

The APEX facility receiver control software

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1 Specification

- the system allows local tuning through a graphical user interface
- the system allows control through a socket interface, i.e. remote control
- both interfaces implement fully automatic tuning as much as possible
- the software provides an interface to a database storing tuning tables. *Implemented via web interface to underlying postgresql database.*
- the software allows recording and display of iv-, pv- and magnetic flux curves. *The latter two are not yet implemented.*
- asynchronous commands are implemented via threads.

2 Tools

The software is implemented using the freely available Qt C++ Library (version 3.3 or higher) from Trolltech. A few widgets are used from the Qwt widget set (Qt widgets for technical applications), e.g. a plot widget for the mixer curves. Advantages:

- interactive design of GUI
- easy implementation of socket interface with notifier for incoming data.
- easy implementation of threads, mutexes, etc.
- database aware widgets.
- by combining GUI and socket interface in the same program the two tuning interfaces will be guaranteed to stay *in sync*.

3 Design

A model-view-control paradigm is used to keep GUI separated from hardware. All hardware communication is channeled through one thread, no need to lock/unlock hardware resource. A lex/yacc generated parser is used for the socket interface.

The GUI consists of a main window with separate tabs for each channel with controls for:

- LO tuning
- mixer tuning
- curve plotting
- HEMT setting and reading
- temperature monitoring

A number of dialogs are available via the main menu. The frequency and sideband setting is visible at all times.

4 Classes

4.1 Hardware

- ModbusClient: handles all communication with the cFieldPoint unit via the network using the Modbus protocol
- cFPModule: parent class to represent I/O modules available in cField-Point configuration. Inherited by all of the following:
 - cFP_AI_112: analog input
 - cFP_AI_118: analog input
 - cFP_AO_200: analog output
 - cFP_AO_210: analog output
 - cFP_DO_403: digital output
 - cFP_PG_522: pulse train control
- cFieldPoint: instantiates one representation of the cFieldPoint configuration with the correct numbers of cards in their correct slot positions. Implemented as a singleton, i.e. it is guaranteed that there is only exactly one instance of this class.
- SerialPort: handles communication via an RS232 interface
- SelectMirror: uses SerialPort to control the selection mirror
- QL355Port: communicate with USB port of TTI power supply
- QL355PowerSupply: handle commands to TTI power supply via USB

4.2 Controller

- Facility
- FacilityCtrl
- Rx: parent class of the following, which each control the LO and mixer of their respective channel:
 - Rx230
 - Rx345
 - Rx500
 - RxHEB
- SelectorThread: thread implementation for control of selection mirror
- MethodThread: thread implementation for asynchronous handling of methods. Methods are put in a queue and executed sequentially, because they are using the same hardware.
- Method: parent class of all methods:
 - InitBandMethod
 - IVScanMethod
 - ShutDownMethod
 - StabiliseMethod
 - TuneMethod
 - UpdateMethod
 - SelectMethod
- ScanEvent: transfer of data from thread performing mixer scan to GUI thread.

4.3 Graphical User Interface

- FacilityGui: main window with tabs for the various channels.
- FacilityPrintFilter: handle printing of mixer curves
- RxWidget: parent class to all of the following, which are basically the individual tabs of the main window:

- Rx230Widget
- Rx345Widget
- Rx500Widget
- RxHEBWidget

Rx widgets are in turn composed of the following:

- HEB_LOWidget: variation of LOWidget for the HEB channel
- HEMTWidget
- LOWidget
- MixerWidget
- TMonWidget: temperature monitoring

Through menus the following dialogs are available:

- OffsetDlg: adjust x/y scales of mixer curves
- ScanDlg: set parameters for mixer curve
- TuneDlg: select band and frequency for tuning

Not listed here are basic widgets from the Qt widget set, like buttons, labels etc. Some widgets are used from the Qwt widget set like a plot widget, a wheel and a thermometer widget.

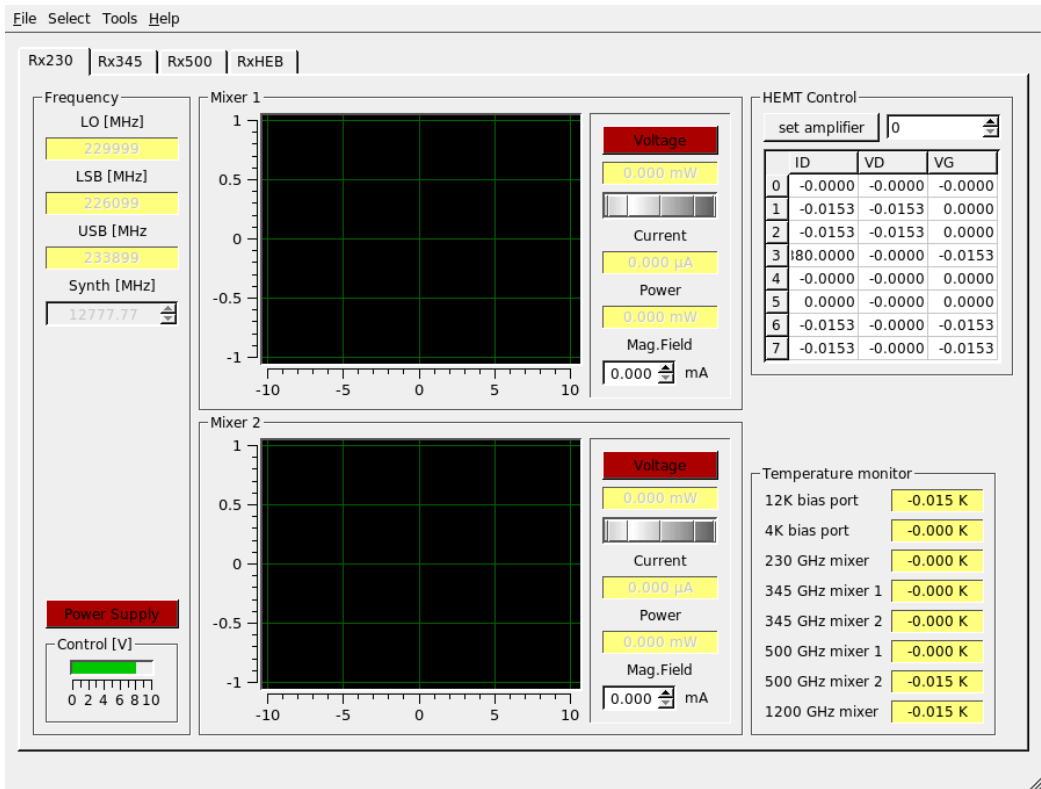


Figure 1: screendump of facility receiver control program