

The background is a solid dark blue color. It features a pattern of concentric circles and a grid of thin, light blue lines. The circles are centered at various points across the page, creating a sense of depth and focus. The grid lines are spaced evenly, forming a subtle reference frame.

Accuracy & Precision in Measurement

Accuracy & Precision

- Accuracy:

- How close you are to the actual value
- Depends on the person measuring
- Calculated by the formula:

$$\% \text{ Error} = (YV - AV) \times 100 \div AV$$

Where: YV is YOUR measured Value &
AV is the Accepted Value

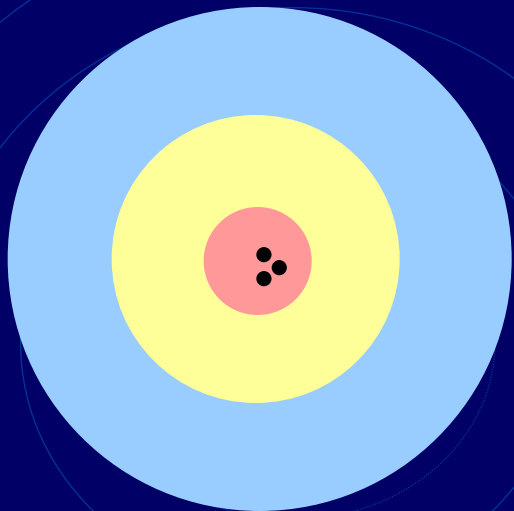
- Precision:

- How finely tuned your measurements are or how close they can be to each other
- Depends on the measuring tool
- Determined by the number of significant digits

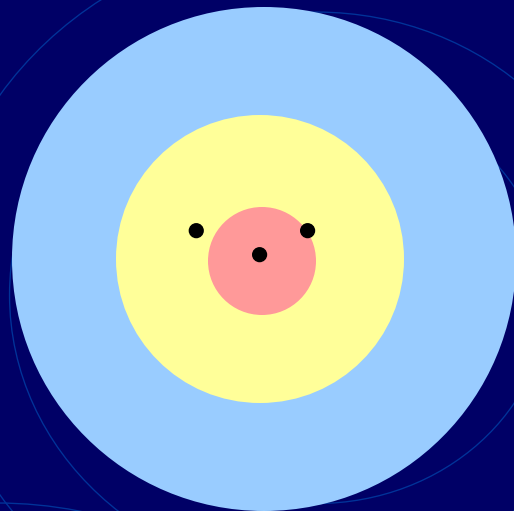
Accuracy & Precision

- Accuracy & Precision may be demonstrated by shooting at a target.
- Accuracy is represented by hitting the bulls eye (the accepted value)
- Precision is represented by a tight grouping of shots (they are finely tuned)

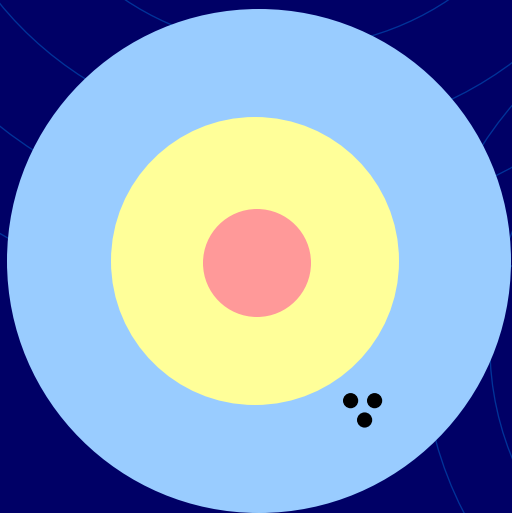
Accuracy & Precision



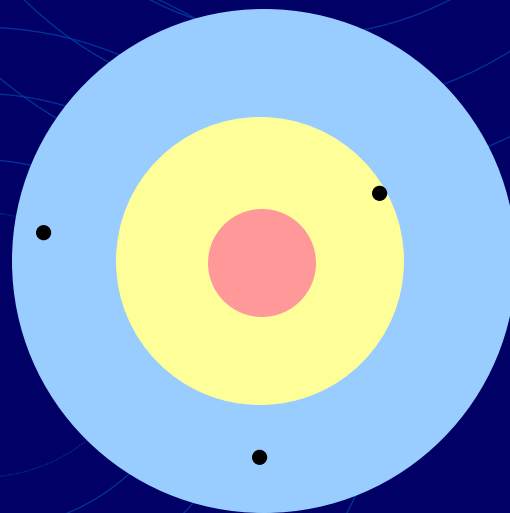
Accuracy without Precision



Precision without Accuracy



No Precision & No Accuracy



Accuracy - Calculating % Error

- How Close Are You to the Accepted Value (Bull's Eye)

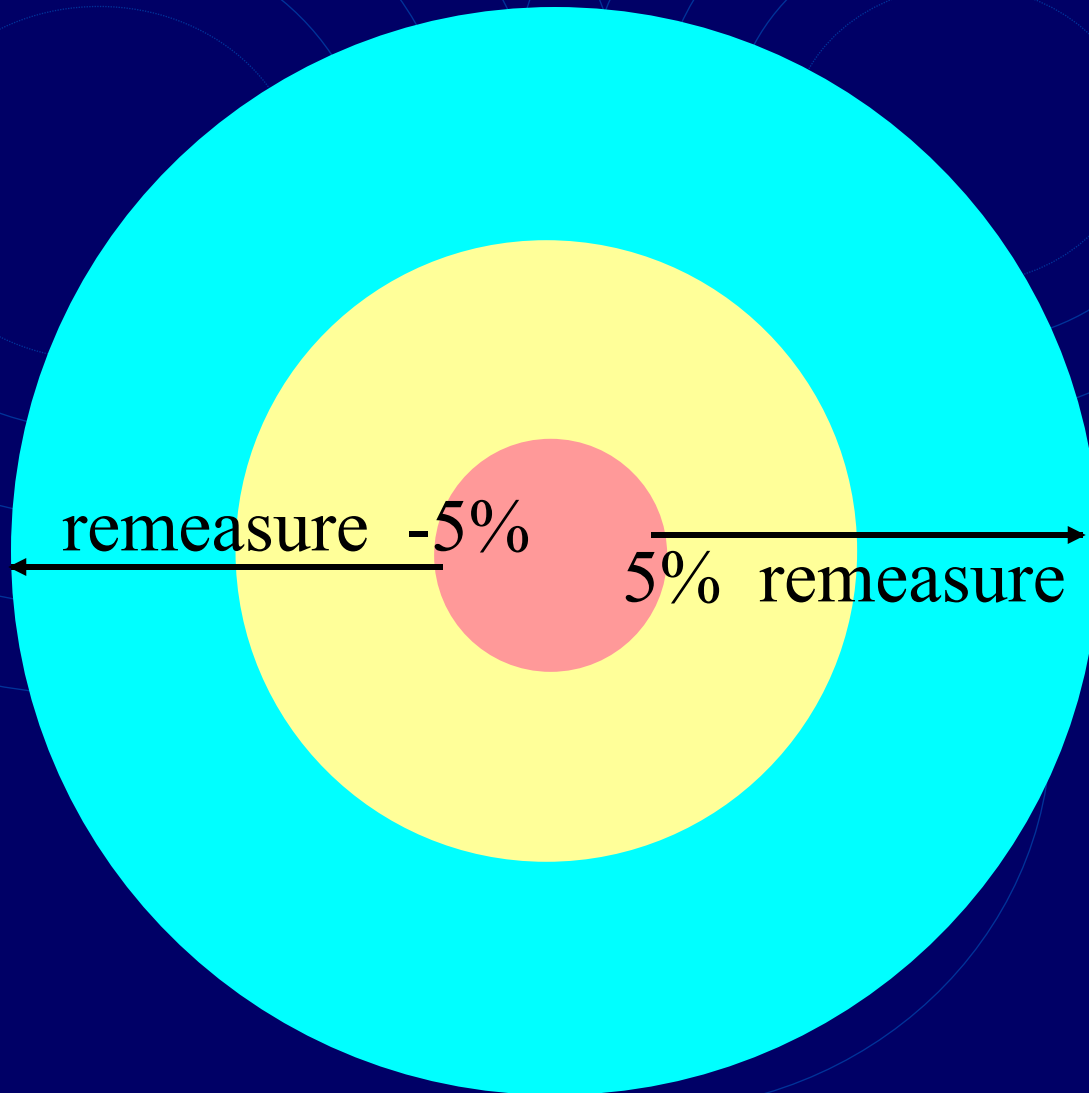
Accuracy - Calculating % Error

- If a student measured the room width at 8.46 m and the accepted value was 9.45 m what was their accuracy?
- Using the formula:
$$\% \text{ error} = (YV - AV) \times 100 \div AV$$
- Where YV is the student's measured value
&
AV is the accepted value

Accuracy - Calculating % Error

- Since $YV = 8.46 \text{ m}$, $AV = 9.45 \text{ m}$
- $\% \text{ Error} = (8.46 \text{ m} - 9.45 \text{ m}) \times 100 \div 9.45 \text{ m}$
- $= -0.99 \text{ m} \times 100 \div 9.45 \text{ m}$
- $= -99 \text{ m} \div 9.45 \text{ m}$
- $= -10.5 \%$
 - Note that the meter unit cancels during the division & the unit is %. The (-) shows that YV was low
- The student was off by almost 11% & must remeasure
- Acceptable % error is within 5%

- Acceptable error is $\pm 5\%$
- Values from -5% up to 5% are acceptable
- Values less than -5% or greater than 5% must be remeasured



Significant Digits

- How to Check a Measurement for Precision

Significant Digits & Precision

- **The precision of a measurement is the smallest possible unit that could be measured.**
- **Significant Digits (sd) are the numbers that result from a measurement.**
- **When a measurement is converted we need to make sure we know which digits are significant and keep them in our conversion**
- **All digits that are measured are significant**

Significant Digits & Precision

- What is the length of the bar?
- How many digits are there in the measurement?
- All of these digits are significant
- There are 3 sd



0 1 2 3 4
cm

Length of Bar = 3.23 cm

Significant Digits & Precision

- If we converted to that measurement of 3.23 cm to μm what would we get?
- Right! 32 300 μm
- How many digits in our converted number?
- Are they all significant digits (measured)?
- Which ones were measured and which ones were added because we converted?
- If we know the significant digits we can know the precision of our original measurement

Significant Digits & Precision

- What if we didn't know the original measurement – such as 0.005670 hm. How would we know the precision of our measurement.
- The rules showing how to determine the number of significant digits is shown in your lab manual on p. 19. Though you can handle them, they are somewhat complex.