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**UC**2010

**Real Time Information** — Currency of the New Decade

Hilton San Francisco Union Square | San Francisco, CA

**April 26-28, 2010**

# Enhancing Six Sigma Projects with PI

Matt Corcoran

# Who is RockTenn?

- One of North America's leading manufacturers of paperboard, containerboard, consumer and corrugated packaging
- Annual net sales of approximately \$2.8 billion
- Founded in 1917 and operates manufacturing facilities throughout the United States, Canada, Mexico, Argentina and Chile
- 10 Recycle Paperboard Mills, 2 Recycle Container-board Mill, 1 Bleached Board Mill
- 90+ Converting Plants
- Headquartered in Norcross, Georgia

# Who is the Chattanooga Mill?

- 93 years old (The original paper mill in RockTenn)
- Produces 100% Recycled Uncoated Paperboard
- Product calipers (thickness) range .014" - .060"
- Our products Include:
  - Tube Board (Cores and Concrete Molds)
  - Folding Carton Board (Boxes and frames)
  - Partition Board (Partitions for breakable items)
  - Specialty Board (Colors, water resistant)
  - RTA Furniture Board (Backing for Furniture)



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Vacuum suction and pressure are utilized to reduce the percentage of water in the web from approximately 80% to low as 40% water.



# Six Sigma at RockTenn

- “RockTenn is creating a culture of innovation and high performance to ensure that our company is the first choice of our customers, our employees, and our shareholders.” - Jim Rubright (2000 Annual Report)
- Our strategy is to drive key initiatives consistent with our business strategy, with a specific focus on:
  - Implementing a long lasting process improvement initiative with significant bottom line results and significant impact on customer satisfaction
  - Investing in our employees
  - Leveraging the resources of a \$2.8 Billion company over our six operating divisions
- RockTenn’s Six Sigma dept was established to provide the tools and expertise to put our strategy into action

# PI Implementation at RockTenn

- 2005 Pilot program at the Chattanooga Mill
- 2006 EA began
- 2007 PI online for all our paper mills

# OSIsoft Enterprise Agreement

- Diane Bricco – Enterprise Project Manager
- Field Service Engineers
- Center of Excellence
  - Brian Palmer
  - Gopal Gopalkrishnan



# Pre-Project – Study Process Capability

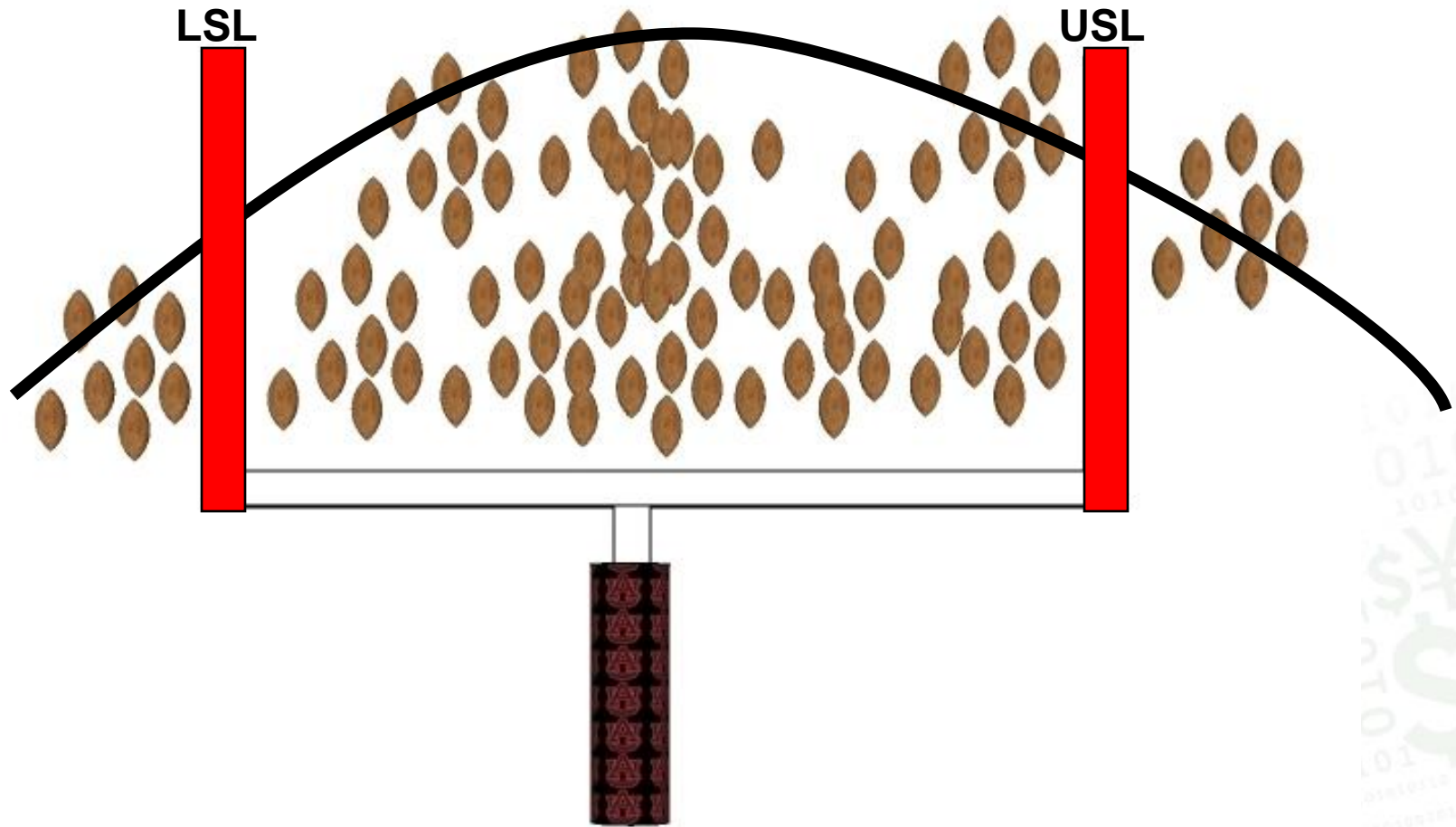
- Business Case
  - Customers requiring a more consistent product not just in spec
- Shrinking Market
  - Strategic positioning to be the prime supplier to the market
- Healthy Customers
  - A happy and healthy customer base is a prime ingredient for long term success
- We're not talking about just \$\$\$ savings, we're talking about staying in business.

# Process Capability

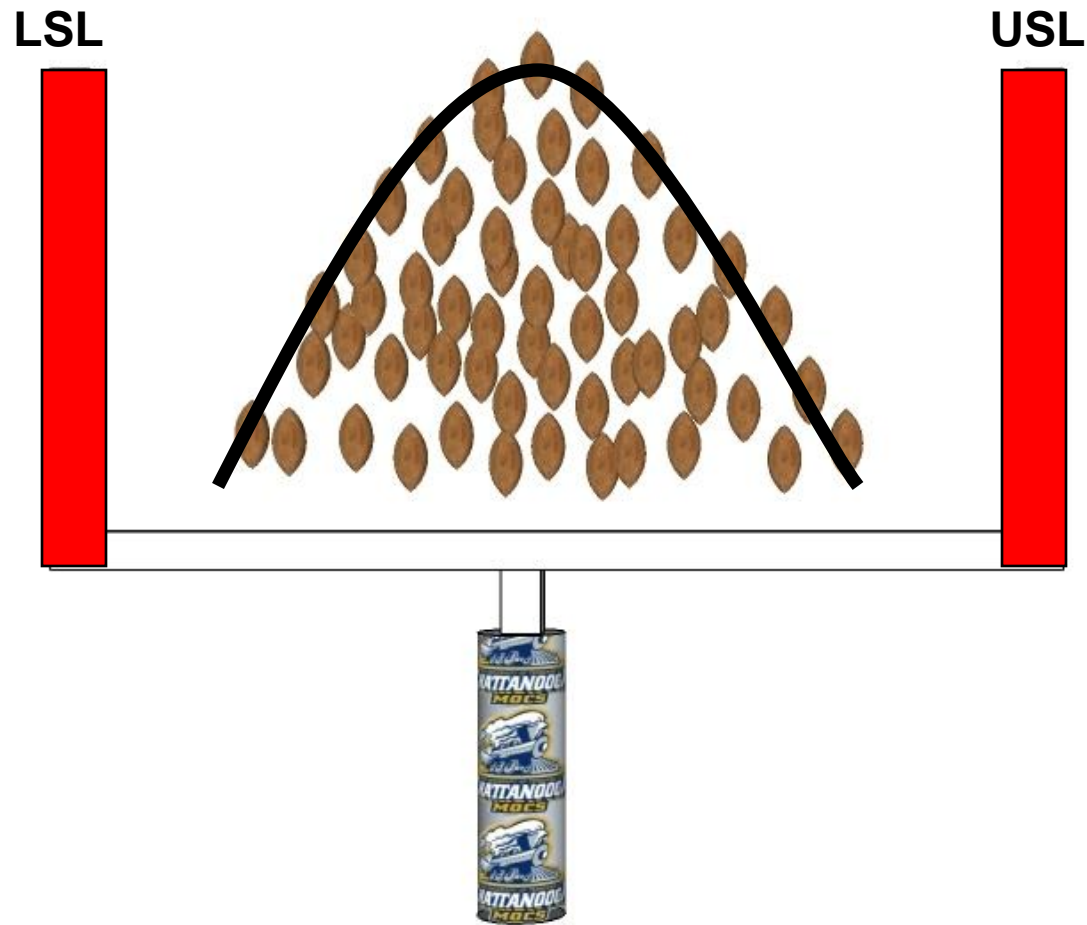
- Having a normal distribution / bell curve allows us to measure “process capability.”
- Process capability compares your process variation to the product specifications and provides an index or “grade.”



# The 3<sup>rd</sup> String Kicker



# The 1<sup>st</sup> String Kicker



# Our Bench Mark

- Data Collection
  - Data Sources
- PI DataLink
  - Import to Excel
  - Filtering
  - Export to Minitab for analysis
- Process Capability
- You are here
- Shock and Awe



# Data Collection

- DCS (Metso)
- 2 In-Line Sheet Scanners on each machine (Metso)
- Quality Database (IBM AS/400)
- All of the data from these sources are collected and archived on the PI Server.
- Access to this kind of data was nearly impossible before the PI Server was installed.

# PI DataLink

Microsoft Excel - Process Data Template PM#1.xls

File Edit View Insert Format Tools Data

3/5/09 10:26 AM 3/5/09 11:55 AM

E4 [=PISampDat(\$A\$4,\$A\$53)]

## Sampled Data

Get evenly spaced, sampled data

☒ PI Tag ☐ PI Expression

Tagname(s)  PI Server [opt.]

Start Time  End Time

Time Interval  Output Cell

Filter Expression [opt.]

☐ mark as filtered

☒ show timestamps ☒ column(s) ☐ row(s)

OK Cancel

Tag	Description
prPM1-PMRLopr.me	PM1 Reel Moisture
prPM1-PMRLfzon.sig	PM1 Moisture Reel, 2 Sig
prPM1-PMvP.fzon.av	PM1 Moisture, avg
prPM1-PMvP.fzon.sig	PM1 Moisture, 2 Sig
prPM1-BwRLopr.me	PM1 Basis Weight
prPM1-BwRLfzon.sig	PM1 Basis Weight Reel, 2 Sig
prPM1-BwvP.fzon.av	PM1 Basis Weight, avg
prPM1-BwvP.fzon.sig	PM1 Basis Weight, 2 Sig
prPM1-CARLopr.me	PM1 Caliper
prPM1-CARLfzon.sig	PM1 Caliper Reel, 2 Sig
prPM1-FRBP.me	PM1 Filler Refiner Pressure
prPM1-FRBP.pos	PM1 Filler Refiner Pressure Valve Position
prPM1-FRFR.me	PM1 Filler Refiner Freeness
prPM1-FRFR.spa	PM1 Filler Refiner Freeness
prPM1-FRUL.me	PM1 Filler Refiner Power
prPM1-FRUL.spa	PM1 Filler Refiner Power
prPM1-BRBP.me	PM1 Back Liner Refiner Pressure
prPM1-BRBP.pos	PM1 Back Liner Refiner Pressure Valve Position
prPM1-BRFR.me	PM1 Back Liner Refiner Freeness
prPM1-BRFR.spa	PM1 Back Liner Refiner Freeness
prPM1-BRUL.me	PM1 Back Liner Refiner Power
prPM1-BRUL.spa	PM1 Back Liner Refiner Power
prPM1-TSF1opr.me	PM1 #1 Vat Stock Flow
prPM1-TSF2opr.me	PM1 #2 Vat Stock Flow
prPM1-TSF3opr.me	PM1 #3 Vat Stock Flow
prPM1-TSF4opr.me	PM1 #4 Vat Stock Flow
prPM1-TSF5opr.me	PM1 #5 Vat Stock Flow
prPM1-TSF6opr.me	PM1 #6 Vat Stock Flow
prPM1-TSF7opr.me	PM1 #7 Vat Stock Flow
prPM1-TSF8opr.me	PM1 #8 Vat Stock Flow
prPM1-TSF9opr.me	PM1 #9 Vat Stock Flow
prPM1-VL1av	PM1 #1 Vat Level
prPM1-VL2av	PM1 #2 Vat Level
prPM1-VL3av	PM1 #3 Vat Level
prPM1-VL4av	PM1 #4 Vat Level
prPM1-VL5av	PM1 #5 Vat Level
prPM1-VL6av	PM1 #6 Vat Level
prPM1-VL7av	PM1 #7 Vat Level
prPM1-VL8av	PM1 #8 Vat Level
prPM1-VL9av	PM1 #9 Vat Level
prPM1-150LB-HSF.av	PM1 150# Steam Header Flow
prPM1-150LB-HSP.av	PM1 150# Steam Header Pressure
prPM1-50LB-HSF.av	PM1 50# Steam Header Flow
prPM1-S2SC.opr.me	PM1 150# Steam Controller
prPM1-SP30.me	PM1 30# Steam Controller
prPM1-SP50.me	PM1 50# Steam Controller
prPM1-SPLP.me	PM1 20# Steam Controller
prPM2-SP30.me	PM2 30# Steam Controller
prPM2-SP50.me	PM2 50# Steam Controller
prPM2-SPLP.me	PM2 20# Steam Controller

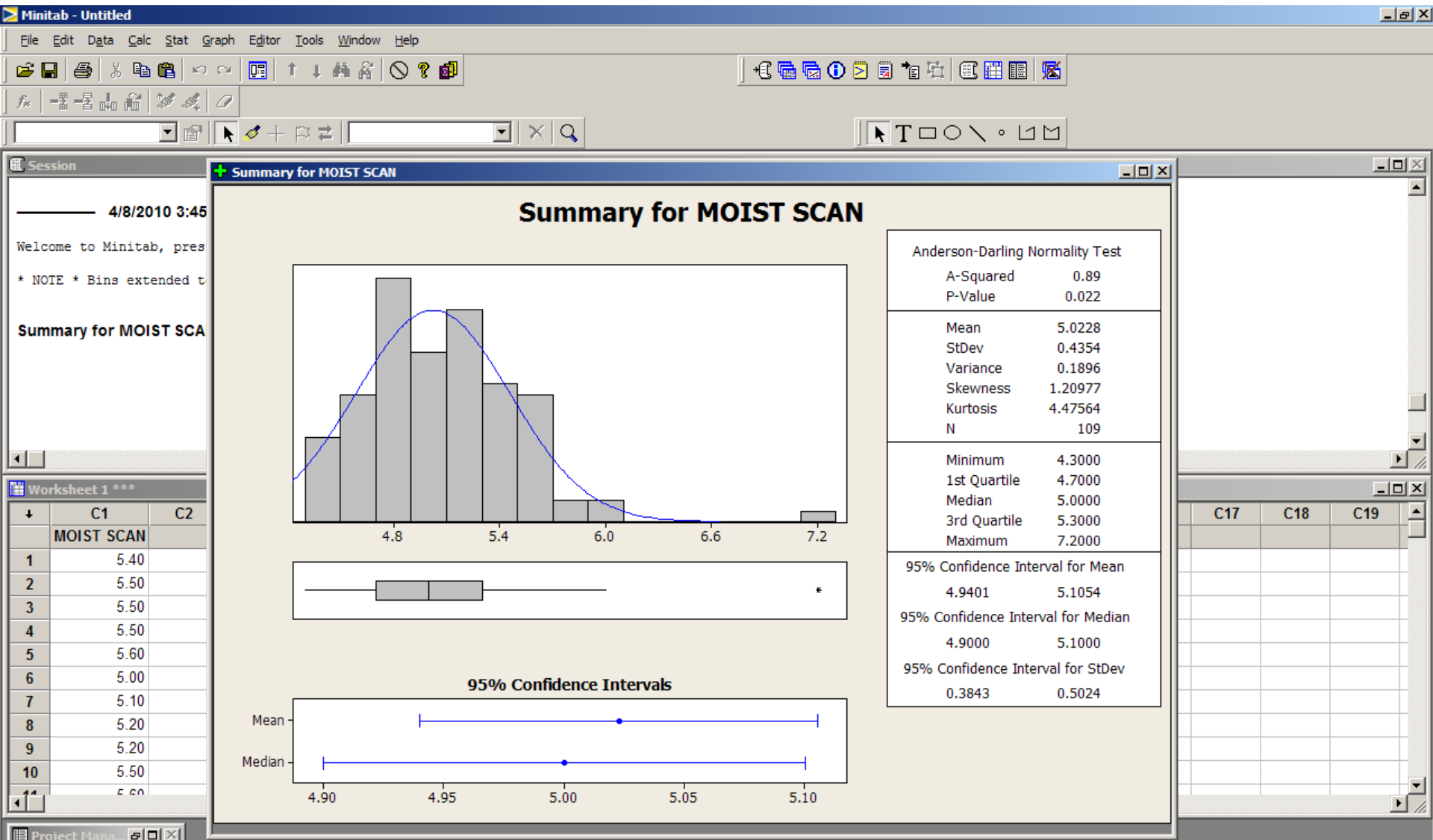
PI Data Data for Jen

Draw AutoShapes

Ready

NUM

# Minitab



# Minitab Process Capability Analysis

## Potential (Within) Capability

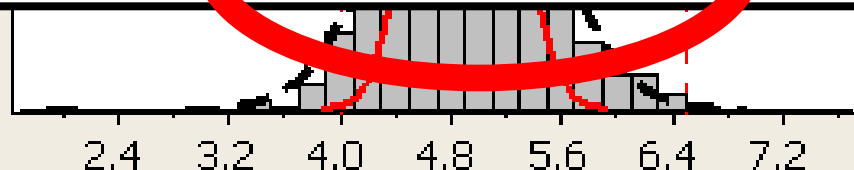
Process Data	
LSL	4
Target	*
USL	6.5
Sample Mean	4.9
Sample N	17
StDev(Within)	0.2
StDev(Overall)	0.5

Cp 1.48

CPL 1.08

CPU 1.89

Cpk 1.08



Within Capability	
Cp	1.48
CPL	1.08
CPU	1.89
Cpk	1.08
Overall Capability	
Cp	0.77
CPL	0.56
CPU	0.97
Cpk	0.56
	*

### Observed Performance

% < LSL	3.00
% > USL	0.46
% Total	3.46

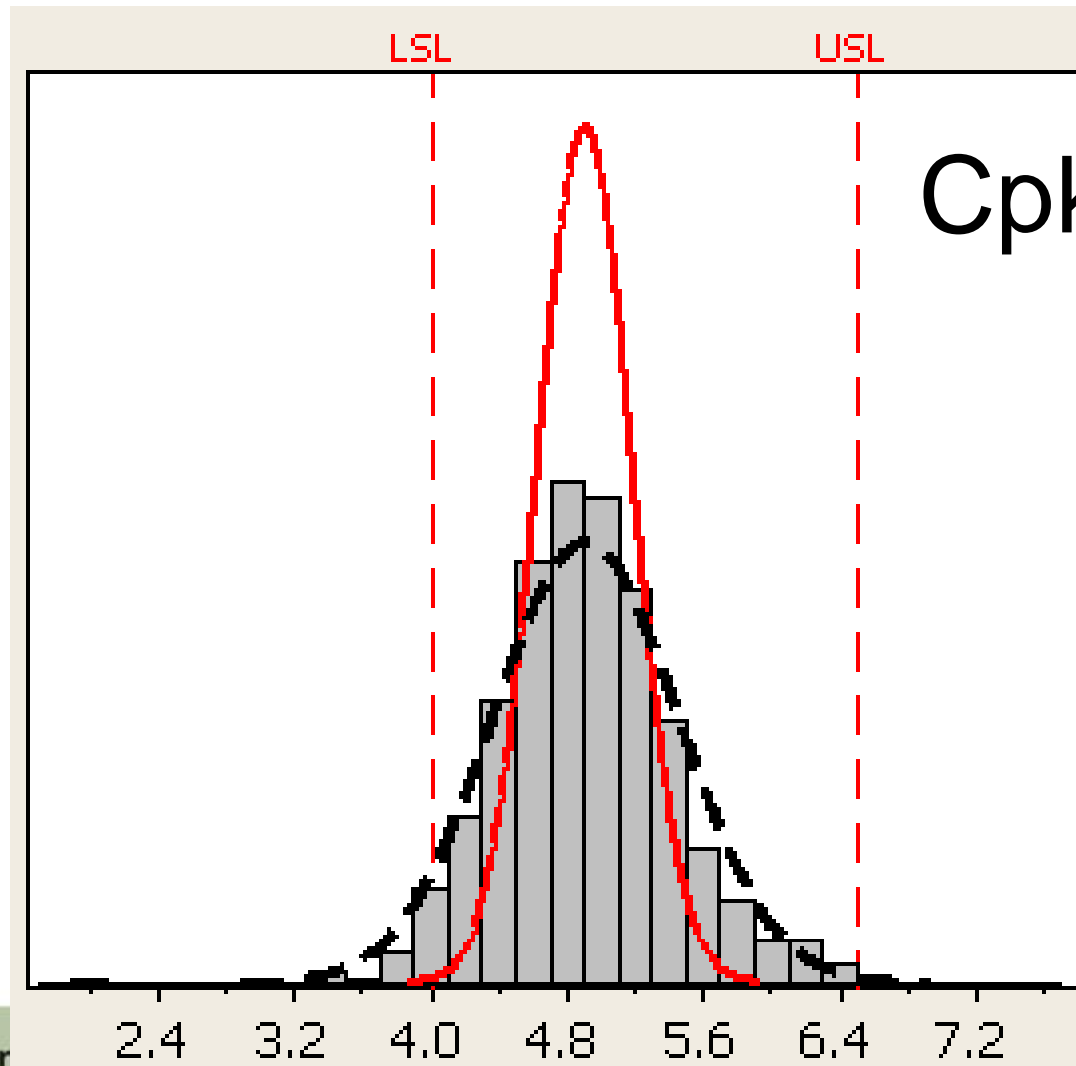
### Exp. Within Performance

% < LSL	0.06
% > USL	0.00
% Total	0.06

### Exp. Overall Performance

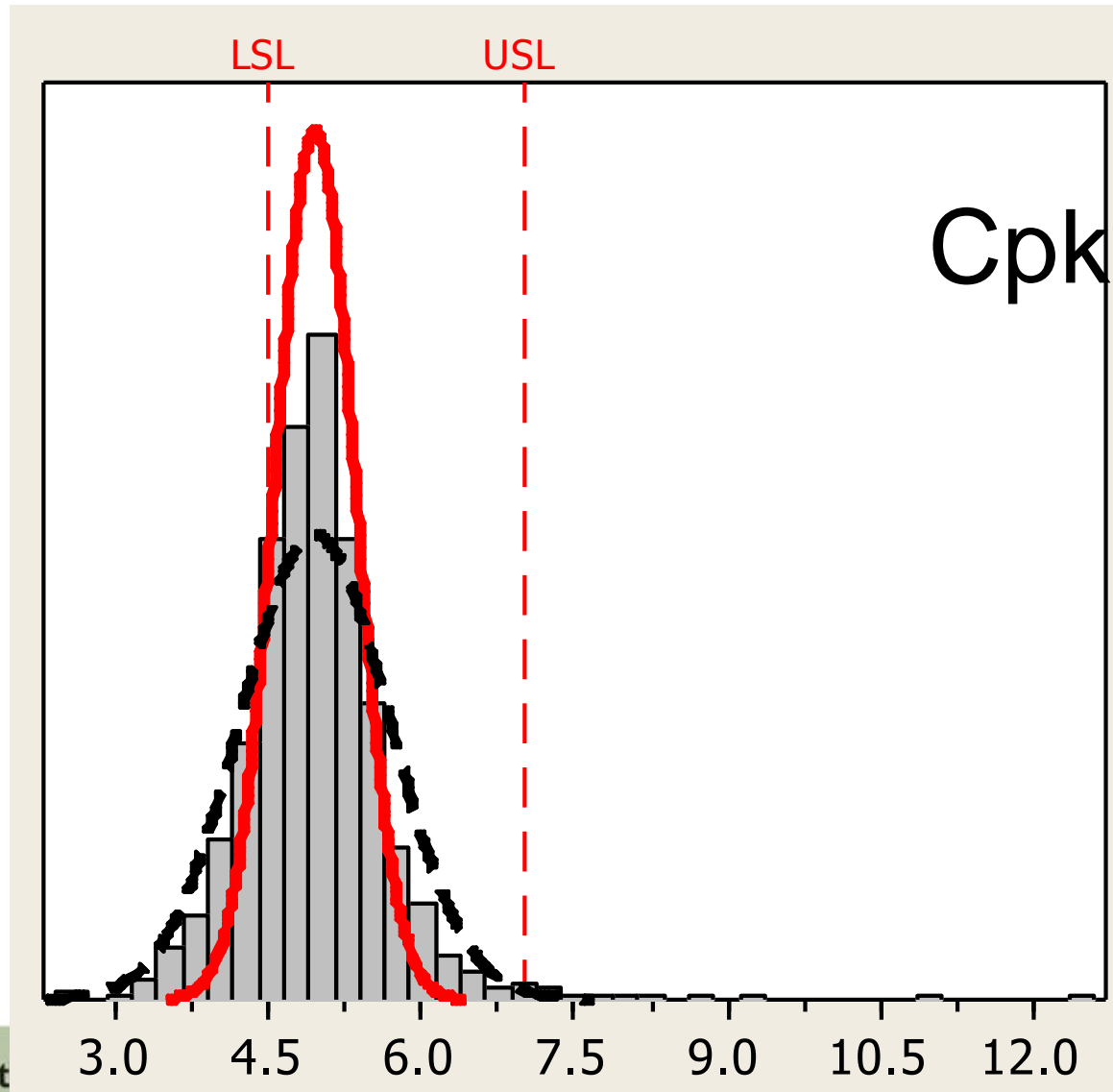
% < LSL	4.72
% > USL	0.17
% Total	4.89

# Grade A Moisture



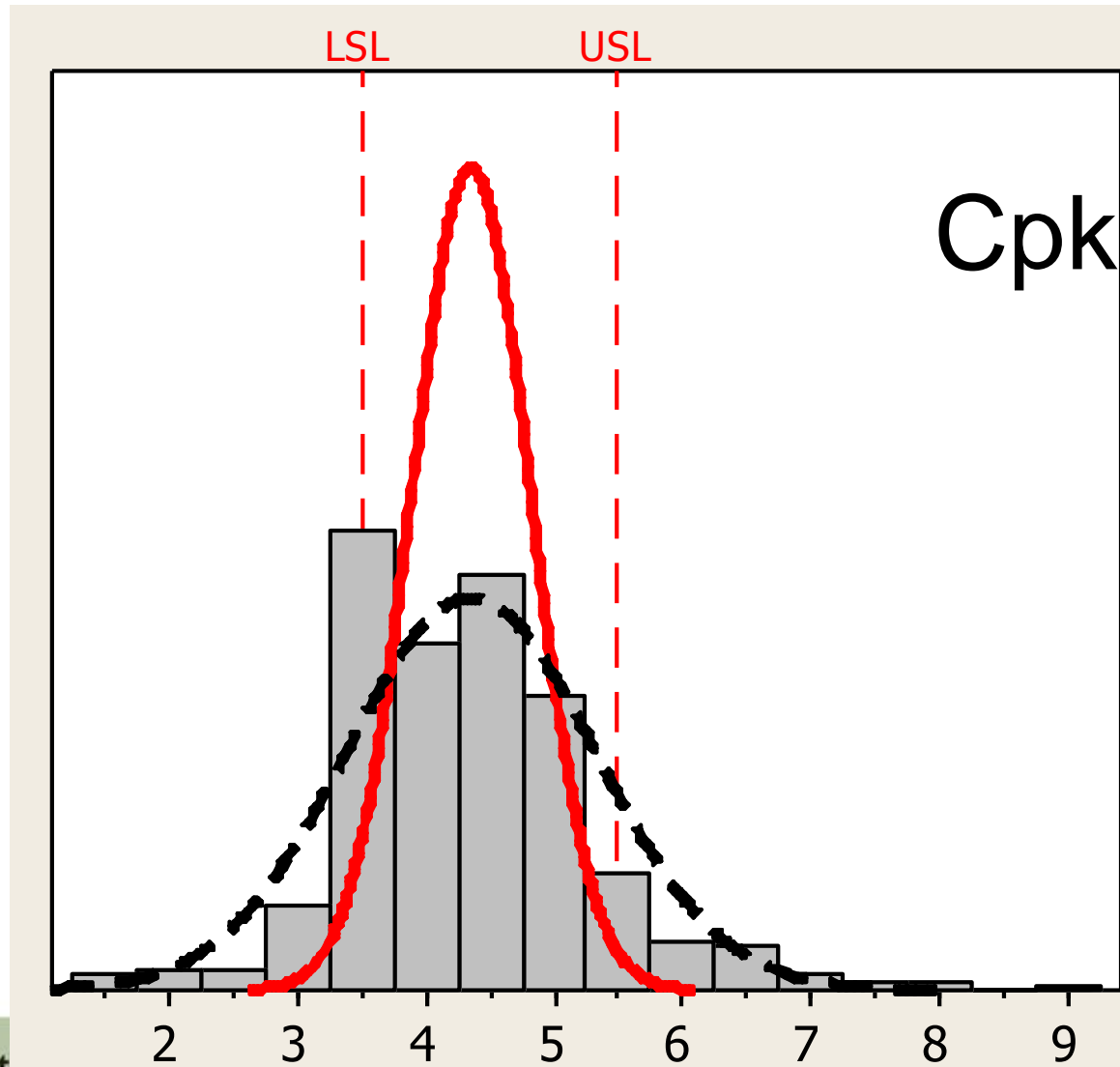


# Grade B Moisture



$Cpk = 0.37$

# Grade C Moisture

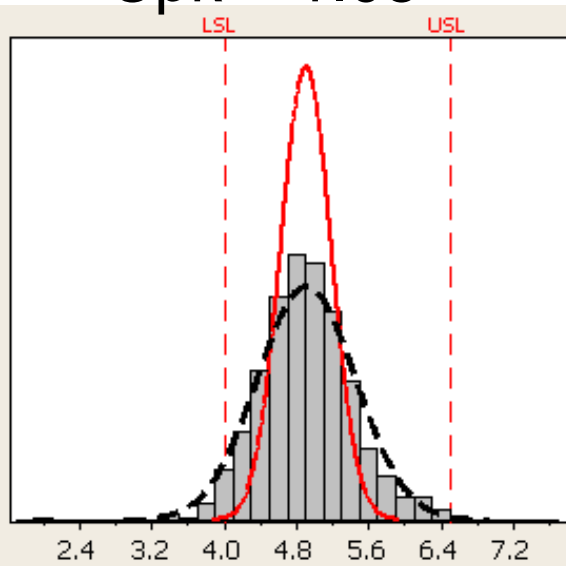


Cpk = 0.61

# All Together – You Are Here

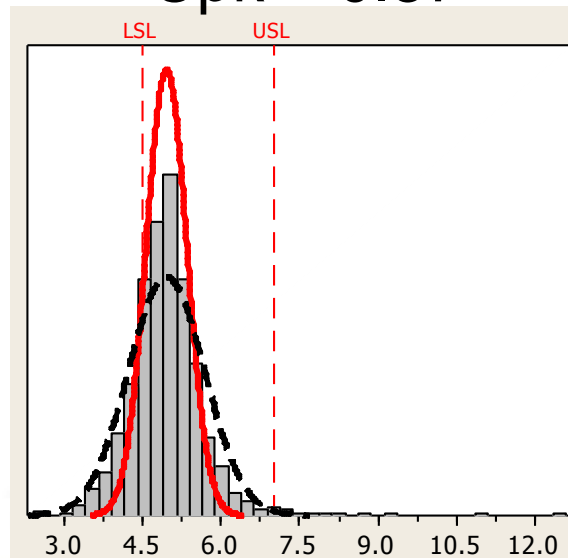
Grade A

$C_{pk} = 1.08$



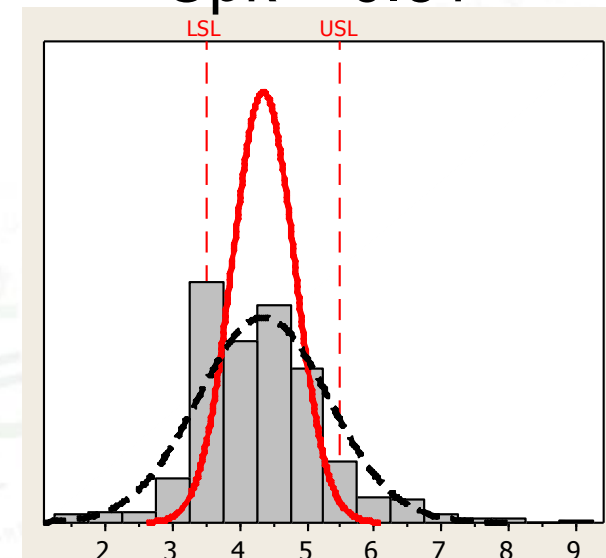
Grade B

$C_{pk} = 0.37$



Grade C

$C_{pk} = 0.61$



# Project Goals

- Leverage knowledge of Grade A to our other grades
- Improve process capability of our systems
- Improve customer quality and satisfaction
- Improve performance/efficiency
- Document and standardize procedures
- Develop continuous monitoring methods (PI Displays & Reports)

# A Six Sigma Project Was Born

- Six Sigma Black Belt
- Kick Off meeting followed by weekly meetings
- Divided the process into two parts
  - Fiber Management
  - Stock Prep/Machine Management



# What Was Different About Grade A?

- What do we do differently on Grade A, compared to the other grades?
- Keep in mind the 6M's. All are sources of variation:
  - Material
  - Method
  - Measurement
  - ~~– Machine (Equipment)~~
  - ~~– Man (People)~~
  - ~~– Mother Nature~~

# Material

- We were much more careful about what fiber and how the bales were added to the process.

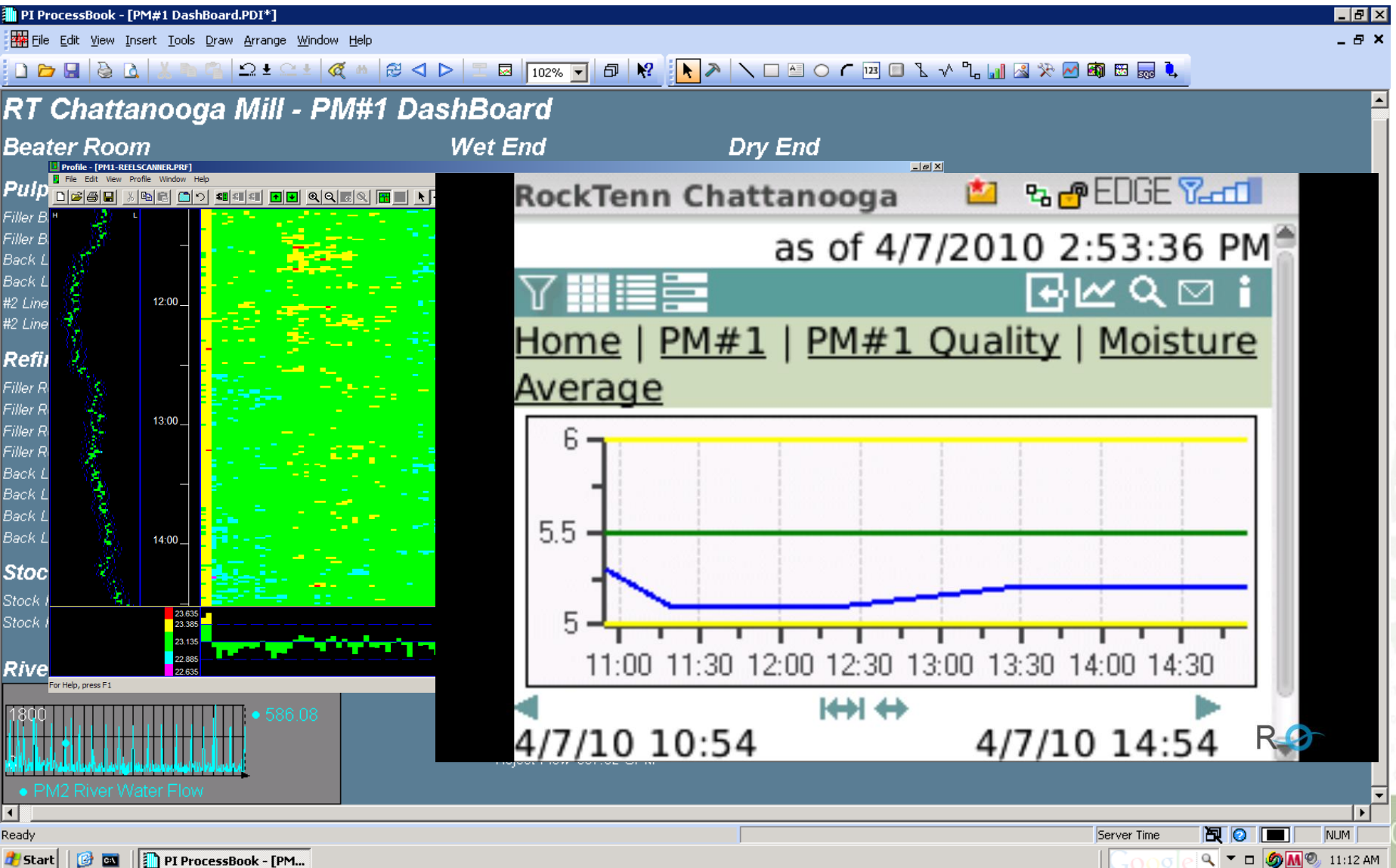


# Method

- We had specifics on raw material, refiner settings and machine settings

GRADE SPECIFICATION CARD					
Grade:	Grade A				
Caliper:	0.035				
Beater Room	Furnish	Dye	Chemical		
Top Liner					
Filler	33% News				
	33% Mix				
	33% Soft Box				
Back Liner	100% DLK				
Wet End	Stock	Dye	Chemical		
Top Liner					
Filler	#2-#8		Size #1 & #9		
Back Liner	#1 & #9				
Dry End	Top	Back			
Wet Stack	All	All			
Calendar Solution	none	none			
Dry Stack	Skip	Skip			
Manufacturing Specifications					
Parameter	Test Frequency	Target	Action	Reject	Profile 2-Sig Max
Caliper	Continuous	35	34.5-35.5	34-36	1
Basis Weight	Continuous	123			7
Moisture	Continuous	5.5	5-6	4.5-7	1
ZDT	5 per Reel	60	55	50	
Mullen	3 per Reel	185	180	175	
Water Drop	1 per Reel	2	1-3	.75-5	
Special Instructions:					
Beater Room:	-Pull from Warehouse A				
Wet End:	-Filler Refiners set to 350 CSF -Liner Refiners set to 400 CSF				
Dry End:	-Load calendar stack to 20 psi				
Quality Lab:					

# Measurement



# Fiber Management

- We overhauled the way we purchased our raw material
- The fiber warehouses were reorganized
- The fiber feeding method was revised
- We tracked every bale we used.









Shift:	1	Machine:	1	Liner Pulper	1	Filler Pulper	1
	2		2		2		2
	3				3		
					4		
Grade(s) Running:							
Operator:							

### Pulper Data Entry

Grade and Pulper settings

Grade

Bending Chip

...

Pulper

Filler\_Pulper\_1

...

Shift

PM

...

Operator

Joe

...

Edit Previous Entries

Bales - Previous

OCC	1998	07:12
OCC	1498	07:22
OCC	1898	07:32
OCC	1845	07:45
Filler NEWS	2031	08:09
Coated DLK	1776	08:21
Coated DLK	1996	08:38

Bales - In Progress

OCC	1927	08:52
OCC	1255	09:12
OCC	1482	09:32
OCC	1687	2:46:38 PM
NEWS	5672	2:47:40 PM

Weight (lbs)

1

Clear

1

2

3

4

5

6

7

8

9

0

Fiber Type

DLK

...

Next Bale Pick

OCC

OCC

OCC

OCC

NEWS

DLK

DLK

Restart Recipe

Submit

Talk OFF

Sorry, did not understand on the new you

05-Nov-2009 2:00 PM

Liner TOP

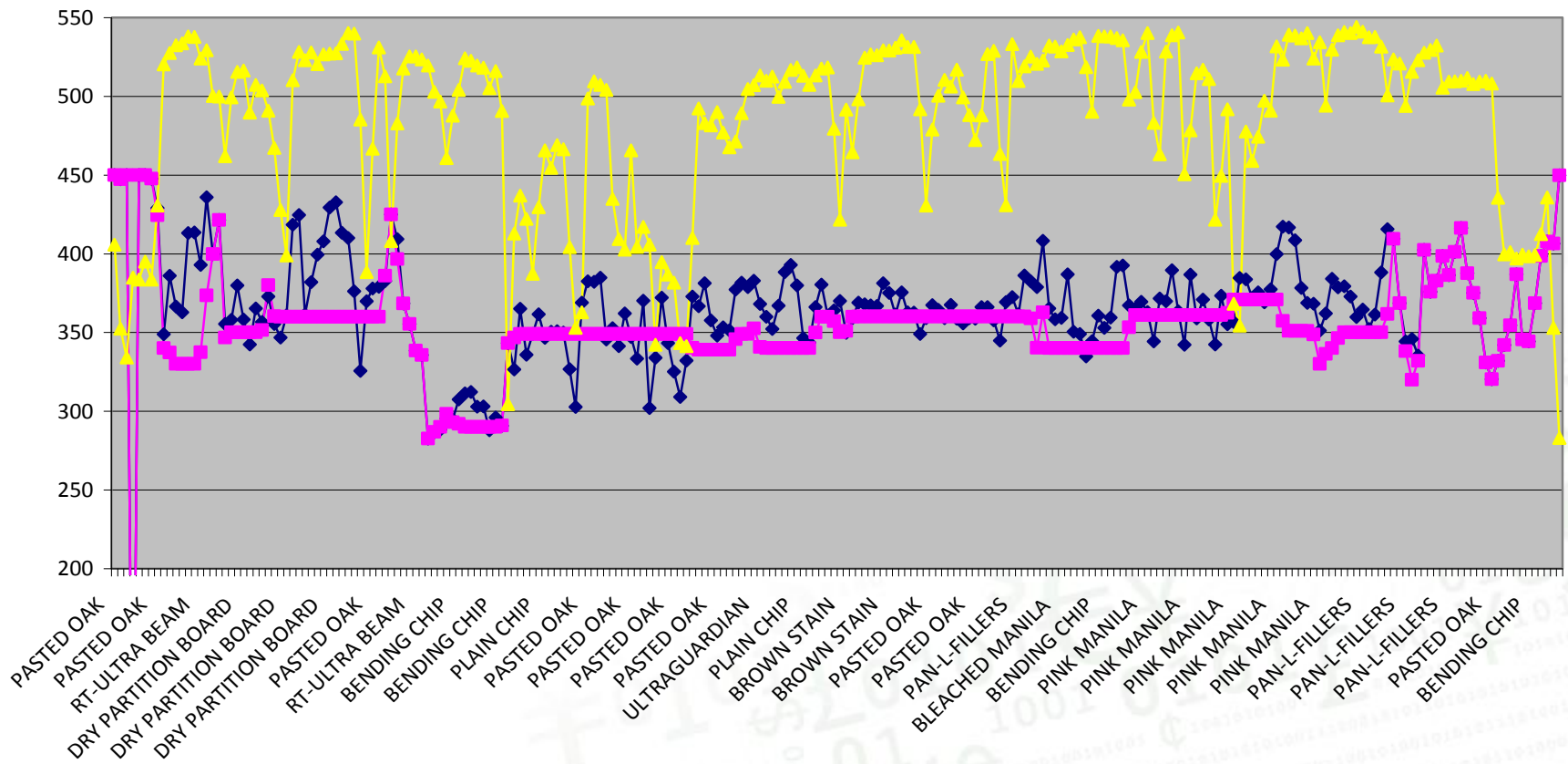
# Stock Prep/Machine Management

- With fiber feed managed stock consistency variation decreased
- Run stock refiners in automatic rather than manual
- Utilize PI ProcessBook and RtAlerts to provide real time information and process alerts

# #1 PM Filler Refiner Control - 2009

#1PM 600HP Filler Refiner Freeness

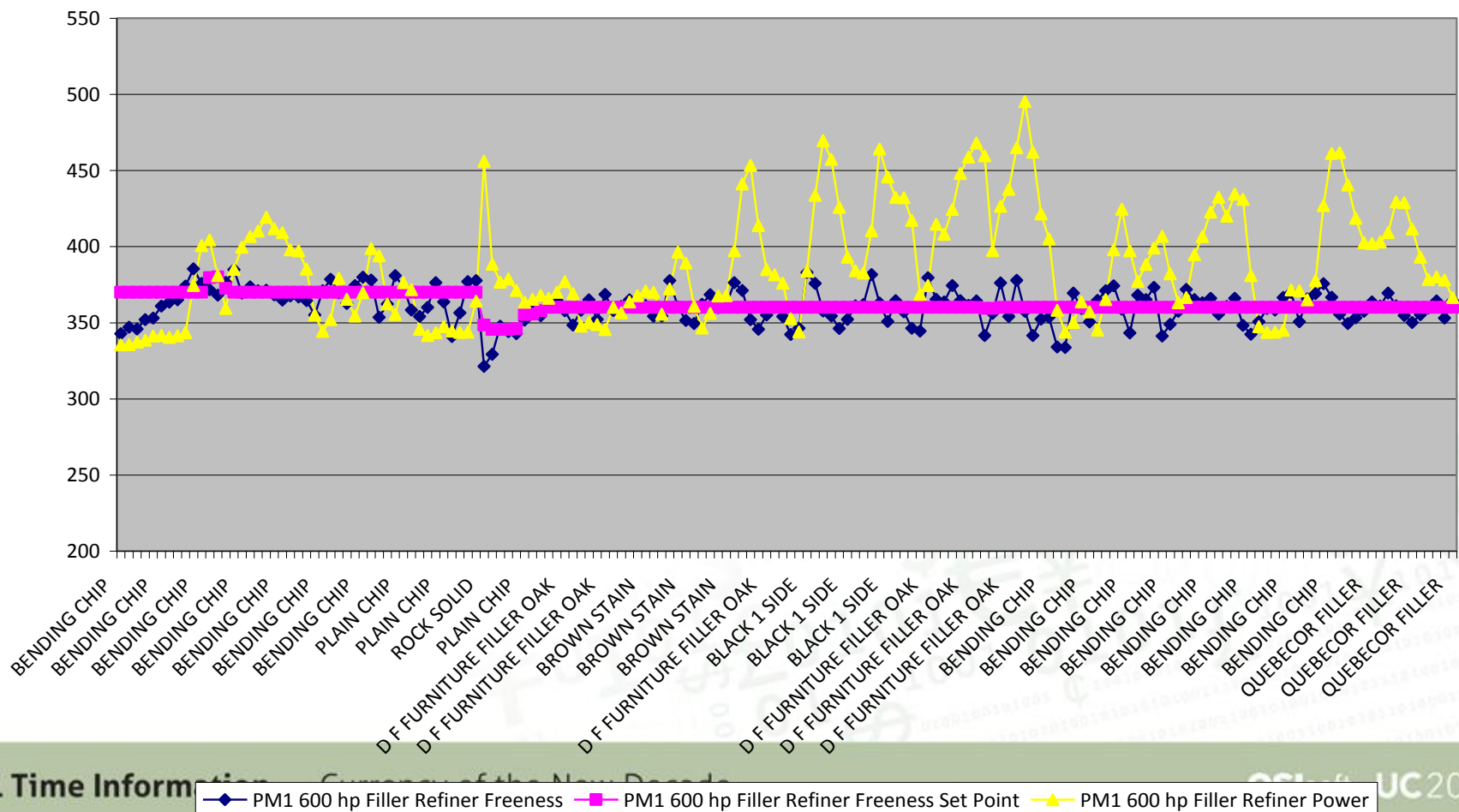
2/9/09 - 2/13/09



# #1PM Filler Refiner Control - 2010

#1PM 600HP Filler Refiner Freeness

2/5/10 - 2/9/10



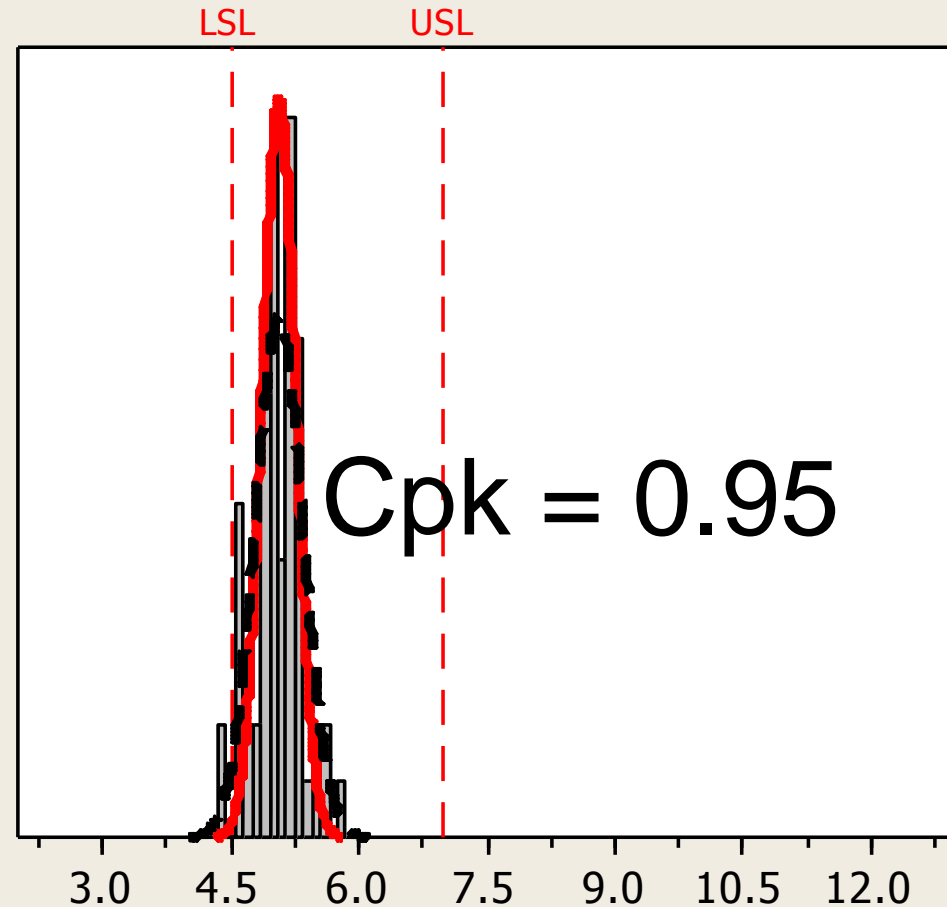
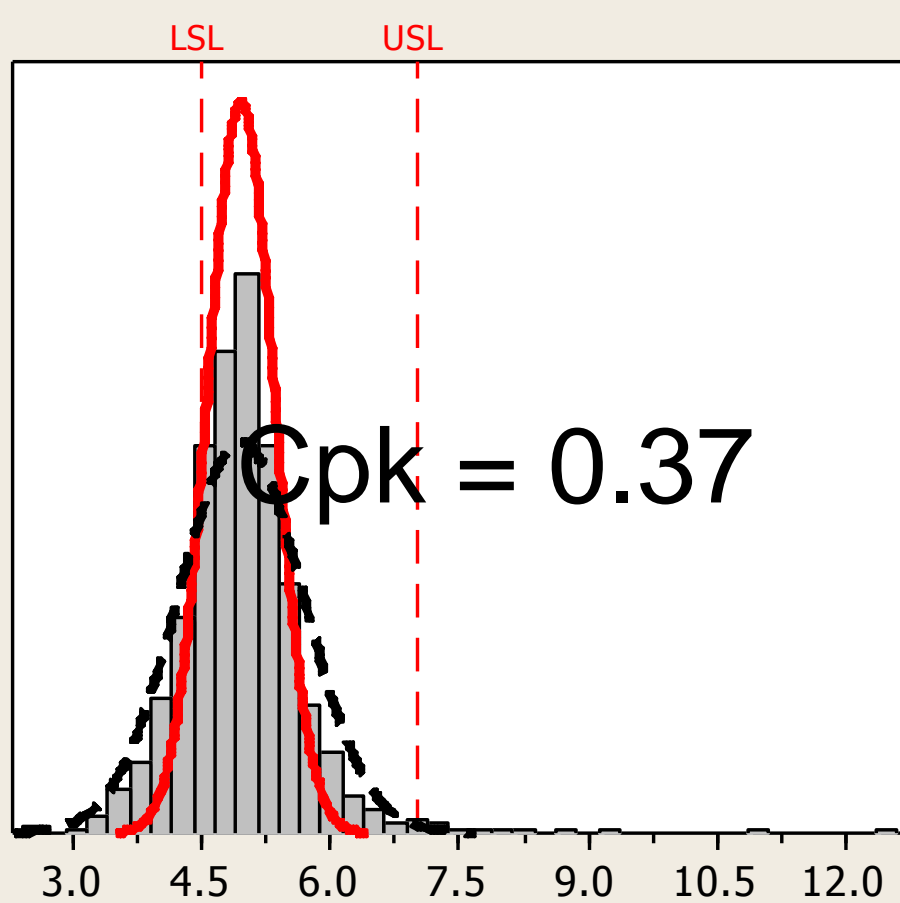
# Project Results – Capability Improvements

- 21.2% over all improvement in caliper process capability
- 10.4% over all improvement in moisture process capability
- Reduced beater tons due to variation and out of spec material

# Grade B

Before

After

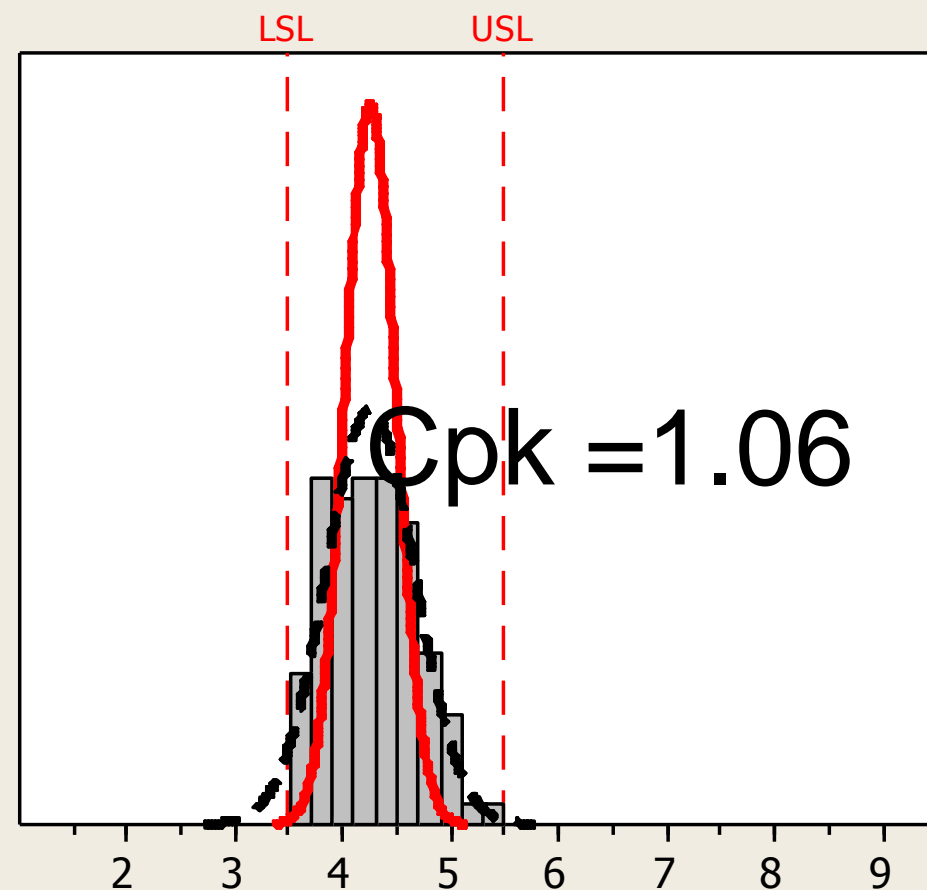
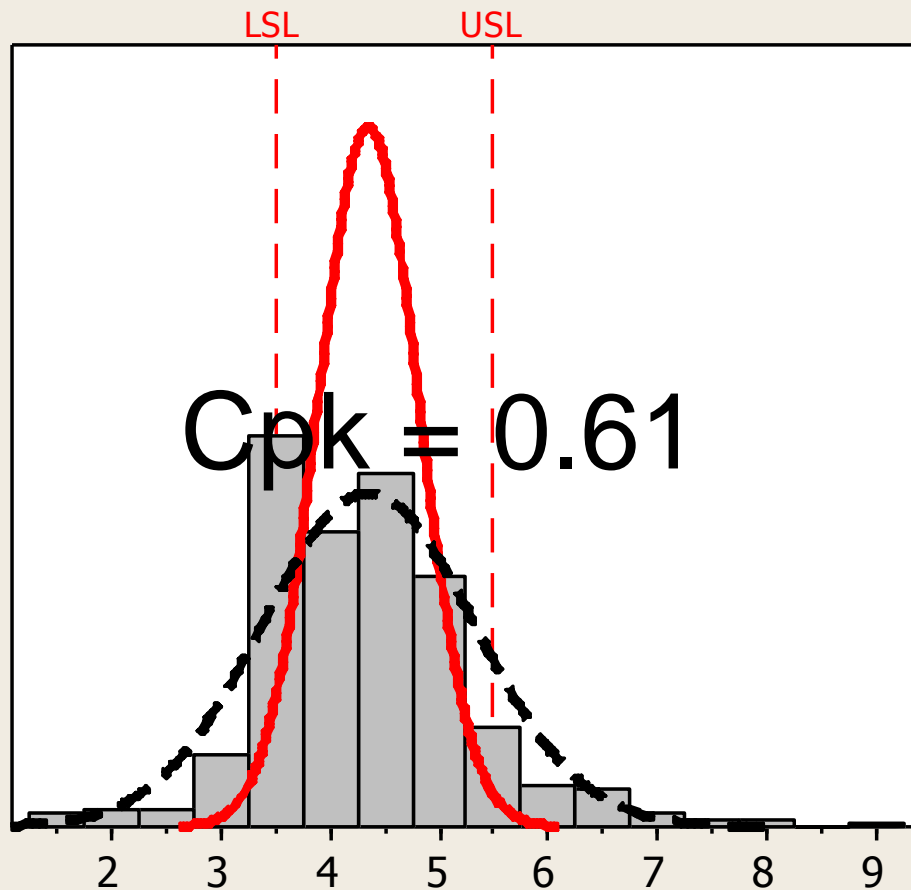




# Grade C

Before

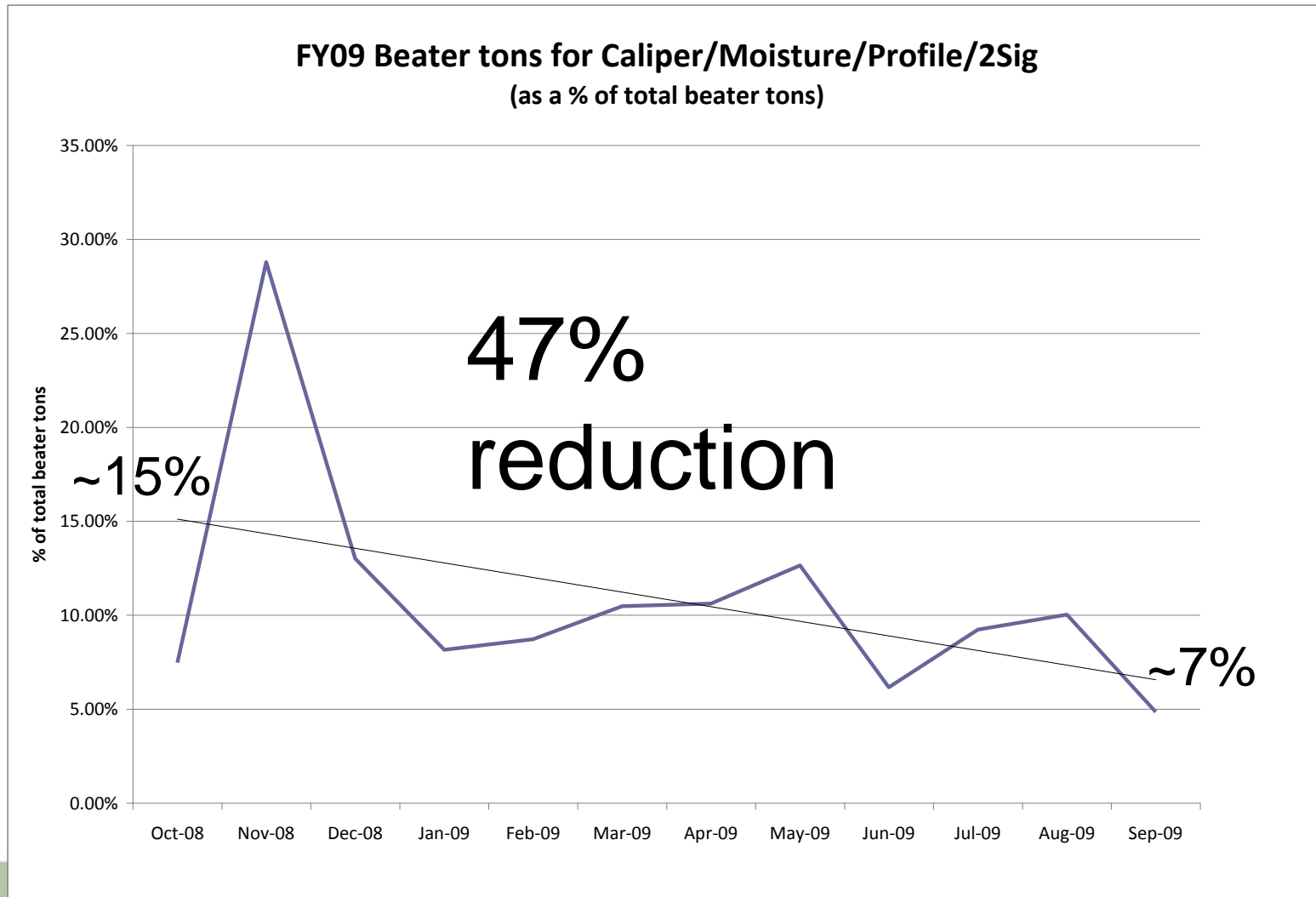
After



# Project Results – Value of Better Process Capability

- More consistent product for our customers
- More consistent process for better production efficiency

# Project Results – Reduced Beater Tons



# Sustainability

## PM1 *Moisture*

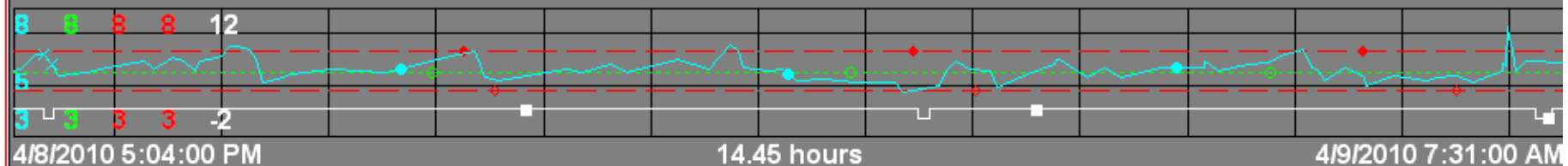
Grade	Caliper	Start Time	Minutes
<input type="checkbox"/> BENDING CHIP .018	0.018	4/9/2010 7:31:00 AM	170
<input checked="" type="checkbox"/> DURAFIBRE FFO .0245	0.0245	4/8/2010 2:04:00 PM	1047
<input type="checkbox"/> ULTRA BEAM .030	0.03	4/8/2010 3:07:00 AM	657

Reel Number 4/9/2010 9:28:00 AM  
 Spec RT110D0161  
 TAN BENDING CHIP .018

Moisture LSL target USL  
 5.00 6.00 7.00

Grade Run Selected  
**DURAFIBRE FFO .0245**

### Moisture



### SQC-Caliper : [Individuals]

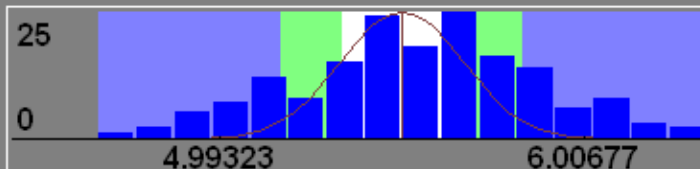
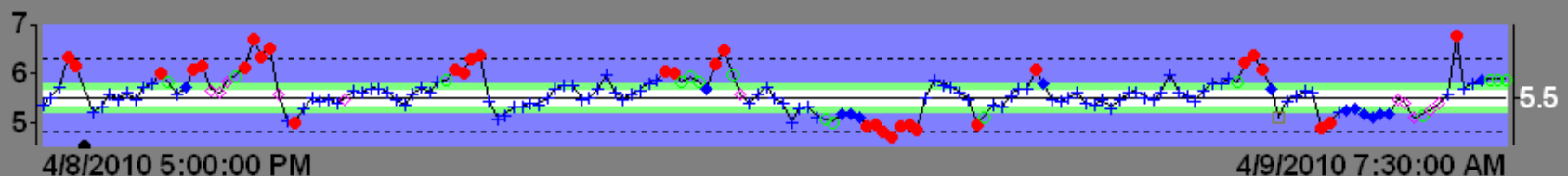


Chart Tag: PR:PM1-PMRL.OPR:MIUSL/LSL: 6.3 / 4.8  
 PM1 Reel Moisture STDEV: 0.37517  
 Value: 5.88141 Cpk: 0.63188  
 Eng. Units: %





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Thank you

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