SOLEIL CONTROL AND ACQUISITION HARDWARE INSTALLATION AND MAINTENANCE MANAGEMENT

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http://www.synchrotron-soleil.fr

Content

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

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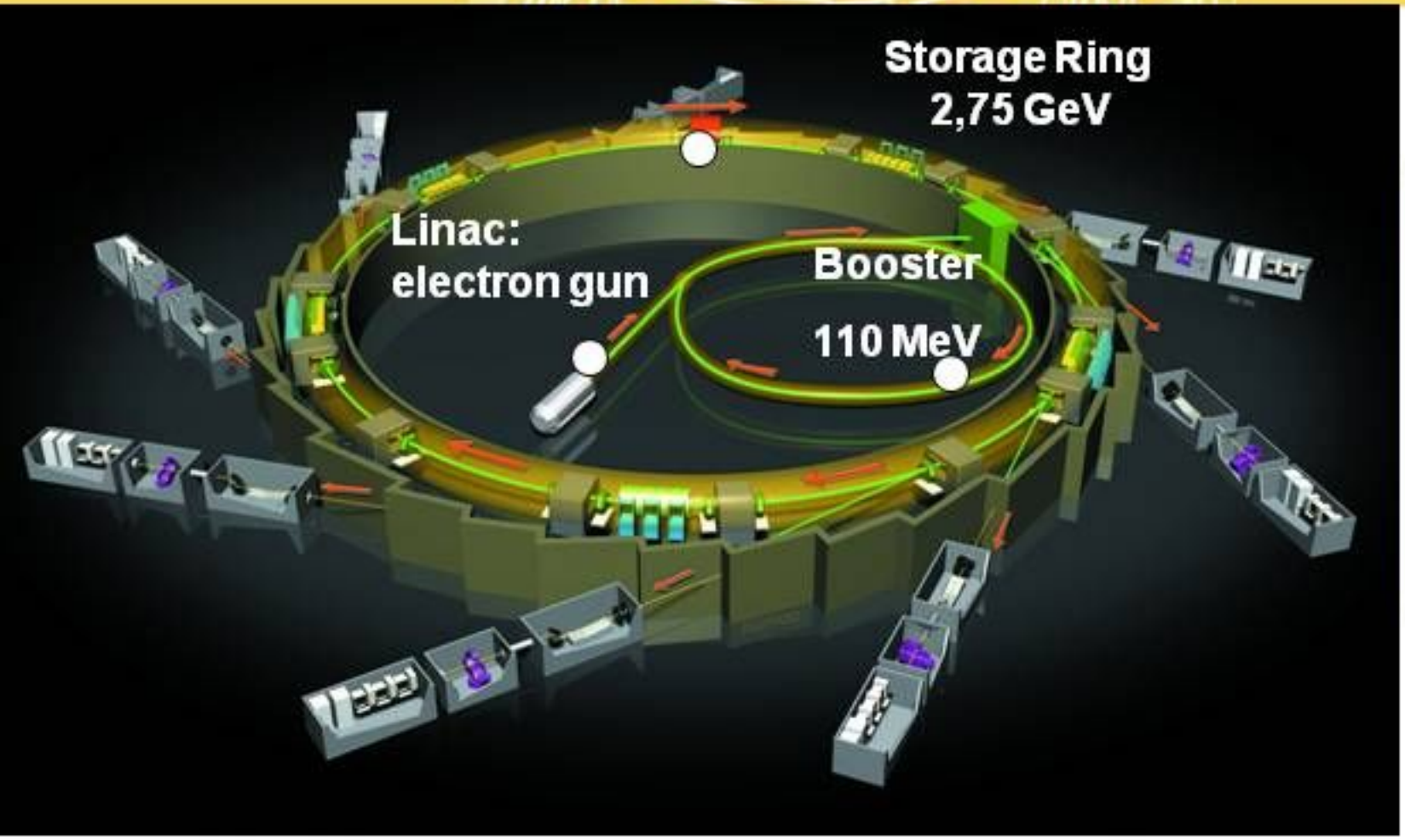
SOLEIL: a third generation Synchrotron



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

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Missions and outlines

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

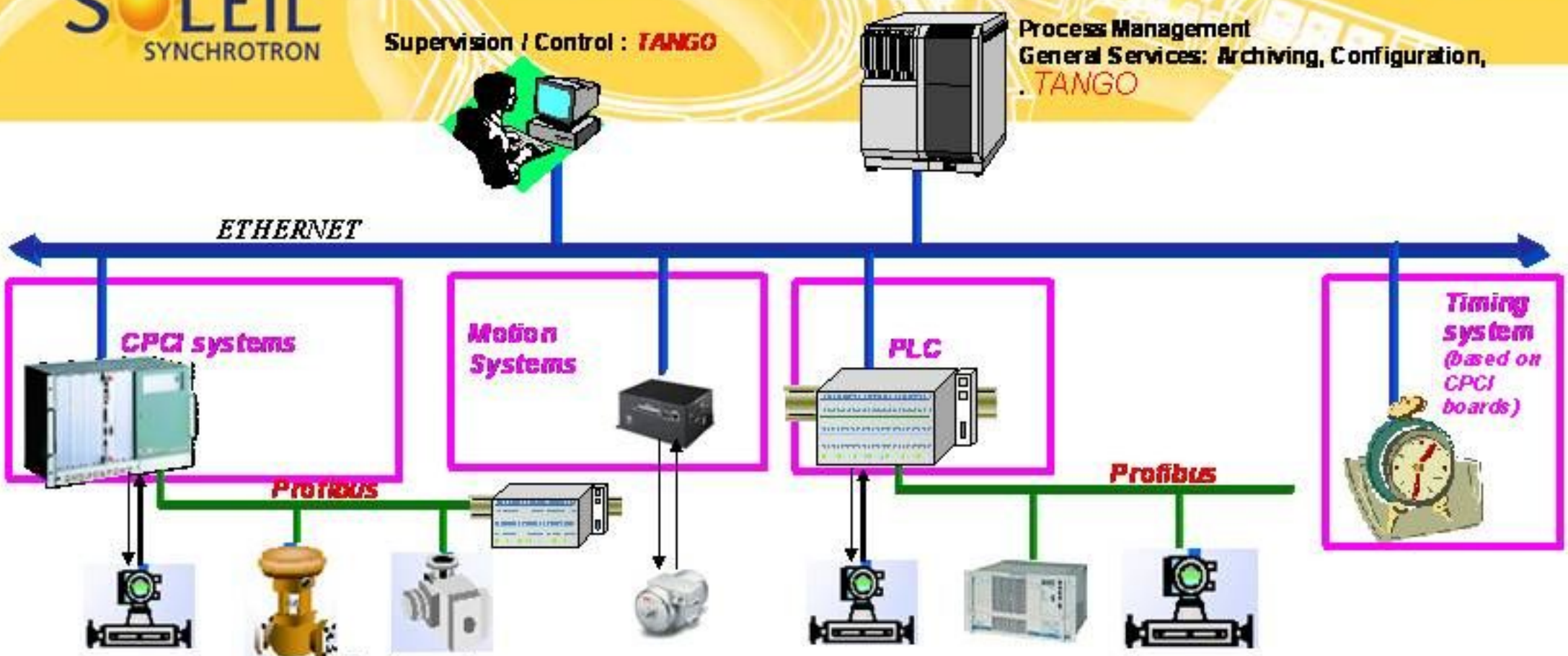
Milestones

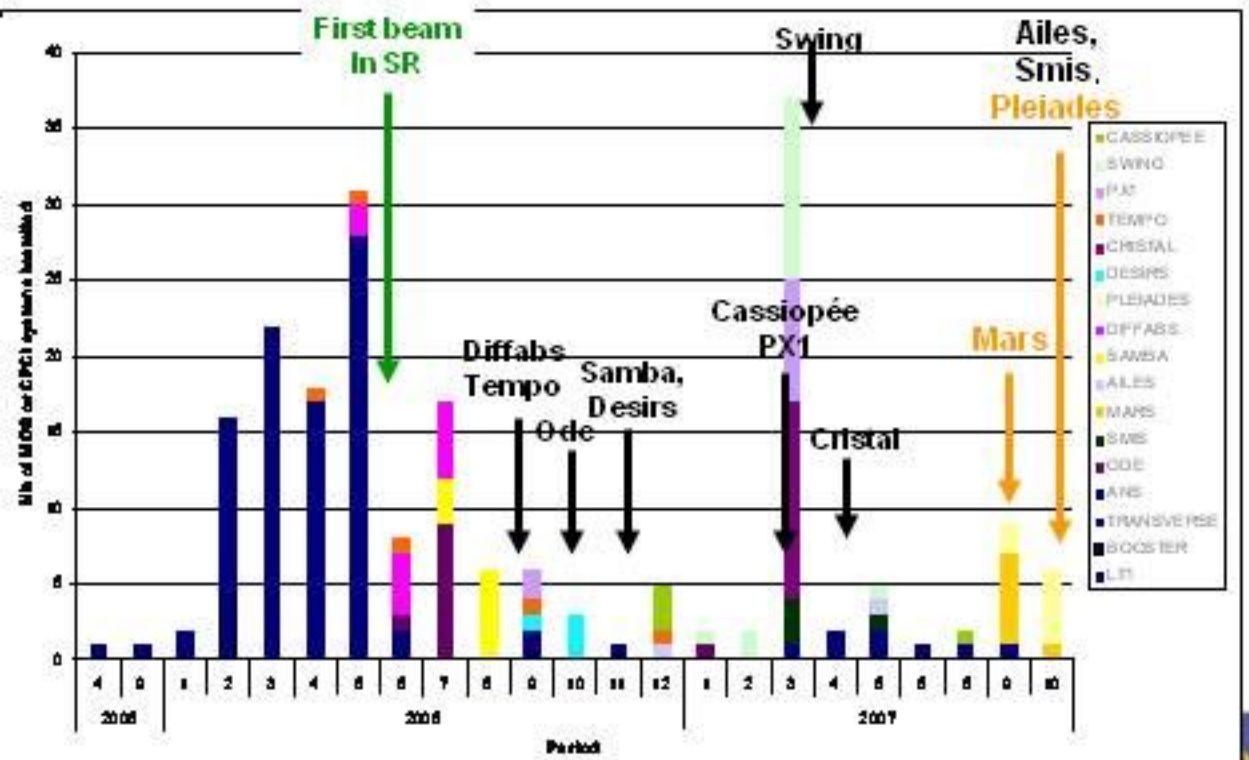
January 2005: beginning of installation
May 2006: First beam in the storage ring
January 2007: opening to users
Since 2007: end of installation and maintenance of the facility

9 permanent staff

5 engineers
4 technicians
+ 1 training engineer
2 contractors for peak load

Installation issues





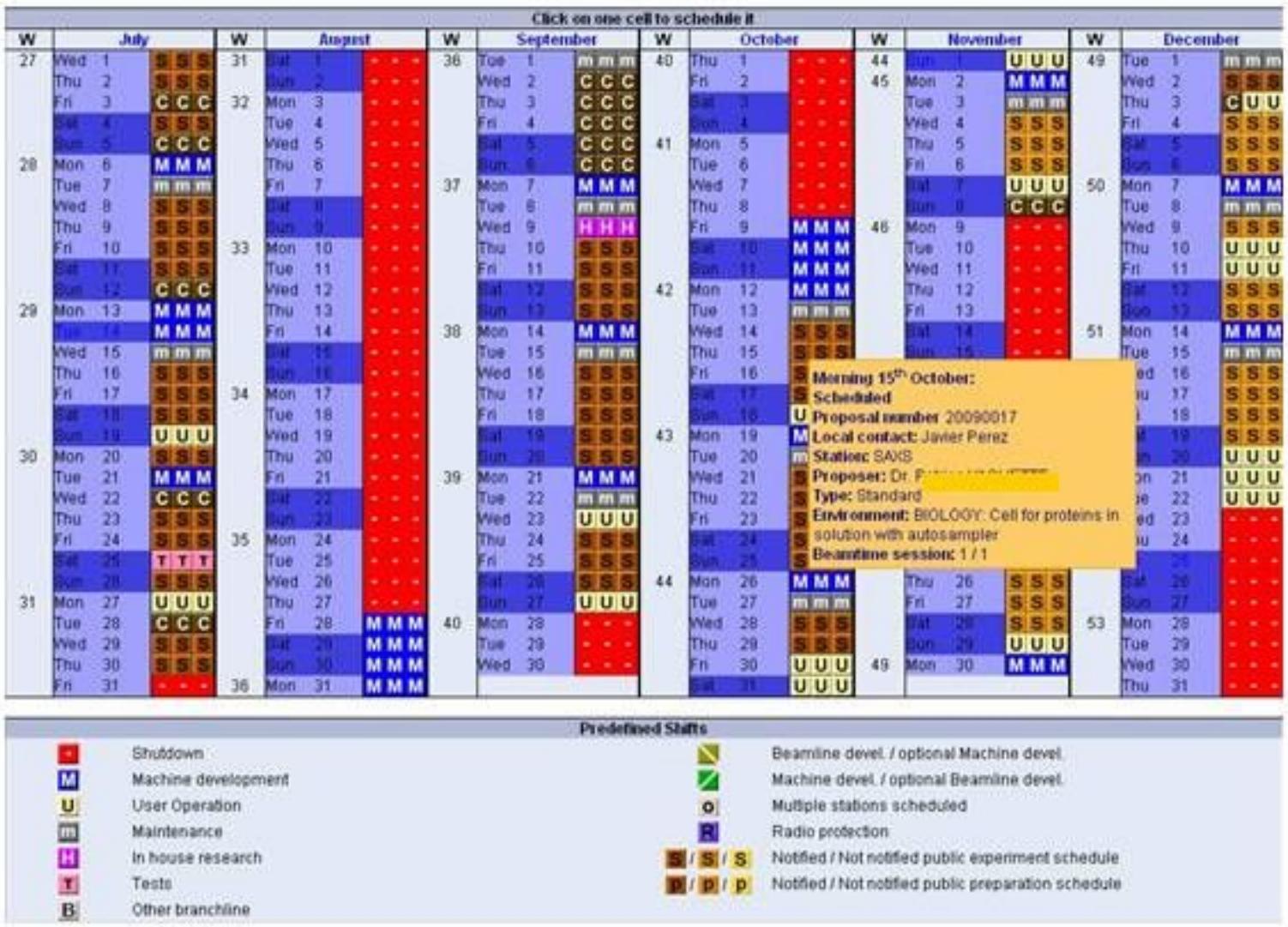
Family	Beamline	Source	Total
Motion systems	748	134	882
CPCI systems	48	105	153
CPCI I/O boards	199	317	516
Timing boards	5	17	22
PLC Systems	29	153	182
Total	1029	726	1755

2005/2009

- 4500 Hardware items installed
- 6000 cables connected

Maintenance issues

SOLEIL SYNCHROTRON



- 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)**

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Organization foundation

- 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 [2]
  - Acceptance forms
  - **Computer-aided Maintenance Management System (CMMS) [1]**

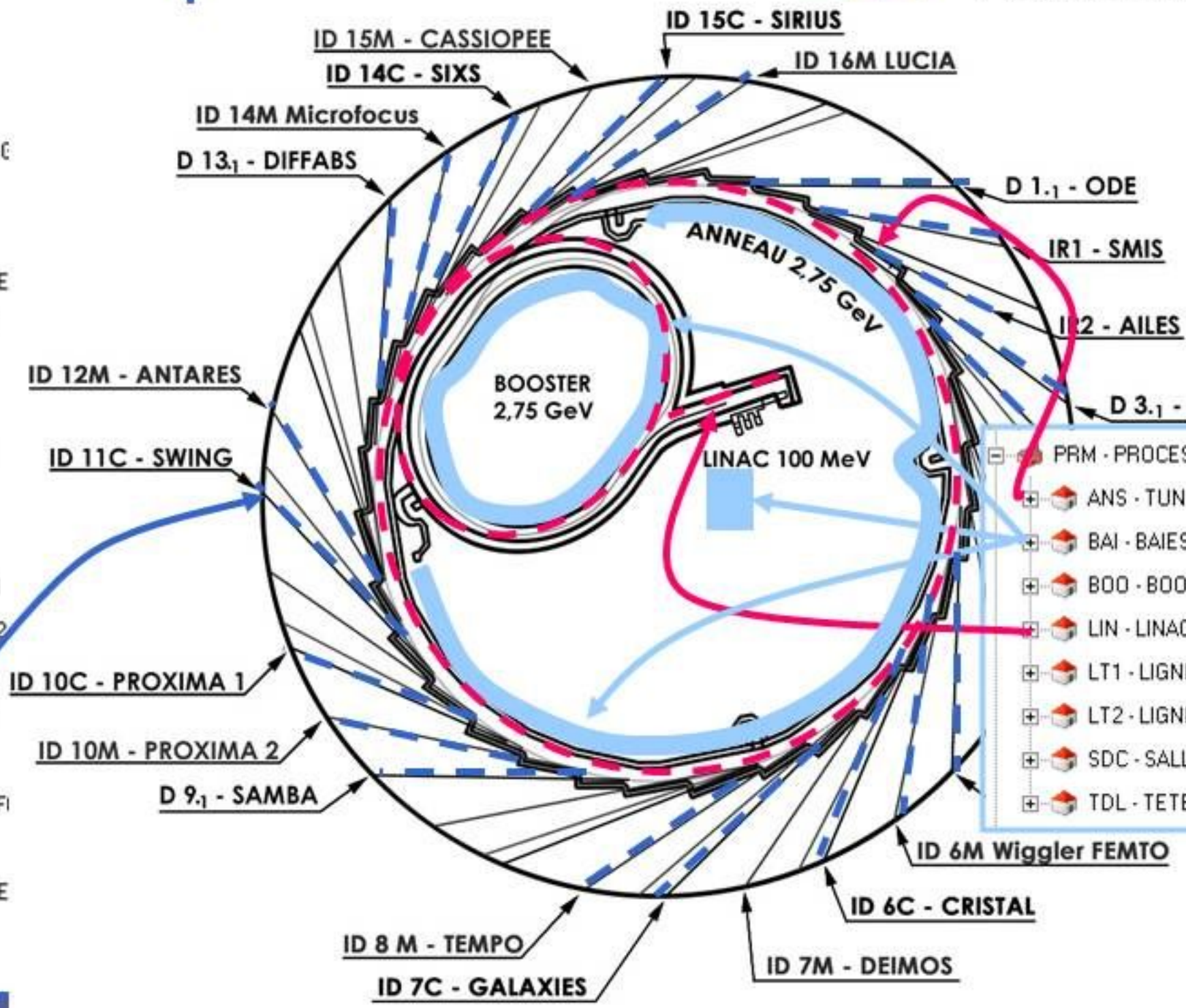
1- Maintimédia from Tribofilm
2- Schemelec from FTZ

Soleil Work Breakdown Structure
Geographical coding

Topologies
Representation: geographical functional
Sorted: by code by description
Look rejecting topologies

- PRL - PROCESS LIGNES DE LUMIERE
  - D01-1 - LIGNE ODE
  - D02-IR - LIGNE SMIS
  - D03-1 - LIGNE MARS
  - D03-IR - LIGNE AILES
  - D04-3 - LIGNE DISCO
  - D05-1 - LIGNE METROLOG
  - 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 MICROFI
  - I15-C - LIGNE SIRIUS
  - I15-M - LIGNE CASSIOPEE
  - I16-M - LIGNE LUCIA
- PRM - PROCESS MACHINE

Cabinet locations (machine)
Electron beam (machine)
Photon beam



- 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

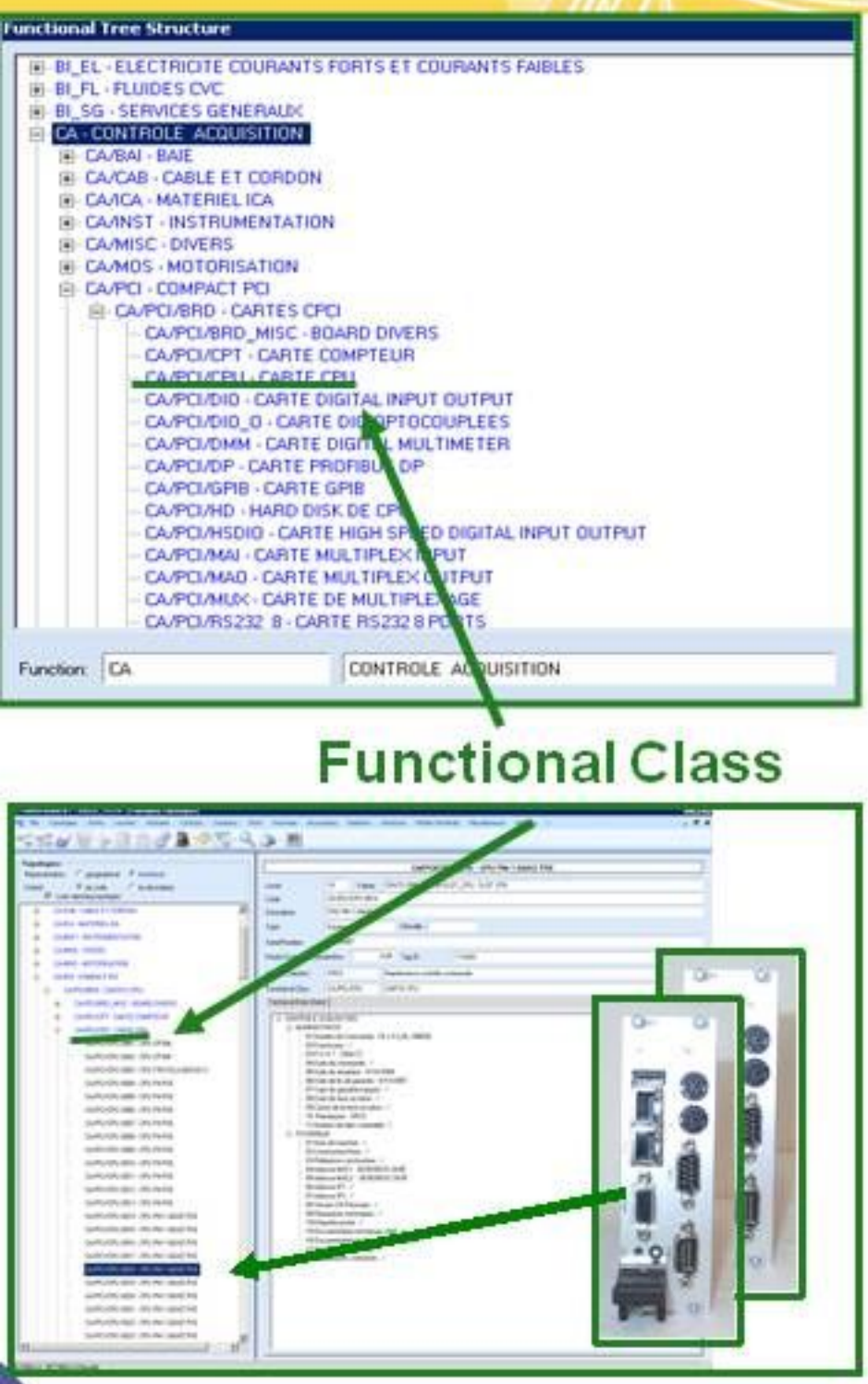
SOLEIL SYNCHROTRON

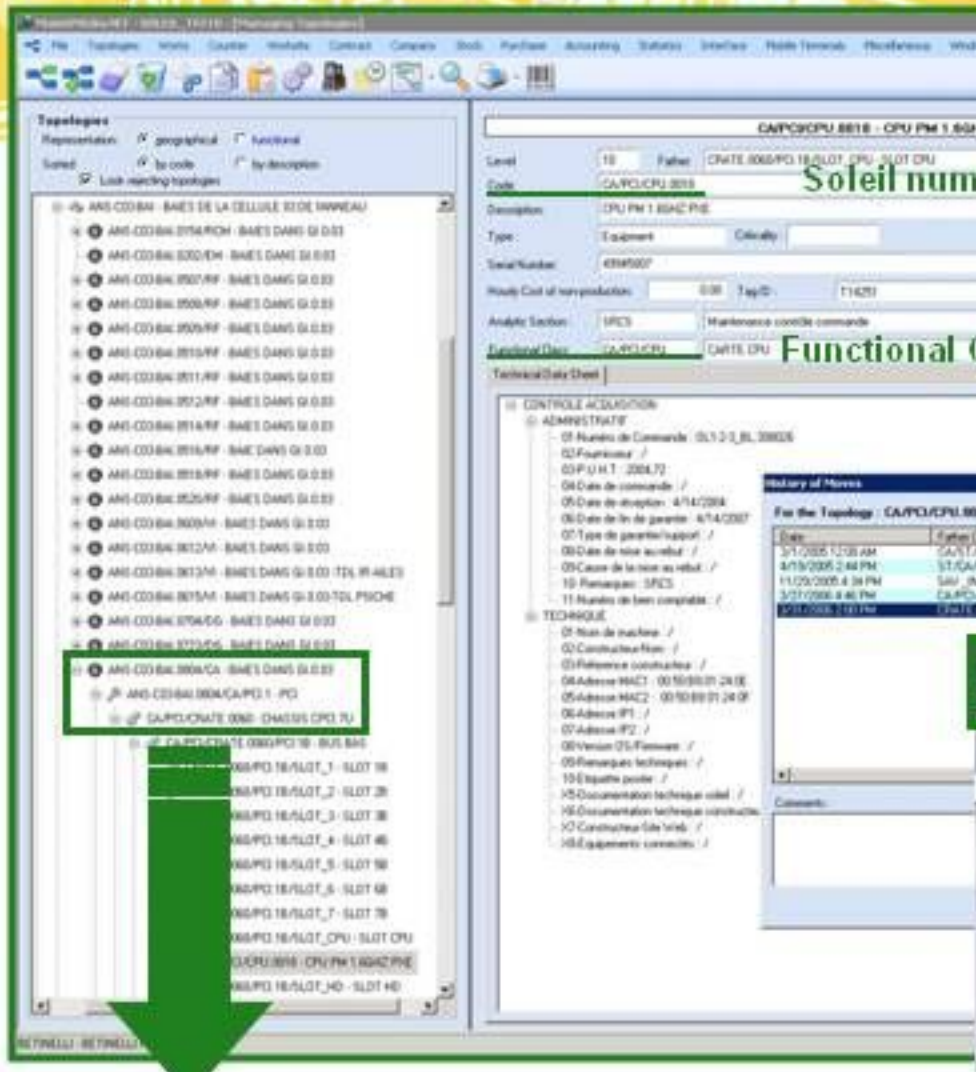
Functional Tree Structure

- 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/CPU - CARTE CPU
      - CA/PCI/DIO - CARTE DIGITAL INPUT OUTPUT
      - CA/PCI/DIO_O - CARTE DIGITAL OPTOCOUPLEES
      - CA/PCI/DMM - CARTE DIGITAL MULTIMETER
      - CA/PCI/DP - CARTE PROFIBUS DP
      - CA/PCI/GPIB - CARTE GPIB
      - CA/PCI/HD - HARD DISK DE CPCI
      - CA/PCI/HSDIO - CARTE HIGH SPEED DIGITAL INPUT OUTPUT
      - CA/PCI/MAI - CARTE MULTIPLEX INPUT
      - CA/PCI/MAO - CARTE MULTIPLEX OUTPUT
      - CA/PCI/MUX - CARTE DE MULTIPLEXAGE
      - CA/PCI/RS232 8 - CARTE RS232 8 PORTS

Function: CA — CONTROLE ACQUISITION

Functional Class





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/CPU	CARTE CPU
3/31/2006 2:00 PM	CRATE.0060/PCI.1...	SLOT CPU

Installation date

Installation Process

Meetings:
Project leader + Hardware team member

Inventory of the electronics to install → Inventory form to complete

1
- ✓Ordering of hardware
- ✓Data entry in cabling database
- ✓Definition of cabling folder
- ✓Writing or adapting embedded software

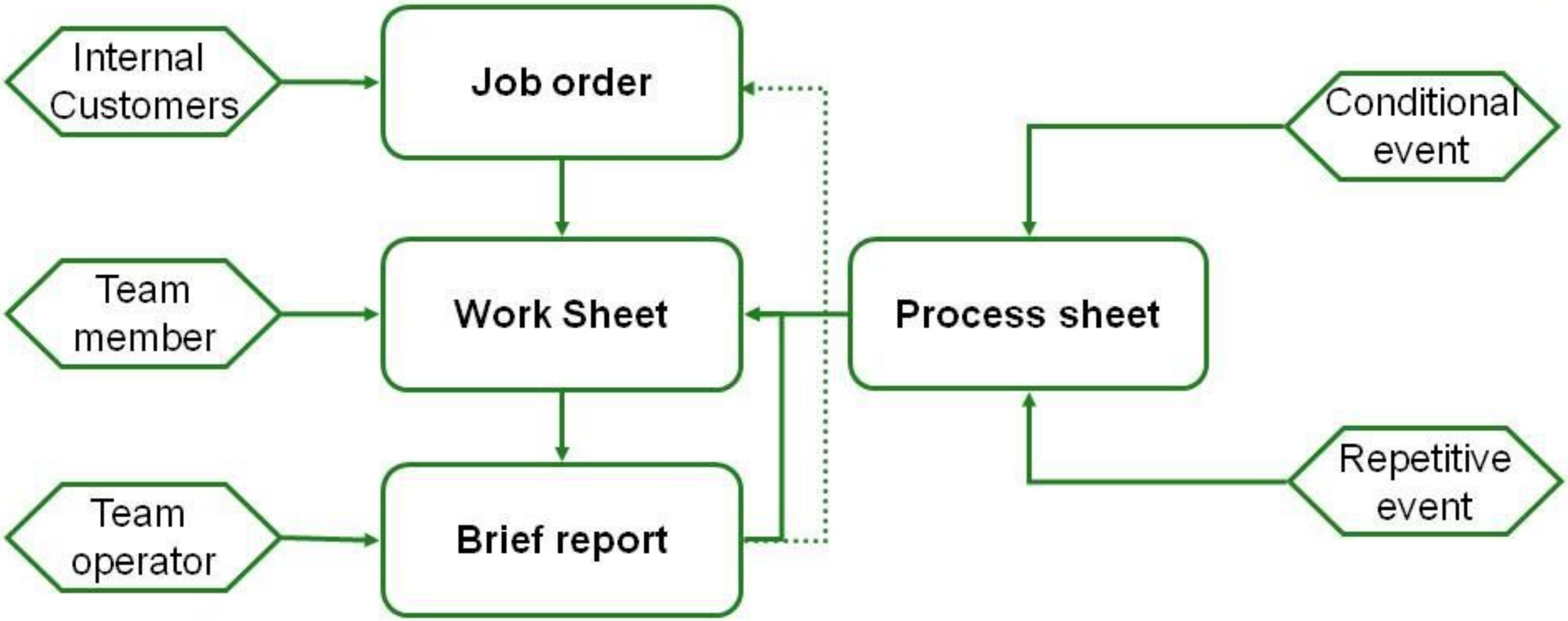
2
- ✓Checking of cables
- ✓Preparing hardware items and testing in Labs
- ✓Installation of hardware

3
- ✓Configuration
- ✓Test
- ✓Low level Tango device deployment and test with software group

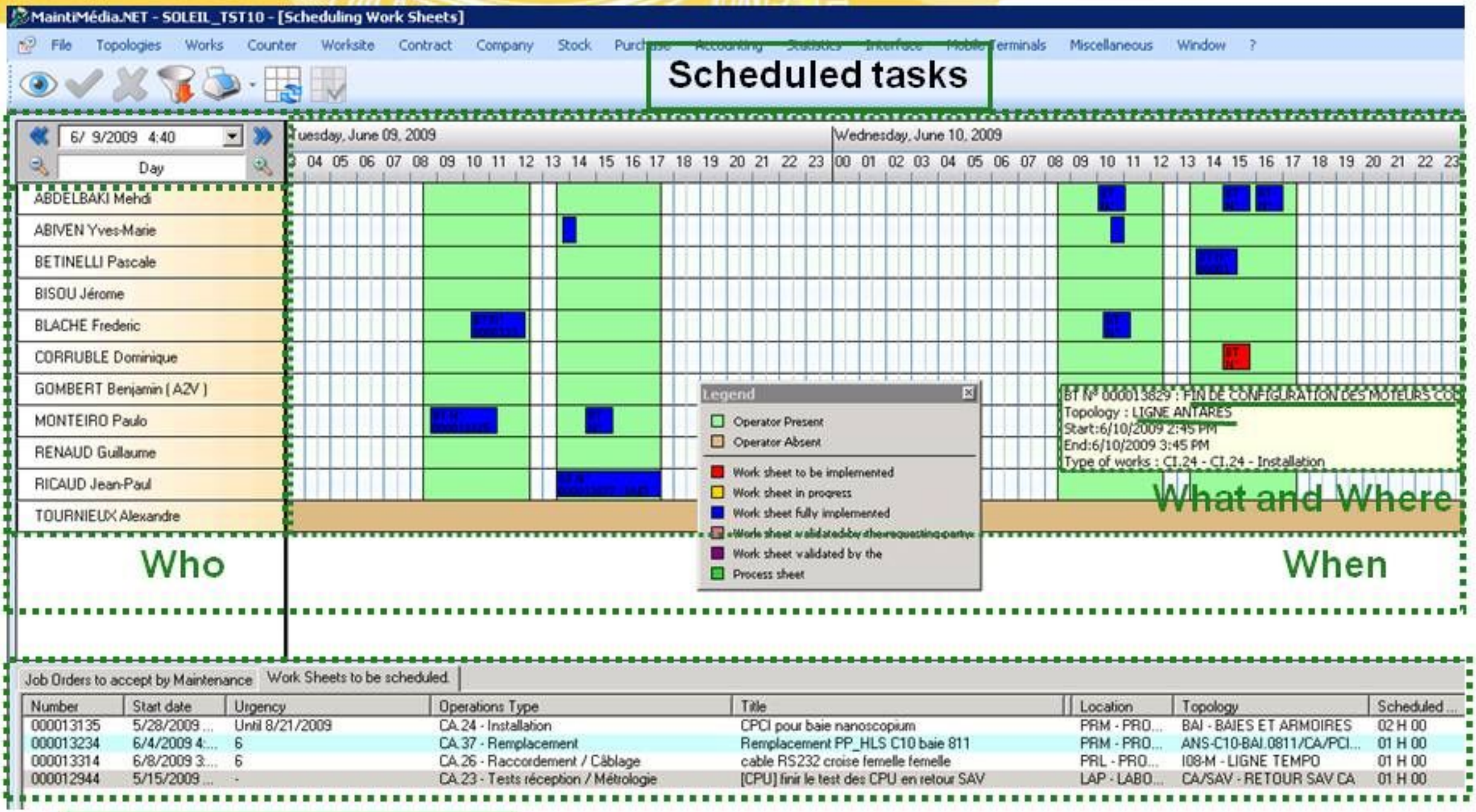
→ Procedure to follow ⇩ data saved on the CVS server

Installation ready → Acceptance form to complete

Maintenance Process



Task scheduling: Who what when where



Tasks to be scheduled

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Data and indicator extraction

- 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

History of interventions

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 - TETES DE LIGNES
- REB - REBUT GENERAL

Where

History

List the work sheets that match the search criteria:

Which | **What** | **When**

Number		Topology Description		Symptom	
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 or...		4/20/2009

Total for Engineering 89 H 35

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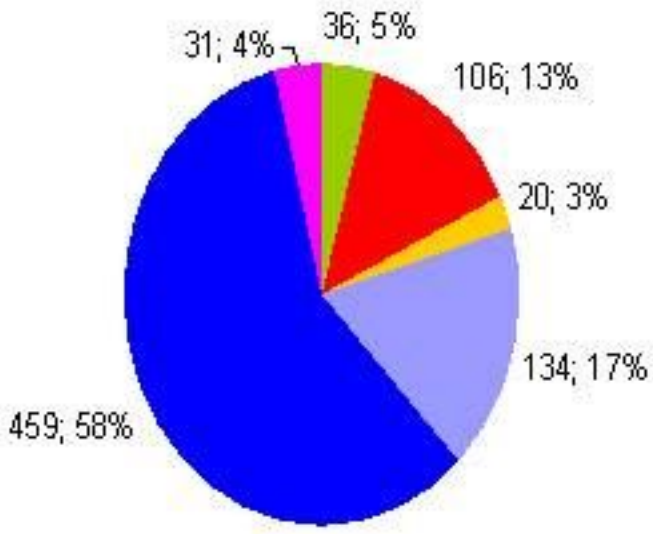
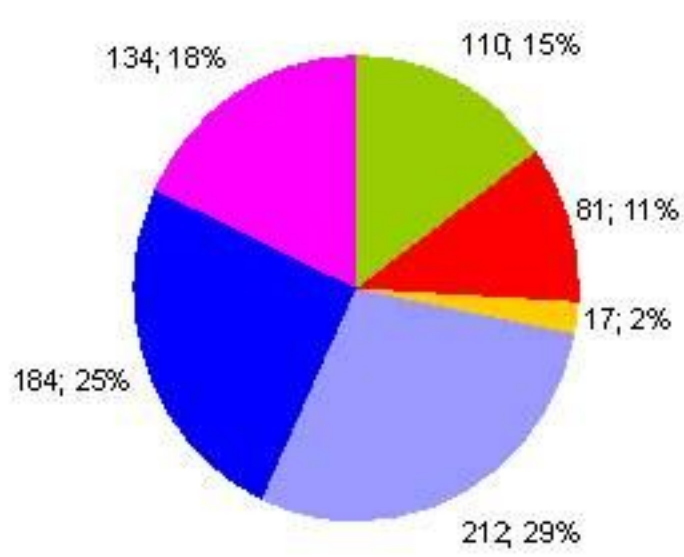
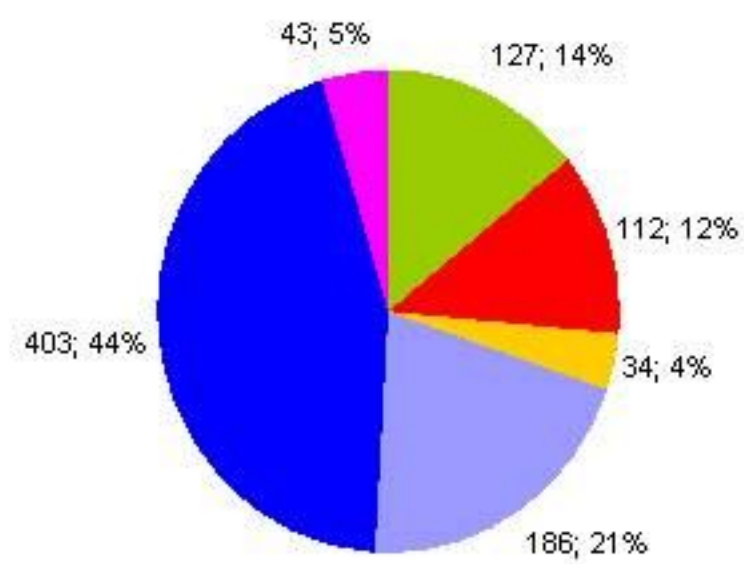
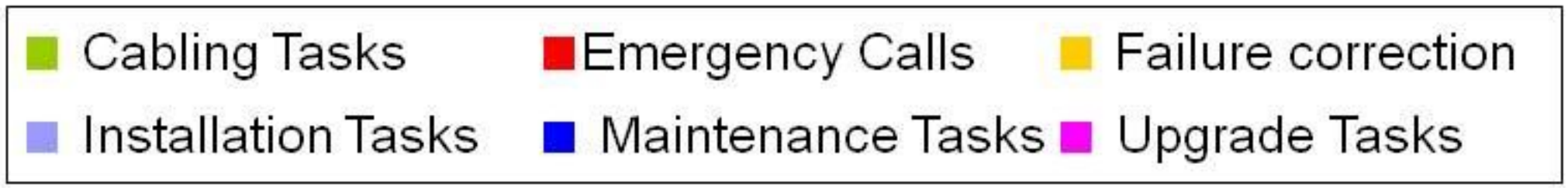
Operation assessment









Conclusion

- 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