O. V. Lounasmaa
Laboratory

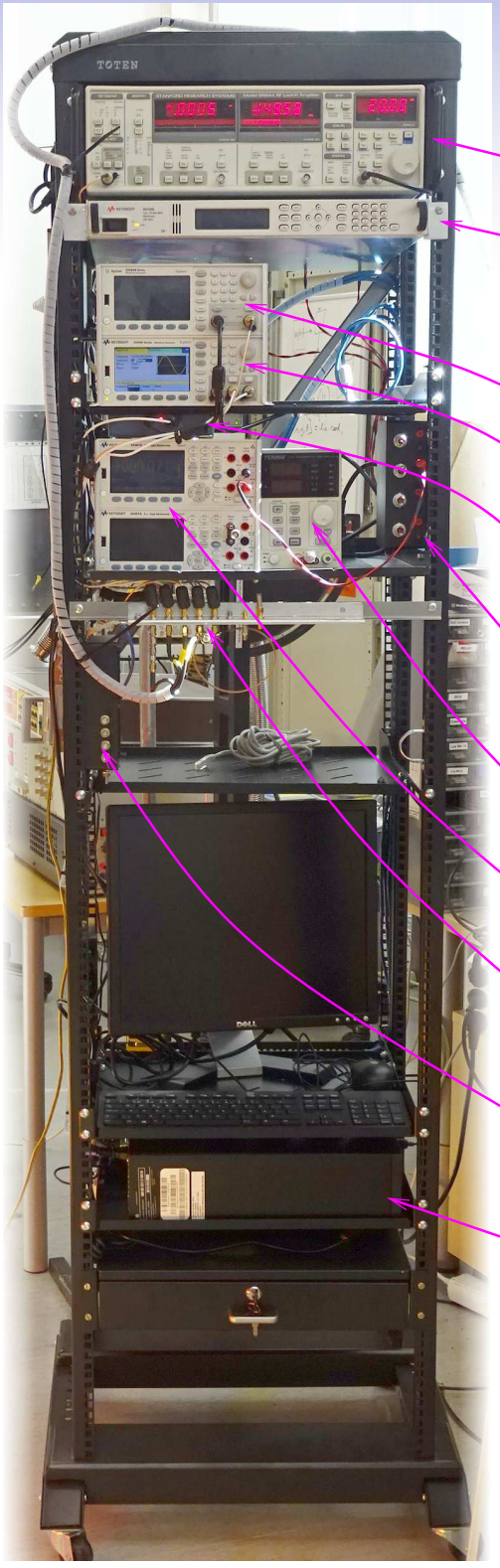
Aalto University

Software system for ^{3}He NMR experiments

Vladislav Zavjalov

Group meeting
5.6.2017

Hardware



RF lock-in (SR844)

power supply frame (Keysight N6700B)
- two N6762A precision modules
- two N6731B modules

generator (Agilent 33511B)

2-channel generator (Keysight 33510B)

grounding plate

oscilloscope (PicoScope 4224)

panel for current terminals

power supply (Tenma)

multimeters (Keysight 34461A)

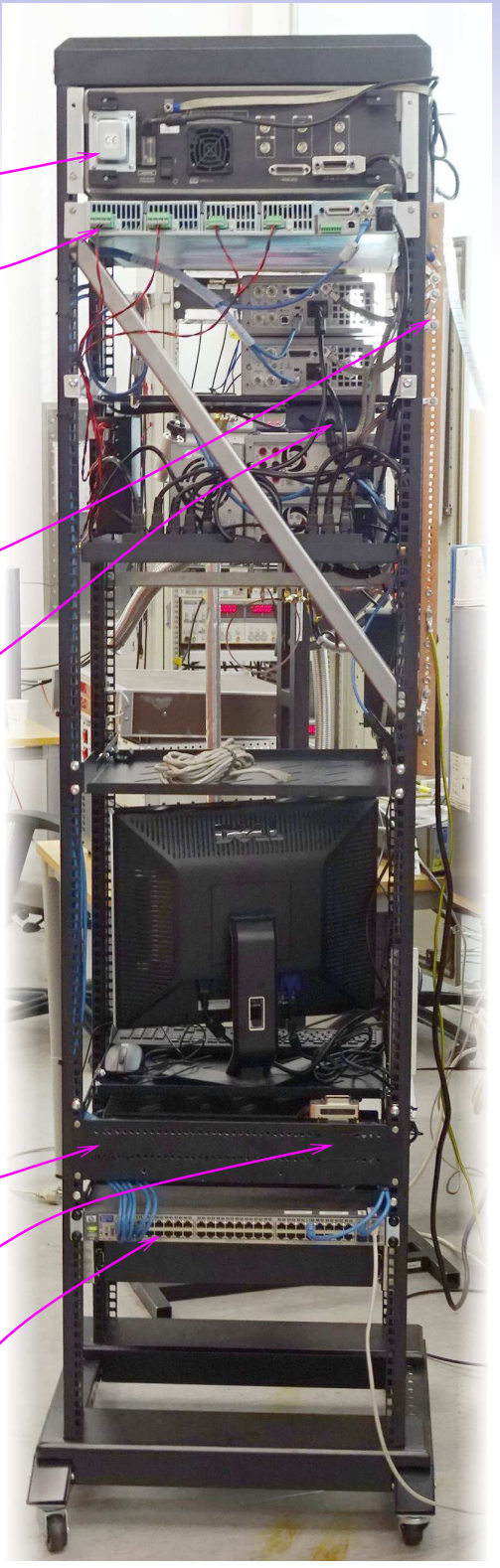
panel with SMA connectors

microcontroller for relay control

computer

gpib to ethernet converter

50-port network switch



Device library

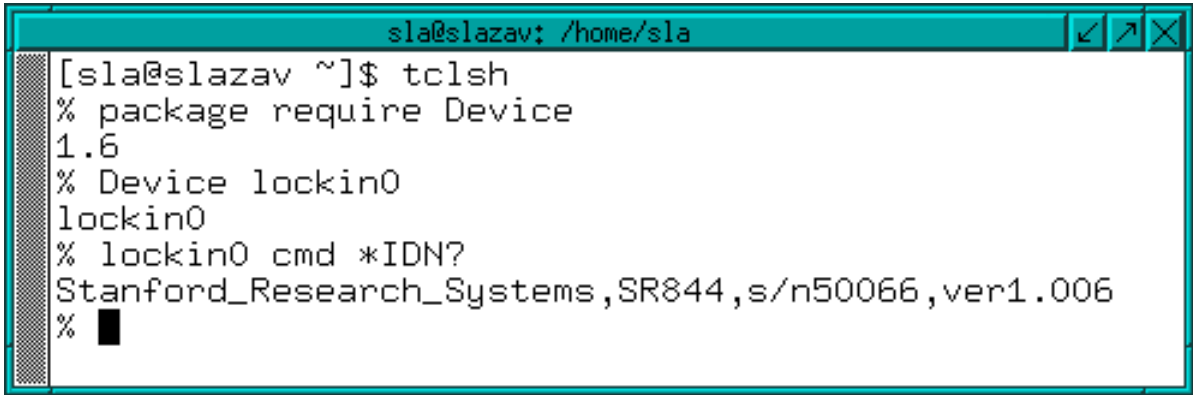
https://github.com/slazav/tcl-device

TCL language:
- easy to make graphical interfaces
- used in ROTA (some programs can be used)
-good for interaction between programs

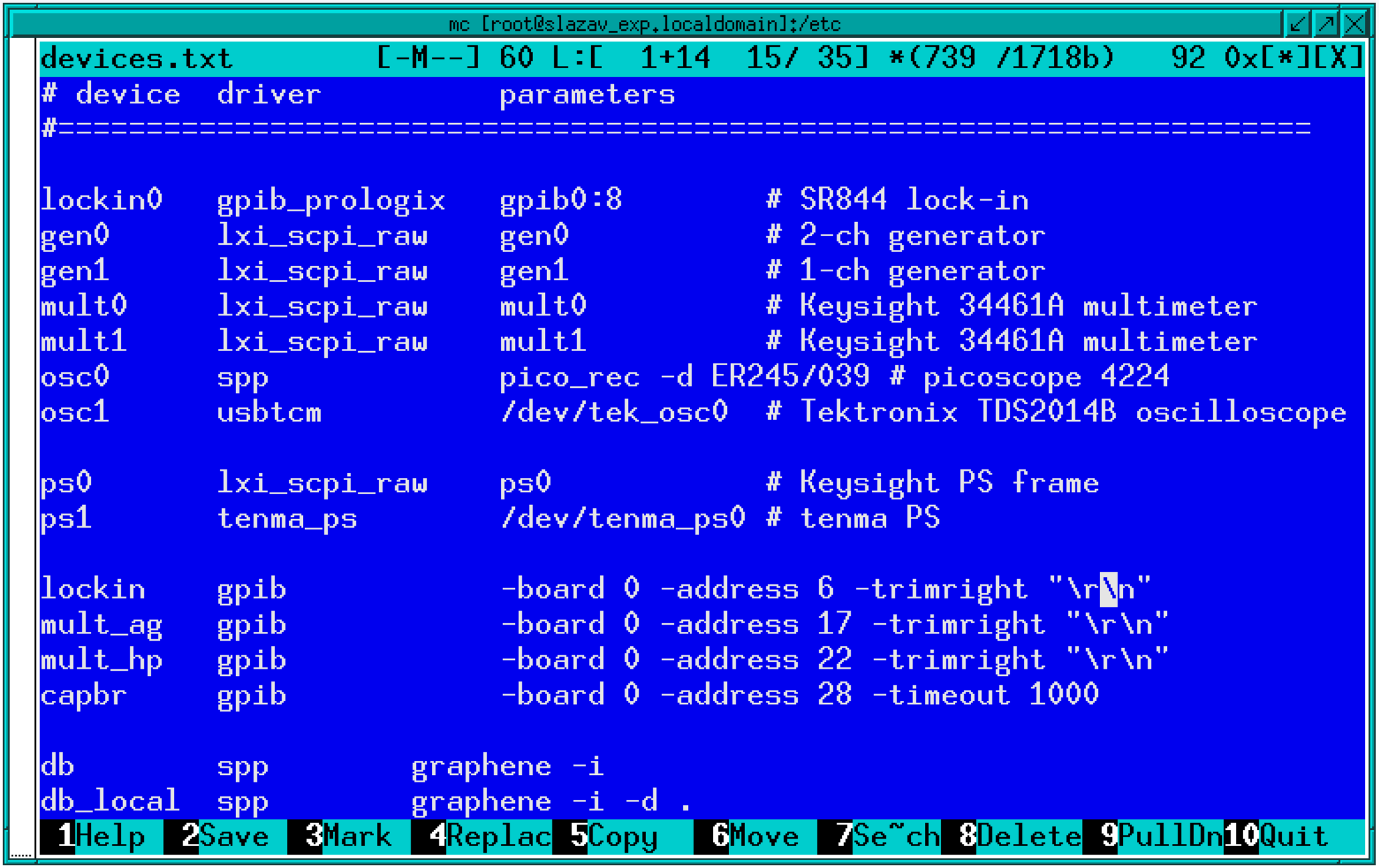
Main idea: programs do not care about how devices are connected.

Program can just open a device, send a command and get an answer.

Other features:
- error handling
- IO locks
- user locks
- timeouts
- logging



Device library – configuration



Device library – using programs as devices, remote access

```
sla@slazav: /home/sla
$ device -d lockin0
#SPP001
#OK
*idn?
Stanford_Research_Systems,SR844,s/n50066,ver1.006
#OK
*i?
#Error: Read timeout: ssh slazav_exp device -d lockin0
```

```
mc [sla@slazav.localdomain]:/etc
devices.txt          [-M--]  0 L:[ 10+ 3  13/ 32] *([*][X]
ps1          spp  ssh slazav_exp device -d ps1
osc0         spp  ssh slazav_exp pico_rec -d ER245/039
osc1         spp  ssh slazav_exp device -d osc1

db           spp  graphene -i
db_exp       spp  ssh slazav_exp graphene -i
db_local     spp  graphene -i -d .

sweep1       spp  ssh slazav_exp sweeper -ps_dev1 ps0:1H
sweep2       spp  ssh slazav_exp sweeper -ps_dev1 ps0:3
sweep3       spp  ssh slazav_exp sweeper -ps_dev1 ps0:4
sweep4       spp  ssh slazav_exp sweeper -ps_dev1 ps1

1Help 2Save 3Mark 4Re~ac 5Copy 6Move 7Se~ch 8De~te
```

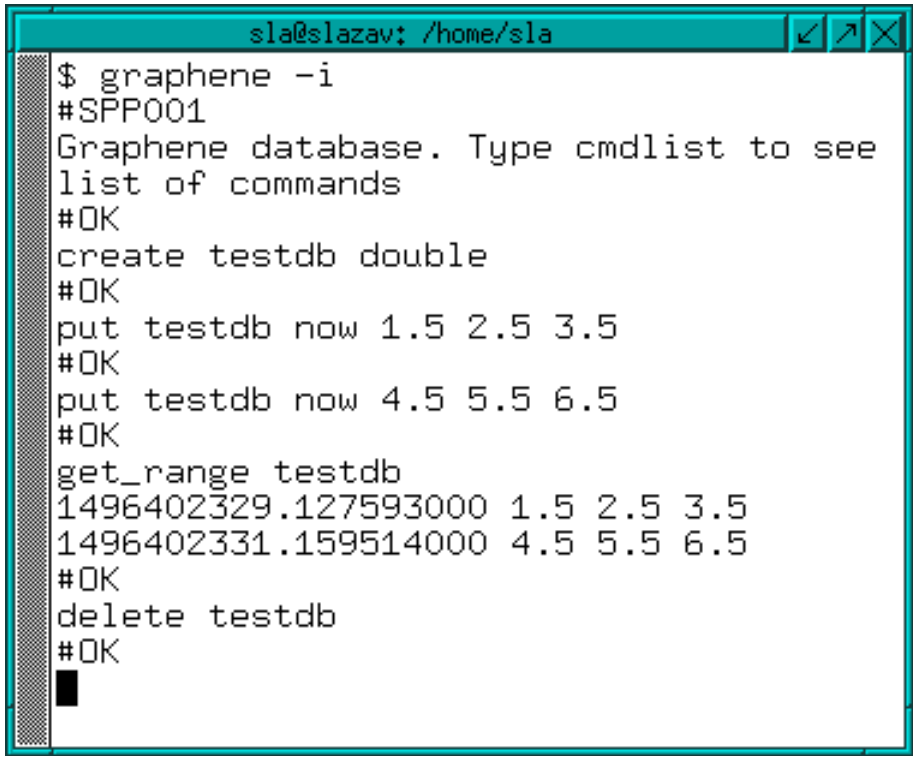
Graphene database

https://github.com/slazav/graphene

Main idea: you can put a few numbers or text with a timestamp into a database. Then you can extract data for any time range

Features:

- based on BerkleyDB
- integer, floating point or text values
- nanosecond-precision timestamps
- multi-column numerical values
- fast access to data, interpolation, downsampling
- command line interface
- http interface for web-applications (Grafana viewer)



DeviceRole library

https://github.com/slazav/tcl-device_role

Main idea: program can use a device in some simple role, without a knowladge about its model and command set.

Program can just open a device "as a voltage source", and run "set voltage" method.

Existing roles and supported devices:

power_supply – a power supply with constant current and constant voltage modes

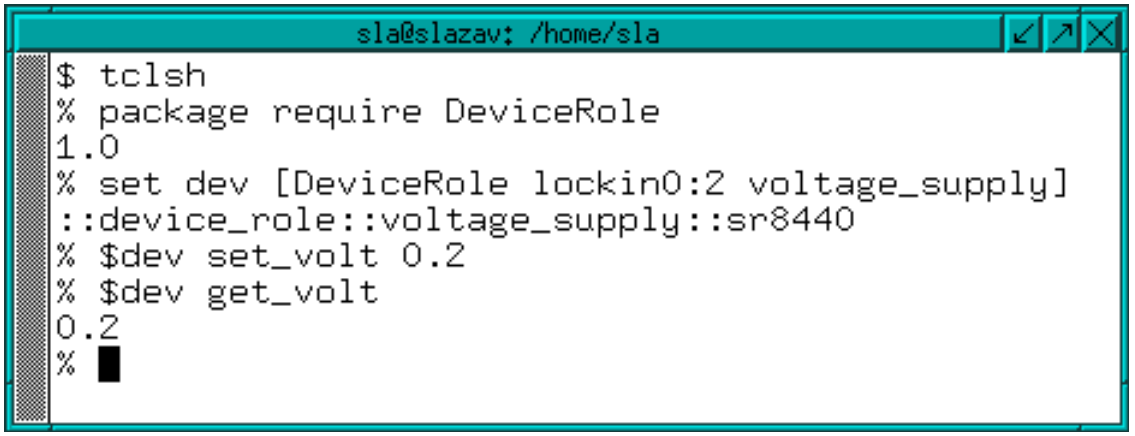
* Keysight N6700B frame with N6762A or N6762A modules
* Korad/Velleman/Tenma 72-2550 power supply

voltage_supply – a simple DC voltage source

* Korad/Velleman/Tenma 72-2550 power supply
* SR844 lock-in (auxilary outputs)
* Keysight 33511B generator (1 channel)
* Keysight 33510B generator (2 channels)

gauge – a gauge device

* SR844 lock-in

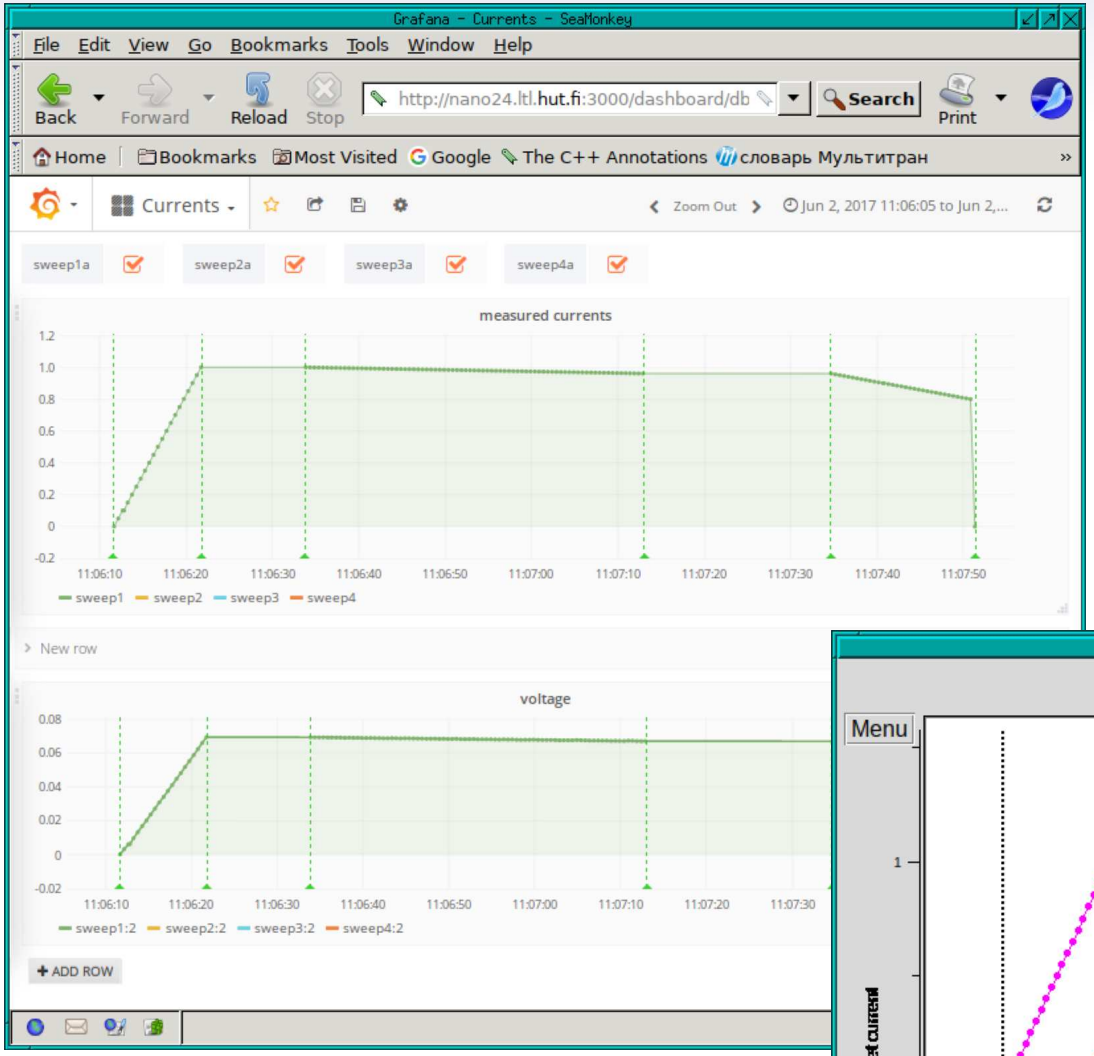


sweeper device

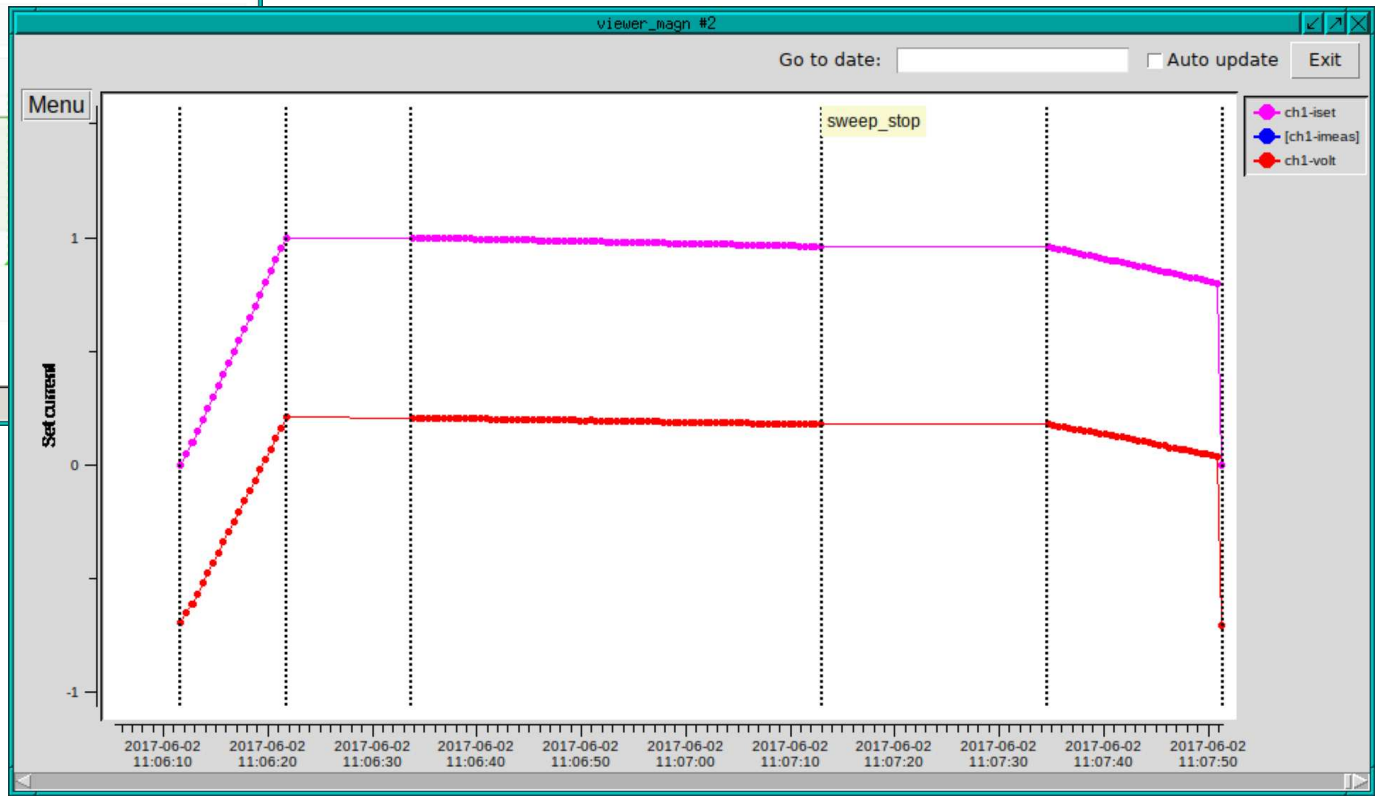
parameters:

- power supply device
- 2nd power supply
- gauge device
- database device, database name

```
sla@slazav: /home/sla
sweep 1 0.1
#OK
sweep 0 0.001
#OK
sweep_stop
#OK
get_mcurr
0.96052838
#OK
sweep 0 0.01
#OK
get_mcurr
0.91052764
#OK
get_mcurr
0.8951434614
#OK
```

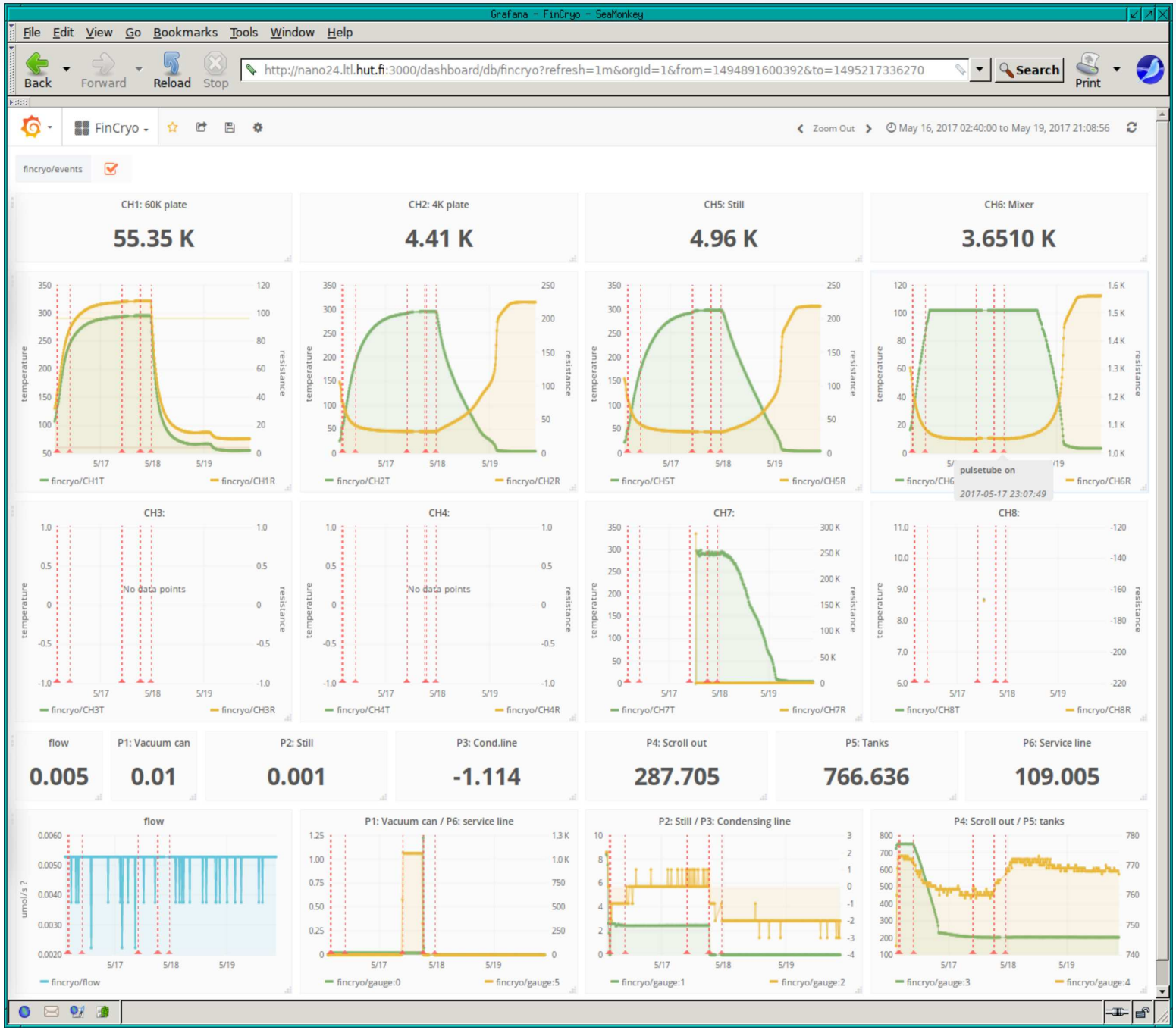


Grafana web-interface

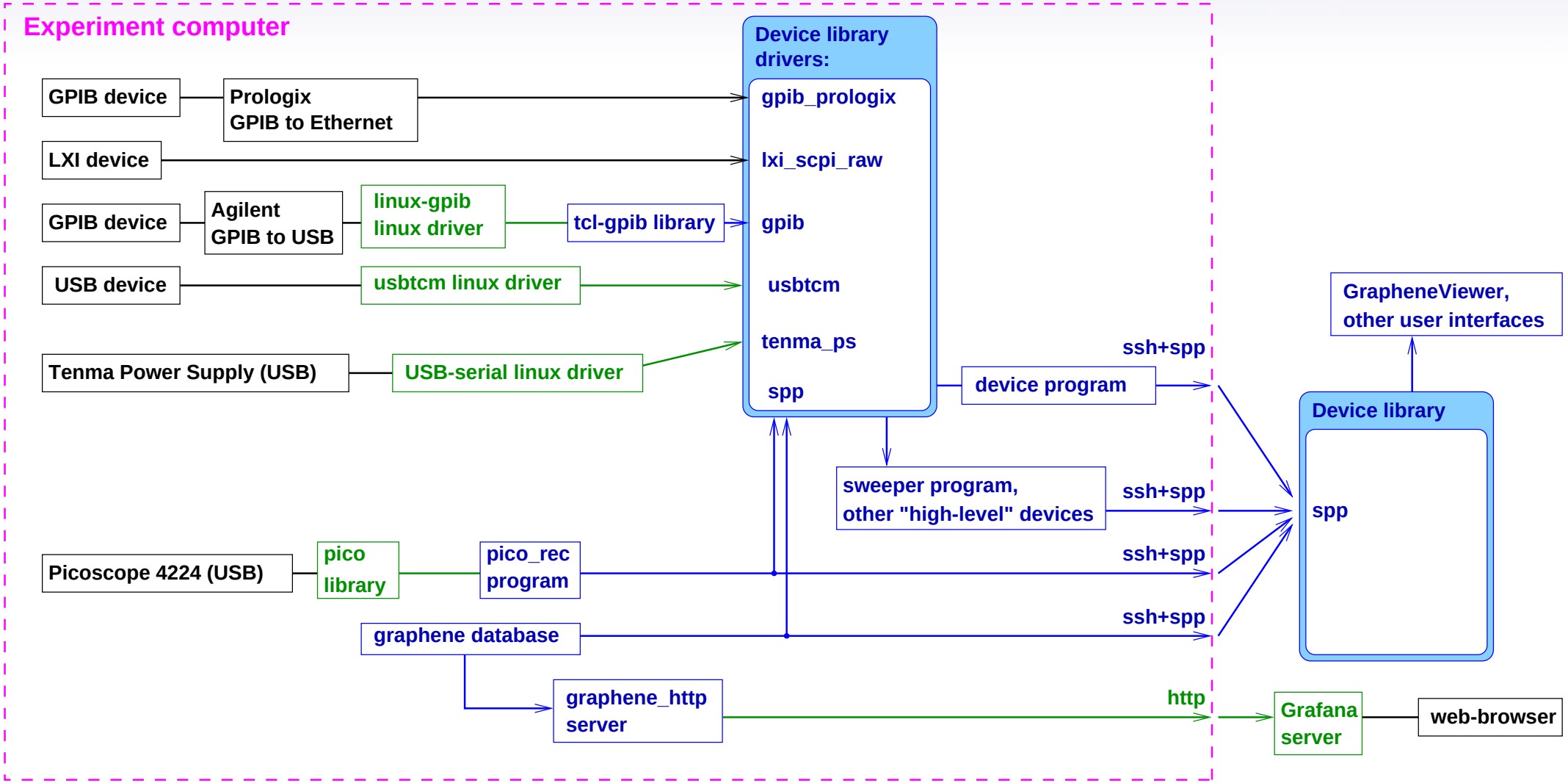


GrapheneViewer →

BlueFors data



All components



All components

Device library:
https://github.com/slazav/tcl-device

DeviceRole library:
https://github.com/slazav/tcl-device_role

Graphene database:
https://github.com/slazav/graphene

pic_osc – program for controlling oscilloscope and processing signals:
https://github.com/slazav/pico_osc

bf2gr – script for syncronyzing graphene database with BlueFors logs:
https://github.com/slazav/tcl-bf2gr

GrapheneViewer – tcl viewer for graphene database:
https://github.com/slazav/tcl-grview

GrapheneMonitor – tcl frame for measurement modules:
https://github.com/slazav/tcl-grmon