Development of System for Evaluation of FEB Quality for Straw Tube Readout

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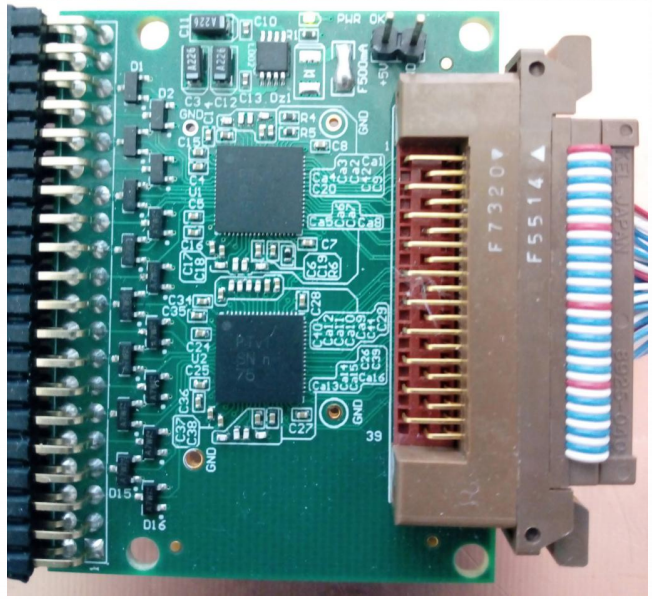
Agenda

- Introduction to FEB Test System
  - motivation, test scenario, test system architecture
- Charge Injector - key block of Test System
  - Schematic, prototype, firmware&software
- Measurements
  - Test setup, example results
- Summary and Future Plan



Motivation and test scenario

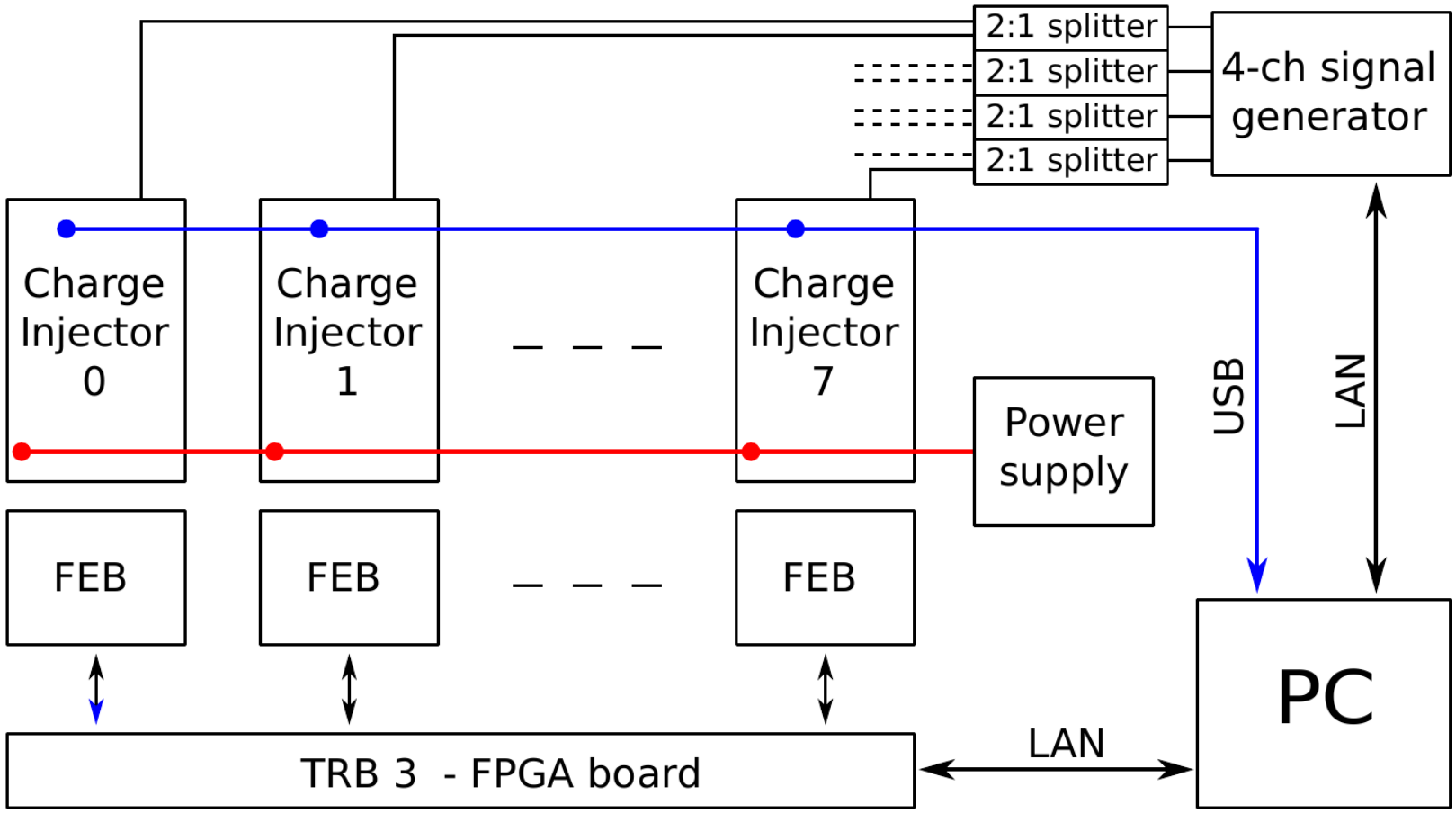
Why detailed FEB measurements are needed?

- FEBs have to be fully verified and parameterized to ensure good performance in the experiment
- Complete database with all measured parameters is needed before installation

What will be checked/done during tests?

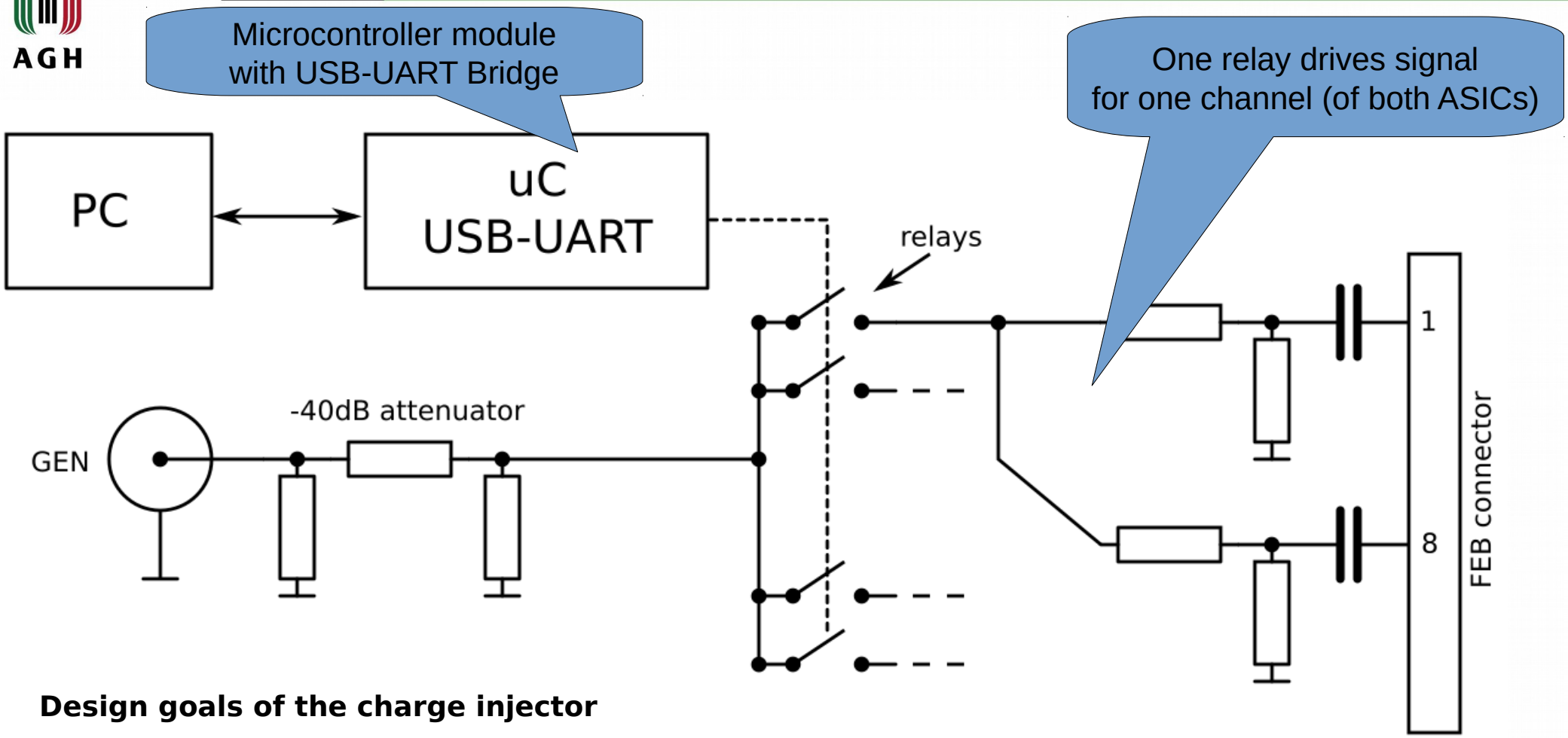
- Communication with FEB and its settings (all bits in PASTTREC configuration registers)
- Monotonicity of the baseline DACs and threshold DAC
- Baseline optimization (best baseline settings)
- Verification of the baselines during threshold scan measurements
- S-curve measurements for different PASTTREC configurations (peaking time, gain, threshold) for all FEB channels
  - Noise
  - Baseline (median of the S-curve)
  - Gain measurements – median versus threshold for different gain settings
- Many plots and reports will be created

Architecture of the Test System



- 8 FEB boards can be tested in parallel (16 PASTTRECs)
- Test signals during S-curve measurements come from Charge Injector boards
- System controlled by PC via python scripts – fully automatic

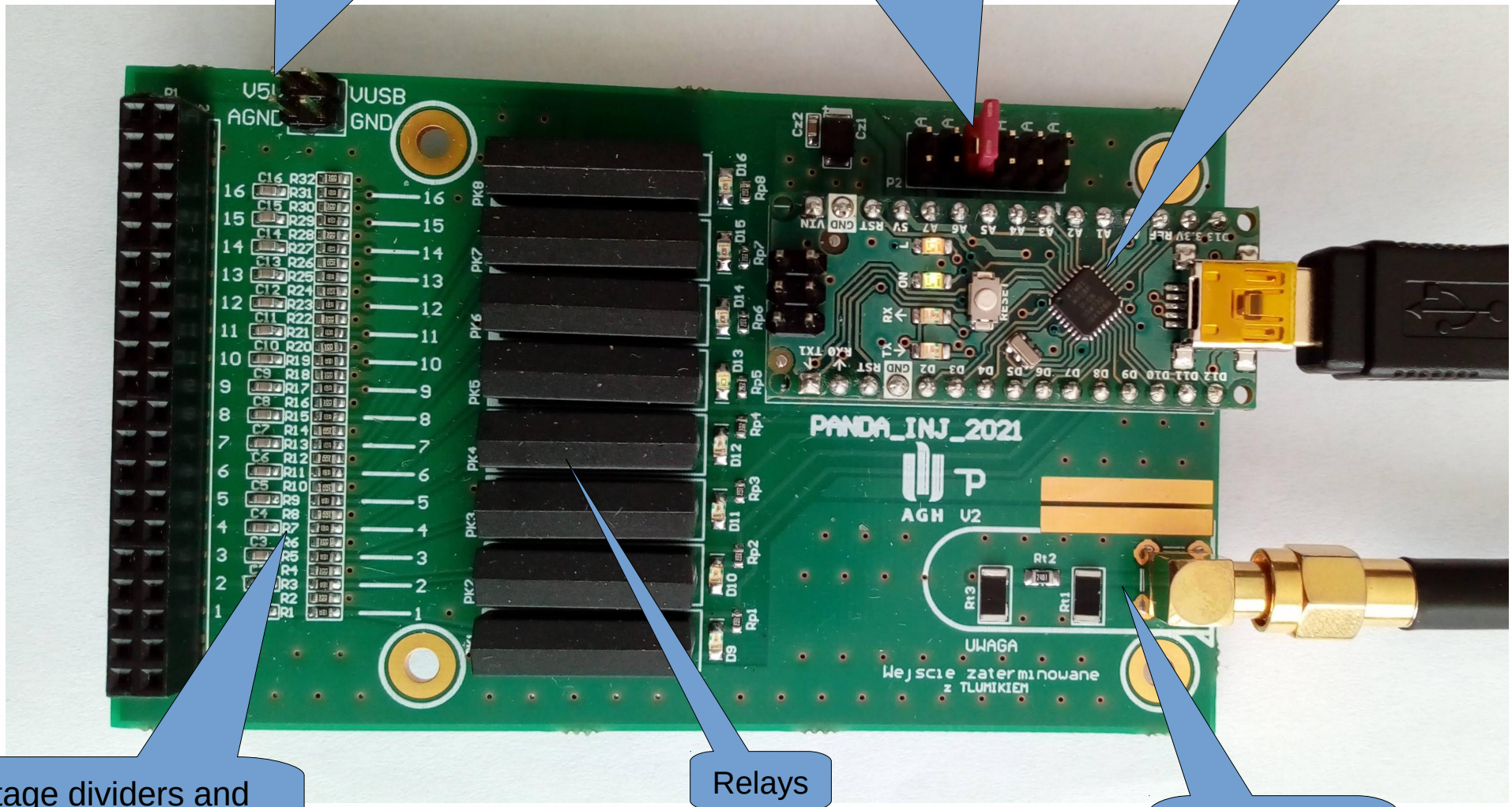
Charge Injector – schematic



Design goals of the charge injector

- Signal from generator delivered to one or more PASTTREC inputs
- All blocks integrated in one, as simple as possible, board
- Separated digital and analogue grounds
- Power supply for FEB delivered via front connector as in final system
- Hardware addresses of injector boards added (important for multi board testing)
- Channel selection controlled from PC

Charge Injector – compact prototype



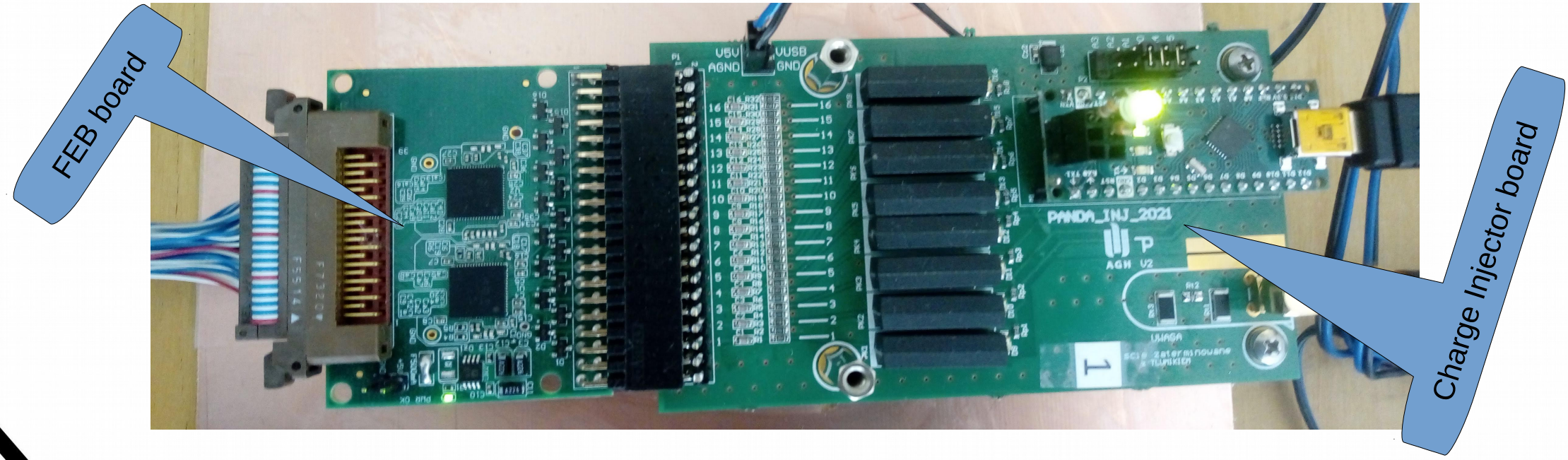
Charge Injector – Firmware and Software

Firmware features:

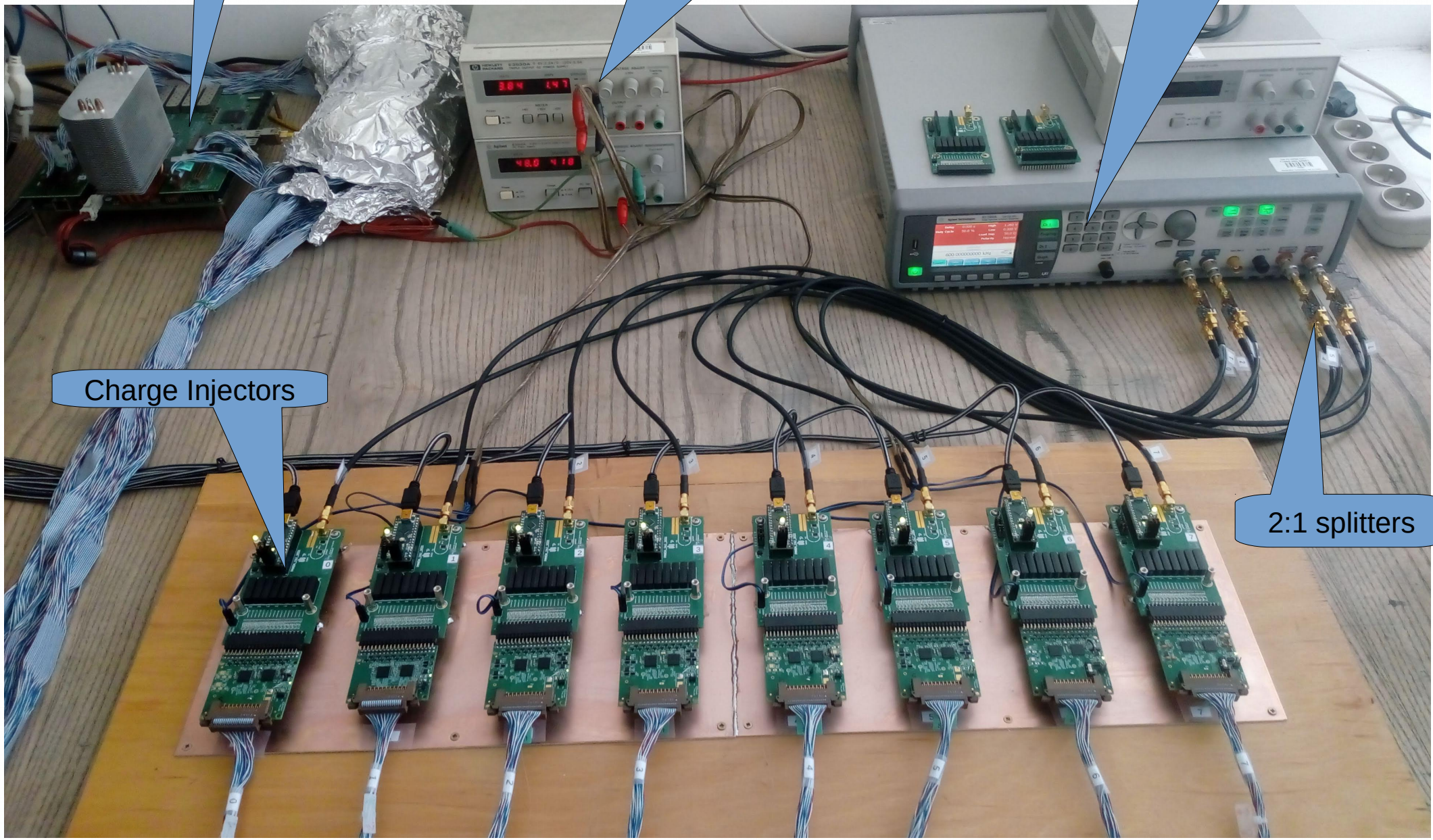
- Hardware address supported – up to 16 injector boards in one system (8 used now)
- Calibration factors (related to components tolerance) are stored in hardware (EEPROM) – system always knows which factors should be used to calculate injected charge

Software features:

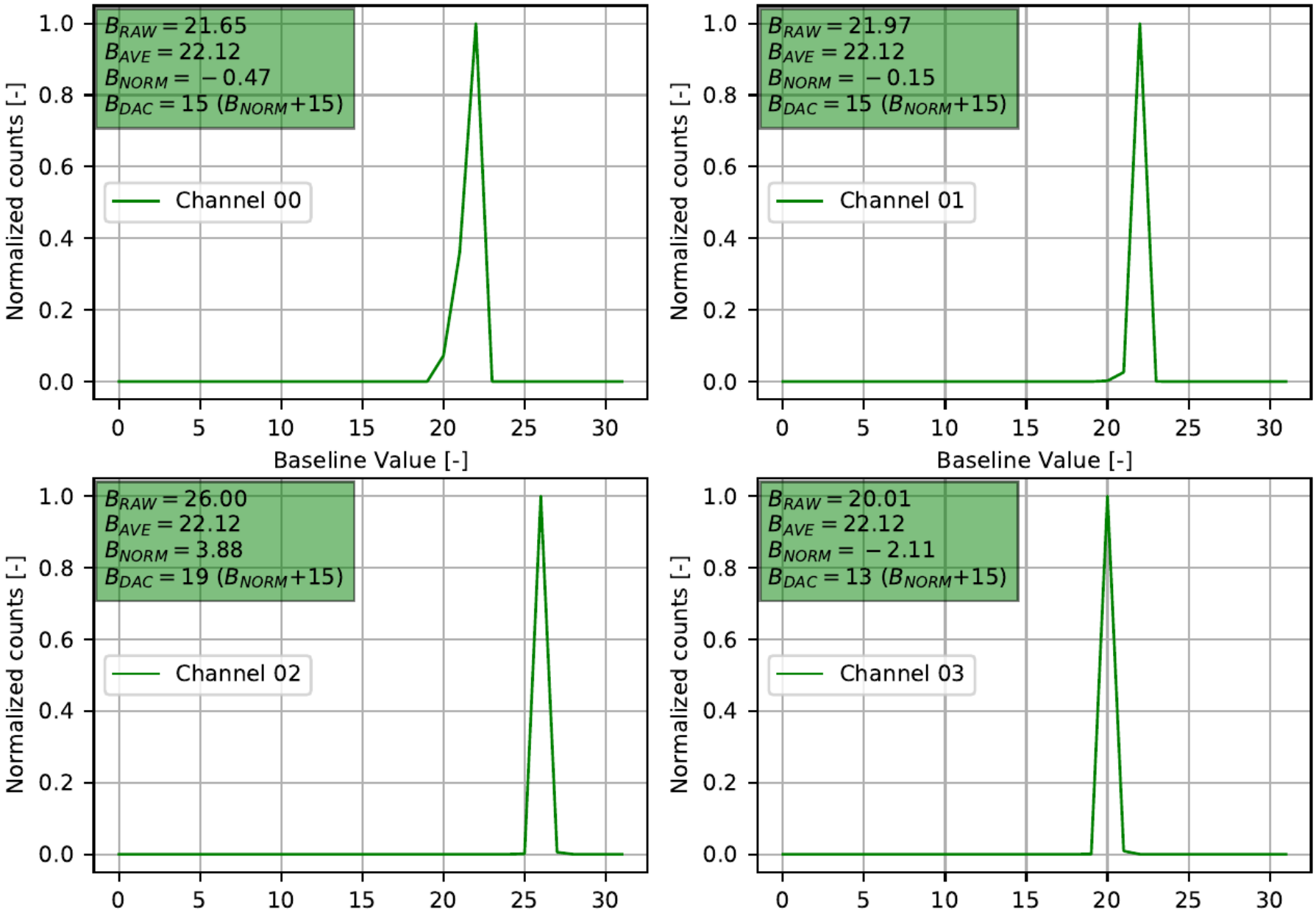
- Developed as Python class (“Injectors”)
- Automatically searches for devices connected to the PC and groups it by hardware address
- Very simple usage – just create class object and go!



Test Measurement Setup

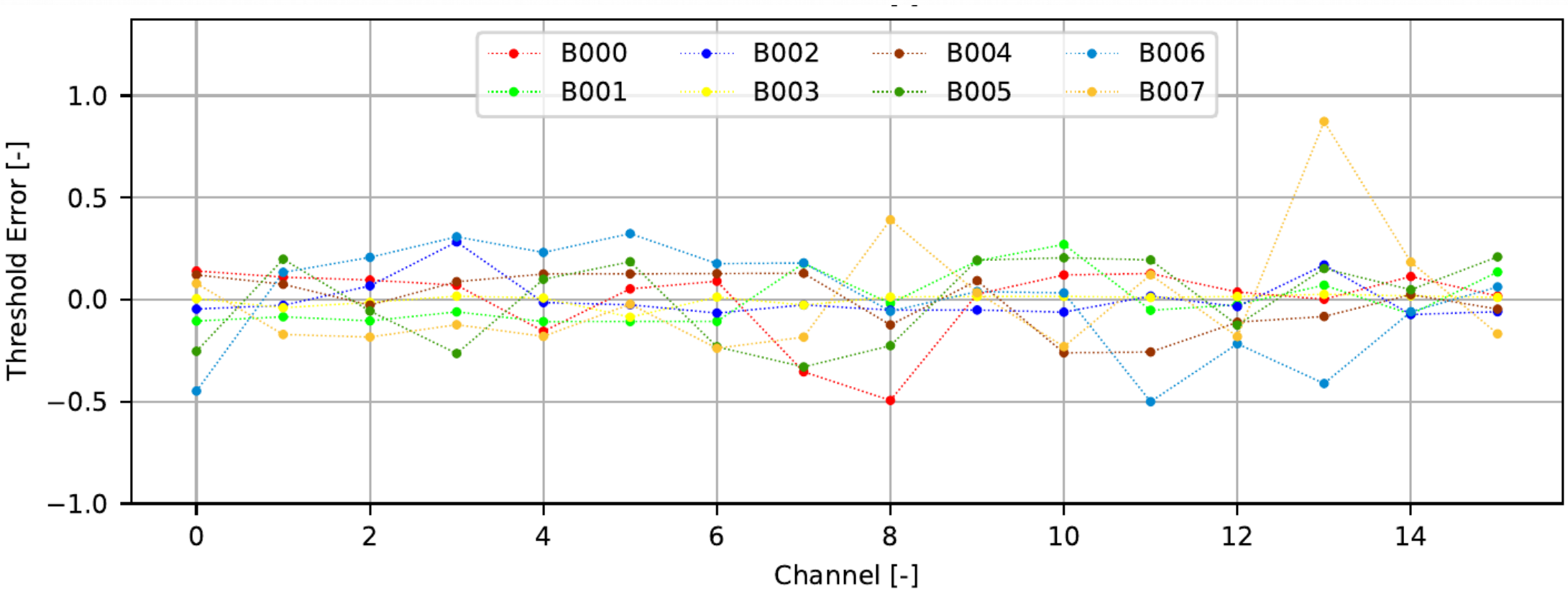


Baseline scan measurements



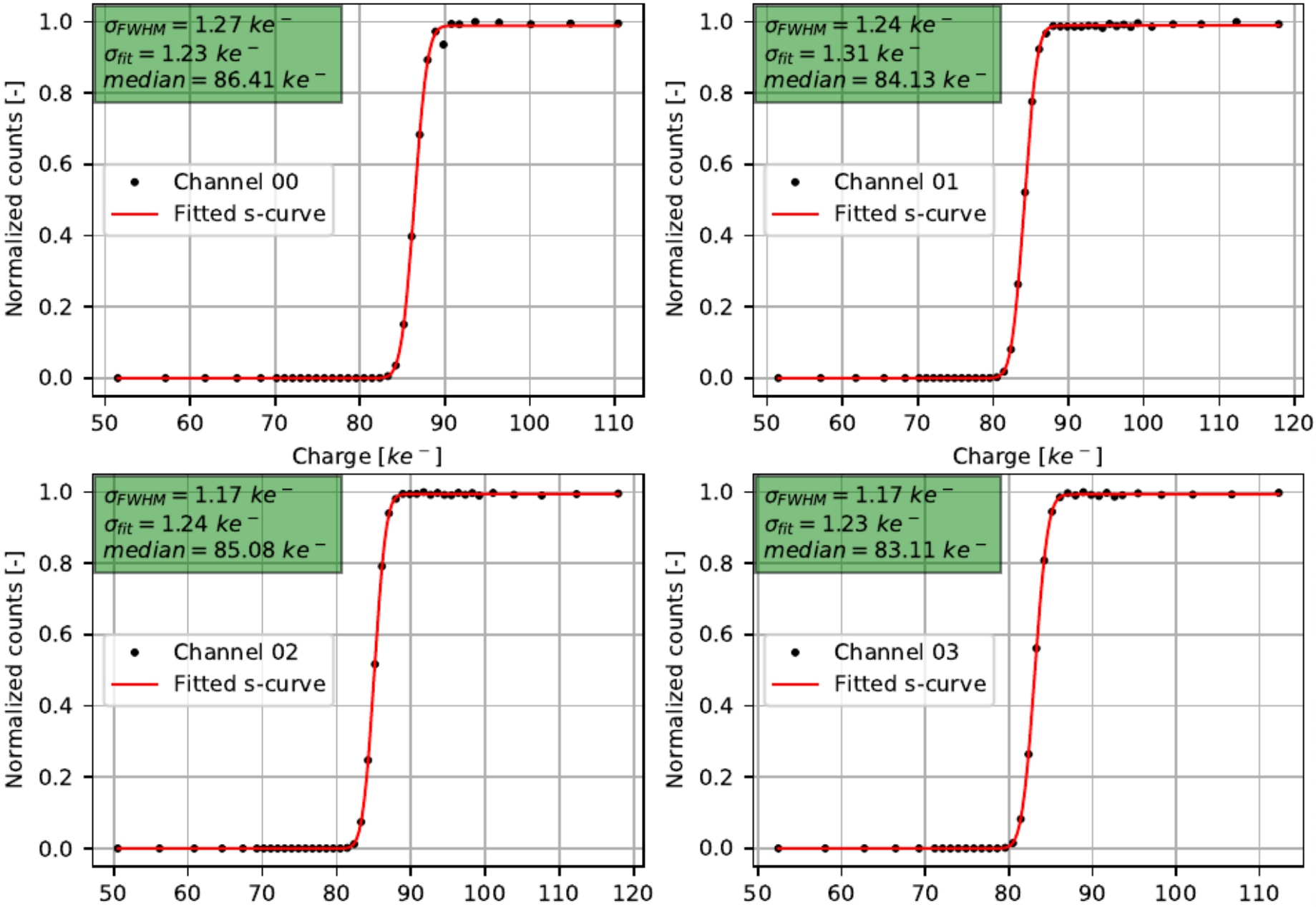
- Example measurements for first four channels

Threshold scan – 8 FEBs



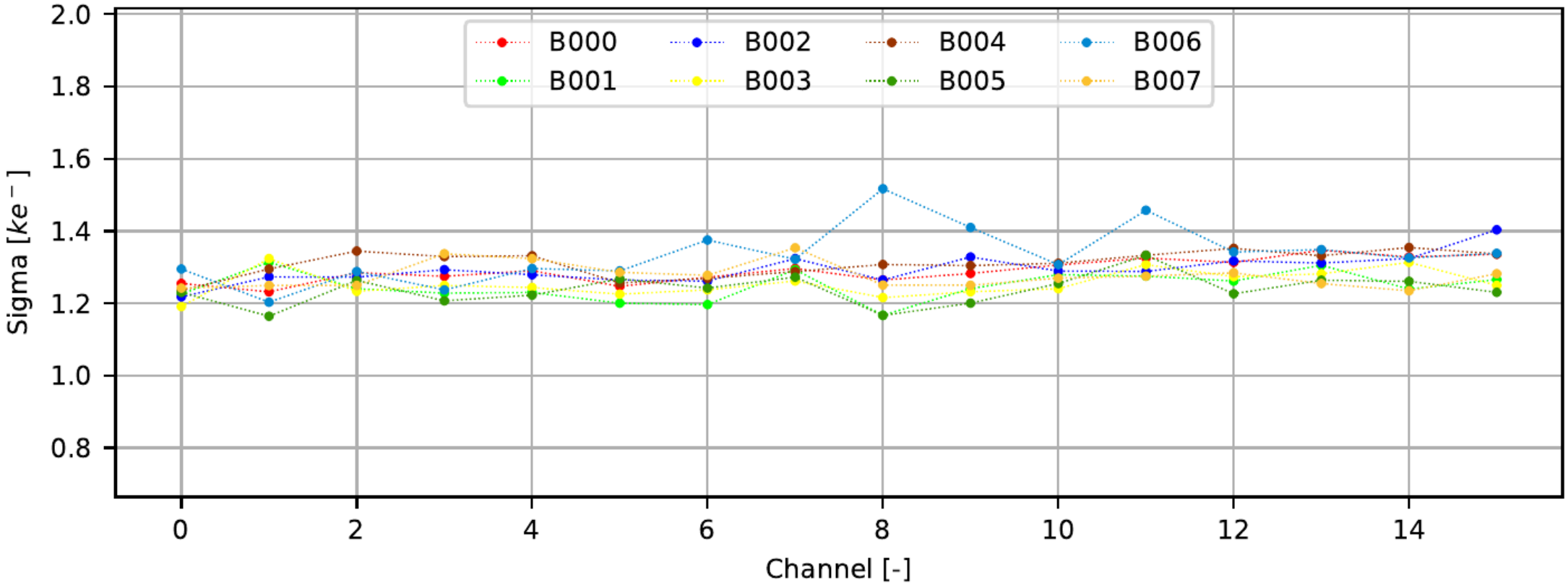
- Measurements done after baseline correction
- Threshold error in range +/-0.5 means that baseline is successfully corrected
- 8 FEBs (B000-B007) measured in parallel

S-curve measurements



- Example measurements for first four channels

S-curve noise – 8 FEBs



- 8 FEBs (B000-B007) measured in parallel
- Good and repetitive performance for all channels
- Measurements done without calibration of charge injectors (for now. Calibration needs still to be done...)

Summary and Future plans

- Prototype board of the charge injector – done
- Charge Injector Firmware and Software development – done
- Verification of the system during tests of FEBs - done
- Optimization of the existing test procedures – in progress
- Construction of system with many FEBs and injectors – almost done
- Software for automatic chart plotting and measurement report - in progress
- TOT based procedure for testing monotonicity of the DACs - near future
- Preparing test scenarios for mass production board testing - in progress