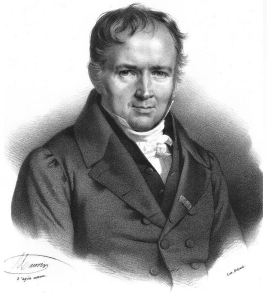
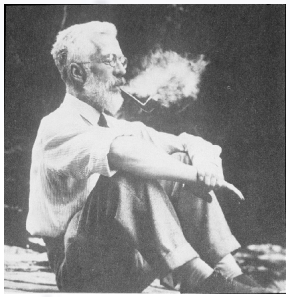
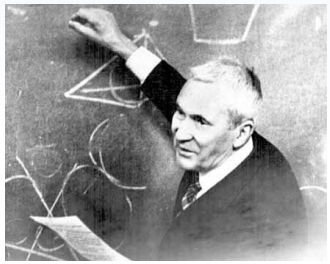
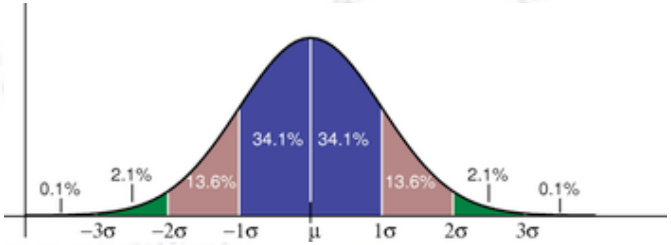
Applied Statistics

Reporting results & Significant digits



Troels C. Petersen (NBI)



"Statistics is merely a quantisation of common sense"

Reporting results

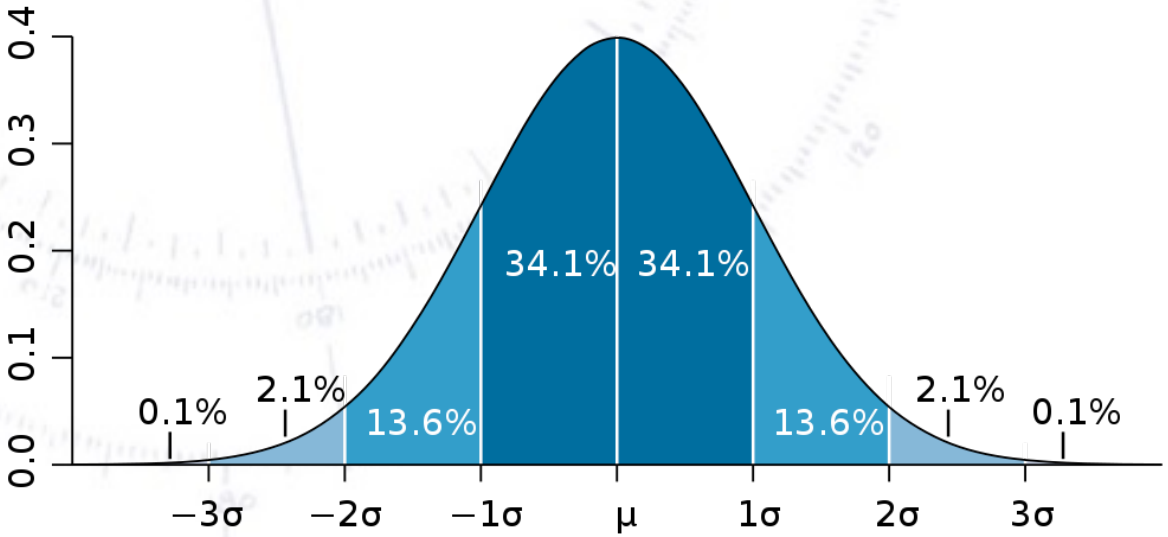
When reporting measurements, the notation is typically:

$$\mathbf{x = (0.24 \pm 0.05) \times 10^3\ m}$$

This should be interpreted as:

"with a mean of 0.24 km and a Gaussian uncertainty of 0.05 km".

This does **NOT** guaranty that x is within 0.19 km and 0.29 km!
Rather it says, that there is a 68% chance of being inside this range.



Reporting results

When reporting measurements, the notation is typically:

$$x = (0.24 \pm 0.05) \times 10^3 \text{ m}$$

The reason for not writing 240 ± 50 m is that one might think, that the uncertainty has been determined with two significant digits, which is most often not the case.

Sometimes, one can find the following reporting:

$$x = (0.24 \pm 0.05_{\text{stat}} \pm 0.07_{\text{syst}}) \times 10^3 \text{ m}$$

The tells the reader, that the statistical and systematic uncertainties have been kept apart, which allows for a better combination with other results (which might share some of the systematic uncertainty).

The good experimentalist gives an explained table of systematic uncertainties!

Reporting results

The "uncertainty on the uncertainty" follows the approximate rule:

$$\sigma_\sigma = \frac{1}{\sqrt{2N-2}}$$

Unless you have worked hard not only to reduce the uncertainty, but also to make it accurate, you should

only quote one significant digit errors, when giving results!

The (possible) exceptions are, if the first digit is a "1" (i.e. 0.51 ± 0.12),
or internally while you are working to reduce your uncertainties.
Using two significant digits for the error is then acceptable (in this course).