

10TH INTERNATIONAL CONFERENCE
MEDSI 2018

MECHANICAL ENGINEERING DESIGN
OF SYNCHROTRON RADIATION
EQUIPMENT AND INSTRUMENTATION



CITÉ
INTERNATIONALE
UNIVERSITAIRE PARIS

25-29 JUNE



APPLICATION OF INDUSTRY RECOGNISED DEVELOPMENT TOOLS AND METHODOLOGIES, SUCH AS SIX SIGMA TO FACILITATE THE EFFICIENT DELIVERY OF INNOVATIVE AND ROBUST ENGINEERING SOLUTIONS AT SYNCHROTRON FACILITIES

By

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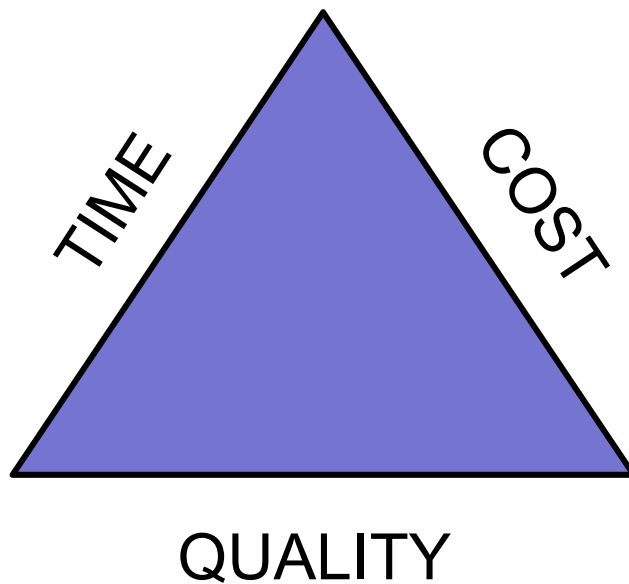


INTRODUCTION

- Explore Difference & Similarities Between Synchrotron Facilities & Commercial Companies
- Six Sigma Basic Overview
- Explore Use of Some Six Sigma Tools

IS THERE A DIFFERENCE?

COMMERCIAL VS. SYNCHROTRONS



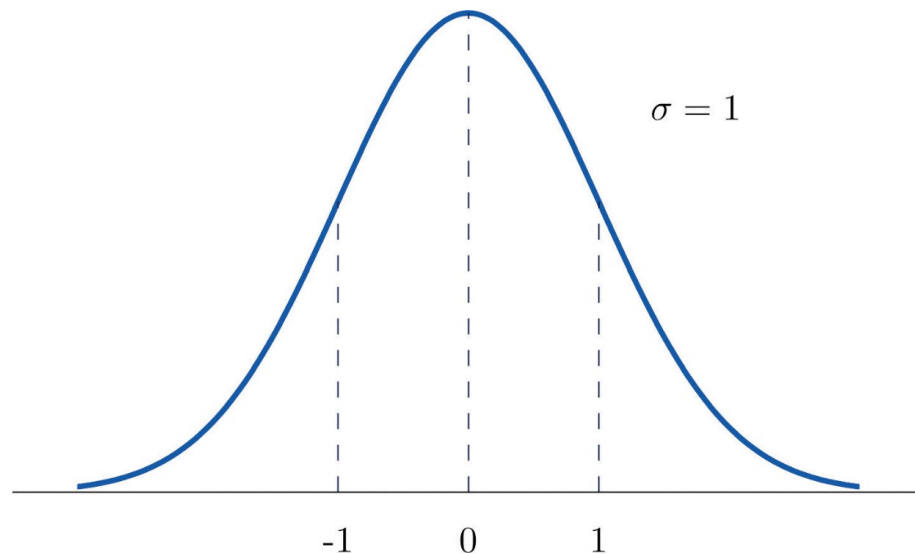
SIX SIGMA

- DESIGN MEASURE ANALYSES IMPROVE CONTROL
- DESIGN FOR SIX SIGMA

Yellow Belts

Green Belts

Black Belts



SIX SIGMA TOOLBOX

**Requirements
Definition**

FMEA

**Stakeholder
Analysis**

DoE

5 Whys

**Paired
Comparison**

**Affinity
Diagrams**



**Criteria
Matrix**

**Creativity
Tools**

**Functional
Tree**

**Process
Mapping**

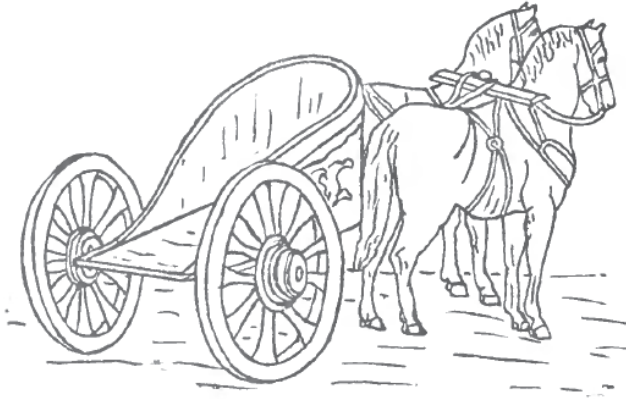
And Many More.....

STAKEHOLDER IDENTIFICATION

- Elliot Kemp Matrix



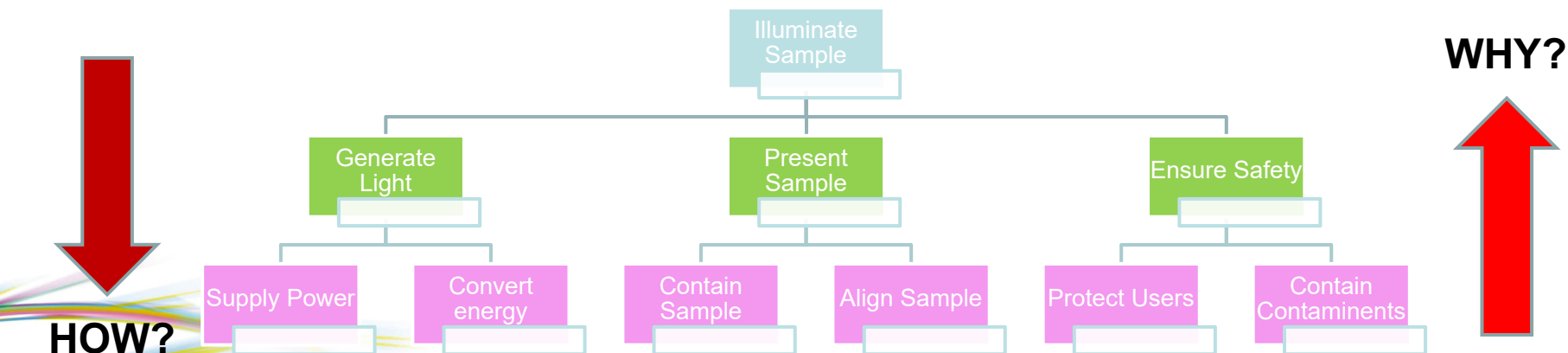
REQUIREMENTS DEFINITION



IMPORTANT: WE NEED TO
UNDERSTAND WHAT IT IS WE
ARE TRYING TO DO AND WHY?

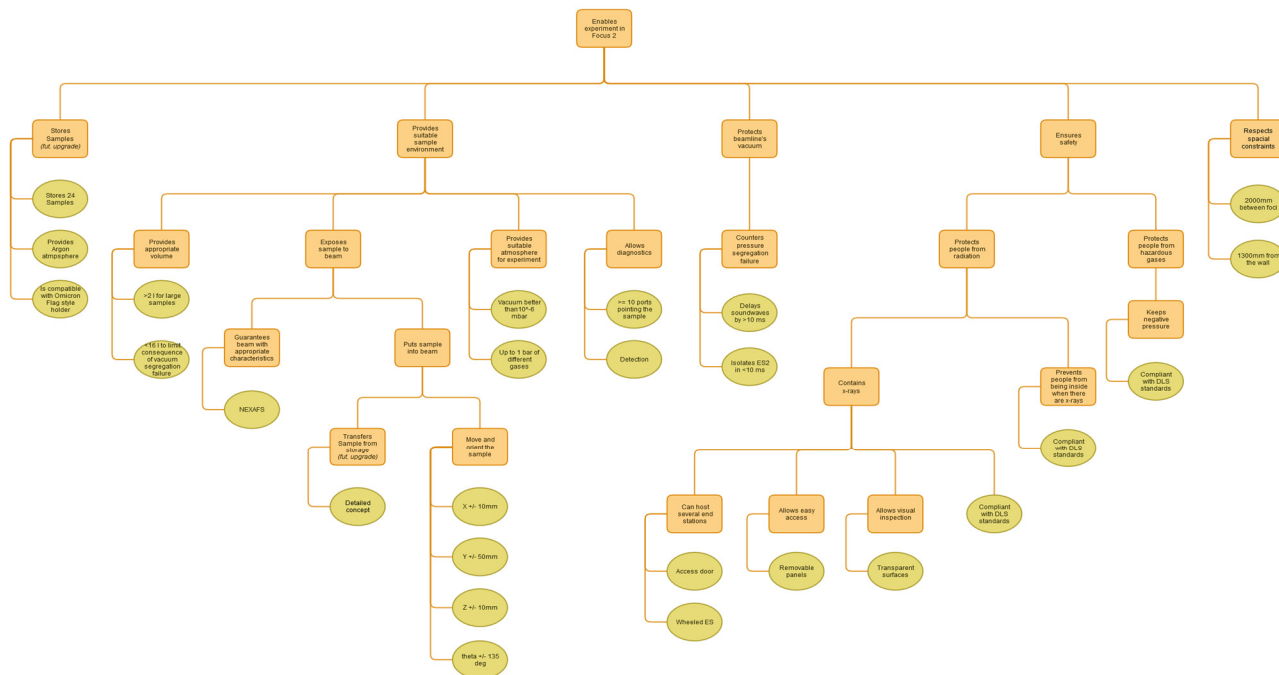
FUNCTIONS IDENTIFICATION

Identify Functions by Describing as
Verb + Noun



DO NOT Include Solutions

FUNCTIONS IDENTIFICATION



FAILURE MODE & EFFECT ANALYSIS

Function: Align Sample

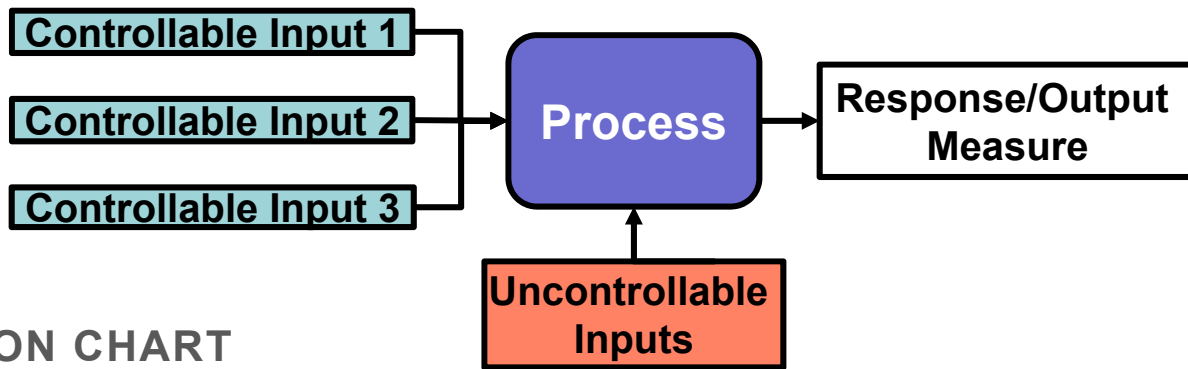
Failure Mode: Sample not aligned

Max
Severity 8

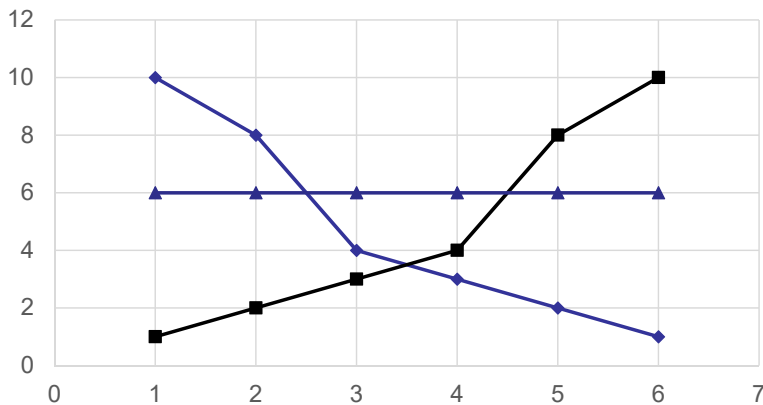
Failure Effects	Severity	Failure Causes	Occurrence	Control Methods	Detection	RPN	Actions
Unable to Measure sample	7	Incorrect encoder Feedback	5	Offline Testing	3	120	
Results not Accurate	5	Motor selection	3	Offline Testing	3	72	
Lost Experiment Time	8						

RPN = MAX SEVERITY X OCCURANCE X DETECTION

DESIGN OF EXPERIMENT



INTERACTION CHART



- Systematic Method to establish relationship between factors affecting a process
- Use of statistical tools & Experimental Concepts

PAIRED COMPARISON

Compare Each Pair of Criteria look for winner

A vs. B – A Wins

A vs. C – A Wins

A vs. D – A Wins

A vs. E – A Wins

B vs. C – B Wins

.....

	A	B	C	D	E
A		A	A	A	A
B			B	D	E
C				D	E
D					D
Σ	4	1	0	3	2

ASK: Which is more important?

CRITERIA MATRIX

Design Criteria	Weight	Design 1		Design 2	
		Score	Wtd. Score	Score	Wtd. Score
A	10	1	10	5	50
B	4	10	40	10	40
C	2	5	10	7	14
D	8	7	56	3	24
E	6	8	48	1	6
Total			164		134

CONCLUSION

- Most Engineering Developments have a Cost, Time & Quality Targets
- There are many useful tools being used by Commercial Companies that can be applied at Synchrotron Facilities
- Synchrotron Facilities need continuous improvement in our engineering developments

Be Brave and Try it!

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THANK YOU

