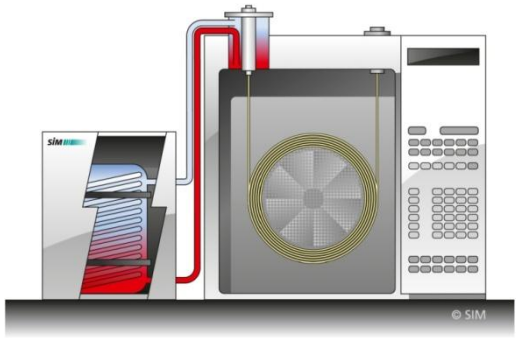
COOL-CUBE – Multi Cooling Device



COOL-CUBE – Multi Cooling Device

- compressor cooling for
  - all temperature controlled **GC inlets**
  - Agilent **G4514A** autosampler tray
  - SIM **CryoTrap** and **PICK-UP**
  - SIM **ICE-DOOR**
- Agilent-PTV, -MMI down to 0 °C

  SIM-Multimode down to **- 20 °C**

  (at oven temperature < 55 °C)

- fast and convenient without the coolants LN_2, LCO_2
- energy-saving due to discontinuous cooling
- maintenance free

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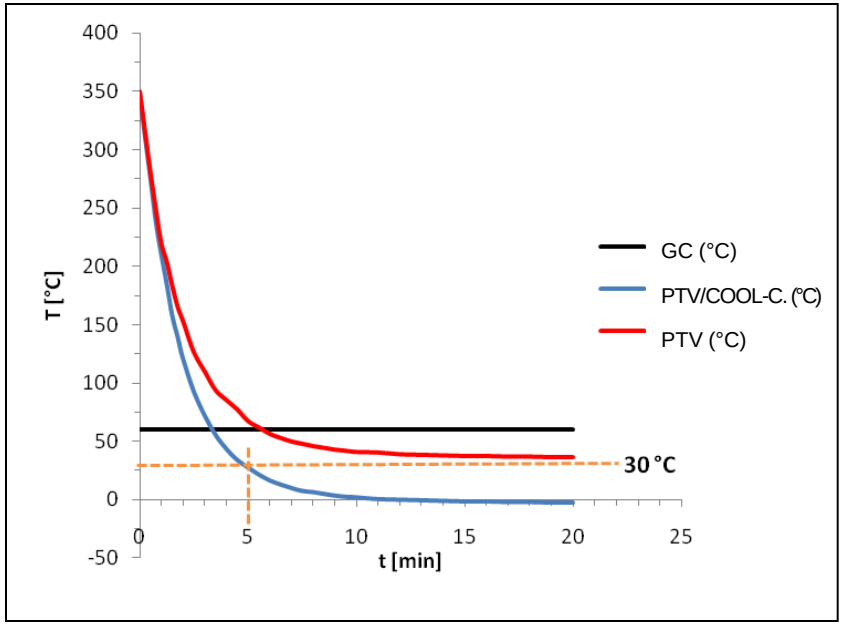
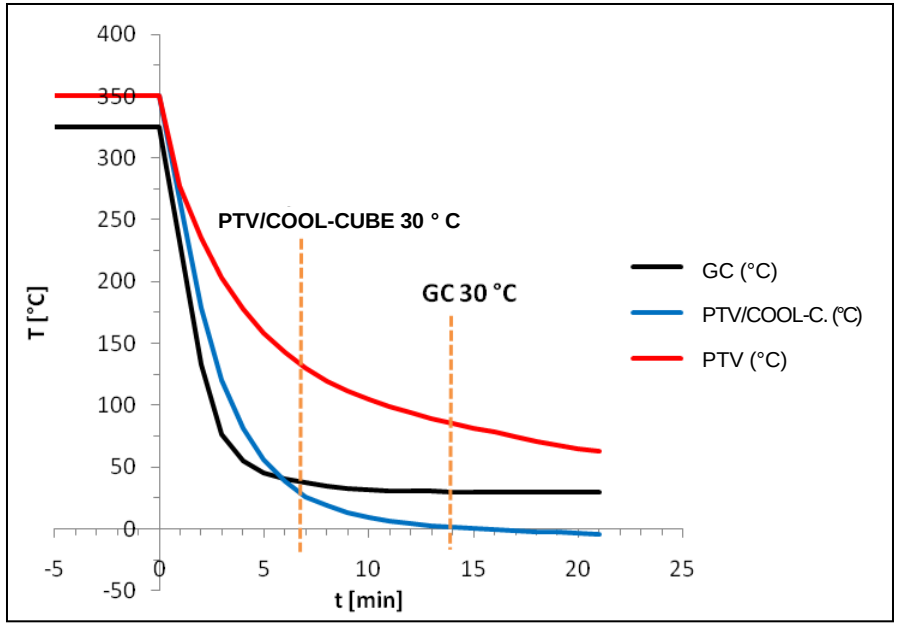
COOL-CUBE/Agilent-PTV: Temperature Profile

Agilent-PTV
cooling with COOL-CUBE (blue line) and without COOL-CUBE (red line):





7890 GC with oven constant 60 °C, $PTV_{initial}$: 350 °C

➔ at a constant temperature of 60 °C, the PTV with COOL-CUBE can be cooled down to **30 °C** within only **5 minutes**

7890 GC with oven: 325 °C (for 15 min), fast cool down mode to 30 °C, $PTV_{initial}$: 350 °C

➔ cooling down the PTV with COOL-CUBE to **30 °C** needs only **6.5 min** , simultaneously with an oven temperature of 30 °C, the PTV reaches **0 °C** (**14 min**)

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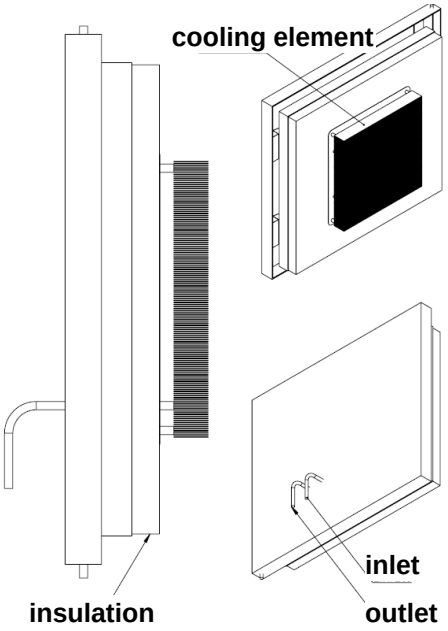
SIM ICE-DOOR

ICE-DOOR for cooling down
Agilent 7890 GC

Scientific Instruments Manufacturer GmbH
Im Erlengrund 21-23 • D-46149 Oberhausen • www.sim-gmbh.de

ICE-DOOR to cool down the GC oven



- cooling element is placed at the inside of the oven door
- fast cooling down of the GC oven together with SIM Multi Cooling Device
- ➔ shorter cyle times, higher throughput
- ➔ gas analysis at low temperatures
- ➔ cooling down to 0 °C without the coolants LN_2, LCO_2
- ➔ closed system, maintenance-free

Application: Composition of Racing Fuel

analysis problem

➔ separation of cyclopentane and 2,3-dimethyl-butane

solution

➔ GC oven cooling with

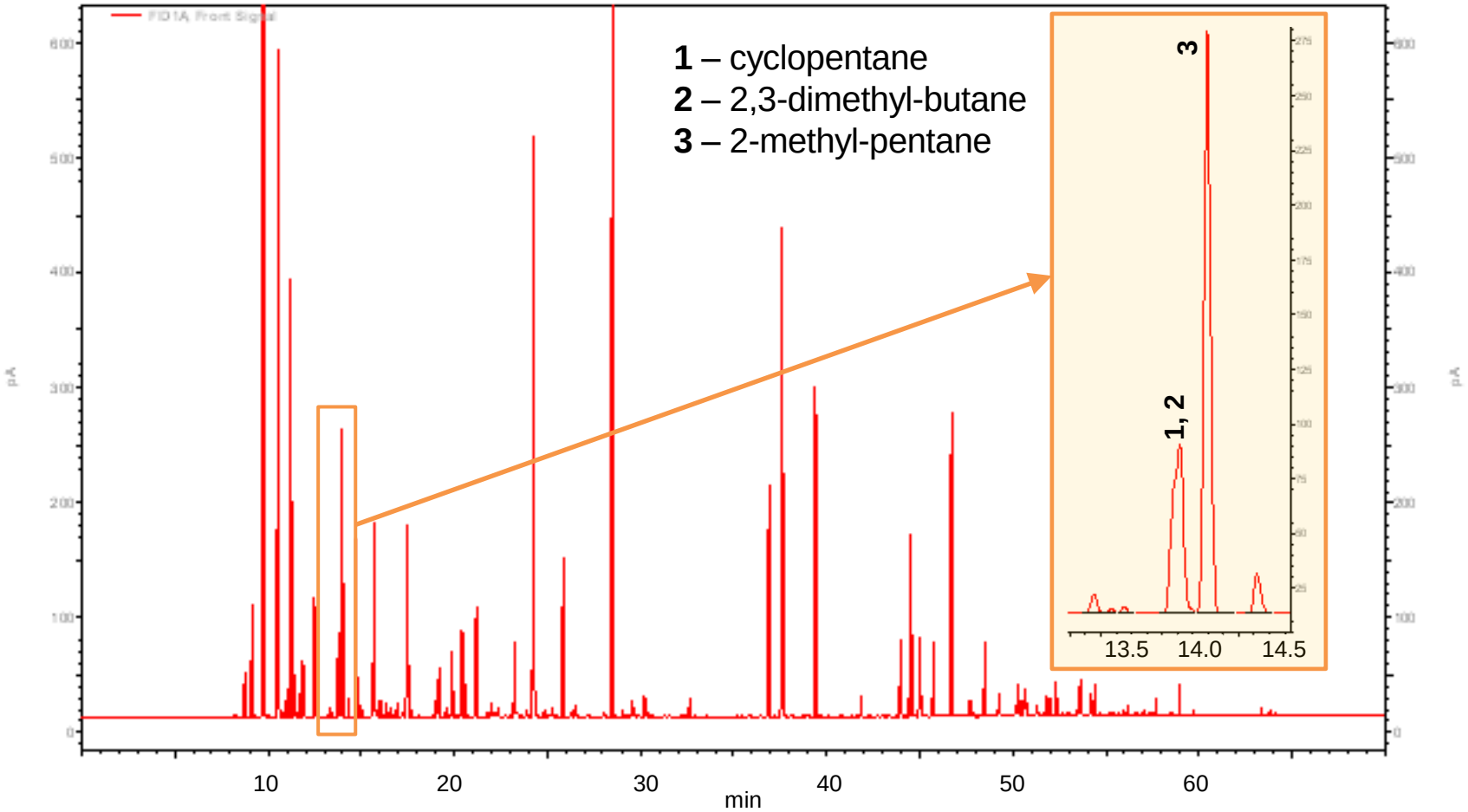
ICE-DOOR

and

SIM Multi Cooling Device

Racing Fuel Analysis without ICE-DOOR

start temperature **30 °C** for 15 min ⇨ **no separation** of cyclopentane and 2,3-dimethyl-butane



Agilent 7890 GC, column: HP Pona (100m x 0.25mm x 0.2µm); carrier gas: H_2 (1 ml/min); injection volume: 1 µl
temp. program: 30°C for 15 min, 1.5°C/min to 60°C, 5°C/min to 120°C, 10°C/min to 240 °C; detection: FID

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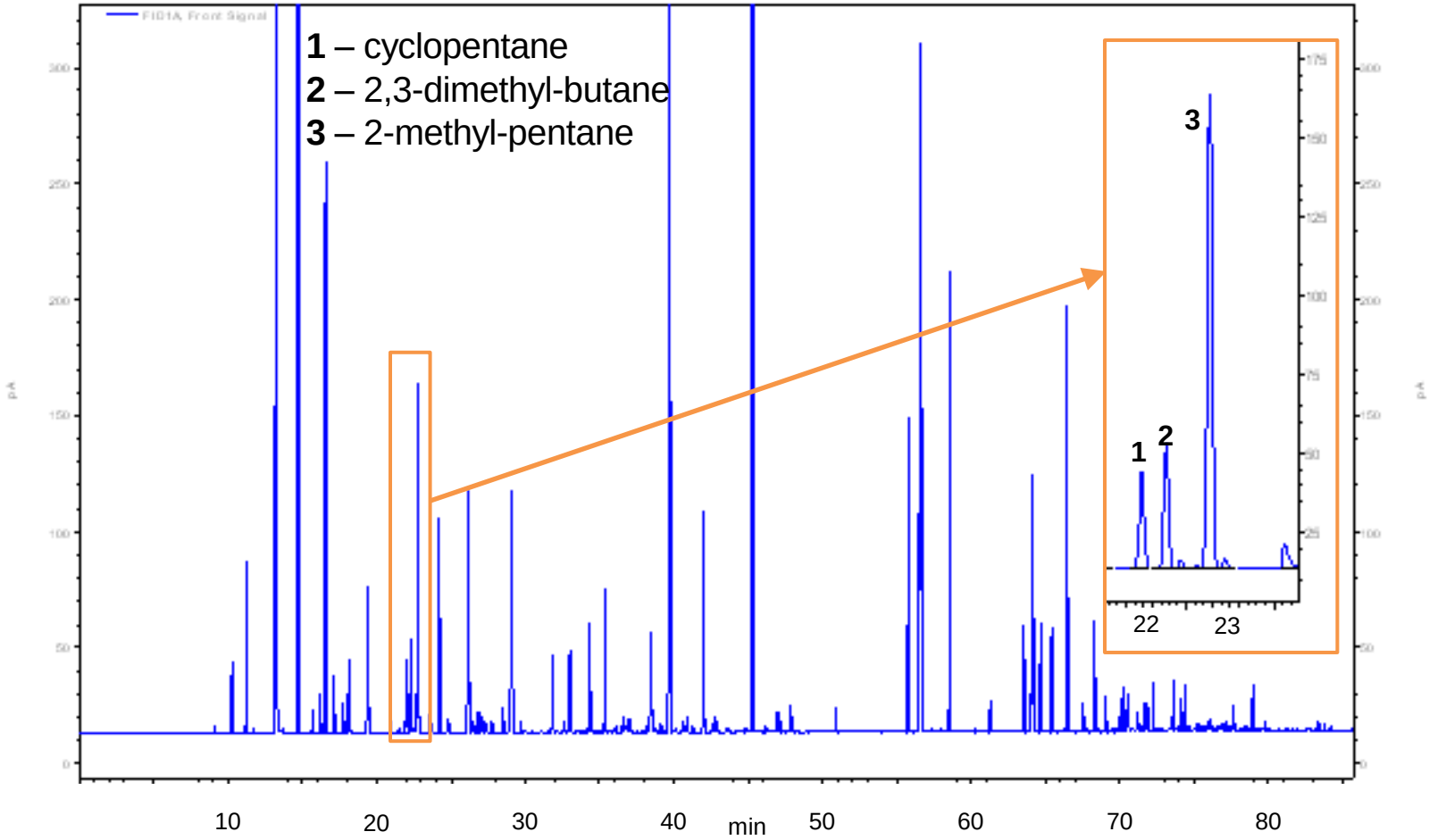
Racing Fuel Analysis with ICE-DOOR

start temperature **0 °C** for 10 min ⇨ **separation** of cyclopentane and 2,3-dimethyl-butane



Agilent 7890GC with ICE-DOOR + SIM Multi Cooling Device, column: HP Pona (100m x 0.25mm x 0.2µm); carrier gas: H_2 (1ml/min); injection volume: 1 µl; temp. program: 0°C for 10 min, 1.5°C/min to 60°C, 5°C/min to 120°C, 10°C/min to 240°C; detection: FID

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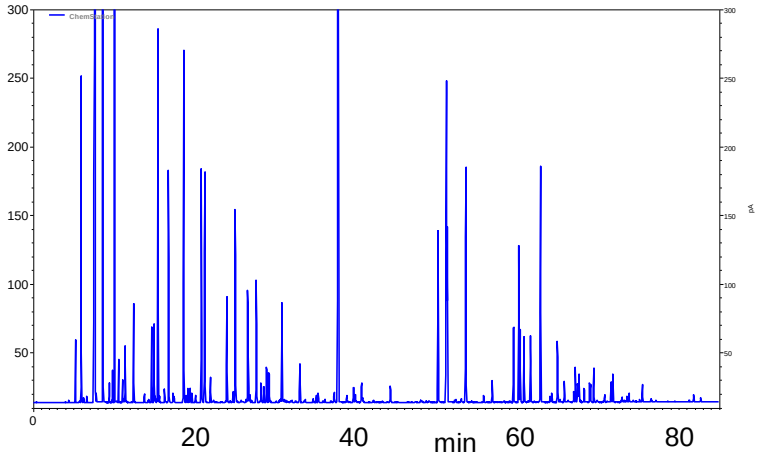
Analysis of petroleum acc. to ASTM D 5134



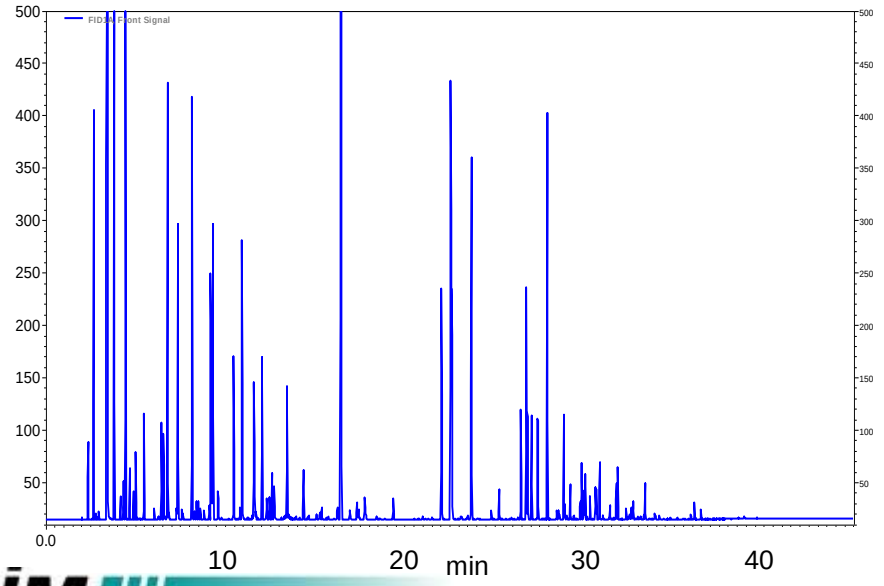
Agilent 6890 GC with CO_2 cooling, column: HP-PONA (50m x 0.2mm x 0.5µm); carrier gas: He (1 ml/min); injection volume: 1 µl; temp. program: 0°C start, 1.5°C/min to 70°C, 3 °C/min to 180°C, 11.66 min (run time 94.99 min); detection: FID

ASTM D 5134 – standard method

carrier gas: **He**

oven cooling: LCO_2

run time: 95 min



Modification for carrier gas H_2 with ICE-DOOR cooling

carrier gas: **H_2**

oven cooling: ICE-DOOR / Multikühleinheit

run time: 45 min

Agilent 7890 GC with ICE-DOOR and Multi Cooling Device, column: HP-5 (50m x 0.2mm x 0.5µm); carrier gas: H_2 (2ml/min); injection volume: 1 µl; temp. program: 0°C start, 3.14°C/min to 70°C, 6.299 °C/min to 180°C, 5.5 min (run time 45.256 min); detection: FID

Analysis of petroleum acc. to ASTM D 5134

Pros of the modified method ASTM D 5134:

- no CO_2 necessary for starting temperture 0 °C:
  - ➔ safe and easy-to-use
  - ➔ no need for a stock of liquid coolants

- replacement of carrier gas helium by hydrogen:
  - ➔ cost-saving (esp. because the need of a split 500:1 for 2 min)
  - ➔ better peak shape compared to He
  - ➔ better separation, same elution order
  - ➔ halve run time (45 min – H_2, 90min – He)