CONTROL APPLICATIONS FOR SOLEIL COMMISSIONING AND OPERATION

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Abstract

Synchrotron SOLEIL, the French third generation light source being commissioned in 2006, is the first facility using TANGO as a full control system. Control applications for operation and Beam Physics Dynamics have being developed using two major tools: the Matlab Middle Layer adapted from ALS and SPEAR3, and GlobalSCREEN, a commercial SCADA software. Both tools are fully interfaced with the TANGO control system. In this paper, a sketch of the software architecture is shown. Then storage ring applications developed in house are presented. Finally configuration and database related applications (archiving, snapshot) are briefly described.

SOLEIL Accelerators

Synchrotron SOLEIL is a 2.75 GeV third generation light source whose storage ring commissioning is under way. The Linac, Booster ring and the two transfer lines have been started since last year. Main results are presented elsewhere in this conference (see general paper [1] and references therein).

Software Architecture

SOLEIL control system is running TANGO, a CORBA based control system initially developed by the ESRF and SOLEIL synchrotrons. This is the first time TANGO is used to fully operate accelerator facilities. The number of equipments already controlled by TANGO is impressive. For instance for the storage ring, 315 power supplies, more than 1,000 vacuum system equipments have been deployed and fully tested during these late months. Quite surprising, we never been delayed up to now by software and control system (see reference [2] for more details).

Using a 1 gigabyte network with already more than 900 Ethernet connections, the control system is hosted on windows and GNU/Linux servers. X-terminals are mainly used in the control room.

Throughout this paper, we attend to present the tools we have been using from the Linac to the storage ring commissioning. Lots of beam dynamics related tools were tested prior to the commissioning using a simulator and pseudo TANGO device servers. A large number of applications for operation are thereafter presented as well.

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MATLAB MIDDLE LAYER

The core of the commissioning tools is based on Matlab ™ [3] applications developed by the SOLEIL Physics group. The Matlab Middle Layer (MML) fully interfaced with TANGO have been adapted from ALS and SPEAR3 version (see Ref. [4, 5] and references therein). For the first time, MML have been configured for running transfer lines, booster and storage rings from day one. Users have the possibility to switch from online to the simulator based on Accelerator Toolbox [6]. Beam transport is also available for transfer lines and first turn tracking in booster and storage rings related applications.

Extending ALS and SPEAR 3 set of high level control applications, more than 30 different families of equipments are available from Matlab environment. Graphical User interfaces (GUIs) such as LOCO, plotfamily (Fig. 1), orbit correction could be used at SOLEIL with very little adaptation, which allowed us to run almost free bug applications.

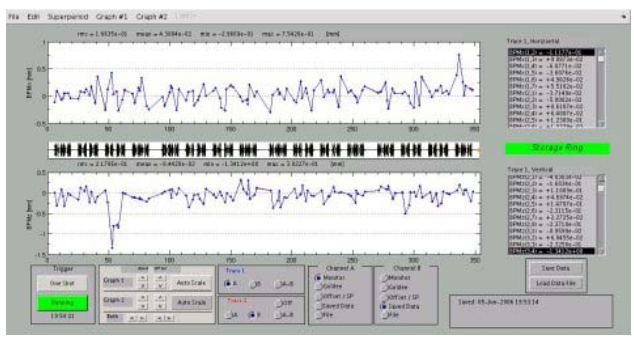

Figure 1: Plotfamily GUI used for displaying the horizontal and vertical storage ring orbit.

As we used a lot Matlab scripts shared by the accelerator community, only a fine machine dependent tuning was needed. So scripts for changing setpoint values, getting readback values, setting tunes, chromatricities, measuring dispersion functions, response matrices were operational in the control room in a very shot time.

New GUIs have been developed for magnet cycling, first turn correction, energy tuning (Fig. 2), emittance and energy dispersion measurements, timing system control for instance in a very efficient way.

Matlab based applications allowed us to do quick commissioning. Its script language, and simple syntax, mathematical and graphical libraries are major features letting Beam Dynamics Physicists develop in a very efficient way new tools and giving them a more independence with re-

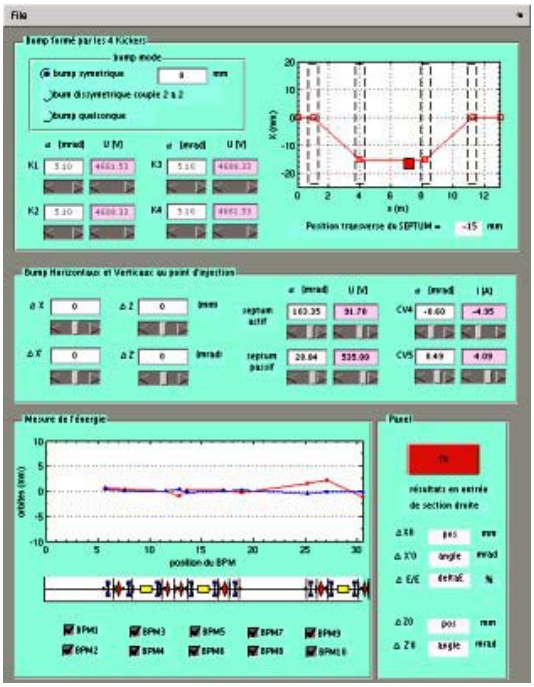

Figure 2: GUI for injection and energy matching.

spect to the control group. It allows us as well to prototype a lot of applications before final encapsulation into robust TANGO device servers.

To end, TANGO/Matlab communications reveal to be very good. For instance retrieving a batch of 120 times 8 times 1,000 double scalar related BPM data turned to be 0.5 s in average using the TANGO group mechanism.

GLOBALSCREEN SUPERVISION

For operation and easy to use (non expert) applications, a JAVA based industrial supervisor named GlobalSCREEN ™ [7] have been interfaced with TANGO. Starting the storage ring commissionning, almost ten supervision applications, mostly developed by the operation group, are daily used:

- Application for Personal System Safety and Radiation monitors,
- two applications for supervising each of the two transfer lines,
- two applications for booster and its RF system,
- seven applications for the storage ring supervision: power supplies and magnet survey (see Fig.3), vacuum systems, interlock system, RF superconducting systems, beamline front-ends, insertion device control, diagnostics.

The last three applications are still in a early development phase and a lot of efforts needs still to be made for enhancing the communication speed with thousand of equipments.

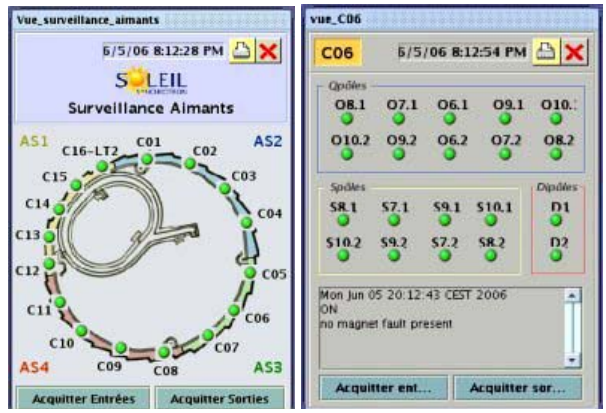

Figure 3: GlobalSCREEN application for surveying all the SOLEIL magnet defaults (water and temperature trips).

LabVIEW Applications

Using the efficient TANGO/LabVIEW binding, three LabVIEW ™applications are used for controlling the Visible Synchrotron Radiation Monitor, the future Pinhole system and, measuring the tunes. Figure 4 depicts the tune measurement applications. Tune excitation is provided either by a shaker magnet or by a strip-line. Excitation is plane dependent. Signal is read either directly on a spectrum analyzer or from the turn by turn BPM. Tunes are then published into TANGO for archiving and full integration into beam dynamics applications.

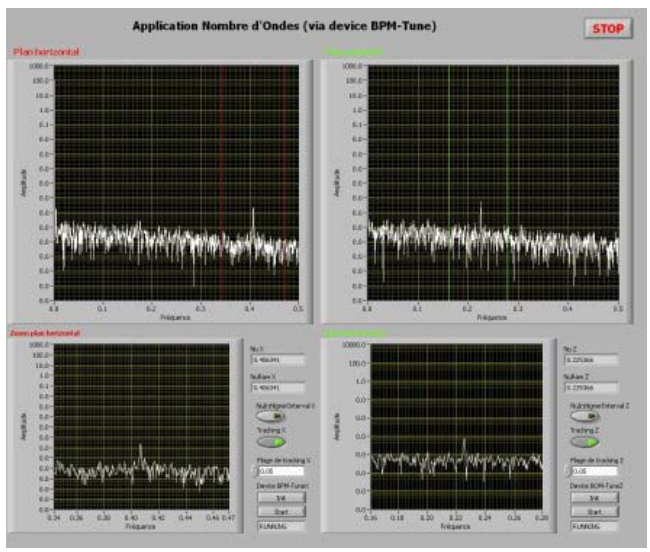

Figure 4: Tune measurement application: horizontal tune (leftside) and vertical tune (rightside) detection.

OTHER COMMISSIONING TOOLS

TANGO Generic Tools

Generic tools such as ATKpanel, monitoring (DeviceTree, ATKtrend) have been extensively used. These simple

JAVA graphical interfaces are provided for free by TANGO environment and allow us to control any equipment.

Tango devices provide also high level services such as average pressure computation, state composer, data analysis, image processing, equipment monitoring, ...

Archiving GUIs

Graphical User Interfaces for archiving configuration and extraction have been intensively improved since one year. The TANGO archiving system is a genuine SOLEIL development. All attributes (signals) are by default archivable in a long term and short term databases. A JAVA based GUI named MAMBO enables the users to archive and extract data from an Oracle database. A snapshot is given by Figure 5.

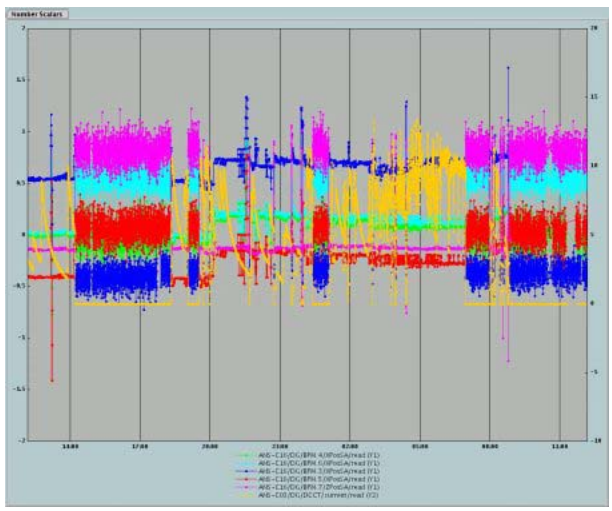

Figure 5: MAMBO application used for extraction BPM and current data over a given time span.

Bensikin application is another user friendly application for generating snapshots of setpoint values and for restoring them back on to the equipments. This tool is also a JAVA based GUI developed in house for SOLEIL and the TANGO community. It demands still speed enhancements to be fully used in the control room.

Elogs and Quality Tools

As a shift electronic logbook, Elog weblog tool [9] have been chosen both for the operation and for commissioning. Now two of them are currently used in the control room.

Software quality is satisfactory thanks to good software engineering practicing: use of CVS as versioning management, PMwiki [10] as a WIKI tool for collecting and storing HOWTOs and control system recipes, MANTIS software [11] as a bug tracker.

CONCLUSION

TANGO bindings developed in a early stage of the SOLEIL project have been proven to ease a lot the writing of physics control applications and their debugging during the commissioning phases. Sharing of the Beam Dynamics Physics Matlab applications used in other accelerators saved of lot of time and provided first day robust applications. TANGO control system has proved its efficiency to control large number of distributed heterogeneous equipments in spite of its youth.

In addition to standard application tuning, the coming milestones are insertion device control and beam-line front-end control, but also slow and fast orbit feedbacks, top up operation.

ACKNOWLEDGEMENTS

Most of this work would not have been possible without the constant support of all the SOLEIL teams and the excellent working atmosphere. The first author wish to thank G. Portmann for lots of interesting discussions about MML. The authors are grateful to the TANGO community.

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[9] S. Ritt, http://midas.psi.ch/elog, PSI, Switzerland.

[10] A wiki based system for collaborative creation and maintenance of websites, http://www.pmwiki.org.

[11] Mantis Bug Tracker, http://www.mantisbt.org.