chromatography (GCXGC)



The use of sample dimensionality

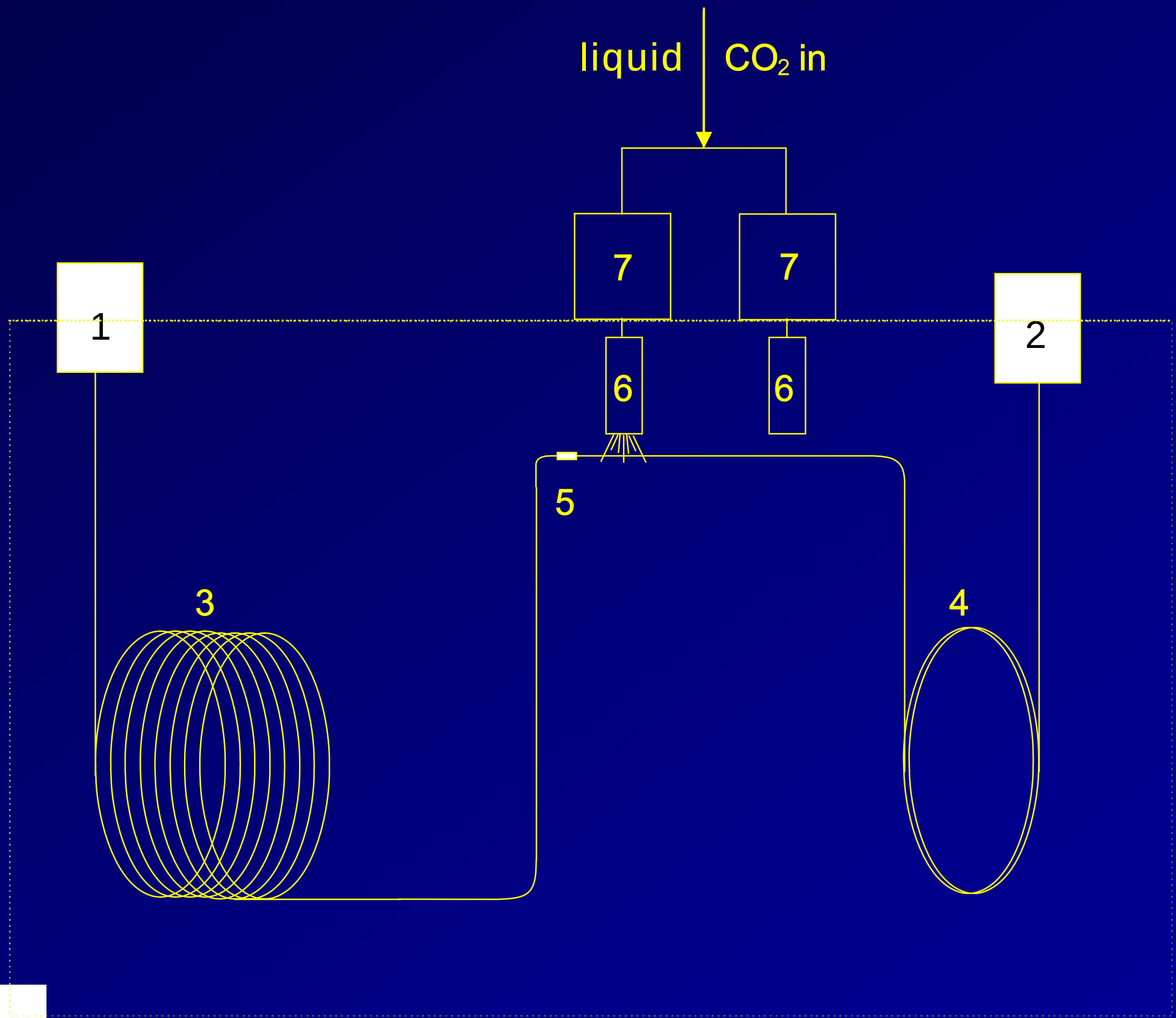


Schematic diagram of a GCxGC system



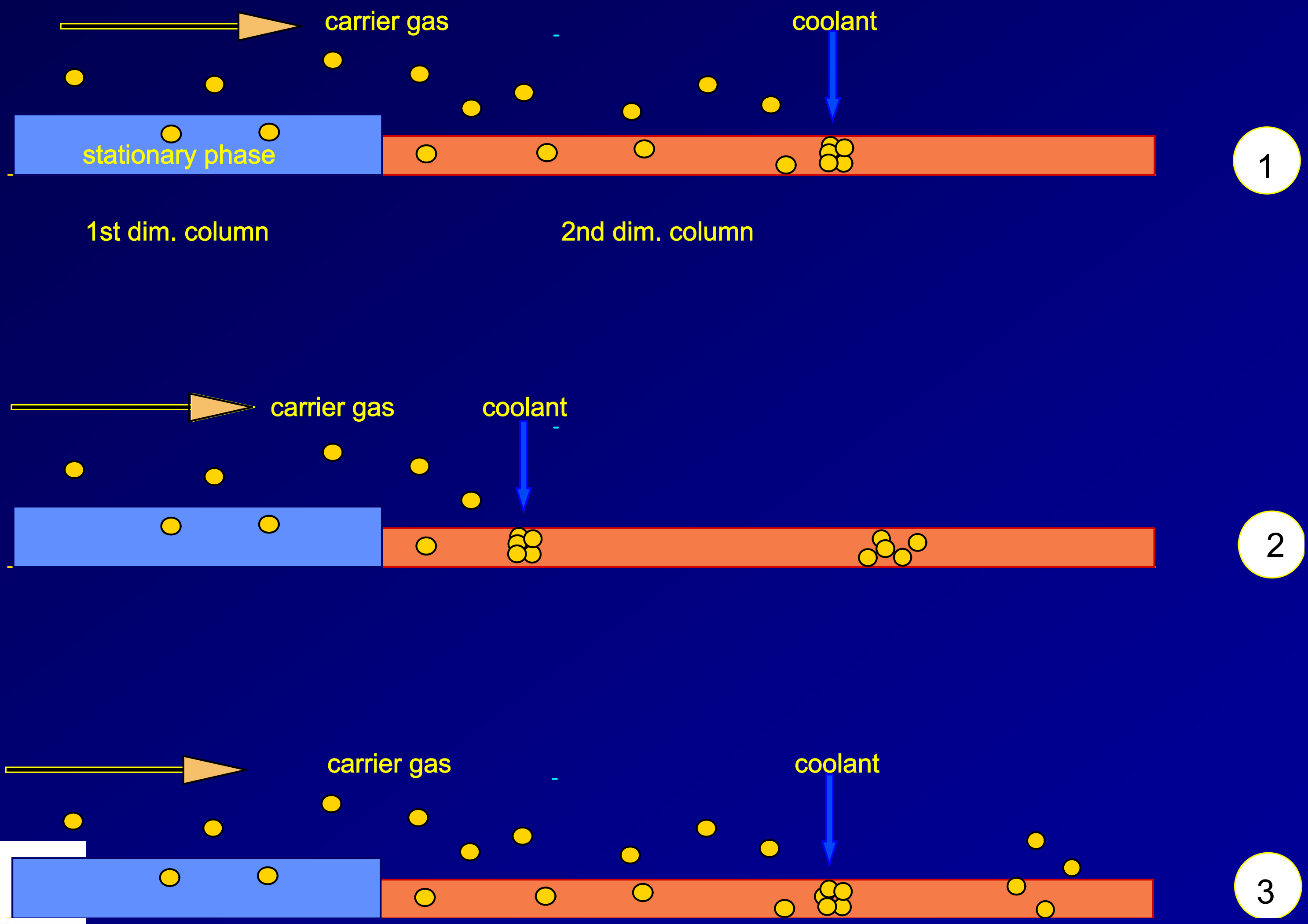
1. injector, 2. detector, 3. 1st column, 4. 2nd column,
5. column connection, 6. modulator

GCxGC with dual cryogenic jets modulator



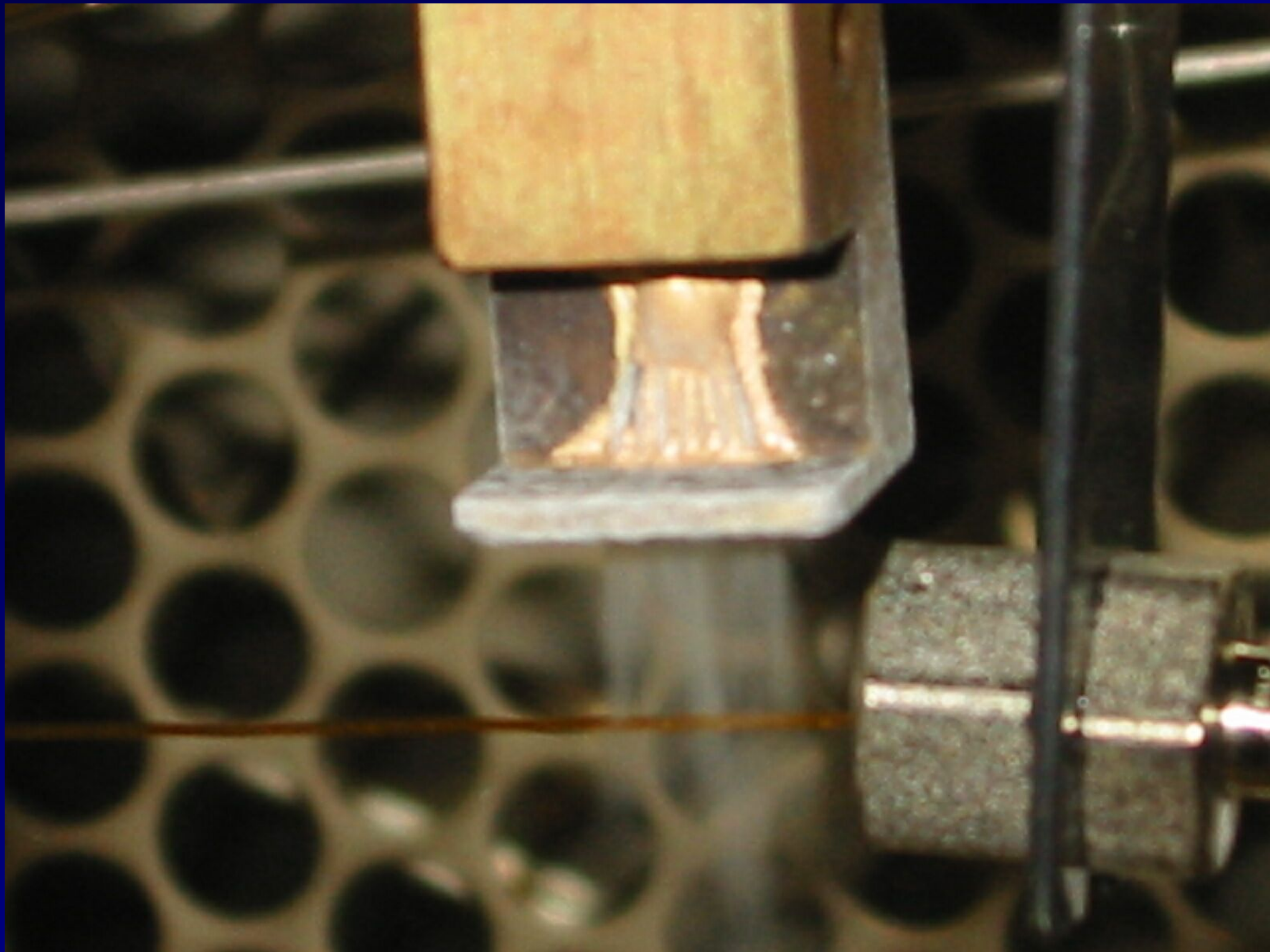
1. injector, 2. detector, 3. 1st column, 4. 2nd column,
2. 5. column connection, 6. CO_2 nozzles, 7. valves

Cryo focusing

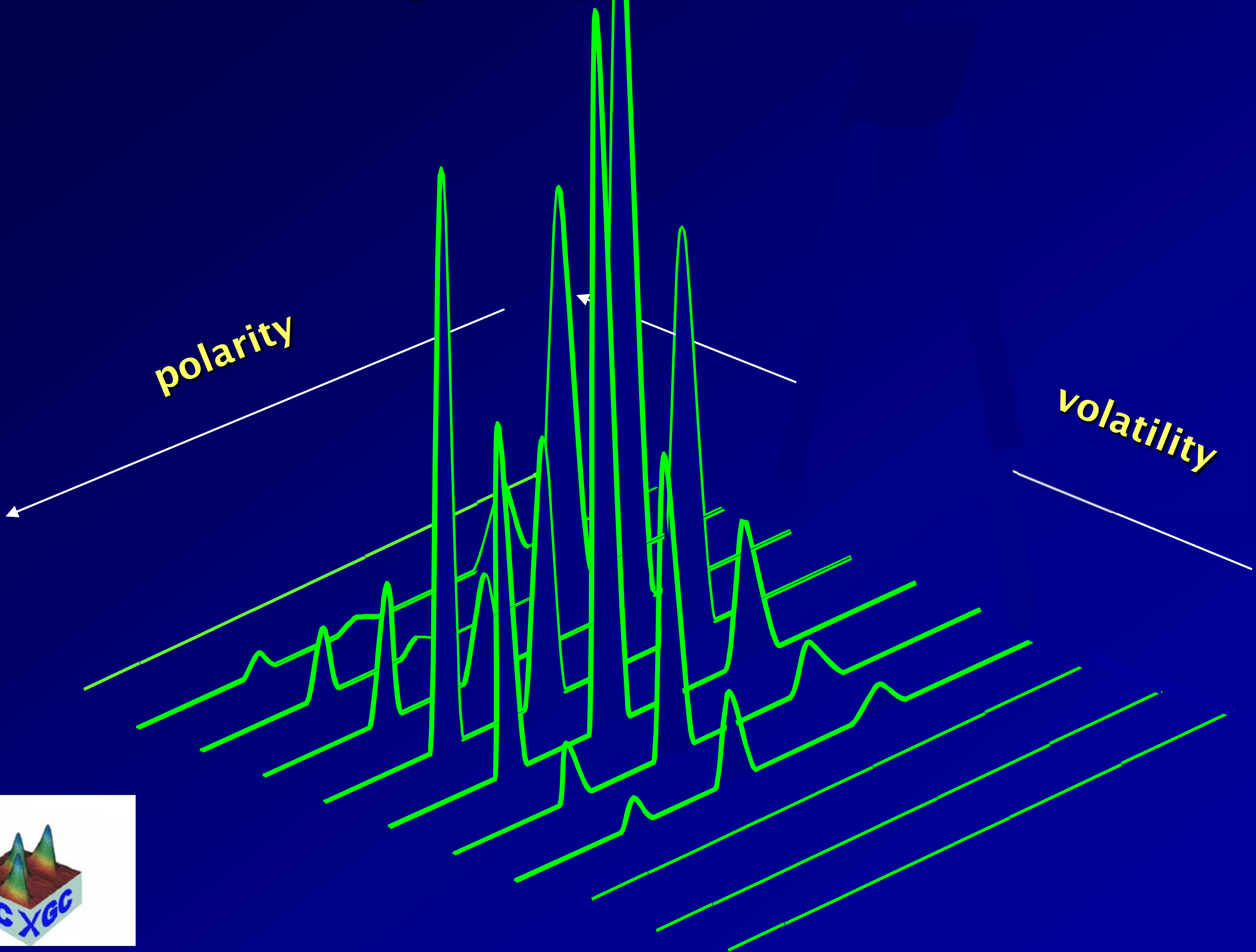


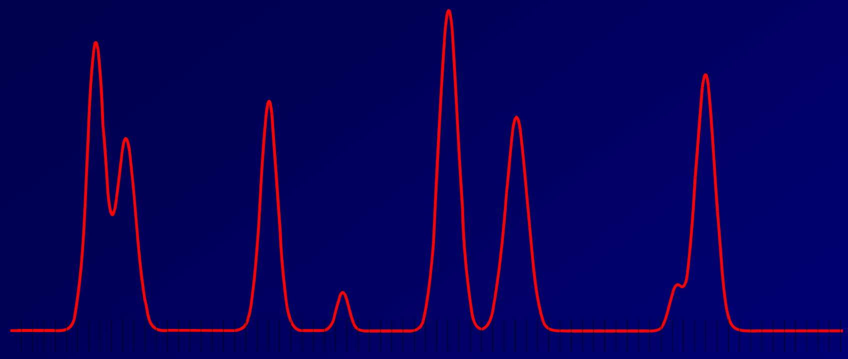
cryofl..exe

One of the two cryo jets

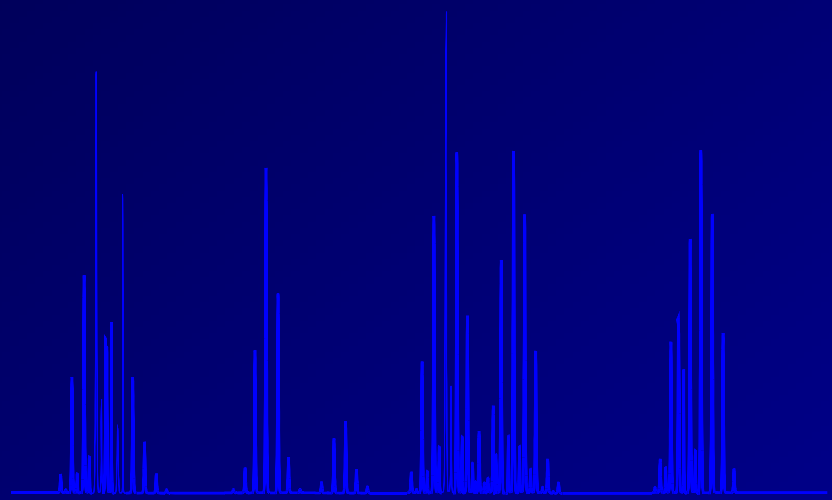


Orthogonality in GCxGC

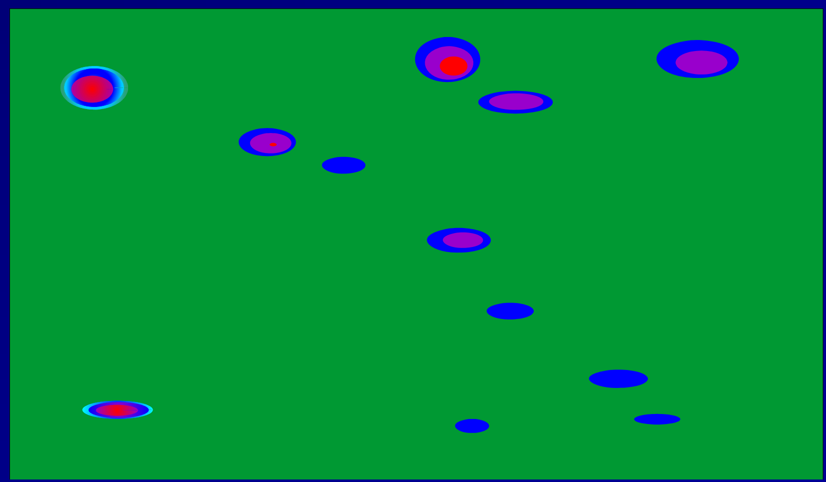




1D-separation

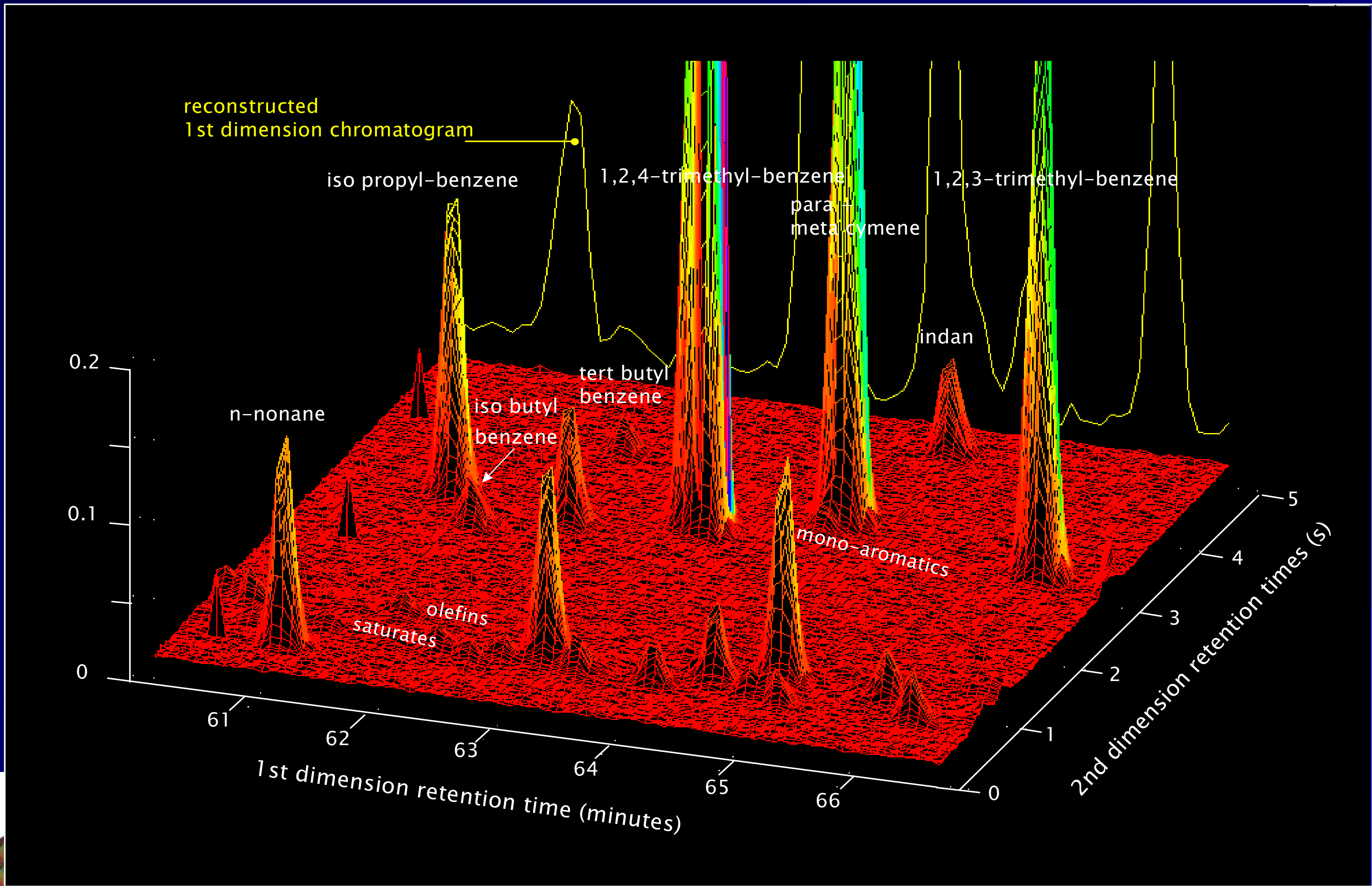


2D-separation



2D-representation

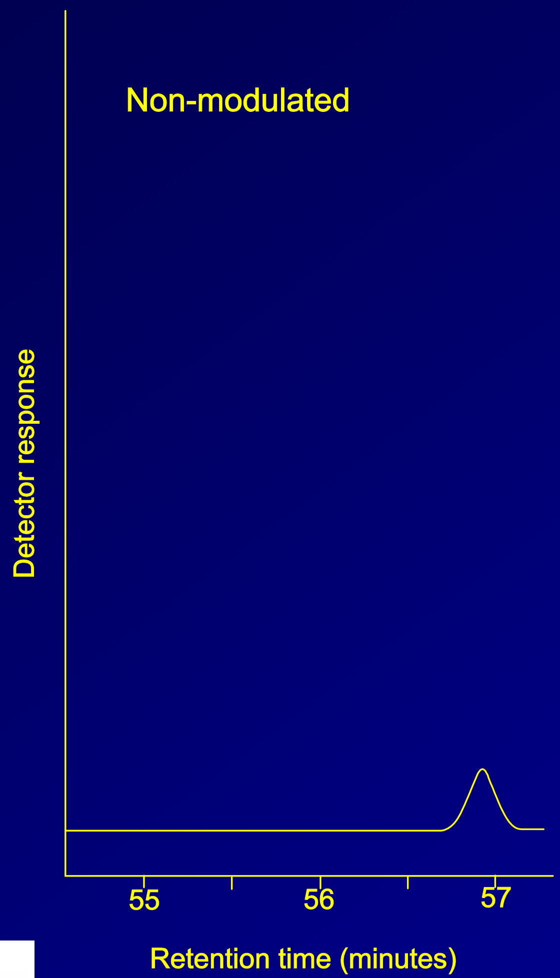
3D-Representation of a GCxGC separation (detail)

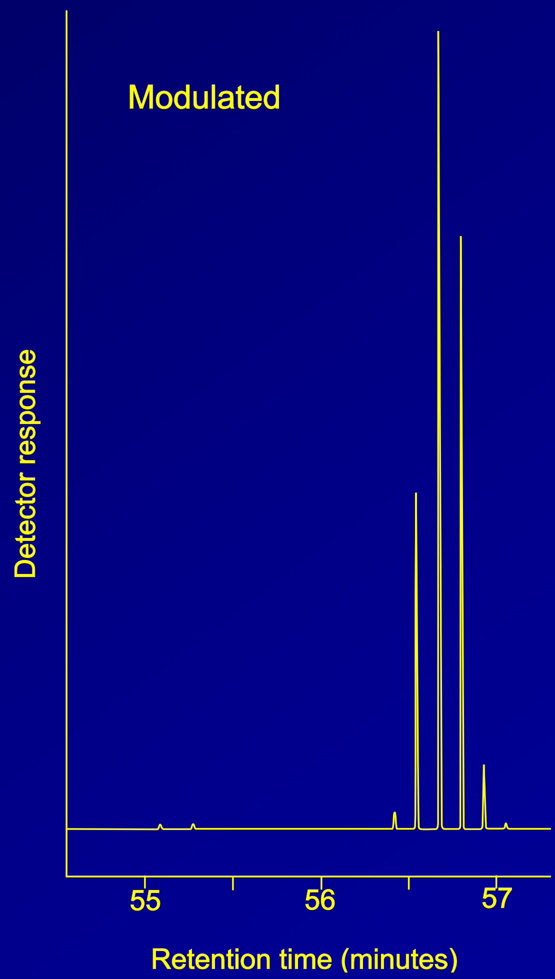


Advantages of GCxGC

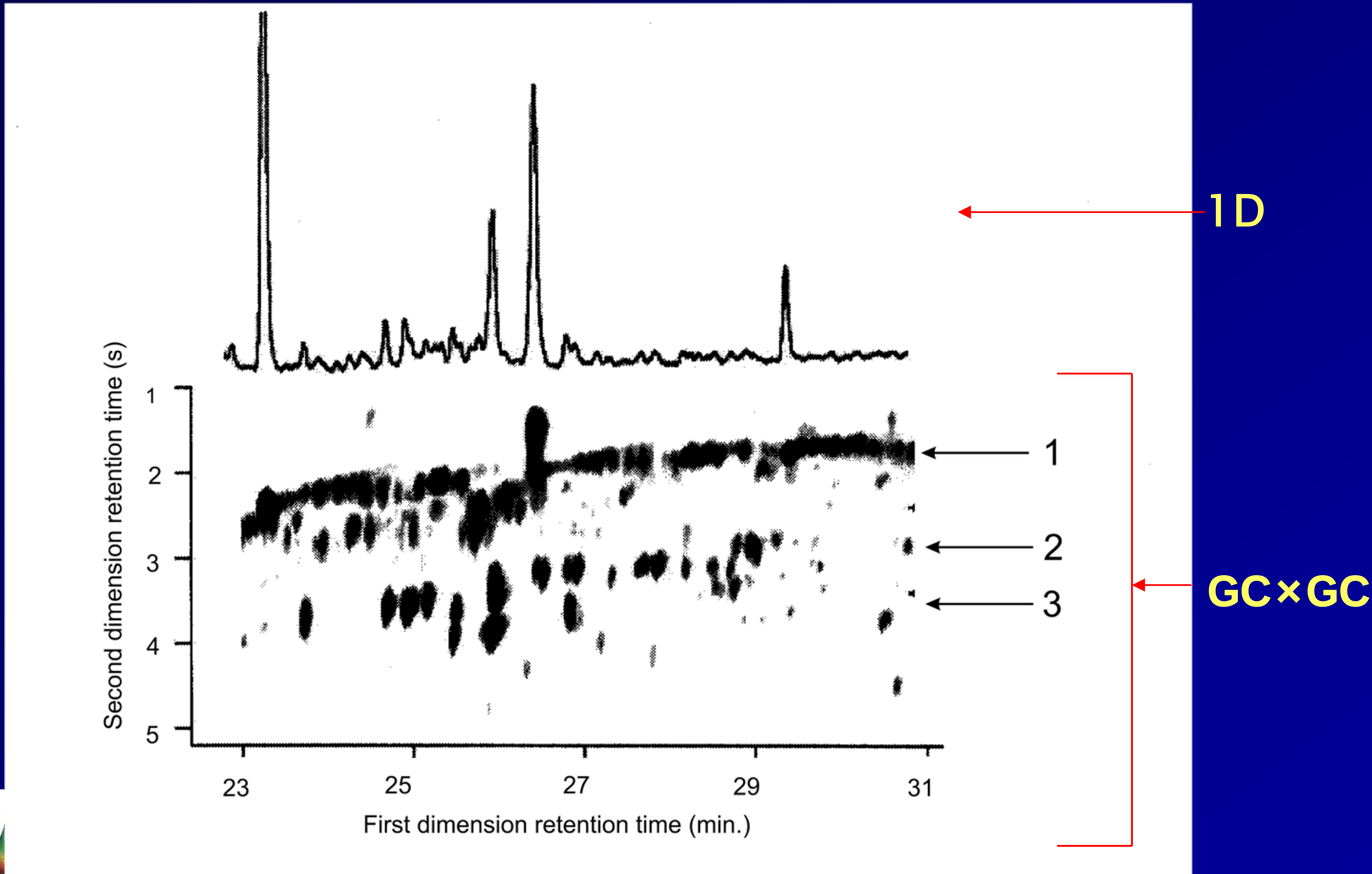
1. Increase in separation power
2. Sensitivity enhancement
3. Structured chromatograms

Enhanced sensitivity





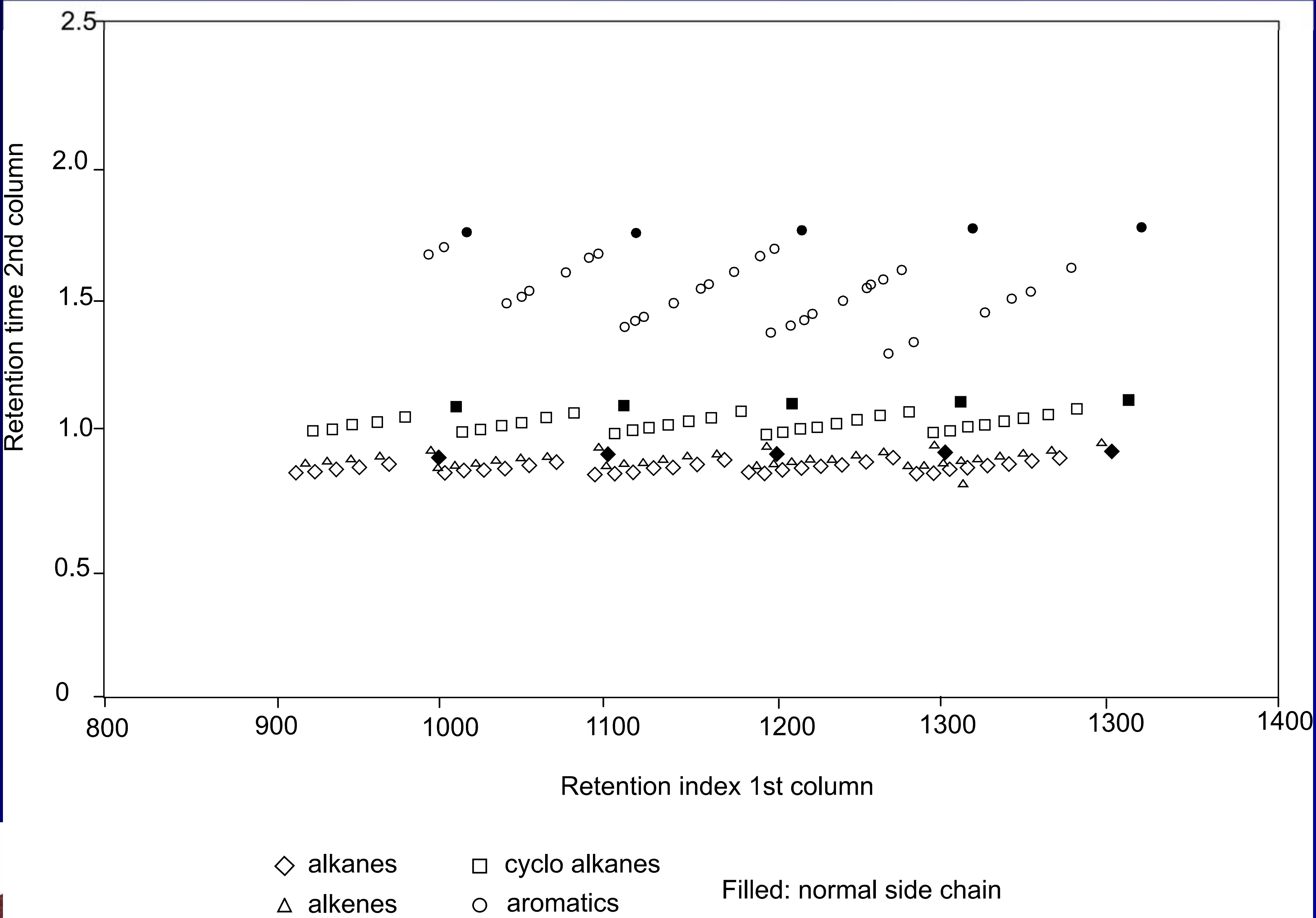
Signal enhancement in GC×GC



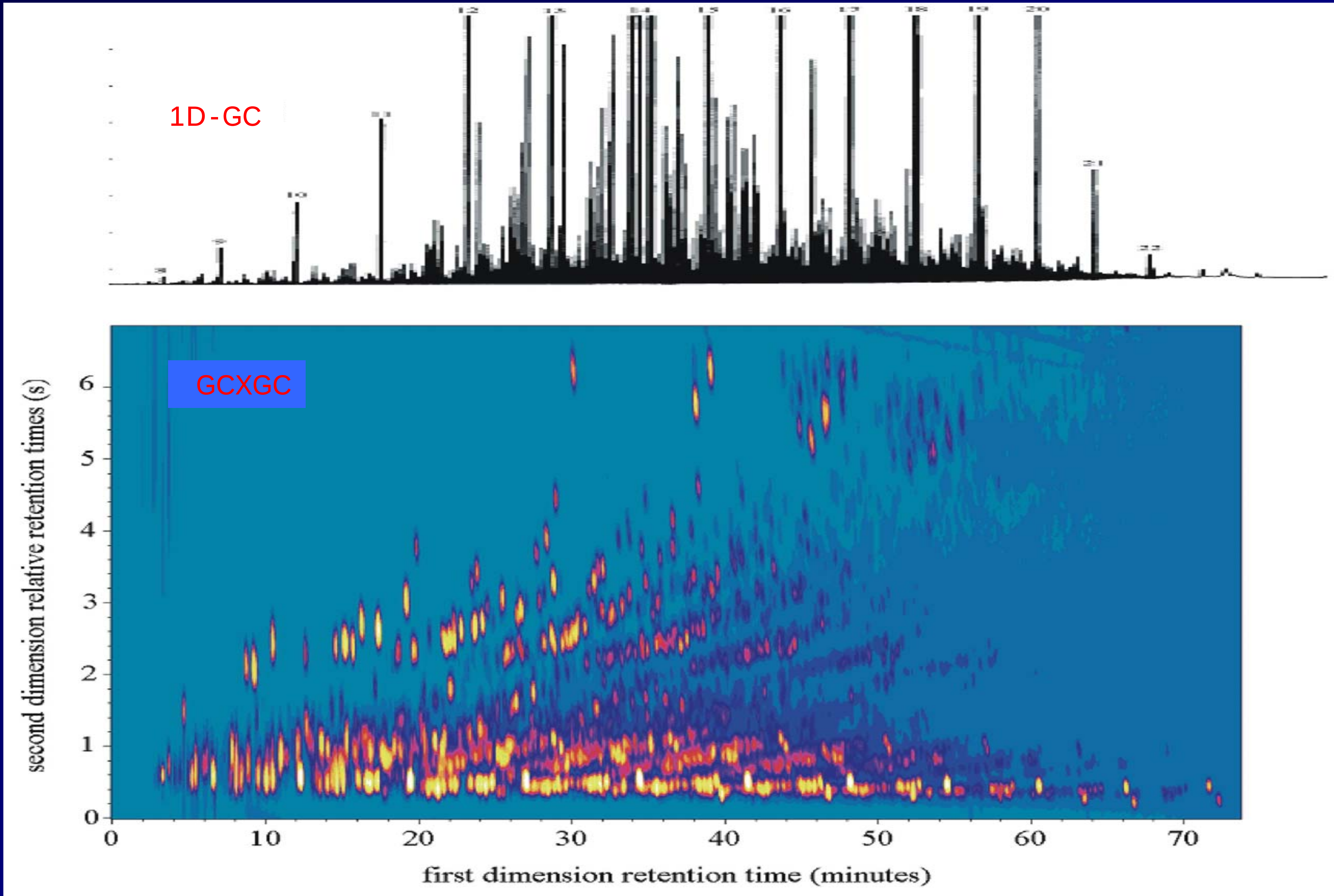
Separation of an urban air sample

Courtesy Allistair Lewis

Ordening of chemical classes on two independent columns

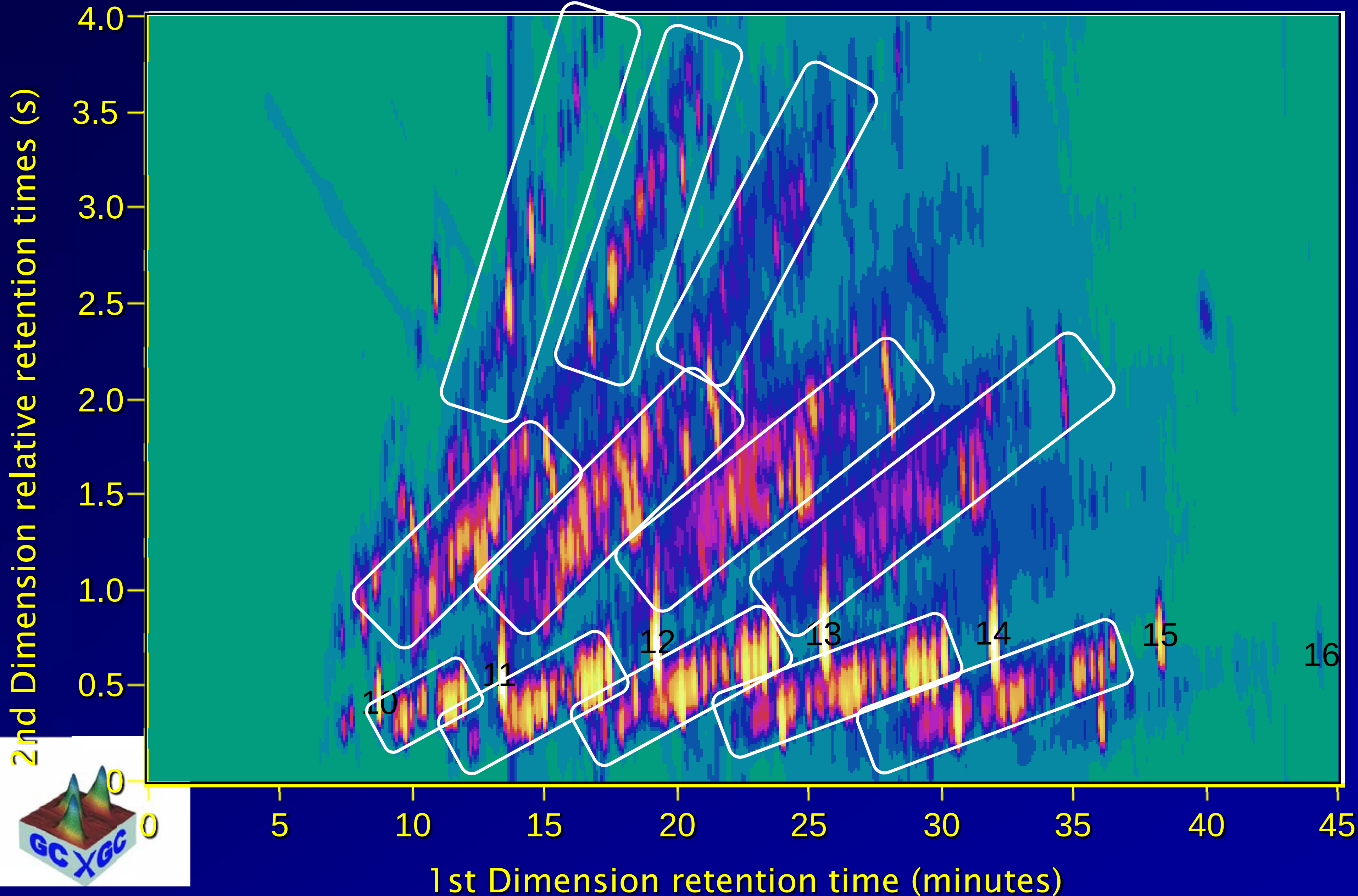


Separation of a kerosene

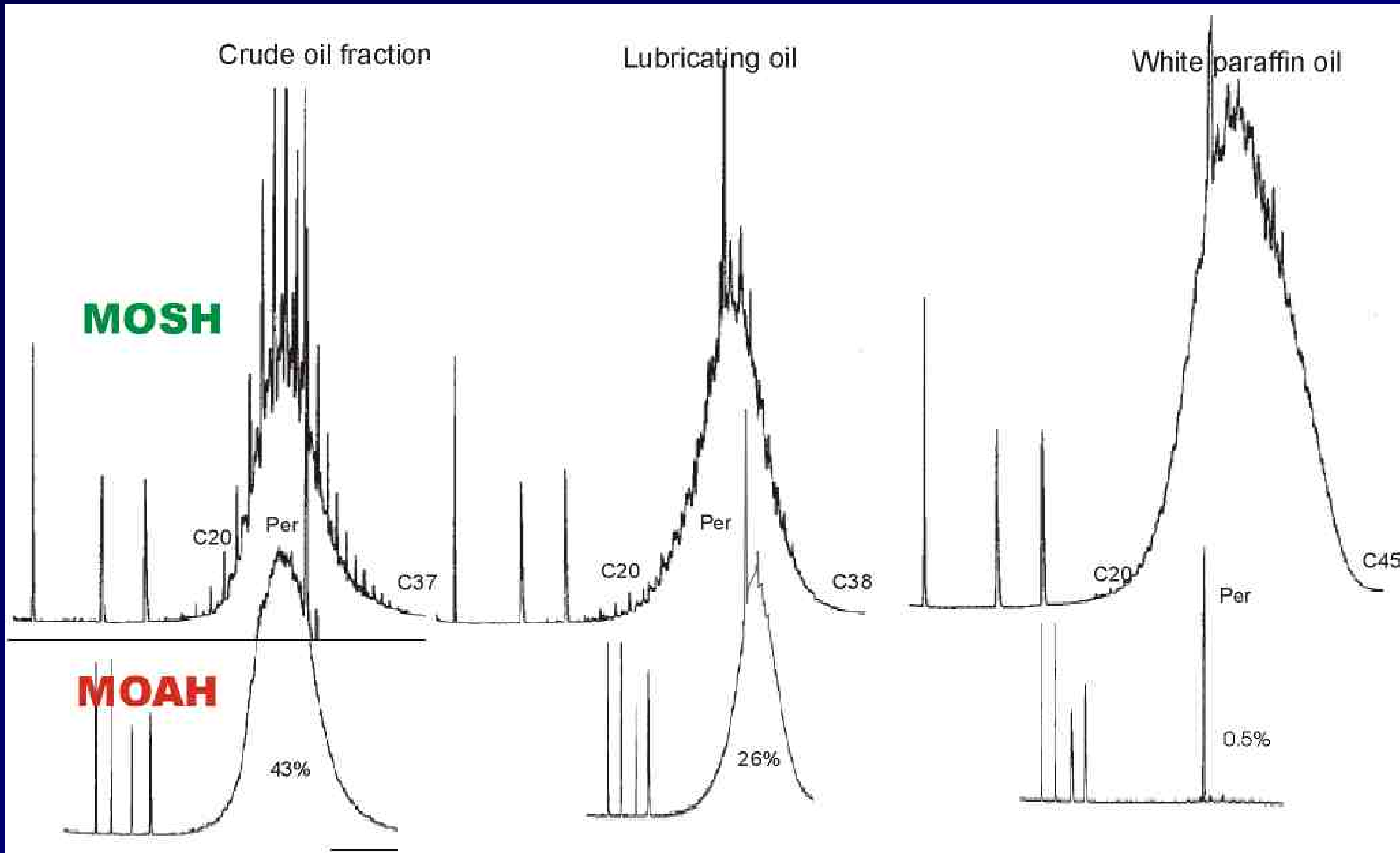


“Ordered” or “structured” chromatograms

(GC×GC separation of a non-aromatic solvent)



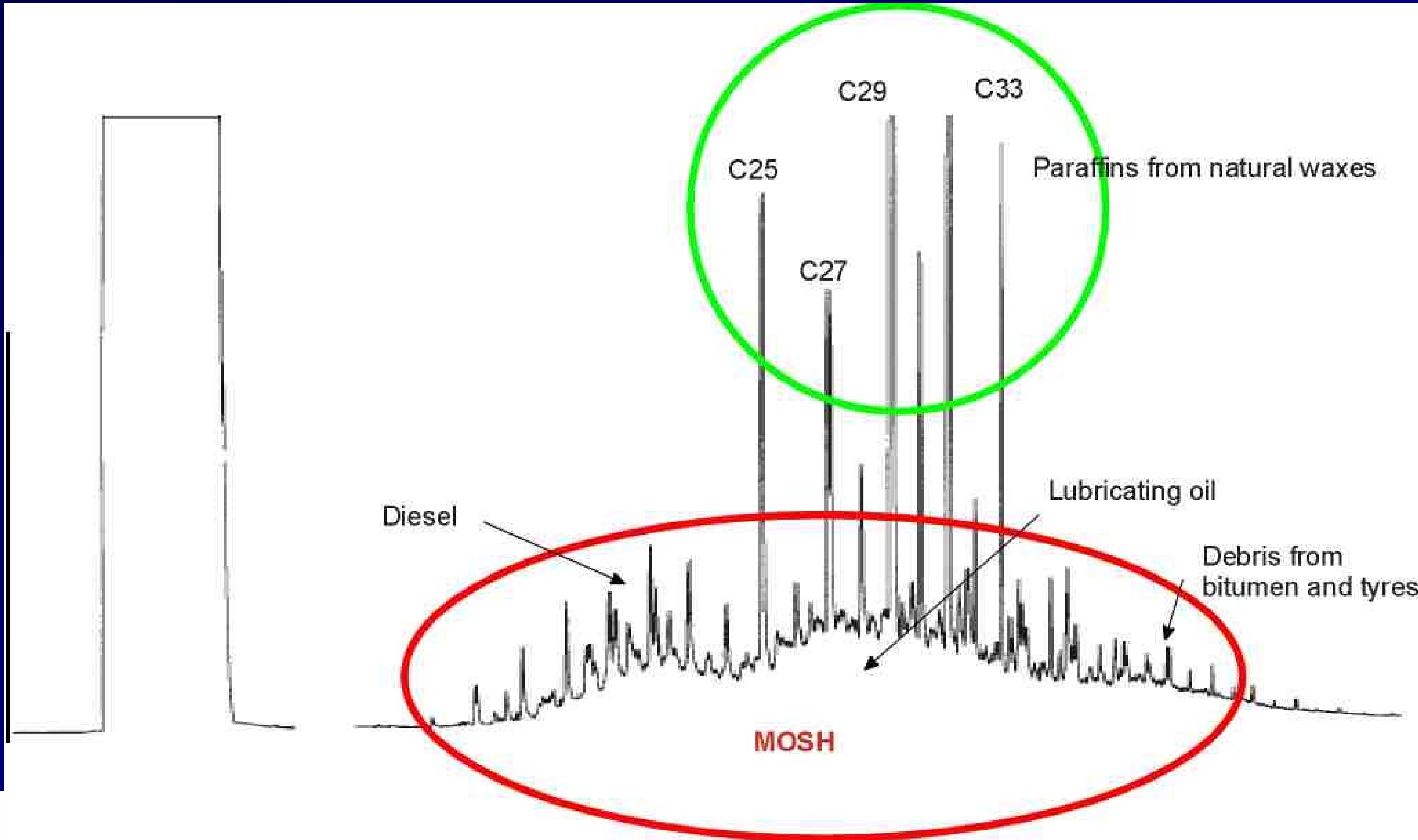
Examples of the separation of MOSH and MOAH fractions



On non-polar stationary phases MOAH are coeluted with MOSH,
but carbon numbers do not correspond:
Methyl anthracene (C_{15}) at n-C_{21}, Chrysene (C_{18}) at n-C_{27}, Pyrene (C_{16}) at n-C_{24}

(These separations have been performed in the Kantonales Labor, Zurich, Switzerland)

MOSH in wheat



(This separation has been performed in the Kantonales Labor, Zurich, Switzerland)