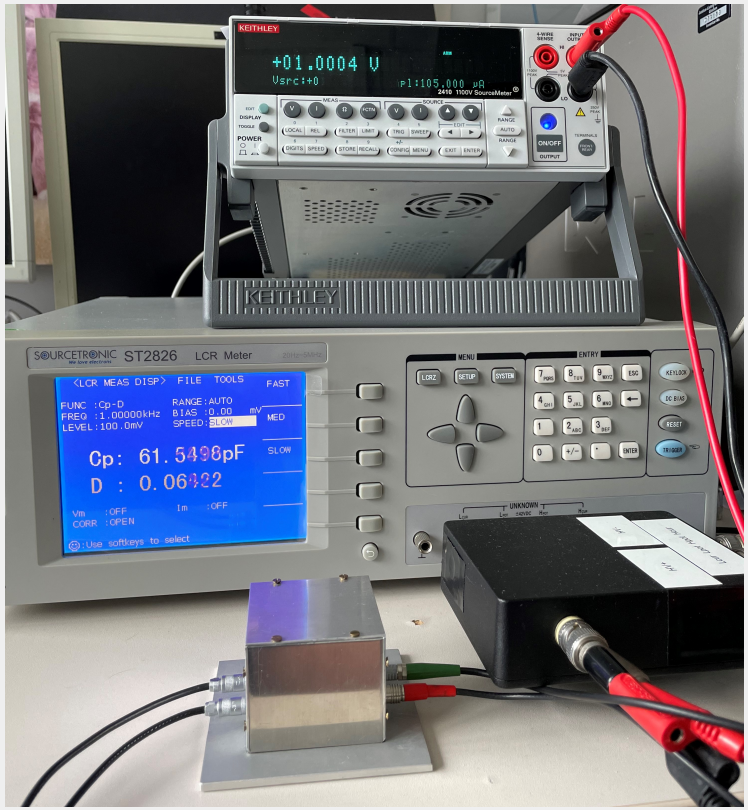
LCR-Measurements

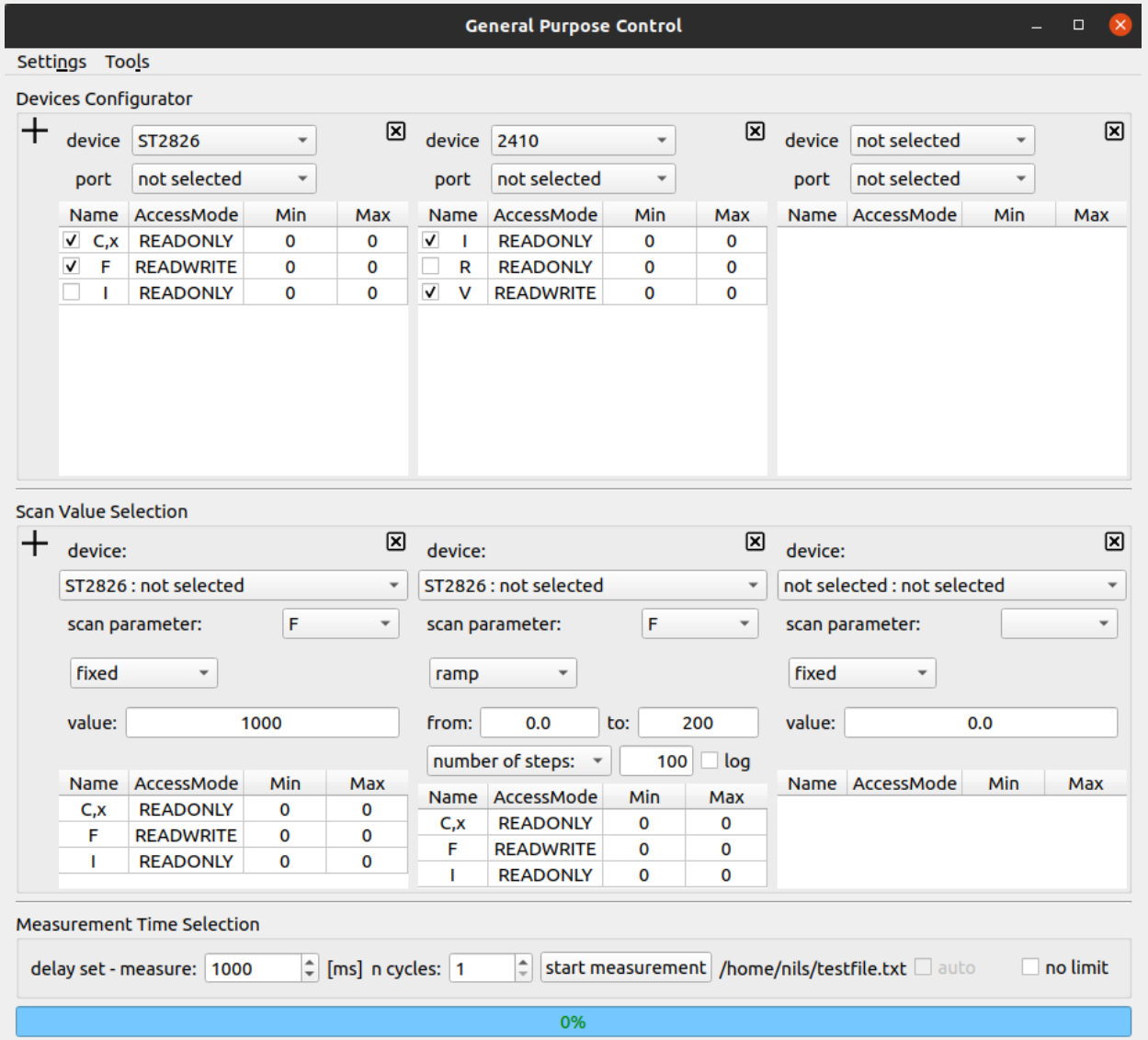
at University of Giessen

- One for all devices program
- First measurements of diodes using a bias-box
- Determination of depletion voltage

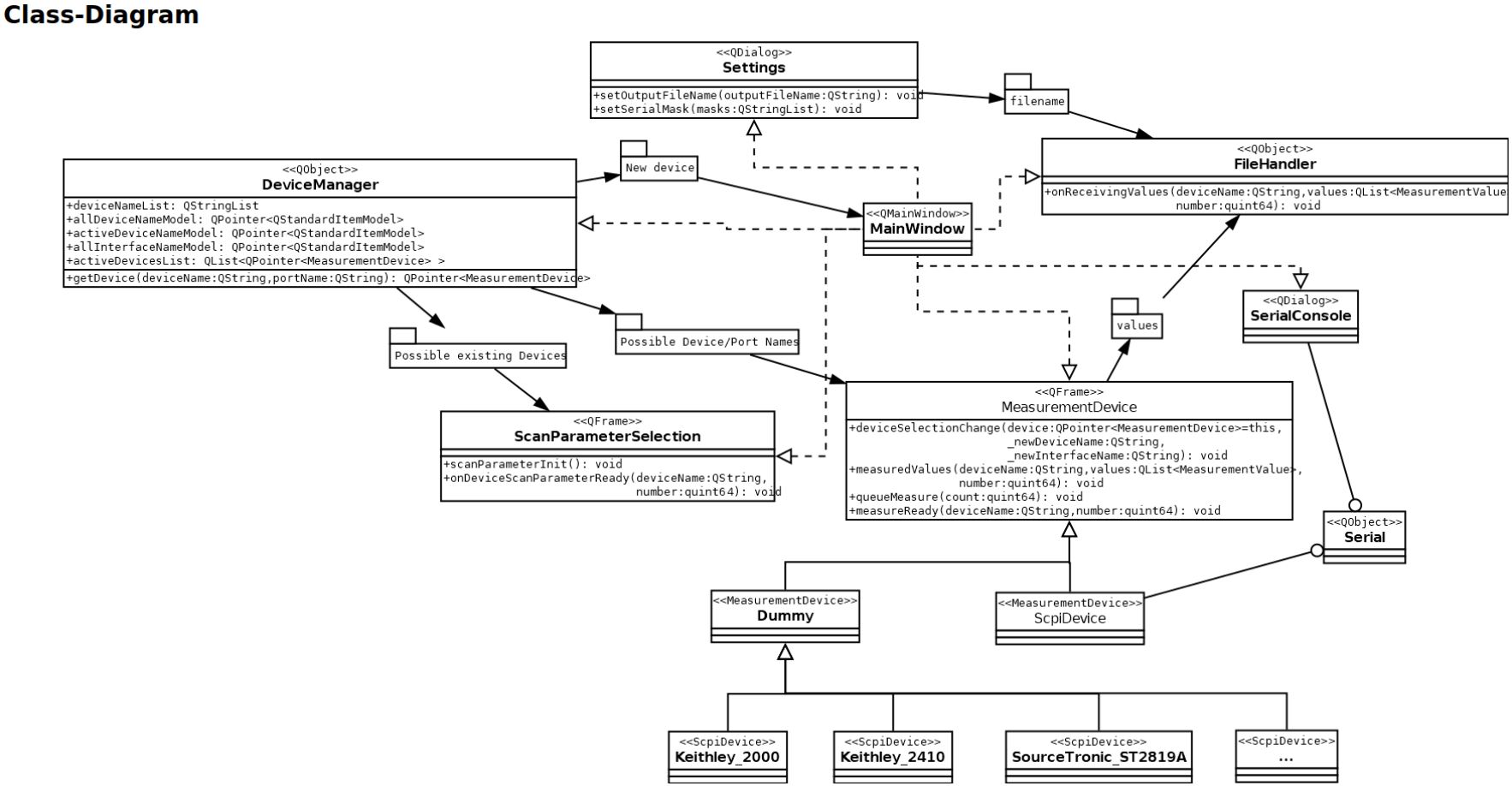


Device Control

- Devices serial connected with RS-232
- Control multiple devices simultaneously
- C++ script send command's and saves received data in selected files



Device Control



- Measurement options: delay, cycles, fixed, ramp, step numbers, logarithmic and linear

Device Control

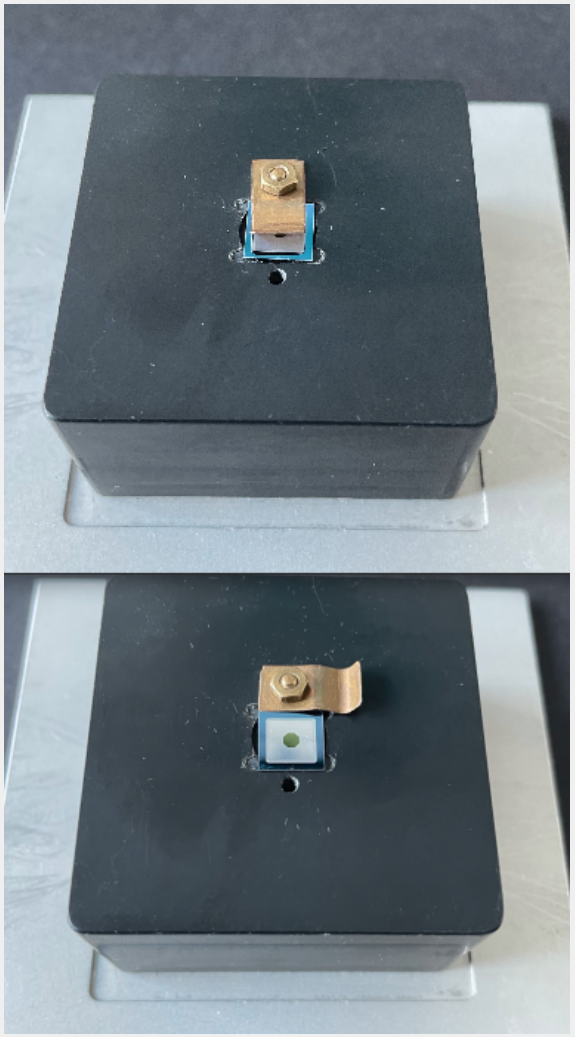
- Easy access on Github
- Over ten devices built-in, more are easy to add
- Currently runs on Raspberry Pi OS, also tested for Windows and Ubuntu
- Evaluation of the measurements with Gnuplot and Python

```
time C,x[ST2826] F[ST2826] D[ST2826] I[2410] V[2410]
1621511706616 1.65864e-10 667000 0.262624 -0.000104933 -0.0252094
1621511708089 5.73022e-11 667000 0.0567683 -7.43468e-09 1.98115
1621511709482 4.88613e-11 667000 0.0123551 1.22942e-08 4.03671
1621511710877 3.81629e-11 667000 0.0138589 1.56107e-08 6.03263
1621511712171 3.43591e-11 667000 0.00504243 1.98125e-08 8.08604
1621511713547 3.07399e-11 667000 0.00251045 2.11951e-08 10.0873
1621511714941 2.88709e-11 667000 0.000653368 2.41122e-08 12.1024
1621511716235 2.8378e-11 667000 0.00347458 2.7343e-08 14.1394
1621511717548 2.66777e-11 667000 0.00410467 2.9458e-08 16.1548
1621511718942 2.33039e-11 667000 0.000862328 3.13691e-08 18.2111
1621511720227 2.57809e-11 667000 0.00704159 3.43075e-08 20.2082
1621511721548 2.42393e-11 667000 0.0070735 3.62565e-08 22.2081
1621511722941 2.10027e-11 667000 0.00327441 3.69182e-08 24.2604
1621511724234 2.04578e-11 667000 0.00410713 4.01246e-08 26.2611
1621511725548 2.18629e-11 667000 0.00787311 4.1968e-08 28.3138
1621511726942 1.93796e-11 667000 0.00402598 4.26578e-08 30.3124
1621511728235 1.92073e-11 667000 0.00542367 4.54206e-08 32.3106
1621511729549 2.02325e-11 667000 0.00878688 4.72334e-08 34.3641
1621511730943 1.79241e-11 667000 0.00443756 4.73503e-08 36.3571
1621511732238 1.9673e-11 667000 0.0101043 5.09235e-08 38.4122
1621511733548 1.86545e-11 667000 0.00905297 5.25493e-08 40.4123
1621511734933 1.67988e-11 667000 0.00466544 5.24849e-08 42.4275
1621511736226 1.83824e-11 667000 0.0100126 5.54317e-08 44.4813
1621511737548 1.80091e-11 667000 0.00927322 5.68223e-08 46.4805
1621511738951 1.59294e-11 667000 0.00504811 5.69204e-08 48.5345
1621511740245 1.79508e-11 667000 0.0106941 5.95844e-08 50.5337
```

Dataset from General-Purpose-Control

Measurements

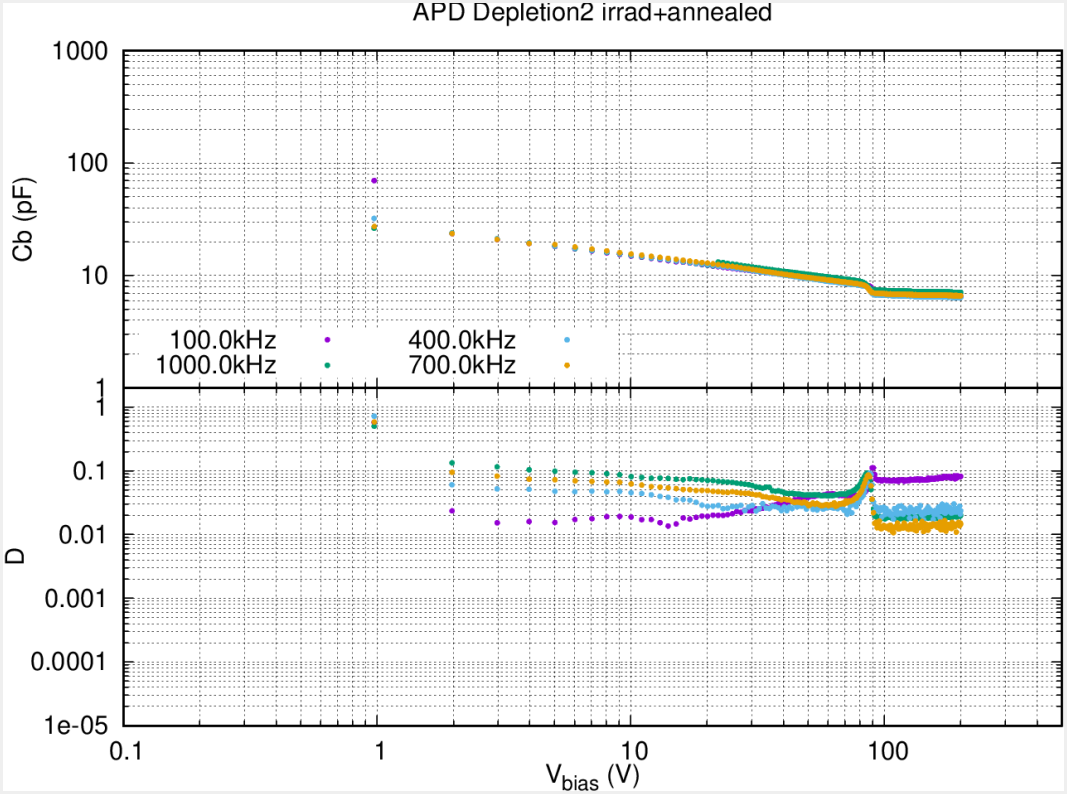
- Capacity versus bias voltage at different frequencies
- Using LCR-Sourcetronic ST 2826 (LCR) and Keithley 2410 (voltage source)
- Bias-box connects diode with the devices
- next step is to carry out measurements in the test station in the clean room



Opened and closed Bias-box

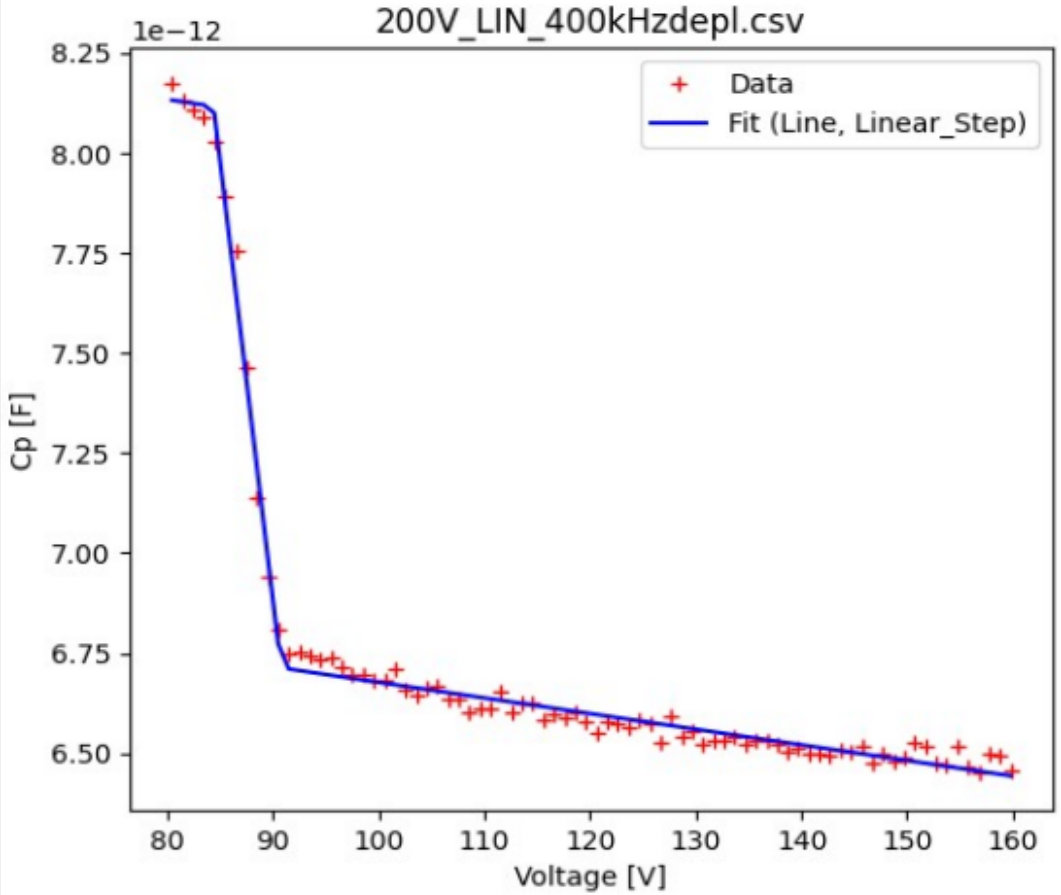
Measurements

- Diode measurement with reverse-bias from 0 to 200 V for four frequencies
- Dip in the logarithmic representation shows the depletion voltage at around 100 V
- D-Factor (losses) is significantly below zero, which represents a meaningful measurement



Determination Depletion Voltage

- Fit-Function with linear and step-model
- Zero of the second derivative gives the depletion voltage
- χ^2 or the goodness of fit is very small
- Error estimation by step size of the measurement here 1 V




```
In [10]: runfile('/home/nils/Desktop/
PAD8AI_Wafer04/2_200V_1_1000khz4stpsdata/multiDepVoltage.py',
wdir='/home/nils/Desktop/
PAD8AI_Wafer04/2_200V_1_1000khz4stpsdata')
200V_LIN_700khzdepl.csv :  DepletionFit:  90.4999999999994
200V_LIN_1e+06hzdepl.csv :  DepletionFit:  90.4999999999994
200V_LIN_400kHzdepl.csv :  DepletionFit:  90.4999999999994
200V_LIN_100khzdepl.csv :  DepletionFit:  92.3999999999993
```