

LHC-CP Controls Project Definition Workshop

Overview of “LHC Controls Activities” at CERN Today

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Outline

- **LHC Controls at CERN today, what's going on ?**
 - Activities
 - Strategies
 - Open Issues
- **Outcome for LHC-CP project**

LHC “Controls Activities” at CERN today, what’s going on ?

- Industrial Automation and Supervision
- Cryogenics for LHC and Experiments
- LHC Vacuum System
- Technical Infrastructure Monitoring
- Controls for PS Complex
- Information Systems Support
- Machine Control Databases
- Beam Instrumentation
- Radio Frequency
- Power Converters
- Beam Transfer
- Warm Magnets
- Operations
- Controls in SL
- Accelerator Physics

LHC “Controls Activities” at CERN today

Industrial Automation and Supervision (LHC/IAS)

- **Activities**

- q **Equipment Control Prototypes (I.e. MPS for String2) including the procurement and support of :**
 - q **Industrial components (PLCs, Acquisition cards, ...)**
 - q **Supervision tools (PCView32, LabView) and interfaces to Siemens and Schneider PLCs**
 - Logging Database + interface (flat files and Oracle)**
- Provide, as next stage, all control facilities for Dipole Test Benches**
- Provide support and guidance for call for tendering and for Profibus technology**

LHC “Controls Activities” at CERN today

Industrial Automation and Supervision (LHC/IAS)

- **Strategy & Open Issues**

- Approach based on industrial components and Supervisory and Data Acquisition Systems (SCADA)
- Ready to contribute their services and expertise to the LHC-CP
- interfaces between these low level systems and the high level LHC machine operation have to be specified and**
- supported by a distributed control system architecture**
- DBMS will be a very important area to address**
- Results of radiation tests are a major subject of concern**

LHC “Controls Activities” at CERN today

LHC Vacuum System (LHC/VAC)

- **Activities**

- Control and procurement of all vacuum equipment, from the low level HW components up to the PLCs
- q LHC QRL Tests and String2
- q Several upgrades and new projects (SPS, TI2/8, LEIR, ...)
- LHC (Points 4-5) QRL commissioning in March 2002

- **Strategy & Open Issues**

- Approach based on Siemens PLCs and Profibus
- Usage of SCADA not clear yet
- Need to connect mobile equipment
- Need for detailed diagnostics at the PLC level
- Results of radiation tests have direct impact on the design**

LHC “Controls Activities” at CERN today

Cryogenics for LHC and Experiments (LHC/ACR, LHC/ECR)

- **Activities**

- Definition, implementation and commissioning of the LHC Cryogenics System (all magnets cooling, beam screens, bus bars, RF cavities, etc)
- Definition, implementation and commissioning of external cryogenics for LHC experiments (and proximity cryogenics for the ATLAS liquid argon calorimeter)
- **UNICOS** : joined project aimed at adopting the same cryogenics control system architecture for LHC experiments and machine ring ~10 MCHF budget (including HW I/Os, PLCs and SCADA)
- Commissioning of Cryoplant and control system for the Sector test by end 2003

LHC “Controls Activities” at CERN today

Cryogenics for LHC Ring and Experiments

(LHC/ACR, LHC/ECR)

- **Strategy & Open Issues**

- Industrial control system based on PLCs and SCADA

- Contract outsourced to industry as follows :

- 10 years of maintenance for HW components

- 10 years of maintenance for SW (upgrades, ...)

- CERN people will perform the modifications in the SW according to potential modifications in the Cryogenics system

- Multi-layered control system (field layer, process layer, supervision layer, ...)

- High level GUIs through the WWW

- Naming conventions is still an open issue**

LHC “Controls Activities” at CERN today

Technical Infrastructure Monitoring (ST/MO)

- **Activities**

- 2 main projects related to LHC controls :**

- TIM (Technical Infrastructure Monitoring) Project**

- Integration of all technical services (CV, Vacuum, Electricity, Cryogenics, ...) in 1 coherent system for optimal monitoring from TCR

- TSI (Technical Supervision Interface) sub-project

- CSAM (CERN Safety Alarm Monitoring) Project**

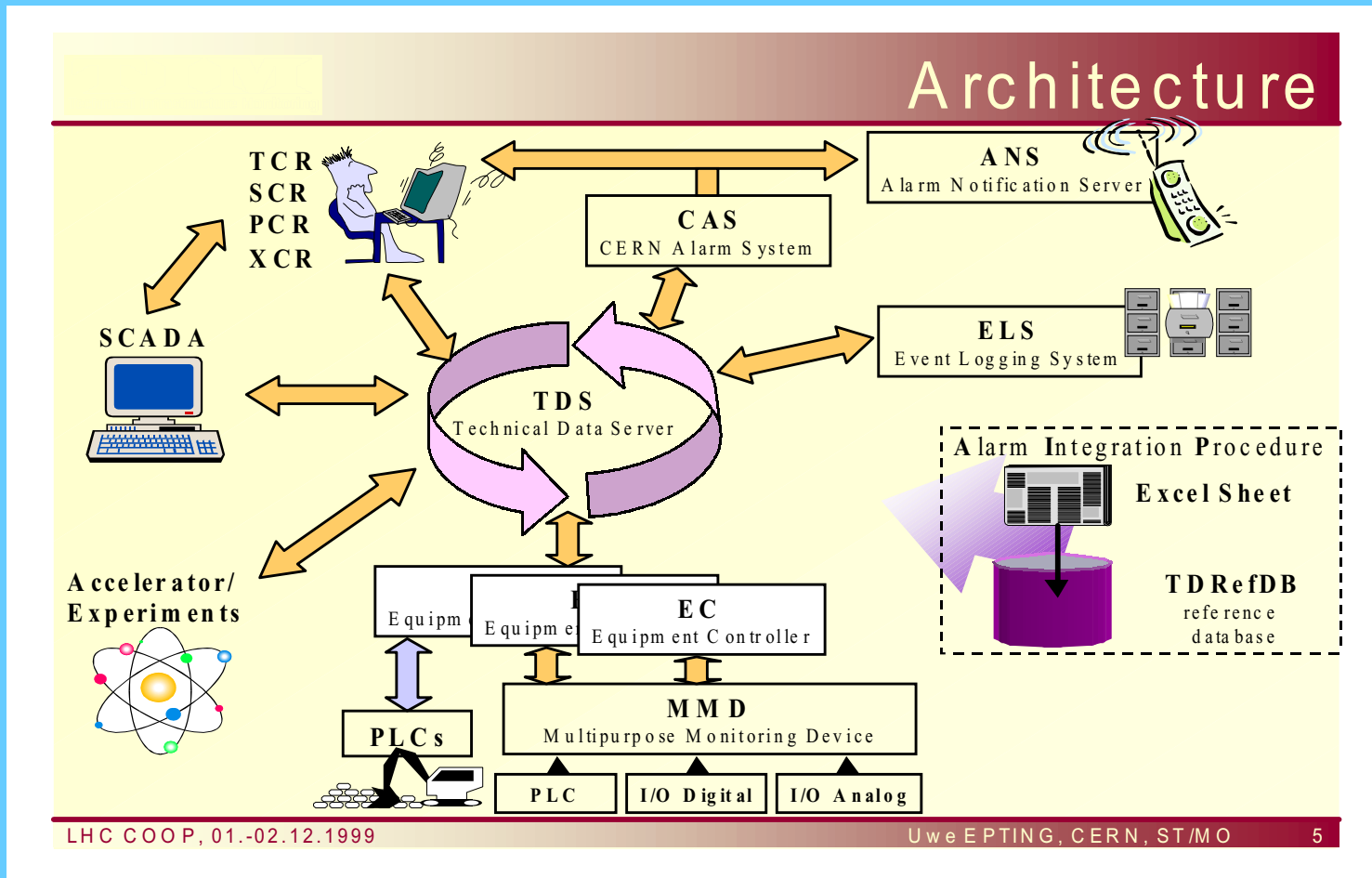
- provide an integrated safety (AL3S) alarm system covering detection, transmission, logging and display for the LHC machine, LHC experiments and experimental areas. Later, the product will be extended CERN wide.

- Architecture to be defined by end 2000 and installation in 2002

LHC-CP CONTROLS PROJECT

LHC “Controls Activities” at CERN today Technical Infrastructure Monitoring (ST/MO)

- TIM @ a Glance



LHC “Controls Activities” at CERN today

Technical Infrastructure Monitoring (ST/MO)

- **Strategy & Open Issues**
 - ❑ Most (all ?) of the technical systems will use :
 - ❑ Siemens and/or Schneider PLCs following the CERN recommendations
 - ☛ communication protocols and SW interfaces defined
 - ❑ Supervisory and Data Acquisition Systems (SCADA)
 - ❑ All information federated in the ST Middleware (TDS using Smartsockets)
 - ❑ **CERN wide Data Exchange mechanisms (Middleware) for exchanging information with Experiments, PCR, etc ...**
 - ❑ **Policy for Alarms Handling, Data time stamping and Logging (where, by whom and with which time granularity ?)**
 - ❑ **Naming conventions (how to manage changes in interconnected systems ?)**

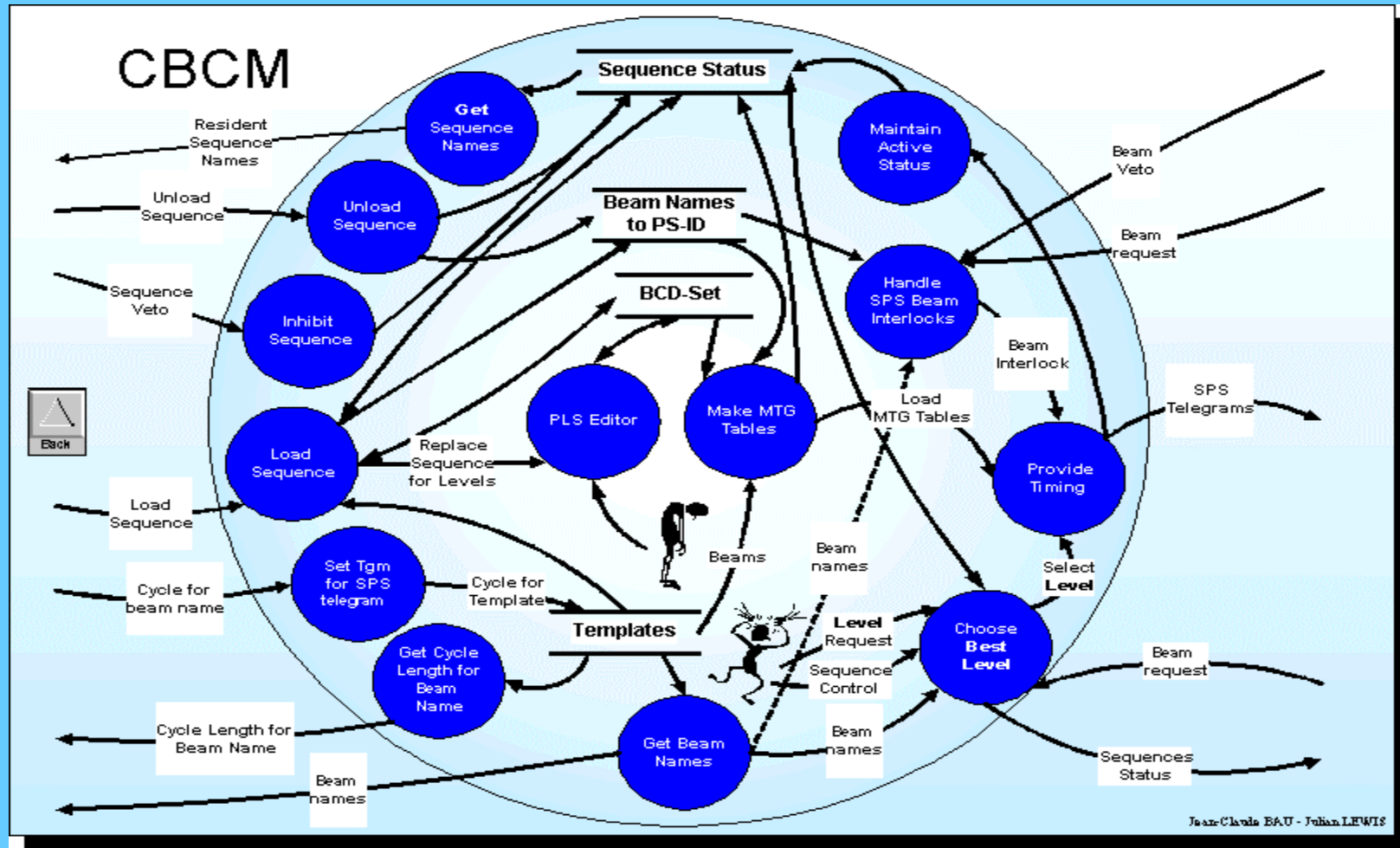
LHC “Controls Activities” at CERN today

Controls for PS Complex (PS/CO)

- **Activities**
 - Involved in the PS/SL Controls Convergence Effort
 - Common Accelerator Middleware
 - Central Beam and Cycle Management System (CBCM)
 - q Several renovation efforts for AD, LINAC, BOOSTER, PS, ...
 - q New control systems to be defined for :
 - q LEIR by end 2002
 - q ISOLDE (between 2000 and 2002)
 - q CTF3 (between 2001 and 2004)

LHC “Controls Activities” at CERN today Controls for PS Complex (PS/CO)

- Central Beam and Cycle Management



LHC “Controls Activities” at CERN today

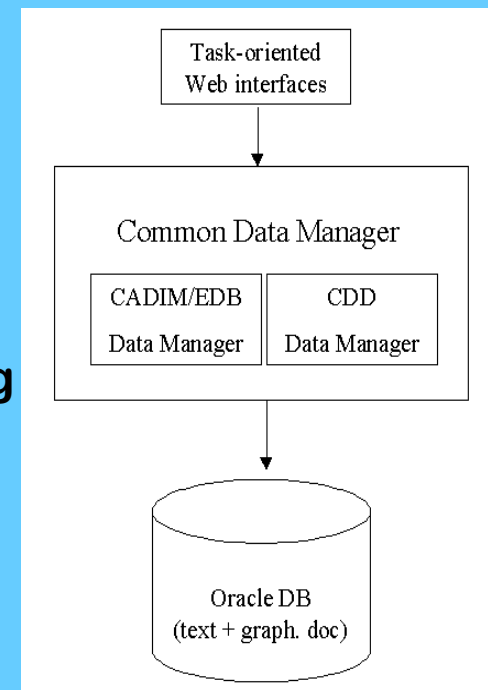
Controls for PS Complex (PS/CO)

- **Strategy & Open Issues**
 - ❑ Evolutionary approach (Java API and GUI Components, LINUX O/S, ...) for the existing control systems
 - ❑ Use VME AND industrial controls solutions for the new machines
 - ☛ high interest of sharing the same approach as for LHC
 - ❑ **All aspects related to the exchange of information between the different CERN control rooms :**
 - Information required ?
 - Techniques and mechanisms for data exchange (Middleware)

LHC “Controls Activities” at CERN today Information Systems Support (EST/ISS)

- **Activities**

- CERN wide Procurement of tools and methodologies for describing and following equipment manufacturing and localisation
 - CEDAR Project : WWW interface to :
 - » MP5 system used for LHC layout description and maintenance
 - » CADIM system for documents handling (functional specifications, drawings, engineering change requests, etc)
 - Travellers
 - » mechanism for tracking and synchronising documents between CERN and external contractors (LHC Dipoles production)



LHC “Controls Activities” at CERN today

Machine Control Databases (SL/MR)

- **Activities**

- Design engineering and support of :**

- SPS and LEP machines databases**

- Machine layout (equipment position and optics)**

- Joined PS/SL effort for using a common Database design and interface**

- Databases for the LEP dismantling project**

- **Strategy**

- Offer SL division wide engineering support in the field of DBMS**

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Outcome for the LHC-CP Project

- **Two major categories of LHC Systems :**
 - ① **Systems built by CERN using industrial components or bought from industry as “Distributed Control Systems” (DCS)**
 - ② **Systems tightly bound to the LHC beam handling and optimization requiring specialized low level control, acquisition, and possible use of a Real Time infrastructure**
- ☛ **Let’s enumerate these systems and look at the major issues to be addressed**

Outcome for the LHC-CP Project

- **Systems built using industrial components and DCS**
 - First Enumeration**
 - All LHC Technical services (Water, Cooling and Ventilation, Electricity, ...)
 - All Test Facilities provided by LHC-IAS
 - LHC Vacuum System
 - LHC Ring and Experiments Cryogenics
 - Some LHC Beam Transfer Systems (injection/extraction kickers slow control)
 - Some LHC RF Systems (Klystrons slow control)
 - LHC Warm Magnets Interlocks

 - LHC Experiments (SCADA for slow control)
 - PS ISOLDE, LEIR, ... ?

Outcome for the LHC-CP Project

- **Systems built using industrial components and DCS**

- Major Issue : How to achieve a “coherent integration and control” of these systems ?

- network and transport protocols
- network management (SNMP, ...)
- configuration management (naming conventions, changes)
- Policy for Interlocks
- Policy for Data Logging (DBMS)
- Policy for Alarms capture, transmission and display
- data acquisitions and/or control **FROM SEVERAL CONTROL ROOMS**

Specific
Middleware
Issue

- » Models of interactions (channels, devices, ...)
- » Software Programming Interfaces
- » Communication technology (CORBA, OPC, MOM, ...) and related services (naming, subscription, ...)

- CERN Technical Specification for DCS