

Towards smooth operations for the SPS North Area that remains as popular as ever

A. Masi, EN/STI

thanks to inputs from: O. Aberle (EN/STI); Jean-Paul Burnet (TE/EPC); S. Deleval (EN/CV); M. Dumas (TE/MSD); S. Girod (EN/MEF); M. Pezzetti (TE/CRG); E. Sallaz (IT/CS); J. Spanggaard (BE/BI); D. Vaxelaire (GS/ASE);

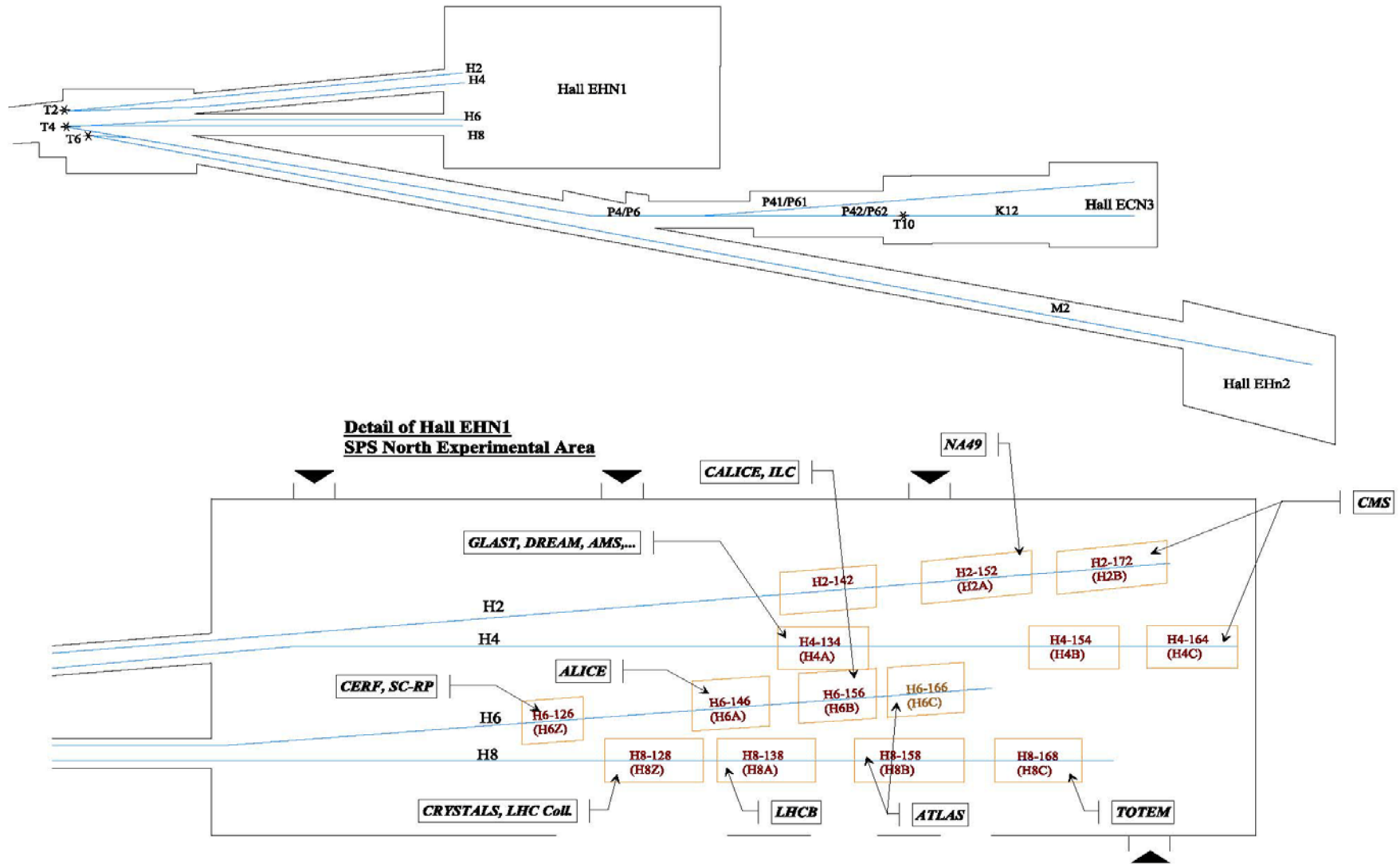
Contents

SPS North area- Status of consolidation programs for:

- Power Supplies
- Beam Instrumentation
- Access System
- Beam Obstacles Controls
- Beam Obstacles Mechanics
- Cooling and Ventilation
- Cryogenics
- Magnets
- Networking in the experimental hall

Budget-resources estimates and possible timeline

North Area



Power Supplies

inputs from **Jean-Paul Burnet (TE/EPC)**

Beam Instrumentation

inputs from **J. Spangaard (BE/BI)**

Access System

inputs from **D. Vaxelaire (GS/ASE)**

Beam Obstacles Controls

inputs from **A. Masi(EN/STI), A. Bland(BE/CO)**

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Cryogenics

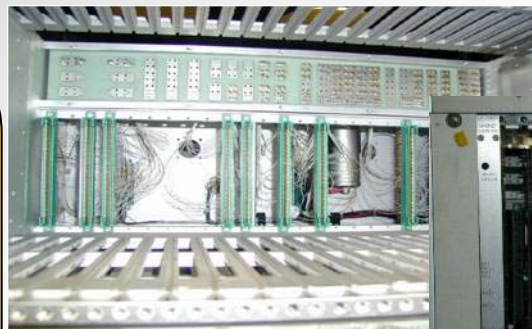
inputs from **M.Pezzetti (TE/CRG)**

Networking in the experimental hall

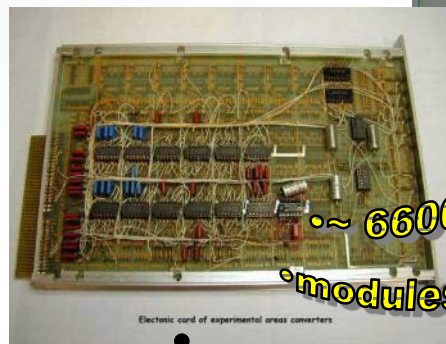
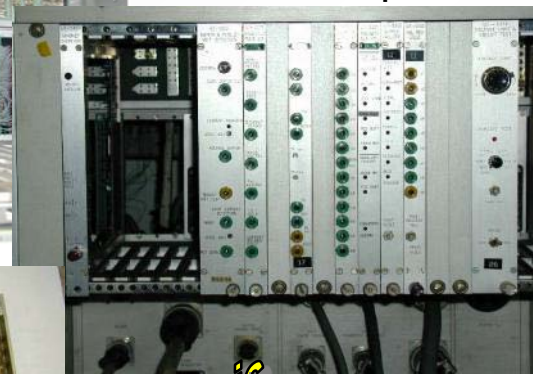
inputs from **E. Sallaz (IT/CS)**

Power supplies: main issues that presently affect operation

- ◆ Power converters in operation since 1976
- ◆ Original analog & digital electronics
- ◆ Wire wrap technology
- ◆ Old control system (Databus)
- ◆ Power converter MTBF very low: $\approx 7000\text{H}$
- ◆ 167 interventions by the first line team in 2009
- ◆ 100 electronic cards repaired each year

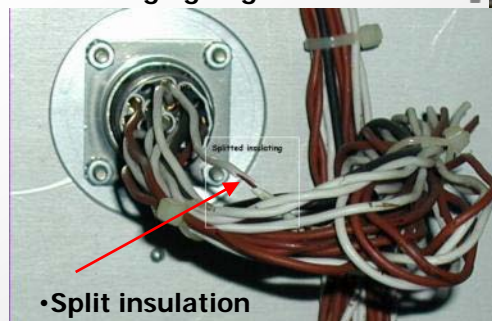


- Wire wrap
- Obsolete components

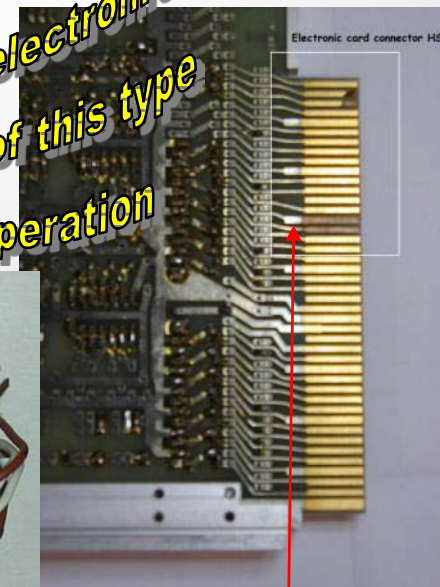


• ~ 6600 electronic modules of this type are in operation

Cabling ageing



- Split insulation



- Damaged gilded contacts



• 330 power converters in operation
• 50 spares

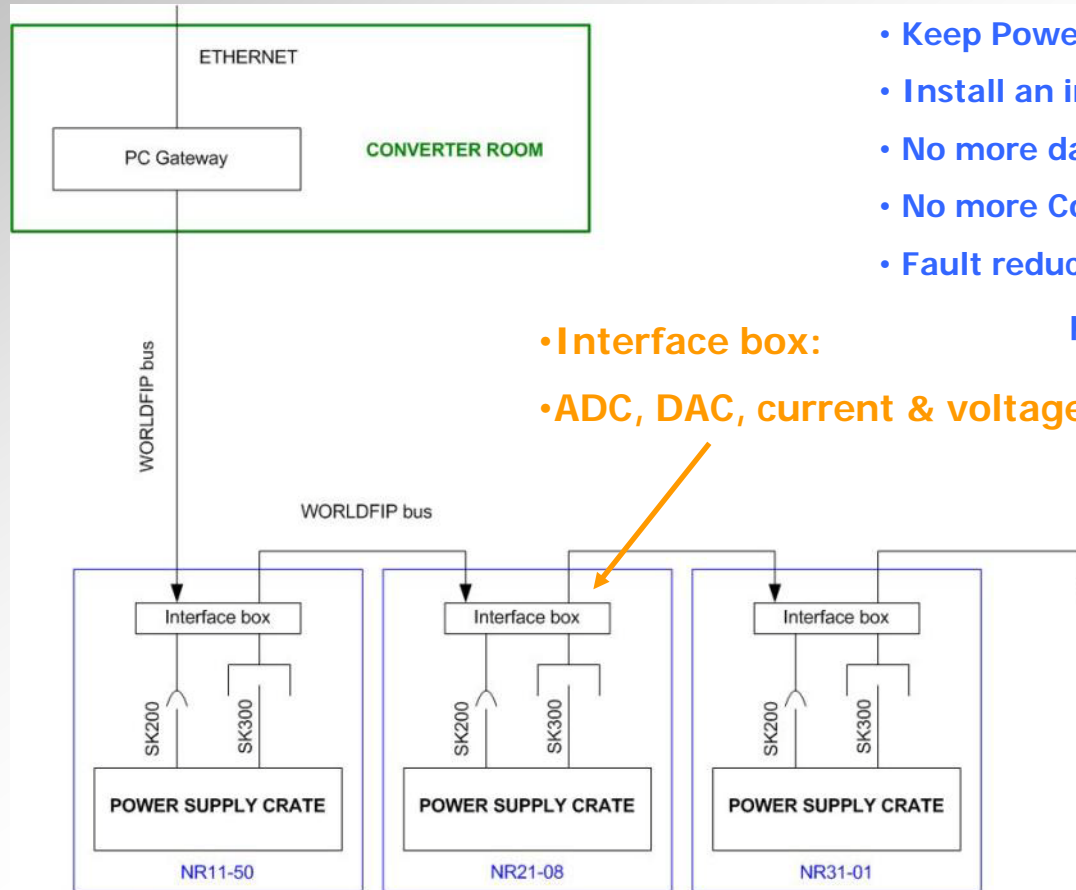
TECHNICAL SOLUTIONS

- ◆ **Replace 180 power converters ($\leq 500A$) by new switch-mode power converters.**
 - C11 250A / 100V
 - R11 500A / 150V
 - R12 500A / 300V
- ◆ **Renovate 150 thyristor converters.**
 - R21 1000A / 300V
 - R22 1500A / 250V
 - R31 2500A / 255V
 - R41 6000A / 600V
 - D21 1500A / 200V
 - D31 2500A / 285V
- ◆ **New electronic control (FGC3 + Worlfiip)**

CONSOLIDATION PLANS

- ◆ **Provisional schedule: 6 years**
 - 2 years studies and contracts
 - 4 shutdowns for implementation
- Budget : 20 MCHF
•Manpower: 19 FTE

Second proposal: Deploy WORLDFIP up to the power converters



- Keep Power Supply crate
- Install an interface box inside all power converters
- No more databus faults
- No more Converter crate faults
- Fault reduction: at least by 60% on bending magnets power supplies (less than 50%)!!!

• Interface box:

- ADC, DAC, current & voltage regulators, command & status

- Interface box will include FGC3
- New DCCT can be easily installed
- Next step:
 - Renovate power part
 - Replace Power supply crate

Advantages

- ◆ **Use WORLDFIP** => CERN standard data bus for power converters
 - As already planed in the consolidation
 - Anticipate the data bus deployment

- ◆ **Use FGC3 control system** => CERN standard control system for power converters
 - As already planed in the consolidation project
 - Anticipate the FGC3 deployment
 - FGC3 hardware will be reused after the power converters renovation
 - FGC3 project is already in progress => Synergy & Convergence

- ◆ **Manpower** => Save at least 0.5 FTE / year
 - Reduce the number of piquet interventions
 - Reduce the maintenance works for electronic cards

- ◆ **Operation** => Improve reliability
 - Reduce the number of faults
 - Improve the quality of the power converter data
 - Improve the magnet current control (replacement of DAC and ADC)
 - Some DCCT can be easily replaced by new ones (for Bends)

Improvement proposal before starting a global consolidation project

- ◆ Deploy WORLDFIP on “high” power converters (R21, R22, R31), 150 units / 330
- ◆ Use FGC3 to control the power converters (3 kCHF / PC)
- ◆ New DCCT in bending converters
- ◆ Budget allocated : 300kCHF (2010), 300kCHF (2011)

- ◆ Provisional schedule:
 - 2010 purchasing of material+ FGC3 production
 - 2011 WORLDFIP cabling + Software development
 - 2012 start with new converter control

- ◆ Manpower: 2 FTE
- ◆ Fault reduction: 60% on upgraded converters (30% in total)

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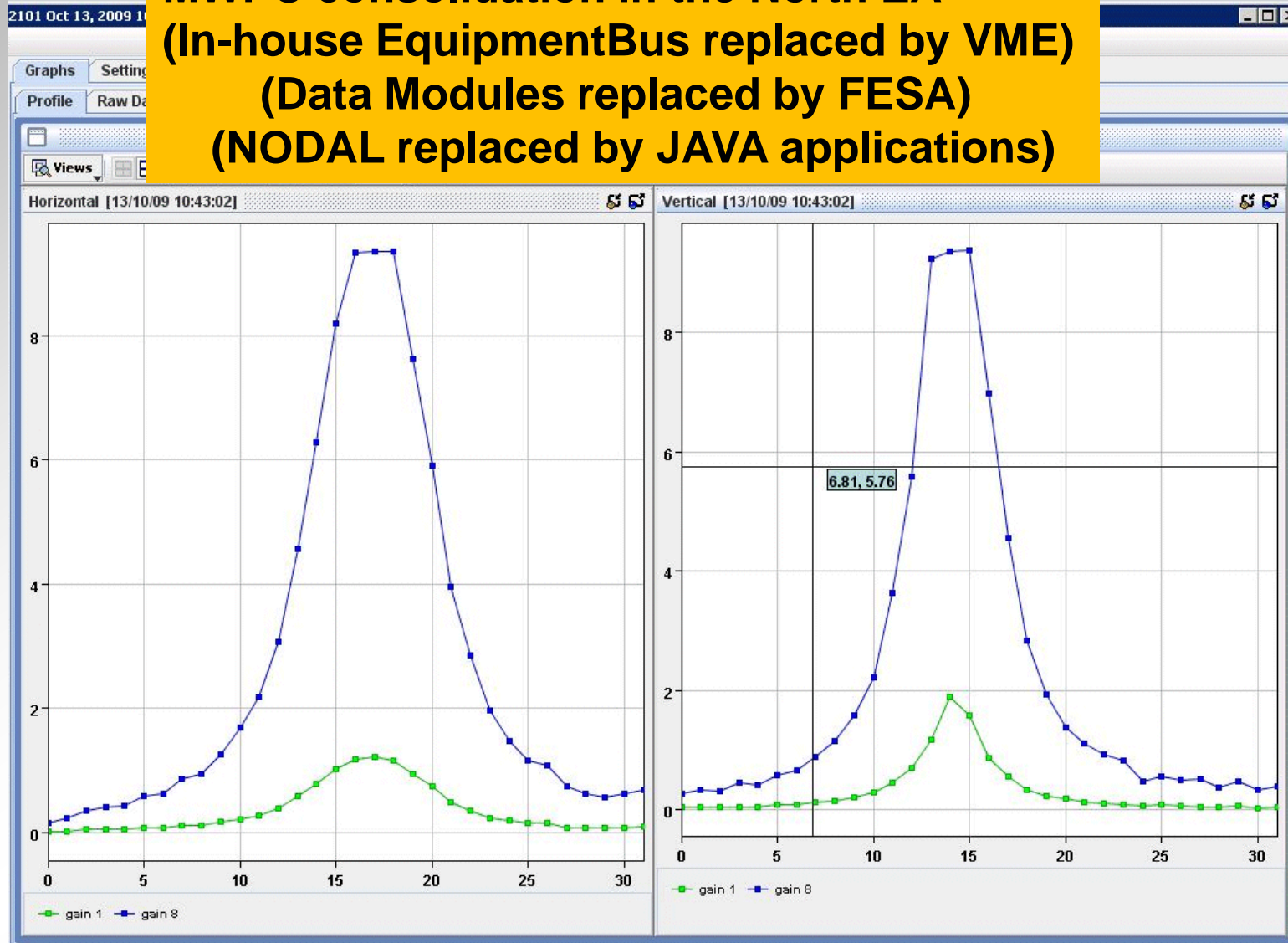
Cryogenics

inputs from M.Pezzetti (TE/CRG)

Networking in the
experimental hall

inputs from E. Sallaz (IT/CS)

**MWPC consolidation in the North EA
(In-house EquipmentBus replaced by VME)
(Data Modules replaced by FESA)
(NODAL replaced by JAVA applications)**

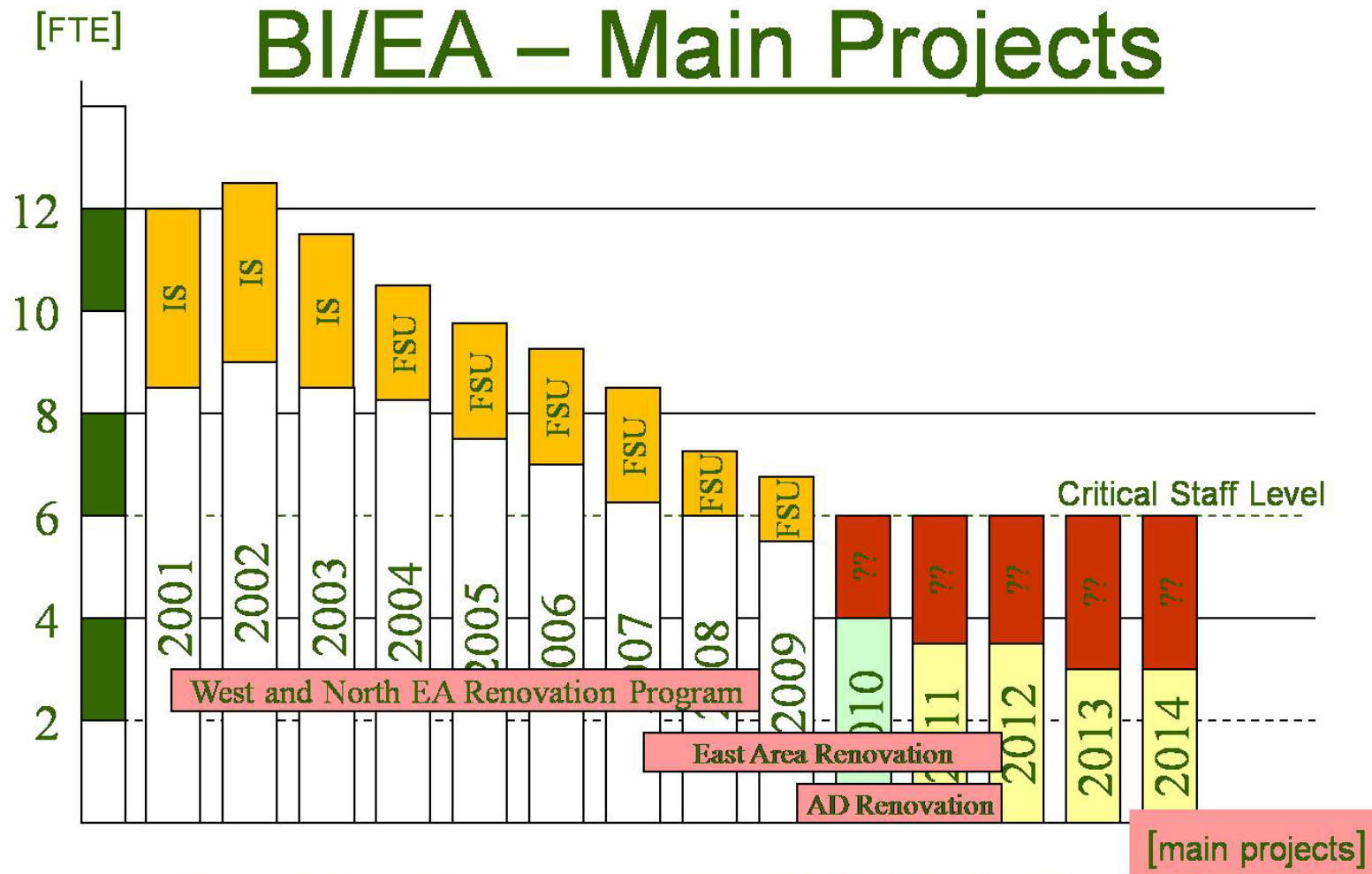


Beam Instrumentation: consolidation plan

Area	Device	State	Consolidation plans & comments
EAN	EXSCAL: Experimental Scaler	Operational	Consolidated in 2003
EAN	MWPC: Multi Wire Proportional Chambers	Operational	Consolidated in 2009
EAN	XCED: Cerenkov Differential counter with Achromatic Ring focus (CEDAR)	Operational	Consolidated in 2008
EAN	XCET: Cerenkov Threshold Counter	Operational	Consolidated in 2007
EAN	XDWC: Delay Wire Chambers / Spectrometer	Operational	Consolidated in 2006
EAN	XEMC: Electromagnetic Calorimeter	Commissioning	Consolidated in 2007 (upgrade application)
EAN	XFFV/XFFH: Filament Scintillator (Fast FISC)	Operational	Consolidated in 2005/2006
EAN	- XFFN: Normalisation Counter (using Fast FISC hardware)	Operational	Consolidated in 2005/2006
EAN	- XPHA: Pulse Height Analysis (Add-on for Fast FISC hardware)	Prototype	New development being terminated in 2010

Beam Instrumentation: consolidation plan

Area	Device	State	Consolidation plans & comments
EAN	XION: Ionisation Counters (Argonion)	Operational	Consolidated in 2003
EAN	XSCI: Scintillation Counters (Scintillator)	Operational	Consolidated in 2003
EAW	HiRad: Instrumentation for Mat. irradiation	Project 2010/2011	
EAD	MWPC: Multi Wires Proportional Chambers	Dying	Detector: Replace by Gas Electron Multipliers
EAD	XGEM: Gas Electron Multipliers		Installation of new detectors, local electronics, VME acquisition system, FESA and Java application during the 2010/1011 shutdown.
EAE	XDWC: Delay Wire Chambers	Operational	Installed in 2007, commissioned in 2008.
EAE	XSCI: Scintillation Counters (Scintillators)	Operational	Installed and commissioned in 2007
EAE	XSEC: Secondary Emission Counters	CAMAC ACQ Dying	Suppress CAMAC and install new VME hardware. Consolidation foreseen during the 2011/2012 shutdown.
EAE	XTEL: Telescope Intensity/Spill monitors	CAMAC ACQ Dying	Suppress CAMAC and install new VME hardware. Consolidation foreseen during the 2011/2012 shutdown.



Evolution of resources in AB/BI/EA (estimate)

❑ North Areas: Consolidation terminated last year.

- Equipment Bus Master maintained for Motors only (See Masi's slides).
- Multi Wire Proportional Chambers could still be upgraded to Gas Electron Multipliers like in the AD (profit from the needed upgrade in the AD).

❑ East Hall: Consolidation is ongoing.

- Old CAMAC electronics to be upgraded.
- Remote control of Telescope, SEC and Cerenkov still missing.

❑ AD Areas: Consolidation is being studied.

- Multi Wire Proportional Chambers have artifacts at low energy that can be overcome with Gas Electron Multipliers.
- Funded via AEGIS, but no qualified manpower.

❑ Know-how disappearing from the BI group.

- Present manpower for the experimental areas will have left by 2011!
- BI should consolidate expertise in the fields of MWPC, GEM and Cerenkov.

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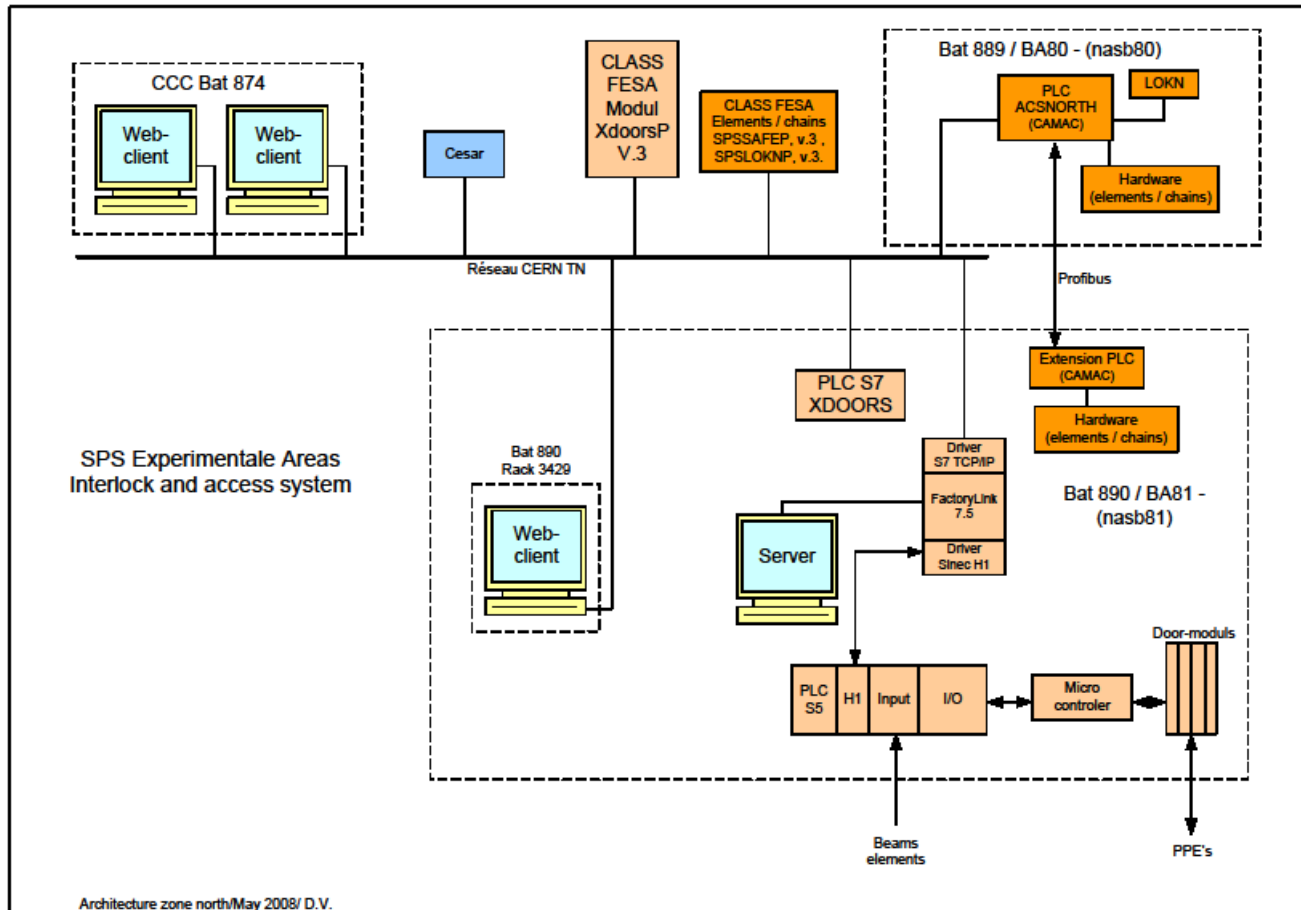
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Access system: main issues that presently affect operation



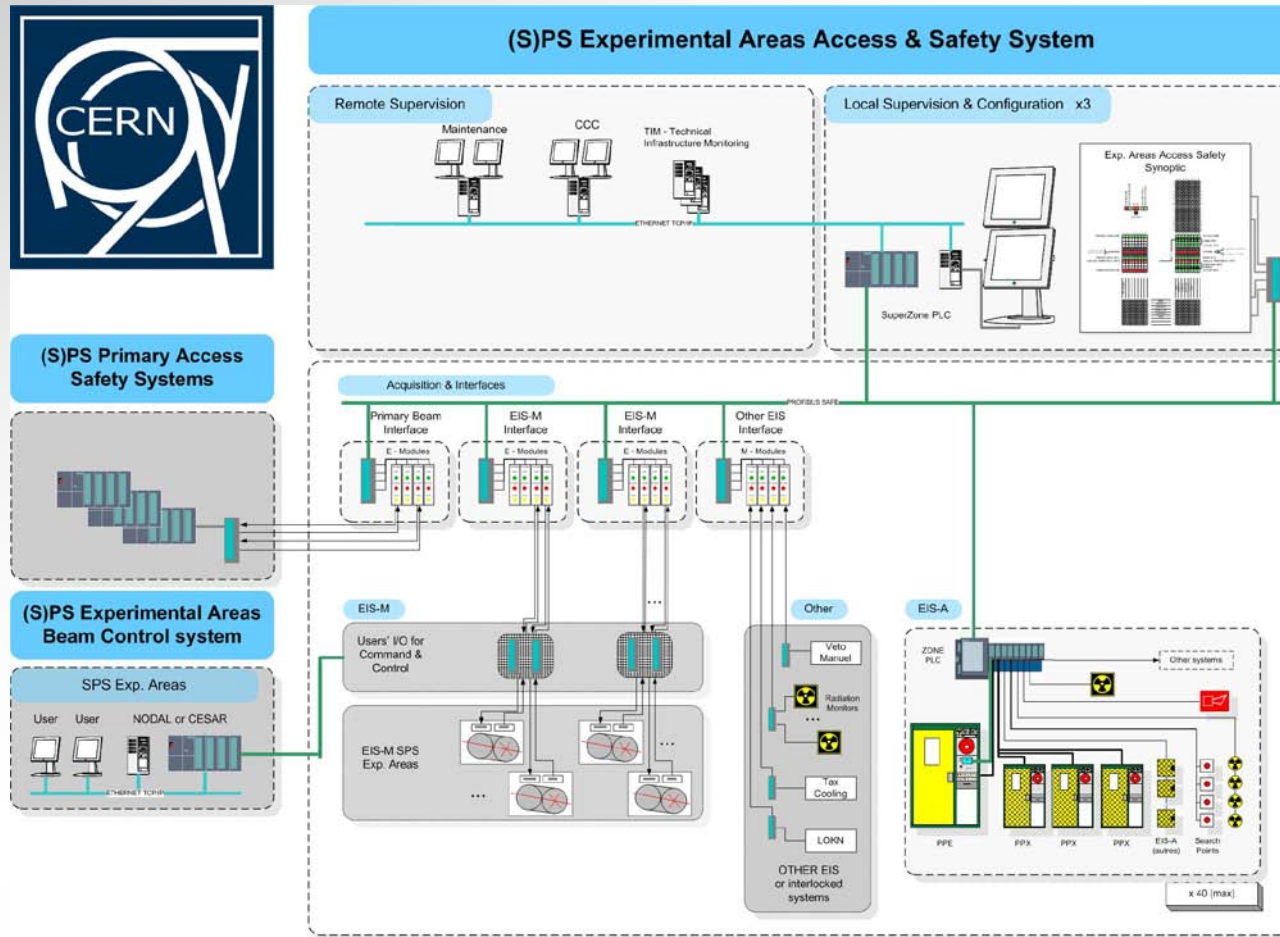
Low reliability of the system:

communication problems affects the operation due to the large number of software layers kept in place for historical reasons and to allow the interfacing with newer devices

Maintenance problems:

- Very old system
- Difficult to integrate the system in the new infrastructure

Installation of a new access system as the one installed in the PS experimental areas (i.e. PS AD and East Hall)



Consolidation project already approved and funded

Hardware already produced and test, software test in progress

Complete upgrade foreseen in 3 shutdowns (by 2011/2012)

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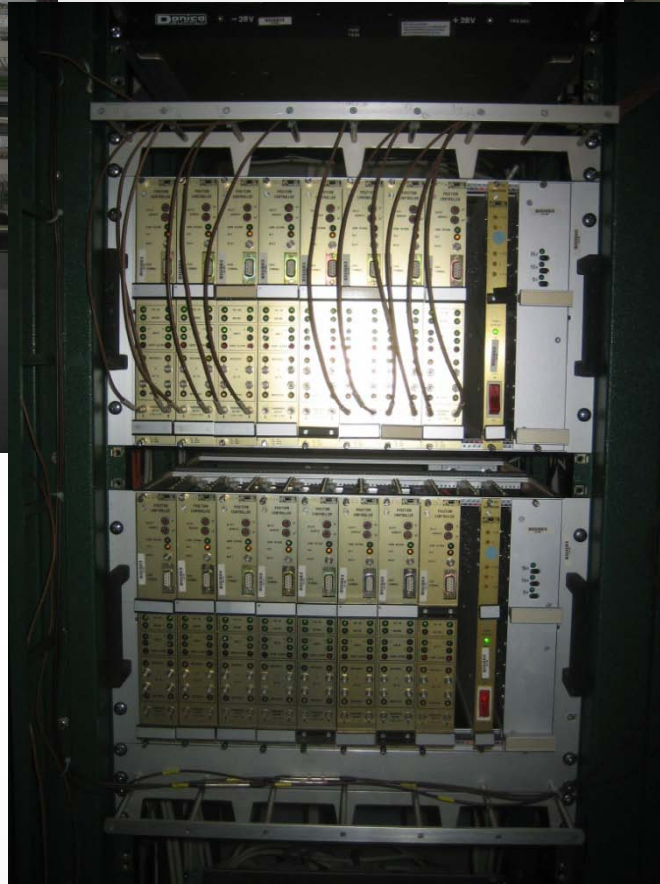
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Obstacles controls: main issues that presently affect operation



**Few spare parts
still available**

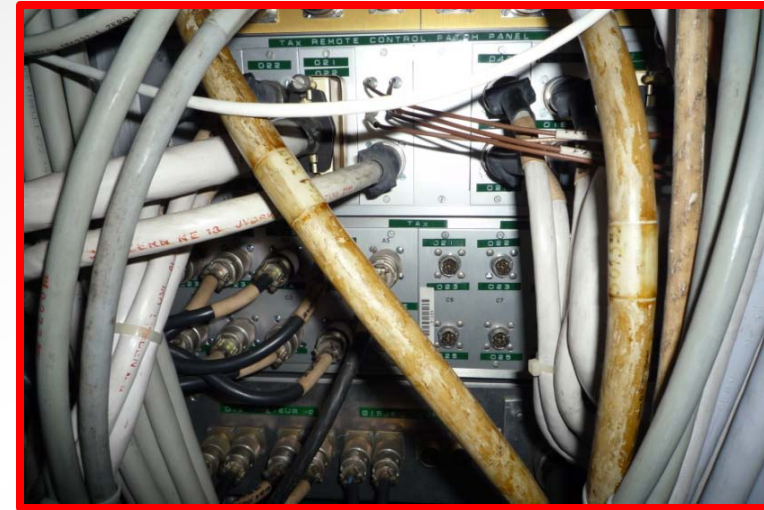


**Maintenance is becoming
difficult to sustain: Failure
rate very high due to ageing
of cables and hardware. In
average we had this year
more than 7 interventions
per month of 2h hours each**

Obstacles controls: main issues that presently affect operation



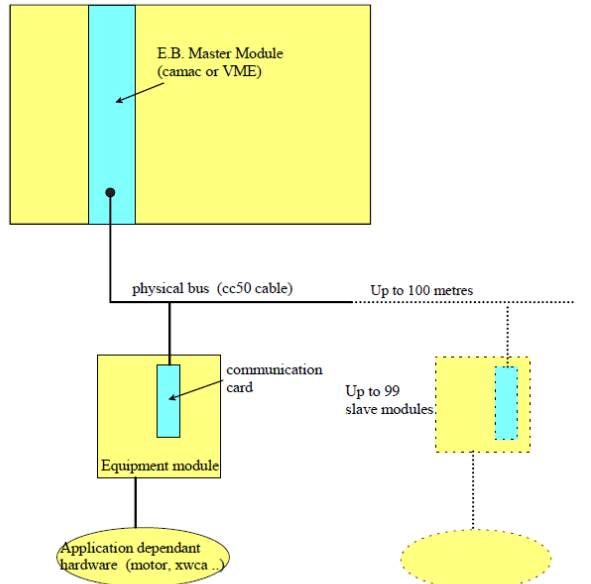
Cables aging



High failure rate of power supplies and controller box



Obstacles controls: main issues that presently affect operation



Known communication problems:

- Equipment Bus is not reliable, in particular when other software on same machine uses a lot of CPU or memory
- Known bug may cause data requested from one Position Controller to be returned as a request for another (out of sync)

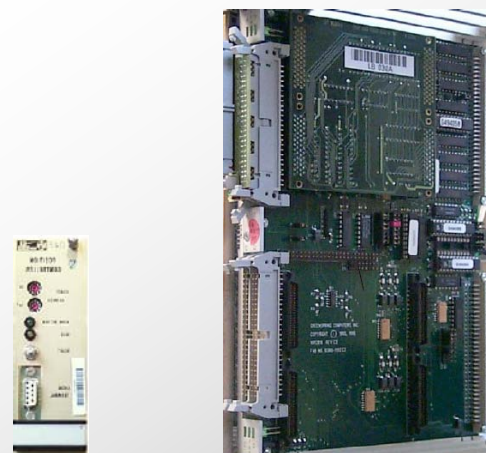
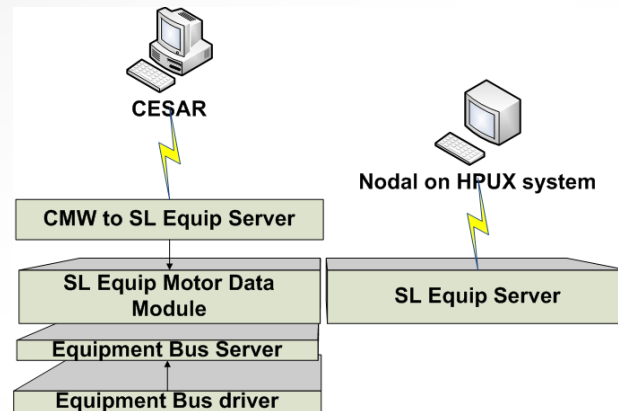
10 operational Equipment Bus Master LynxOS Front Ends:

V1n201, v1n351, v1n394,
v1n403, v1n438, v1n472,
v1n494, v1nb80, v1nx80,
v2n117

YELLOW CARD:

The communication infrastructure is not supported anymore by BE/CO

A. Bland is kindly still ensuring the support for the operation but until when????!!!!



E. Bus Master communication Card



Objectives: Replace the old controls with a new solution based on PLC and FESA gateway fully supported by CO starting from 2009/10 shutdown till 2011/12 shutdown

- **Phoenix modules on Profibus will be used to control DC motors and Siemens AC motor starters will be used for the AC motors**
- **The present VME crate that control motors of different obstacles will be replaced by a PLC**
- **New control software as well as new FESA classes to be developed**
- **New control chassis will replace the old position controller and power box in the racks**

In the meantime

Installation in this shutdown of 9 VME crates to isolate the Equipment bus master by BI applications. This should slightly improve the reliability of the communication and make easier the rebooting in case of failure

Obstacles Controls: budget, resources estimate and timeline

DATA MODULE	Device	BA80	HNC117	HNA494	HNB201	BX80	HNA351	HNA403	HNA438	HNA394	HNA472	N. Obstac	N. axes
MICMOT	XCRV/H (4 axes micro colli)					1							
	XCRT (2 axes Table x,y for micro coll)					1							
TAXMOT	XTAX (1 axis)	12	2									14	14
	EPB2-XSPL0934	1											
COMOT	XCSH/V (2 axes collimator)	7	1			6	1	6				21	42
	XCHV (4 xes collimator)	3	5	3	2	5		3				21	84
	XCON (converter 1 axes)					2		1				3	3
	XCBV (2 axes big collimator)				1							1	2
	XCLD (2 axes collimator with x,y adjust)		3									3	6
CONMOT	XCON (converter 1 axes)	2	1			2	1	9	1			16	16
	XTGT (1 axes secondary target)		1									1	1
EMOT	XEMC (1 axes electromagnetic calorimeter)								2	1		3	3
SCRMOT	XCMV/H (4 axes magnetic collimator)	1	1	5	3							10	40
	XCIO (IN-Out Converter 1 axes DC)	2		1		5				1		9	9
	XTDX (Horizontal IN-Out Dump 1 axes AC motor)						1			1		2	2
	XTIO (In/Out Tilter 1 axes AC motor)							1				1	1
	XTDV (In-Out Dump Pump Motor)								2		3	2	2
	XABS(Absorber IN/Out 3 AC motors)			9								9	27

	Already consolidated last shutdown
	To be consolidated in shutdown 2009/10
	To be consolidated in shutdown 2010/11
	To be consolidated in shutdown 2011/12

- The renovation should proceed by DATAMODULE to avoid conflicts in Cesar between old and new middleware
- Consolidating one shot all the devices concerning the same motorization type produce a considerable costs saving (i.e. materials discount and series production of the control chassis)
- It would be preferable to perform the entire renovation of a barrack

Obstacles Controls: budget, resources estimate and timeline

Shutdown	Data Module t.b.c.	Mot. Type	Devices t.b.c.	N. Devices, N. Axes	Barracks involved	Budget Required
2009/10	TAXMOT	AC	XTAX	14,14	BA80, HNC117	120 KCHF (allocated)
2010/11	COMOT, CONMOT, EMOT	DC	XCSH/V, XCHV, XCON, XCBV, XCLD, XCON, XTGT, XEMC	69,157	BA80, HNC117, HNA494, HNB201, BX80, HNA351, HNA403, HNA438, HNA 394	500 KCHF
2011/12	SCRMOT	AC	XCMV/H	10,40	BA80, HCN117, HNA494, HNB201	350 KCHF
		AC,DC	XCIO, XTDX, XTIO, XTDV, XABS	21, 39	BA80, HNA494, BX80, HNA351, HNA403, HNA438, HNA394, HNA472	

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Networking in the
experimental hall

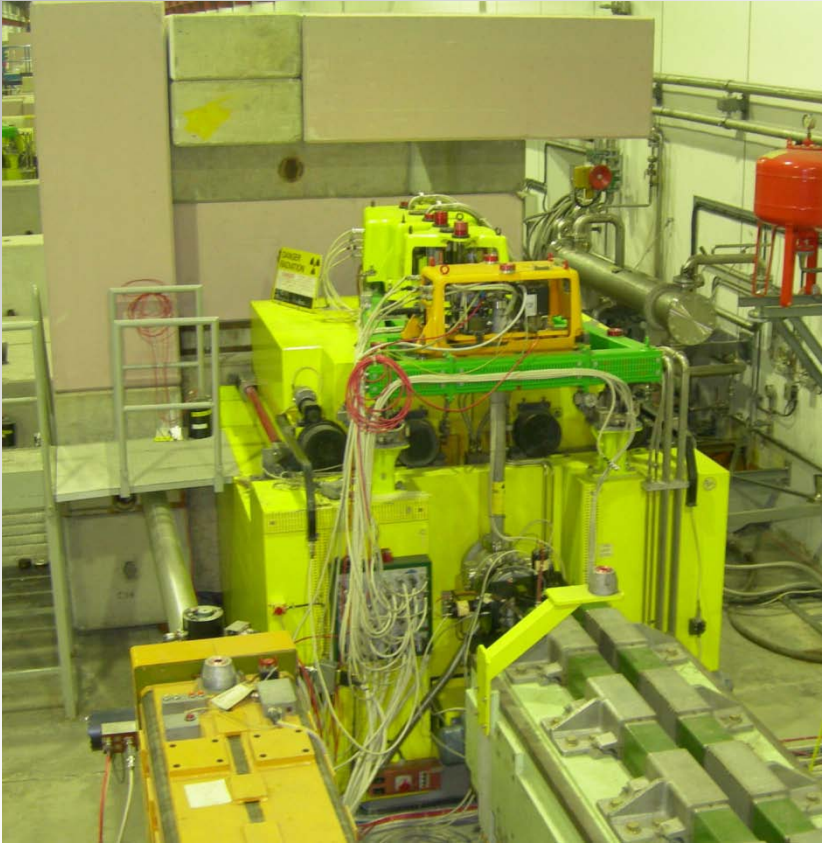
inputs from E. Sallaz (IT/CS)

The movable obstacles mechanics is in good shape. Yearly maintenance performed and covered by operational budget

BUT

- ◆ Target stations in the North (T2,T4,T6,T10) are in bad shape
 - Difficult to intervene
 - Regular maintenance very limited
- ◆ Operation of targets for more than some years (5?) would need a complete renovation (means new target mechanisms)

Strong aging due to radiation



- rust
- loss of oil
- cable breakage
- switches fails

-Mobile shielding of T6 doesn't open anymore



- ◆ Target stations in the North area will not be able to run reliably for another 5-10 years
- ◆ Some radioactive spare parts are available
- ◆ Renewal of the drivers for the monitors, the target boxes and the collimator plus two new spare chassis
- ◆ Consolidation budget for mechanics renewal of 750 kCHF over 5 years needed



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• **Important leak for the chilled water circuit**

→ **Pipe in very bad state (+ asbestos insulation)**

→ **incl. in the CV consolidation plan but not foreseen for the next 2 years**

• **Ventilation of the EHN1 Barracks : lack of spare parts.**

→ **no spare part for ventilation controller
Modification of the control cubicle**

→ **incl. in the CV consolidation plan but not for foreseen for the next 2 years**

• **Ventilation of the EHN1 Barracks regulation not compatible with the user needs.**

→ **the ventilation is not adapted anymore for the present need of the user**

→ **study and modification**

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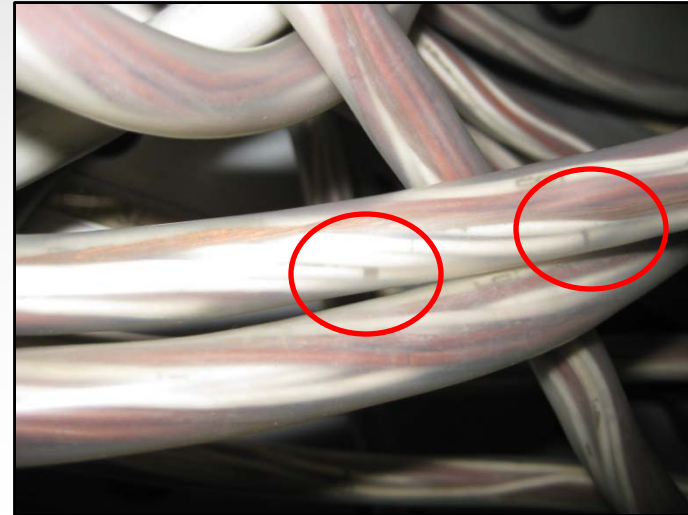
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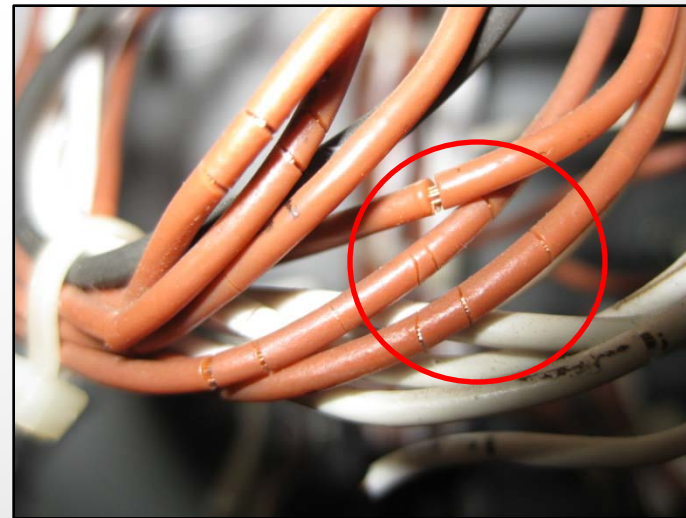
Current situation:

No major issue identified at the moment for the magnets in operation



Cracked insulation on interlock cables.

- > Risk of short circuit on the interlock electronic rack.
- > Risk of "shunting" magnet securities.



- ◆ **Strategy:**
Careful monitoring of the magnet, notably during each technical stop, during the run. Magnet piquet is available in any case 24/24 h.

- ◆ **Spare policy:**
Global program of certification of the magnet in storage currently ongoing. Following results, additional spare magnets and/or coils could have to be built. (E.g. MSN)

- ◆ **Auxiliary equipment:**
Interlock: Thermometer and Manometer contacts get corroded, triggering inconsistent machine stops;
Insulation of cables is cracked in the patch panels, securities of the magnet could be shunted.

Interlock systems will need consolidation in the future. A more modern system should be defined and implemented in the same time.

- ◆ **-Cooling:** Global replacement of EPDM/Kevlar water hoses and gaskets in TDC2 / TCC2

Will be implemented during shutdown 2010/11 (if sufficiently long)

- ◆ **Project:**
K12 beam line to NA62. Certification of the magnets that will be reused, in progress.

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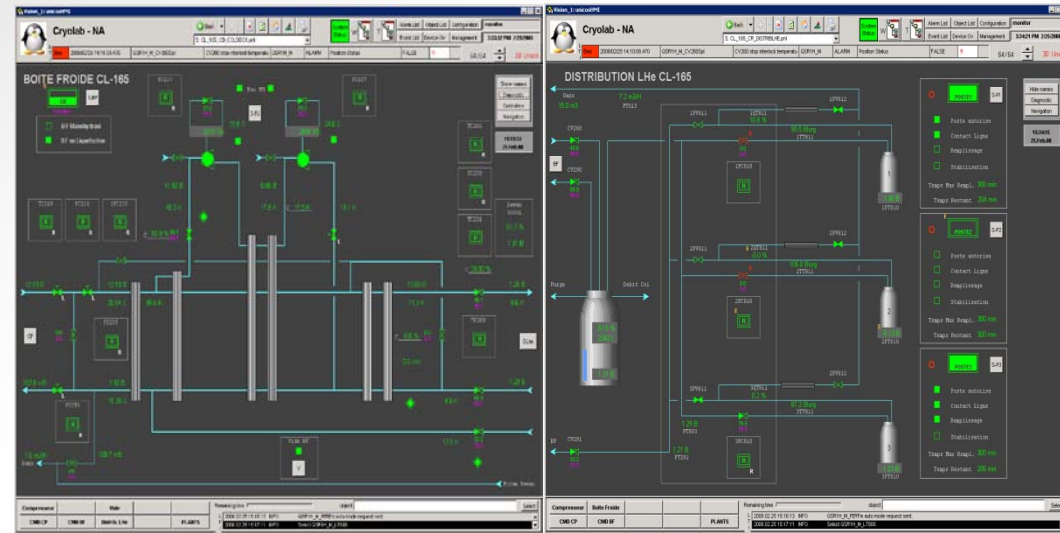
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Cryogenics: consolidation plan

- Upgrade of the cryogenic process control system (ABB to CERN/UNICOS) coupled to the Detectors He superconducting magnets for ATLAS H8, NA61 (1-2) and RD5 (in total 4 cryoplants).

- To be realized by TE/CRG/CE.
- Cost estimation 300 KCHF.
- Planning 2010/2011 included.



- Operating
- Workstation
- with PVSS



- Operating
- Workstation
- without PVSS



• Ethernet Technical Network

• Terminal
• Service

• Ethernet GPN



• Eng. Workstation

• PLC Premium

• Data Server PVSS

• Operation line

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**Networking in the
experimental hall**

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- **Networking infrastructure renovation in the North area halls HCN1, HCN2 and ECN3 completed in a couple of weeks**
- **10 new star points installed to replace the old coax outlets with new UTP ones and cover new requests**
- **New UTP outlets are going to be installed in proximity of the old ones**
- **Users are invited to move their devices on the new outlets and/or send request to IT/CS in case a new outlet is not made available close to an old one**

Conclusions: consolidation plans summary (not exhaustive)

	Shutdown 2009/10	Shutdown 2010/11	Shutdown 2011/12	Shutdown 2012/13	Shutdown 2012/13	Remarks
Obstacles Controls	upgrade of 14 TAX	upgrade collimators (COMOT, CONMOT,EMOT)	Renewal absorbers and IN/OUT (SCRMOT)			Provided that budget will be made available
Target mechanics		upgrade target mechanics T6	upgrade target mechanics T4	upgrade target mechanics T2	upgrade target mechanics T10	Provided that budget will be made available
Power Supply			upgrade bending magnets power supply			Partial consolidation plan (faults reduction 30%)
Beam Instrumentation	entire renovation of the instrumentations on equipment bus (now VME and FESA)					Manpower risk: no overlap between staff retired and new hired
Access System	upgrade access system H2-H4	upgrade access system H6-H8	upgrade access system M2-EHN2			
Cryogenics		upgrade control systems cryoplants for ATLAS H8, NA61 (1-2) and RD5				
Networking	Infrastructure renovation in north experimental halls					Installation of 10 new star points
Magnets		Global replacement of EPDM/Kevlar water hoses and gaskets in TDC2 / TCC2				
Cooling and V.				????	????	consolidation foreseen but not before 2 years