ELI-ALPS Control System Status Report

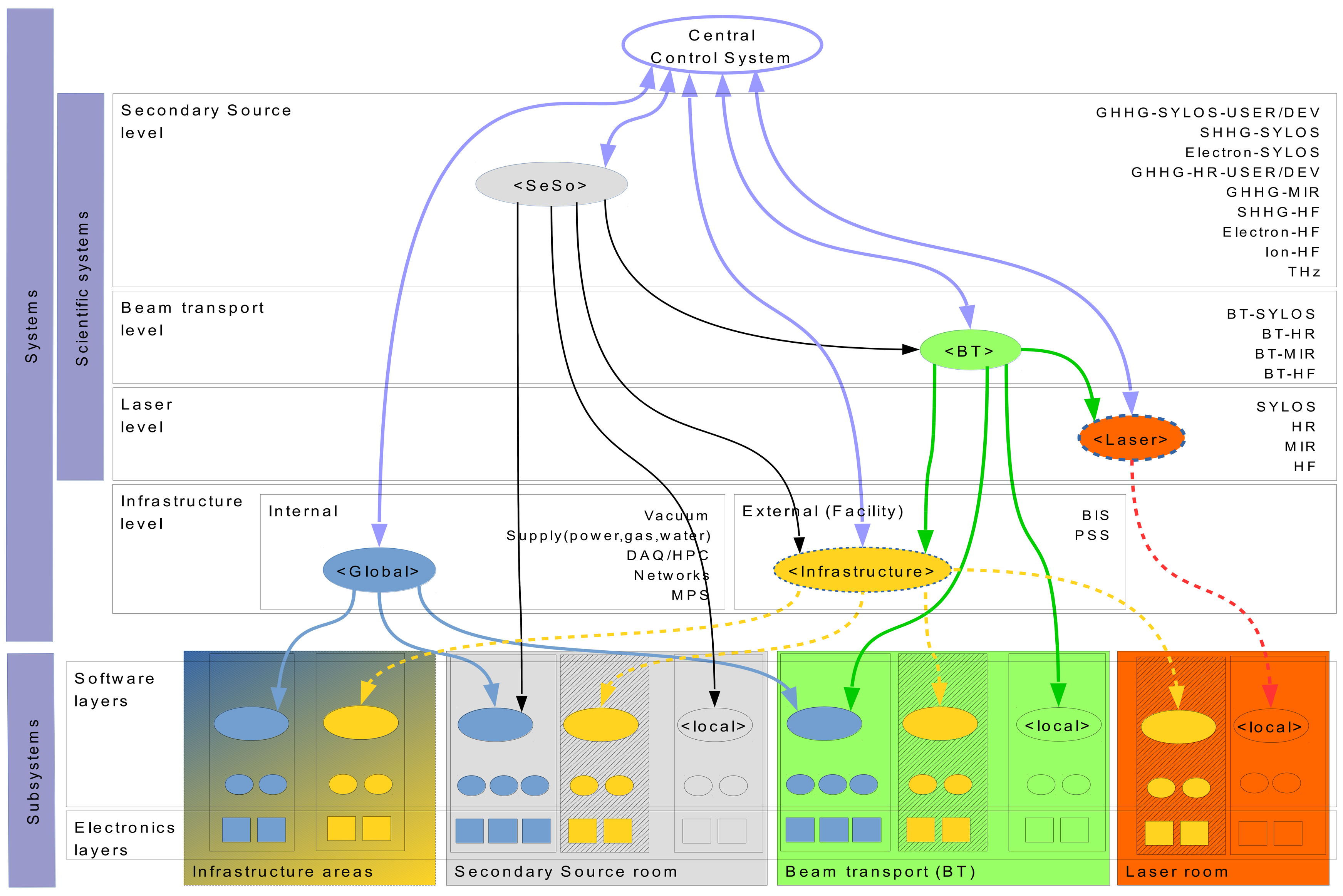
L.J. Fülöp, S. Brockhauser, S. Farkas, V. Hanyecz, M. Kiss, M.T. Koncz, Á. Mohácsi, K. Nelissen, L. Schrettner, B. Szalai, P. Szász, C. Turner

ELI-HU Nonprofit Ltd., Dugonics tér 13., H-6720 Szeged, Hungary

Motivation

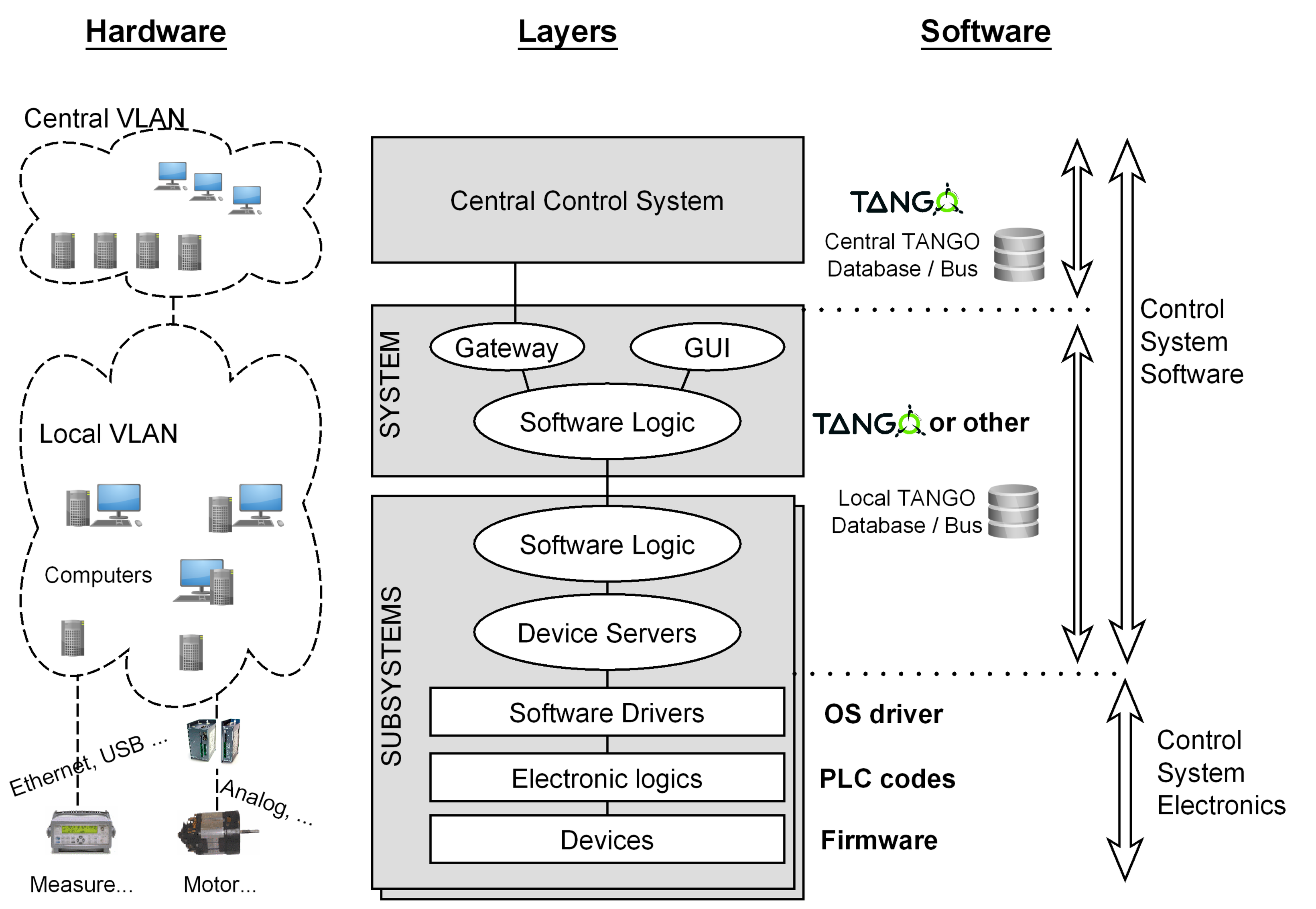
ELI-ALPS is one of the three pillars of the European Extreme Light Infrastructure project. As a research facility, the infrastructure will contain a large number of experimental devices and equipment which have to be managed and controlled by a robust and flexible system. The Control System of ELI-ALPS will be based on TANGO.

Systems and Subsystems



Systems are composed of combining subsystems. These can be organized into different levels, represented by boxes in the Figure: the group name (e.g. Beam Transport Level) is indicated in the top-left corner, while the instances (the corresponding systems) are indicated on the right side of the box (e.g. BT-SYLOS).

Layers



Each system (and subsystems) has some layers and each layer addresses hardware and software aspects. The layers can be grouped into Control System Electronics and Control System Software.

Layer	Role	Hardware	Software
Devices	Elementary building blocks	electronically controllable device, e.g. a motor	Firmware
Electronic Logics	Controlling the device and providing fast logics	An electronic controller, a relay, a PLC, etc.	PLC codes, interlocks, etc.
Software Drivers	Connecting the electronic and software worlds	A device/controller can be connected to computer(s)	OS drivers and/or dedicated ones, e.g. LIMA
Device Servers	Making the devices available on the TANGO network and hiding all details about layers below	One computer can host several device servers on the local network	One device server can provide access to several devices
Software Logic (subsystem)	Providing subsystem level functionalities on sets of related device servers	Computer(s) host all the software logics	Software logics are implemented also as TANGO device servers
Software Logic (system)	System level functionalities on sets of subsystems	Computer(s) host all the software logics	Also implemented as TANGO device servers
Graphical User Interface (GUI)	Giving access to the software logics and to the devices for the operators and users.	Clients can be executed on dedicated computers of the local network	TANGO provides generic clients and a toolkit to create custom ones
Gateway	System provides this as an access point (monitor/ control) for other subsystems and to the central control system	One or several computers can provide the gateway. It should be accessible on the local LAN.	TANGO device server(s) can represent the Gateway. It should accessible in the local TANGO Bus.

Requirements

Scientific Systems

- Laser Sources will be delivered as black-box turn-key systems with the Gateway
- Secondary Sources: The requirements, the technical design, the hardware shopping list are provided by expert institutes
- Beam Transport: The requirements, the technical design, the hardware shopping list are provided by in-house experts
- The control systems and the integration of these will be delivered by dedicated project(s)

Central Control System

- Basic central services: archiving, alarms, logging, overview GUIs
- Integration platform orchestrates the collaboration of the systems through the gateways. The gateways are accessible only from the central system; the systems can communicate through a proxy. Systems can be pre-allocated.

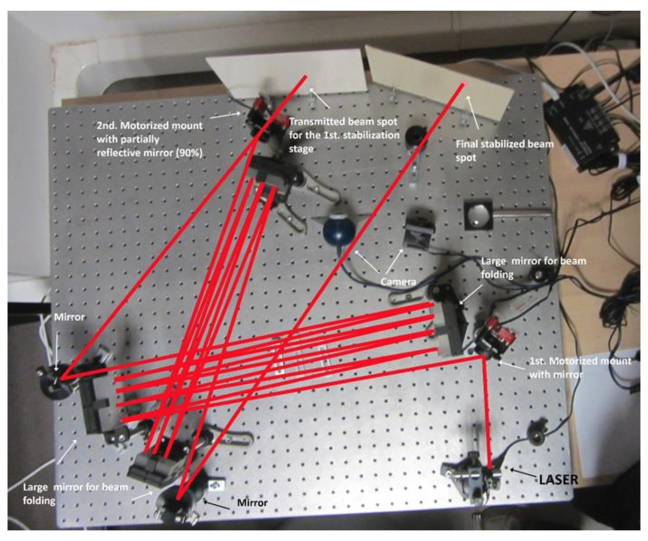
Data Acquisition

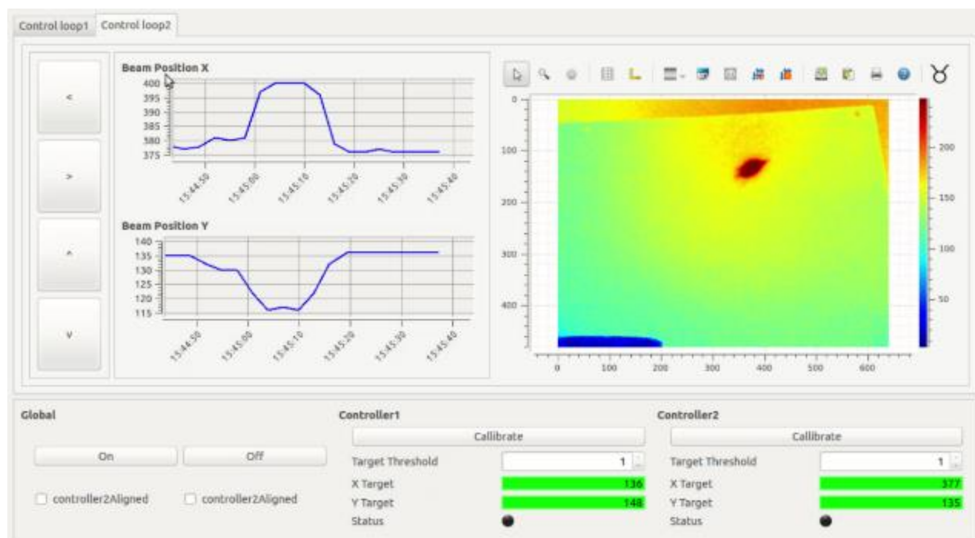
- Software framework acquiring, data processing, and augmenting experimental data with metadata from all of the experiments and secondary sources
- use the common facility level timing for both triggering and timestamping
- An experiment consist a series of batches, each batch will have a unique ID

Prototypes

Two types of PoC prototypes were developed: vertical prototype works with real-hardware on a small setup, while horizontal prorotype works with simplified hardware simulation of all laser and secondary sources (~700 simulated devices).

Vertical prototype

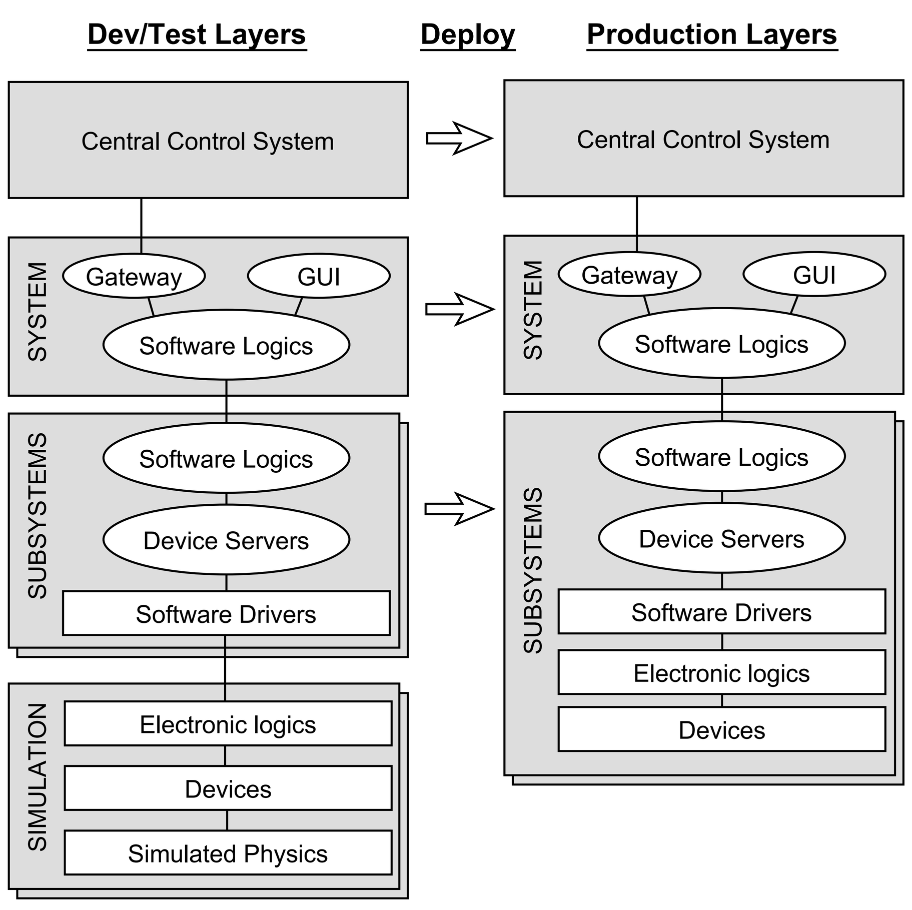


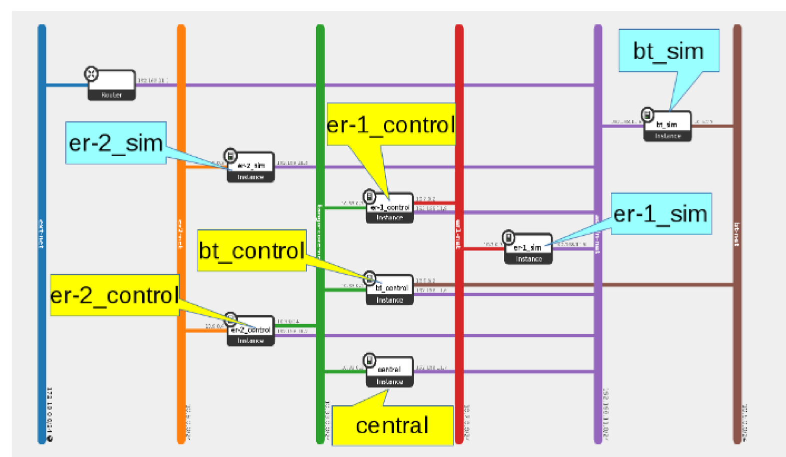


A really simplified optical system has been assembled (on the left). In the software logic layer there were two loops for stabilizing the manually pre-aligned beam. The GUI (on the right) displays these loops and also gives action buttons to the users.

Simulation framework

The horizontal prototype was not enough generic and reusable directly for development and testing, therefore a simulation framework PoC prototype is elaborated. The framework is demonstrated with a simplified scenario.





Layers of simulation and deployment to the production (on the left); hardware and network is virtualized with Openstack (on the right); the software differs only in configuration.

Acknowledgement

The ELI-ALPS project (GOP-1.1.1-12/B-2012-000, GINOP-2.3.6-15-2015-00001) is supported by the European Union and co-financed by the European Regional Development Fund.

Contact: sandor.brockhauser@eli-alps.hu