

# Plant / Crushing Automation

## Charles Hillman



**LIGHTEN UP!**

# Agenda

- **Program Overview / Agenda**
- **Discuss crushing station automation**
  - ✓ Automation needs
  - ✓ Automation benefits
- **Show some examples & results**
  - ✓ Pay backs
  - ✓ Data evaluation

# Automation

## *Audience Survey*

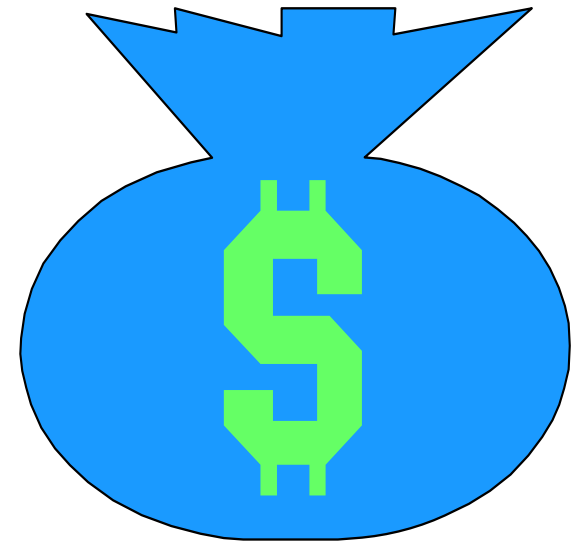
- **How many of you have some form of automation in your plants today?**
- **How many of you have some form of automation on your cone crushers today?**
- **How many of you really understand how the automation works and the importance of it in your plants today?**



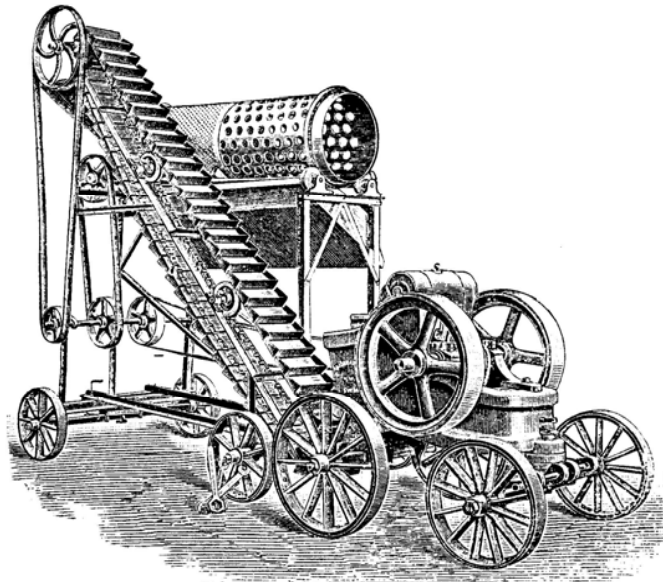
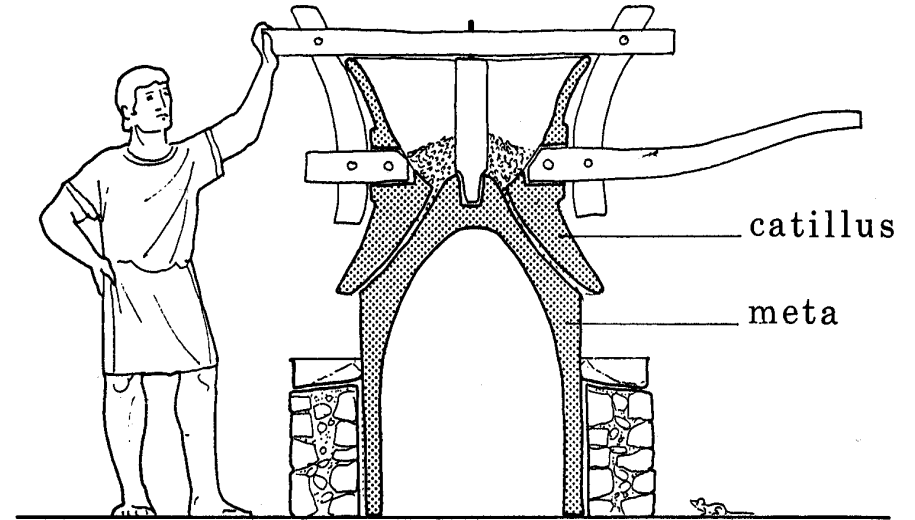
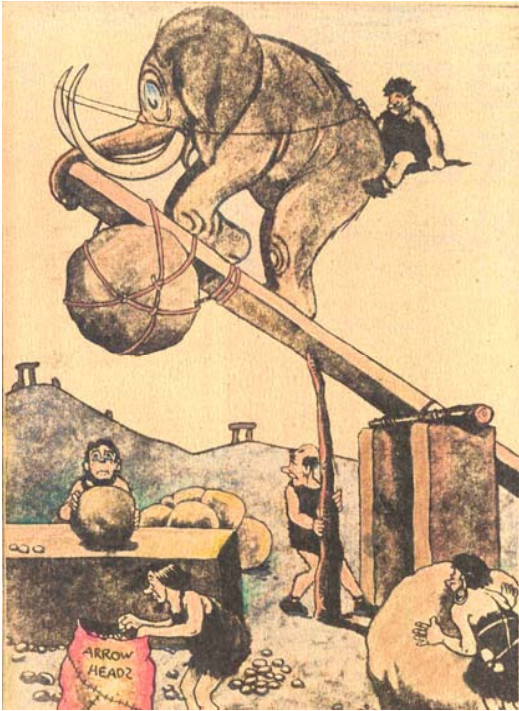


# Why Automation

- Repetitive conditions
- Free up man power
- Increase reaction time
- Control a system remotely
- Increase efficiency of a system
- Maximize efficiency of a piece of equipment
- Increase product quality
- Protect capital investment
- Optimize a particular product
- Monitoring operation
- Data gathering



# From early dawn



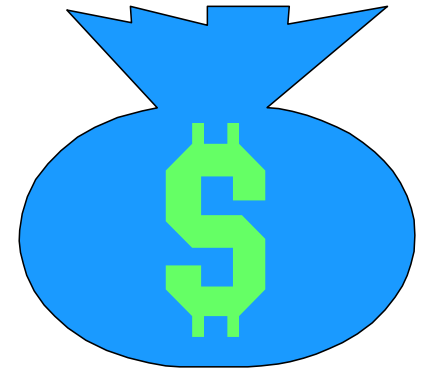
Help.....!





## WHY AUTOMATE YOUR CONE CRUSHER ?

- **Realize a higher return on your investment.**
  - ✓ Higher net production of desired products
  - ✓ Optimum power utilization
  - ✓ Continuous generation of quality products
- **Protection of your investment**
  - ✓ Constant overload protection
  - ✓ Continuous adjustment compensating for changes in material characteristics
  - ✓ Ability to analyze operational data



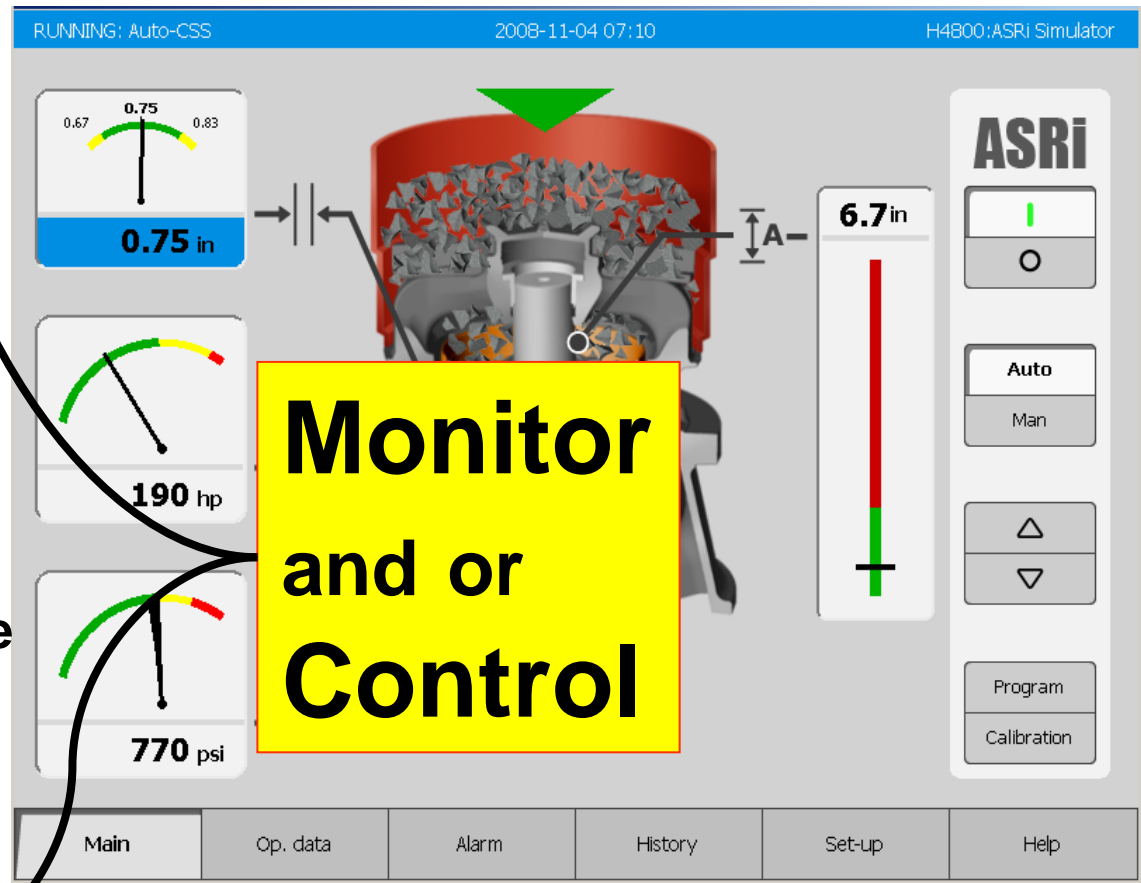
Monitor and Control  
Available at the push of a button



# Monitor and Control

Available at the push of a button

- Closed Side Setting
- Horsepower in use
- Power consumption
- Load Time
- Operating time
- Hydraulic Pressure
- Lubrication Oil temperature
- Liner Wear
- Recorded data
- Graphing data



# Automation

- **Other things to consider**
  - ✓ **Automation mode vs Manual mode**
  - ✓ **Durability of use**
  - ✓ **Is the tool easily used**

**ASRI**

Select program Edit program Calibration

**11.9 mm**

**121 kW**

**4.6 MPa**

**Mantle Position Calibration & Liner Wear**

Description

A-Min	15.0 mm
A-Cal-Calculated	41.3 mm
A-Cal-Latest	41.3 mm
A-Bottom	100.5 mm
Current	65.2 mm

A-Min     A-Cal-Calculated  
 A-Cal-Lates     A-Bottom  
 Current

Auto P1, Auto-CSS Setpoint: 12.0 mm

Normal Set-up Op. data **Wear** History Help

**Op. data**

**Combination**

Power	Pressure	Lub. oil temp.	A-dimension	CSS
98 kW	3.4 MPa	0.0 C	69.7 mm	14.9 mm

Operating time (h)

	Total	Loaded
Since original start-up	15	5
Since latest liner change	8	2
Since latest calibration	8	2
Since resetting	0	0

Energy consumption (MWh)

Since original start-up	0.4
Since resetting	

**Combined Status Listing**

Normal Set-up **Op. data** Alarm History Help

ASRI Reporter

History

Power

12 seconds 10 minutes **Power** 1 hour 12 hours

08:02 08:23 08:44 09:05 09:26

Analog	Value	Unit	State
A1 Average power - setpoint	294.8 h		Off
A2 Average power	190.3 h		Off

**Historical Activity Log**

Normal Set-up Op. data **History** Help

**Op. data**

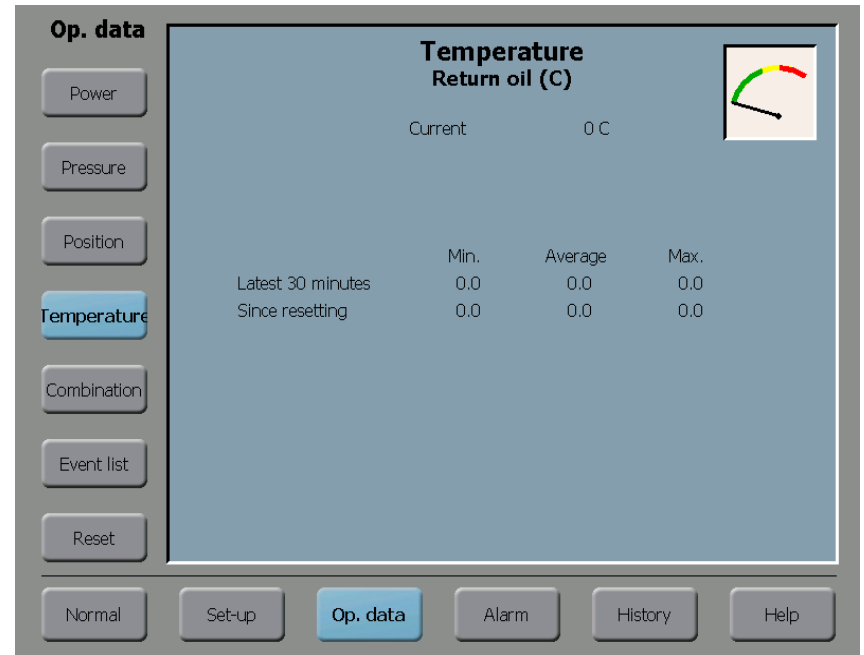
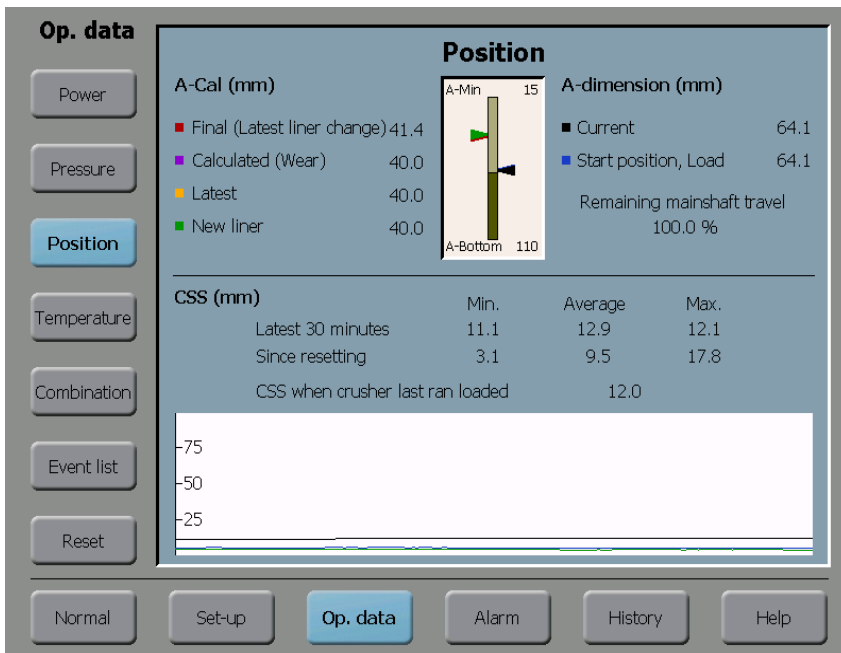
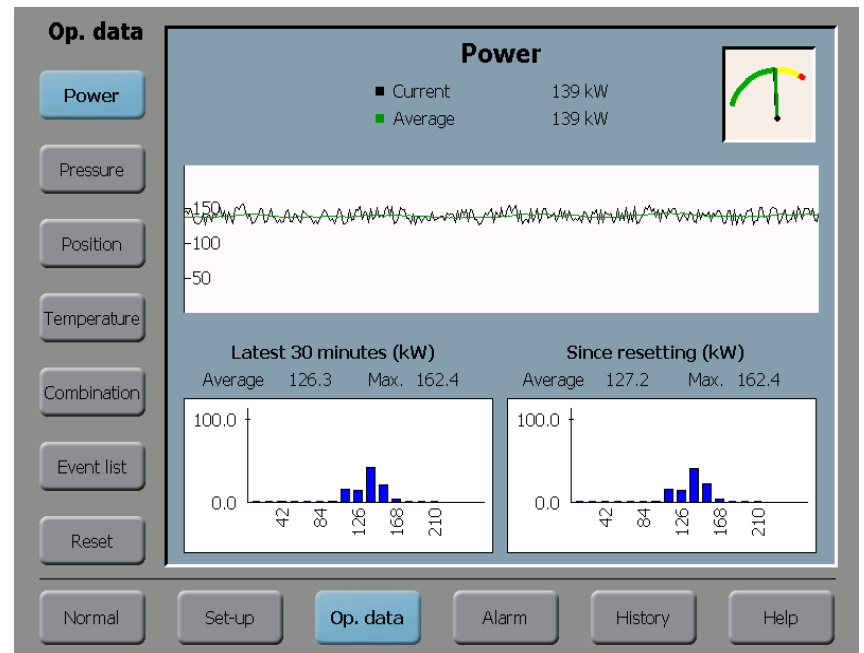
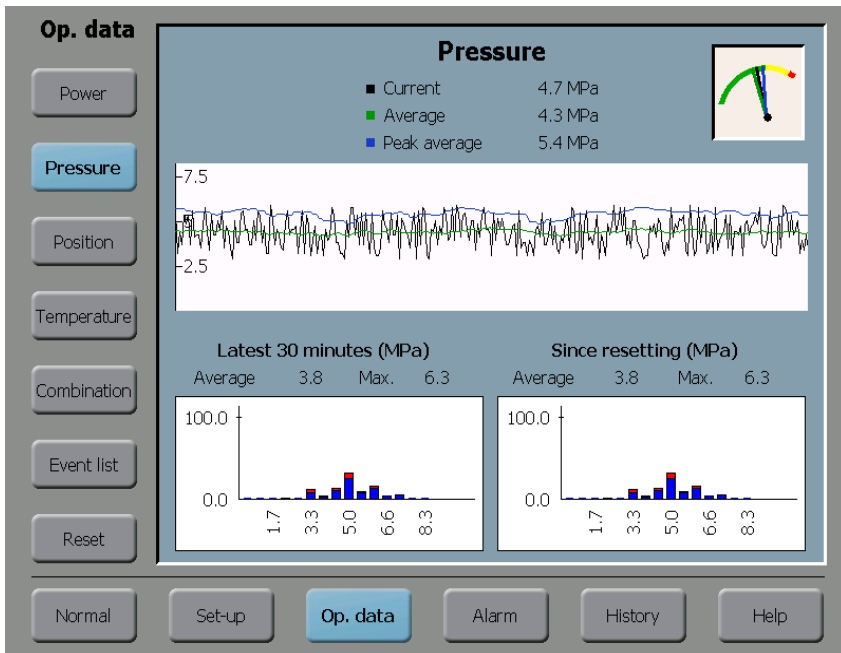
**Temperature Return oil (C)**

Current 0 C

	Min.	Average	Max.
Latest 30 minutes	0.0	0.0	0.0
Since resetting	0.0	0.0	0.0

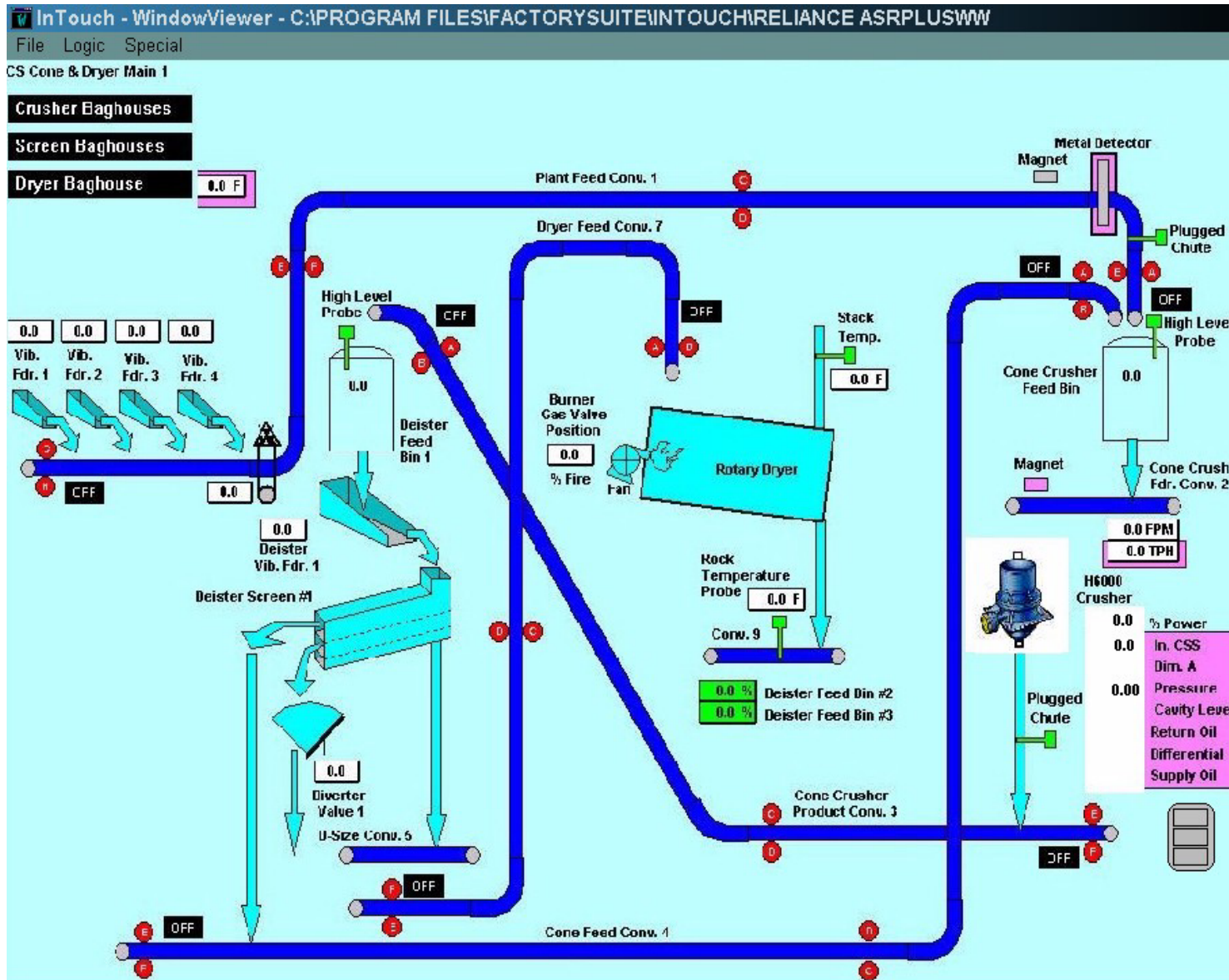
**Lubrication Oil Temperature**

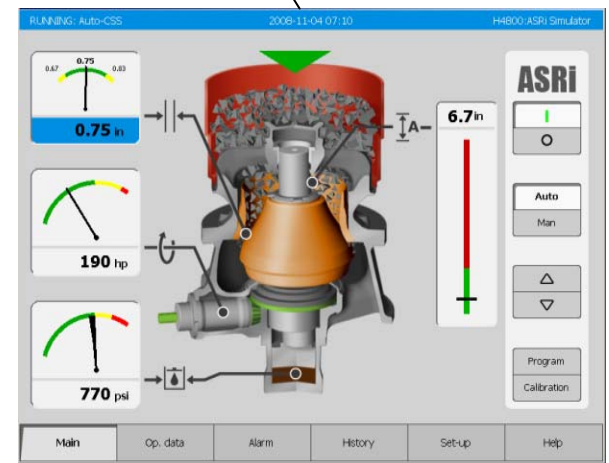
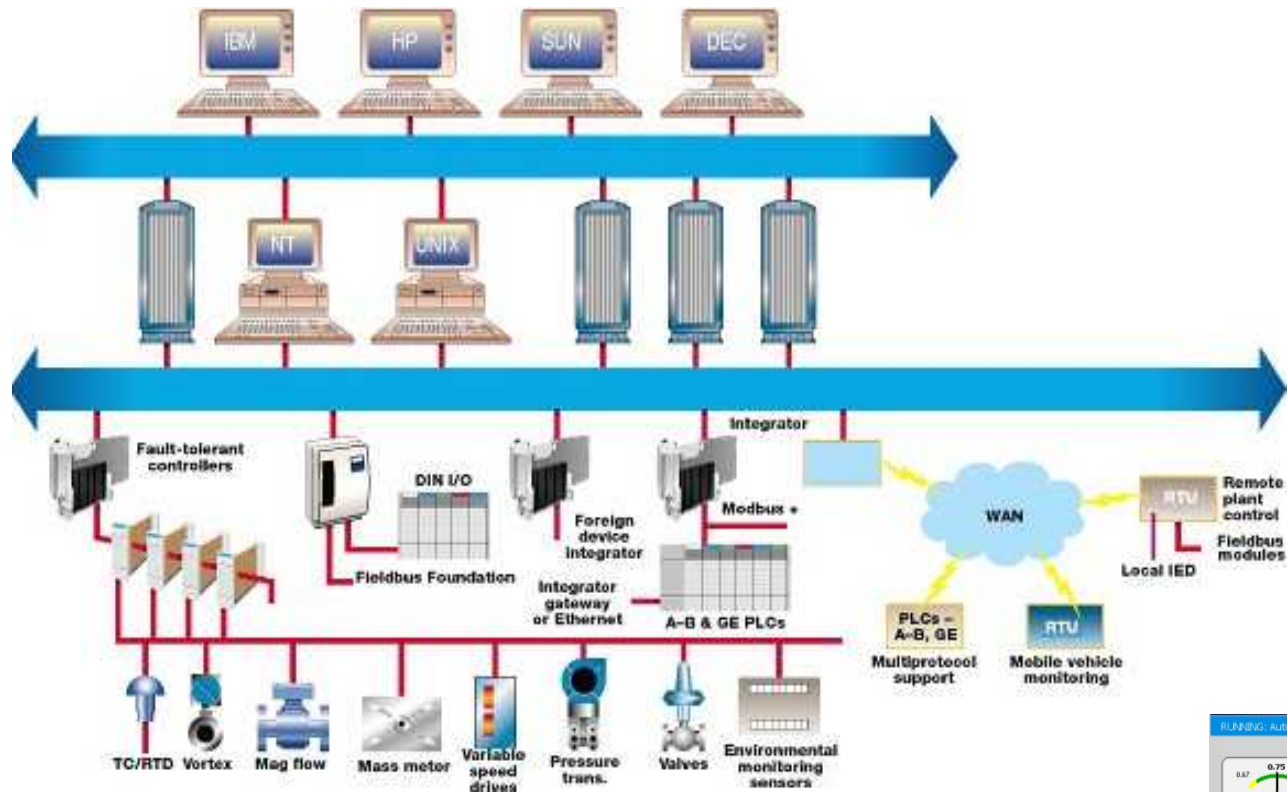
Normal Set-up **Op. data** Alarm History Help



# Historical Activity Logs

Detailed and comprehensive crusher data is easily available with a click of the mouse.

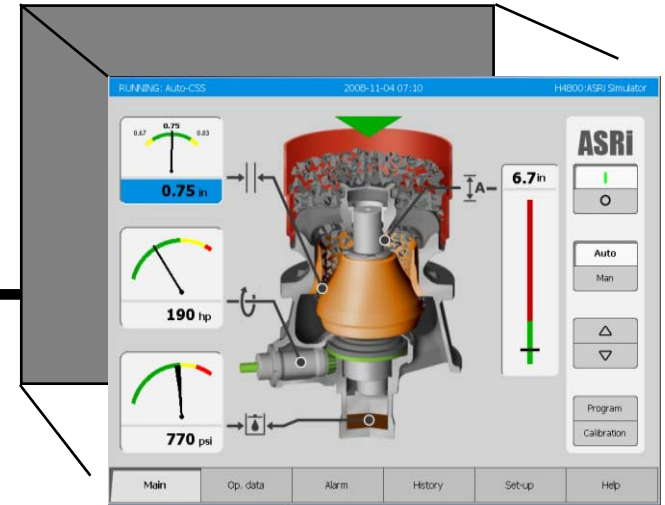
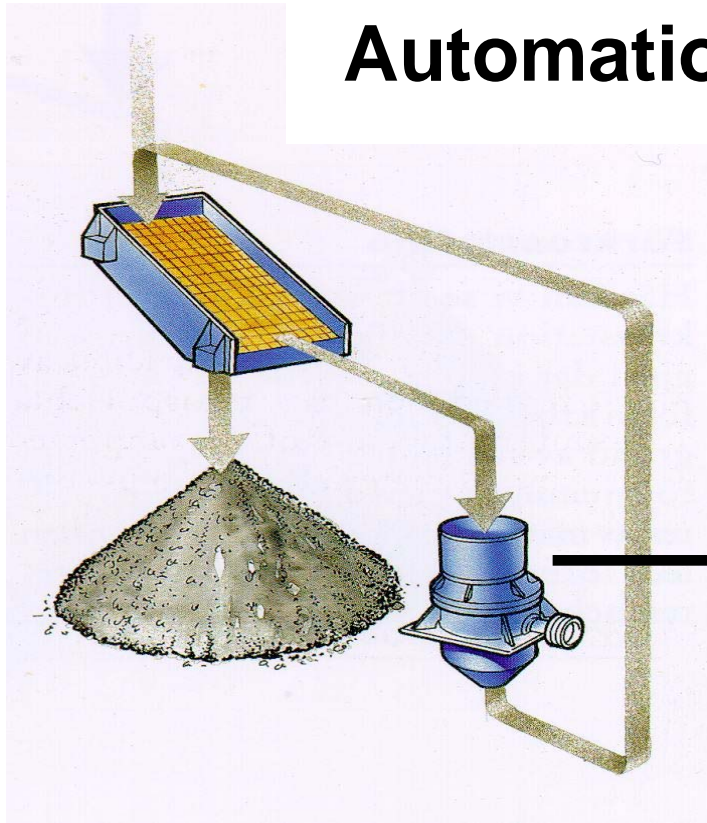




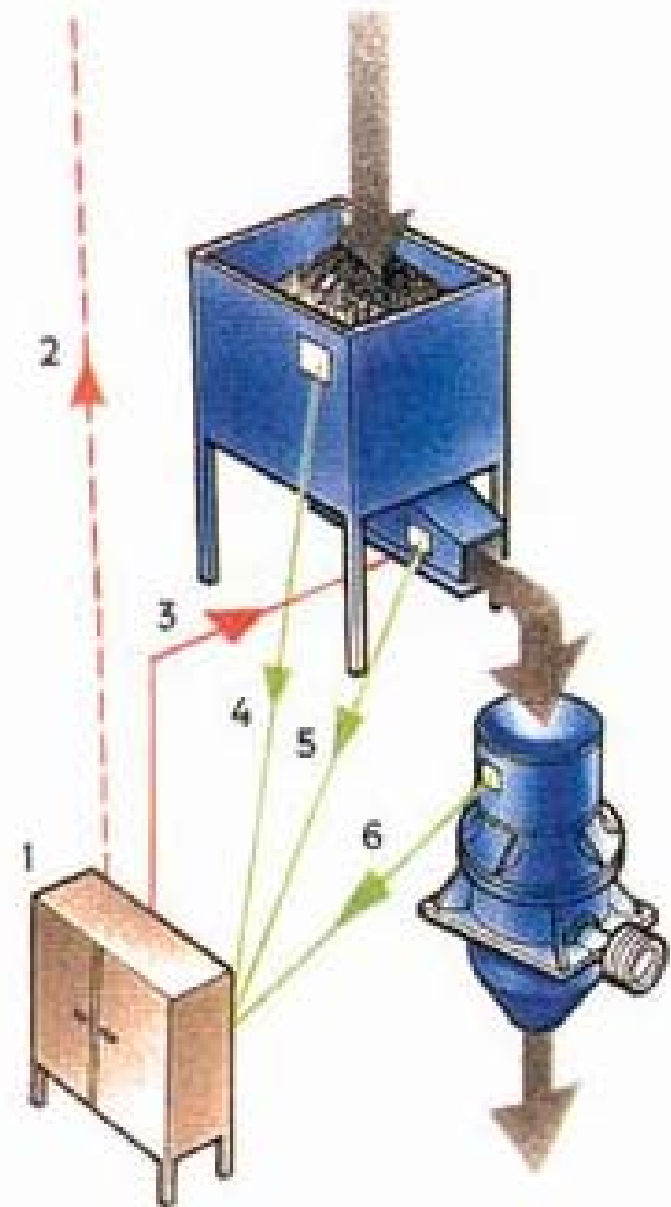
# Crusher Automation and PLC System



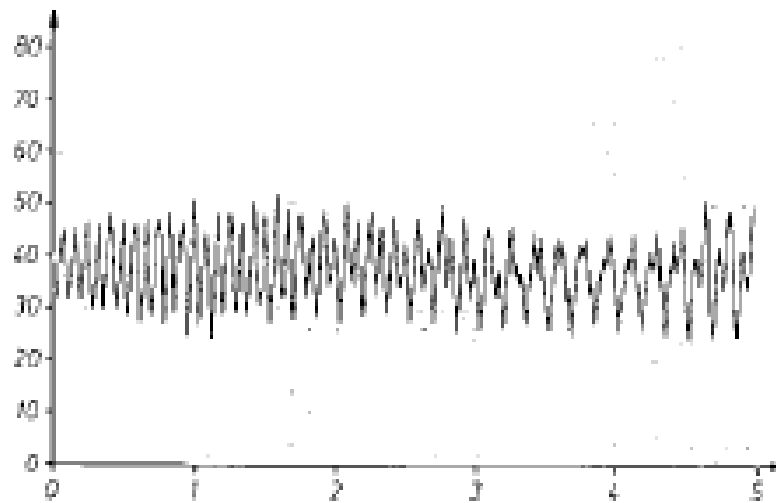
# Continuous Control with Automation



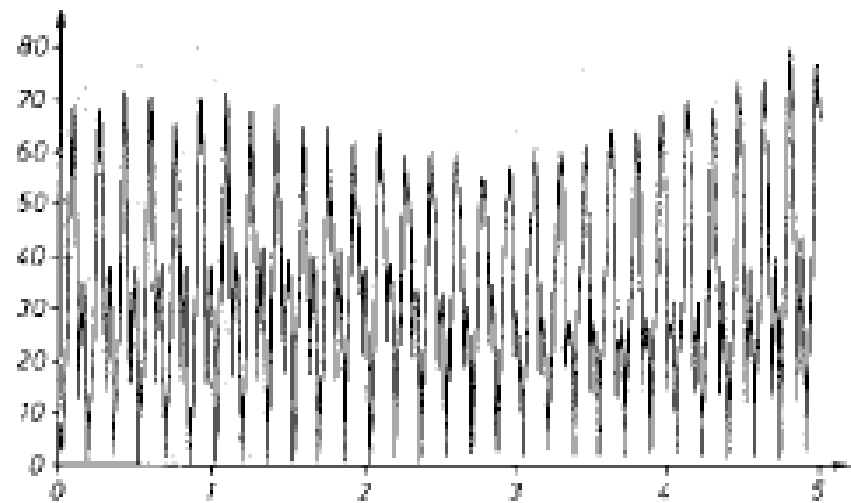
1. Switch gear unit
2. Stop signal to feeder
3. Control signal to feeder
4. Max. level in surge bin
5. Min. level in surge bin
6. Max. level in crusher feed hopper







Crushing force –  
Choke-fed chamber



Crushing force-  
Starve-fed chamber

Hydroset pressure (bar)  
Time (seconde)

# Poor Feed



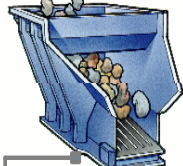
# Better Feed





Quality = \$

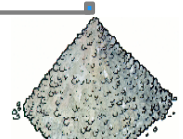
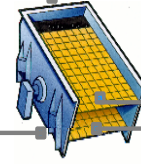
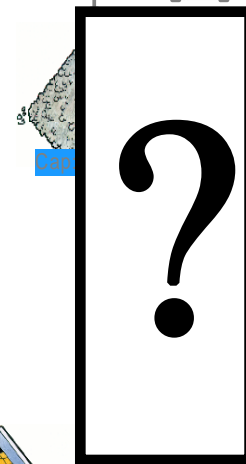




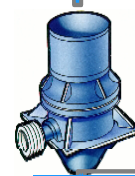
Load: 63%



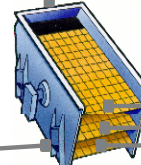
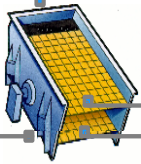
Load: 88%  
Cap: 171 STPH



Cap: 10 STPH



Load: 98%  
Cap: 138 STPH



RUNNING: Auto-CSS 2008-11-04 07:10 H4500-ASRI Simulator

**ASRI**

0.75 in

190 rpm

770 psi

6.7 in

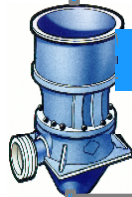
Auto

Man

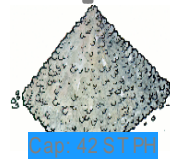
Program

Calibration

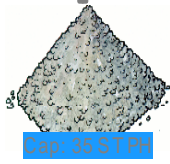
Main Op. data Alarm History Setup Help



Load: 70%  
Cap: 202 STPH



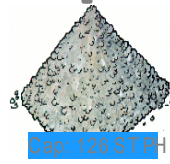
Cap: 42 STPH



Cap: 35 STPH



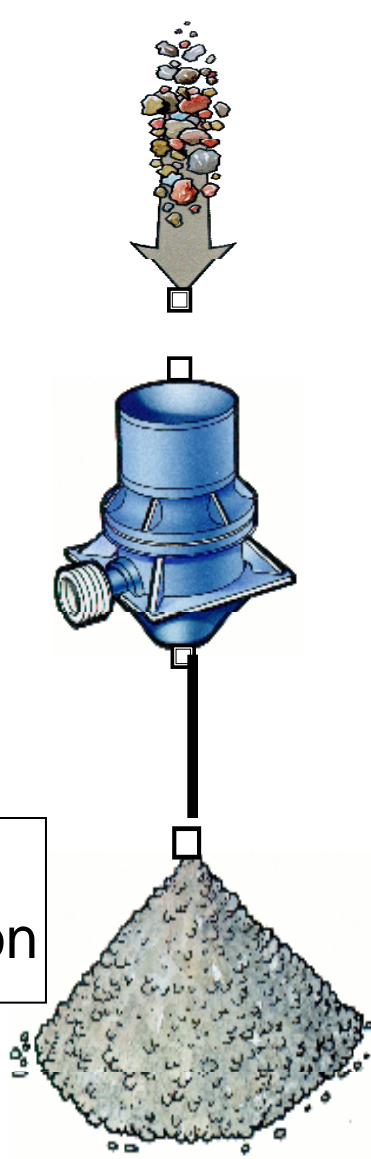
Cap: 6 STPH



Cap: 28 STPH

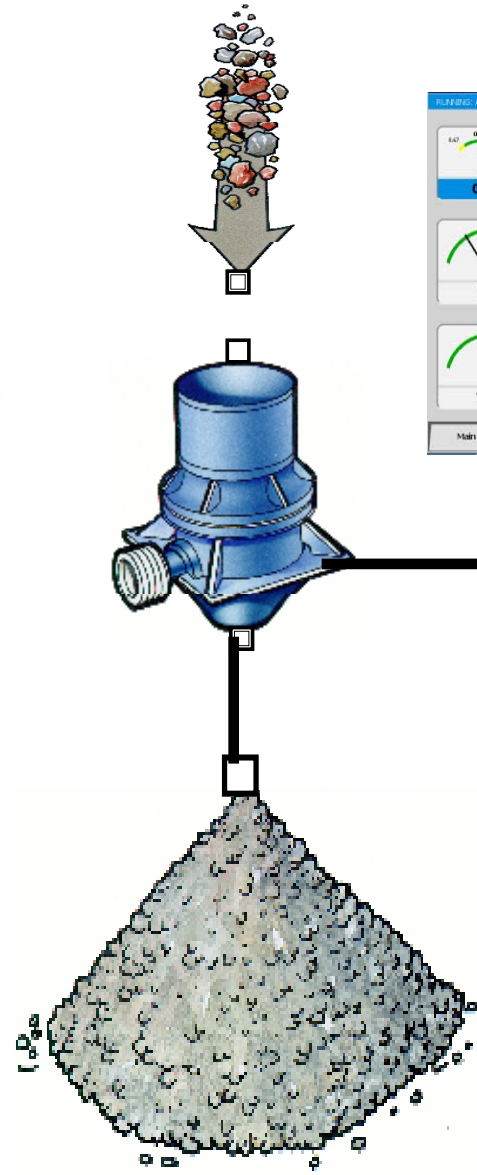


# Automation can work for you

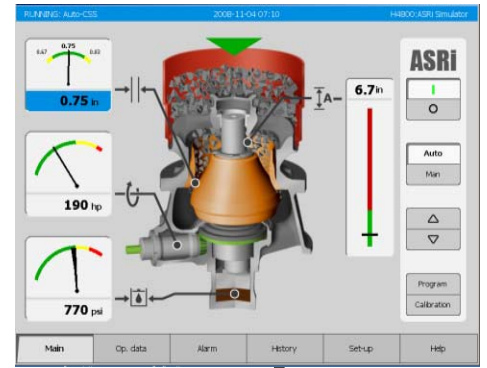


Without Automation

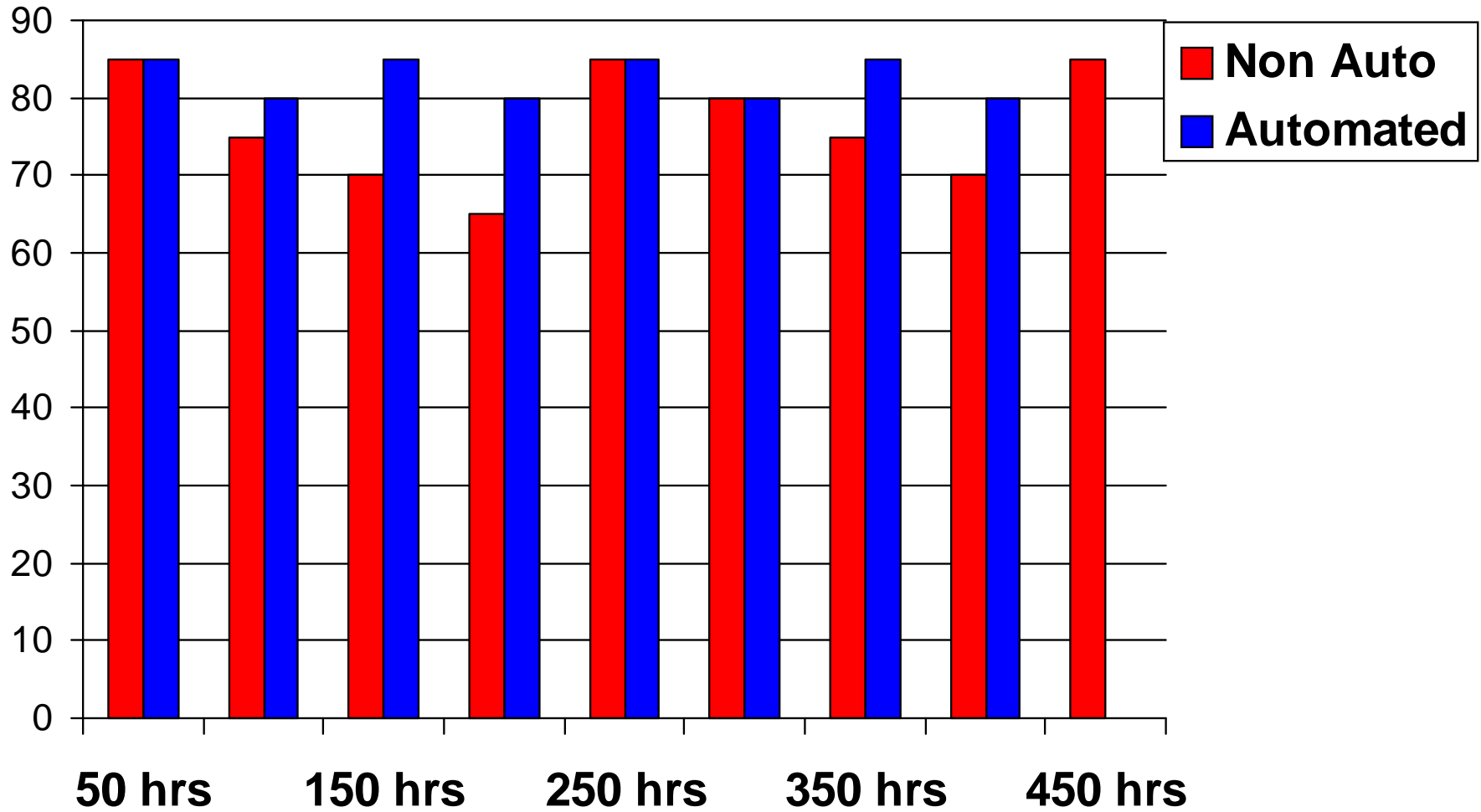
Case study



With Automation



# Crusher Discharge % available minus 1/2 "

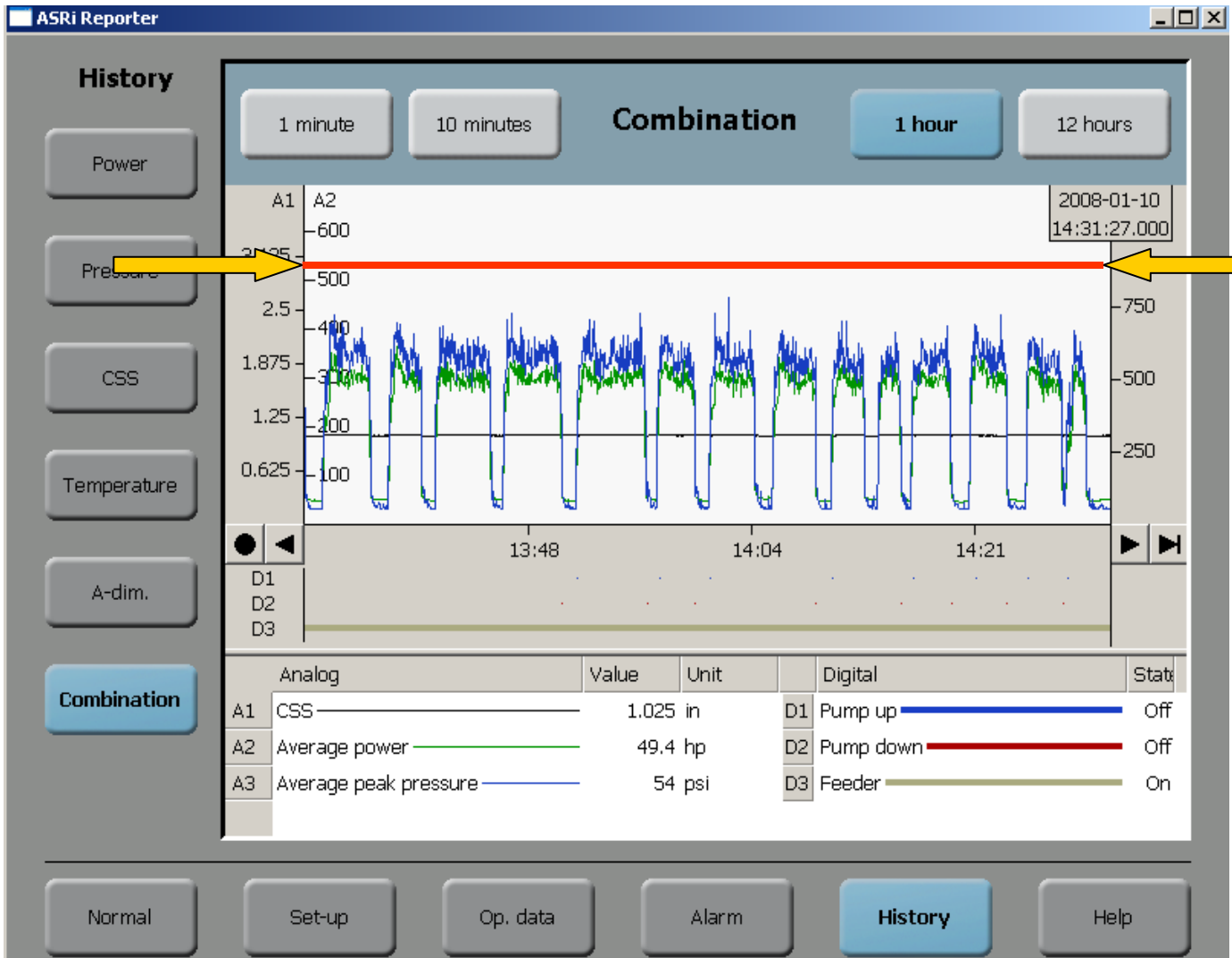


# The advantages

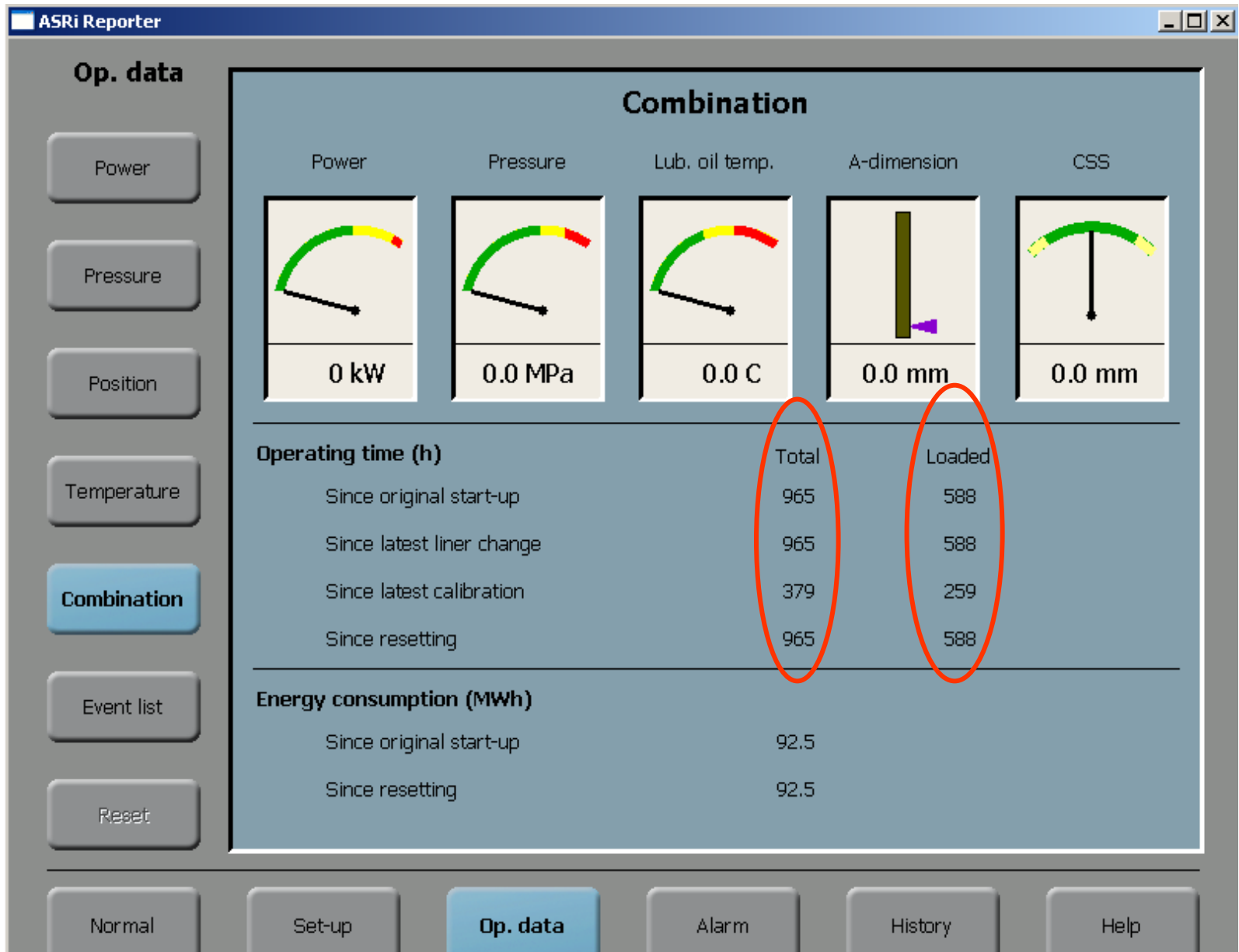


- **Can operate choke-fed and utilize the maximum motor power.**
- **The reduction increases.**
- **The product shape gets better**
- **The liner life increase**
- **Mechanical life of components & machine increase**
- **Overloading protections**
- **An automated crusher looks after it self**

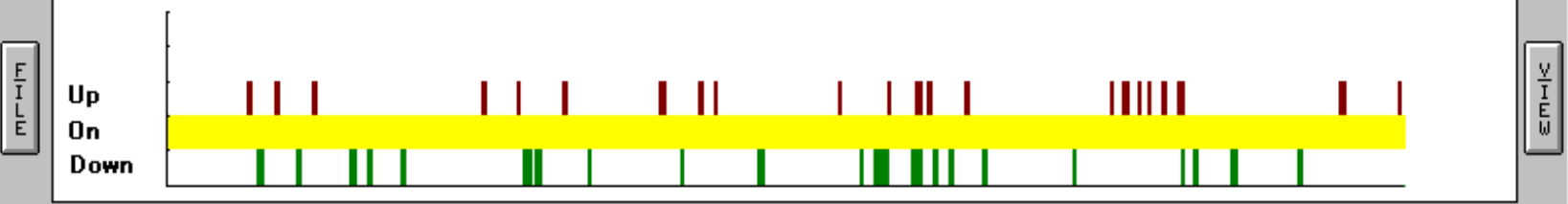
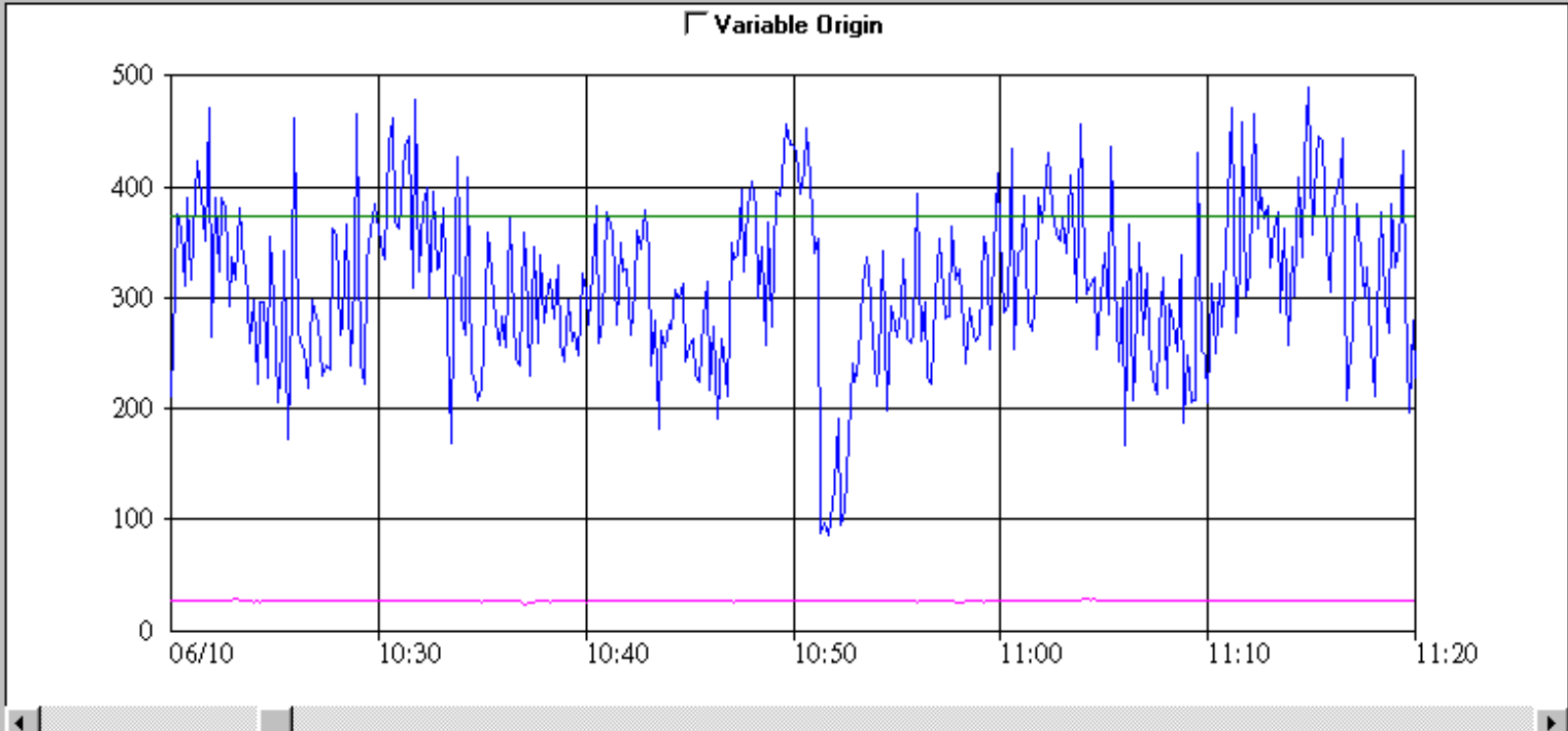
Automation crusher produces 10 tons more of desired product and 33 tons less over size



One Hour time span



Loaded 66% of each hour



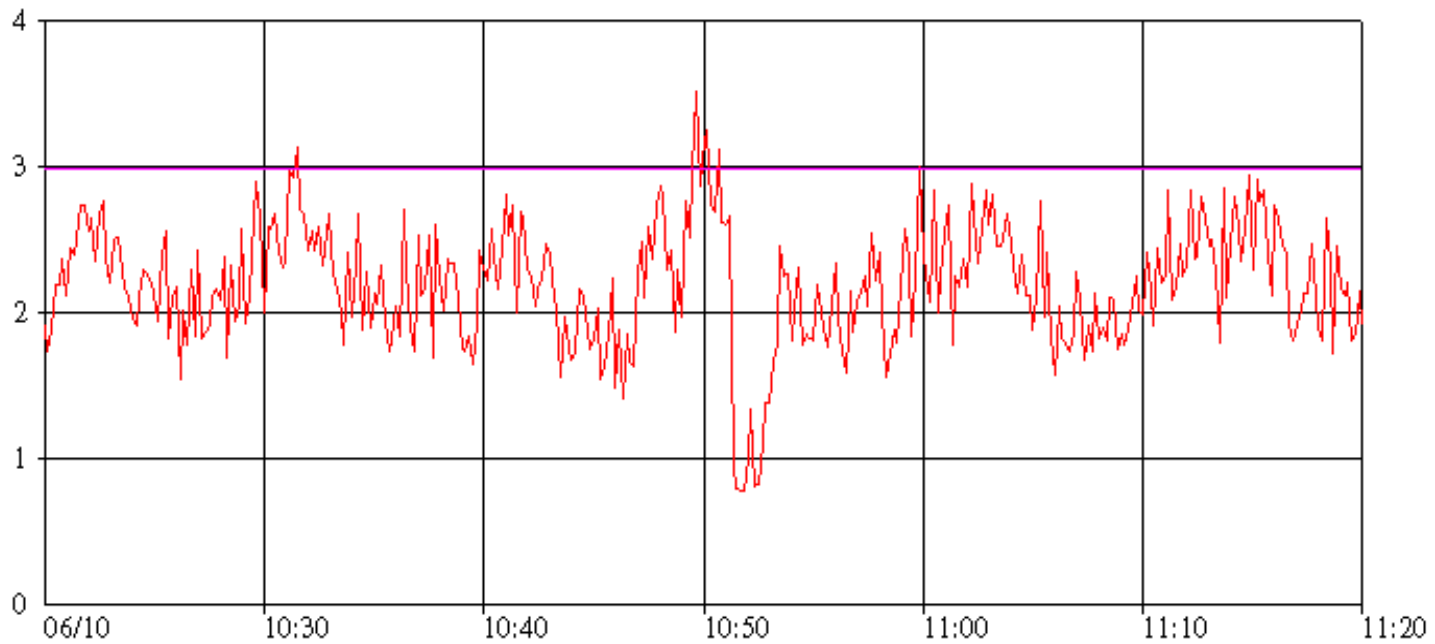
- |  |                                 |  |   |   |  |
|--|---------------------------------|--|---|---|--|
| <input type="radio"/> 7 Days               | <input type="radio"/> Mode      | <input type="radio"/> Status lamps                 | <input checked="" type="checkbox"/> Power     | <input type="checkbox"/> A-dim.         | <input type="checkbox"/> Desired CSS   |
| <input type="radio"/> 24 Hours             | <input type="radio"/> Principle | <input checked="" type="checkbox"/> Feed/Mainshaft | <input checked="" type="checkbox"/> Max power | <input type="checkbox"/> A-dim. at cal. | <input type="checkbox"/> Min CSS       |
| <input checked="" type="radio"/> 1 Hour    | <input type="radio"/> Programme |  | <input type="checkbox"/> Pressure             | <input type="checkbox"/> Min A-dim.     | <input type="checkbox"/> Lub. oil temp |
| <input type="radio"/> 10 Minutes           |                                 |  | <input type="checkbox"/> Max pressure         | <input checked="" type="checkbox"/> CSS |  |
| <input checked="" type="radio"/> 5 Minutes |                                 |  |   |   |  |



Win Plus - H1000

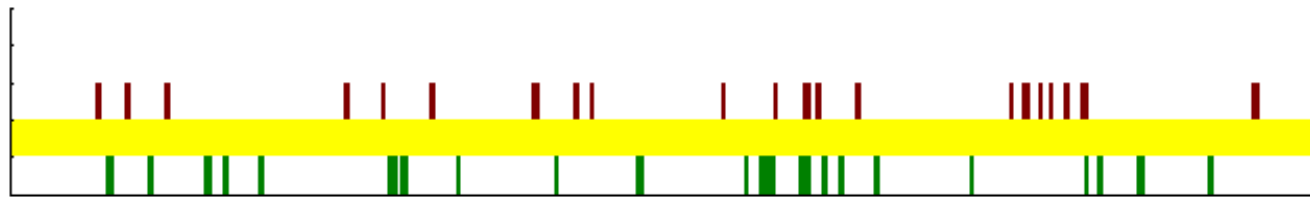


Variable Origin



FILE

Up  
On  
Down



VIEWS

- |   |                                 |   |  |   |  |
|---|---------------------------------|---|--|---|--|
| <input type="radio"/> 7 Days            | <input type="radio"/> Mode      | <input type="radio"/> Status lamps              | <input type="checkbox"/> Power                   | <input type="checkbox"/> A-dim.         | <input type="checkbox"/> Desired CSS   |
| <input type="radio"/> 24 Hours          | <input type="radio"/> Principle | <input checked="" type="radio"/> Feed/Mainshaft | <input type="checkbox"/> Max power               | <input type="checkbox"/> A-dim. at cal. | <input type="checkbox"/> Min CSS       |
| <input checked="" type="radio"/> 1 Hour | <input type="radio"/> Programme |   | <input checked="" type="checkbox"/> Pressure     | <input type="checkbox"/> Min A-dim.     | <input type="checkbox"/> Lub. oil temp |
| <input type="radio"/> 10 Minutes        |                                 |   | <input checked="" type="checkbox"/> Max pressure | <input type="checkbox"/> CSS            |  |
| <input type="radio"/> 5 Minutes         |                                 |   |  |   |  |

# Summary

- **In summary automation of a compression crusher will provide:**
- **Higher net production of desired products**
- **Optimum utilization of motor power**
- **Continuous adjustment of setting to compensate for feed conditions.**
- **Full utilization of the units capacity**
- **Constant overload protection**
- **The ability to analyze operating data**
- **The opportunity to monitor the unit from remote location.**



## FUTURE DEVELOPMENTS

The new handheld, high performance computers will give remote access and allow distant control through mobile phones and Internet. It may be possible to for example to control an automated mobile cone crusher from an office, using a hand held computer, on the other side of the globe. (Bill Malone)



# Future of Automation

There are many on-line size sampling systems available today.

Whether by mechanical means, or by photo thechnology.

With this ability to sample it is possible to use a control loop in conjunction with and automated crusher station to complete the system and become closer to full automation.

Service in a box.....?

Automatic wear indication.....?

Automatic Parts Re-Order.....?

# Thanks



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**QUARRY  
ACADEMY**

**LIGHTEN UP!**