19NRM03 SI-Hg
Validation results of the calibration of mercury gas generators

Workshop
19 Sep 2023

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SI-Hg Objectives / Oxidised mercury

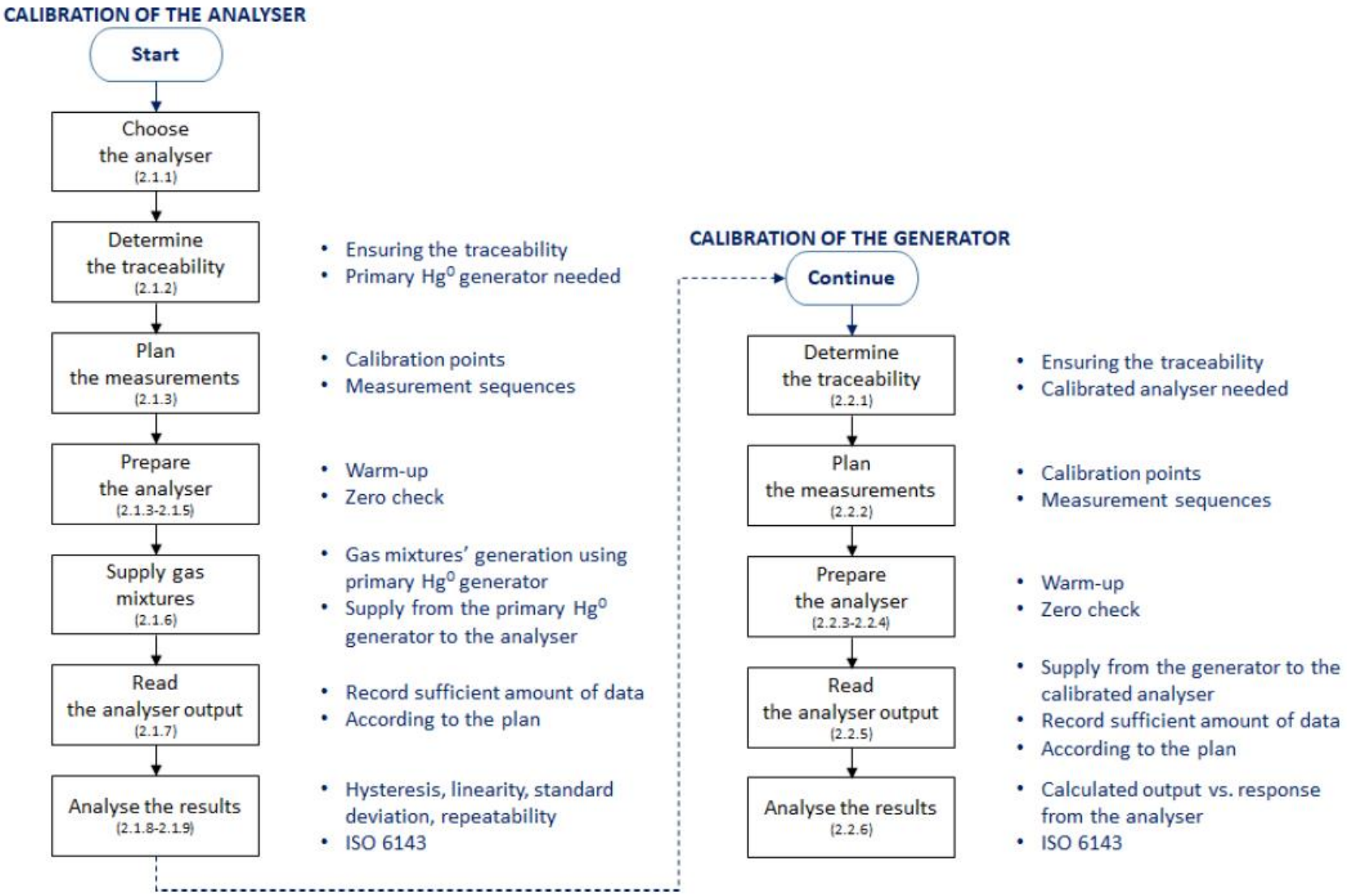
Objective 2

To validate a certification protocol for the certification of oxidised mercury (Hg^{II}) gas generators used in the field for low mercury concentrations present in the atmosphere and higher concentrations from emission sources. The validation will include (1) metrological evaluation of state-of-the-art dual Hg^0 and Hg^{II} analytical systems, (2) repeatability, reproducibility and uncertainty evaluation of the certification procedures at representative concentration levels extended to the low ng/m^3 level.

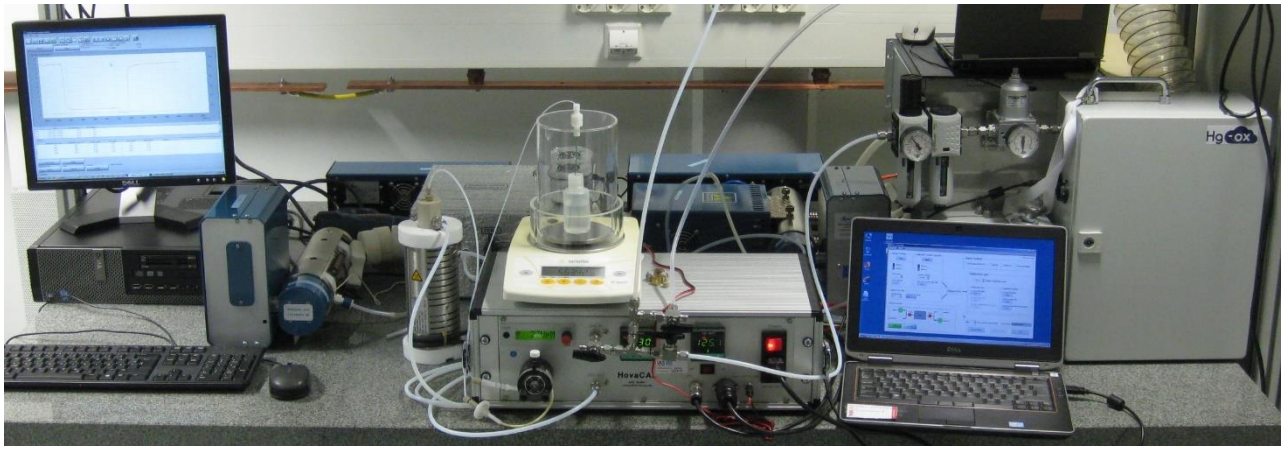
Objective 3

To organise a performance evaluation to gather data on the characteristics of at least three Hg^0 and three Hg^{II} gas generators on the market.

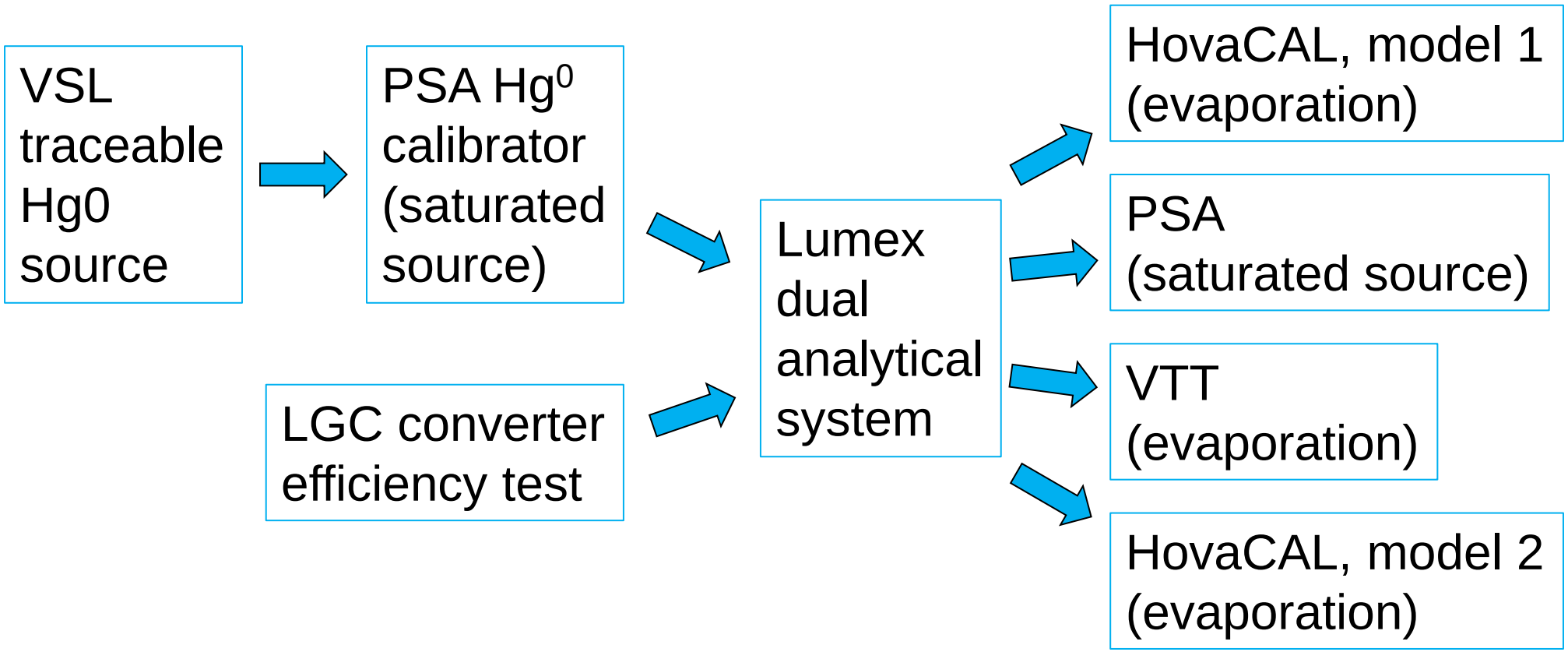
Certification protocol for the certification of oxidized mercury gas generators



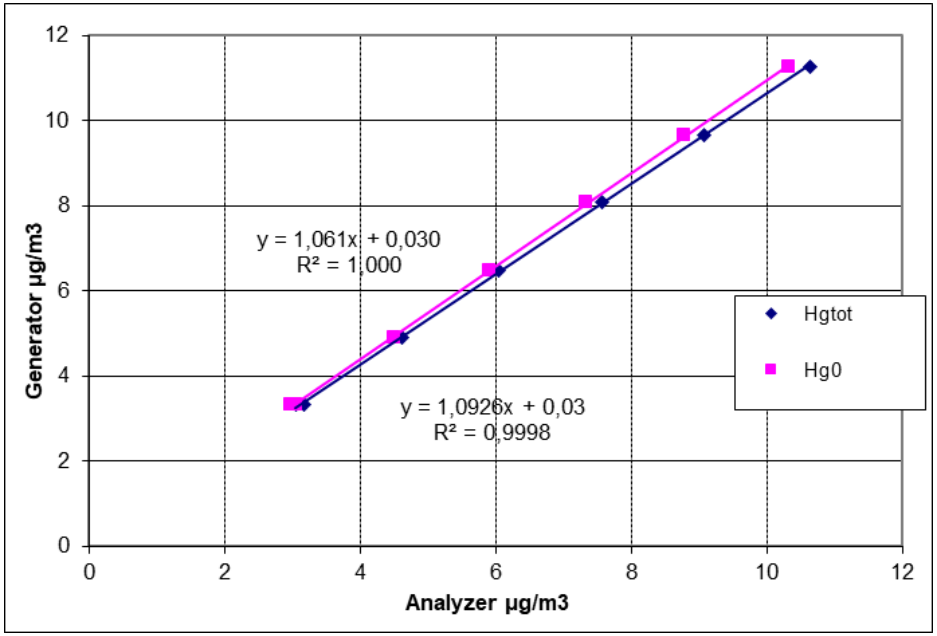
Test setup including four HgII generators

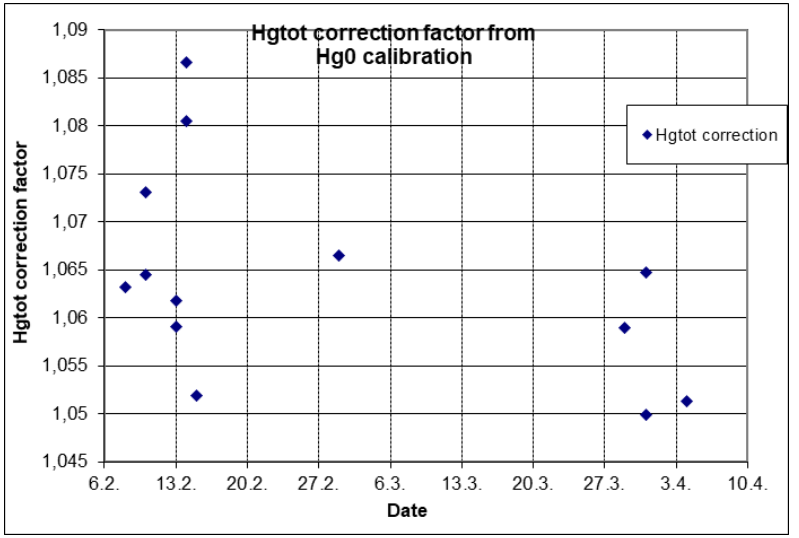


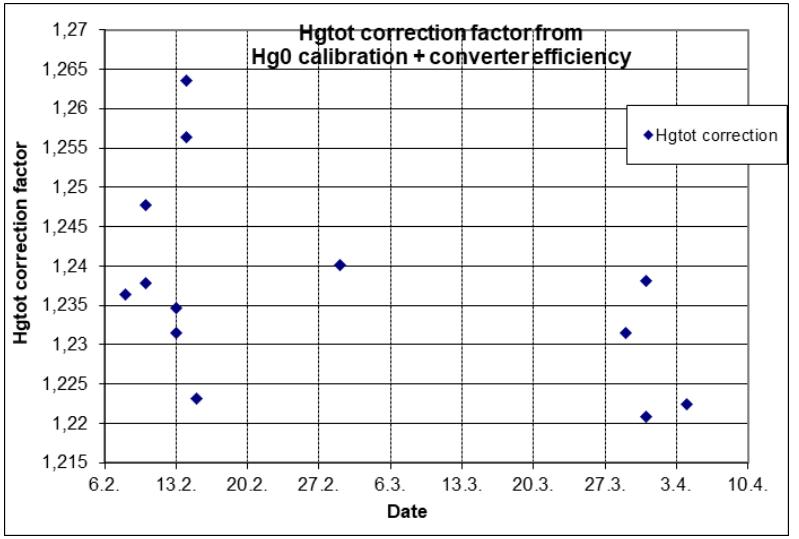
Traceability chain



Dual analyzer calibration with traceably calibrated Hg^0 generator (secondary gas standard)







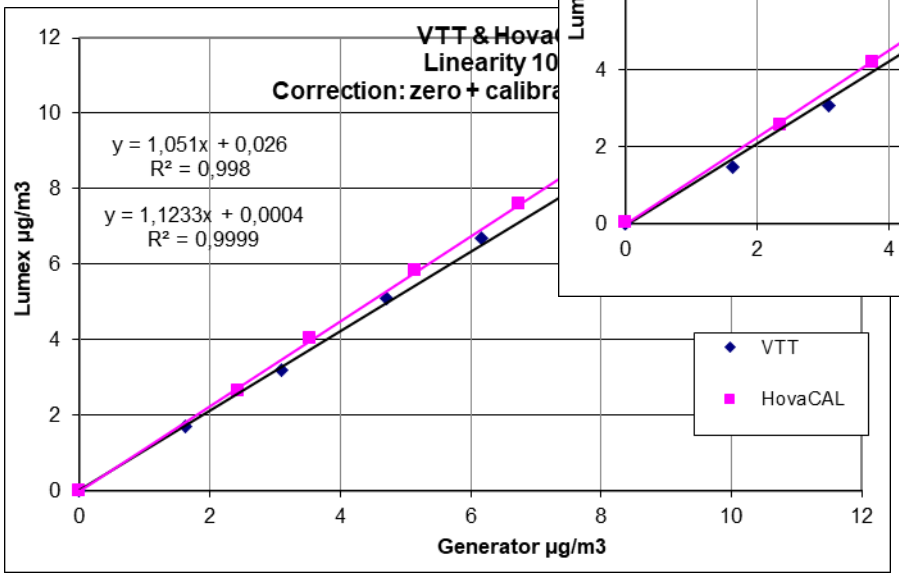
Hgtot correction factor	Hg0 calibration	Hg0 calibration + converter efficiency
Average	1,064	1,237
Standard deviation	0,011	0,013

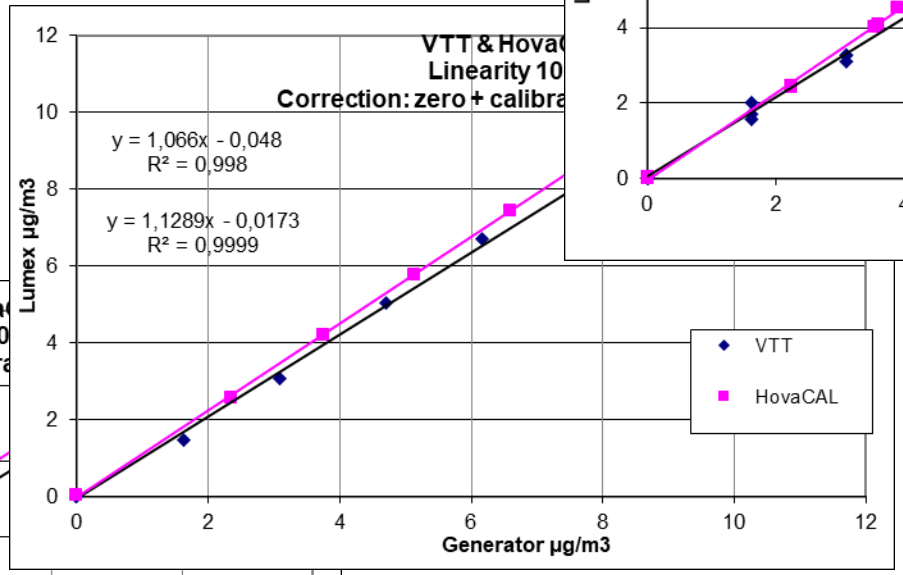
Evaporative generators, range 10µg/m³

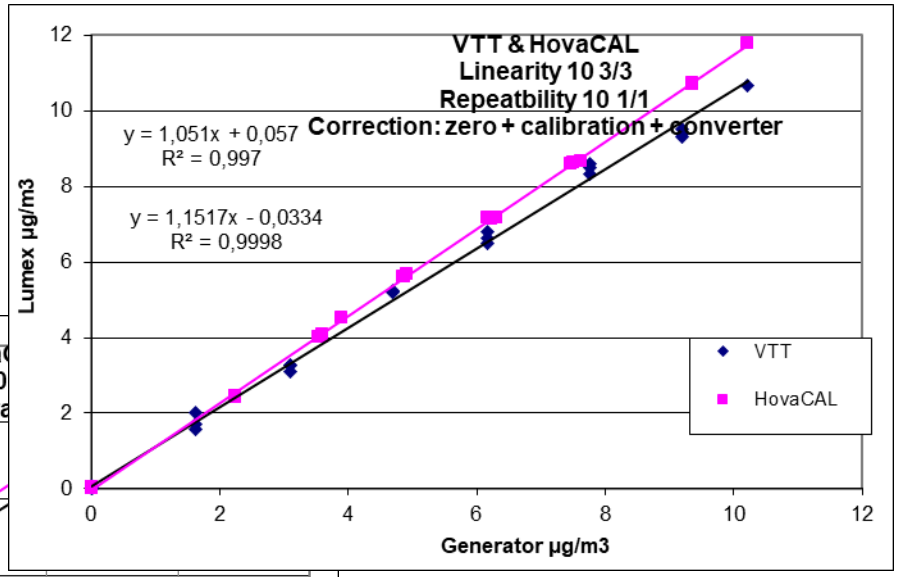
Hg^0 < 1% of output

Data collected for:

- Accuracy
- Linearity
- Repeatability
- Reproducibility



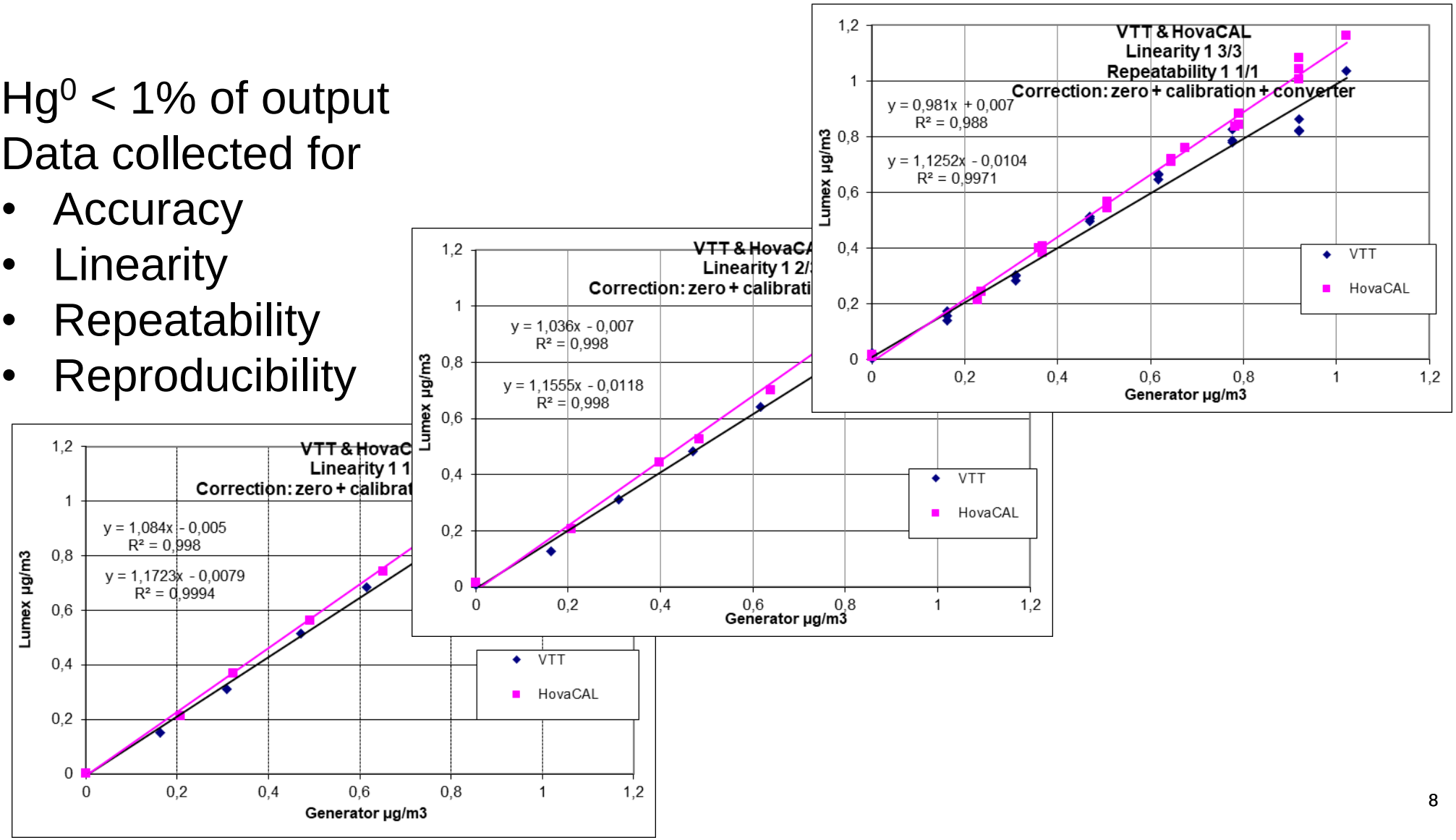




Evaporative generators, range 1µg/m³

Hg^0 < 1% of output
Data collected for

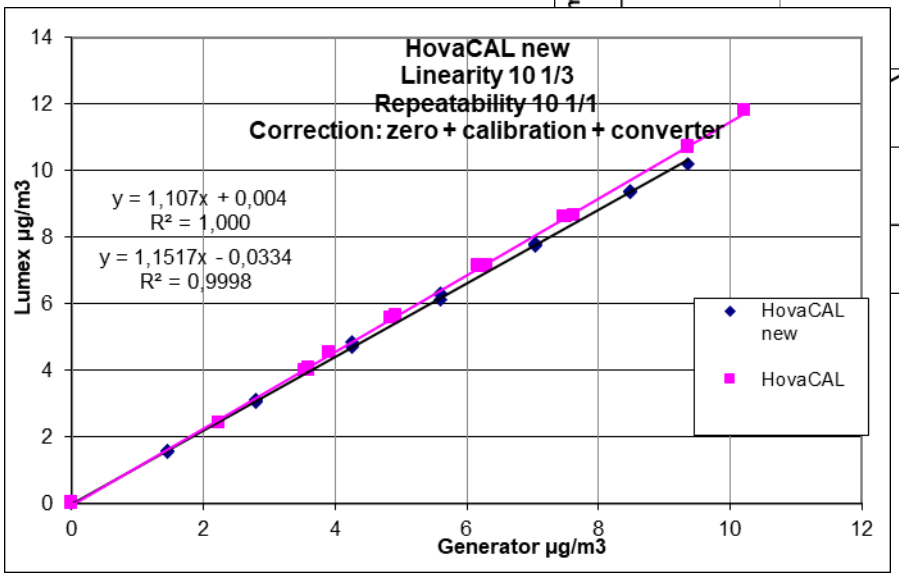
- Accuracy
- Linearity
- Repeatability
- Reproducibility

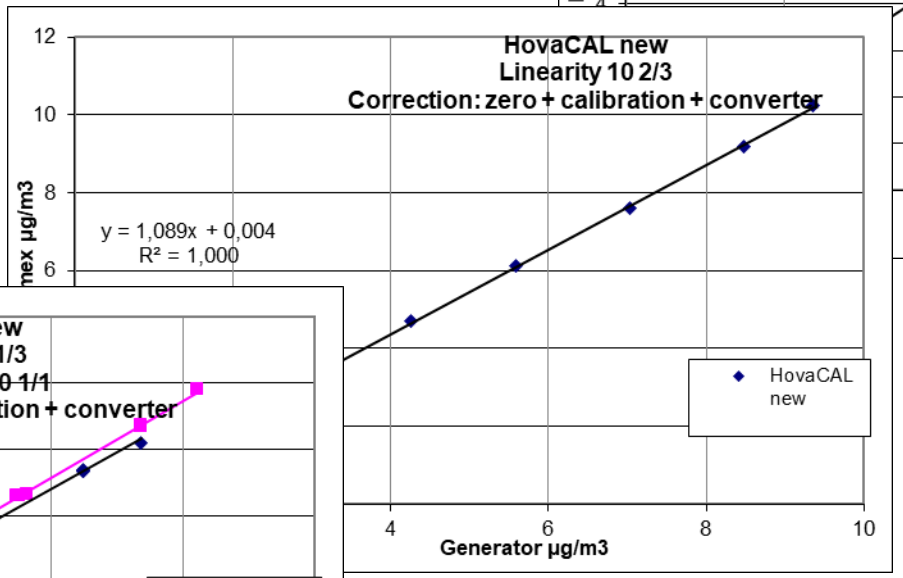


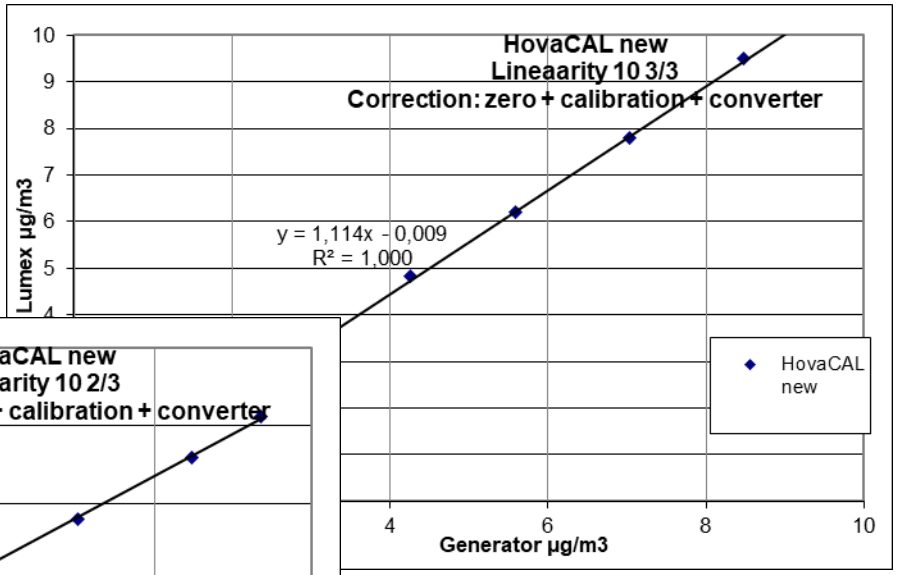
Evaporative generators, range 10µg/m³

Hg^0 < 1% of output
Data collected for

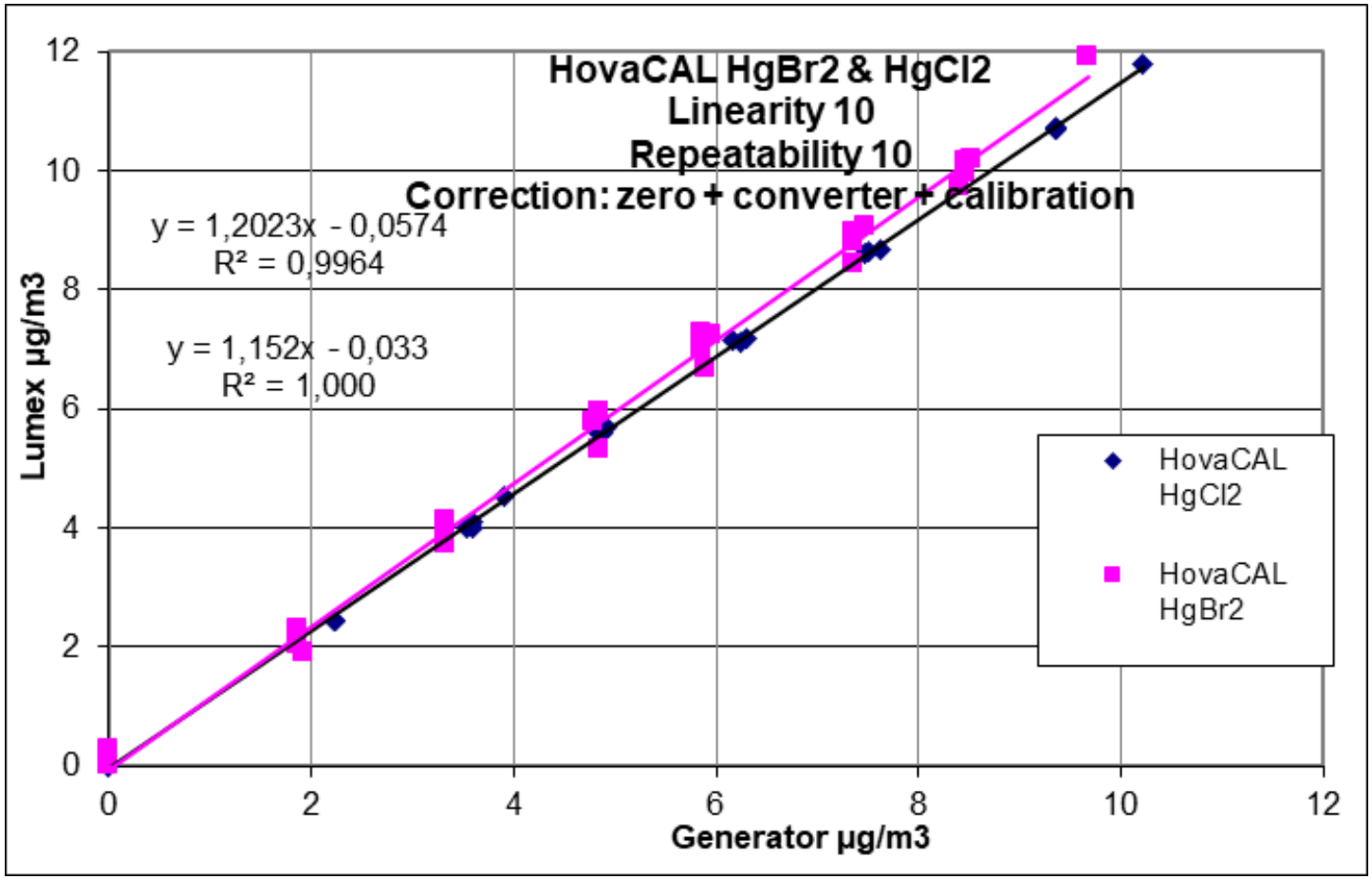
- Accuracy
- Linearity
- Repeatability
- Reproducibility



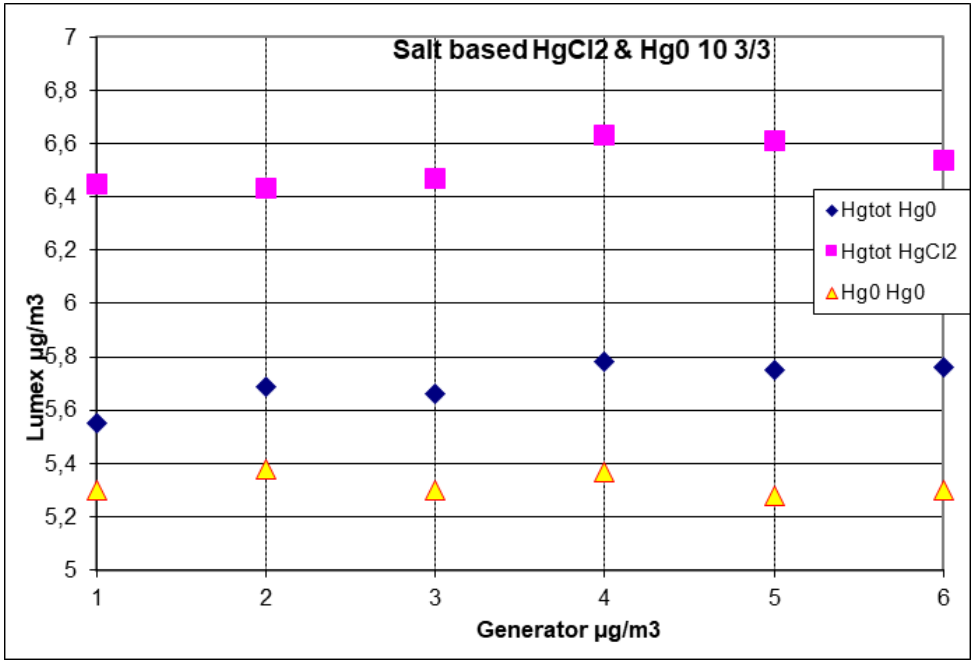


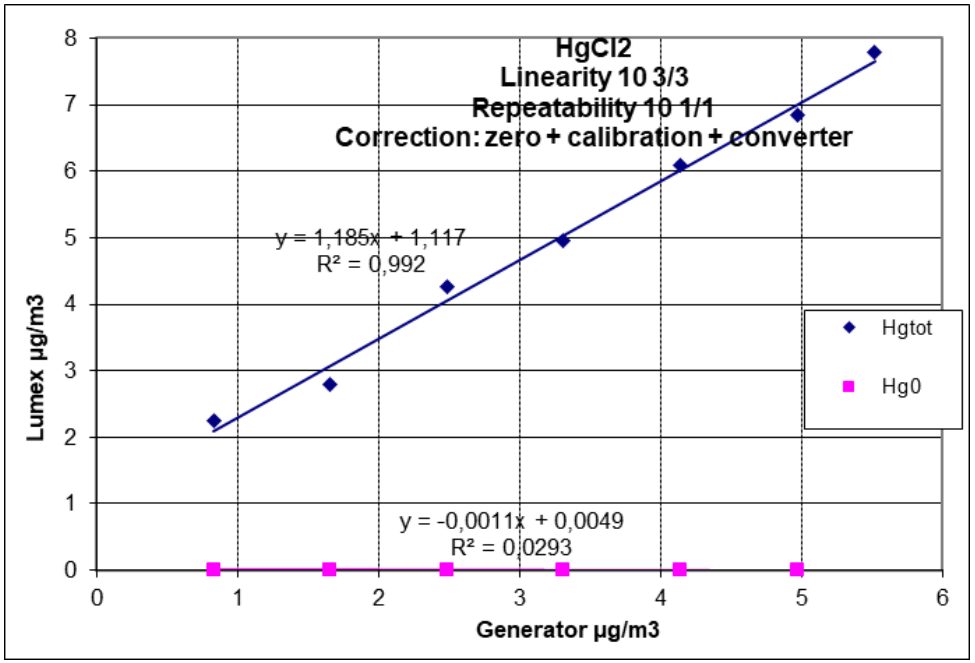


Evaporative generator with $HgCl_2$ and $HgBr_2$, range 10µg/m3

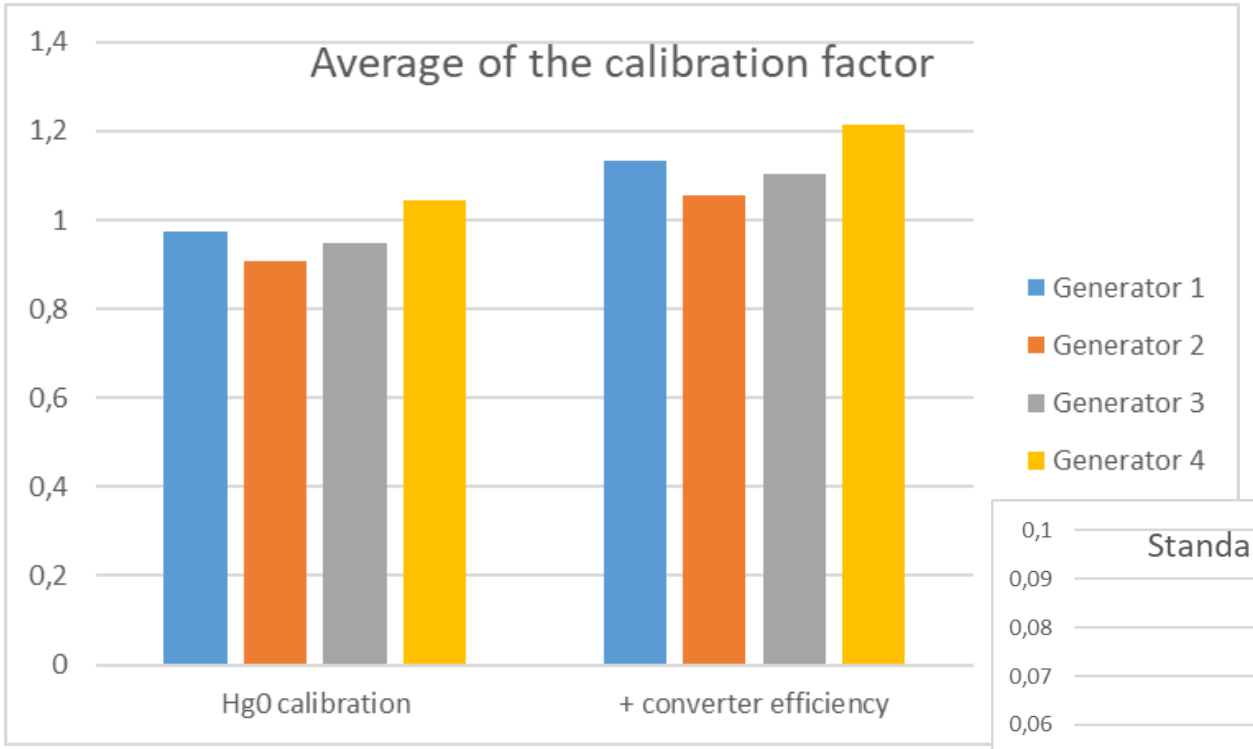


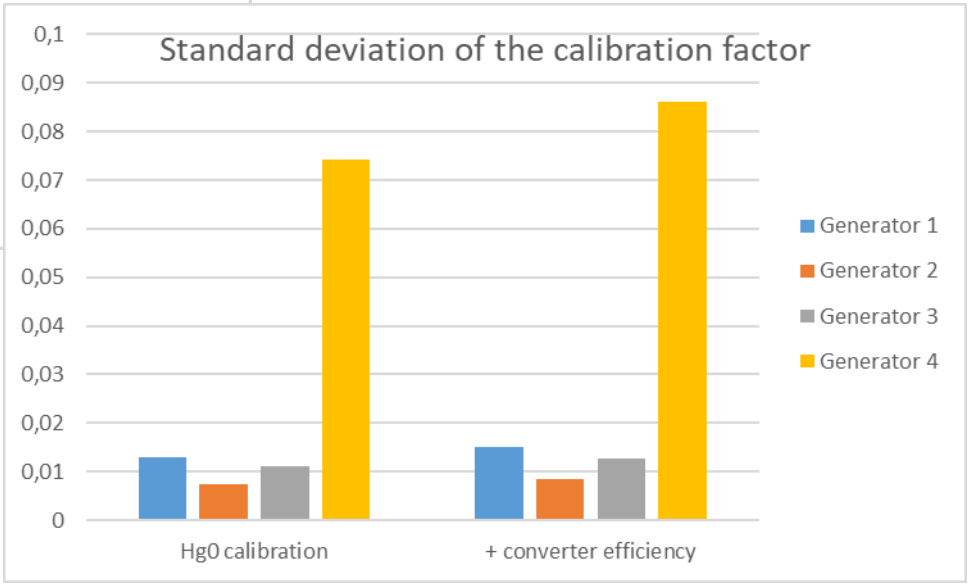
Salt based generator, range 10µg/m^3





Hg^{II} generators, range 10µg/m³





Validation results of the calibration of mercury gas generators

- Complicated setup with several parts and unknowns is needed for the process easily causing high uncertainties
- Process for traceable calibration of a Hg^{II} generator without direct measurement of Hg^{II} (or Hg^{tot})
  - OK: Traceable calibration with Hg^{0}
  - BUT: Two unknowns, generator and converter
- Fast response time of all system parts is highly beneficial in practical measurements
- The project outcome is several essential suggestions for the complete validation process