Condition-Based Asset Management Using PI

How to use PI for condition-based maintenance and save money; Experiences from Irving Paper's Saint John newsprint mill's intiative to integrate PI data with Peoplesoft EnterpriseOne

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Irving Paper, Saint John, New Brunswick CANADA

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OSIsoft Inc.

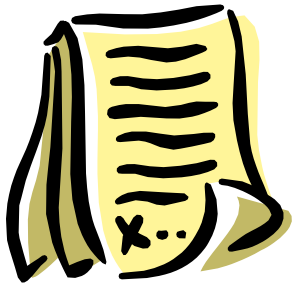
PI gurus at Irving Paper

John Sanford

Harry Bullock

Agenda - what we will discuss

- About Irving Paper company
- PI environment and tools
- 2003 condition-based maintenance initiative
  - Assets monitored
  - Rules for condition monitoring in PI
  - PI events become action items that are integrated and tracked via the maintenance system (JDEdwards)
  - Metrics for measuring performance success in the combined operations/maintenance (PI/JDEdwards) system
- Future plans
- Questions



Not on Agenda - what we will NOT discuss

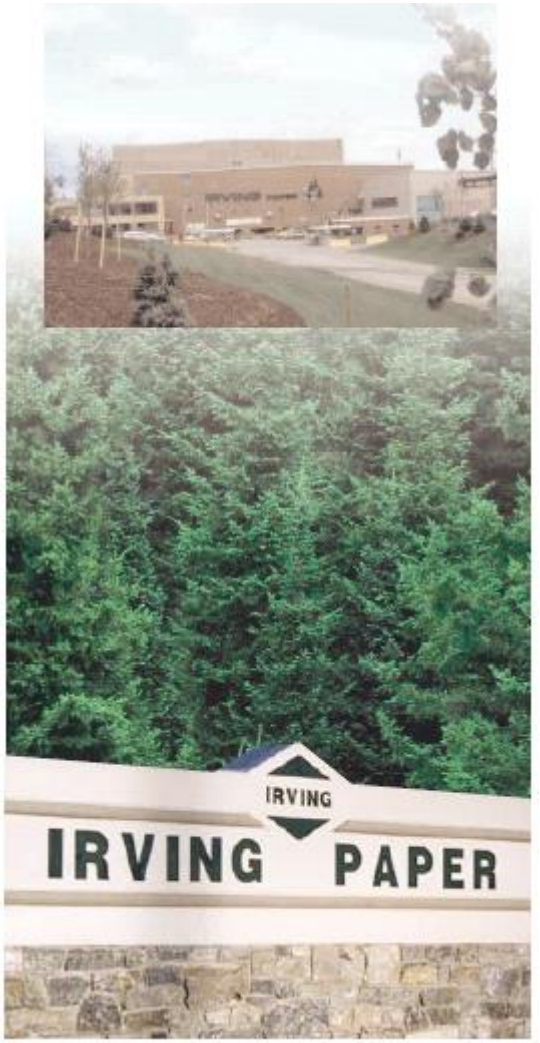
- Why integrate Operations and Enterprise?
- Why do condition-based maintenance?

(may be towards the end of the presentation)

Instead discuss HOW IS IT BEING DONE

- How to use PI for condition-based maintenance and save money?
- "YOU CAN DO IT, WE CAN HELP"

About Irving Paper, Saint John, New Brunswick, Canada



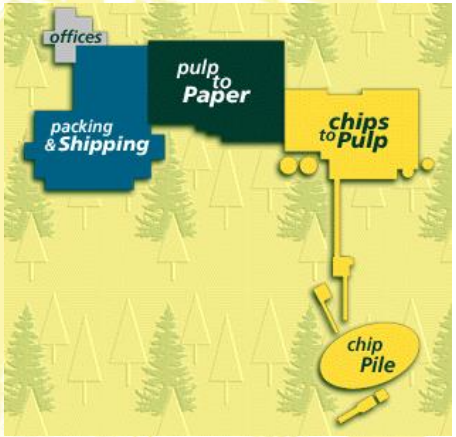
www.IrvingPaper.com
www.JDIrving.com

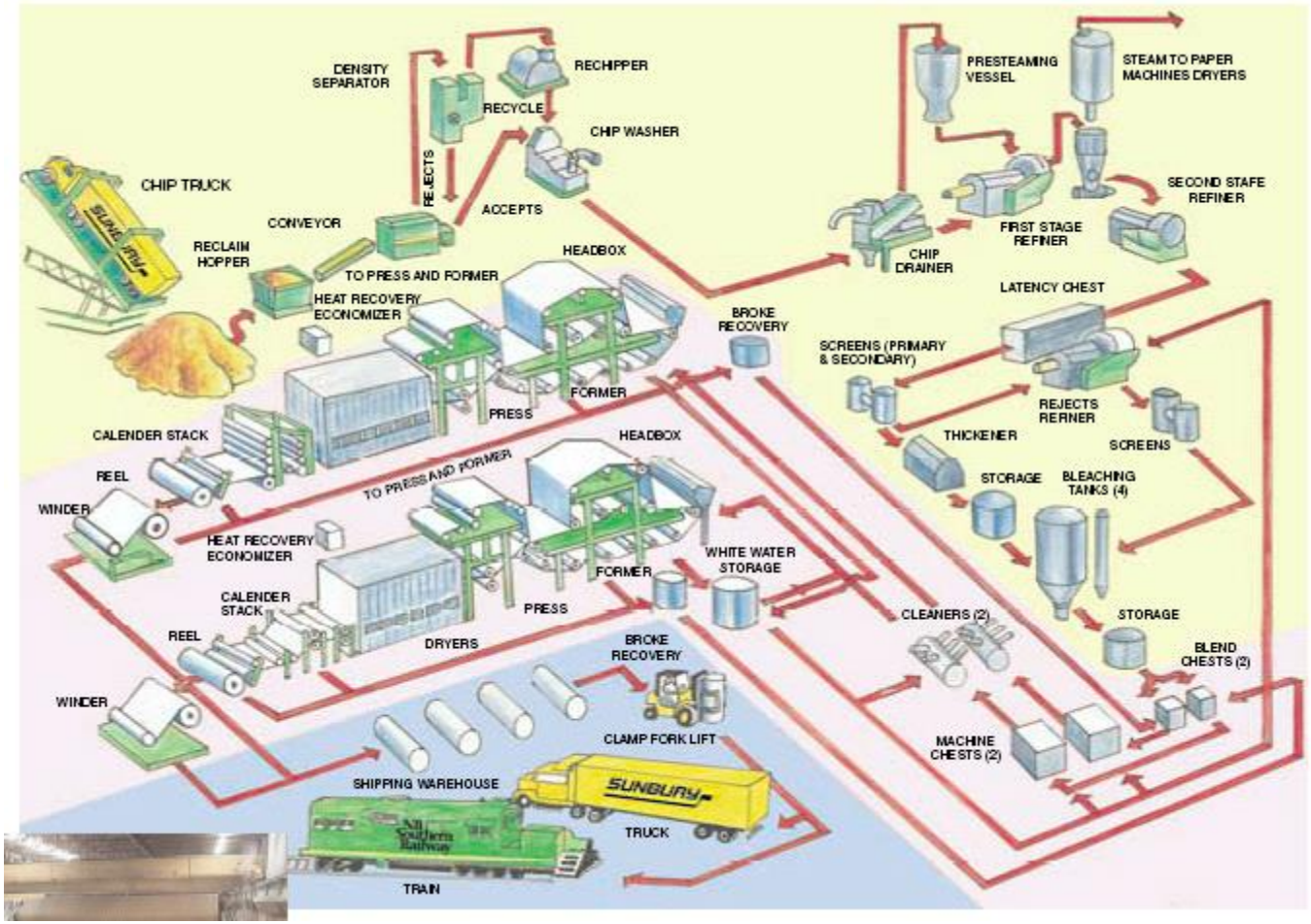
Irving Paper is a part of J.D. Irving Limited, a privately owned company

Key Stats for Irving Paper:

- ✓400 employees
- ✓400,000 tonnes per annum of newsprint and super calendered paper
- ✓250 million dollars sales

About paper making at Irving Paper





http://www.jdirving.com/pdf/Paper_making_brocure.pdf

Slide show: http://www.ifdn.com/paper/paper.htm

About Irving Paper - cont'd (1)

- **1964 Mill initial commission (Rothesay Paper Corp.)**
  - PM#1 production 150,000 tonnes per annum of newsprint
- **1970 PM#2 added**
  - PM#2 production 300,000 tonnes per annum of newsprint
- **1981 Acquired by Irving Group**
- **1981 JDEdwards World (green terminals) AS/400 and DB2**
- **1990 Honeywell DCS**
- **1990 Soft calender added to PM#1**
- **1996 PI2 System(VAX), 5000 PI points, purchased via Honeywell(CM50)**
- **1999 On-line calender added to PM#2**

About Irving Paper - cont'd (2)

- 1999/2000 JDEdwards OneWorld (client/server) deployment
- 2001/2002 PI3 server upgrade and roll-out

- 2003 production total was 400,000 TPA (tonnes per annum) including newsprint and calendered paper
  - used for printing inserts, magazines, catalogs etc.

- 2003/2004 Condition-based maintenance initiative

RtPM (PI) Environment and tools used

OSIsoft RtPM™

- PI3 server, 20,000 tags
- Interfaces
  - Honeywell OPC and Scan3000, Measurex MX-Open, AllenBradley RSLinx, Wonderware InTouch, GE Cimplicity, PI-OPC, PI-OLEDB, PI-DAP (some custom interfaces to get data from CEMS, roll-tracking etc.)
- Terminal services to access JDEdwards
- PI clients on desktops
  - PI-ProcessBook
  - PI-DataLink
  - PI-ControlMonitor (200+ loops currently monitored, 800 more to add)
  - PI-Profile
  - PI-Batch (pilot)
- RLINK – integration with PeopleSoft EnterpriseOne (aka JDEdwards OneWorld), this is work in progress
- ICE/RtPortal (pilot, IrvingPaper is already a SharePoint 1.0 site since 2002)

2003/2004 - Condition-based maintenance initiative

- Since the early 90s – basic care package and a work management system already in place using JDEdwards electronic requisition

HOWEVER,

- Most routine maintenance was calendar-based (filter change, lubrication etc.)
- Most process maintenance was driven by the "squeaky wheel" philosophy (lab complaint, customer complaint), i.e., reactive/corrective maintenance

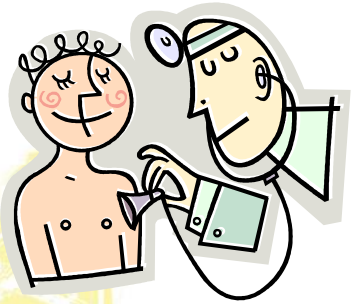
2003/2004 - Condition-based maintenance initiative – cont'd

TODAY, proactive maintenance, with emphasis on diagnostic/analytical tools, the following have been identified at Irving Paper:

- 1000+ process variables (i.e. items that are not in a control loop)
- 900+ control loops
- 500+ motor/pumps

Annual maintenance budget – 22 million dollars at Irving Paper

Add similar effort at several other mills in the Irving Forest Products Group



Sample items monitored

Unit/Equipment	Description	PI Tags	Condition	WO Template
PM2/8053	PM2 to BL/C Flow	PDI8053.PV PDI8053.AL	High filter ΔP	PIDIFF
PM1/6835	Calender1 Pocket Pump Suction	PI6835.PV PI6835.AL	Low suction P	PILOPSI
SLF1/G0684	SLF1 Motor Temp	TC0684.PV TC0684.AL	High temp.	PIHITEMP
Line3/G2957	L3STP Refiner Vibration	XI2957.PV XI2957.AL	High vibration	PIVIB
PM2/M15L11	PM2 DE Beater runtime	M15L11.TZ	Motor runtime	PITOT
PM2/8127	PM2 Clay Flow	FIC8127.CM	Loop needs tuning	PITUNE

Mapping PI and Maintenance

- ✓ Identify and set up PI events (Alarm, Totalizer, PE, ACE, ControlMonitor, External program….)

2. Create a SMT like spreadsheet, include mapped Maintenance items, Export to RLINK

3. Ensure RLINK service is running

4. When said PI event occurs, corresponding Maintenance action is triggered

5. Use familiar PI tools to diagnose PI event further, if necessary

Condition monitoring using *Alarm Tags:* process parameters are NOT in a control loop

Microsoft Excel - IrvingAlarm Tags_FORScreenCaptureWithColumnHidden.xls

File Edit View Insert Format Tools Data Window PI RLINK PI-SMT Help

Type a question for help

Arial 10

Security...

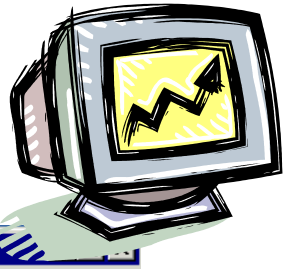
AY5 GT (2) +30m

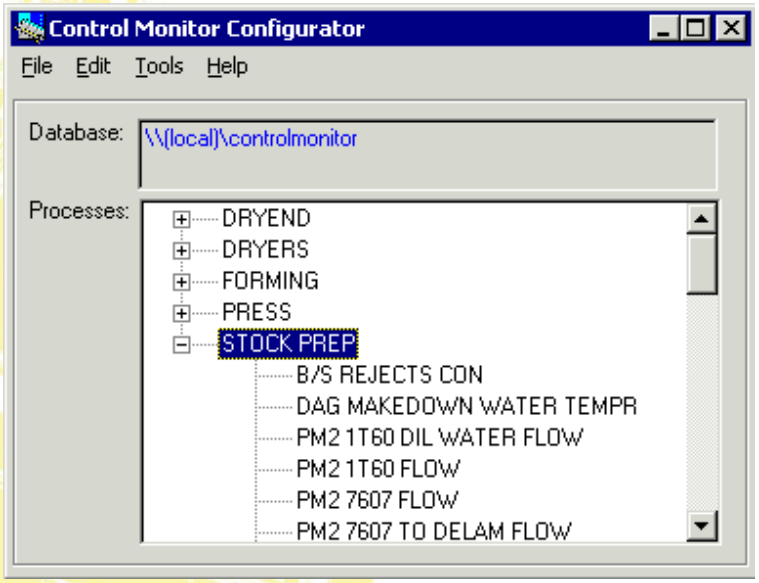
	B	D	J	Z	AH	AK	AL	AN	AU	AY
1	Tag	action1	AutoAck	descriptor	exdesc	pointsource	pointtype	ptclassname	sourcetag	test1
2	PDI8053.AL	High 1	yes	SAVEALL SHOWER PRESSURE	ONEWORLD.AG	@	digital	Alarm	PDI8053.PV	GT (1) +30m
3	PI6835.AL	Low 1	yes	POCKET PUMP SUCTION LOW	ONEWORLD.AG	@	digital	Alarm	PI6835.PV	LT (5.5) +30m
4	TC0684.AL	High 1	yes	SLF1 MOTOR TEMP HIGH	ONEWORLD.AG	@	digital	Alarm	TC0684.PV	GT (150) +30m
5	XI2957.AL	High 1	yes	L3STP REFINER VIBRATION HI	ONEWORLD.AG	@	digital	Alarm	XI2957.PV	GT (2) +30m
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										

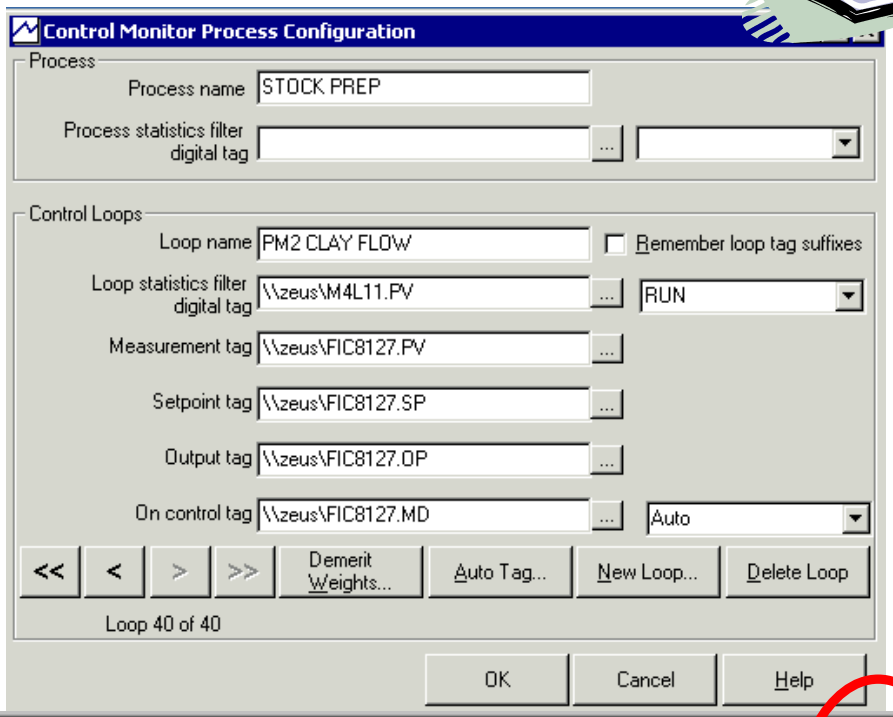
Sheet1 Sheet2 Sheet3

Ready

Condition monitoring using *ControlMonitor:* process parameters in a control loop

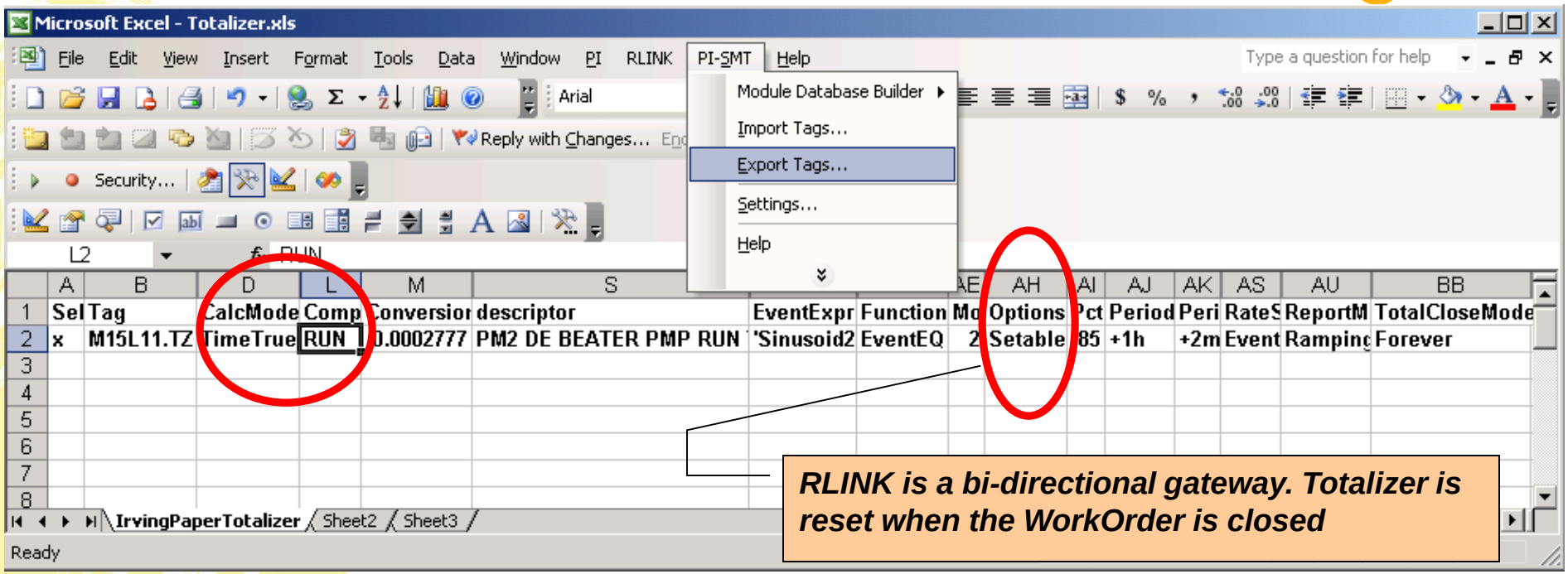






Process	Loop	Meas Tag	On Control	Output	Stability	Avg Error	%Error	Units	Demerits
STOCK PREP	PM2 BROKE SCREEN REJ FLOW	FIC8080.PV	0.0	0.0	100.0	344.2	100.0	GPM	230
STOCK PREP	PM2 BROKE SCREEN DIL FLOW	FIC8077.PV	0.0	0.0	100.0	200.2	100.1	GPM	230
STOCK PREP	PM2 WW STORAGE TANK LEVEL	LIC8040.PV	0.0	0.0	100.0	37.7	94.2	%	224
STOCK PREP	B/S REJECTS CON	CSIC8081.PV	0.0	-6.9	100.0	0.4	3.5	%	140
STOCK PREP	PM2 CLAY FLOW	FIC8127.PV	0.0	-6.9	100.0	0.0	0.0	GPM	137
STOCK PREP	PM2 RLF FLOW TO SAVEALL	FIC8019.PV	0.0	0.0	100.0	0.0	0.0	GPM	130
STOCK PREP	PM2 KRAFT FLOW TO SAVEALL	FIC8129.PV	0.0	0.0	100.0	0.0	0.0	GPM	130

Condition monitoring using *PI-Totalizer:* motor runtime hours, counting RUN/IDLE events



Mapping PI and Maintenance

- ✓ Identify and set up PI events (Alarm, Totalizer, PE, ACE, ControlMonitor, External program….)
- ✓ Create a SMT like spreadsheet, include mapped Maintenance items, Export to RLINK

3. Ensure RLINK service is running
4. When said PI event occurs, corresponding Maintenance action is triggered
5. Use familiar PI tools to diagnose PI event further, if necessary

Mapping PI and Maintenance

Microsoft Excel - RLINKJDEIrvingSMTIPI02.xls

File Edit View Insert Format Tools Data Window PI RLINK PI-SMT Help

Generate | Configuration File

Security...

O10 | FIC8053.PV

Highlighted columns show key field mappings between PI tags and JDE WorkOrder parameters

	A	B	D	F	G	K	L	M	N	O	P
1		**RLINK Configuration Worksheet** (v1.2.0)									
2		© 2003 OSIsoft, Inc. All Rights Reserved									
3											
4											
5											
6											
7		**Plant Name**	**Unit Name**	**Equipment Alias**	**Equipment Description**	**Point Group Type**	**Param1**	**Param**	**Param3**	**Tag ID**	**Tag ALIAS**
8				(JDE Asset Identifier)			(JDE NotUsed)		(JDE ServiceType)		
9		*JDE Work Order*									
10	X	Irving Paper	PM2	8053	PM2 TO BL/C FLOW	ALARM	NotUsed		PIDIFF	FIC8053.PV	VALUE
11	X									FIC8053.AL	ALARM
12	X									FIC8053.ST	NOTIFICATION
13											
14	X	Irving Paper	PM1	6835	Cal 1 Pocket Pump Suction	ALARM	NotUsed		PILOPSI	PI6835.PV	VALUE
15	X									PI6835.AL	ALARM
16										PI6835.ST	NOTIFICATION
17											
18	X	Irving Paper	SLF1	G0684	SLF1 Motor Temp	ALARM	NotUsed		PIHITEMP	TC0684.PV	VALUE
19	X									TC0684.AL	ALARM
20	X									TC0684.ST	NOTIFICATION
21											
22	X	Irving Paper	L3	G2957	L3STP Refiner Vibration	ALARM	NotUsed		PIVIB	XI2957.PV	VALUE
23	X									XI2957.AL	ALARM
24	X									XI2957.ST	NOTIFICATION
25											
26	X	Irving Paper	L3	8127	PM2 Clay Flow	STATE	NotUsed		PITUNE	FIC8127.CM	ALARM
27										FIC8127.ST	NOTIFICATION

Sheet1

Ready

Mapping PI and Maintenance

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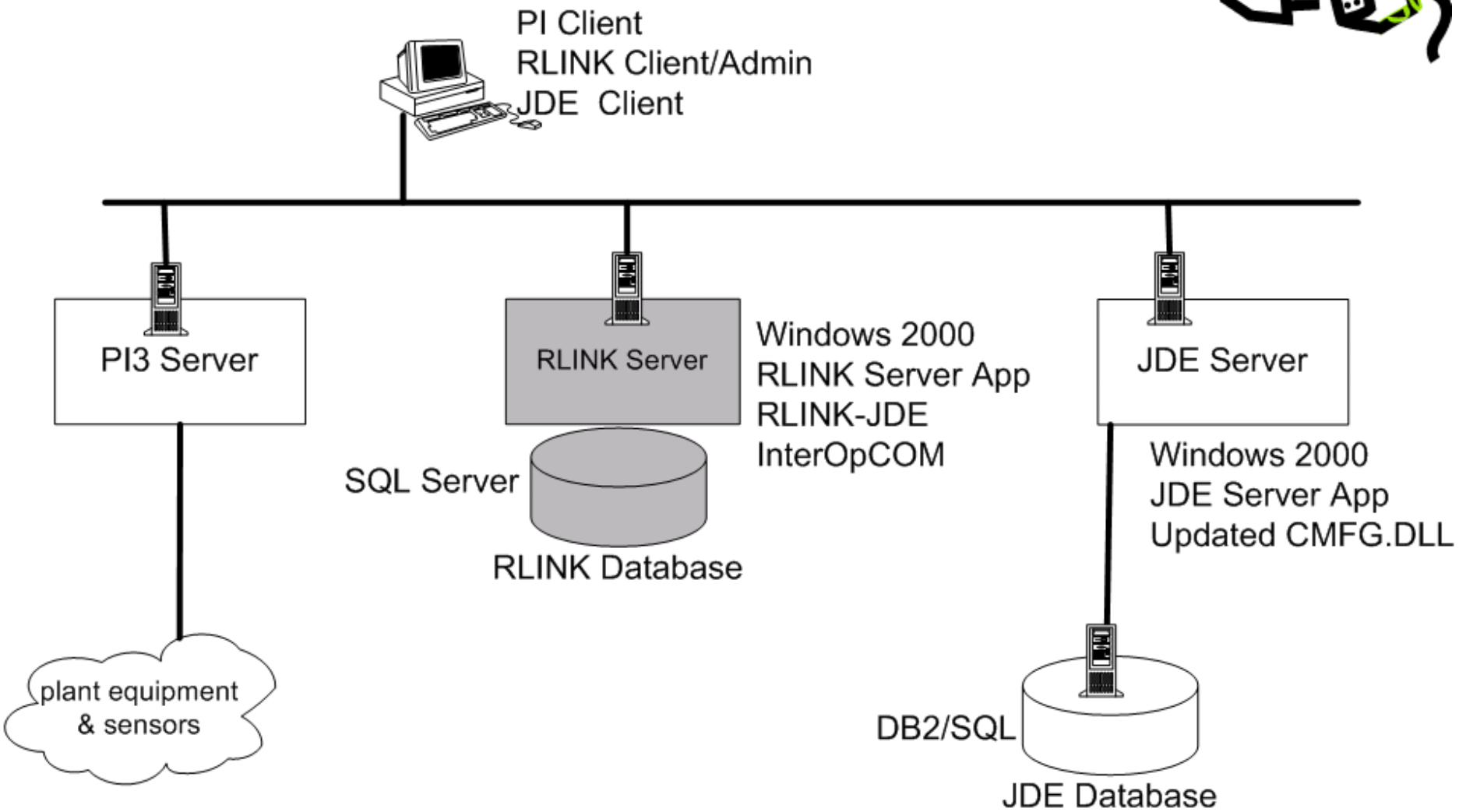
- ✓ Ensure RLINK service is running

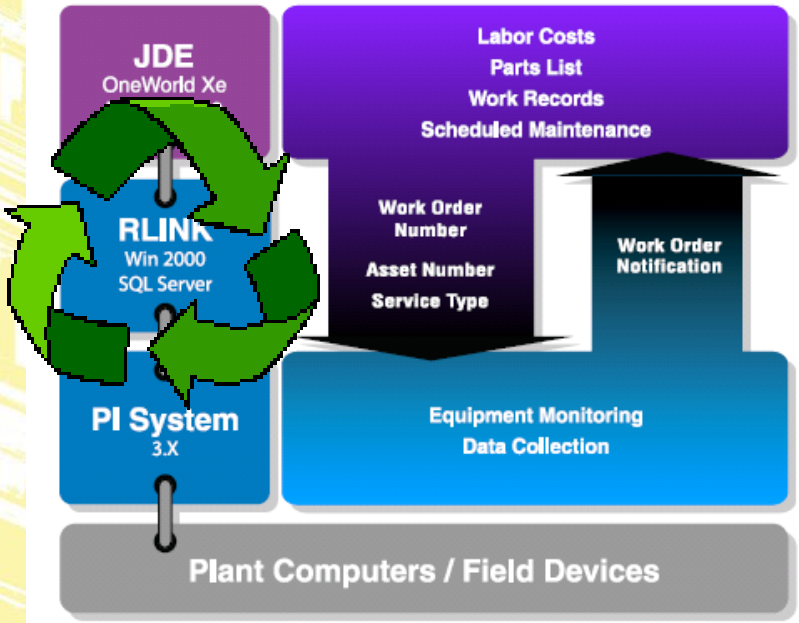
4. When said PI event occurs, corresponding Maintenance action is triggered

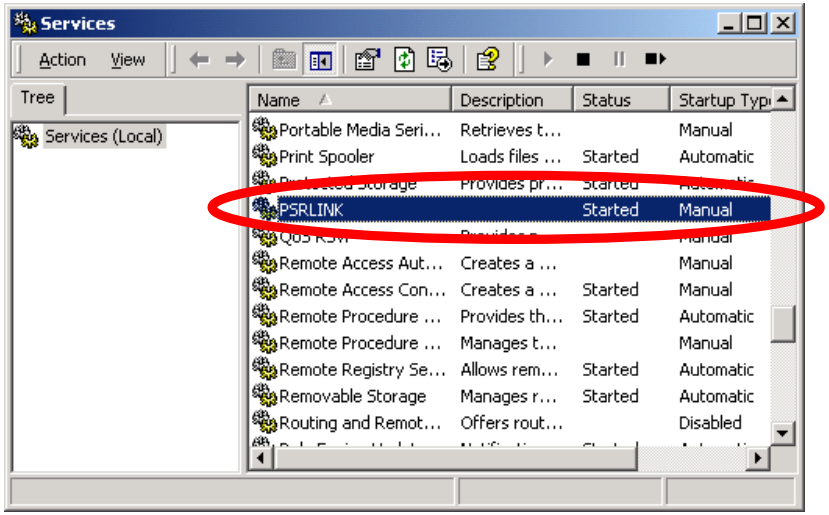
5. Use familiar PI tools to diagnose PI event further, if necessary

PI-Maintenance (JDEdwards) data flow: Hardware connectivity

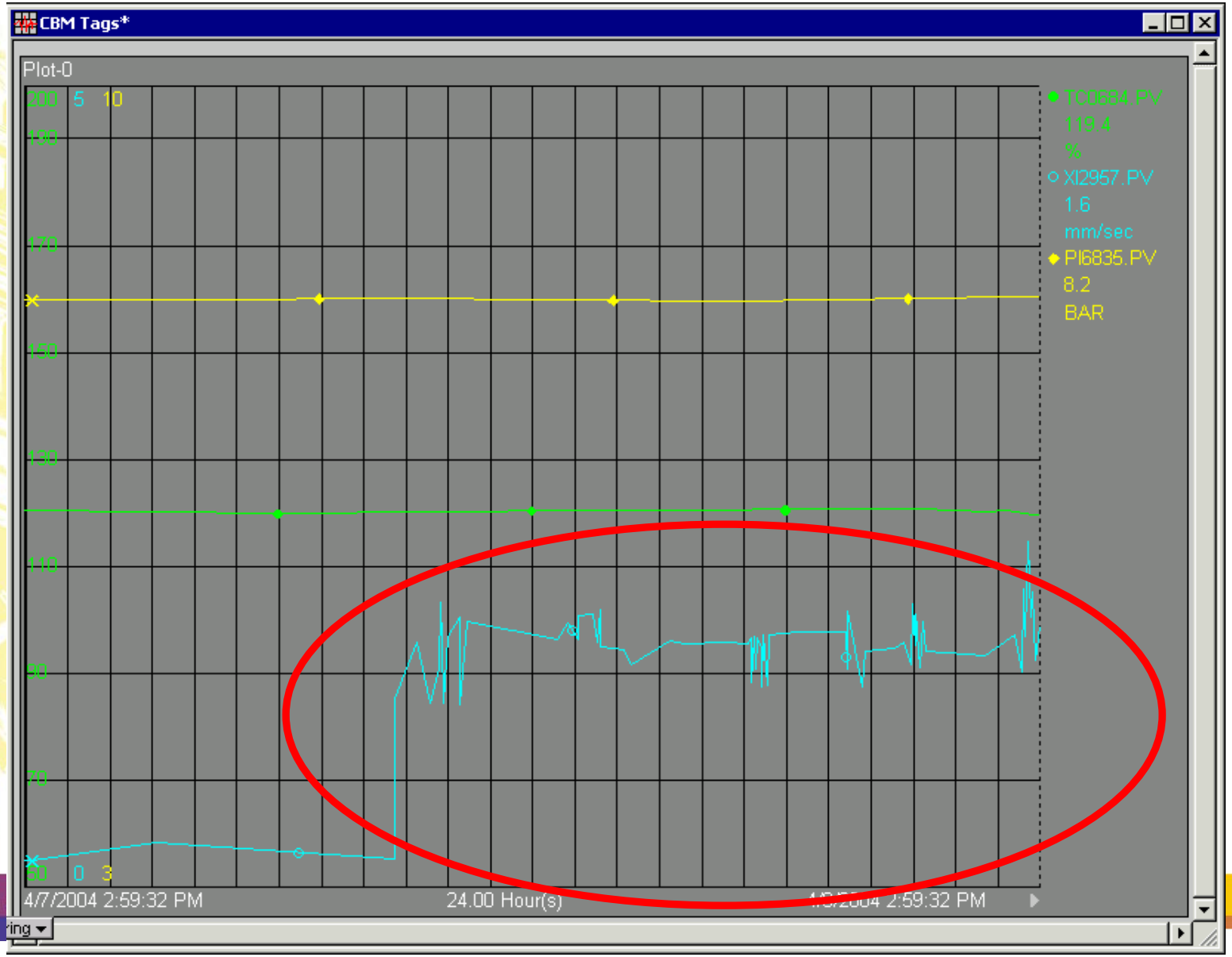


PI-Maintenance (JDEdwards) data flow: RLINK service

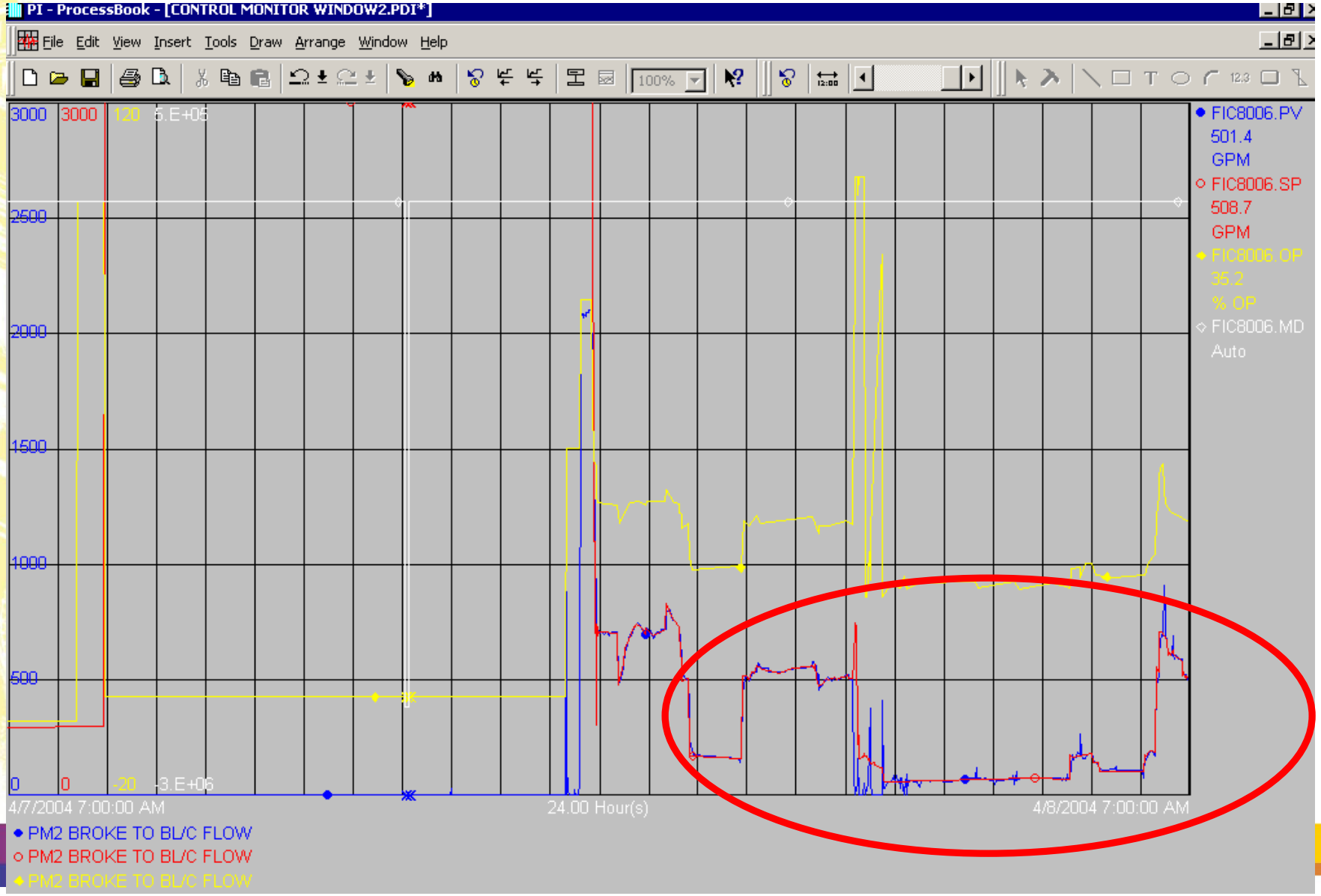




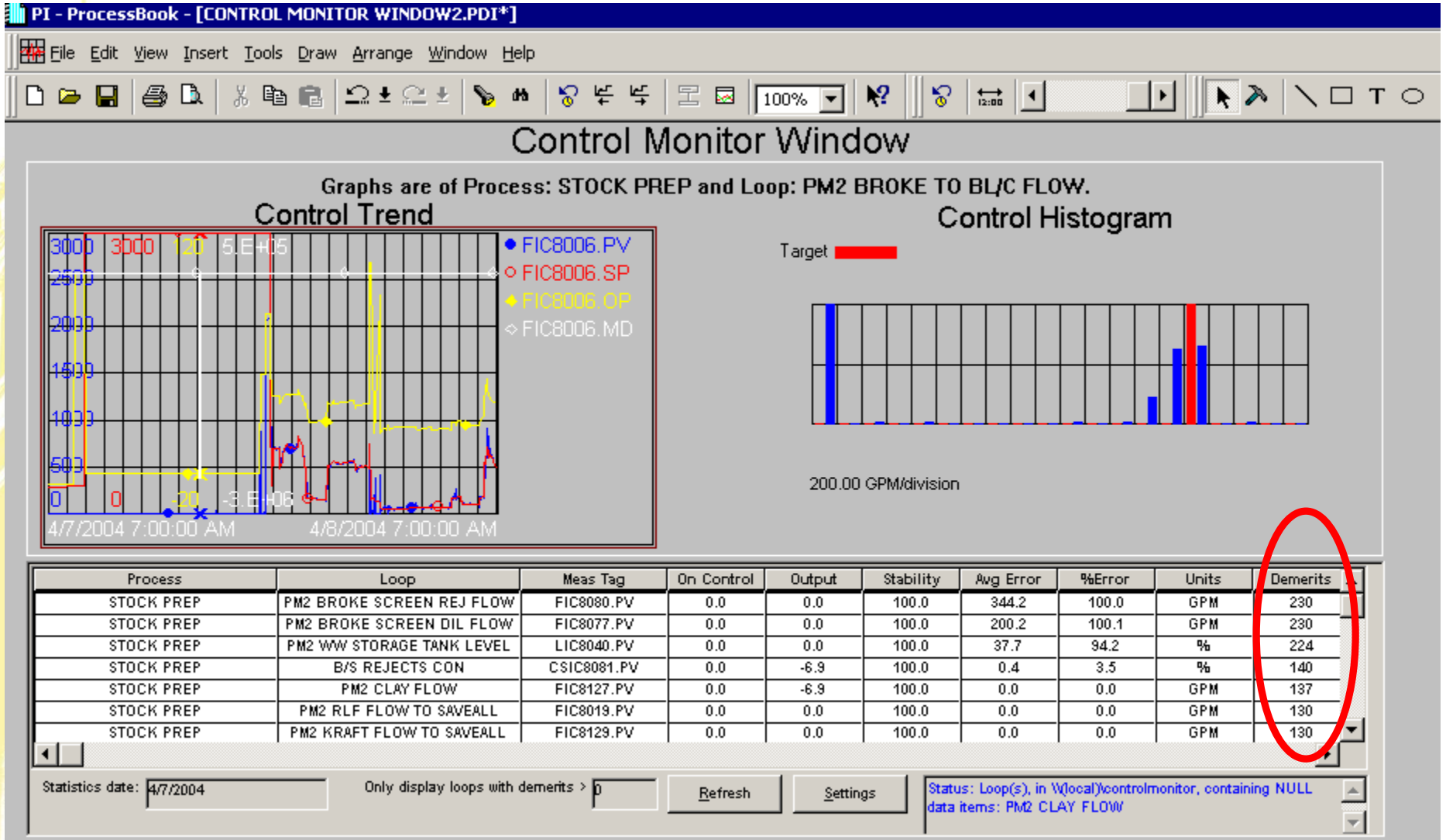
Diagnostic – High vibration, equipment needs inspection



Diagnostic – process loop needs tuning



Diagnostic – process loop needs tuning (cont'd)



Automatic WorkOrder - High vibration

APR-08-2004 15:11 IPI MAINTENANCE 6442642 P.01

R5648425B

36062 BULLOCK, HARRY

Irving Paper Inc.

Time: 11:16:22

Date: 4/8/2004

Irving Work Order Report

Order Number *242696* Order Type *VIBRATION HIGH ALARM*

Entity	G2957	VIB. -SECONDARY THERMOPULP REF INER					
BOM	G2957	VIB. -SECONDARY THERMOPULP REF VIB. -SECONDARY THERMOPULP REF					
Type	5 CORRECTIVE MAINTENANCE	Priority	1 URGENT	Start Date	4/5/2004		
Status	60 Active	Shutdown Event Code	C NO SHUT DOWN REQUIRED				
Supervisor		Location		Column		Row	

Work Order Description

VIBRATION HIGH ALARM
VIBRATION HIGH ALARM

Equipment Cross Reference

Entity Lockout Procedure

Parts List

Automatic WorkOrder – process loop needs tuning

APR-08-2004 15:10 IPI MAINTENANCE 6442642 P.01

R5648425B

36062 BULLOCK, HARRY

Irving Paper Inc.

Irving Work Order Report

Time: 11:10:04AM

Date: 4/8/2004

Order Number 242697 Order Type CHECK CONTROL LOOP

Entity 8127 PM2 CLAY FLOW

BOM 8127 PM2 CLAY FLOW PM2 CLAY FLOW

Type 4 BASIC CARE READY TO SCHEDULE Priority 2 NORMAL Start Date 4/5/2004

Status 52 Ready to Go / Unscheduled Shutdown Event Code C NO SHUT DOWN REQUIRED

Supervisor Location Column Row

Work Order Description

CHECK CONTROL LOOP

CHECK CONTROL LOOP

Equipment Cross Reference

Entity Lockout Procedure

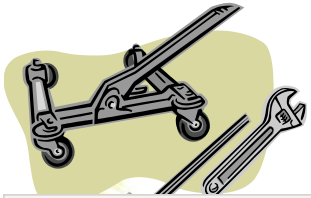
Parts List

Recap – Mapping PI and Maintenance

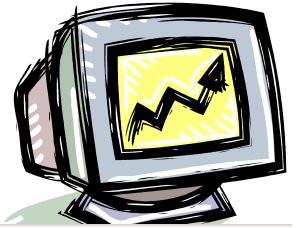
- ✓ Identify and set up PI events (Alarm, Totalizer, PE, ACE, ControlMonitor, External program….)
- ✓ Create a SMT like spreadsheet, include mapped Maintenance items, Export to RLINK
- ✓ Ensure RLINK service is running
- ✓ When said PI event occurs, corresponding Maintenance action is triggered
- ✓ Use familiar PI tools to diagnose PI event further, if necessary

So, what has changed for the maintenance personnel?

Easy access to *combined* operations/maintenance data in a *context sensitive manner*



Easy access to combined operations and maintenance data (ProcessBook)

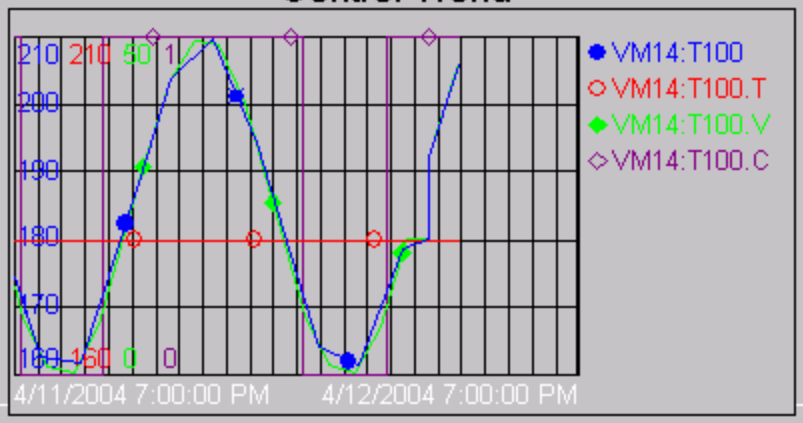


Control Monitor Window*

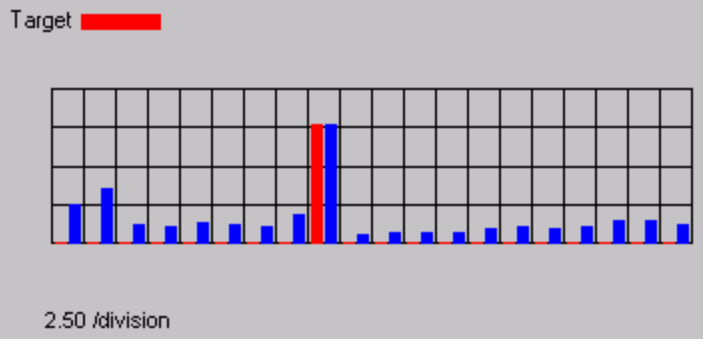
Control Monitor Window

Graphs are of Process: 02 and Loop: VM14.

Control Trend



Control Histogram



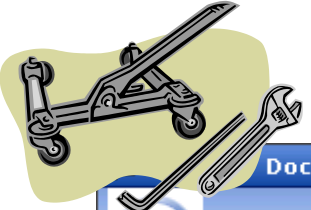
Process	Loop	Meas Tag	On Control	Output	Stability	Avg Error	%Error	Units	Demerits
02	VM14	VM14:T100	37.0	21.7	99.0	14.3	8.0	DEG F	80

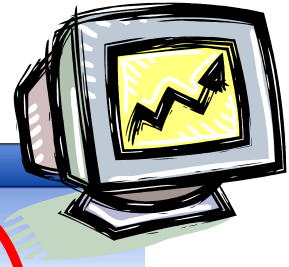
Statistics date: 4/11/2004 | Only display loops with demerits > 0 | Refresh | Settings

REFRESH

AssetID	WONum	WODesc	WOStatus	WODate	WOTime
VM14	451661	Replace numeric contro	MA	4/14/2000	130604
VM14	451645	Refurbish VM14 Vertica	MA	3/27/2000	151843
VM14	400004	Emergency Motor Repla	MH	12/20/1999	144118
VM14	451653	Replace motor on vertic	MA	12/20/1999	141436

Easy access to combined operations and maintenance data (RtPortal)





Documents and Lists Site Settings Help

Control Loops and WorkOrders

My Lists
- Private Documents
- Shared Documents
- My Pictures

My Pages
No pages.

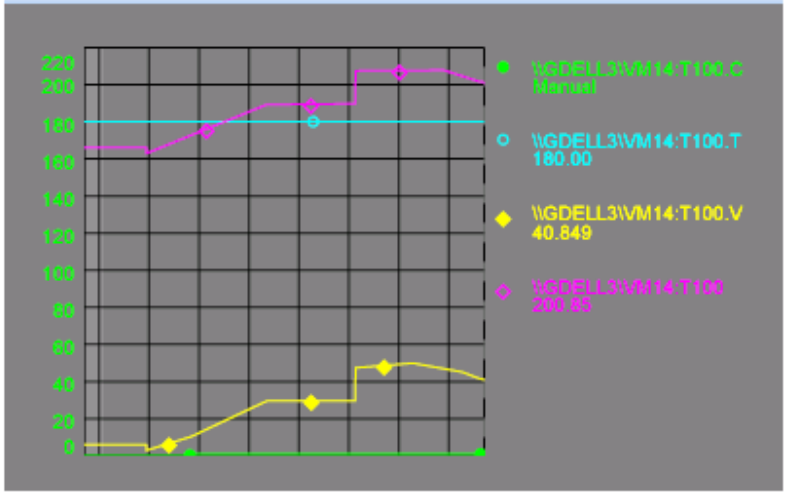
Equipment/Control Loop Alerts

Process.Name	ControlLoop.Name	TOC	points
02	VM14	14.7	98.16
02	02Loop	14.7	98.16

Equipment or Control Loops

- MyPlant
  - MyArea1
  - MyControlLoops
    - 02
      - VM14

Parameters Trend



WorkOrders for Selected Equipment/Control Loop

AssetID	WONum	WODesc	WOStatus	WODate
VM14	451661	Replace numeric control	MA	2000-04-14T13:06:04
VM14	451645	Refurbish VM14 Vertical Mill	MA	2000-03-27T15:18:43
VM14	400004	Emergency Motor Replacement	MH	1999-12-20T14:41:18

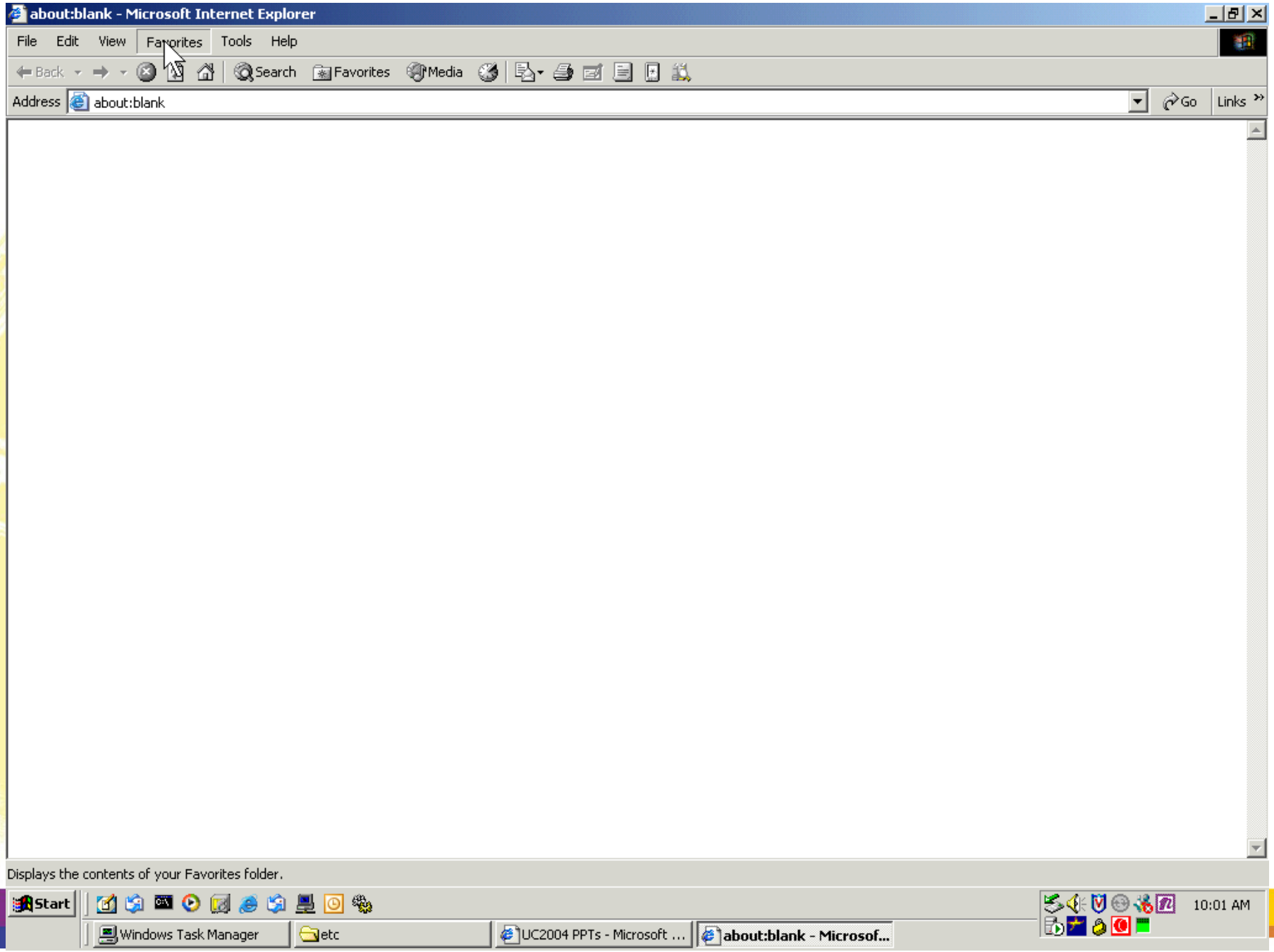
RtPortal RLINK-JDE demo screen-cam

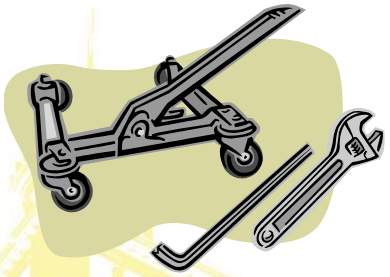
Go to the screen cam available separately as a media (".avi") file:

RtPortal_RLINK_JDE_Demo_ScreenCam.avi

Or

RtPortal_RLINK_JDE_Demo_ScreenCam.EXE

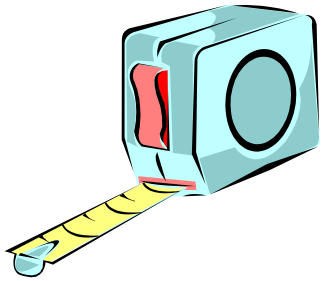

about:blank - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address about:blank
Go Links
Displays the contents of your Favorites folder.
Start
Windows Task Manager
etc
UC2004 PPTs - Microsoft ...
about:blank - Microsof...
10:01 AM

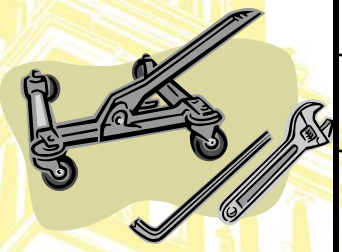


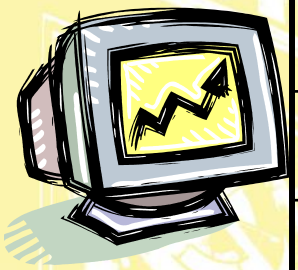
Maintenance KPIs?

- Maintenance cost per Sales dollar
  - $44 per tonne or approx. 9-10% of every sales dollar
- Current equipment availablity 89%
- %CM WOs 39% expected to go down to 30%
- %PM WOs 61% expected to go up to 70%
- %PM overdue 19% (better planning can help reduce this)

Combined operations/maintenance measurable metrics (partial list)







Measurable Metric	↓ ↑	Comment
Priority1/Emergency WOs	↓	Equipment monitored for early indication of failure
Planned WOs	↑	More planned WOs
Total WOs	↑ ↓	Better equipment usage; may increase initially as problem loops are identified, but decrease in the long term
Overtime labor hours	↓	Less unplanned work
Spare parts inventory	↓	No need to carry extra spare, if early warning of failure
Chemicals consumption eg. Bleach per ton of paper	↓	Process running closer to limits, control loops continuously tuned
Variability in product quality	↓	Better control, well-tuned loops
OEE	↑	Better planning and scheduling, longer equipment runtimes

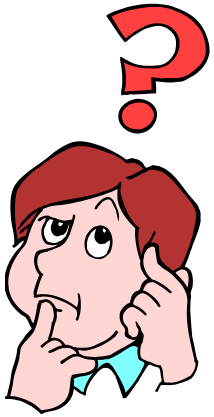
Key learnings from the deployment

- **Rapid (within days) install by plant personnel**
  - Simple test programs help to ease IT's concerns, OSI's close relationship with the ERP vendor helped immensely
  - Engage your maintenance team early on for a list of 10-20 items that are representative samples for "conditions" that trigger an inspection or a work order
- **Maintenance of process equipment (physical assets) is well documented; Control loops maintenance is NOT typically done, but has more benefits**
  - Comprehensive system to proactively identify poorly performing loops and better utilize instrument maintenance personnel
  - A well-tuned regulatory control and properly functioning instrumentation layer is a pre-requisite for sustained benefits from advanced control
- **Conditioned based maintenance (Enterprise Asset Management) is a culture (not a project) and it must be internalized by the entire team**
- **Adaptive learning approach to continually improve the system and adopt best practices on an ongoing basis**
  - What process constraints are appropriate?
  - What process can be run closer to tolerance limits?
- **Avoid transferring data between systems, instead transfer events**
- **RLINK infrastructure allows us to start small and grow using in-house resources**

Future plans

- Expand maintenance integration to other mills in eastern Canada and eastern US, including:
  - **Adjacent Irving Pulp&Paper mill in Saint John (produces 325,000 TPA of kraft pulp)**
  - **Saw mills**
  - **Tissue and personal care products**
- Expand integration to other items such as Production Data Management, Shop Floor, Inventory etc.

Questions?



John Sanford

ERP/EAM integrations

- ✓ Already shipping or soon to ship
  - ✓ SAP
  - ✓ MRO Software MAXIMO
  - ✓ PeopleSoft EnterpriseOne (aka J. D. Edwards OneWorld)
  - ✓ MIMOSA (OpenO&M) - XML based interface (MIMOSA is the OPC equivalent, but in the maintenance arena)
  - ✓ Indus PassPort and EMPAC
- ✓ In discussions with a PI site or the ERP vendor
  - ▶ Synergen Series
  - ▶ Datastream MP 2, 5 , 6 and 7i
  - ▶ Oracle E Business Suite (eAM)
  - ▶ Mincom Ellipse

mro software
ALLIANCE PARTNER

JDEDWARDS
BUSINESS PARTNER

INDUS

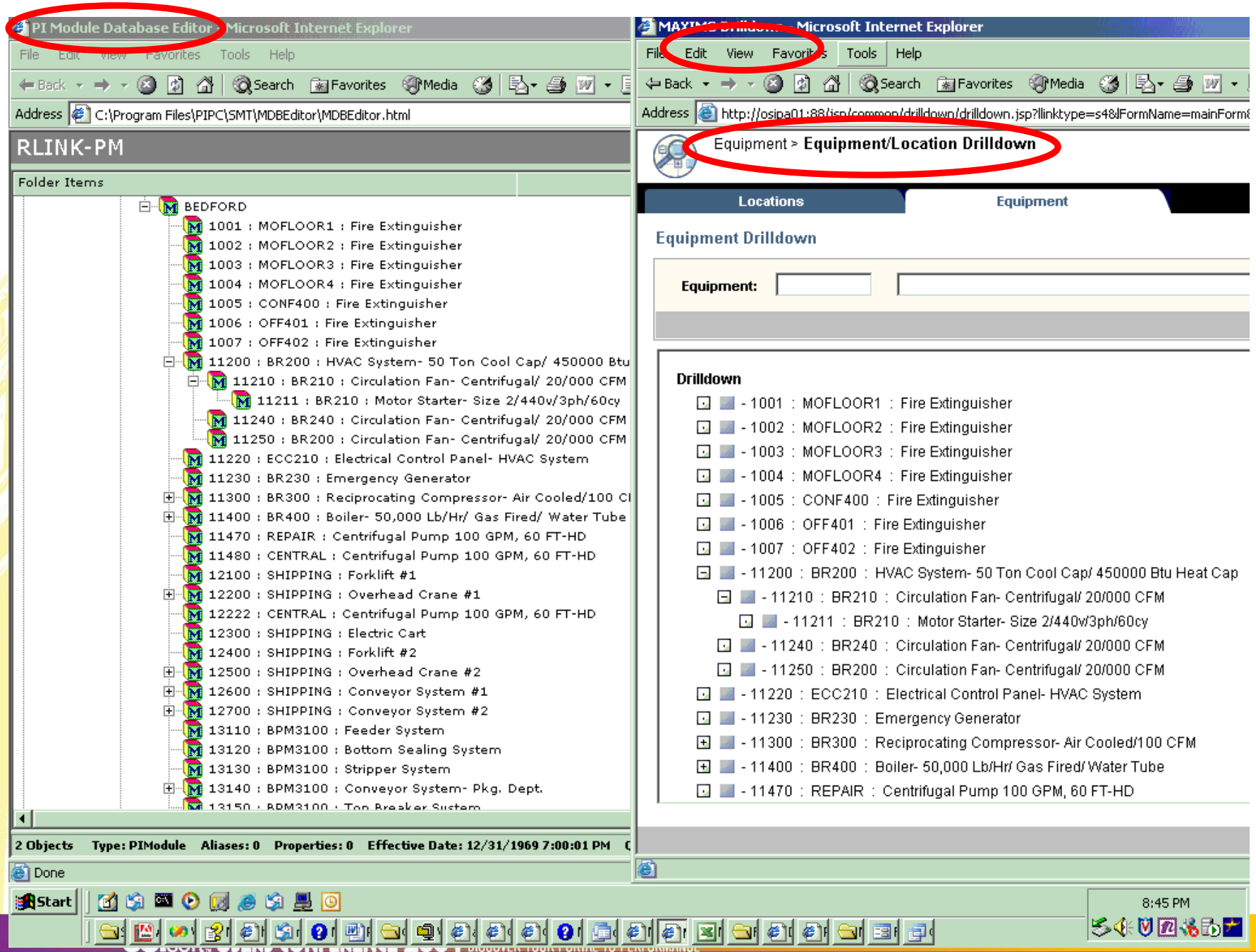
SYNERGEN

Datastream

ORACLE
PARTNERNETWORK

Mincom

MIMOSA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File Edit View Favorites Tools Help
Back Search Favorites Media
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RLINK-PM
Folder Items
BEDFORD
1001 : MOFLOOR1 : Fire Extinguisher
1002 : MOFLOOR2 : Fire Extinguisher
1003 : MOFLOOR3 : Fire Extinguisher
1004 : MOFLOOR4 : Fire Extinguisher
1005 : CONF400 : Fire Extinguisher
1006 : OFF401 : Fire Extinguisher
1007 : OFF402 : Fire Extinguisher
11200 : BR200 : HVAC System- 50 Ton Cool Cap/ 450000 Btu
11210 : BR210 : Circulation Fan- Centrifugal/ 20/000 CFM
11211 : BR210 : Motor Starter- Size 2/440v/3ph/60cy
11240 : BR240 : Circulation Fan- Centrifugal/ 20/000 CFM
11250 : BR200 : Circulation Fan- Centrifugal/ 20/000 CFM
11220 : ECC210 : Electrical Control Panel- HVAC System
11230 : BR230 : Emergency Generator
11300 : BR300 : Reciprocating Compressor- Air Cooled/100 CI
11400 : BR400 : Boiler- 50,000 Lb/Hr/ Gas Fired/ Water Tube
11470 : REPAIR : Centrifugal Pump 100 GPM, 60 FT-HD
11480 : CENTRAL : Centrifugal Pump 100 GPM, 60 FT-HD
12100 : SHIPPING : Forklift #1
12200 : SHIPPING : Overhead Crane #1
12222 : CENTRAL : Centrifugal Pump 100 GPM, 60 FT-HD
12300 : SHIPPING : Electric Cart
12400 : SHIPPING : Forklift #2
12500 : SHIPPING : Overhead Crane #2
12600 : SHIPPING : Conveyor System #1
12700 : SHIPPING : Conveyor System #2
13110 : BPM3100 : Feeder System
13120 : BPM3100 : Bottom Sealing System
13130 : BPM3100 : Stripper System
13140 : BPM3100 : Conveyor System- Pkg. Dept.
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Microsoft Internet Explorer
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Back Search Favorites Media
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Equipment > Equipment/Location Drilldown
Locations
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Equipment:
Drilldown
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- 1002 : MOFLOOR2 : Fire Extinguisher
- 1003 : MOFLOOR3 : Fire Extinguisher
- 1004 : MOFLOOR4 : Fire Extinguisher
- 1005 : CONF400 : Fire Extinguisher
- 1006 : OFF401 : Fire Extinguisher
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- 11400 : BR400 : Boiler- 50,000 Lb/Hr/ Gas Fired/ Water Tube
- 11470 : REPAIR : Centrifugal Pump 100 GPM, 60 FT-HD
Start
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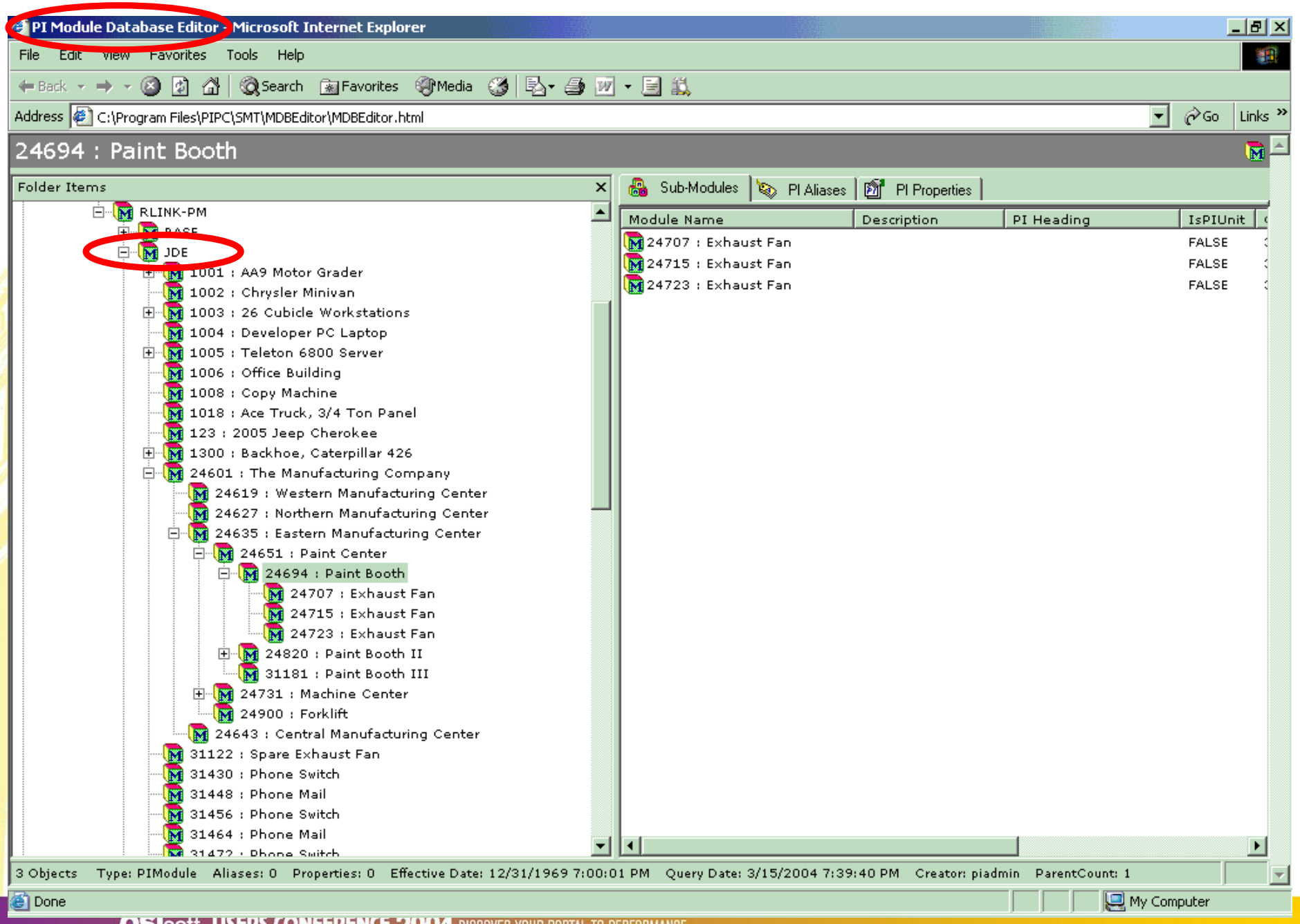
PI Module Database Editor - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address C:\Program Files\PIPC\SMT\MDBEditor\MDBEditor.html
Go Links
24694 : Paint Booth
Folder Items
RLINK-PM
BASE
JDE
1001 : AA9 Motor Grader
1002 : Chrysler Minivan
1003 : 26 Cubicle Workstations
1004 : Developer PC Laptop
1005 : Teleton 6800 Server
1006 : Office Building
1008 : Copy Machine
1018 : Ace Truck, 3/4 Ton Panel
123 : 2005 Jeep Cherokee
1300 : Backhoe, Caterpillar 426
24601 : The Manufacturing Company
24619 : Western Manufacturing Center
24627 : Northern Manufacturing Center
24635 : Eastern Manufacturing Center
24651 : Paint Center
24694 : Paint Booth
24707 : Exhaust Fan
24715 : Exhaust Fan
24723 : Exhaust Fan
24820 : Paint Booth II
31181 : Paint Booth III
24731 : Machine Center
24900 : Forklift
24643 : Central Manufacturing Center
31122 : Spare Exhaust Fan
31430 : Phone Switch
31448 : Phone Mail
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31464 : Phone Mail
Sub-Modules
PI Aliases
PI Properties
Module Name
Description
PI Heading
IsPIUnit
24707 : Exhaust Fan FALSE
24715 : Exhaust Fan FALSE
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Done
My Computer

Thank you

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