

Exhaust emissions from small utility engines: effect of fuels and lube oils

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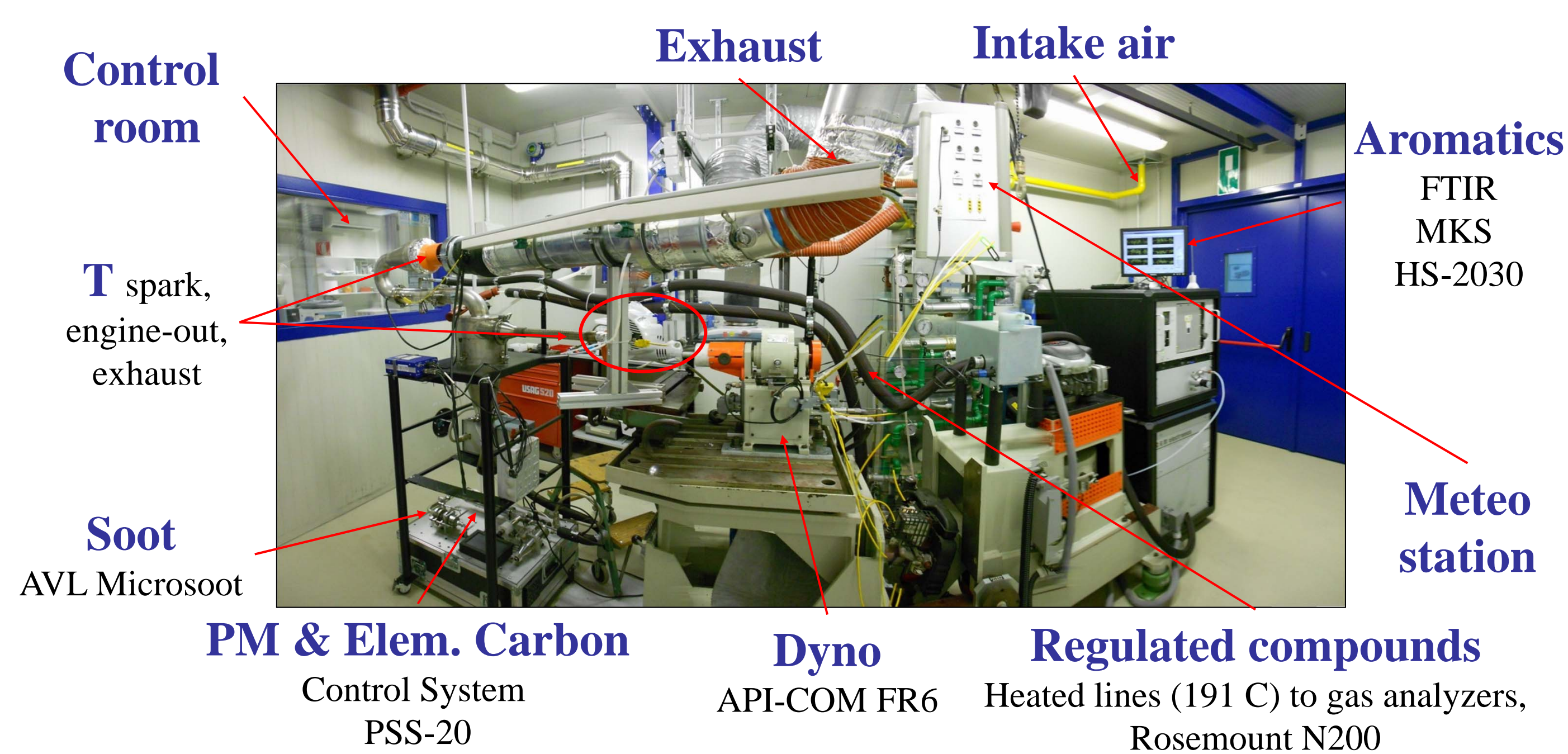
Background & Scope

Small utility engines are typically petrol fuelled, without after-treatment, with carburettor, often 2-stroke → **large emissions** of hydrocarbons (HC), carbon monoxide (CO), particle mass (PM), aromatics. Their deployment in proximity of the operator enhances the impact on **human health**.

The latest EU legislation revision dates back to 2004.

Scope *Evaluate the emission reduction by using aromatic free fuel and low-ash oil*

Method

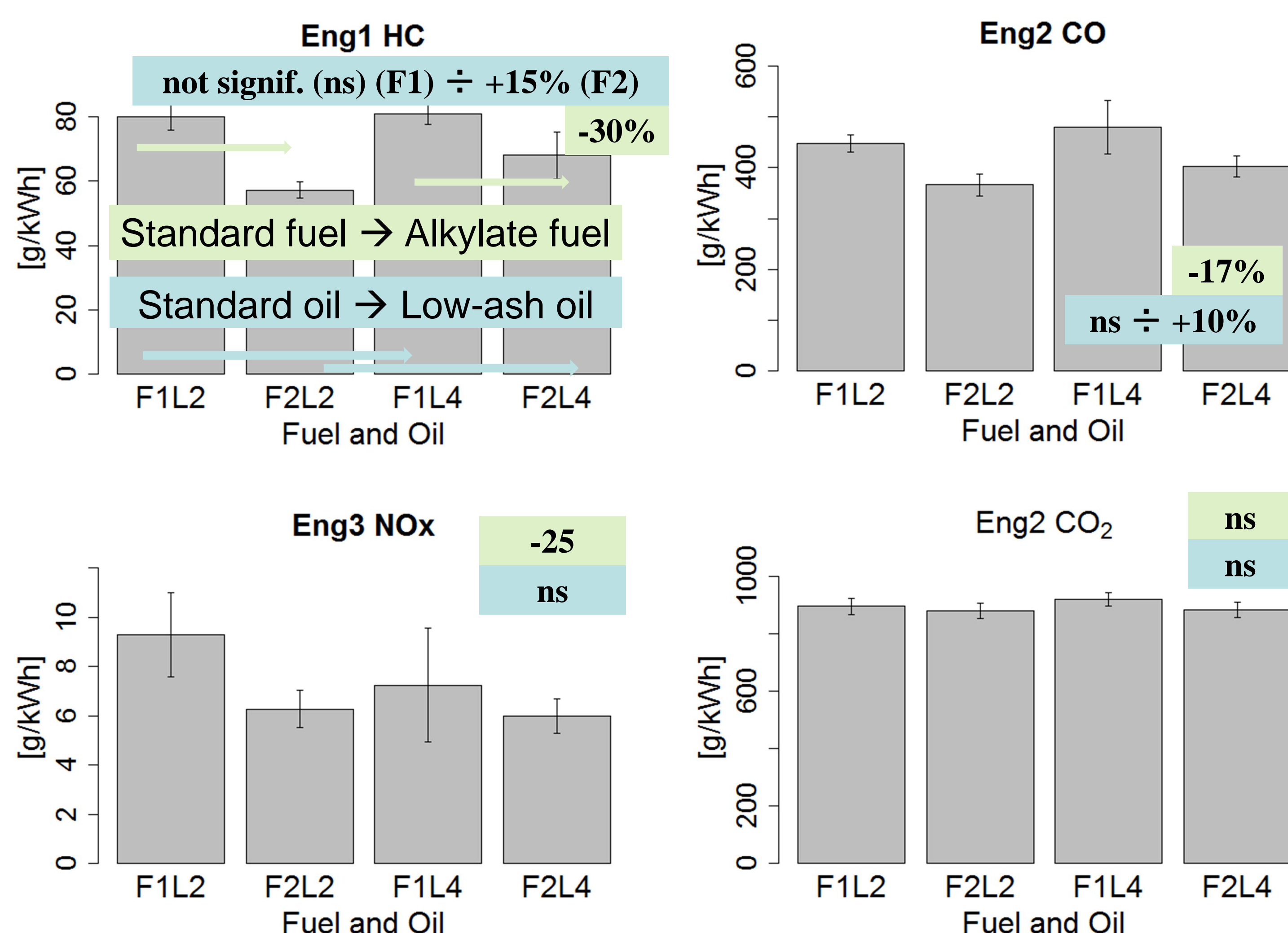


Engine	Stroke	Engine Capacity [cc]	Power [kW]	Max Rotation	EU Stage
Eng1	2	25	0.7	8500	I
Eng2	2	27	0.8	7500	I
Eng3	4+oil	30	1	7000	II

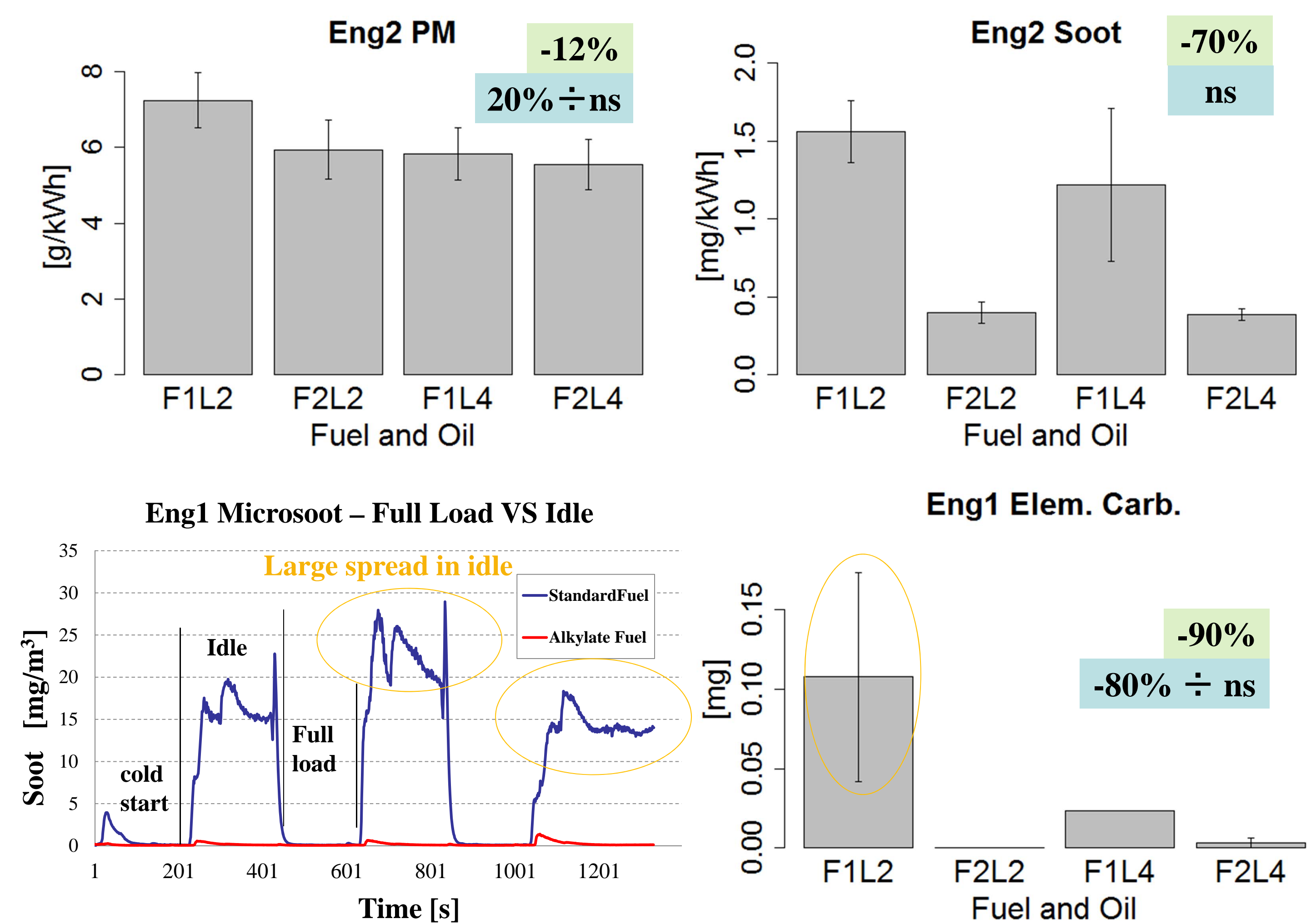
Fuel effect (average on L2 and L4)
Oil effect (split for F1 and F2)

Parameter	Standard Fuel F1	Alkylate Fuel F2
Density [kg/m ³]	753.1	692.4
Aromatics [%vol]	31.9	<0.4
Parameter	Standard Oil L2	Low-ash Oil L4
Ash [%w]	0.1	0.005
Sulfur [%w]	0.42	0.006

Regulated compounds

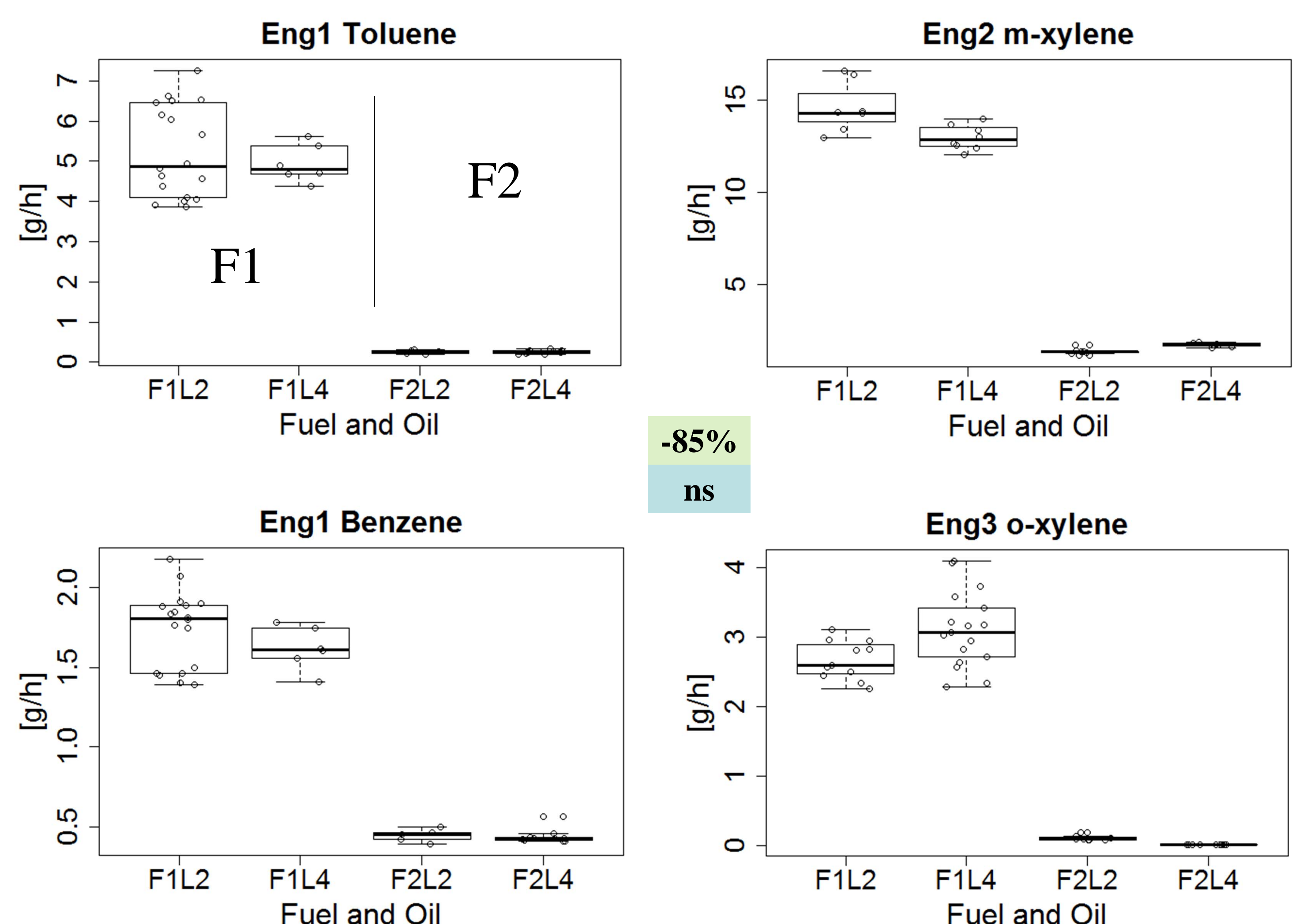


Particles



PM amount slightly affected, **PM quality dramatically affected**

Aromatics



Summary

Emission Reduction % (range min/max, over 6 engines)															
Parameter	HC		CO		NOx		CO ₂	Aromatics		PM		Soot		EC	
F1 → F2	-30	ns	-10	+20	-55	-25	ns	-100	-70	-84	ns	-75	ns	-95	-80
L2 → L4	ns	+10	ns	+10	-20	+20	ns	-10	ns	-20	ns	-80	ns	-80	ns

The use of alkylate fuel

- **Drastically reduced** emissions of aromatic compounds and soot
- Has potential to reduce total hydrocarbons carbon monoxide and NOx
- Would certainly reduce health-related, societal costs

The use of low-ash oil

- Has lower impact than the fuel change
- It can increase emissions (reset engine map?)
- Has potential to reduce soot, esp. with standard fuel