

# **SOLEIL CONTROL AND ACQUISITION HARDWARE INSTALLATION AND MAINTENANCE MANAGEMENT**

Pascale Betinelli

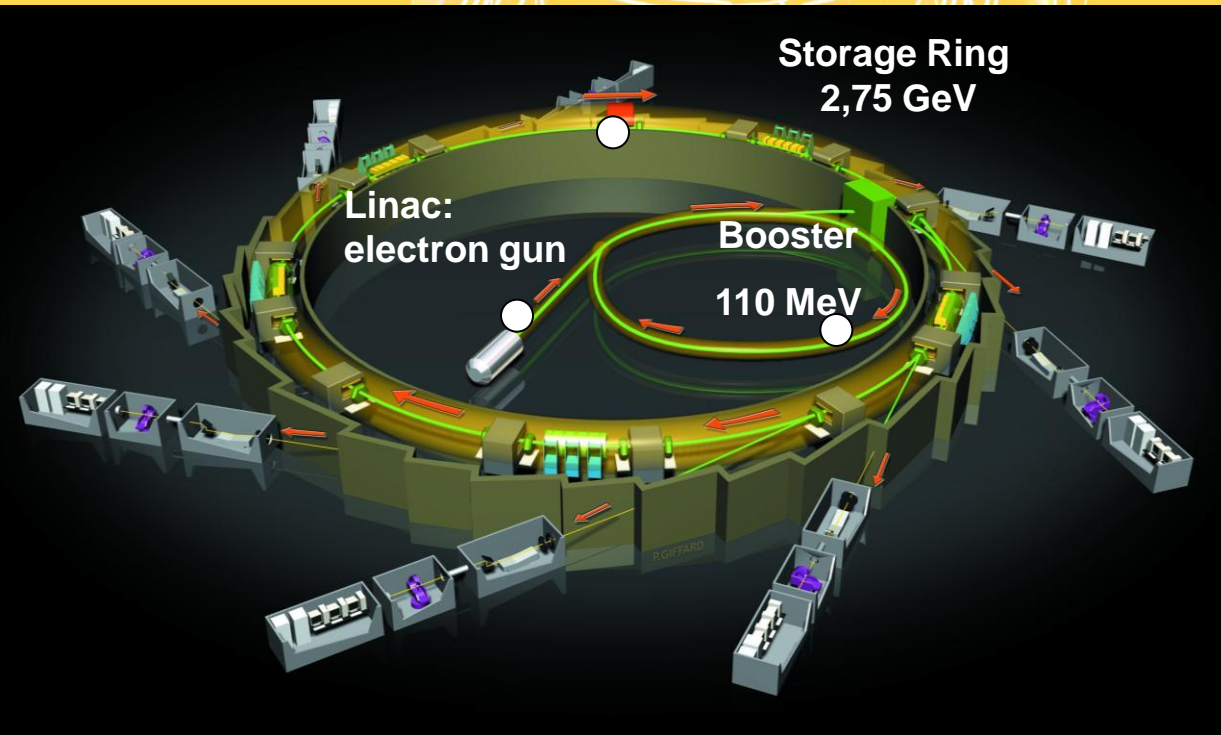
On behalf of the SOLEIL ECA team



*Synchrotron SOLEIL, Saint Aubin, France,  
<http://www.synchrotron-soleil.fr>*

- About Soleil
- Context and issues
- The organization
  - Installation process
  - Maintenance
- The results

- About Soleil
- Context and issues
- The organization
  - Installation process
  - Maintenance
- The results



26 BLs planned up to 2010:

- ✓ 20 are receiving already light
- ✓ **14 are open to users**

■ A **multidisciplinary** research tool open since **2007** with many applications **in fundamental and applied research**:  
physics, chemistry, new materials, nanotechnologies, environmental science, biology, medicine. But also a **tool for industrial applications**

- Operating **24 hours a day**
- **2500 users** per year (25% foreigners)
- **350 permanent staff**
- Annual budget **~€47 million** in operation

- About Soleil
- Context and issues
- The organization
  - Installation process
  - Maintenance
- The results

To **specify, design, implement** and **maintain** the analog and digital electronic devices for the control and acquisition systems on the **machine** and **beamlines**

## Guidelines

- As far as possible, we have to use **standardized hardware components and methods** for Machine Control & Beamline Control
- **Integration of up-to-date commercial products and technologies** must be preferred to development

### Milestones

January 2005: beginning of installation

May 2006: First beam in the storage ring

January 2007: opening to users

Since 2007: end of installation and maintenance of the facility

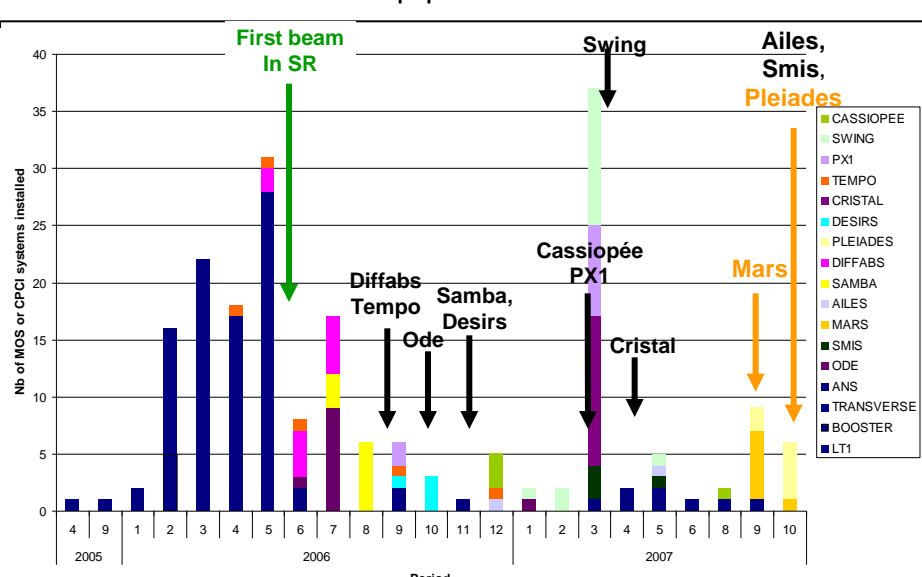
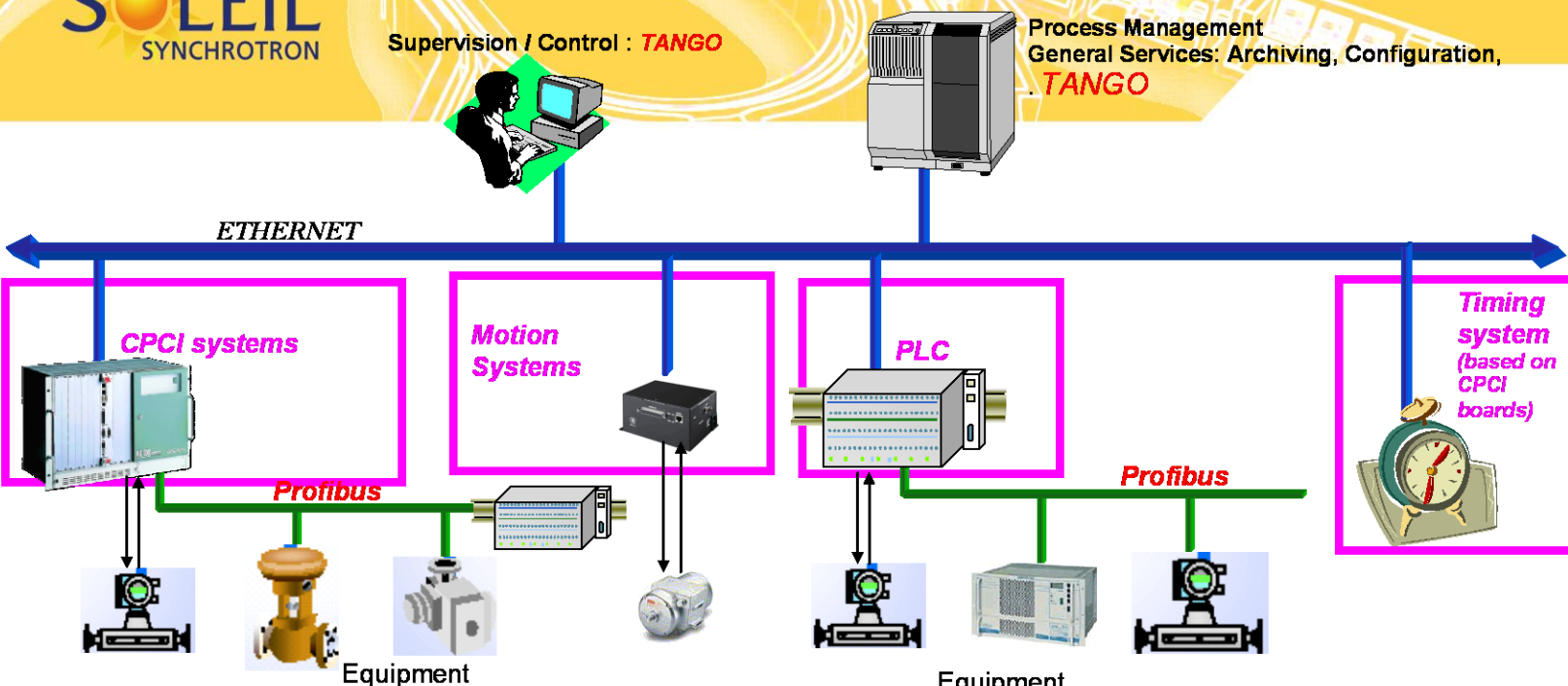
### 9 permanent staff

5 engineers

4 technicians

+ 1 training engineer

2 contractors for peak load



Family	Beamline	Source	Total
Motion systems	748	134	882
CPCI systems	48	105	153
CPCI I/O boards	199	317	516
Timing boards	5	17	22
PLC Systems	29	153	182
<b>Total</b>	<b>1029</b>	<b>726</b>	<b>1755</b>

**2005/2009**  
 ↪ 4500 Hardware items installed  
 ↪ 6000 cables connected

SOLEIL Calendar of SWING from July to December 2009

Click on one cell to schedule it

W	July	W	August	W	September	W	October	W	November	W	December
27	Wed 1 S S S S	31	Sat 1 . . . .	36	Tue 1 m m m	40	Thu 1 . . . .	44	Sun 1 U U U U	49	Tue 1 m m m
	Thu 2 S S S S		Sun 2 . . . .		Wed 2 C C C C		Fri 2 . . . .	45	Mon 2 M M M M		Wed 2 S S S S
	Fri 3 C C C C	32	Mon 3 . . . .		Thu 3 C C C C		Sat 3 . . . .		Tue 3 m m m		Thu 3 C U U U
	Sat 4 S S S S		Tue 4 . . . .		Fri 4 C C C C		Sun 4 . . . .		Wed 4 S S S S		Fri 4 S S S S
	Sun 5 C C C C		Wed 5 . . . .		Sat 5 C C C C	41	Mon 5 . . . .		Thu 5 S S S S		Sat 5 S S S S
28	Mon 6 M M M M		Thu 6 . . . .		Sun 6 C C C C		Tue 6 . . . .		Fri 6 S S S S		Sun 6 S S S S
	Tue 7 m m m		Fri 7 . . . .	37	Mon 7 M M M M		Wed 7 . . . .		Sat 7 U U U U	50	Mon 7 M M M M
	Wed 8 S S S S		Sat 8 . . . .		Tue 8 m m m		Thu 8 . . . .		Sun 8 C C C C		Tue 8 m m m
	Thu 9 S S S S		Sun 9 . . . .		Wed 9 H H H		Fri 9 M M M M	46	Mon 9 . . . .		Wed 9 S S S S
	Fri 10 S S S S	33	Mon 10 . . . .		Thu 10 S S S S		Sat 10 M M M M		Tue 10 . . . .		Thu 10 U U U U
	Sat 11 S S S S		Tue 11 . . . .		Fri 11 S S S S		Sun 11 M M M M		Wed 11 . . . .		Fri 11 U U U U
	Sun 12 C C C C		Wed 12 . . . .		Sat 12 S S S S	42	Mon 12 M M M M		Thu 12 . . . .		Sat 12 S S S S
29	Mon 13 M M M M		Thu 13 . . . .		Sun 13 S S S S		Tue 13 m m m		Fri 13 . . . .		Sun 13 S S S S
	Tue 14 M M M M		Fri 14 . . . .	38	Mon 14 M M M M		Wed 14 S S S S		Sat 14 . . . .	51	Mon 14 M M M M
	Wed 15 m m m		Sat 15 . . . .		Tue 15 m m m		Thu 15 S S S S		Sun 15 . . . .		Tue 15 m m m
	Thu 16 S S S S		Sun 16 . . . .		Wed 16 S S S S		Fri 16 S S S S		Sat 16 . . . .		Thu 16 S S S S
	Fri 17 S S S S	34	Mon 17 . . . .		Thu 17 S S S S		Sat 17 S S S S		Sun 17 . . . .		Fri 17 S S S S
	Sat 18 S S S S		Tue 18 . . . .		Fri 18 S S S S		Sun 18 U U U U		Mon 19 . . . .		Sat 18 S S S S
	Sun 19 U U U U		Wed 19 . . . .		Sat 19 S S S S	43	Mon 19 M		Tue 20 . . . .		Mon 19 U U U U
	Mon 20 S S S S		Thu 20 . . . .		Sun 20 S S S S		Tue 20 m		Wed 21 . . . .		Tue 20 S S S S
	Tue 21 M M M M		Fri 21 . . . .	39	Mon 21 M M M M		Wed 21 S S S S		Thu 22 . . . .		Mon 21 U U U U
	Wed 22 C C C C		Sat 22 . . . .		Tue 22 m m m		Thu 22 S S S S		Fri 23 . . . .		Tue 22 U U U U
	Thu 23 S S S S		Sun 23 . . . .		Wed 23 U U U U		Fri 23 S S S S		Sat 24 . . . .		Wed 23 U U U U
	Fri 24 S S S S	35	Mon 24 . . . .		Thu 24 S S S S		Sat 24 S S S S		Sun 25 . . . .		Thu 24 U U U U
	Sat 25 T T T T		Tue 25 . . . .		Fri 25 S S S S		Sun 25 S S S S		Mon 26 . . . .		Sat 25 . . . .
	Sun 26 S S S S		Wed 26 . . . .		Sat 26 S S S S	44	Mon 26 M M M M		Tue 27 . . . .		Sat 26 . . . .
	Mon 27 U U U U		Thu 27 . . . .		Sun 27 U U U U		Tue 27 m m m		Fri 27 S S S S		Sun 27 . . . .
	Tue 28 C C C C		Fri 28 . . . .	40	Mon 28 . . . .		Wed 28 S S S S		Sat 28 U U U U	53	Mon 28 . . . .
	Wed 29 S S S S		Sat 29 M M M M		Tue 29 . . . .		Thu 29 S S S S		Sun 29 U U U U		Tue 29 . . . .
	Thu 30 S S S S		Sun 30 M M M M		Wed 30 . . . .		Fri 30 U U U U	49	Mon 30 M M M M		Wed 30 . . . .
	Fri 31 . . . .	36	Mon 31 M M M M				Sat 31 U U U U				Thu 31 . . . .

Predefined Shifts

Shutdown	Beamline devel. / optional Machine devel.
Machine development	Machine devel. / optional Beamline devel.
User Operation	Multiple stations scheduled
Maintenance	Radio protection
In house research	Notified / Not notified public experiment schedule
Tests	Notified / Not notified public preparation schedule
Other branchline	

- Beam is available 24 hours a day, 7 days a week.
- Shut-down periods for maintenance and upgrade are scheduled on a regular basis.
- The allocation of beamtime is scheduled in time slots
- Any breakdown strongly disrupts the schedule

We have to ensure high reliability by preventive maintenance

We have to solve all blocking problems during operation (duty 24h a day)



- About Soleil
- Context and issues
- **The organization**
  - Installation process
  - Maintenance
- The results

- Definition of Work Breakdown Structures (WBS)
  - Each project is independent
  - Geographical and functional coding is defined
  - Standardized products, tools and procedures are used
- Procedures are integrated in our process management tools:
  - Inventory needs form
  - Process cabling database
  - Concurrent Version System (CVS)
  - Electrical Computer-Aided Design software <sup>2</sup>
  - Acceptance forms
  - **Computer-aided Maintenance Management System (CMMS) <sup>1</sup>**

1- Maintimédia from Tribofilm

2- Schemelec from FTZ

**Topologies**

Representation:  geographical  functional

Sorted:  by code  by description

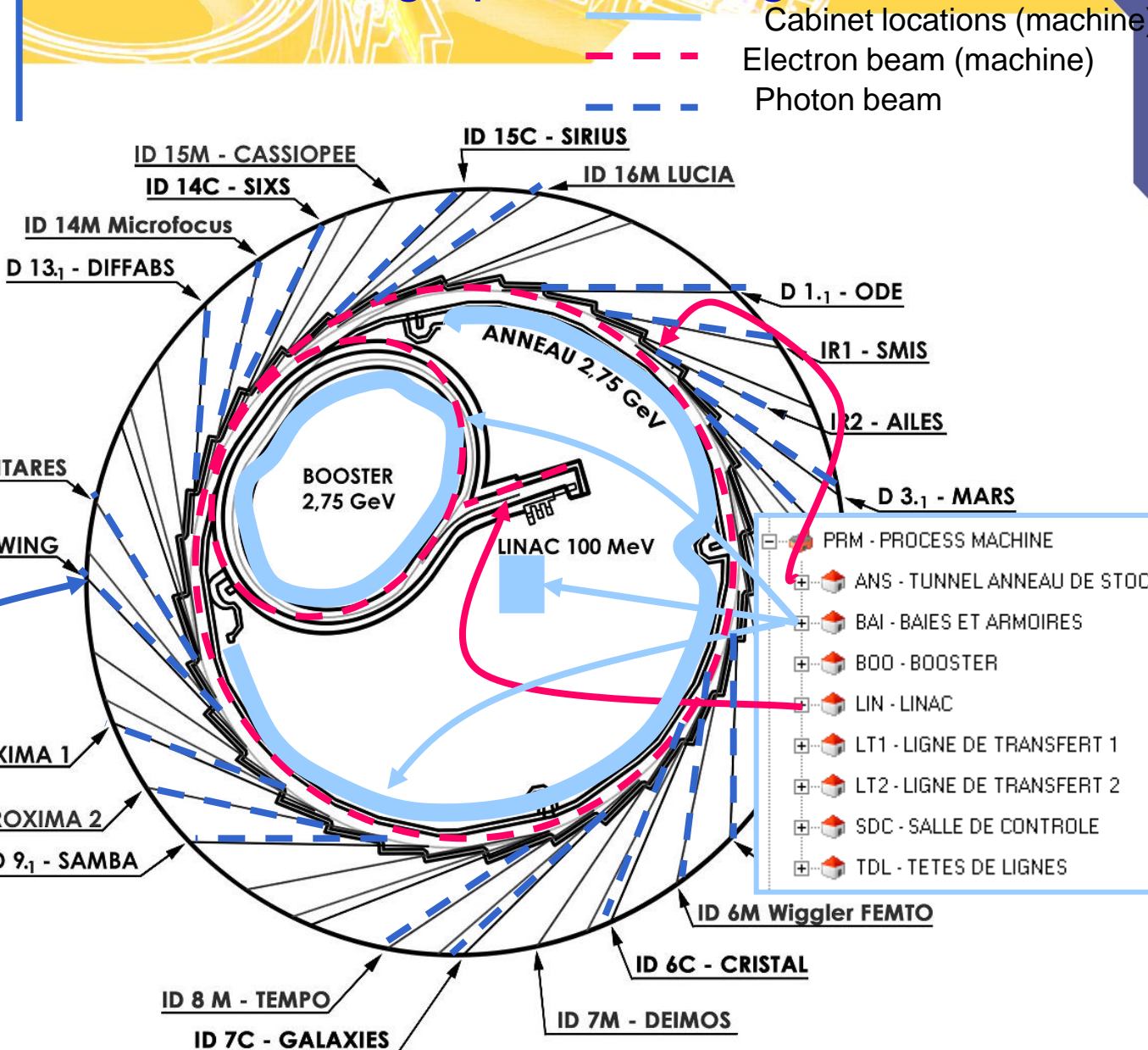
Look rejecting topologies

# Soleil Work Breakdown Structure

## Geographical coding

**PRL - PROCESS LIGNES DE LUMIERE**

- D01-1 - LIGNE ODE
- D02-1R - LIGNE SMIS
- D03-1 - LIGNE MARS
- D03-1R - LIGNE AILES
- D04-3 - LIGNE DISCO
- D05-1 - LIGNE METROLOC
- D09-1 - LIGNE SAMBA
- D13-1 - LIGNE DIFFABS
- I03-C - LIGNE HAUTE PRE
- I04-M - LIGNE PLEIADES
- I05-L - LIGNE DESIRS
- I06-C - LIGNE CRISTAL
- I07-C - LIGNE GALAXIES
- I07-M - LIGNE DEIMOS
- I08-M - LIGNE TEMPO
- I10-C - LIGNE PROXIMA 1
- I10-M - LIGNE PROXIMA 2
- I11-C - LIGNE SWING
- I12-M - LIGNE ANTARES
- I14-C - LIGNE SIXS
- I14-M - LIGNE HF MICROF
- I15-C - LIGNE SIRIUS
- I15-M - LIGNE CASSIOPEE
- I16-M - LIGNE LUCIA
- PRM - PROCESS MACHINE



- PRM - PROCESS MACHINE
- ANS - TUNNEL ANNEAU DE STOCK
- BAI - BAIES ET ARMOIRES
- BOO - BOOSTER
- LIN - LINAC
- LT1 - LIGNE DE TRANSFERT 1
- LT2 - LIGNE DE TRANSFERT 2
- SDC - SALLE DE CONTROLE
- TDL - TETES DE LIGNES

# Standard products and coding

**Functional Tree Structure**

- BI\_EL - ELECTRICITE COURANTS FORTS ET COURANTS FAIBLES
- BI\_FL - FLUIDES CVC
- BI\_SG - SERVICES GENERAUX
- CA - CONTROLE ACQUISITION
  - CA/BAI - BAIE
  - CA/CAB - CABLE ET CORDON
  - CA/ICA - MATERIEL ICA
  - CA/INST - INSTRUMENTATION
  - CA/MISC - DIVERS
  - CA/MOS - MOTORISATION
  - CA/PCI - COMPACT PCI
    - CA/PCI/BRD - CARTES CPCI
      - CA/PCI/BRD\_MISC - BOARD DIVERS
      - CA/PCI/CPT - CARTE COMPTEUR
      - CA/PCI/CPUI - CARTE CPU
      - CA/PCI/DIO - CARTE DIGITAL INPUT OUTPUT
      - CA/PCI/DIO\_0 - CARTE DIGIT MULTICOULEES
      - CA/PCI/DMM - CARTE DIGIT MULTIMETER
      - CA/PCI/DP - CARTE PROFIBUS DP
      - CA/PCI/GPB - CARTE GPB
      - CA/PCI/HD - HARD DISK DE CPU
      - CA/PCI/HSIDIO - CARTE HIGH SPEED DIGITAL INPUT OUTPUT
      - CA/PCI/MAI - CARTE MULTIPLEX INPUT
      - CA/PCI/MAD - CARTE MULTIPLEX OUTPUT
      - CA/PCI/MUX - CARTE DE MULTIPLEXAGE
      - CA/PCI/RS232\_8 - CARTE RS232 8 PORTS

Function: CA      CONTROLE ACQUISITION

**Functional Class**

**Topologies**

- ANS-C03-BAI-BAIES DE LA CELLULE 03 DE VANNEAU
- ANS-C03-BAI.0154/PCM - BAIES DANS GI.0.03
- ANS-C03-BAI.0202/EM - BAIES DANS GI.0.03
- ANS-C03-BAI.0507/RF - BAIES DANS GI.0.03
- ANS-C03-BAI.0508/RF - BAIES DANS GI.0.03
- ANS-C03-BAI.0509/RF - BAIES DANS GI.0.03
- ANS-C03-BAI.0510/RF - BAIES DANS GI.0.03
- ANS-C03-BAI.0511/RF - BAIES DANS GI.0.03
- ANS-C03-BAI.0512/RF - BAIES DANS GI.0.03
- ANS-C03-BAI.0514/RF - BAIES DANS GI.0.03
- ANS-C03-BAI.0516/RF - BAIE DANS GI.0.03
- ANS-C03-BAI.0518/RF - BAIES DANS GI.0.03
- ANS-C03-BAI.0520/RF - BAIES DANS GI.0.03
- ANS-C03-BAI.0609/MI - BAIES DANS GI.0.03
- ANS-C03-BAI.0612/MI - BAIES DANS GI.0.03
- ANS-C03-BAI.0613/MI - BAIES DANS GI.0.03-TDL I/R AILES
- ANS-C03-BAI.0615/MI - BAIES DANS GI.0.03-TDL PSICHE
- ANS-C03-BAI.0704/DG - BAIES DANS GI.0.03
- ANS-C03-BAI.0723/DG - BAIES DANS GI.0.03
- ANS-C03-BAI.0804/CA - BAIES DANS GI.0.03
  - ANS-C03-BAI.0804/CA/PCI.1 - PCI
  - CA/PCI/CRATE.0060 - CHASSIS CPCI 7U

**CA/PCI/CPU.0018 - CPU PM 1.6GHZ PXE**

Level: 10    Father: CRATE.0060/PCI.18/SLOT\_CPU - SLOT CPU

Code: CA/PCI/CPU.0018      **Soleil number**

Description: CPU PM 1.6GHZ PXE

Type: Equipment    Chicality: /

Serial Number: 49945007

Hourly Cost of non-production: 0.00    Tag ID: T14251

Analytic Section: SRCS    Maintenance contrôle commande

Functional Class: CA/PCI/CPU      **Functional Class**

**Technical Data Sheet**

ADMINISTRATIF

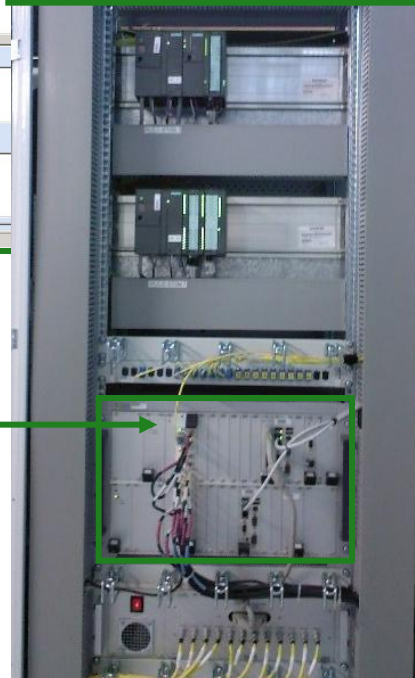
- 01-Numero de Commande: DL12-3\_BL308026
- 02-Fournisseur: /
- 03-PU H.T.: 2004.72
- 04-Date de commande: /
- 05-Date de réception: 4/14/2004
- 06-Date de fin de garantie: 4/14/2007
- 07-Type de garantie/support: /
- 08-Date de mise au rebut: /
- 09-Cause de la mise au rebut: /
- 10-Remarques: SRCS
- 11-Numero de bien comptable: /

**History of Moves**

For the Topology : CA/PCI/CPU.0018 - CPU PM 1.6GHZ PXE

Date	Father Code	Father Description
3/1/2005 12:00 AM	CA/ST/A_REPART...	STOCK CA EN COURS DE REPARTITION (MAC/...
4/19/2005 2:44 PM	ST/CA/PCI	STOCK COMPACT PCI
11/29/2005 4:34 PM	SAV_INOVA	INOVA
3/27/2006 4:46 PM	CA/PCI/CPUI	CARTE CPU
3/31/2006 2:00 PM	CRATE.0060/PCI.1...	SLOT CPU

**SOLEIL ANS-C03-BAI 0804/CA**



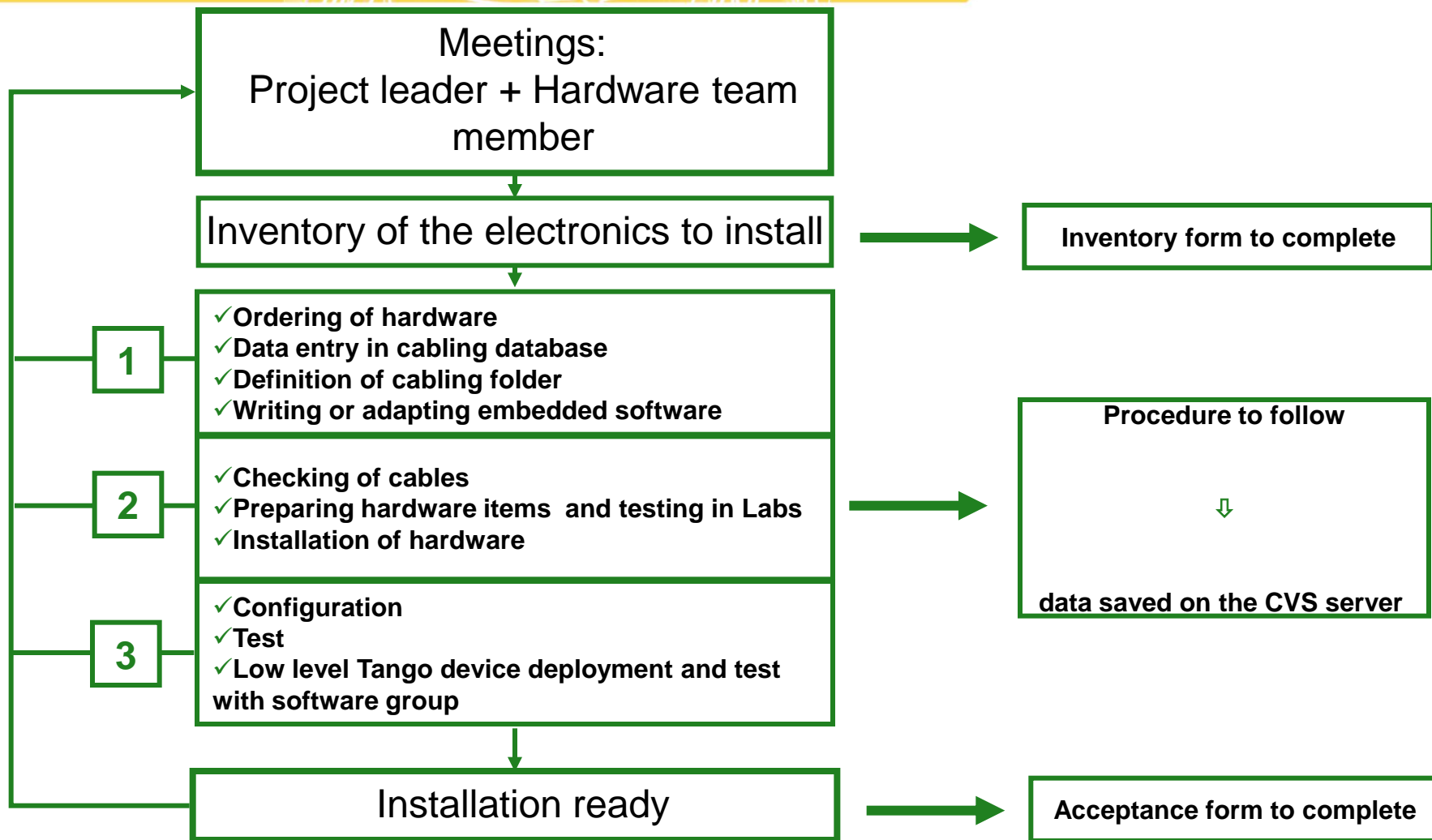
- ANS-C03-BAI.0804/CA - BAIES DANS GI.0.03
- ANS-C03-BAI.0804/CA/PCI.1 - PCI
- CA/PCI/CRATE.0060 - CHASSIS CPCI 7U

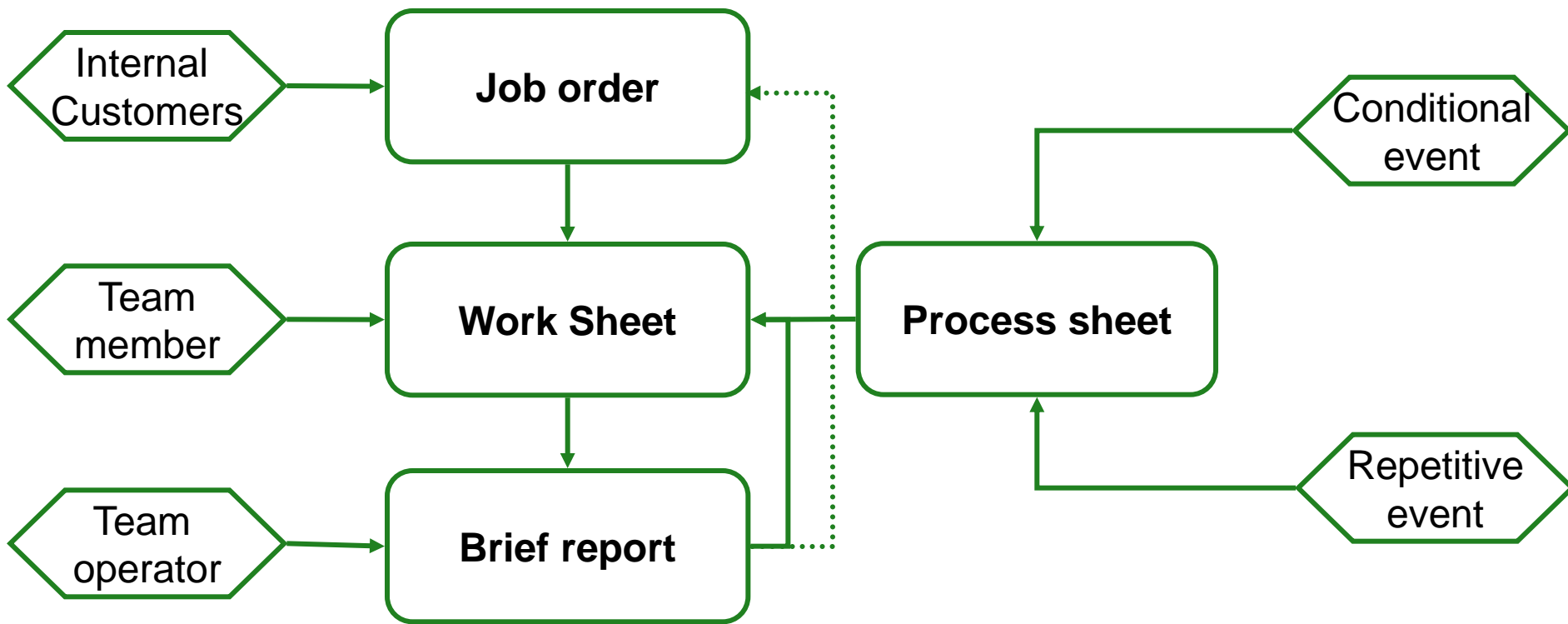
**History of Moves**

For the Topology : CA/PCI/CPU.0018 - CPU PM 1.6GHZ PXE

Date	Father Code	Father Description
3/1/2005 12:00 AM	CA/ST/A_REPART...	STOCK CA EN COURS DE REPARTITION
4/19/2005 2:44 PM	ST/CA/PCI	STOCK COMPACT PCI
11/29/2005 4:34 PM	SAV_INOVA	INOVA
3/27/2006 4:46 PM	CA/PCI/CPUI	CARTE CPU
3/31/2006 2:00 PM	CRATE.0060/PCI.1...	SLOT CPU

**Installation date**







- About Soleil
- Context and issues
- The organization
  - Installation process
  - Maintenance
- **The results**



- Data extracted directly from the CMMS:
  - what has happened in a particular place during a specific period
    - ↪ useful during operation on blocking problems
  - failure information on devices
    - ↪ used to anticipate problems and to plan maintenance tasks
- Data extracted with InfoView from Business Objects:
  - Installed base and intervention assessment
    - ↪ Watch out for unexpected failure trends or unjustified calls
  - Feedback on time spent on tasks
    - ↪ Anticipate peak load periods

Sorted:  Look rejecting topologies

- BAT - BATIMENTS
- BE\_MECANIQUE - BUREAU D'ETUD
- LAP - LABORATOIRES ET ATELIERS
- MAGSYNC - MAGASINS SYNCHROT
- PRE - PROJETS EXPERIENCES
- PRL - PROCESS LIGNES DE LUMIEF
- PRM - PROCESS MACHINE
- ANS - TUNNEL ANNEAU DE STC
- BAI - BAIES ET ARMOIRES
- ANS-BAI - BAIES ET ARMOIR
- BOO-BAI - BAIES DU BOOSTI
- LT1-BAI - BAIES DE LT1**
- LT1-BAI.0170/RCM - BAIE
- LT1-BAI.0674/VI - BAIE D
- LT1-BAI.0824/CA - BAIE D
- LT2-BAI - BAIES DE LT2
- TRA-BAI - BAIES ET ARMOIR
- BOO - BOOSTER
- LIN - LINAC
- LT1 - LIGNE DE TRANSFERT 1
- LT2 - LIGNE DE TRANSFERT 2
- SDC - SALLE DE CONTROLE
- TDL - TÊTES DE LIGNES
- REB - REBUT GENERAL

**History**

List the work sheets that match the search criteria:

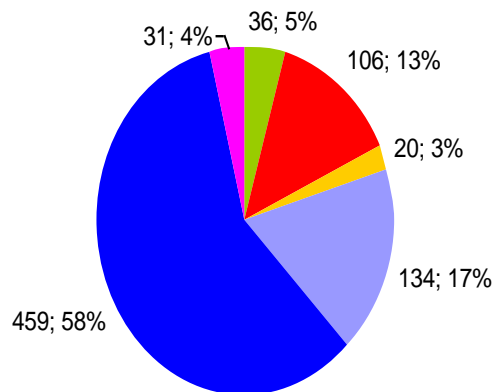
Number	<b>Which</b>	Topology Description	<b>What</b>	Symptom	<b>When</b>
000000011	CA/PCI/CRATE.0007/PCI.1B	BUS BAS	Modif synchro provisoire pour reprise t...		2/7/2006
000000030	CA/MOS/CB.0004	CONTROLBOX 3U	Echange CTRL_AX sur CB/LT1 ave...		2/28/2006
000000328	LT1-BAI.0170/RCM	BAIE DANS CO.0.11	Démontage de la synchro provisoire		5/17/2006
000003187	LT1-BAI.0170/RCM/PCI.1	PCI	Default alimentation bus bas du chassis		5/21/2007
000003354	CA/SY/LOCAL.0015	CARTE LOCAL	Maj et update Carte Timing phase2		5/24/2007
000004402	CA/MOS/CB.0004	CONTROLBOX 3U	Mise à jour firmware et sauvegarde c...		8/14/2007
000004801	LT1-BAI.0824/VI/MOS.1	MOS	Position des fentes LT1 non conform...	ECA04-PB M...	9/13/2007
000005124	CA/PLC/CP315.0002	S7-300 CPU 315-2 DP	Perte de comm avec PLC surveillanc...	ECA21-ERR...	10/4/2007
000005123	CA/PCI/DP.0056	CARTE PROFIBUS	Configuration des nouveaux moniteur ...		10/9/2007
000005176	LT1-BAI.0824/VI/PLC.1	PLC	pb de raz sur LT1 boîtier : automate ...	ECA21-ERR...	10/9/2007
000005236	LT1-BAI.0170/RCM/PLC.1	PLC	Probleme sur le reset des boîtiers AE...	ECA21-ERR...	10/12/2007
000005442	CA/SY/LOCAL.0005	CARTE LOCAL	carte local ne fonctionneplus	ECA21-ERR...	10/26/2007
000005356	LT1-BAI.0170/RCM/PLC.1	PLC	[SurveillanceAimant] MAJ du program...	ECA99-AUT...	11/13/2007
000006101	CA/PCI/DP.0056	CARTE PROFIBUS	[PSS-RP] Pb de communication avec...	ECA22-ERR...	12/10/2007
000006505	CA/MOS/CB.0004	CONTROLBOX 3U	[LT1] Mise en place de GAV2 sur la f...		2/18/2008
000007591	CA/PCI/RS232_8.0028	CARTE CPCI-3538/9	Mise en place patch pannel RITTAL ...		4/3/2008
000007592	CA/PCI/RS232_8.0003	CARTE CPCI-3538/9	Mise en place patch pannel RITTAL ...		4/3/2008
000007656	CA/SY/LOCAL_LINAC.0002	CARTE LOCAL_LINAC	[synchro] LOCAL LINAC HS	ECA21-ERR...	4/9/2008
000007708	CA/SY/TIMPO.0001	CARTE TIMPO	[synchro] La carte TIMPO.0002 n'est ...		4/11/2008
000007945	CA/MISC/MISC.0011	CARTE CONVERSION RS232-RS...	[Moniteur neutron] Plantage MON1 et...	ECA22-ERR...	5/6/2008
000008289	CA/MISC/MISC.0011	CARTE CONVERSION RS232-RS...	vérification sur les moniteurs neutron...	ECA22-ERR...	6/2/2008
000008315	CA/MOS/CB.0004	CONTROLBOX 3U	[LT1-B0824-MOS1] Migration GAV2 - ...	ECA06-MICR...	6/3/2008
000009178	CA/MOS/CB.0004	CONTROLBOX 3U	[MOS] explication utilisation command...	ECA04-PB M...	8/22/2008
000009205	LT1-BAI.0824/VI/PCI.1	PCI	[LINAC] probleme de positionnement ...		8/25/2008
000009208	CA/SY/LOCAL_LINAC.0002	CARTE LOCAL_LINAC	[Synchro] Carte LINAC SPM ne sort p...	ECA22-ERR...	8/25/2008
000009492	CA/SY/LOCAL_LINAC.0002	CARTE LOCAL_LINAC	[synchro] Pb d'injection ce matin		9/12/2008
000009637	LT1-BAI.0170/RCM	BAIE DANS CO.0.11	INSTALLER PORTE DOCUMENTS ...		9/23/2008
000009588	LT1-BAI.0824/VI/PCI.1	PCI	[DG] Mise en place 2eme alim sur ecr...	ECA99-AUT...	9/24/2008
000010862	CA/PCI/CRATE.0007/PCI.1H	BUS HAUT	Pb Communication Profibus ALIm LT1	ECA22-ERR...	1/14/2009
000010877	CA/PCI/CRATE.0007/PCI.1H	BUS HAUT	[CIG] Pb communication Profibus - CIG	ECA22-ERR...	1/14/2009
000011365	LT1-BAI.0824/VI/PLC.1	PLC	[Interlock] Pb de remonté du FirstInter...		2/16/2009
000011550	CA/PCI/DP.0056	CARTE PROFIBUS	[MAC] Maj reperage cables réseaux p...	ECA99-AUT...	3/3/2009
000011120	CA/PCI/CRATE.0007/PCI.1H	BUS HAUT	[CIG] Changement des connecteur br...		4/20/2009

**Where**

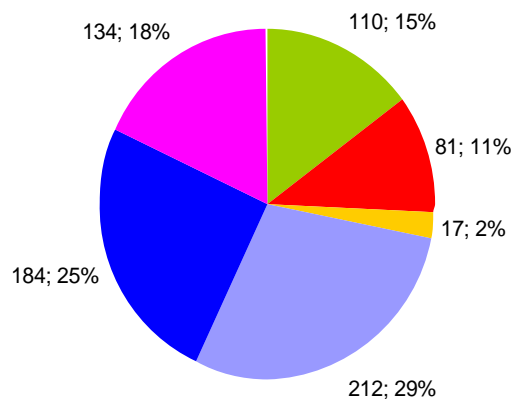
Total for Engineering 89 H 35

< Back
Next >
Print History
Print Downtimes
Consult
Close

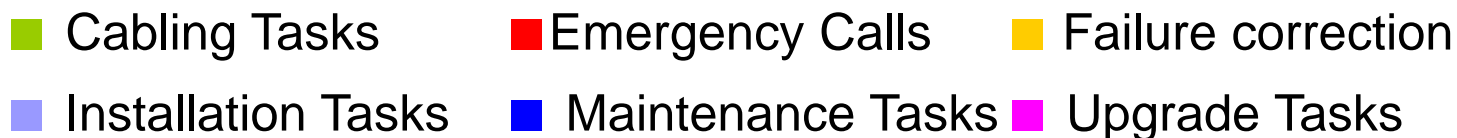
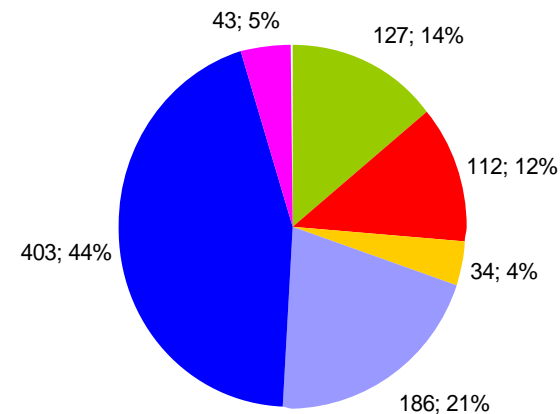
**Number of worksheets 2007**  
Total 786



**Number of worksheets 2008**  
Total 738



**Number of worksheets 2009**  
Total 905



- Indicators\*
  - Only **3.4%** of our work tasks are failure corrections
  - **1.5%** of our installed equipment required replacement per year
- With a CMMS, behavior must change
  - Required **discipline** and collaboration of **the entire team**
- Today this organization is being extended to the whole installation

**Benefits take time to appear  
but IT asset management methods significantly improve  
the working of a big facility**

**\*should be moderate by the age of the installation**

**Thanks for your attention**

