



An expert controller for your ball mill

Presentation Sequence



1. Introduction
2. The ***MILL ExCS*** software
3. Case Study
4. Project Schedule
5. Conclusion



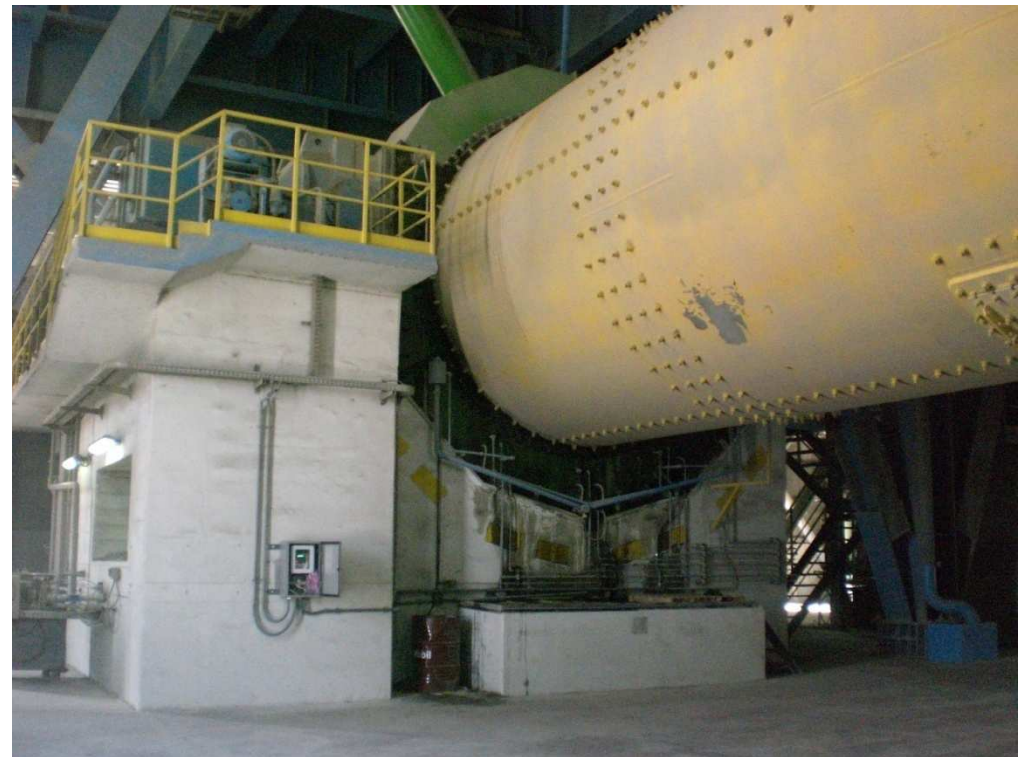
Introduction - MillExCS



What is **THE MILLEXPERT CONTROL SYSTEM** ?

MillExCS is an **Expert Controller** for control in automatic and optimize ball mills.

MillExCS control philosophy is to **reproduce the same control actions as the best operator in plant.**



Why to control systems in automatic mode?

The main objective of an automatic control in the industry is to **reproduce the same control actions as the operators in an automatic way.**

A second important point, is that an automatic system can adapt better and faster to new operation conditions due to changes in the process (change of material grindability, abrasion of liners, etc.)



Introduction



The **difficult** part is to **teach** the computers to think like humans.

There are some important differences between “human thinking” and “computer thinking”.

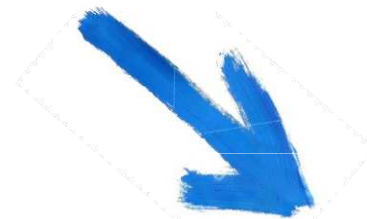
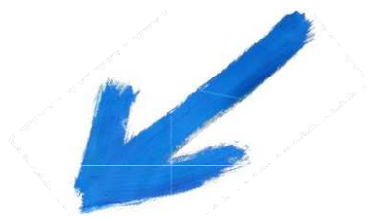
- Usually the computers take “linear” decisions, but most of the industrial process are hardly “**non-linear**”.
- These kind of systems works with a **fixed set point**, do not take into consideration the possibility to increase capacity if the other signals of the process give conditions.

Introduction



EXAMPLE:

Divide some persons in two groups: tall or short people.



GROUP 1:
Short People
Smaller than 2,0m



GROUP 2:
Tall People
Bigger than 2,0m



Introduction



Person 1:



1,74 m

Short



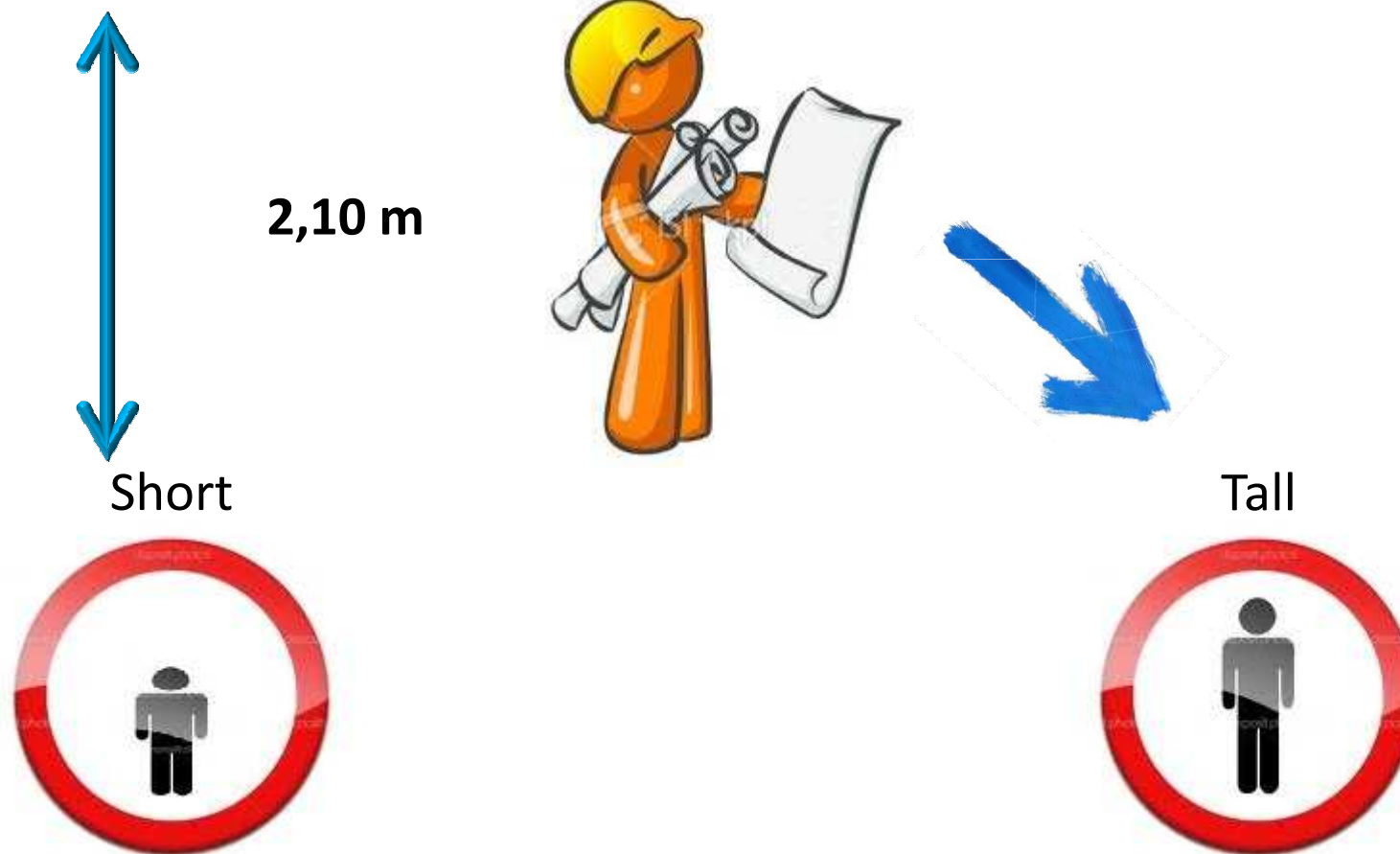
Tall



Introduction



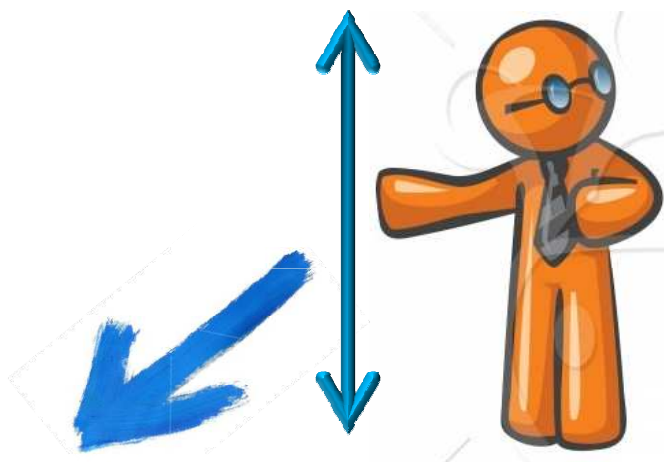
Person 2:



Introduction



Person 3:



1,99 m

Short



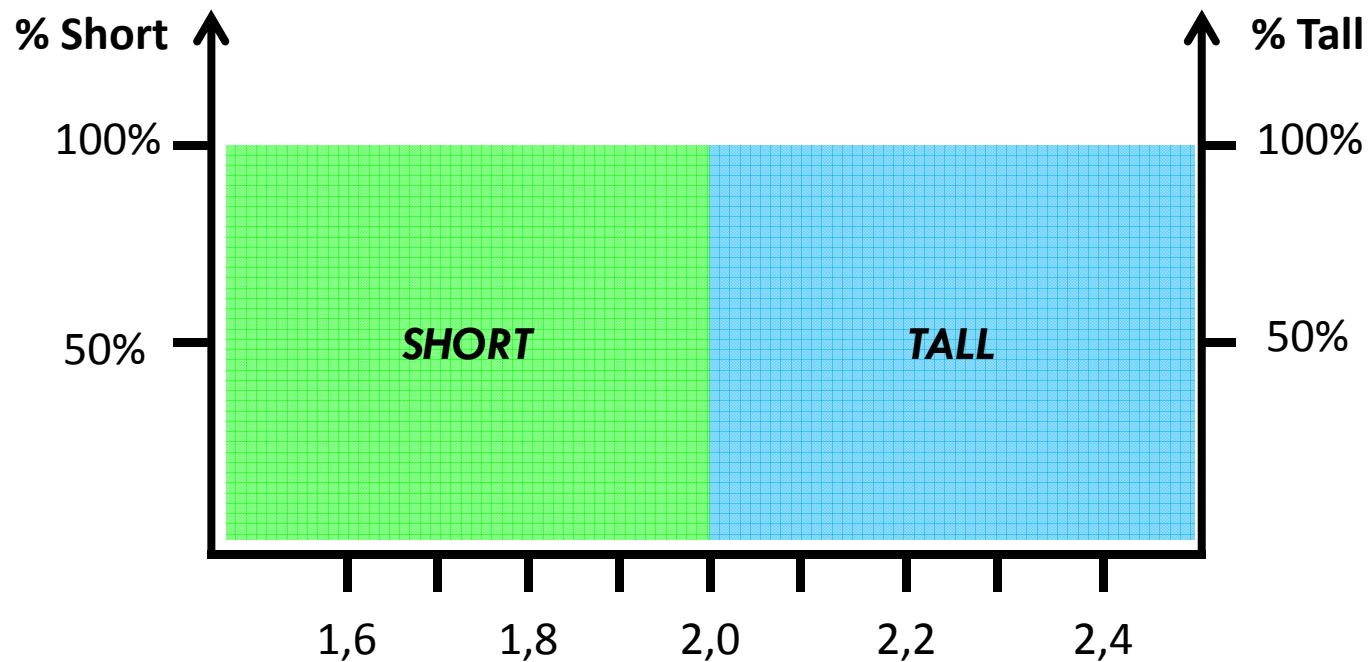
Tall



Introduction



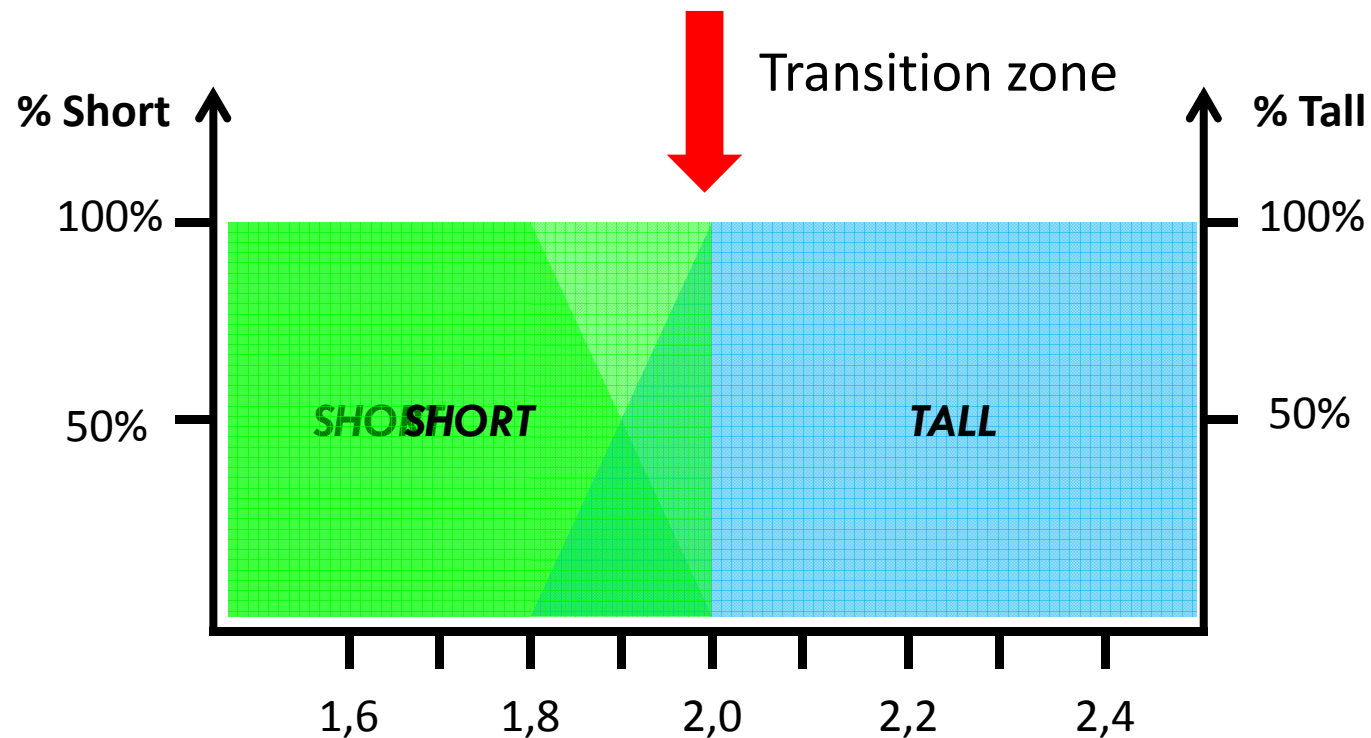
In a **linear** decision, Person num. 3 would be considered “short”.
In a real world we could not consider this person even short, even tall.



Introduction



Between 1,8m and 2,0 the person is considered part shot, part tall.
In this case, a “transition zone” should be created between the groups.

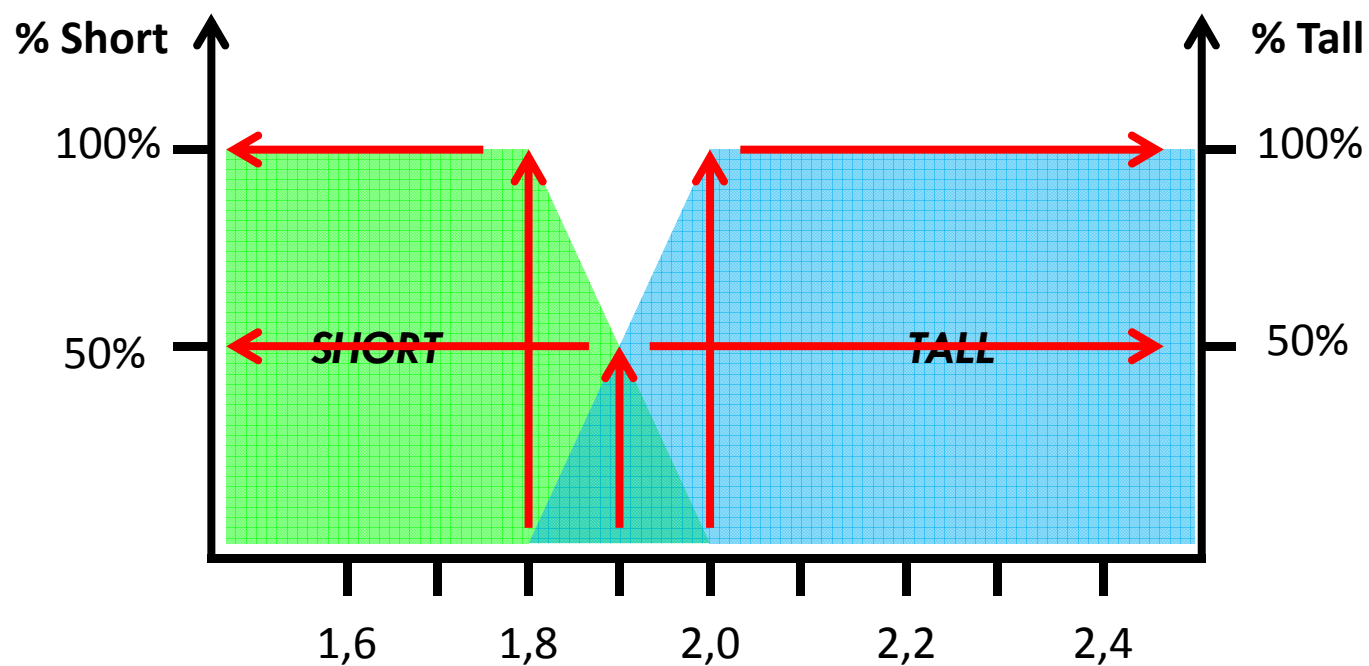


Introduction



Example:

Person with 2,0 m



The MillExCS Software – Water tank



The MillExCS Software – Water tank



EXAMPLE IN THE WATER TANK:

Objective: Control the water fill level.
Desired fill level: 50%

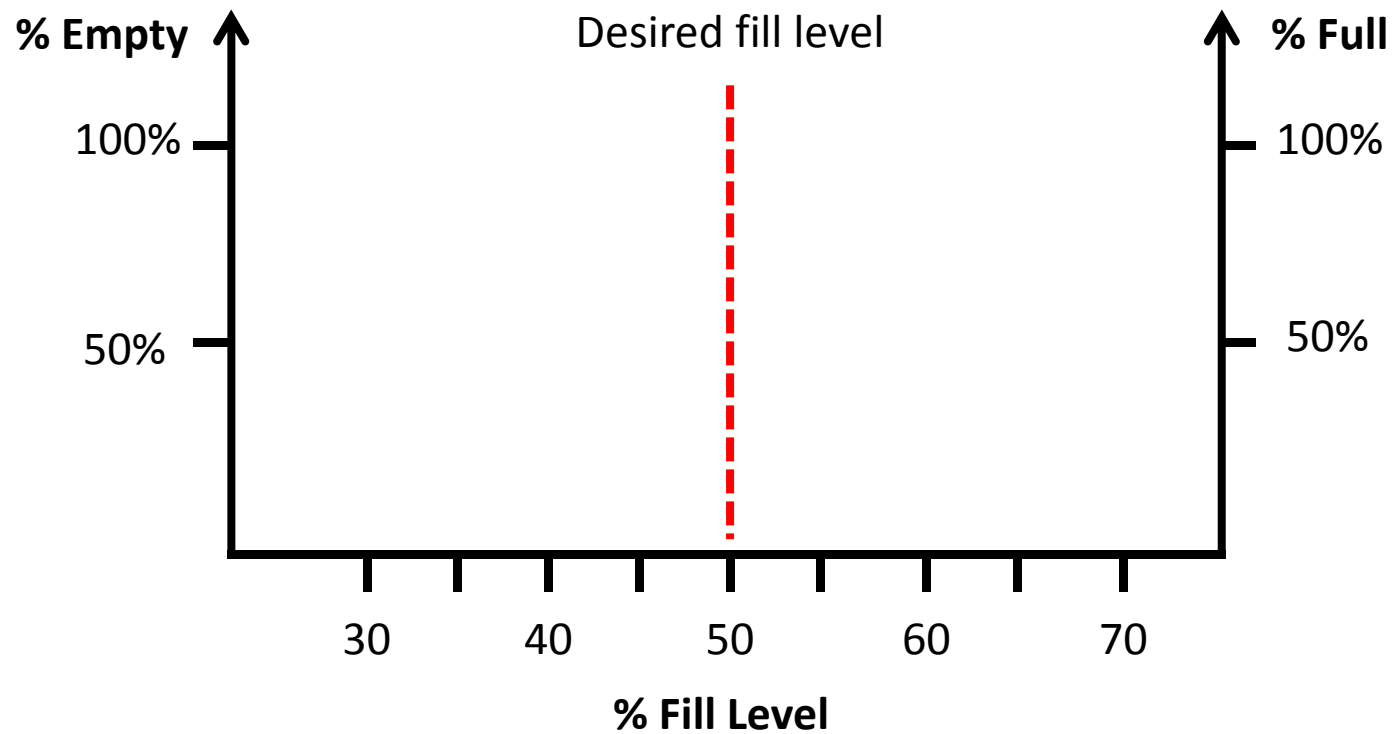
Sensors: Fill level sensor;
Light sensor.

Actuators: Pump with variable speed.

The MillExCS Software – Water tank



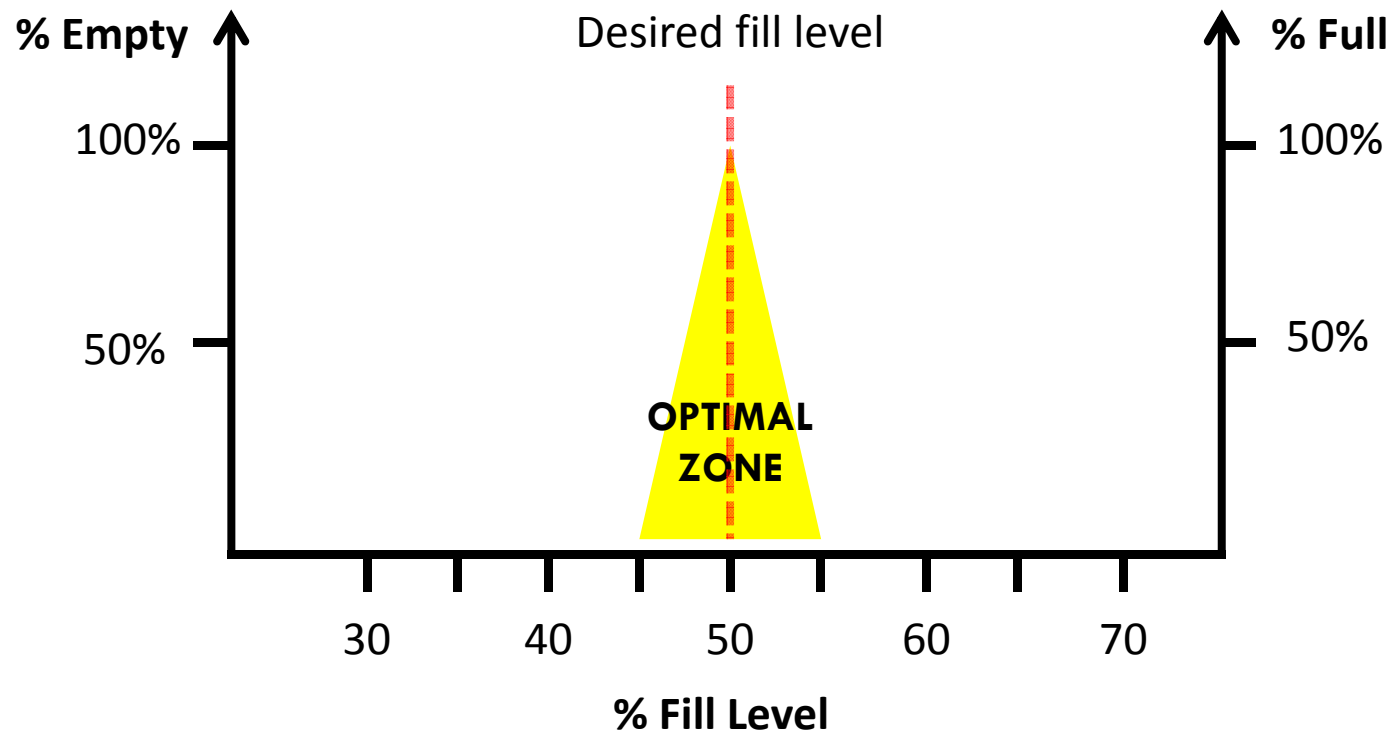
EXAMPLE IN THE WATER TANK:



The MillExCS Software – Water tank



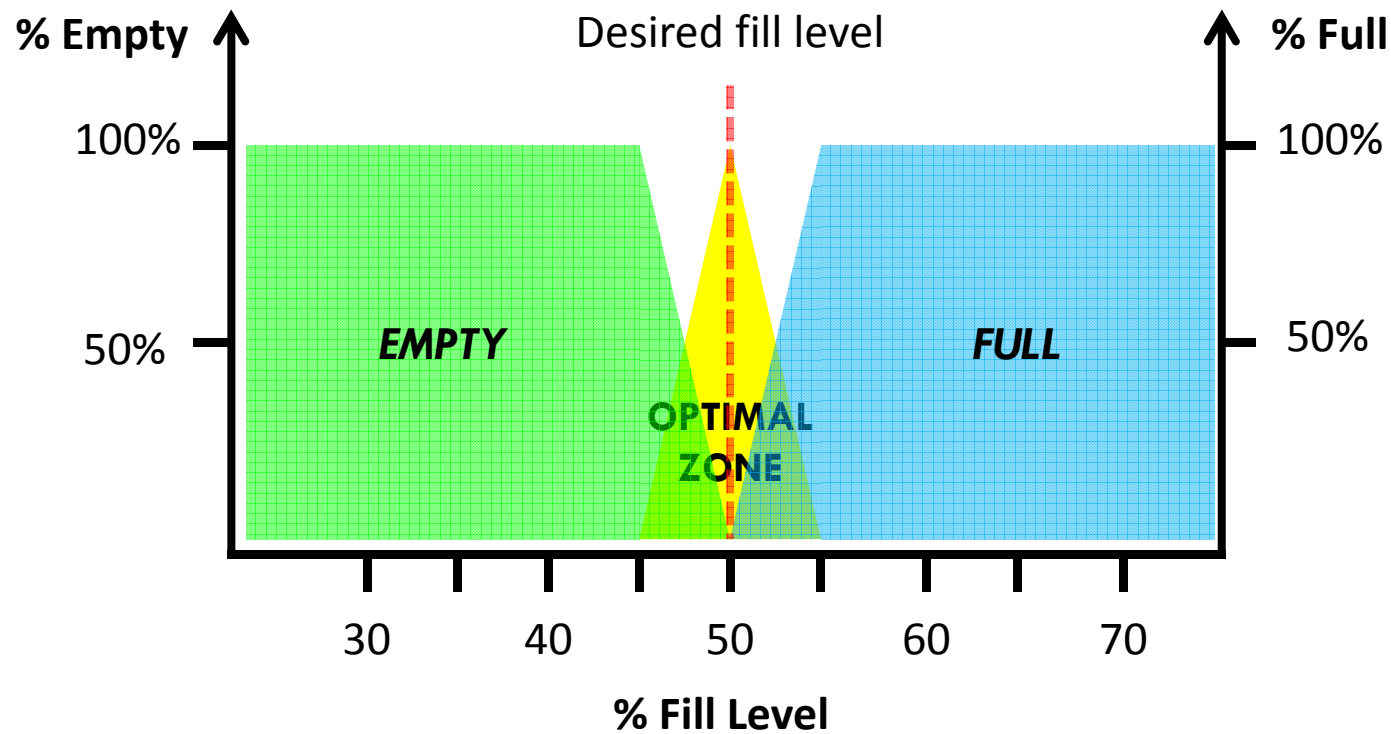
EXAMPLE IN THE WATER TANK:



The MillExCS Software – Water tank



EXAMPLE IN THE WATER TANK:



The MillExCS Software – Water tank



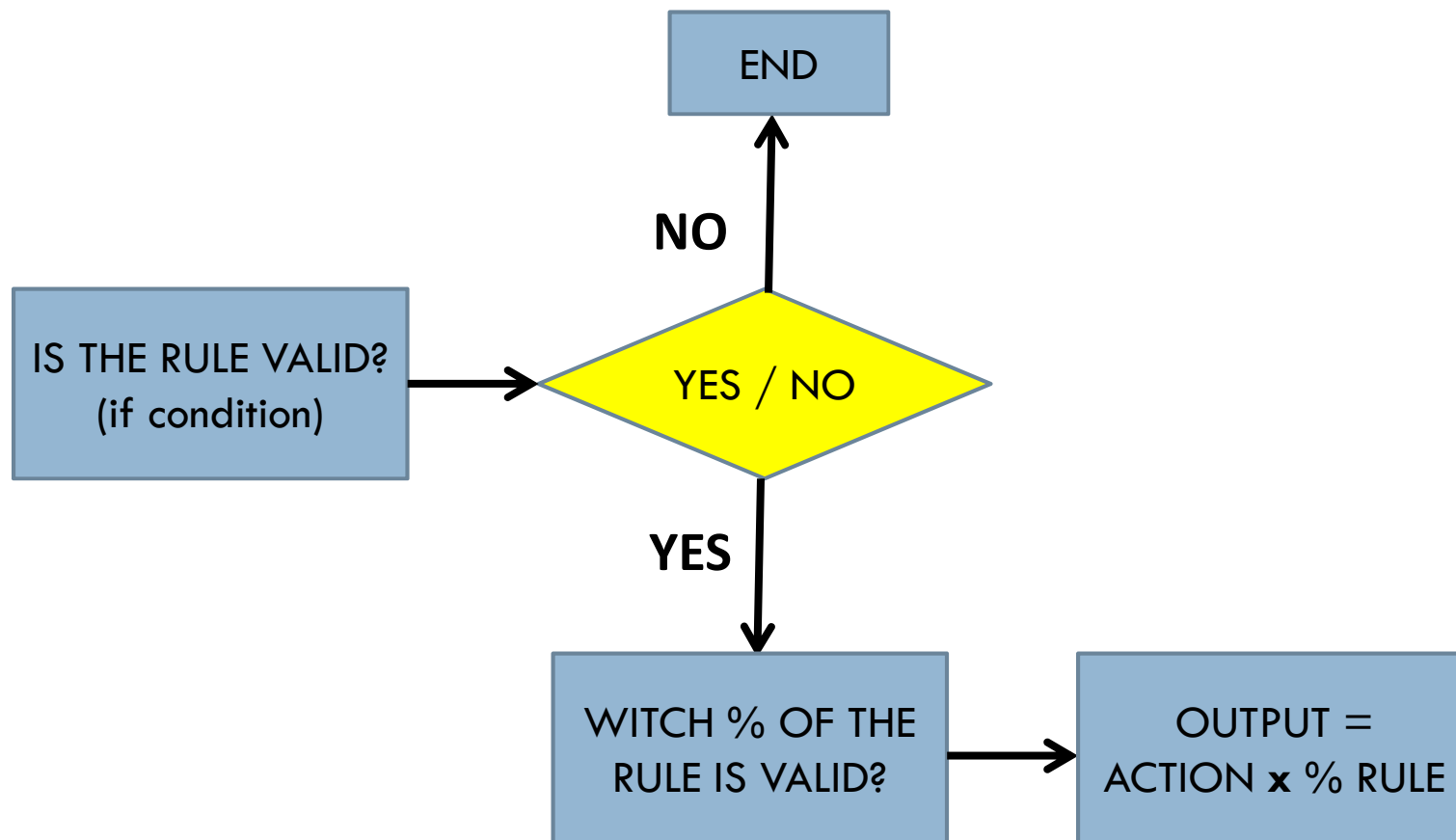
CONTROL RULES, how they work?

understand the
concept

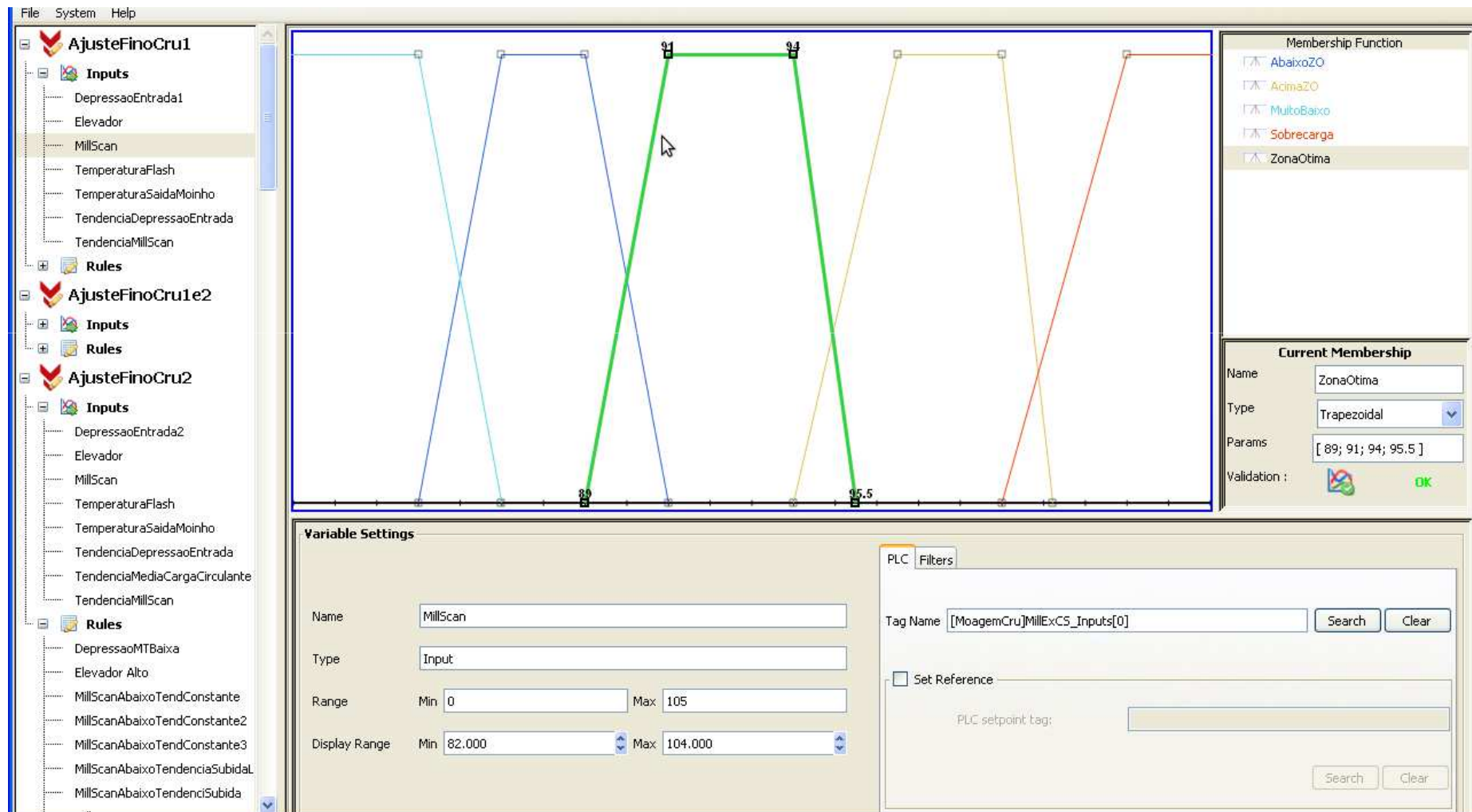
The MillExCS Software – Water tank



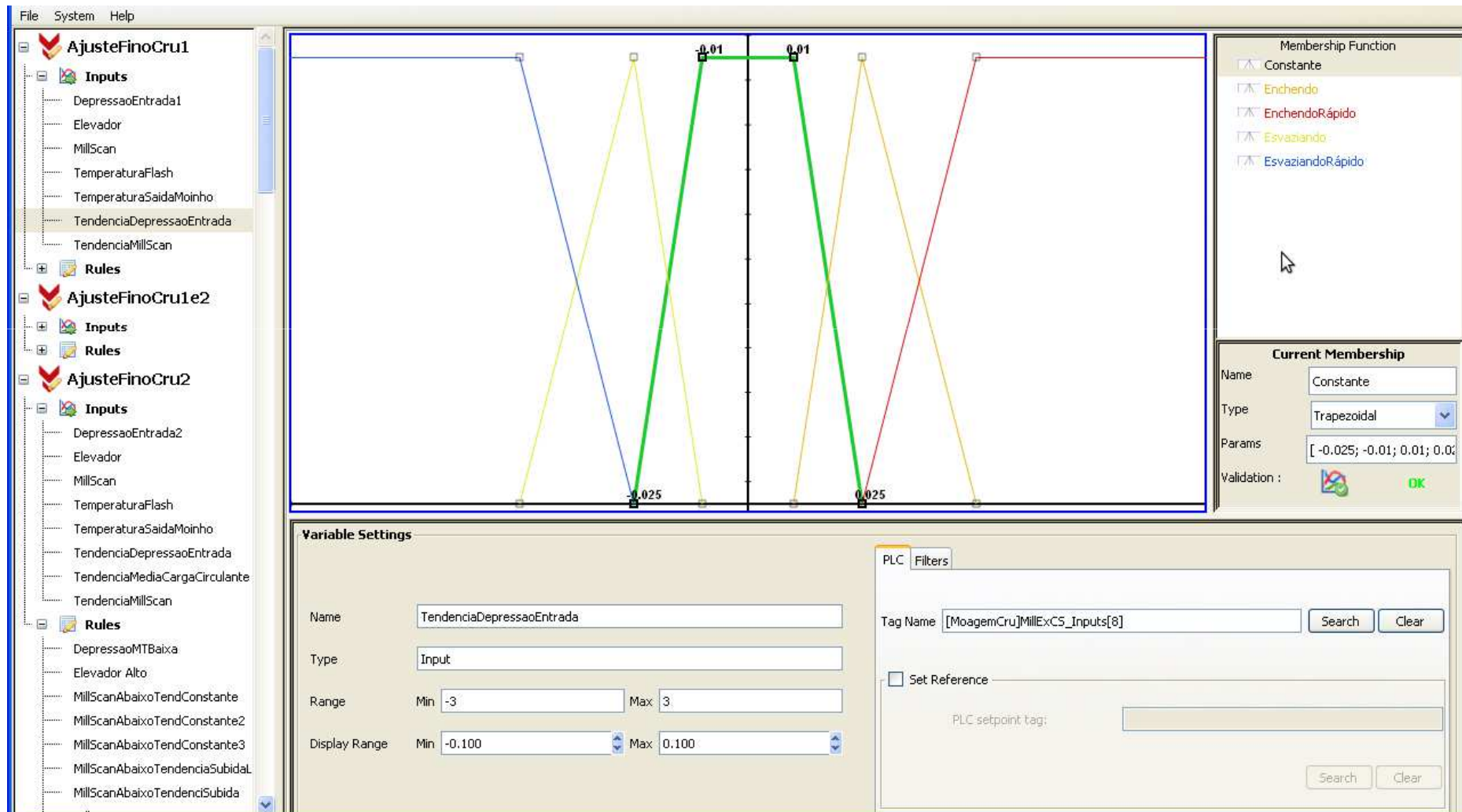
CONTROL RULES, how they work?



The MillExCS Software – Water tank



The MillExCS Software – Water tank



The MillExCS Software – Water tank





MILL ExCS Case Study I

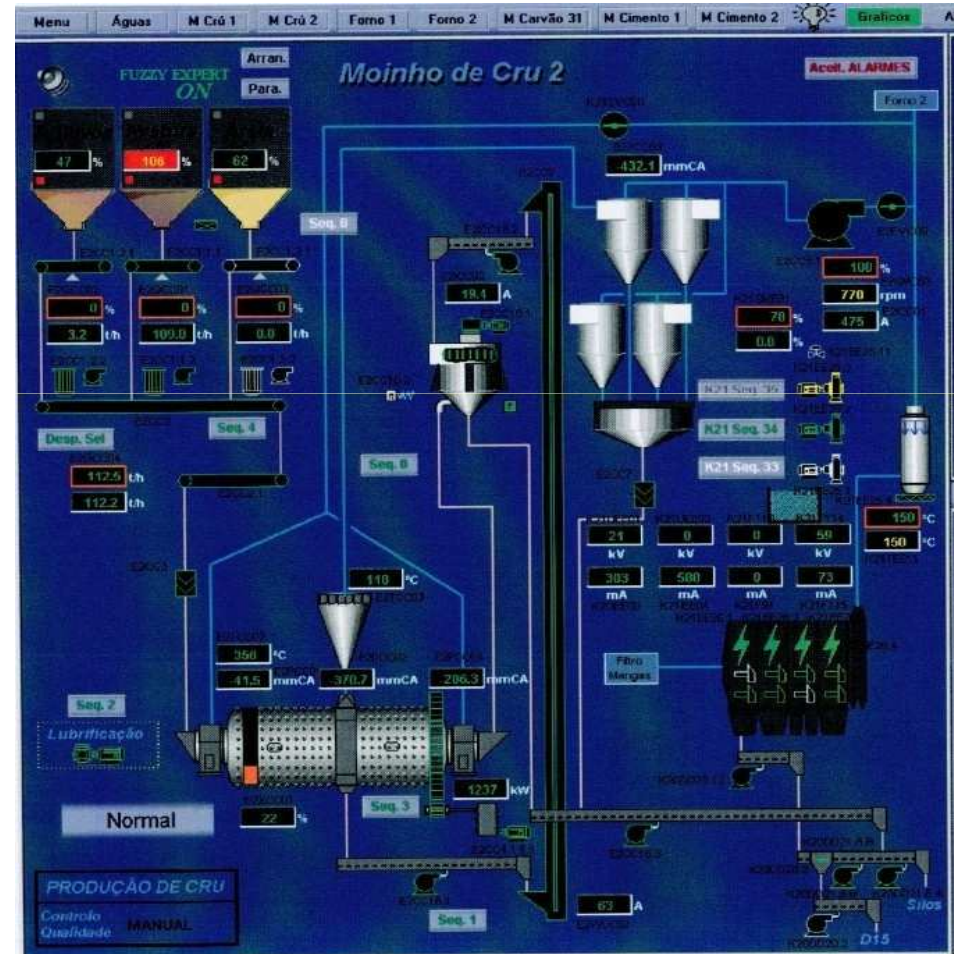
Raw Meal Mill



Case Study I – Raw Meal Mill



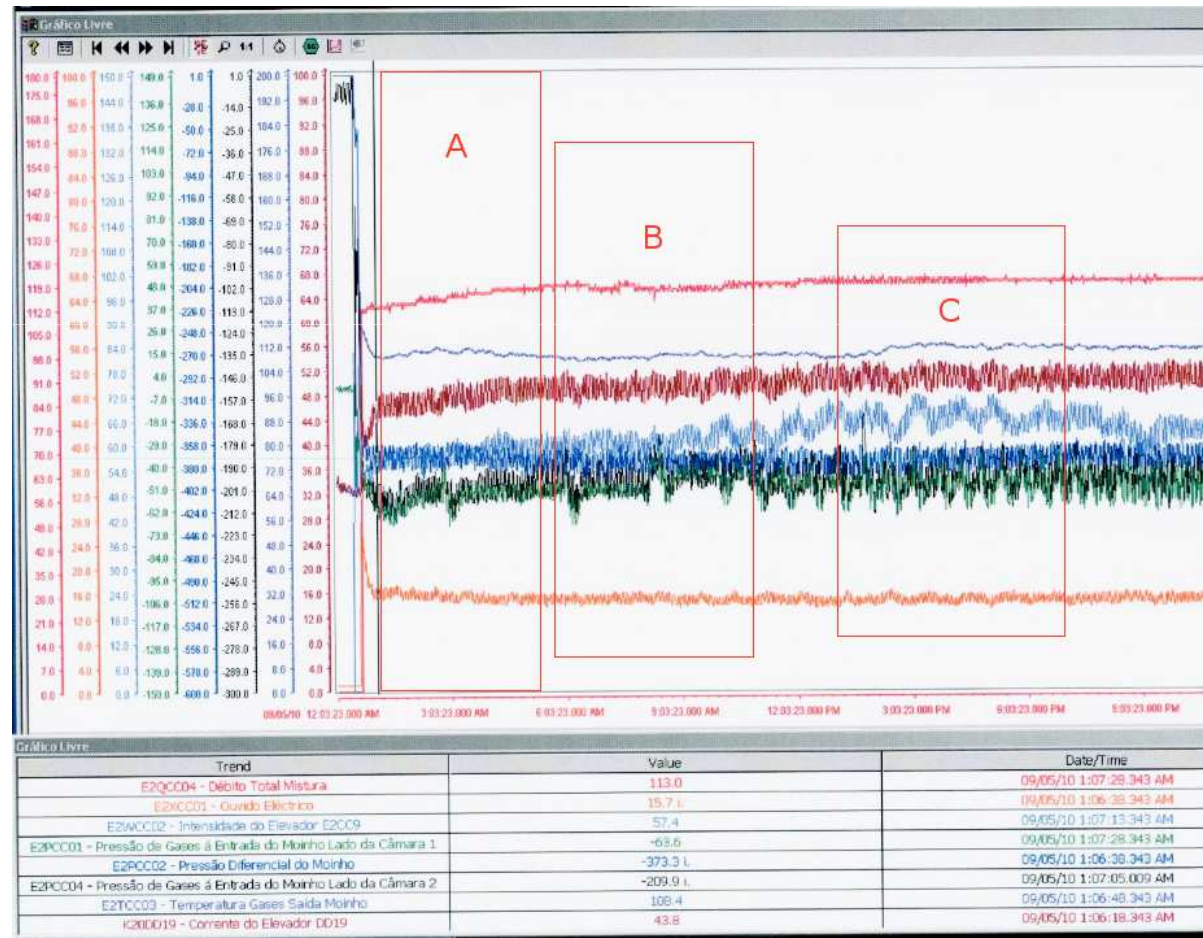
- Raw meal mill, tree chambers with central discharge.
- Dynamic separator (2nd generation).
- Fresh feed manually controlled by the operator.



Case Study I – Raw Meal Mill



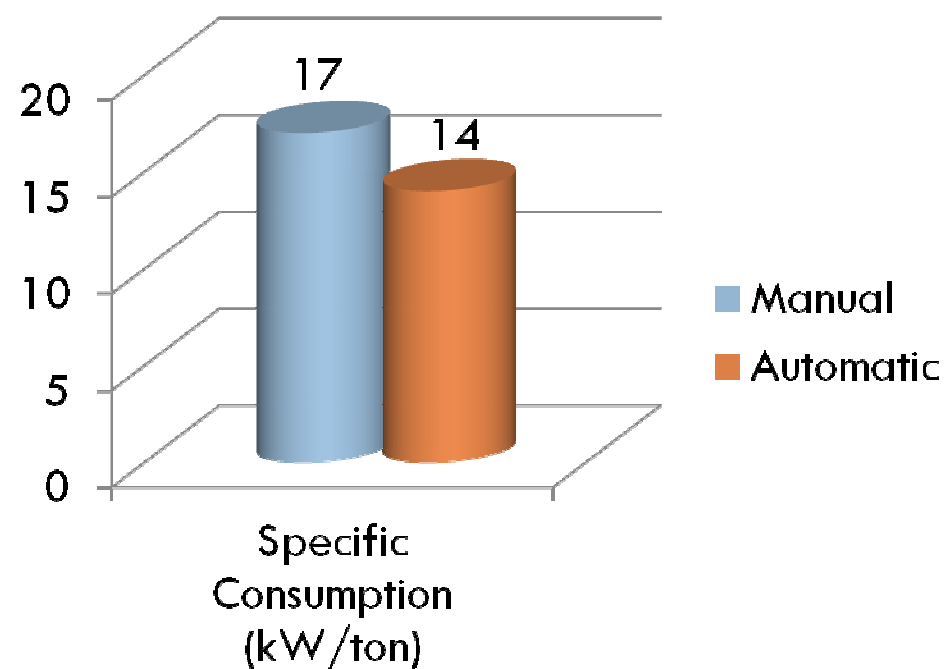
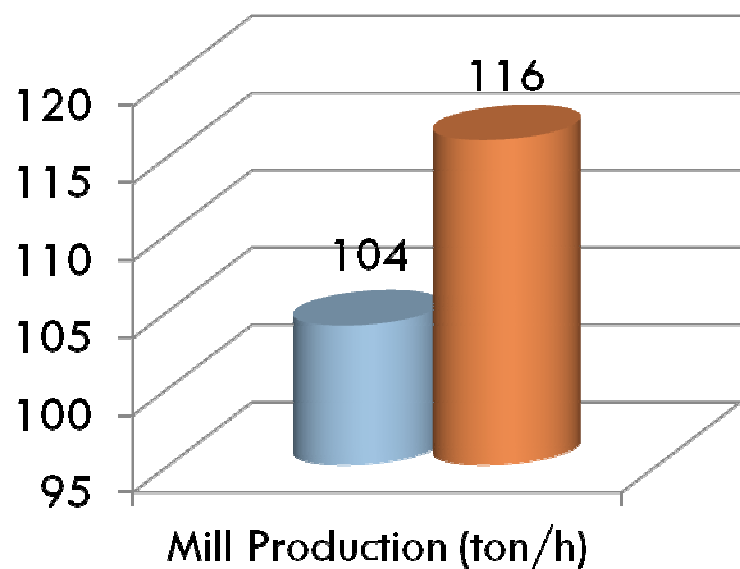
Mill under Automatic control



Case Study I – Raw Meal Mill



Comparison between manual and automatic mode:





MILL ExCS Case Study II

Cement Mill



Case Study II – Cement Mill



Mill characteristics

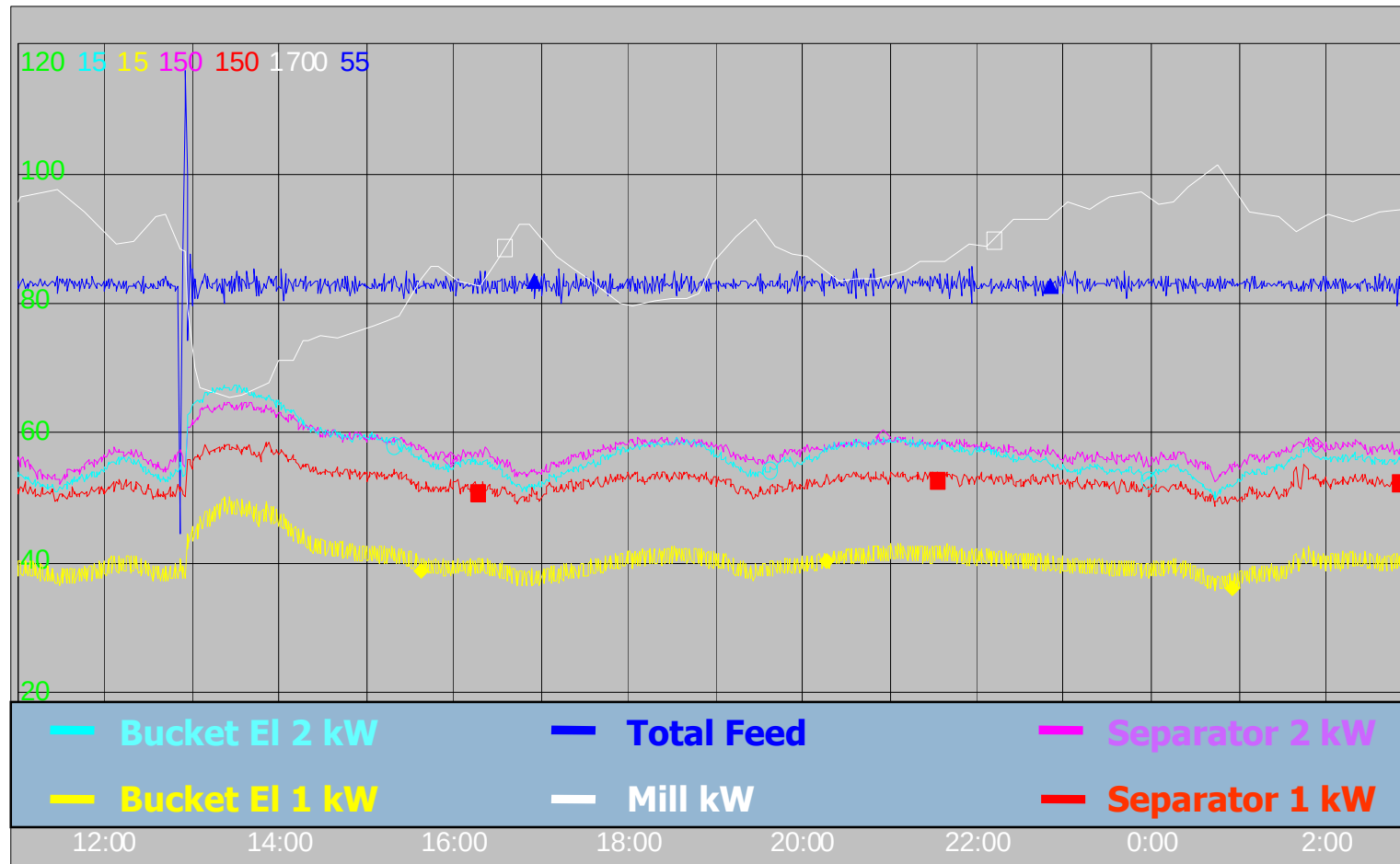
- Cement Mill, 2 chambers
- Dimensions: 4,0m diameter; 6,4m long; 2.000HP
- 2 separators, first generation;
- 4 Different cements produced (blaine: 5500-4000).



Case Study II – Cement Mill



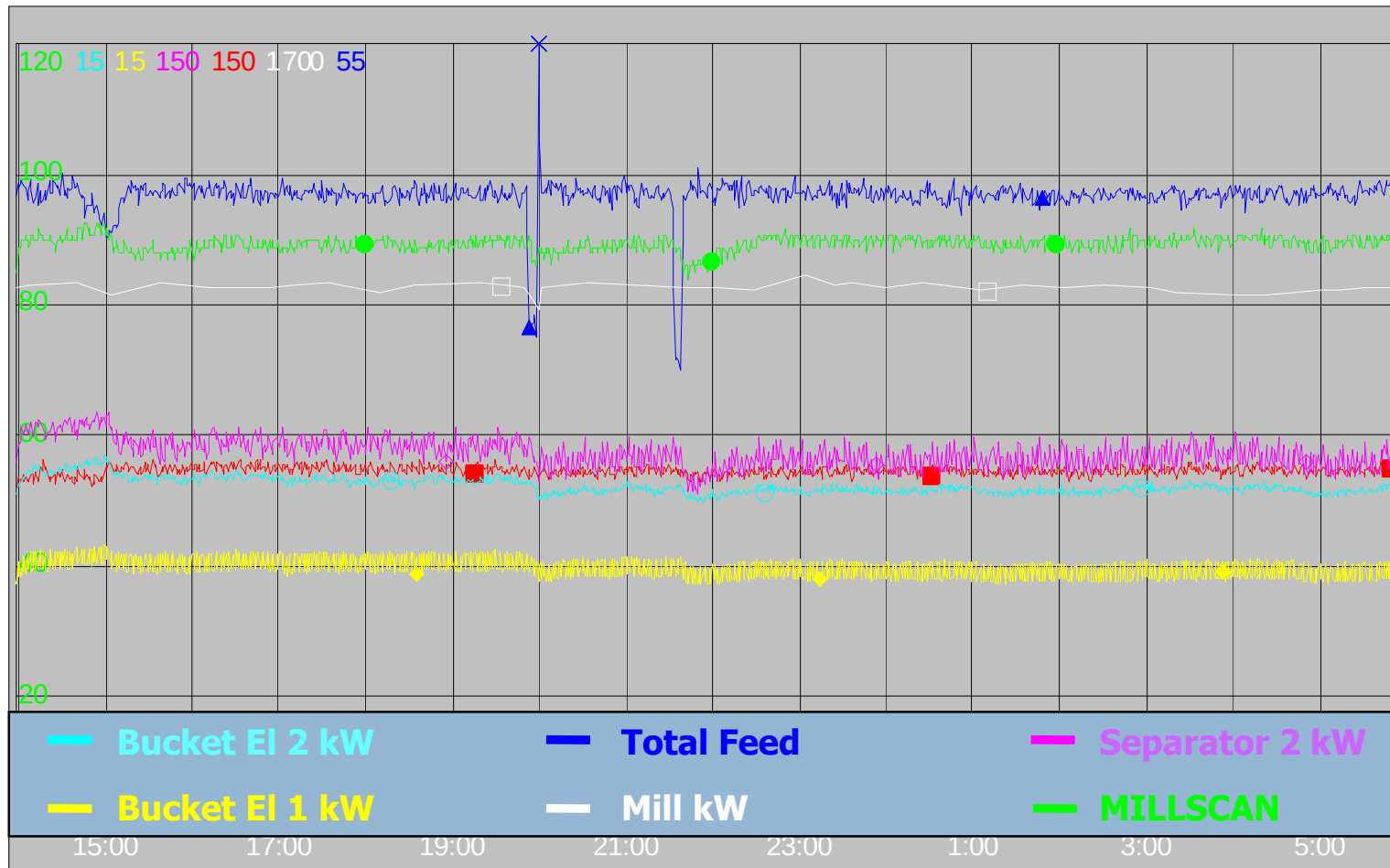
Mill under Manual control



Case Study II – Cement Mill



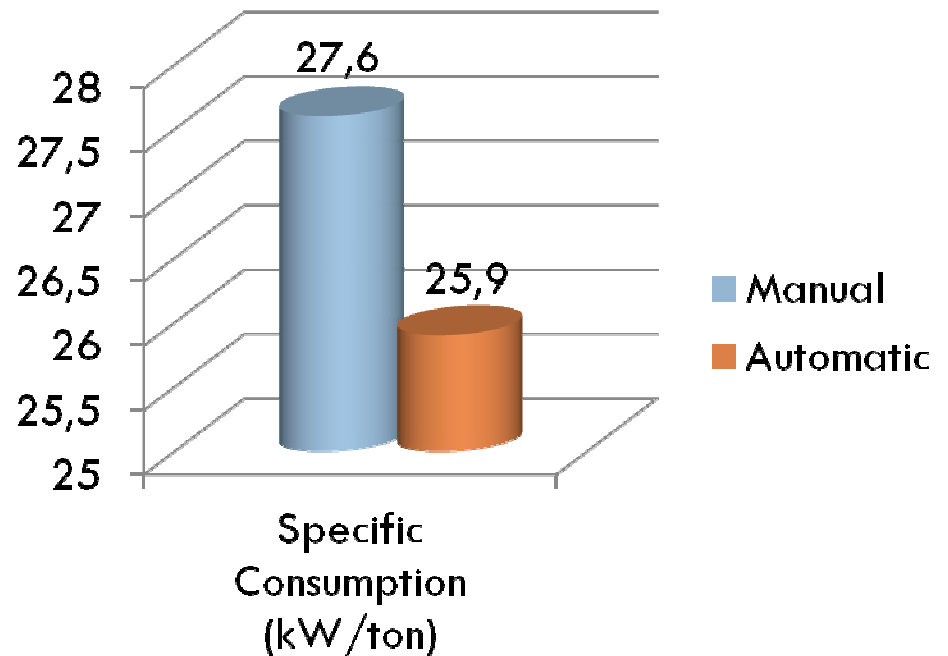
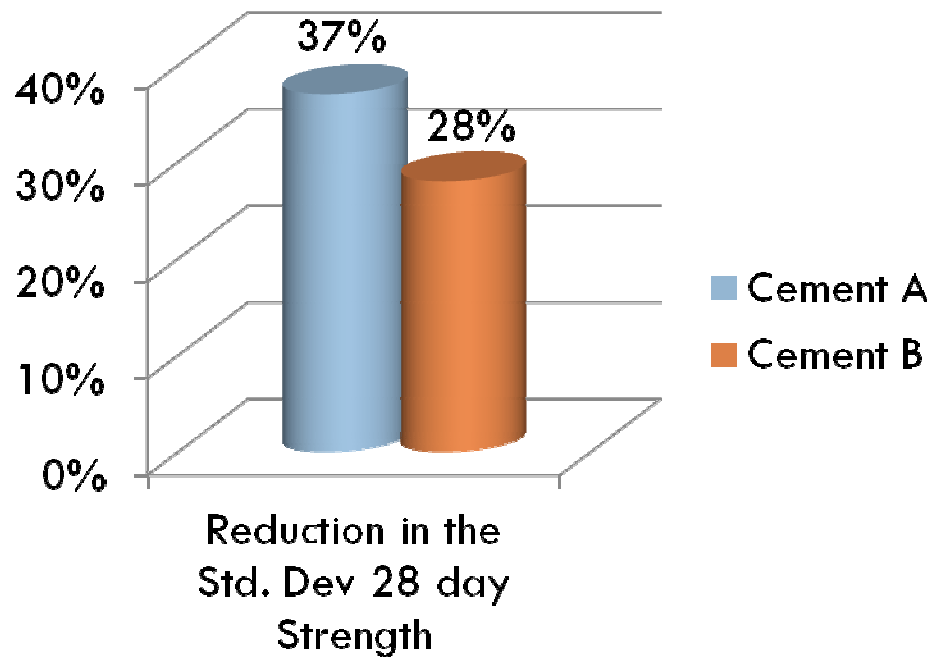
Mill under Automatic control



Case Study II – Cement Mill



Some Results (after OptiMill installation)

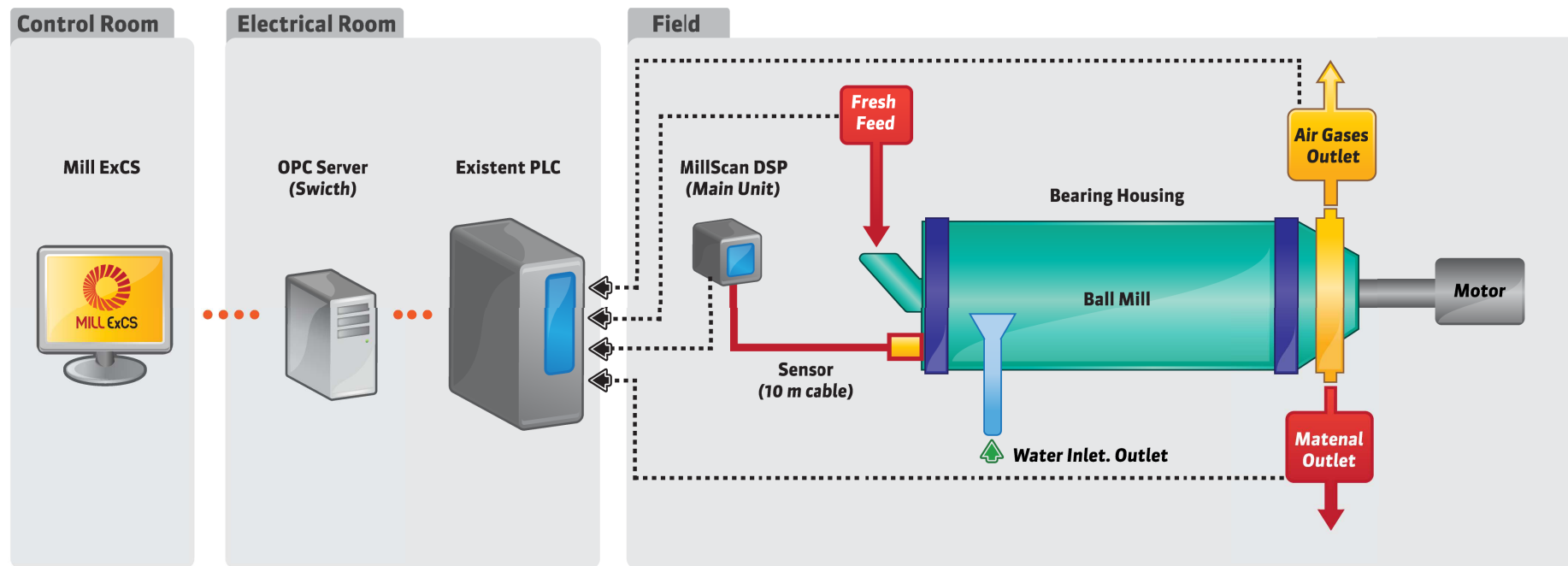


Reduction In kWh/ton (Overall Cements) : 6%

MillExCS – Typical configuration



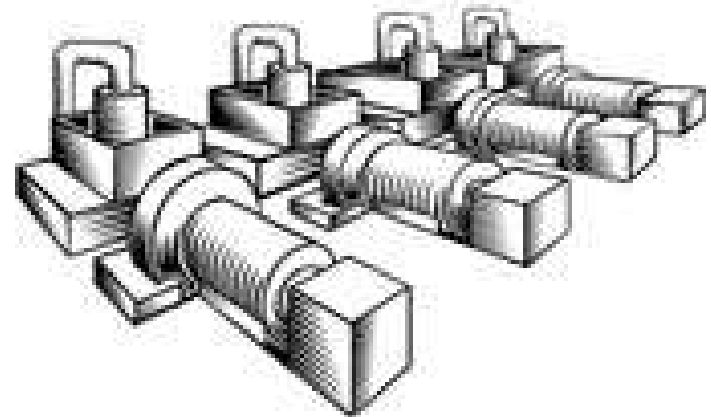
- **No modifications** are required in the existent control system;
- Communication between PLC and **MillExCS** is done via an OPC server using an Ethernet connection existent in plant;
- MillExCS runs in a standard PC computer.



MilExCS – Commissioning and Start-up



- Commissioning and start-up made by a team of specialist.
- The control rules will be exactly the same procedures as the operators use to control the mill.
- People in plant are trained to use and maintain the system (plant people have total knowledge to work with the software without help from outside sources).
- A remote technical assistance is included in the package. By a VPN connection our experts connect to the system to check the operation



MilExCS – Typical installation Schedule



A typical installation of the **MilExCS** takes tree weeks as indicated in the chronogram below.

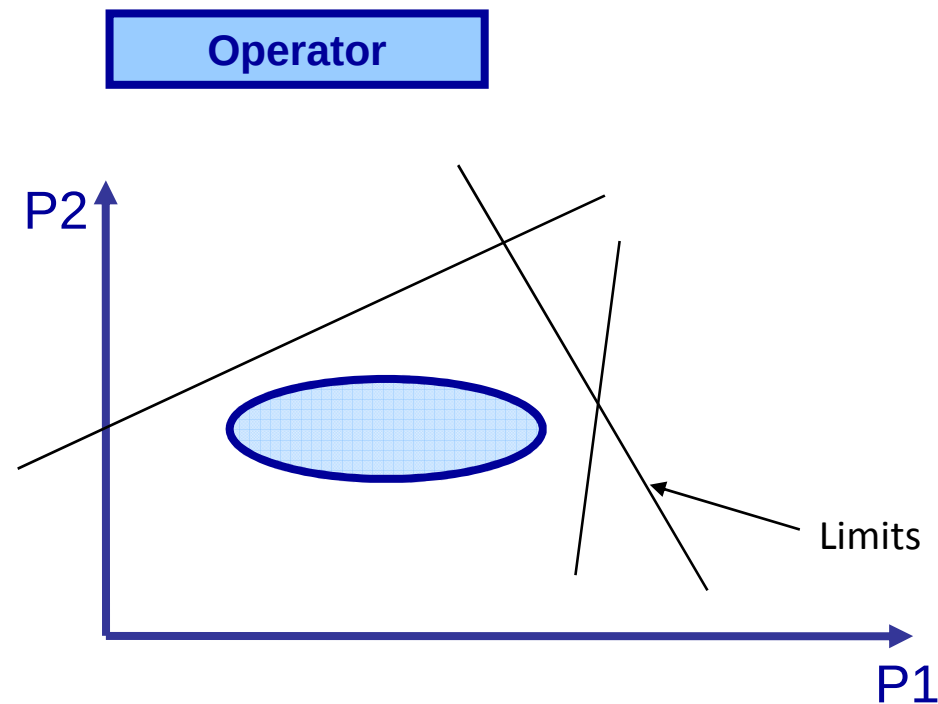
Phase	Week 1	Week 2	Week 3
MilExCS installation	■		
Communication with exist. control system	■	■	
Communication tests		■	■
Rules set-up		■	■
Commissioning		■	■
Operational tests		■	■
Parameters optimization		■	■
Assisted operation		■	■

The user friendly interface and the simple way of setting the systems makes the installation period shorter.

Introduction



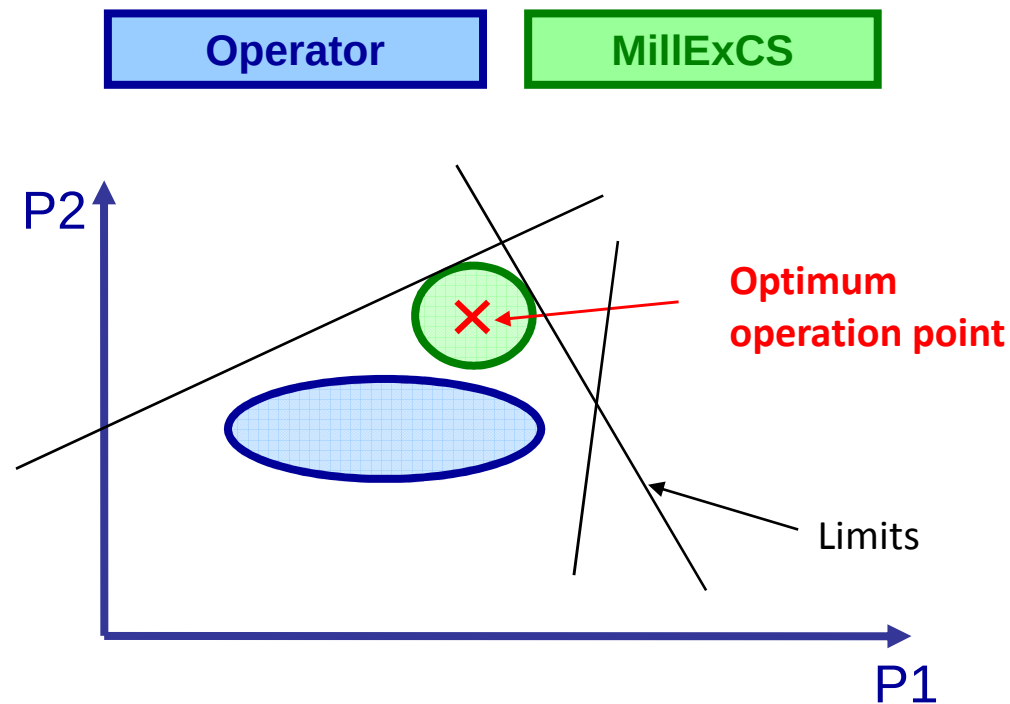
As normal, operator run the mill to an stable and safe condition (and so far **away from the limits of the process**). This actions avoid problems and keep the system running.



Why control mill in automatic ?



Computer Based Decisions are **faster, more precise, constant and repetitive**. Automatic control allows a softer and Stable operation **closer to the limits** of the process.





Questions??

THANKS FOR YOU ATTENTION !!!



Pricast Control Systems, S.L.

Calle Caballero, 79, 7º - 08014 – Barcelona, Spain

Tel: (+34)93.419.2396 Fax:(+34)93.419.2396

pricast.controlsistemas@pricast.es – www.pricast.es