# PM RLINK Utilization at Dow Corning

Bryan Sower
(Bryan.Sower@DowCorning.com)

DOW CORNING



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# 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




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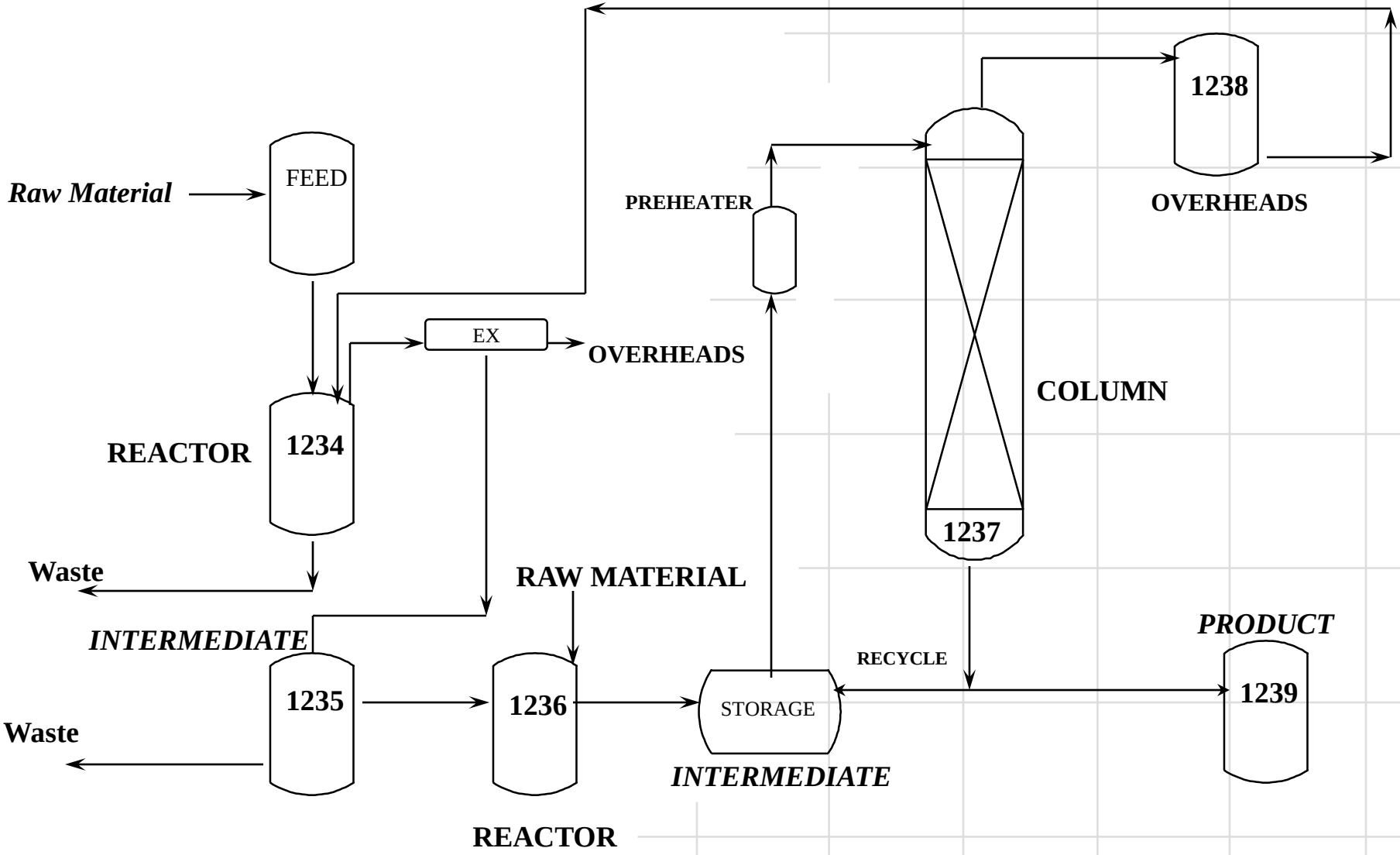
# Industry Types Within Dow Corning

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

# Process Flow Diagram



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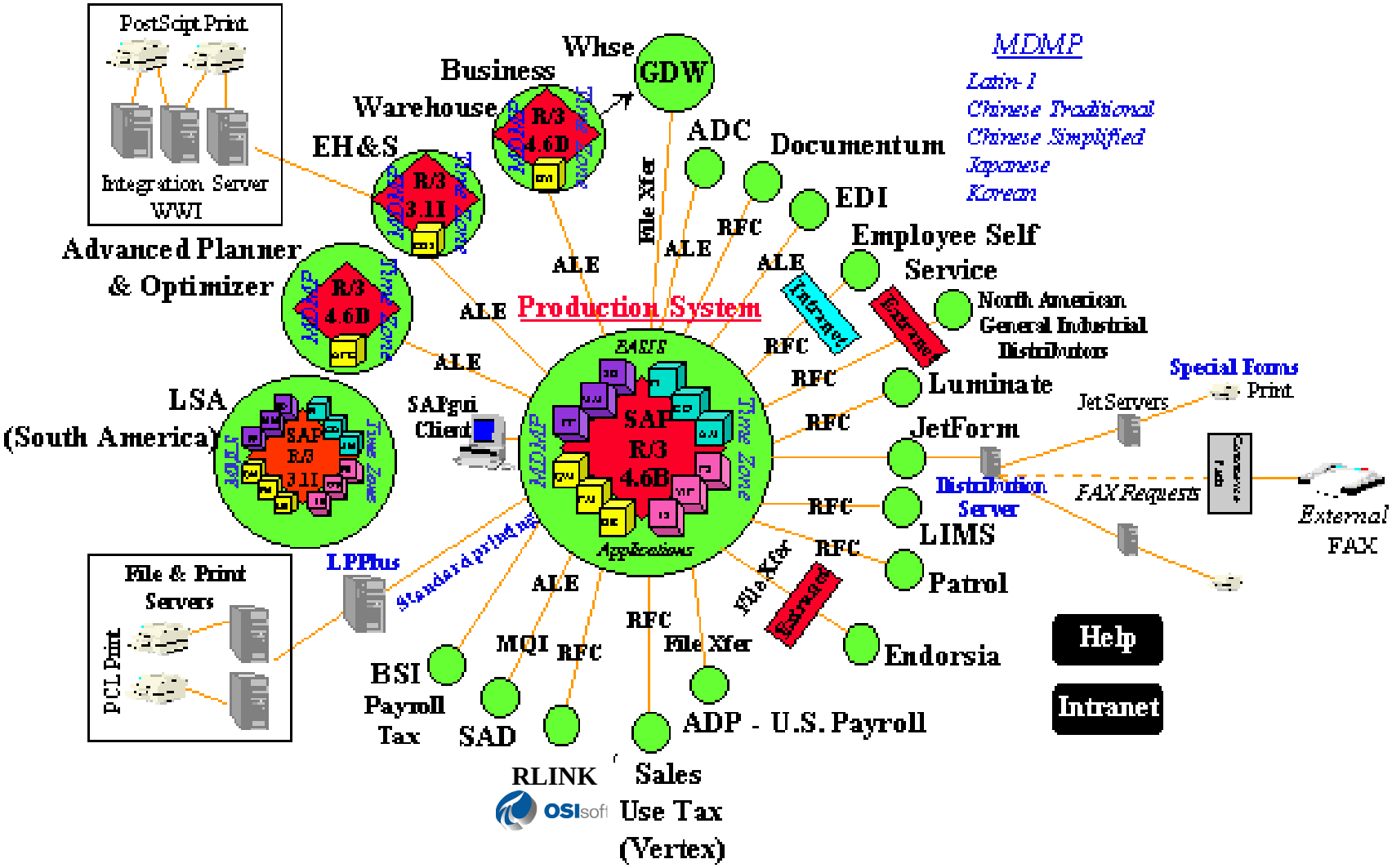
# Process Controller Interfaces

- 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



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# 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<br>$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<br>$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.

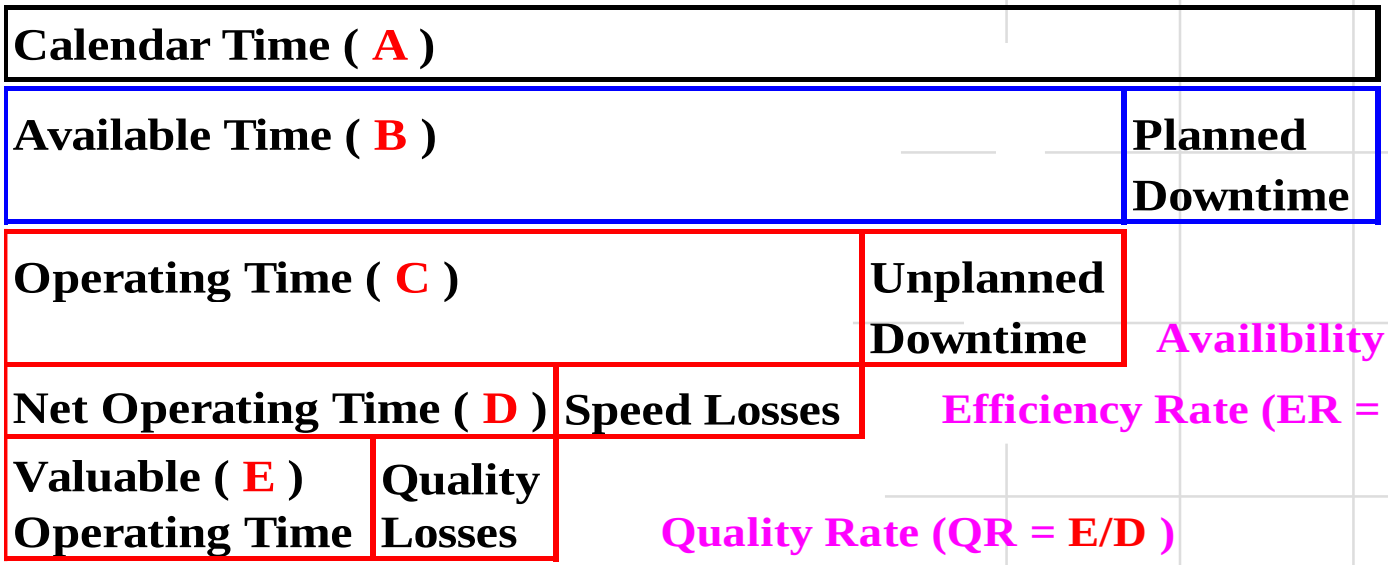
# OEE Definition

- **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<br>2. No or Reduced Demand | → ***Capacity*** |
| Downtime Losses | 3. Equipment Failures<br>4. Set-up and Adjustment | → ***Availability*** |
| Speed Losses | 5. Idling & Minor Stoppages<br>6. Reduced Speed | → ***Efficiency*** |
| Quality Losses | 7. Defect in Process (FTR, Scrap)<br>8. Reduced Yield (Rework) | → ***Quality*** |

# Performance Measures : TEEP & OEE




Planning Rate (PR = B/A )

Availibility Rate (AR = C/B )

Efficiency Rate (ER = D/C )

Quality Rate (QR = E/D )

## Overall Equipment Effectiveness

**OEE = AR x ER x QR**

**OEE = Valuable Operating Time ( E ) / Available Time ( B )**

## Total Effective Equipment Productivity

**TEEP = PR x OEE = PR x AR x ER x QR**

**TEEP = Valuable Operating Time ( E ) / Calendar Time ( A )**



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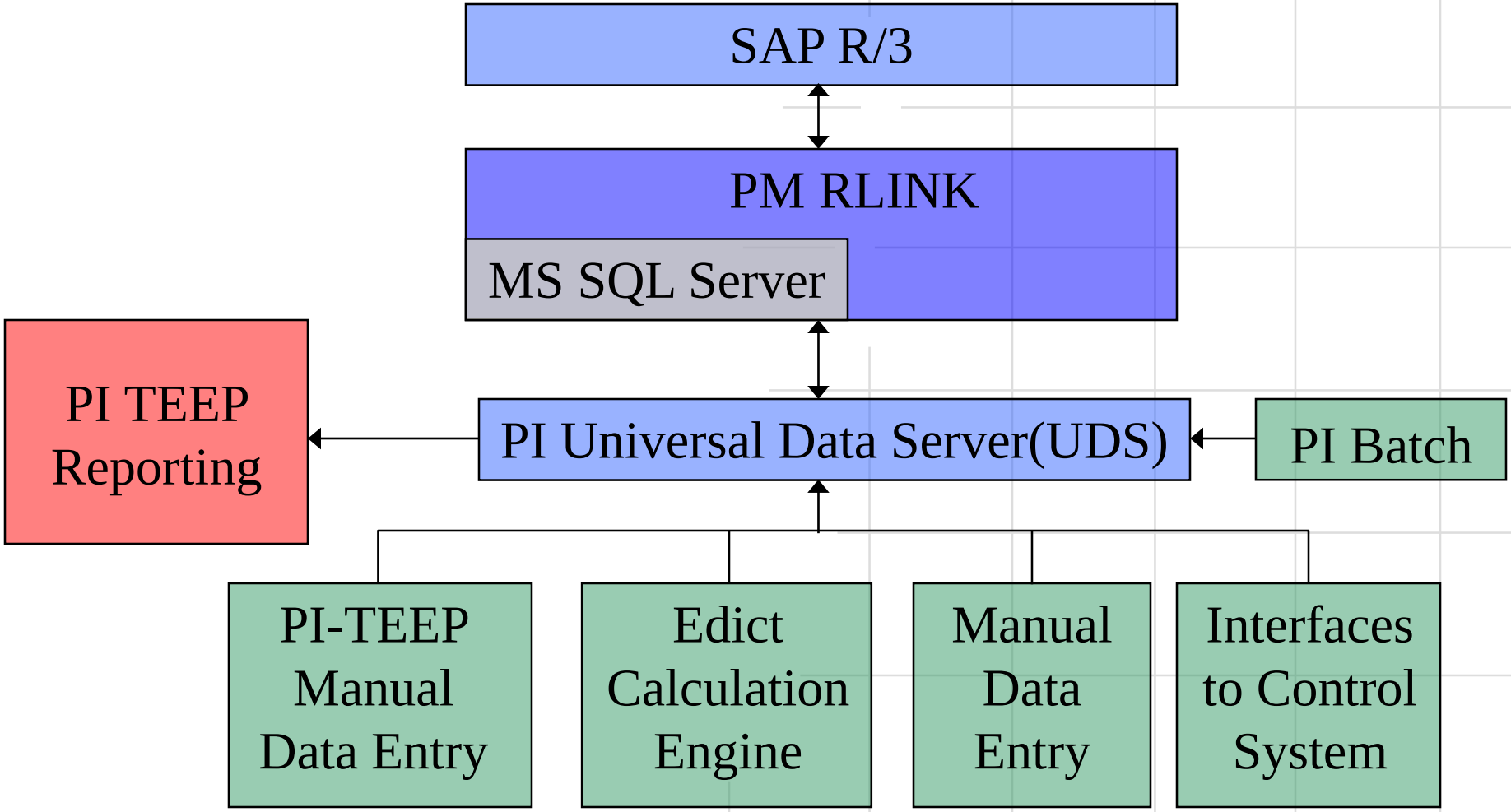
# PI-TEEP

- 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 | |

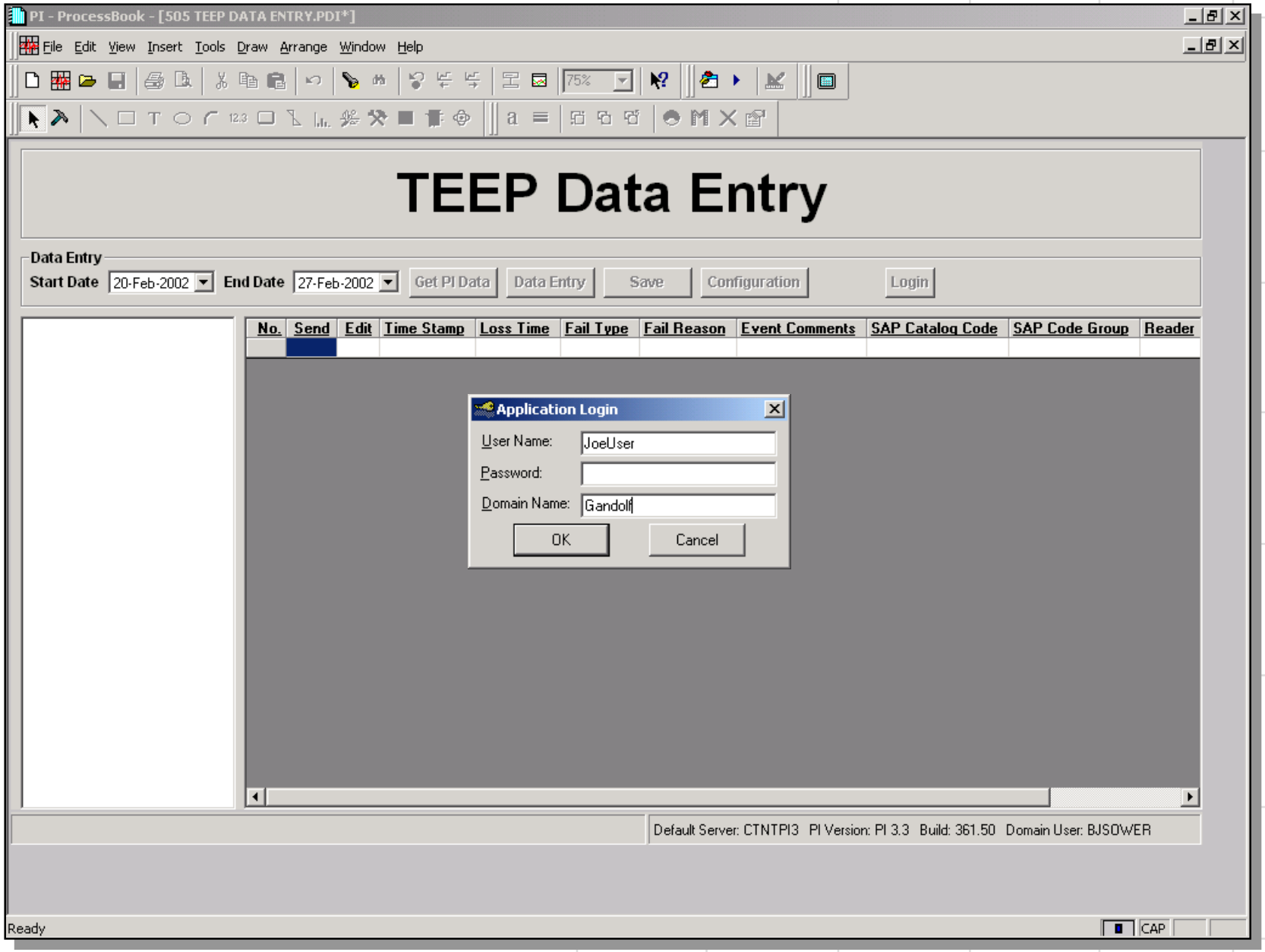
- The DCC aliases are used for mapping PI tags specific to the PI-TEEP set of applications.

# 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.



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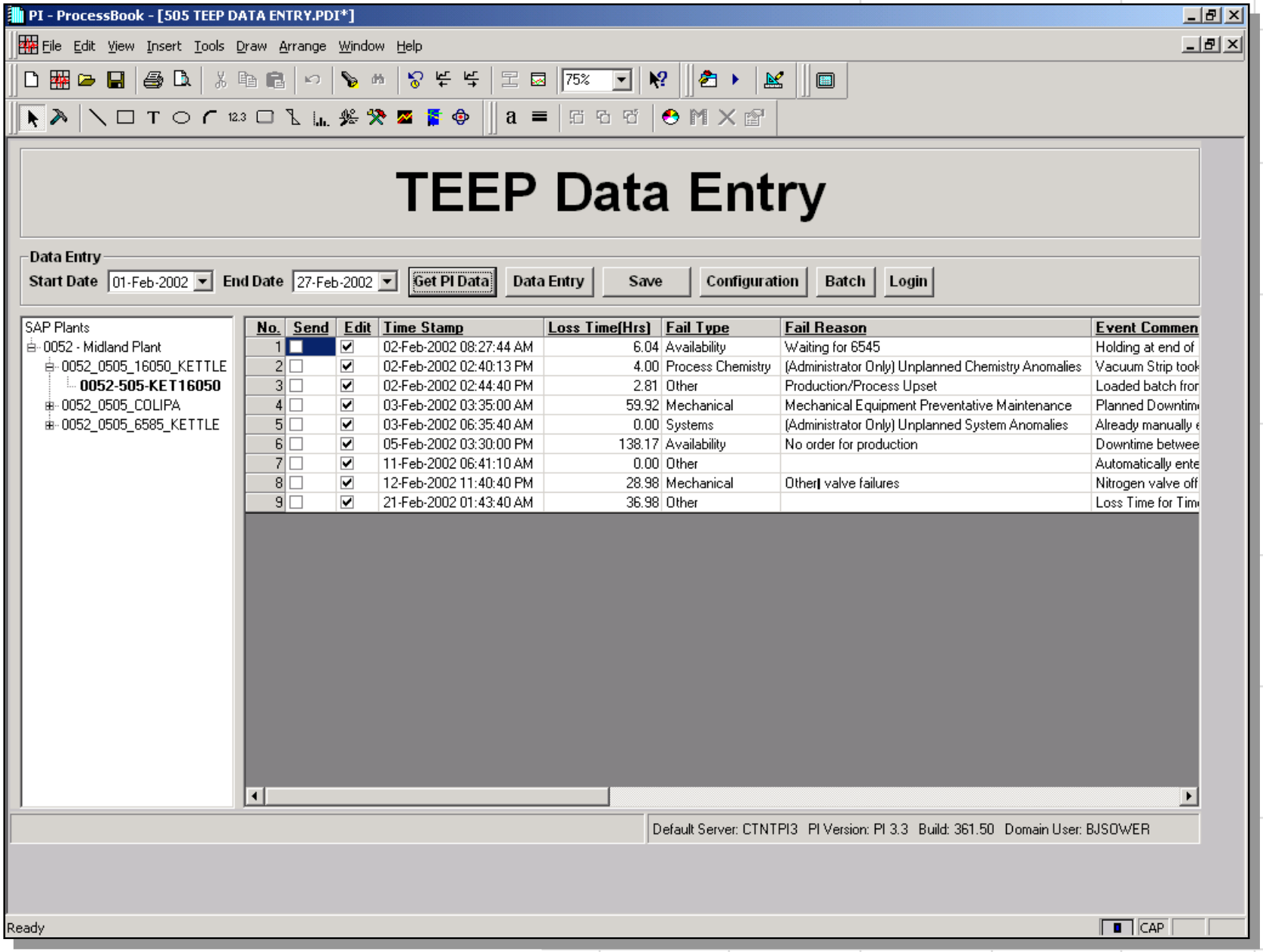




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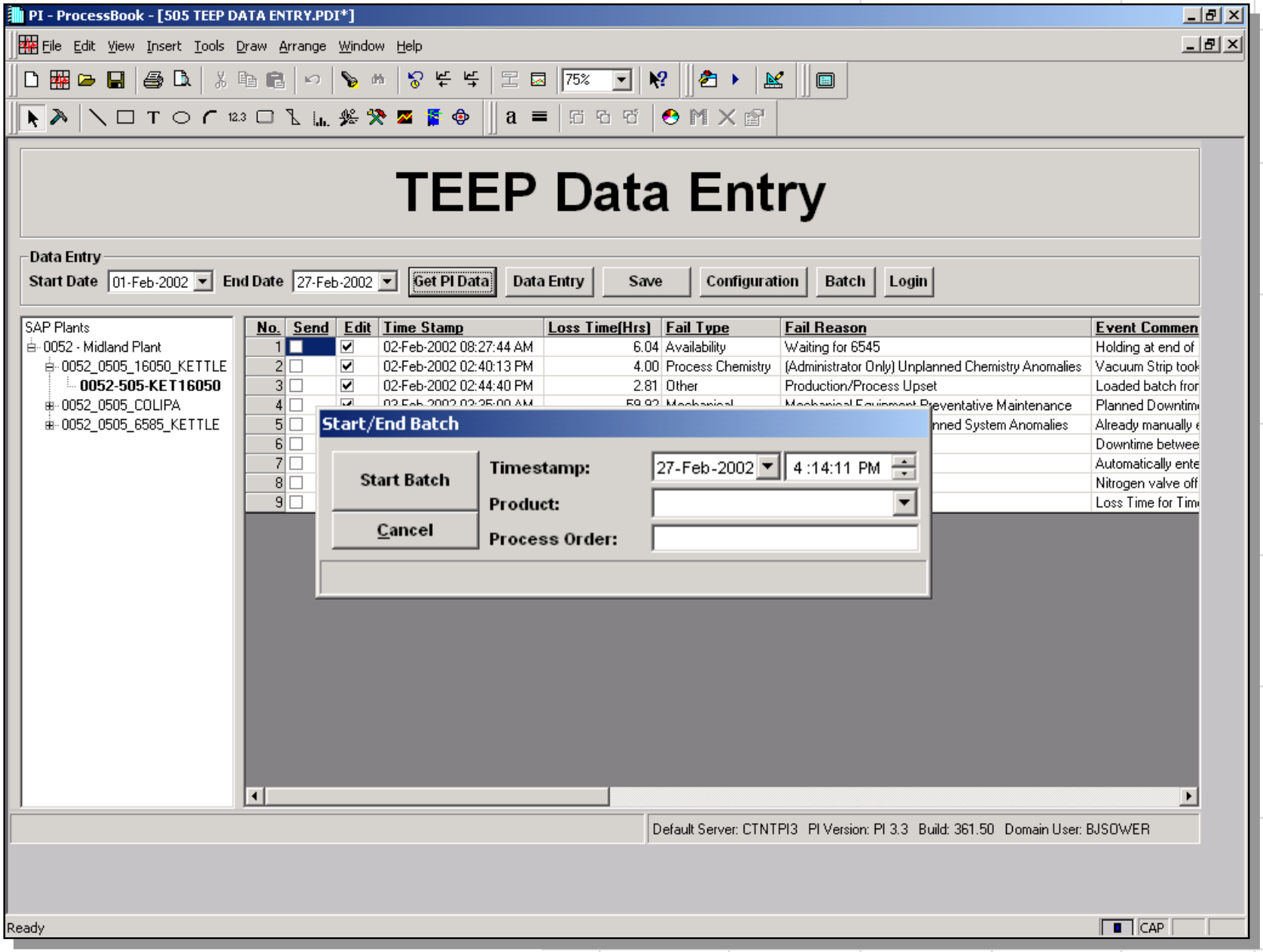




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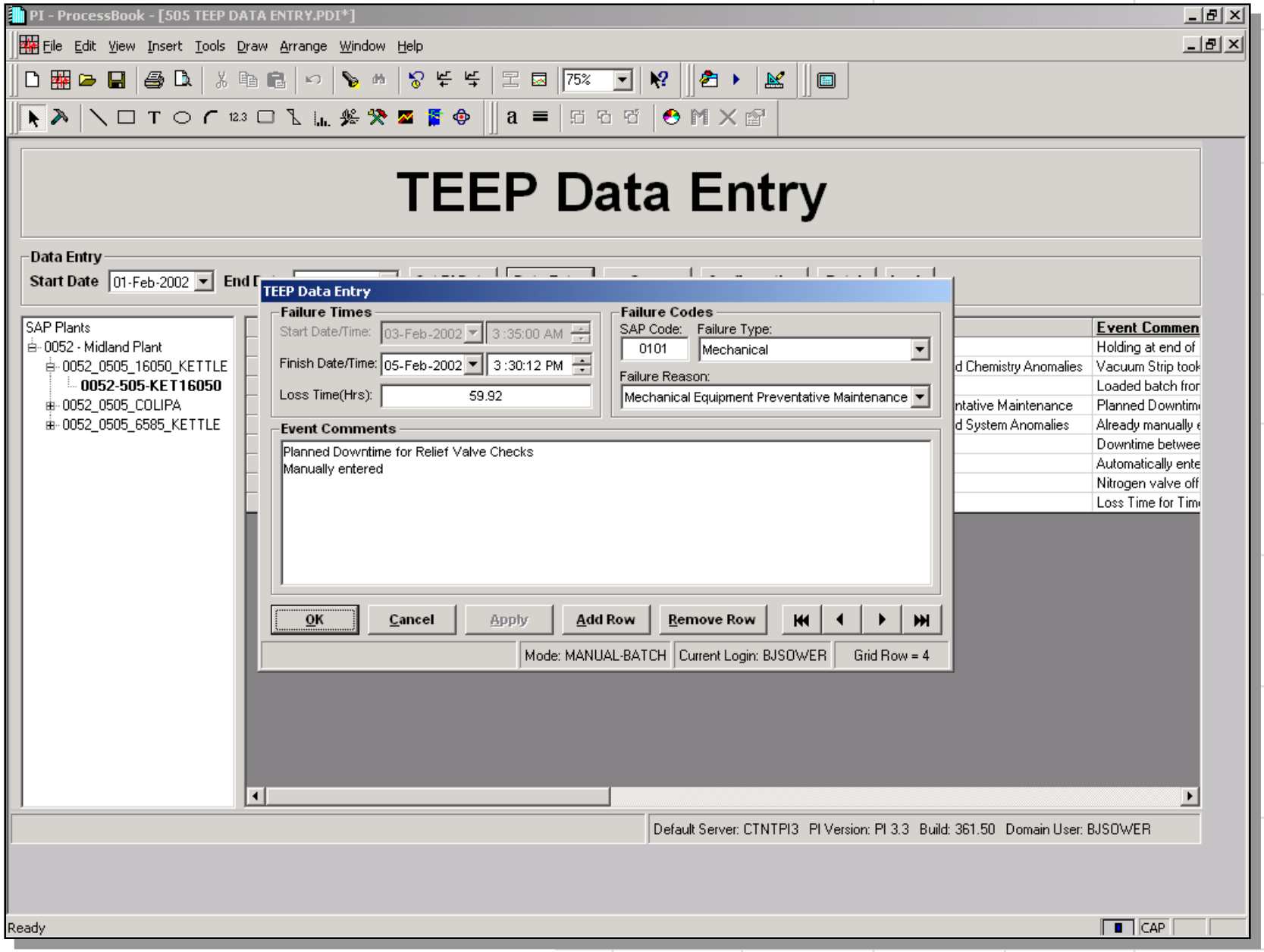




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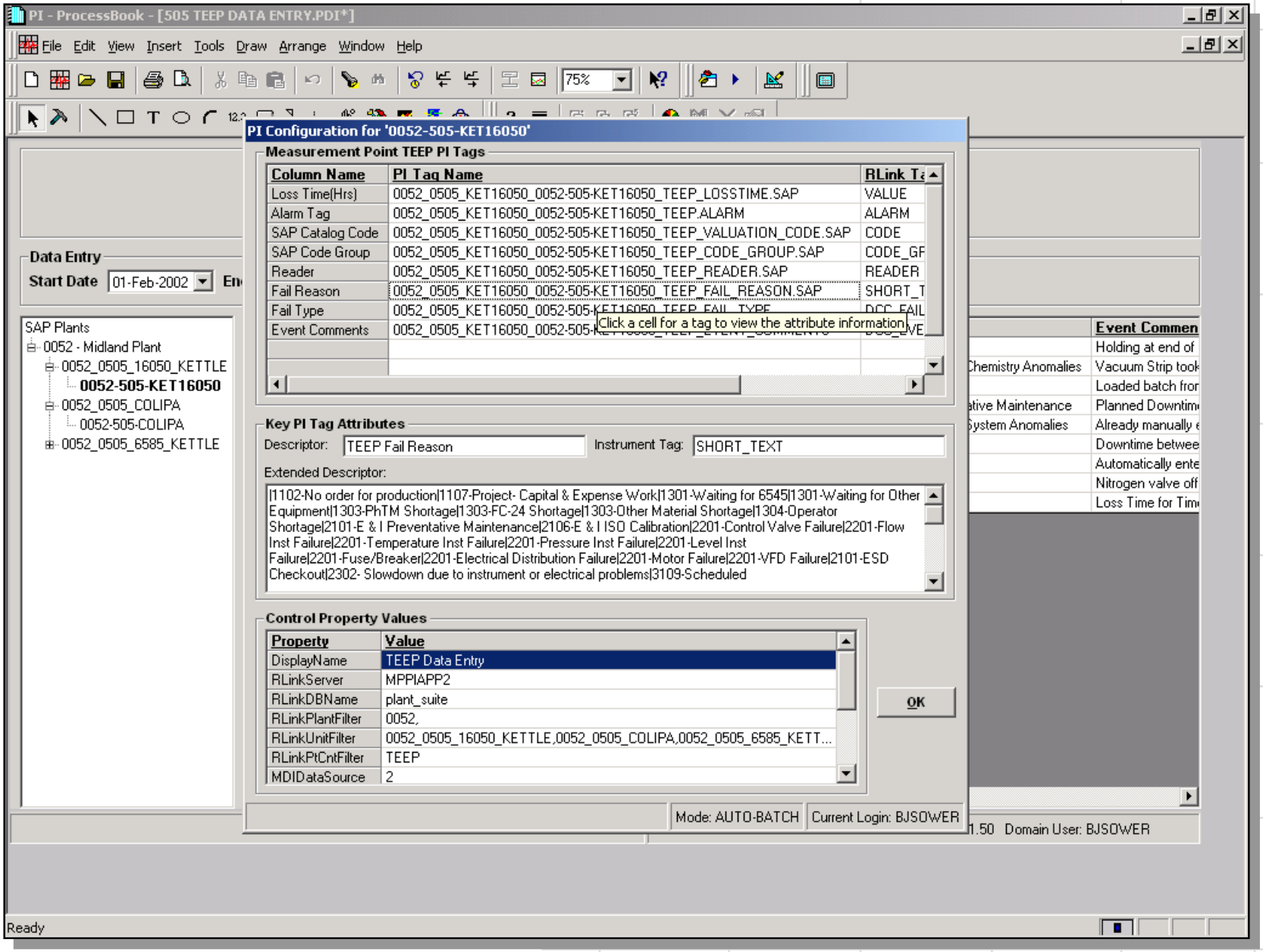




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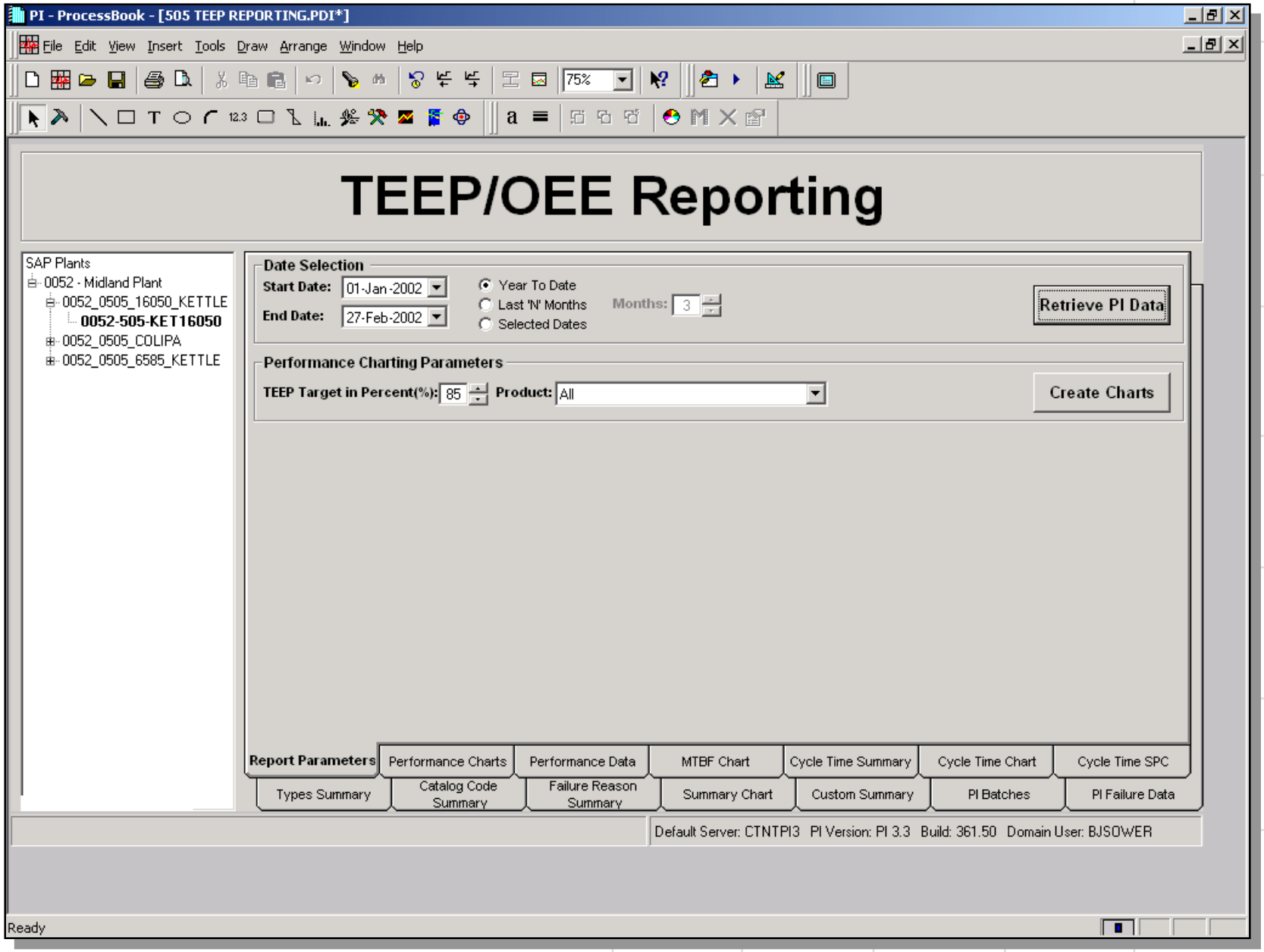




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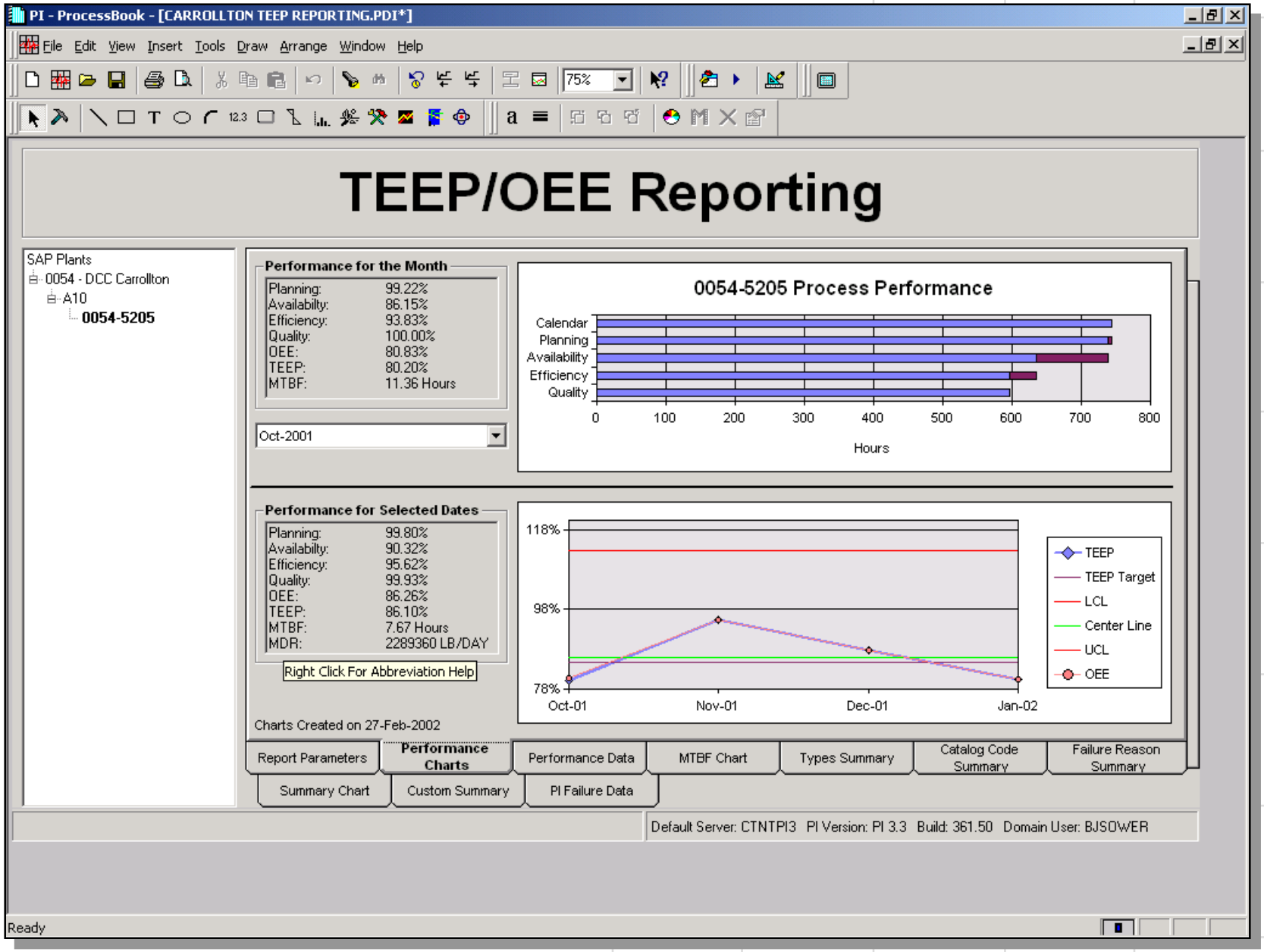




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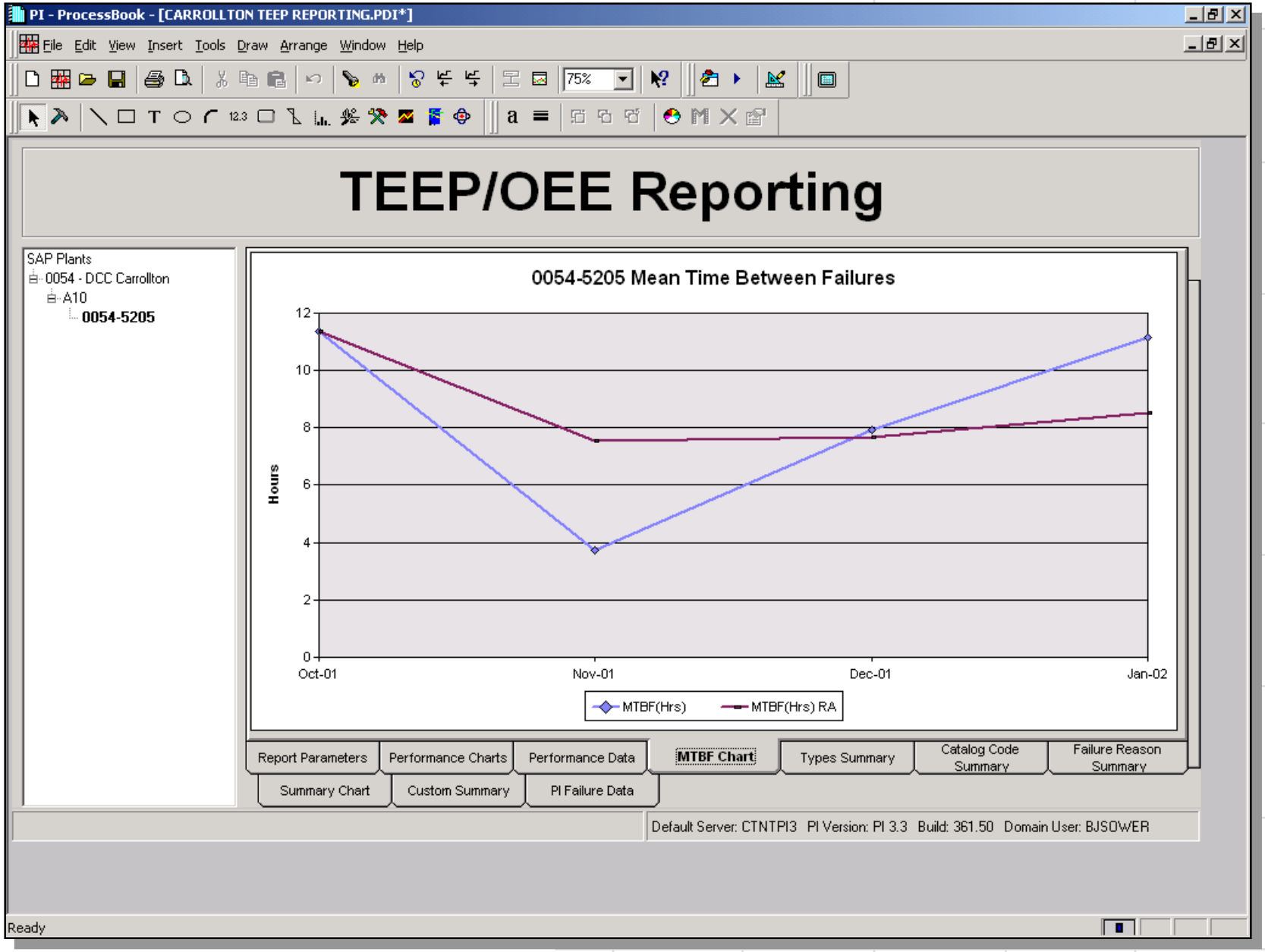




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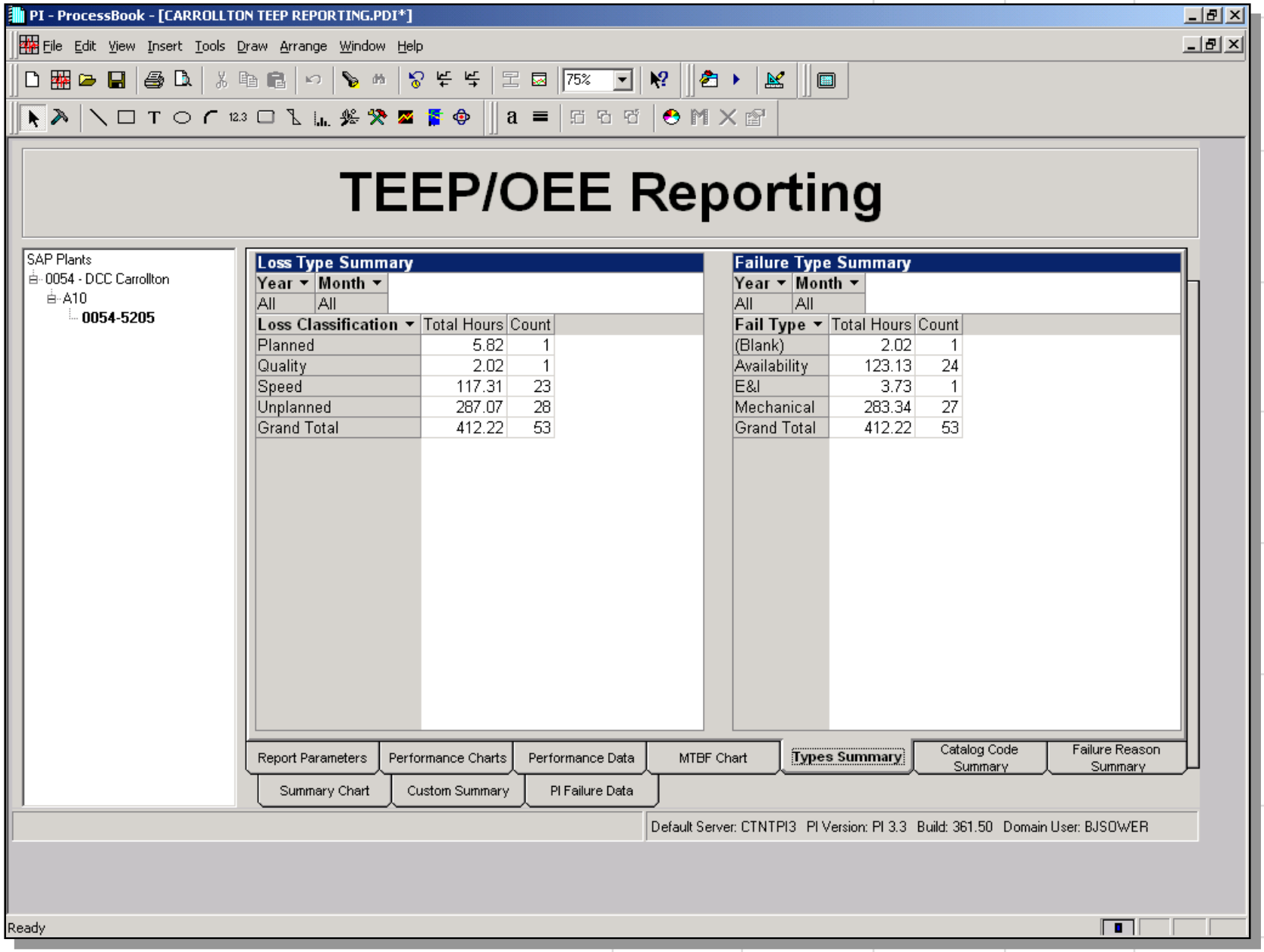




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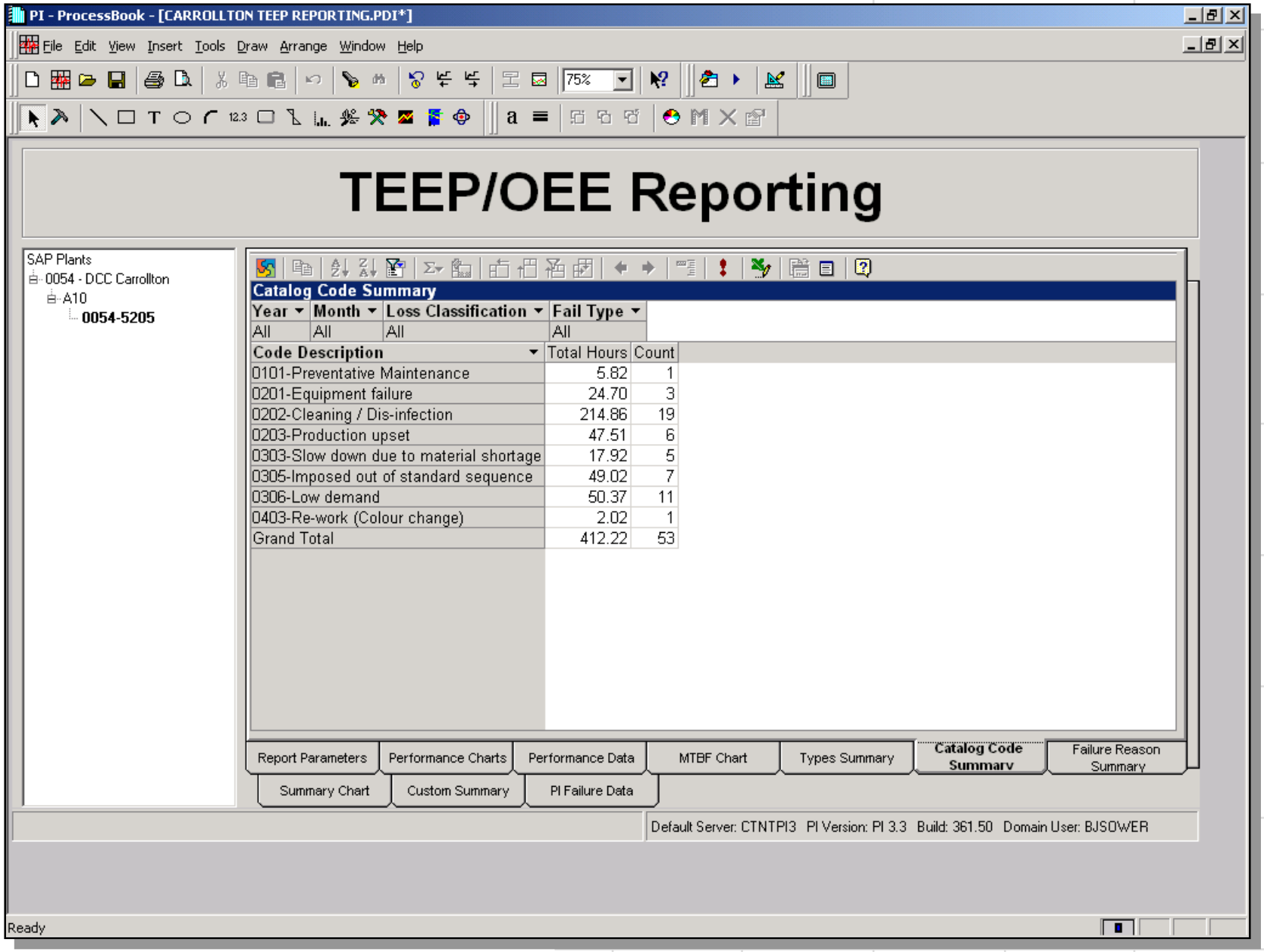




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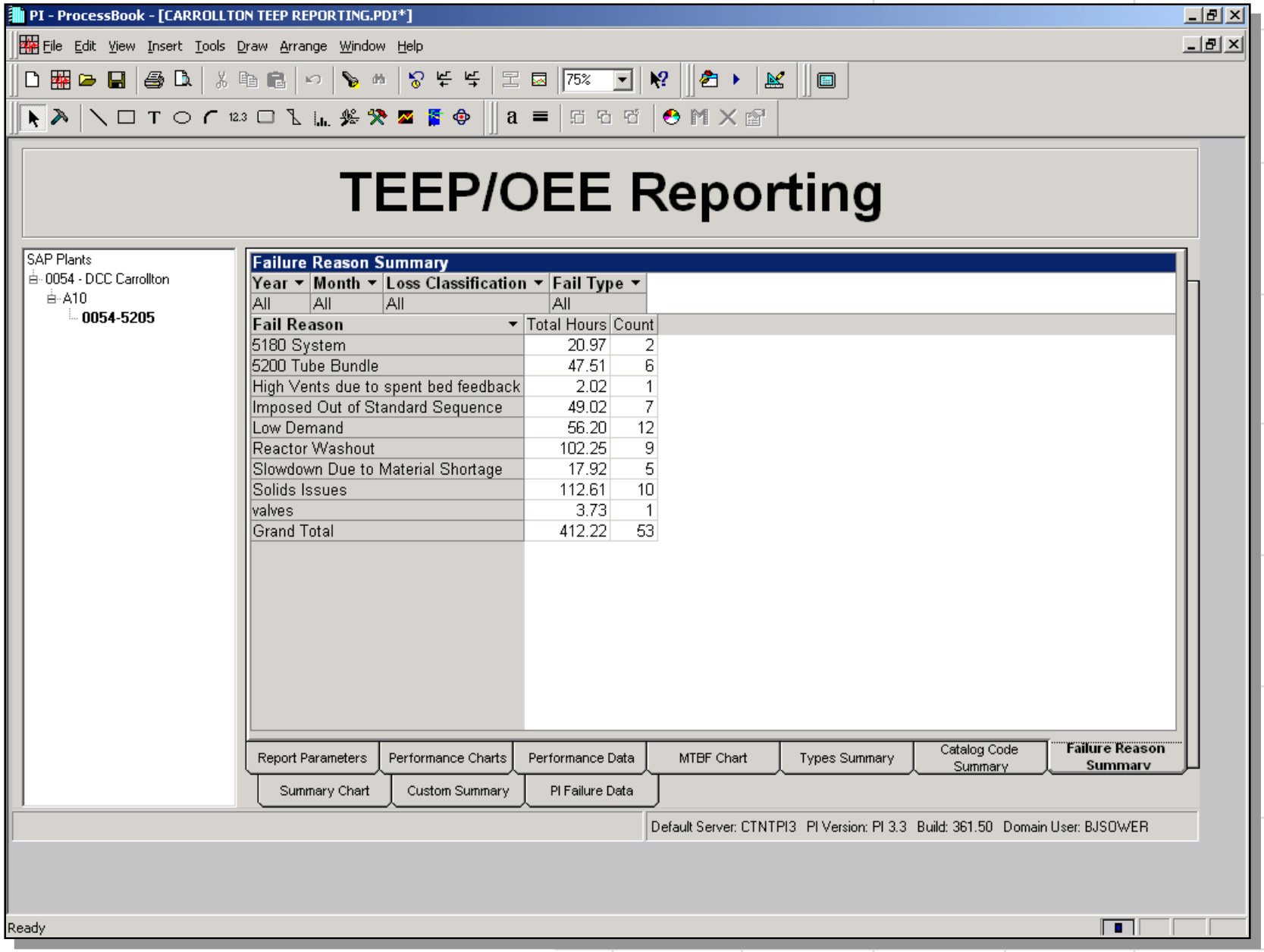




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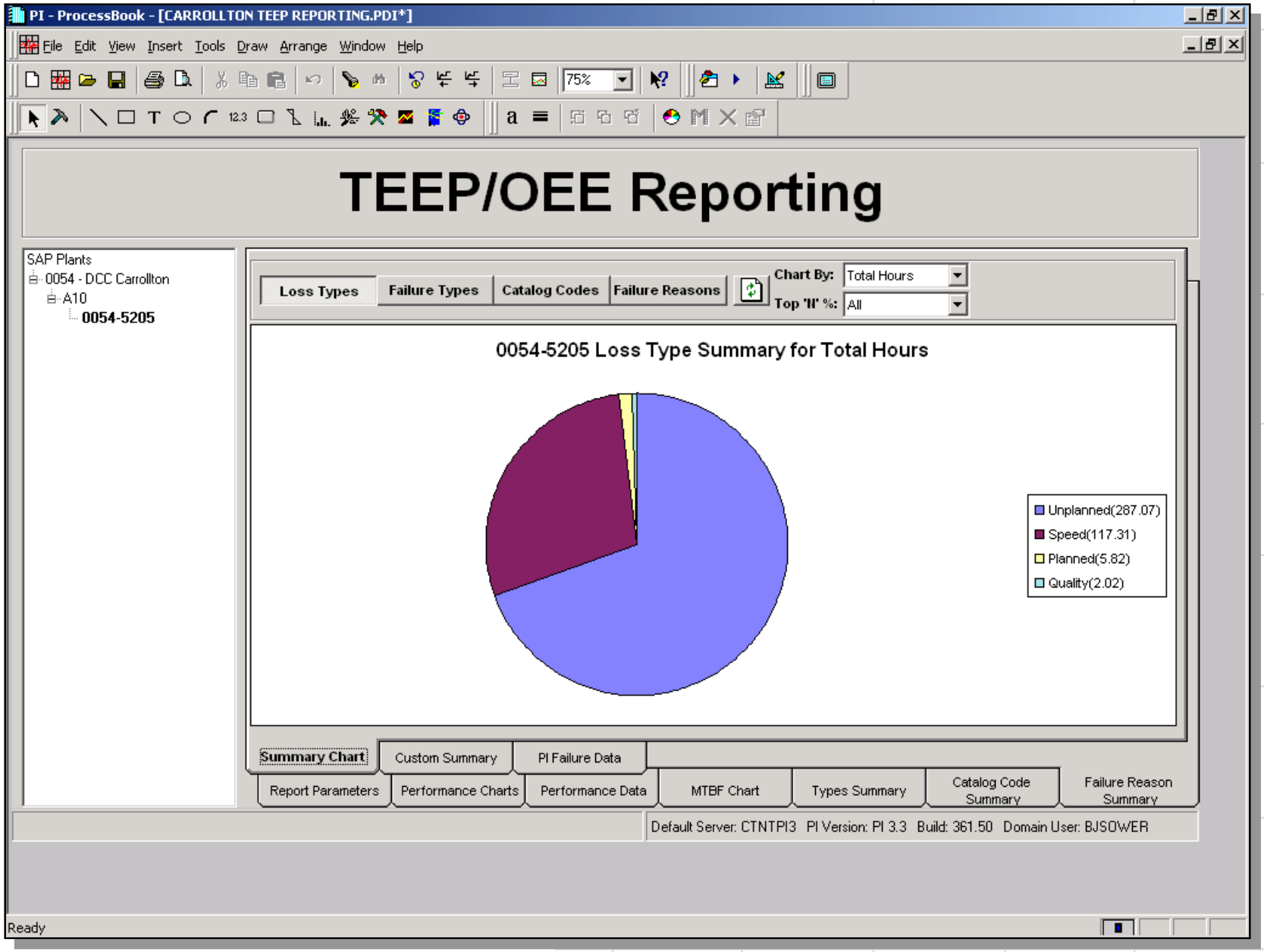




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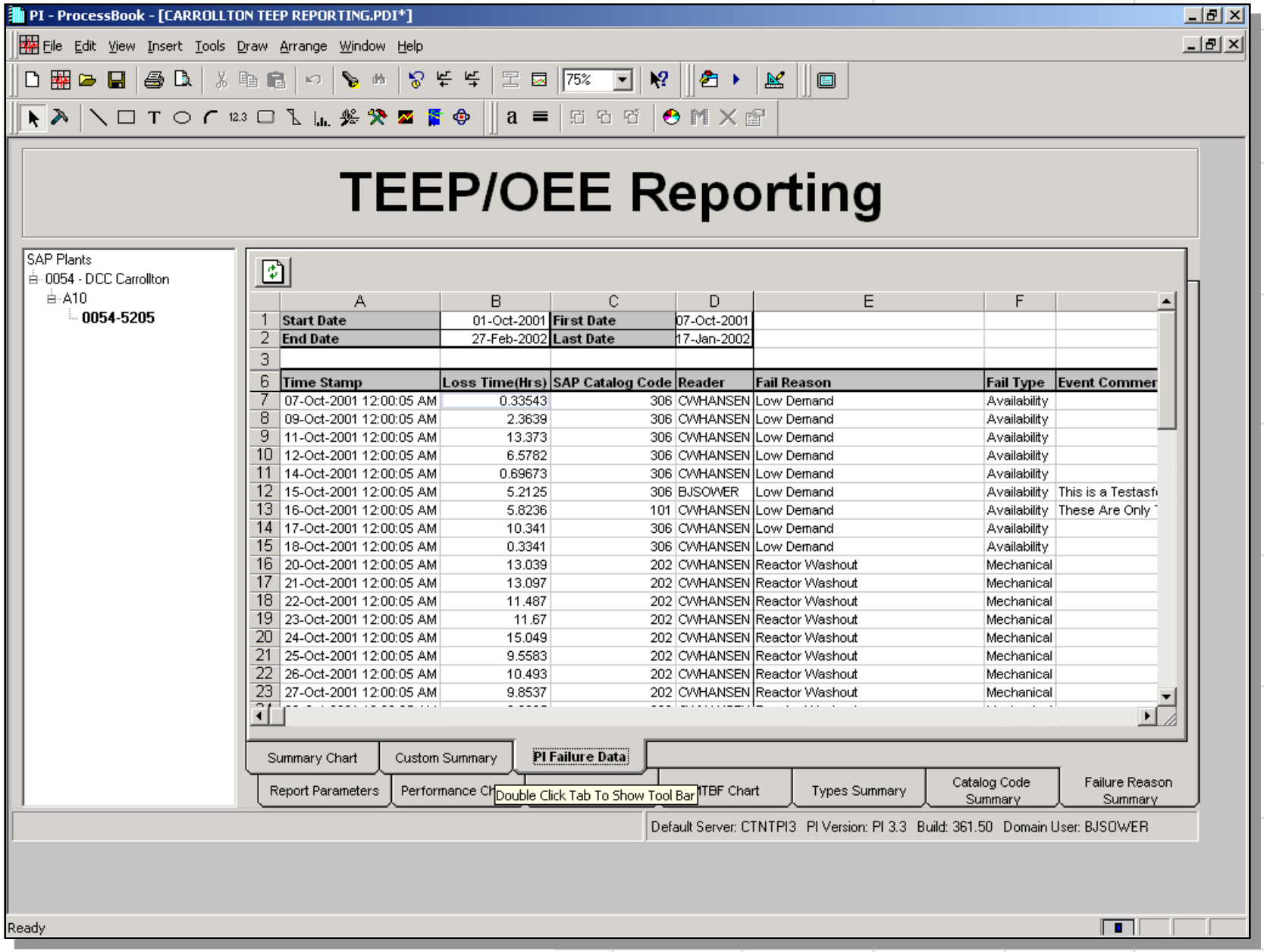


| | A | B | C | D | E | F | |
|---|---|---|---|---|---|---|---|
| 1 | **Start Date** | 01-Oct-2001 | **First Date** | 07-Oct-2001 | | | |
| 2 | **End Date** | 27-Feb-2002 | **Last Date** | 17-Jan-2002 | | | |
| 3 | | | | | | | |
| 6 | **Time Stamp** | **Loss Time(Hrs)** | **SAP Catalog Code** | **Reader** | **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 Testasf |
| 13 | 16-Oct-2001 12:00:05 AM | 5.8236 | 101 | CWHANSEN | Low Demand | Availability | These Are Only T |
| 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 | |



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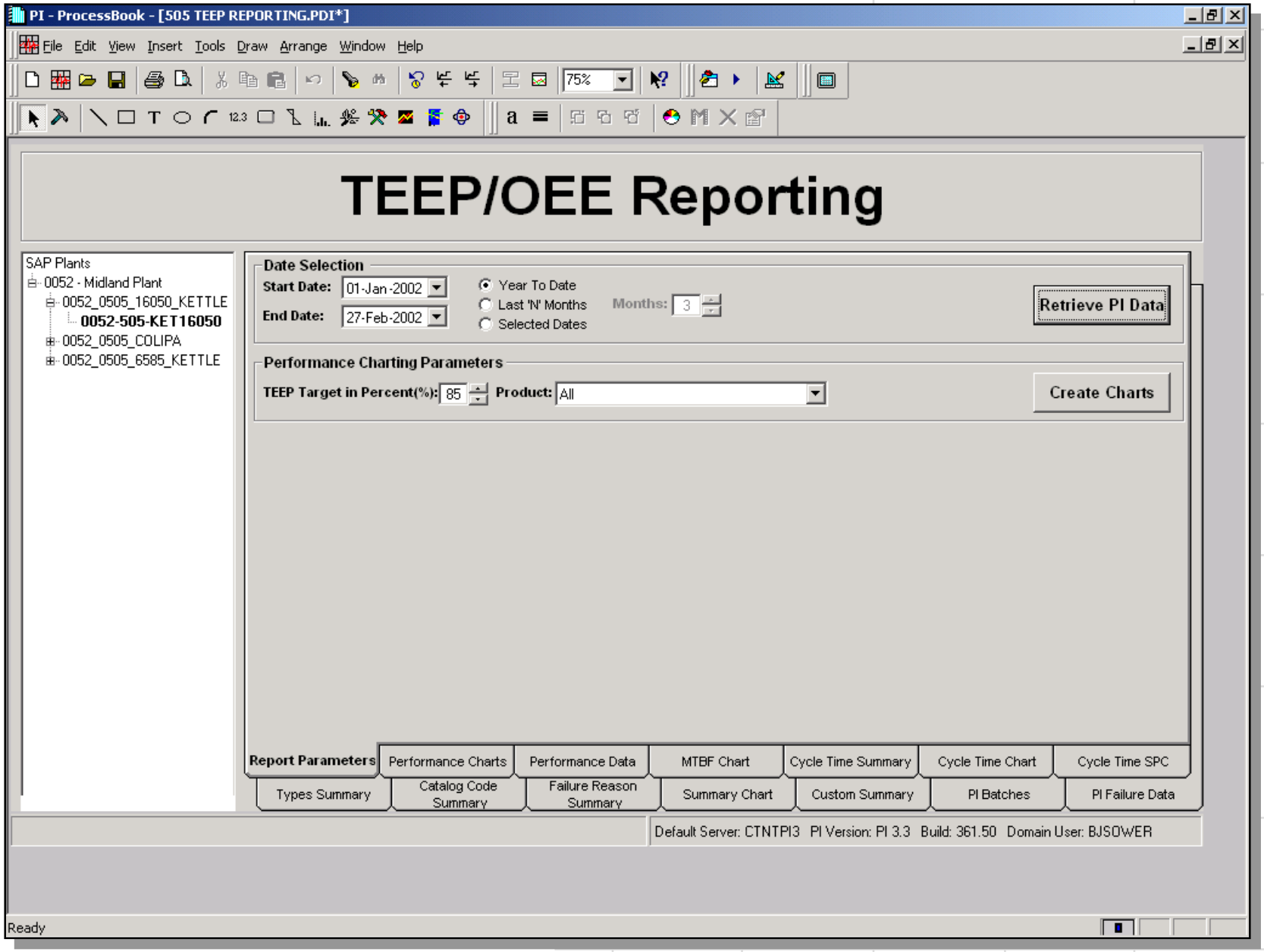




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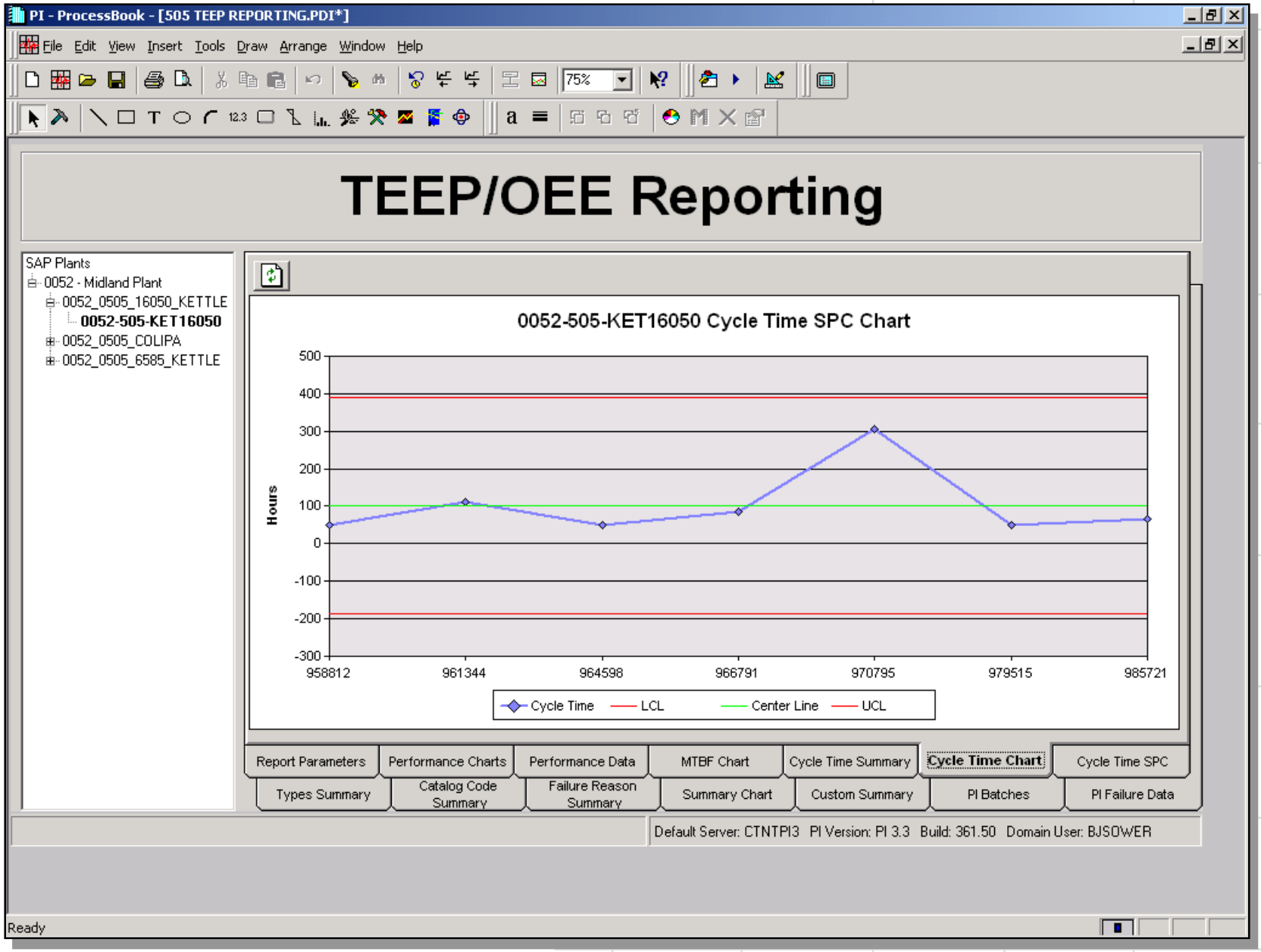




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System Help

# 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

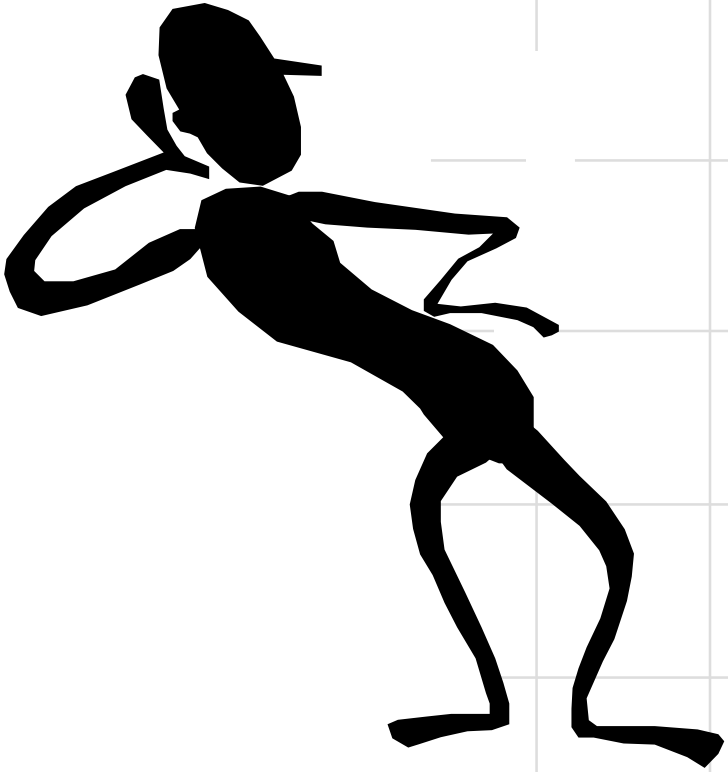
# Summary

- 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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