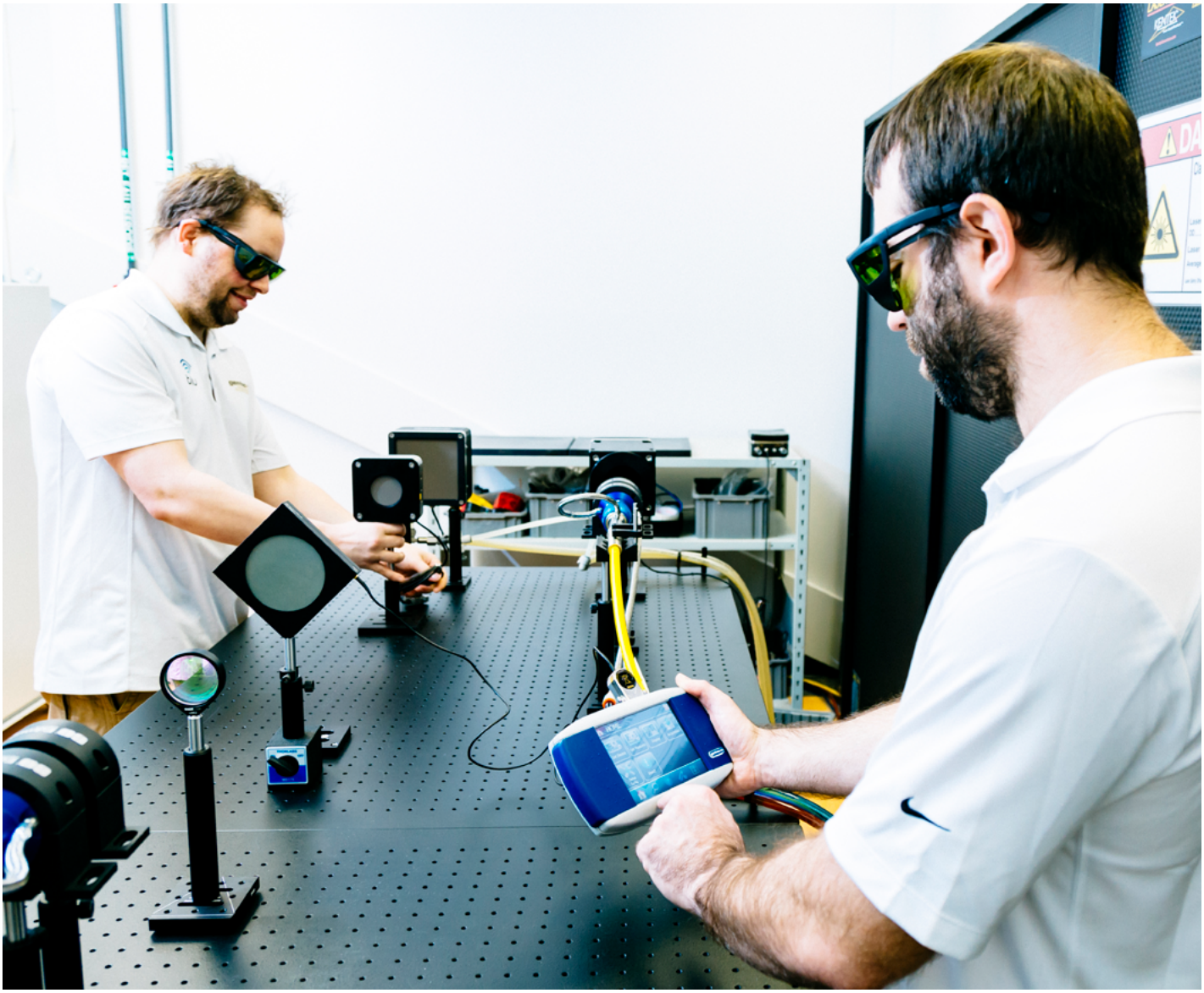
HIGHEST CALIBRATION STANDARDS

Measuring with Gentec-EO accuracy



At Gentec-EO, we understand that the essence of our business since over 50 years has been delivering accuracy. There are no half measures : it either measures accurately or it doesn't. This is why one of our company's values is rigor, because our customers expect nothing less.

THE GENTEC-EO ADVANTAGE

We use only **GOLD Calibration Standards**, guaranteeing our customers the lowest calibration uncertainty possible

For each detector that we calibrate, **50 Parameters are collected and logged** in our ISO-certified quality system

The calibration reference is checked 2 to 3 Times during EACH calibration process

Our uncertainty values are based on **Proven Statistical Calculation Processes**

Our Personnal Wavelength CorrectionTM (PWC) data offers you **NIST and/or NRC Traceable over the entire range of the detector**

NIST* Traceable

Each of these steps contributes to the **TOTAL ACCURACY** of your detector

THE TERMS

ACCURACY

The accuracy of a measurement is defined as the closeness of the agreement between the result of a measurement and the true value.

UNCERTAINTY

Uncertainty is a measure of the "goodness" of a result. The definition and concept of uncertainty is a quantitative attribute to the final result of measurement, considering all systematic and random components of all known input quantities.

ERROR

The error on a measurement is the difference between the measurement result and the true value.

REPEATABILITY

The repeatability is the closeness of the agreement between the results of successive measurements under the same conditions of measurements.

REPRODUCIBILITY

The reproducibility is the closeness of the agreement between the results of successive measurements under changed conditions of measurements. This is also defined as "precision under reproducibility conditions".

PRECISION

The precision of a measurement is defined as the closeness of agreement between independent test results obtained under stipulated conditions.

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THE CALIBRATION PROCESS

1 Comparison Process

4 Certification

ACCURACY

2 Gold Standard

3 Uncertainty Calculation

THE TECHNIQUE

By definition, calibration is a comparison between measurements, one of a known magnitude or correctness, which is typically called a “gold standard”, and another measurement comparable to the first one. In the calibration process, there are four critical aspects that need to be controlled precisely:

1 COMPARISON PROCESS

The first step in the calibration process is the comparison to a known and traceable standard. At Gentec-EO, we always do this using Gold and not a Silver calibration standards, unlike some of our competitors. This extra carefulness in the comparison process comes from decades of experience in the laser measurement business.

2 GOLD STANDARD

Gentec-EO’s gold laser power detector heads are compared to NIST standard calorimeters at different wavelengths, in accordance to the different lasers used to calibrate your own detector heads. The laser beam has a nominal diameter appropriate for the detector, and is centered on the detector’s absorbing surface. The laser energy impinging upon the test instrument is measured concurrently using a NIST standard calorimeter and a calibrated beam splitter. The beam splitter ratio is measured using NIST standard calorimeters. Before the measurements are performed, the test instrument is allowed to reach equilibrium with the laboratory environment. The calibration factor is found by dividing the instrument output reading by the calculated average incident laser power. The calculation is based on the output reading of the NIST standard calorimeters.

3 UNCERTAINTY CALCULATION

At Gentec-EO we offer the best uncertainty on the market, which means more than just giving the customer the lowest uncertainty value. These calculations also need to follow recognized statistical calculation standards, including those given in NIST’s Technical Note 1297. Another important parameter to verify, and one that is less known, is the confidence level. At Gentec-EO, we use a very high confidence level of 95 %. Like every other step in the calibration process, our uncertainty calculations are done rigorously. We don’t aim to give you just the lowest number, whatever its meaning, we rather aim to give you the true value, with the highest confidence possible.

4 CERTIFICATION

Gentec-EO has been using its own control quality system for many years and is now certified ISO 9001:2015 and our calibration laboratory is accredited ISO/IEC 17025:2017. Over and above the quality system certification process, the most important aspect is how rigorously the different steps and parameters are controlled in order to deliver an accurate calibration day after day.

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ELECTRICAL INSTRUMENTS

All of our electrical instruments are calibrated by certified calibration suppliers. They certify that, at the time of calibration, the instruments used for calibration meet or exceed all published specifications and have been calibrated using standards whose calibrations are traceable to the NIST and/or other recognized international standards. The electrical and physical properties of their laboratories meet the highest requirements for ambient temperature, relative humidity and cleanliness. Their equipment is maintained by procedures that meet the requirements of ISO 9001:2015 and ISO/IEC 17025:2017.

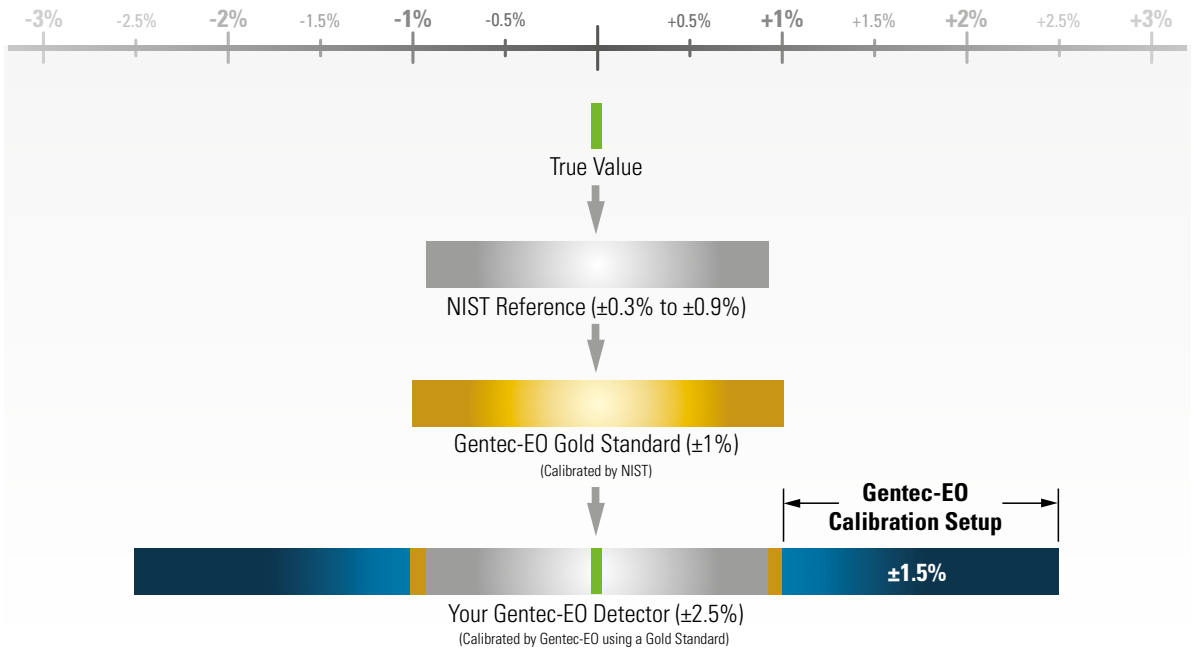
THE FACTS

HOW GENTEC-EO CALIBRATES YOUR DETECTOR

Every detector is individually calibrated to the best possible accuracy traceable to NIST standards. Stable laser sources at various wavelengths are used in our calibration process.

UNCERTAINTY

One very common misconception is the absolute value of calibration uncertainty. Be aware that this value is made using a complex statistical method that takes in account ALL the sources of uncertainty that are present in the process. The figure below shows these steps and their respective contribution to the value of uncertainty. As you can see, the manufacturer itself is only one of these sources.



CALIBRATION WAVELENGTHS

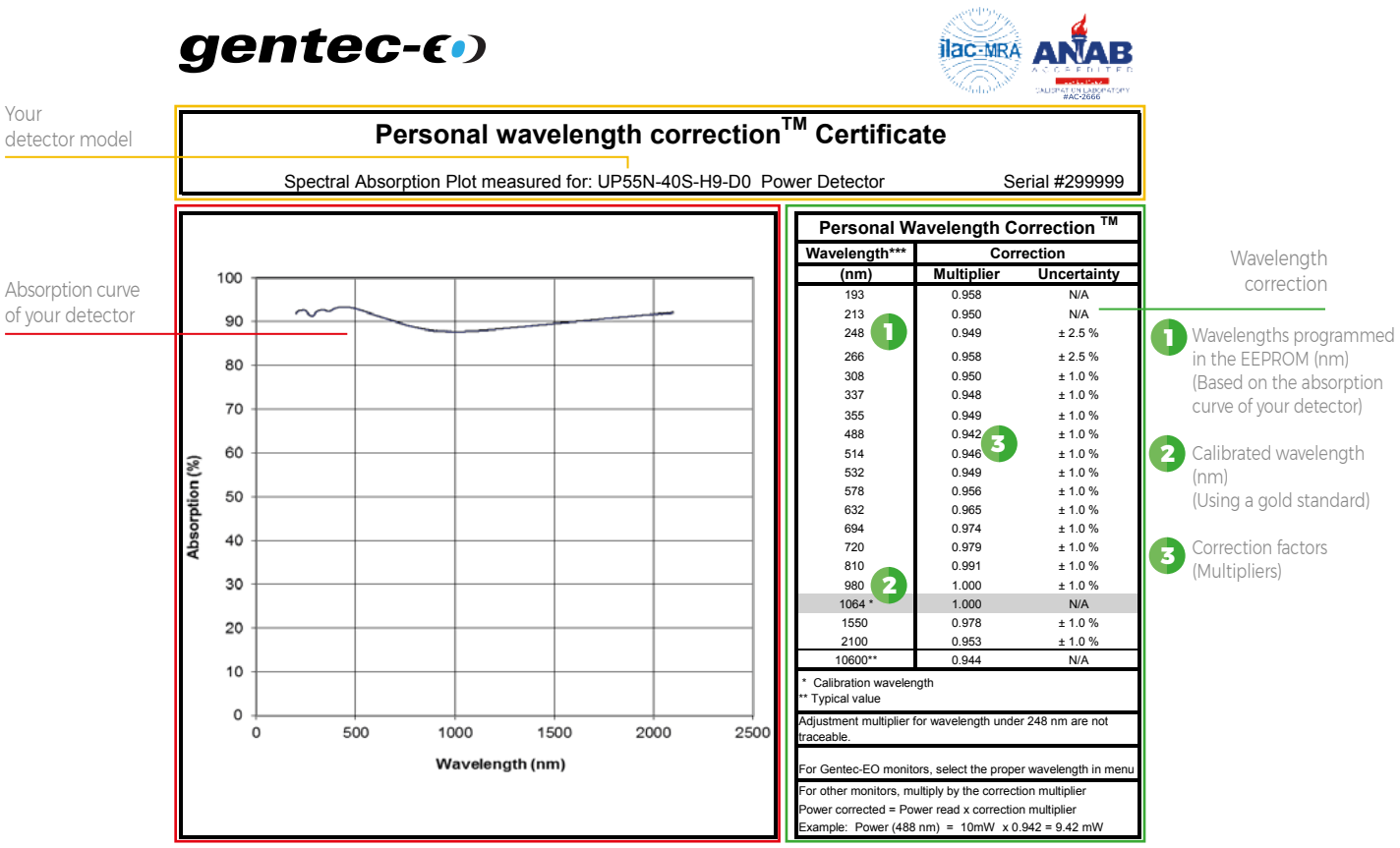
Another misconception is that any wavelength can be NIST calibrated. The NIST only supplies references for distinct wavelengths contained between 157 nm (F_2 excimer lasers) and 10.6 µm (CO_2 lasers). Every other wavelength within this range or out of this range is subject to an additional error.

For more information about NIST's calibration wavelengths, please visit their website at: https://www.nist.gov/calibrations

PERSONAL WAVELENGTH CORRECTION™ CERTIFICATE

To fill the gaps between the NIST references, Gentec-EO offers you the only NIST traceable calibration in nm steps, from 250 nm to 2.5 µm. We achieve this using our proprietary setup that is based on a NIST traceable spectrophotometer. This way, instead of supplying you with typical values, we offer you a NIST traceable calibration. What you get is an overall accuracy that is not more than ± 1 % away from the original calibration accuracy, in the calibrated spectral range.

Each Gentec-EO detector comes with a Personal wavelength correction™ Certificate. The correction factors are based on measurements that were made with YOUR detector. They are not based on the general curve of the absorbing material or the general response of equivalent products. This means you get the best wavelength correction tool available on the market. This data is stored in the smart interface of your Gentec-EO detector, you just have to select the wavelength in your display device or PC interface to get the most precise laser measurements on the market.



For more info, see Application Note **202184** - Understanding your Calibration Certificate.