

For help with accessing this document, email NEI_Help@epa.gov

Detailed hydrocarbon analysis as tool for identification of fuel blending synergies to reduce emissions of mobile source air toxics

DI Georg Stefan Pflieger

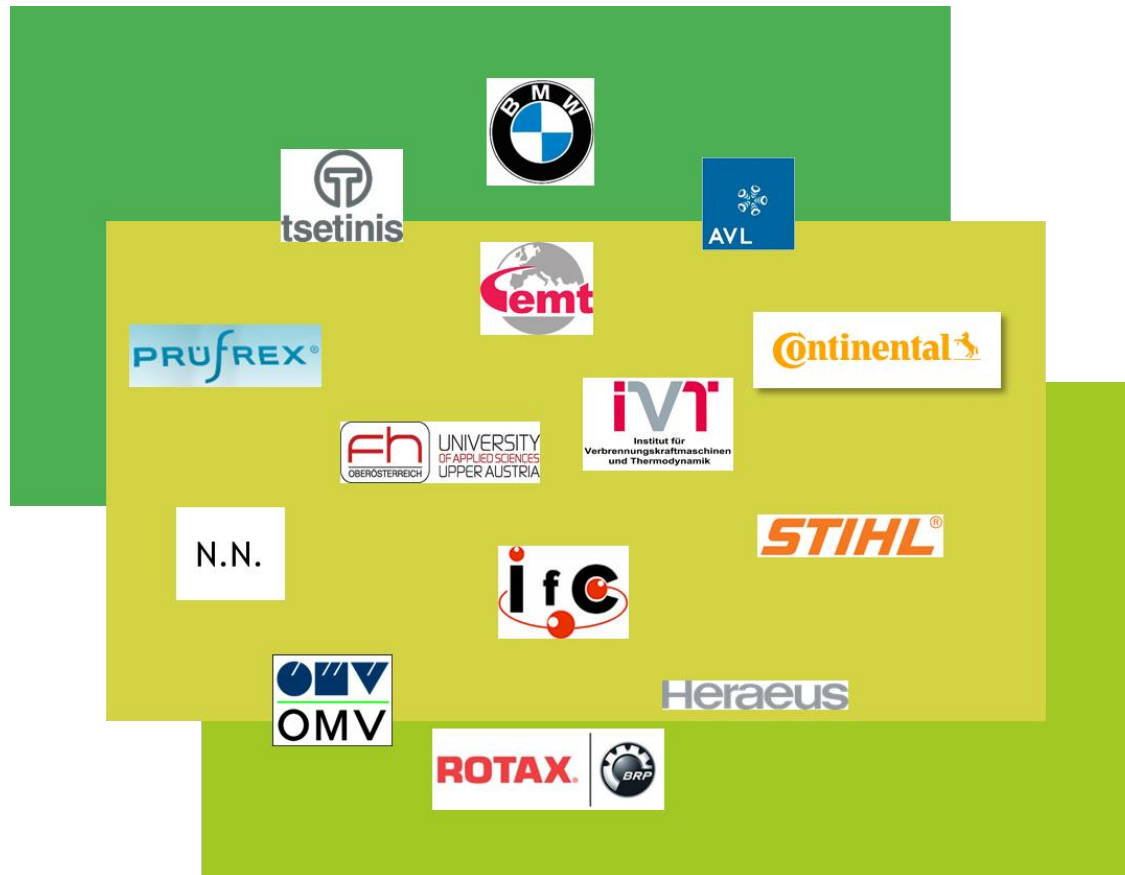
PhD candidate

Dr. Sigurd Schober

Institute of Chemistry

University of Graz

Research Center for Low Carbon Special Powertrain



- 2-stroke engines – gasoline



- 4-stroke engines – gasoline

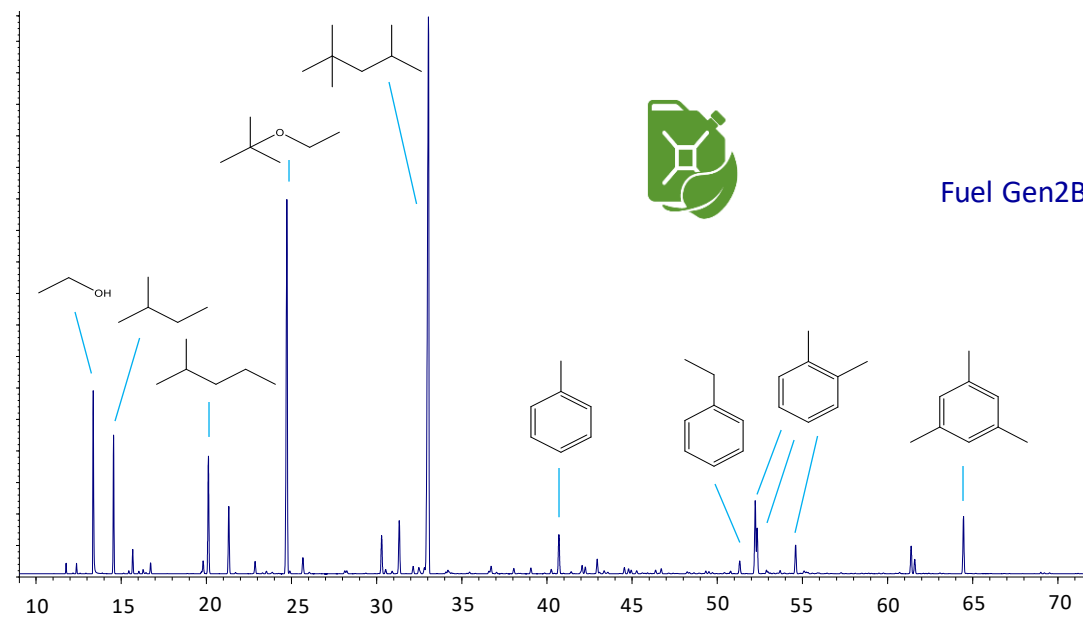
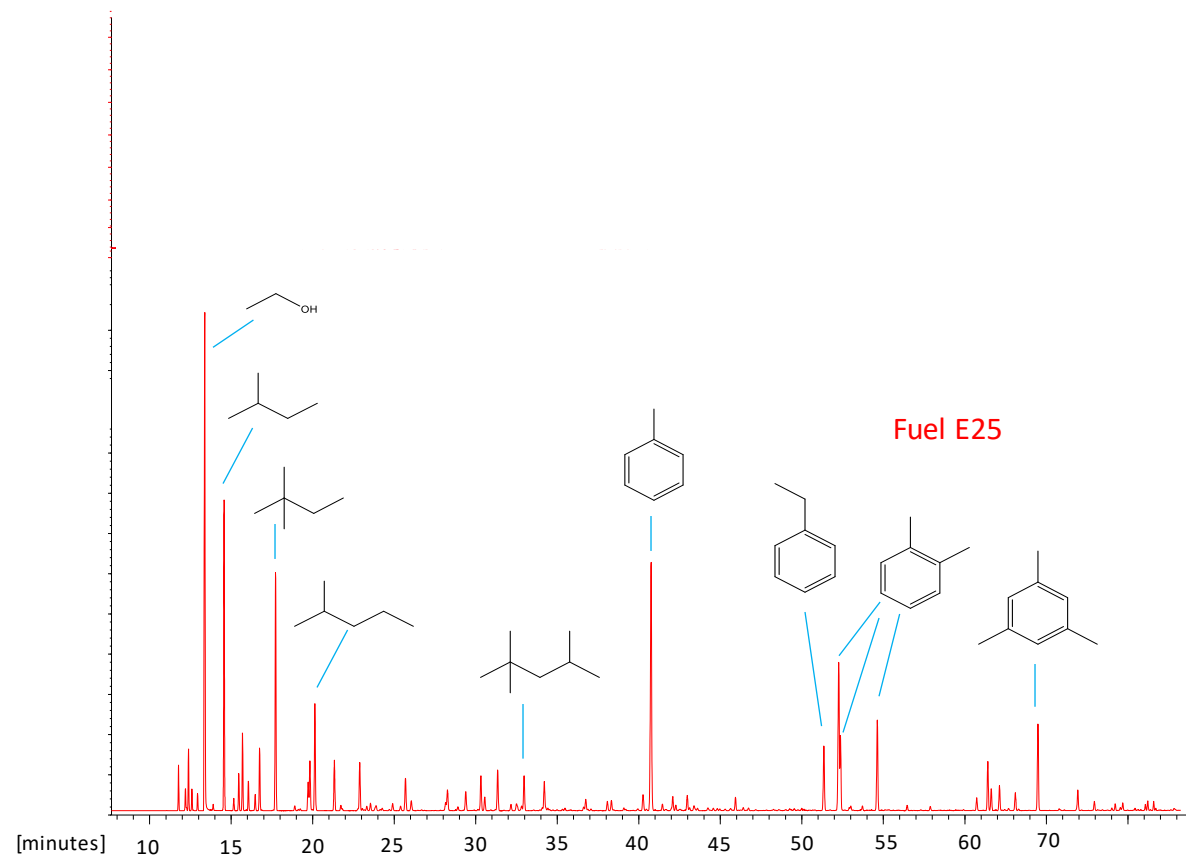
Procedure

Identification

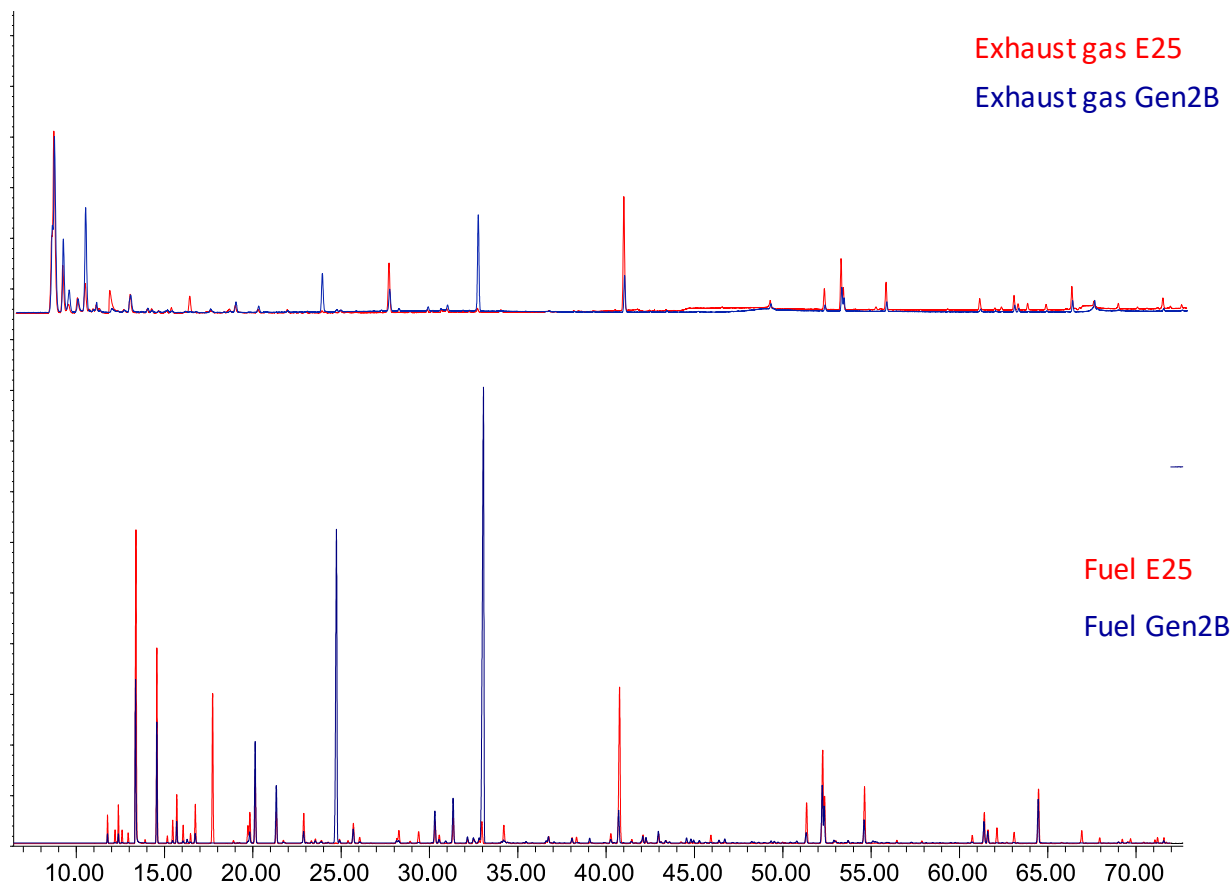
GC-MS

Quantification

GC-FID



Fuel influence on HC emissions



2000 RPM 5 IMEP

THC C1 Emissions:

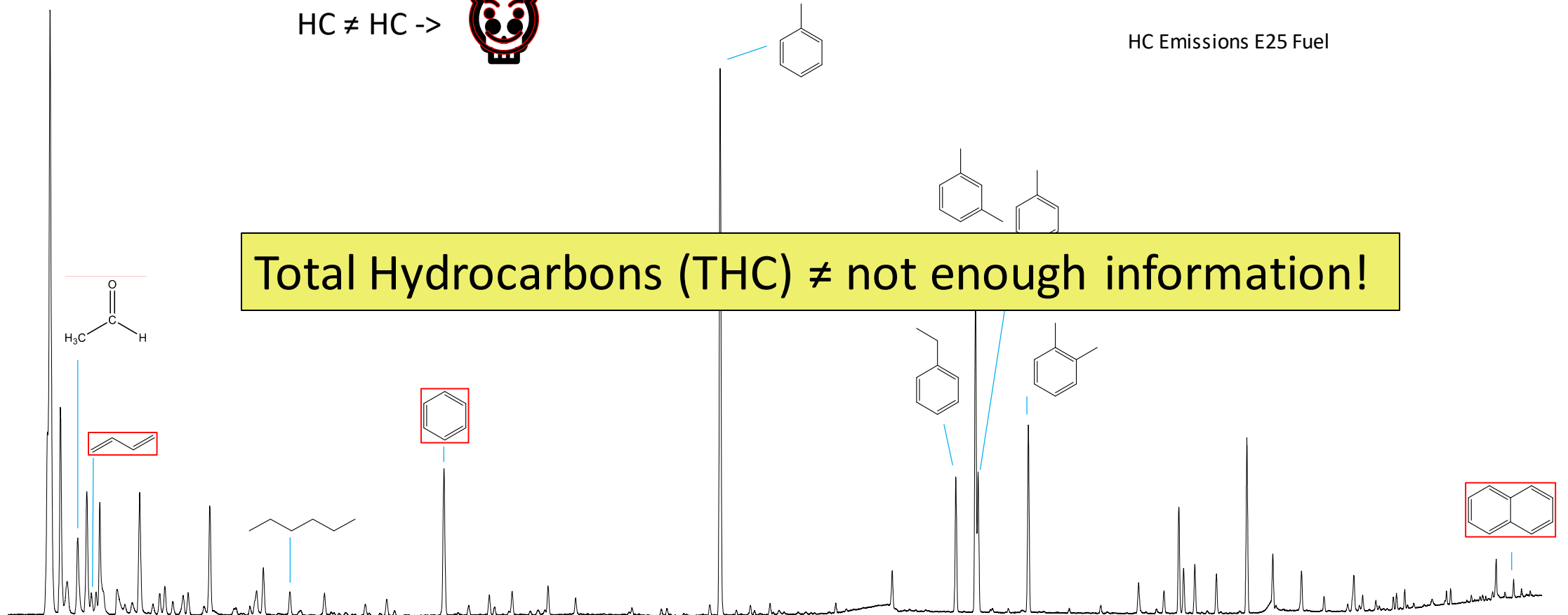
E25: 706 ppm

Fuel Gen2B: 694 ppm

EPA - Mobile Source Air Toxics¹

HC ≠ HC ->

HC Emissions E25 Fuel



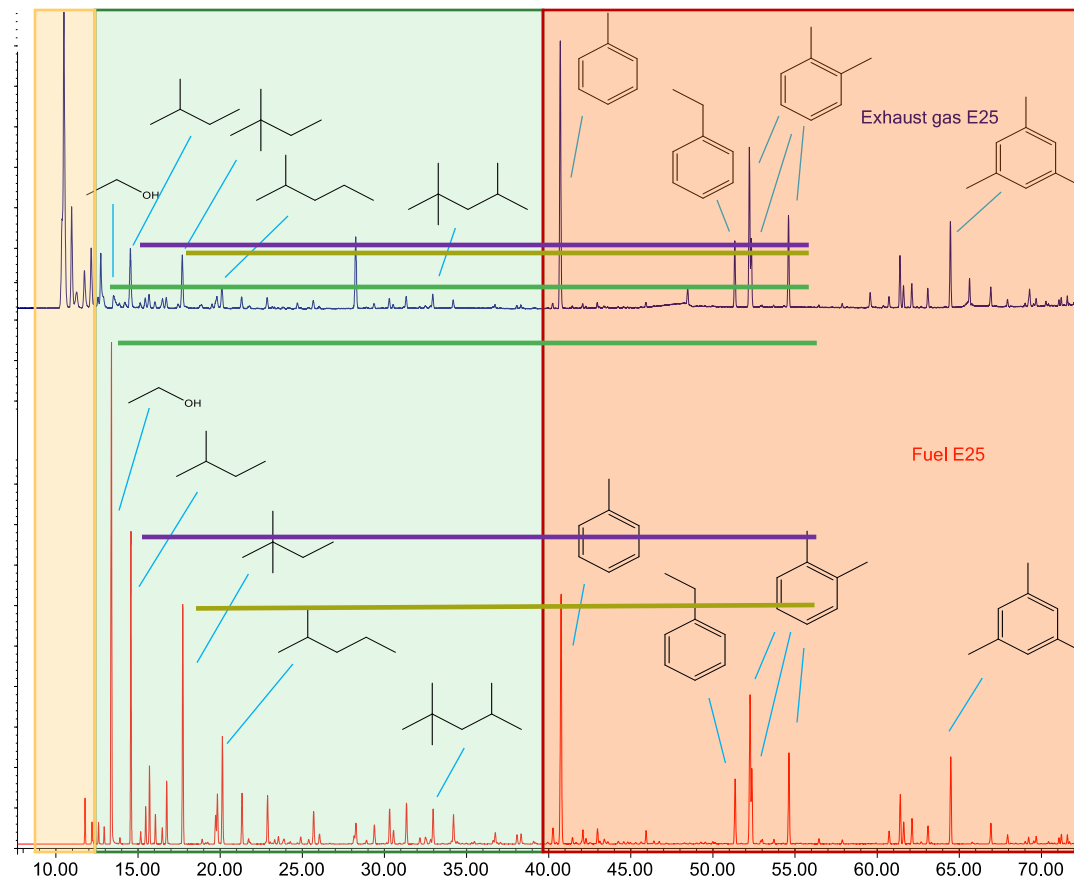
¹Mobile Source Technical Review Subcommittee, Clean Air Act Advisory Committee DRAFT Findings and Recommendations, June 2003

Fuel vs HC Emissions - E25

Combustion side products

methane, ethene,
acetylene, acetaldehyde...

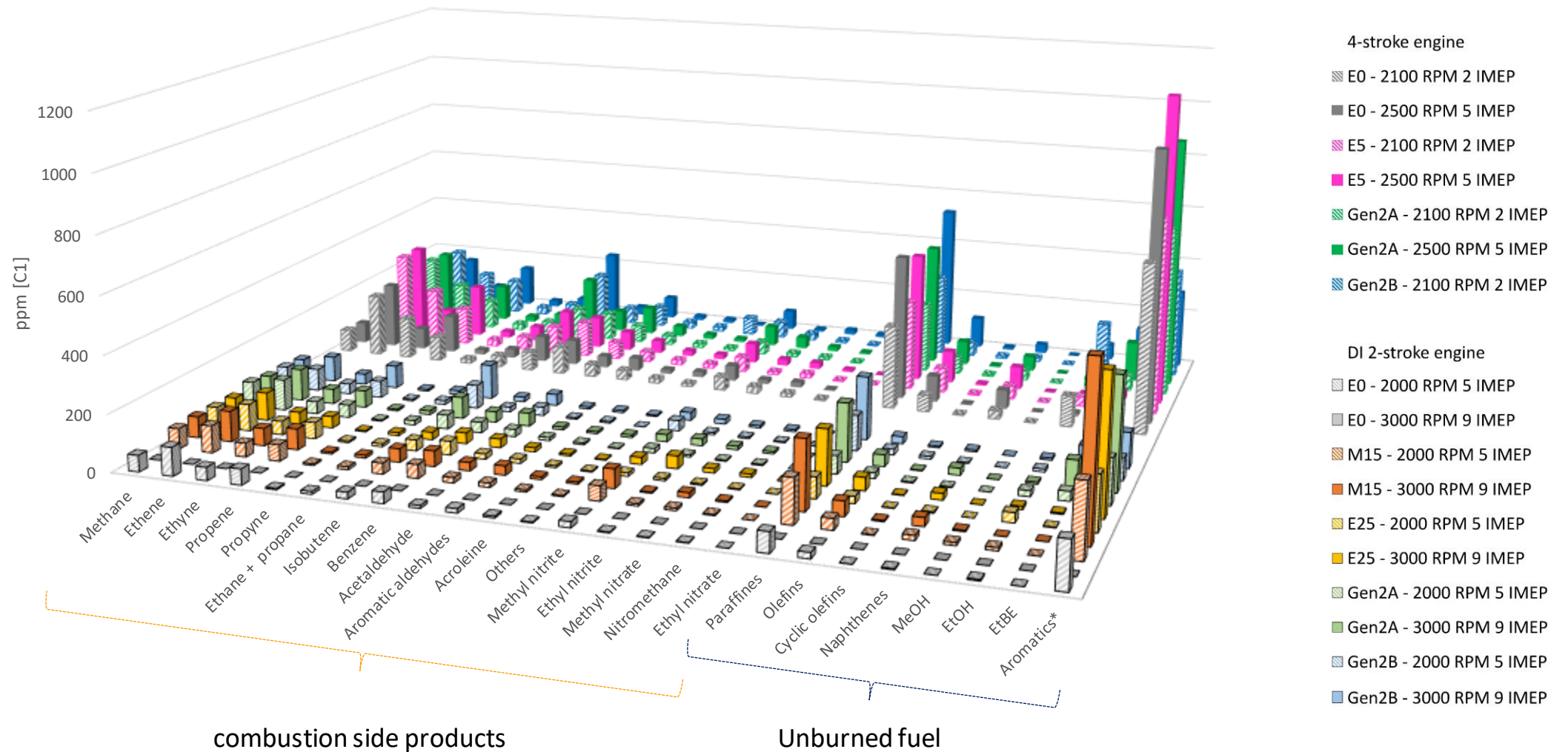
Unburned fuel -
**paraffines and
oxygenates**



- Oxygenates high conversion
- Paraffins and rest average/good
- Aromatics low conversion

Unburned fuel -
aromatics

Overview detailed HC emissions - all fuels



Expected aromatic behavior

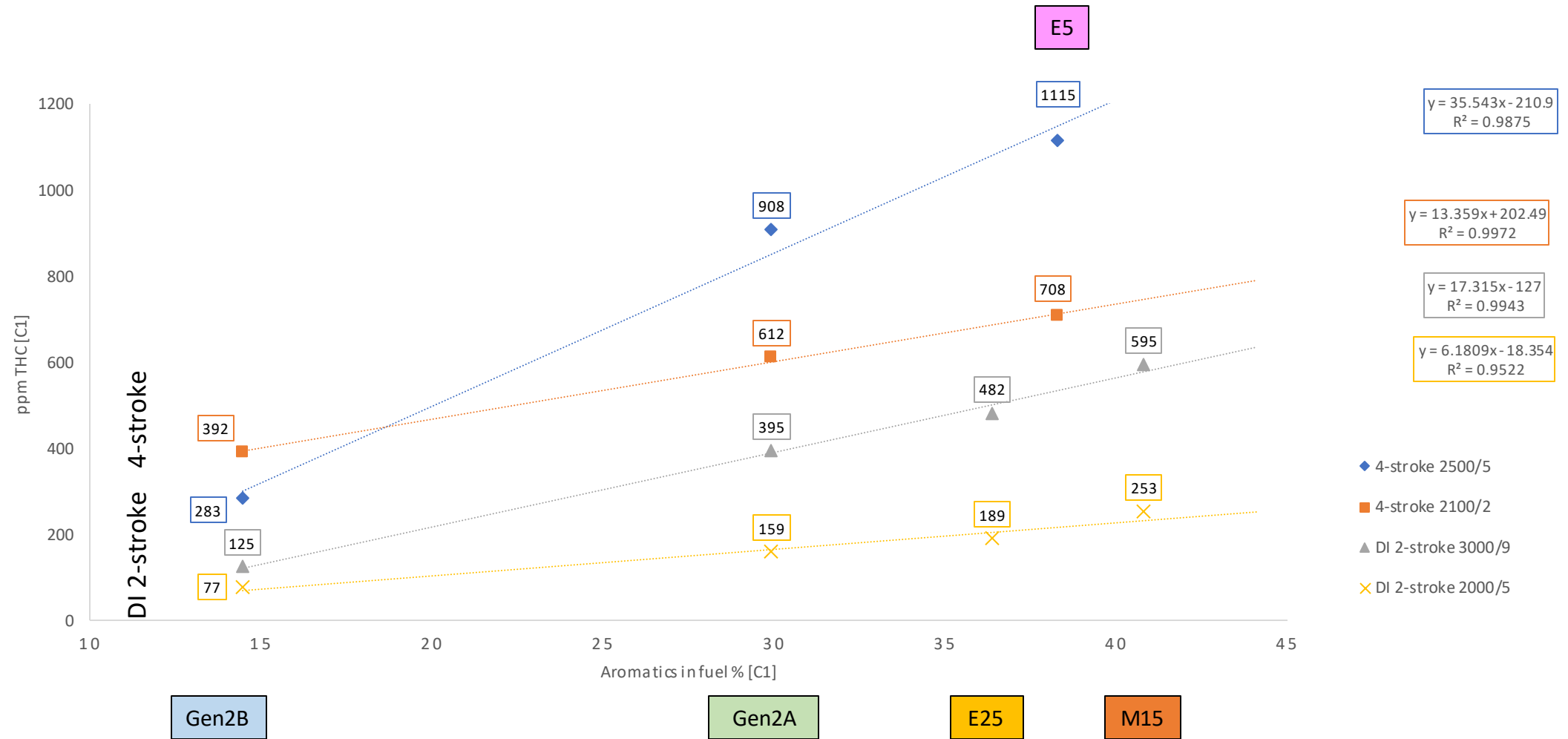
- Aromatics low conversion

Substance class	Fuels % [v/v]					
	Gen2B	Gen2A	E25	E5	M15	E0
Paraffins	49.17	34.36	35.26	44.58	39.97	47.02
Naphthenes	4.36	6.93	5.65	8.43	6.41	7.54
Olefins	1.68	2.99	6.33	8.05	7.17	8.43
Cycloolefins	1.77	0.50	0.75	1.27	0.85	1.00
Aromatics	10.56	22.57	27.00	30.25	30.60	36.01
Alcohols	10.78	11.28	25.00	5.14	15.00	n.d.
Ethers	21.68	21.35	n.d.	2.28	n.d.	n.d.

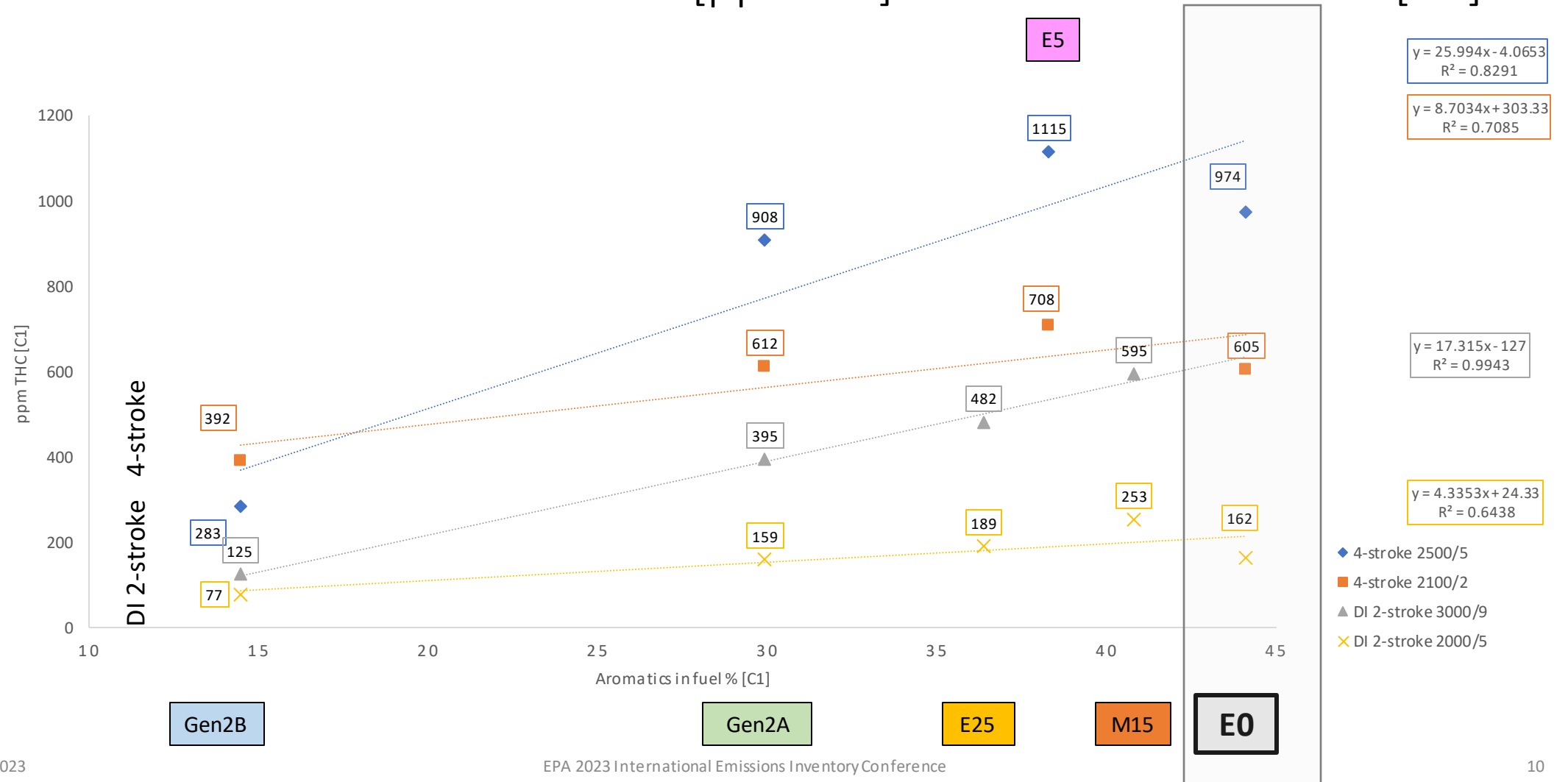
Increase in aromatic emissions



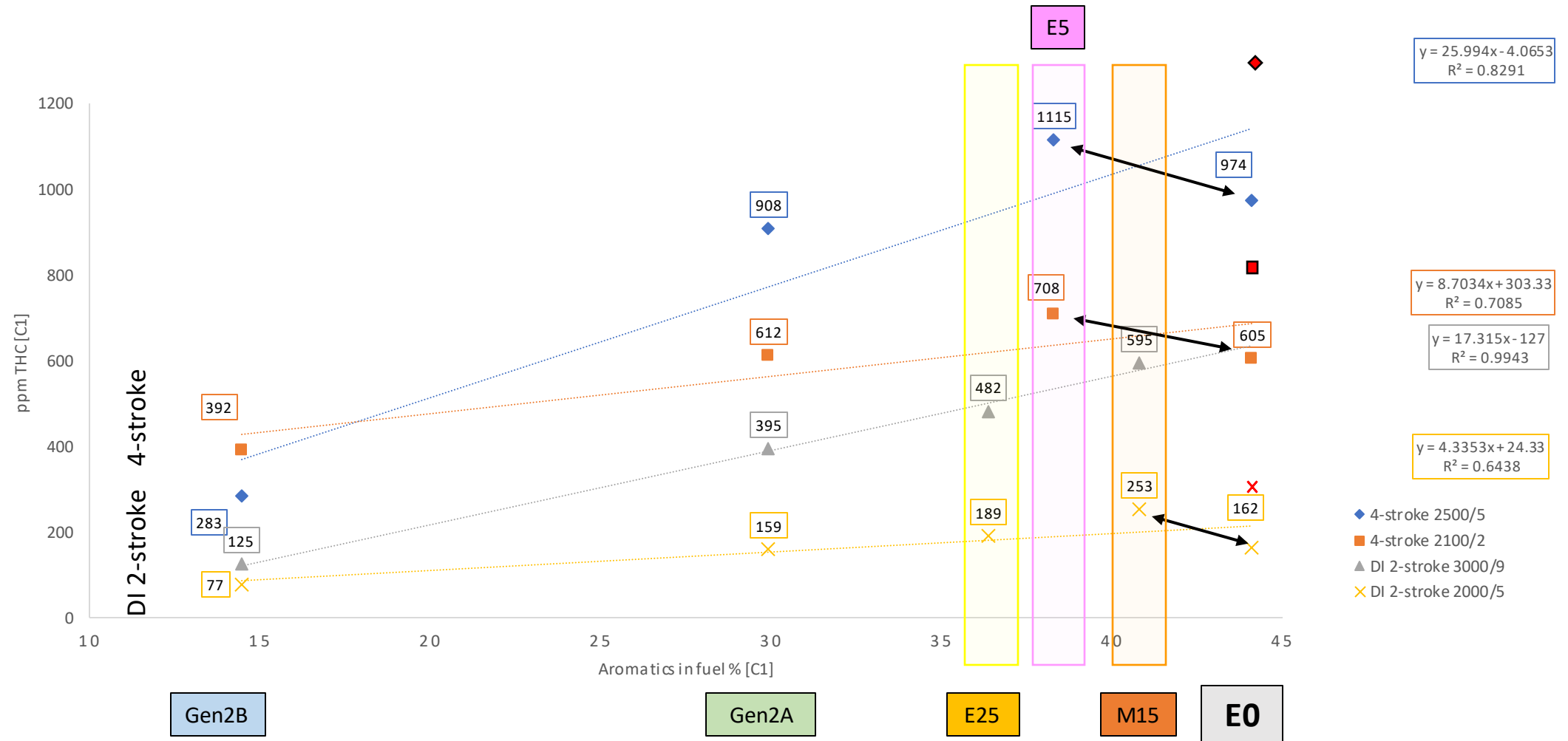
Emissions of unburned aromatics [ppm C1] vs aromatics in fuel % [C1]



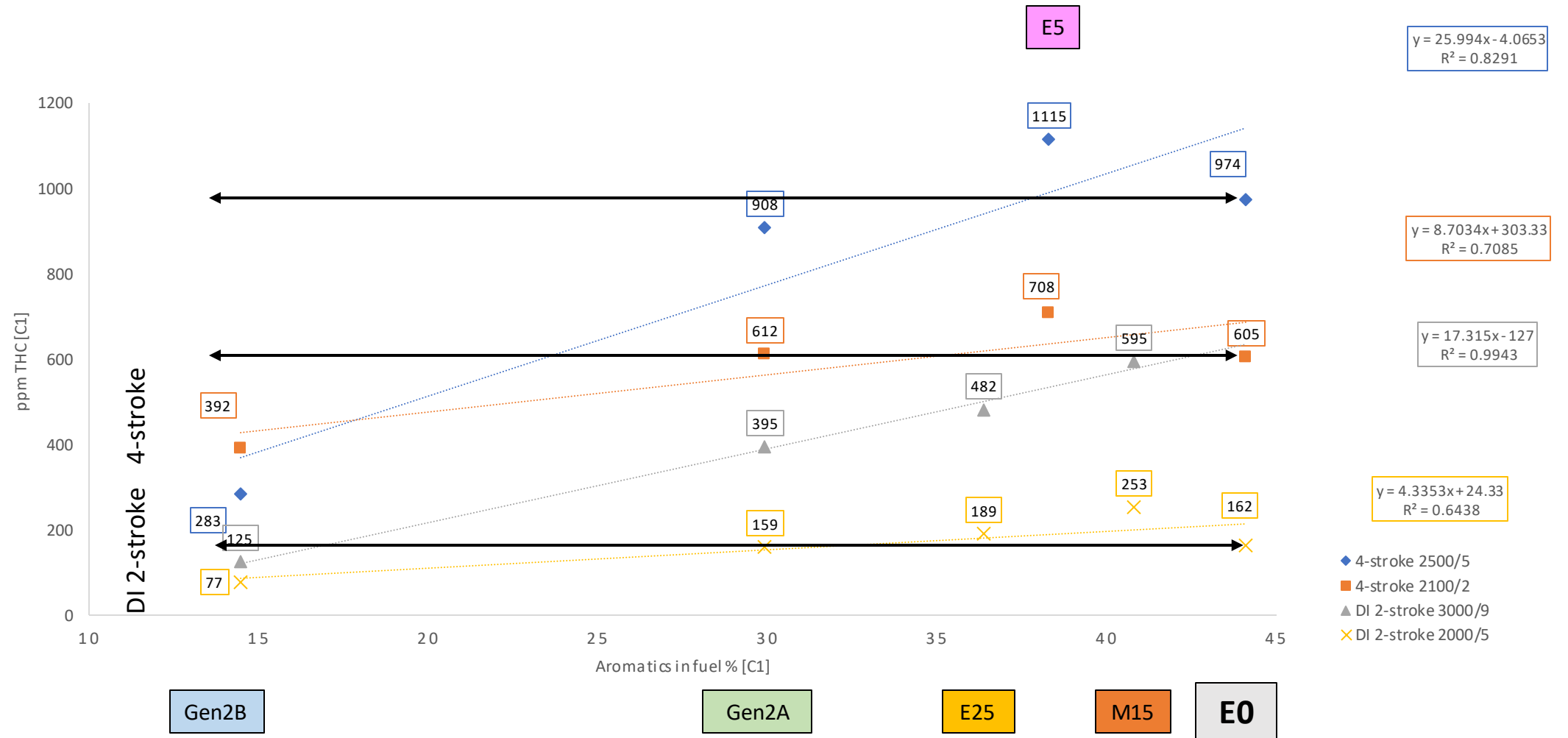
Emissions of unburned aromatics [ppm C1] vs aromatics in fuel % [C1]



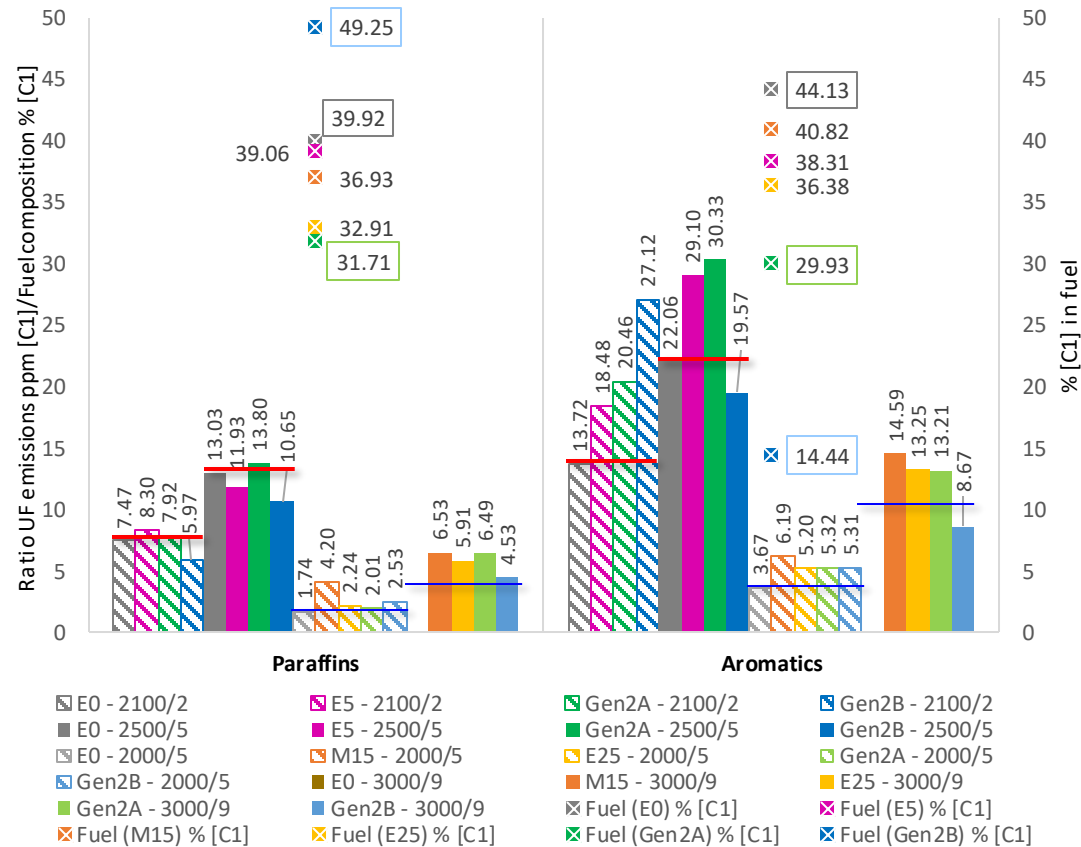
Emissions of unburned aromatics [ppm C1] vs aromatics in fuel % [C1]



Emissions of unburned aromatics [ppm C1] vs aromatics in fuel % [C1]



Effect of oxygenates on HC conversion rates – paraffins vs aromatics



Conclusions

1. Paraffins are not affected by oxygenates
2. Aromatics are strongly affected by oxygenates
3. Combine oxygenates with paraffins!
4. Detailed analysis > THC

Thank you for your attention!

I am looking forward to your questions!

Georg Stefan Pflieger
University of Graz
Institute of Chemistry
Heinrichstraße 28, 8010 Graz, Austria
+43 316 380 5327
georg.pflieger@uni-graz.at