

# PM RLINK Utilization at Dow Corning

Bryan Sower

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**DOW CORNING**

# Dow Corning Profile

- 2001 Sales: \$2.44 Billion
- Employees: 7500 Globally
- Manufacturer of Silicon Based Chemicals & Materials
- Significant Softwares
  - OSIsoft PI Tools Including RLINK
  - SAP 4.6B – Single Instance Globally
  - Thermo LabSystems Sample Manager LIMS
  - Web Based Bar-coding Interface to PI and SAP
  - Various Control Systems (One of Everything)

# OSIsoft in Use at Dow Corning

- First PI System in 1992 – VMS Based PI 1.X
- Interfaces – 16, Including Many Dow Corning Written
- UDS/Edict (PI3.3)– 14 Sites With 18 Servers, 250,000 Tags
- PI Batch – 200 Batch Units
- Process Template SPC – 35 Implementations
- Process Book & Excel Add-in – 700 Clients
- RLINK PM & PP/PI– 22 Implementations at 3 Sites

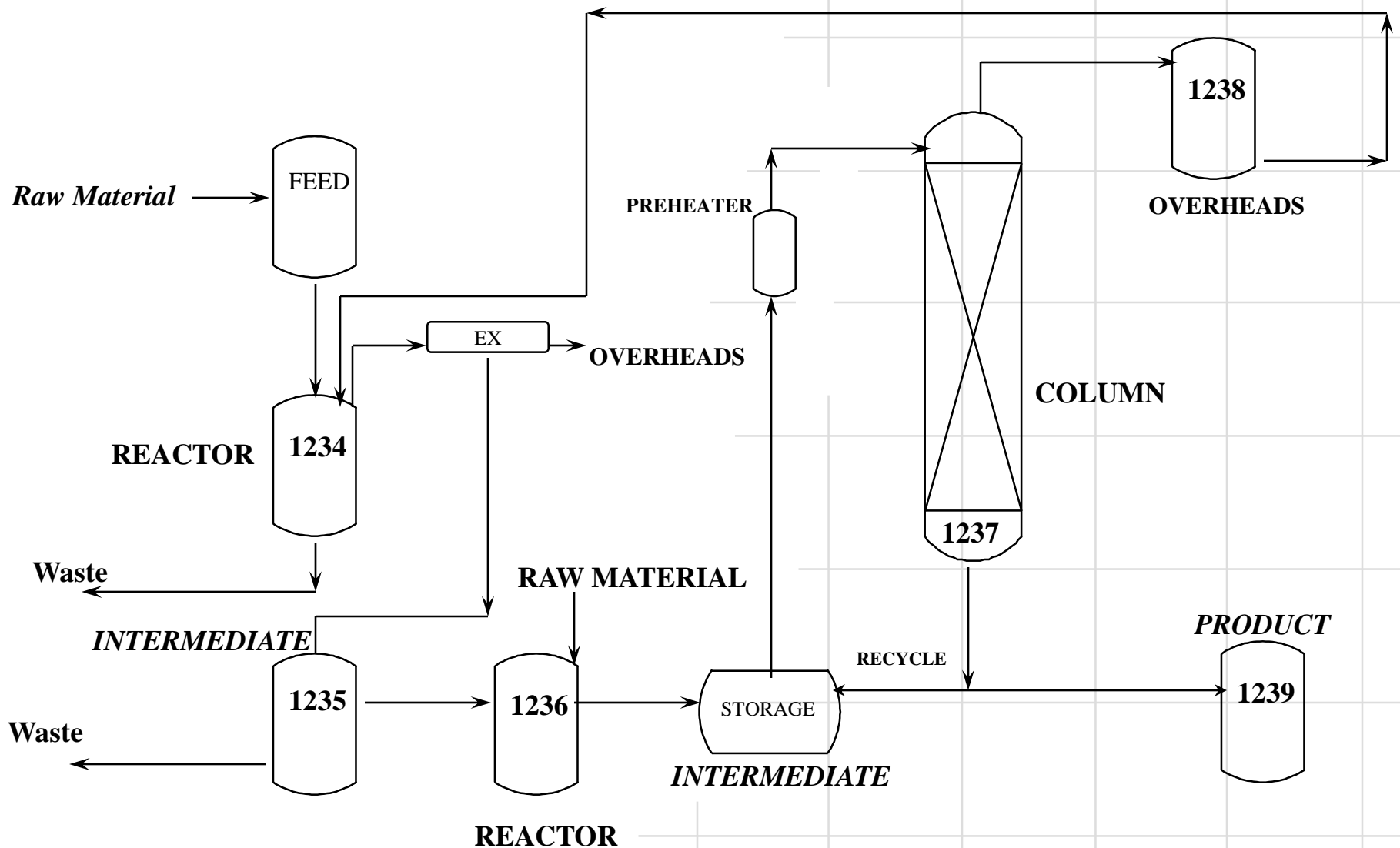
# Current PI Server Locations



# Industry Types Within Dow Corning

- Process
  - Batch
  - Continuous
  - Semi-Continuous
- Discrete
  - Packaging
  - Robotics

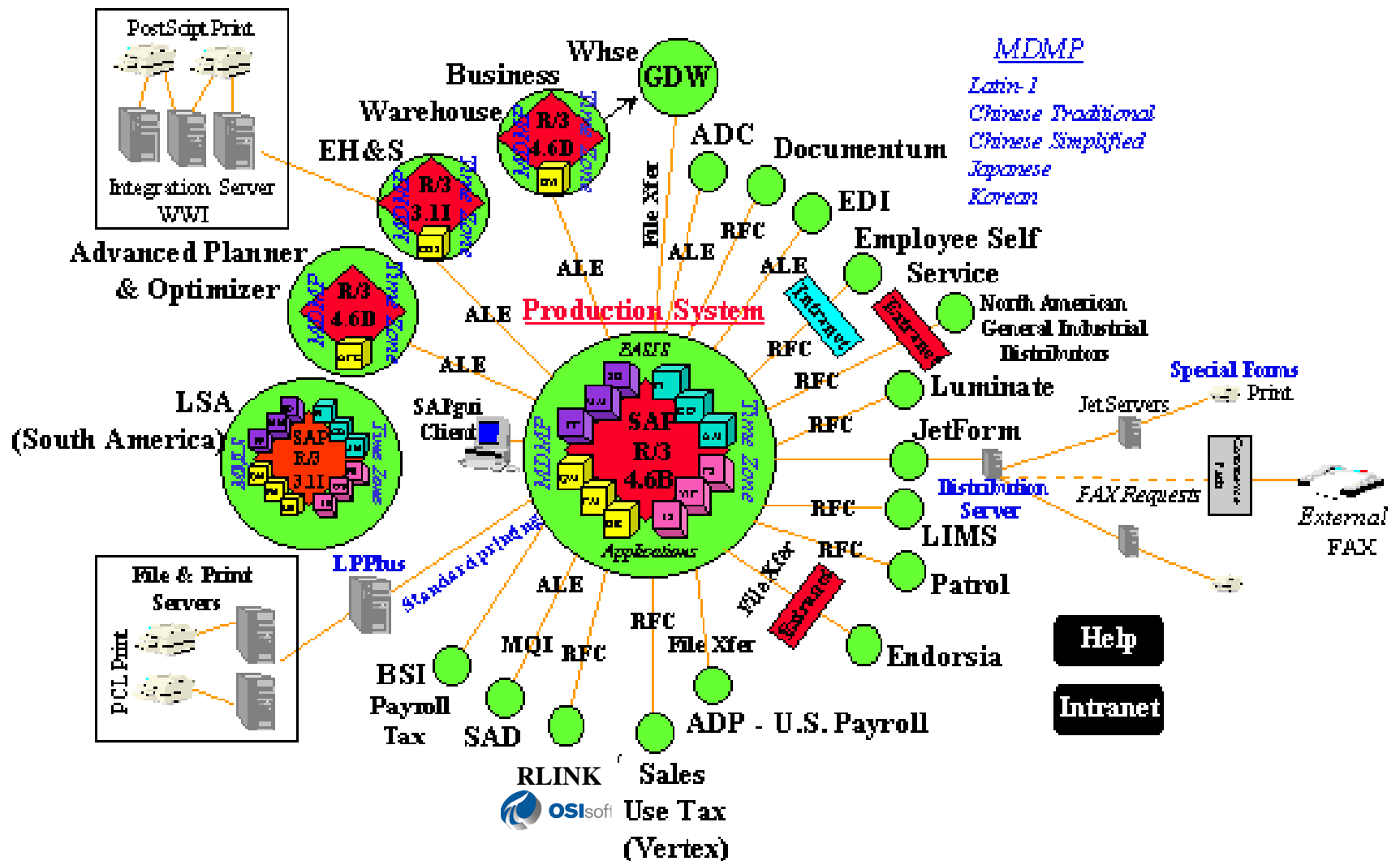
# Process Flow Diagram



# Process Controller Interfaces

- Fischer & Porter / Bailey
- Allen Bradley PLC
- Siemens PLC
- Intellution SCADA
- Foxboro I/A
- Fisher/Rosemont
- Batch Execution Systems (Batch Engines)
- Radio Frequency and Bar-coding for Manual Data Entry
- PC Based Manual Data Entry

# SAP Architecture





# SAP Modules

- PP

- PS

- APO

- MM

- SD

- WF

- PP/PI

- QM

- BW

- WM

- CO

- IS

- PM

- FI

- HR

- CRM

- AM

# RLINK

- 22 Implementations – globally
  - PM – 3
  - PP/PI – 19
- Provided PM RLINK implementation and follow up consulting to the mining operations at BHP Escondida in Chile - Cedric Luyt presentation

*Kris reviewed our SAP-RLINK-PI configuration and stabilised its operation. It had been operating but with the generation of some errors. He also reviewed R-Link behaviour when SAP and/or PI were down and fed the results to Osisoft to review. He carried out training for our system support people as well as for the Chilean Osisoft personnel.*

Joe Garcia, project manager at BHP in Escondida

# PM RLINK

- Process Monitoring
  - Both Batch and Continuous
  - Equipment/Machine Service Hours
  - On/Off Cycles
  - Run Times
  - Threshold Calculations

# PM RLINK

- SAP Transactions
  - Automated PM Notifications
  - Measurement Document Creation
  - Automated Measures
    - Overall Equipment Effectiveness (OEE)
    - Total Effective Equipment Productivity (TEEP)

# PM RLINK Installations

- Current 2 plants monitoring 77 SAP Measuring Points
  - 47 Continuous Processes
  - 30 Batch Processes
- 2 More Plants Scheduled for This Year
- Current Is PM RLINK Version 1.2 Build 1 With Additional Patches

# PM RLINK Utilization

- Began evaluating PM RLINK in 2001 with a pilot to exercise it's capabilities and determine if it could :
  - Be a Tool to Aid in Equipment Maintenance Cost Reduction
  - Improved Metrics for Asset Utilization and Operational Effectiveness.
- Based on positive results of pilot we proceeded with the roll out to a second plant late in 2001.

# PM RLINK Utilization

- Single Supply Chain

Maintenance Expense Budget	\$13,000,000
10% Expense Reduction resulting from just PI-TEEP in 2002 and again in 2003	\$1,300,000
	\$1,300,000

- Supply Chain Within a Large Plant

Asset Value	\$321,000,000
Maintenance Expense Budget	\$8,000,000
10% Expense Reduction resulting from just PI-TEEP in 2002 and again in 2003	\$800,000
	\$800,000

# Condition Monitoring

- Through the use of an auxiliary calculation engine and a library of functions we monitor a wide variety of equipment and process conditions.
  - Pump Start/Stop Cycles Reaching Defined Limit
  - Temperature Reaches Upper Limit of Equipment
  - Heat Exchanger Coefficient Drops Below Limit
  - Impingement Plate Fatigue Measured with Strain Gage
  - Possibilities Are Only Limited to the Measurements Available to PI and Your Imagination
- Based on process condition changes or cycle counts we can generate PM measurement documents and notifications if necessary.
- The type of monitoring determines if a notification is generated and of what type.



# Condition Monitoring Configuration

- PI Tags Required
  - Minimum of 9 when using notifications for each measuring point
- RLINK Tag Aliases Used
  - VALUE                      - SHORT\_TEXT                      - NOTIFY\_PRIORITY
  - ALARM                      - READER                      - NOTIFY
  - DOCUMENT                      - NOTIFY\_TYPE                      - NOTIFICATION
- One SAP Functional Location Required for Each Piece of Equipment Defined in RLINK
- One Measuring Point Required for Each Condition to Be Monitored.
- Multiple RLINK Alarms Can Be Defined for a Given Piece of Equipment Which Allows Monitoring Multiple Conditions.

# Condition Monitoring Benefits

- Dramatically reduced maintenance cost due to only performing it when required and non on a regular time based schedule. The key is know what to monitor and what the limitations of your equipment is.
- More timely notification of problem avoid potentially major loss events due to equipment failure. This allows for planned maintenance, less process down time and an overall reduction of operating cost for the process.
- Improved Process Online Time. By only performing maintenance when the condition of equipment dictates it can be scheduled for more opportune times. This allows the process to operate for longer periods at a reduce operating costs.

# Measuring Reliability Performance

- The ultimate goal of every process plant is to improve asset utilization such that the production output equals the maximum demonstrated production rate. (i.e. speed losses, quality losses, unplanned and planned downtime losses all equal to zero).
- **TEEP & OEE** give us insight into the broadest definition of our Process Reliability and Capability. It is a record of how we use our processes based on documented losses. It is as much a Operations tool as it is a Reliability Engineering tool.

# Advantages of This Measurement System

- Unique Measurement Unit: TIME
- Time = Universal Measure Unit
- Valid for All Types of Plants:
  - Basic or Finishing
- Valid for All Types of Processes:
  - Continuous or Batch
- Valid for All Types of Industries
  - Direct and Process

# World Class Targets

- *Based on results consistently achieved by PM prize-winning companies, the following percentages are achievable targets :*
- Availability Rate > 90 %
- Efficiency Rate > 95 %
- Quality Rate > 99 %
- 90 % x 95 % x 99 % = an OEE of 85 %

# USING TEEP & OEE

- First Step Is to Measure
- Second Step Is to Perform Pareto Analysis
- Third Step Is to Prioritize High Frequency Downing Events. Bottle Necks Become Visible.
- Forth Step Is to Find Root Cause and Fix.
- Fifth Step Is to Report Progress With Metrics

# USING TEEP & OEE

- Operators are Key
  - TEEP/OEE is monitoring how well the process is running. These measurements are based on logging non-productive that occur. Operators are in the best position to monitor and document their problems. The accountability is the same as today, except the Methodology is different.

# TEEP Definition

- **TEEP is measuring how well we are using the total capacity of our assets.** It is recording, all planned and unplanned losses, which includes scheduled downtime for lack of product demand. TEEP is the sole indicator integrating all parameters that affect productivity of the equipment or process. It uncovers the “Hidden Factory” costs, not just maintenance deficiencies. It is expressed as Valuable time / Calendar Time, in percent.



# OEE Definition

- **OEE** is a key measure focused on equipment and process reliability improvement. It is a measure of how well we are capable of using of using our Production Equipment when we want them to operate (excludes planned down time). OEE is the product of three effective factors, Efficiency, Availability and Quality and can also be expressed as Valuable Operating Time / Available Time, in percent

# The 8 Manufacturing Losses

Planned  
Losses

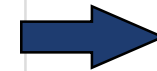
1. Planned Maintenance
2. No or Reduced Demand



*Capacity*

Downtime  
Losses

3. Equipment Failures
4. Set-up and Adjustment



*Availability*

Speed  
Losses

5. Idling & Minor Stoppages
6. Reduced Speed



*Efficiency*

Quality  
Losses

7. Defect in Process (FTR, Scrap)
8. Reduced Yield (Rework)



*Quality*

# Performance Measures : TEEP & OEE

Calendar Time ( <b>A</b> )			
Available Time ( <b>B</b> )		Planned Downtime	Planning Rate ( $PR = B/A$ )
Operating Time ( <b>C</b> )		Unplanned Downtime	Availability Rate ( $AR = C/B$ )
Net Operating Time ( <b>D</b> )	Speed Losses	Efficiency Rate ( $ER = D/C$ )	
Valuable Operating Time ( <b>E</b> )	Quality Losses	Quality Rate ( $QR = E/D$ )	

## Overall Equipment Effectiveness

$$OEE = AR \times ER \times QR$$

$$OEE = \text{Valuable Operating Time ( **E** )} / \text{Available Time ( **B** )}$$

## Total Effective Equipment Productivity

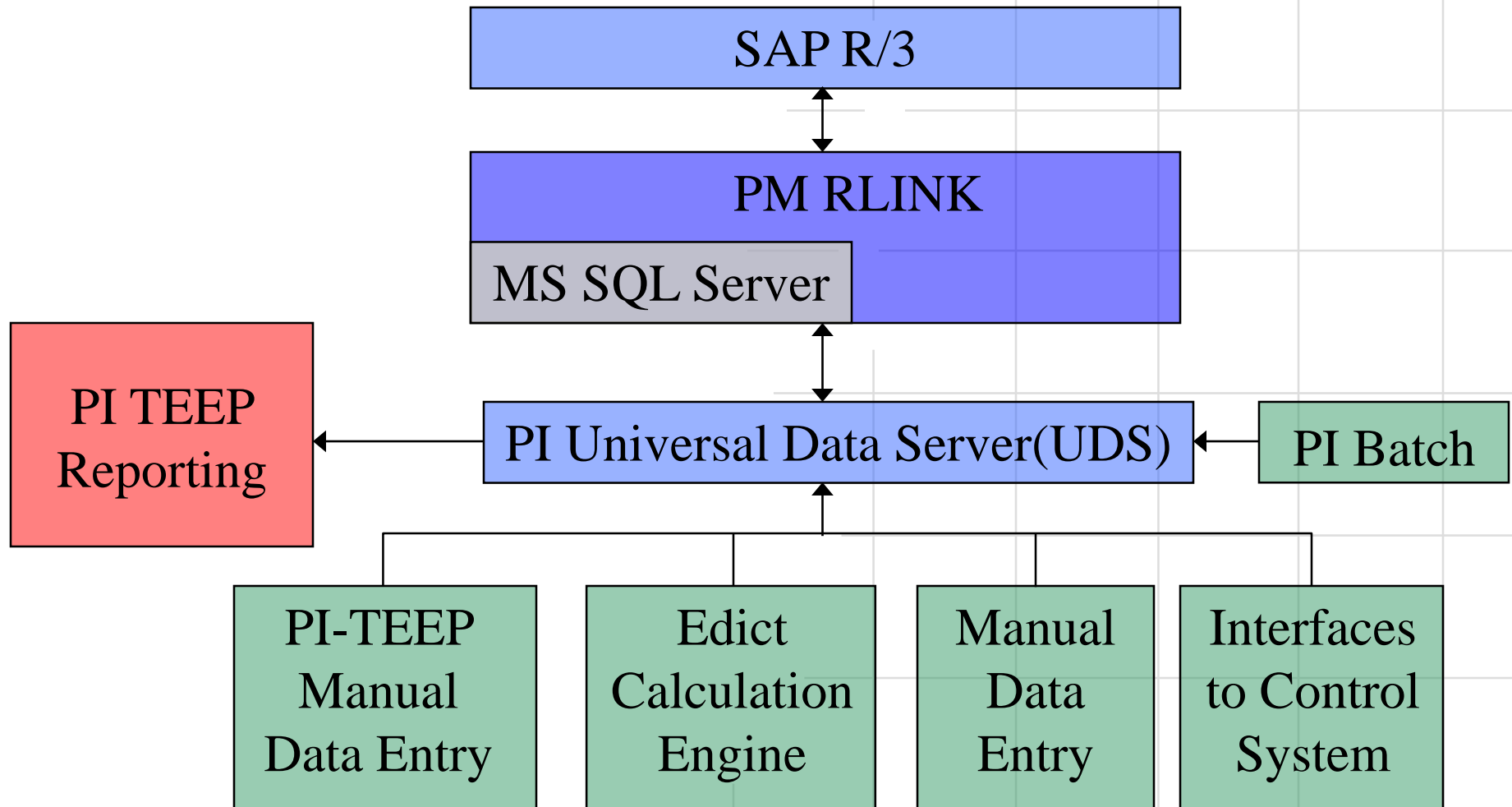
$$TEEP = PR \times OEE = PR \times AR \times ER \times QR$$

$$TEEP = \text{Valuable Operating Time ( **E** )} / \text{Calendar Time ( **A** )}$$

# PI-TEEP

- TEEP/OEE
  - Captures Loss Time, Failure Code, Reason and Comments
  - Additional Information Being Stored in PI for Description and Comments
  - Initial Reporting Capability Will Be From PI Data
  - High Level Reporting Available From SAP
  - Provided analysis capabilities for user
    - Parato analysis
    - SPC Charts
    - Mean Time Between Failure

# PM RLINK Data Flow



# PI-TEEP Configuration

- PI Tags
  - Continuous – Minimum of 10 required
  - Auto-Batch – Minimum of 10 required
  - Manual-Batch – Minimum of 13 Required
  - Varying tag attributes are used to contain static data utilized in the PI-TEEP applications. For example failure reasons and types list are defined in the extended descriptor.
- RLINK Tag Aliases Used
  - VALUE                      - CODE\_GP                      - DCC\_BATCHACTIVE
  - ALARM                      - CODE                      - DCC\_BATCHID
  - DOCUMENT                      - DCC\_FAIL\_TYPE                      - DCC\_PRODUCT
  - SHORT\_TEXT                      - DCC\_EVENT\_COMMENTS
  - READER                      - DCC\_MAXDEMRATE
- The DCC aliases are used for mapping PI tags specific to the PI-TEEP set of applications.

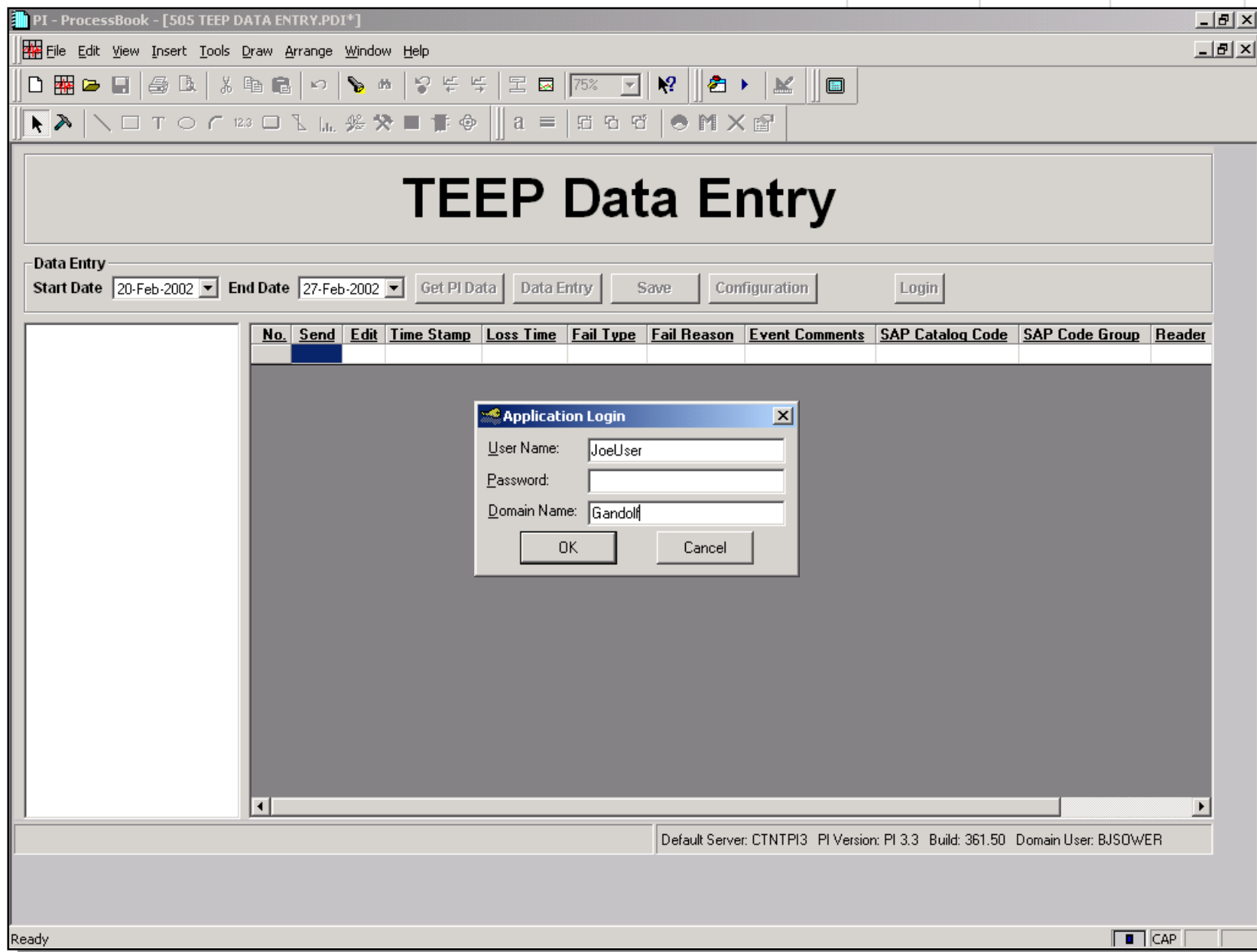
# PI-TEEP Configuration

- One SAP Functional Location Required for Each Piece of Equipment Defined in RLINK
- One and Only One Measuring Point Required for Each Functional Location.
- The RLINK Unit is named to match the PI-Batch unit for batch processes
- One Equation for each measuring point to automatically calculate loss times when they occur. This can be by either flow or batch events, but not both. Care must be taken to avoid overlapping events.

# PI-TEEP Applications

- A pair of custom written ActiveX controls that are utilized in ProcessBook displays. One for data entry and one for reporting.
- Built on the PI-API, PI-SDK, Office Web Components, a custom manual data entry application which utilizes Microsoft SQL Server and other commercially available COM components.
- Automatic recording of loss times for batch processes include time between batches and batches that exceed standard cycle time for a product.
- Automatic recording of loss times for a continuous process creates entries when a flow drops below a defined threshold.





PI - ProcessBook - [505 TEEP DATA ENTRY.PDI\*]

File Edit View Insert Tools Draw Arrange Window Help

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# TEEP Data Entry

Data Entry

Start Date 01-Feb-2002 End Date 27-Feb-2002 **Get PI Data** Data Entry Save Configuration Batch Login

SAP Plants

- 0052 - Midland Plant
  - 0052\_0505\_16050\_KETTLE
    - 0052-505-KET16050**
  - 0052\_0505\_COLIPA
  - 0052\_0505\_6585\_KETTLE

No.	Send	Edit	Time Stamp	Loss Time[Hrs]	Fail Type	Fail Reason	Event Comment
1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	02-Feb-2002 08:27:44 AM	6.04	Availability	Waiting for 6545	Holding at end of
2	<input type="checkbox"/>	<input checked="" type="checkbox"/>	02-Feb-2002 02:40:13 PM	4.00	Process Chemistry	(Administrator Only) Unplanned Chemistry Anomalies	Vacuum Strip took
3	<input type="checkbox"/>	<input checked="" type="checkbox"/>	02-Feb-2002 02:44:40 PM	2.81	Other	Production/Process Upset	Loaded batch from
4	<input type="checkbox"/>	<input checked="" type="checkbox"/>	03-Feb-2002 03:35:00 AM	59.92	Mechanical	Mechanical Equipment Preventative Maintenance	Planned Downtime
5	<input type="checkbox"/>	<input checked="" type="checkbox"/>	03-Feb-2002 06:35:40 AM	0.00	Systems	(Administrator Only) Unplanned System Anomalies	Already manually e
6	<input type="checkbox"/>	<input checked="" type="checkbox"/>	05-Feb-2002 03:30:00 PM	138.17	Availability	No order for production	Downtime between
7	<input type="checkbox"/>	<input checked="" type="checkbox"/>	11-Feb-2002 06:41:10 AM	0.00	Other		Automatically ente
8	<input type="checkbox"/>	<input checked="" type="checkbox"/>	12-Feb-2002 11:40:40 PM	28.98	Mechanical	Other valve failures	Nitrogen valve off
9	<input type="checkbox"/>	<input checked="" type="checkbox"/>	21-Feb-2002 01:43:40 AM	36.98	Other		Loss Time for Time

Default Server: CTNTP13 PI Version: PI 3.3 Build: 361.50 Domain User: BJSOWER

Ready

CAP

PI - ProcessBook - [505 TEEP DATA ENTRY.PDI\*]

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# TEEP Data Entry

Data Entry

Start Date: 01-Feb-2002 End Date: 27-Feb-2002

Get PI Data Data Entry Save Configuration Batch Login

SAP Plants

- 0052 - Midland Plant
  - 0052\_0505\_16050\_KETTLE
    - 0052-505-KET16050
  - 0052\_0505\_COLIPA
  - 0052\_0505\_6585\_KETTLE

No.	Send	Edit	Time Stamp	Loss Time[Hrs]	Fail Type	Fail Reason	Event Comment
1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	02-Feb-2002 08:27:44 AM	6.04	Availability	Waiting for 6545	Holding at end of
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4	<input type="checkbox"/>	<input checked="" type="checkbox"/>	02-Feb-2002 02:35:00 AM	59.92	Mechanical	Mechanical Equipment Preventative Maintenance	Planned Downtime
5	<input type="checkbox"/>	<input type="checkbox"/>				Unplanned System Anomalies	Already manually e
6	<input type="checkbox"/>	<input type="checkbox"/>					Downtime between
7	<input type="checkbox"/>	<input type="checkbox"/>					Automatically ente
8	<input type="checkbox"/>	<input type="checkbox"/>					Nitrogen valve off
9	<input type="checkbox"/>	<input type="checkbox"/>					Loss Time for Time

Start/End Batch

Start Batch

Timestamp: 27-Feb-2002 4:14:11 PM

Product:

Process Order:

Cancel

Default Server: CTNTP13 PI Version: PI 3.3 Build: 361.50 Domain User: BJSOWER

Ready

CAP

PI - ProcessBook - [505 TEEP DATA ENTRY.PDI\*]

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# TEEP Data Entry

**Data Entry**

Start Date: 01-Feb-2002 End Date:

**SAP Plants**

- 0052 - Midland Plant
  - 0052\_0505\_16050\_KETTLE
    - 0052-505-KET16050
  - 0052\_0505\_COLIPA
  - 0052\_0505\_6585\_KETTLE

**TEEP Data Entry**

**Failure Times**

Start Date/Time: 03-Feb-2002 3:35:00 AM

Finish Date/Time: 05-Feb-2002 3:30:12 PM

Loss Time(Hrs): 59.92

**Failure Codes**

SAP Code: 0101 Failure Type: Mechanical

Failure Reason: Mechanical Equipment Preventative Maintenance

**Event Comments**

Planned Downtime for Relief Valve Checks  
Manually entered

OK Cancel Apply Add Row Remove Row

Mode: MANUAL-BATCH Current Login: BJSOWER Grid Row = 4

Default Server: CTNTP13 PI Version: PI 3.3 Build: 361.50 Domain User: BJSOWER

Ready

	Event Comment
	Holding at end of
d Chemistry Anomalies	Vacuum Strip took
ntative Maintenance	Loaded batch from
d System Anomalies	Planned Downtime
	Already manually e
	Downtime between
	Automatically ente
	Nitrogen valve off
	Loss Time for Time

PI - ProcessBook - [505 TEEP DATA ENTRY.PDI\*]

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**PI Configuration for '0052-505-KET16050'**

**Measurement Point TEEP PI Tags**

Column Name	PI Tag Name	RLink Tag
Loss Time(Hrs)	0052_0505_KET16050_0052-505-KET16050_TEEP_LOSTIME.SAP	VALUE
Alarm Tag	0052_0505_KET16050_0052-505-KET16050_TEEP.ALARM	ALARM
SAP Catalog Code	0052_0505_KET16050_0052-505-KET16050_TEEP_VALUATION_CODE.SAP	CODE
SAP Code Group	0052_0505_KET16050_0052-505-KET16050_TEEP_CODE_GROUP.SAP	CODE_GF
Reader	0052_0505_KET16050_0052-505-KET16050_TEEP_READER.SAP	READER
Fail Reason	0052_0505_KET16050_0052-505-KET16050_TEEP_FAIL_REASON.SAP	SHORT_T
Fail Type	0052_0505_KET16050_0052-505-KET16050_TEEP_FAIL_TYPE	DCC_FAIL
Event Comments	0052_0505_KET16050_0052-505-KET16050_TEEP_EVENT_COMMENTS	DCC_EV

Click a cell for a tag to view the attribute information

**Key PI Tag Attributes**

Descriptor: TEEP Fail Reason Instrument Tag: SHORT\_TEXT

Extended Descriptor:

[1102-No order for production|1107-Project- Capital & Expense Work|1301-Waiting for 6545|1301-Waiting for Other Equipment|1303-PhTM Shortage|1303-FC-24 Shortage|1303-Other Material Shortage|1304-Operator Shortage|2101-E & I Preventative Maintenance|2106-E & I ISO Calibration|2201-Control Valve Failure|2201-Flow Inst Failure|2201-Temperature Inst Failure|2201-Pressure Inst Failure|2201-Level Inst Failure|2201-Fuse/Breaker|2201-Electrical Distribution Failure|2201-Motor Failure|2201-VFD Failure|2101-ESD Checkout|2302- Slowdown due to instrument or electrical problems|3109-Scheduled

**Control Property Values**

Property	Value
DisplayName	TEEP Data Entry
RLinkServer	MPPIAPP2
RLinkDBName	plant_suite
RLinkPlantFilter	0052,
RLinkUnitFilter	0052_0505_16050_KETTLE,0052_0505_COLIPA,0052_0505_6585_KETT...
RLinkPtCntFilter	TEEP
MDIDataSource	2

OK

Mode: AUTO-BATCH Current Login: BJSOWER

1.50 Domain User: BJSOWER

Ready

**Data Entry**

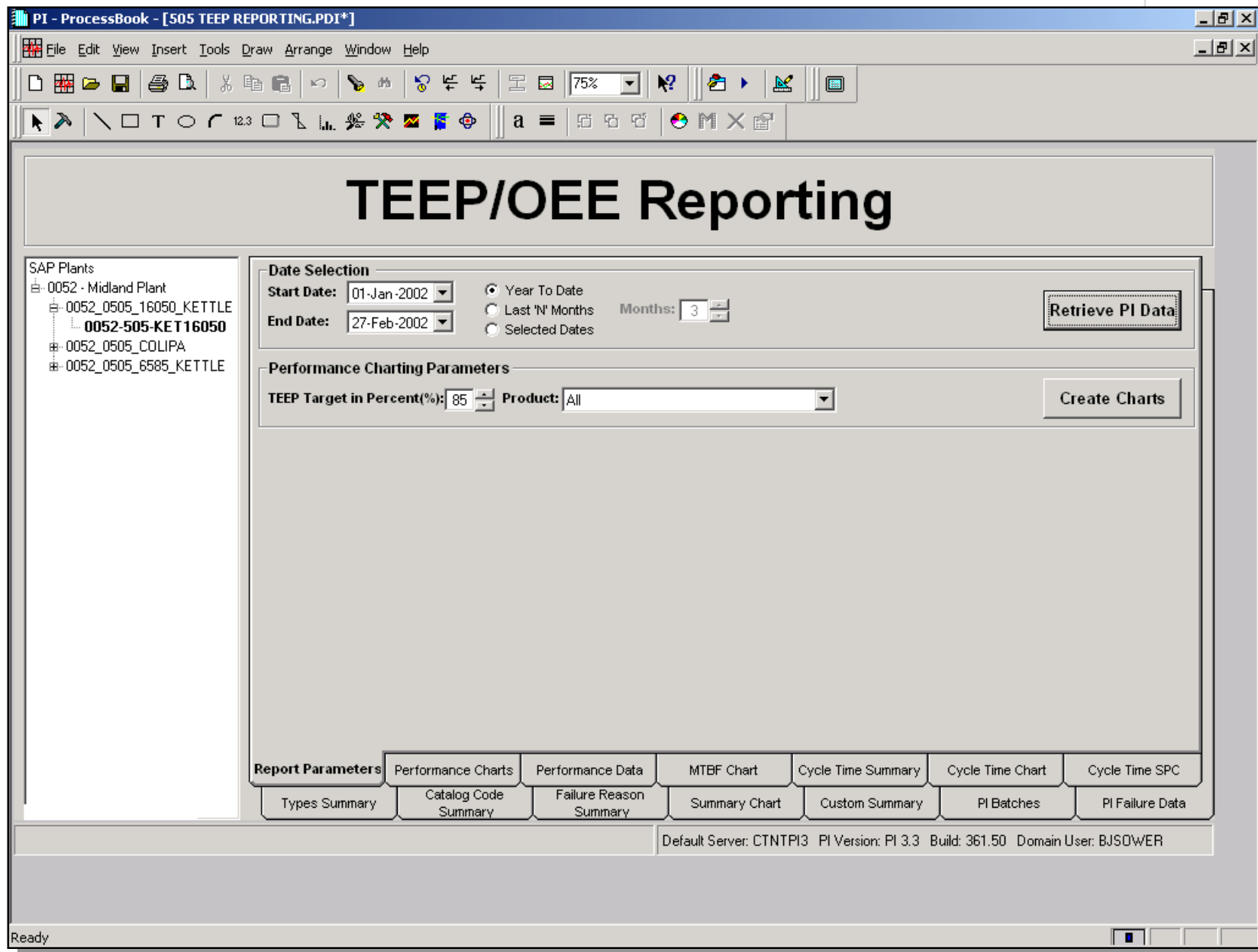
Start Date: 01-Feb-2002

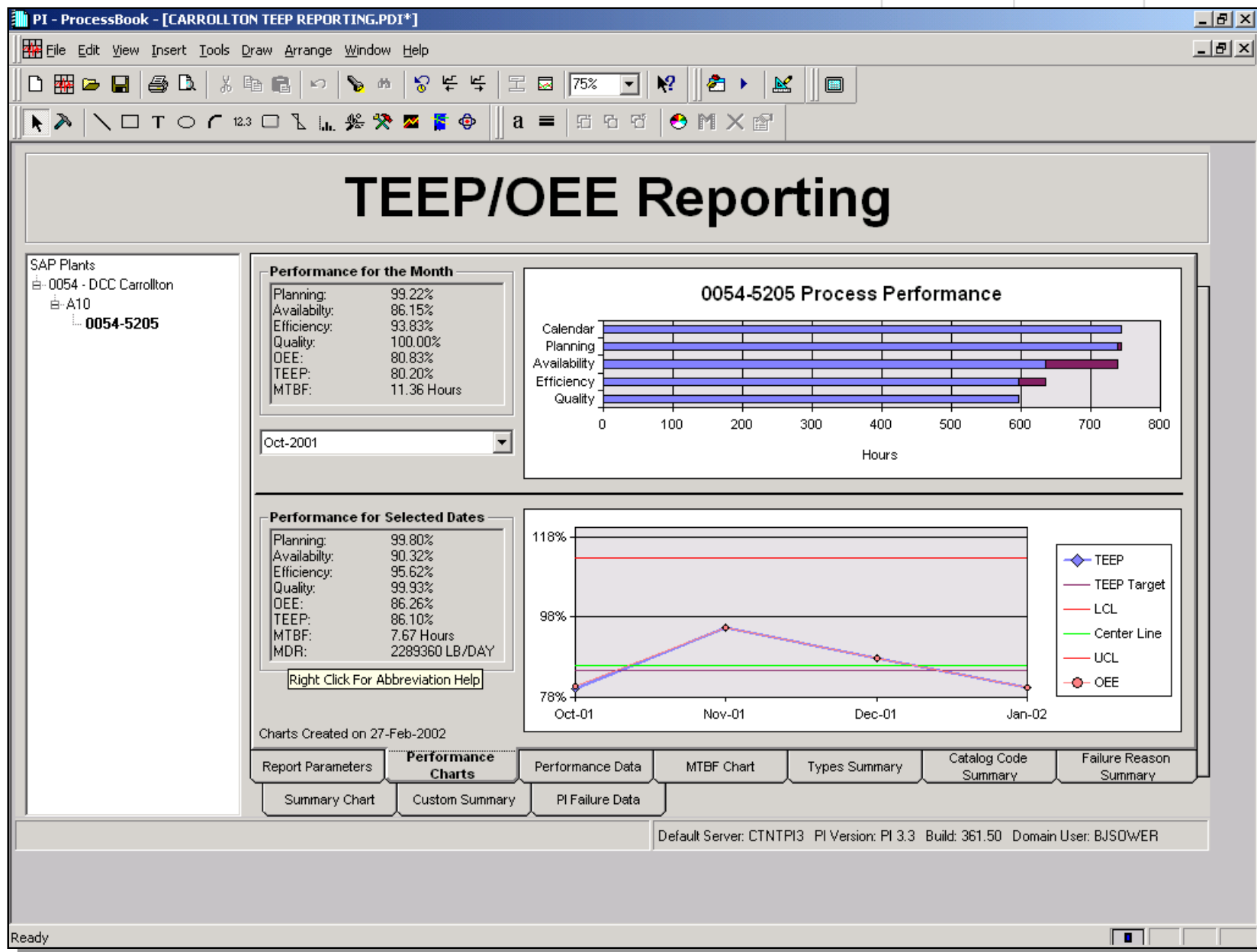
SAP Plants

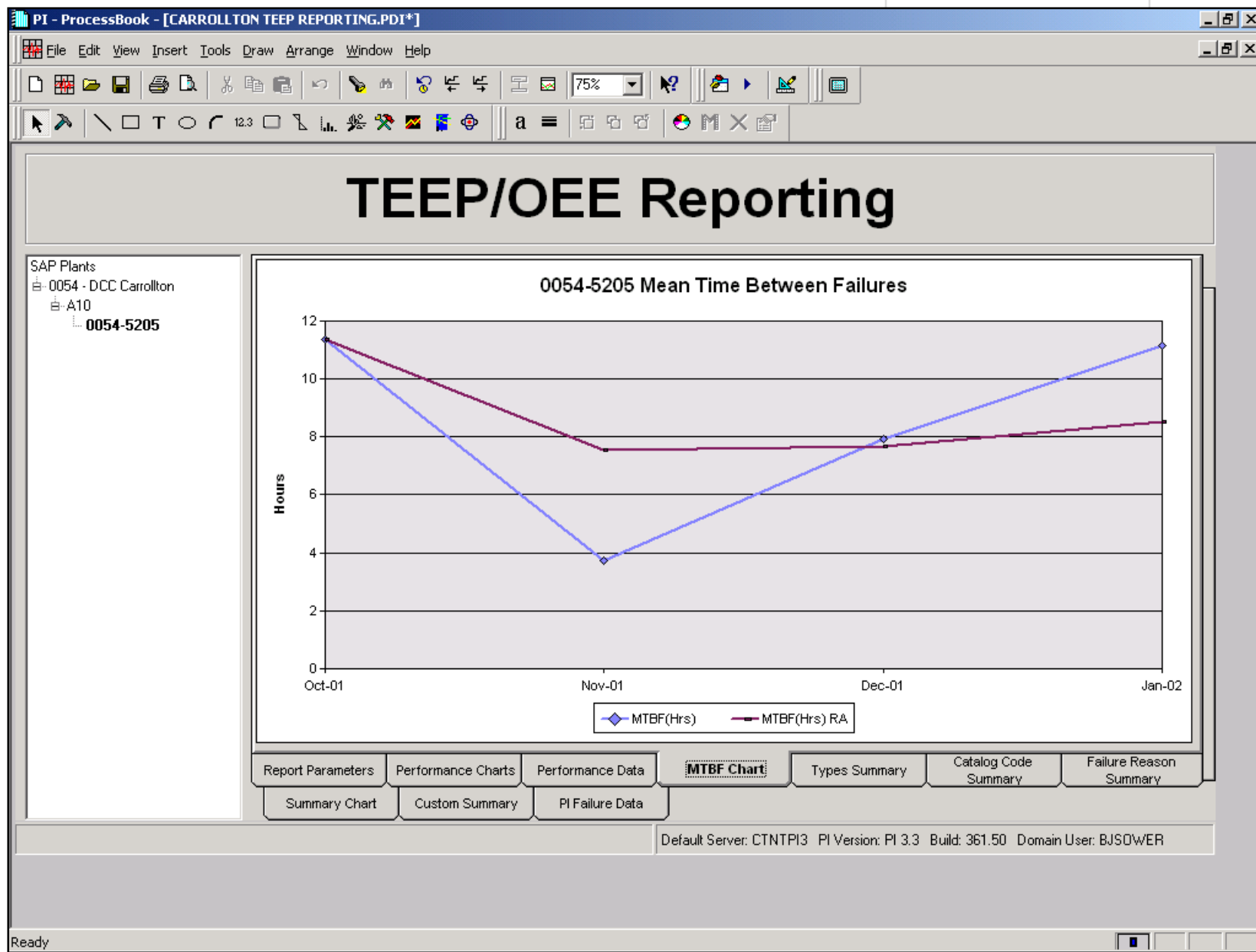
- 0052 - Midland Plant
  - 0052\_0505\_16050\_KETTLE
    - 0052-505-KET16050
  - 0052\_0505\_COLIPA
    - 0052-505-COLIPA
  - 0052\_0505\_6585\_KETTLE

**Event Comments**

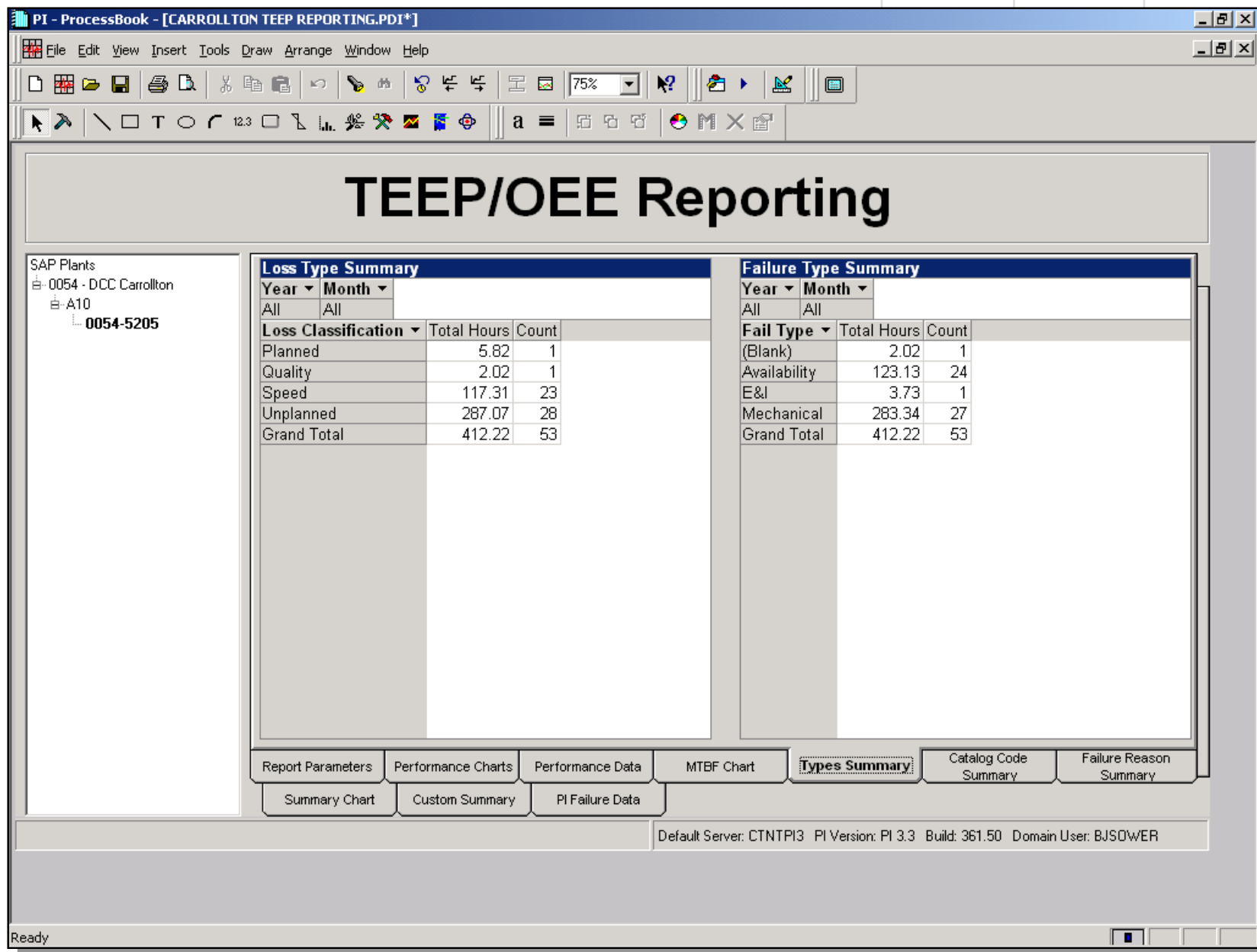
Event	Comments
Chemistry Anomalies	Holding at end of
Vacuum Strip took	Loaded batch from
Planned Downtime	Planned Downtime
Already manually e	Already manually e
Downtime between	Downtime between
Automatically ente	Automatically ente
Nitrogen valve off	Nitrogen valve off
Loss Time for Tim	Loss Time for Tim

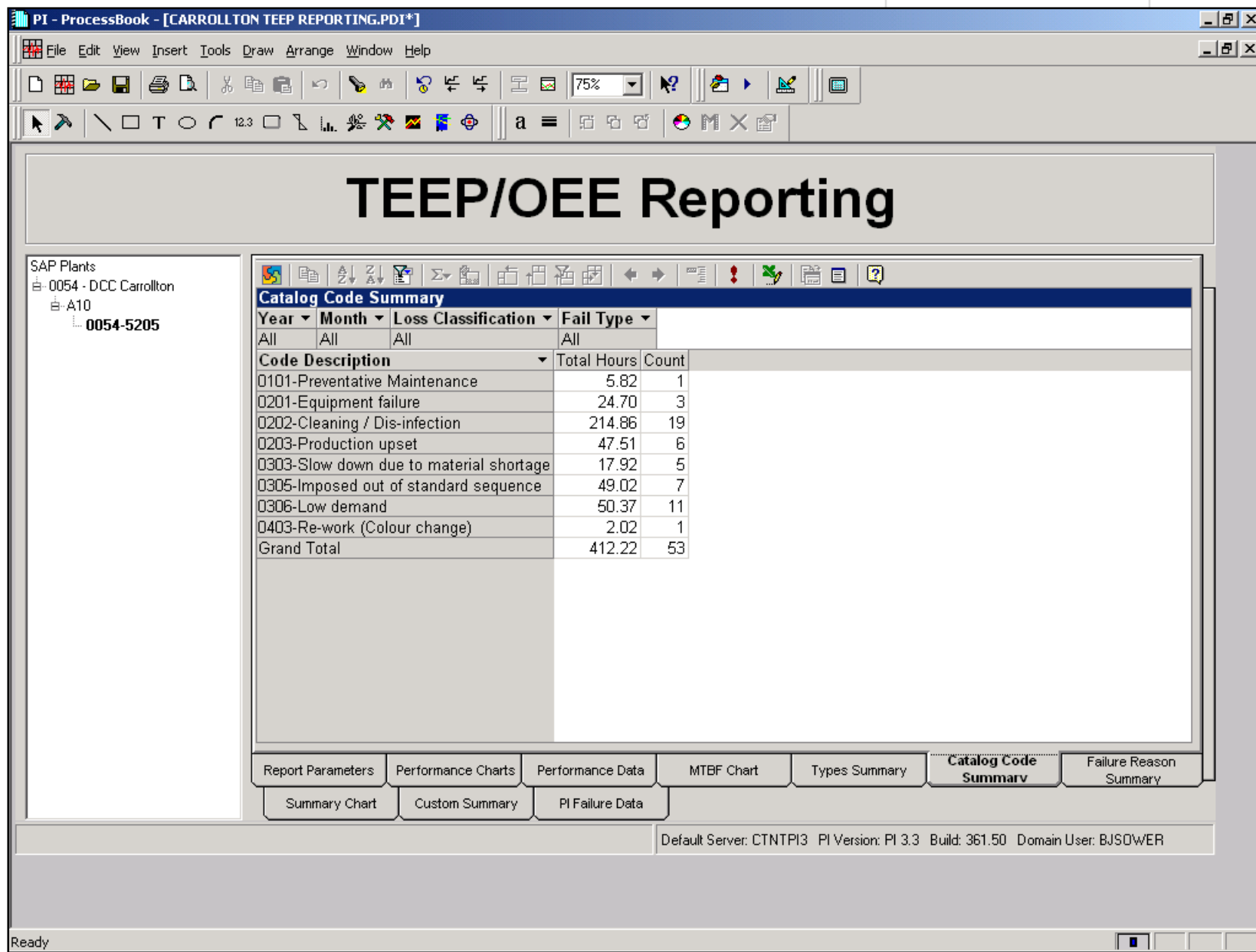


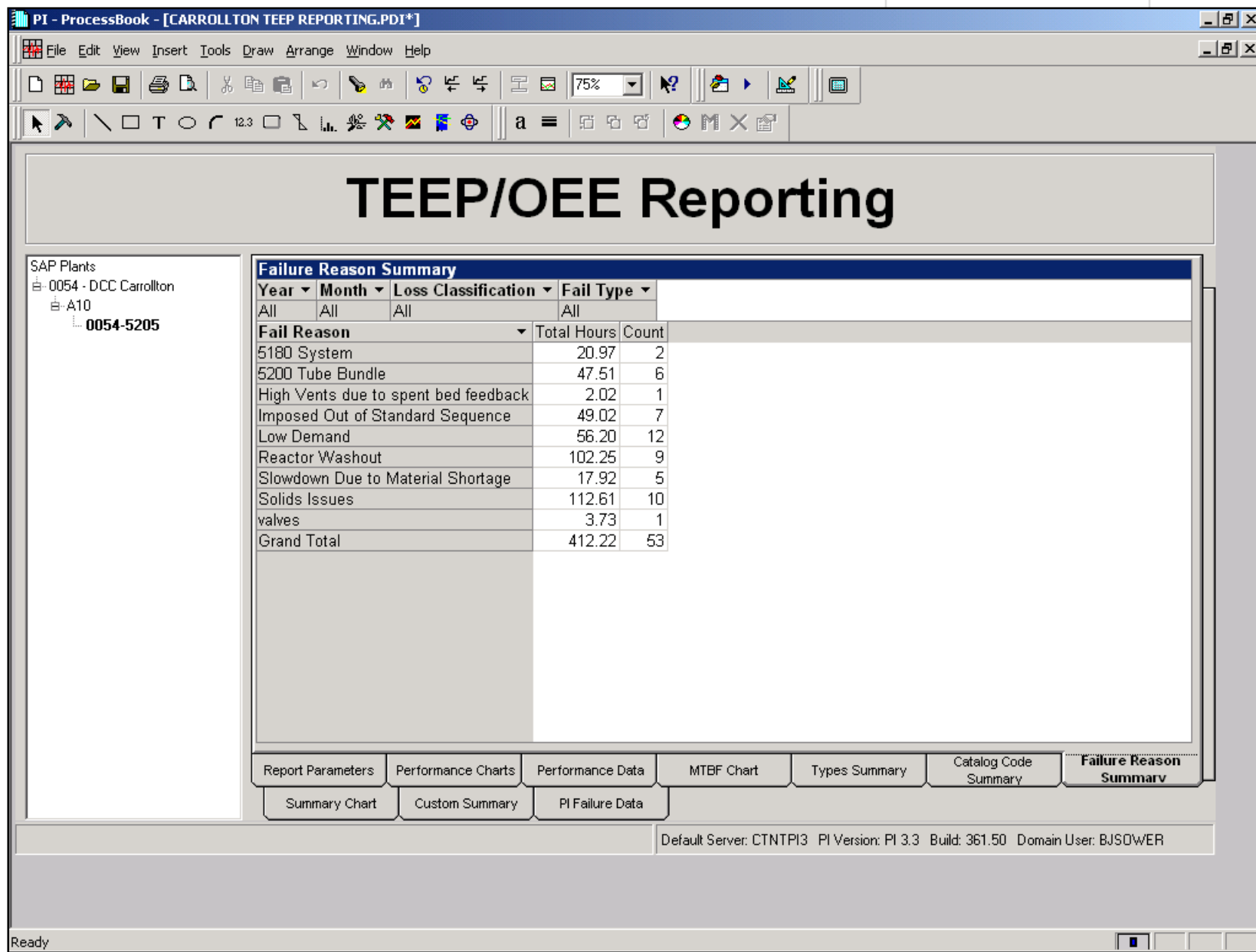


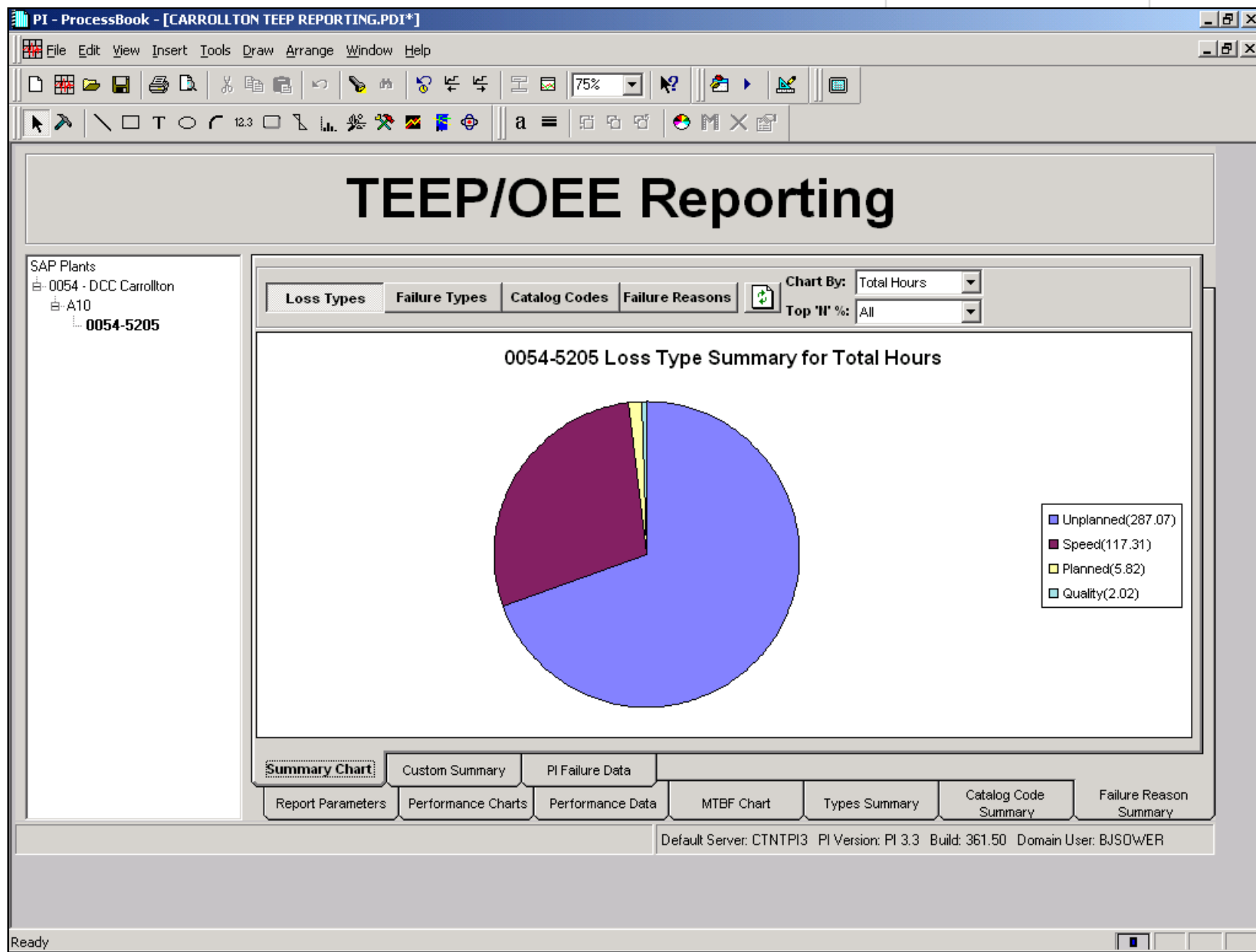












PI - ProcessBook - [CARROLLTON TEEP REPORTING.PDI\*]

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# TEEP/OEE Reporting

SAP Plants  
 0054 - DCC Carrollton  
 A10  
 0054-5205

	A	B	C	D	E	F	
1	Start Date	01-Oct-2001	First Date	07-Oct-2001			
2	End Date	27-Feb-2002	Last Date	17-Jan-2002			
3							
6	Time Stamp	Loss Time(Hrs)	SAP Catalog Code	Reader	Fail Reason	Fail Type	Event Commer
7	07-Oct-2001 12:00:05 AM	0.33543		306 CWHANSEN	Low Demand	Availability	
8	09-Oct-2001 12:00:05 AM	2.3639		306 CWHANSEN	Low Demand	Availability	
9	11-Oct-2001 12:00:05 AM	13.373		306 CWHANSEN	Low Demand	Availability	
10	12-Oct-2001 12:00:05 AM	6.5782		306 CWHANSEN	Low Demand	Availability	
11	14-Oct-2001 12:00:05 AM	0.69673		306 CWHANSEN	Low Demand	Availability	
12	15-Oct-2001 12:00:05 AM	5.2125		306 BJSOWER	Low Demand	Availability	This is a Testasi
13	16-Oct-2001 12:00:05 AM	5.8236		101 CWHANSEN	Low Demand	Availability	These Are Only
14	17-Oct-2001 12:00:05 AM	10.341		306 CWHANSEN	Low Demand	Availability	
15	18-Oct-2001 12:00:05 AM	0.3341		306 CWHANSEN	Low Demand	Availability	
16	20-Oct-2001 12:00:05 AM	13.039		202 CWHANSEN	Reactor Washout	Mechanical	
17	21-Oct-2001 12:00:05 AM	13.097		202 CWHANSEN	Reactor Washout	Mechanical	
18	22-Oct-2001 12:00:05 AM	11.487		202 CWHANSEN	Reactor Washout	Mechanical	
19	23-Oct-2001 12:00:05 AM	11.67		202 CWHANSEN	Reactor Washout	Mechanical	
20	24-Oct-2001 12:00:05 AM	15.049		202 CWHANSEN	Reactor Washout	Mechanical	
21	25-Oct-2001 12:00:05 AM	9.5583		202 CWHANSEN	Reactor Washout	Mechanical	
22	26-Oct-2001 12:00:05 AM	10.493		202 CWHANSEN	Reactor Washout	Mechanical	
23	27-Oct-2001 12:00:05 AM	9.8537		202 CWHANSEN	Reactor Washout	Mechanical	

Summary Chart Custom Summary **PI Failure Data**

Report Parameters Performance Chart Double Click Tab To Show Tool Bar TBF Chart Types Summary Catalog Code Summary Failure Reason Summary

Default Server: CTNTP13 PI Version: PI 3.3 Build: 361.50 Domain User: BJSOWER

Ready

PI - ProcessBook - [505 TEEP REPORTING.PDI\*]

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# TEEP/OEE Reporting

SAP Plants

- 0052 - Midland Plant
  - 0052\_0505\_16050\_KETTLE
    - 0052-505-KET16050
  - 0052\_0505\_COLIPA
  - 0052\_0505\_6585\_KETTLE

**Date Selection**

Start Date: 01-Jan-2002

End Date: 27-Feb-2002

☒ Year To Date  
☐ Last 'N' Months Months: 3  
☐ Selected Dates

**Performance Charting Parameters**

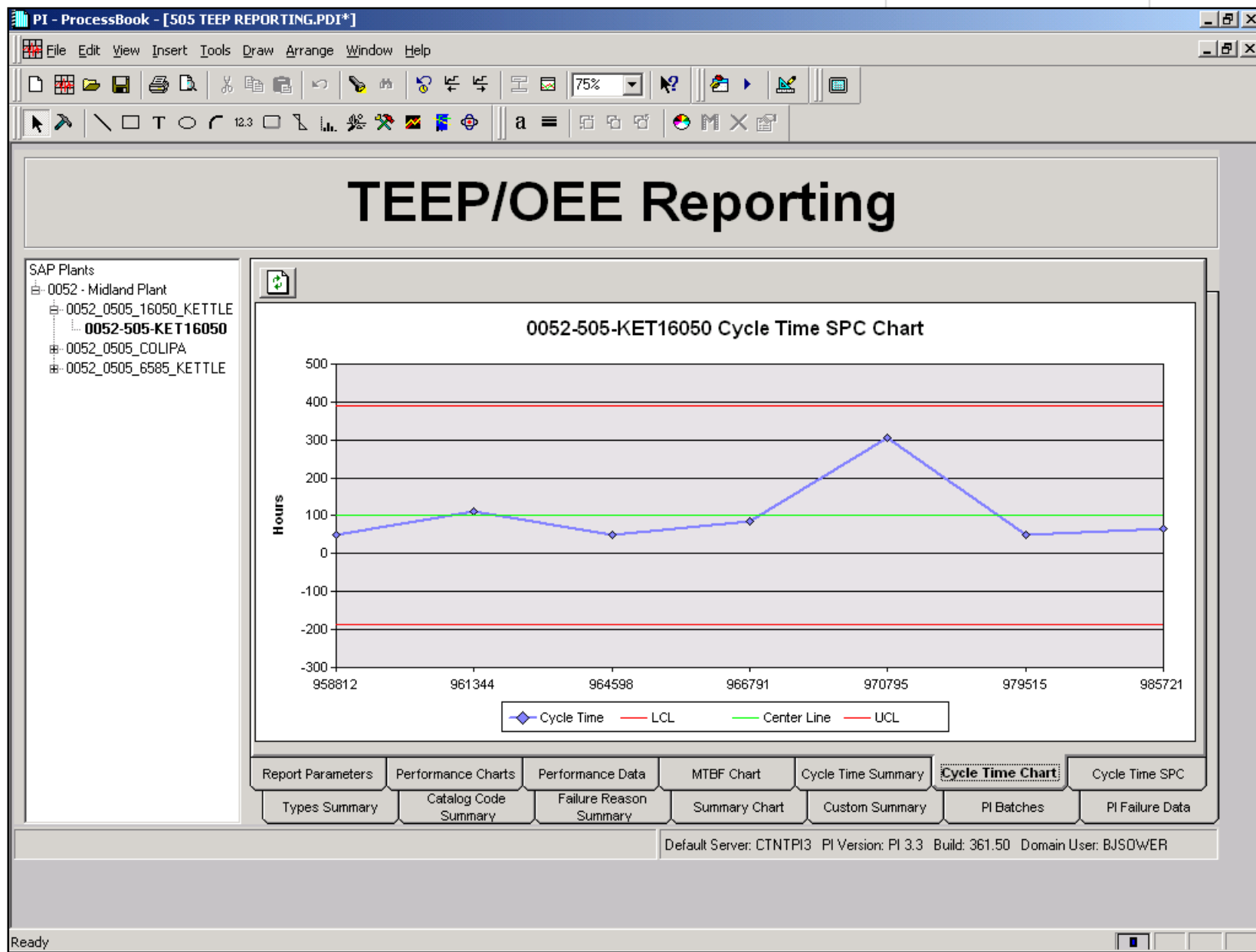
TEEP Target in Percent(%): 85 Product: All

**Report Parameters**

Performance Charts	Performance Data	MTBF Chart	Cycle Time Summary	Cycle Time Chart	Cycle Time SPC	
Types Summary	Catalog Code Summary	Failure Reason Summary	Summary Chart	Custom Summary	PI Batches	PI Failure Data

Default Server: CTNTP13 PI Version: PI 3.3 Build: 361.50 Domain User: BJSOWER

Ready



**PM strategic measure of TEEP / OEE**

Summary Analysis

Detail listing

REPORT #: ZPM00042 DOW CORNING CORPORATION PAGE# 1

RUN DATE: 10/03/2001 PM strategic measure of TEEP / OEE

RUN TIME: 15:42:36

Period - from 01/2001 to 12/2001

Functional Location : 0054-5205

Period	TEEP (%)	OEE (%)	PR (%)	AR (%)	ER (%)	QR (%)	Actual Cost	Unit	#Error
01/2001	50.29	50.29	100.00	96.00	52.39	100.00	41,364.83	USD	0
02/2001	77.92	77.92	100.00	99.14	78.60	100.00	61,466.06	USD	0
03/2001	62.32	62.32	100.00	80.94	76.99	100.00	97,279.76	USD	0
04/2001	75.16	75.16	100.00	92.02	81.68	100.00	62,498.55	USD	0
05/2001	78.60	78.60	100.00	100.00	78.60	100.00	28,436.61	USD	0
06/2001	73.87	73.87	100.00	100.00	73.87	100.00	20,575.47	USD	0
07/2001	66.92	66.92	100.00	98.78	74.55	90.88	30,144.72	USD	0
08/2001	83.92	83.92	100.00	100.00	83.92	100.00	34,176.41	USD	0
09/2001	100.00	100.00	100.00	100.00	100.00	100.00	32,532.43	USD	0
10/2001	100.00	100.00	100.00	100.00	100.00	100.00	362.32	USD	0
11/2001	100.00	100.00	100.00	100.00	100.00	100.00	0.00	USD	0
12/2001	100.00	100.00	100.00	100.00	100.00	100.00	0.00	USD	0



# PI-TEEP Benefits Realized

- More Timely and Accurate Data Collection
- Improved Data Analysis
- Consistent Methodology Used Across The Organization for Measuring Asset Utilization and Operational Effectiveness
- Visibility of the True Cost of Downing Events at All Levels of the Organization
- Lower Manufacturing Cost, More Competitive and Greater Profitability

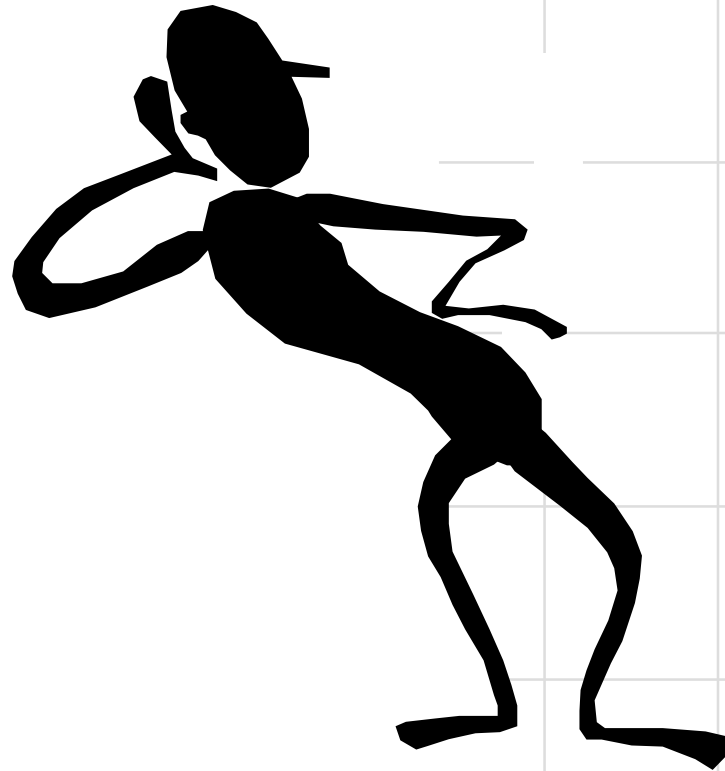
# Summary

- PM RLINK is an excellent way to introduce RLINK to the organization and train support personnel.
- For our typical site we were able to easily justify the cost of the license for PM RLINK due to the short term payback resulting from the elimination of unnecessary time based PM's
- As an added benefit the PI-TEEP tools developed gave great insight to asset utilization and allowed us to focus our efforts where we would get the most benefits.
- A key component to the success of PM RLINK is the use of an Auxiliary Calculation Engine like PI-ACE or Excele's Edict. This is true for both PM and PPPI RLINK.
- Be mindful that the PI engineering units match SAP and the SAP account uses the same decimal separator as PI.

# Summary

- PM RLINK is the backbone to our reliability improvement efforts for the company.
- SAP provides a common independent repository that can be used by management to review reliability data across the organization.

# Questions & Hopefully, Answers



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