

Pyrame, a rapid-prototyping framework for online systems

Frédéric Magniette, Miguel Rubio-Roy - LLR



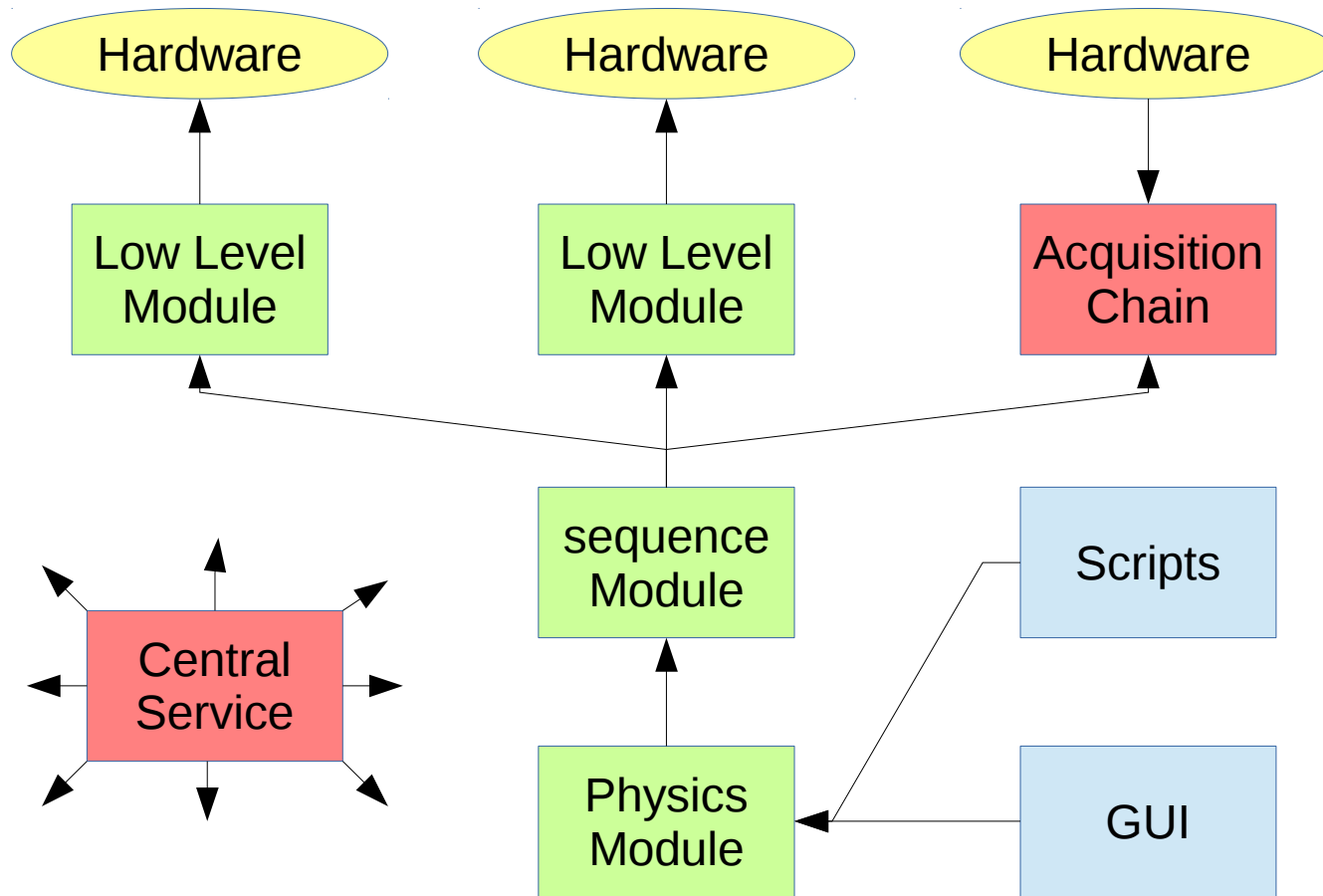
Why a new framework ?

During the R&D phases on a test-bench, we need :

- Very flexible system (Quick setup)
- Long term stability
- Easiness of programming
- Reusability
- Scalability over a network

No existing framework with all this properties !

Architecture

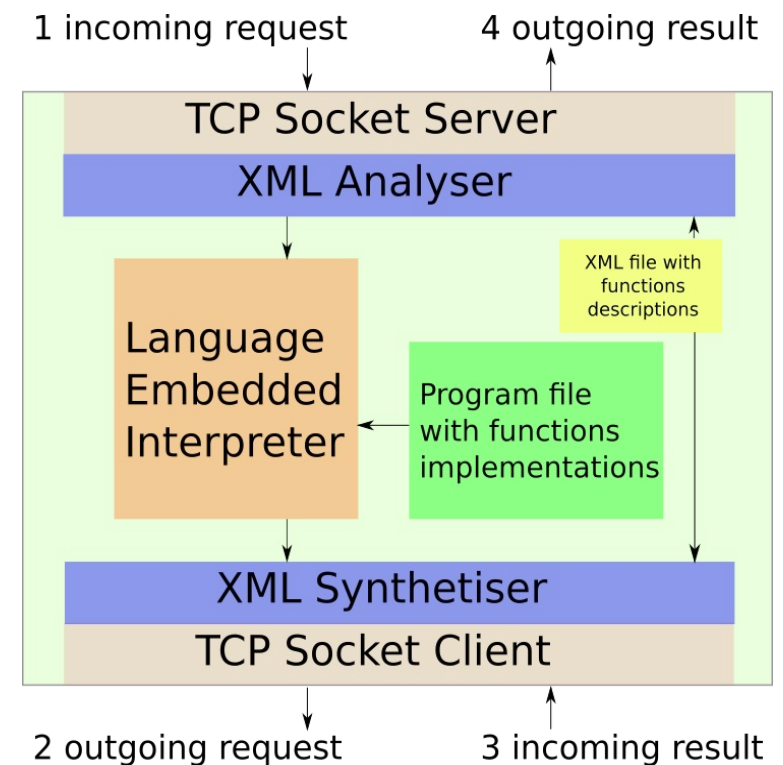


- Hierarchical architecture of unitary modules
- Emulated by peer to peer asynchronous network
- Protocol is XML over TCP

Command Module

- Virtual machine handling network and protocol aspects
- The onliner developer can concentrate on online problems
- Multiple available languages Python, Lua, C/C++, Bash
- Average performance :

Language	Performance $\mu\text{s/op}$
C	187
C++	193
Lua	241
Python	259
Bash	280



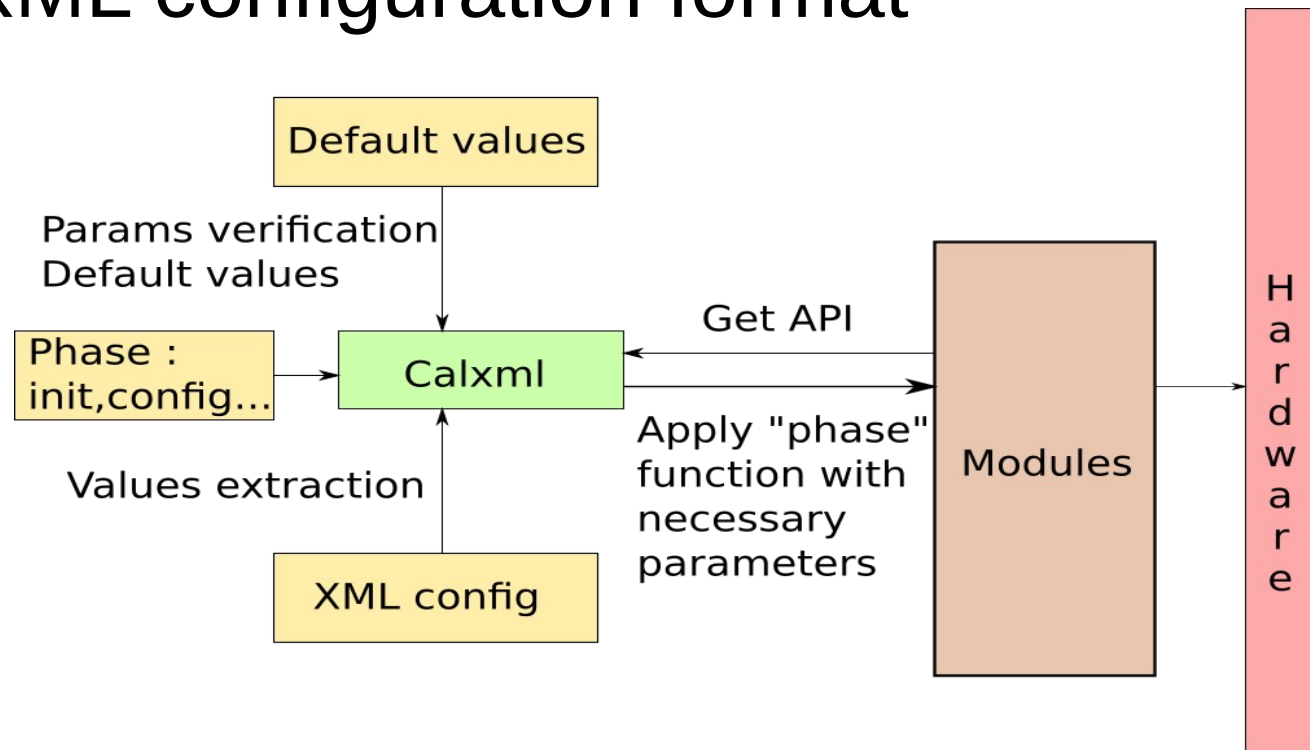
Dozens of hardware modules

- Buses : RS232, GPIB, Ethernet, TCP, UDP, USB
- Power Supplies (Agilent, CAEN, Hameg...)
- Pattern Generators (Agilent)
- Motion controllers and probe station (Newport, Thorlabs, Signatone)
- Digital storage oscilloscopes (Lecroy)
- Particle detector chip (Omega)
- GaussMeter (LakeShore)
- Multimeter (Keithley)
- Arduino



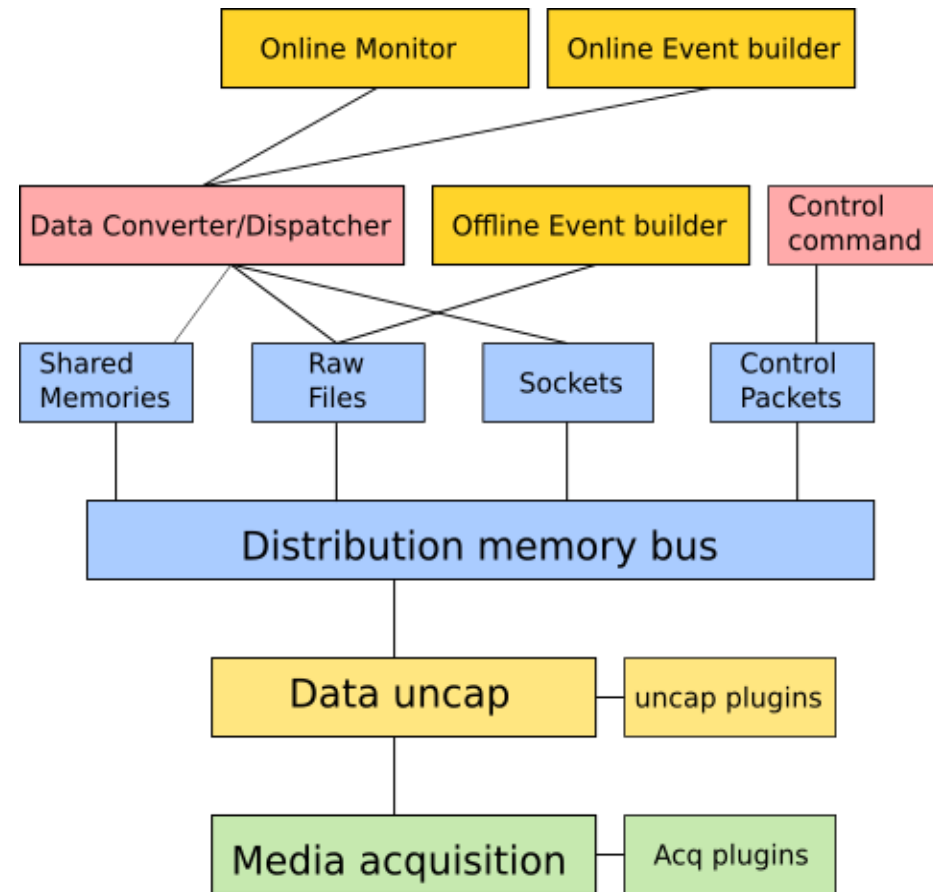
Service modules

- Variables-sharing module
- Configuration module (parameters hierarchical DB)
- Automatic configurator (calxml) based on a unified XML configuration format



Acquisition Chain

- Multimedia (plugin system) :
Ethernet, TCP, UDP, USB, RS-232
- Multi-format (plugin system)
- Distributes data :
 - Raw files
 - Shared memory (raw data)
 - TCP sockets (raw data)
 - Event Subsampling (via converter/dispatcher)
- Online event builder (ongoing work)
- Good performance : 1.7Gb/s



Bindings

- Bindings allow to pilot the setup via scripts or GUIs
- Available bindings in C, C++ (including Root), Python, R
- Easy GUI developpement in Labview or Javascript
- Interfacing with SCADA :

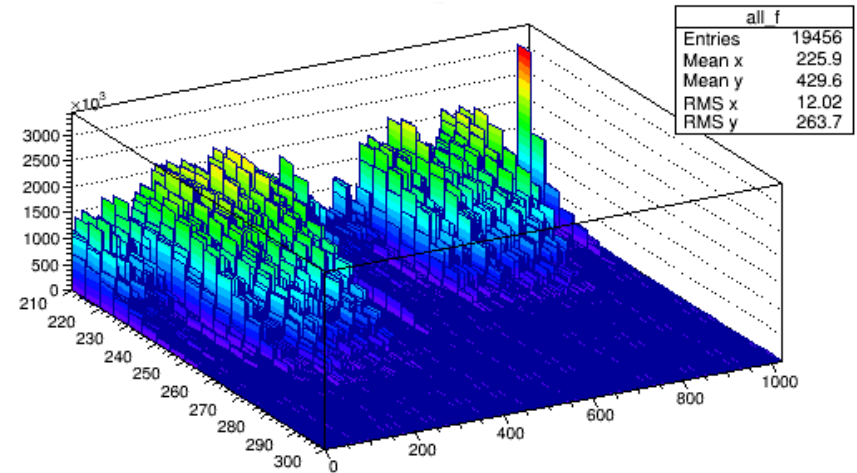


Application ILC ECAL

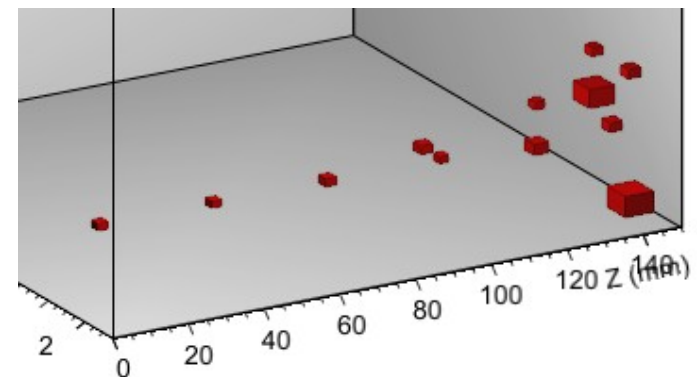
- Ten layers of Si-W calorimeter with dedicated DAQ electronics
- Pyrame is used to pilot the whole detector
- Physics : calibration, S-curves, long acquisitions, monitoring
- Stability : more than 100k successful configurations and data acquisitions
- Web GUI



ILC ECAL test-beam at DESY

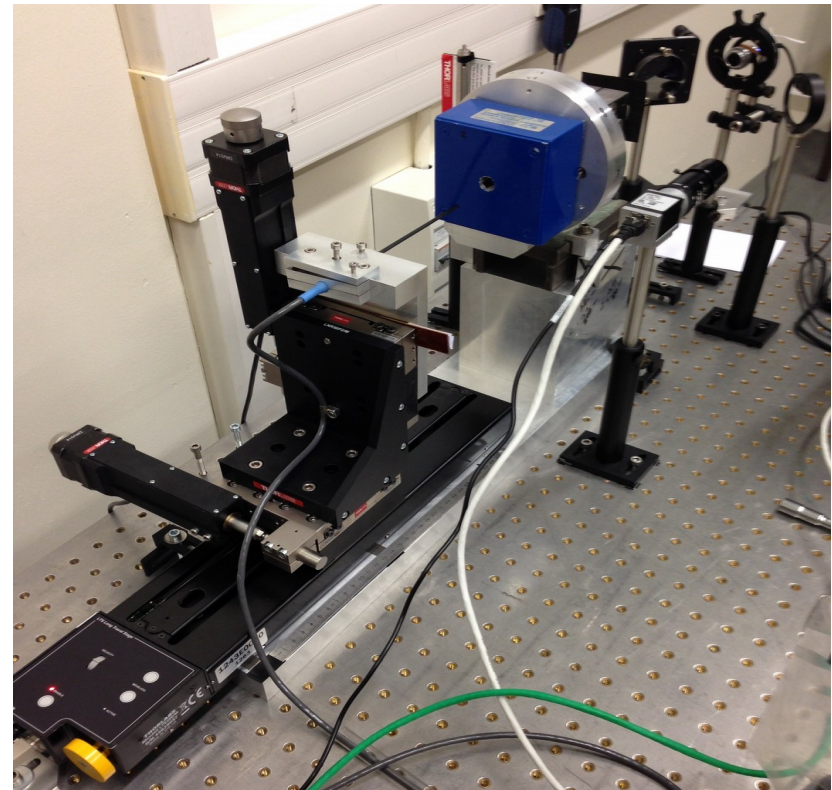
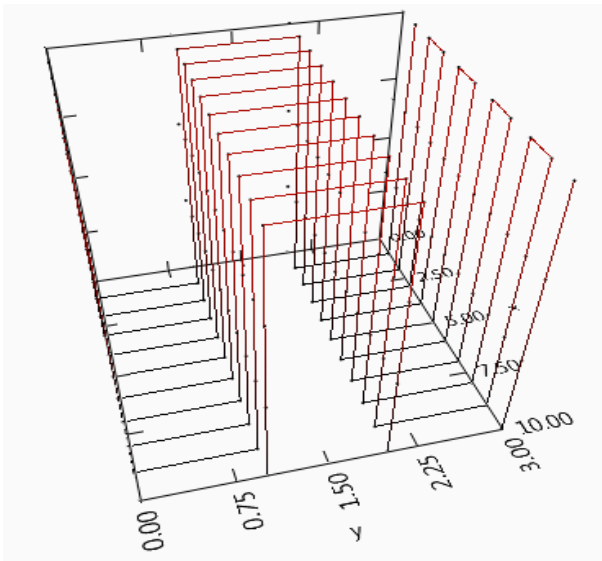


S-Curves and Shower plot



Application : Gauss Bench

- Automatic 3D mapping of magnetic fields
- Pilot a motorized magnetic probe
- Automatized generation of scan paths with obstacles constraints
- Labview GUI



Conclusion

- Open-source and freely downloadable at <http://lr.in2p3.fr/sites/pyrame/>
- Actively developed : version 2.1
- Stable and powerful
- Lightweight (usable in embedded systems)
- Scalable over networks
- Easy to use
- Fully documented

