FEB Test Results

A. Molenda for the AGH group

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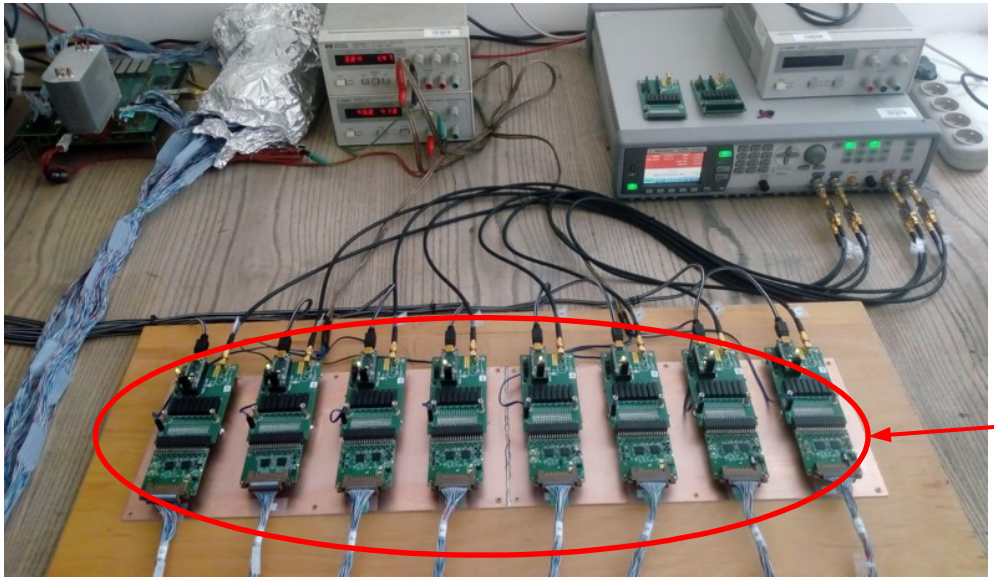
Outline

1. Test setup
2. PASTTREC results from 1st mass-test series
3. Results with straws
4. Summary and future plans

Test Measurement Setup



8 FEBs (16 PASTTREC) measured in parallel

All FEBs tested in 5 configurations:

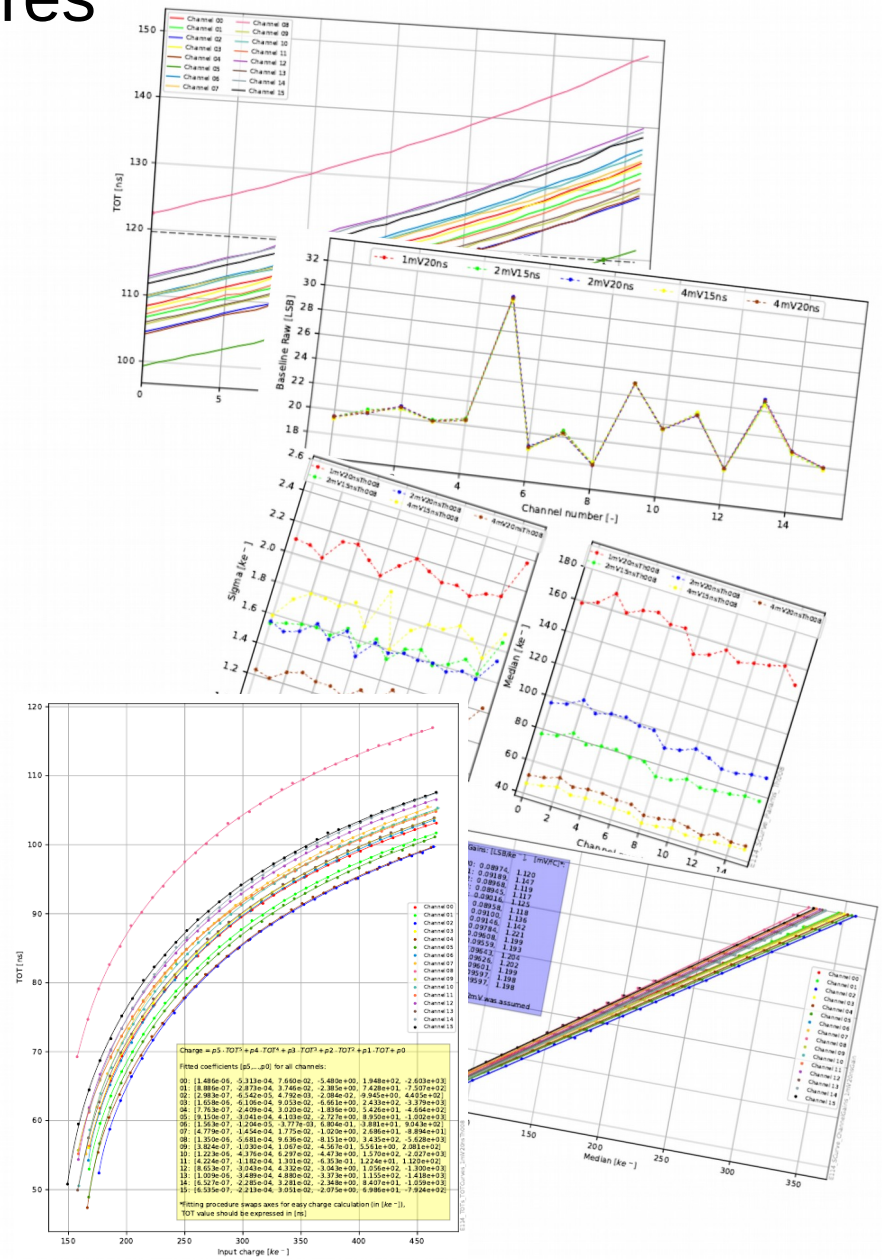
Configuration name	Gain	T_{peak}	TC_{C1}	TC_{R1}	TC_{C2}	TC_{R2}
1mV20ns	1 mV/fC	20 ns	6.0 pF	23 kΩ	0.6 pF	11 kΩ
2mV15ns	2 mV/fC	15 ns	15.0 pF	7 kΩ	0.6 pF	8 kΩ
2mV20ns	2 mV/fC	20 ns	7.5 pF	27 kΩ	0.75 pF	17 kΩ
4mV15ns	4 mV/fC	15 ns	13.5 pF	19 kΩ	1.5 pF	23 kΩ
4mV20ns	4 mV/fC	20 ns	10.5 pF	27 kΩ	0.9 pF	20 kΩ

Default configuration

Configurations for final mass test still to be slightly modified

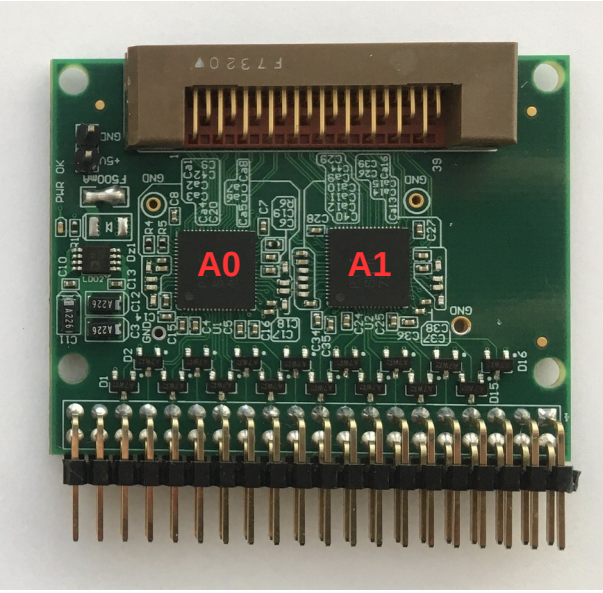
Measurements: Types and Procedures

- **Baseline DACs test** (for 4mV20ns only)
  - checks DACs monotonicity with DAC scan and TOT measurements
- **Threshold DAC test** (for 4mV20ns only)
  - checks DAC monotonicity with DAC scan and TOT measurements
- **Baseline measurements** (all configurations)
  - find baseline settings/corrections for all channels
- **Threshold scan** (all configurations)
  - verification of the baseline settings, shows differences between channels after baseline correction
- **Quick channels test** (for 4mV20ns only)
  - checks whether channels give right response for small and big input charges (further measurements possible only when all channels are good)
- **S-curve measurements** (all configurations)
  - measure the number of counts versus input charge for selected thresholds, to calculate noise, gains, etc.
- **TOT Scan** (all configurations)
  - measure the TOT value versus input charge for selected thresholds - allows to calculate charge from TOT value for specific threshold



Preliminary results

Yield estimation

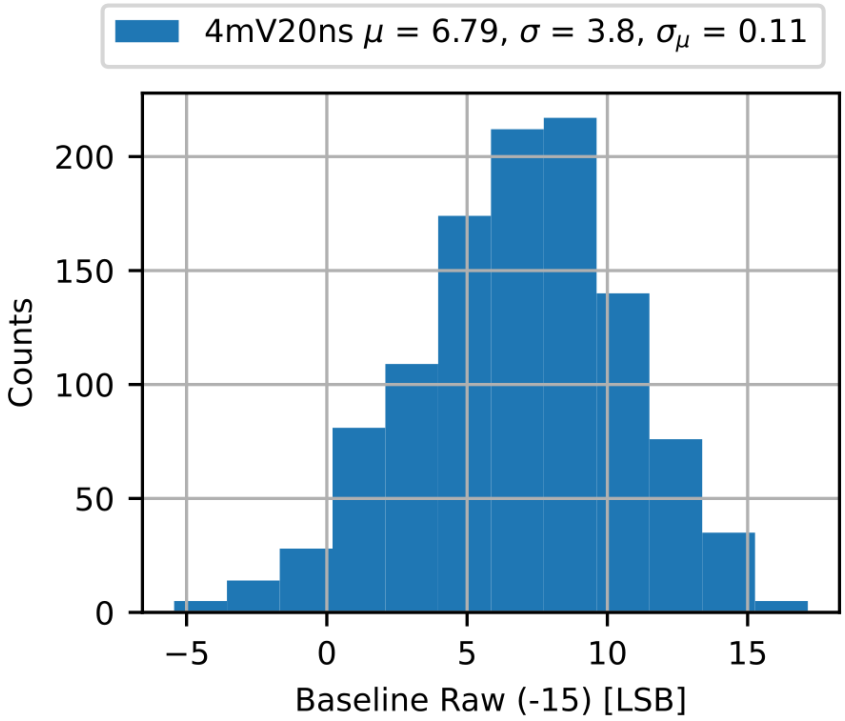


- 133 (125) of 140 FEBs considered good
- 7 FEBs (one of the two PASTTRECs) marked as failed:
  - 4 FEBs (E025, E042, E096, E136) work relatively well, but:
    - too large offset spread
    - threshold DAC cannot set very low thresholds (1-2 LSB) for one channel
  - 3 FEBs (E024,E081, E129) have communication problem (slow control)
    - two of them (E024,E081) show reasonable behavior in default settings
    - third FEB (E129) has one chip which does not respond
- 8 FEBs too big gain spread between PASTTRECs (>15%) - backup (E009, E014, **E018**, E034, E038, E062, E083, E090)

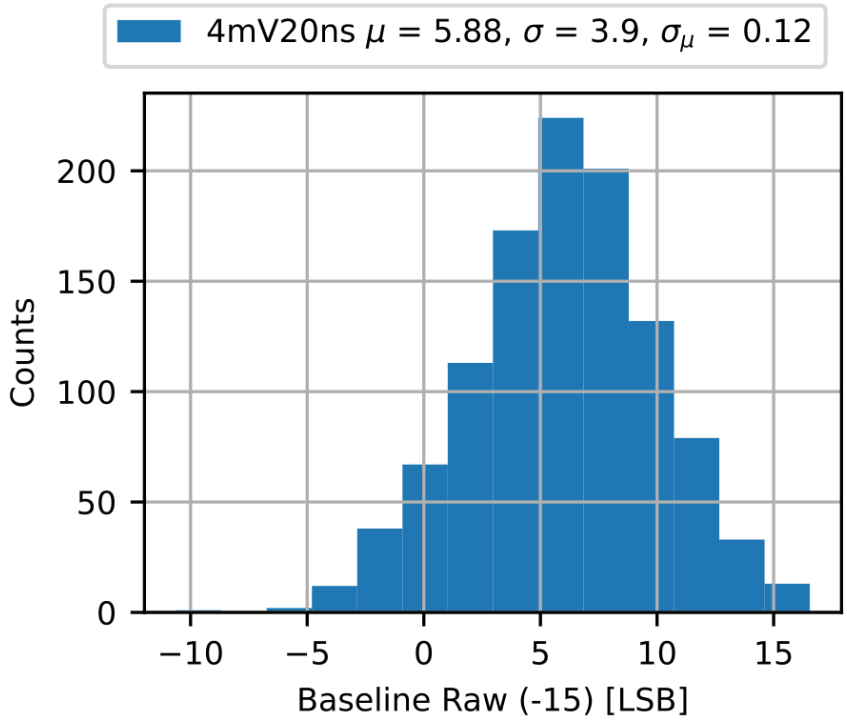
Yield estimation: 95% (89%) for FEBs, 97,5% (94,6%) for PASTTRECs – assuming that all FEBs considered presently good, will be verified as good in the experiment

Results - Baseline

ASIC0



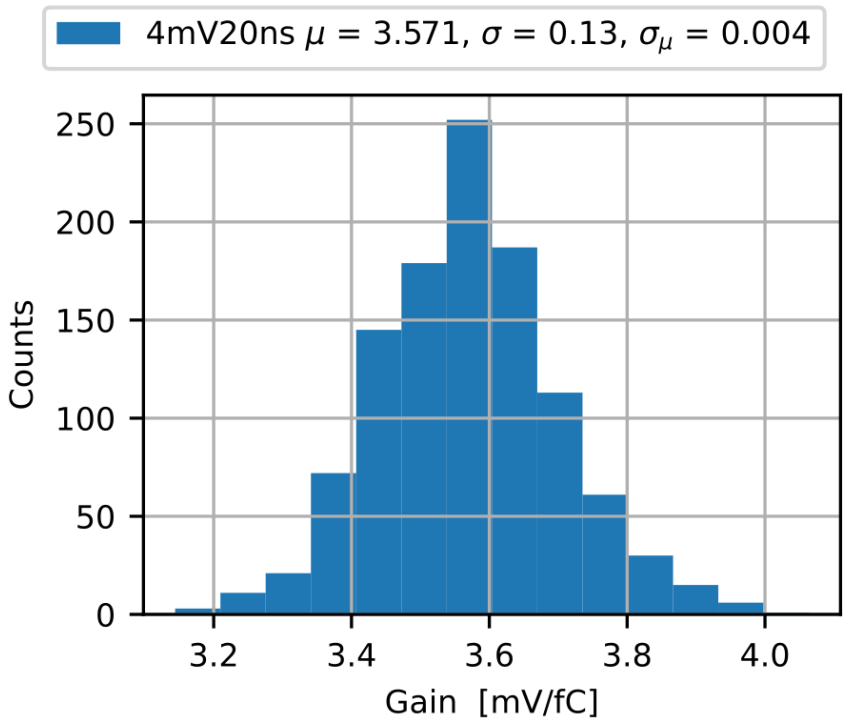
ASIC1



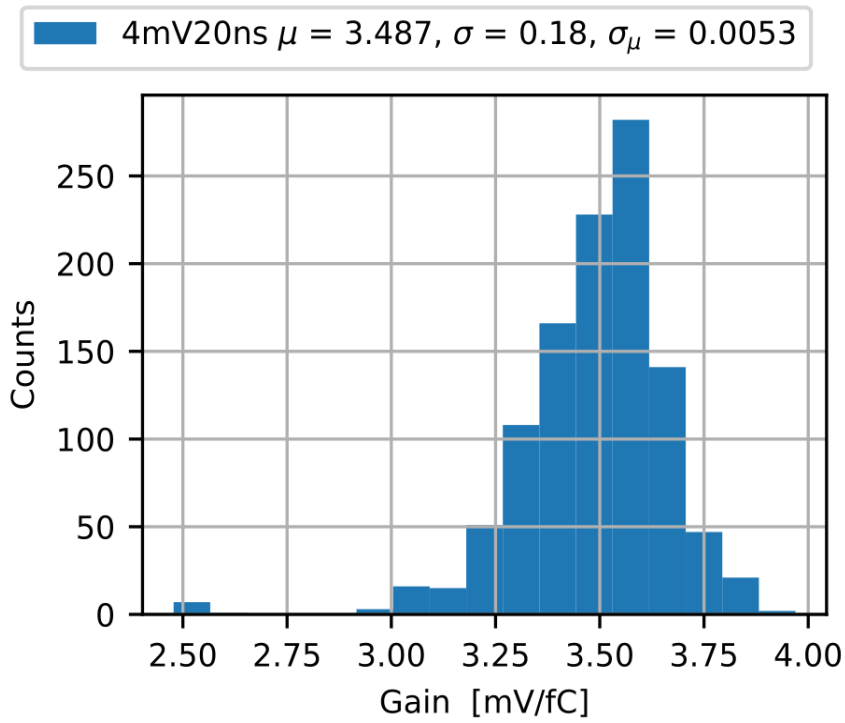
- μ ≈ 6-7 LSB – systematical offset in all chips,
- Small difference between ASIC0 and ASIC1,
- All within +/- 8 LSB – half of the range of the DAC (32 LSB),
- Same results for all ASIC configurations – baseline independent on settings.

Results - Gain

ASIC0

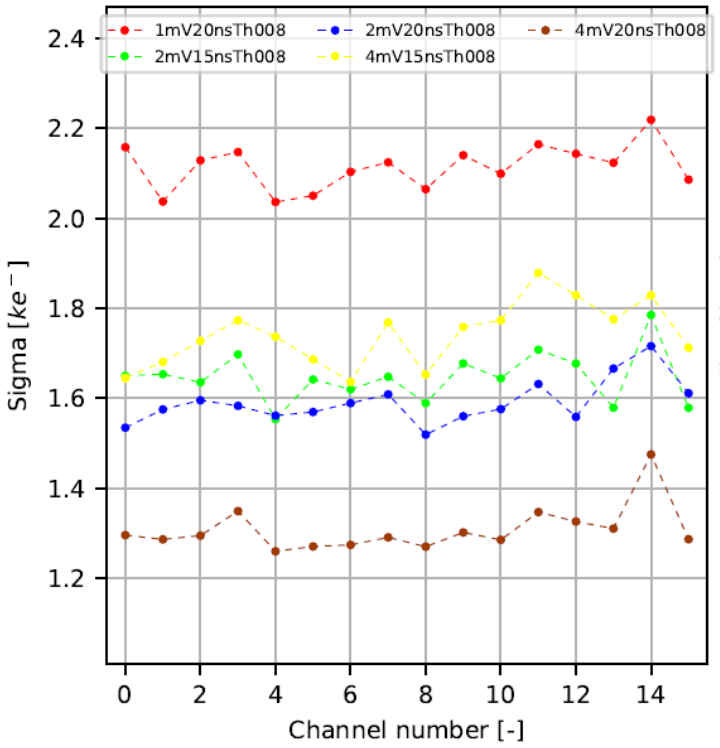


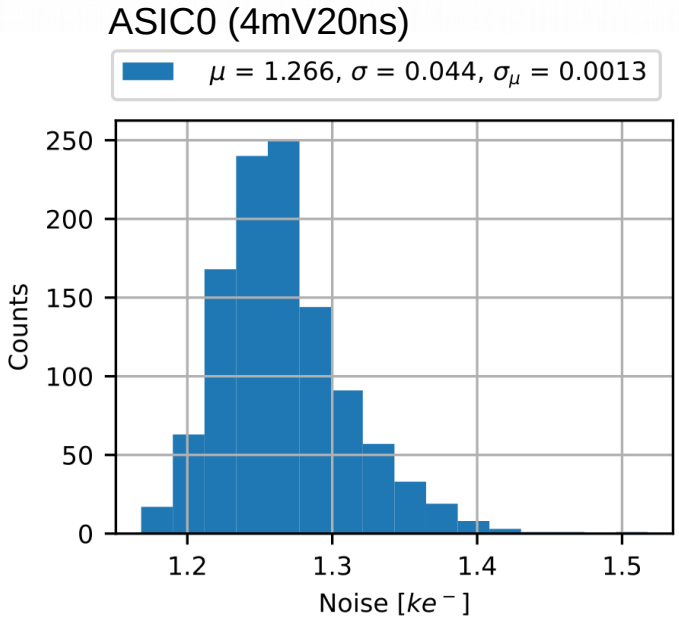
ASIC1

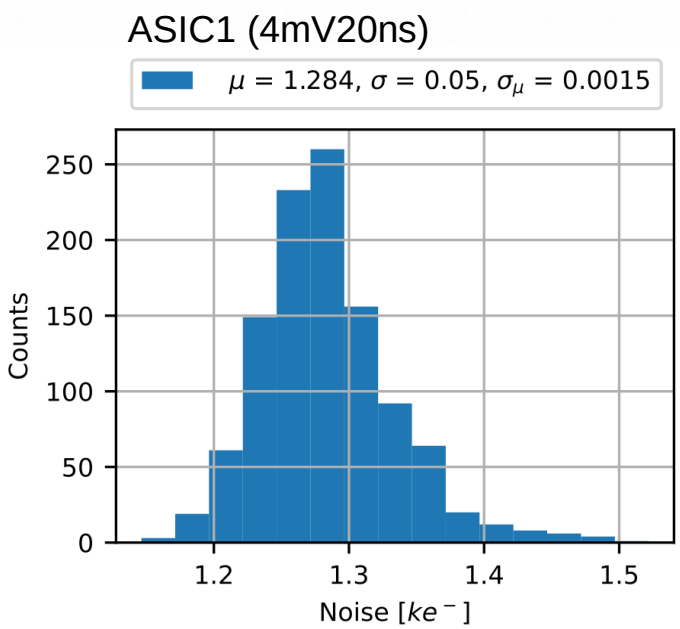


- Small difference between ASIC0 and ASIC1,
- One A1 PASTTREC found with very low gain – E018,
- Higher gain for smaller peaking time,
- Similar conclusions for other configurations

Results - Noise



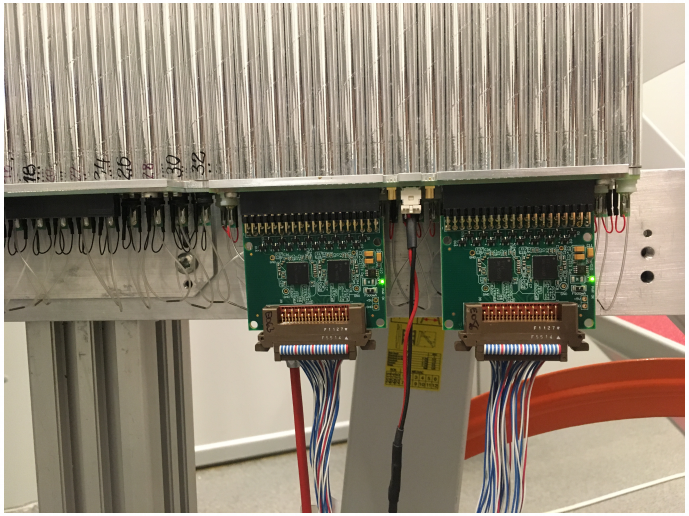




- Smaller noise for higher gain settings (~1300 e^-) – higher gain settings in the experiments,
- Difference between channels – depends also on external factors

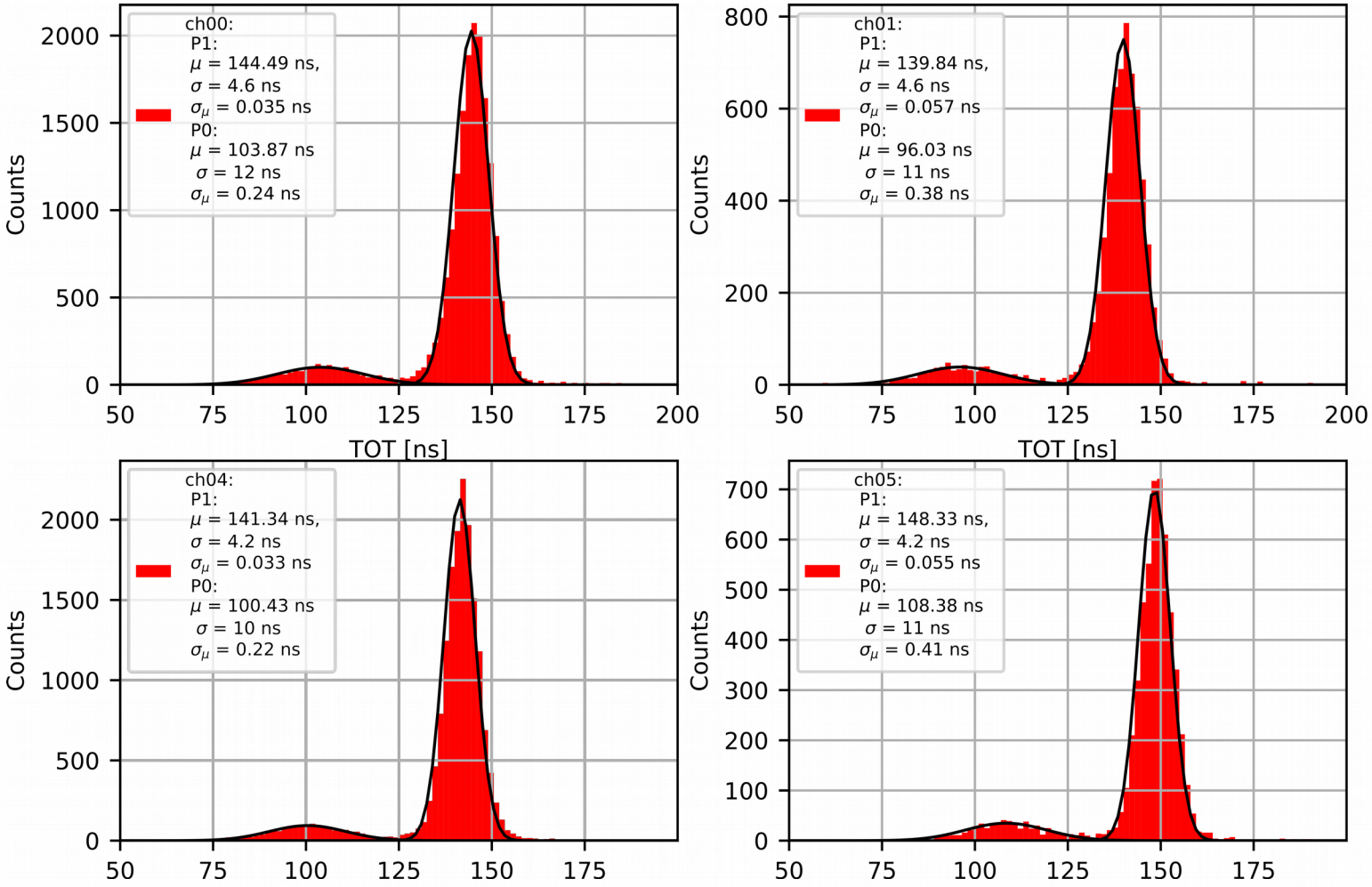
Measurement with straws

4 FEBs (E001, E004, E056, E063) tested with straws to verify the whole detector readout chain



Results

With straws and iron source (single channel)

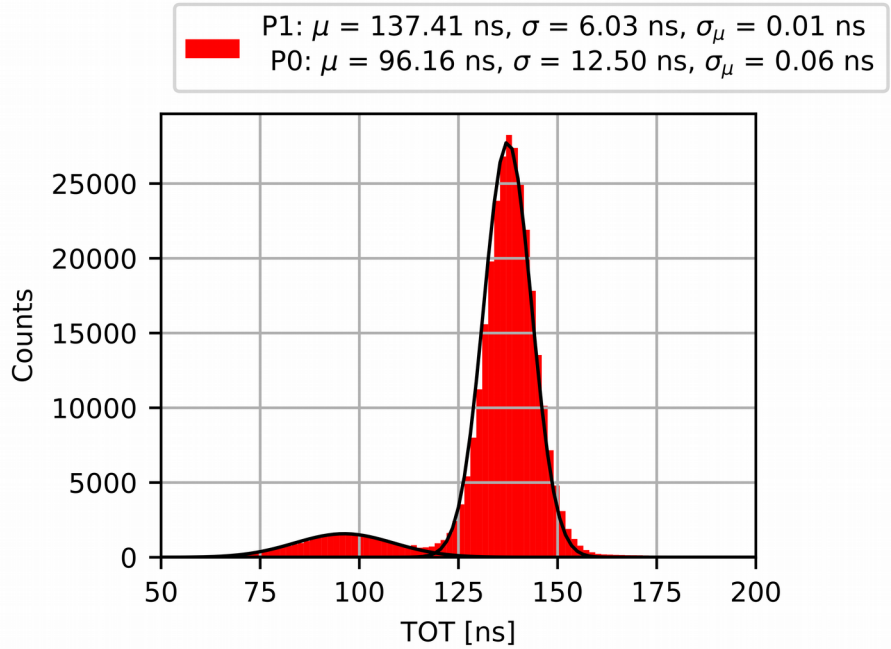


Settings:
K = 4 mV/fC
Tpeak = 20 ns
Th = 16

- Good peaks recognition,
- Main peak: σ ≈ 4.5 ns (for single channel)
- Verification for other configurations to be done

Results

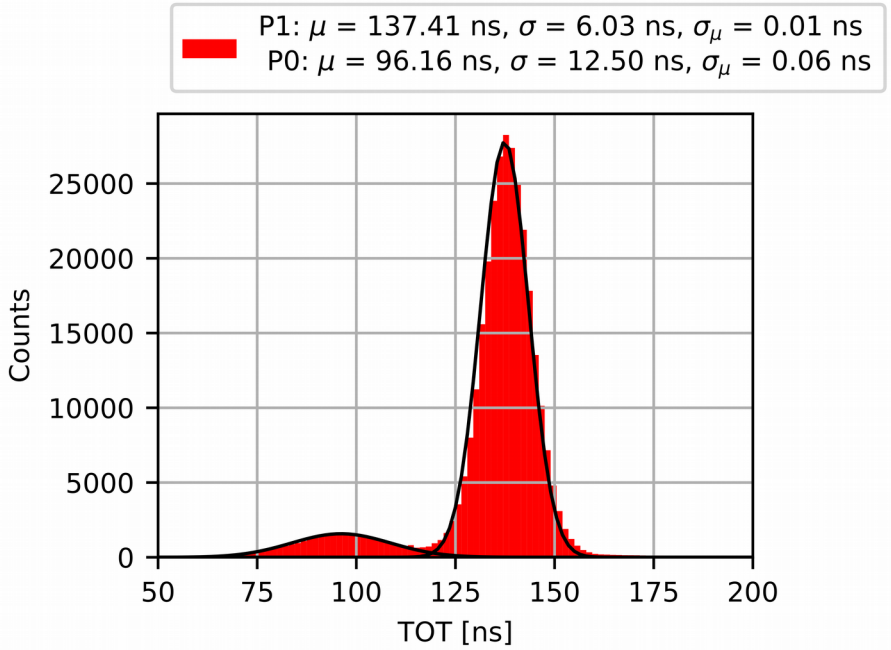
With straws and iron source (sum of channels from one straw module)



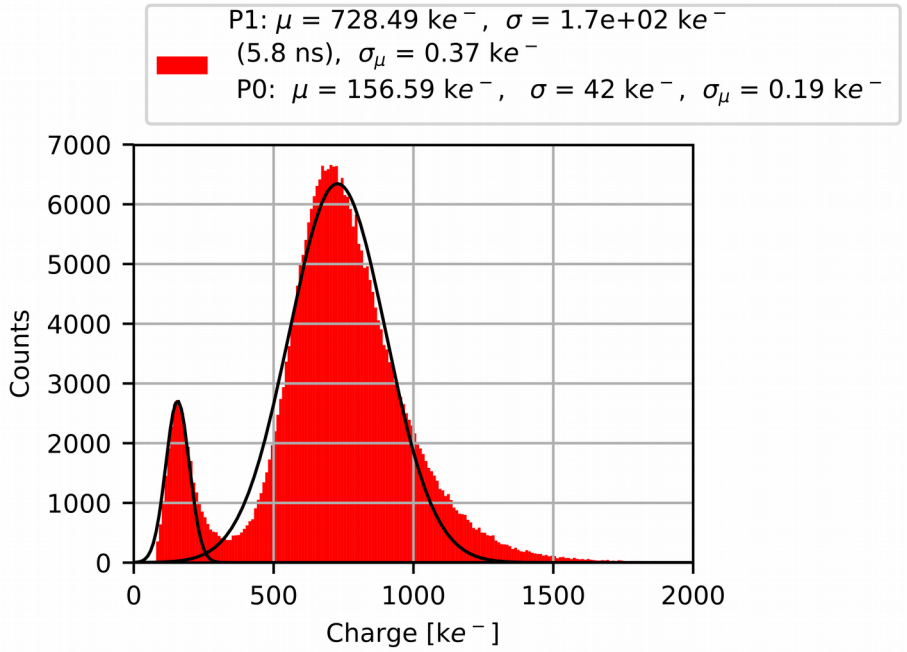
- Still good recognition of both peaks
- Main peak: σ = 6.03 ns (slightly bigger than for single channel)

Results

First try of TOT corrections (sum of all channels within straw module)



Default results



After TOT correction

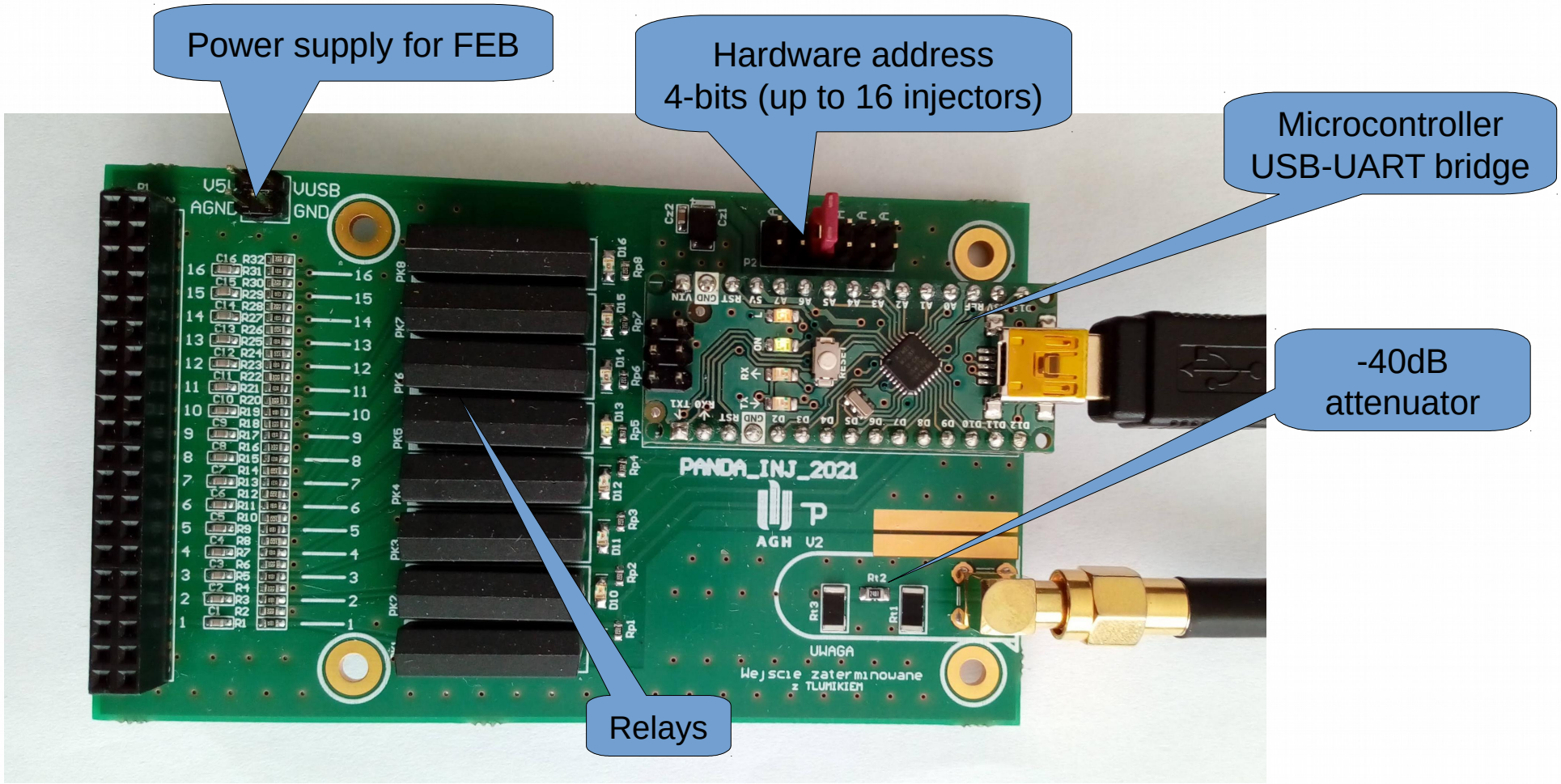
- TOT correction do not give expected results – position of peaks do not correspond expectations from physics,
- The origin of the problem may be the shape of the injected signal from generator during tests (delta, no ion tail) – work in progress...

Summary and future plans

- Setup for mass tests with 8 FEBs – done
- First version of software for data analyses and plotting – done
- Results of first 140 prototype FEBs (partially for HADES) – done
- First verification tests with straws – partially done, in progress
- Optimization of test procedures and software – in progress
- TOT corrections – in progress

BACK-UP

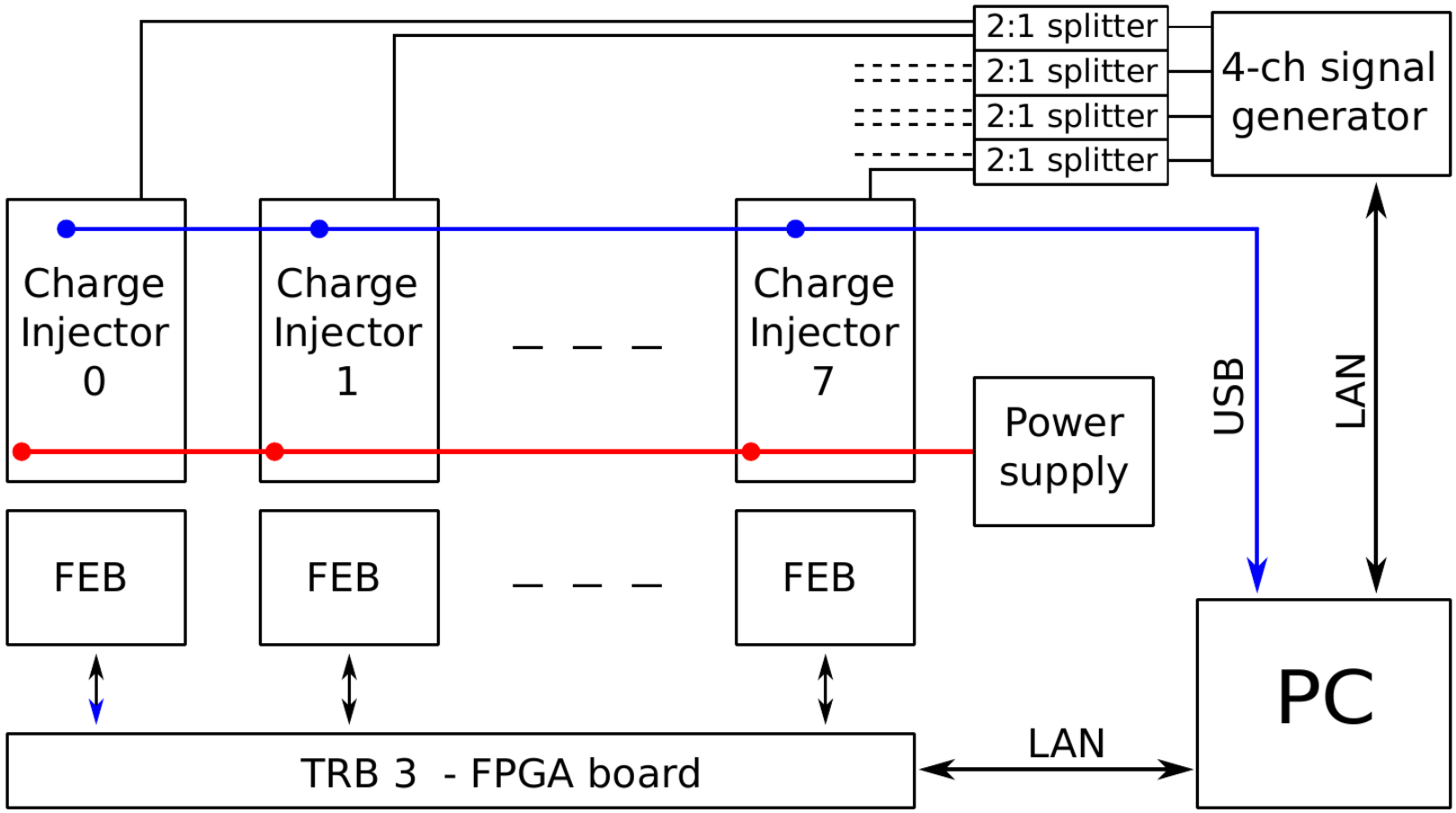
Charge Injector – compact prototype



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)

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