THE ELECTRONIC LOGBOOK FOR LNL ACCELERATORS

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Abstract

In spring 2009 all run-time data concerning the particle accelerators at LNL (Laboratori Nazionali di Legnaro) were still registered mainly on paper. The electrostatic accelerator TANDEM-XTU and its Negative Source data were logged on a large format paper logbook. For the ALPI booster and the PIAVE injector with its Positive ECR Source a number of independent paper notebooks were used, together with plain data files containing raw instant snapshots of the RF super-conductive accelerators. At that time a decision was taken to build a new tool for a general electronic registration of accelerators run-time data. The result of this effort, the LNL electronic logbook, is here presented.

INTRODUCTION

The LNL Electronic Logbook is a new many-layers software tool; it was put into operation at the end of 2010 after 12 months of work including several plan-do-check-fix cycles.

Here this tool is described in its main components and features. The most significant steps of the long commissioning phase are also described.

CONFIGURATION

An electronic logbook is made of data sets and software programs. It is used to register states, events, texts, images, notes and files according to the shift structures in the working time of the systems to which it applies, here the LNL accelerators and their experimental set-ups. The same tool is used both to register data (to write new data sets) and to retrieve them (to read old data sets) .
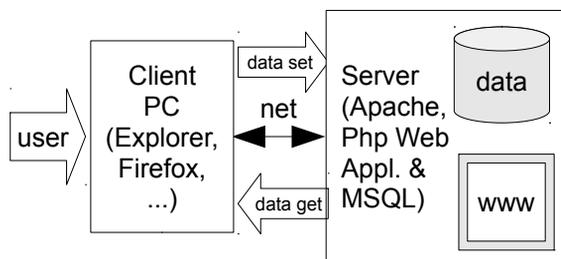

Figure 1: LNL Logbook structure.

The LNL Electronic Logbook has a client-server structure (Fig. 1). A web server application supplies a web interfaces to data. It may be accessed by standard browser (Explorer, Firefox) on any platform (MS Windows, Linux). For a medium and long time range endurance, data are stored in RDBMS (Relational Data Base Management System) structures, At LNL the RDBMS is MySQL in an Apache http server environment. Php procedures dynamically build (on request) the web forms to write or read data from tables in the data base.

Because LNL accelerators are subjected to periodic reconfigurations and rejuvenations, a high degree of flexibility is necessary in the data structures and related web-forms. This was achieved adding to the electronic logbook some intrinsic editing capabilities on the data set configuration and form pages. So the system itself is highly configurable.

General Layout

The main components of the LNL Electronic Logbook are installed on a Linux PC (Fedora) and are:

- An instance of MySQL RDBMS for data table structures and registered data [1].
- The Apache [2] web-server and the related PHP language interpreter, to access data, tables in write and read mode, for configuration and registration.
- AJAX (Asyncronous Javascript And XML) [3] to support dynamic, interactive data throughput from and to the user on the web browser.

Figure 2: LNL Logbook – The main Accelerators Menu.

Data Structure

In LNL Electronic Logbook the data system has a hierarchic, tree structure.

At the top of all there are different electronic logbooks, one for each accelerator (Fig. 2): the electrostatic TANDEM-XTU (with its negative ion source), the ALPI booster and the PIAVE injector (with its positive ECR ion source). In each specific logbook, the root of data tree relies on the calendar experimental shifts list.

The calendar of experiments contains the list of experimental shifts, on a start-end dates basis, plus some attributes for each shift, where these last two terms mean also periods reserved for tests, accelerators maintenance, set-up or shut-down. In the table of shifts, which is updated every 3-6 months, the configured fields are: a code (unique), a spoke-person, start date, end date, experimental set-up, beam-line, beam type (ion specie), ion mass (ion isotope), required energy, energy range (if different energies are required), beam current, accelerator configuration, notes (Fig 3).

All accelerators registrations are therefore associated to the specific accelerator and to its shift defined by the registration date.

On the time side, data registrations are of two kinds: day registrations and hour registrations. The first are written, generally, in the first hours of the day by the operators' team working between midnight and 7 A.M. This set of data may be deleted, updated or changed all the day long and is frozen at midnight. The second set of data (hour registrations) are automatically linked to the current day registration, and to the due shift, too. Hour registration data may be deleted, updated or changed only by the operators who wrote them and only up to the following hour registration, which, automatically, freezes the preceding one.

A special user (administrator) has the privileges necessary to delete or correct any data set at any time.

Besides conventional data sets, specific for each logbook, i.e. integers, decimals, time and string values, attached files, in LNL Electronic Logbook two other tables are foreseen to help shift accelerator logging: Annotations and Announcements. Annotations are free text registrations linked to the current day. They must be one a day for each operator, may be inserted, changed or deleted all the day long but only by its author. Its purpose is to better explain, in textual form, special events, to make comments to current data, or textual amendment to frozen data.

Annotations are always tight to current day data and current accelerator configuration. They may also be characterized by an alert flag that makes them always visible for a given (user settable) amount of time.

This mechanism may be particularly useful for important and/or urgent exchange of messages among operators.

Announcements are similar, but are general purpose and not specifically tight to a given accelerator (logbook) or day registration: they are more free and intended for general messages exchange on accelerators status and necessities. There is no limit in writing these entries.

System Access and Use Modes

The LNL Electronic Logbook is installed on a Linux PC in the LNL data network and there is a limited set of users that may access and use it: the TANDEM-PIAVE-ALPI operators' team, the source team, the experiments coordinator, the administrator.

There are three levels of privileges:
1. administrator
2. calendar coordinator
3. operator

The administrator may do everything, i.e. read, write, create and delete any data, text and defined structure. He is responsible of logbook configuration (defining fields and related attributes included in each logbook) and of DB data maintenance for serious data mistakes that may not be fixed simply by annotations.

Table 1: DB Objects Sizes.

Type of object	n. of items
Accelerators (logbooks)	3
Configuration Tables	7
Data Tables	14
Total n. of Tables	21
Total n. Records in 12 months	~1500

The calendar coordinator has the responsibility of filling the experimental shifts calendar, so determining the associations between accelerators registrations and physic experiments. He only may write, modify or delete current (in terms of date) and future experimental shifts (but not the old ones, which are automatically frozen for him also, after midnight).
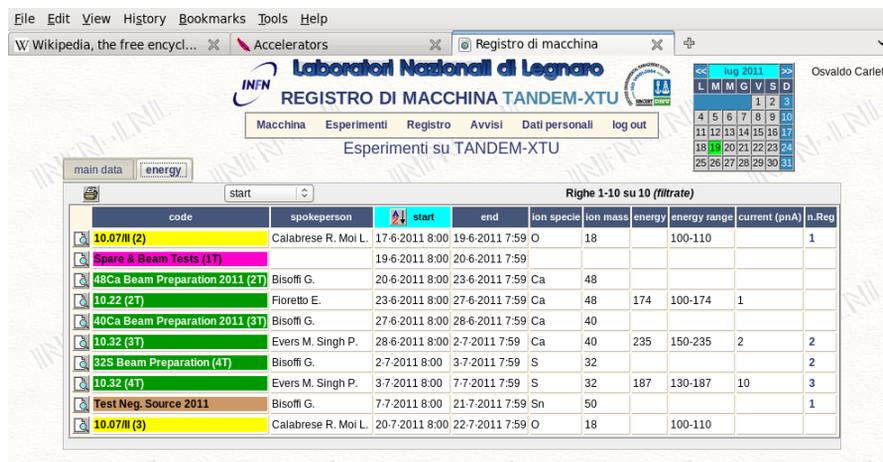

Figure 3: The list of experimental shifts for the TANDEM accelerator.

Figure 4: The external tank of the LNL 15 MV Tandem electrostatic accelerator with photos of an old paper logbook and of the new system.

The operators may read everything, i.e. the calendar tables and registered data of all days and hours in all logbooks, but they may write, delete and change only current day registration and only last hour data (and only if they are the authors of that registration).

Any defined logbook user, no matter which privileges he has, may access in read/write mode to his personal data (name and password).

FINAL NOTES

At the end of 2010 three debugged logbooks have been configured: TANDEM-XTU, ALPI and PIAVE.

TANDEM-XTU (Fig. 4 shows the external tank of the accelerator, its operators' team an photos of its old and new logbooks) is a one-to-one mapping of the old paper logbook into MySQL tables and records.

Differently from the previous, ALPI and PIAVE logbooks both include only a set of essential data and a number of attached files to describe the minimal run-time configuration description of the two accelerators.

The commissioning of the system took place in two steps. A first amount of debugging, especially on table and user privileges and data read/write permissions was performed in June 2010, with the help of two summer students. A second and finer set of check-and-fix cycles took place in autumn 2010 when the system was delivered to LNL operators. At this time a large amount of data

configuration or re-configuration, in addition to the final debugging, through proper and intensive use, was performed, together with some deep re-design of the experiments calendar structure.

At the end of 2010 the system was largely debugged and stable.

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REFERENCES

[1] P. Dubois "MySQL, 4th Edition" Addison-Wesley Professional, 2009, http://www.mysql.com/

[2] "About the Apache HTTP Server Project" Apache Software Foundation, http://httpd.apache.org/

[3] J. J. Garrett "Ajax: A New Approach to Web Applications". AdaptivePath.com, http://www.xul.fr/en-xml-ajax.html