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Federal Institute of Metrology METAS



Calibration services for ozone standards at METAS

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Agenda

History

- Legitimation
- Procurement of the NIST SRPs

Changes

- Alternative temperature and pressure
- LabVIEW based OzoneLab Software
- Upgrade cells and isolation (2007)

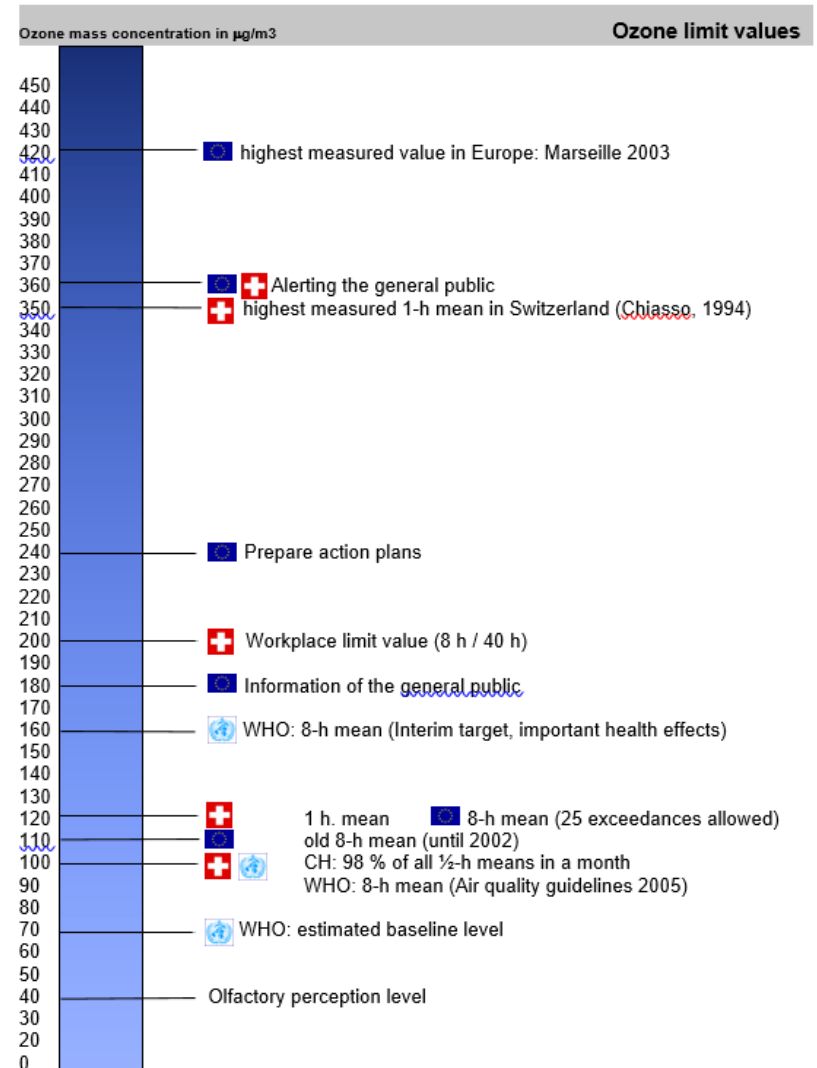
Outcome

- Stability #14 to #18
- International comparison BIPM-QM.K1
- National round robin of 20 stations
- Conclusions for Swiss activities

History / Legitimation

- **Action plans** in Switzerland were based on the exceedances of air quality limit values.
- The **quality** of the measured values **was challenged** by traffic associations.

➔ METAS started to build up a **national ozone standard** and **calibration service in 1993**.



History / Procurement of NIST SRPs

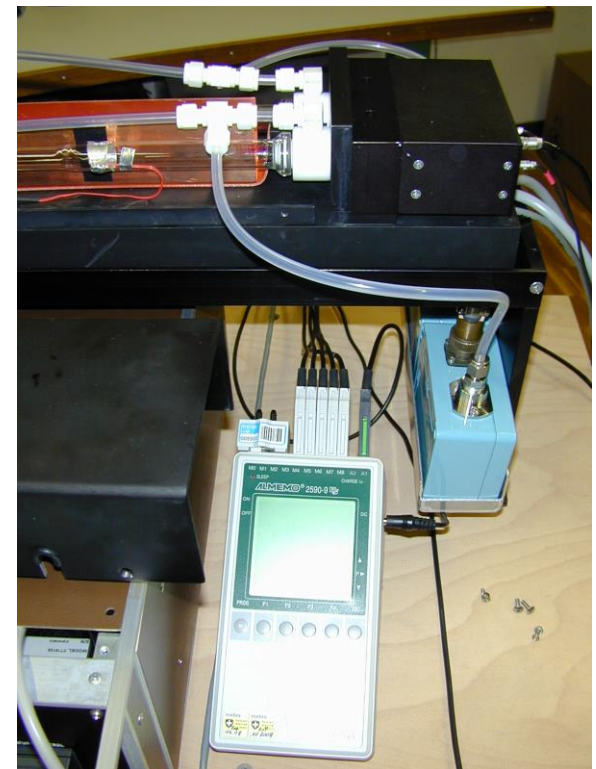
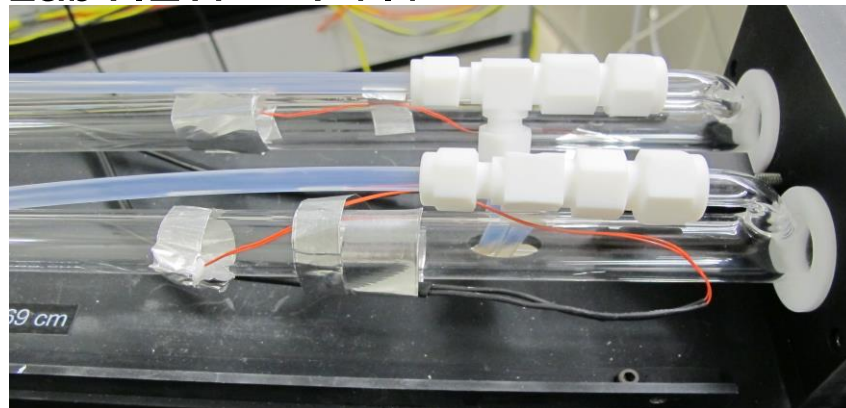
- SRP#14 installed in May 1993, SRP#18 in March 1996



Changes Alternative **Temperature** and Pressure Sensors

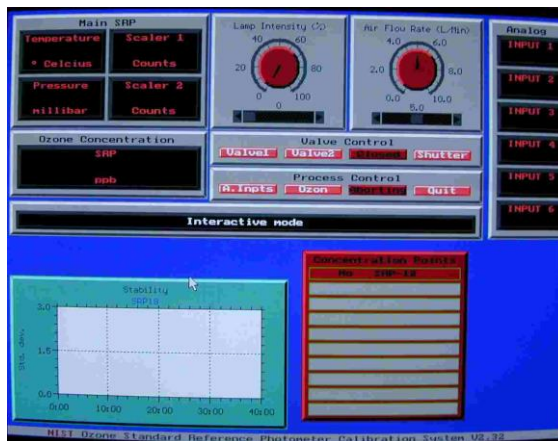
- **Temperature gradients** and therefore lack of representative measurement site were detected and corrected by **4 NTC thermistors** on cells.
- Individual pressure measurement per cell was implemented (RPT 301)

➔ These changes and automatic data acquisition for new devices asked for a **flexible software** based on LabVIEW™ V 7.1

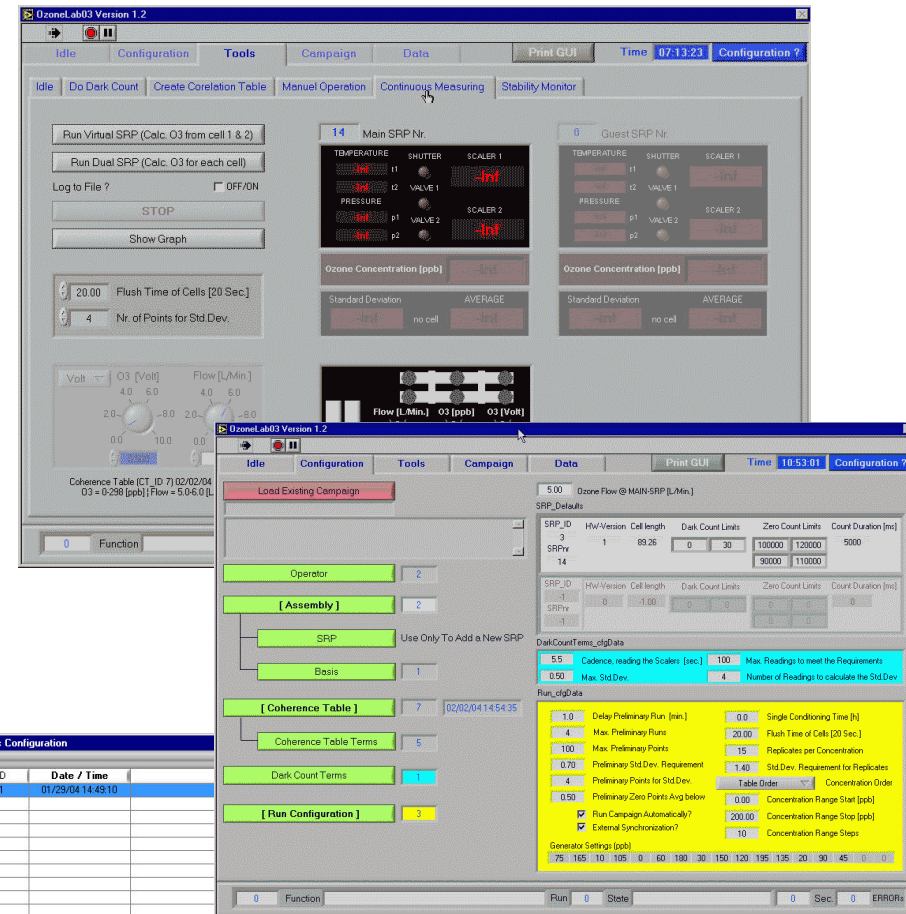


Changes LabVIEW™ based **OzoneLab** Software 2003

From

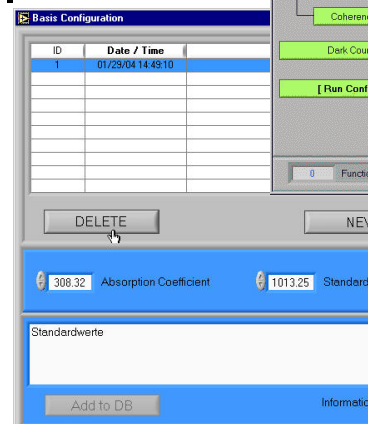


To



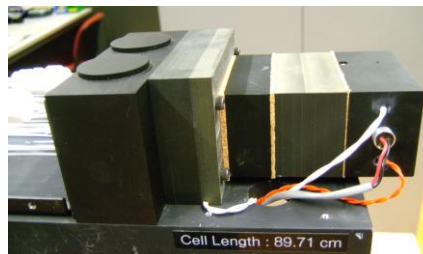
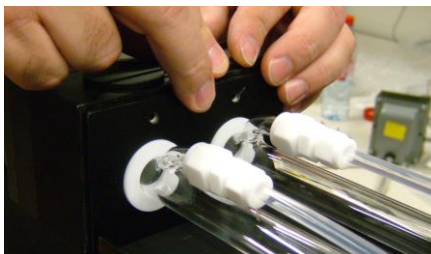
Advantages:

- **Configurable** hardware.
- **Drivers** for data acquisition of **new DUT**
- **Flexibility**



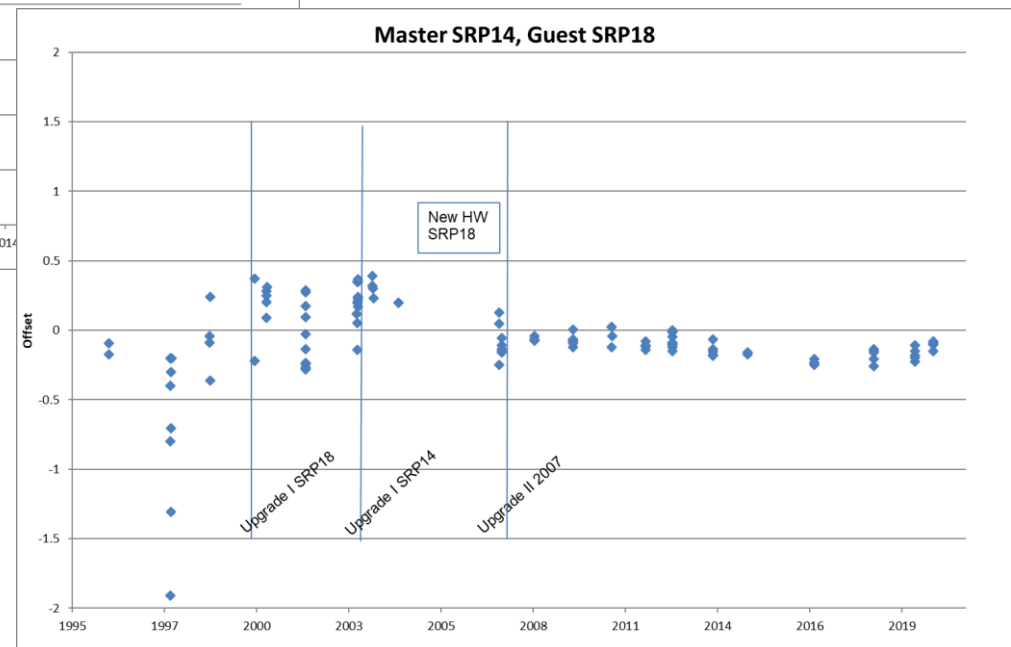
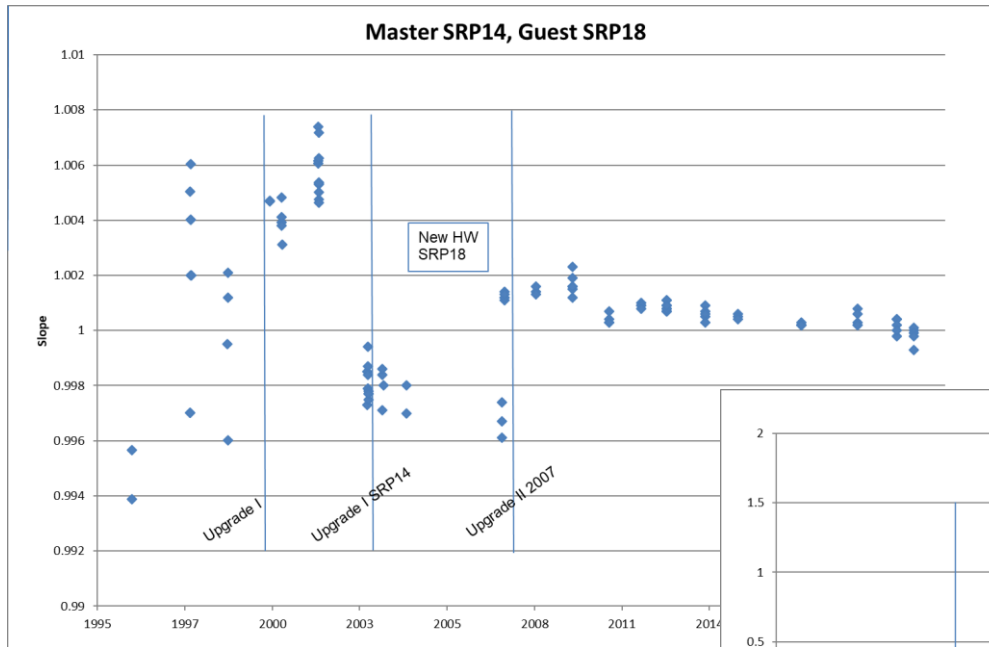
Changes

Upgrade of cells and isolation (2007)



	Effect of Upgrade 1	Effect of Upgrade 2	Total effect	Deviation to SRP0 after Upgrades
SRP14 (METAS)	-0.63 %	+0.50 %	-0.13 %	+0.05 %
SRP15 (EMPA)	-0.60 %	+0.45 %	-0.15 %	+0.03 %
SRP18 (METAS)	-0.85 %	+0.12 %	-0.73 %	-0.06 %
SRP23 (EMPA)	-0.68 %	+0.58 %	-0.10 %	+0.06 %
SRP26 (UBA)	-0.53 %	+0.46 %	-0.07 %	-0.02 %

Outcome Stability #14 to #18



Outcome

International comparison BIPM-QM.K1

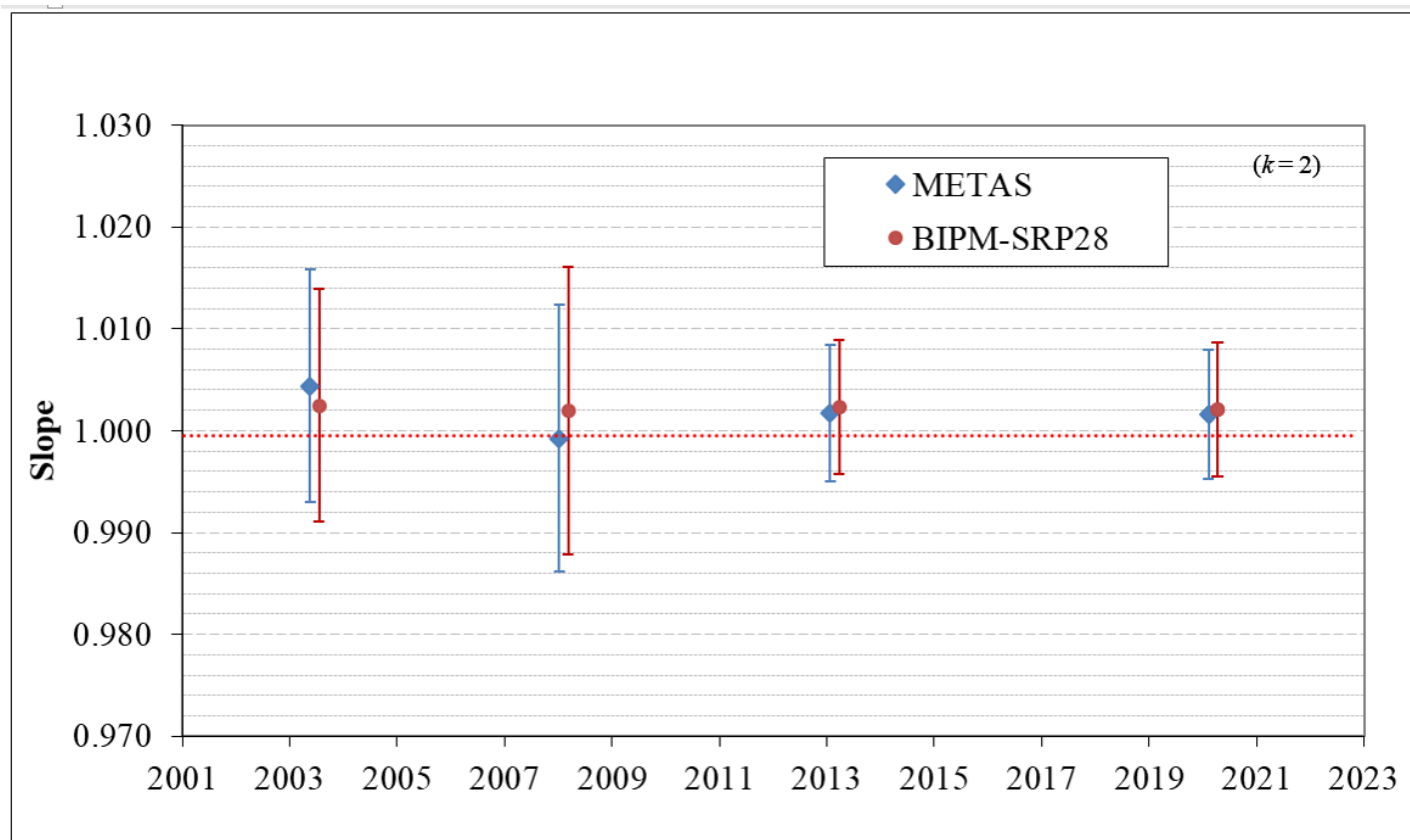


Figure 2: Results of previous comparisons between SRP27, SRP28 and METAS SRP14 realised at the BIPM. Uncertainties are calculated at $k=2$, with the uncertainty budget in use at the time of each comparison.

Outcome

National round robin of 20 stations (2019)

Fig.1: Slopes and uncertainty of the slopes of regression line per station

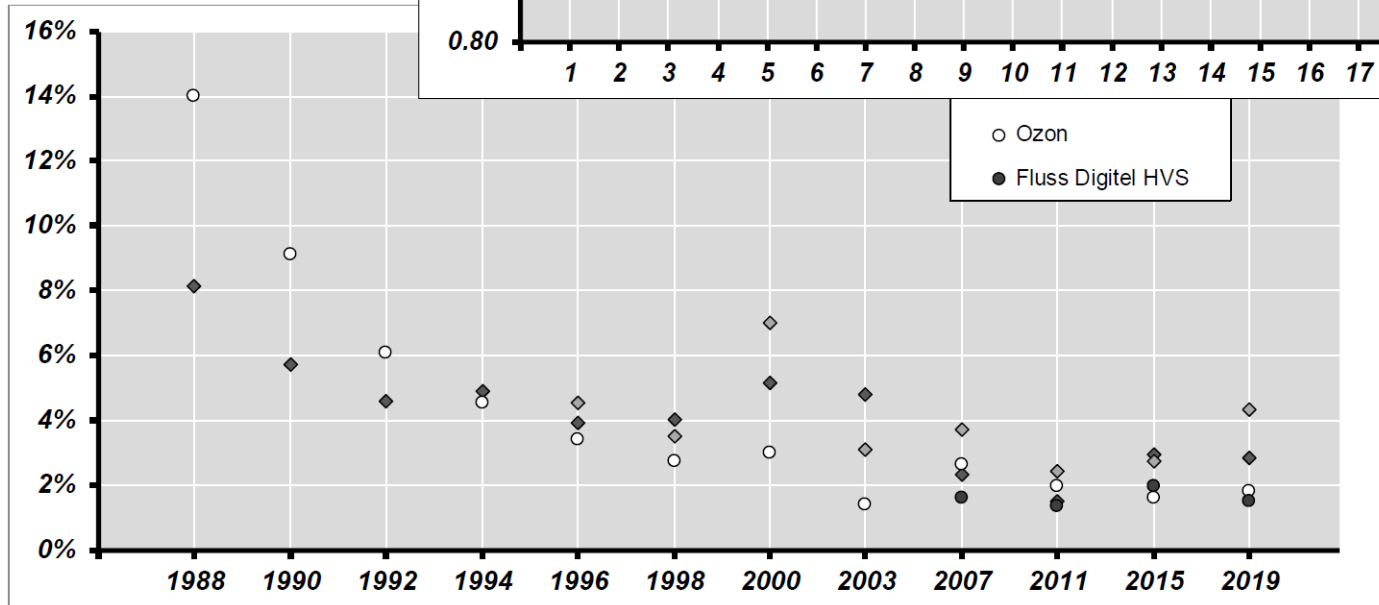
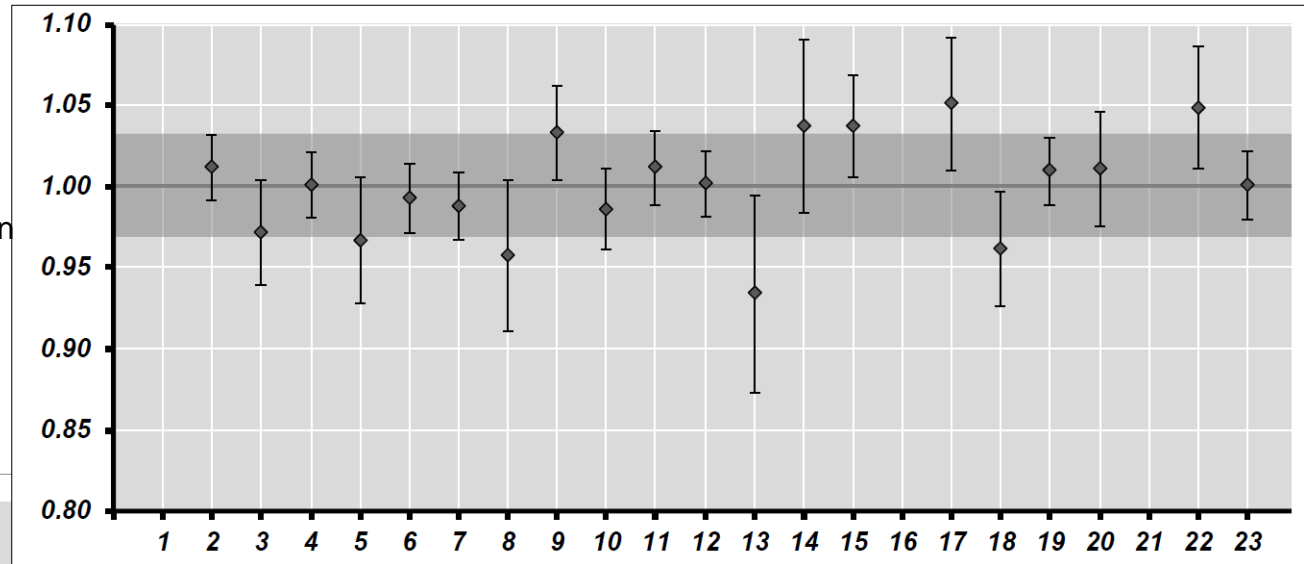


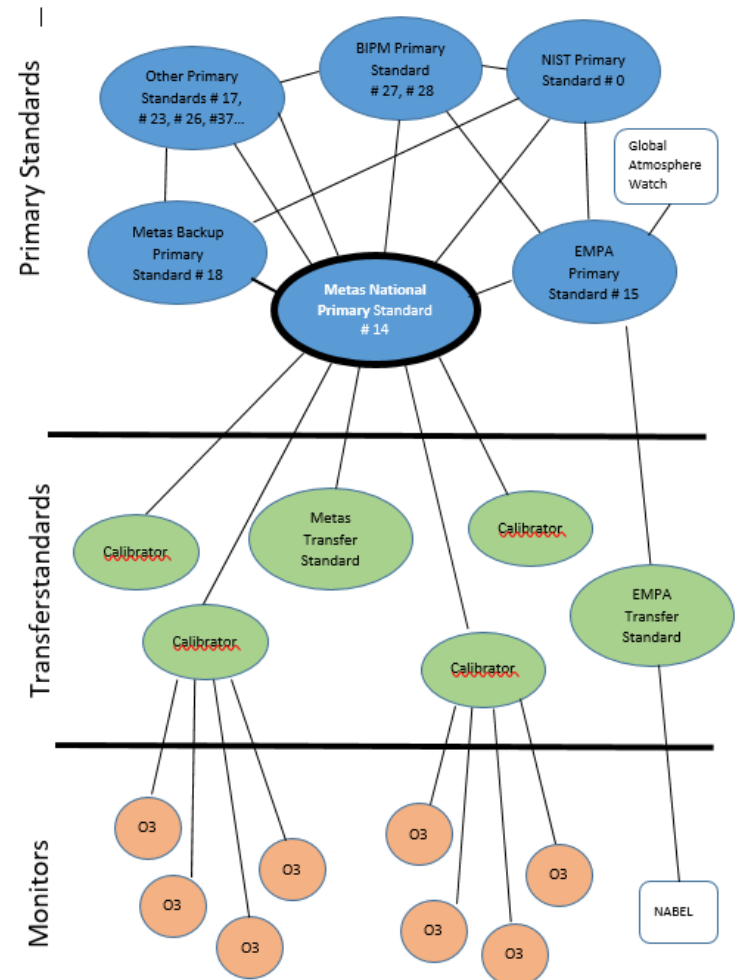
Fig.2: Relative comparison standard deviations from 1998 to 2019

Outcome Conclusions for CH activities

- Established **Traceability** (chain, network)
- Flexibility, independence and sustainable instrumentation through METAS software
- Station **results** far **within** EU **DQOs** (MU rel. < 15%)
- **Ready** for implementing the revised cross section value

$$\alpha_x = 304.39 \text{ cm}^{-1}$$

Calibration Chain (Network) in Switzerland



Outcome Conclusions for CH activities (II)

- \approx **900 calibrations**
since 1993
- $>$ **50 satisfied clients**



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Certificate of Calibration No 232-38543

Object: **Ozone transfer standard**
T703
SN 353

Order: Calibration of the photometer

Applicant:

Traceability: The reported measurement values are traceable to national standards and thus to internationally supported realizations of the SI units.

Date of Calibration: 24.01.2020

Marking: Calibration label METAS 01_2020

3003 Bern-Wabern, 24 January 2020

For the Measurements: Daniel Schwaller

Approved by: C. Pascale / B. Niederhauser, Head of Laboratory

Mutual recognition
This certificate is consistent with Calibration and Measurement Capabilities (CMCs) that are included in Appendix C of the Mutual Recognition Arrangement (MRA) drawn up by the International Committee for Weights and Measures. Under the MRA, all participating institutes recognize the validity of each other's calibration certificates and measurement reports for the quantities, ranges and measurement uncertainties specified in Appendix C (for details see www.bipm.org).
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Thank you very much for your attention