Investigation of primary and secondary organic aerosols from wood combustion with a high resolution time of flight aerosol mass spectrometer

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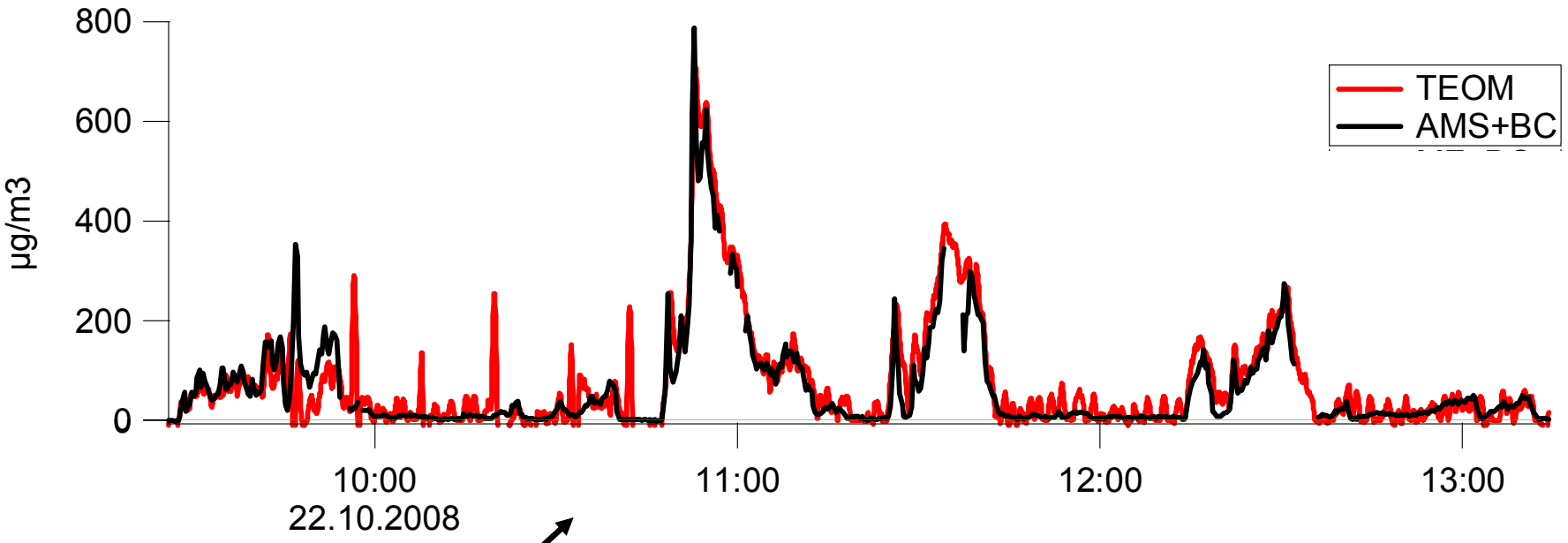
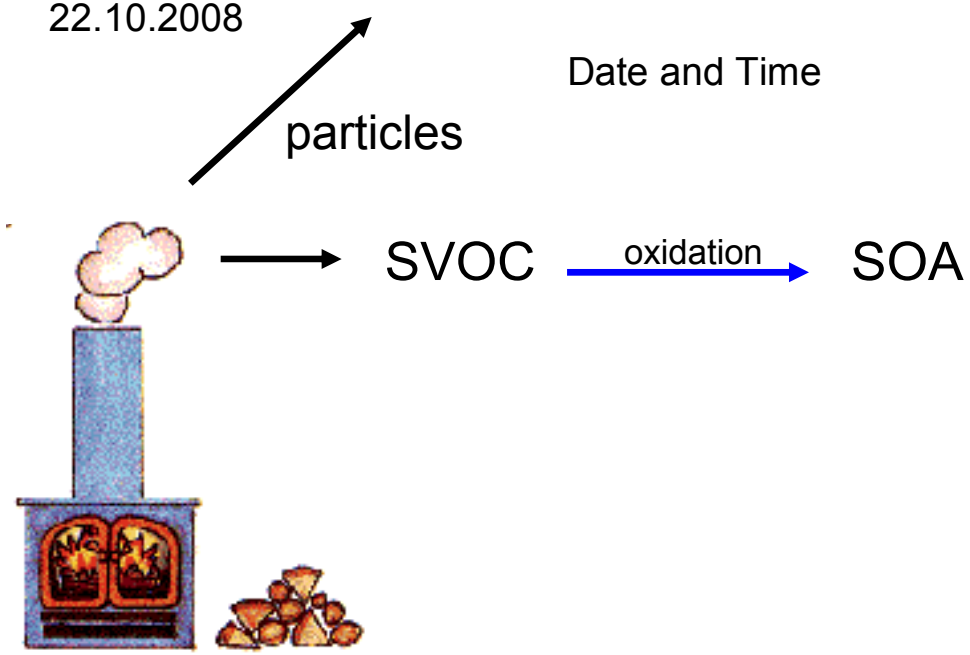
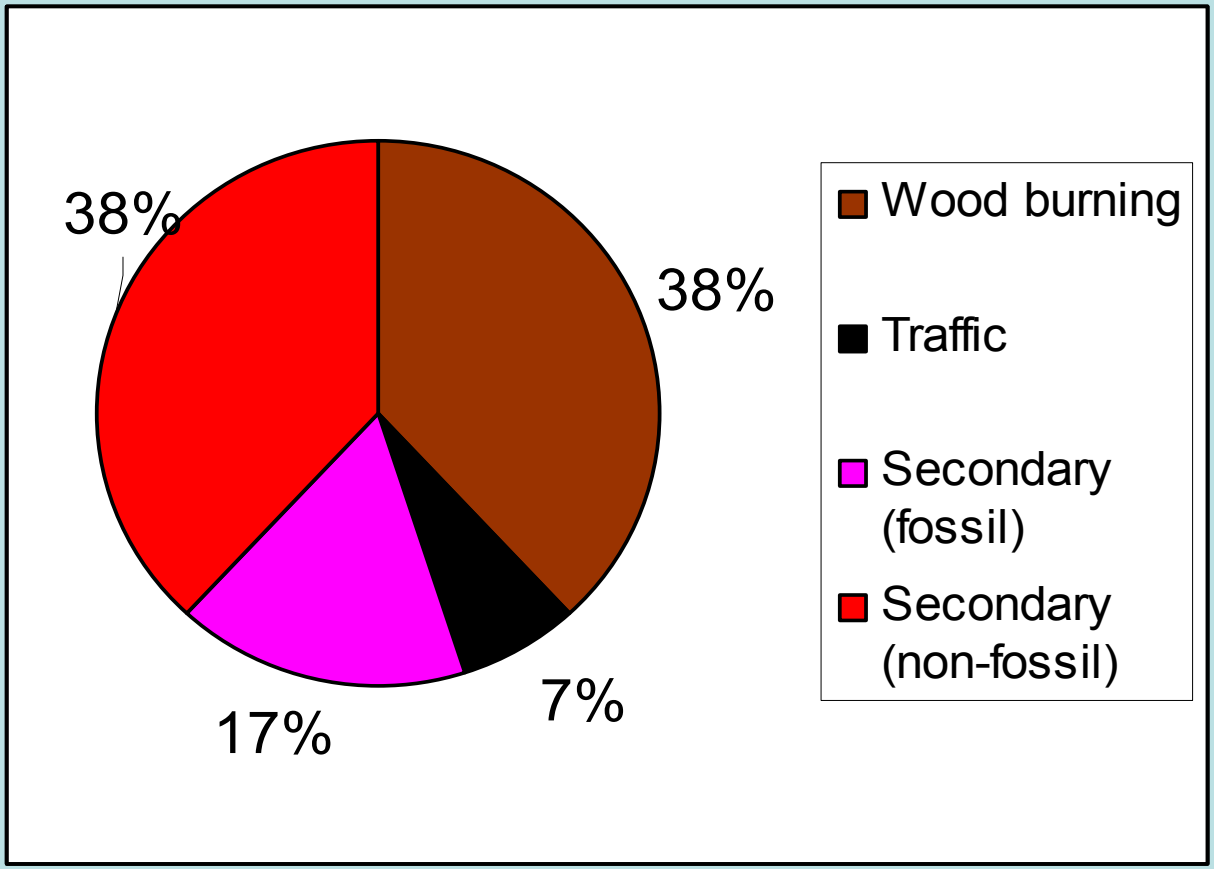
Emissions from wood burning





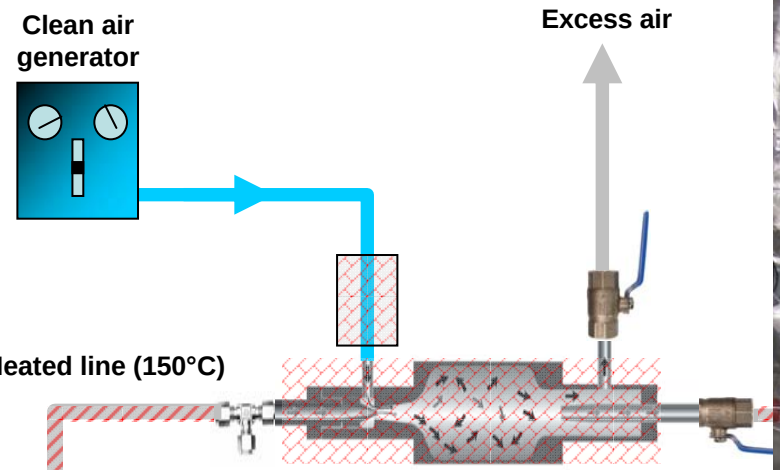
Carbon apportionment using ^{14}C analysis
Estimation of fossil and non-fossil SOA contribution

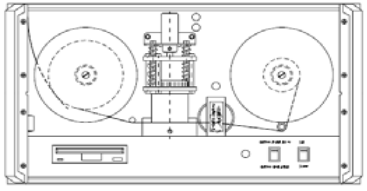
OM



Lanz et al., ES&T 2008

PSI smog chamber setup

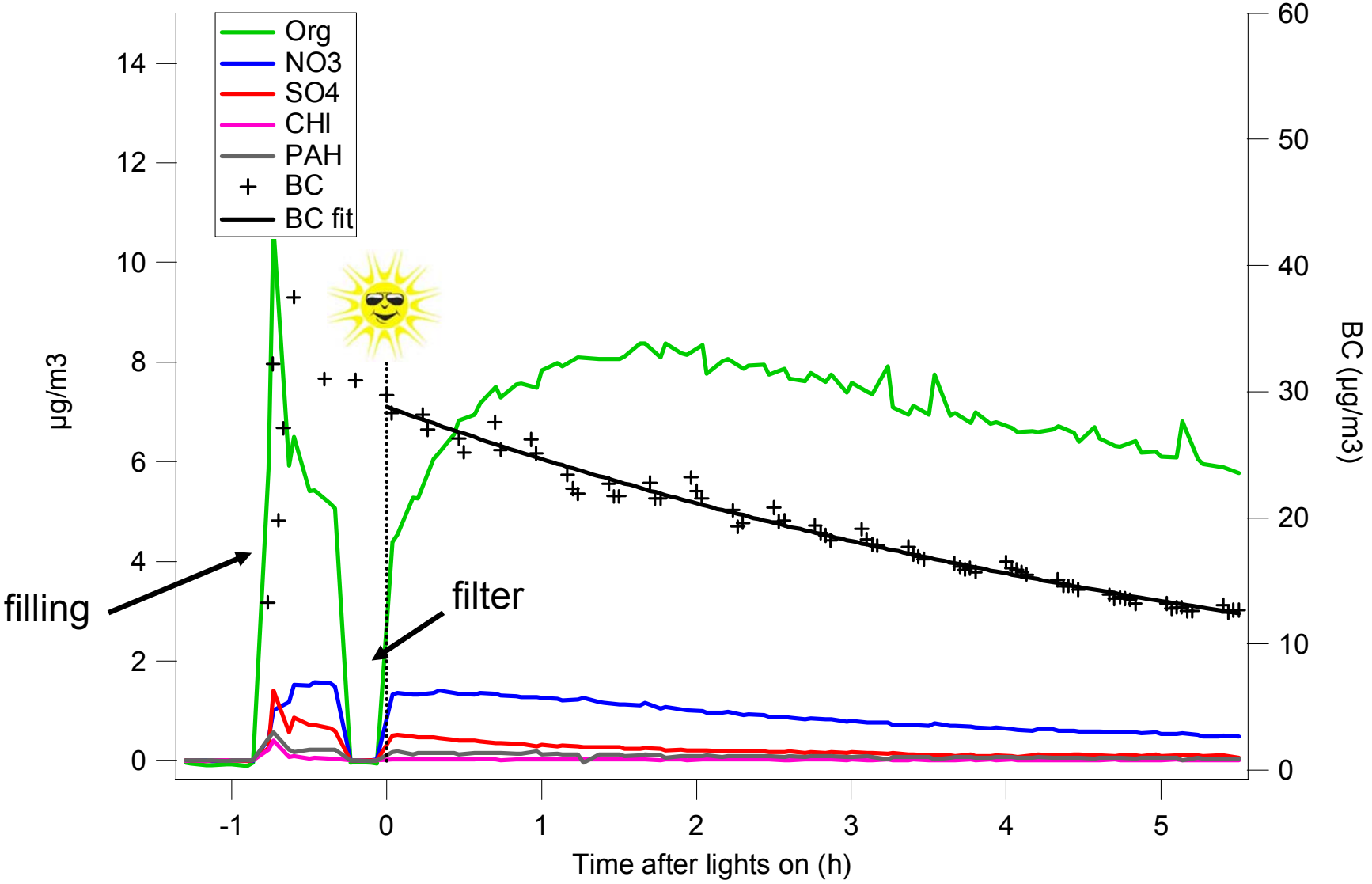




Aethalometer

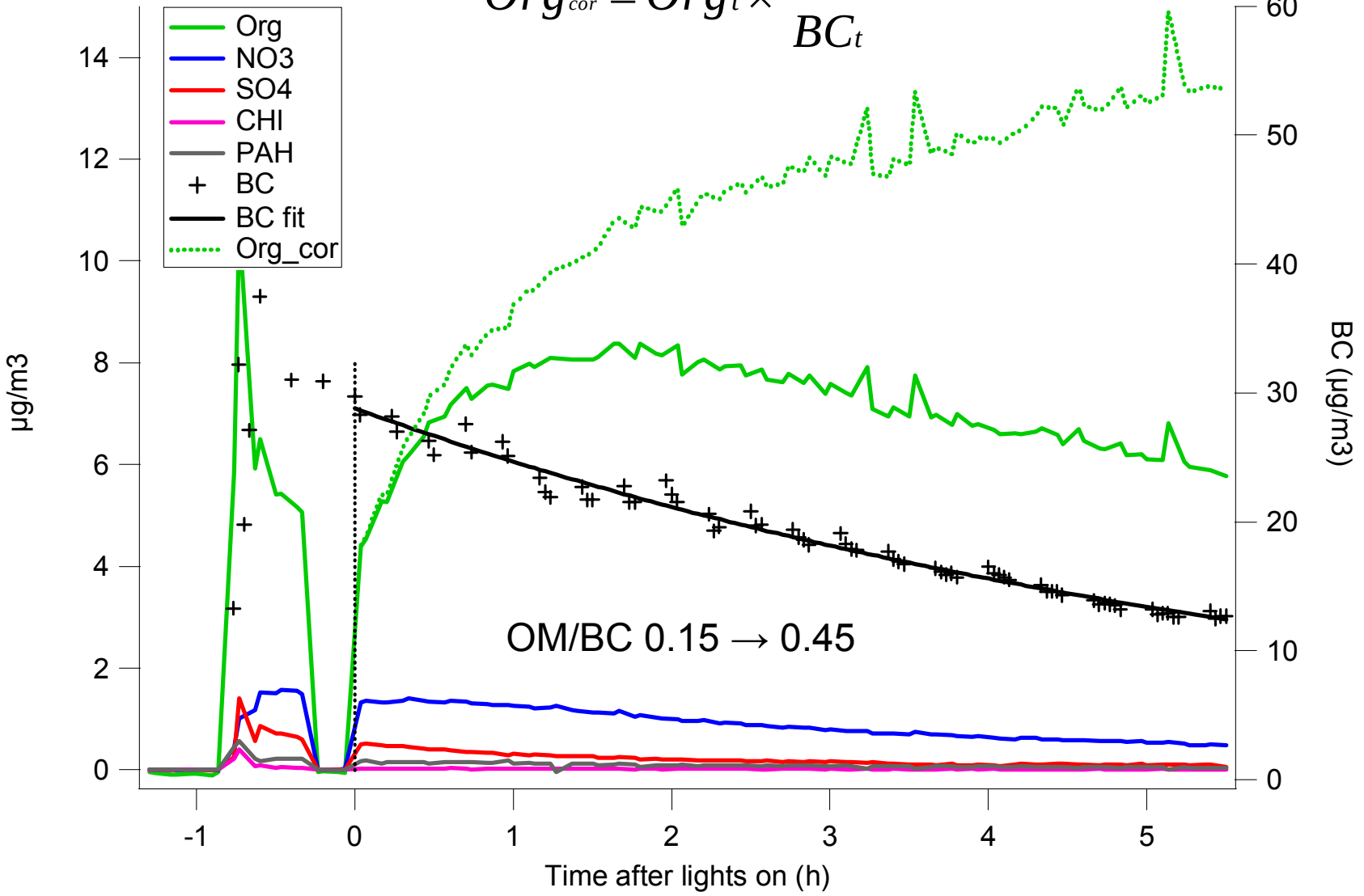
CPC + SMPS

Chamber experiment (flaming phase)



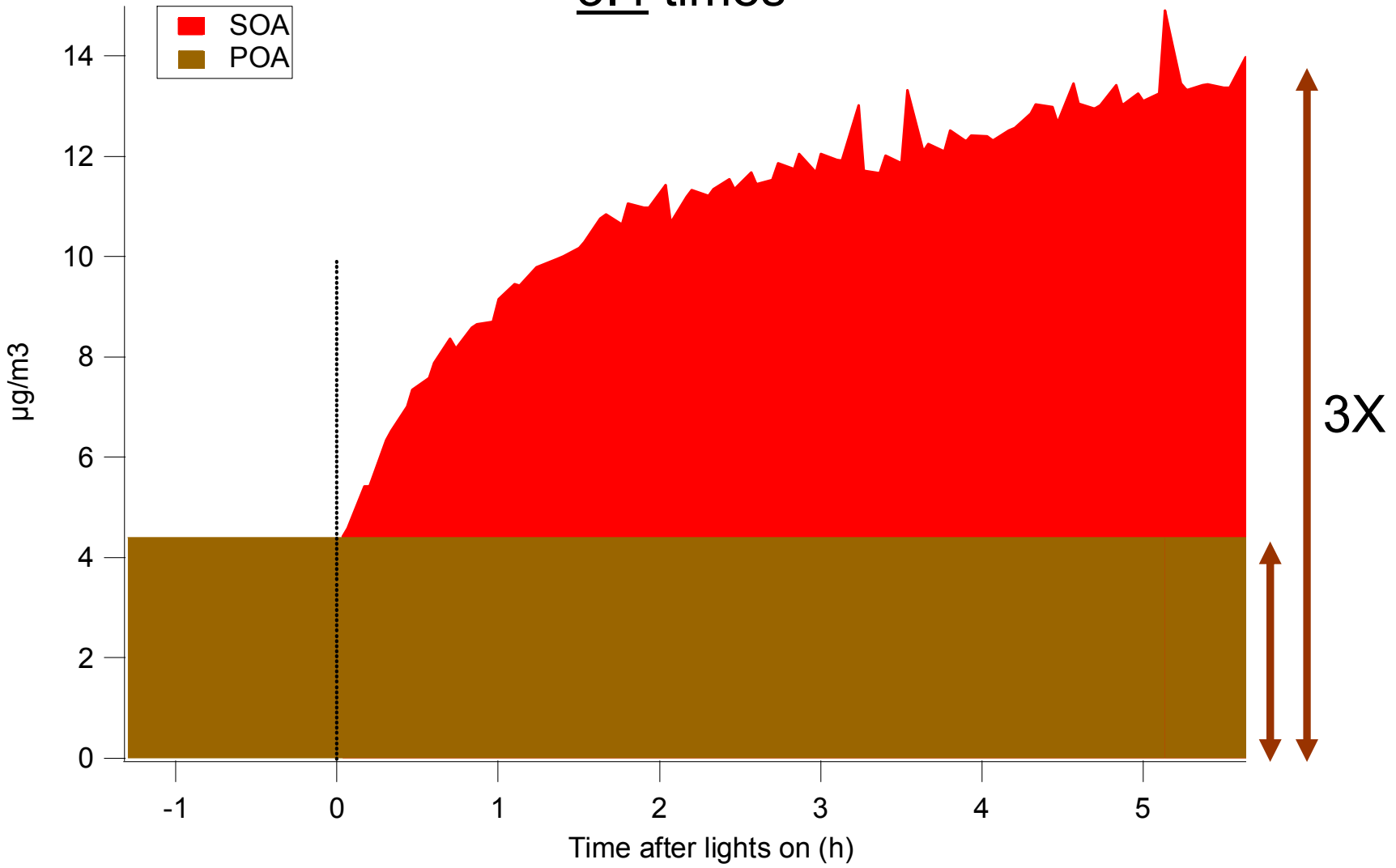
Wall loss correction

$$Org_{cor} = Org_t \times \frac{BC_{t0}}{BC_t}$$

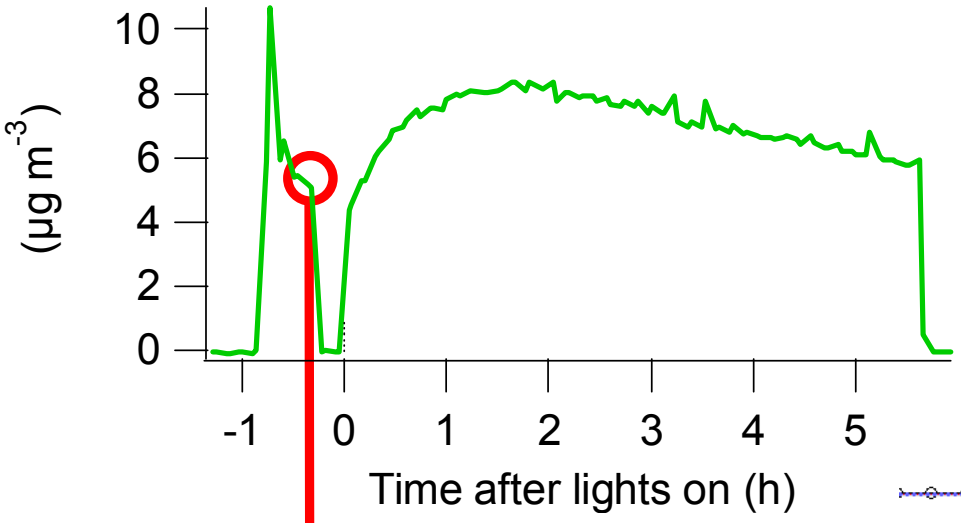


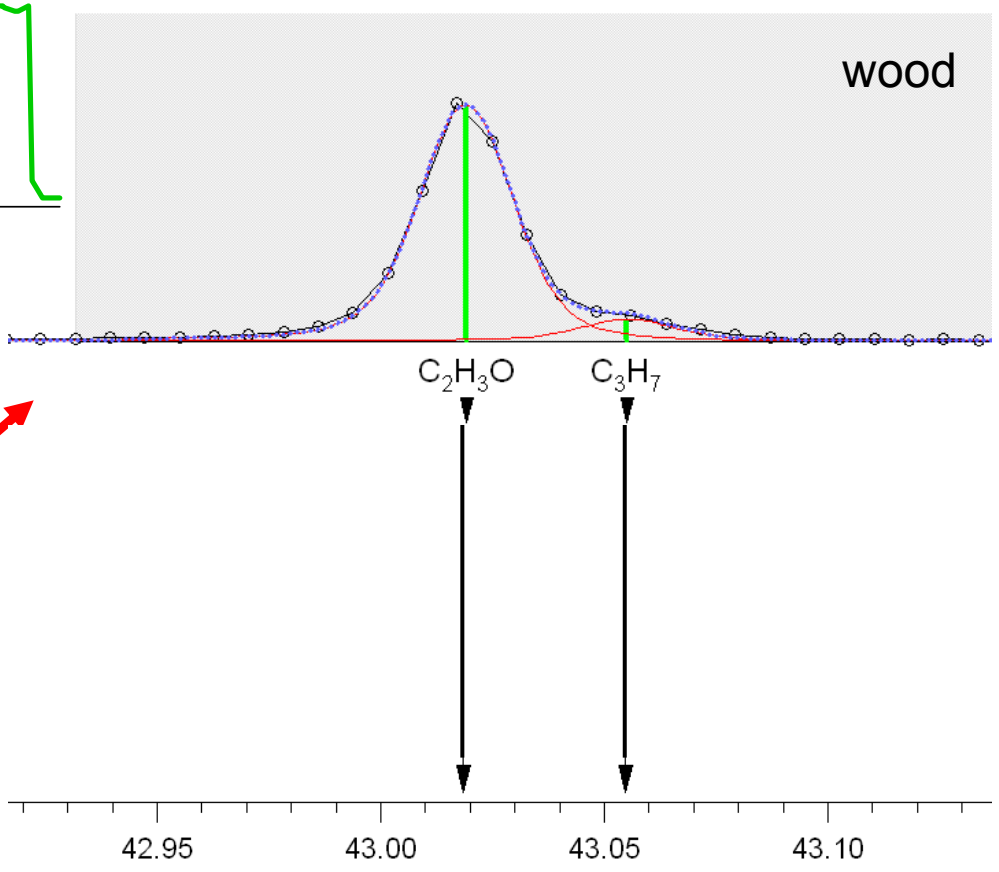
POA & SOA

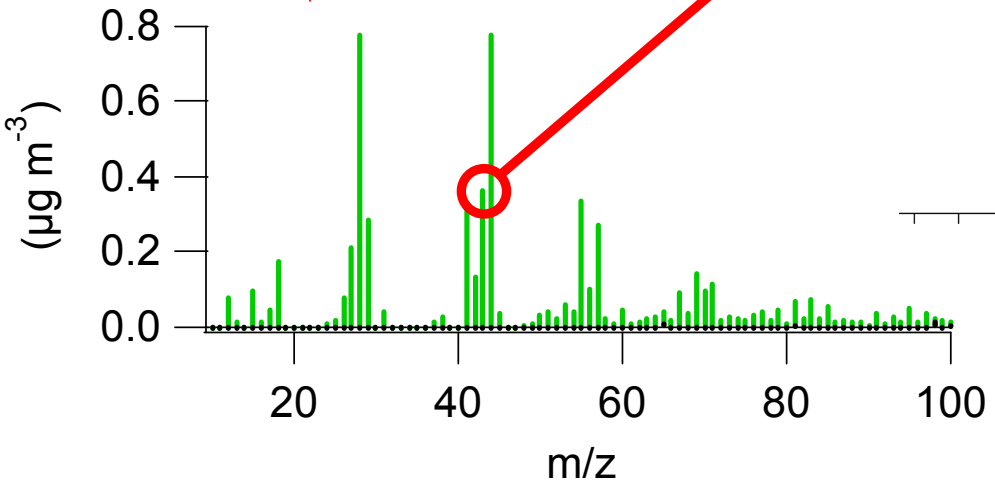
Average increase for starting and flaming phase experiments:
3.4 times



High resolution data







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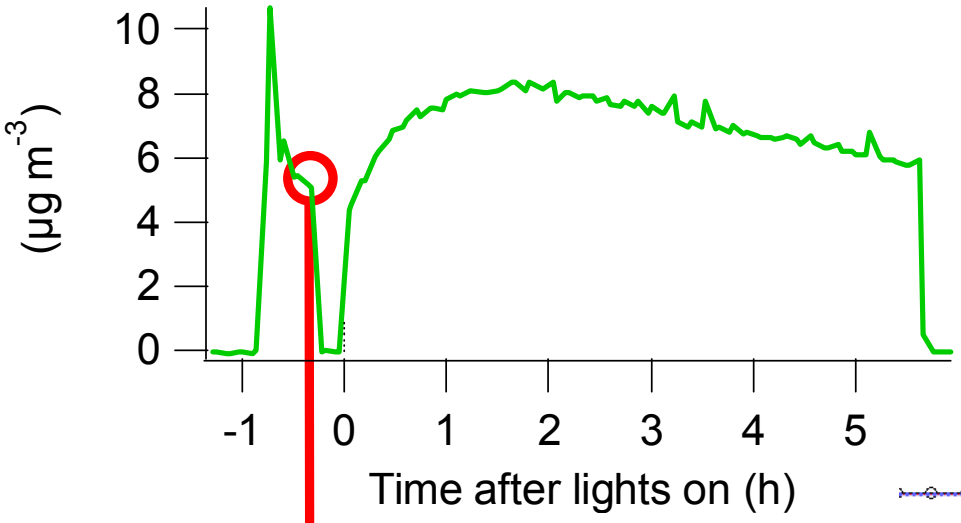
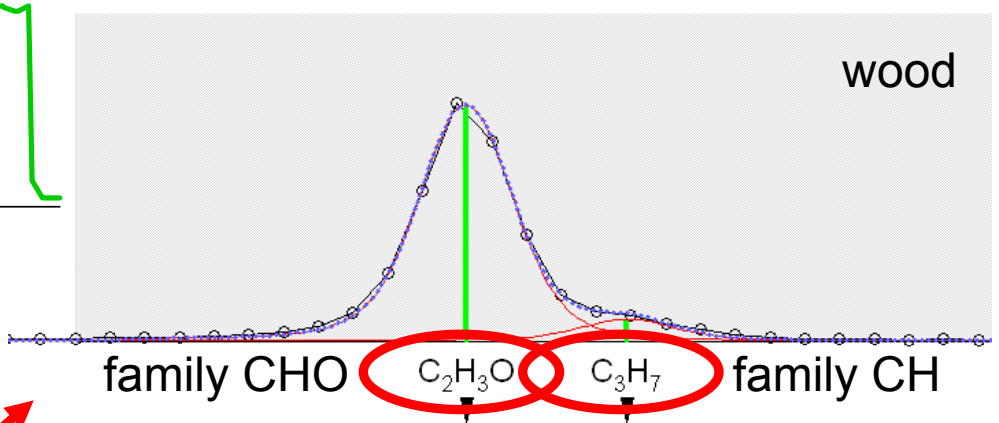
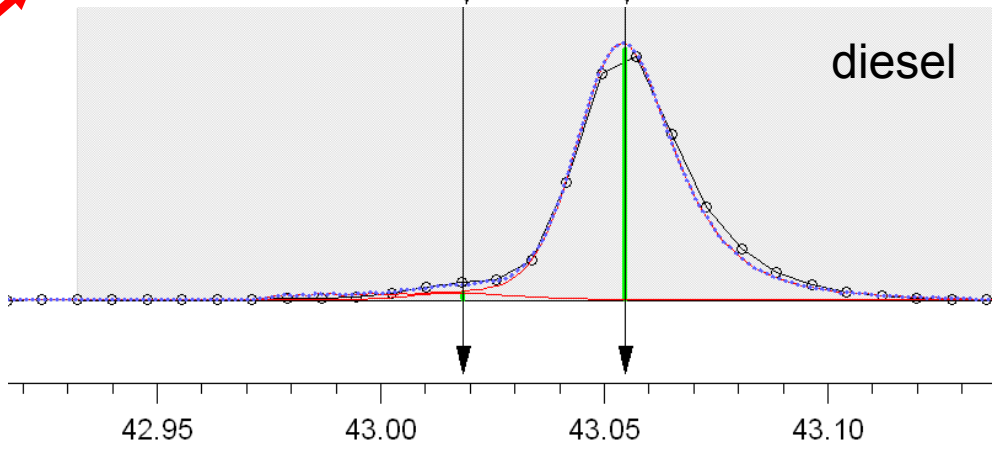
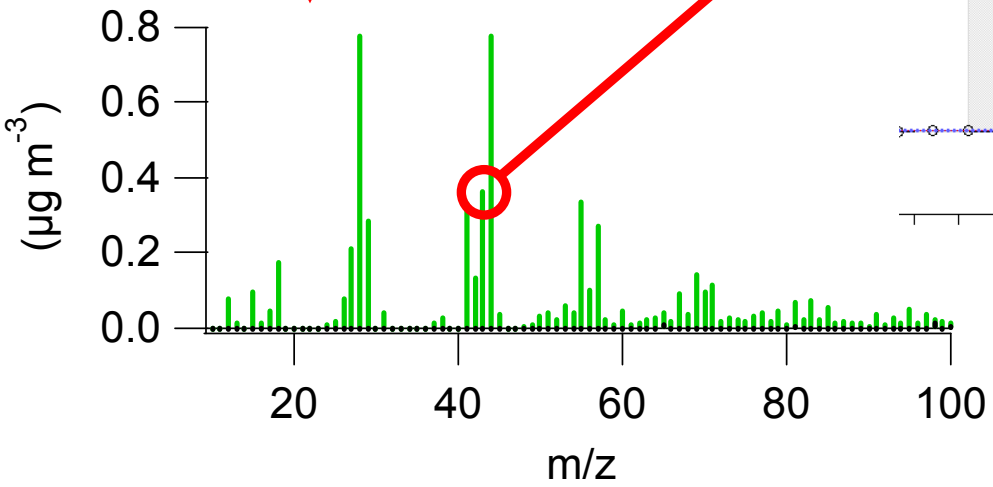


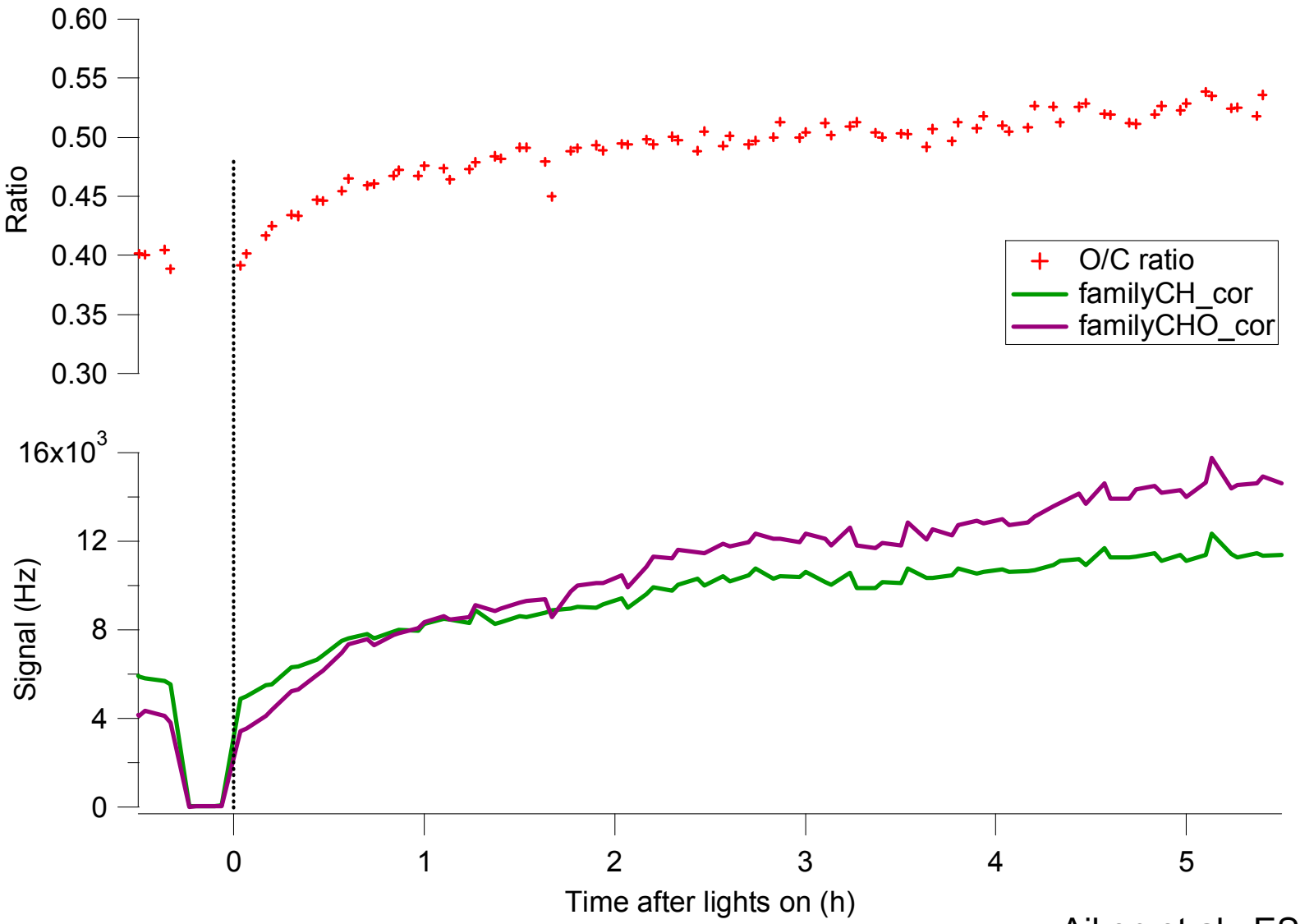






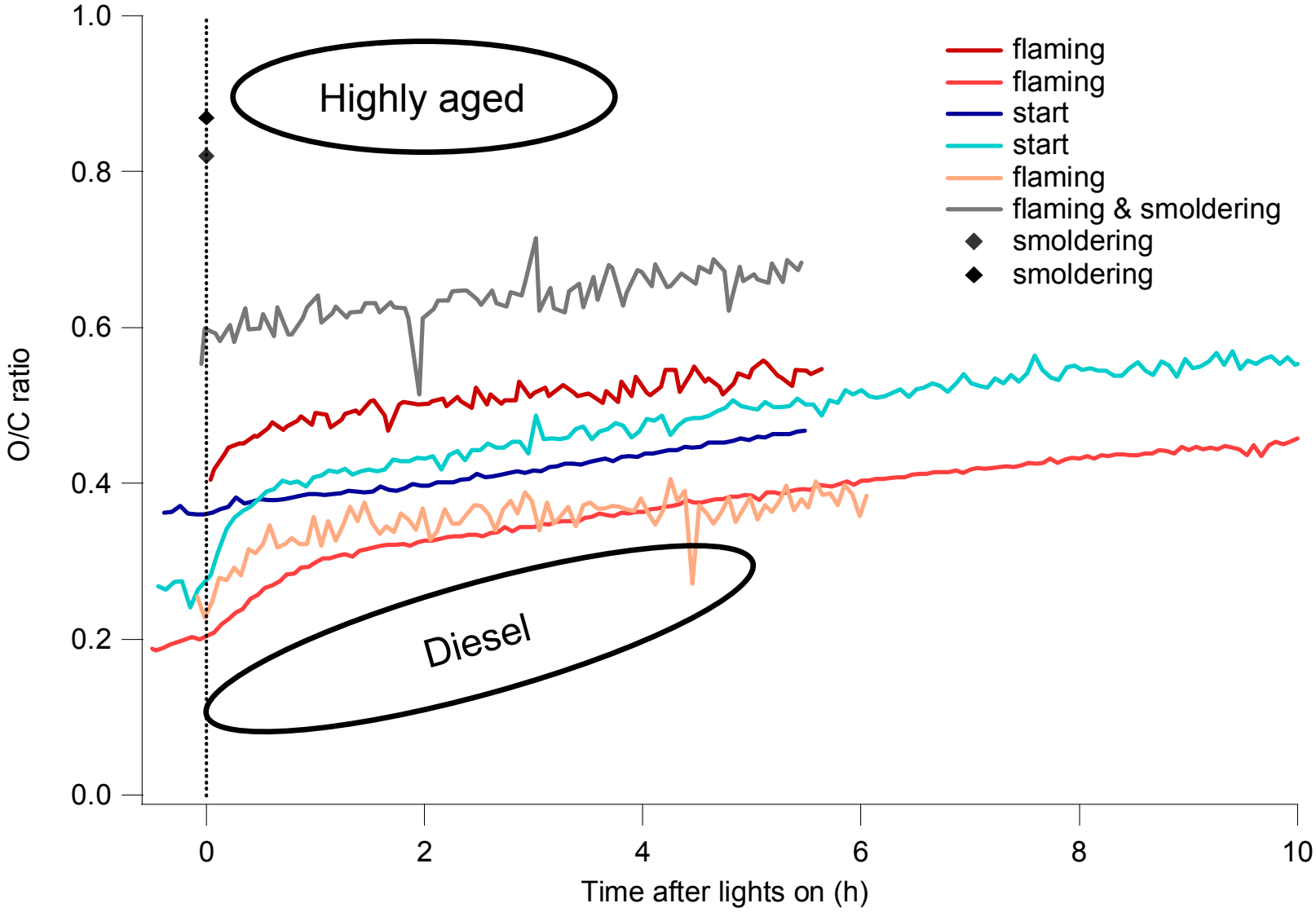
DeCarlo et al., Anal. Chem 2006

Ion family time series



Aiken et al., ES&T 2008

O/C ratio


1.0
0.8
0.6
0.4
0.2
0.0
O/C ratio
0
2
4
6
8
10
Time after lights on (h)
Highly aged
Diesel
flaming
flaming
start
start
flaming
flaming & smoldering
smoldering
smoldering

Conclusions

- The emission of organic aerosol from the tested burner increased by a factor 3.4 when SOA formation is taken into account
- Primary organic aerosols showed a large range of initial O/C ratio
- The instantaneous increase in organic mass after “lights on” indicates that possibly just 1 oxidation step can lead to SOA formation
- The efficiency of exhaust after treatment based on POA will be lower if SOA is considered as well
- Air quality assessments should not only include POA but also the SOA formation potential

Thanks to…

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Thank you for your attention