Novel method for TPM determination
Combination of ENPME and Porous Tube Dilution
Method description and preliminary results

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Real-LIFE Emissions

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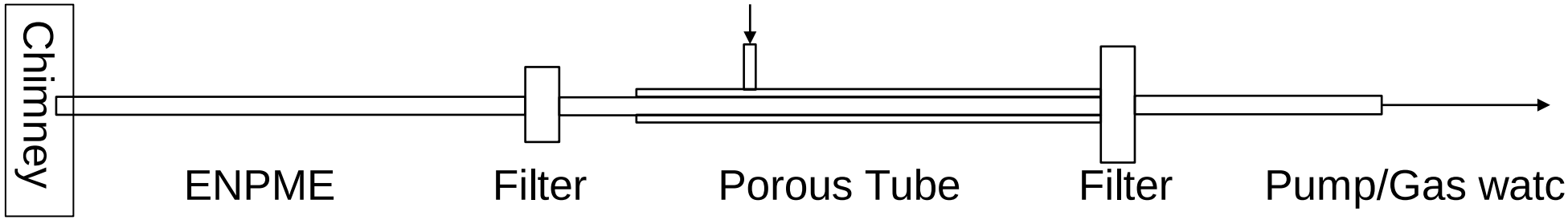
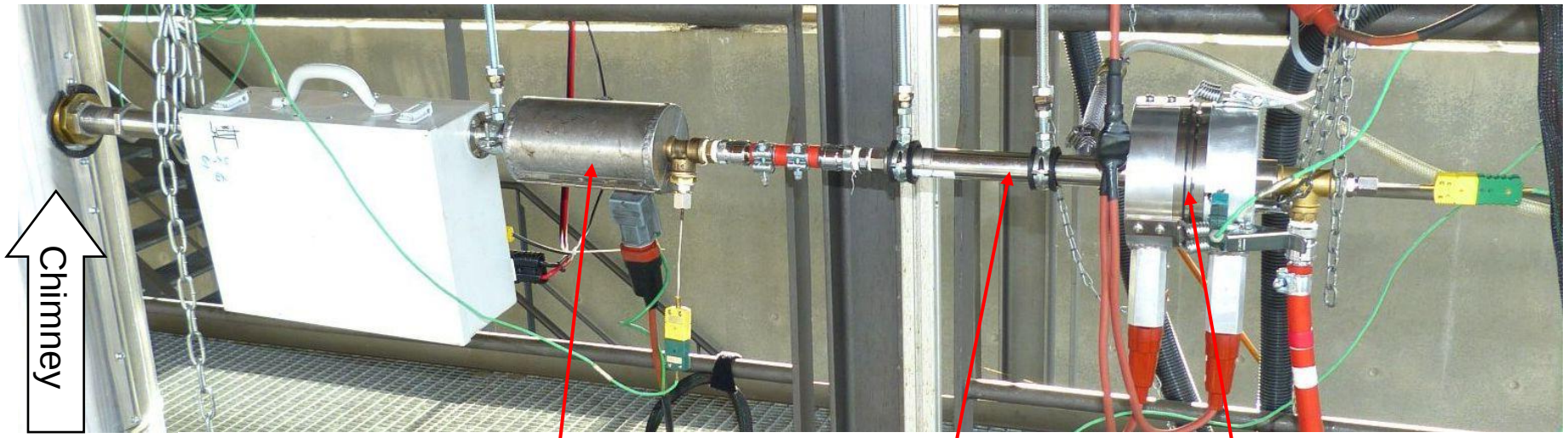
Background regarding TPM determination

- ENPME method has been introduced into EN 16510:2023 as method for TPM determination during type testing
- Full flow dilution tunnel has been removed from EN 16510:2023
- Only TPM at 180°C in the hot flue gas is detected which will clearly underestimate TPM emission for poor combustion conditions as well as during batch combustion in stoves
- → Therefore: Method which detects TPM emissions at 180°C as requested in EN 16510:2023 using ENPME but still giving more information on condensable particles for emission inventories using a compact experimental setup
- We may have a solution ☺

Novel TPM method: Setup

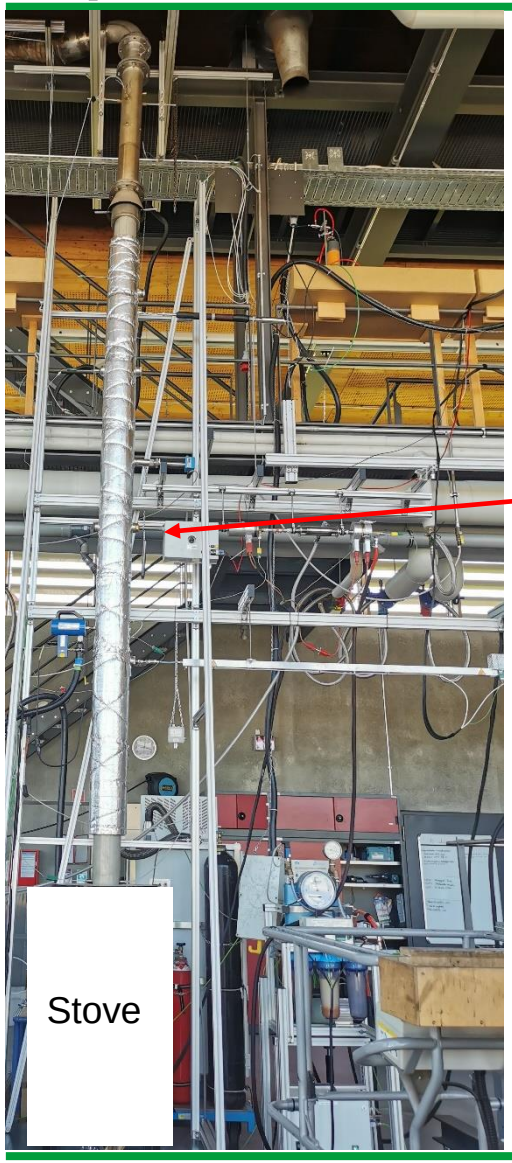
- Combination of ENPME (EN16510:2023) and Porous Tube for dilution



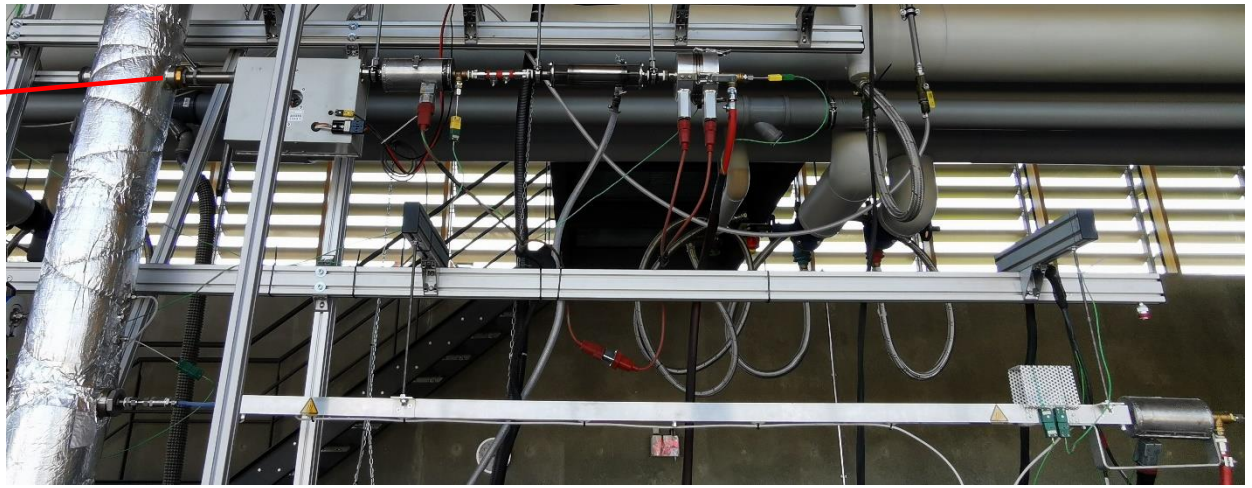


ENPME	Filter	Porous Tube	Filter
	47 mm	DR 1:8	110 mm
Temperatures	180°C		< 40 °C

Experimental setup at TFZ using a 4 m flue gas tunnel



Novel method: combined ENPME + Porous Tube at DR 1:8 (only during 2nd, 4th, 6th and 8th batch)



Novel TPM method: Pictures after sampling

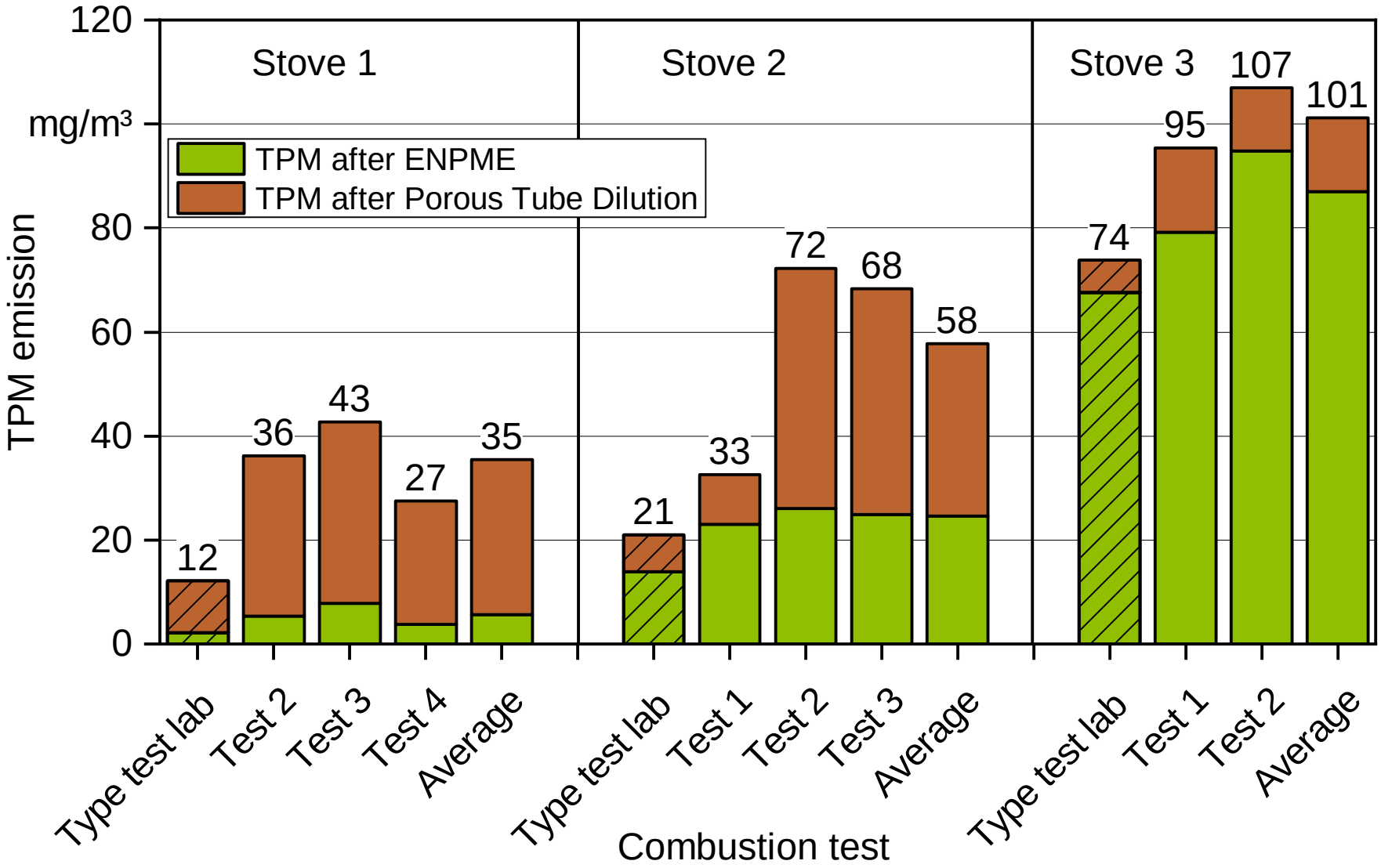
- Combination of ENPME (47 mm filter) and Porous Tube

+

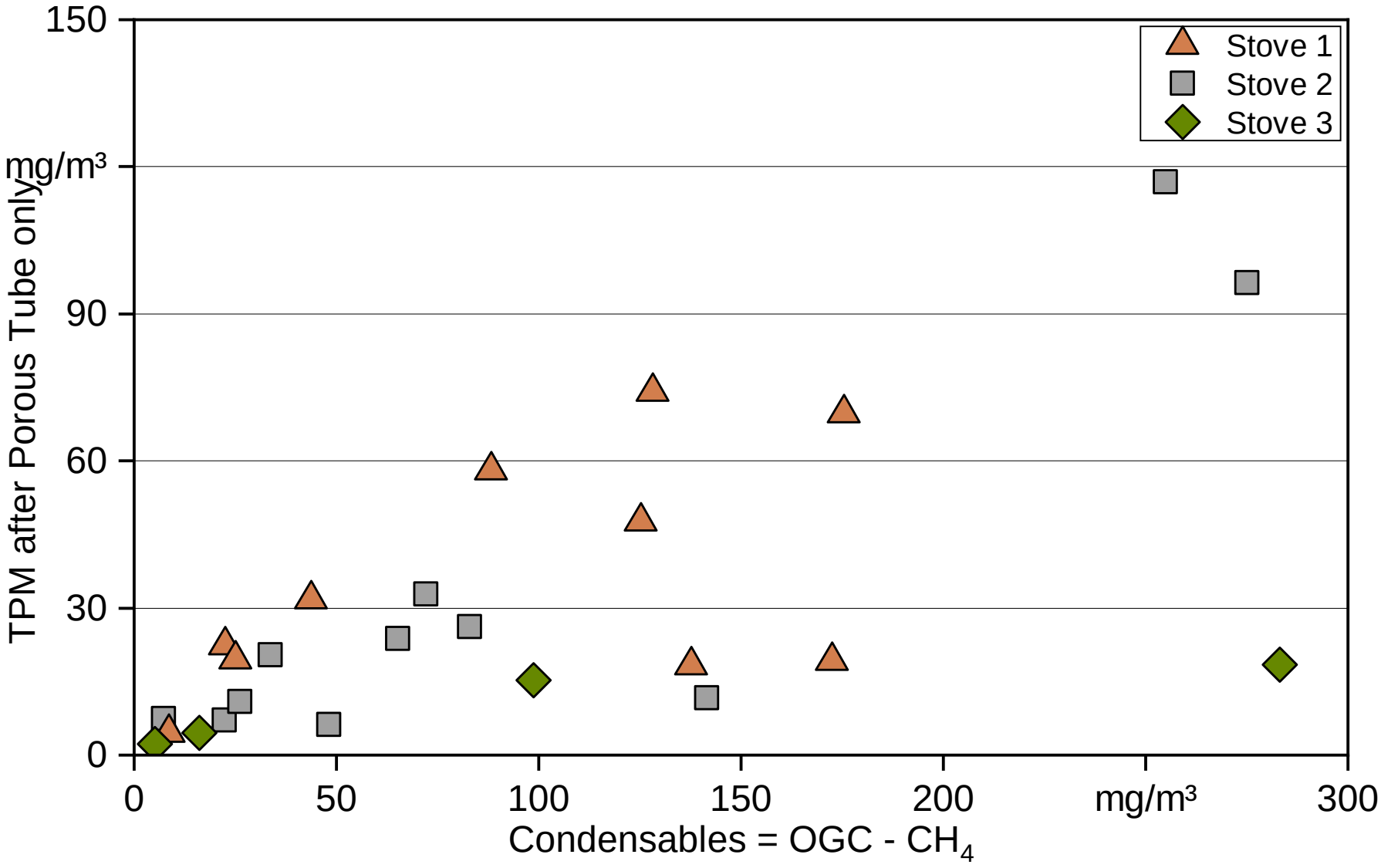
- ENPME: collected at 180°C

condensation of some OGCs → brownish

TPM emission – Fractions of TPM



Additional TPM in dependency of condensables



New method: Advantages

Advantages of novel measurement setup:

- No full flow dilution tunnel is required
- Condensables and non-condensables are determined from identical sampling gas flow (no sampling errors!)
- The two TPM emission fractions are differentiated during one measurement
- With a sufficient database, the added fraction of condensables can in the future be used for correcting emission factors which are still based on heated filter measurements

Summary and Outlook

- Combination of ENPME and Porous Tube using a dilution ratio of about 1:8 during RealLIFE test protocol in 2nd, 4th, 6th and 8th batch for 3 stoves

  → clear increase in TPM emission if novel TPM method was used

- Evaluation of data collected by project partners during RealLIFE test protocol

- Comparative measurements using ENPME only in hot flue gas, novel method (combination) in hot flue gas and TPM determination in full flow dilution tunnel for selected batches at:

  - Different fuel loads (nominal load, partial load, overload)
  - Different log wood stoves

- Intercomparison campaign at INERIS took place in September 2023 using this novel TPM method by four project partners → evaluation of data still ongoing

Thank you for your attention!

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