

Minutes of LHC-CP Link Meeting 22

- Subject** : LHC Controls Project
- Date** : 05 March, 2002
- Place** : 864-2-B14
- Participating Groups**
- | | |
|---------|--------------------|
| EST-ISS | P. Martel, |
| LHC-ACR | no representative, |
| LHC-ECR | no representative, |
| LHC-IAS | J. Brahy, |
| LHC-ICP | apologies, |
| LHC-MMS | no representative, |
| LHC-MTA | no representative, |
| LHC-VAC | R. Gavaggio, |
| PS-CO | F. DiMaio, |
| SL-AP | E. Wildner, |
| SL-BI | J-J Gras, |
| SL-BT | E. Carlier, |
| SL-CO | A. Bland, |
| SL-HRF | E. Ciapala, |
| SL-MR | R. Billen, |
| SL-MS | no representative, |
| SL-OP | M. Lamont, |
| SL-PO | Q. King, |
| ST-MA | P. Sollander. |
- Others** :
- A. Butterworth (SL-HRF),
 - A. Daneels (Planning),
 - P. Gayet (Core Team),
 - J-C. Guillaume (ST-EL),
 - R. Lauckner (Chair),
 - B. Puccio (Machine Interlocks),
 - R. Schmidt (Machine Protection),
 - M. Tyrrell (Alarm Project),
 - M. Vanden Eynden (Core Team),
 - J. Wenninger (Post-mortem)
- Distribution** : Via LHC-CP website: <http://cern.ch/lhc-cp>
Notification via: lhc-cp-info@cern.ch
- Agenda** :
- | | |
|--|----------------|
| 1. Matters arising from Previous Meeting | |
| 2. LHC-CP News | R. Lauckner |
| 3. Central Control Support | E. Hatziangeli |
| 4. Control Cables Requests | J-C. Guillaume |
| 5. Status of Post-mortem Work | J. Wenninger |
| 6. AOB | |

1. Matters arising from Previous Meeting

P. Gayet reported that the requested support for supervision of the new SPS vacuum installations has been provided by IAS group. H. Milcent has worked with R. Gavaggio to produce the necessary facilities. Concerning the coordination of fieldbus cables this subject was dealt with under point 4, below.

M. Vanden Eynden reported that some discussion has taken place with the QPS and Multipole Factory teams concerning their requirements for VME Front Ends that need to be included in the functional specification. However more information is still required.

ACTION: M. VANDEN EYNDEN

Concerning the VME crates for BI group in the Transfer lines and ring, J.J Gras reported that R. Jung and G. Baribaud had discussed this with Atlas specialists and it has been decided that BI will use the VME64X specification prepared by Atlas.

Ed Ciapala reported that a meeting had taken place to get information from the PS, the LHC Equipments groups and the operations team about requirements for the future Analogue Signals facilities. Minutes are being prepared. R. Lauckner said that he considered that it should now be possible to launch the work on this system.

ACTION: R. LAUCKNER

2. LHC-CP News R. Lauckner

R. Lauckner reported that the Interdivisional Working Group on Controls (P. Charrue, B. Frammery, R. Lauckner, P. Ninin and C-H Sicard) have made their final recommendations to Task Force 5 – restructuring accelerator sector. Structures for 1 and 2 controls groups in the sector had been presented and the proposal to strengthen central controls support within the sector. Both issues are contended and the task force did not make any recommendations.

PVSS license negotiations are almost complete but are awaiting validation tests by the cryogenics and CSAM projects.

Preparations are well advanced for the 3rd LHC-CP workshop. It is hoped to produce the final program in the coming week. Participants should register by mail to N. Boimond.

The Alarm URD has been released and the Timing Functional Specification is being approved.

3. Central Control Support E. Hatziangeli

E. Hatziangeli [presented](#) a status report of the work to define central support activities for controls at CERN that could be assumed by the IT division. This initiative was launched by the Controls Board who has nominated people representing the activities of interest. E. Hatziangeli from SL and A. Silverman from IT are carrying out the work. Users have been interviewed from the accelerator, technical and research sectors; they were requested to forget the present situation and consider the issues from a far perspective. The areas of support considered have been:

- Network

- Fileservers and filesystems
- Operating Systems
- Oracle support
- Web infrastructure
- Software development tools.

In each of these areas the common support requirements of the CERN users are being identified and translated into a set of Service Level Agreements. It is planned to publish the proposal in April 2002.

Making some observations E. Hatziangeli commented that IT have understood that there is a need for 365 x 24 hour support. Nevertheless the potential clients have not yet been convinced that IT have the aptitude to provide operational support for CERN's technical and accelerator complex. There may be a need for local duplication of services and user's themselves must resolve conflicting requirements. While today, certain IT services are very much appreciated by users these are sometimes offered on a goodwill basis which would be incompatible with a commitment to guarantee services.

R. Lauckner asked how quickly action might follow these recommendations. E. Hatziangeli considered that where new implementations are already planned the associated support might be put in place on a similar timescale. More grey areas such as introducing 24 hour support and establishing support for software development tools will be slower.

A. Bland insisted that the current IT procedure for requesting support: requests to a central support point and electronic follow-up, was unacceptable. E. Hatziangeli replied that IT understands that direct access to specialists is required.

R. Schmidt wanted to know how the TCR obtains 365 x 24 hour support today. It emerged that various colleagues from IT and SL supply services, network, server and database support on a goodwill basis. In addition hardware is installed close to the TCR and operators can resolve certain problems themselves.

F. Di Maio pointed out that PS operators use the services of the operators in IT to resolve difficulties with their servers that are operated by IT.

E. Hatziangeli warned that IT would not accept new responsibilities without proper resourcing.

4. Control Cables Requests J-C. Guillaume

R. Schmidt introduced this subject pointing out that at the last TCC it had become apparent that requests for Controls Cabling are far from complete. J-C. Guillaume had been invited to the present meeting as the most effective way to pass the message to the controls community.

J-C Guillaume **reminded** the LHC-CP that each group is responsible for requesting and budgeting its own Control cables. His responsibility does not include optical fibres. It is now urgent for Controls Cables requests to be submitted and the deadline of March 15th, 2002 was announced at the recent LHC TCC meeting. He gave instructions for how orders are to be made and pointed out that cable trays must be included in the integration work and that by foreseeing and grouping needs economies of up to 18% can be made. Appreciating that some groups may find it difficult to foresee all needs he pointed out that costs will probably increase and in any case the missing requests should be identified.

A large number of high cost junction boxes for WordFIP have been installed for String 2 and J-C. Guillaume requested confirmation that the same practice will be used for the machine with the ensuing cost to users. The WorldFIP coordinator in LHC-IAS will be asked to address this issue.

ACTION: P. Gayet

R. Lauckner asked if optical fibre requests were to be made in the same time frame. JCL replied that Luit de Jonge is responsible for optical fibres but he confirmed tubes are to be treated in the same time frame. (Secretaries note: de Jonge was contacted after the meeting - he is organising an information meeting for users)

In summary while the TEWG have identified many cable needs their work has been restricted to the arcs. Many requests are missing, the examples of Front End cabling and Timing Cabling were raised during the meeting. R. Lauckner emphasized that it is now the responsibility of the controls linkmen to take this message back to the groups who are directly responsible for ordering their own controls cables.

ACTION: ALL LINKMEN

This subject has also been covered at the TCC meetings of 23rd November, 2001 and 1st March, 2002.

5. Status of Post-mortem Work J. Wenninger

J. Wenninger **recalled** the global architecture of the Machine Interlock system which is split into the Powering Interlock System and the Beam Interlock System. The future post-mortem (PM) facility will be tightly coupled to these systems and other beam related systems and loosely coupled to the technical services. He compared the PM data to a particle physics event. It will be a snapshot of the LHC during a short interval before and after a beam or power abort. It will contain all relevant equipment and beam information to understand the cause of each failure. It requires data buffers that will be frozen by a PM trigger.

Systems will require an external trigger, be self-triggering or be un-triggered. The external PM trigger will be carried over the General Machine (slow) timing and must arrive with a latency of 1 ms.

The PM system will be required from the early commissioning phases of the sectors. Many systems must be monitored before beam operation. When beam is present a full PM recording will be made. It is also necessary to foresee testing of PM with beam but this must only be possible with low intensities.

Data buffer depths and time resolutions are very process dependent. Tentative figures for these parameters were presented and discussed. Data formats must be pre-defined system wide and should be self describing, perhaps employing XML. Finally unforeseen channels may need to be added at any time.

Data analysis techniques are expected to evolve with operational experience of the system. However online analysis to locate faults and causes will be required and analysis tools must support this as there will be far too much data to browse! Data compression, data tagging, and off line archiving were also presented.

The PM team has also looked into the issue of general analogue signal facilities and found similar functional requirements. The same system should serve both needs, for example a view of the continuous PM recording should be available on request.

Documentation of the studies is in progress and major milestones for the design and implementation were presented. However resources must be foreseen for design and implementation.

M. Lamont wanted to know if the BST will be used to trigger a post-mortem action in the instrumentation. J.-J Gras explained that he intends to receive the post-mortem trigger after a beam dump and broadcast it over the BST.

M. Vanden Eynden said that as the data collection for post-mortem will pass through the LHC Front Ends he needs to include the associated requirements in their specification. In particular as machines will be diskless so he would like to know the implication for memory requirements.

ACTION: M. Vanden Eynden

A. Bland asked if UPSs would protect equipment in the post-mortem chain? R. Schmidt said UPS must protect post-mortem equipment and that equipment should not provide its own battery type protection. Q. King pointed out that UPSs are not foreseen for the power converters, including the embedded current controllers. There will be a real time flow of information to the gateways but this will be interrupted when power fails. R. Schmidt said that that it was very important to monitor energy extraction even in these circumstances.

ACTION: R. SCHMIDT, J. WENNINGER

6. AOB

R. Schmidt commented on the approval procedure that has been launched for the Timing Functional Specification. The list of people on the approval list should include all the users of the LHC Timing System.

Long-Term Actions	People
Underground Control Rooms requested	R. Lauckner
Establish Post-mortem sub-project	R. Lauckner
Clarify Middleware Services to be used by LHC-CP	Core Team

Reported by R. Lauckner

IT Support Requirements for CERN Controls

E. Hatziangeli

Outline

- # The Mandate
- # The Users and their Requirements
- # Areas of Support
- # Common Requirements
- # Observations and Conclusions
- # Work phases and Milestones

5th March 2002

E. Hatziangeli (SL/CO)

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The Mandate

Define as a service level agreement the IT support requests for CERN controls activities.

People involved:

- n E. Hatziangeli (SL)
- n A. Silverman, representing IT division

CB nominated representatives of the accelerator and technical sectors

- n representing the various areas of support
- n assisting with URs

Work started October 2001

The Users and their Requirements

Interviewed ~40 people in 8 two hours sessions

- | | | |
|-----------------------|--------------|-----------------|
| n LHC/IAS | n ST/MO (MA) | n SL/CO |
| n LHC Cryo project | n ST/AA (MA) | n SL/OP |
| n LHC/VAC (QRL tests) | n ST/EL | n SL/BI |
| n PS/CO | n ST/CV | n SL/BT |
| n IT/CO | n EDMS | n SL/EA (Cesar) |

No assumption were made based on existing IT services

- n Existing services to be continued as are
- n Existing services to be upgraded
- n New services

All requirements were recorded, prioritized and confirmed by the interviewees

5th March 2002

E. Hatziangeli (SL/CO)

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5th March 2002

E. Hatziangeli (SL/CO)

4

Areas of Support

n Network

Exploitation of the network infrastructure for controls

n Fileservers & File Systems (AFS, NFS, DFS)

Support and deployment of central AFS/NFS services

Operation of large file servers

n Operating Systems

Support of W2000 and of Linux as OS for controls

n Oracle support

databases & tools

n WEB infrastructure

Support of a web infrastructure and of the associated publishing tools

n Tools

PVSS, PLC eng. tools, LabView, 3rd party, SCM, dev. tools, Java dev.

5th March 2002

E. Hatziangeli (SL/CO)

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Common Requirements

Network support

n Official support for controls & services network 128.142.##

n Security: need for **controls private** subnet

Protection from offsite access

Isolation when required

n High availability during beam

24hx7d

Uptime 99.9%

n Short "**response + back to service**" time ~ 1 - 4h

n Need to **monitor/diagnose network problems** from CRs

n Need **priority access** to IT resources when problems

n Secure access to controls from outside CERN

n Forum for new requirements/feedback

General satisfaction with current level of support

5th March 2002

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Common Requirements

Fileservers, File Systems

n Vital operational servers support on highest priority

n Access to files independently from all file systems (AFS, NFS, DFS)

n Available IT supported technology BUT clients must be consulted

OS

n Exempt from default upgrades/patch distribution

n Security groups for users or/and consoles to assign/publish applications

Oracle

n Considered as the best IT supported service

n High availability

n Support for 3rd party tools

n Oracle on Linux

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Common Requirements

PLC

n Database for PLC (cards, drivers)

n Conformity of installation

n Secure web servers

WEB

n Secure web servers (no visibility offsite)

n Proxy to access Internet

n Policy for PVSS web servers

Tools (PVSS, PLC eng. tools, LabView, 3rd party, SCM, dev., WEB publishing)

n Should be supported and configured by IT

n Centralized support for tool licenses, installations and upgrades

n JVM available and centrally supported

n Support for Java development tools (IDE, Optimizers, etc.)

n SCM central support

n 1st level support for PVSS

5th March 2002

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Observations and Conclusions

- # Controls groups need to be convinced that IT could provide the level of support necessary for operations
 - High priority problem resolution **24hx7d** during run time
 - TCR **24hx365** for many central IT services
- # Local duplication of services to ensure high availability
- # Conflicting requirements (private network vs. offsite access)

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Observations and Conclusions

- # Need for improved communication between Accelerator controls groups and IT support units
 - Users not consulted early enough before changes in IT services
 - Description of basic IT services
 - Forum for discussions
- # Several common requirements across SL, ST, PS, LHC
 - Centralized support makes good sense
- # Solution differ for similar problems
 - Rationalization of solutions and support is necessary
- # Tendency for divisional dumping

5th March 2002

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Work phases and Milestones

- # Interviews Accelerator Controls groups
 - n **December 2001 => Done**
- # URD Document: Confirmed and Completed
 - n **February 2002 => Done**
- # Present URD to IT and document response
 - n **March 2002 => In progress**
- # Iterate support proposal with the users
 - n **March 2002 => In progress**
- # Draw Final Support proposal
 - n **April 2002 => In progress**
- # Present support proposal to CB
 - n **End April 2002**
- # Published accepted Support proposal
 - n **April 2002**

5th March 2002

E. Hatziangeli (SL/CO)

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Câblage LHC

Rappels

- Rappels
- Situation générale actuelle
- Besoins
- Pourquoi ?
- Conséquences

JCG / TCC / 01-03-2002

Câblage LHC

Rappels

- Chaque groupe finance le câblage contrôle qu'il demande.
- La participation définie concerne les campagnes de tirage planifiées.
- La part de chaque groupe sera corrigée en fonction de ce qui est réellement installé. Transparence de ce qui est fait !!
- Ne concerne pas les fibres optiques.

JCG / TCC / 01-03-2002

Câblage LHC

Besoins

Pour le 15 mars 2002:

Soit:

Mémorandum avec les quantités de câbles prévues pour le LHC
(Les DIC correspondantes au plus tard le 15 mai pour en permettre le traitement)

Soit:

Les Demandes d'Installation de Câbles (DIC)

Mais dans les deux cas des schémas synoptiques

JCG / TCC / 01-03-2002

Câblage LHC

Pourquoi ?

- Besoins pour la définition des échelles à câbles et pour leur intégration.
 - Insertion en câblodthèque, longueur, cheminement, approvisionnement.
- Votre intérêt:
- Achat des câbles groupé pour obtenir des prix intéressants.
 - Organisation des campagnes les plus rentables possibles. Définition des moyens.

JCG / TCC / 01-03-2002

Câblage LHC

Conséquences

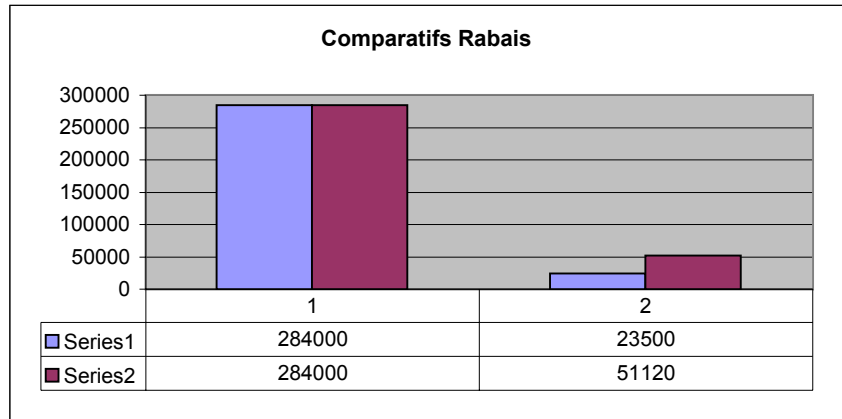
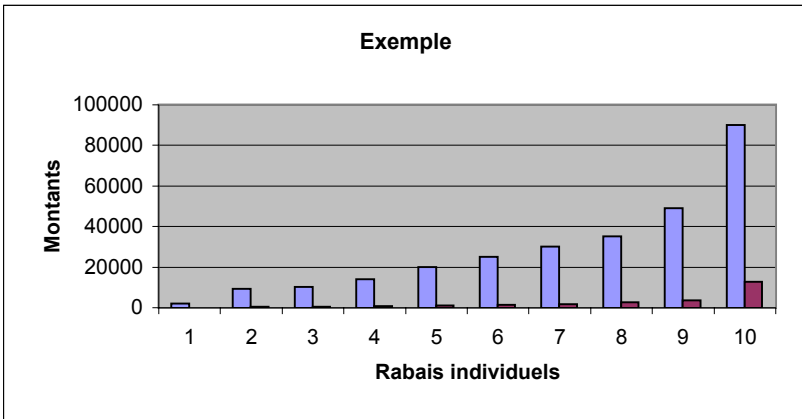
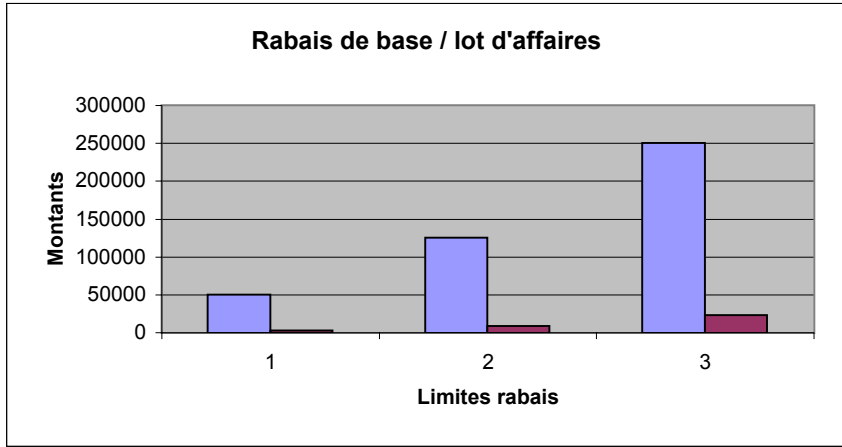
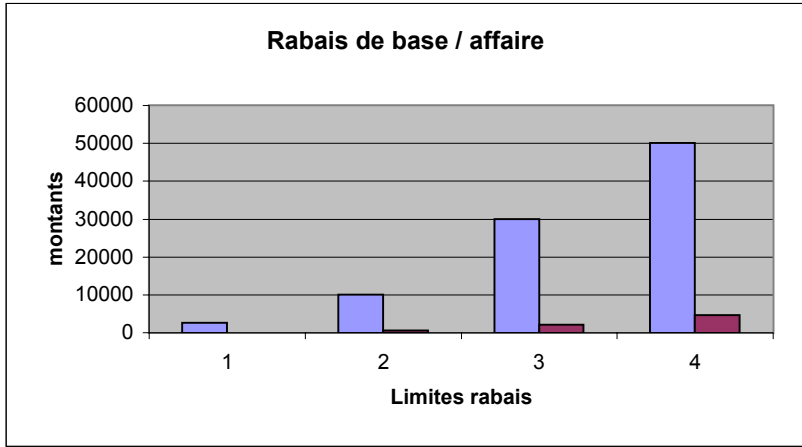
Dans le cas où les informations sont manquantes:

- 1) La fourniture des câbles sera vraisemblablement plus chère, (fc volume)
- 2) L'installation des câbles sera plus chère (hors campagne),
- 3) Modification du planning d'installation. (créer une nouvelle fenêtre d'intervention)

Câblage LHC

Si cela n'est pas possible:

Identifier ce qui n'est pas compté.



Dans l'exemple et compte tenu de la somme de 284KCHF; les rabais sont de :

Série 1: 8,27 %

Série 2: 18 %

Différence: 9.73 % du montant total.

	Groupes	Qté 23-11-2001	Qté 01-02-2002	Situation actuelle	
1	LHC-VAC	830000	650500	Simplification du câblage dans les parties courbes / attente confirmation pour le reste	(-179 km)
2	ST-EL	180000	179850	Status quo /recalcul des longueurs suite à la version 6.4	
3	LHC-ICP	187000	186955	Manquent câbles Interlock + résistances quench /attente confirmation pour le reste	
4	LHC-ACR	190000	189484	Parties courbes définies - Reçu qqes schémas de principe sections droites / attente confirmation	
5	SL-BI	495000	494447	Status quo / attente confirmation	
6	ST-MA-DET	50000	175090	Report des signaux dans les SR; définition du matériel -> augmentation du câblage	(+125 km)
7	ST-MA-AC	307000	307728	Status quo / attente de renseignements	
8	ST-MA-AL	31000	30458	Status quo / attente de renseignements	
9	SL-PO	70000	69480	Points à éclaircir avec SL-CO et LHC-ICP / confirmation par les groupes concernés.	
10	EST-SU	185000	74760	Simplification du câblage et du matériel.	(-110 km)
11	SL-MS	74000	73880	Renvoi des informations en SR / confirmation en attente	
12	SL-CO	50000	49965	PIC: Confirmation en attente / manque Beam Interlock Control	
13	SL-BT	27000	38186	Reçu qqes DIC UA/RA pts 2,6 & 8 / attente pour le reste (PM).	(+11 km)
14	SL-RF	234000	234080	Diminution nbre de câbles - long. reste / attente confirmation	
15	TIS-RP	0	0	Appels d'offres à faire par TIS/RP; câblage reporté	
	Total	2910000	2754863		
	Différence		155137		

Status of Post-Mortem

J. Wenninger

for the post-mortem team,

E. Ciapala, F. Rodriguez Mateos, R. Schmidt and J. Wenninger

Introduction

The LHC machine protection / interlock system is split into 2 sub-systems.

§ Powering Interlock System

Provides independent interlocking of each powering sub-sector (one or more cryostats) through one Power Interlock Controller (PIC).
Each powering sub-sector can be powered independently.

§ Beam Interlock System

Gives permission to circulate beam via the Beam Interlock Controllers (BIC) which concentrate all the interlocks relevant for beam operation.



Implications for post-mortem

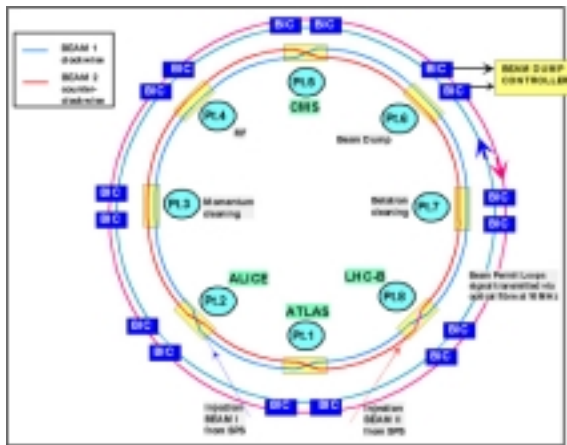
Beam interlock system

There will be :

- 16 BICs
- ~ 30 PICs

The **Beam Permit Loop** connects all BICs to the beam dump.

One Loop per beam.



The PM data

The post-mortem data set should be considered as the equivalent of a **particle physics experiment event**,

a 'snapshot' of the LHC during a short interval before and after a beam or power abort.

- The aim is to be able to understand the cause(s) of each failure.
- The data must contain all relevant beam measurements and all equipment information.
- The PM data requires data buffers that must be frozen whenever a power or beam abort is happening PM trigger.

PM trigger

The LHC equipments can be grouped into **3 distinct classes** according to their **triggering mode** :

- **Systems requiring external triggering**
Beam instr., Power converters, RF, ...
- **Self-triggering systems**
Quench protection, Vacuum (valves), Beam dump, Power converters (faults), ...
- **Un-triggered systems**
Interlock system (PIC & BIC), Alarm system, Trim recordings, ...



PM system will have to deal with this !

PM trigger generation

- The external PM trigger will be send over the **GM timing system**.
- Triggers should be generated by a 'module' observing **the state of the Beam Permit Loop** :
 - use one of the BICs ?
 - dedicated module ?
- Latency of the trigger : **~ 1 ms (10 turns)** , not much more !
requirement for the timing system.
- The system should be '**armed**' before injection (**as part of the injection sequence**)
avoids generation of spurious triggers.

PM operation modes

There are **3 basic operating modes** for PM :

- § **Operation without beam**
- § **Operation with beam**
- § **Test mode (with and without beam)**

Other possibility/variations :

- collection of a subset of data during injection setup/test ?
- collection of a subset of data for operator triggered dumps ?
(at injection ?)
- ...

PM mode : no beam

During commissioning, cold-checkout, ... each powering sub-sector is operated independently.

- A power abort in a given sub-sector should only provoke a PM data collection for that sub-sector !
- Key systems involved in powering :
PCs, quench protection, power interlocks, cryogenics (?)
- To avoid the need for distinct events for each sub-sector
all key systems should be **self-triggered** (on faults).
- The state of the PIC triggers the PM data collection .

PM operation : beam

- The 'text book' mode for a full PM recording !
- The PM timing event must be generated :
transition of Beam Permit Loop to BEAM-OFF.
timing event delay ~ 1 ms required.
event generation must be enabled (armed) as part of the injection procedure.
- **Special case** : dump of one out of 2 beams.
 - Not excluded (required !?) at injection.
 - **Proposal** : **no PM recording** for this deliberate dump.
(except for the beam dumping system)
 - If the second beam becomes unstable (due to the first dump) rely on the buffer depth to cover the event sequence.
depth ~ 30-60 seconds is completely sufficient.

05/03/2002

Post-Mortem - J. Wenninger

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PM test mode

- **It must be possible to test the PM with beam in LHC !**
- **Proposal** :
 - tests are only allowed with **low intensity beams** (below damage threshold – to be defined) at **injection**.
 - timing event generation : could profit from the proposed interlock system for injection of high intensity beam which requires a BCT coupled to the interlock system.
prevent test triggers with 'high' intensity beam.
- This mode **provides the opportunity for accelerator physics experiments with low intensity beams.** We may actually have a mode where we read out only beam instrumentation...

05/03/2002

Post-Mortem - J. Wenninger

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Buffer depth

The characteristic time scales of faults span a few orders of magnitude !

Examples :

- **The shortest timescales** :
PCs off on warm magnets dump within ~ **3-5 turns !**
- **The longest timescales – before trigger** :
~ **seconds** for cold magnets (correctors).
- **The longest timescales – after trigger** :
~ **few minutes** for the energy extraction.

Before trigger :

- § **Buffer depth of ~ 30 seconds (not yet fixed).**
- § **High resolution (turn by turn) ~ 1000 turns (if applicable).**

After trigger – mainly post-quench monitoring :

- § **Very strongly system dependent – case-by-case.**

05/03/2002

Post-Mortem - J. Wenninger

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Times-tamping & format

(Relative) time-stamping accuracy :

- § For most systems : ~ **1 ms is OK.**
- § For 'high resolution' systems (BI,RF,BT) : **better than 1 turn.**

Do we need GPS/IRIG-B connections in each point or is the GM timing OK ?

Data format :

- § **Self-describing**
- § **ASCII XML format**

The PM system should be flexible and open for new channels at any time.

05/03/2002

Post-Mortem - J. Wenninger

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Data analysis

- There is too much data to browse through !
- We must run the data through an **online analysis** to determine :
 - § which equipment is in a wrong state ?
 - § who was first ?
 - § what did the beams do ? [Orbit RMS, beam loss, current, ... evolution over last 1000 turns]
 - § ...
- ...and to generate **summary/processed information** :
 - § for the operation crew
 - § for the machine history
 - § for future offline analysis
 - § ...

05/03/2002

Post-Mortem - J. Wenninger

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Data analysis

- This online analysis will :
 - § evolve with time and not be complete on D-day.
 - § be complemented by displays and expert software.
 - § require input and help from equipment experts.
 - § ...
- We should produce different PM data sets :
 - § **raw data** : contains everything !
 - § **processed data** :
 - Compressed data for channels without faults,..
 - Includes summary data.
 - § **summary data** :
 - Energy and beam intensity, beam dump data,.. **INB.**
 - Summary info from analysis.



Similar to what is done in experiments with raw data, reconstructed data...

05/03/2002

Post-Mortem - J. Wenninger

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Data storage

Possible availability of PM data ('easy' access) :

- full data ~ 2 months - 1 run (?) **Only Tricky cases ?**
- compressed data ~ few years
- summary data lifetime of the LHC

We should consider archiving of all the raw data on an 'offline' medium for the lifetime of LHC !

05/03/2002

Post-Mortem - J. Wenninger

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Analog acquisitions

Meeting on analog signal acquisition organized by E. Ciapala on 28/02/200. Points that were addressed :

- Functionality
- Hardware choices
- Timing & triggers
- Software
- PM

Concerning PM :

- **Similar functionality for PM and general observation. should be done by same system.**
- Possibility to recover the continuous PM data on request.

05/03/2002

Post-Mortem - J. Wenninger

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Status

We are still looking at scenarios and open issues, going through various scenarios...

We are in the process of writing a document on PM
– to come out in the next months.

Should we produce functional specification ?

For all **critical** systems :

§ **PM is part of the design.**

§ People are aware that it is an important element of the machine.

Milestones & Resources

2005 : sector commissioning

§ PM 'sub-system' : PCs, QP, Interlocks, Cryo, Vacuum.

§ Ample time until 2007 to gain experience.

2004 : implement the system

2003 : finalize design – freeze (some) parameters...

I'm happy to continue and follow up the work, but ...
some resources (fellow, staff) are required !