

Eurachem/CITAC Workshop on Quality in Analytical Measurements
Uncertainty and Results Interpretation
Lisbon, Portugal



CHRYSOS
PhotonAssay™
Faster, more accurate gold analysis

Assignment of Self-Certified Reference Values for PhotonAssay™ using ISO 33405:2024 and ReML

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1

Presentation Overview

- Poster Overview
- PhotonAssay™ (PA) Overview
- Context
- Methodology
- Gold and Silver Results Plots
- En Comparison
- Uncertainty Contributions
- Certificate Generation
- Conclusion

2 |



2

Poster Overview

PhotonAssay™ self-certification (PA-SC) of 11 commercially available reference materials (RM) was undertaken to assign reference values using ISO 33405:2024 (**AN**alysis **Of VA**riance, ANOVA). Results interpretation was supported by a Reduced Maximum Likelihood (ReML) approach, which improves the determination of assigned values by accounting for between-instrument variability and reveals dominant sources of uncertainty.

3 |



3

PhotonAssay™ Overview



Scan for video
guide to
instrument

- PhotonAssay™ is a photo-nuclear method using gamma activation analysis.
- Reports gold, silver and copper by mass fraction.
- 325 ml sample size (~500 g)
- Non-destructive and automated
- Instrument as a Service (IaaS)

4 |



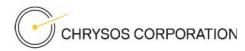
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Context



As a novel method, pragmatism required PhotonAssay™ to adopt existing commercially available certified reference materials with characterisation through other methods (fire assay, 4 acid) until PA round robins could be run.

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5

Methodology



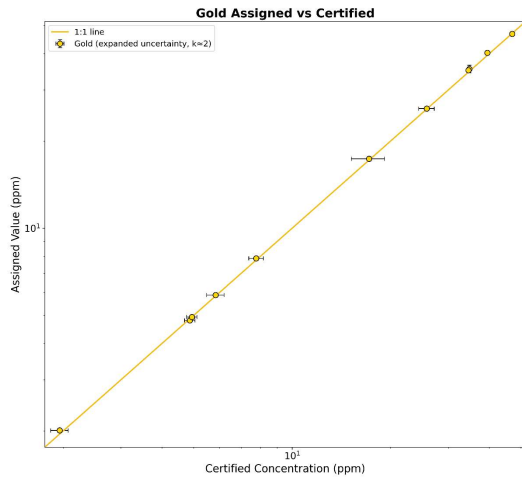
- Round Robin Design
- Shapiro-Wilk Assessment
- ANOVA and ReML Models
- Assigned Values
- Uncertainty Components
- Prediction Intervals

6 |



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Gold Results

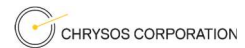


In general, good agreement visible across the RM range of ~2 ppm to ~50 ppm Au.

Long-term pattern of PhotonAssay™ reading slightly higher but more precisely than other methods continues.

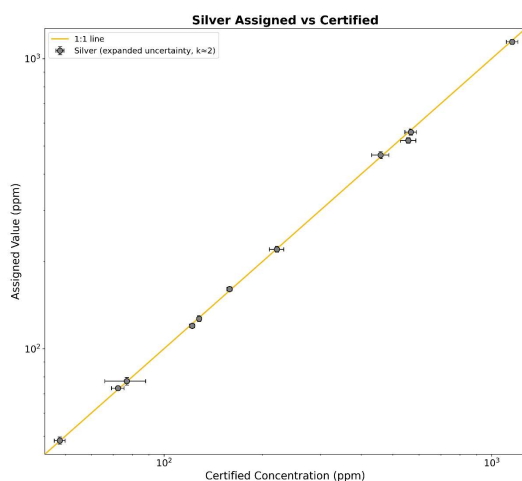
Some certified uncertainties are much greater than others due to few participating laboratories

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Silver Results

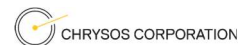


In general, good agreement visible across the RM range of ~50 ppm to ~1200 ppm Ag.

Long-term pattern of PhotonAssay™ reading slightly lower than other methods for Ag continues.

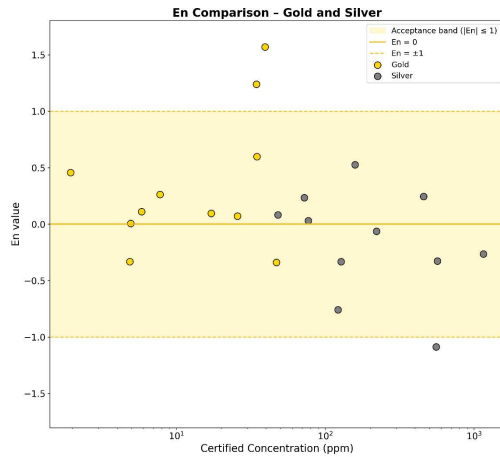
Matrix effect visible for highly attenuating RM (AMIS 0872)

8 |



8

Comparison – Normalised Error (En)

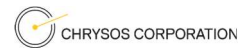


$$E_n = \frac{x_{assigned} - x_{certified}}{\sqrt{U_{assigned}^2 + U_{certified}^2}}$$

Recovery evaluation:

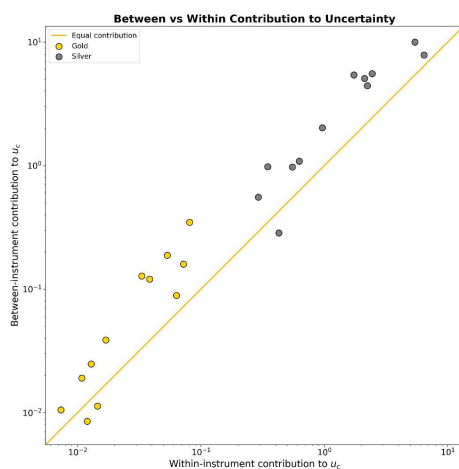
- Compared to certified values
- Observing overall bias

9 |



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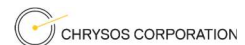
Uncertainty Contributions



Recovery evaluation reveals between-instrument variability exceeds within-instrument variability across most materials.

Improvements in standardisation of calibration and parameters should yield improvements to have between < within.

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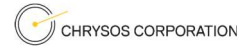
Certificate Generation



Certificates generated for all 11 materials, including method appropriate:

- Assigned Values
- Combined Expanded Uncertainties
- Uncertainty Budgets
- Plots
- Dataset

11 |



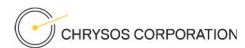
11

Conclusion



- Existing commercially available reference materials through PhotonAssay™
- Supports calibration accuracy and/or use as monitoring materials
- Evaluation can be used for interlaboratory comparisons


12 |



12

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Thank you



CHRYOS
PhotonAssay™
Faster, more accurate gold analysis

The slide features a solid yellow background with a decorative graphic of multiple thin, white, wavy lines that curve across the bottom half of the slide. The contact information is listed on the left, and the 'Thank you' message is on the right. The Chrysos PhotonAssay logo is positioned in the bottom right corner of the slide area.