

The Proper (and Improper) Use of OEE Metrics

Presenter: John Kravontka

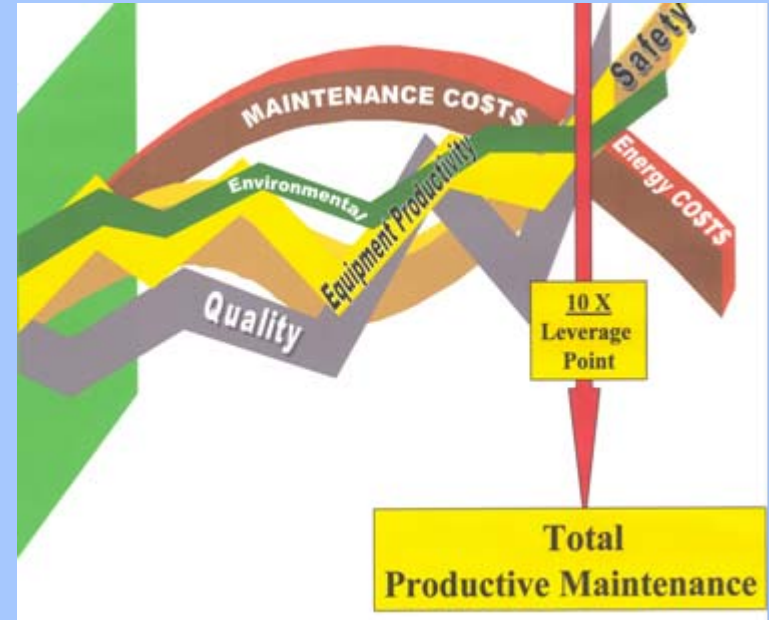
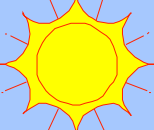
President, Fuss & O'Neill Manufacturing Solutions

The 2nd webcast in a 5-part series:

The Real TPM: Beyond Autonomous & Preventative Maintenance

Sponsored by:



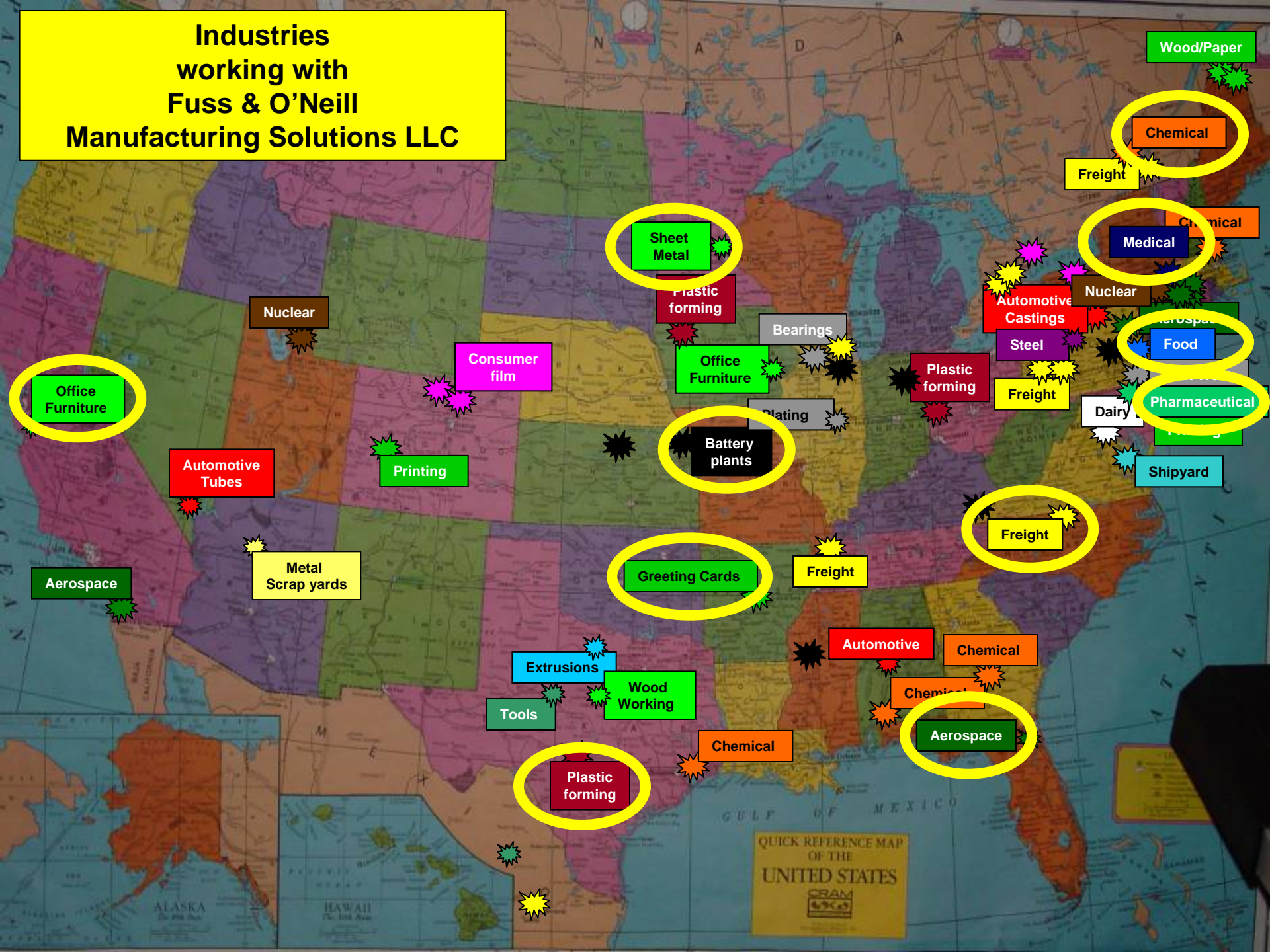


Overall Equipment Effectiveness

 **FUSS & O'NEILL**
Manufacturing Solutions
"Enhancing Productivity"

10/8/08

Industries working with Fuss & O'Neill Manufacturing Solutions LLC



In the U.S. each year:

- **Equipment productivity < 50%**
- **Over \$200 billion spent on wasteful maintenance related practices.**

Definition :

TPM is a process that maximizes the productivity of equipment for its entire life.

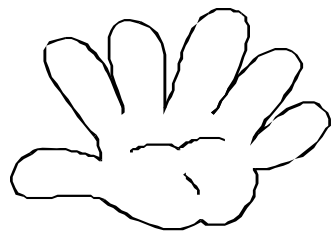
TPM fosters an environment where improvement efforts in Safety, Quality, Cost, Delivery and Creativity, are encouraged, through the participation of all employees.

OEE

Overall Equipment Effectiveness

How effectively does your equipment run? When you plan to run it?

OEE =
Availability X Performance Efficiency X Rate of Quality

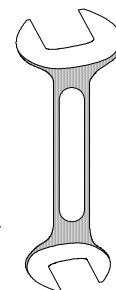
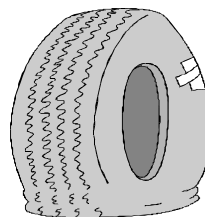


SIX

MAJOR LOSSES

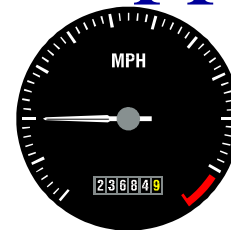
Availability

- Breakdowns
- Setup & Adjustment



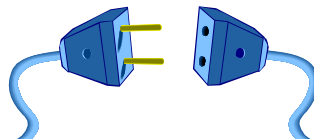
Performance

- Idling & Minor Stoppages
- Reduced Speed

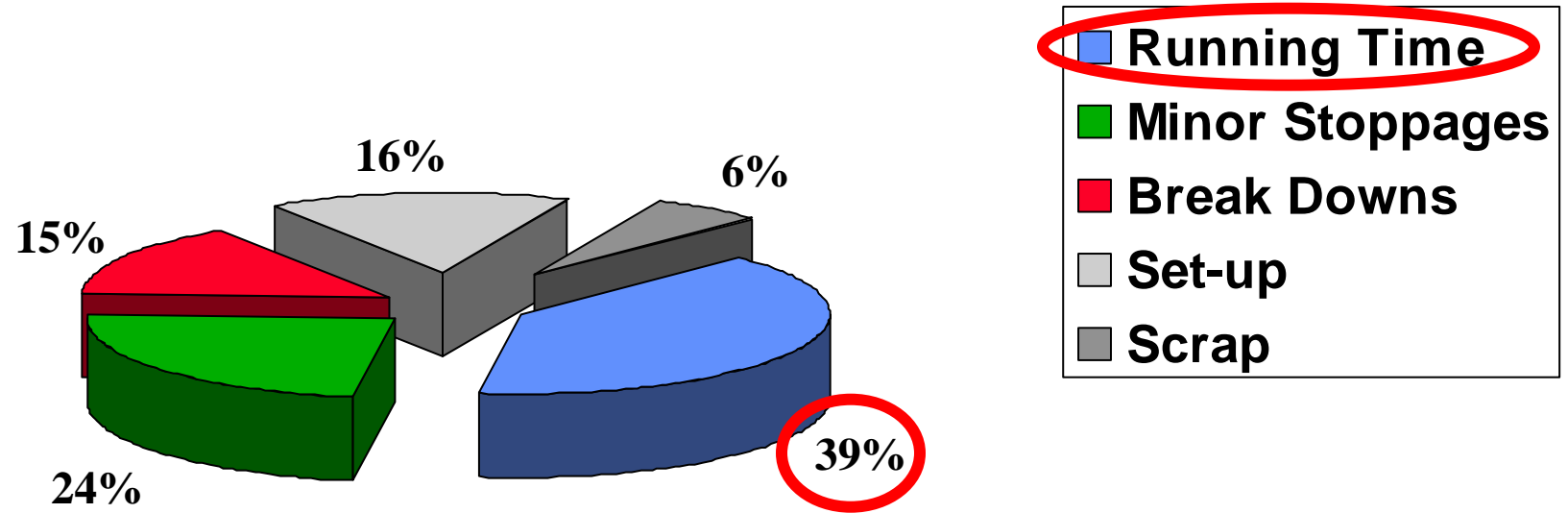


Rate of Quality

- Start-up
- Quality Defects & Rework



Typical Overall Equipment Effectiveness



Lost Capacity - 60%

PRODUCTION REPORT

DATE: 3-10-98

TIME	START	STOP	PRODUCTION	REASON FOR	CORRECTIVE MEASURES
1	6:00-7:00	450	300	10	
2	7:00-8:00	500	350	10	
3	8:00-9:00	500	350	10	
4	9:00-10:00	450	300	10	
5	10:00-11:00	500	350	10	
6	11:00-12:00	500	350	10	
7	12:00-1:00	450	300	10	
8	1:00-2:00	500	350	10	
TOTAL FOR DAY			3500	2450	10

1	2:00-3:00	500	350	10	
2	3:00-4:00	500	350	10	
3	4:00-5:00	500	350	10	
4	5:00-6:00	500	350	10	
5	6:00-7:00	500	350	10	
6	7:00-8:00	500	350	10	
7	8:00-9:00	500	350	10	
8	9:00-10:00	500	350	10	
TOTAL FOR DAY			3500	2450	10
1	10:00-11:00	450	300	10	
2	11:00-12:00	450	300	10	
3	12:00-1:00	450	300	10	
4	1:00-2:00	450	300	10	
5	2:00-3:00	450	300	10	
6	3:00-4:00	450	300	10	
7	4:00-5:00	450	300	10	
8	5:00-6:00	450	300	10	
TOTAL FOR DAY			3500	2450	10
TOTAL					

PRODUCTION REPORTING

DATE: 8-10-99 Tuesday				REASON WHY	CORRECTIVE MEASURES
TIME	TARGET	ACTUAL	DIFFERENCE		
1 6:50-7:50	450	360	90		
2 7:50-8:50	300	180	120		
3 8:50-9:50	450	468	+18		
4 9:50-10:50	450	360	-90		
5 10:50-11:50	300	144	-156		
6 11:50-12:50	450	288	-162		
7 12:50-1:50	450	324	-126		
8 1:50-2:50	350	144	-206		
TOTAL 1st Shift	3200	2332	-868		
			-30/6		



CAUTION
NOT OPERATE
THIS MACHINE
WITHOUT
GUARDS IN PLACE

WARNER / SWASEY GRAB

WARNER / SWASEY GRAB RM/80

GE Fanuc

OEE OBSERVATION FORM

Date _____

Equipment # _____ Description Vertical Turret Lathe Dept. _____ Observer _____

Start	End	Run	Idling & Hidden Loss				Breakdowns			Setup	Speed	Reject	Comments
			Chips	Jam	Insert	Other	Lube		Other	Adj.	Loss		
6:50	7:20												Lunch
7:20	8:50						90						
8:50	9:00	10											
9:00	9:10		10										
9:10	9:30			20									
9:30	9:40	10											
9:40	10:55								75				
10:55	11:05	10											
11:05	11:35			30									
11:35	11:45	10											
11:45	12:00					15							
Totals		369	225				140			150		56	

Equipment Utilization

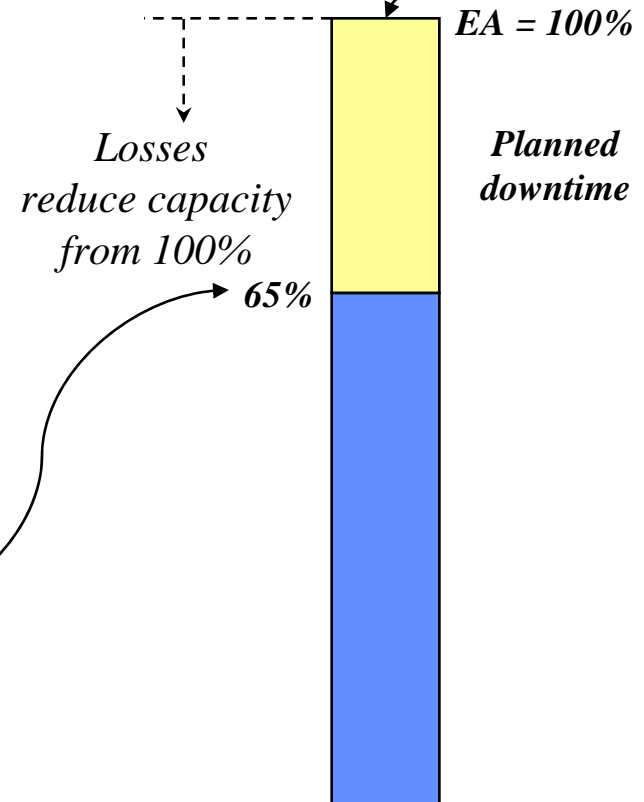
Equipment Availability = 1440 minutes (24 hours)

Planned Downtime

No 3rd shift = 420 Min.
Lunch (2 shifts) = 60 Min.
Dept. Meetings = 20 Min.
Total = 500 Min.

1440 Min. - 500 Min. = 940 Min.
(Running Time)

$\frac{940}{1440} = 65.3\%$ Equipment Utilization



This is where OEE Starts!

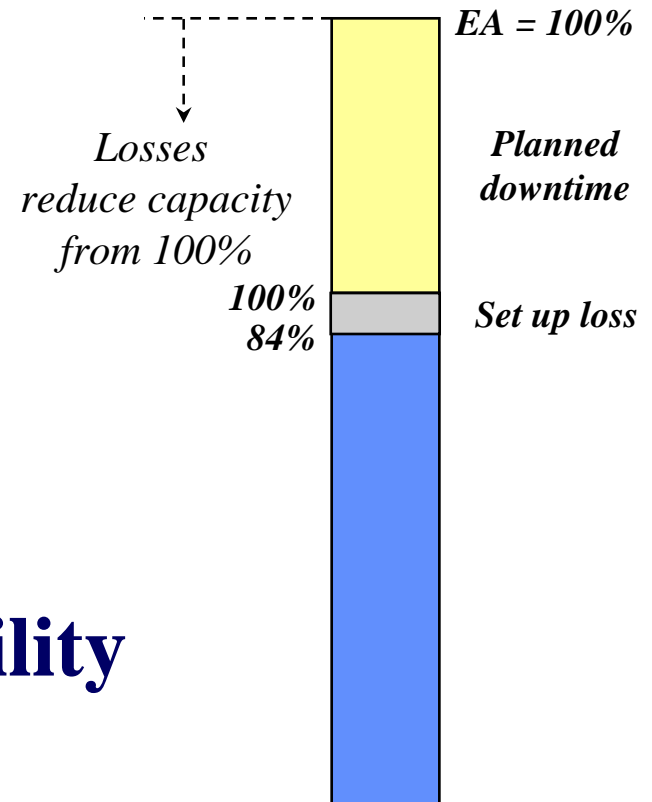
Planned Availability

940 Min. (Running Time)

- 150 Min. (Set Up)

790 Min. (Planned Availability)

$$\frac{790}{940} = 84.0\% \text{ Planned Availability}$$



Uptime

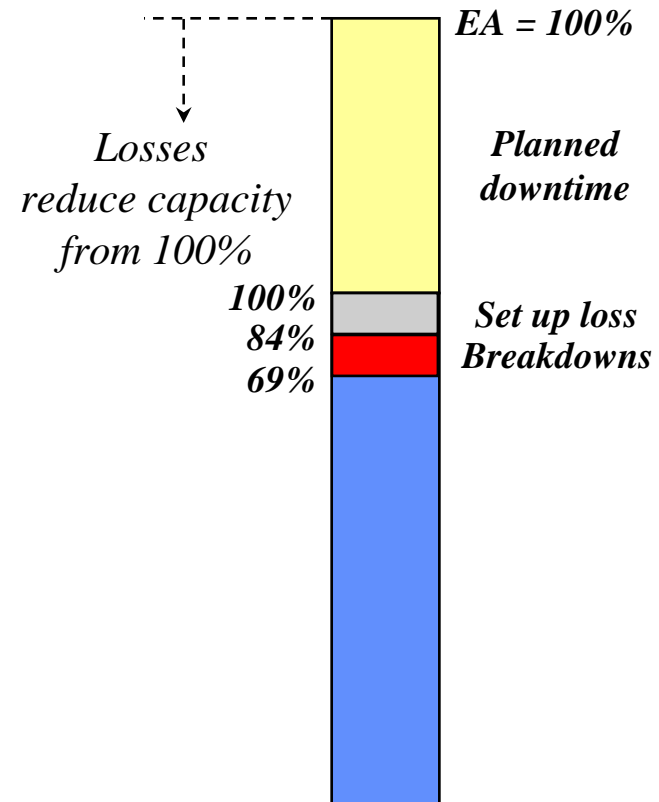
790 Min. (Operating Time)
- 140 Min. (Breakdowns)

650 Min. (Net Operating Time)

650 = **82.3%** Uptime
790

84.0% Planned
Availability
x
82.3% Uptime

69.1% Availability

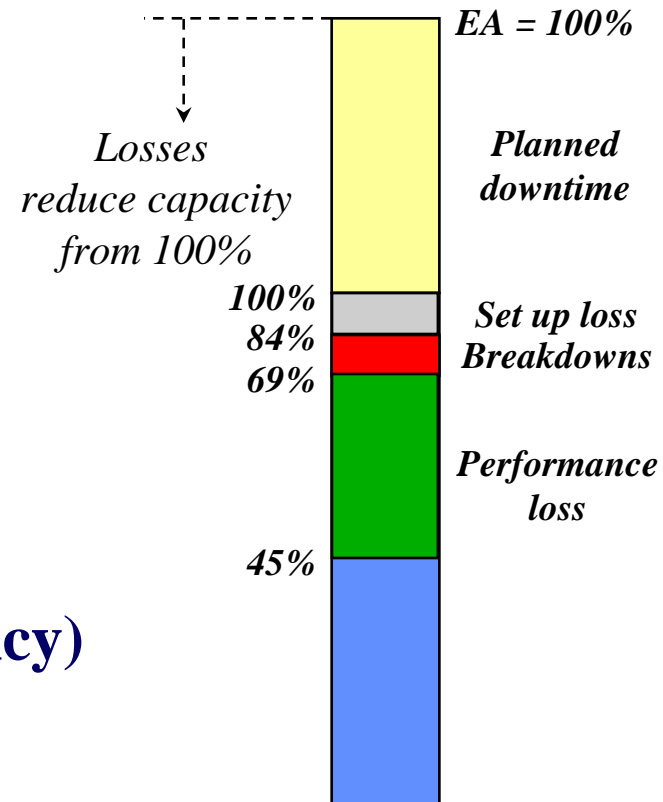
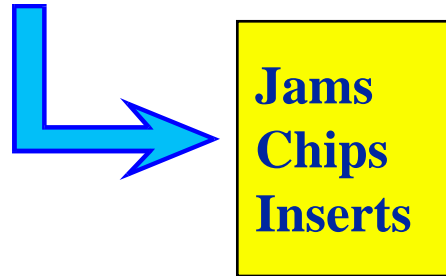


Performance Efficiency

650 Min. (Net Operating Time)

- 225 Min. (Minor Stoppages)

425 Min.



$$\frac{425}{650} = 65.4\% \text{ (Performance Efficiency)}$$

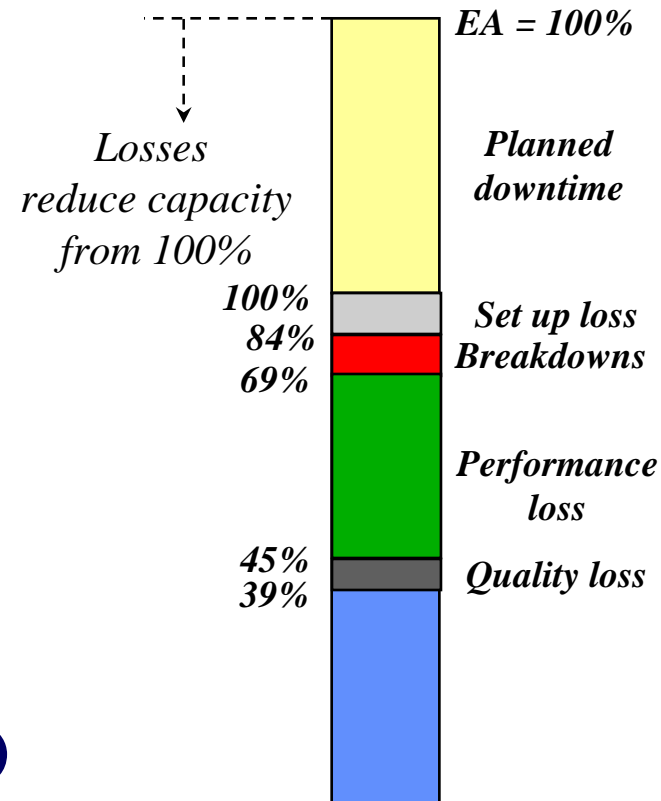
425 Min. is also called Usable Operating Time

Rate of Quality



425 Min. (Usable Operating Time)
- 56 Min. (Time Used Manufacturing
369 Min. a Defective Part)

$$\frac{369}{425} = 86.8\% \text{ (Rate of Quality)}$$



OEE

Overall Equipment Effectiveness

69.1% (Availability)

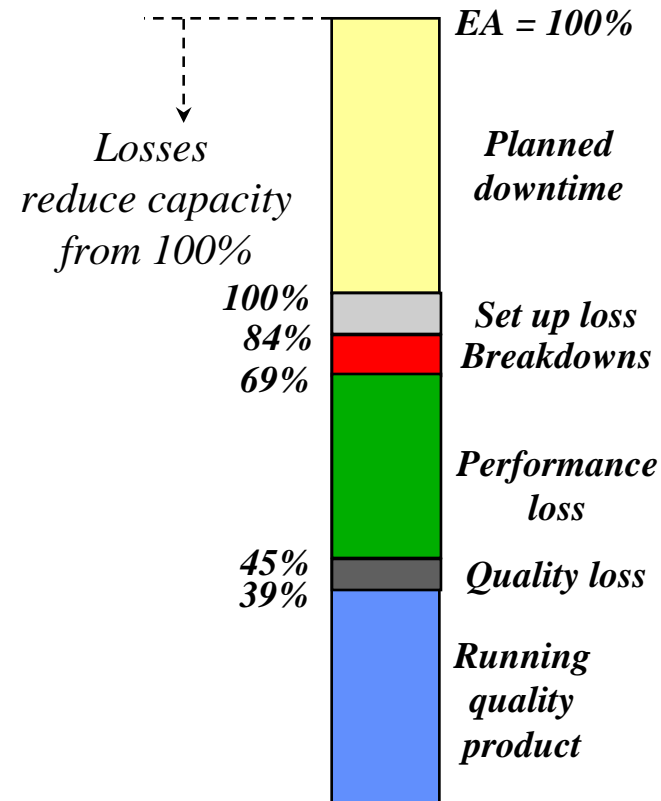
X

65.4% (Performance Efficiency)

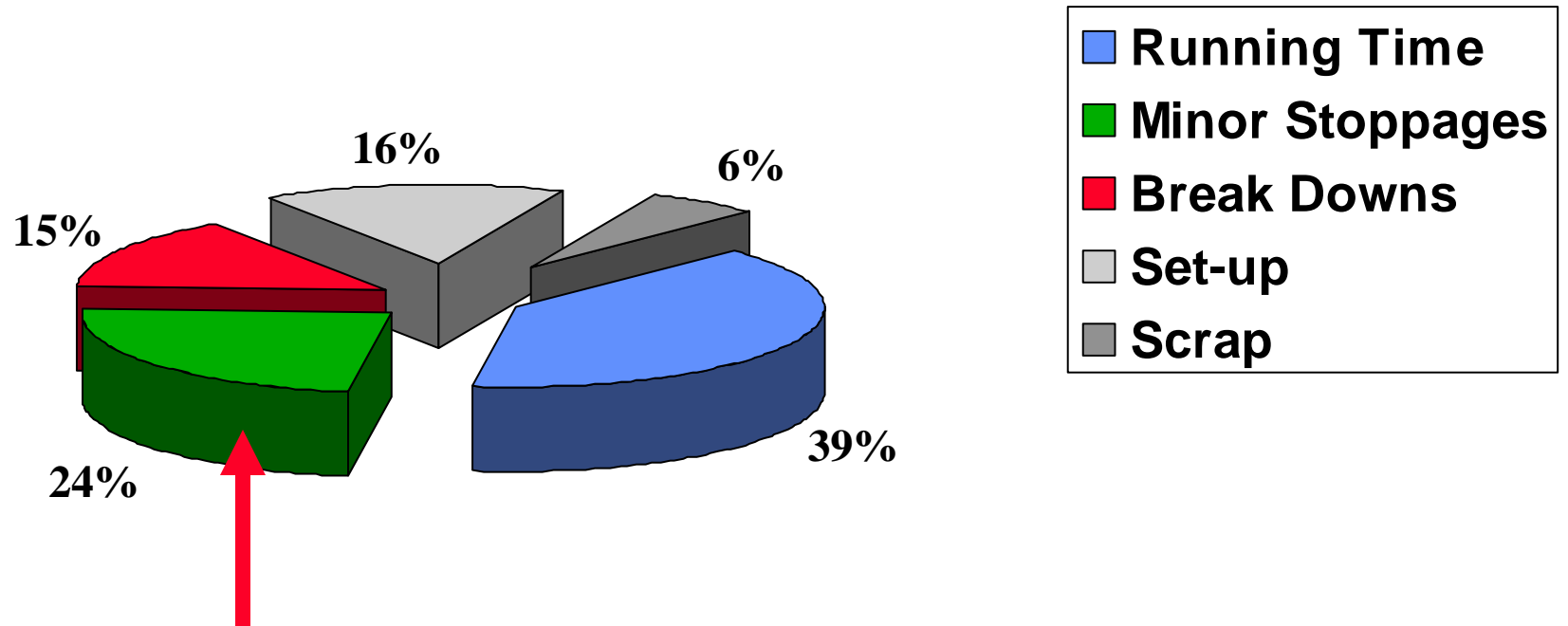
X

86.8% (Rate of Quality)

39.2% OEE



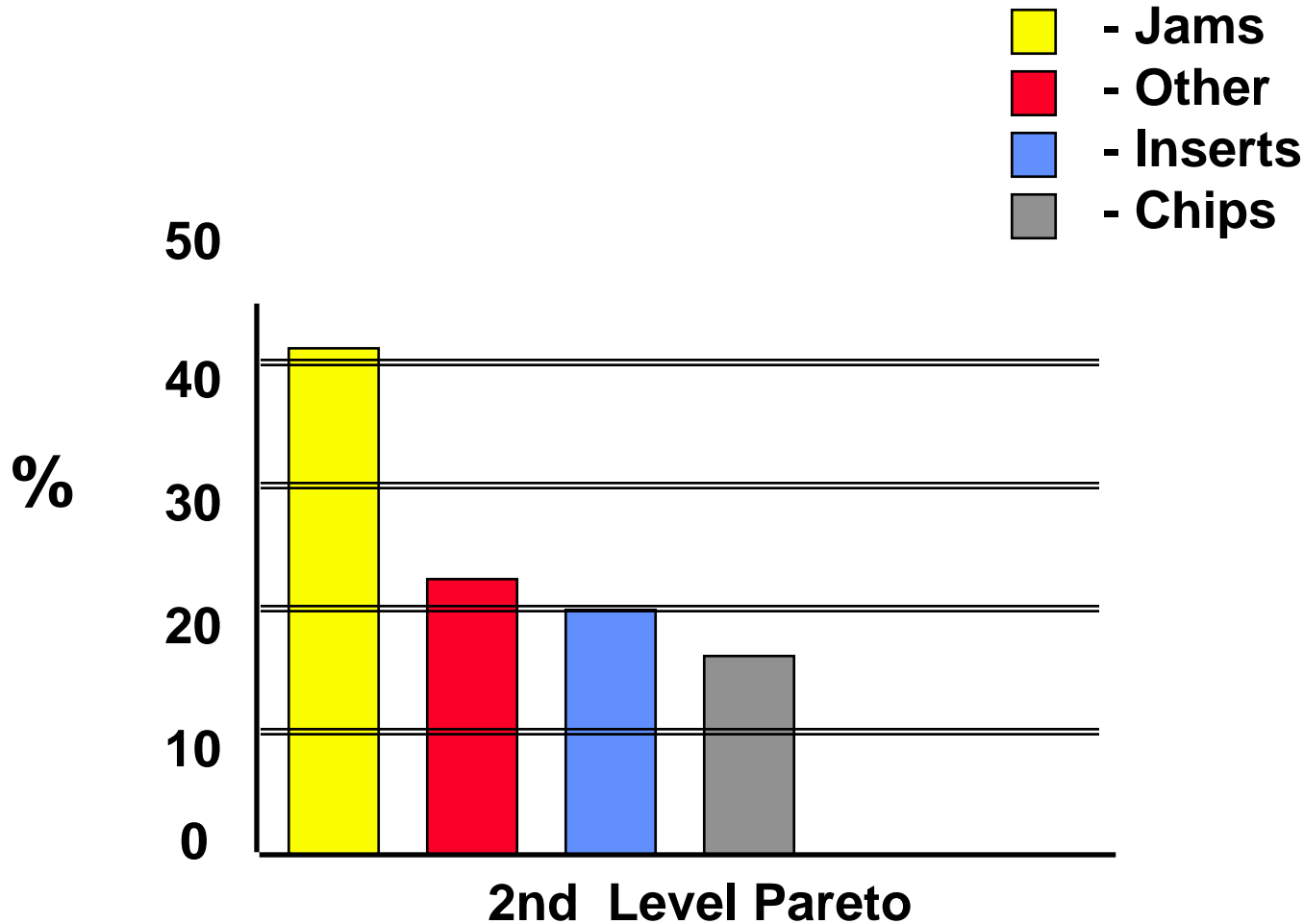
Typical Overall Equipment Effectiveness



Lost Capacity - 60%

Pareto Analysis

Idling & Minor Stoppages



Improvement Plan

Case Study: Vertical Turret Lathe

Description of problem you are going to improve:

Too many minor stoppages interrupt the flow of work through the equipment and keep the operator from performing other tasks

List of questions you have:

How can we better measure the minor stoppages: number of stoppages, average time between stoppages, total stoppage time?

Summary of Action Steps:

- 1) Determine if the different stoppages are at all related to each other.
- 2) Implement 5S system to eliminate lack of cleanliness as cause of problems.
- 3) Get operators and maintenance personnel involved in developing a PM plan

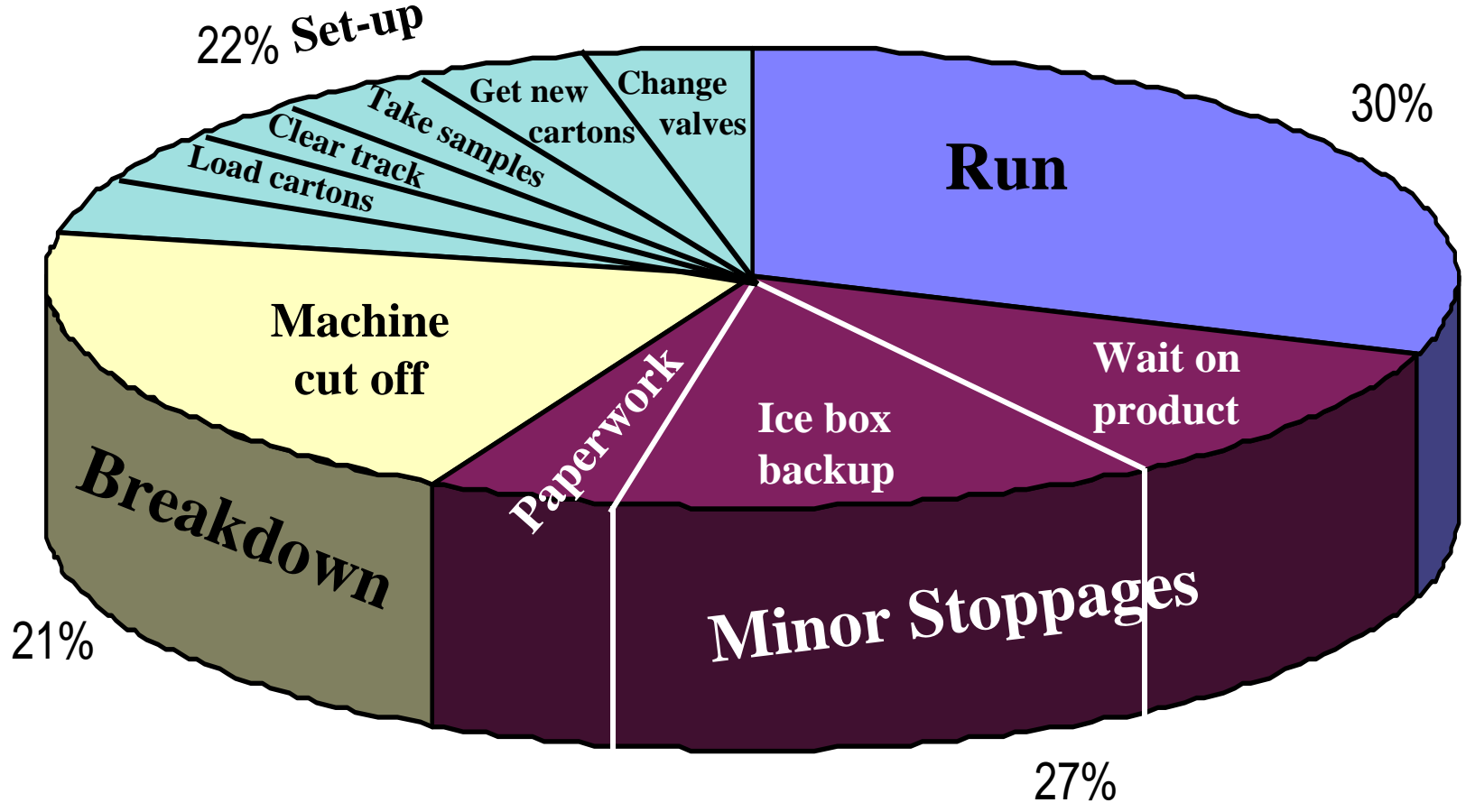
Plan to monitor improvements:

Observe the equipment running in its natural state. Get the operator and "team" involved. Prioritize improvements and implement or "trystorm" them. Continue to measure and identify any positive outcomes.

283 Minute OEE Observation Q-11

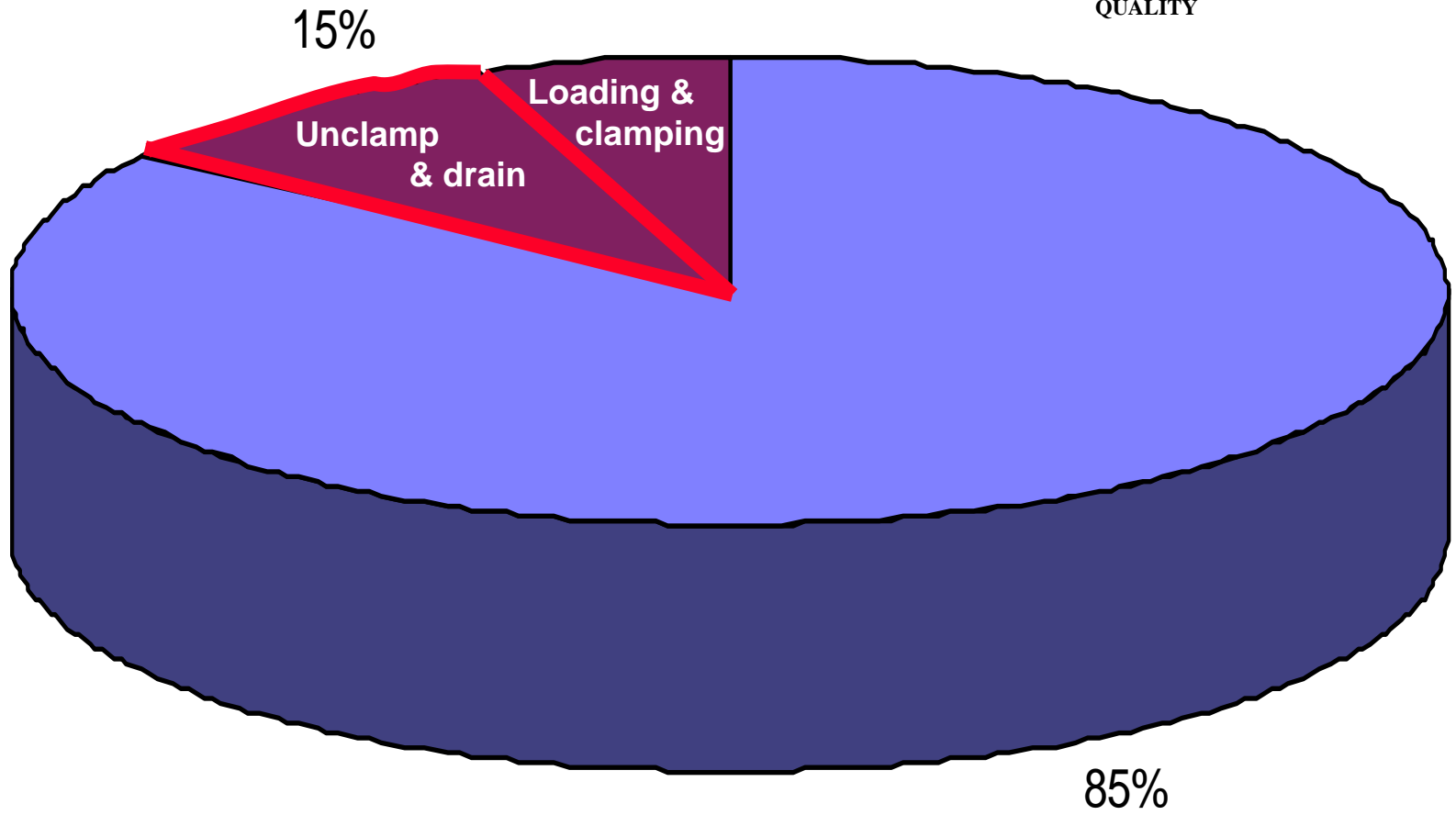
Monday 10/21/04

RUN TIME		31%
MINOR STOPPAGES		27%
BREAKDOWNS		21%
SET UP		22%
QUALITY		0%



Hone - 52 minute OEE observation

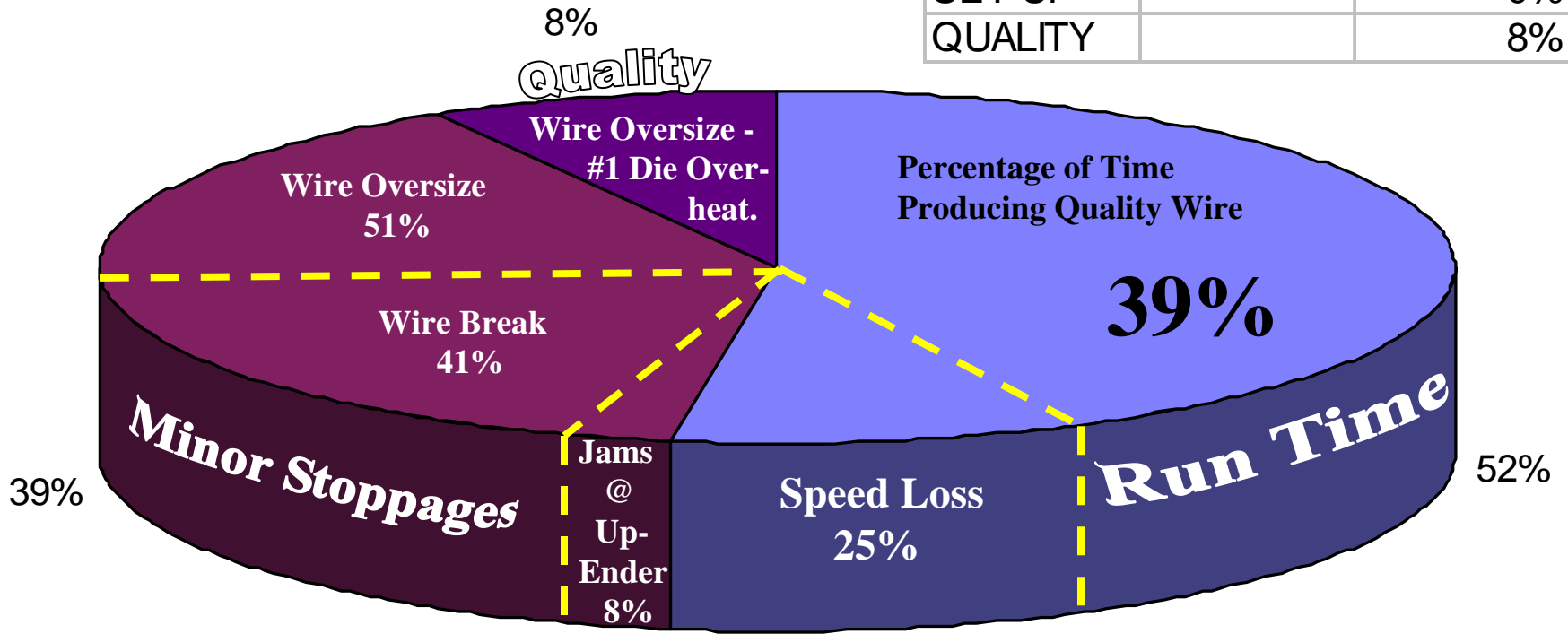
RUN TIME	85%
MINOR STOPPAGES	15%
BREAKDOWNS	0%
SET UP	0%
QUALITY	0%



Overall Equipment Effectiveness

Rod Breakdown #12

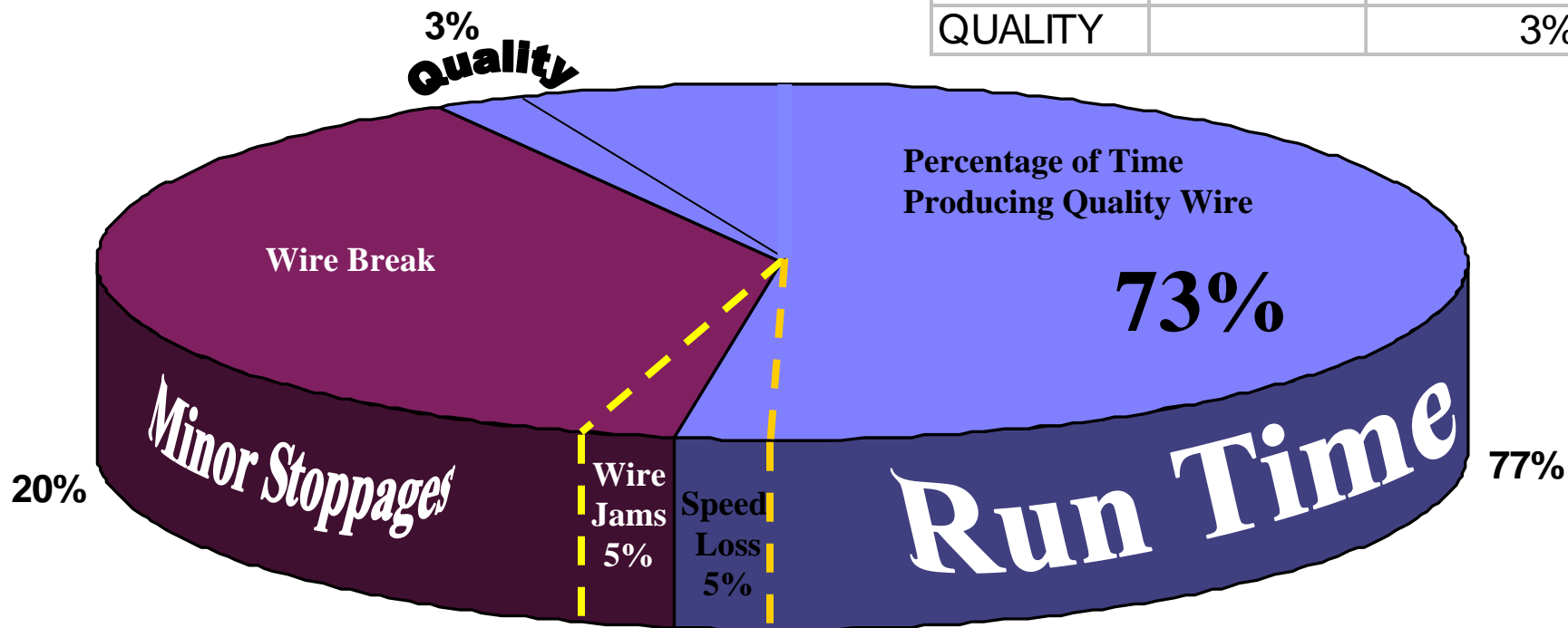
RUN TIME		52%
MINOR STOPPAGES		39%
BREAKDOWNS		0%
SET UP		0%
QUALITY		8%



Overall Equipment Effectiveness

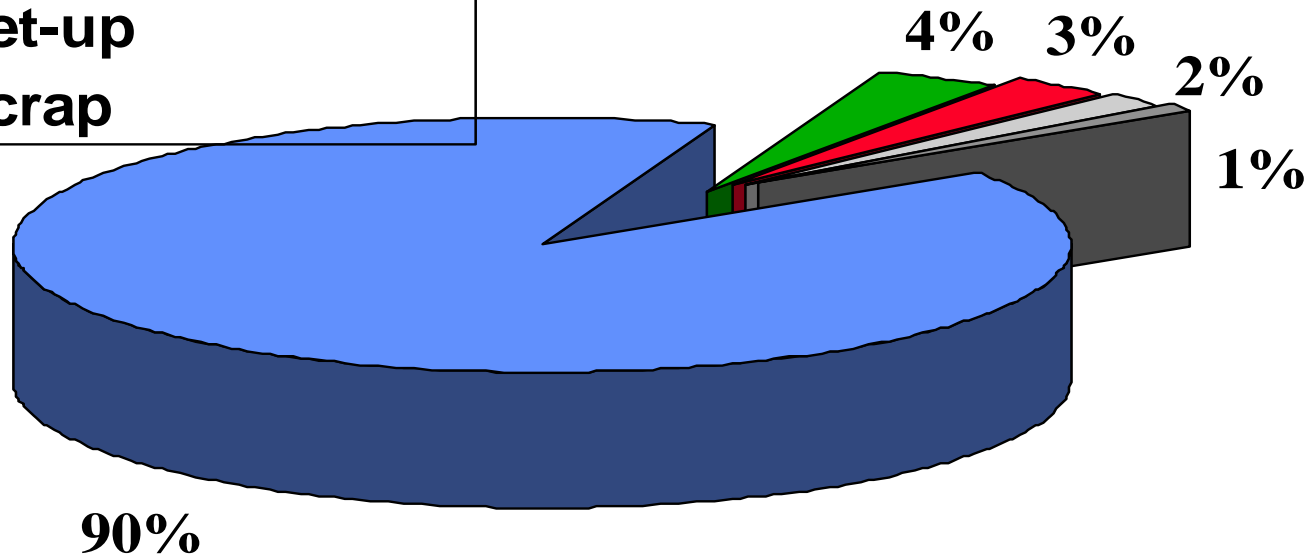
Rod Breakdown After Focused Improvement

RUN TIME		77%
MINOR STOPPAGES		20%
BREAKDOWNS		0%
SET UP		0%
QUALITY		3%



“World Class” O.E.E. Measurements

- Running Time
- Minor Stoppages
- Break Downs
- Set-up
- Scrap



The Same Equipment

More Capacity-130%

What Can You Accomplish with

O E E

- o **Identify Major Losses**
 - **A Road map to find problems & Enhance Your Capacity**
- o **Determine Current Output**
 - **Baseline Your Equipment**

Theoretical output of equipment is

500 parts per hour X 8 hours X 5 days = 20,000 parts/week

The equipment actually produces 11,000 parts per week, but 1,000 are scrapped out. We actually produce 10,000 parts per week.

$$\text{OEE} = 10,000 / 20,000 = \underline{50\%}$$

Plant manager wants 75% OEE in the next 6 months.....

What do you do?

Revisit the equation... of course.....

500 parts per hour can be produced, but out of the 8 hours per day:

1st 15 minutes of the day is production meeting, and last 15 minutes of the day is clean up.

**The plant also has (2) 15 minute breaks per day.
This brings 8 hours per day to 7 hours per day.**

Maintenance performs a 2 hour PM once per week.

500 parts per hour X 7 hours per day x 5 days = 17,500 parts.

Subtract 1,000 parts for the 2 hours of PM and we have a total potential of 16,500 parts per week.

OEE = 10,000 / 16,500 = 61%

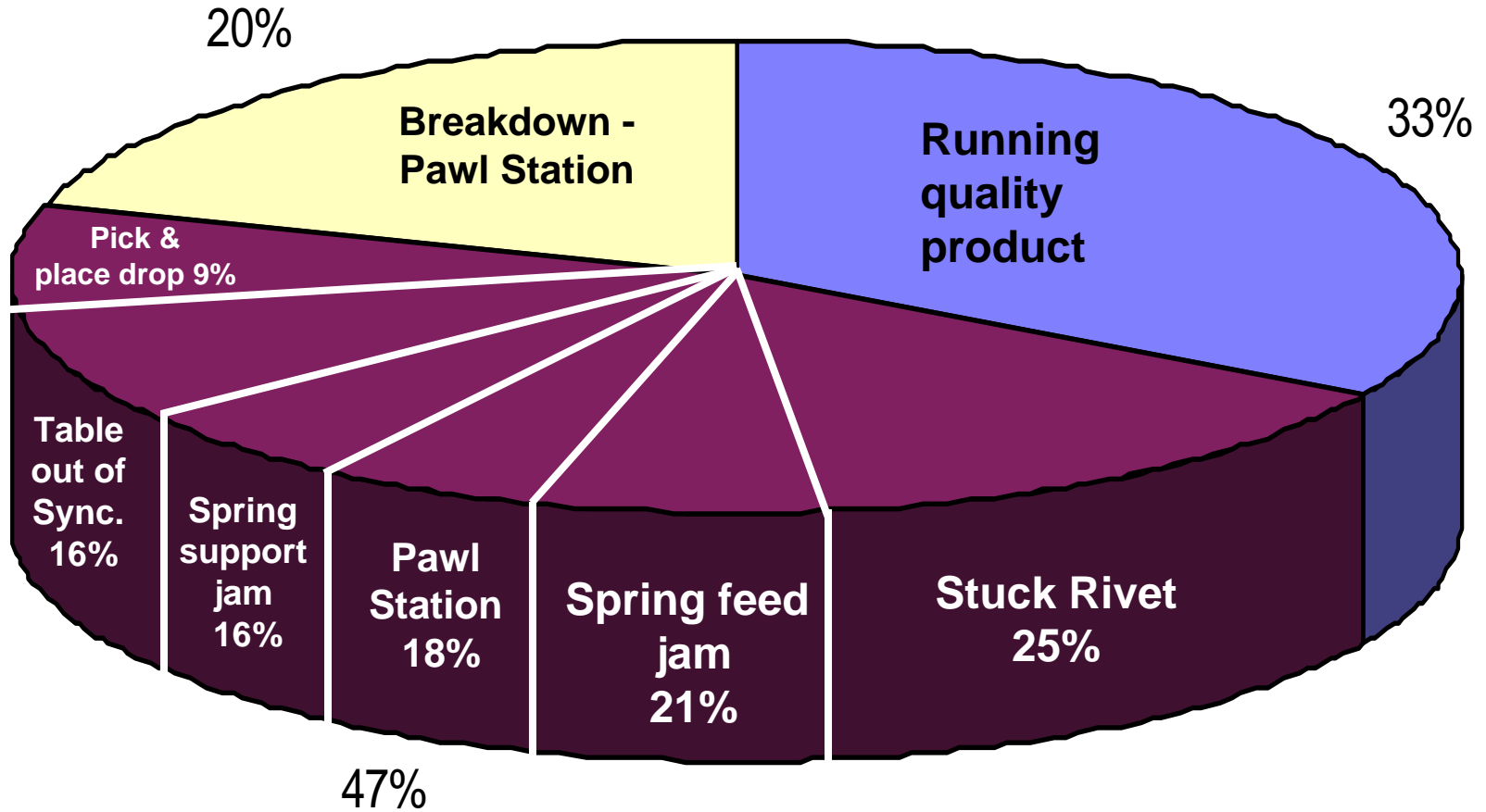
OEE & Preventive Maintenance Condition Based...

C-3 60 minute OEE observation 7/13/04

100 made

1st Study

RUN TIME	33%
MINOR STOPPAGES	47%
BREAKDOWNS	20%



C3 MACHINE MONTHLY CLEAN AND INSPECTION.

- 1) CHECK TIGHTNESS AND ALIGNMENT OF ALL MECHANISMS ESP. TRANSFER.....
- 2) CHECK ALL OPTICAL SENSORS ARE CLEAR OF DIRT OR OBSTRUCTIONS (USE COTTON BUD).....
- 3) VISUAL CHECK INTEGRITY OF CABLING AND PIPING TO MOVABLE STATIONS.....
- 4) CLEAN OUT VACUUM GENERATOR FILTERS ON BOTH TABLES.....

===HEALTH & SAFELY===

WEAR GLOVES AND SAFETY GLASSES

HEALTH & SAFETY DATA SHEETS (C.D.S.H.H.) ARE KEPT IN CLIP FOLDER IN WALL MOUNTED BOX UNDER STAIRS LEADING UP TO CANTEEN

CONTACT ENVIRONM

OPERATION, DATA, D
TECHNICIAN DEPART

PLASTIC UNIT PROD

RODUCTION ENGINEERING

E.....

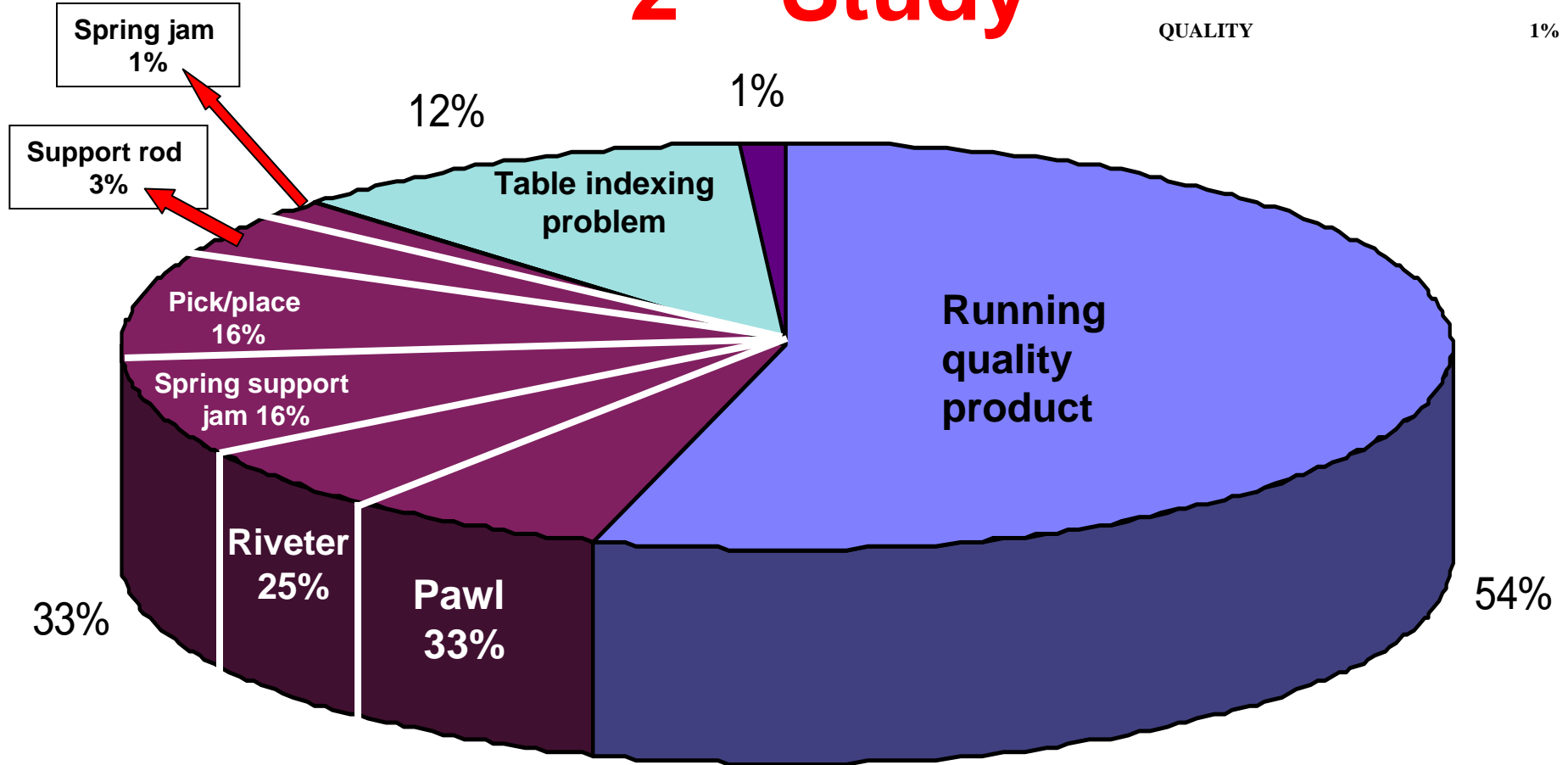
- We need to:**
- **Modify the PM**
 - **Collect data before the PM**
 - **Perform the PM with the Operator....**

C-3 60 minute OEE observation 7/14/04

200 made

2nd Study

RUN TIME	55%
MINOR STOPPAGES	33%
SET UP	12%
QUALITY	1%

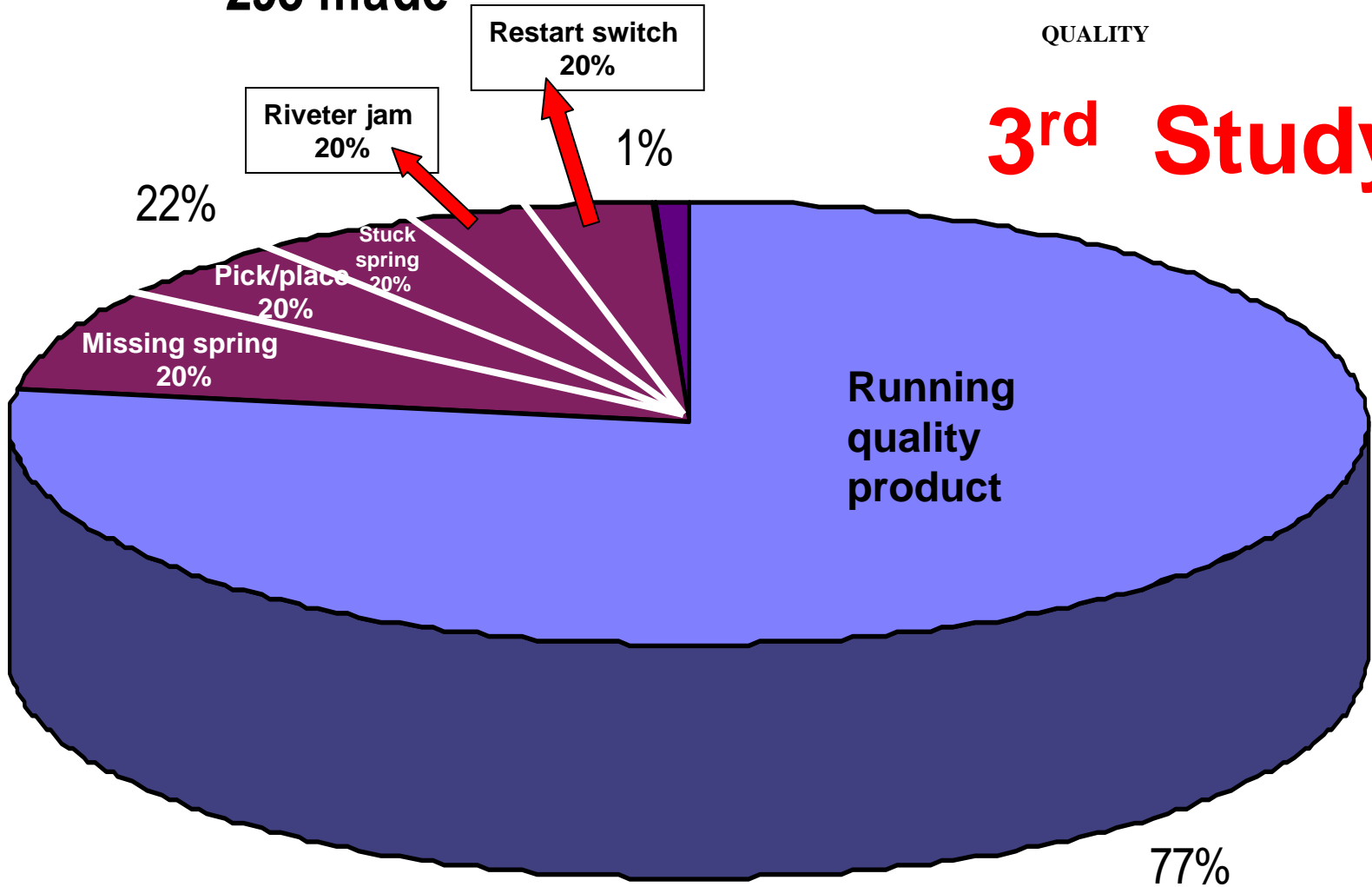


C-3 60 minute OEE observation 7/15/04

298 made

RUN TIME	78%
MINOR STOPPAGES	22%
QUALITY	1%

3rd Study

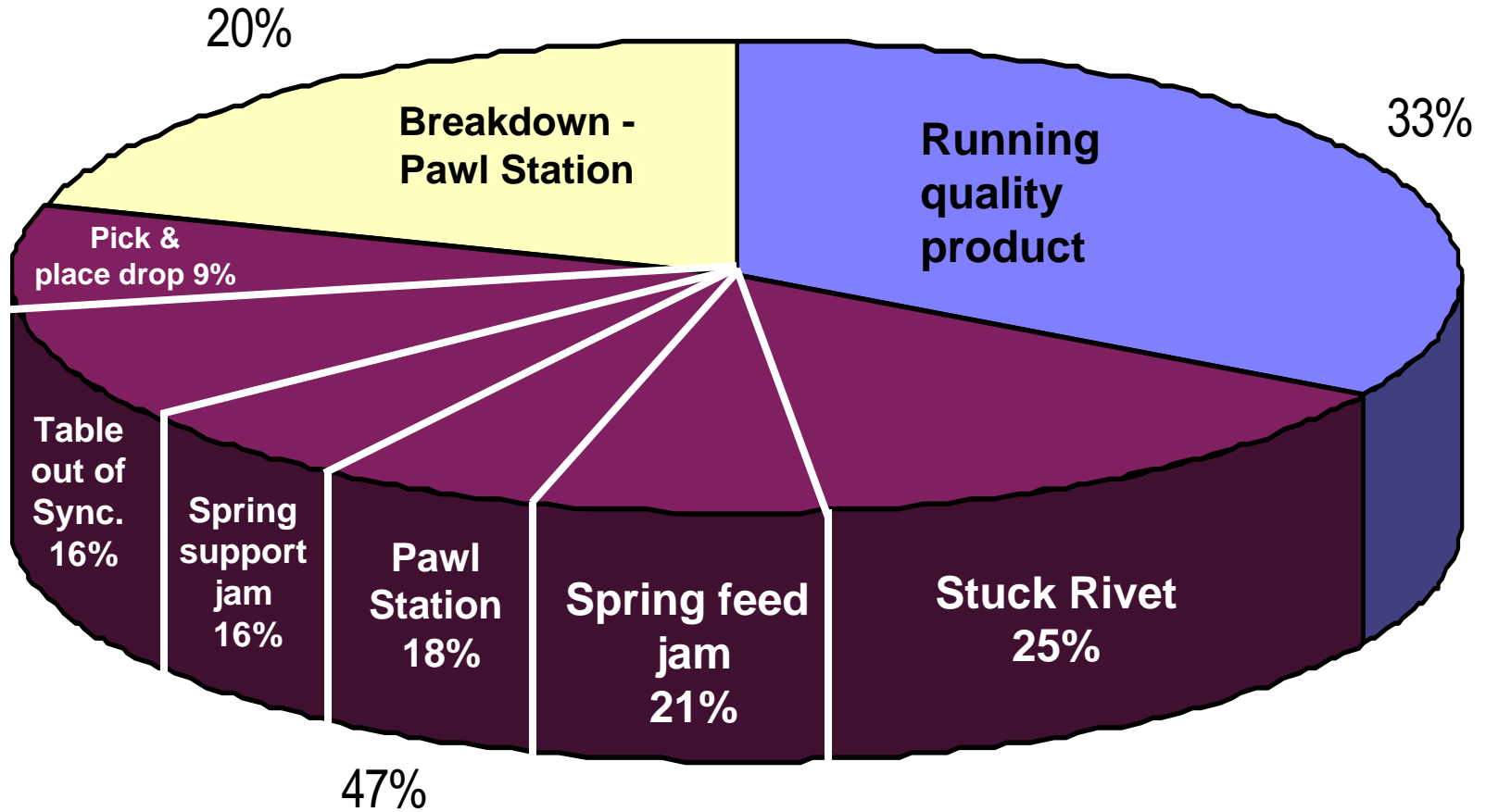


C-3 60 minute OEE observation 7/13/04

100 made

Before

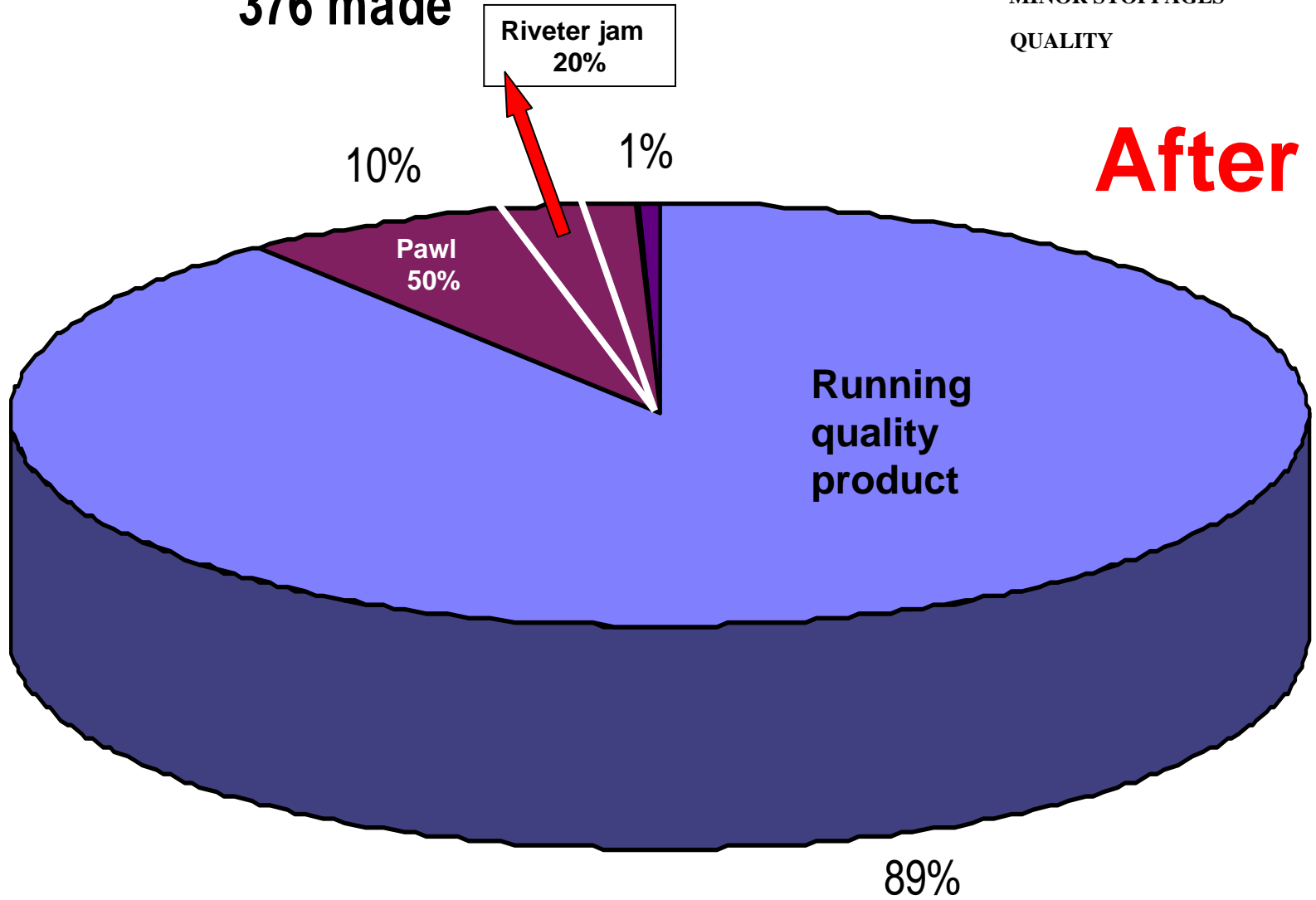
RUN TIME	33%
MINOR STOPPAGES	47%
BREAKDOWNS	20%



C-3 30 minute OEE observation - 7/16/04

376 made

RUN TIME	89%
MINOR STOPPAGES	10%
QUALITY	1%



What Can You Accomplish with

O E E

- o **Identify Major Losses**
 - **A Road map to find problems & Enhance Your Capacity**
- o **Determine Current Output**
 - **Baseline Your Equipment**

Improve OEE Set-up Reduction

- Separate internal and external set-up.
- Convert internal to external.
- Improve internal then external set-up.
- Analyze set-up - stopwatch, time & motion.
- Interview people - study conditions
- Videotape entire set-up process.
 - Watch it, brainstorm, then trystorm.

Improve OEE Minor Stoppages

- Measure:
 - Number of minor stoppages.
 - Average time between stoppages.
 - Total stoppage time.
- Slight defects are usually the cause.
- Lack of cleanliness and lack of PM usually cause the slight defects.
- Too many adjustments also contribute.

Improve OEE

Minor Stoppages-cont.

- Improve:
 - Perform OEE observations
 - Measure your losses
 - Analyze results
 - Brainstorm solutions
 - Prioritize possible solutions
 - Trystorm solutions
 - Plan-do-check
 - Follow up

Improve:

- Develop standard speed for each product.
- Install devices to visually show the speed.
- Increase standard speed to design speed.
- Surpass the design speed.

Improve OEE Start-up Losses

- Improve:
 - Process parameters set?
 - Check set-up before starting.
 - Warm up or cool down to required temperature before starting production.

Improve OEE

Quality Defects/Rework

Due to malfunctioning equipment

- Types:
 - Sporadic: A sudden increase in defects. Easily corrected by returning equipment to its original condition.
 - Chronic: Minor defect or “I got used to it” condition. They are difficult to identify. Thorough problem solving needed.

Improve OEE Quality Defects/Rework-cont.

- Improve Sporadic loss:
 - Restore equipment to original condition.
 - Compare to current standard
 - Daily check of control points
- Improve Chronic loss:
 - Restore equipment to original condition.
 - Review existing standards and control points.

Q & A Session

Type your questions into the Q&A box at the bottom right of your screen.

Speaker Contact Info

John Kravontka

President, Fuss & O'Neill Manufacturing Solutions, LLC

146 Hartford Road, Manchester, CT 06040

Tel: 800-286-2469

Email: jkgravontka@fando.com

Website: www.FandO.com

WEBCAST INFORMATION

How To Effectively Manage & Sustain a TPM Program

- Presenter: Eric Whitley, Management Consultant Productivity Inc.
- Time: October 27, 12:00 pm CST

Go to www.bradyid.com/visualworkplace

- View a recording of webcasts #1 or #2
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COMMENTS / SUGGESTIONS

Send to:

Chris Rutter

Sr. Marketing Manager, Brady Corporation

Tel: 414-438-7027

Email: chris_rutter@bradycorp.com

Thank you for participating!