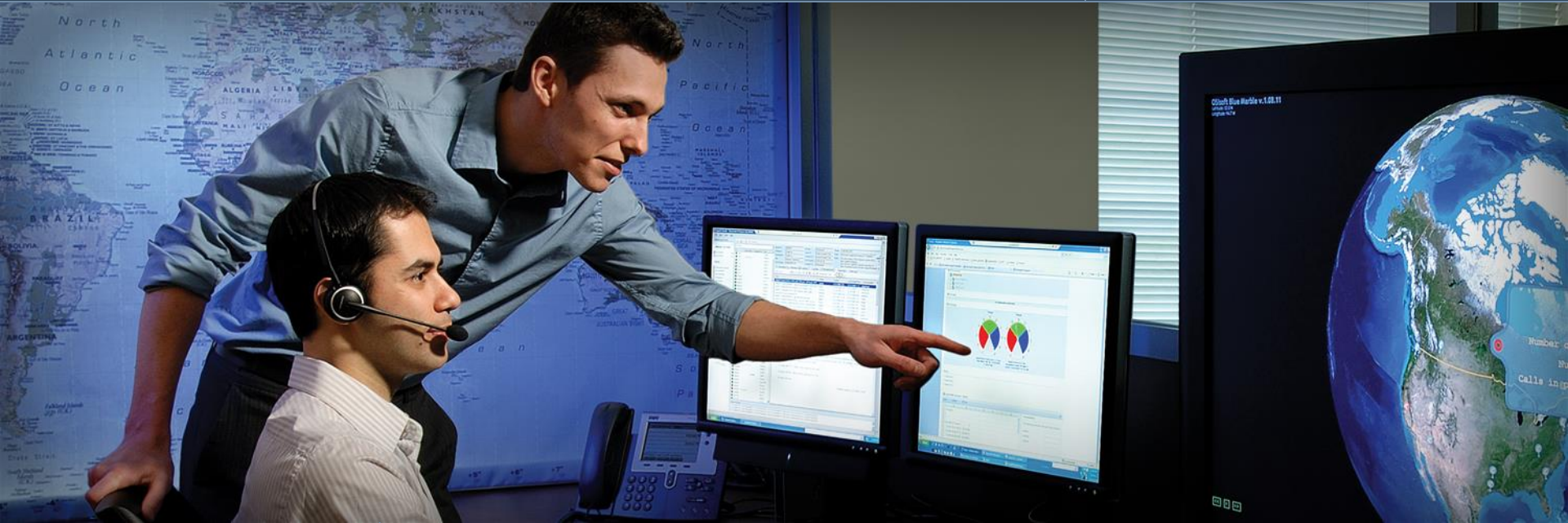




OSIsoft®

Regional Seminar Series



## Customizations for Batch Traceability and Alarm Notifications

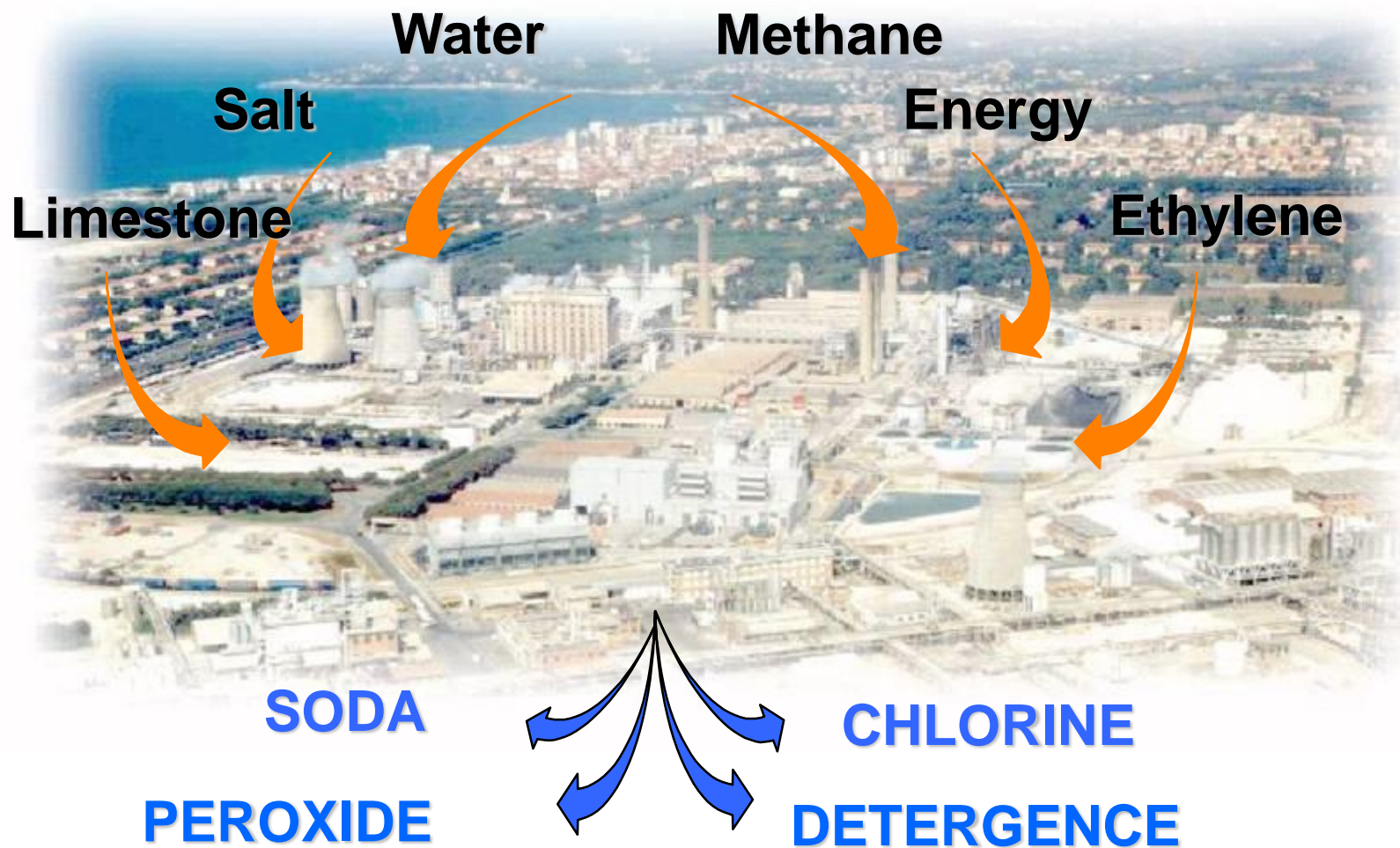
Dr. Michele Albicocchi, Solvay Chimica Italia

03-Feb-2010

Empowering Business in Real Time.

© Copyright 2010, OSIsoft LLC. All rights Reserved.

# Solvay Factory in Rosignano



# Presentation Index

## **Batch Traceability (2004-2005)**

- **Goal**
- **Needed data objects**
- **Traceability flow**
- **Solution description**

## **Alarm Notifications (2004)**

- **Goal**
- **Basic concepts**
- **Solution description**



## Batch Traceability - Actors

Sarralbe - France

**PE/PP Plants and IT Service**  
(Project Owner)



(Formerly member of Solvay Group)

Torino - Italy

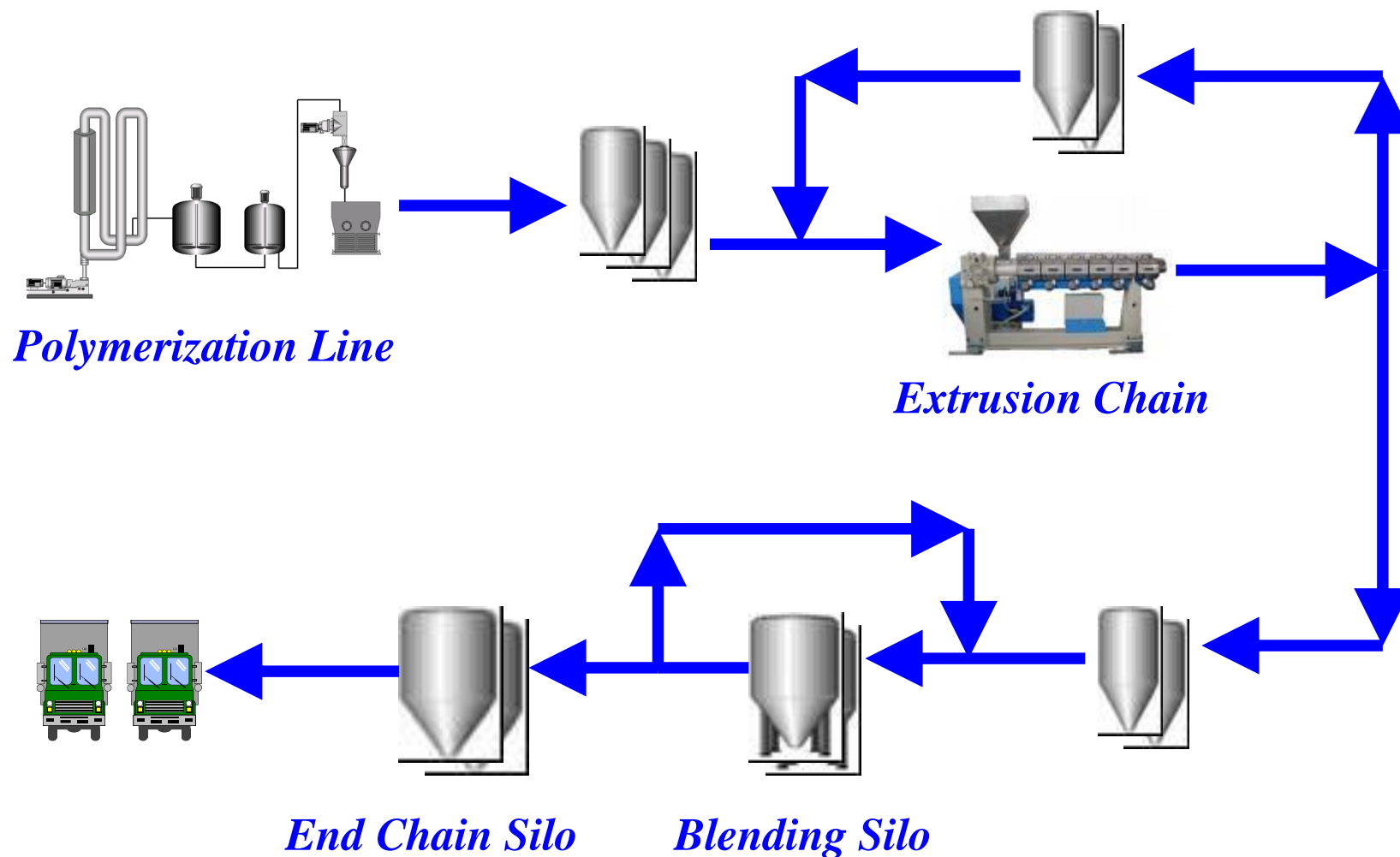
**SOFTPEOPLE**  
PIMSOFT  
(Solution Developer with PI & RLINK)

Rosignano - Italy

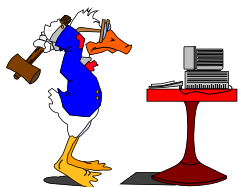
**UST- Technical Service**  
(PI Expertise & Specs)



## Batch Traceability – General Flow

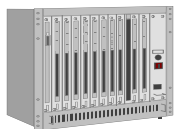


## Batch Traceability – Achievements



### Replacement of an old Laboratory system

(manual data update, high costs - ROI over 100% in a few years)



### DCS Connection

(real time upgrading, checks on product compatibility, etc.)



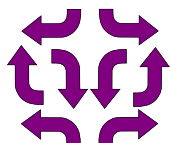
### Process Management

(real time production control and material movement)



### Treatment of Quality Parameters

(automatic calculation on batch closure, results to SAP)



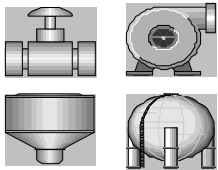
### Upward and Downward Traceability

(complaint management, problem delimitation, etc.)

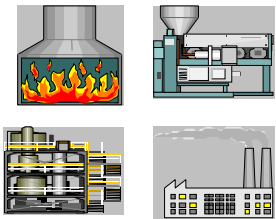
## Batch Traceability – Data Objects



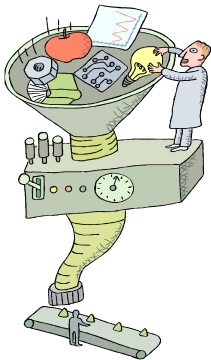
**Batch**: a Batch of any material made.



**Element**: any piece of Equipment within the Plant.

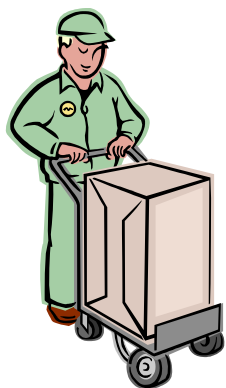


**Unit**: an Element used for process activities and production.

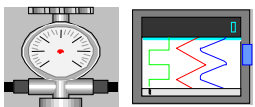


**UnitBatch**: a phase of production process inside a Unit, executed to make material.

## Batch Traceability – Data Objects



**Transfer Record**: an instance of material transfer.  
Source and Destination are Plant Elements or UnitBatches.



**Tag** : standard component representing a measurement revealing data along the time.



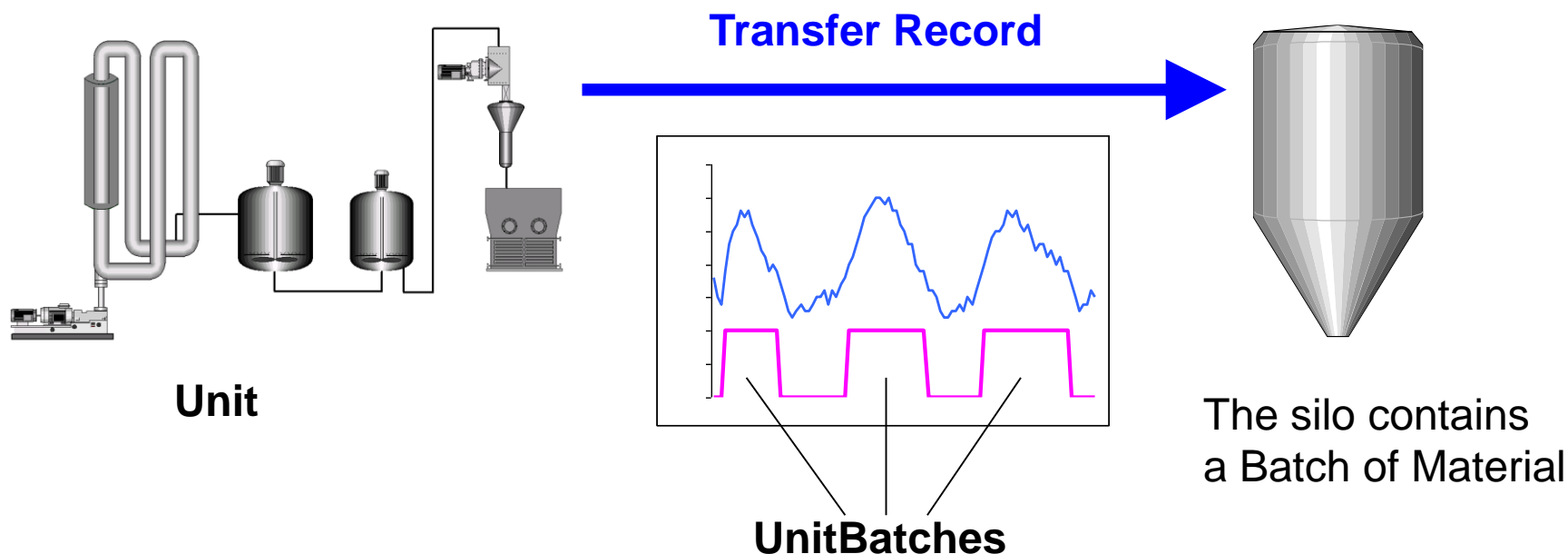
**Property** : object characteristic (unique value).



## Data Objects in our context

A **Polymerization Line** produces a **Batch of Material** at different **time periods**.

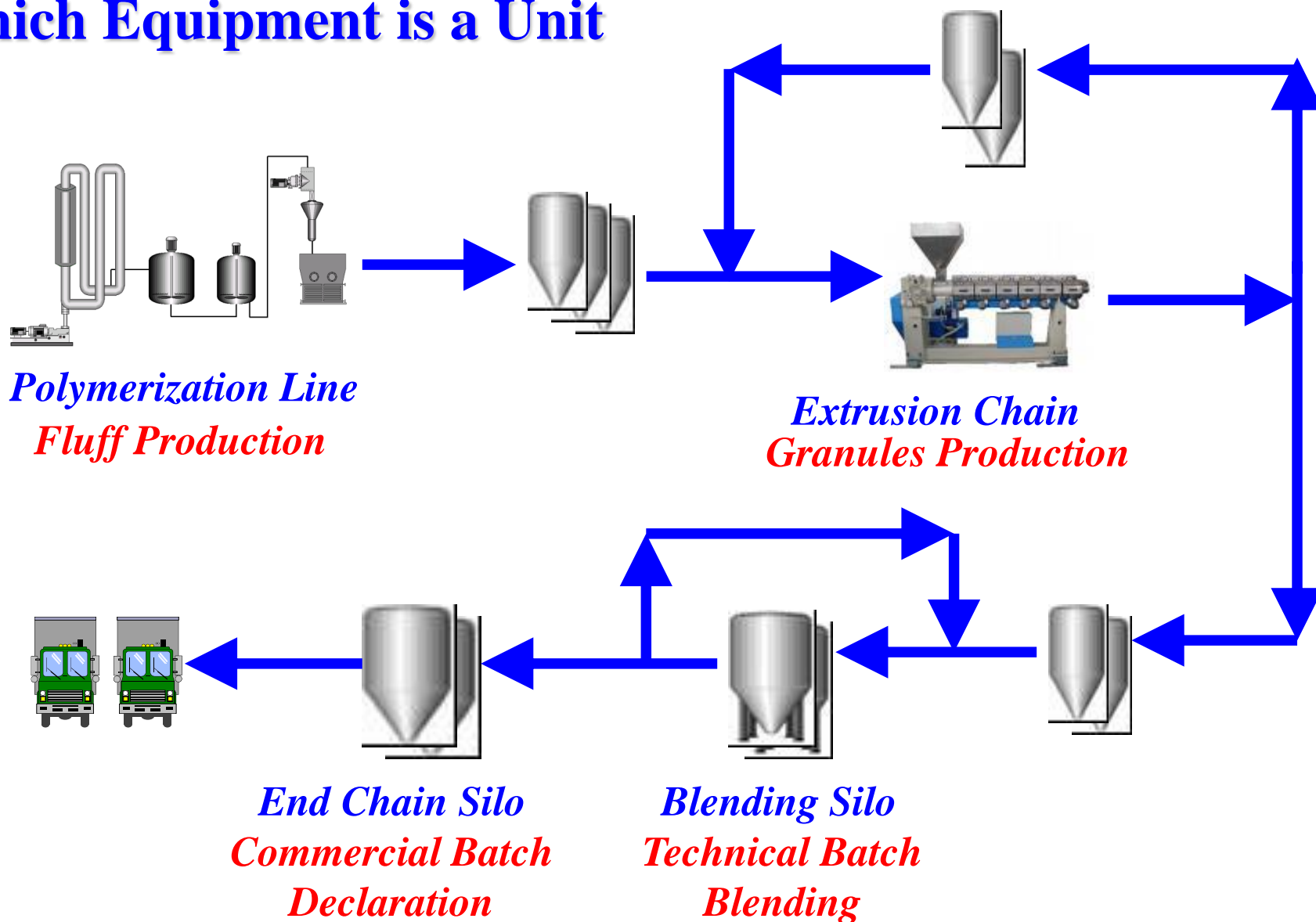
A **Unit** produces a **Batch** at different **UnitBatches**



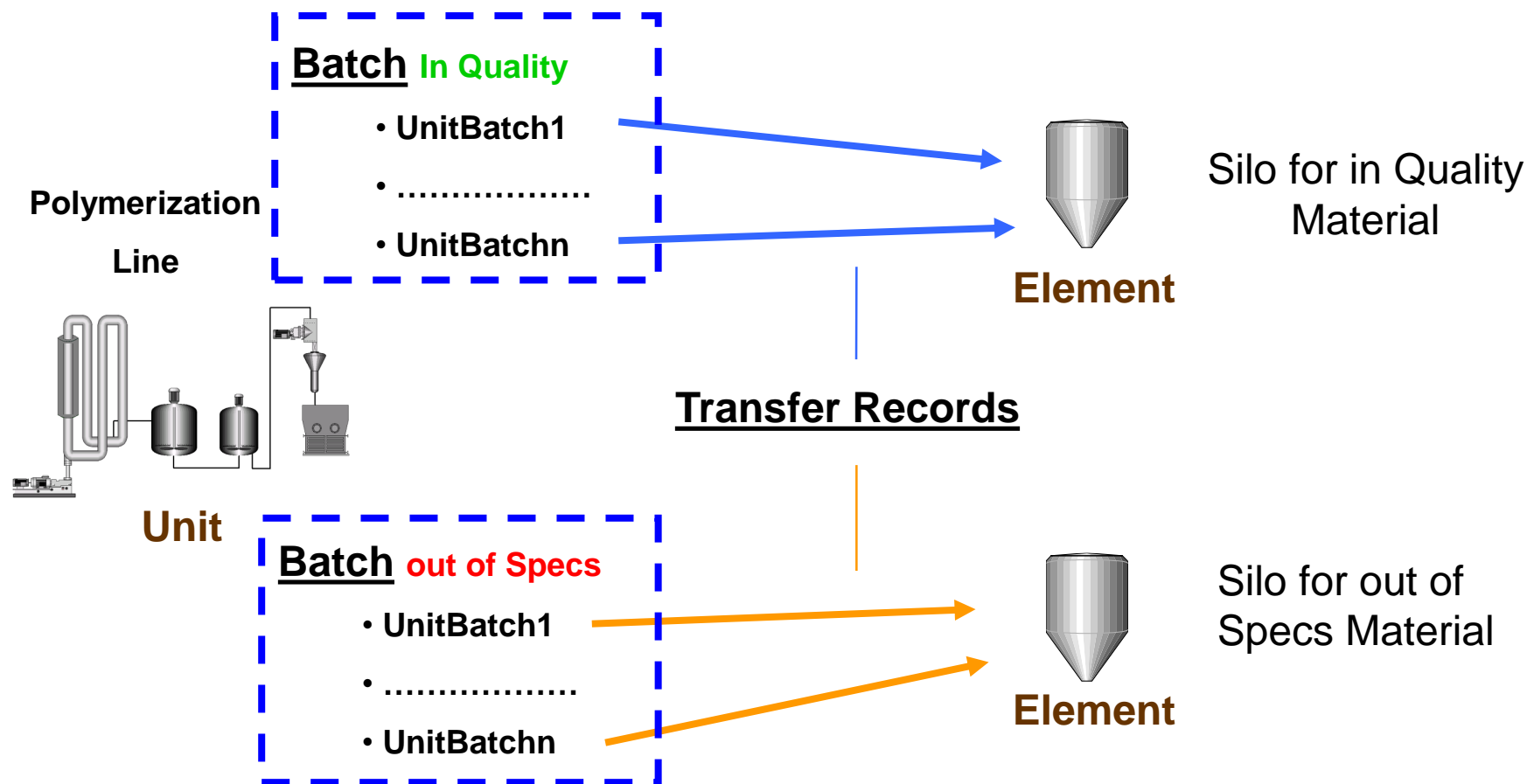
A UnitBatch is always related to a Unit.

A Unit can have only one UnitBatch running at a time.

## Which Equipment is a Unit

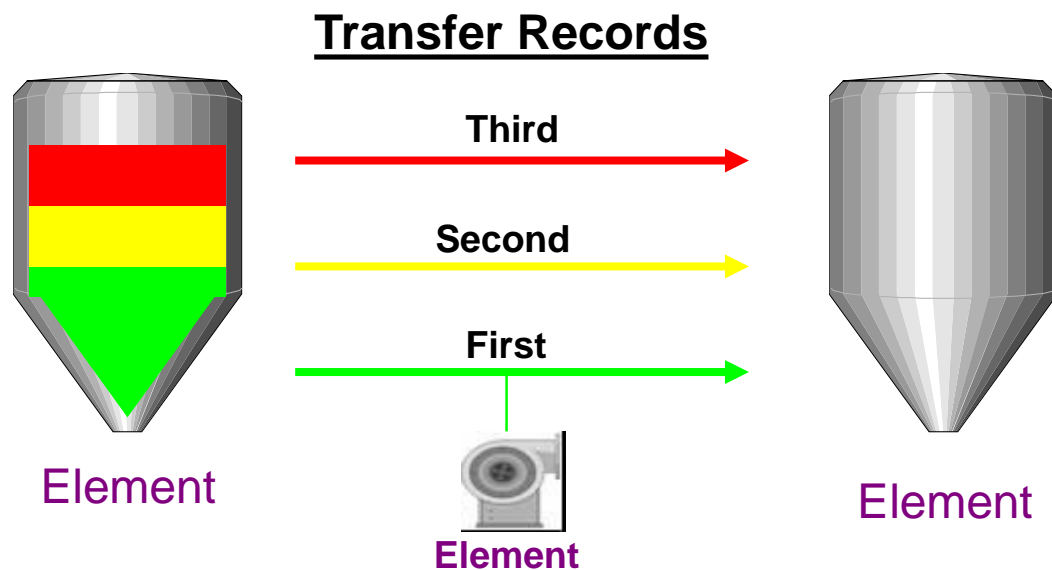


## Track Flow: Polymerization line → Silo



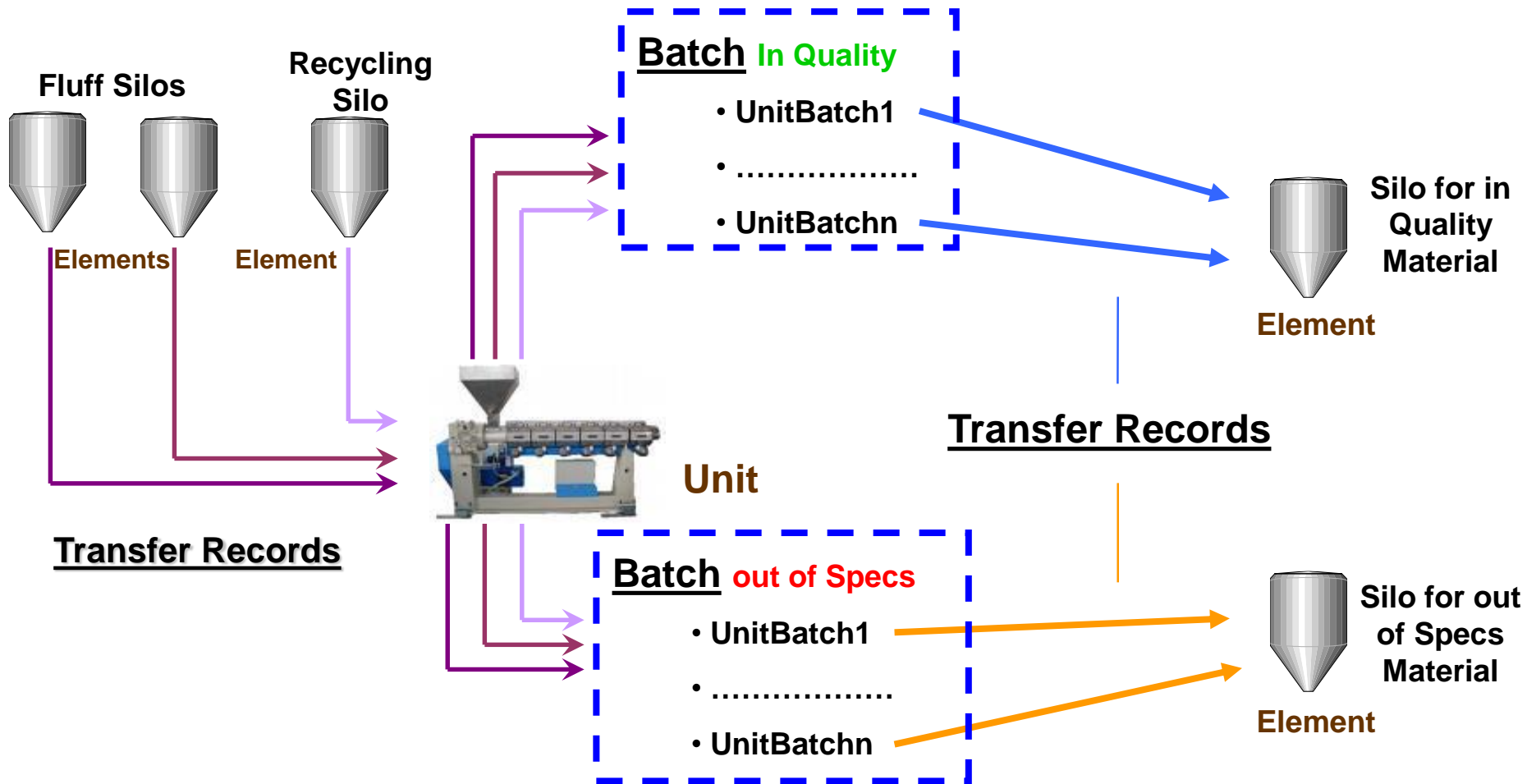
A Batch is produced during one or more UnitBatches. A UnitBatch belongs to only one Batch. During each production period there is a batch transfer from the polymerization line to the destination silo.

## Track Flow: Silo → Silo



- Material transfer activated by the Air Compressor
- One Transfer Record per each material Batch transferred
- A Transfer Record contains parameters such as Batch name, quantity, etc.
- A silo can be the source or destination of several transports at the same time
- We assume Material is transferred into FIFO (first in first out) mode.

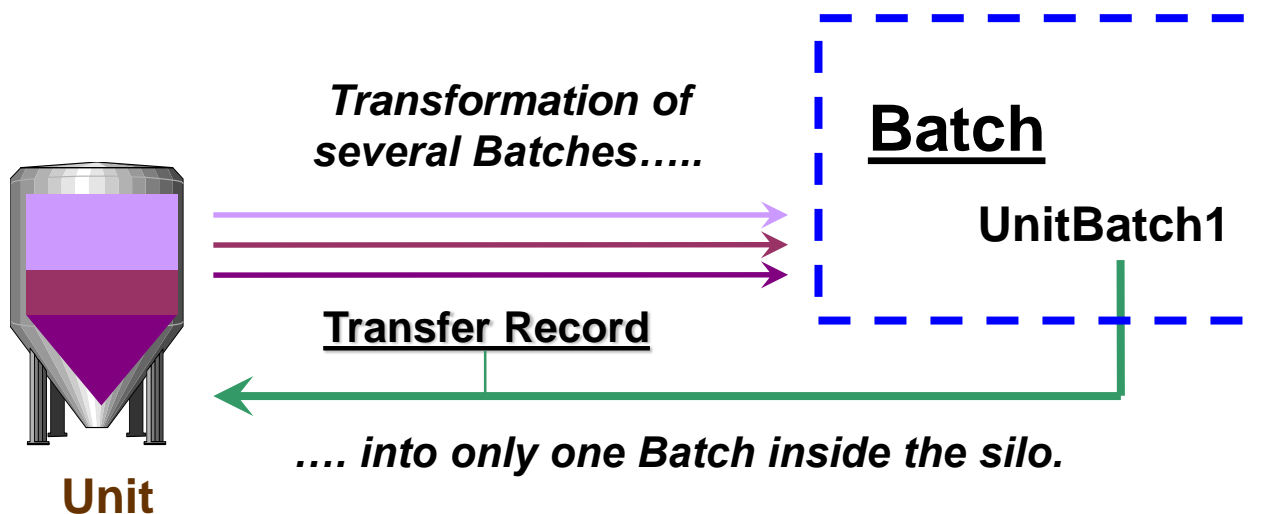
## Track Flow: Silo → Extruder → Silo



During each production phase (UnitBatch), at least two Fluff and one Recycling Batches are used to produce the Granule Batch sent from the Extruder to the destination Silo. All this Info is stored in the Transfer records.

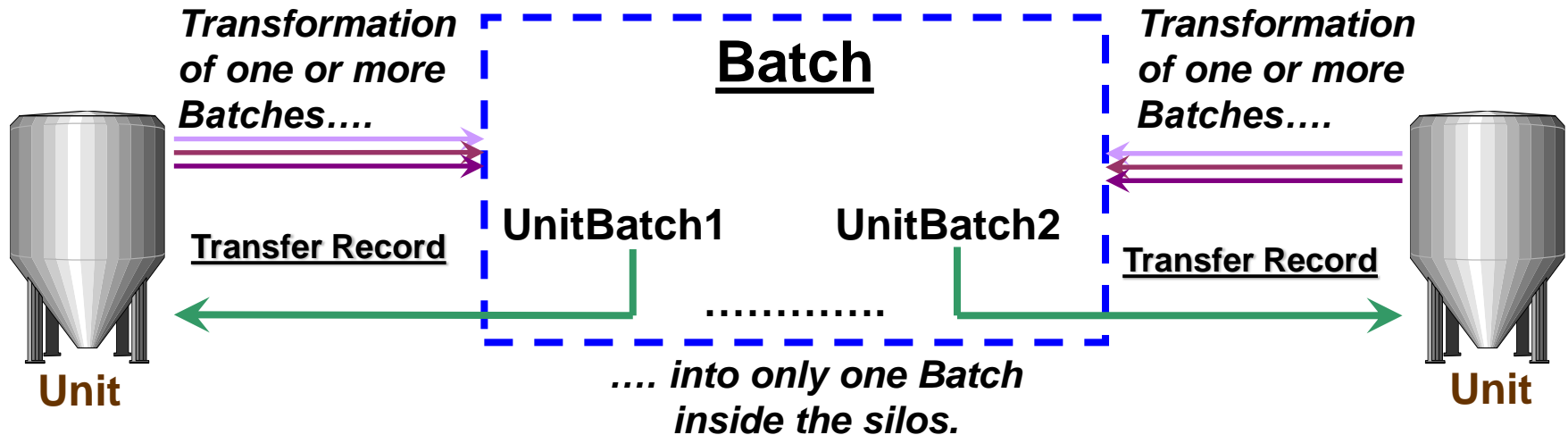


## Track Flow: Technical Batch



- A Batch is generated as a result of the blending operation.
- This Batch has a unique UnitBatch as its transformation process.
- Only one Transfer Record from the blending silo to itself. Input Batches are all those initially contained. Output Batch is the produced one.

## Track Flow: Commercial Batch



- All materials contained in one or more silos (two in the above example) are declared to be the same Batch of material.
- A transformation process per silo is operated: all Batches (Batches) inside a silo are transformed into the commercial one.
- The Commercial Batch (Batch) groups all transformation processes (UnitBatches).
- There is a Transfer Record for each silo, moving material inside the silo. Input: Batches initially dwelling. Output: Commercial Batch.

## Batch Traceability: Possible Solutions

Two possible solutions were examined; usage of

1) PI Batch Data Base      2) PI Analysis Framework

Data Object	PI Batch DB	PI - AF
Batch	PIBatch	
Unit	PIUnit	AF Element
UnitBatch	PIUnitBatch	
Element	PI Module	AF Element
Transfer Record	PITransferRecord	AF Transfer
Tag	MDB Alias	AF Attribute
Property	MDB Property	AF Attribute

## Batch Traceability: Solutions with PI Batch Data Base

### PRO:

- Only PI Batch Server Application is needed
- Less PI License Costs (points and software)

### CON:

- PISystemRecords: indexes (only time) and name (not set)
- Performance doubts (real time update and management)
- More Programming and Configuration Costs

## **Batch Traceability: Solutions with Analysis Framework**

### **PRO:**

- Easier Configuration
- Less Programming Costs
- Commitment on Performances

### **CON:**

- More PI License Costs
- PI – AF recently released (year 2004)



## Batch Traceability: chosen Solution

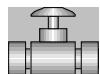
**Choice:** Solution with PI-AF due to performances and programming costs.

Data Object	PI Batch DB	PI - AF
Batch	PIBatch	
Unit	PIUnit	AF Element
UnitBatch (opt.)	PIUnitBatch	
Element	PI Module	AF Element
Transfer Record	PITransferRecord	AF Transfer
Tag	MDB Alias	AF Attribute
Property	MDB Property	AF Attribute

## Batch Traceability: Data Objects in our Solution



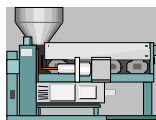
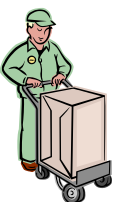
**PIBatch**: Batch of produced material, from polym.line, extruder, blending, commercial batch declaration.



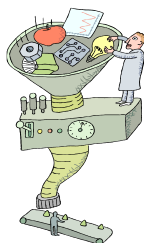
**AF Element**: any piece of Equip. concerning the Plant, including the ones producing

batches.

**AF Transfer**: record of Batch transfer from one Element to another.

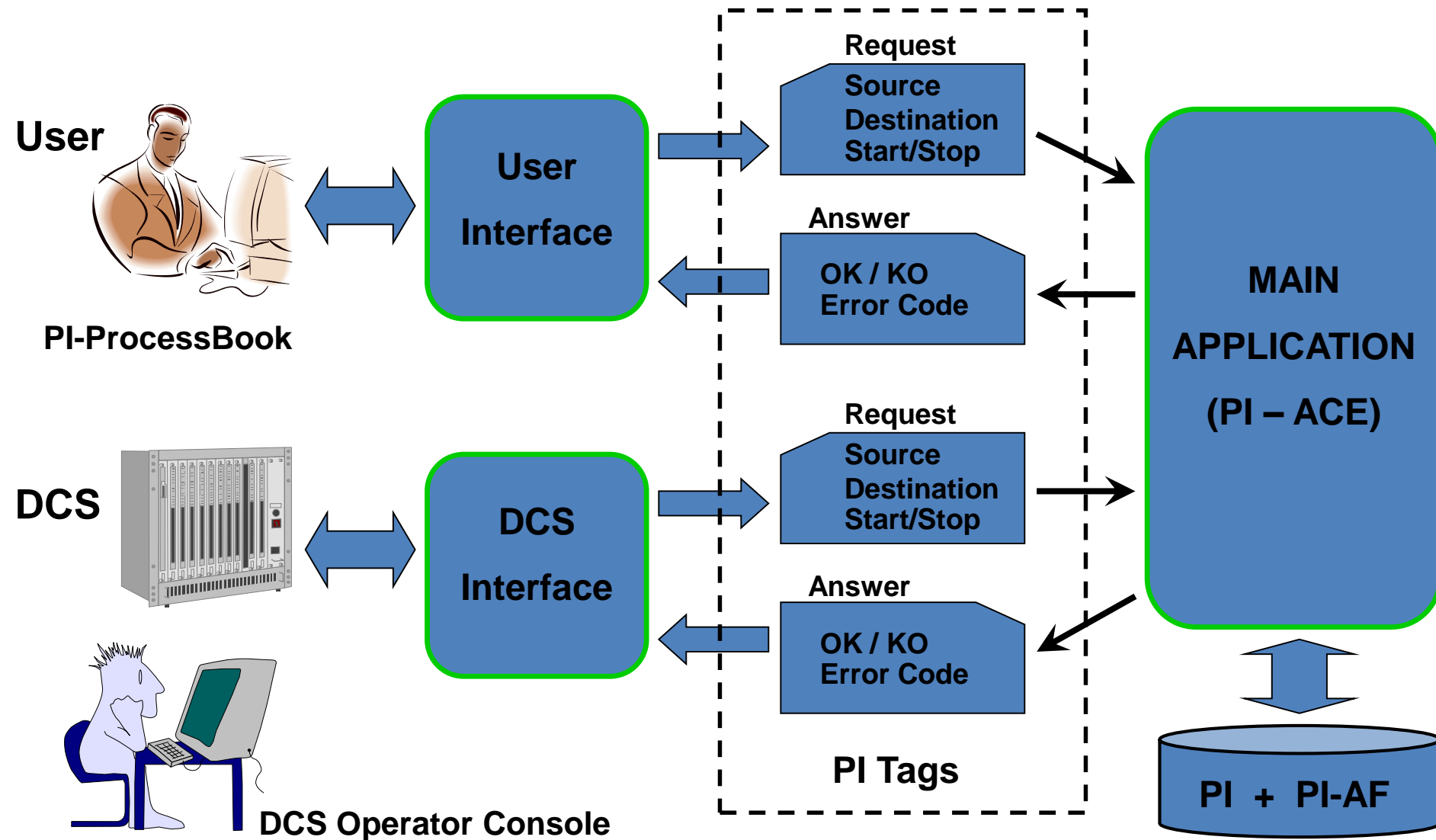


**PIUnit** (optional): piece of Equipment where a Batch is generated (polym.line, extruder, blend.silo...).



**PIUnitBatch** (optional): process executed to produce a Batch, like polymerization, extrusion, blending, commercial lot declaration.

## Batch Traceability: Architecture of our Solution



PI - ProcessBook - [DISPLAYTEST.PDI [Read Only]\*]

File Edit View Insert Tools Draw Arrange Window Help

100%

Unit1 -

Source: S1

Destination: S2

Flow: 1.5

Start-Time: ----

End-Time: ----

Stopped

S1

AC

B4943PN1943R01

EF05100180:22t

EF05100179:38t

EF05100178:37t

EF05100177:40t

EF05100176:40t

EF05100175:39t

EF05100174:39t

EF05100173:38t

EF05100172:37t

Details: - [S1]

Batch	Product	Quantity
EF05100180	PRODUIT102	22.349
EF05100179	PRODUIT102	38.457
EF05100178	PRODUIT102	36.875
EF05100177	PRODUIT102	39.795
EF05100176	PRODUIT102	39.795
EF05100175	PRODUIT102	38.579
EF05100174	PRODUIT102	38.941
EF05100173	PRODUIT102	37.728
EF05100172	B4943PN19...	37.481

LIGNE1 -

Silos OK: S1

Silos KO: ----

Flow: 720.0

Lot number: EF05100180

Start-Time: ----

Stopped

SHOMO -

Silos OK: SHOMO

Silos KO: ----

Flow: ----

Lot number: ----

Start-Time: ----

Stopped

EXTR1 -

Silos OK: ----

Silos KO: S6HN

Flow: 3800.0

Lot number: EG05100101HN

Start-Time: ----

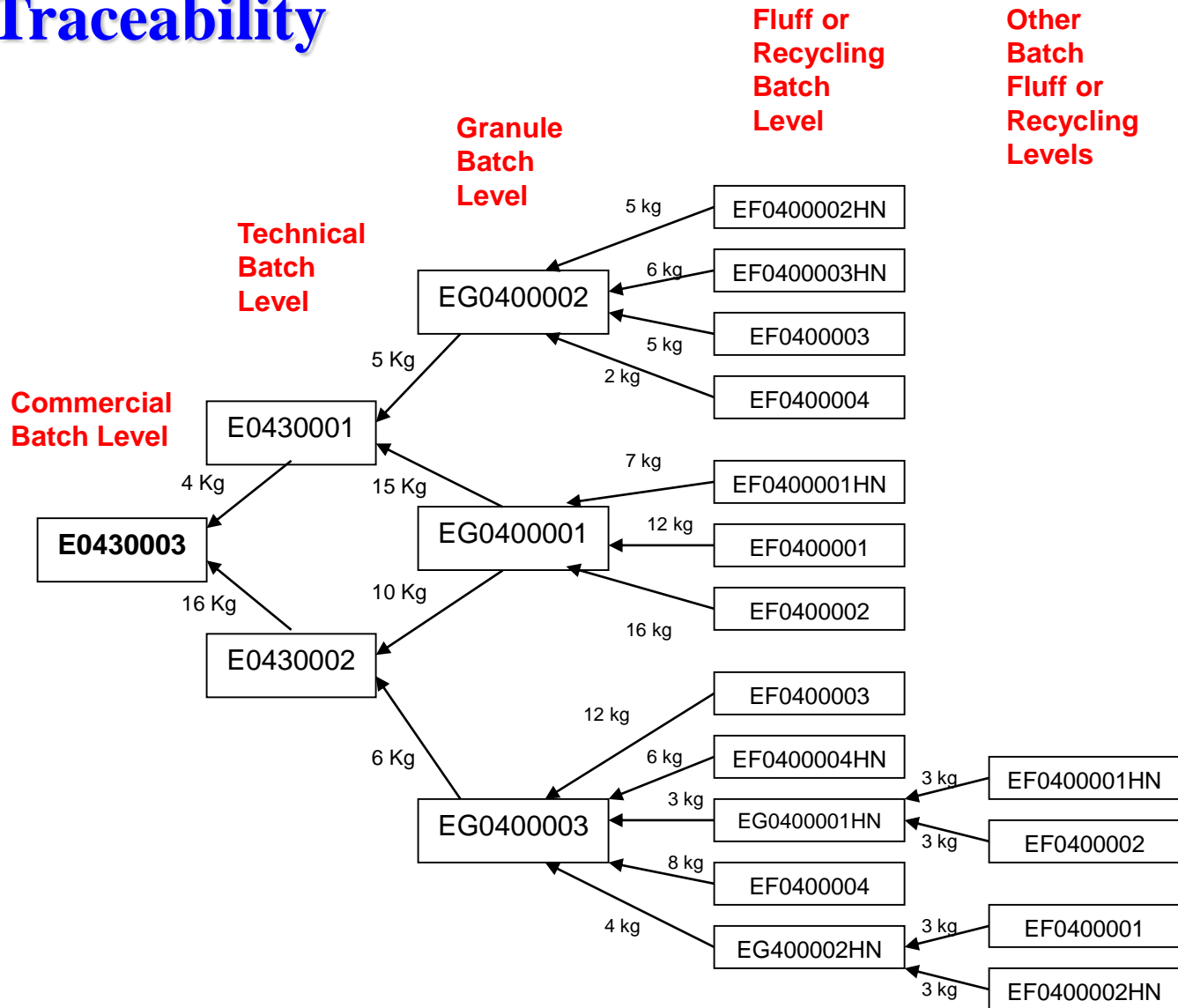
Stopped

Example of a Display used to Monitor the Plant Status

Ready

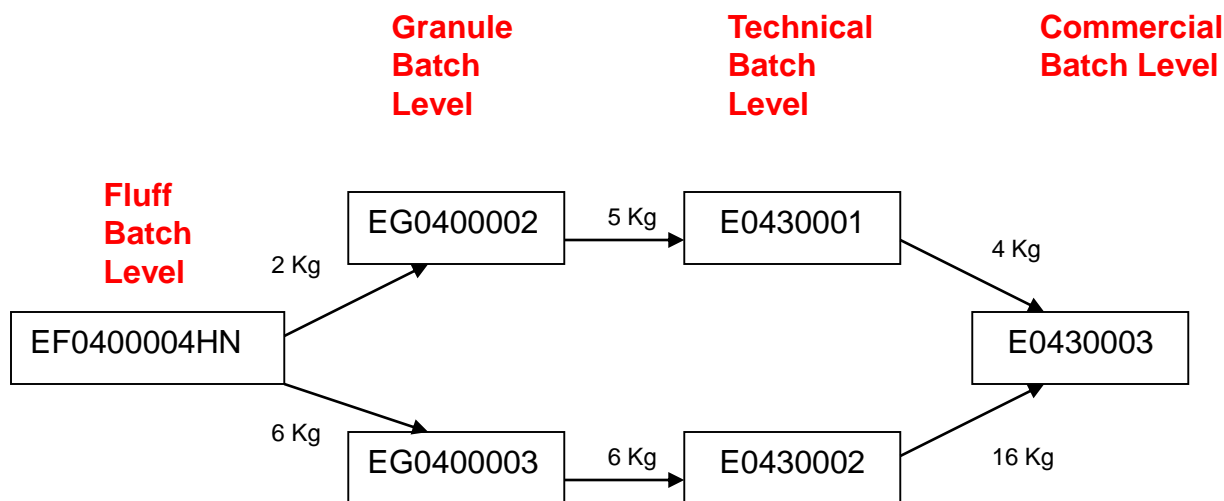
NUM

## Upward Traceability

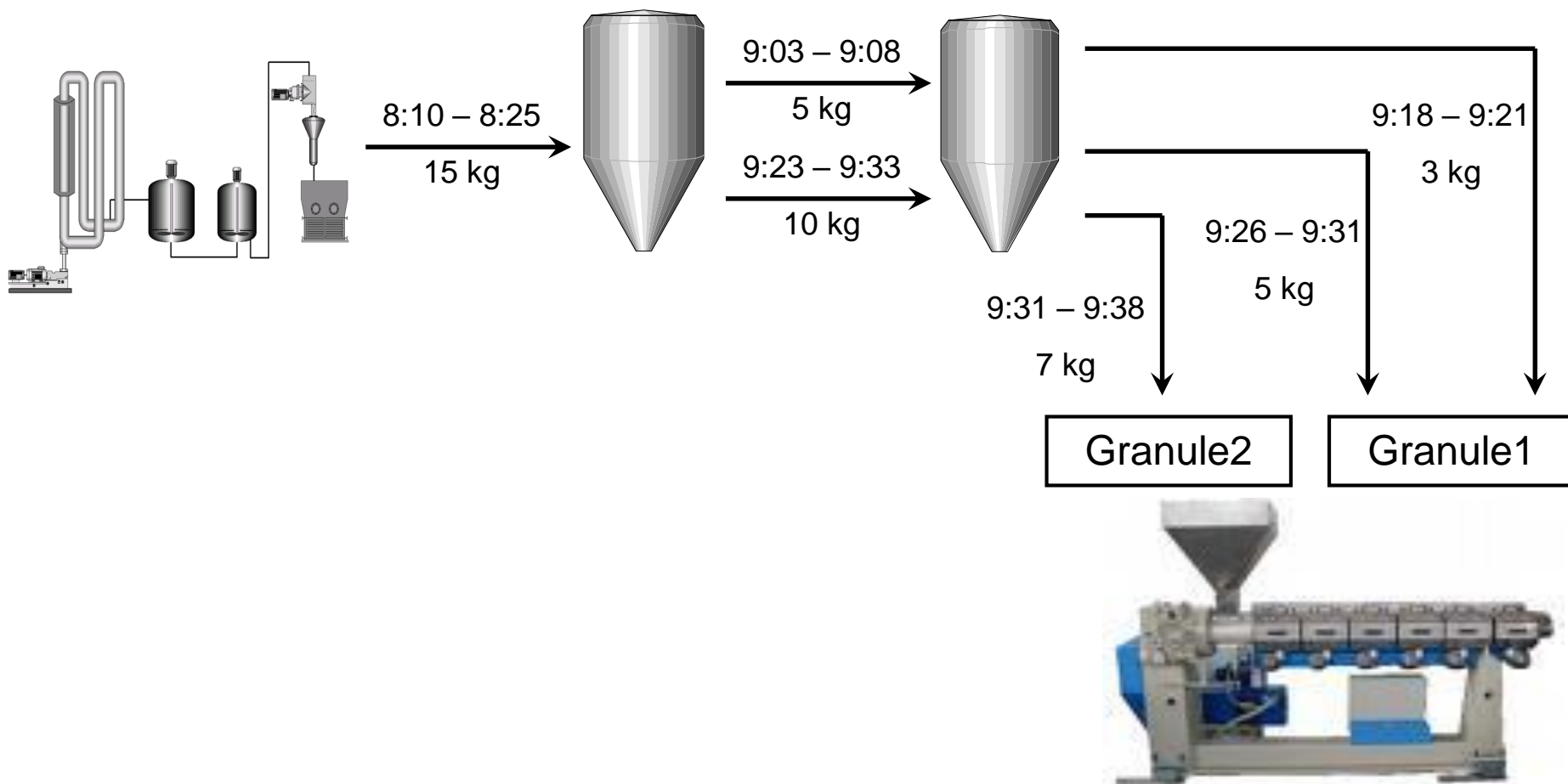




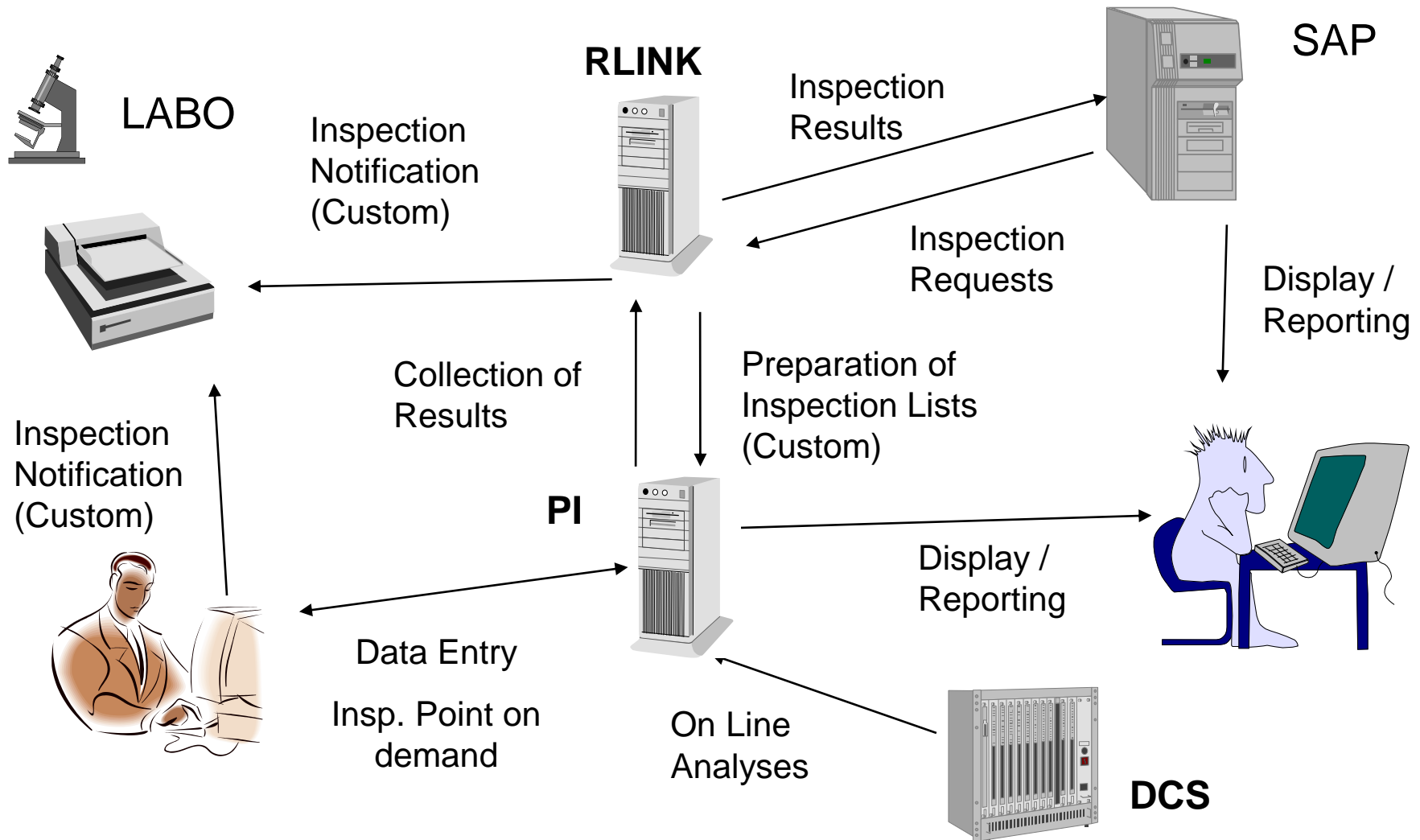
## Downward Traceability



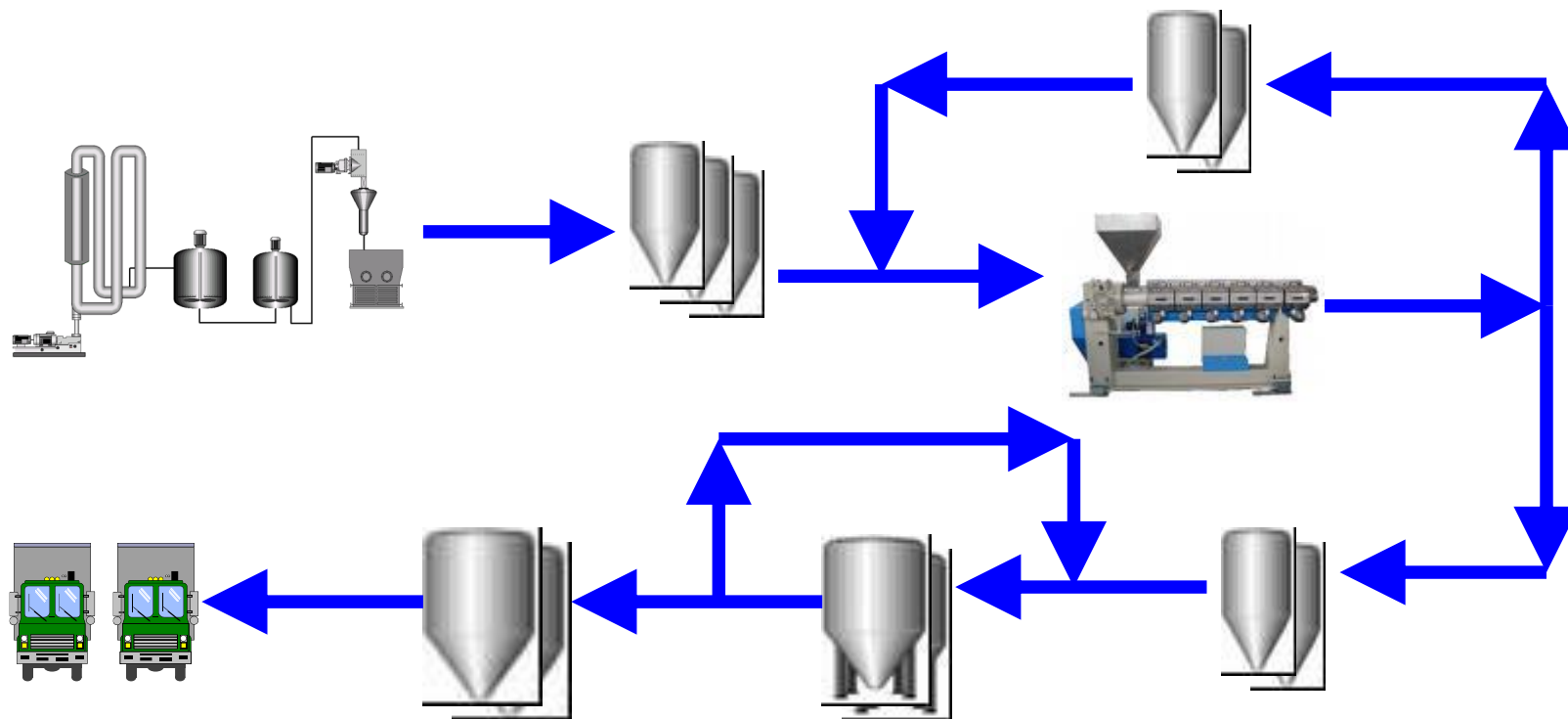
## Find the Equipment where fluff Batch “XYZ” was



## RLINK – SAP/QM



## Expected results from Batch Traceability



**Complaints  
Management**

+



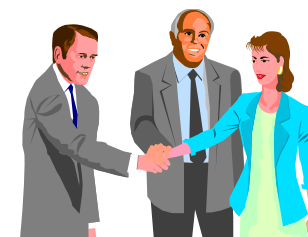
**Control, Doc,  
Analysis, ...**

+



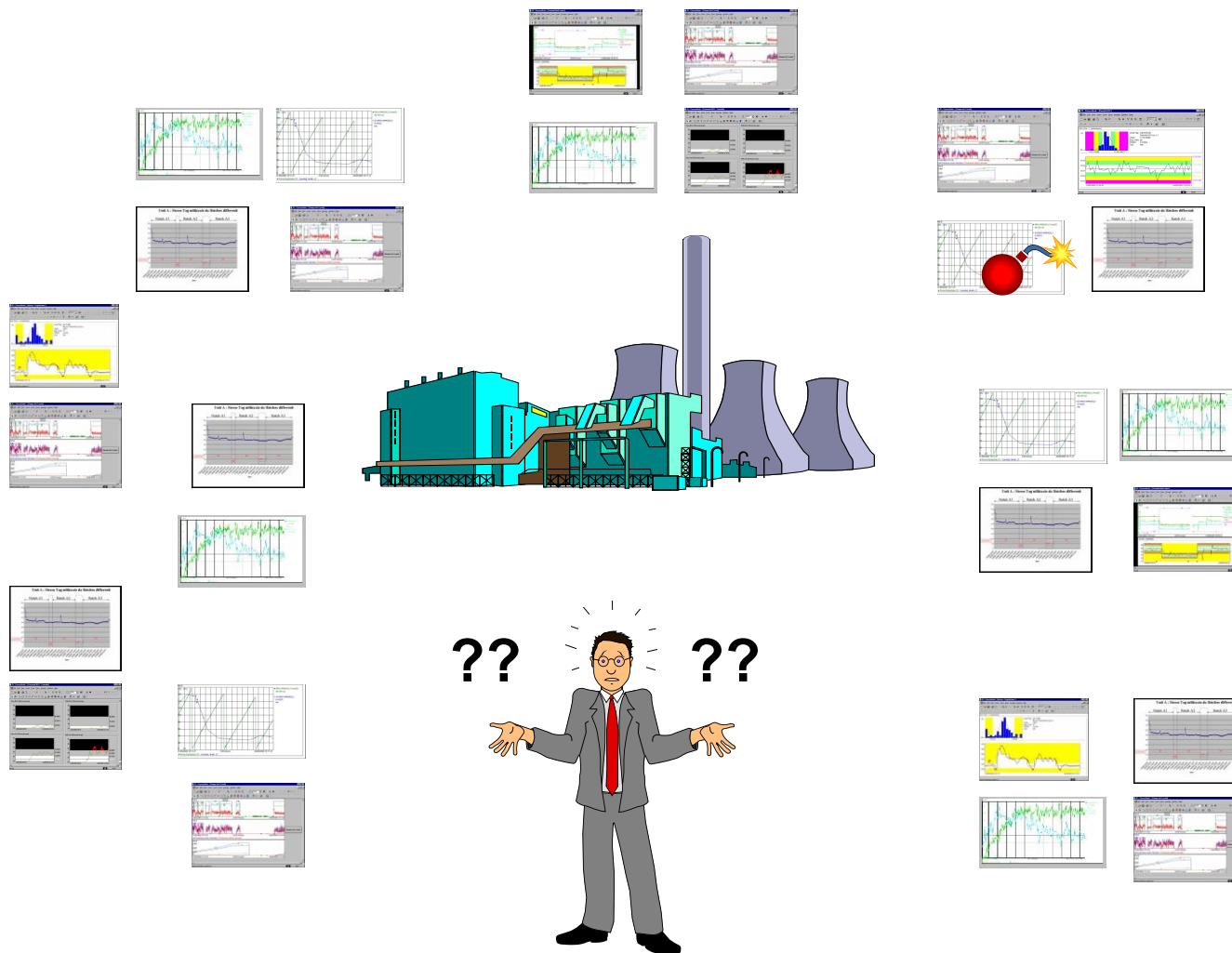
**Conduction  
Help**

=

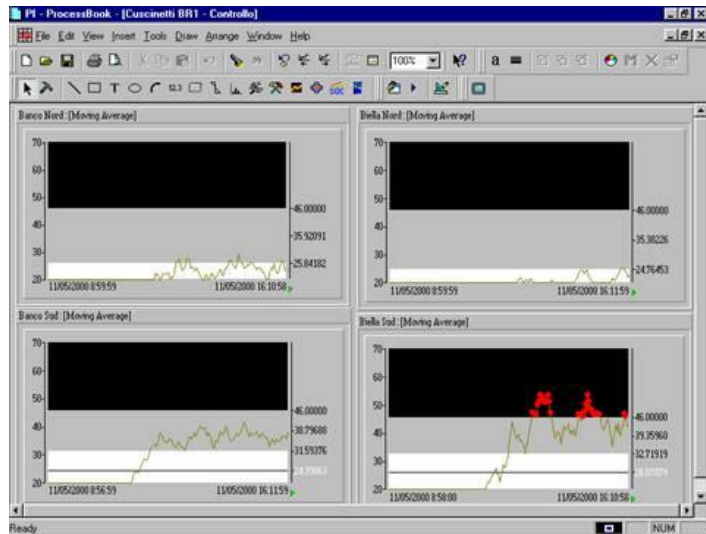


**Satisfaction**

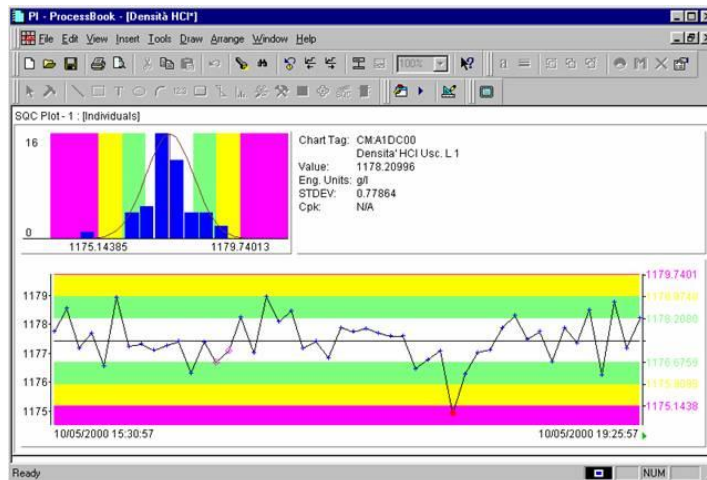
## Alarms Notifications: Why ?



## What kind of Alarms ?

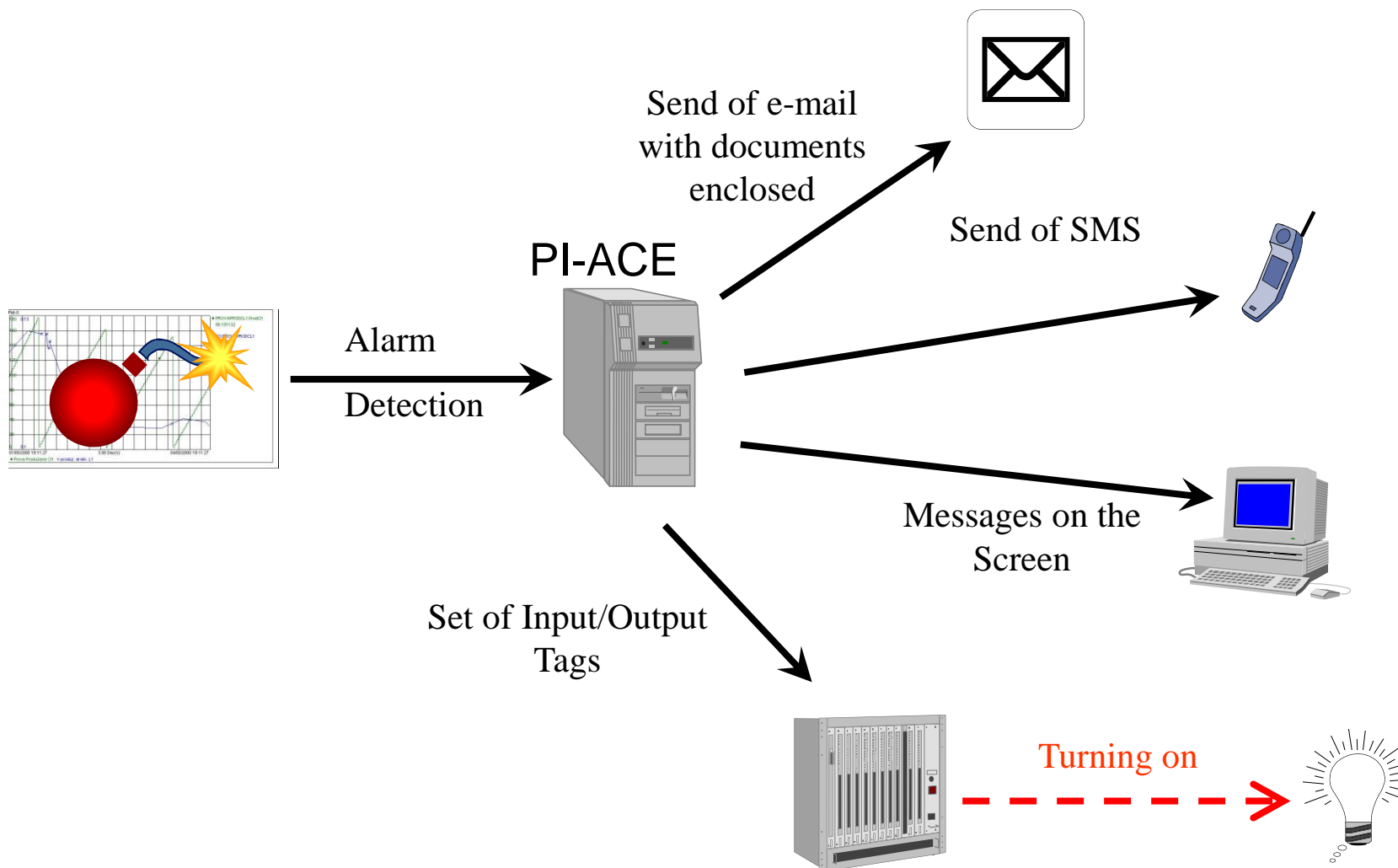


**“Measurement Alarms”:** tag values are checked against a threshold or status.



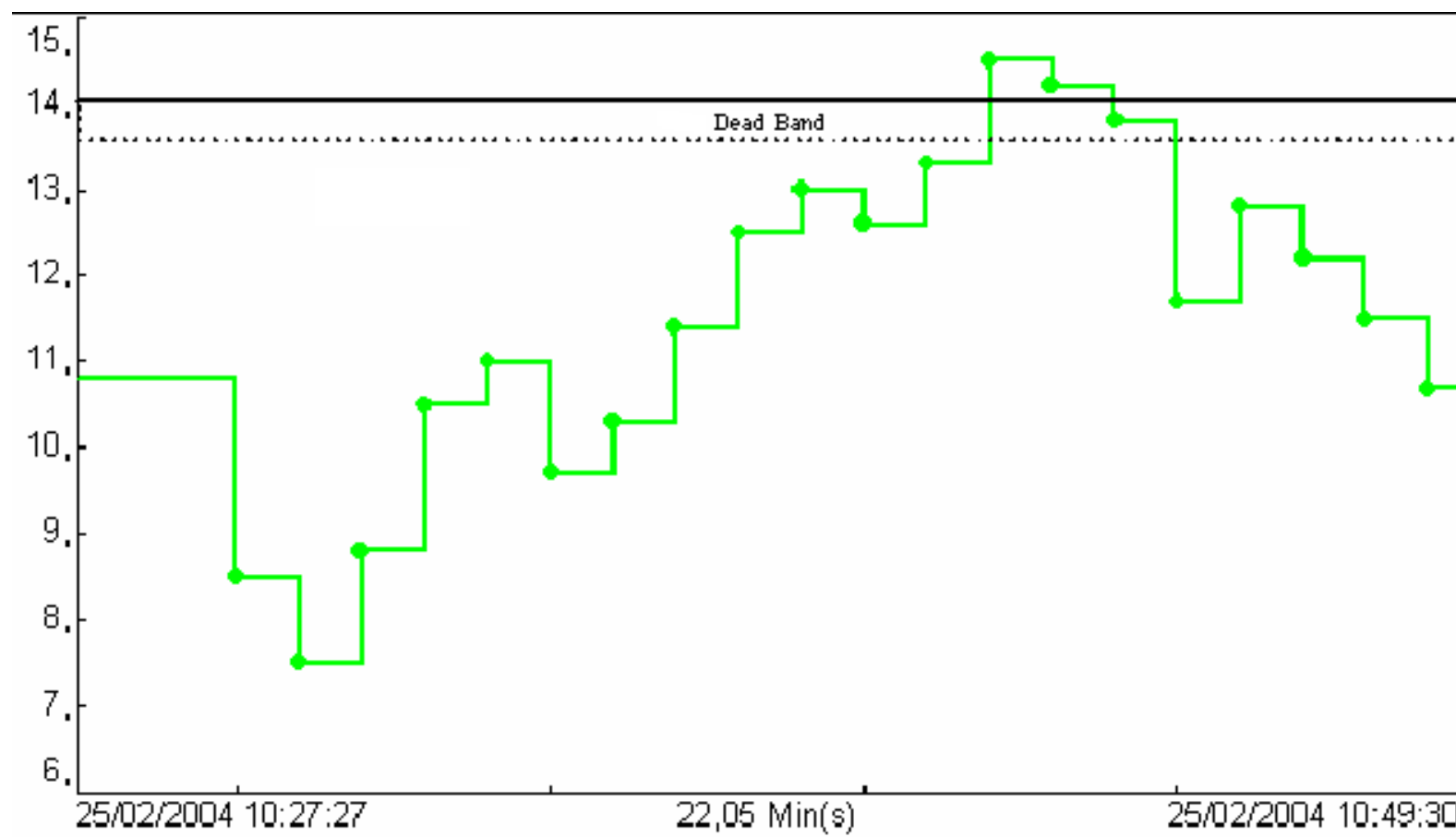
**“SQC Alarms”:** a sequence of tag values are evaluated to verify if a particular SQC alarm status is happening.

## Notification means



## Measurement Alarms: Basic Concepts

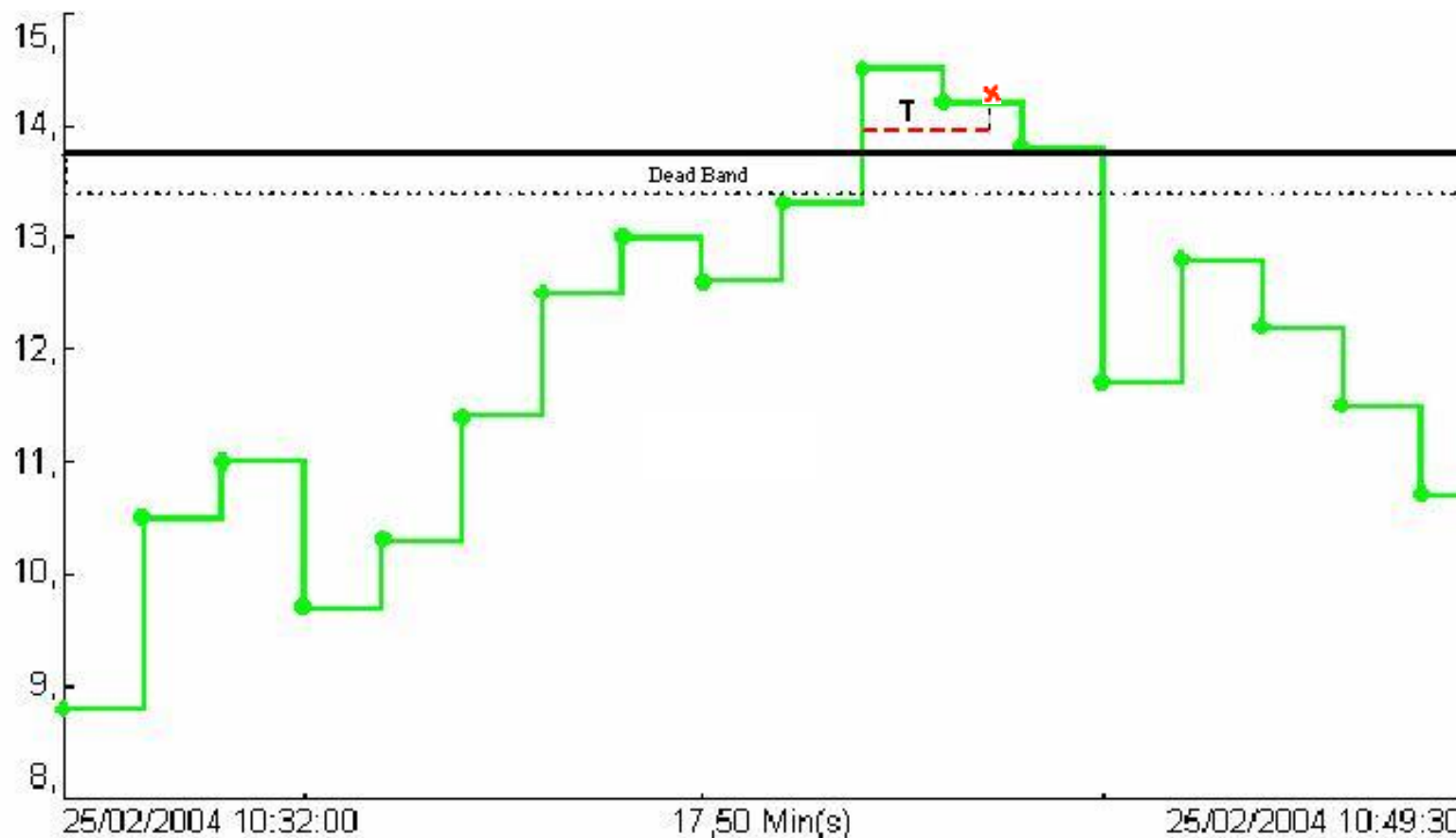
### Step over the Threshold





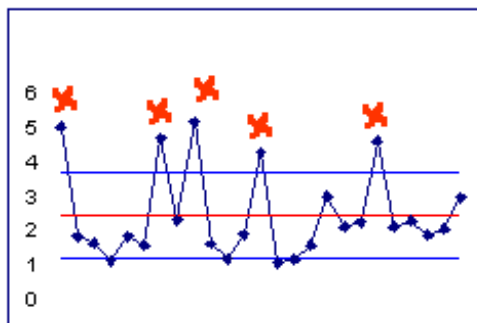
## Measurement Alarms: Basic Concepts

### Step over the Threshold with Filter Time

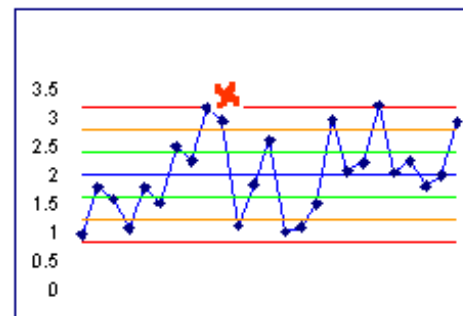


## Statistical Alarms: Basic Concepts

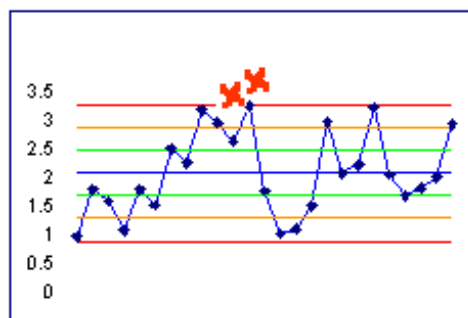
### Instability



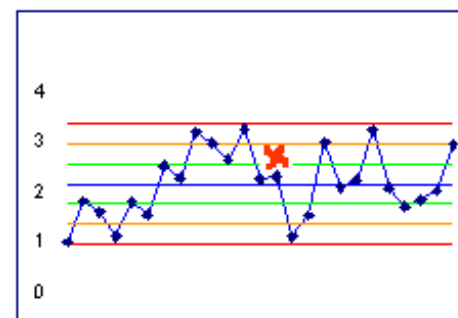
**1 point outside  $3\sigma$**



**2 out of 3 points beyond  $2\sigma$**



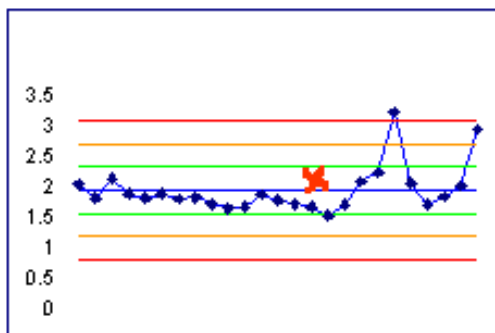
**4 out of 5 points beyond  $\sigma$**



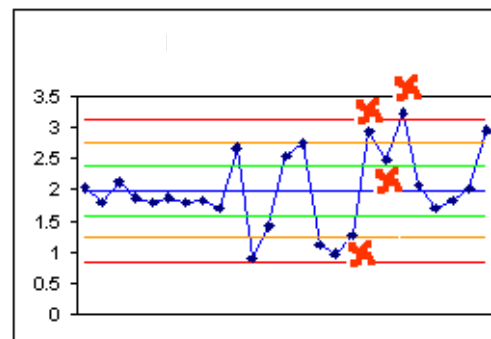
**8 successive points on one side of the CL**

## Statistical Alarms: Basic Concepts

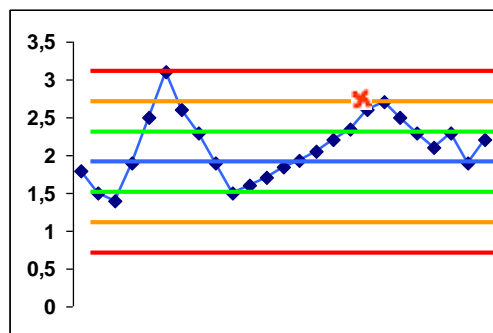
### Other Tests



**Stratification**



**Mixtures**



**Trend**

## Statistical Alarms: Basic Concepts

### Alarm Tag

- *It takes an alarm status according to Values/States of another Tag*
- *Are hierarchically grouped (Site/Area/Plant...)*
- *They can use time filters (alarm triggered after condition persistence)*
- *Possible States: Lolo, Low, Normal, High, Hihi...*
- *Threshold Value can be determined by another Tag (Reference)*
- *For each alarm tag we must define at least another one (Source)*

## Statistical Alarms: Basic Concepts

### SQC Tag

- *It is similar to an Alarm Tag with no Time Filter*
- *Possible States (in order of precedence):*

*OutsideControl, Outside2Sigma, Outside1Sigma, OneSideofCL, Stratification, Mixture, Trend, Normal*

- *Tests are made on the single states of the Source Tag*
- *For each SQC Tag other 6 tags must be defined:*

*Source, Center Line, TestStatus, UCL, LCL, Reset*

- *Other 4 additional Tags can be defined:*

*USL, LSL, Comment, Product*

## Alarm Notifications: usable Tag Types

Tag Type	Usage of Source Tag(s)	Numeric	Digital
Process/Labo Tag		X	X
Calculated Tag	X	X	X
Alarm Tag	X		X
SQC Tag	X		X

## Alarm Notifications: PI Aliases configuration

PI Module Database Editor - Microsoft Internet Explorer provided by Solvay Amigo 2002

File Modifica Visualizza Preferiti Strumenti ?

Indirizzo C:\PIPC\SMT\MDBEditor\MDBEditor.html

Test

Folder Items

- My Module Databases
  - ITR\_SPI
    - PI BatchDB
    - PI ModuleDB
      - %OSI
      - Allarmi\_PI
        - Alarm\_Code\_Class
        - ClientSMS
        - Mail\_Server
        - Plants
          - Sodiera
            - Test
            - Test\_Allarme
            - Test\_Statistico
        - Sodiera
        - BDTU
        - Calcoli
      - Register PI Servers

Sub-Modules PI Aliases PI Properties

PIAlias Name	Tag Name	Server	Snapshot Value	Snapshot Time
InputTag	TEST	ITR_SPI	71	22/04/2004 3:21:00
OutputTag	PROVA	ITR_SPI	5	22/04/2004 3:21:00

0 Objects Type: PIModule Aliases: 2 Properties: 15 Effective Date: 01/01/1970 1:00:01 Query Date: 23/04/2004 12:12:22 Creator:

Operazione completata

My Computer

## Alarm Notifications: configuration for a process/labo tag

PI Module Database Editor - Microsoft Internet Explorer provided by Solvay Amigo 2002

File Modifica Visualizza Preferiti Strumenti ?

Indirizzo C:\PIPC\SMT\MDBEditor\MDBEditor.html

Test

Folder Items

- My Module Databases
  - ITR\_SPI
    - PI BatchDB
    - PI ModuleDB
      - %OSI
        - Allarmi\_PI
          - Alarm\_Code\_Class
          - ClientSMS
          - Mail\_Server
          - Plants
            - Sodiera
              - Test
                - Test\_Allarme
                - Test\_Statistico

Sub-Modules PI Aliases PI Properties

PIProperty Name	Value	Datatype
Enable	True	Boolean
Operator	>	String
Limit	49	String
DeadBand	5	String
AlarmActive	False	Boolean
Net_Message	Tag %T: Valore %V: Soglia %S	String
SMS_Message	Tag %T: Valore %V: Soglia %S	String
Email_Address	massimo.zupo@solvay.com	String
Email_Message	Tag %T: Valore %V: Soglia %S	String
Net_Computer_ID	R-1665	String
SMS_Phone_Number		String
Email_Attachment	c:\allarmipi\prova.txt	String
PI_Output_State	2;5	String
PI_Output_Enable	True	Boolean
Alarm_Code_Class		String

0 Objects Type: PIModule Aliases: 2 Properties: 15 Effective Date: 01/01/1970 1:00:01 Query Date: 23/04/2004 12:06:06

Operazione completata

My Computer

Limit condition

Text Messages

Addressees

Enclosed document

Output tag values (False;True)



## Alarm Notifications: configuration for an alarm tag

PI Module Database Editor - Microsoft Internet Explorer provided by Solvay Amigo 2002

File Modifica Visualizza Preferiti Strumenti ?

Indirizzo C:\PIPC\SMT\MDBEditor\MDBEditor.html

### Test\_Allarme

Folder Items

- My Module Databases
  - ITR\_SPI
    - PI BatchDB
    - PI ModuleDB
      - %OSI
        - Allarmi\_PI
          - Alarm\_Code\_Class
          - ClientSMS
          - Mail\_Server
          - Plants
            - Sodiera
              - Test
                - Test\_Allarme**
                - Test\_Statistico
              - Sodiera
            - BDTU
            - Calcoli
          - Register PI Servers

Sub-Modules PI Aliases PI Properties

PIProperty Name	Value	Datatype
Enable	False	Boolean
Operator	<=	String
Limit	.	String
DeadBand	0	String
AlarmActive	True	Boolean
Net_Message	Tag %T: Valore %V: Soglia %S	String
SMS_Message	Tag %T: Valore %V: Soglia %S	String
Email_Address	massimo.zupo@solvay.com	String
Email_Message	Tag %T: Valore %V: Soglia %S	String
Net_Computer_ID	r-1665	String
SMS_Phone_Number		String
Email_Attachment	c:\allarmipi\prova.txt	String
PI_Output_State	2;6	String
PI_Output_Enable	True	Boolean
Alarm_Code_Class	Standard	String

0 Objects Type: PIModule Aliases: 2 Properties: 15 Effective Date: 01/01/1970 1:00:01 Query Date: 23/04/2004 12:09:17

Operazione completata

My Computer

Limit condition

## Alarm Notifications: configuration for an SQC tag

PI Module Database Editor - Microsoft Internet Explorer provided by Solvay Amigo 2002

File Modifica Visualizza Preferiti Strumenti ?

Indirizzo C:\PIPC\SMT\MDBEditor\MDBEditor.html

### Test\_Statistico

Folder Items

- My Module Databases
  - ITR\_SPI
    - PI BatchDB
    - PI ModuleDB
      - %OSI
      - Allarmi\_PI
        - Alarm\_Code\_Class
        - ClientSMS
        - Mail\_Server
        - Plants
          - Sodiera
            - Test
              - Test\_Allarme
              - Test\_Statistico
            - Sodiera
          - BDTU
          - Calcoli
- Register PI Servers

Sub-Modules PI Aliases PI Properties

PIProperty Name	Value	Datatype
Enable	False	Boolean
Operator	=	String
Limit	OutsideControl	String
DeadBand	0	Double
AlarmActive	False	Boolean
Net_Message	Tag %T: Valore %V: Soglia %S	String
SMS_Message		String
Email_Address		String
Email_Message		String
Net_Computer_ID	r-1665	String
SMS_Phone_Number		String
Email_Attachment		String
PI_Output_State		String
PI_Output_Enable	False	Boolean
Alarm_Code_Class	SQC	String

0 Objects Type: PIModule Aliases: 2 Properties: 15 Effective Date: 01/01/1970 1:00:01 Query Date: 23/04/2004 12:11:08

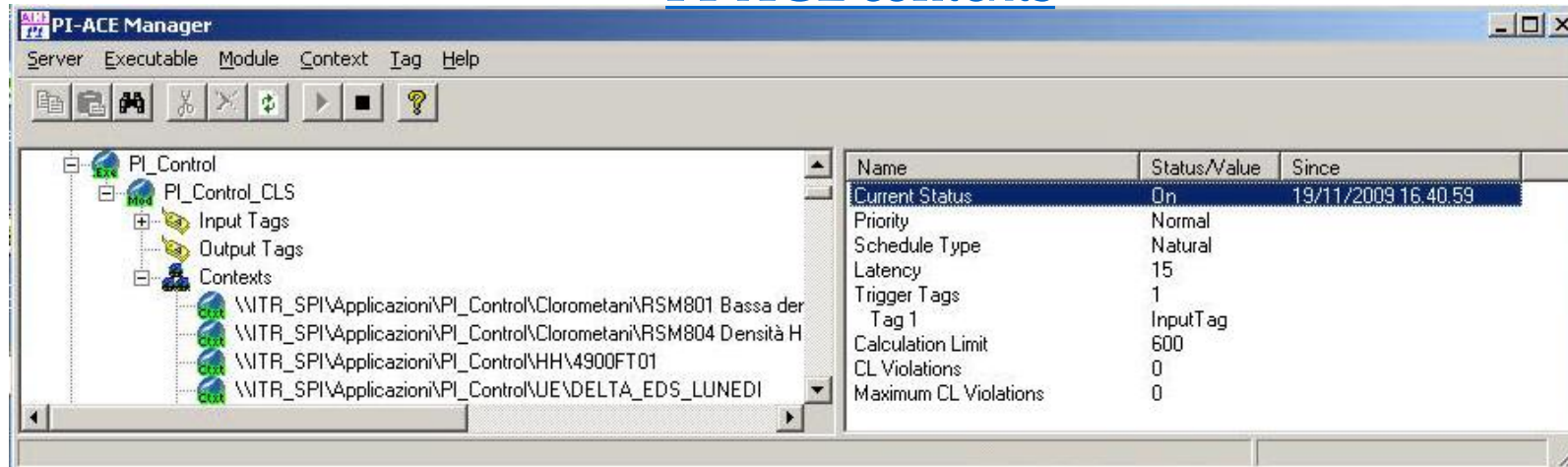
Operazione completata

My Computer

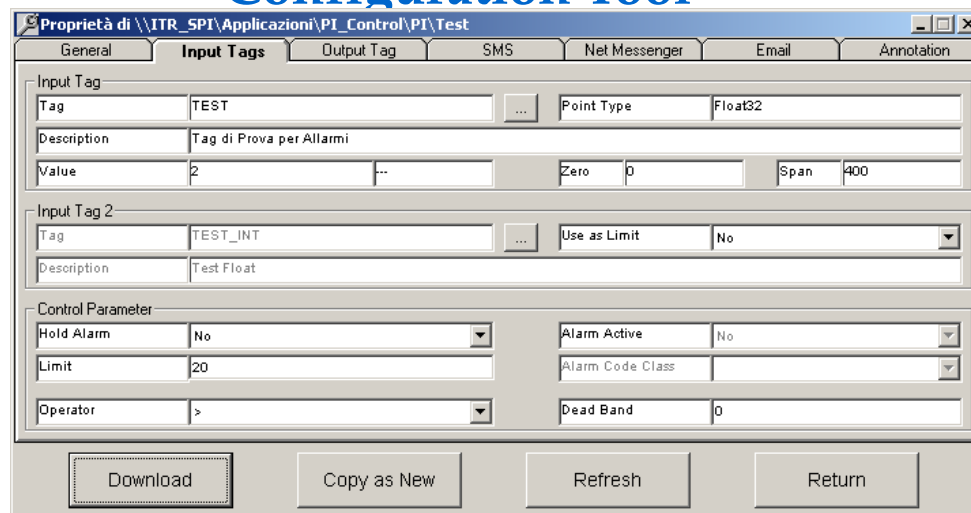
Limit condition

## Alarm Notifications

### PI-ACE contexts



## Configuration Tool



## Project Costs

### Batch Traceability

Purchases: PI-AF + PI-ACE + PI-Batch (if modules are not owned)

External Development/Installation: around 100 k€

### Alarm Notifications

Purchases:

- PI-ACE + PI-SQC (if modules are not owned)
- Software for sending SMS and e-mail

Internal Development: around 30 working days



# Thank you

© Copyright 2010 OSIsoft, LLC.

777 Davis St., Suite 250 San Leandro, CA 94577