



PI System in Cobre las Cruces

(a story of increasing usage
across the company)

Presented by **Joaquín Gotor**





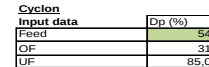
PI SYSTEM AT COBRE LAS CRUCES

Cobre las Cruces: an introduction to the company

- Copper mine in SW Spain, near Seville (Andalucia)
- 1,3 Mt ore/y treated in the plant to produce 72.000 t/y of copper cathodes
- Ore treatment plant stages:
 - ✓ Crushing-Grinding
 - ✓ Leaching in stirred reactors at 90°C
 - ✓ Solution purification in SX
 - ✓ Pure copper as cathodes in EW



- Plant start-up in June 2009. No PI System installed
- Plant trends available in DCS. Trends plots not easy to track and slow
- Data tables from DCS not available. Not the proper tool for process analysis
- Plant performance checked daily by noting down data manually from DCS trends. Plant balances done in excel files by manual data introduction



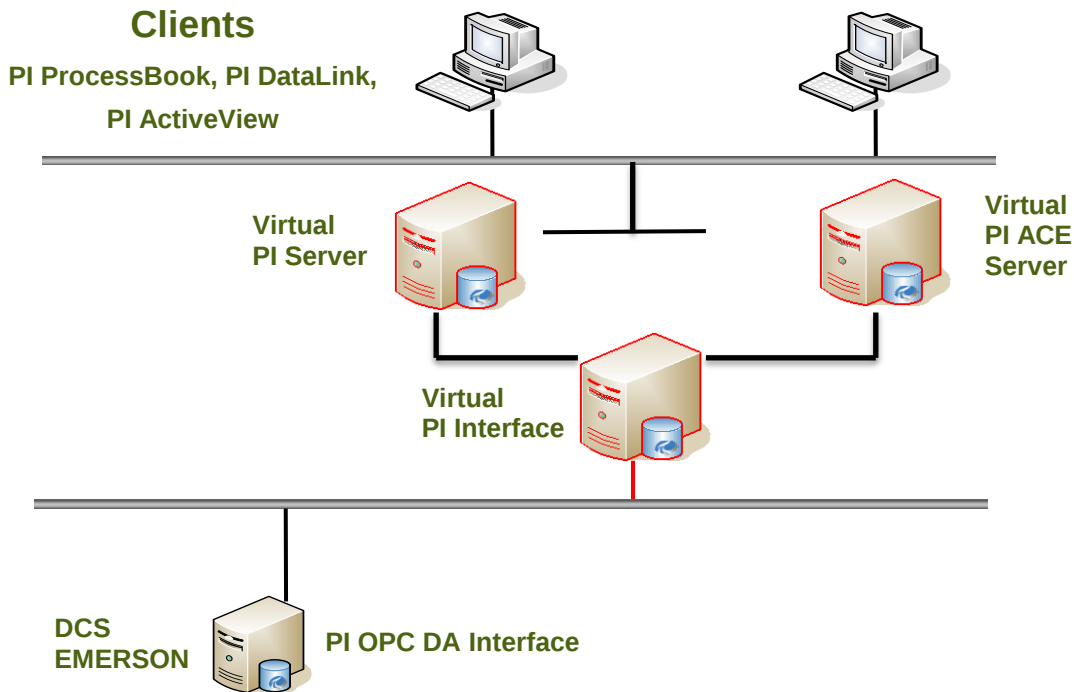
Cyclon calc	solids		pulp
Circulating load	198%	243 ton	
UF	243 t/h	55 m3/h	98 m3/h
OF	122 t/h	28 m3/h	300 m3/h

DATA SUMMARY:



PI SYSTEM AT COBRE LAS CRUCES

PI System at CLC. Used applications: PI ProcessBook, PI DataLink, PI ActiveView, PI ACE



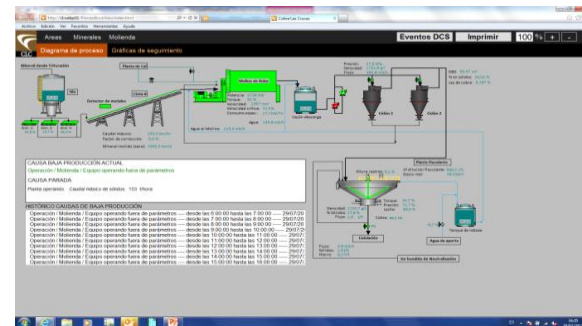
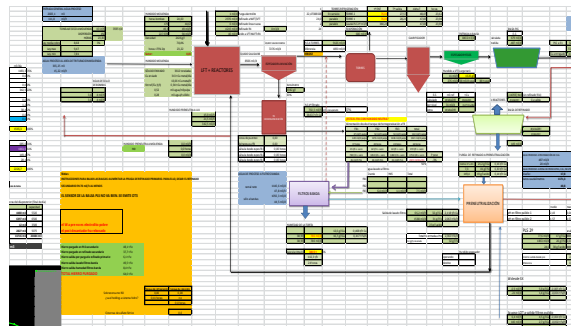


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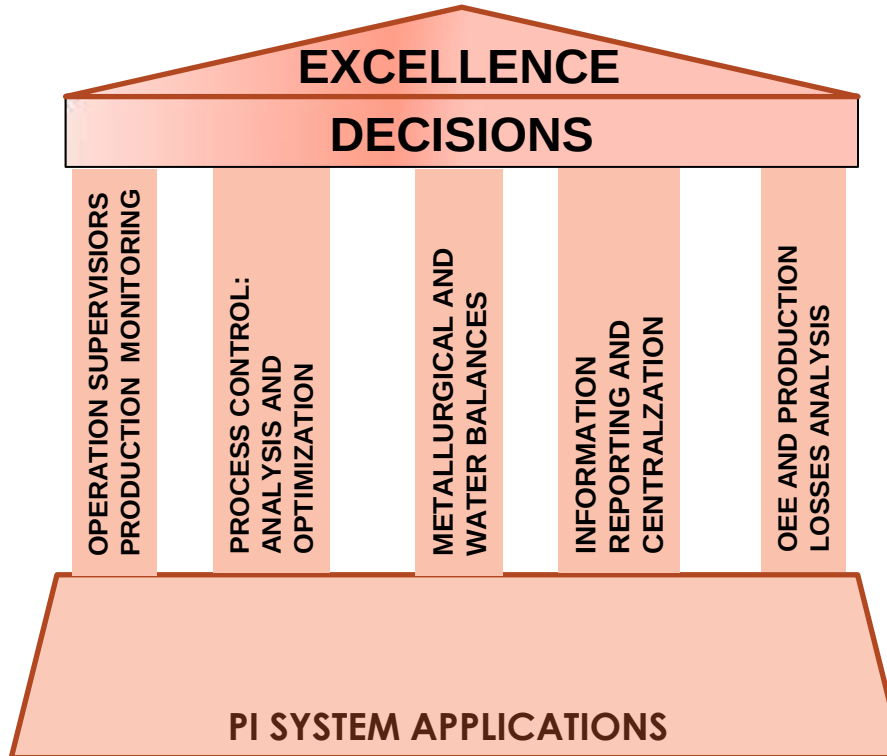
PI System at CLC. The highlights:

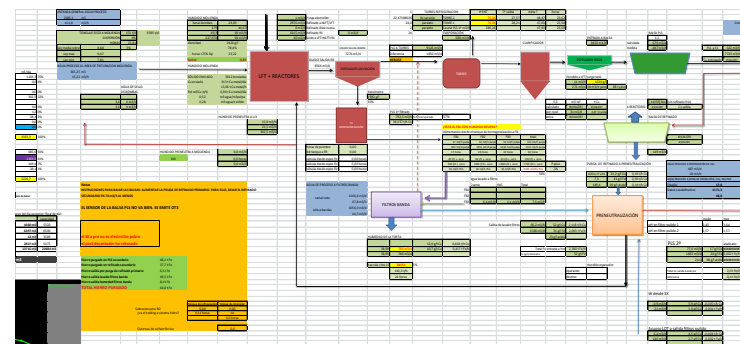
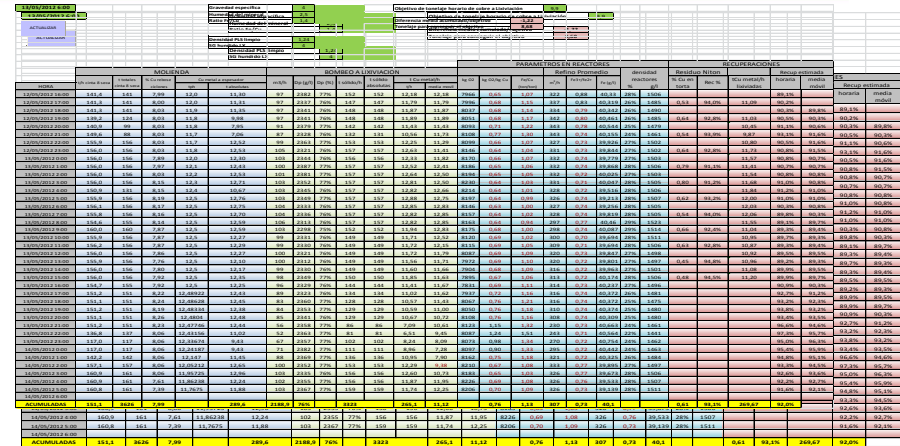
What did PI System allow?:

- Develop tools for plant operation and performance monitoring: PI ProcessBook, PI ActiveView and PI DataLink
- Plant metallurgical complete balances: global and specific areas, based on PI DataLink
- OEE calculation and failure trees analysis: PI DataLink
- Plant water balance: PI DataLink and PI ActiveView
- Information reports: internal and external. Based on PI ActiveView and asp
- KPI and indicators tables for all the staff range: PI ActiveView
- And last, but not least, allows information centralization



PI SYSTEM AT COBRE LAS CRUCES

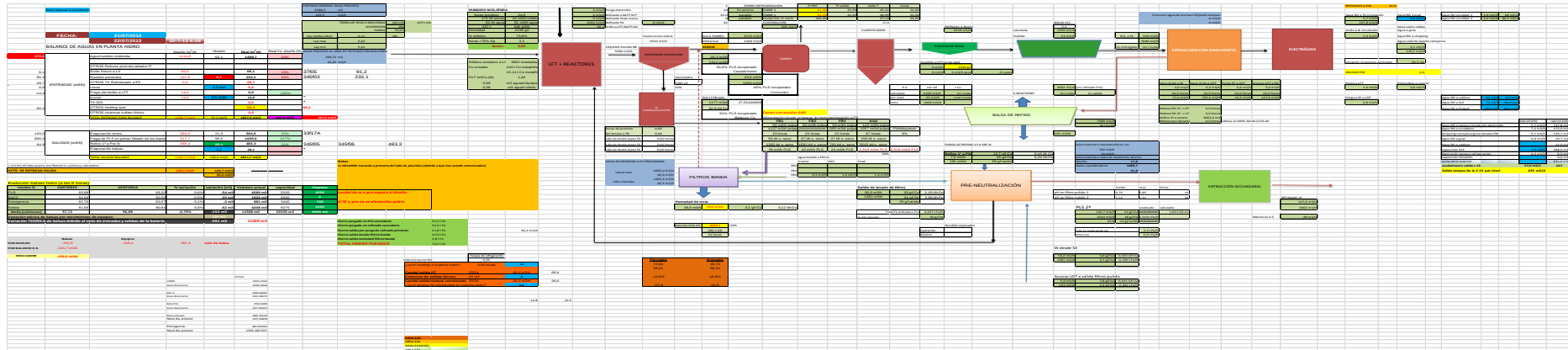




PI SYSTEM AT COBRE LAS CRUCES

Added Value: operation supporting data. Problems management

- Support during the start-up. Data analysis leading to focus on actual problems
- Balance sheets to analyze critical plant areas: eg water balance management:
 - ✓ **1 m3** of water to plant over design means loosing **160.000 €**
 - ✓ Water balance analysis leads to corrective actions to optimize production
 - ✓ Water balance modelization for deeper analysis in Process Control





PI SYSTEM AT COBRE LAS CRUCES

Added Value: operation followed on hourly base oriented to production goals

- Process performance tracking on real time: Copper recovery calculation on hourly base
- At standard throughput, 220 tpd Cu are fed to process, of which 200 are recovered
- Any process disturbance causing two points in recovery drop means 4 tpd Cu losses
- This means loosing **32,000 USD**
- Plant supervisor has the tools to undertake corrective actions on time
- Not only applied to standard operation. The impact on recovery caused by any plant modification is followed through this files

											PARAMETROS EN REACTORES										
	MOLIENDA														Refino Promedio				RECUPERACIONES		
HORA	t/h cinta 8 seca	t totales cinta 8 seca	t/h frescas totales	% Cu rebose ciclones	Cu metal a espesador		m3/h	Dp (g/l)	t sólido/h	t Cu metal/h	kg O2	kg O2/kg Cu GLOBAL	Fe/Cu (ton/ton)	Fe ³⁺ /Cu (t/t)	m³/h	Ferroso	Fe3+/Fe2+	Fe (g/l)	% Cu en torta	Rec %	tCu metal/h lixiviadas
	tph	t absolutas	t/h																		
28/07/2013 16:00	148	141	148	5,89	8,7	8,3	96	2173	150	8,8	7924	0,90	1,71	1,16	332	14,5	2,13	45			
28/07/2013 17:00	151	151	151	5,97	9,0	9,0	96	2173	150	9,0	7943	0,88	1,66	1,13	329	14,5	2,13	45,4			
28/07/2013 18:00	151	151	151	6,32	9,6	9,6	92	2226	150	9,5	7951	0,84	1,60	1,08	334	14,5	2,12	45,4			
28/07/2013 19:00	152	152	152	6,33	9,6	9,6	96	2167	150	9,5	7987	0,84	1,66	1,13	347	14,6	2,12	45,4			
28/07/2013 20:00	151	151	151	6,25	9,5	9,5	96	2176	150	9,4	7991	0,85	1,57	1,07	325	14,6	2,11	45,4			
28/07/2013 21:00	151	151	151	6,20	9,4	9,4	98	2155	150	9,3	8044	0,86	1,59	1,08	325	14,6	2,10	45,4	0,45	93,5%	8,71
28/07/2013 22:00	152	152	152	6,13	9,3	9,3	98	2145	150	9,2	8081	0,88	1,62	1,10	328	14,7	2,09	45,4			
28/07/2013 23:00	151	151	151	5,97	9,0	9,0	96	2171	150	8,9	8093	0,90	1,65	1,11	325	14,7	2,08	45,4	0,51	92,3%	8,26
29/07/2013 0:00	151	151	151	5,93	9,0	9,0	99	2133	150	8,9	8104	0,91	1,63	1,10	320	14,8	2,08	45,4			
29/07/2013 1:00	151	151	151	5,91	9,0	9,0	98	2149	150	8,9	8088	0,91	1,63	1,10	320	14,8	2,06	45,3	0,55	91,6%	8,15



PI SYSTEM AT COBRE LAS CRUCES

Added Value: plant OEE and production losses Pareto analysis. Tracking production plans

TONNES MILLED

PI SYSTEM

FAILURE TREE REPORT

OEE

CUMULATIVE
PARETO CHARTS

ANALYSIS OF
LOW
PRODUCTION
CAUSES

INFORMATION

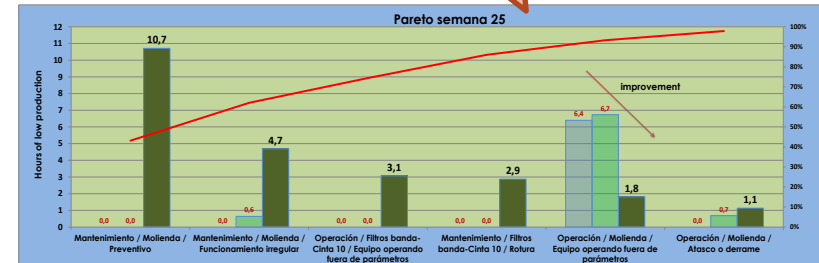
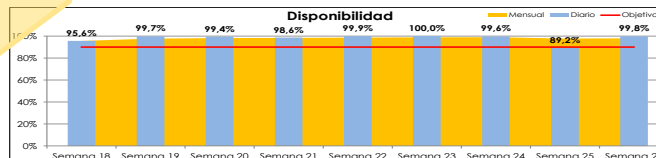
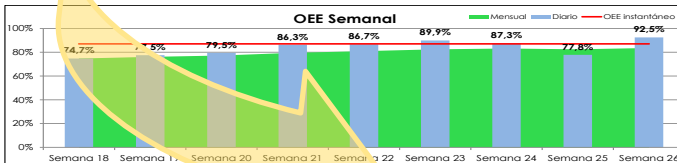
AVAILABILITY

UTILIZATION

cause: maintenance

cause: operation

CORRECTIVE
ACTIONS





PI SYSTEM AT COBRE LAS CRUCES

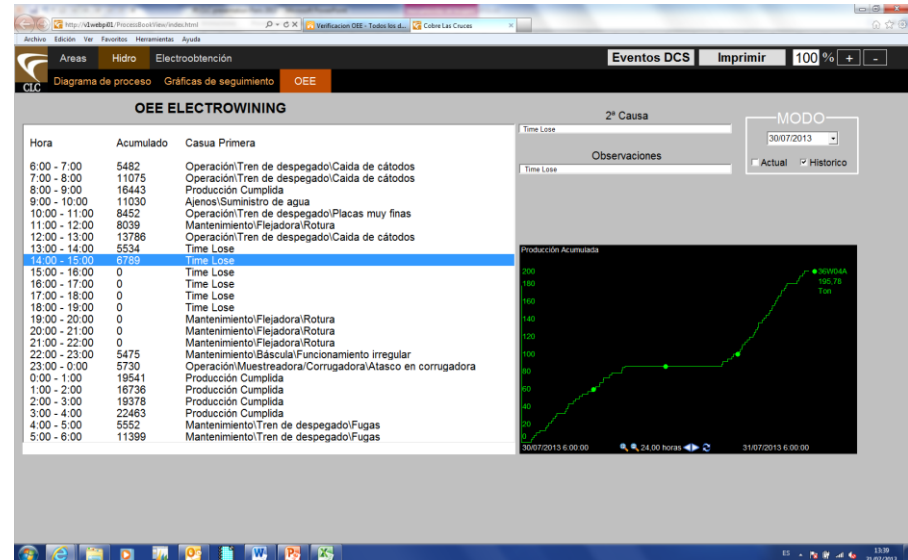
Added Value: OEE and production losses is specific areas: cathodes harvesting

- Was production fitted as to planned? If not, why?....Maintenance or operational problems? What specific problems?
- What actions to be undertaken? What was the impact in month production plan? What to be done to catch-up?

Día actual	30/07/2013	Actualizar Hoja		
	1ª Causa	2ª Causa	Observaciones	OT
30/07/2013 6:00	Operación/Tren de despegado/Caída de cátodos	Operación/Flejadora/Cambio de fleje	VACIADO DE LLENADO DE LOS TANQUES DE LAVADO	
30/07/2013 7:00	Operación/Tren de despegado/Caída de cátodos	No Procede	No Procede	
30/07/2013 8:00	Producción Cumplida	Producción Cumplida	Producción Cumplida	
30/07/2013 9:00	Ajenos/Suministro de agua	No Procede	PREPARACIÓN DE HIDROLAVADORA PARA LAVADO DE CÁTODOS	
30/07/2013 10:00	Operación/Tren de despegado/Placas muy finas	Operación/Flejadora/Cambio de fleje	No Procede	
30/07/2013 11:00	Mantenimiento/Flejadora/Rotura	No Procede	No Procede	
30/07/2013 12:00	Operación/Tren de despegado/Caída de cátodos	Operación/Flejadora/Cambio de fleje	No Procede	1034442
30/07/2013 13:00	Time Lose	Time Lose	Time Lose	
30/07/2013 14:00	Time Lose	Time Lose	Time Lose	
30/07/2013 15:00	Time Lose	Time Lose	Time Lose	
30/07/2013 16:00	Time Lose	Time Lose	Time Lose	
30/07/2013 17:00	Time Lose	Time Lose	Time Lose	
30/07/2013 18:00	Time Lose	Time Lose	Time Lose	
30/07/2013 19:00	Mantenimiento/Flejadora/Rotura	No Procede	No Procede	1034442
30/07/2013 20:00	Mantenimiento/Flejadora/Rotura	No Procede	No Procede	1034442
30/07/2013 21:00	Mantenimiento/Flejadora/Rotura	No Procede	No Procede	1034442
30/07/2013 22:00	Mantenimiento/Báscula/Funcionamiento irregular	No Procede	No Procede	1034517
30/07/2013 23:00	Operación/Muestreadora/Corrugadora/Atasco en corr.	No Procede	No Procede	
31/07/2013 0:00	Producción Cumplida	Producción Cumplida	Producción Cumplida	
31/07/2013 1:00	Producción Cumplida	Producción Cumplida	Producción Cumplida	
31/07/2013 2:00	Producción Cumplida	Producción Cumplida	Producción Cumplida	
31/07/2013 3:00	Producción Cumplida	Producción Cumplida	Producción Cumplida	
31/07/2013 4:00	Mantenimiento/Tren de despegado/Fugas	No Procede	No Procede	1034520
31/07/2013 5:00	Mantenimiento/Tren de despegado/Fugas	No Procede	No Procede	
31/07/2013 6:00				
Toneladas diarias cosechadas	195,777 t/d			
Tiempo de funcionamiento	24,0			
Tiempo de periodo sin cosecha	0,0			
Tiempo disponible para cosecha	19,1			
Tiempo utilizado	11,9			
Ritmo en base día	8,2 t/h			
Ritmo en base disponibilidad	10,2 t/h			
Ritmo en base utilización	16,4 t/h			
Referencia	15,7 t/h			

Disponibilidad	79,7%
Utilización	62,4%
OEE	49,7%

Horas perdidas	6,9
Horas perdidas de mantenimiento	4,9
Horas perdidas de operación	7,2
Horas sin asignación	5,2

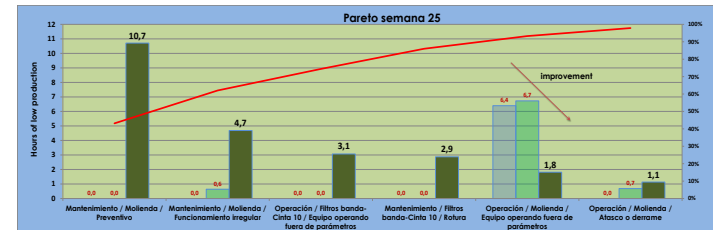
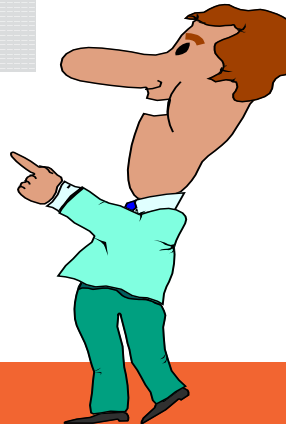
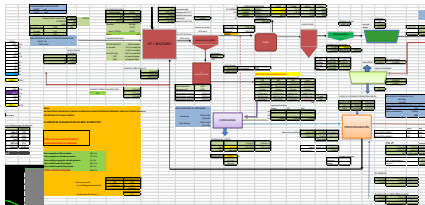
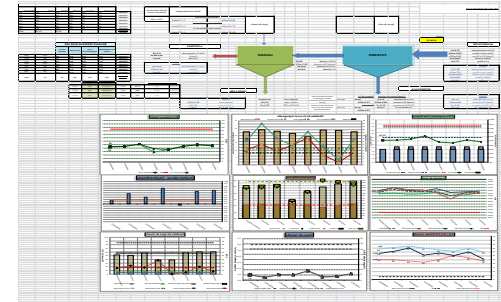
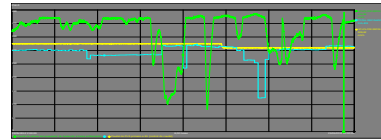
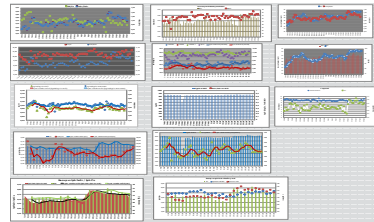
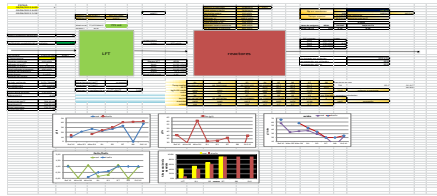




PI SYSTEM AT COBRE LAS CRUCES

Added Value: Huge amount of data. Analysis tools development. PI ACE as support for calculation

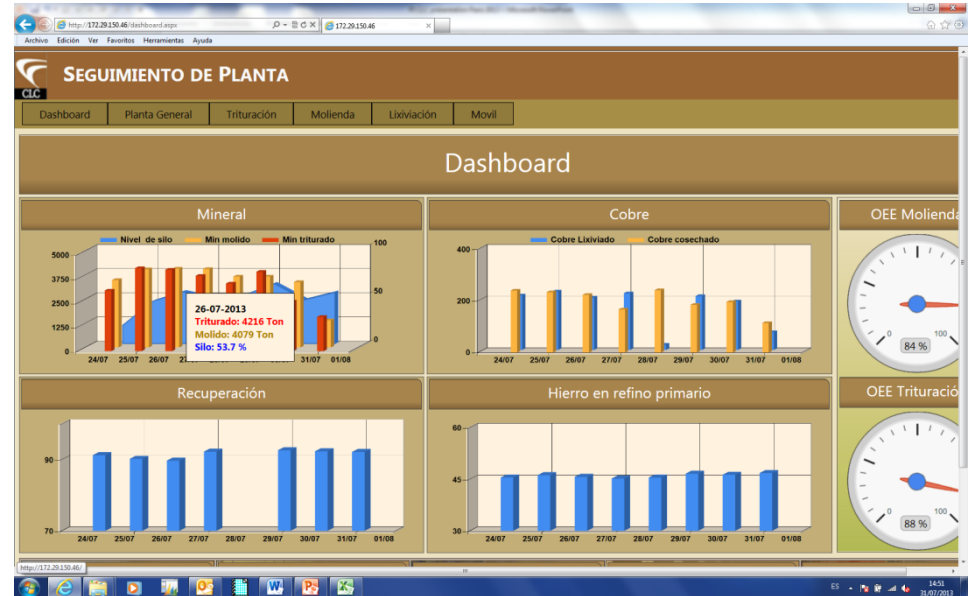
- Process performance optimization through data analysis
- Analysis tool to improve process efficiency
- A much better profitability of the huge amount of data available
- Backs up the production goals achievements by continuous improvement and innovation





PI SYSTEM AT COBRE LAS CRUCES

Added Value: Information reporting





PI SYSTEM AT COBRE LAS CRUCES

What is ongoing?

- Pushing forward PI ACE role
- Synergy of PI DataLink and Six Sigma data analysis methodology
- Full automation of reports in PI ActiveView

What next?

- Think over PI AF and PI Event Frames

Conclusion

PI System at Cobre las Cruces: a story of widened scopes



Business Challenge

- Improve production management
- Data processing to take decisions
- Reference in reporting

Solution

- PI ProcessBook
- PI DataLink
- PI ActiveView
- PI ACE

Results and Benefits

- Better control of copper losses caused by poor performance of process or capacities
- Information management more reliable and sound

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Process Control Chief

Cobre las Cruces

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