Minutes of LHC-CP Link Meeting 11

Subject : LHC Controls Project

Date : 13th March, 2001

Place : 936-Conference Room

Participating Groups :

EST-ISS	P. Martel,
LHC-ACR	Ph. Gayet,
LHC-ECR	no representative,
LHC-IAS	J. Brahy,
LHC-ICP	apologies,
LHC-MMS	no representative,
LHC-MTA	L. Walckiers,
LHC-VAC	R. Gavaggio,
PS-CO	apologies,
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	P. Dahlen replacing G. Mugnai,
SL-OP	M. Lamont,
SL-PO	Q. King,
ST-MO	P. Solander.

Others : A. Daneels (Project Planning),
R. Lauckner R. (Chair),
M. Vanden Eynden (Core Team),
R. Schmidt (Machine Protection),
M. Tyrrell (Alarm Sub-Project).

Distribution : Via LHC-CP website: **http://cern.ch/lhc-cp**
Notification via: **lhc-cp-info@cern.ch**

Agenda :

1. Minutes from previous meeting	
2. LHC-CP News	R. Lauckner
3. Feedback on Proposed EDMS Tree	M. Vanden Eynden
4. LAWG Sub-Project Progress Report	M. Lamont
5. Tentative planning for the QRL Reception Tests	A. Daneels
6. AOB	

1. Minutes from Previous Meeting

The previous minutes had not reflected the importance to the LHC-CP of including beam tests as had been stressed by O. Brüning and R. Lauckner. This will be added.

The action on all link people to provide feedback on the EDMS tree proposal is dealt with under the 3rd agenda point.

2. LHC-CP News R. Lauckner

The link person to 2 groups has changed. P. Solander is now the link to ST-MO and the rest of that division. E. Wildner takes over from O. Brüning for SL-AP. O. However, O. Brüning will continue as member of the LAWG.

The Controls Board is organising a 2-day seminar on PVSS on 26th and 27th of March. In order to encourage attendance the LHC-CP meeting scheduled for the 27th is postponed.

R. Billen reported that the LCC has asked the LHC-CP to study the implications of the need for a dynamic evaluation of the transfer function of the sextupole spool pieces. M. Lamont reported that he was following up.

The schedule and main topics for the next LHC-CP meetings are:

24/4	COMPONENTS Sub-Project Report	P. Gayet	Bât. 865-1D 17
8/5	Timing	G. Beetham	Bât. 936

3. Feedback on Proposed EDMS Tree M. Vanden Eynden

Meetings had taken place between M. Vanden Eynden, N. Boimond-Lopez and J. Muller to define and create the project documentation tree in EDMS. After some feedback the structure has been simplified as was shown.

EDMS offers complex approval procedures but it has been decided to start with a very simple approach, documents will only need approval by the LHC-CP leader.

The structure includes a branch for the Control System infrastructure that will be maintained by the SL-CO group. Links are possible to other documentation trees. This will be used to incorporate existing structures of participating groups. M. Vanden Eynden remarked that a compromise is required here between too much information and too many links. He will define the solutions with the groups concerned.

M. Tyrrell asked about the co-existence of this approach and web pages for various activities. R. Lauckner replied that the EDMS system is provided to ensure long term documentation maintenance so the general policy is to secure documentation in EDMS. The project secretary and core team provides assistance so that this policy will be implemented consistently and without unnecessary effort from the project members.

A clarification is still required concerning the storing of documentation in the LHC-CP tree or the LHC Project baseline.

ACTION: M. Vanden Eynden

4. LAWG Sub-Project Progress Report M. Lamont

M. Lamont, his slides are attached, recalled the main features of the LAWG mandate. The working group has invested mainly in 2 areas - Use case analysis of the PCR activities and providing requirements information for novel control system requirements. The use case activity tends to raise more questions than answers provided. At the moment this is considered positive as it is providing very useful communication channels between groups concerned. Progress was slow last year because of the commitment to LEP operation.

This year has also seen a large effort invested in novel requirements particularly real time control. Groups concerned now accept that Real-Time control places strict boundary conditions on the deterministic behaviour of systems that will be used for LHC Control.

There was some discussion about the effect of relaxing RT constraints, accepting a certain number of missing packages. However the consequences of such practices seem very complex and M. Lamont insisted that strict real-time behaviour was the objective.

Q. King pointed out that String2 could be useful for prototyping studies and he would be ready to support this at the end of 2002.

5. Tentative planning for the QRL Reception Tests A. Daneels

Daneels reported on the controls planning activity for the QRL reception tests. This was based on 3 meetings that had been held with the teams concerned and numerous preparation meetings. He outlined the method that had been followed in these meetings based on identification of activities and link people. The major systems involved for these tests are cryogenic controls, vacuum controls and the services monitoring from the TCR. Communication infrastructure will also be essential but has not yet been analysed. Based on external constraints major milestones have been identified for the systems concerned. In addition important questions have been raised concerning the technical goals for alarms, logging and time stamping. These subjects connect the systems concerned to the general controls infrastructure.

R. Lauckner asked A. Daneels to provoke technical discussions with the aim of fixing the objectives in these areas.

ACTION. A Daneels

R. Schmidt pointed out the importance of the connection between the PCR activities and the QRL operation. P. Gayet reported that R. Bailey has launched an initiative to define the interactions betwen PCR operation and the cryogenics system. It was decided that this should be followed up in the TCC.

A. Daneels did not show the detail of the present planning but invited those interested to contact him directly.

6. AOB

There was no further business.

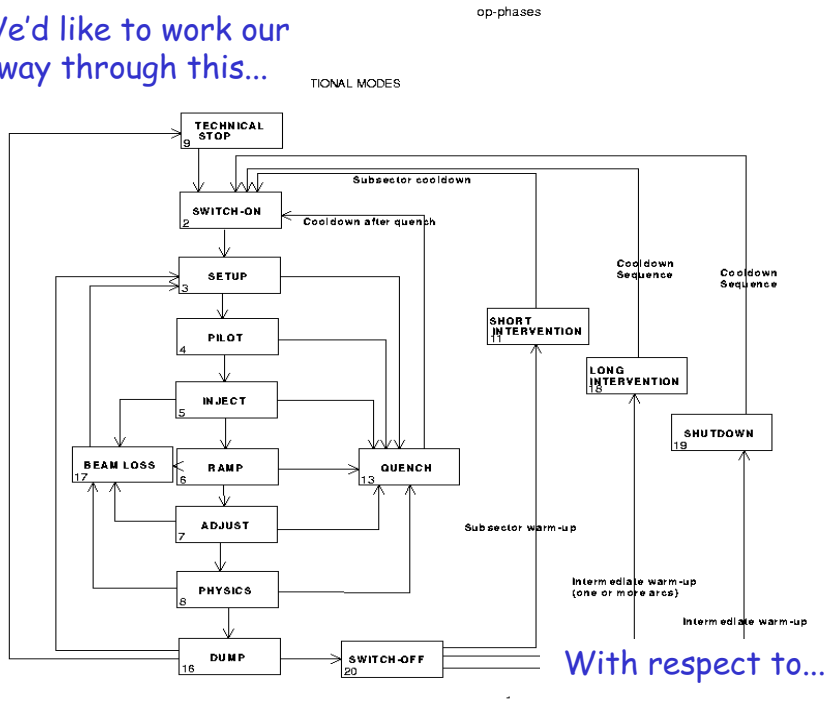
Long Term Actions	**People**
Establish Real-time sub-project.	R Lauckner
Establish Post Mortem sub-project	R. Lauckner

Reported by R. Lauckner

LAWG progress

- Preliminary Aims:
  - Use Case operational scenarios to establish controls requirements
  - Target specific novel control infrastructure issues to establish requirements & possible solutions
  - establish and confirm low level level functionality required of equipment by high level controls
- Deliverables
  - good question!

We'd like to work our way through this...



With respect to...

Use Case

- Switch on
- Injection Setup
- Establish circulating beam
- Injection
- Injection Optimisation
- Prepare ramp
- Nominal snapback
- Ramp
- Programmed stop in ramp
- Squeeze
- Collide
- Physics
- Luminosity optimisation
- Ramp down

⊗

- Power converters
- RF
- Collimators
- TDI & TDE, Dumps
- Kickers
- Beam Instrumentation
- Multipoles Factory
- Interface to cryogenics & vacuum
- Interface to experiments

- Timing
- Synchronisation
- Real-time
- Middleware

↕ + exceptions and faults

Use Case - progress

- Halting!
- Framework established, attempting to build up some momentum.
- Capturing on the Web for the moment
  - Rational Rose CASE Tool, UML diagramming notation, DSDM/ODP methodology and some systematic Project Management method will eventually be used
- So far concentrated on injection where the main challenges for LHC control will be found, some targeting of individual equipment e.g collimators, power converters
- Upcoming:
  - RF
  - Multipole factory
  - Revisit power converter requirements

Injection… for example

- Pre-requisites established in Prepare Injection.
- Having spent predefined length of time at the pre-injection porch issue command to power converters to ramp to injection level presumably via a PELP.
- Verify that all power converters have reached the required current and are within tolerance.
- Start tracking and correcting for drifts in b1, b2 and b3 (at least) via readings from the Harmonic Factory (here we include Hall Probes etc.).
- Drive the power converters of the spool pieces with pre-established functions during the injection plateau. These functions to multipoles factory also.
- To keep energy constant the horizontal orbit correctors will be driven a la BFS. This is assumed to be via a knob.
- Issue pilot injection beam request (how?)
- Take PILOT.
- RF needs to know when beam is coming in so it can invoke functions in dampers. Slow timing event, requirements to be established.
- Etc.. Etc...

Identify: overall sequence, functionality, unanswered questions & misconceptions

Controls' infrastructure

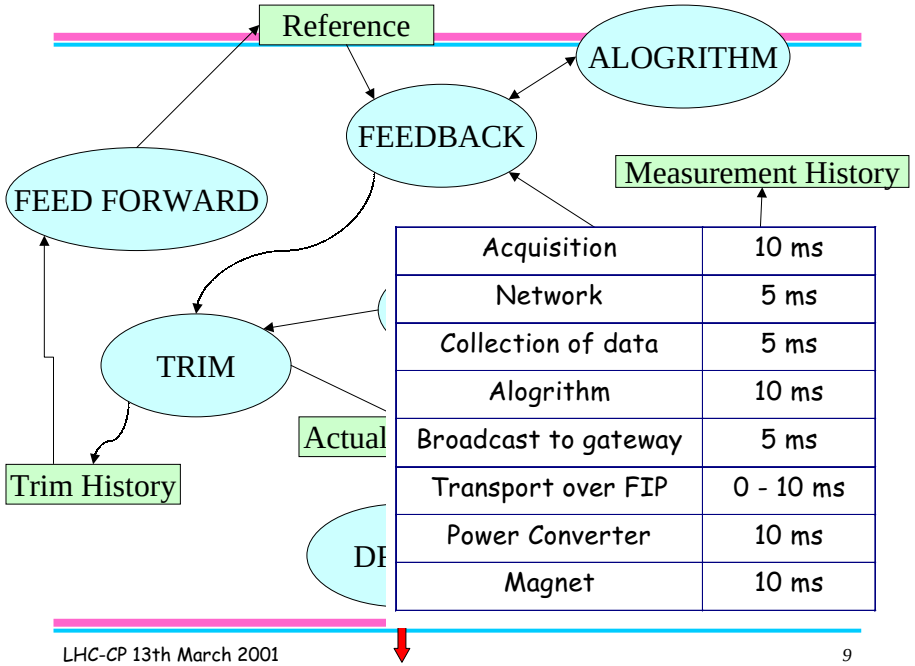
- Timing: under auspices of TIWG, but had a couple of brain stormings - hopefully LHC requirements are more-or-less elucidated. Still some open questions…
- Middleware:
  - Look, Don't be so f"@#$%g traumatic over this. Solution is as follows:
  - CORBA III Orb, Servers written in C++, GUI's in VB/DELPHI with CORBA/COM fast bridging technology. Use Oracle V8 DB, will need orb with event service.
  - Probably Solaris O/S
- Real Time: ➔

Real time to SLTC

		Acquisition	Actuators
Reference magnets	3 - 10 Hz		Trim quads, sextupoles…
Global orbit feedback	1 Hz	As below…	2*500
Chromaticity	1 Hz	Single instrument	Trim sextupoles
Tune feedback	10 Hz	Single instrument	Trim quad PC
Beam loss display + poss input to feedback system	10 Hz	250 crates 130 Kbytes/s	N/A
Real-time knobs	10 Hz	Real-time display	1 to 500
Global orbit acquisition	10 Hz	250 crates 200 Kbytes/s	N/A
Local orbit correction & acquisition	10 Hz	~10 PUs	~5 warm correctors

Real time

- 3 meetings so far. Real-time will be required to operate the LHC. Agreed by BI, PC, RF, CO, OP, AP.
- The demands on speed appear to be reasonable, and data acquisition, or measure & correct appear to be necessary at a maximum of 10 Hz. Bandwidth requirements are also moderate.
- Both Beam Instrumentation and Power Converter systems are already planning on providing real-time acquisition and correction from the front-ends to at least the gateway level.
- Ethernet by over resourcing appears to be capable of providing the necessary level of performance, foreseen is a dedicated Gigabit Ethernet
- A real-time environment will be necessary at the high-level.
- A logical architecture is required to allow the implementation of a well-designed, flexible, global, integrated system - first look has been taken…



Acquisition	10 ms
Network	5 ms
Collection of data	5 ms
Alogrithm	10 ms
Broadcast to gateway	5 ms
Transport over FIP	0 - 10 ms
Power Converter	10 ms
Magnet	10 ms

Conclusions

- Use Case is long & painstaking, but no real alternative if we really want to understand the problems:
  - We'll keep plugging away.
  - It is valuable & good for communication
- Need to anticipate choices that are to be made soon that will effect our ability to control the machine and work to reach a consensus across groups:
  - real-time
  - timing
  - middleware
- Need to make sure that low level design choices match high level requirements, & that system dependent choices don't compromise operability
  - e.g. Power converters

Acknowledgements

- LAWG:
  - Oliver Bruening, Andy Butterworth, Mike Lamont, Marc Vanden Eynden, Joerg Wenninger (plus… the usual suspects)
- Real Time:
  - M. Jonker, Q.King, R. Jones, A. Butterworth, T.Wijnands, P. Ribeiro, JJ Gras, P. Charrue, R. Lauckner, P. Anderssen, M. Lamont, Olav Berrig
- Details
  - http://lamontm.home.cern.ch/lamontm/lawg/Lawghome.htm

QRL Commissioning

Control System Planning

(Tentative / Provisional)

Axel Daneels

Content:

- **Steps undertaken**
- **Persons involved**
- **Systems to be installed & Link-Person**
- **Controls Components that are required**
- **Planning**
  - Scope
  - Strategy
  - Major Milestones
  - Critical Tasks (???)
- **Open questions & Next Steps**

Steps undertaken

- **Identify all systems that are involved in the commissioning of the QRL and needing controls**
- **For each system: identify "Link-Persons"**
- **For each system identify what operations will be performed**
- **"Requirements" for these operations**
  - **infrastructure (process & controls)**
  - **control functionality**
- **Plan**
- ***(3 meetings: 11 Jan., 2 Feb., 16 Feb. , and numerous discussions)***

Persons involved

- **P.Bonnal_(AC/TCP), M.Vanden Eynden (SL/CO), R.Gavaggio_(LHC/VAC), J.Cl.Guillaume_(ST/EL), P.Ninin_(ST/MO), P.Charrue_(SL/CO), R.Trant_(LHC/ACR)**
- **J.Casas-Cubillos_(LHC/ACR), A.Daneels_(IT/CO), Ph.Gayet_(LHC/IAS), R.Lauckner_(SL/DI), M.Tyrrell_(SL/CO), G.Riddone (LHC/ACR),**

Thanks to all!!

Systems to be installed & Link-Person (1)

- **QRL Commissioning (Link-Person)**
  - " (J. Casas-Cubillos / G. Riddone)
- **General Services**
  - Main power & Electrical distribution (P. Ninin)
  - Personnel Safety system (access control, gas & fire detection, ...) (P. Ninin)
  - Cooling & Ventilation (P. Ninin)
  - Piping (warm & cold) (P. Ninin)
  - Machine (Equipment) Protection: Interlocks, Abort System (R. Schmidt)
  - Cabling (mains, Fieldbusses, 20 mA, etc) (J-Cl. Guillaume)
  - Racks in tunnel, alcoves, buildings, … (J-Cl. Guillaume)

Systems to be installed & Link-Person (2)

- **Controls Infrastructure (Link-Person)**
  - Communication (interfaces, networks, telephone, …) (P.Anderssen)
  - Timing (Time of Day Distribution, Event Distribution) (G.Beetham)
  - Equipment in Control Rooms: TCR (Pierre Ninin), PCR (if requested) (P.Charrue)
- **Processes with their associated controls (Link-Person)**
  - **QRL** (mechanical elements, …) (Ph.Gayet)
  - **QUI** (Ph.Gayet)
  - **Refigerator** (Ph.Gayet)
  - **Cryogenics** (Ph.Gayet)
  - **Vacuum** (R.Gavaggio)

Controls Components that are required

- **SCADA** (Ph.Gayet)
- **Databases** (incl. Logging & Archives) (R.Billen)
  - Calibration (Y), Addresses (Y), Logging (Y/?), Alarm (Y)
  - Layout (?), Measurement (?), Settings (?)
  - Anything else?
- **Logging System** (R.Billen)
- **Alarm System** (M.Tyrrell)
- **Time Stamping** (G.Beetham)
- **Post Mortem (?)** (R.Lauckner)
- **Middleware** (K.Kostro)
- **TCR Operation** (P.Ninin)
- **PCR Operation** (if requested) (P.Charrue)

Planning: Scope

- **Includes**
  - **Major tasks (linked to life cycle):**
    - Specification (UR)
    - Development / Installation
    - Test (by developer)
    - Commissioning (developer + client)
    - Acceptance (client)
  - **Pre-commissioning is part of Installation**
  - **Commssioning and Reception tests**
- **Not included**
  - **Infrastructure = input from P.Bonnal's general planning"**
  - **"Wrap-up" (after commissioning dead-line)**

Planning: Strategy

- **Liaise with P.Bonnal's general planning**
  - **Sector 7-8 available for QRL installation (incl. General services): end 02**
  - **QRL Contractor ready for installation: 6 Jan. 2003**
- **QRL Commissioning & Reception Must Finish on 22 Aug. 03**
  - **—> "backwards" Planning**
- **Identify tasks and estimate their duration with Link-Persons**
- **No resources (and thus no leveling)**
- **No contingencies**

Planning: Major Milestones

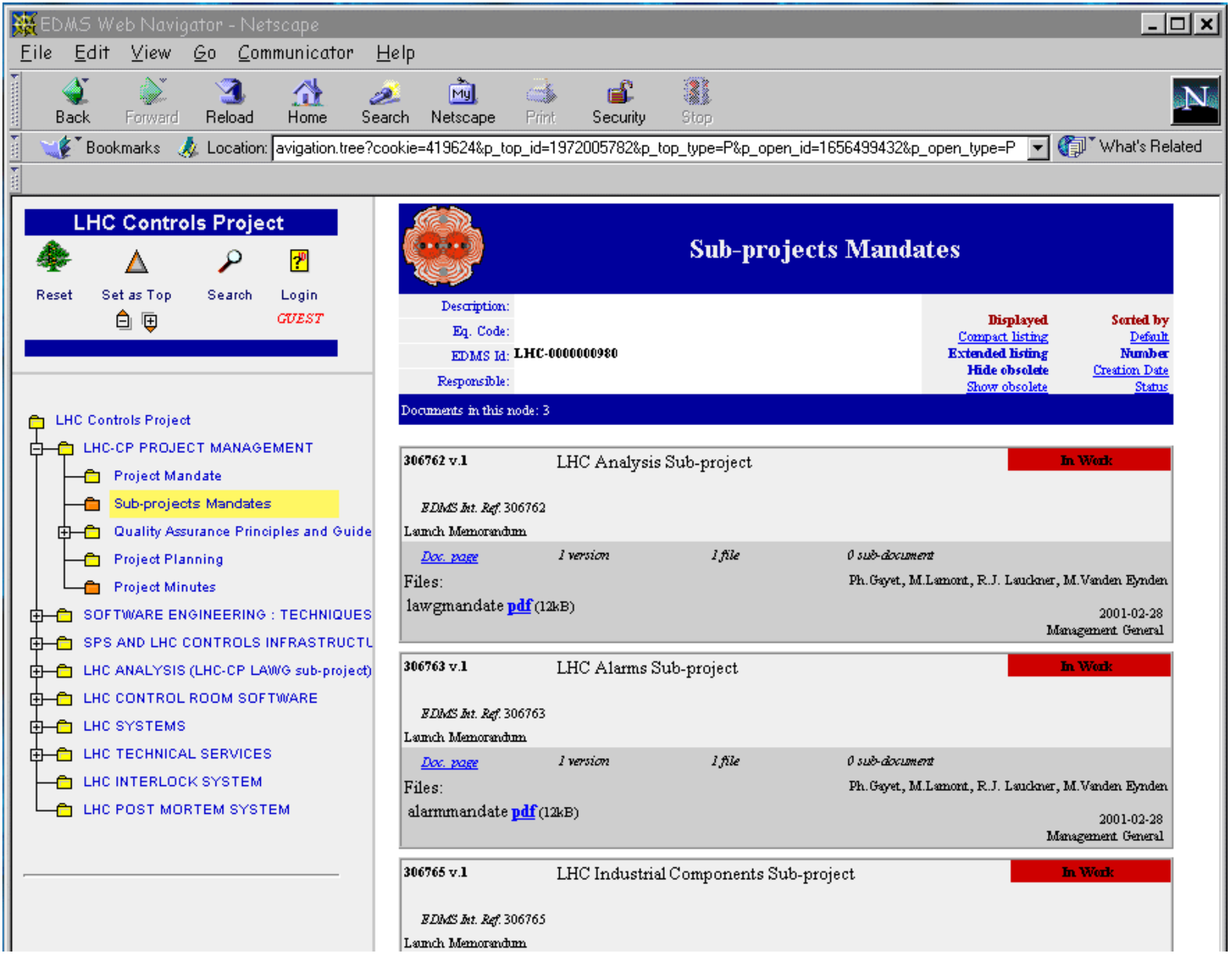
- Define which SCADA will be used: Apr-01
  - **needed for** UNICOS (needed for CRYO, QUI, Refrigerator control), VAC
- QRL ready for installation in sector 7-8: 6-Jan-03
- QRL Control System: *"en cours"* ready: 06-Mar-03
  - Unicos v.2: start Apr-01 ready: Nov-01
  - CRYO: *"en cours"* ready: Mar-03
  - QUI : start Aug-02 ready: Feb-03
  - Refrigerator: start Aug-01 ready: Nov-02
  - QRL Vacuum controls: start May-01 ready: Mar-03
- QRL Commissioning & Reception: start Apr-03
- QRL Acceptance: 22-Aug-03

Planning: Critical Tasks (???)

- Around 50 tasks
- None highly critical yet, but remember:
  - - no consideration of resources, no leveling !
- But: decision cc SCADA is needed by Apr. 01
- May become critical:
  - Tasks subsequent to Installation of QRL Mechanical Elements
    - contractor starts installation on 6 Jan. 03
  - QUI + Refrigerator
    - QUI construction can not start until mid Oct. 02 (takes 3 months)
  - Controls' Infrastructure (Ethernet, radio,, etc): info available end Mar.01
  - cf. "Open Questions"

Open questions & Next Steps

- Clarify:
  - Database (Calibration, Logging, ...)
  - Logging
  - Alarm System
  - Time-stamping
  - PCR or no PCR
- Date when "alcoves" ready ? (currently assumed 6 Jan. 03)
- Who plans the tasks in more detail (resources!)
- Next Steps
  - TCR requirements ...
  - Local & Central Operational (Control rooms) requirements
  - Baseline Planning
  - Track Progress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SPS AND LHC CONTROLS INFRASTRUCTU
LHC ANALYSIS (LHC-CP LAWG sub-project)
LHC CONTROL ROOM SOFTWARE
LHC SYSTEMS
LHC TECHNICAL SERVICES
LHC INTERLOCK SYSTEM
LHC POST MORTEM SYSTEM
Sub-projects Mandates
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