

# HIGH-LEVEL CONTROL APPLICATIONS FOR SOLEIL COMMISSIONING AND OPERATION

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## Abstract

The SOLEIL control system, namely TANGO, developed in collaboration with ESRF, is now mature and stable. TANGO has been also chosen now by several other laboratories. High-level control applications implemented in the control-room for the storage ring, the two transfer lines, and the booster will be described in this paper. Three kinds of tools for commissioning are used. First the generic TANGO tools (alarms, simple graphical control applications), which allow us to control in a simple way any TANGO Device Server. Secondly a Matlab Middle Layer (adapted from ALS and SPEAR3): Matlab is fully interconnected with TANGO; it is used primarily for writing physics control applications. Finally GlobalSCREEN, a commercial SCADA software devoted for building operation applications has been selected (panels for controlling or displaying setpoint, readback values, status of equipments). In addition an overview of the historical and short-term databases developed in house will be given.

## INTRODUCTION

### *The new French third generation light source*

SOLEIL [1] is a 2.75 GeV third generation light source under construction. Starting of the injector [2] is underway. Booster elements are installed in their tunnel [3]. Installation of the storage ring is in progress. Commissioning of storage ring will start beginning of 2006. The reader can be referred to Ref. [4, 5, 6] for a complete status of the project.

### *Tango overview*

TANGO [7, 8, 9, 10] is a CORBA based control system being developed by the ESRF and SOLEIL synchrotrons. It offers a set of generic services like logging, polling, events, alarms, configuring. Communication can be synchronous, asynchronous or event driven. Device servers can be written in C++, JAVA, and soon Python. On the client side, Igor-Pro, Python, Matlab, LabVIEW softwares are fully interfaced.

TANGO is now mature and well tested: more than 150 servers and 25 applications installed at ESRF; the LUCIA SLS beamline [11] is managed by SOLEIL team.

ELETTRA [12] and ALBA [13] (new Spanish third generation Light Source) have joined the TANGO collaboration: the former for controlling their booster to be built, the latter for all the accelerators and beam lines.

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## DATABASE FOR ACCELERATORS

Databases are a major service to understand and to follow about 6,000 main parameters of the accelerators. They are valuable in the control-room to give the heartbeat of the machines, to enable operators and experts to correlate signals, to get a picture of the accelerator at a given time, to compare snapshots.

Two databases have been developed by SOLEIL and are fully integrated in TANGO as a service (any signal can be archived).

- A historical database with an archiving frequency up to 0.1 Hz. Data are stored for ever. Main archiving modes are : periodic, absolute, relative, on threshold.
- A short-term database (a few hour retention) but with a higher archiving frequency (up to 10 Hz). It will be used mainly for daily operation in the control-room.

Both databases can be running under either Oracle or MySQL. They are now in production. Nevertheless, their graphical user interfaces (GUI) for configuration and data extraction are still under development.

Finally, handling snapshots is centralized in a dedicated database. Generation, configuration and application of snapshots will be fully integrated as a new generic TANGO service.

## TOOLS FOR COMMISSIONING

Controlling the accelerators will be done using mainly three types of tools: generic TANGO tools, Matlab and GlobalSCREEN.

### *Generic TANGO tools*

Generic tools are ready-to-be-used graphical applications whatever the device to control (by use of the TANGO introspection mechanism). They are powerful, providing a full interface (commands, attributes, states), but not very user-friendly for everyday operation. These tools are based on ATK Tango library, a set of JAVA graphical components (integrated notion of errors, alarms, re-connection mechanisms, data refreshing). An example of control panel for an ion-pump is illustrated by Fig. 1. Figure 2 shows a trend panel for monitoring a signal.

### *GlobalSCREEN*

A commercial JAVA SCADA, named GlobalSCREEN [14] has been chosen and linked to TANGO.

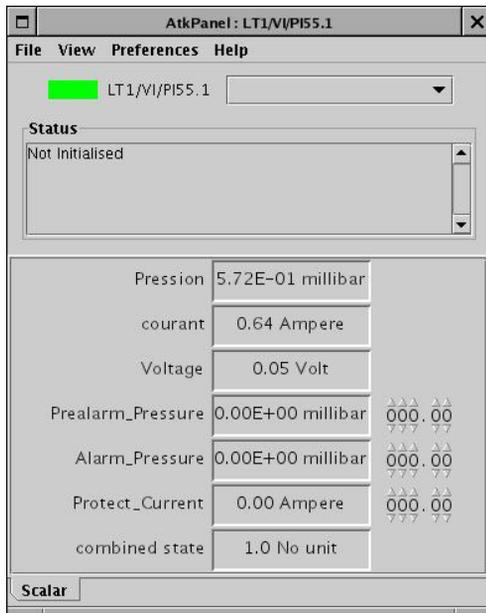


Figure 1: Generic control panel: ATKpanel.

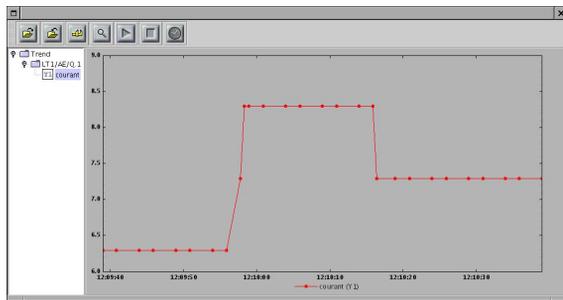


Figure 2: Generic monitoring: magnet current time-evolution.

It enables developers to build quickly user-friendly GUIs without writing any lines of code (just using drag-and-drop). It uses JAVA-BEAN technology (pure JAVA developed components). A SOLEIL library has been written and ATK-library components have been encapsulated as java-beans.

GlobalSCREEN software provides users with an homogeneous and quick framework to develop GUIs (same interfaces for controlling RF-systems, power-supplies, motors, insertion devices, etc, for the control-room, beamlines). At level-application, access permission can be easily defined: mainly operators versus experts control modes.

An example of synoptic for controlling the booster power supplies is given by Fig. 3. Figure 4 shows a summary panel for the linac-to-booster transfer line correctors (names, setvalues, readback values, differences, states).

### Interfacing external applications

Communication between TANGO and turn-key systems such as Linac application (through LabVIEW datasockets),

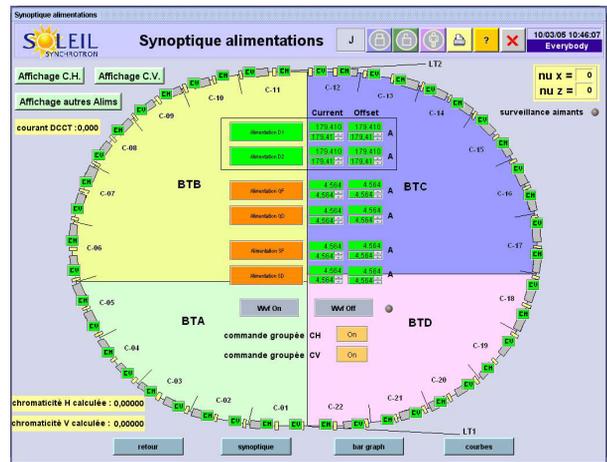


Figure 3: GlobalSCREEN application: Booster power-supplies.

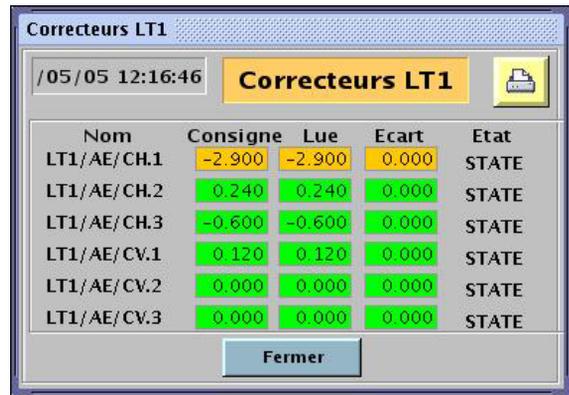


Figure 4: GlobalSCREEN application: corrector power-supply summary panel for linac-to-booster transfer line.

cooling system (through OPC communication) are being written by the control group. An interface with EPICS Data Channels has also been written for the LUCIA beamline.

### Matlab in the control-room

Matlab [15] will be used as a major tool for commissioning the accelerators and writing accelerator physicist applications. It provides ready to use graphical, mathematics, development, platform independent libraries.

At the ALS [16], a Middle Layer [17] has been used for 10 years for controlling the storage ring. Its purpose is to mask to the users all the low-level of the control system (EPICS nomenclature, commands). Equipments are organized into families and elements (different levels of abstraction). It is built mainly around two functions to read and write setpoint values. Unit conversion function from Hardware to Physics world, shortcut functions, utility functions, script language make its use very convenient. Users benefit from an extended tested set of accelerator physics applications (e.g. orbit correction, power-supply control, tune measurement, orbit response matrix).

At SSRL, external toolbox were added to provide interfaces with a beam simulator (AT simulator [18, 19, 20], LOCO interface [21]). This middle layer is now being used in control-room of SPEAR3 [22], CLS [23] and soon at least at DIAMOND [24] and ALBA. Users can easily switch from the online machine to the simulator.

For SOLEIL use, the middle layer has been adapted by replacing the EPICS layer with a layer enabling TANGO communication. A Matlab/TANGO binding developed at SOLEIL for this purpose. Then the middle layer was extended to control all the accelerators (Booster, transfer lines).

ALS and SPEAR3 applications have been enriched. GUI have been written for configuring the TANGO static Database, archiving, taking snapshots. For the first transfer line (TL1), applications for measuring the emittance and energy spread coming out of the Linac are now available. Figure 5 exhibits an application for controlling TL1 optics. For the booster, GUIs to handle BPM data are under development.

Whenever complex graphical user interfaces or very efficient codes are required, Matlab can be used for prototyping applications to be latter developed in C++ or JAVA languages.

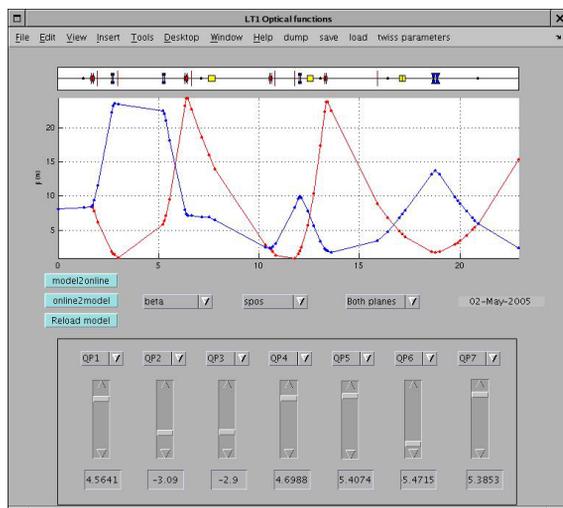


Figure 5: Matlab application: control of the optical function for the linac-to-booster transfer line.

## CONCLUSION

Most high-level applications for SOLEIL have been tested directly with TANGO thanks to pseudo-device servers simulating the equipments and to the Beam simulator under Matlab.

On the TANGO side development goes on: writing of equipment device servers, TANGO enhancement with other institutes. On the high-level control application side, operation GUI construction will start for the storage ring and the beam lines.

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