Macmon: A Monitoring Program for ELETTRA

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Abstract

Macmon is a program entirely developed at ELETTRA that monitors and stores all the relevant machine parameters like beam position, beam current, vacuum, rf, injection, insertion devices, magnets current etc. during machine runs. Storage and retrieval of the data, their graphical display and correlations are some of the tasks that Macmon successfully performs. The methods used, its performance and some results are presented and discussed.

1. INTRODUCTION

ELETTRA is a third generation synchrotron light source situated at Trieste (Italy) operating at a variable beam energy from 1.0 to 2.3 GeV [1]. Operational aspects concerning the synchrotron can be found elsewhere [2], here need only be mentioned that currently 25% of the time is dedicated to machine studies while the rest is allotted to the users.

To facilitate machine studies and operation reliability we have developed a machine monitoring program that not only monitors a wide choice of machine parameters but also stores, analyses and compares them. Thus useful correlations can be found and interesting conclusions can be drawn leading towards a better understanding of the machine and consequently increasing its reliability.

The program, Macmon (Machine Monitoring), has been entirely developed at ELETTRA. The program is written in C, the data analysis part utilises the Motif (Toolkit) widgets and it is installed in the ELETTRA control system environment on the control room level workstations.

2. THE PROGRAM

Macmon can mainly be divided into two parts (A better understanding may be obtained from Fig. 1 below) A "low" level part that performs the data acquisition and storage and a "high" level part with the graphical user interface that deals with data reading, analysing and comparing. Additionally some high level software programs used to control and/or to measure from the machine are equipped with routines that can also store data in the Macmon storage files.

The low level Macmon is monitoring the following machine parameters: machine current, lifetime, injection rate, accumulated current, tunes, beam position in all 2x96 beam position monitors, beam size, rf frequency, voltage and temperature for each individual rf cavity, injection elements voltage and time delays, vacuum in each vacuum sector, insertion devices gap opening , power supplies current read and set values, scraper positions and radiation.

Additional information stored in Macmon from application/control programs is: dispersion, chromaticity and actions like the file name used to load the machine power supply currents, cycling and ramping.

3. THE LOW LEVEL PART

This part of the program is used for the data registration and storage. Our approach to the problem is by using separate programs that write on separate files at predetermined but independent time intervals. This way one may save much space rendering high flexibility to the system. Wherever it makes sense, groups of parameters are acquired and stored together. In order to save disk space, the acquired parameters are only written if at least one of them differs from its previously stored value by a predefined threshold. Further disk

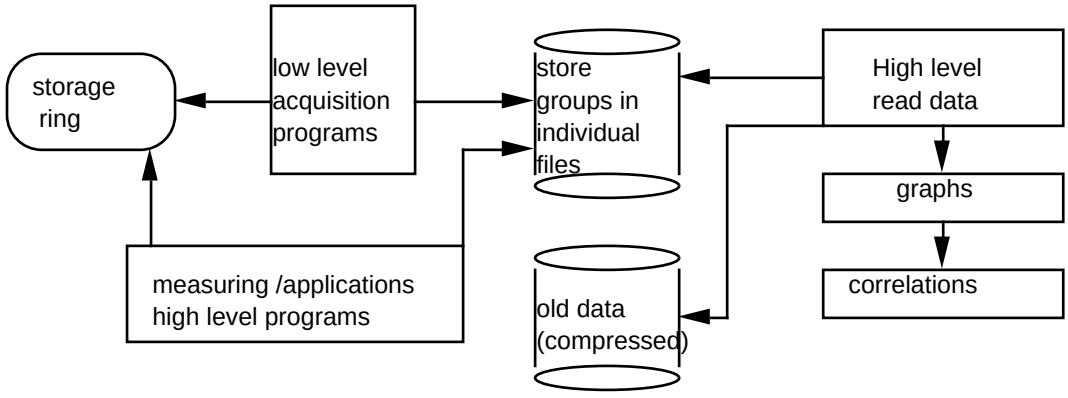

Figure 1: The main features of the ELETTRA Machine monitoring concept.

space saving is achieved by compressing data from previous runs. The decompression is handled transparently by the high level part of Macmon.

The programs run independently from each other, therefore even in the case of one program crashing or being locked up due to the hardware not responding, the others continue the data taking, minimising thus the loss of data. All programs have been written in the same fashion, based on the very successful high level software data structure and functions, developed for ELETTRA [3,4].

A particular group of the low level routines reside directly in some application and control programs which affect the settings of the machine. Therefore when and only when one of these programs change a parameter, this is recorded by Macmon.

4. THE HIGH LEVEL PART

This part of Macmon deals with the data manipulation e.g. retrieval and reading. It furthermore analyses the data in a effective way producing graphs while correlations between two machine parameters are also possible (e.g. see Fig. 2).

The program is user friendly and starts in the "running mode" -real time- namely reads the last line of the currently used monitoring files. For the display the user has to open the logbook window were all the aforementioned parameters are shown. A concise version of the logbook also exists which shows only the most important of the registered parameters. The history of those parameters can also be exported into tables for further analysis and printing.

To see the history of one or more parameters the user has simply to enter the start time and the end time. This is possible either directly or by opening a machine file catalogue that permits the user to target the time of a special action like loading a machine file, cycling or ramping. After the time interval is set the user opens the plot window where one chooses the item to be plot. The plot pops out as a separate widget equipped with scale and save/print buttons.

In order to monitor quickly changing parameters, e.g. in the case of power supply oscillations, a trend routine is available, which logs one parameter as fast as possible and plots its history over the last few minutes.

5. CONCLUSIONS

The program has been successfully used since its first version one year ago and has provided much valuable information. It has been continuously upgraded and increased in performance over the past year. New structures and parameters could be added without major changes, due to the modular structure of the program and of the high level software of ELETTRA. In the figures 2 and 3 below one can see some characteristic pictures out of Macmon's imbedded graphic routine.

6. ACKNOWLEDGEMENT

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REFERENCES

[1] A. Wrulich, " ELETTRA Status Report", proc. EPAC 1994, London, (1995)57

[2] C.J. Bocchetta et al, "One and a Half Year of Experience with the Operation of the Synchrotron Light Source ELETTRA", these Proceedings.

[3] M. Plesko, "A complete Data Structure for the High Level Software of ELETTRA", proc. EPAC 1994, London, (1995)1773.

[4] M. Plesko et al, "The High Level Software of ELETTRA", proc. EPAC 1994, London, (1995)1776.

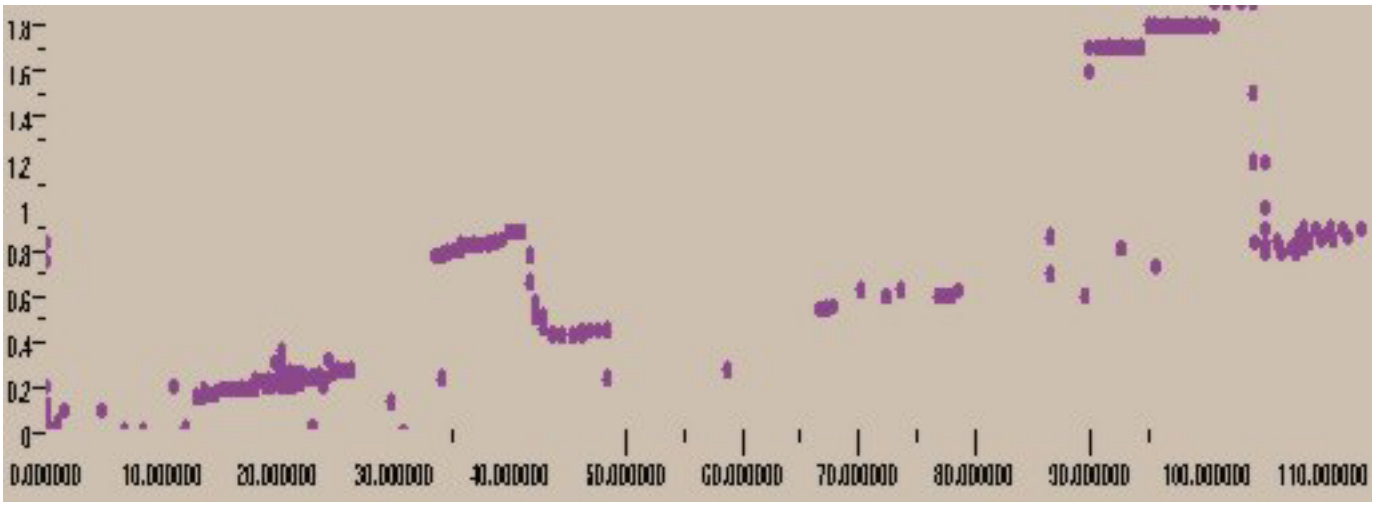

Figure 2: A Macmon correlation graph between pressure (pBar, y-axis) and beam current (mA, x-axis) over four days. As the storage ring was running both at 1 GeV and 2 GeV one can see the two main trends as straight lines.

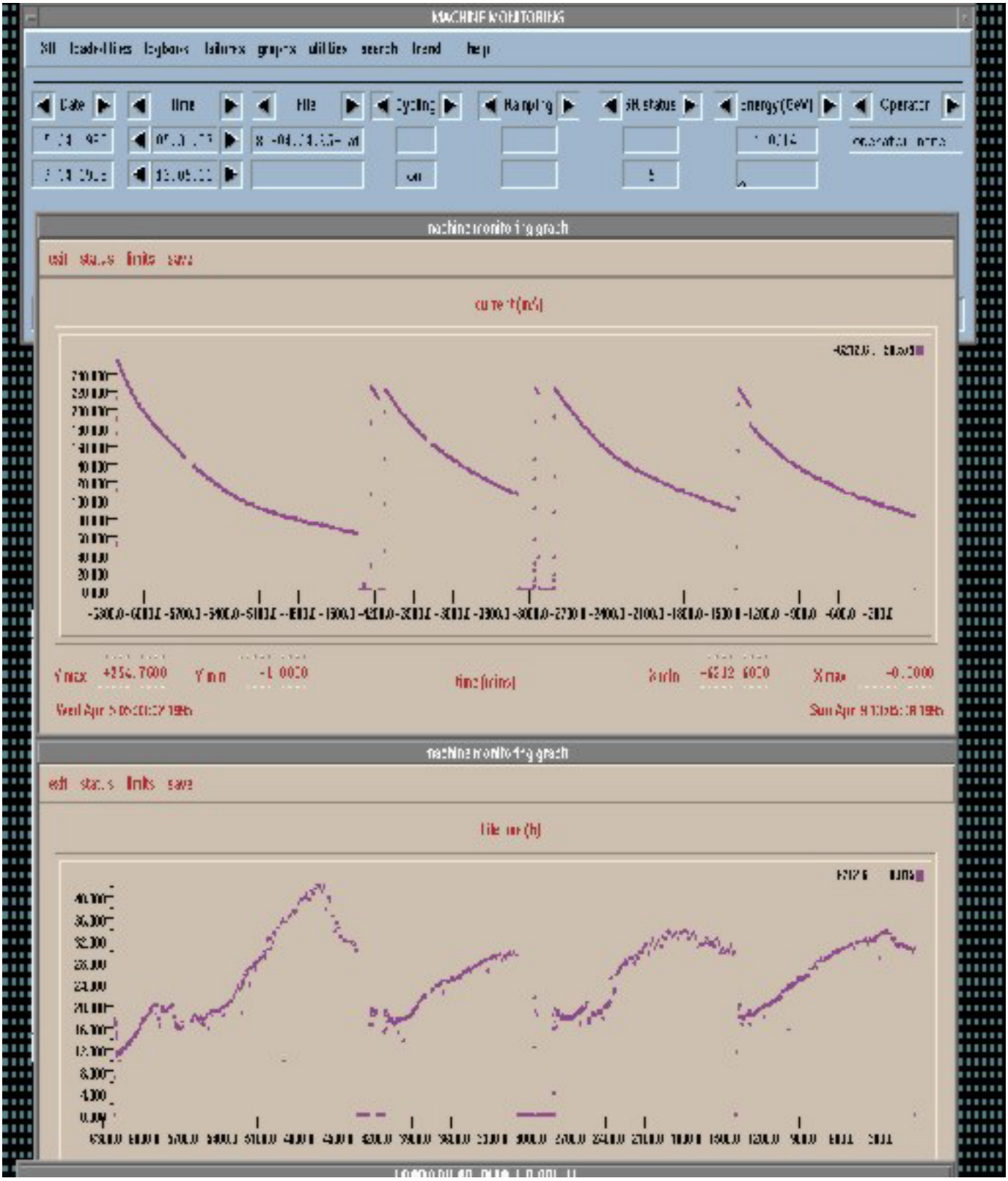

Figure 3: A classic picture of the machine current (mA, above) and lifetime(hours, below) on two independent graphic windows, for a period of four days and one injection per day. On the top it can be seen the main panel of the interface.