

POST-MORTEM OF EXPERIENCE WITH LEIR CONTROLS

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Abstract

The Low Energy Ion Ring LEIR was selected as a test bed, to validate certain concepts which will compose the LHC control system. LEIR is inserted between the Linac3 and PS accelerators which are completely controlled by the CPS control system. The LEIR control system is hybrid, as it is the aggregation of parts coming from the PS Complex control system and different components from the LHC. After a period of strong instabilities, modifications, adjustments and training, this control system is usable in a commissioning environment. Before it is declared operational, some components or functionalities need to be added, and others should be corrected in order to improve the speed, reliability and ergonomics.

INTRODUCTION

The Low Energy Ion Ring LEIR was selected as a test bed, to validate the concepts and technologies which will be used for the new control system of the LHC. LEIR is inserted between the Linac3 and PS accelerators which are completely controlled by the CPS control system. The LEIR control system is hybrid, as it is the aggregation of parts coming from the PS Complex control system and different components from the LHC.

The design of the control system of the CPS was made at the end of the Eighties with an architecture 2-tier. The main part of the applications were built with Xmotif/C++ and the front end software in C/C++ were built with the concept of GM (General Module). Since the year 2000, the new applications are built with Java. For the new LHC control system the architecture of the control system is 2-tier or 3-tier and the applications are built with Java. The front end software in C++ is build with the concept of FESA (Front End Software Architecture). For the LEIR we use 2-tier or 3-tier architecture, applications are Xmotif/C++ or Java and in the front end we have GM or/and FESA.

From its experience on the fast cycling machine and to guarantee a good commissioning, the LEIR OP team has required that all the currently available functionalities in the CPS control system should be implemented in the LEIR.

During all the period 2005, the use of these technologies and of these concepts, on a new machine, has been a challenge for all the people involved.

THE COMMISSIONING

The commissioning team has produced and submitted a list of control software needs which cover

- Sequencing (CBCM)
- Basic Controls (Working Set, Knobs)

- Observation (OASIS, Samplers, Orbit ...)
- Instrumentation: (MTV, Orbit ...)
- Function Editor, Cycle Editor (LSA)
- Tools (Logbook, Archives, References ...)
- Alarms

In agreement with the group CO, we planned a gradual startup, of the various software according to the schedule of the commissioning.

These phases were:

1. **Hardware Commissioning:** Basic control & Sequencing available at the beginning of May.
2. **Beam Injection:** Partial Controls of the injection lines available at the beginning of June.
3. **Ring :** Full Controls available at the beginning of August
4. **Ejection :** Control available at the beginning of February 2006

Status of Hardware Commissioning (May): This phase was to allow the validation of the equipment as well as their controls. Except for the new timing class LTIM, the major part of the new software was not available during this phase. The Working Set & Knobs didn't receive correctly the data from the middleware or from the FESA. The persistence of the data in the FESA was not ready and we were losing the data at each DSC reboot. We began this phase by employing the applications of Xmotif/C++, but tested only the equipment controlled with the GM (Xmodif/C++ application cannot manage equipments controlled with FESA)

Status of the Beam Injection (June): This part of the commissioning was to validate the software necessary for the LEIR injection line and the first injection elements in the ring. Except for the MTV application, the situation was the same as the hardware commissioning. OASIS (Open Analogue Signal Information System) was also in hard debugging state. The major problems with OASIS were bad signals synchronization, connection difficulties, several GUI faults etc... When we have started to use intensively the new applications, we have encountered problems of memory leak and we had to reboot several times per day the workstations. The alarm application LASER was not able to receive GM equipments errors. A new magnet interlock system based on the PLC was successfully installed and tested during this period.

Status of the Ring (September): We used this period to validate one of the major software, the new Cycle Editor (LSA). After some difficulties in the precedent phases, and a lot of works of the different software developers the Working Set & Knobs, FESA, OASIS, LASER were

90% available. The application Orbit was a success, after the first correction the orbit was almost perfect! The Cycle Editor, except a confuse GUI, was ready at 90%. The commissioning team, in close collaboration with the LSA team, spent time debugging and validating the functionalities implemented in the Editor. Functionalities such as Archives, References, PPM copy, EQP survey and the Passerelle, very useful for the operation, were not ready.

The memory leak was resolved by increasing to 2GB the memory and with a deep analysis of the new software.

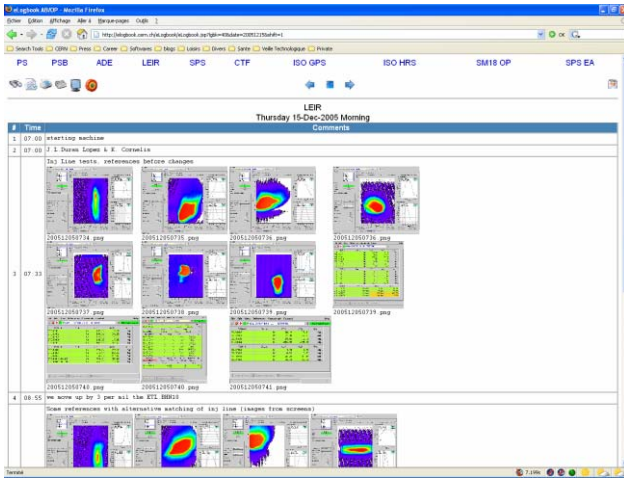


Figure 1: Beam snapshots in the eLogbook

Status end 2005: After 8 months of commissioning, the control system was usable in a commissioning environment and all necessary software was in the optimization phase. But before it was completely operational, some components or functionalities needed to be added, and others should be corrected in order to improve the speed, reliability and ergonomics.

Requests for 2006: Except the optimization of several software, the most requested tools are to have full operational Archives, PPM copy, the Passerelle and the EQP survey for GM and FESA equipments.

CONCLUSION

The use of the software of the LHC was very ambitious, because even with the excellent support and reactivity of the developers, there were delays in planning and in the availability of various software. During this startup phase, we could note a lack of communication between the various protagonists of the CO projects. For the new software implemented at the LEIR both experience and knowledge from the CPS and CSL complex are used. The most important thing for everyone is:

A Control system allowing working (not yet perfect) is available.

REFERENCES

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Electronic logbook (extranet):

<http://ab-dep-op-elogbook.web.cern.ch>

FESA:

<http://project-fesa.web.cern.ch>

LSA:

<http://proj-sps2001.web.cern.ch/proj-sps2001>

OASIS:

<http://project-oasis.web.cern.ch>

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