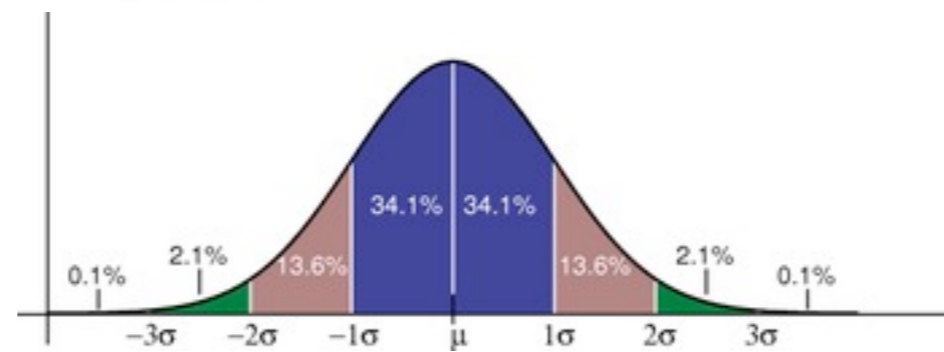


Applied Statistics

Troels C. Petersen (NBI)



"Statistics is merely a quantization of common sense"

Systematic Errors



Even with *infinite* statistics, the error on a result will never be zero!

Such errors are called “systematic uncertainties”, and typical origins are:

- Imperfect **modeling/simulation**
- Lacking **understanding of experiment**
- Uncertainty in **parameters involved**
- Uncertainty associated with **corrections**
- **Theoretical** uncertainties/limitations

While the ***statistical uncertainty*** is Gaussian and scales like $1/\sqrt{N}$, the ***systematic uncertainties*** do not necessarily follow these rules.

When the statistical uncertainty is largest, more data will improve the precision.

The finding/calculation of systematic errors is hard work.

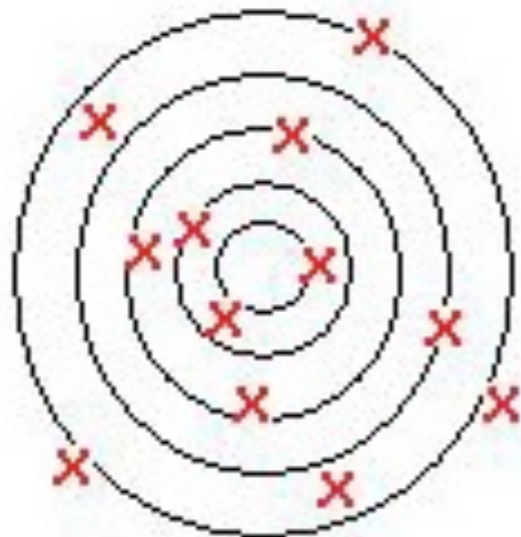
Everything is vague to a degree you do not realize till you have tried to make it precise. [Bertrand Russell]

How to find systematic errors?

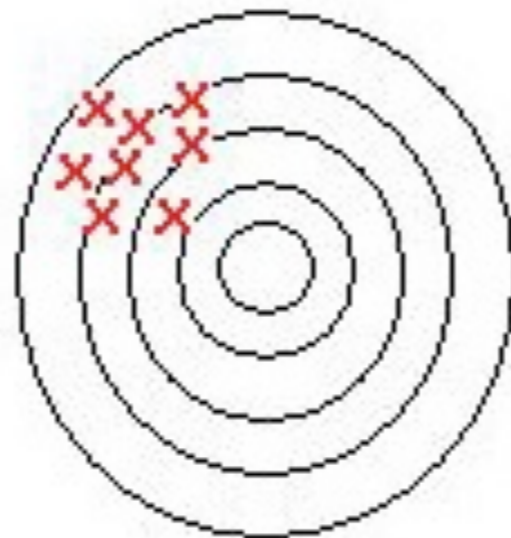
Look for **ANY** effect that can have an influence on your results.

Divide your data in any way you can (space, period, condition, analysis, etc.).

Large statistical error
Small systematic error



Small statistical error
Large systematic error

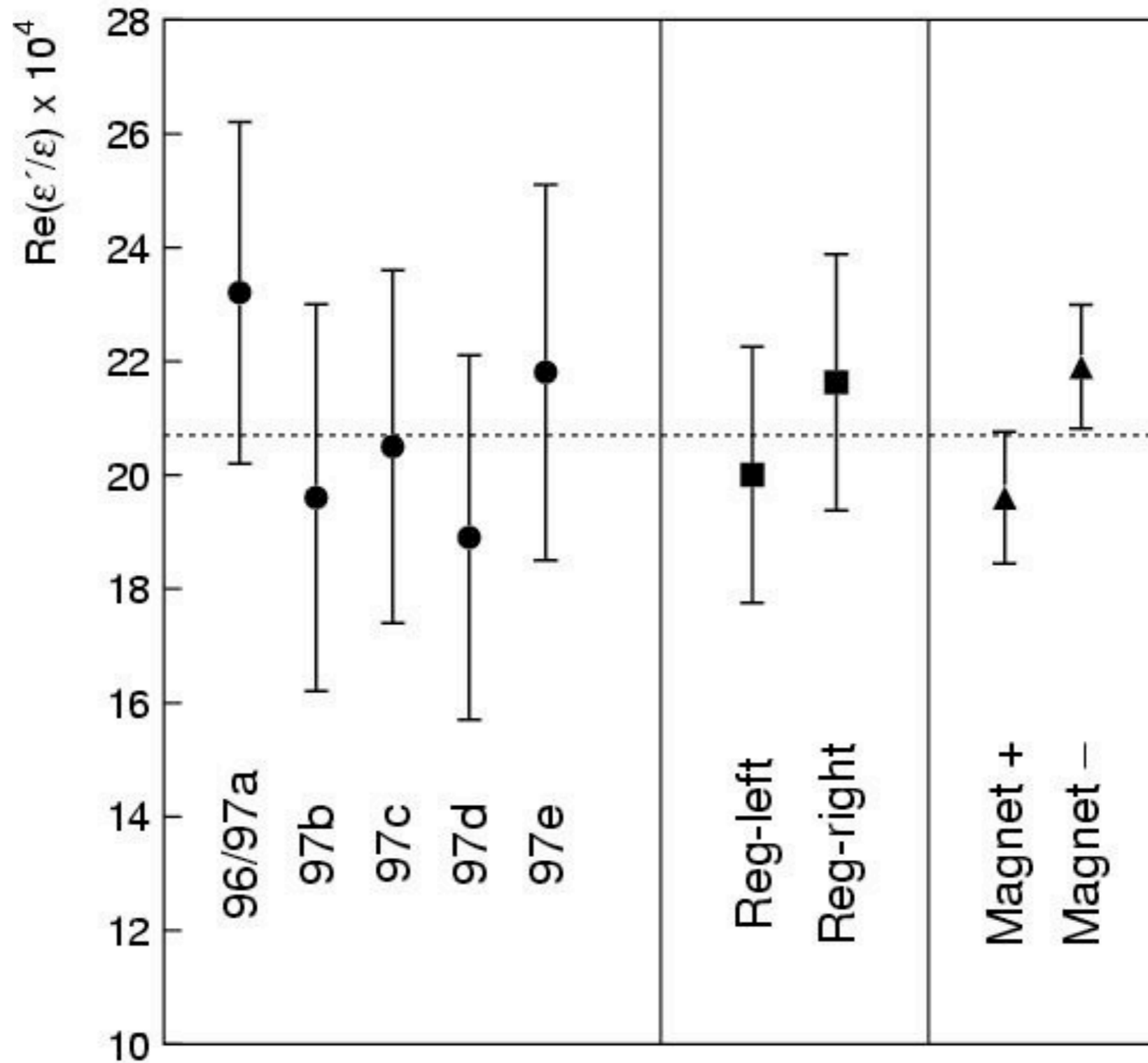


Medium stat. error
??? syst. error



Often, systematic errors are studied using simulation. However, this requires that the simulation is accurate! To check this, one studies known phenomena.

Cross check of data



Systematic Error

Example of experimental error, which would be a disaster if not corrected for.

