
# Achieve Exceptional Precision in Your ICP-OES Workflow

## Agilent ICP-OES standard bracketing solution

**Agilent ICP-OES instruments routinely deliver high sensitivity and precision—now boosted by standard bracketing**

- **Confident analysis of high-purity samples**—achieve accurate and precise results in high-purity and complex matrices by bracketing samples between higher and lower standards.
- **Compliance and trust**—the method meets stringent ISO and industry-specific requirements, including hallmarking, catalyst testing, and SEMI standards.
- **Traceable quality assurance**—reliable, traceable data builds trust in quality certificates and strengthens customer and regulatory confidence in high value products.
- **Versatility and flexibility**—applicable across a wide range of industries—from precious metals (gold, silver, PGMs) and alloys to battery materials, plating solutions, catalysts, semiconductors, and fertilizers—applications where tight composition control is essential.

### What is standard bracketing?

ICP-OES standard bracketing is a high-precision calibration technique used to verify the composition and purity of precious metals and alloys. Accurate quantification of major components is critical because sample valuation and classification depend directly on those results. By alternately measuring calibration standards and samples throughout a run, the method compensates for instrument variability and matrix effects, delivering exceptional accuracy, precision, and traceability.

### Purity verification of metals and advanced materials

The standard bracketing method is widely used by producers, refiners, and recyclers of precious and platinum group metals (PGMs), where purity and accurate alloy composition directly influence physical properties and monetary value. The technique is also adaptable to other demanding applications, including the semiconductor and fertilizer industries, as well as emerging sectors focused on battery materials, energy, e-waste processing, and materials recycling.

### A smarter way to enhance trust in metals analysis

By measuring samples between calibration standards of similar composition and purity, the method avoids external calibration anomalies and compensates for matrix interferences—delivering precise, traceable quantification of each element. These benefits make standard bracketing ideal for high-value materials, where composition control, often within ±0.1%, is needed for quality assurance and functionality.

Such high levels of precision are now achievable with the Agilent ICP-OES standard bracketing solution introduced in Agilent ICP Expert Pro software version 7.8. The software also adds support for the new Agilent SPS 6 higher-capacity autosampler and includes enhanced QC controls, enabling higher throughput and clearer result tracking for your ICP-OES system.

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## Automated sample-specific calibration

Agilent standard bracketing automates the pairing of samples with calibration standards, so each sample's concentration is determined by direct interpolation between two closely matched standards (Figure 1).

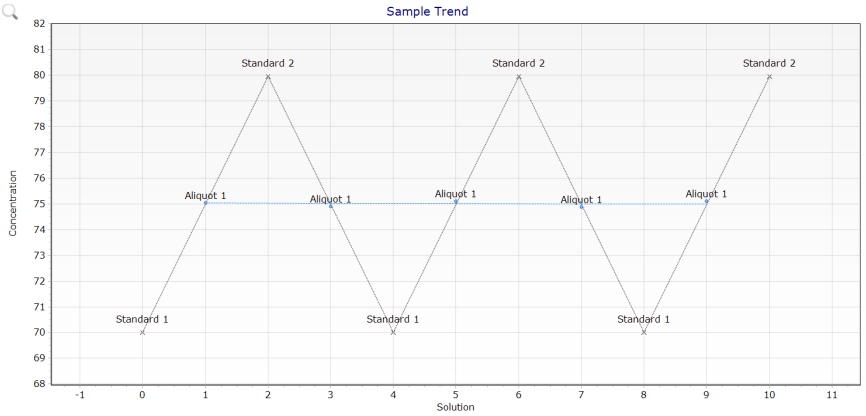


**Figure 1.** Concentration results (mg/L) for Pd from measurements of Pd jewelry alloy sample aliquot 1, confirming consistent precision across multiple bracketing cycles.

## Accuracy and precision of the standard bracketing method

The Agilent 5800 VDV ICP-OES was used to measure gold (Au), palladium (Pd) and platinum (Pt) in two preparations of three precious-metals alloys. The sample preparation and reporting follow relevant principals of ISO 11494 and ISO 11495. ICP Expert provides built-in result summarization and ISO-compliant reporting formats, allowing results to be expressed in fineness, karat, or concentration units.

Table 1 summarizes the measured concentrations and the corresponding relative standard deviations (RSDs) of the measurements acquired over five bracketing cycles (Figure 2). The results demonstrate excellent precision with RSDs and relative percentage differences (RPDs) between repeated analyses <0.1%, confirming the robustness of the Agilent ICP-OES standard bracketing method for assaying high-value precious metals.

**Table 1.** Sample fineness and relative standard deviation (RSD) of bracketing sequence and relative percent difference (RPD) of duplicate measurements, n=5.

| Wavelength (nm) | Aliquots Analyzed | Fineness (‰) | RSD (%) | RPD (%) |
|---|---|---|---|---|
| Au 267.594 | Aliquot 1 | 755.40 | 0.052 | |
| | Aliquot 2 | 756.59 | 0.071 | 0.0036 |
| | Aliquot 2-2 | 756.56 | 0.073 | |
| Pd 342.122 | Aliquot 1 | 997.21 | 0.055 | |
| | Aliquot 2 | 999.22 | 0.033 | 0.00056 |
| | Aliquot 2-2 | 999.23 | 0.028 | |
| Pt 224.552 | Aliquot 1 | 944.86 | 0.048 | |
| | Aliquot 2 | 941.36 | 0.044 | 0.017 |
| | Aliquot 2-2 | 941.52 | 0.072 | |

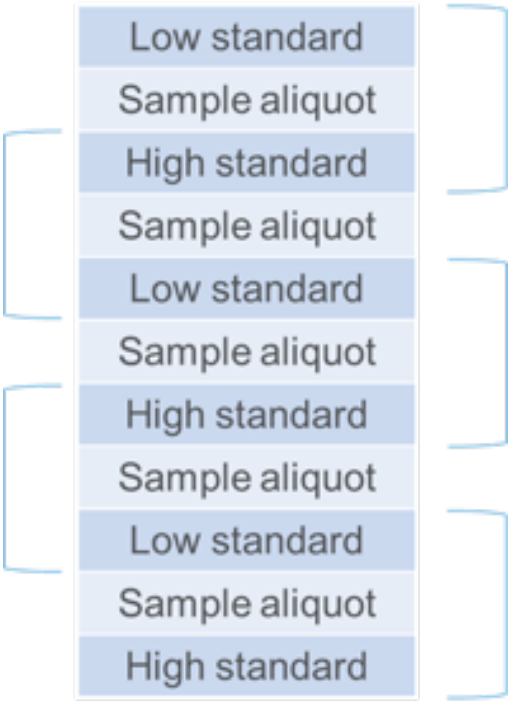


**Figure 2.** Standard bracketing sequence applied to two Pd jewelry alloy sample preparations, with five or more replicate measurements per preparation.

## Choose Agilent ICP-OES standard bracketing

- Enhanced calibration accuracy
- Confident, traceable quantification
- Extremely high sensitivity and precision
- Supports compliance with ISO 11494 and ISO 11495
- Built-in result summarization and ISO-compliant reporting in fineness, karats, or ppm, depending on the sample
- Ideal for quality control of gold, platinum, palladium, and other high-value metals
- Extends to gold-plating baths, catalyst refining, battery material quality control, e-waste processing, and materials recycling

Learn more:

**Agilent publication 5994-8849EN**

**www.agilent.com/chem/icp-expert**

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