

# Charring characteristics of water-soluble organic compounds from particulate samples of diesel exhaust fume and wood smoke analyzed by a thermo-optical transmittance method

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- Thermo-optical analysis dependent on chemical composition of sample, temperature, ramping times, gas flow etc
- Diesel exhaust of large interest for occupational and public health measurements
- Need for standardization of protocol

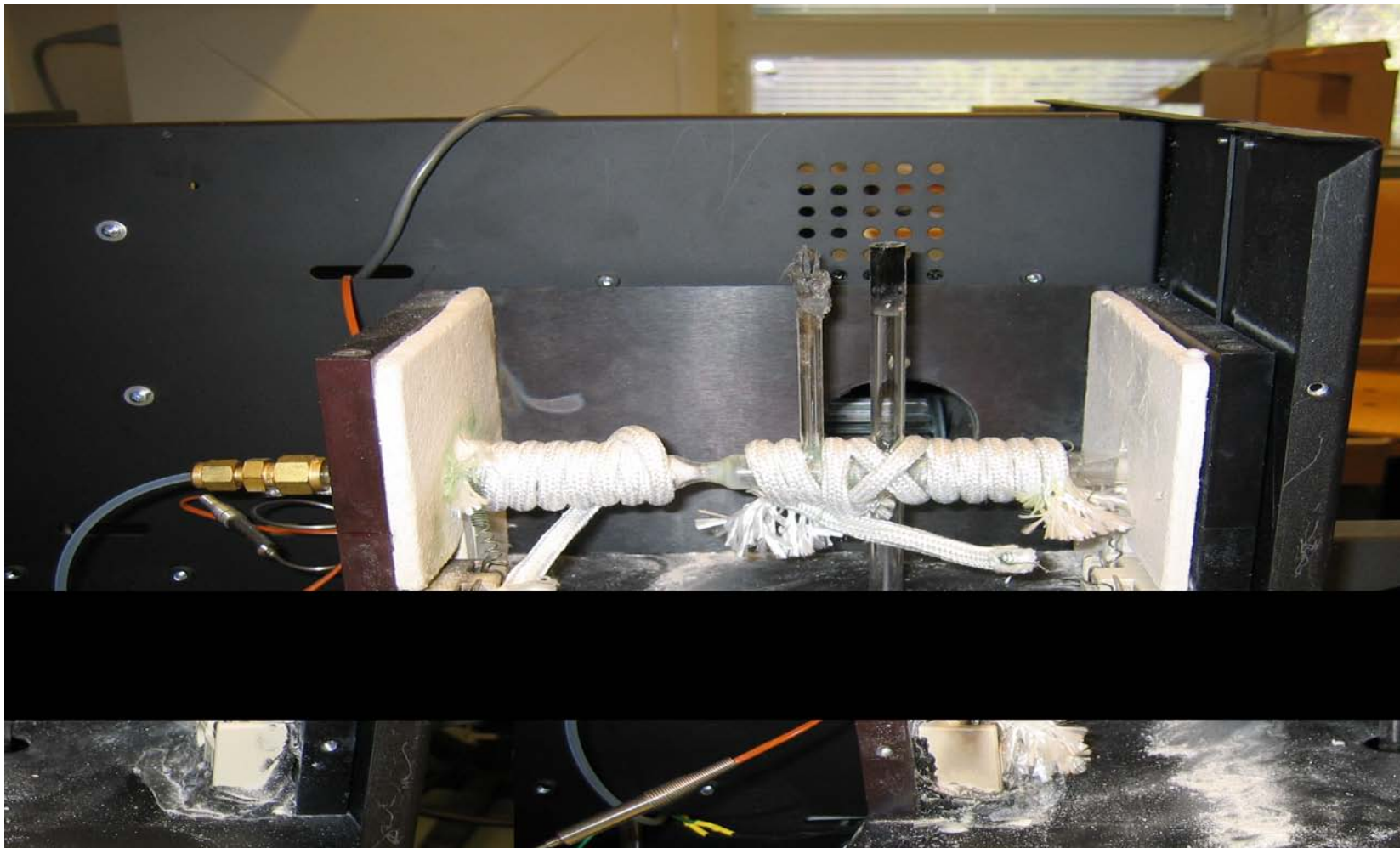
# Thermal/Optical Carbon Aerosol Analyzer



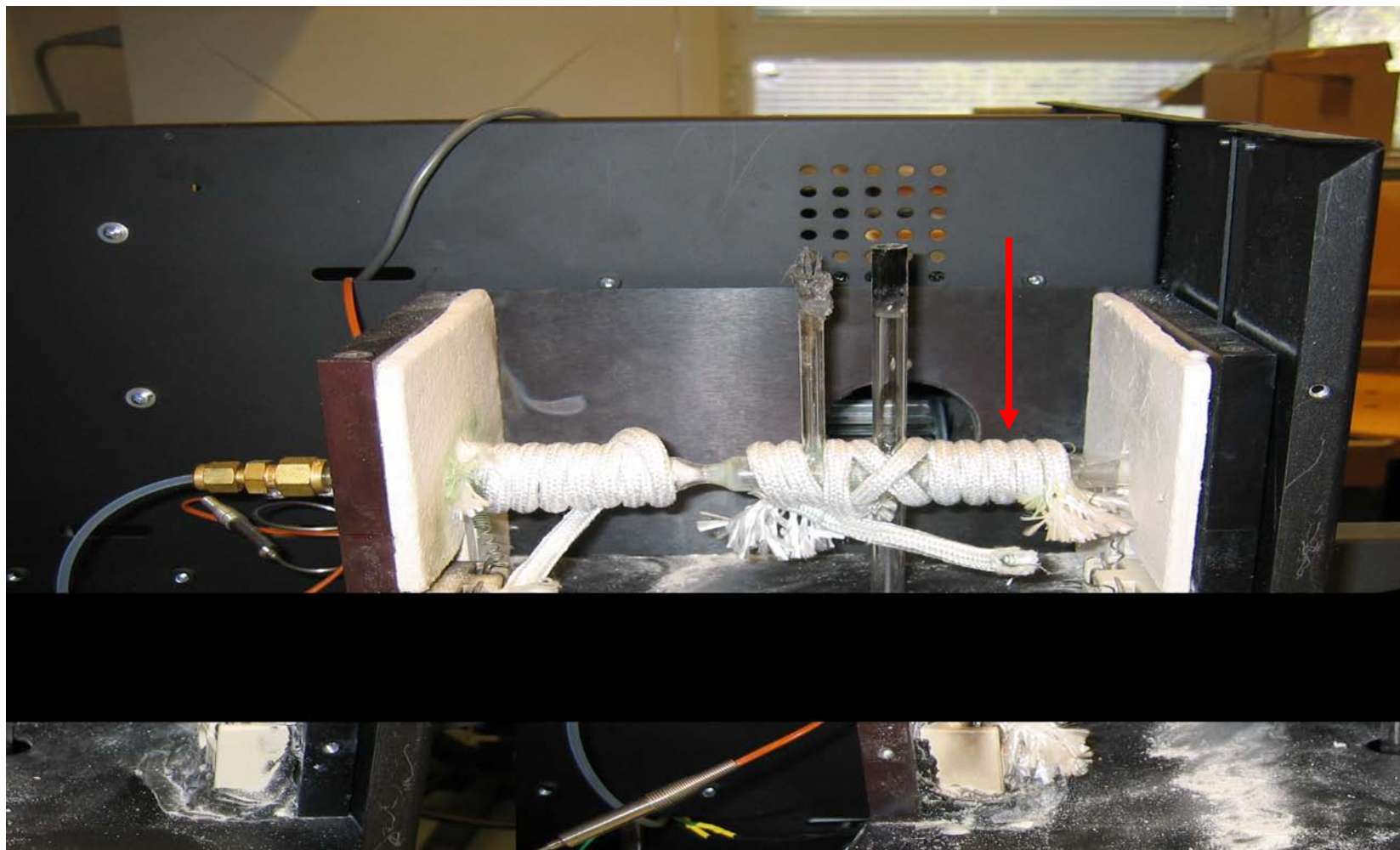
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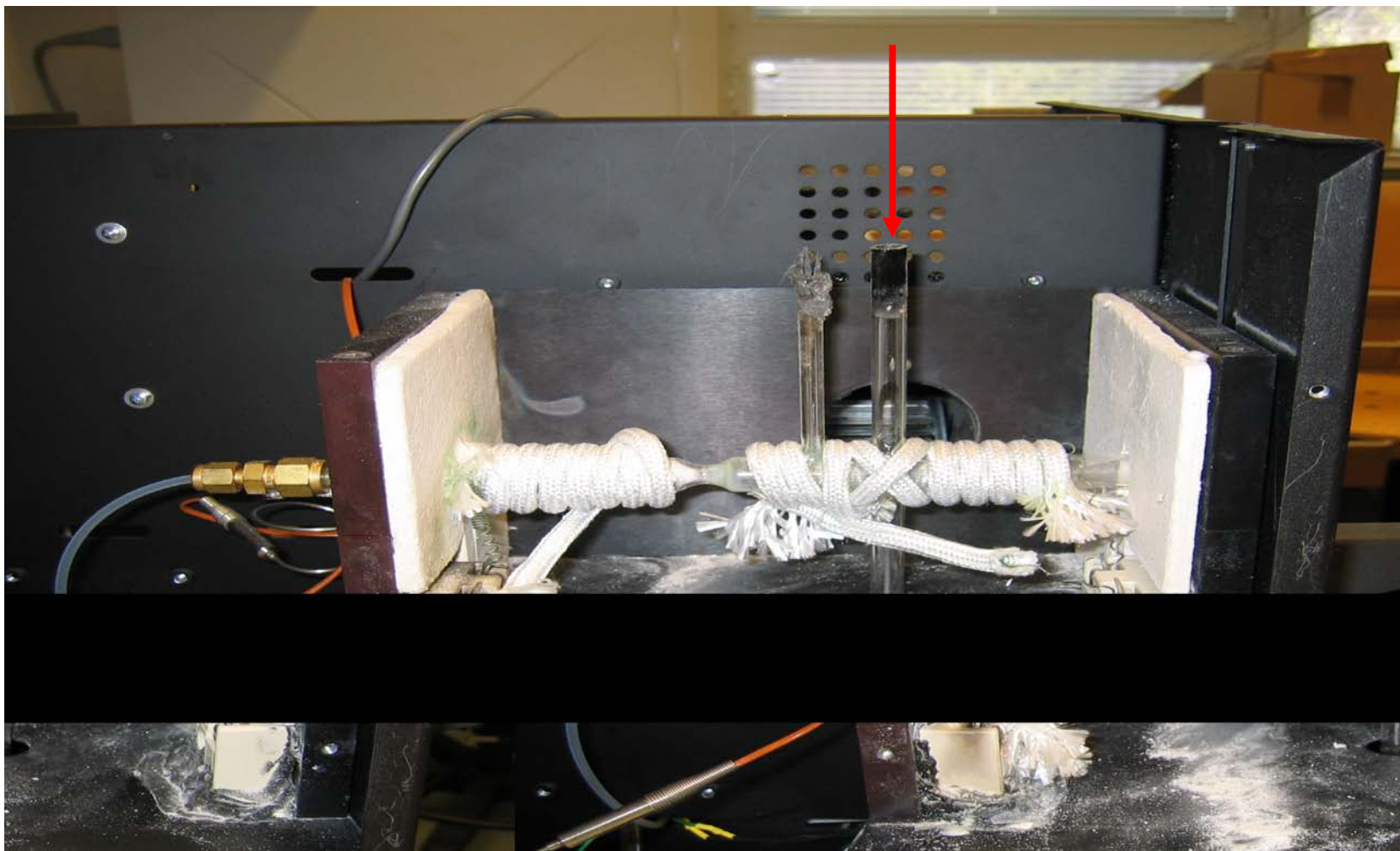
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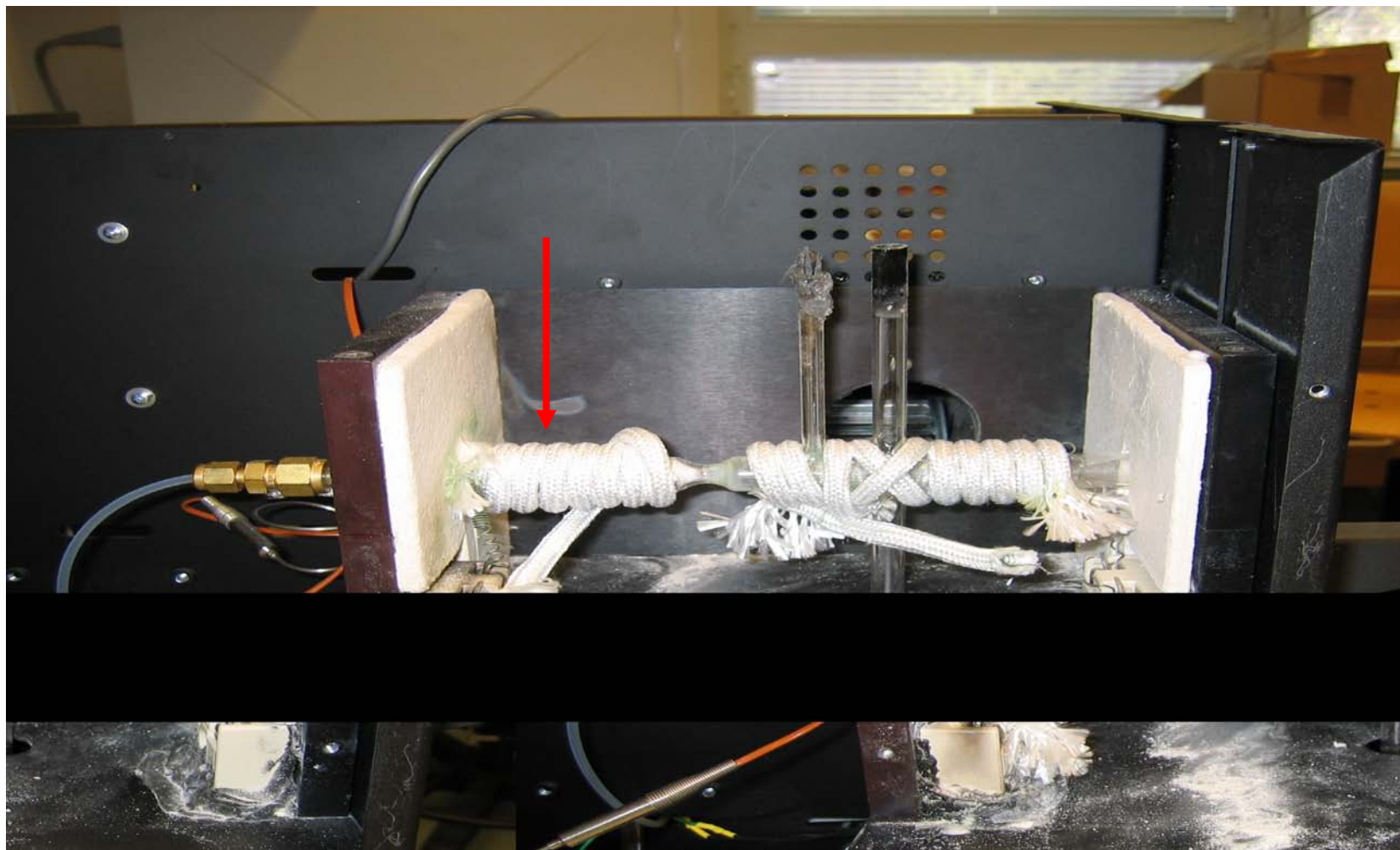
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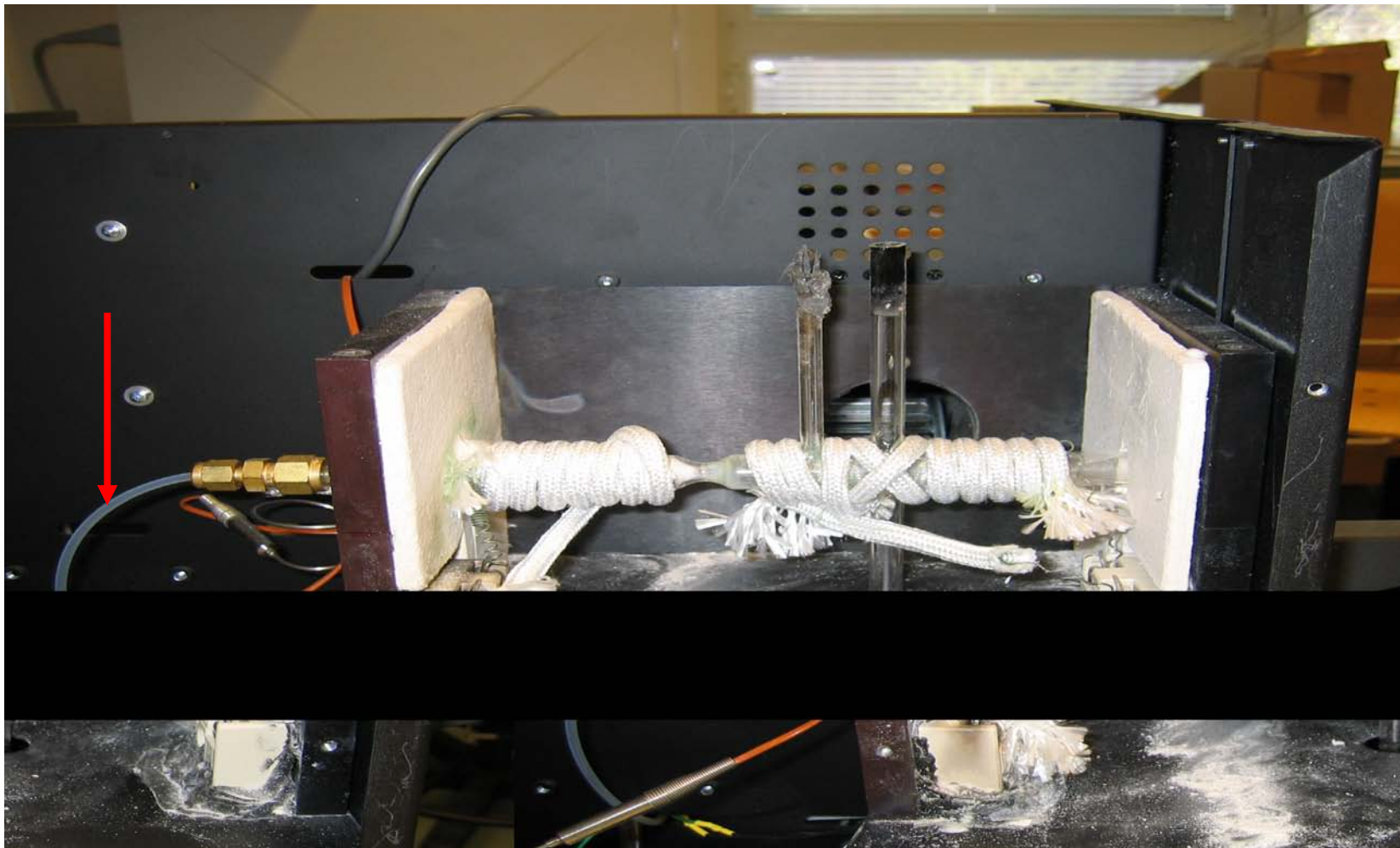


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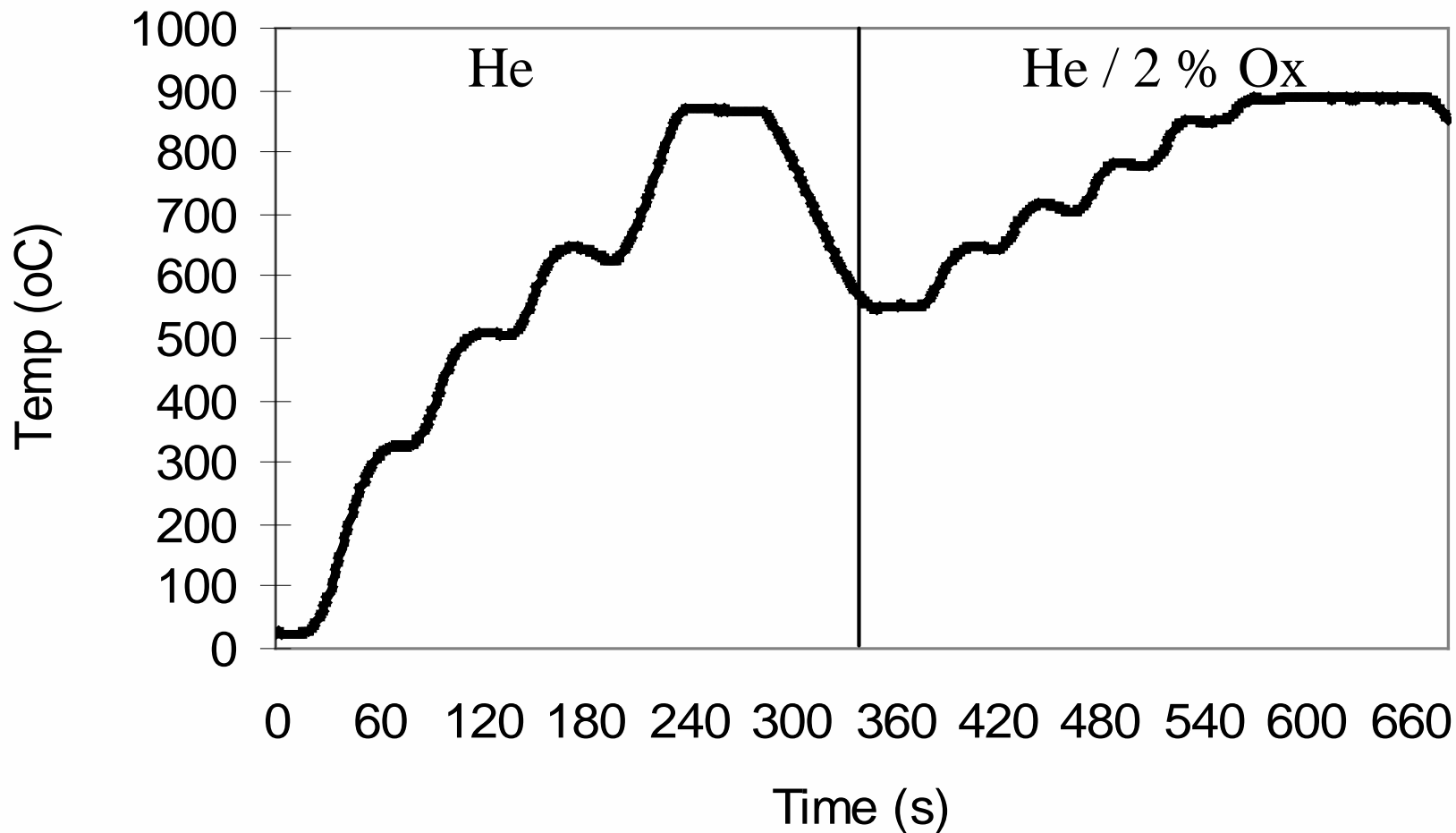


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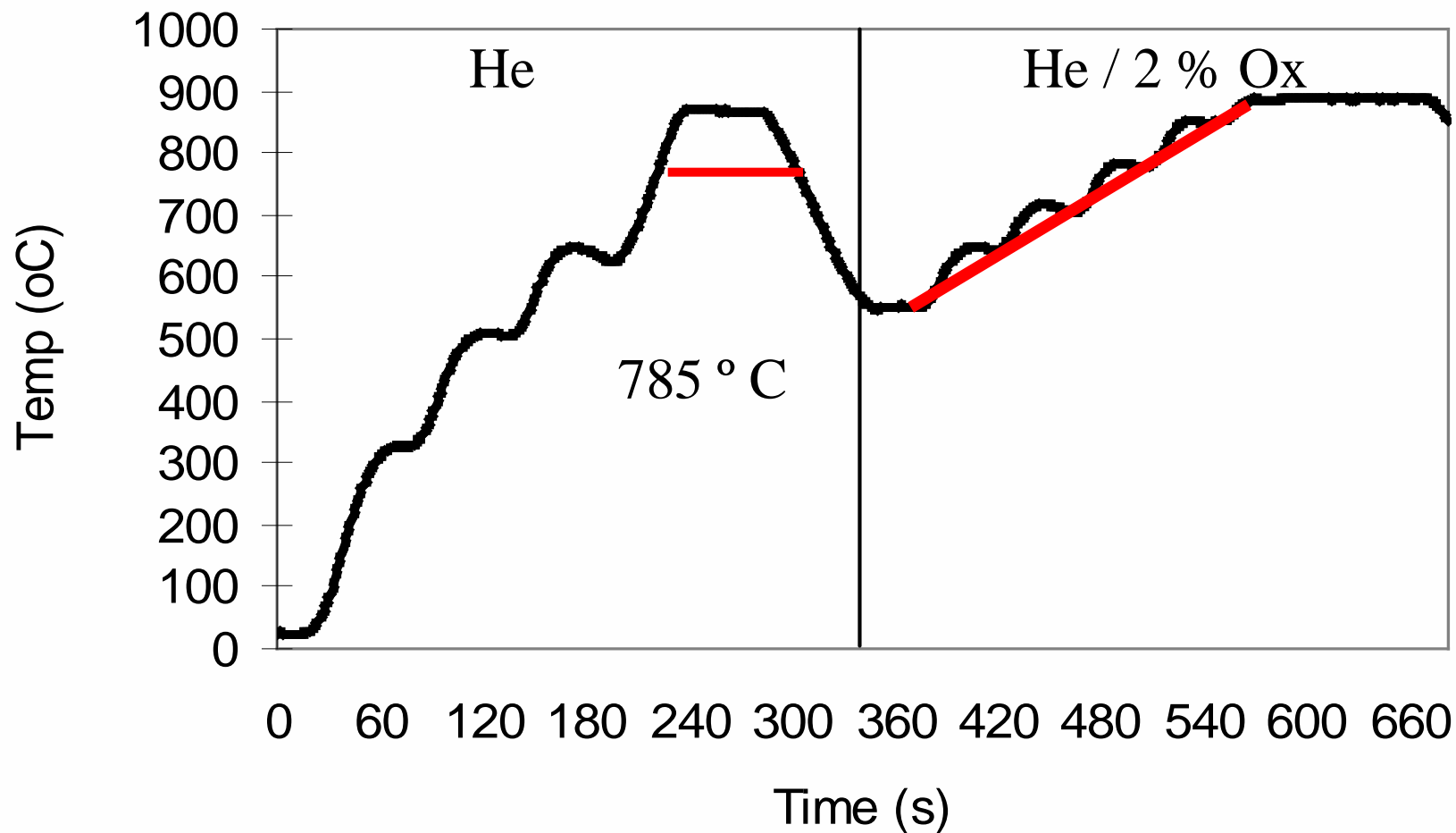


# Temperature protocol NIOSH 5040

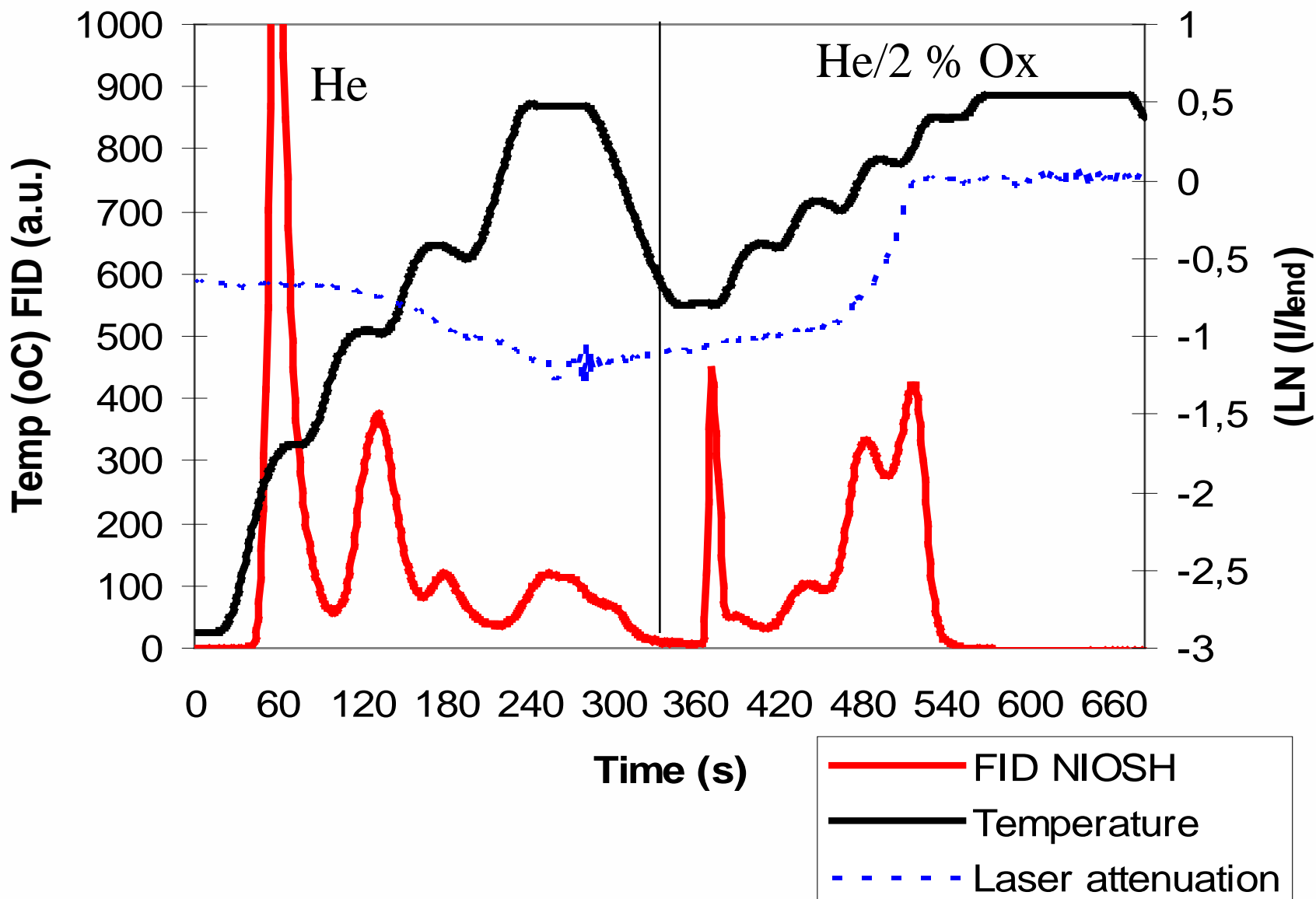
<b>He</b>		<b>He/Ox</b>	
<i>Time (s)</i>	<i>Temp (°C)</i>	<i>Time (s)</i>	<i>Temp (°C)</i>
60	310	45	550
60	475	45	625
60	615	45	700
90	870	45	775
		45	850
		120	890



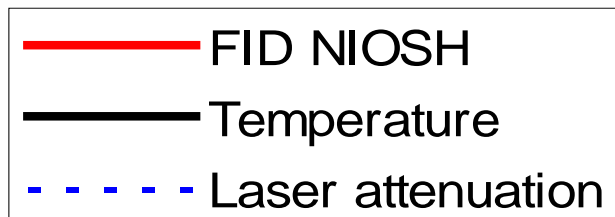
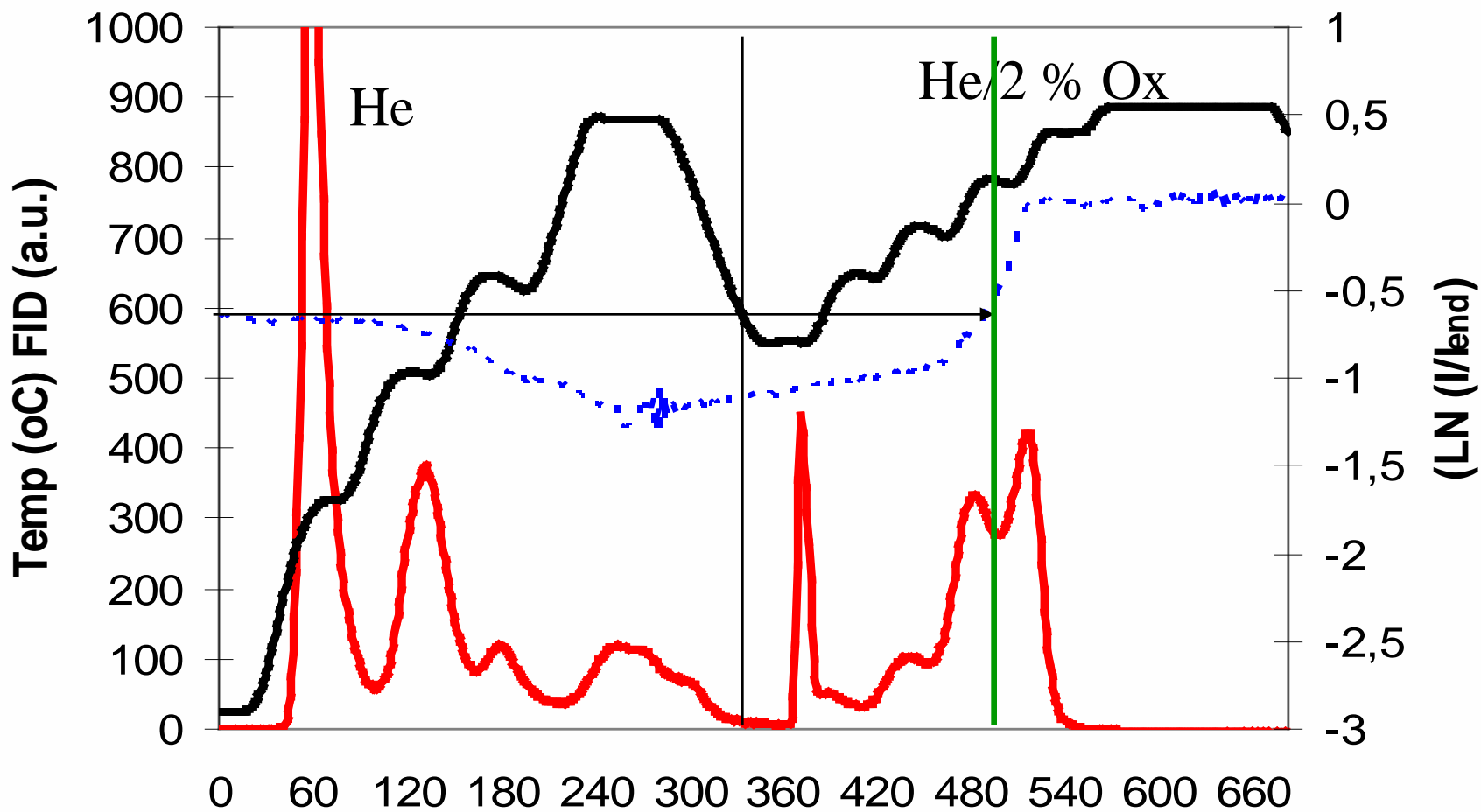
## Conny JM, EPA 2007



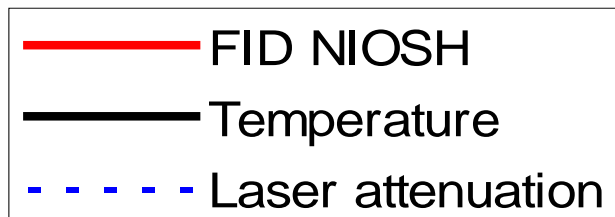
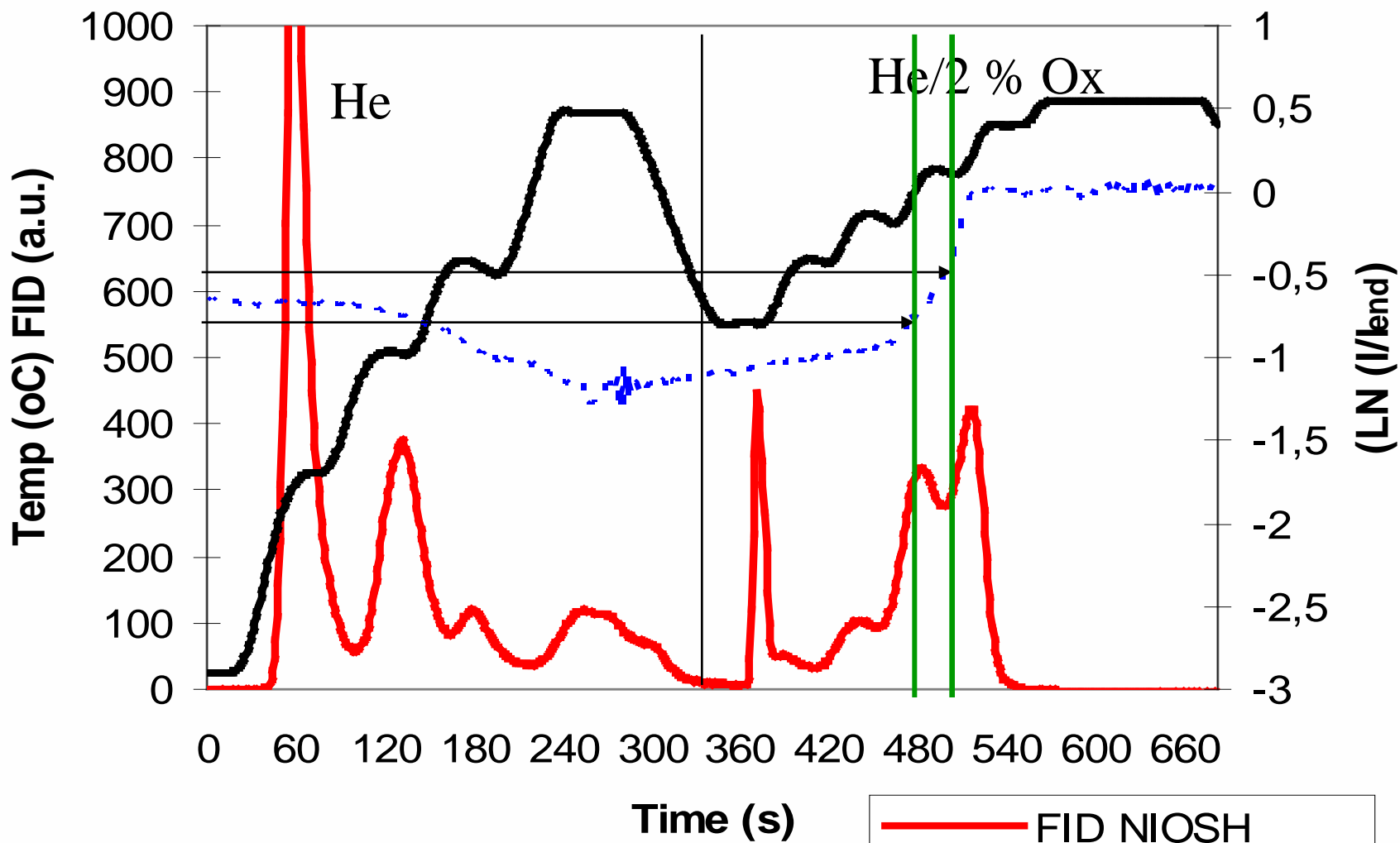
# Woodsmoke



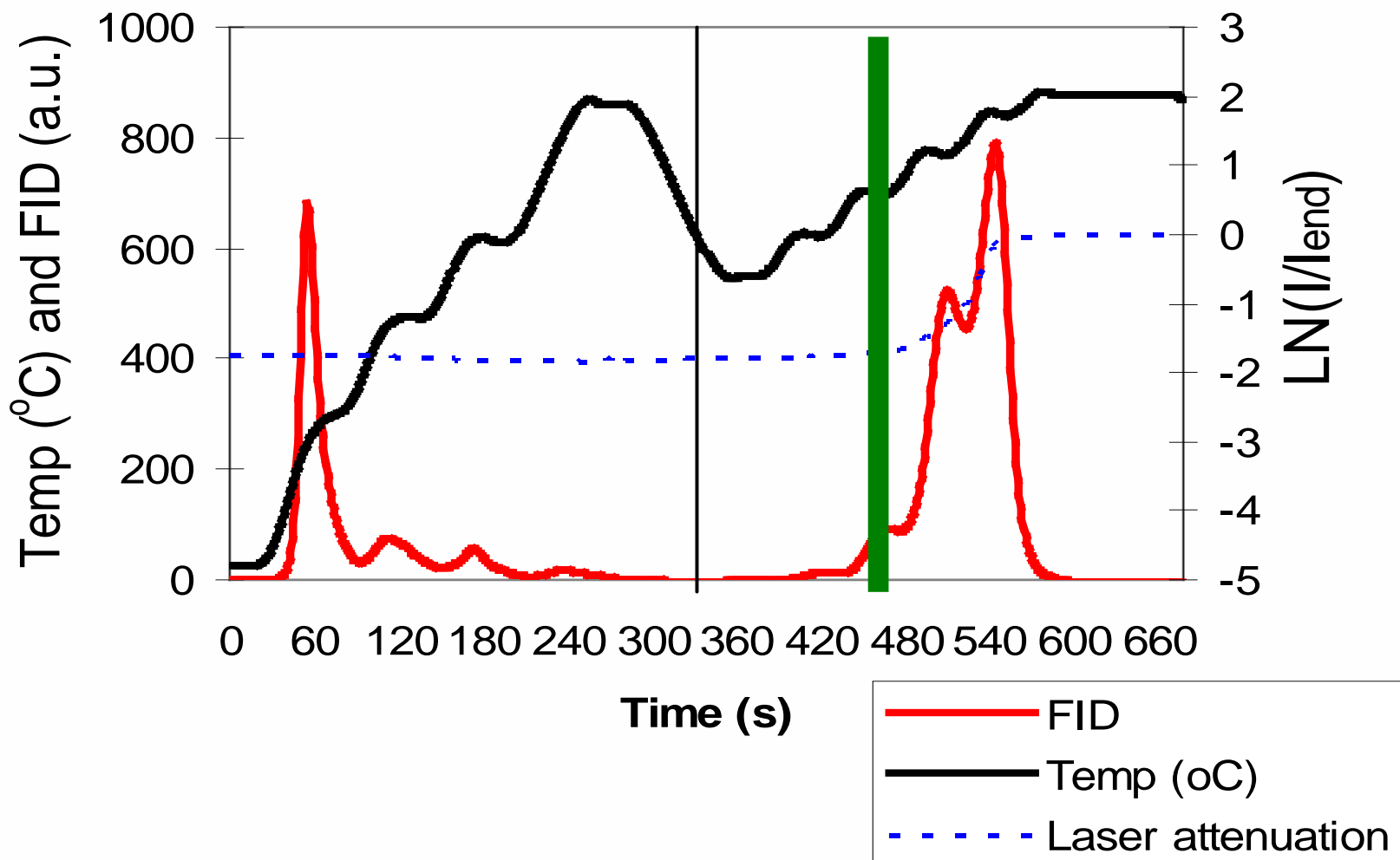
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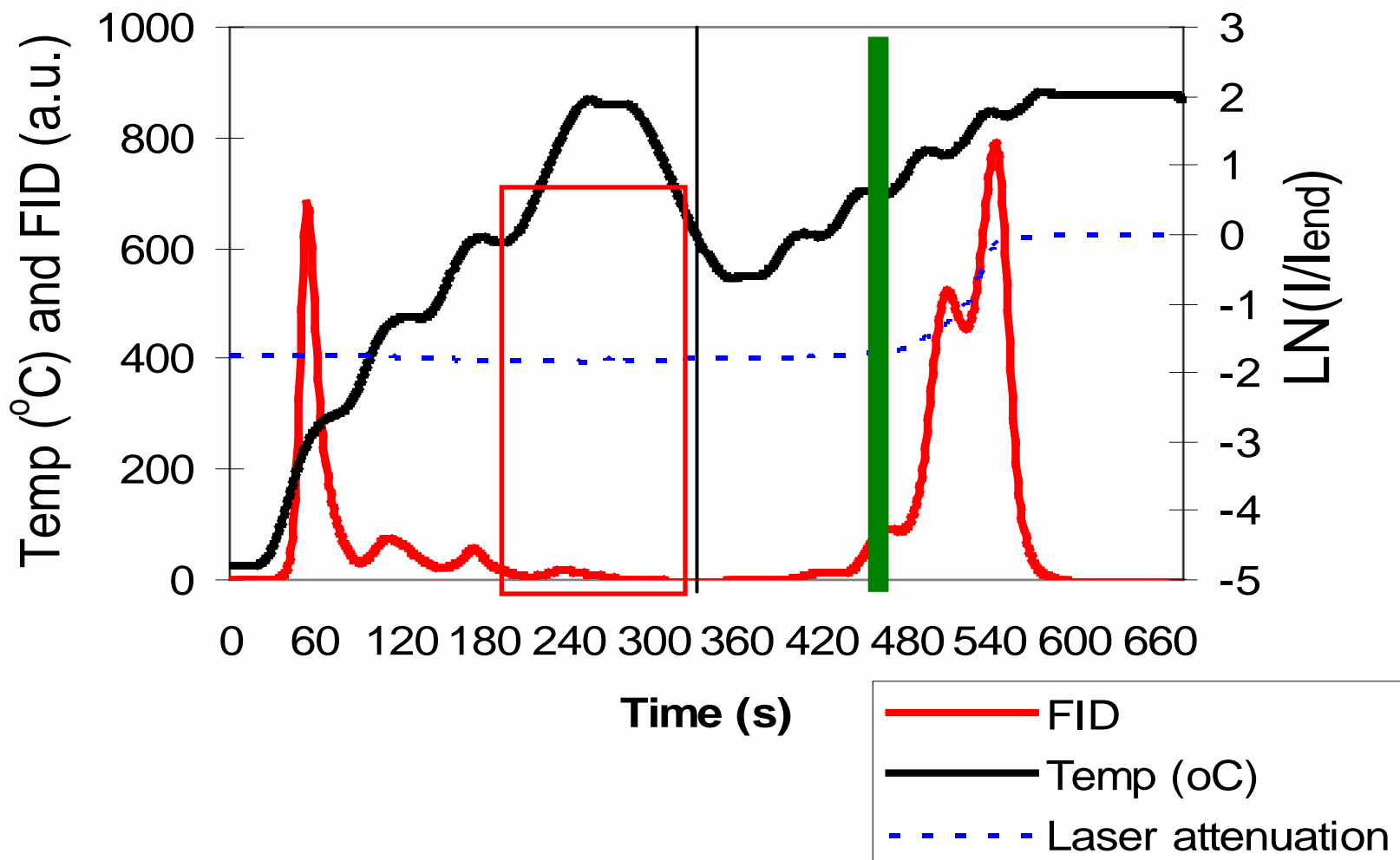


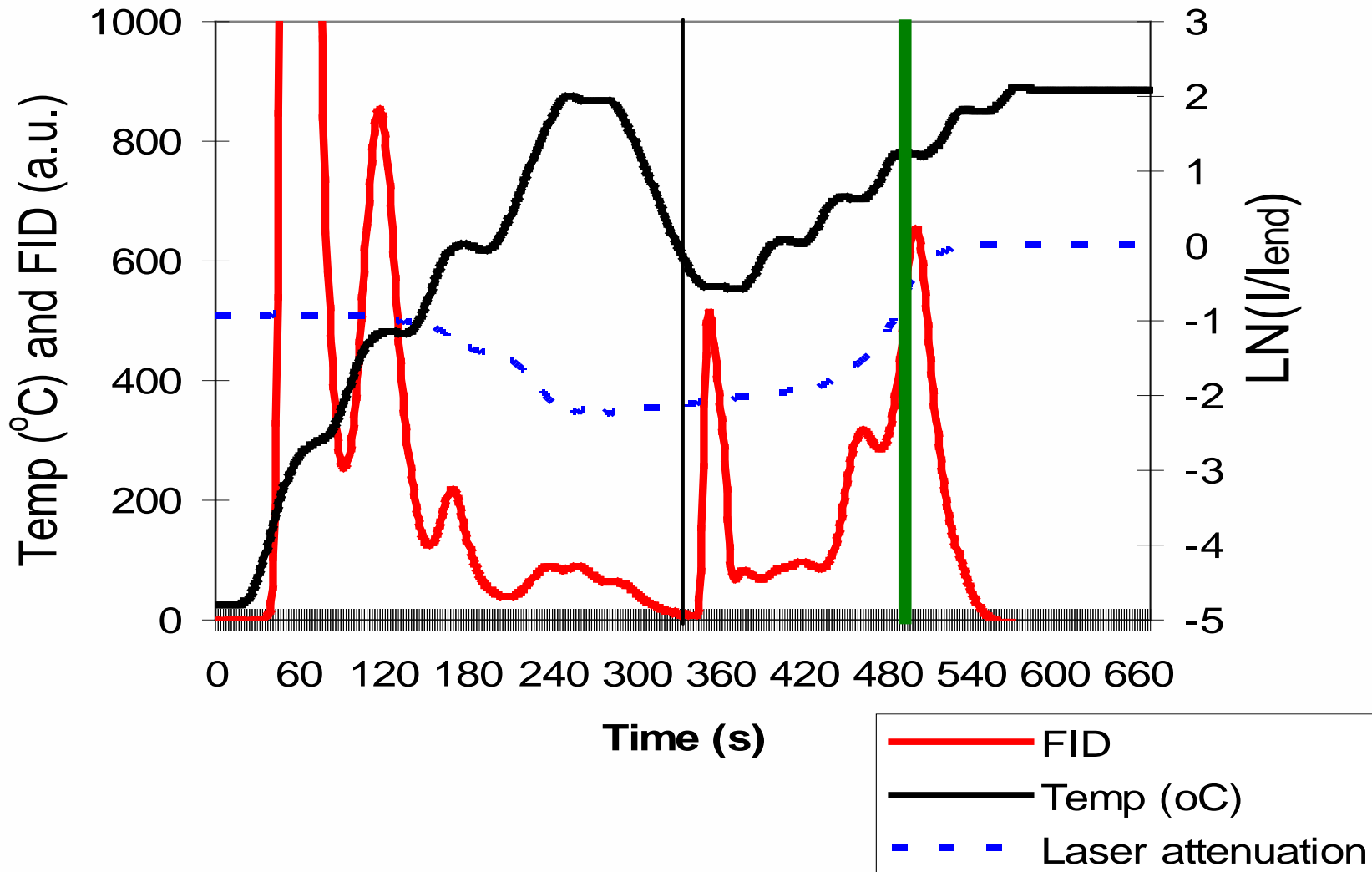
# Diesel exhaust $EC/TC = 0,70$



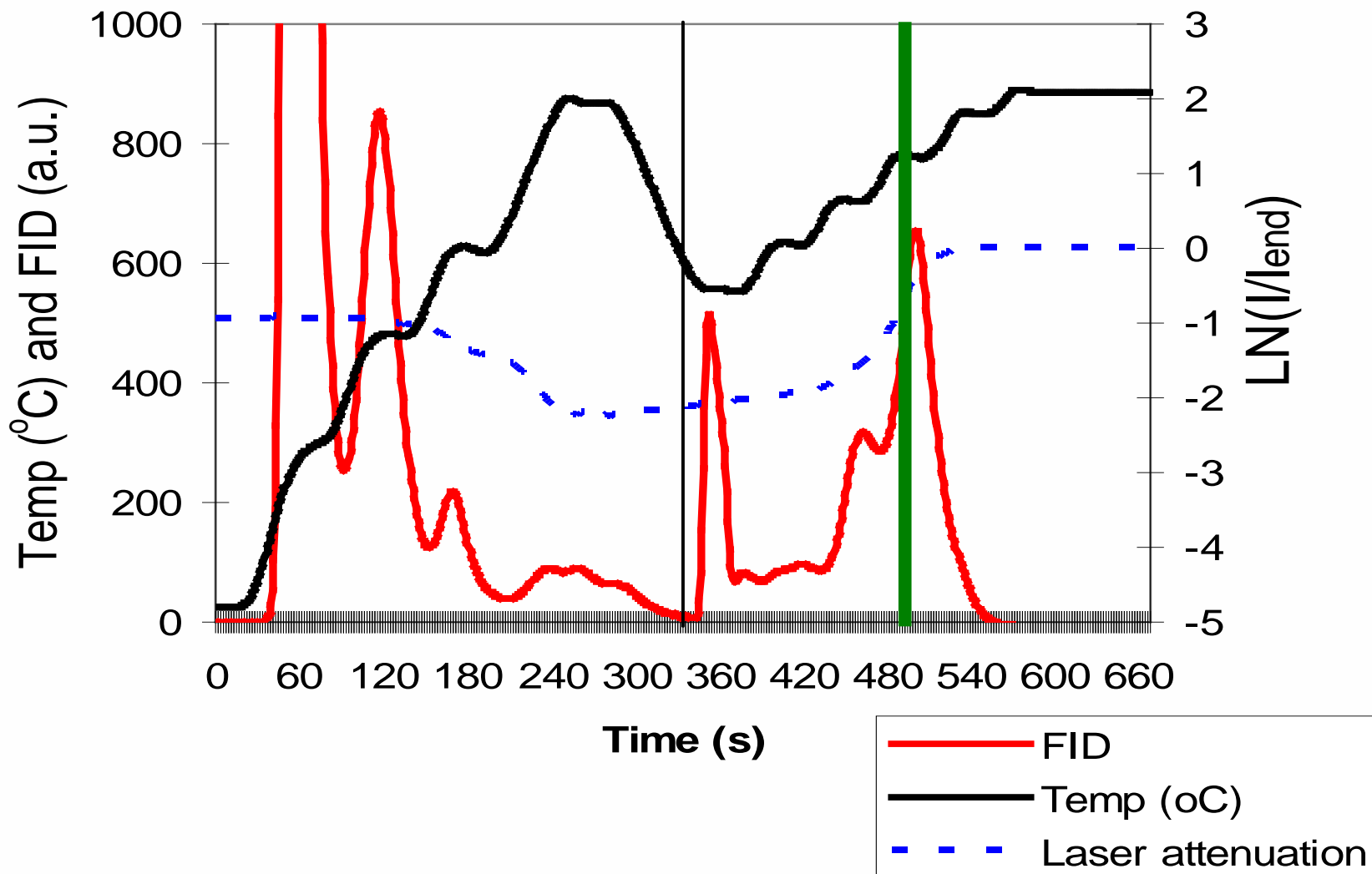


# Diesel exhaust $EC/TC = 0,70$





# Diesel exhaust - idling



How to investigate artefacts for diesel measurements with the purpose of reaching a standard?

# Main objective

Standardize a protocol for OCEC measurement of diesel exhaust

- Step 1: Investigate if water-soluble non-particulate OC pyrolyzes and can be misinterpreted as EC
- Step 2: Investigate if organic-soluble non-particulate OC pyrolyzes and can be misinterpreted as EC

# Why?

Yu *et al* (Environ. Sci. Technol 2002)

Ambient samples Hong Kong and Nanjing,  
China

13-66 % pyrolyzing carbon in the aqueous  
extract

# Procedure

- Use particle-free water-soluble extracts of different collected filter samples to test for charring
- If TOT analysis shows EC is present in filtered water extract this implicates charring which might lead to erroneous split

# Water extraction of samples

- 4.5 cm<sup>2</sup> of filter sample was used
- Extracted twice in 10 ml pure water with 15 min sonification – both portions pooled
- Filtered with Anopor **20 nm** disposable filters
- Aqueous solution freeze-dried until dry
- Reconstituted with 200 µl of water
- 20 µl of solution placed on clean filter
- Analyzed with TOT - NIOSH



# Aerosol filter samples - pure

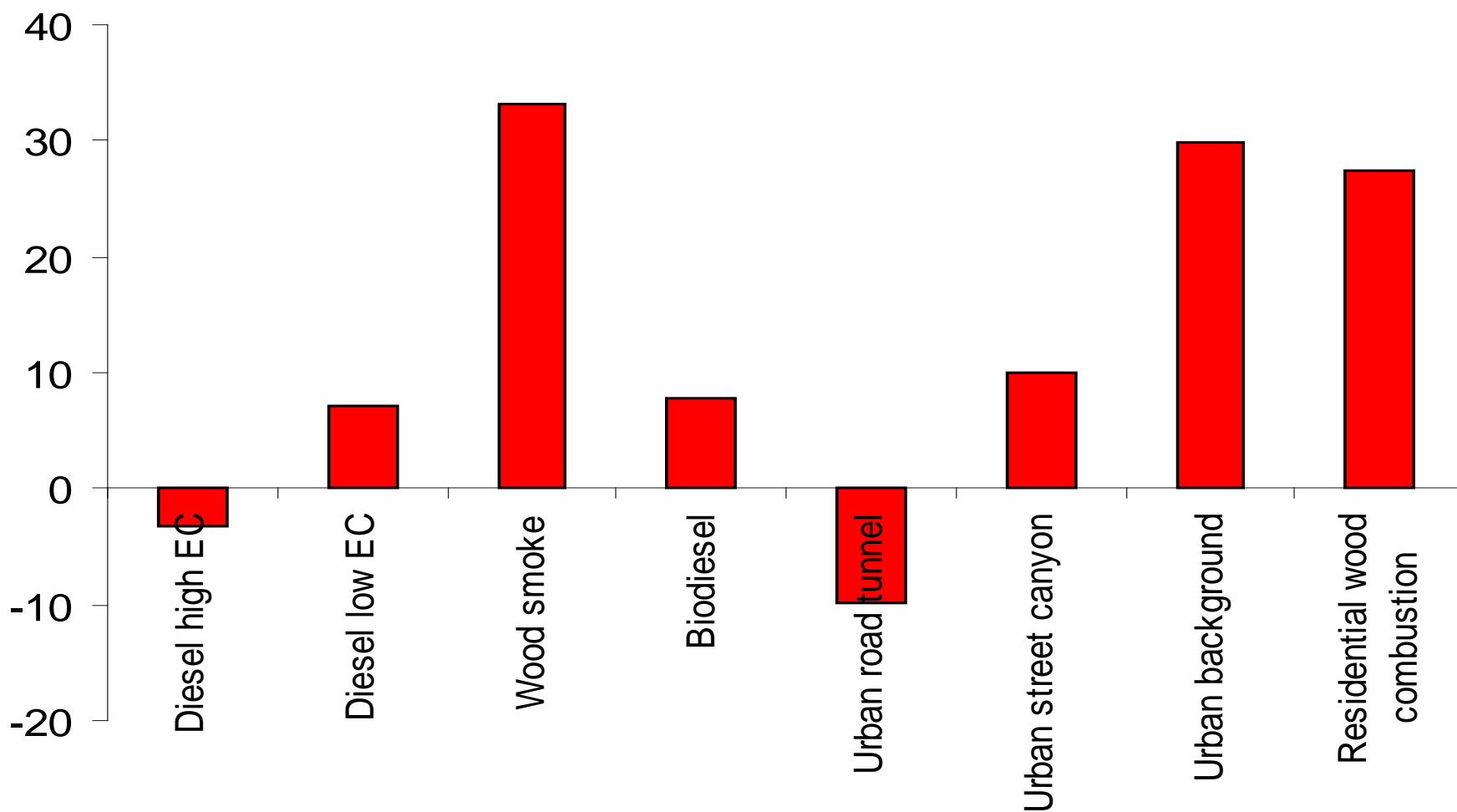
- Pure diesel exhaust - high EC
- Pure diesel exhaust - low EC
- Pure biodiesel exhaust
- Pure wood smoke

# Aerosol filter samples - ambient

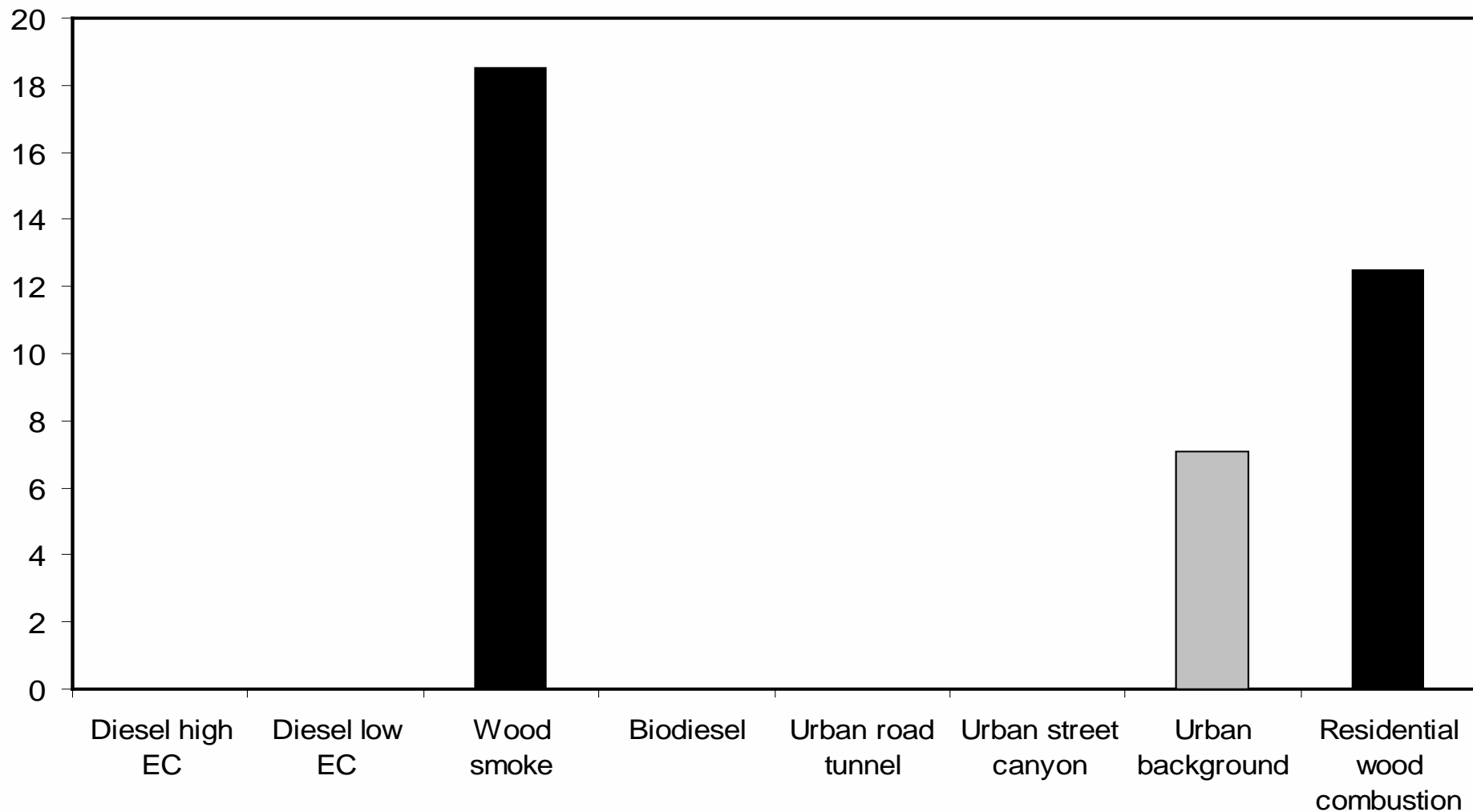
- An urban road tunnel
- An urban street canyon
- An urban background site
- Residential wood combustion in an urban area

# Water-extractable total carbon in percent of total carbon in sample

Samples are corrected for blank values



# EC from water-soluble extracts in percent of total EC of sample



# Conclusion

- Wood combustion particulate samples contain water-soluble organic compounds that convert to EC by charring.
- Diesel exhaust samples contain no water-soluble organic compounds that convert to EC by charring.

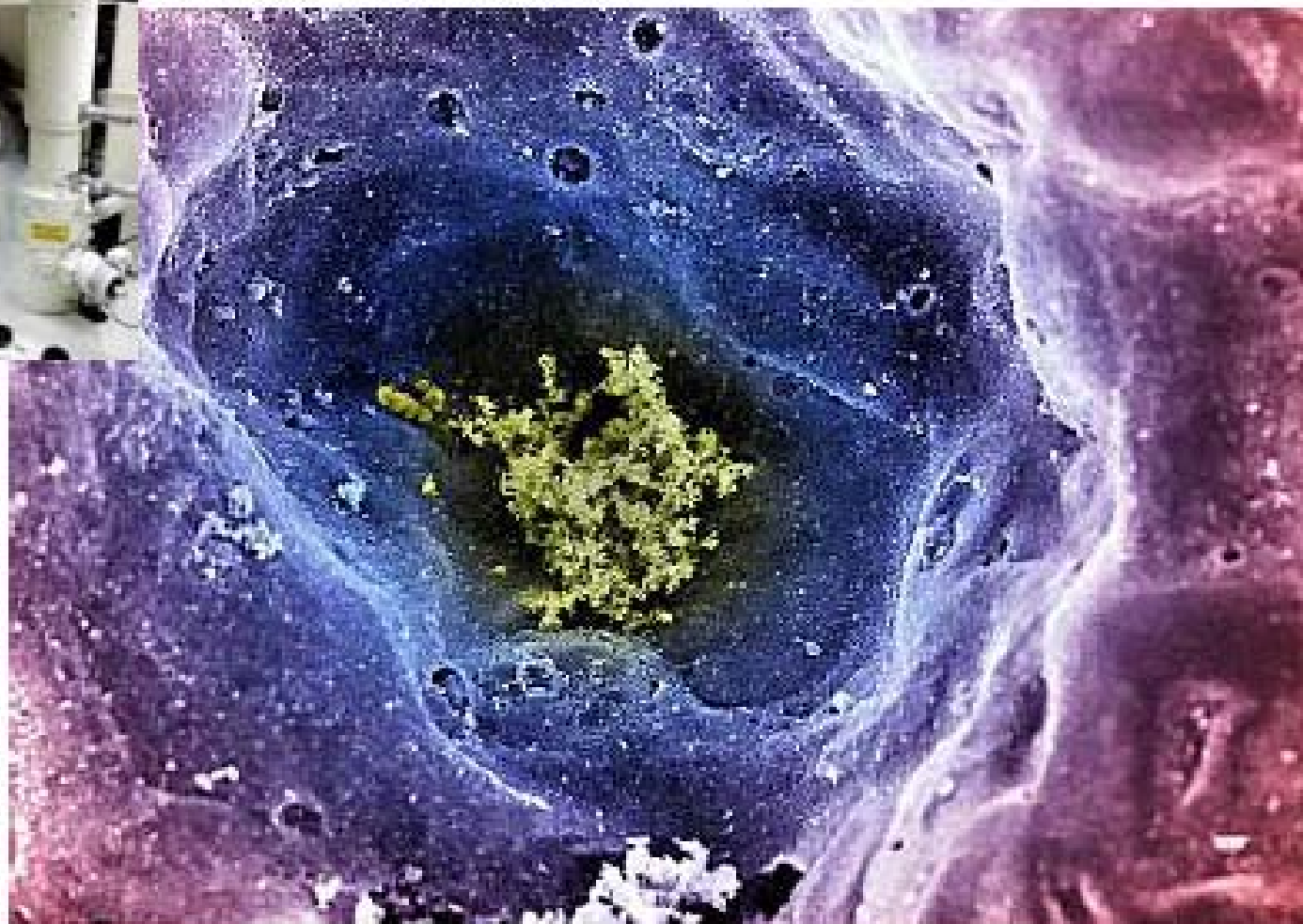
# Conclusion

- NIOSH 5040 seems promising as a standard for OC/EC analysis of diesel dominated samples, but temperatures and time ramping must be defined.
- Influence of non-water soluble organics have to investigated

Thank you for your attention!



Photographer: Lennart Nilsson



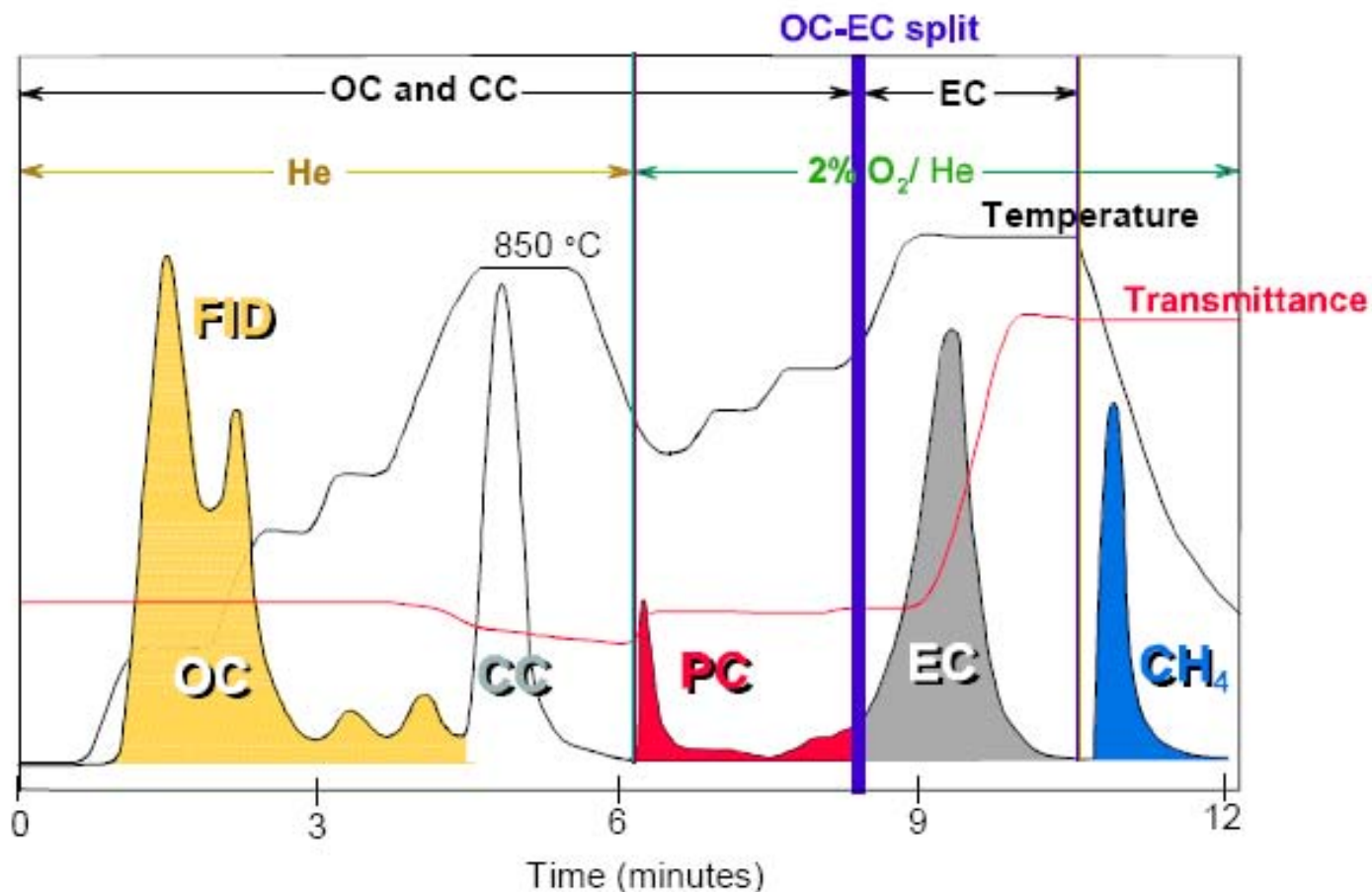
Soot particles (yellow) deposited in the alveoli.



# Having a Bad Air Day ?

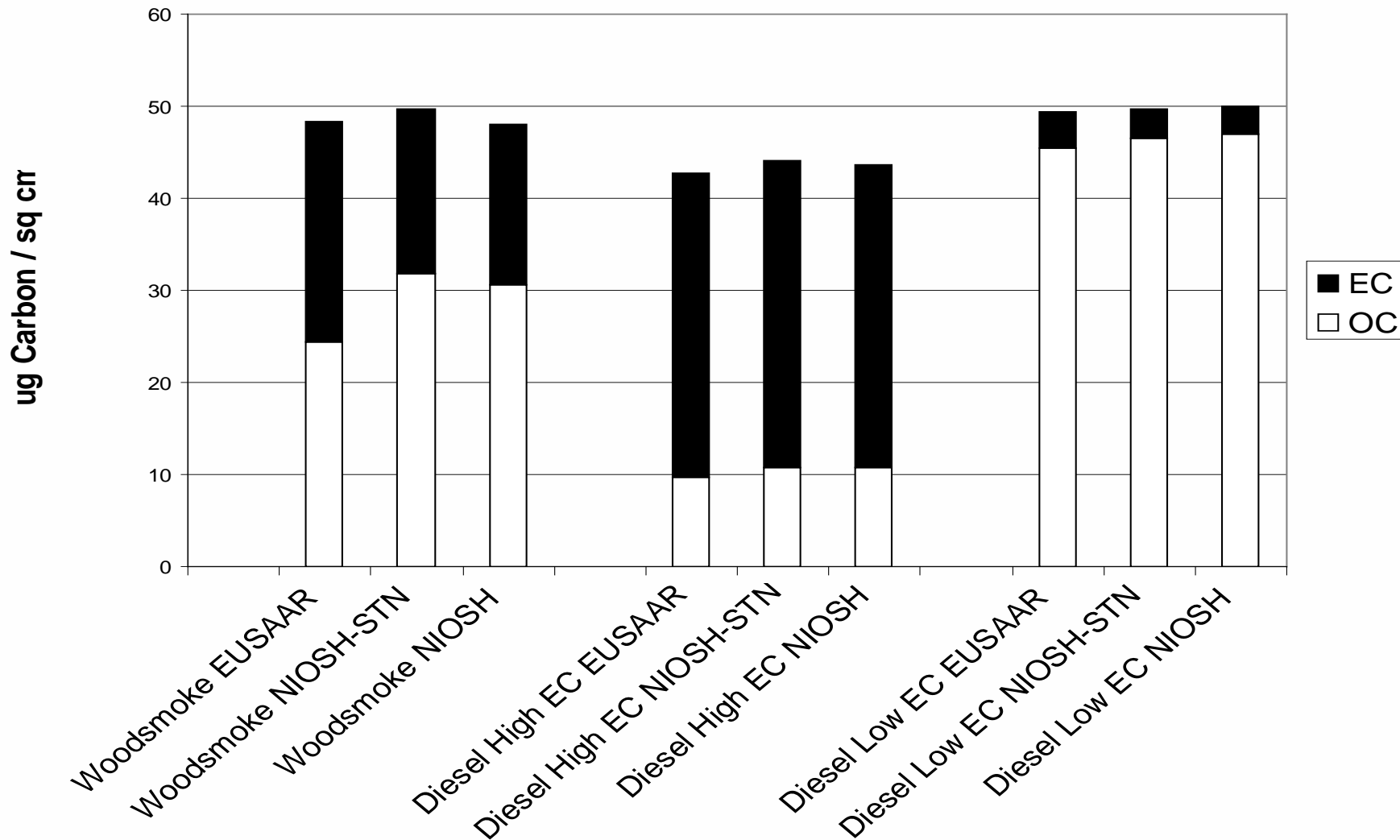


# Method NIOSH #5040



OC=organic carbon; CC=carbonates; PC=pyrolysed carbon;  
 EC=elementary carbon; CH<sub>4</sub>=methane internal standard

### Comparison NIOSH - NIOSH-STN - EUSAAR



# Working principle of Thermal/Optical Carbon Aerosol Analyzer

