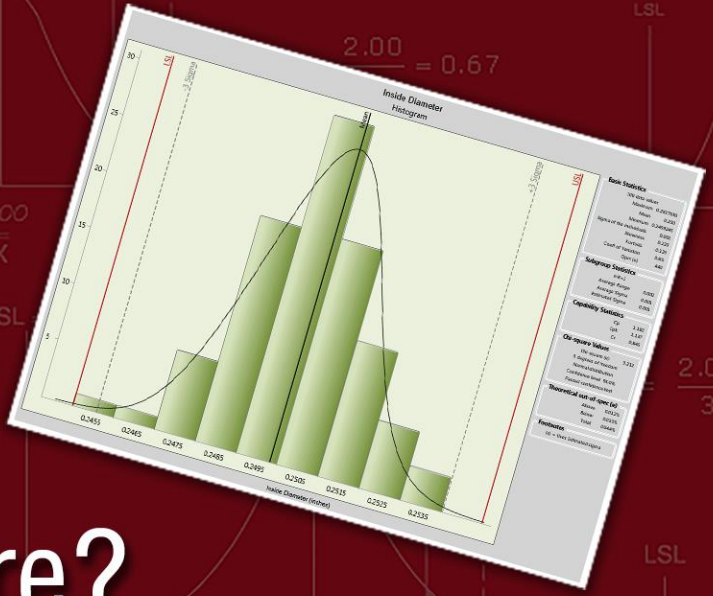
Cpk:

Indispensable index or misleading measure?



Presented by

Steve Daum
PQ Systems
Director of Development

Matt Savage
PQ Systems
SPC Product Manager

Guest Moderator

Dirk Dusharme
Quality Digest
Editor in Chief

What is Cpk?

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- A statistic
- Simple to calculate

Why use Cpk?

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- Cpk ***can*** answer this question:
  - Are we able to meet customer requirements?

Why use Cpk?

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- More specifically:
  - Can our system produce consistently within tolerances required by the customer now and in the future?

Why use Cpk?

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- In the supply chain
  - Cpk is a standard way for producers and consumers to communicate about quality levels.

What is a good Cpk value?

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- Your customer has a requirement for Cpk.
- A higher number is better; reduced **risk** of delivering a product that is out of tolerance.
- A Cpk of 1.0 is considered “capable.” Your customer may require 1.33 or 1.66.

Fully understand Cpk

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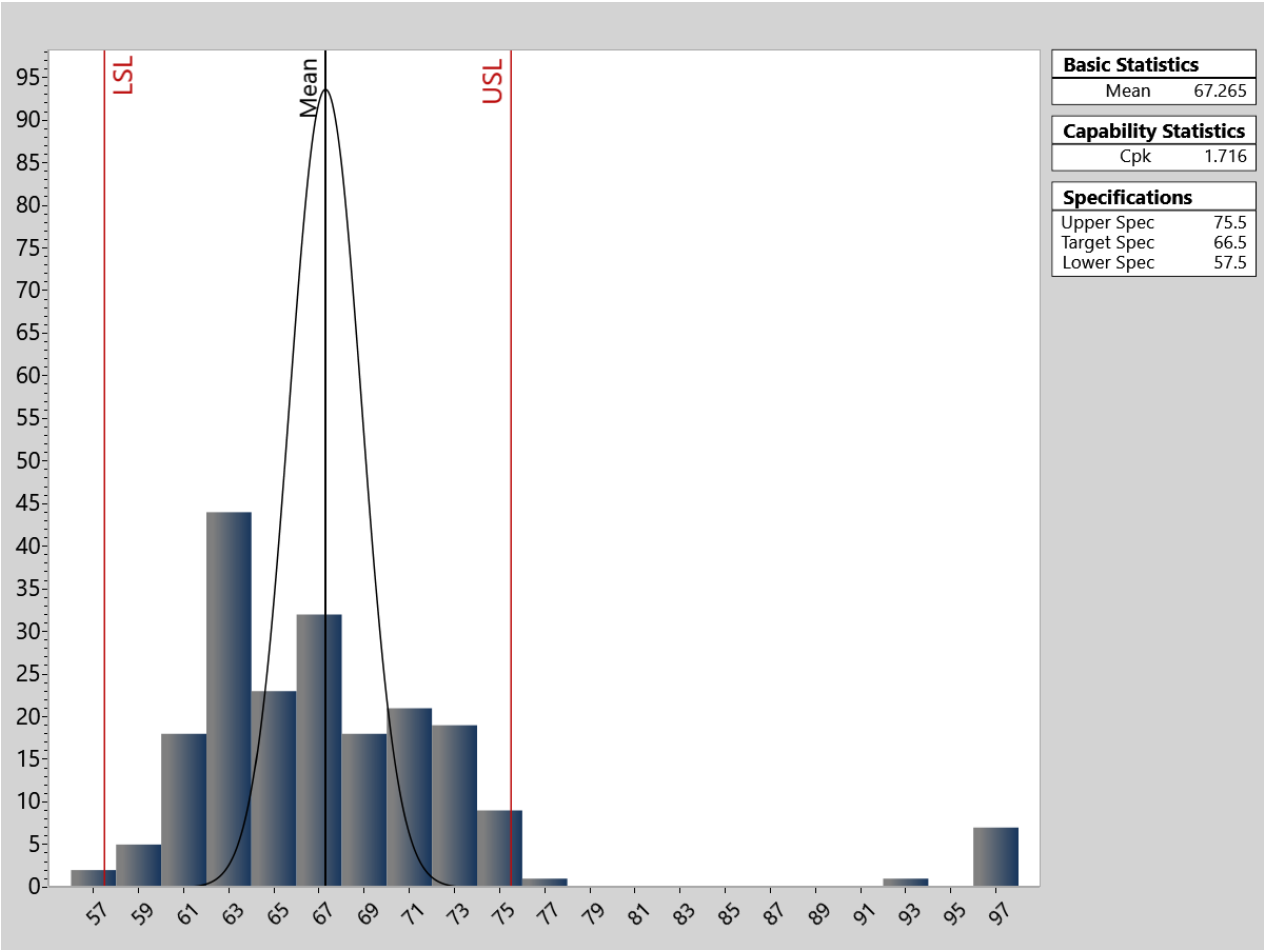
- *Facts are stubborn things, but statistics are pliable.*
    - Mark Twain


LSL
Mean
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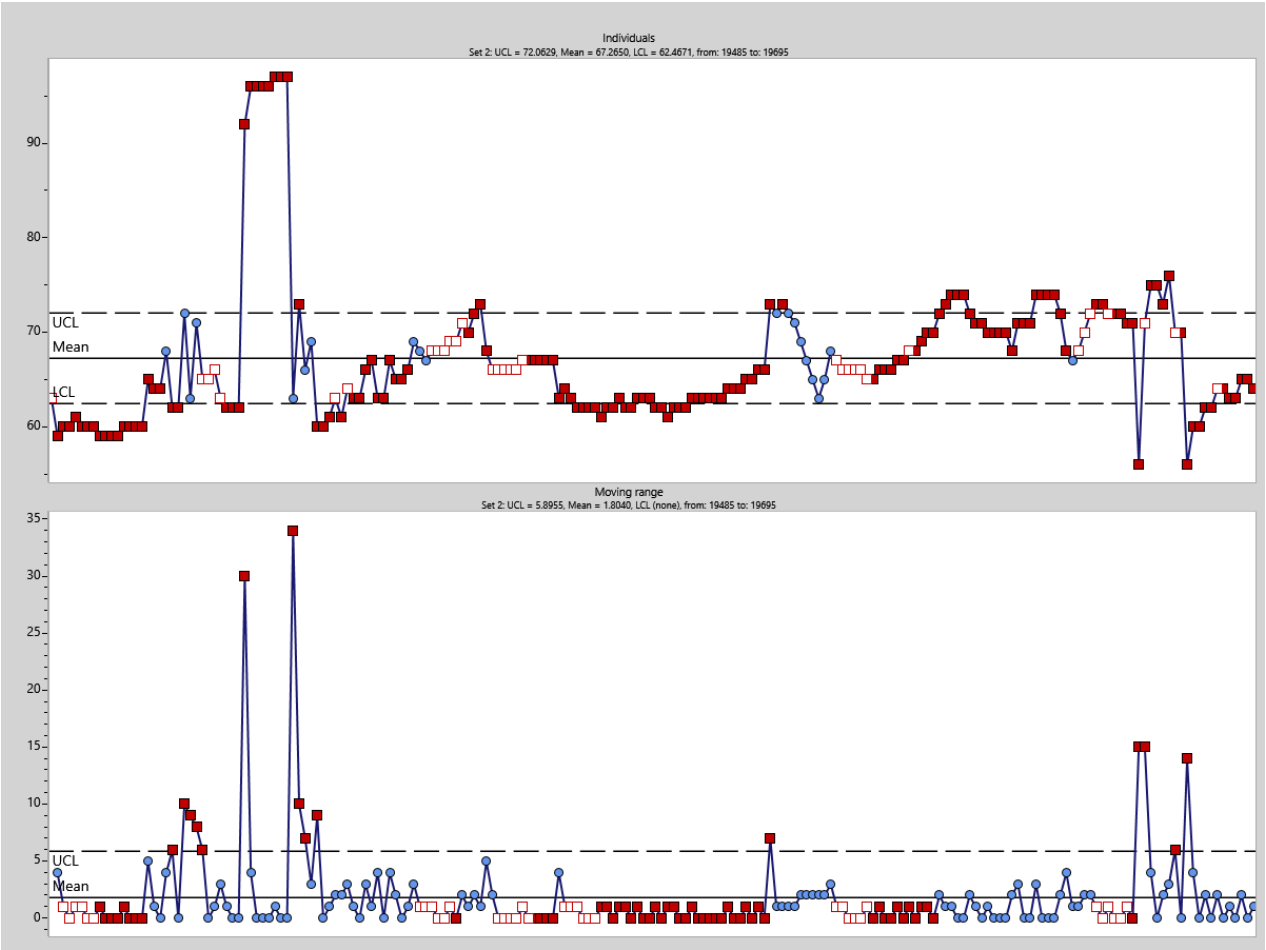
Basic Statistics
Mean 67.265
Capability Statistics
Cpk 1.716
Specifications
Upper Spec 75.5
Target Spec 66.5
Lower Spec 57.5


Individuals
Set 2: UCL = 72.0629, Mean = 67.2650, LCL = 62.4671, from: 19485 to: 19695
90
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60
UCL
Mean
LCL
Moving range
Set 2: UCL = 5.8955, Mean = 1.8040, LCL (none), from: 19485 to: 19695
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25
20
15
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5
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UCL
Mean

Fully understand Cpk

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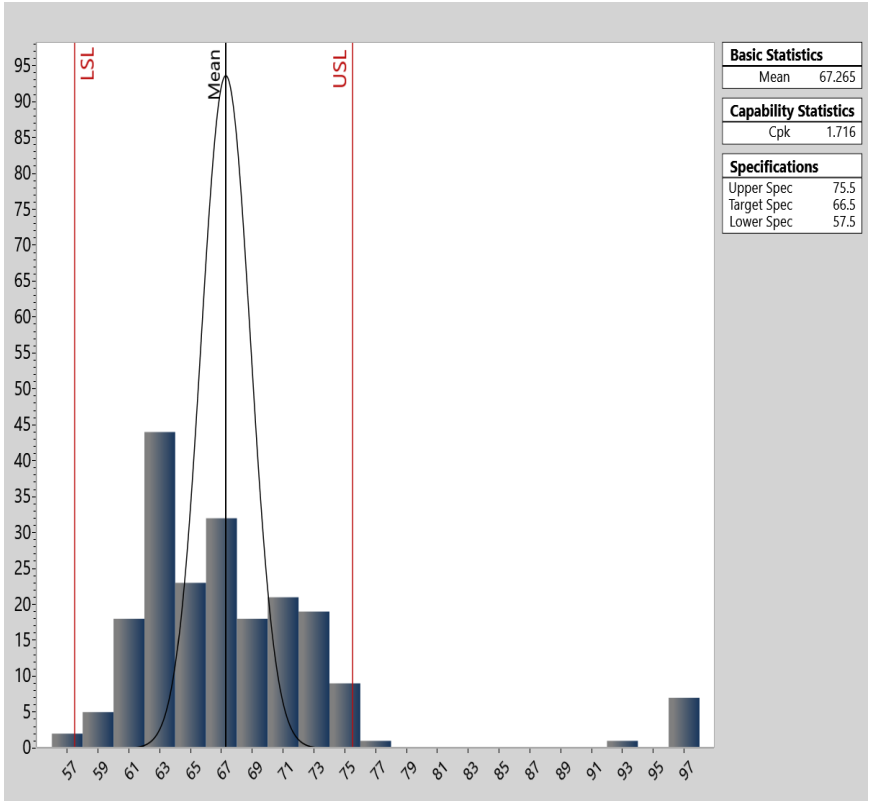

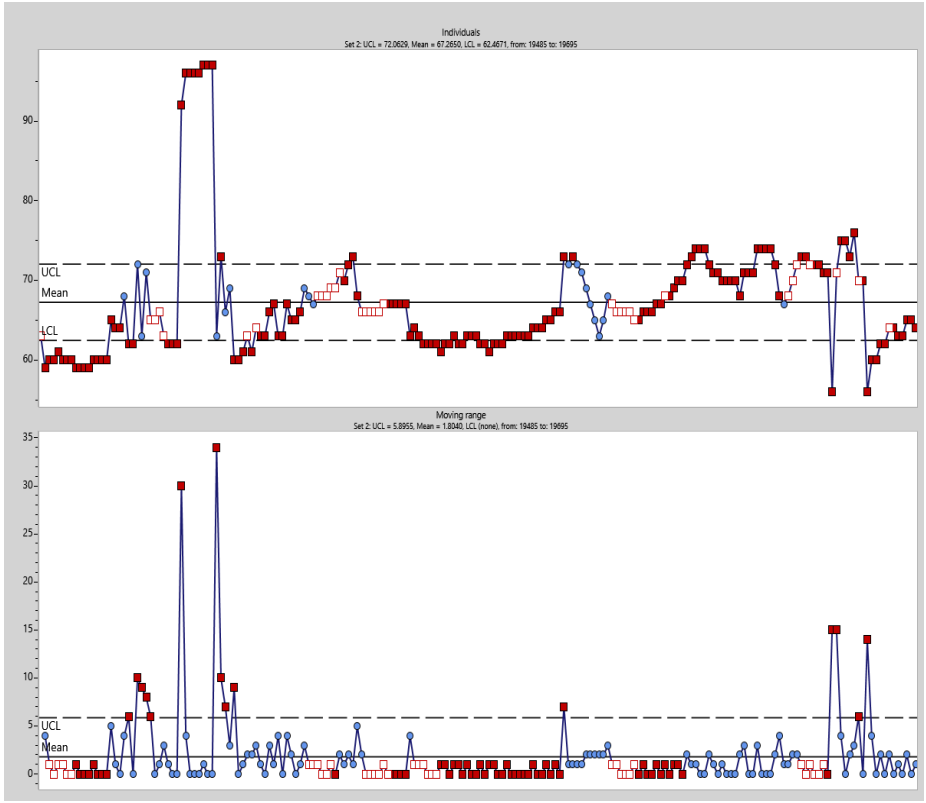

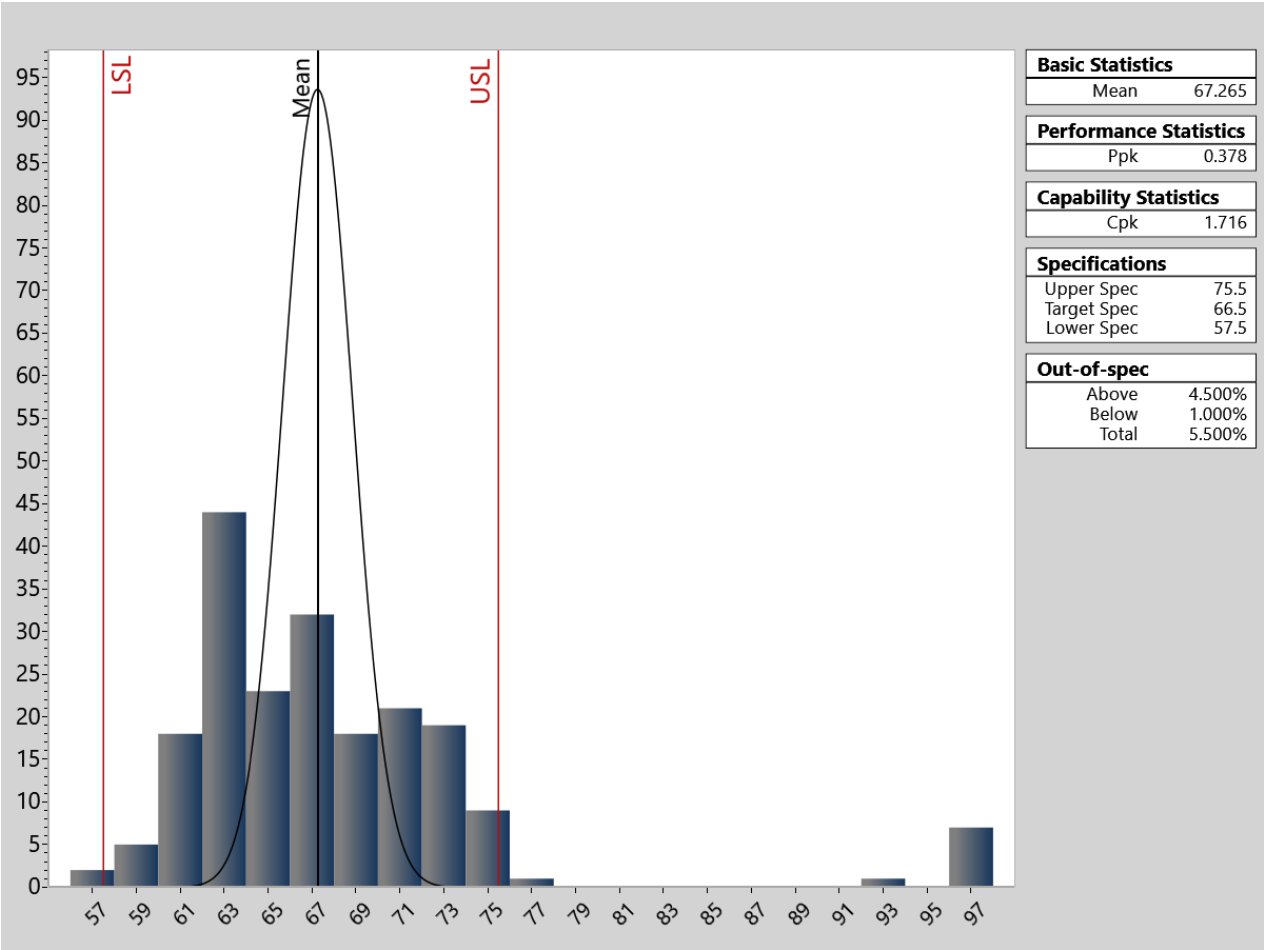
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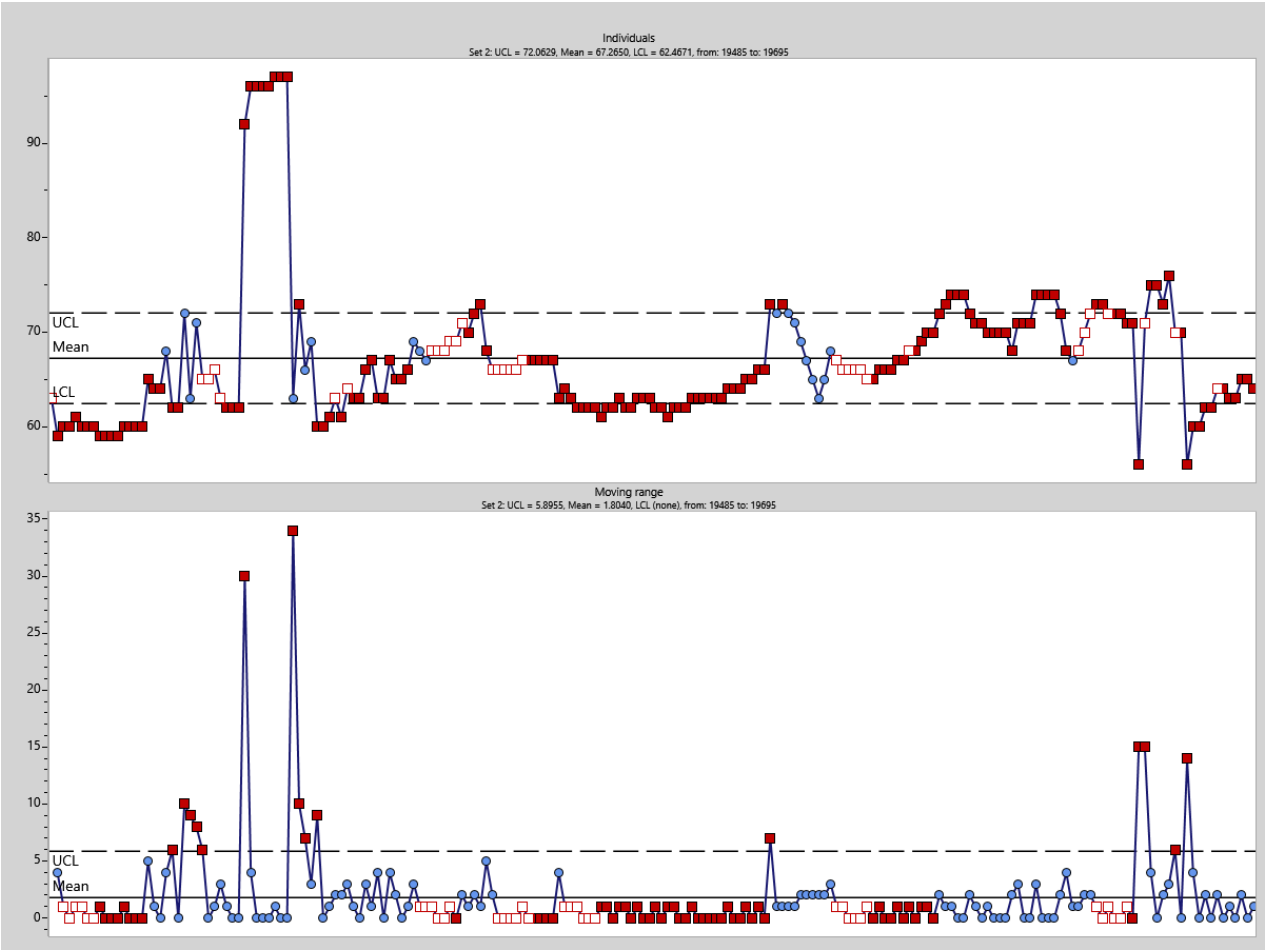
93
95
97
Basic Statistics
Mean 67.265
Performance Statistics
Ppk 0.378
Capability Statistics
Cpk 1.716
Specifications
Upper Spec 75.5
Target Spec 66.5
Lower Spec 57.5
Out-of-spec
Above 4.500%
Below 1.000%
Total 5.500%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Fully understand Cpk

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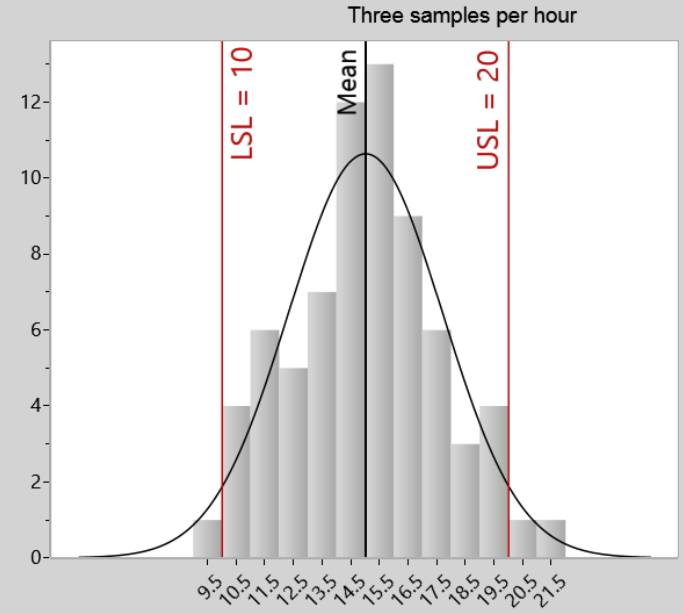
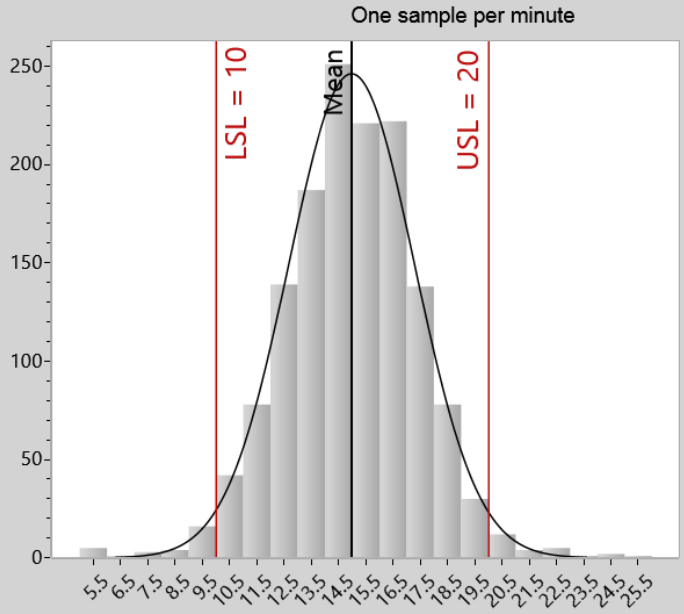


Basic Statistics	
Mean	15.012

Capability Statistics	
Cpk	0.620



Basic Statistics	
Mean	14.982

Capability Statistics	
Cpk	0.718

Understand what your customer needs

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- Once you fully understand Cpk and Capability analysis…

- Seek to understand what your customer needs.

Understand what your customer needs

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Understand what your customer needs

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- Potentially thousands of characteristics…
- Which ones are critical?

"One that is **both** important to your customer and difficult to produce consistently within the specifications."

Donald Wheeler, Ph.D.

Study what your current system can do

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- Ensure process is in-control, predictable, stable (using control chart)
  - Alternative definition of SPC:
    - *Stability, Predictability,* ***then*** *Capability*
- Perform capability analysis on critical characteristics

Study what your current system can do

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- Specification limits:
  - The voice of the **customer**
- Control limits:
  - The voice of the **process**

"There is no logical connection between control limits and specifications."
- Dr. W. Edwards Deming

Customer needs vs. your capability

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Customer needs	Your capability
Cpk 1.33 or higher	Cpk = 0.96
Cpk 1.0 or higher	Cpk = 1.17

- Increasing Cpk

Your capability is less than customer needs…

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- Steer the process average to the Target

Your capability is less than customer needs…

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- Reduce variation

Your capability is less than customer needs…

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- Widen tolerances

Your capability is less than customer needs…

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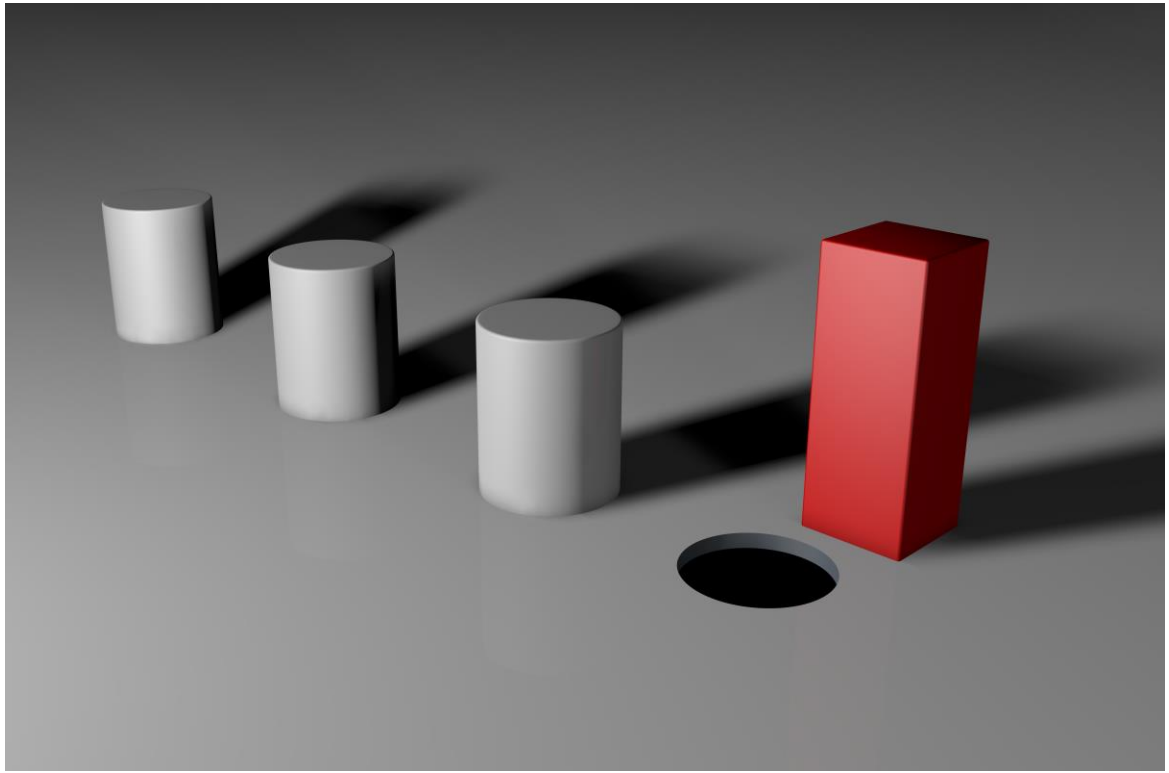
- Can you supply what they need?



When you **do** meet customer requirements:

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- Continue to improve process
- Move from old school to new school
  - Old school (category thinking):
    - In specs = good
    - Out of specs = bad
  - New school (continuous thinking):
    - Any distance from target is **a loss**
    - Further from target = more loss
    - Taguchi Loss Function

Taguchi Loss Function:

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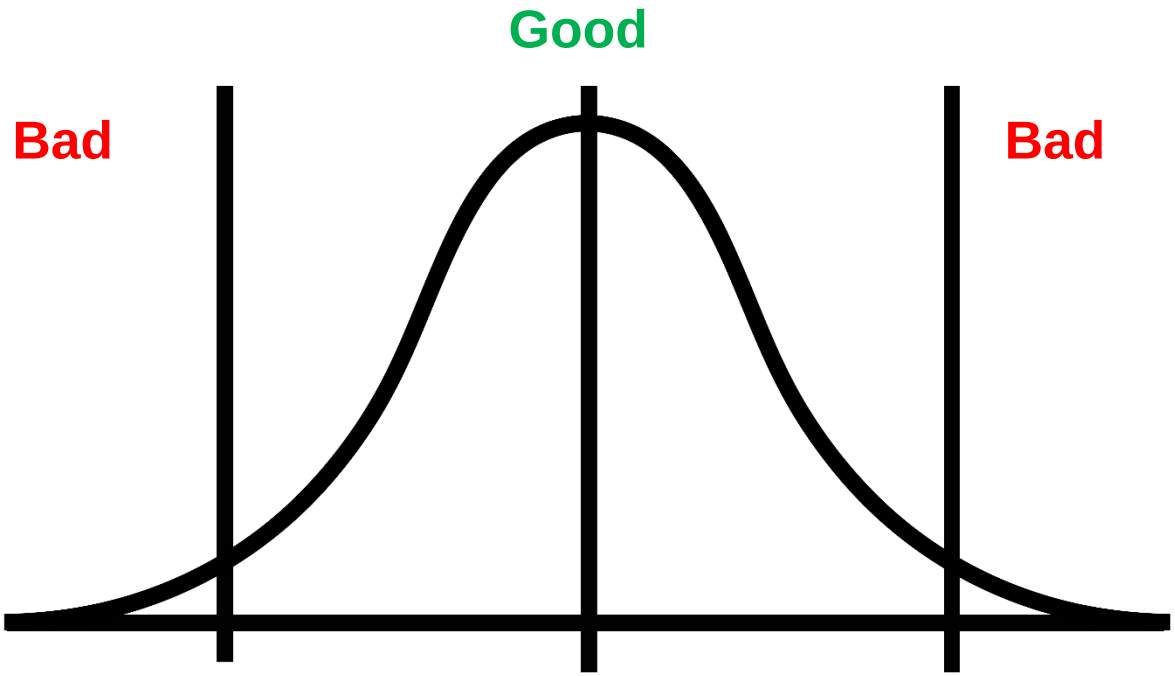

Taguchi Loss Function:

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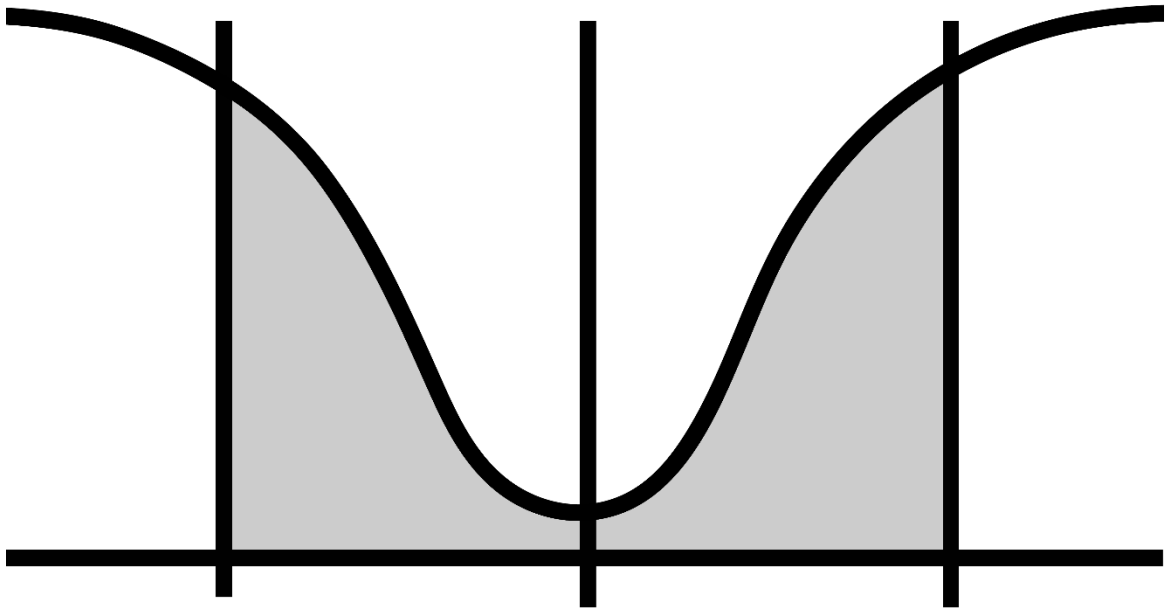

Taguchi Loss Function:

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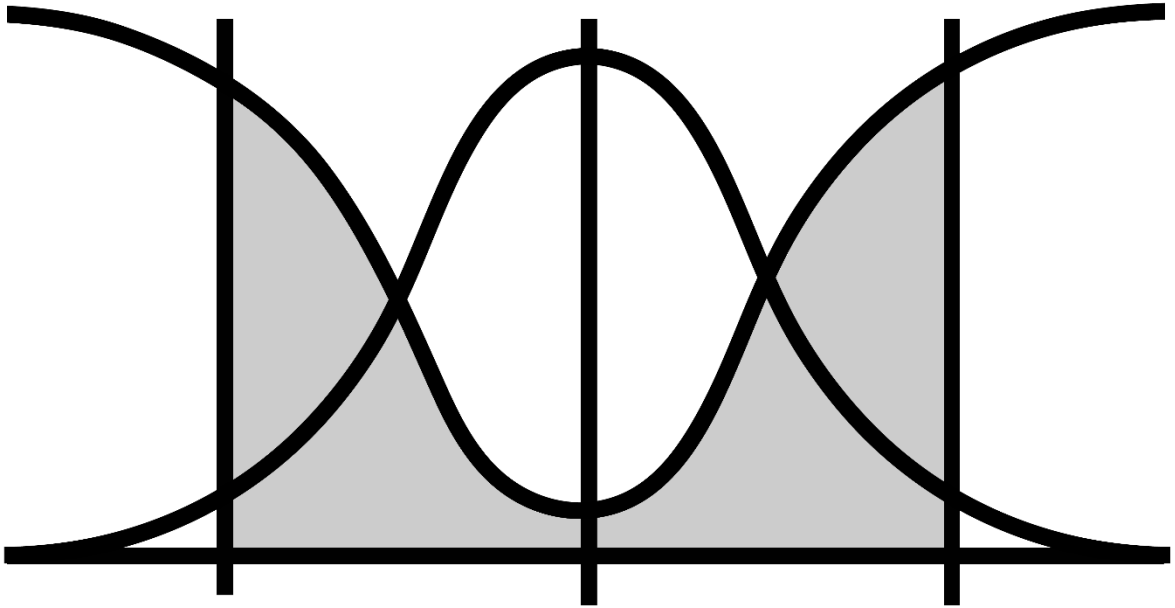

When you **do** meet customer requirements:

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- Increase:
  - Capability mindset among employees
  - Scale and speed at which you can assess capability
  - Holistic view including measurement system, control, and capability

Tips for improving capability analysis

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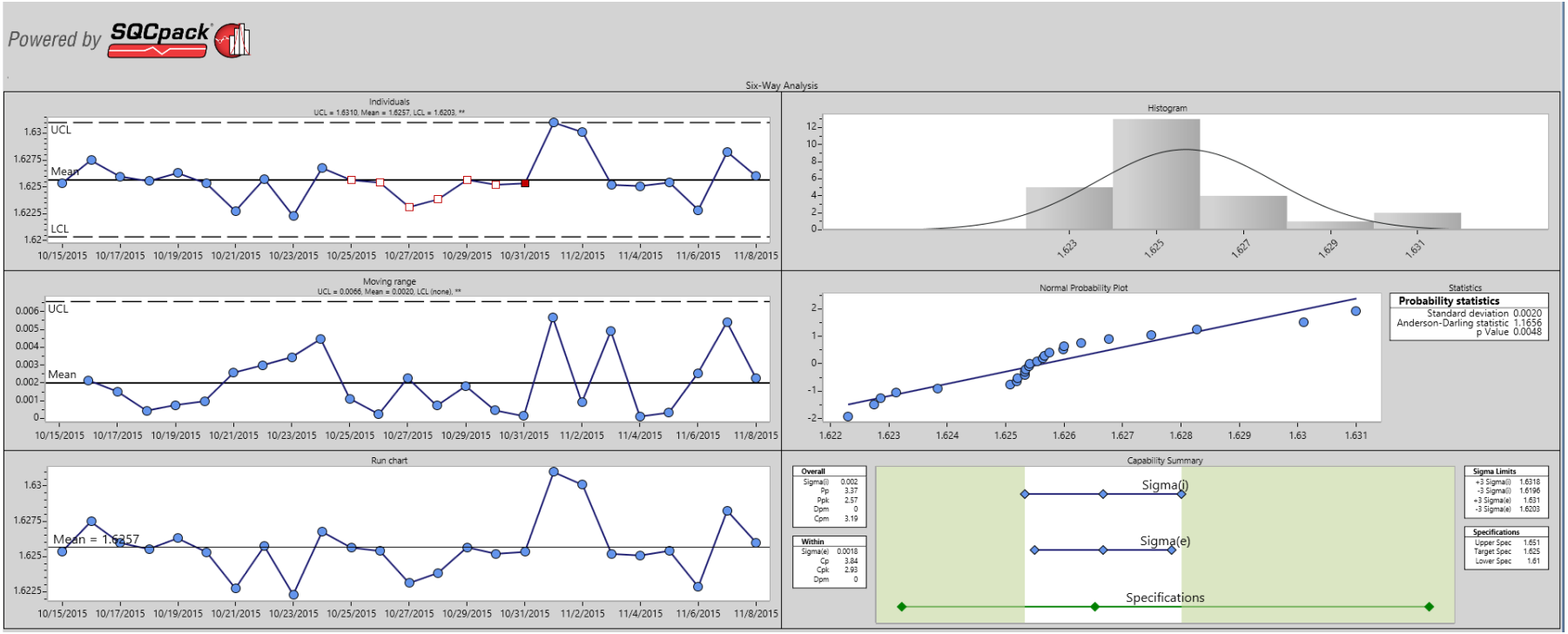
- Six-Way Analysis – *holistic view*



Tips for improving capability analysis

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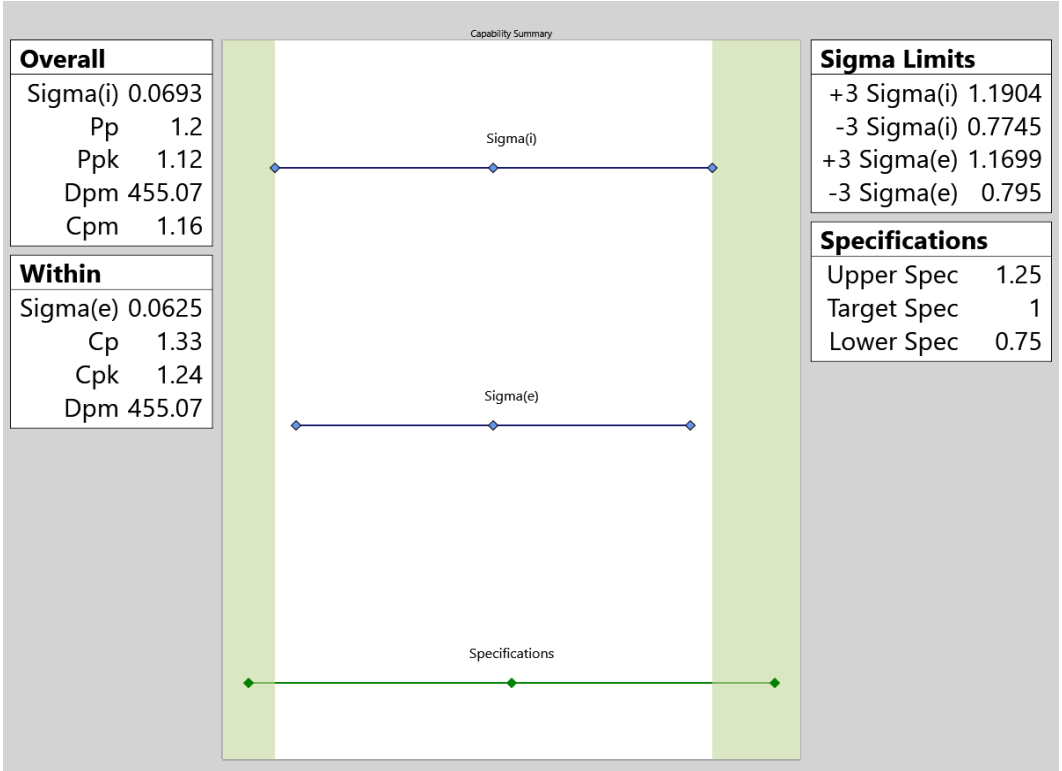
- Strive for “at-a-glance” visuals:



Tips for improving capability analysis

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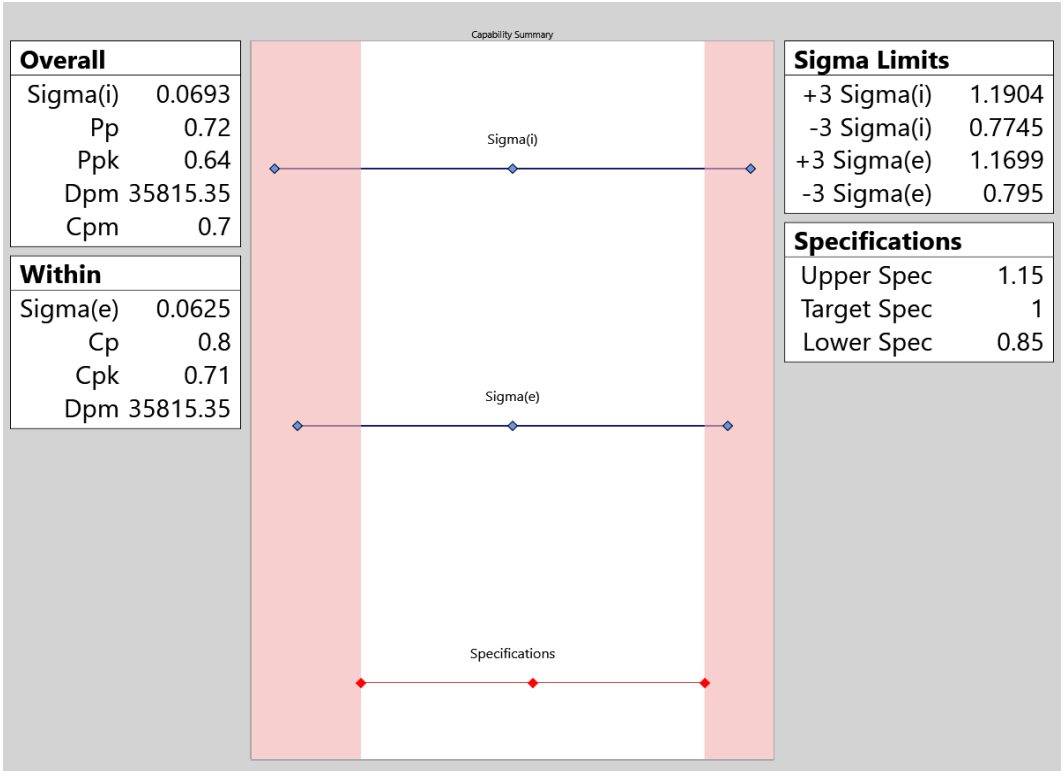
- Capability summary chart – red means “bad”



Tips for improving capability analysis

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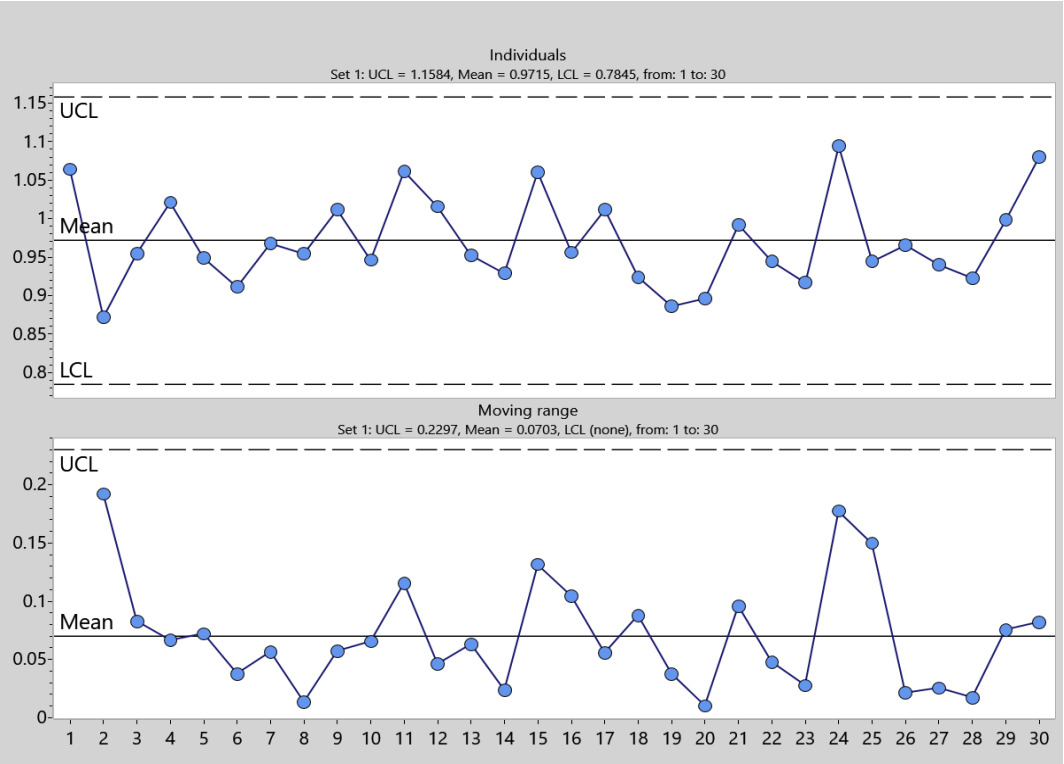
- Key requirement: Statistically stable process



Tips for improving capability analysis

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- Requirements for a good control chart:

Tips for improving capability analysis

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- Requirements for a good control chart:

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- Requirements for a good control chart:

Getting the most from Cpk (Capability Analysis)

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1. Fully understand capability analysis

2. Understand what your customer needs

3. Study what your current system can do

4. Compare customer needs with your capability

5. On-going monitoring for system changes

Thank you for attending!

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Questions?

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Request the white paper

Cpk: Indispensable index or misleading measure?

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