ETH zürich

The influence of Temperature and a Lightguide on the Crosstalk Probability of a SiPM

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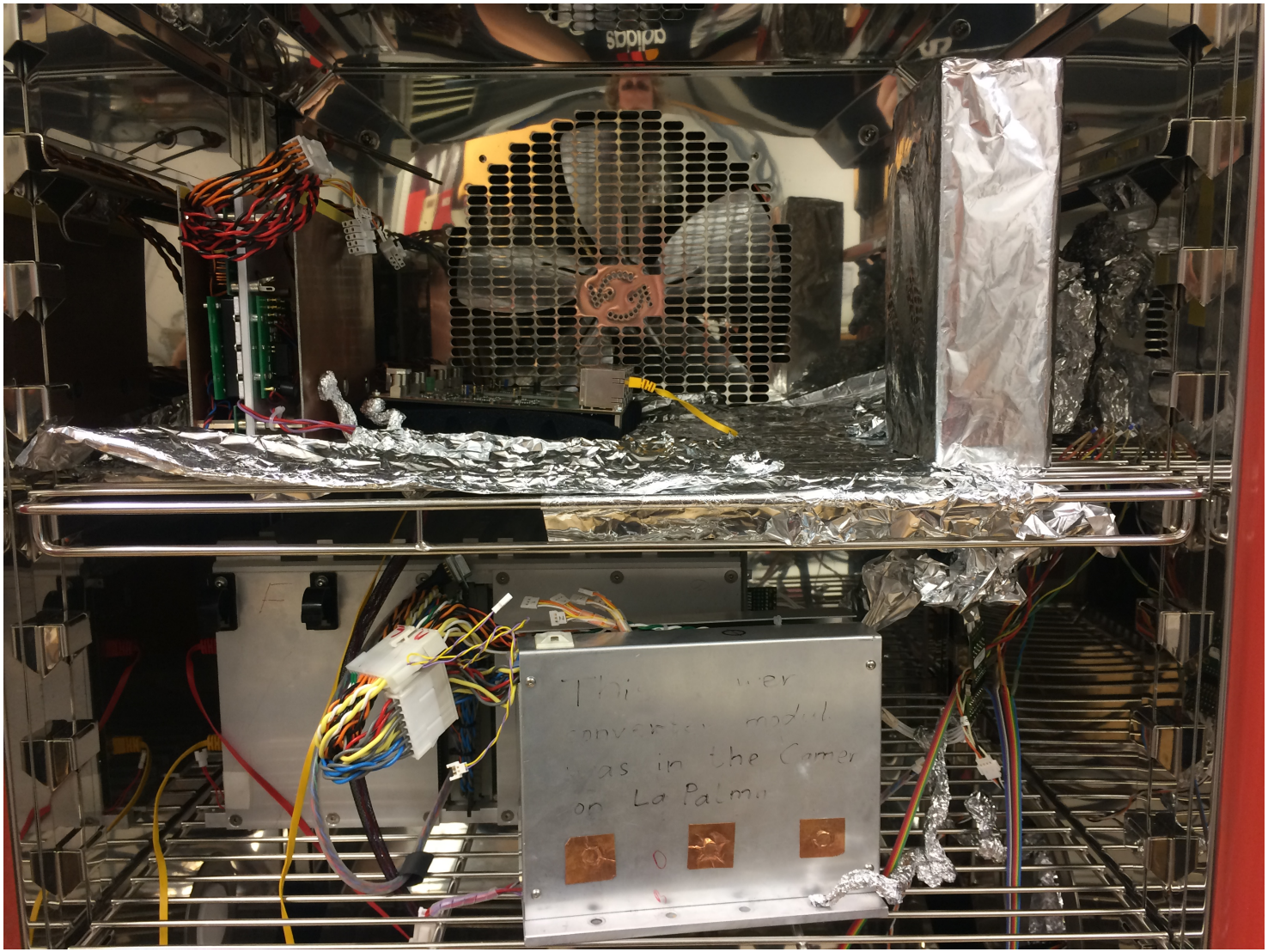
Goals

Investigate:

- Temperature dependence of optical crosstalk probability
- Influence of a lightguide on optical crosstalk probability

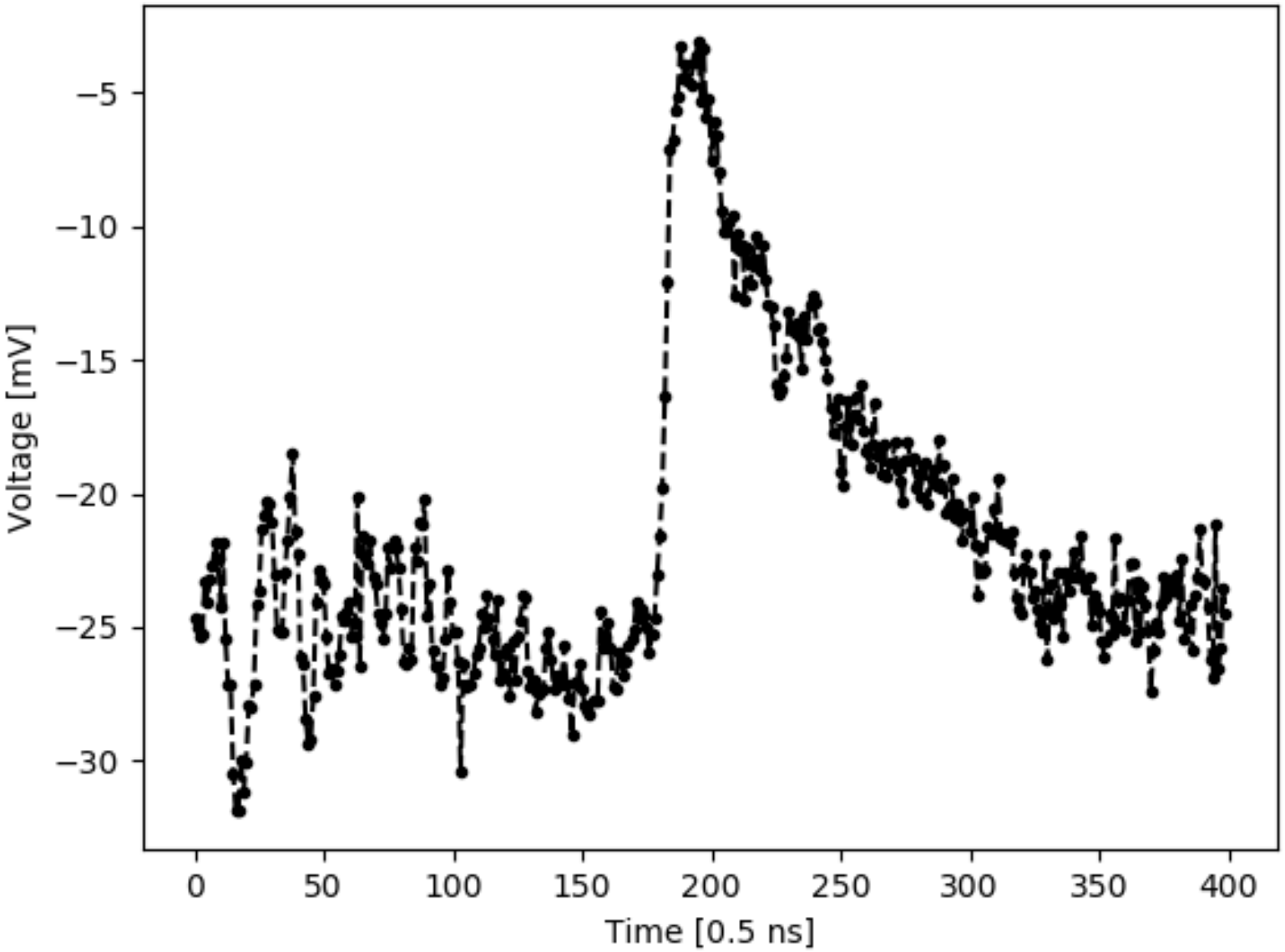
General Measurment Information

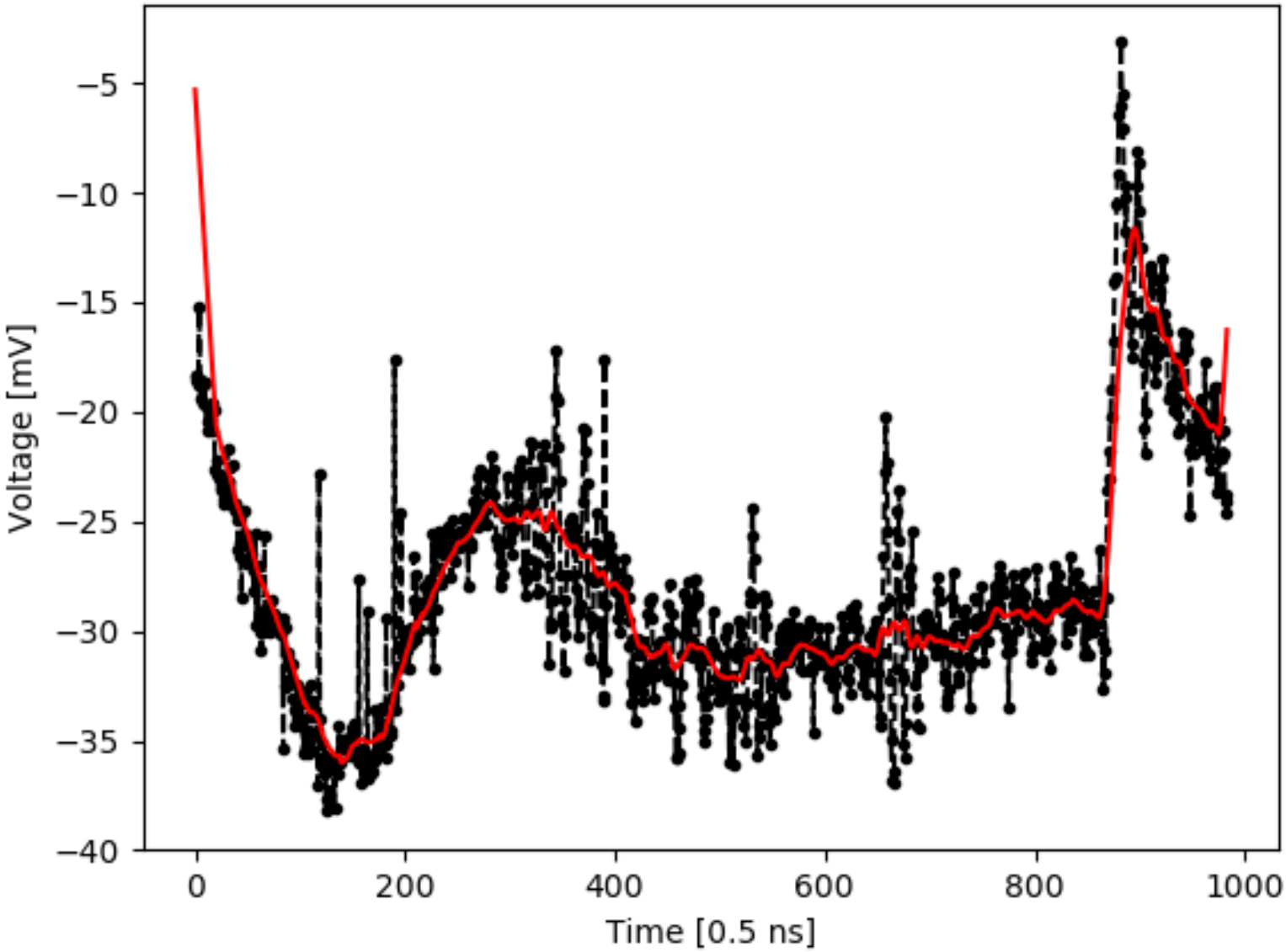
- SiPM: Hamamatsu's MPPC S10362-33-100C
- Measurements in climate chamber (from 5 to 25 C)
- Temperature measurement: PT-1000
- Bias Voltage supply: Agilent N5770A
- Bias Voltage measurement: Solatron Schlumberger 7081 precision voltmeter (+/- 0.0001 V)

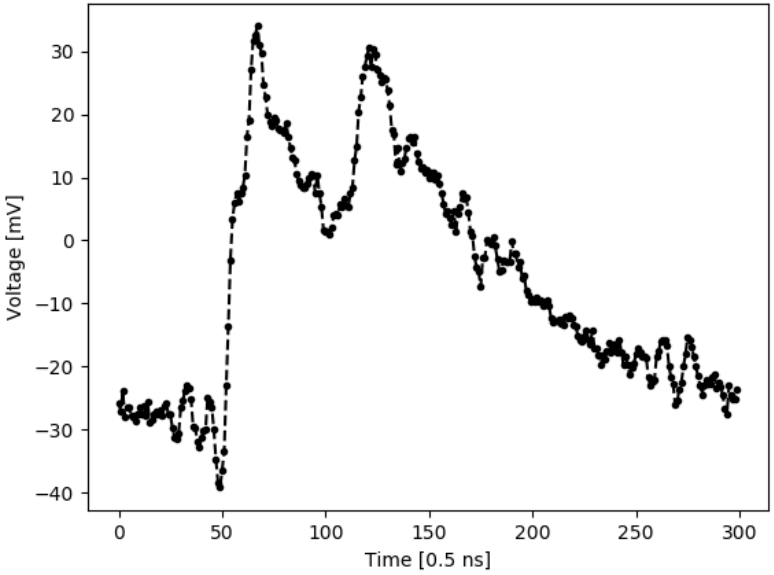

This
converter
was in the Camer
on La Palma

Analysis Procedure

- (i) Event selection:
  - Convolve raw signal with pulse shaped kernel
  - Search for flanks with large derivative (steep) and a minimum amplitude
  - Throw away events having other events shortly after them
  - Throw away “pile-ups”
  - Biggest Problem: Ringing
- (ii) Integration:
  - Perform baseline fit
  - Use nummerical integration
- (iii) Produce Fingerplots and readout parameters

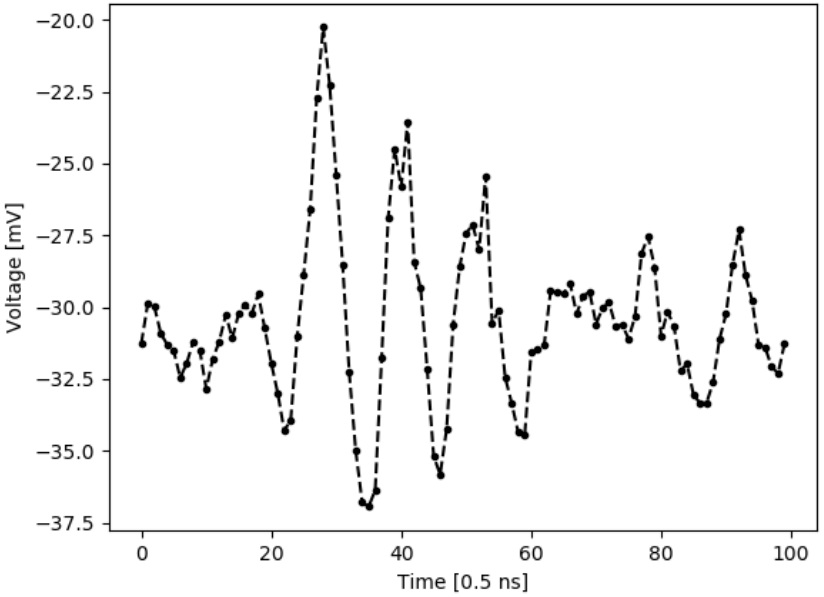

−5
−10
−15
−20
−25
−30
Voltage [mV]
0
50
100
150
200
250
300
350
400
Time [0.5 ns]


−5
−10
−15
−20
−25
−30
−35
−40
Voltage [mV]
0
200
400
600
800
1000
Time [0.5 ns]



Double but not a pile-up

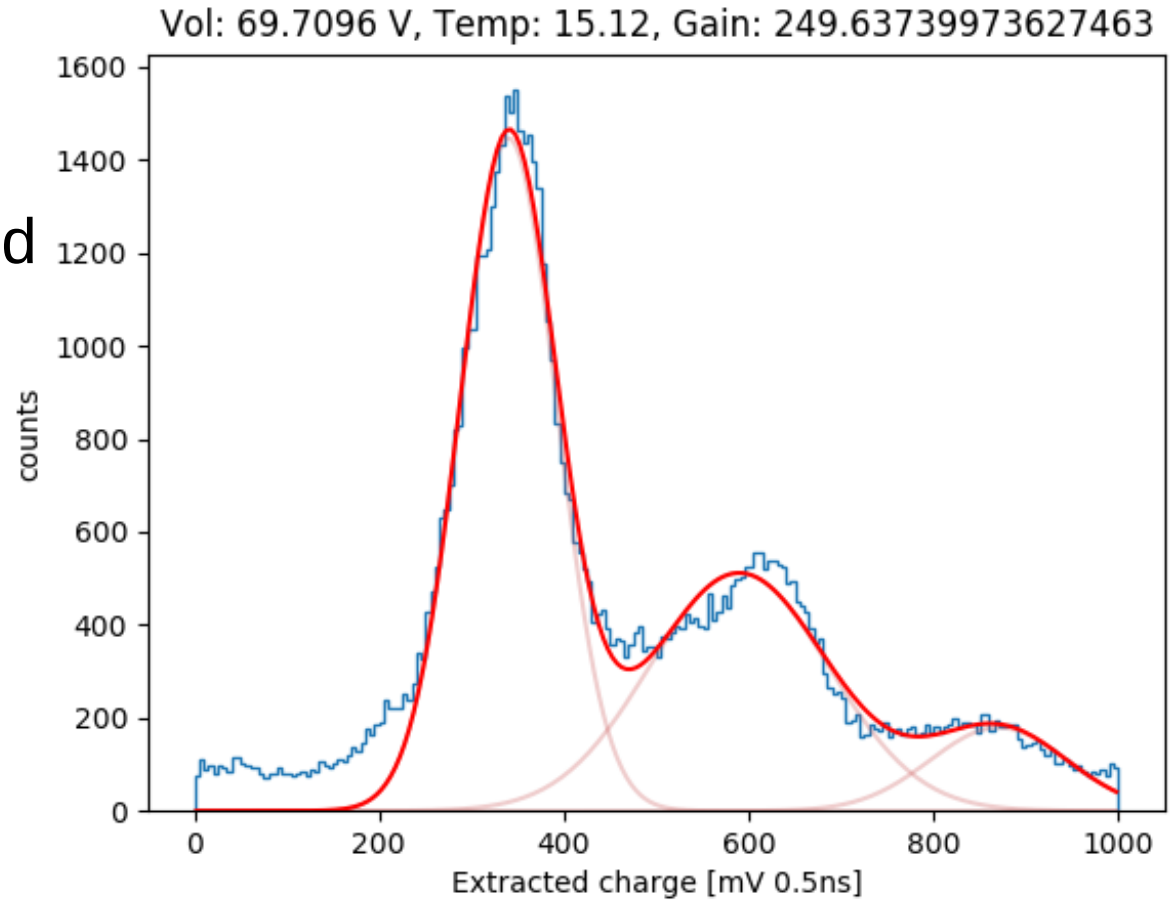
Ringing



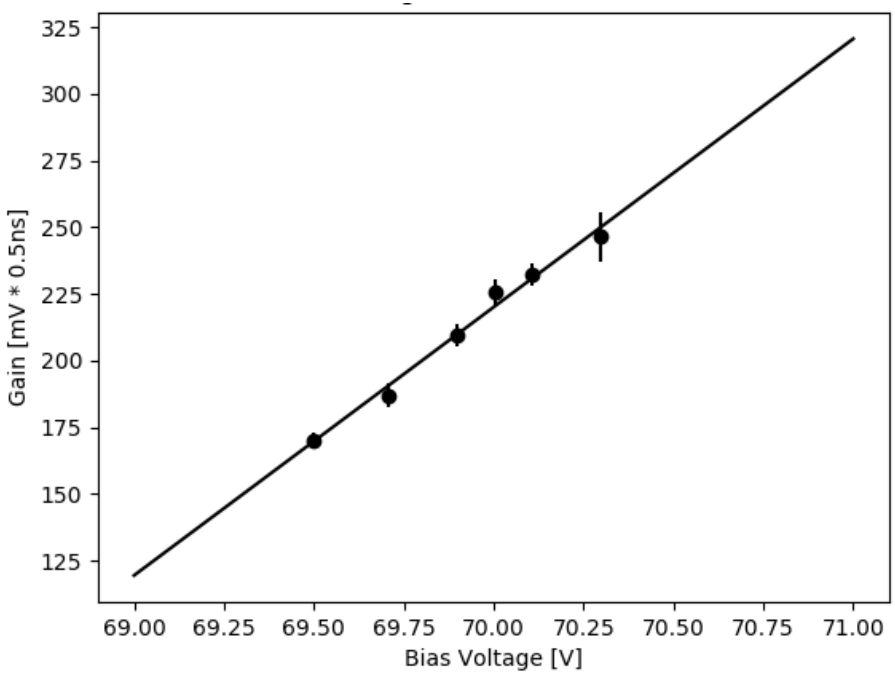
- Gain:

  Difference of 2nd and 1st peak
- Crosstalk Probability:

  Area of peak 2+3 / Total area



1.) Determination of the Breakdown Voltage

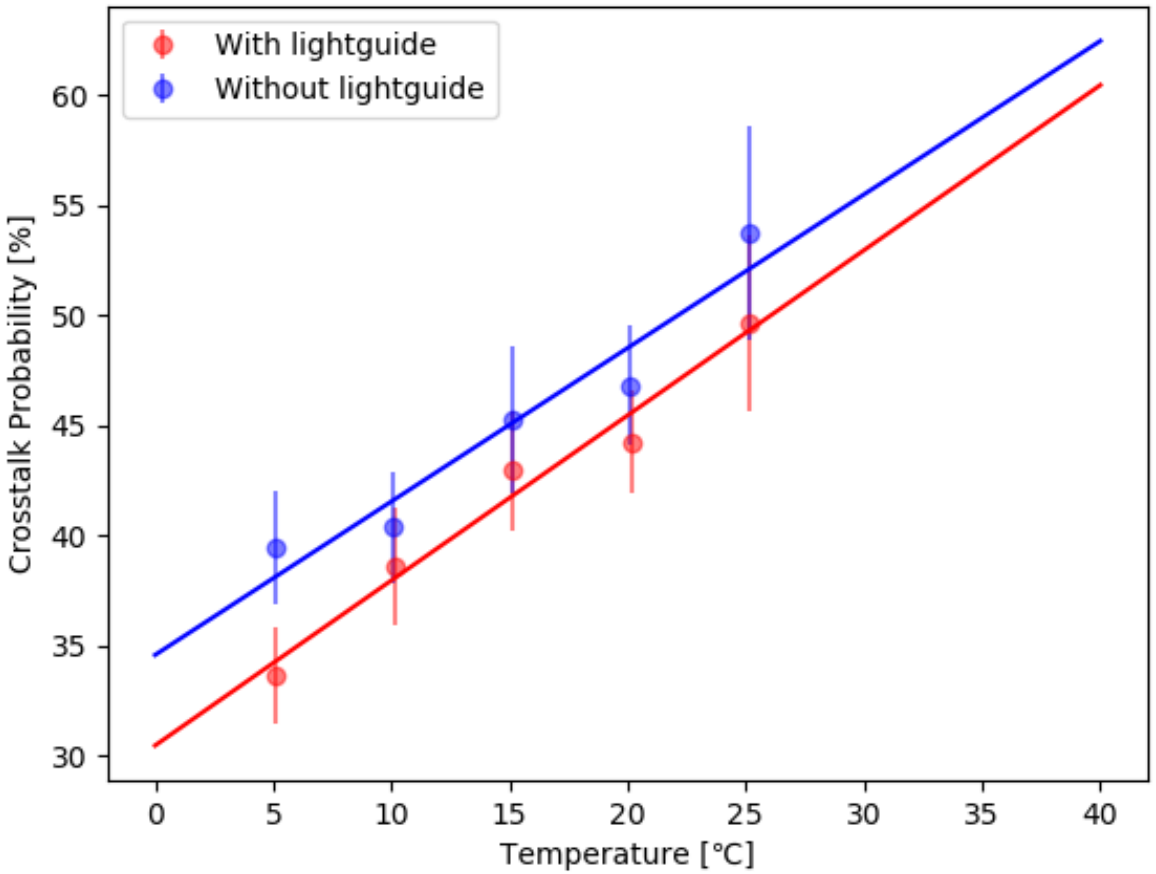


- 6 Measurements at 25 C
- Recorded 10’000 timeslines each
- Breakdown voltage:

  67.8 +/- 0.117 V
- Bias voltage for further measurements:

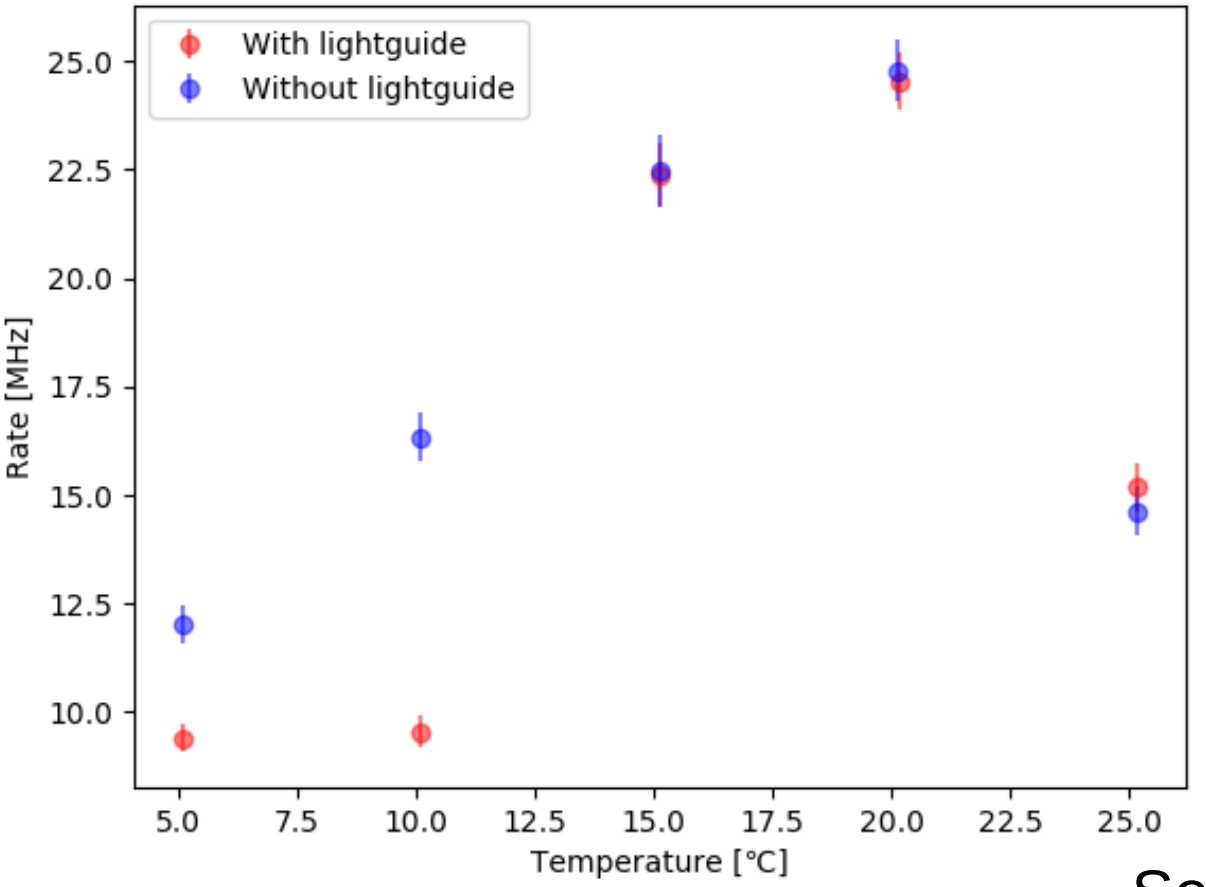
  70.2 V at 25 C
- High over voltage due to noise

2.) Temperature and lightguide influence



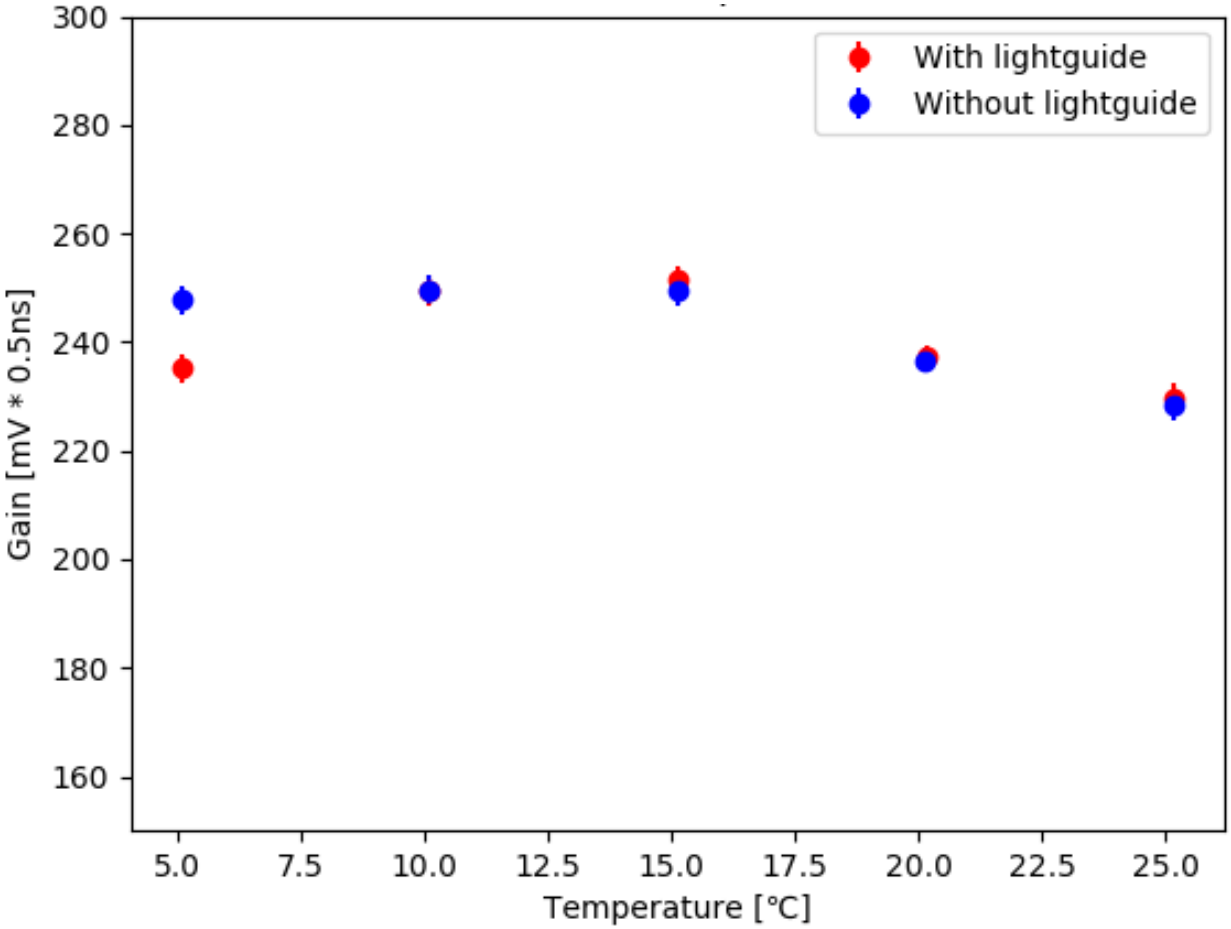
- 10 Measurements in total
- 30’000 timelines each
- Temperature dependence!
- Indications for decrease by lightguide

Controls



Selection algorithm fails!

Controls



Gain fluctuations too low to explain temperature dependence!

Conclusions:

- Setup, method and algorithm working basically
- Clear temperature dependence
- Indications for decrease of crosstalk probability by lightguide

Next steps:

- Reduce noise in setup
- Understand and improve selection algorithm (simulation)
- Theory for influence of the lightguide (maybe also simulation)
- Test more SiPMs (inhomogeneities)