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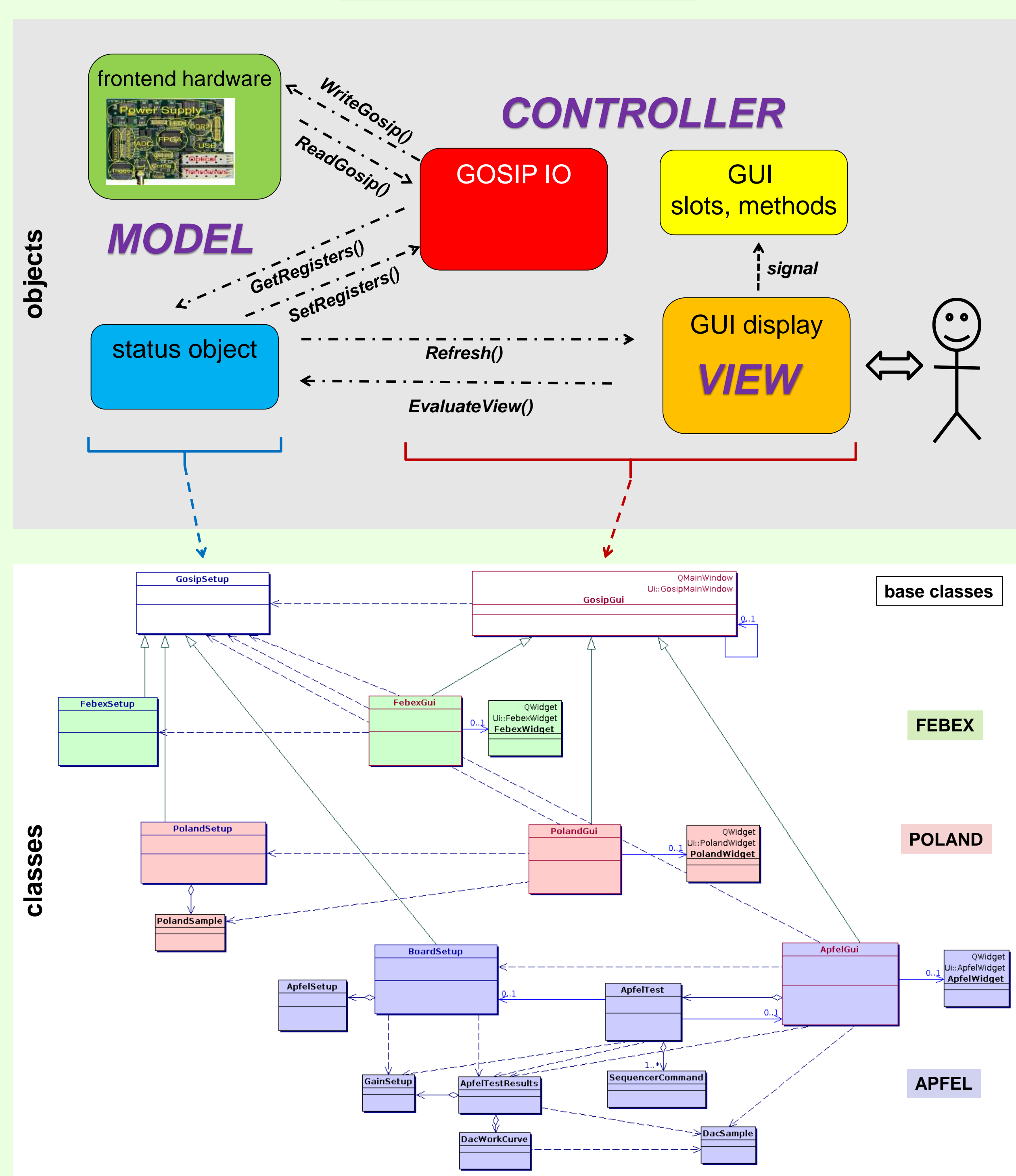
Abstract

The GOSIP (Gigabit Optical Serial Interface Protocol) [1] provides communication via optical fibers between multiple kinds of frontend electronics and the KINPEX PCIe receiver board located in the readout host PC. In recent years a stack of device driver software has been developed to utilize this hardware for several scenarios of data acquisition [2]. On top of this driver foundation, several graphical user interfaces (GUIs) have been developed in previous years. These GUIs are based on the Qt graphics libraries and are designed in a modular way: All common functionalities, like generic I/O with the front-ends, handling of configuration files, and window settings, are treated by a framework class GossipGUI. In the Qt workspace of such GossipGUI frame, specific subclasses may implement additional windows dedicated to operate different GOSIP front-end modules. These readout modules developed by GSI Experiment Electronics department are for instance FEBEX sampling ADCs, TAMEX FPGA-TDCs, or POLAND QFWs [3]. For each kind of front-end the GUIs allow to monitor specific register contents, to set up the working configuration, and to interactively change parameters like sampling thresholds during data acquisition. The latter is extremely useful when qualifying and tuning the front-ends in the electronics lab or detector cave. Moreover, some of these GossipGUI implementations have been equipped with features for mostly automatic testing of ASICs in a prototype mass production. This has been applied for the APFEL-ASIC component [4] of the PANDA experiment currently under construction, and for the FAIR beam diagnostic readout system POLAND. The GossipGUI framework is available under GPL at [5].

References

- [1] S. Minami, J. Hoffmann, N. Kurz, and W. Ott, "Design and Implementation of a Data Transfer Protocol via Optical Fibre" (PDAQ-31), presented at the 17th IEEE-NPSS RT2010, Lisbon, Portugal, May 24-28, 2010
- [2] J. Adamczewski-Musch, N. Kurz, and S. Linev, "MBSPEX and PEXORNET - Linux Device Drivers for PCIe Optical Receiver DAQ and Control", IEEE Trans. on Nucl. Science, vol. 65, issue: 2, Feb. 2018, <https://doi.org/10.1109/TNS.2017.2783043>
- [3] S. Löchner, J. Adamczewski-Musch, H. Bräuning, J. Frühauf, N. Kurz, S. Linev, S. Minami, and M. Witthaus, "POLAND - Low Current Profile Measurement Readout System", GSI Darmstadt, Germany, Sci. Rep. [Online], 2013. <http://dx.doi.org/10.15120/GR-2014-1> (FG-CS-13)
- [4] P. Wiczorek, S. Löchner, and J. Adamczewski-Musch, "First setup for the routine tests of the APFEL-ASIC rigid flex PCBs", GSI Darmstadt, Germany, Sci. Rep. RESEARCH-PANDA-HAD-6, [Online], 2017. Available: <http://dx.doi.org/10.15120/GSI-2017-01856>
- [5] J. Adamczewski-Musch, GossipGUI framework, <https://subversion.gsi.de/dabc/drivers/mbsex/gui/qt-mainwindow/>

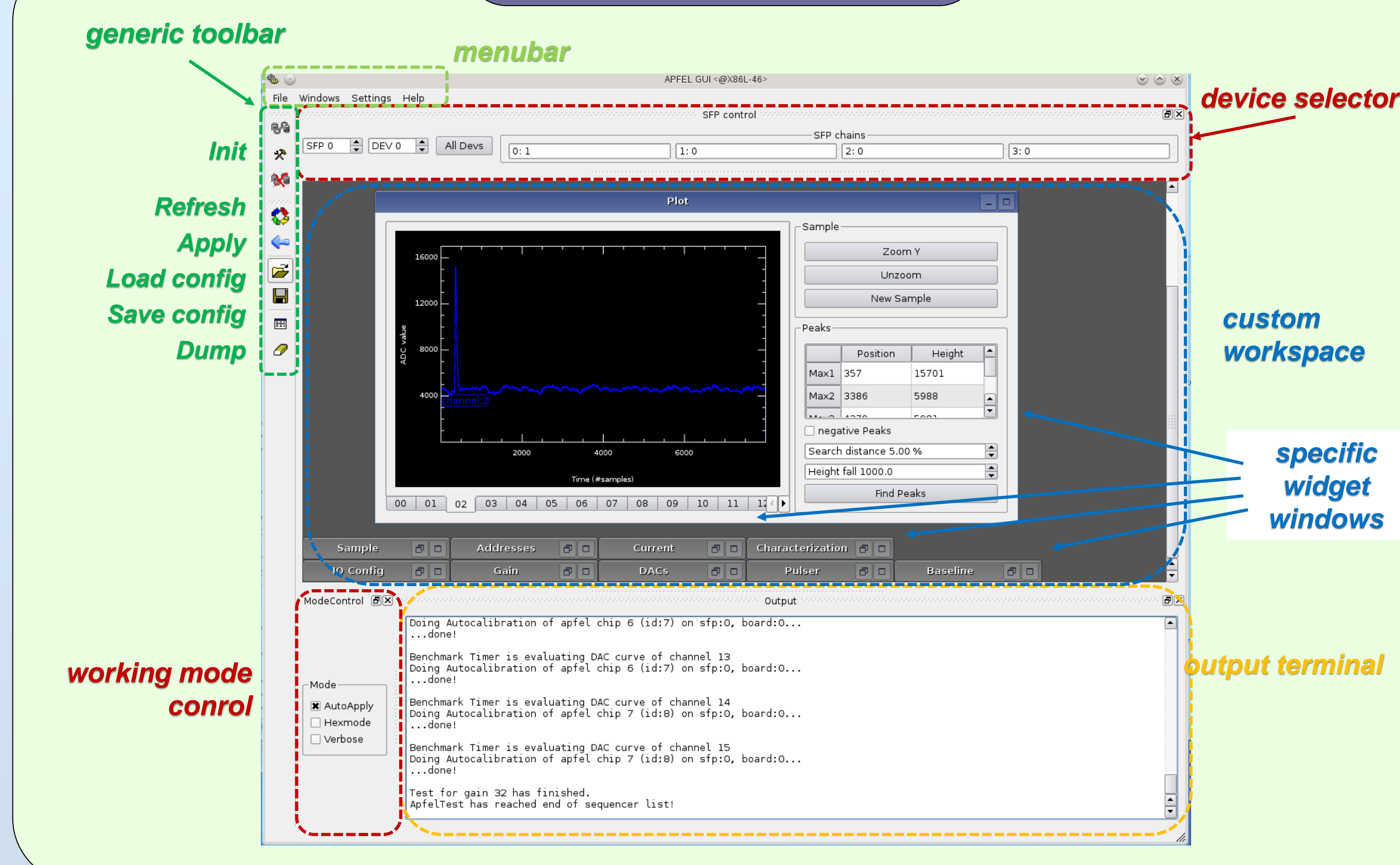
GossipGUI architecture



Base class features

- GossipGui:**
- based on Qt5 environment, inherits `QMainWindow`, provides `QWorkspace`, uses `QSettings`
 - implements all common GUI elements:
 - selector of currently controlled front-end
 - controls operation mode (auto-apply, number display, terminal verbosity)
 - buttons to set and retrieve all hardware registers, save and apply setup scripts
 - embedded terminal for text dump
 - status message line
 - offers central workspace to operate specific widgets of subclass GUIs
 - fully configurable dock window toolbars and menus
 - save and restore window and toolbar geometry preferences
 - implements generic GOSIP communication methods via device driver software
 - keeps list of `GossipSetup` objects for each connected front-end slave
 - factory pattern to create appropriate `GossipSetup` object in `GossipGUI` subclass
 - virtual methods interface to use subclass functionalities with generic GUI elements
- GossipSetup:**
- interface for any kind of structure representing the register state of one GOSIP slave
 - virtual method `Dump()` for optional printout to terminal

Common GUI frame



Framework interface

- GossipGui virtual methods (to be re-implemented in subclass):**
- GossipSetup* CreateSetup()** - factory method for the setup object
 - RefreshView()** - update gui display from status structure
 - EvaluateView()** - put gui values into status structure
 - GetRegisters()** - get register contents from hardware to status structure
 - SetRegisters()** - set register contents from status structure to hardware
 - SaveRegisters()** - get registers and write them to config file
 - ResetSlave()** - reset or initialize the GOSIP slave device
 - DumpSlave()** - printout some device registers to terminal window
 - SaveConfig()** - save current hardware configuration to a gossipcmd script file
 - ApplyFileConfig()** - apply configuration from gossipcmd file to the hardware.
- Preprocessor macros (used in GossipGui subclass):**
- theSetup_GET_FOR_SLAVE (X)** - cast `GossipSetup` to actual implementation X, provides handle `theSetup->` to access special member
 - GOSIP_BROADCAST_ACTION (X)** - execute function X for the selected front-end; can optionally do it in a "broadcast mode" for an SFP chain, or for all chains
 - GOSIP_AUTOAPPLY (X)** - execute function X for selected front-end only if GUI is in "auto-apply" mode. Used for interactive tuning of single registers without writing complete setup to hardware

Application examples

FEBEX 16 channel-pipelining ADCs

self trigger filters, baselines, thresholds

POLAND: 32 channel charge frequency converters for FAIR beam diagnostic SEM grid system

sample of channel traces, DAC offset pattern, temperature monitor, fans control

Characterization of APFEL preamplifier ASIC for PANDA experiment

carrier board set up, output gain, test pulser, external current measurements, channel ADC sample, pulser peak finder

automatic characterization sequence

- used for commissioning of APFEL ASIC
- carrier board with 8 sockets for APFEL rigid flex PCBs
- control via FEBEX front-end
- sample DAQ with MBS system
- APFEL chip id from QR code scanned by human operator
- sequencer runs all required tests
- figures of merit are stored to a database
- already 8000 APFEL PCBs for PANDA EMC-Barrel processed since 2017

***APFEL (ASIC for Panda Front-end ELectronics):** integrated charge sensitive preamplifier and shaper optimized for the readout of avalanche photo diodes with large detector capacitance and high event rates.

Device driver software

