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# SIX SIGMA



DMAIC CONTROL PHASE

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## Institutionalize the Improvement & Implement Ongoing Monitoring

- Develop, Document & Implement an Ongoing Process / Monitoring Plan
- Standardize the Process
- Document Procedures
- Develop and Display Response Plan

# CONTROL PHASE QUESTIONS

- Once defects have been reduced, how do we ensure that the improvement achieved is sustained?
- What systems need to be in place to check that the improved procedures remain implemented?
- How can these improvements be shared with the rest of the company?

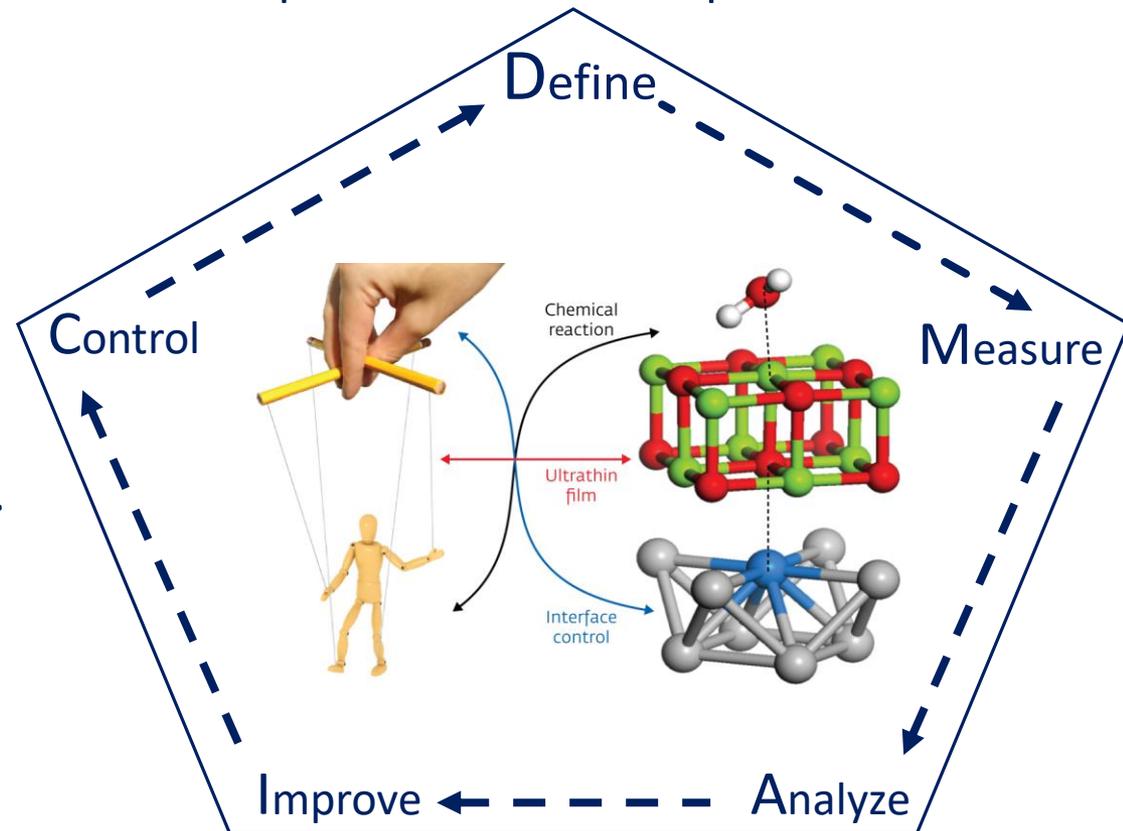
During the control phase, a standardized set of documents for procedures, as well as a means to record data and check it against historical values are important tools.

# SIX SIGMA CONTROL

The **CONTROL PHASE** aims to establish standard measures to maintain performance and correct problems as needed, including those with the measurement systems. This includes:

- Validation of measuring systems.
- Validations of long-term capability.
- Implementation of process control with a plan to ensure that problems do not reoccur.

**Control** process performance & ensure that defects do not recur.



# CONTROL

**The Goal of the Improve Phase is to Test Sources of Variation to Determine which of These Actually Cause Process Variation.**



- 10.** Validate the measurement system of the control variables.
- 11.** Determine process capability.
- 12.** Implement process control system & bring the process to a close.

# CONTROL

## 10. Validate the measurement system of the control variables.

**GOAL:** Make sure the implemented solution remains effective and in control

### HERE WE ESTABLISH THE Process Control System

Even though our solution may be an excellent one, the nature of most systems is toward entropy or degradation, thus we will:

- (a) Create an implementation plan with controls for each x
- (b) Prepare documentation and provide (for) training, and
- (c) Collect data to re-evaluate process capability.

RECALL our Measurement System Analysis, as used in Step 3 of MEASURE:

- a. what is the measurement process used?
- b. describe that procedure
- c. what is the precision of the system?
- d. how was precision determined
- e. what does the gage supplier state about:
  - \* Accuracy
  - \* Precision
  - \* Resolution
- f. Do we have results of either a:
  - \* Test-Retest Study? or a
  - \* Gage R&R Study?

In MEASURE the MSA was applied to y. In CONTROL it is applied to x.

# CONTROL

## **11. Determine process capability.**

The GOAL at this stage is to statistically confirm that the implemented changes have produced improved performance.

Process capability is reassessed.

A Hypothesis Test may be appropriate to evaluate the difference in performance prior to and after the implemented changes

# CONTROL

## 12. Implement process control system and bring the project to a close

Three primary approaches may be used at this stage:

### **Risk Management:**

This is similar to FMEA but now focus is trained on x, rather than y.

Risk Management Score =  $RMS = (\text{Impact}) * (\text{Probability})$

RM identifies and quantifies risks, establishes a risk abatement plan, and monitors the progress of the plan.

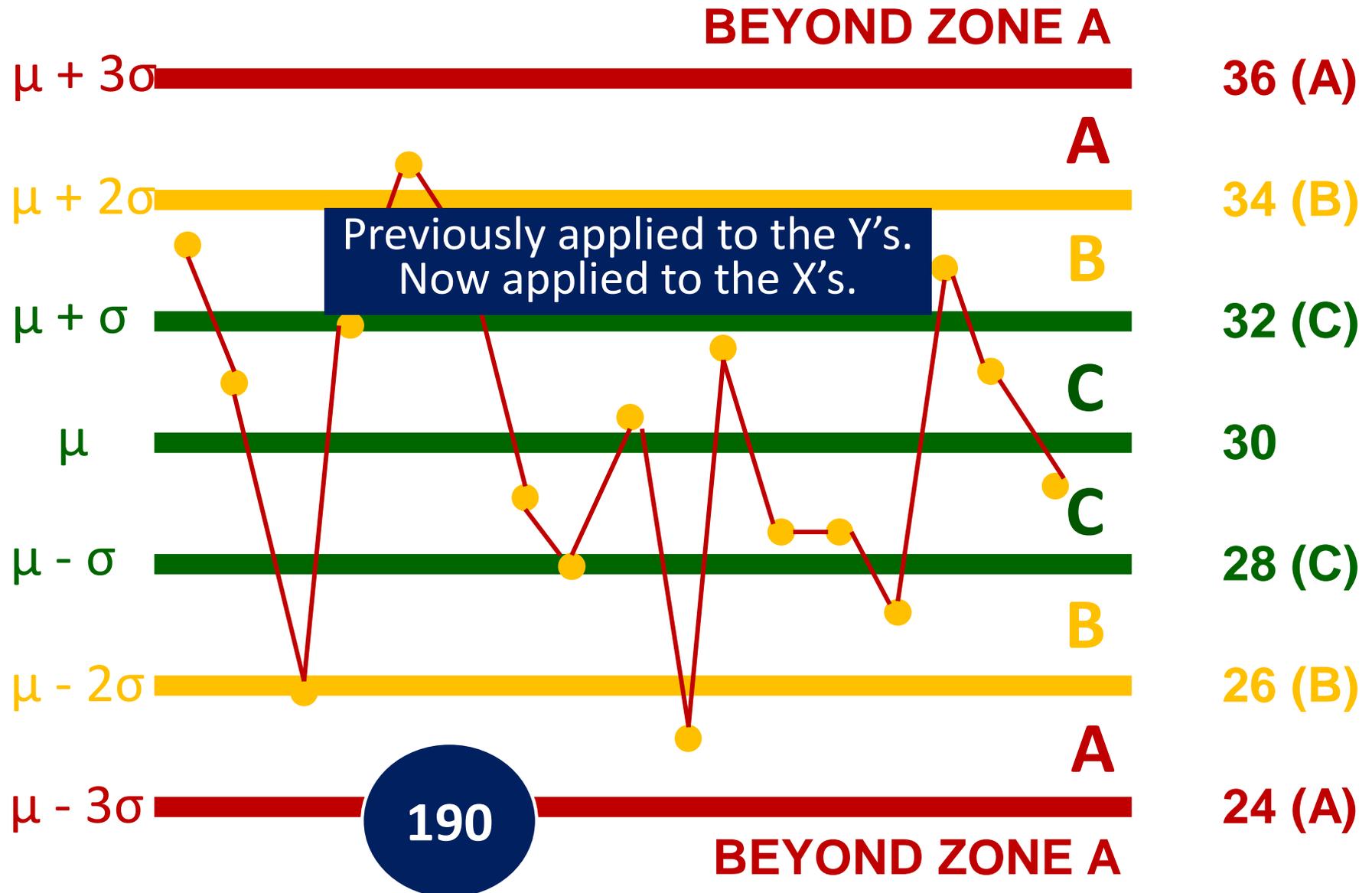
### **Mistake Proofing:**

This is a technique for eliminating errors by making it impossible to make them in the process. To quote: “It is good to do it right the first time. It is even better to make it impossible to do it wrong.”

### **Statistical Process Control (Charts):**

This is a feedback system with sequential data and ongoing process data collection.

# Control Chart with PAT Zones



# SIX SIGMA

Six Sigma is comprised of highly structured strategies for acquiring, assessing, and activating customer, competitor, and enterprise intelligence leading to superior product, system, or enterprise innovations and designs with the intent of generating a sustainable competitive advantage.

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END OF CONTROL PHASE

# STATISTICAL ANALYSIS OVERVIEW