

**Influence of common rail fuel injection parameters
on particulate emissions of heavy duty diesel engines**



Eidgenössische
Technische Hochschule
Zürich

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Influence of Common Rail Fuel Injection Parameters on Particulate Emissions of Heavy Duty Diesel Engines

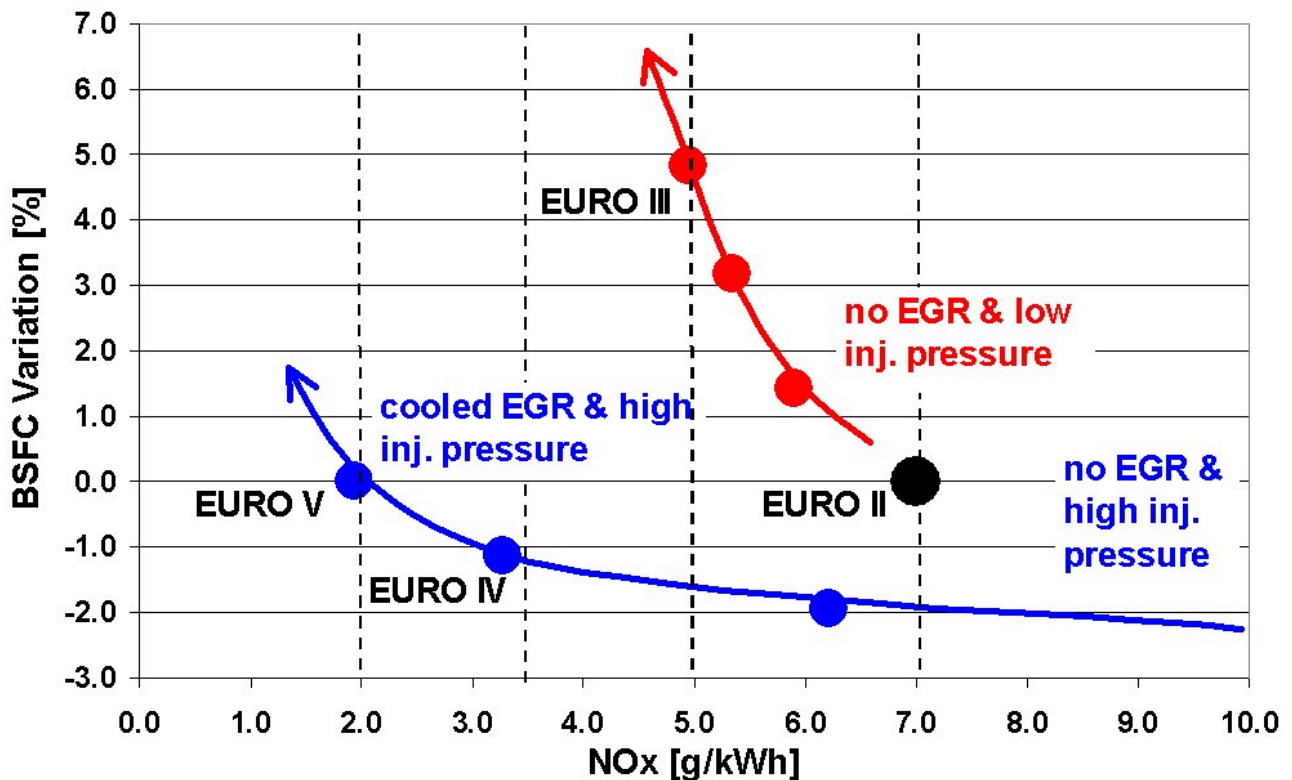
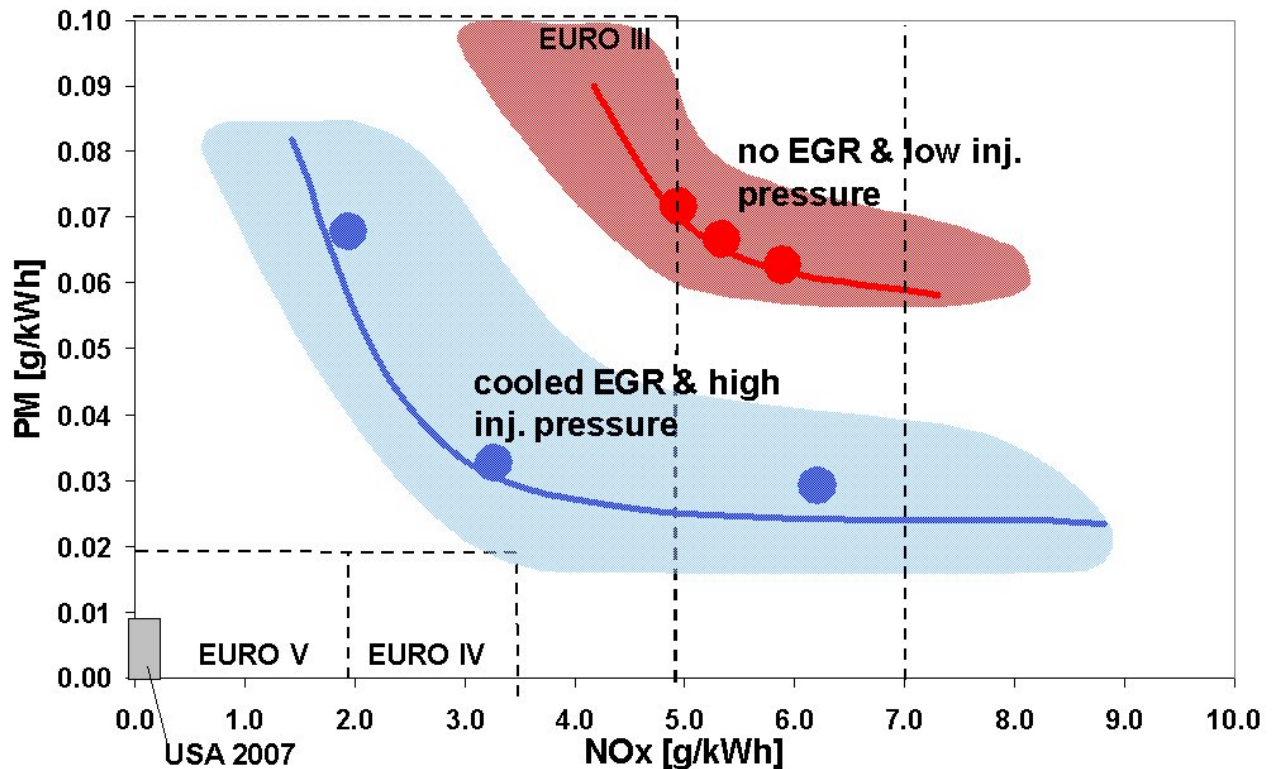
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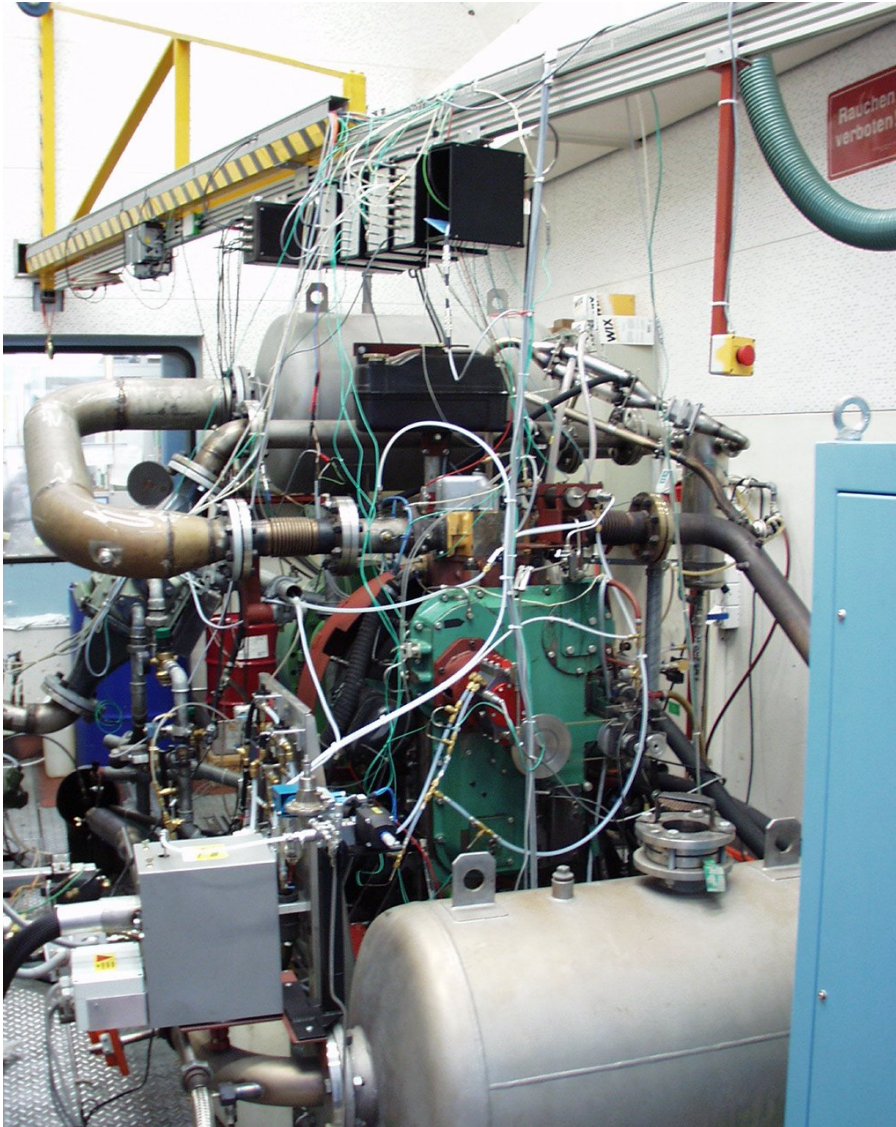
Contents

- Overview on advanced diesel engine technology
- Test bed, Common Rail injection system
- Particulate matter size distribution
 - Influence of **injection pressure**
 - Influence of **injection timing**
 - Influence of **Exhaust Gas Recirculation**
- Conclusions

Advanced Diesel Engine Technology



Liebherr Single-Cylinder Research Engine



Main Engine Data

Heavy Duty Diesel Engine

4 Stroke, 2 Valves

Displacement 2.14 Lit

Supercharger, Intercooler

Exhaust Gas Recirculation

Common Rail Direct Injection

Electronic controlled

Precise & independent setting of:

Injection Pressure

Start of Injection

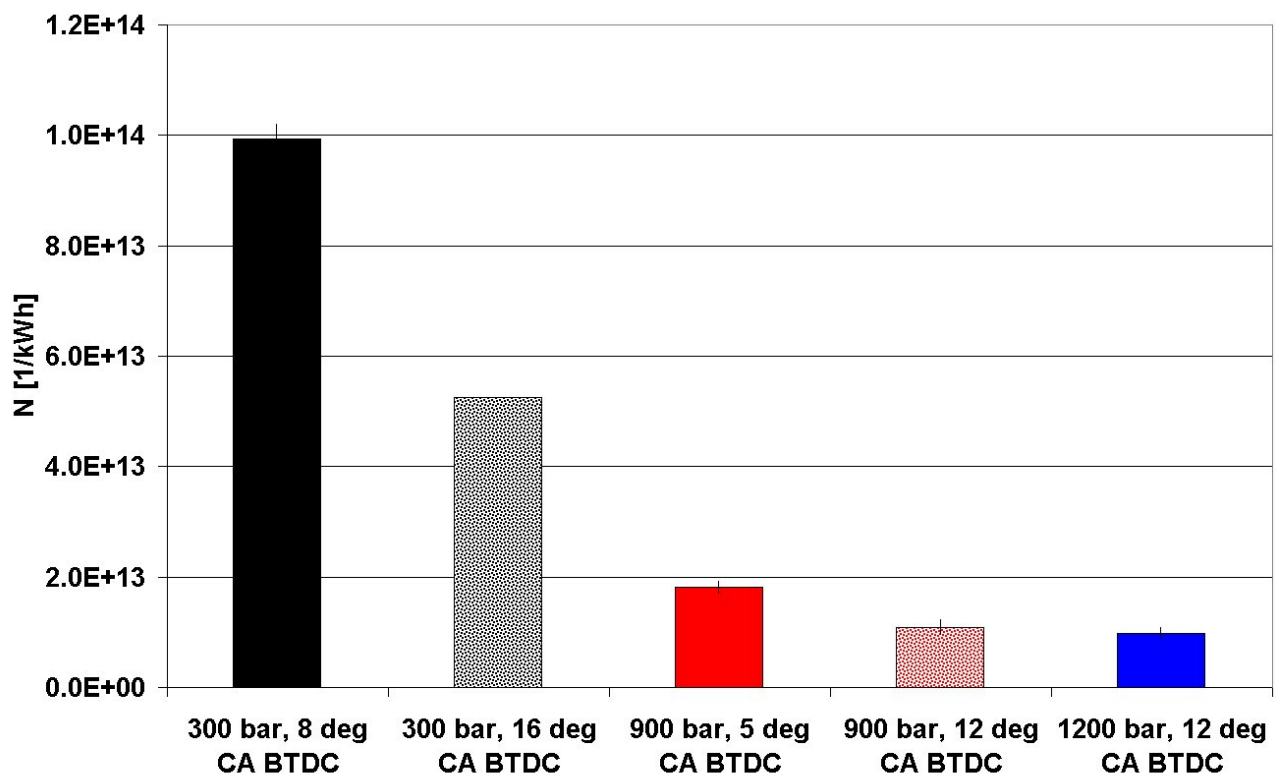
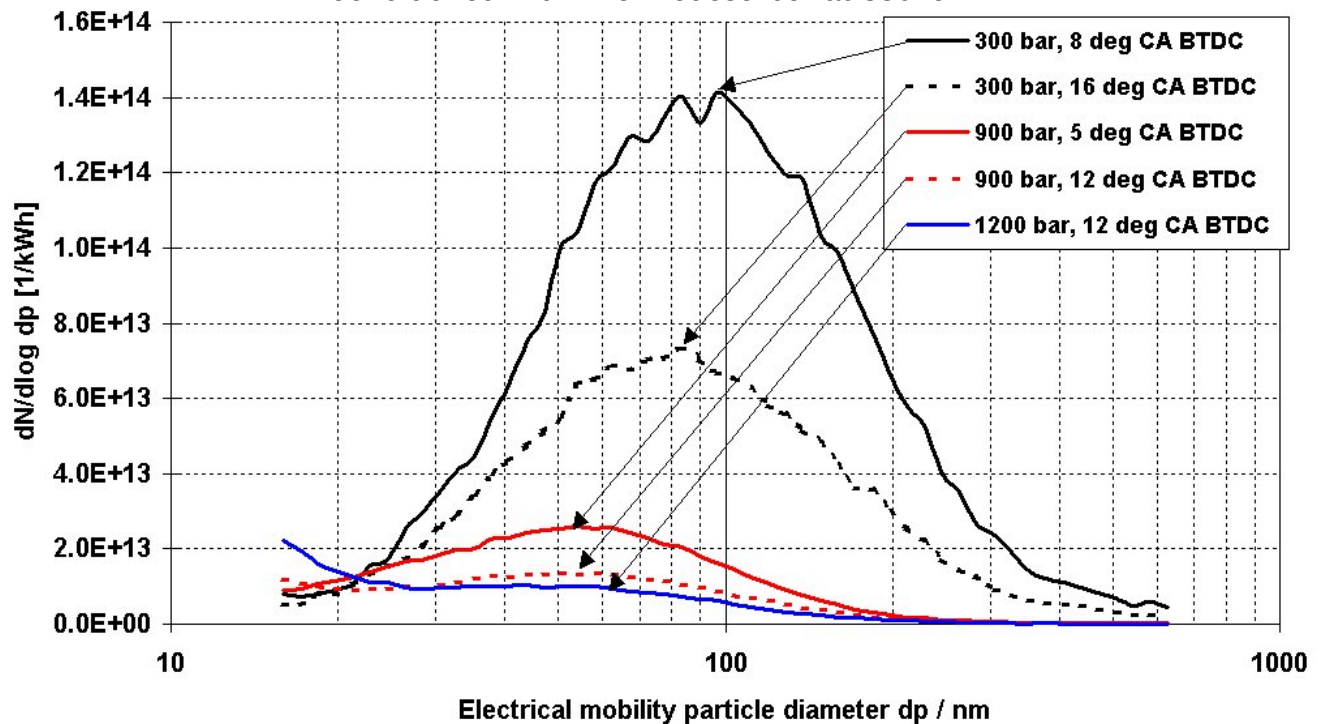
Multiple Injections

Single-Cyl. Heavy Duty Diesel engine, 1180 rpm, 25 % load

Diesel 50 ppm S

Injection Parameters Variation

Conditioned with Thermodesorber at 350°C

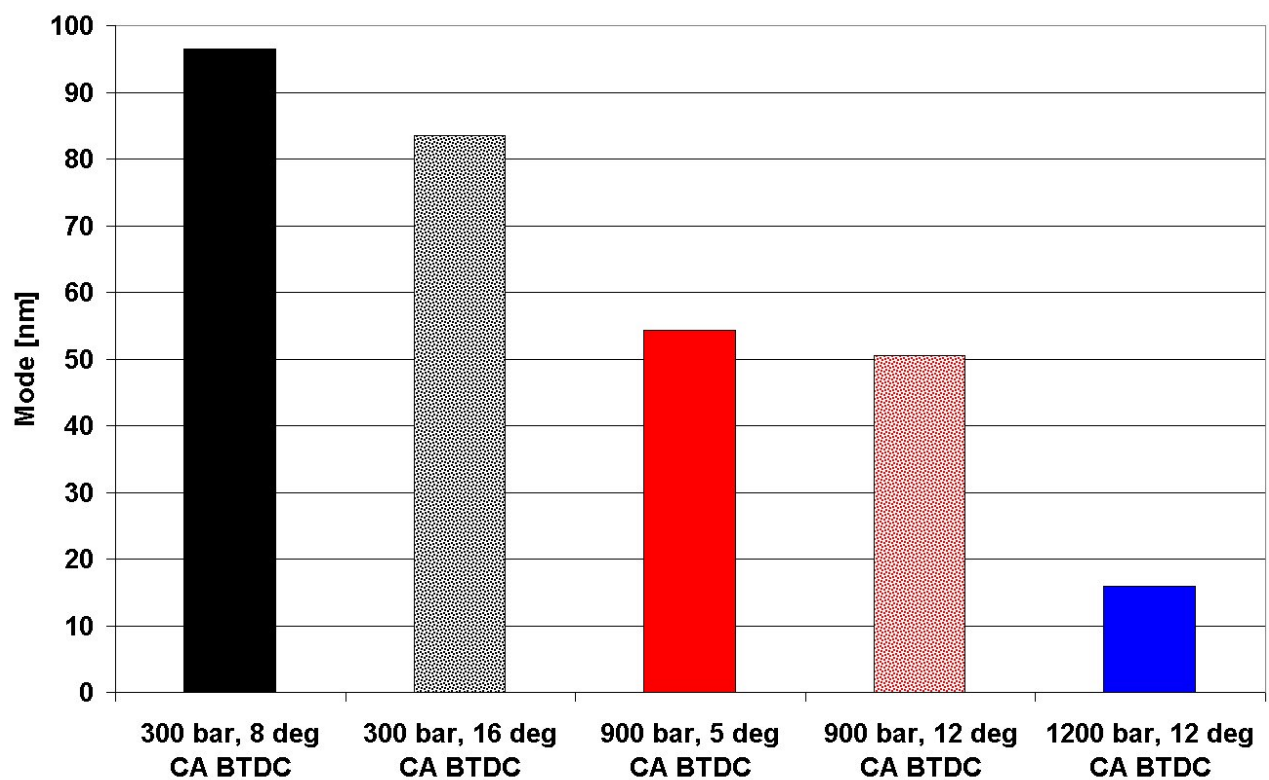
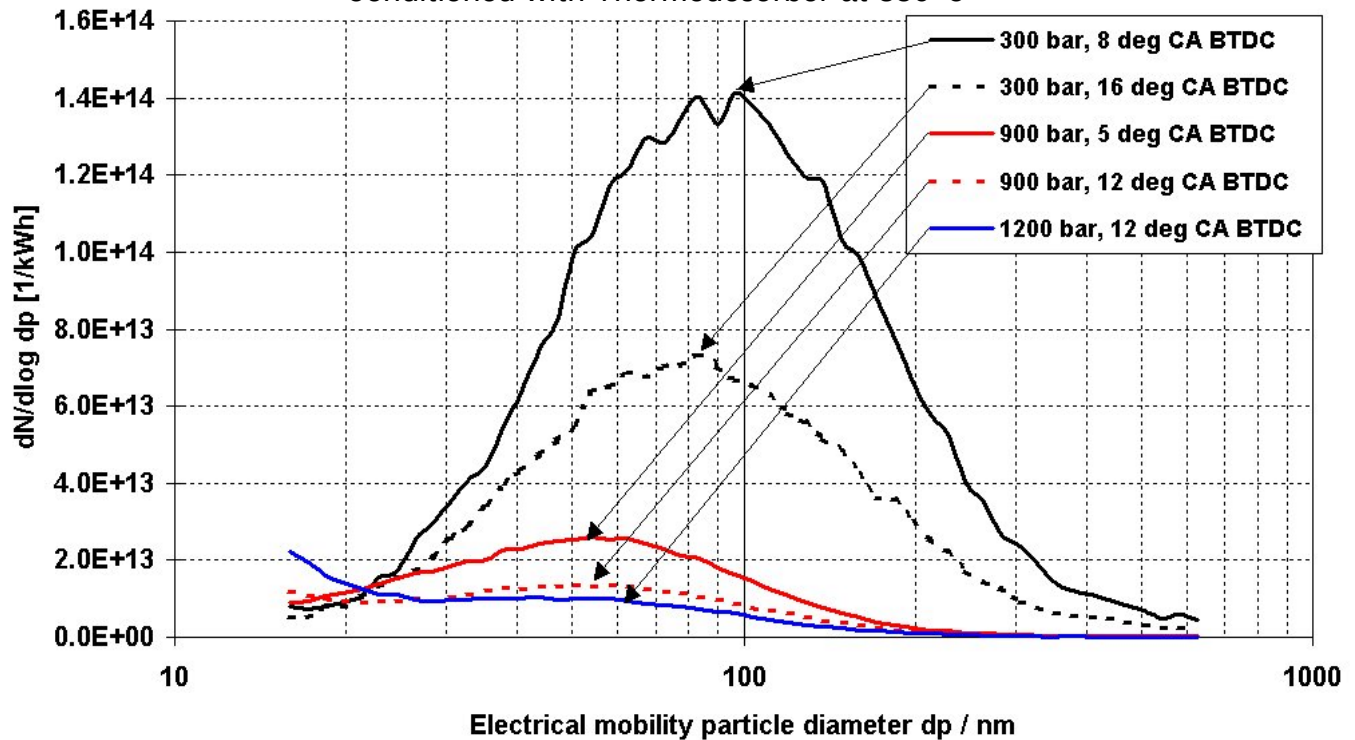


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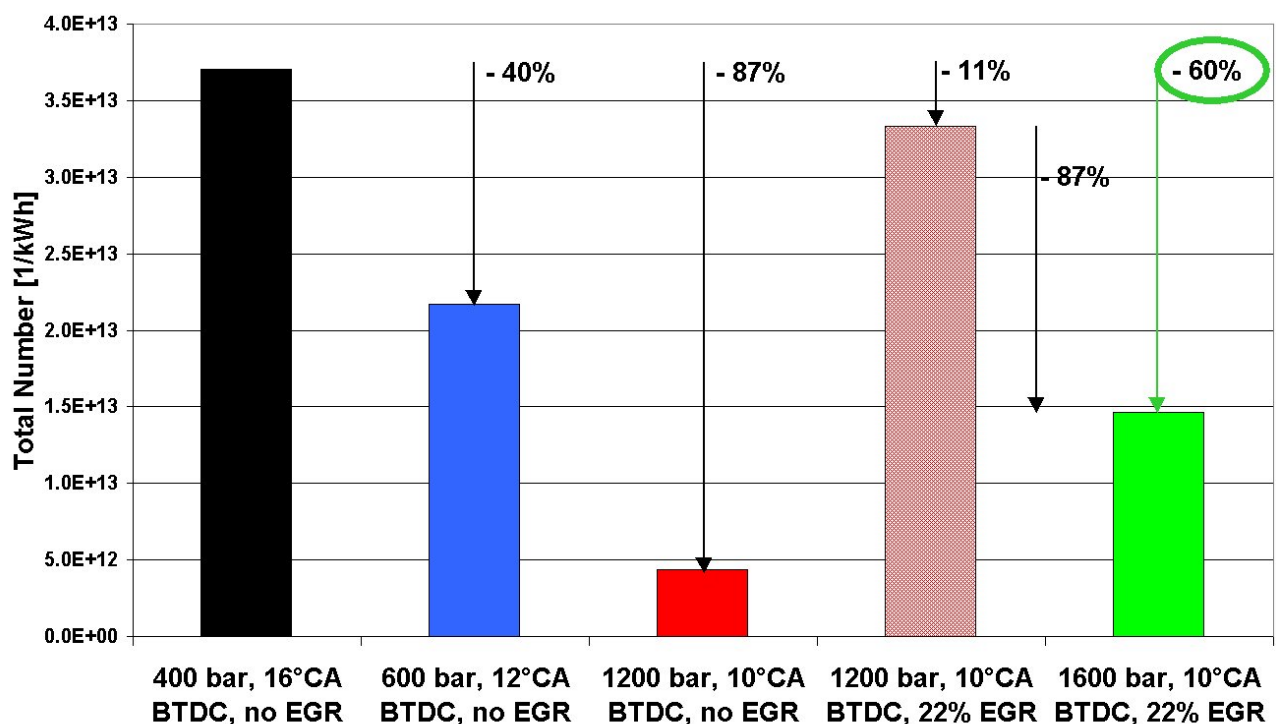
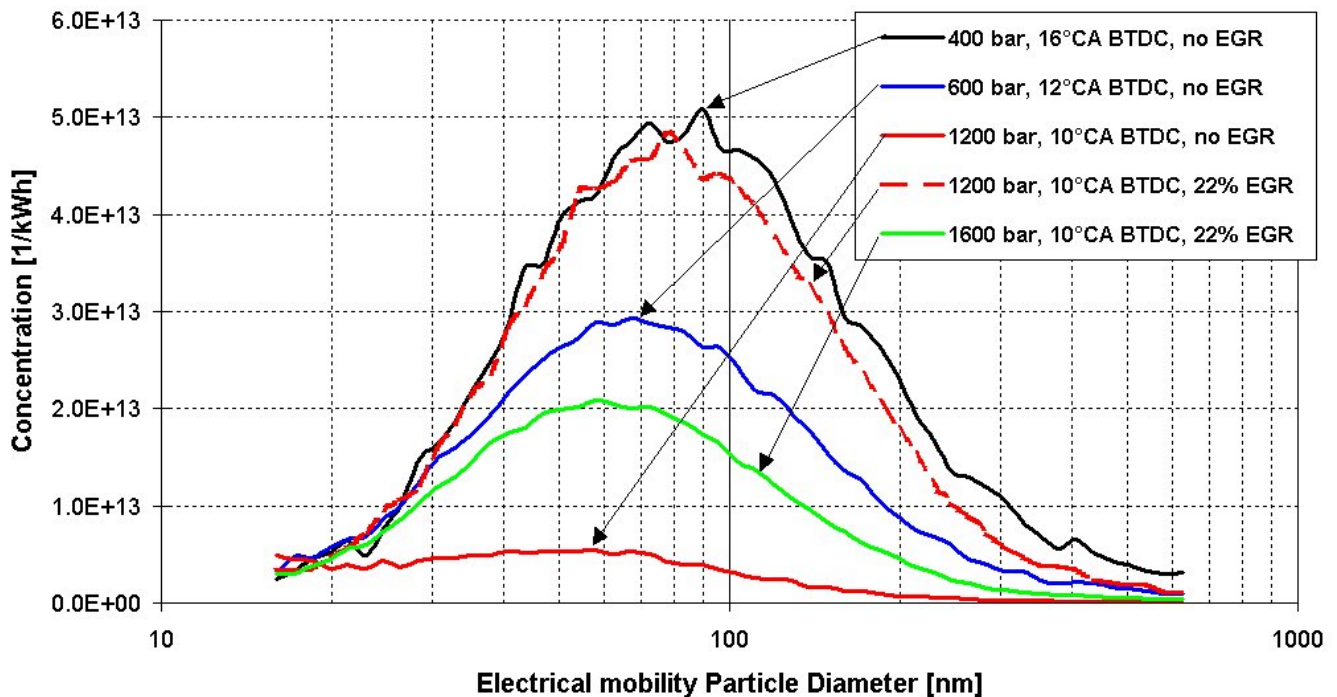


Single-Cyl. Heavy Duty Diesel engine, 1460 rpm, 50 % load

Diesel 50 ppm S

Injection Parameters & EGR Variation

Conditioned with Thermodesorber at 350°C

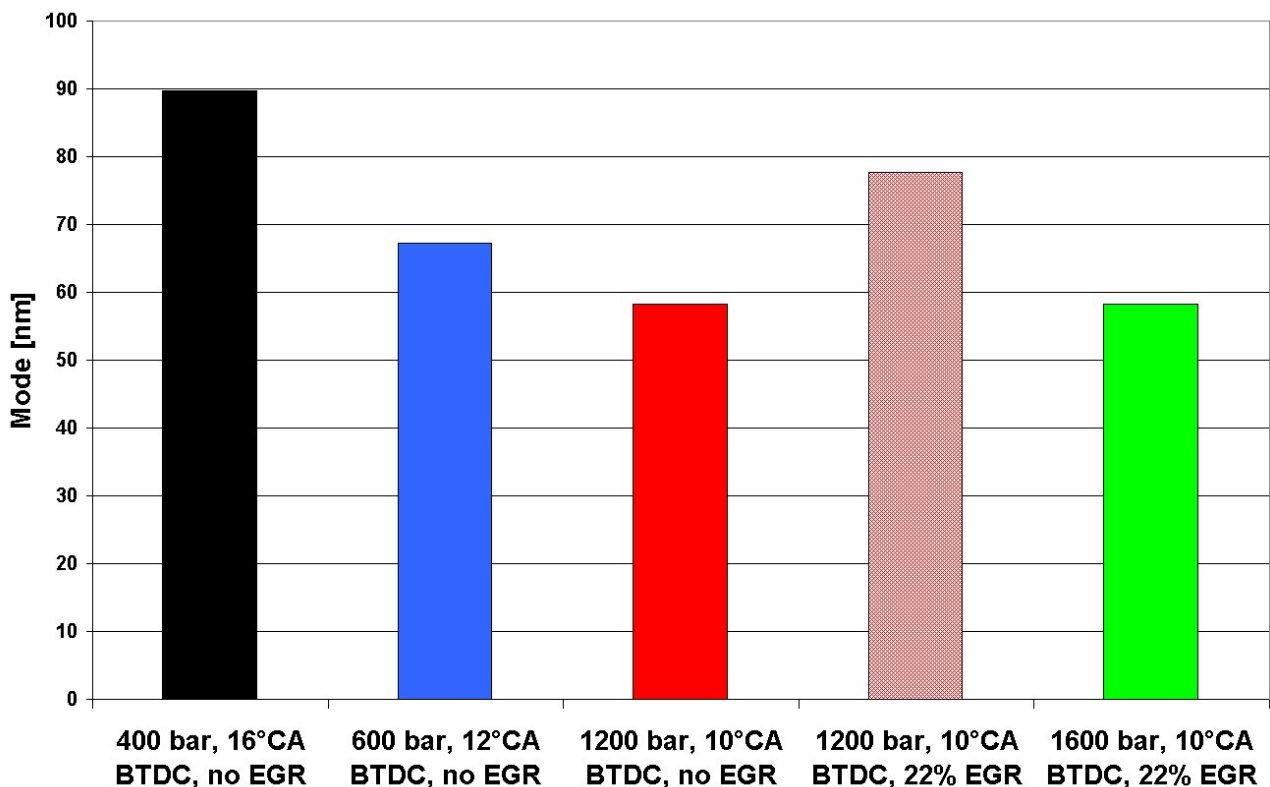
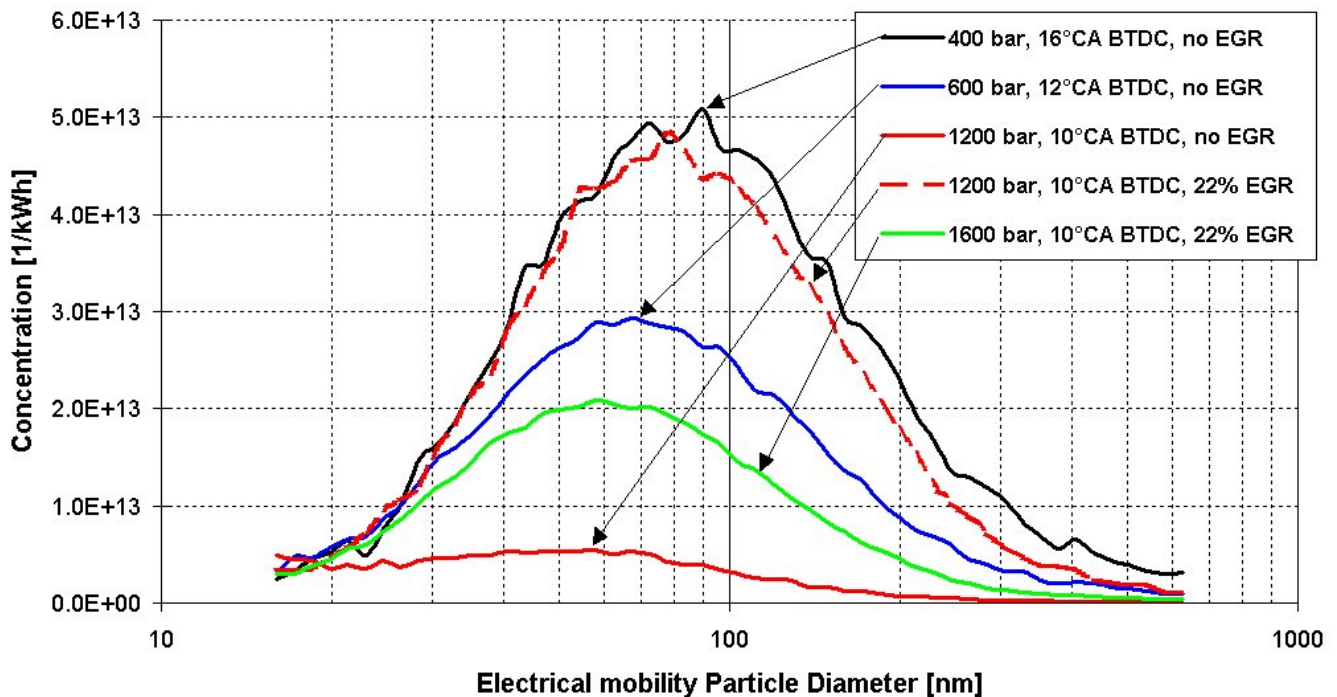


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Injection Parameters & EGR Variation

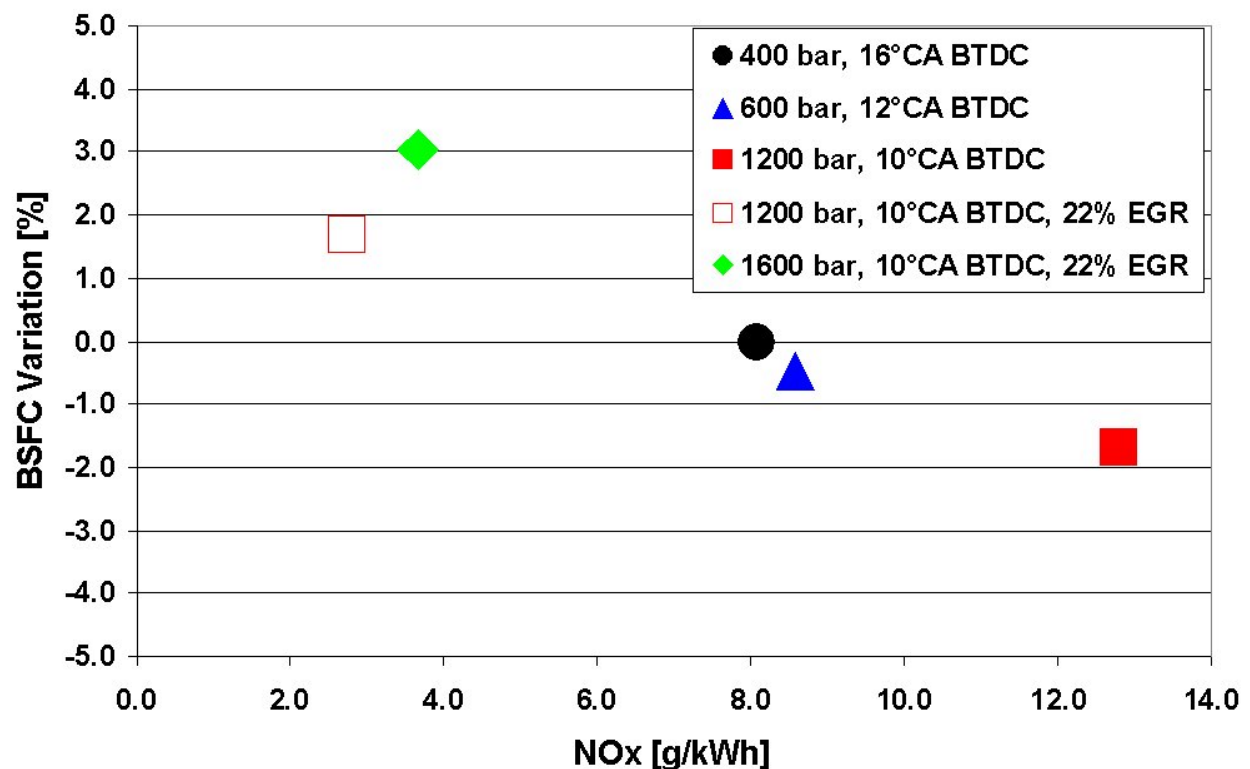
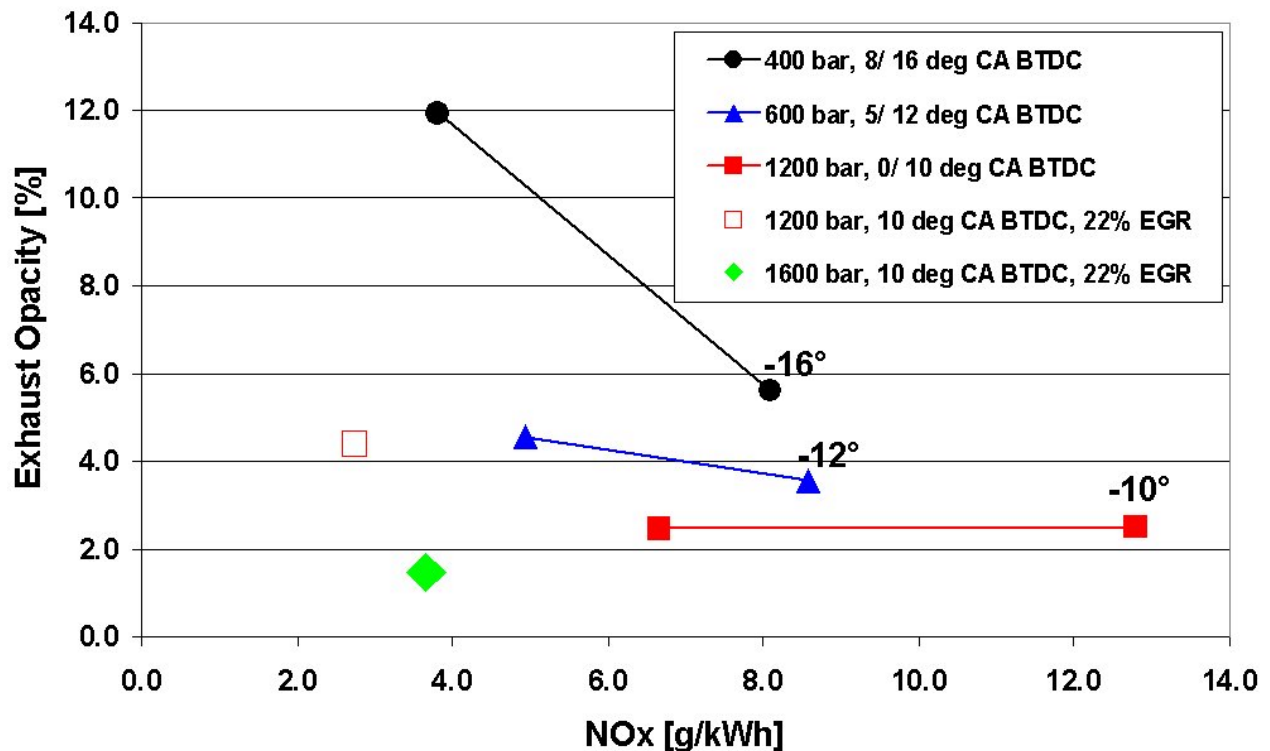
Conditioned with Thermodesorber at 350°C



Single-Cyl. Heavy Duty Diesel engine, 1460 rpm, 50 % load

Diesel 50 ppm S

Injection Parameters & EGR Variation



Conclusions

- The injection parameter settings have the predominant role in the shape of the particulate matter size distribution.
- High injection pressures and advanced injection timings **lower** the particle number concentrations.
- Cooled EGR shifts the maximum in the number size distribution to **more and larger** particles.
- Post injection **lowers** the particle number concentration.
- It is possible to optimize the parameters injection pressure, start of injection and EGR rate in order to **minimize the total number** of emitted particles.