



# ACCURACY VS PRECISION

A White Paper Series on Biomedical Metrology, Calibration, and Trust

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**BITS White Paper** • Think About It - S03 •

**BITS Biomedical Inc. | Quality Forward**

Accredited ISO/IEC 17025:2017 Calibration and Testing Laboratory (ANAB ACT-3400)

# WHY CONSISTENT RESULTS CAN STILL BE DANGEROUSLY WRONG

## The Comfort of Consistency

"The readings are stable."

"They're repeatable."

"Nothing is drifting."

These statements are often delivered with confidence and a sense of relief.

In many technical and healthcare settings, consistency is often taken as proof of correctness. When results appear the same again and again, it is easy to assume they are accurate.

However, consistency alone does not guarantee truth.

**Precision** refers to how consistent results are when measurements are repeated. **Accuracy** refers to how close those results are to the true value.

A system can produce results that are very consistent but still be wrong due to bias, poor calibration, or other errors.

In these situations, the real risk is not variation, but consistent results that hide a problem.

## What Precision Really Means

Precision refers to repeatability.

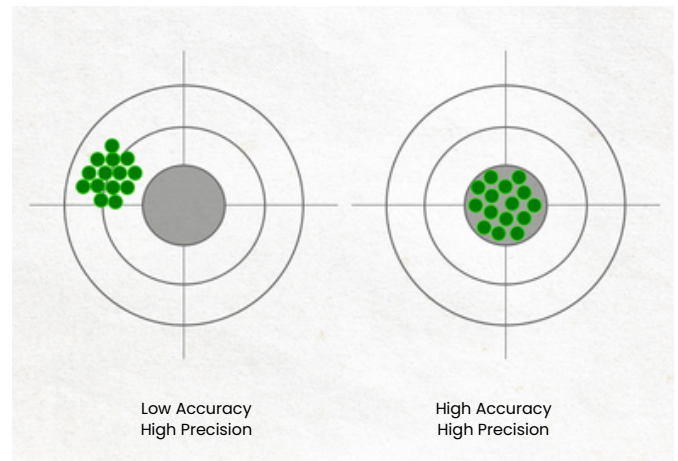
If you measure the same parameter multiple times and obtain similar results, the measurement is considered precise.

Precision answers a single question:

*"Can I get the same result again?"*

It does not indicate whether the result is correct.

*"Precision is consistency. Accuracy is correctness."*



## The Dangerous Combination: Precise but Inaccurate

One of the most common and risky situations in measurement system occurs when a process appears reliable but produces incorrect results.

This happens when a system is:

- Highly repeatable
- Stable over time
- Consistently inaccurate

At first, such a system can seem trustworthy. The results are consistent, and there is little variation over time. However, this consistency can hide a serious problem. The measurements are biased and do not reflect the true value.

Because the results do not change much, the error is difficult to detect. As a result, decisions are made with confidence, even though they are based on incorrect data.

Precision without accuracy does not just reduce quality. It increases risk by hiding errors behind consistent results.

*“A precise error is still an error – just a very consistent one.”*

### Why Precision Often Gets More Attention

Precision is easier to see and often gives a strong sense of confidence.

- Repeated values look reassuring
- Charts appear stable
- Trends show clear consistency

Accuracy, however, is harder to confirm. It requires deliberate checks and reliable references:

- Comparison against a known standard
- Use of a validated method
- Consideration of known uncertainty

Without proper calibration, accuracy is not proven. It is simply assumed.

### Where Calibration Fits In

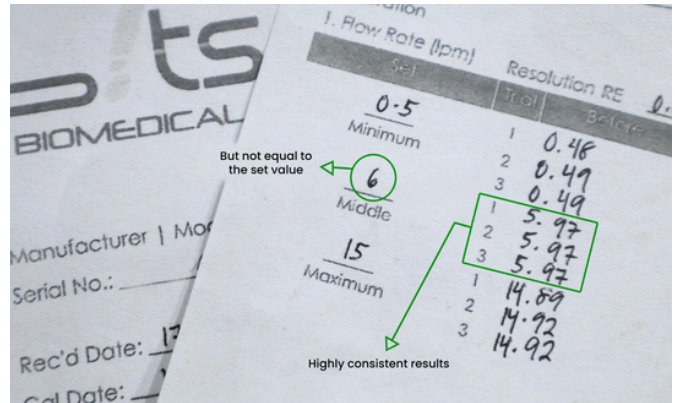
Calibration is the process that:

- Quantifies deviation
- Establishes accuracy
- Links measurements to reference standards

Calibration does not improve precision on its own. Instead, it shows whether the precision you observe is meaningful and reliable.

It brings clarity to a critical question:

“Are the results consistently correct, or consistently incorrect?”



### Why Audits Focus on Accuracy, Not Just Stability

Auditors do not usually raise concerns when results vary. Variation is visible and often managed. Their concern is when systems appear stable but lack proof of correctness.

They question systems when:

- No reference comparison exists
- Accuracy is not documented
- Measurement uncertainty is not defined
- Decisions are made without validated confidence

Precision helps maintain control of a process. Accuracy builds trust in the results.

### Accuracy, Precision, and Patient Safety

In healthcare and biomedical applications, measurement results directly influence critical decisions, including:

- Dosage selection
- Diagnostic thresholds
- Equipment safety margins

When measurements are precise but inaccurate, the risk is significant. Consistent but incorrect data can:

- Hide clinical risk
- Delay needed corrective action
- Create false confidence in decisions

Stable results alone do not ensure safety. Without accuracy, consistency can lead to harm rather than protection.

*“Stability does not equal safety.”*

### How Mature Systems Treat Accuracy and Precision

Organizations with well-developed measurement systems manage both precision and accuracy as essential elements of performance.

They:

- Monitor precision through internal controls
- Track and review performance trends over time
- Use calibration to confirm accuracy
- Quantify measurement uncertainty
- Perform periodic independent verification

These organizations recognize a clear distinction:

- Precision supports process control
- Accuracy supports confidence and trust in results

### Why This Distinction Is Often Overlooked

Precision is often favored because it is easy to see and gives a sense of control. Consistent results feel reliable and are quickly accepted.

Accuracy, on the other hand, requires more effort. It depends on:

- Willingness to question results
- Comparison with trusted references
- External verification
- Acceptance of uncertainty

Focusing only on precision can be misleading. Avoiding accuracy does not remove error, it only hides it.

### Think About It:

Being consistently wrong is more dangerous than being occasionally uncertain.

## Final Thought

- Precision keeps measurements consistent.
- Accuracy keeps decisions correct.
- Confusing the two does not improve performance. It quietly increases risk.



### About the Authoring Organization

This paper is written from the perspective of an ISO/IEC 17025-accredited calibration & testing laboratory actively supporting healthcare institutions, laboratories, and engineering teams in meeting regulatory, accreditation, and patient safety requirements.

The purpose of this paper is to clarify the distinction and relationship between accuracy and precision, and to explain their importance in calibration.

### Preserving Independent Assurance

When calibration must withstand audit scrutiny, independence and competence are critical.

Review which equipment truly requires accredited calibration and align your strategy with clinical risk and regulatory requirements. For guidance on calibration, uncertainty, or audit readiness, consult an ISO/IEC 17025-accredited laboratory.