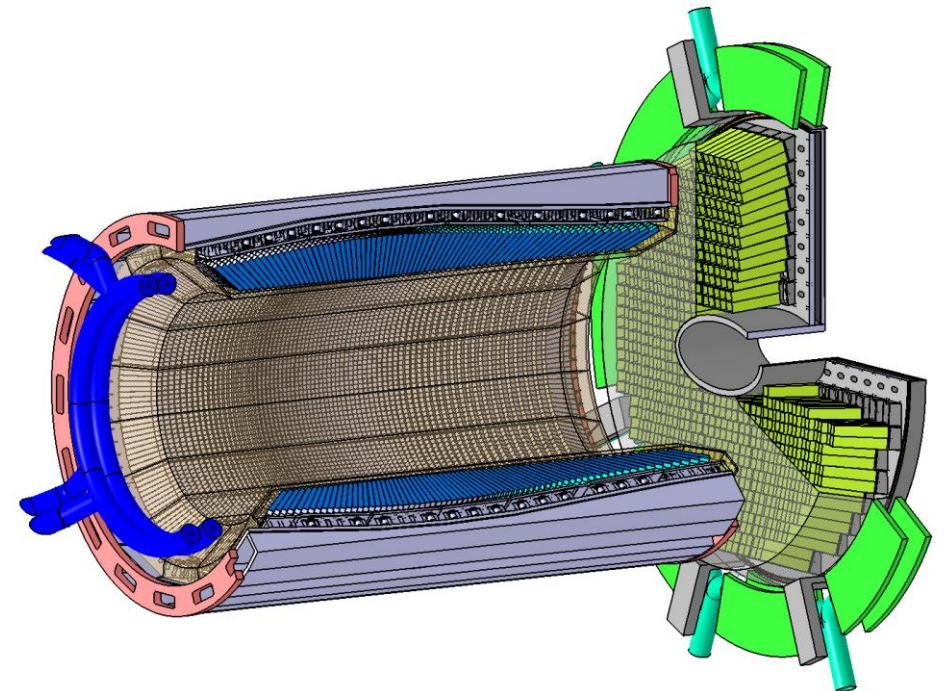
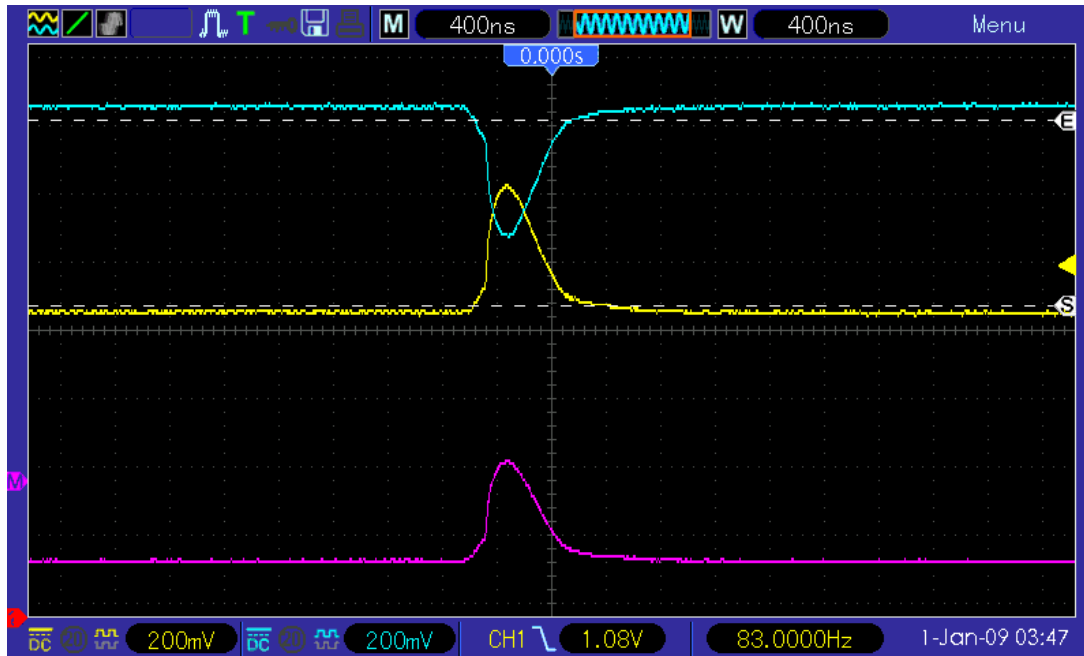
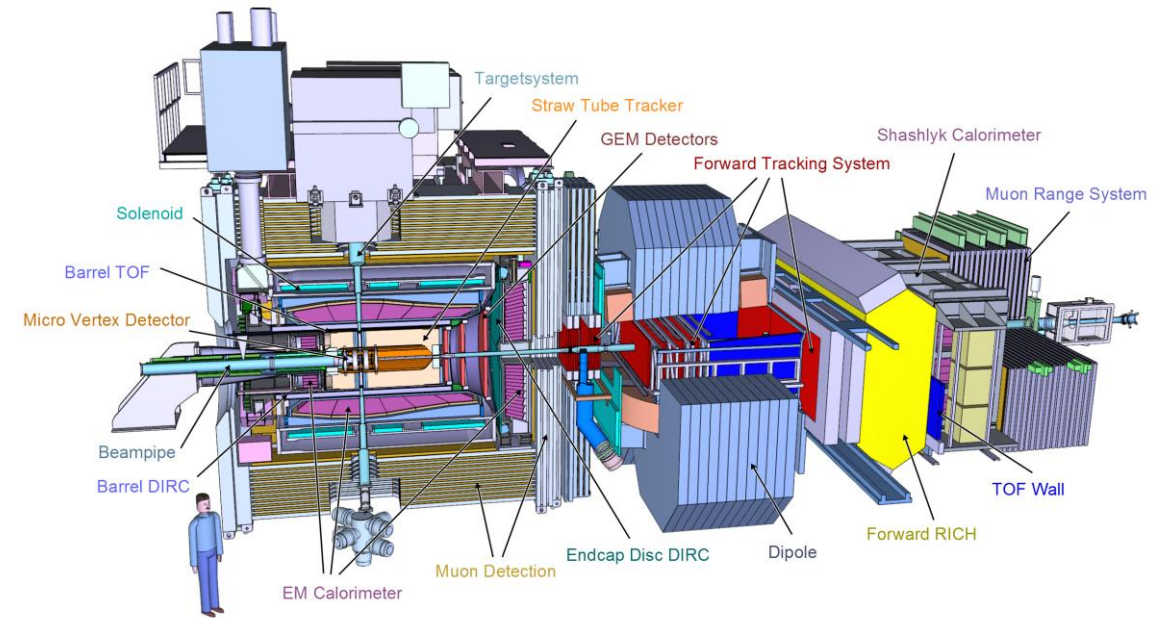


APFEL Software Autocalibration

Raphael Ratz, Justus-Liebig-Universität Gießen
10/12/2022, PANDA Collaboration Meeting

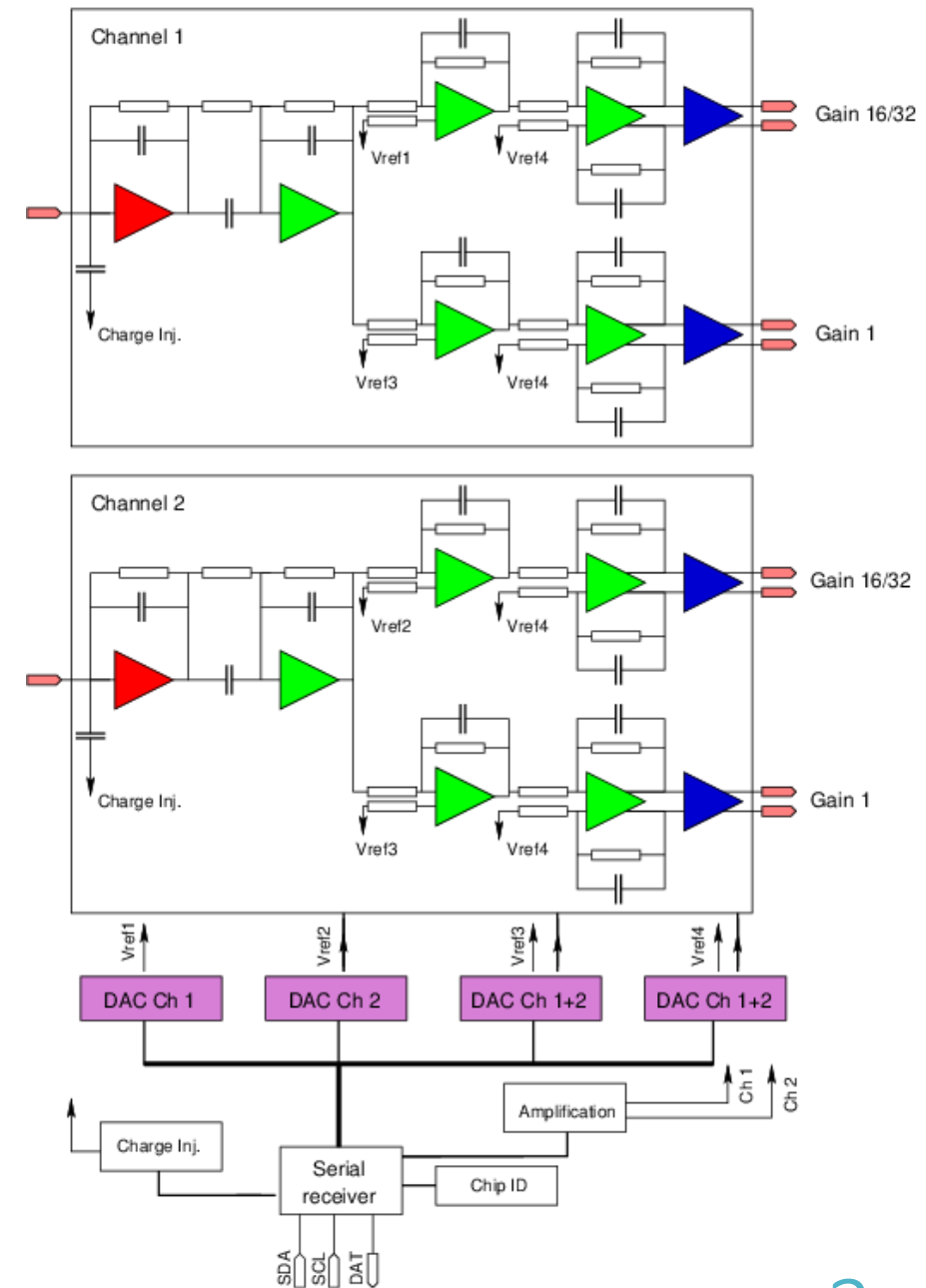
APFEL

- ASIC for Panda Frontend Electronics
- Preamplifier for signal of APDs
- Differential signal



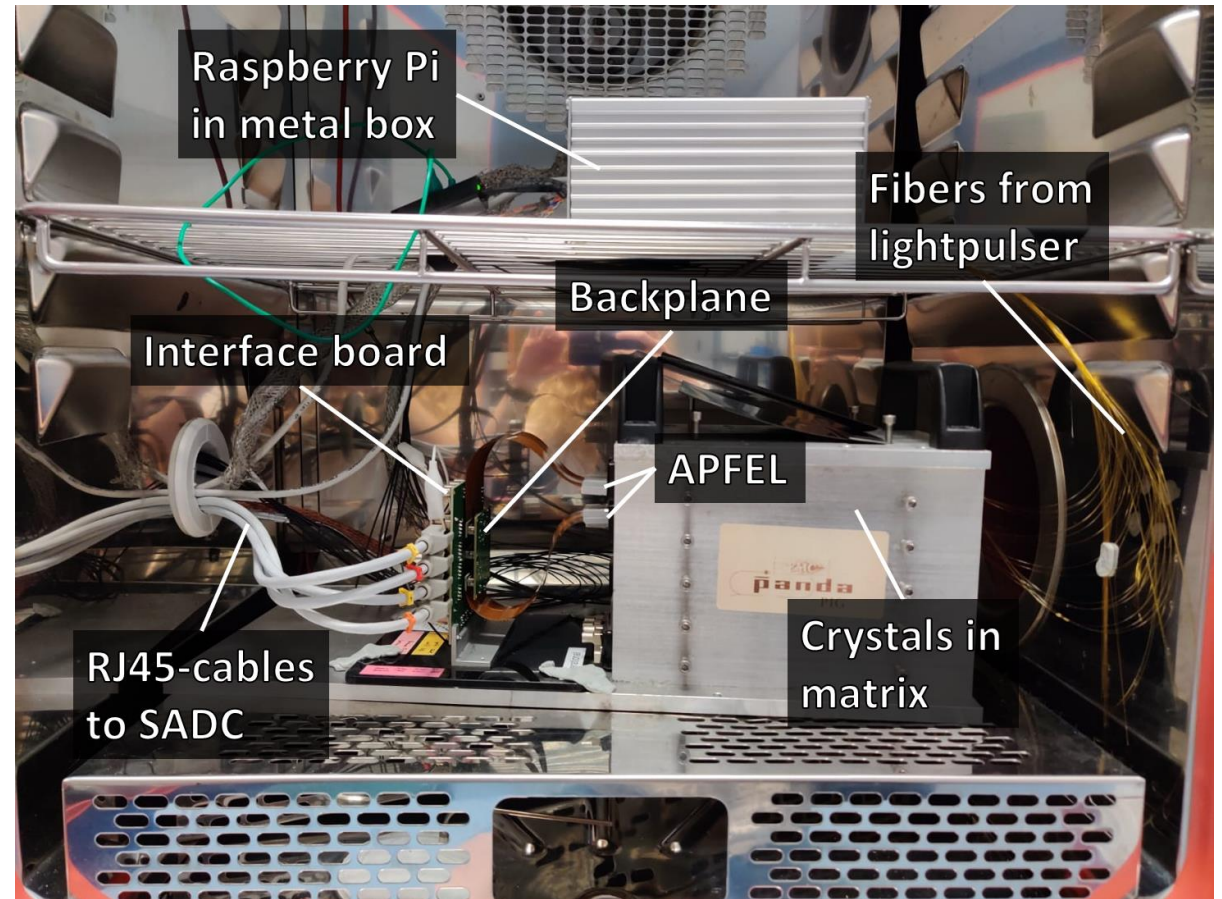
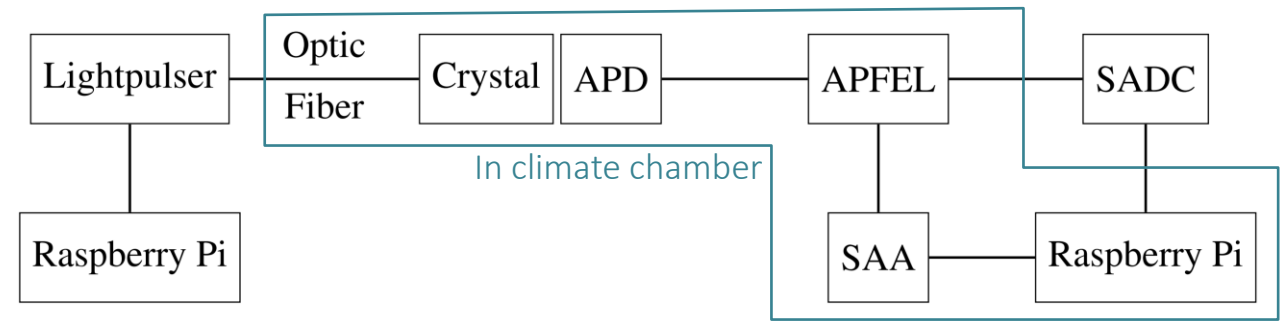
APFEL

- 2 channels for 2 APDs per crystal
 - Low gain (1) and high gain (16 or 32) output
- 4 DACs for signal shaping
 - 1 coarse (DAC1 – DAC3) and 1 fine (DAC4) adjustment per output
- Hardware autocalibration available → Used as starting point



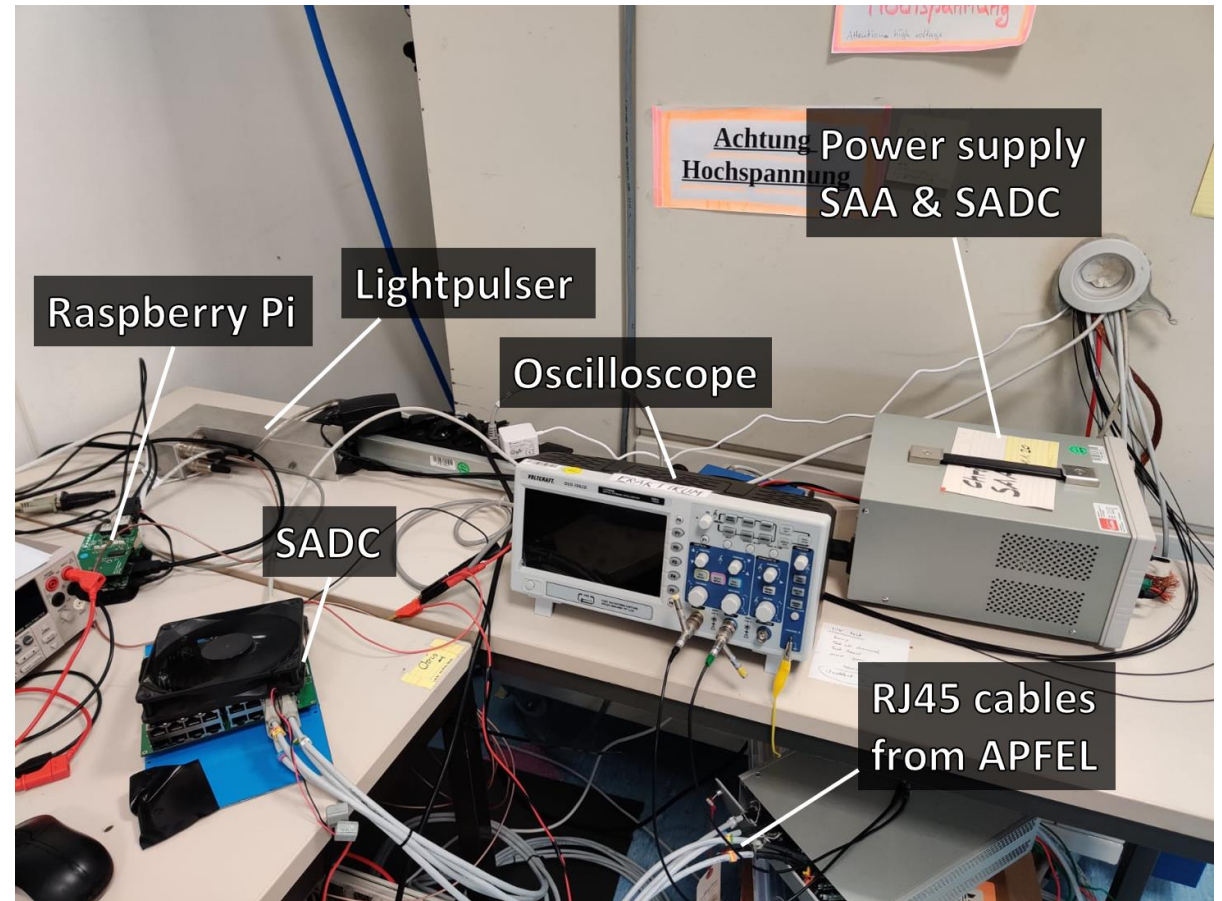
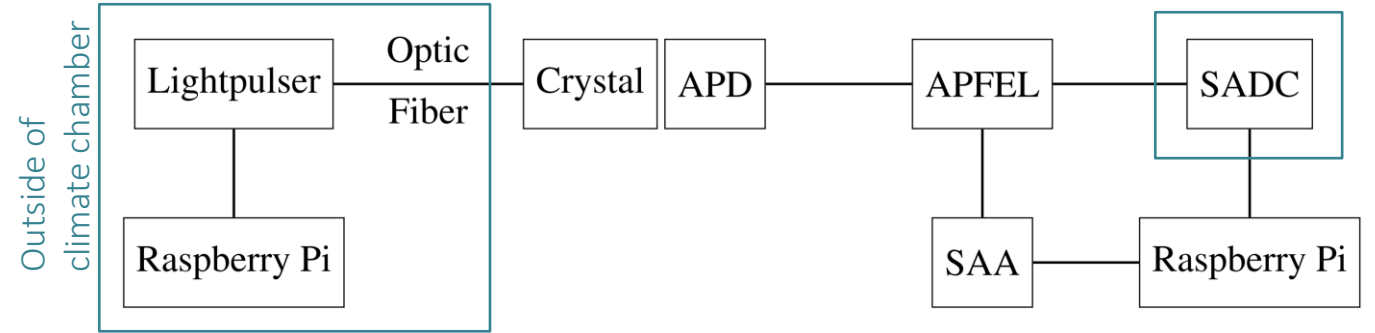
Setup

- Most of setup in climate chamber
 - Lightproof
 - Different temperatures possible
- 4 PWO-II crystals used
- APFELs connected to SAA
 - SAA controlled by Raspberry Pi



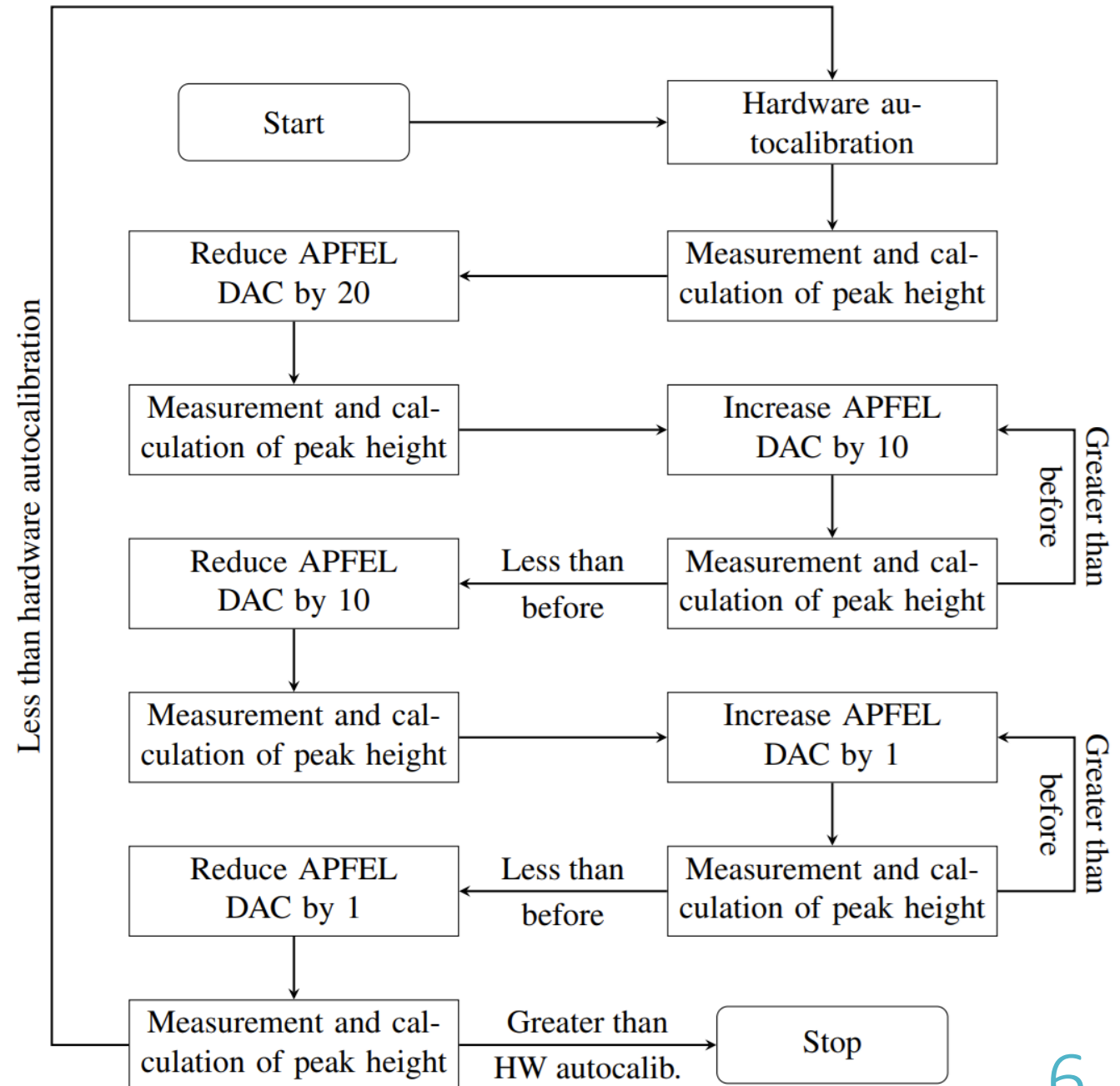
Setup

- Lightpulsers generate signal at APD
 - High intensity → get FEE in saturation on purpose
- SADC used to digitize signal from APFEL
 - Signal not differential anymore → use peak height for calibration
 - SADC and SAA connected to same Raspberry Pi



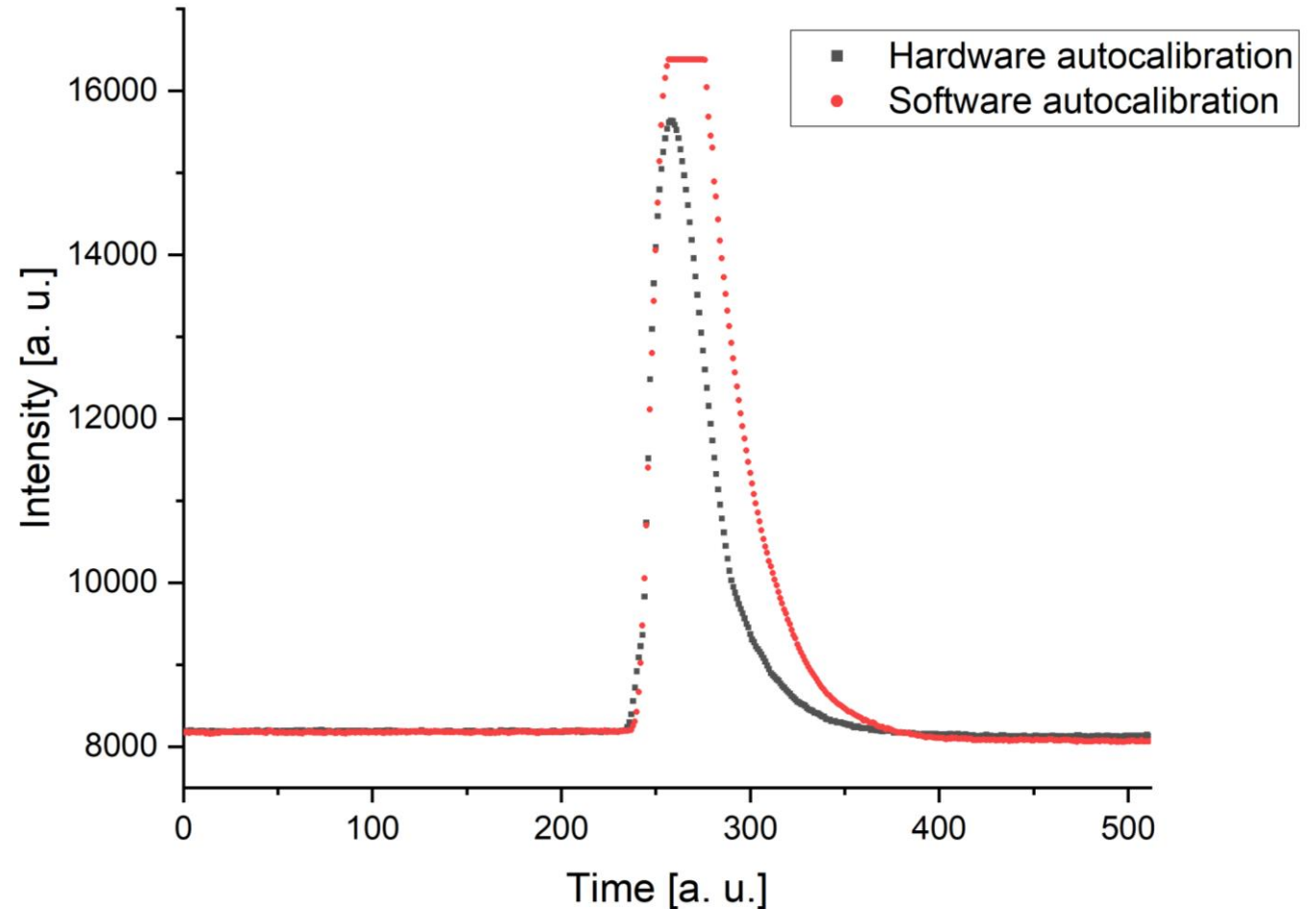
Algorithm

1. Hardware autocalibration
 2. Reduction of DAC below optimal value
 3. Coarse adjustment
 4. Fine adjustment
 5. Comparison to HW autocalibration
 6. If necessary, repeat
- First for coarse DAC, then fine DAC
 - If more than one channel affected → mean value



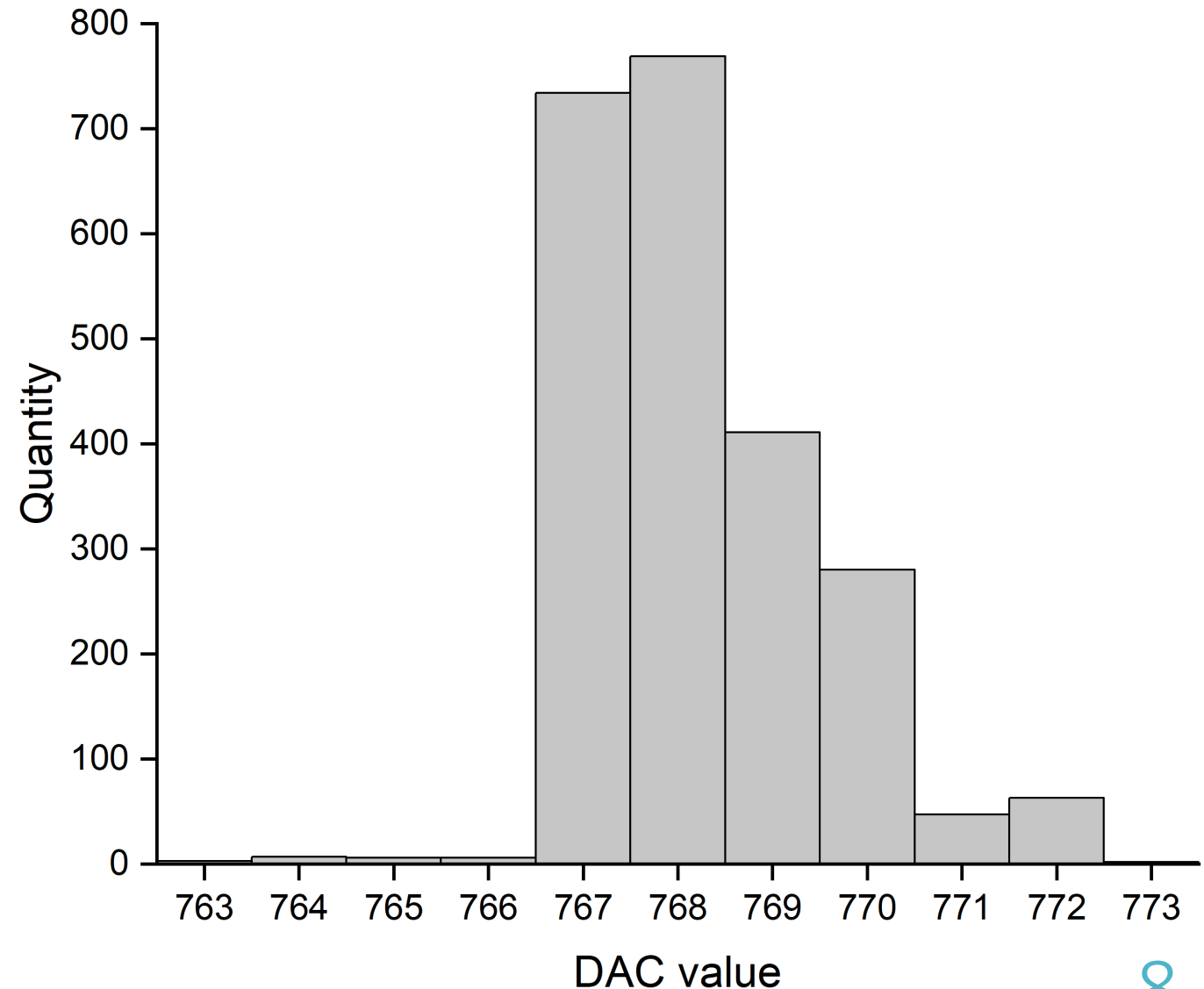
Results

- Measurement via SADC
 - Channel 1 – low gain output
- Peak height of SW-autocalib. bigger → more coverage of dynamic range
- SW-autocalib. cut off
 - No problem, because lightpulser higher intensity than real signals



Results

- 2328 software autocalibrations for same APFEL
 - Temperature and humidity constant ($44^{\circ}\text{C} \pm 1^{\circ}\text{C}$)
- DAC distribution for DAC3
 - Peak around 768
 - Variance low
 - Stable and reproducible
- Average time: 72s
 - HW-autocalib.: 0.3s



Outlook

- More testing
 - More crystals (Preseries slice)
 - Different temperatures
 - Different backplanes
- Calibrate independent DACs with same measurements → Faster
- Use integrated pulser from APFEL
 - Problem: Simultaneous signal generation and measurement