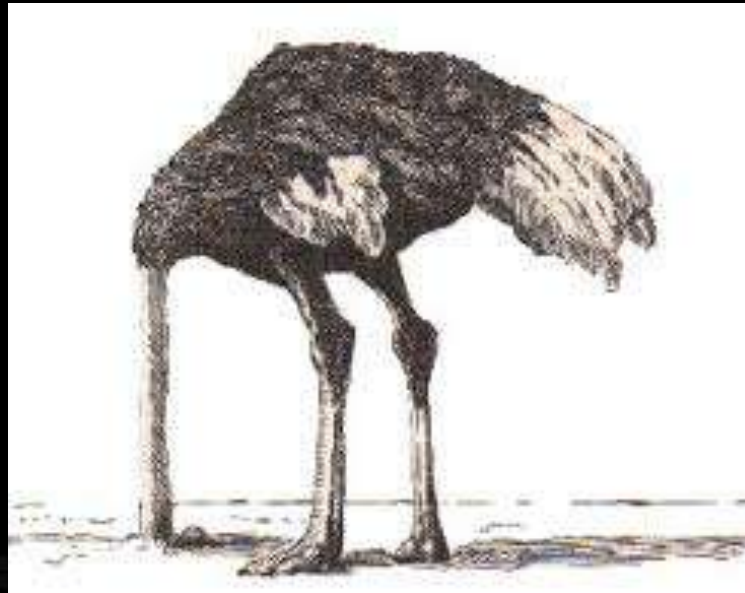




Test och kvalitetssäkring

Can you trust your measurements?







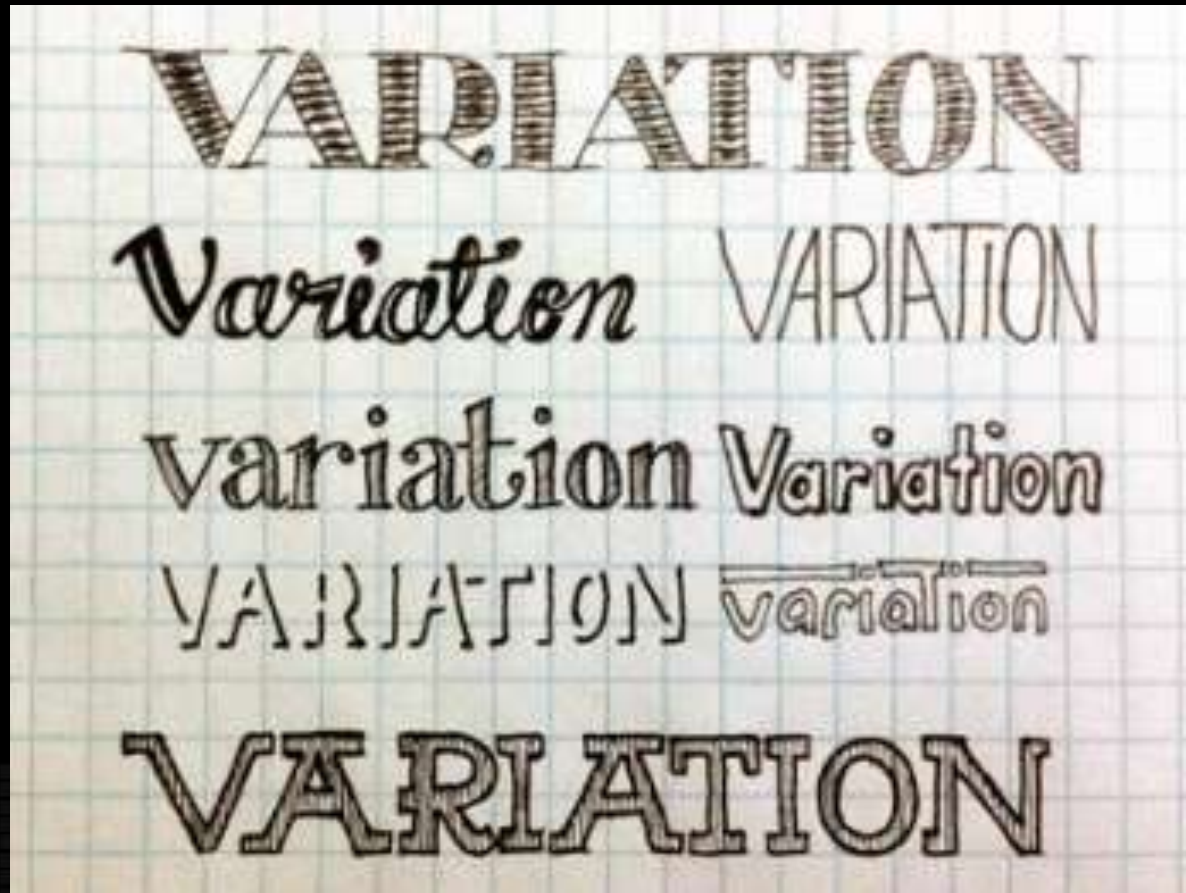


- **Patrik Carlos**
- **AddQ Consulting**
- **LabVIEW Partner Program**
- **Products and Concepts**

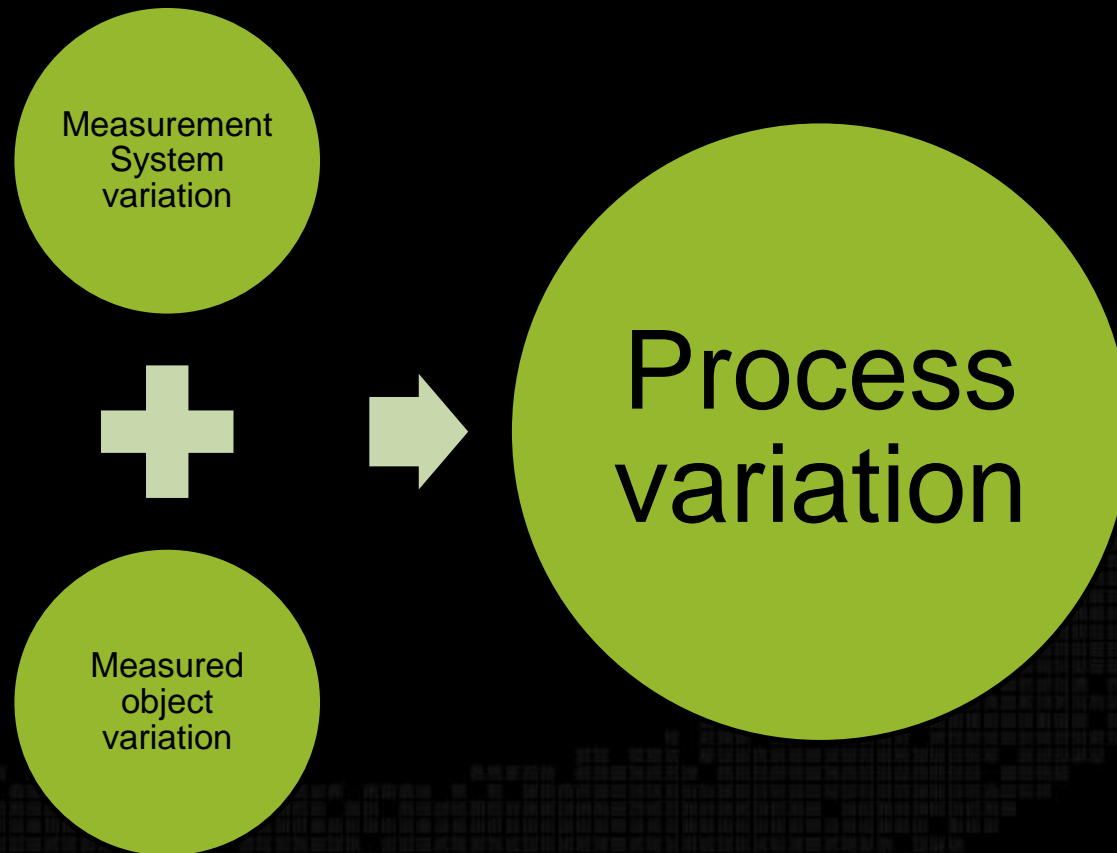
Sun Tzu – The Art of War



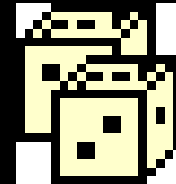
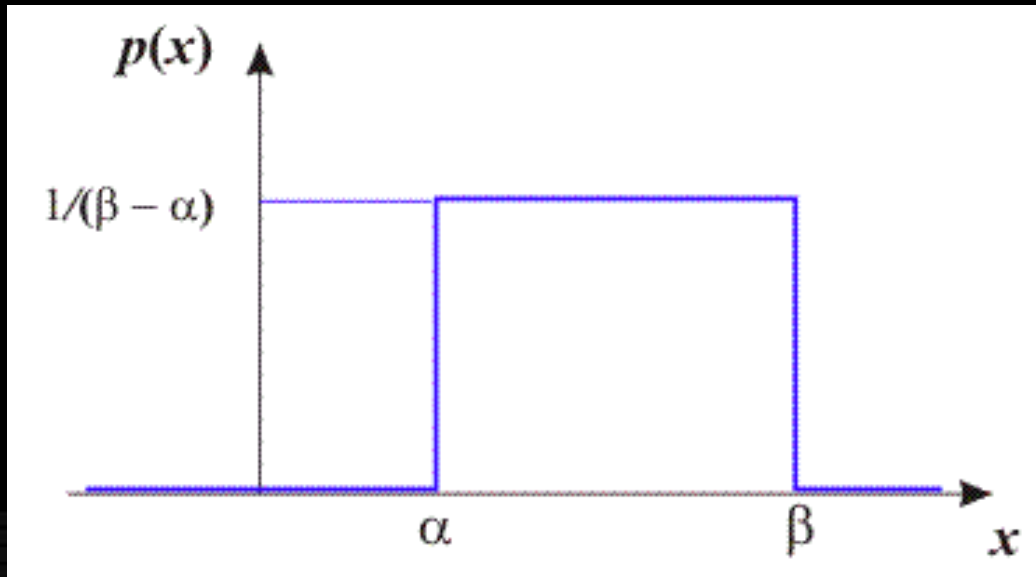
A sneaky enemy



Process variation



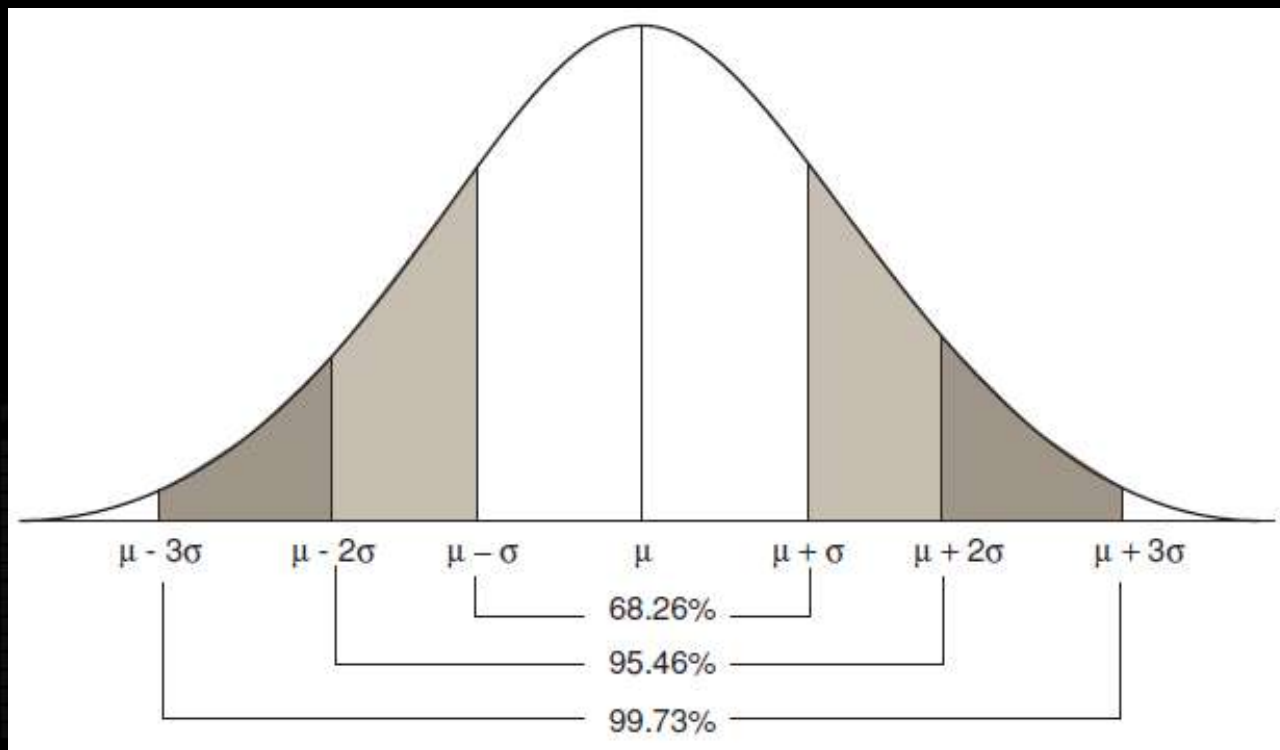
Uniform distribution



Normal distribution

$$\phi(x) = \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2}$$

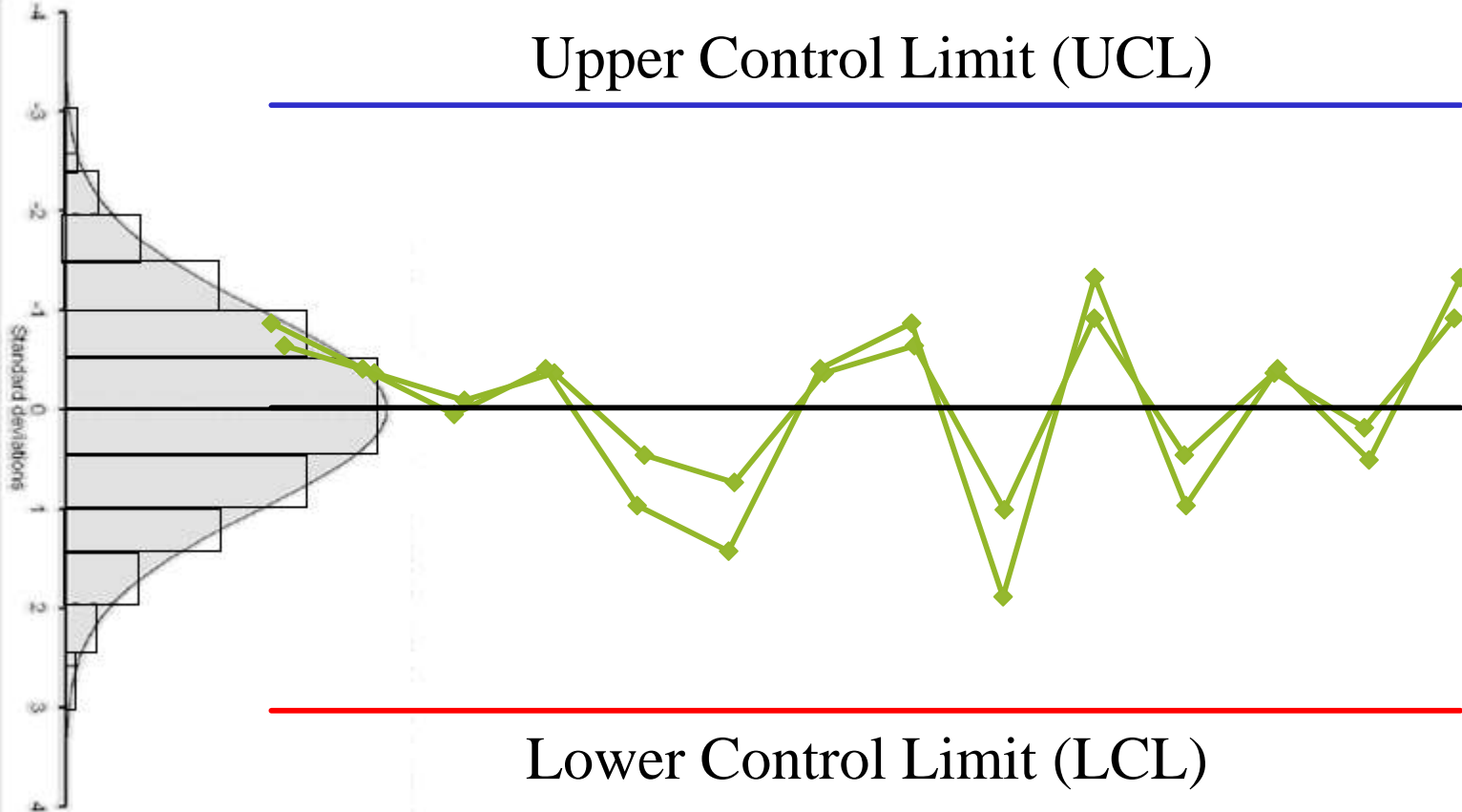
- Two parameters
 - Average
 - Standard deviation



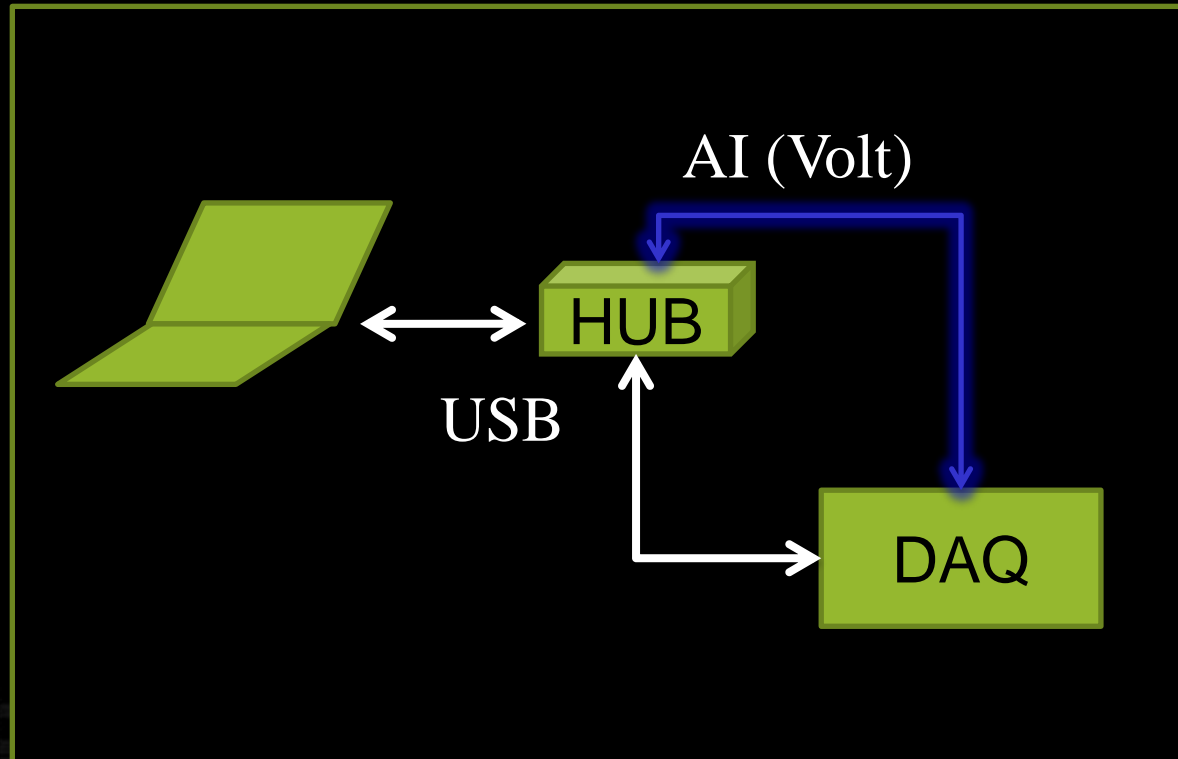
Process window

Upper Control Limit (UCL)

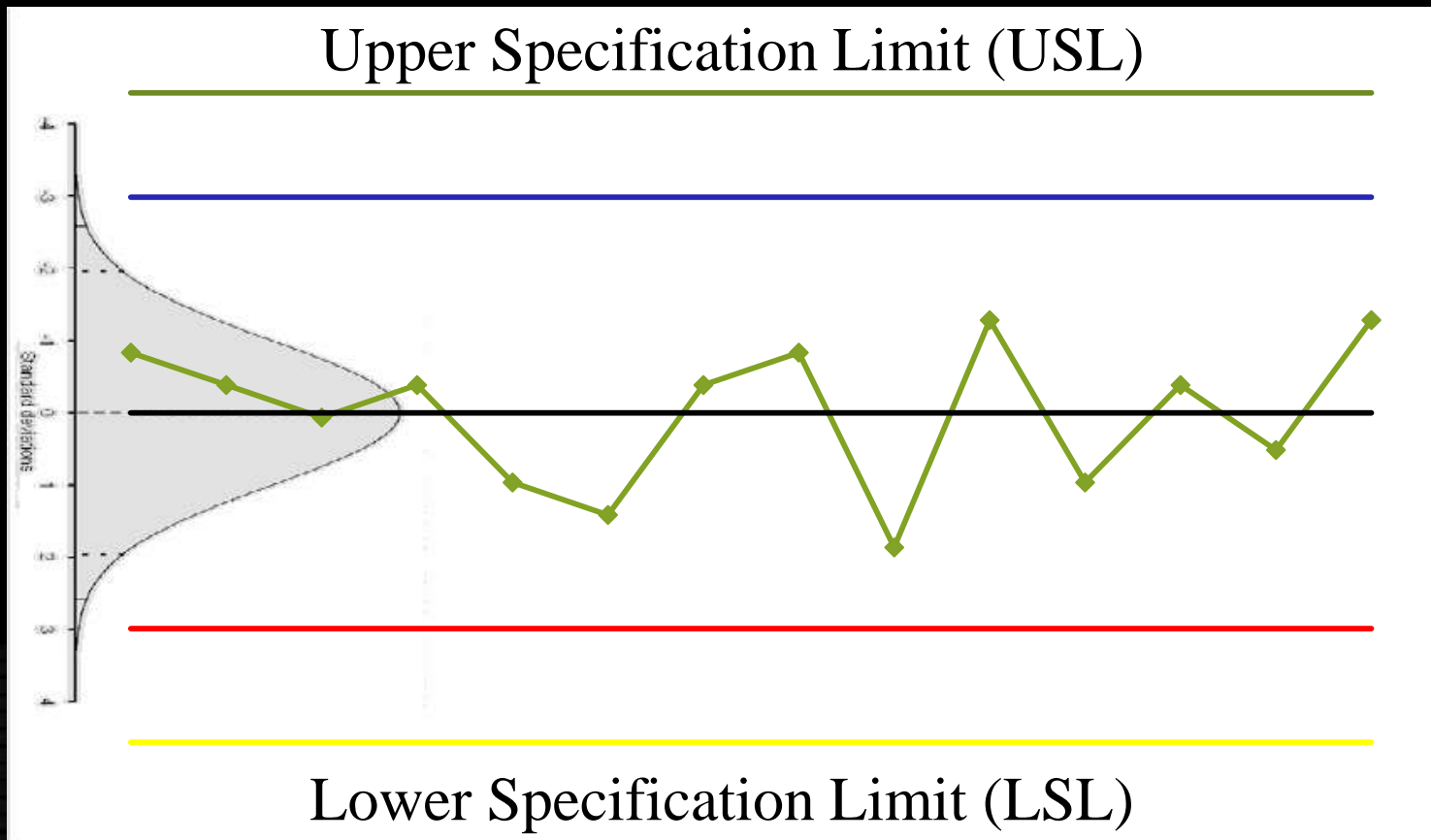
Lower Control Limit (LCL)



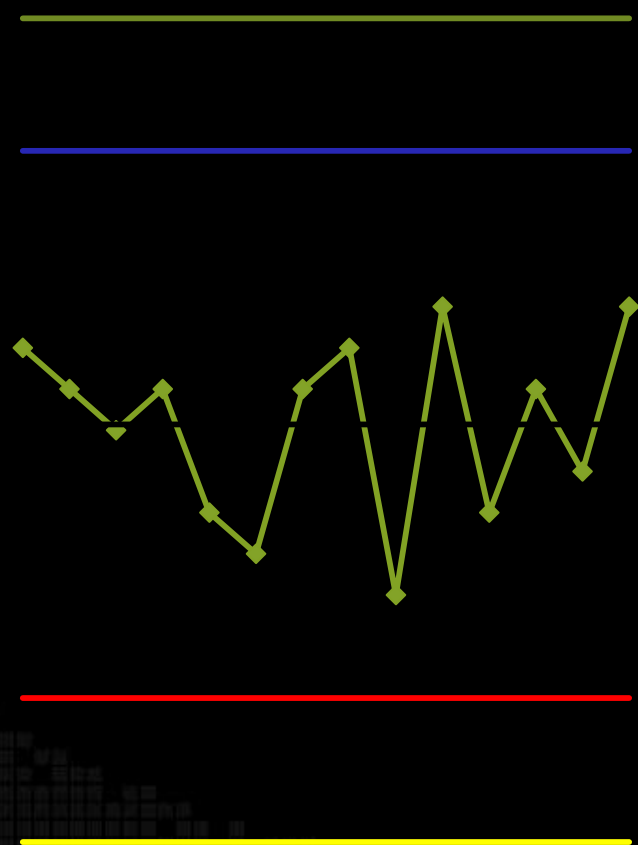
Demo



Control Chart



$$C_p = \frac{USL - LSL}{6\sigma}$$



6σ

USL - LSL

Cpk is an adjustment of C_p for the effect of non-centered distribution

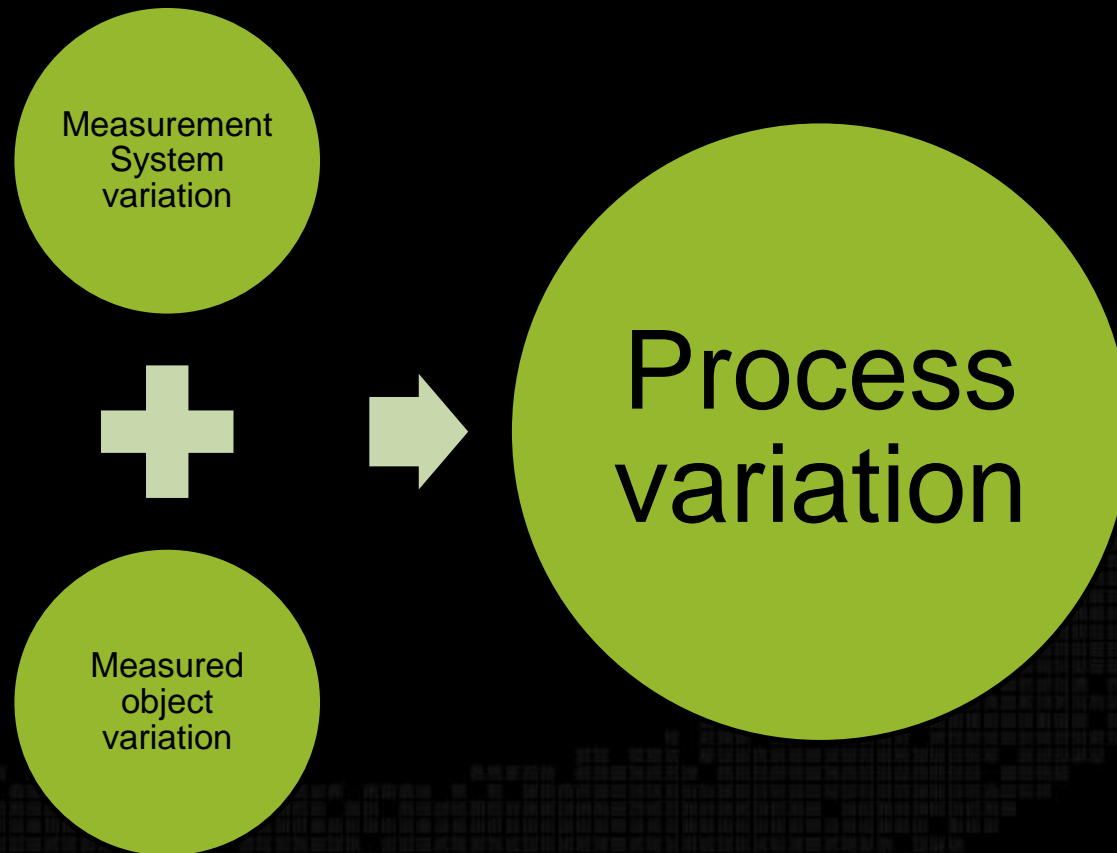
Lower Specification Limit (LSL)

Process Capabillity

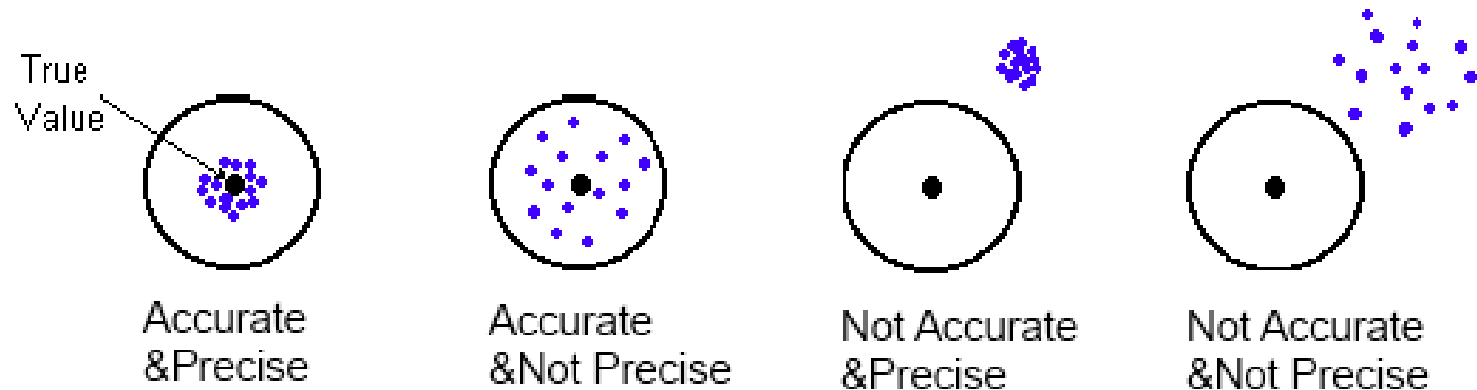
$$C_p = \frac{(USL - LSL)}{6\hat{\sigma}}$$
$$C_{pU} = \frac{(USL - \bar{X})}{3\hat{\sigma}}$$
$$C_{pL} = \frac{(\bar{X} - LSL)}{3\hat{\sigma}}$$
$$C_{pk} = \text{Min}(C_{pU}, C_{pL})$$

- C_p
 - A simple and straightforward indicator of process capability
- C_{pk}
 - Adjustment of C_p for the effect of non-centered distribution.

Process variation



Accuracy and precision



The golden unit.....



Mästsystemanalys (MSA)



“The purpose of Measurement System Analysis is to qualify a measurement system for use by quantifying its accuracy, precision, and stability.”





- Know your enemy
- Show the Capability
- Work the Variation