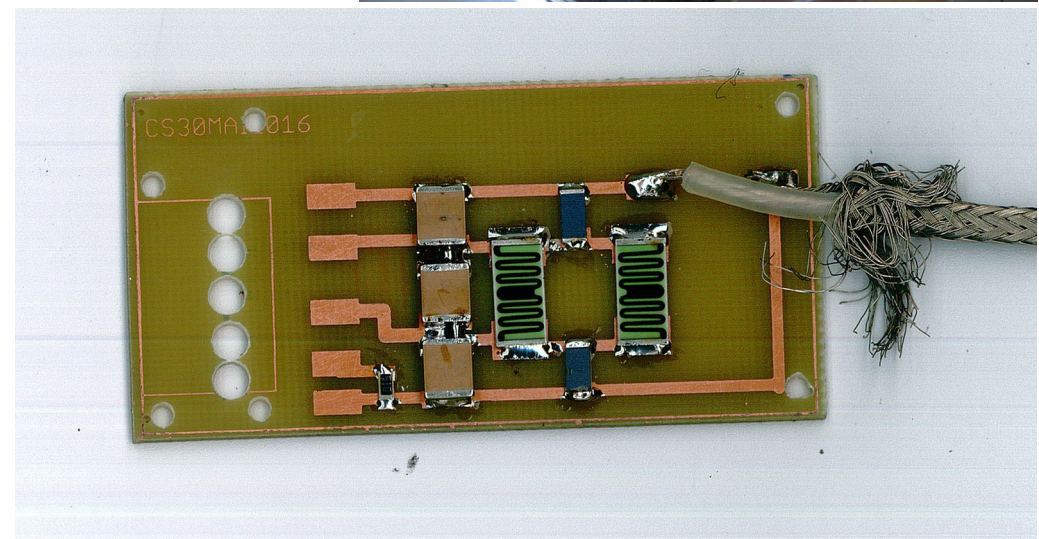
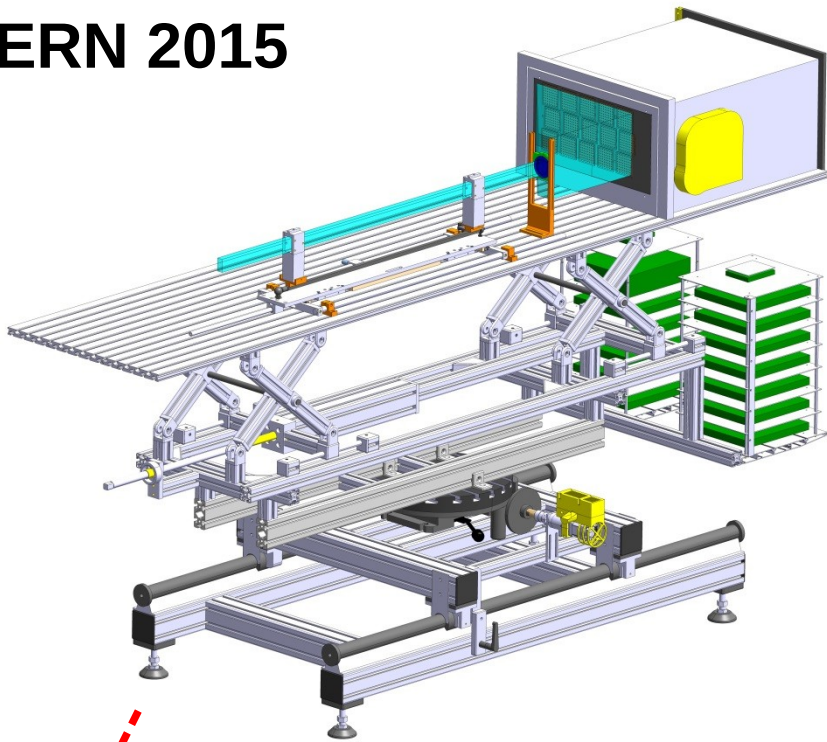


Barrel DIRC timing

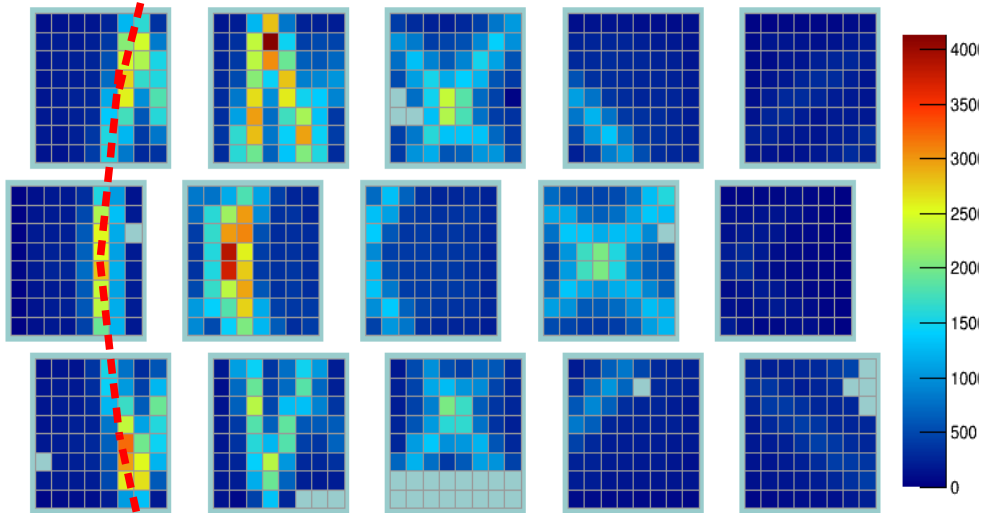
CERN 2015
PADIWA research
Setup stability



CERN 2015



view from back



p, 3 GeV/c

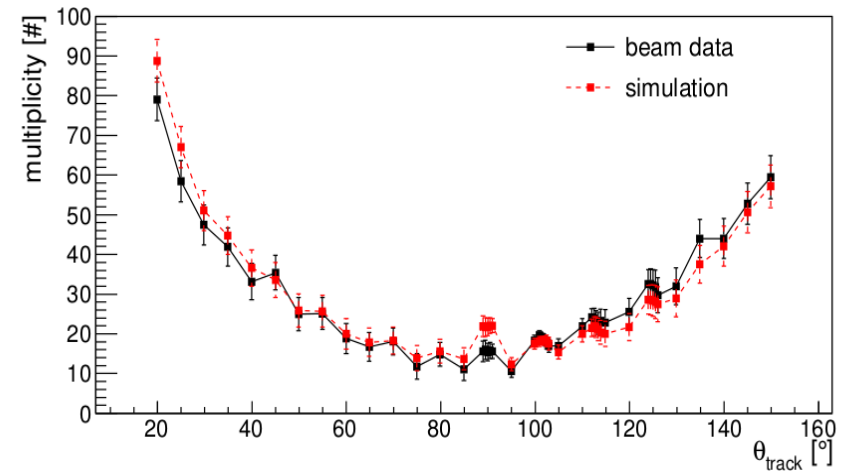


Figure 6.9: Photon yield as function of the track polar angle for data and simulation results as black and red symbols, respectively. The error bars correspond to the rms distribution in each bin.

Efficiency was as expected

Plate prototype in beam 2015

7 GeV/c, polar angle 55°, cyl. Lens

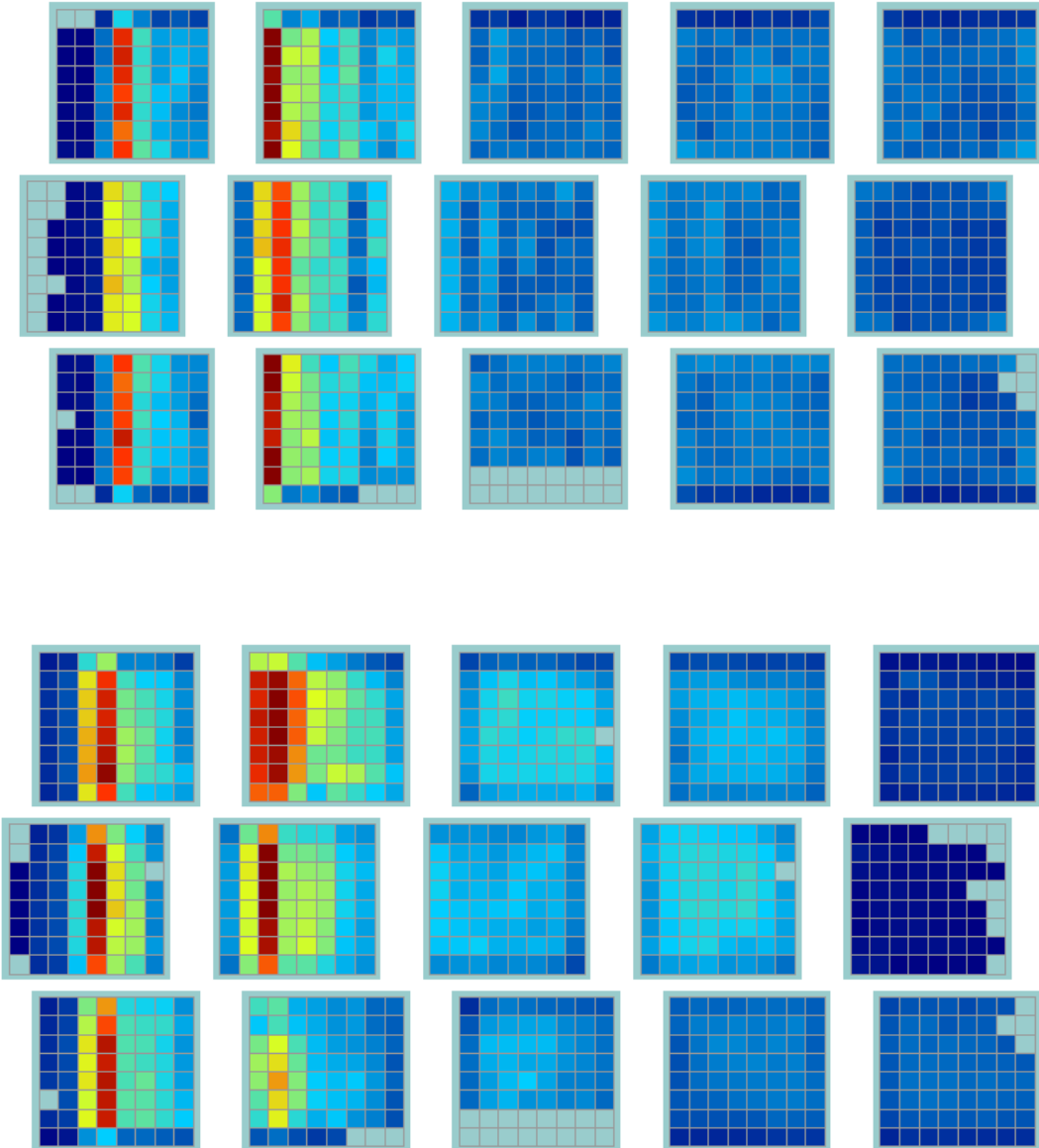
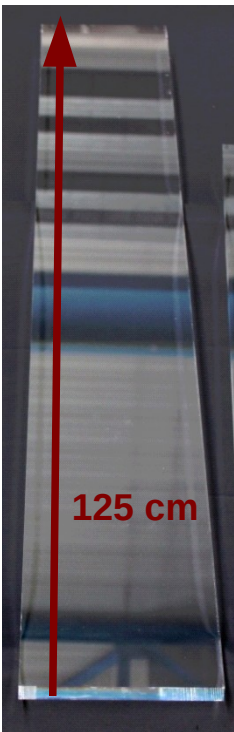
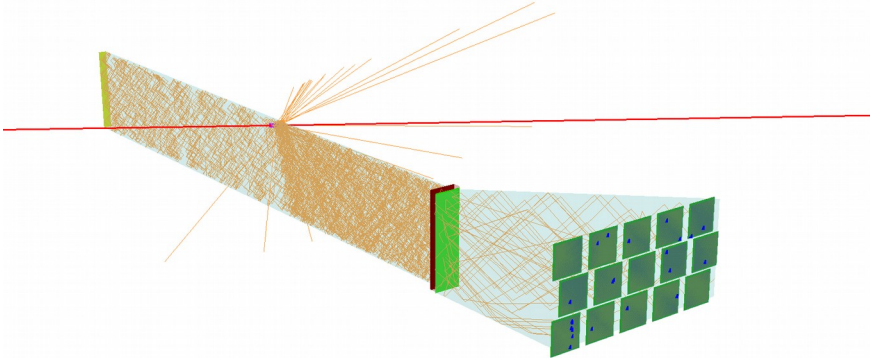
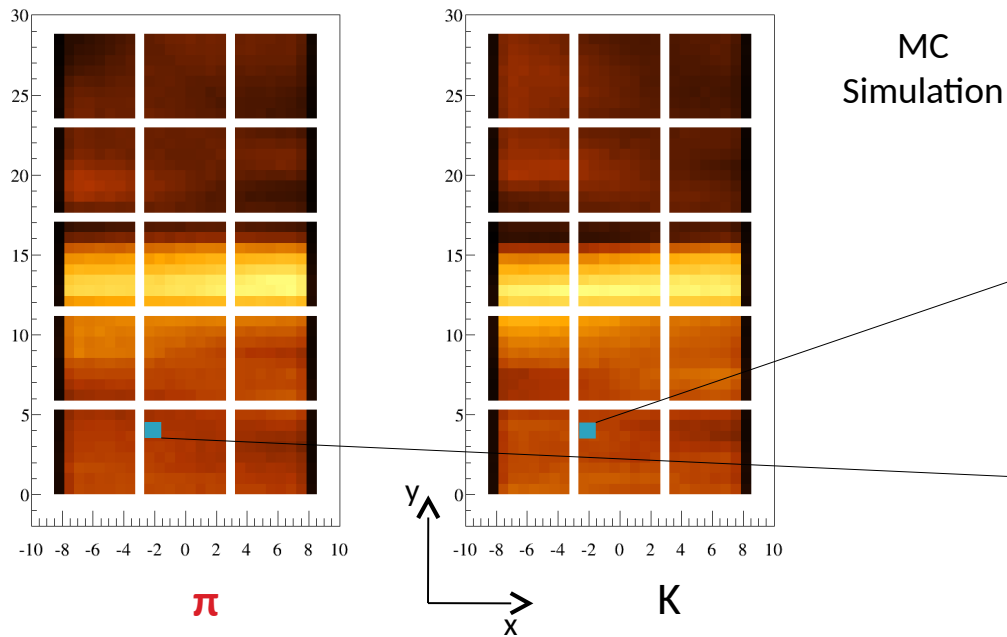


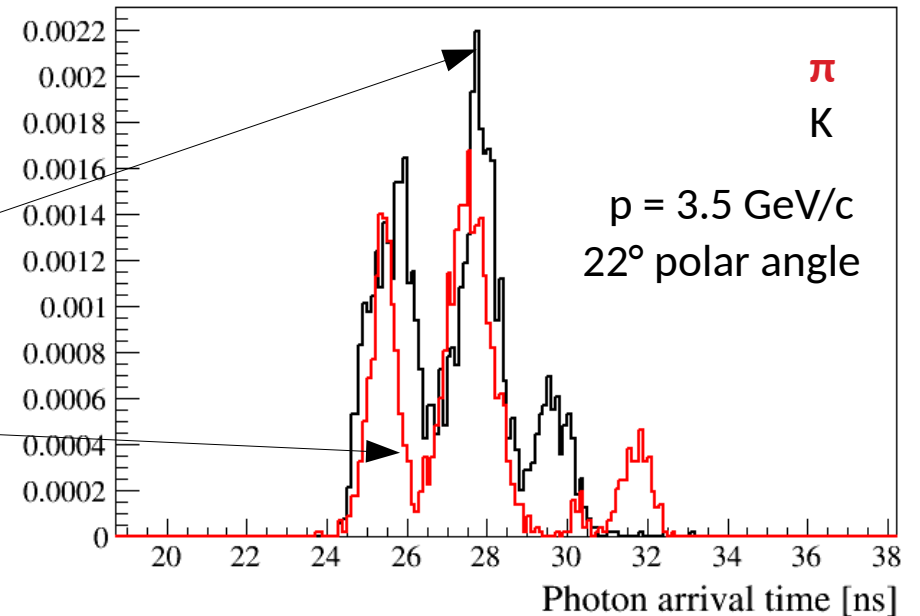
Plate: Simulation

At 3.5 GeV/c no difference visible in x-y



PMT map, with 5 x 3 sensors, 64 pixels each

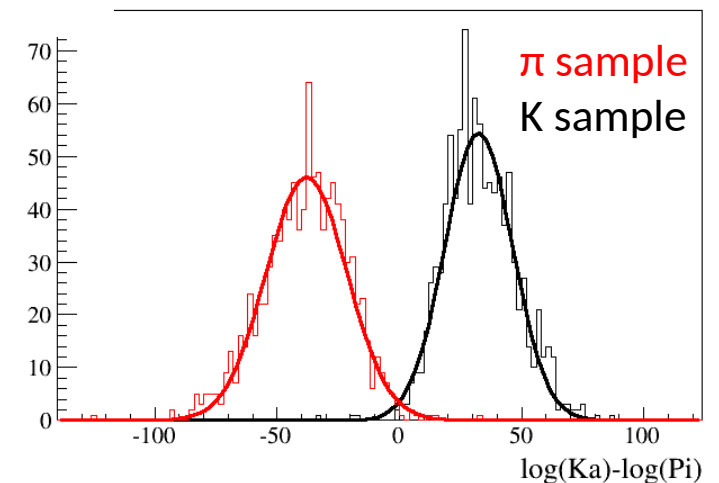
normalized PDF for a specific pixel



In **3 dimensions** (x, y, t) hit patterns show **differences** between particle species

Probability density functions (**pdf**) can be generated with $\sim 100k$ **Monte Carlo** tracks with same parameters and saved in histograms.

Inspired by Belle II TOP



Likelihood ratio test

$\ln L_K - \ln L_\pi$

Time resolution

Time spectra (Leading Edge)
show modulation which we ignore
for **walk correction**

Understood:
TOT + small high frequency noise

NIM A791 (2015) 16, Gonella et al.

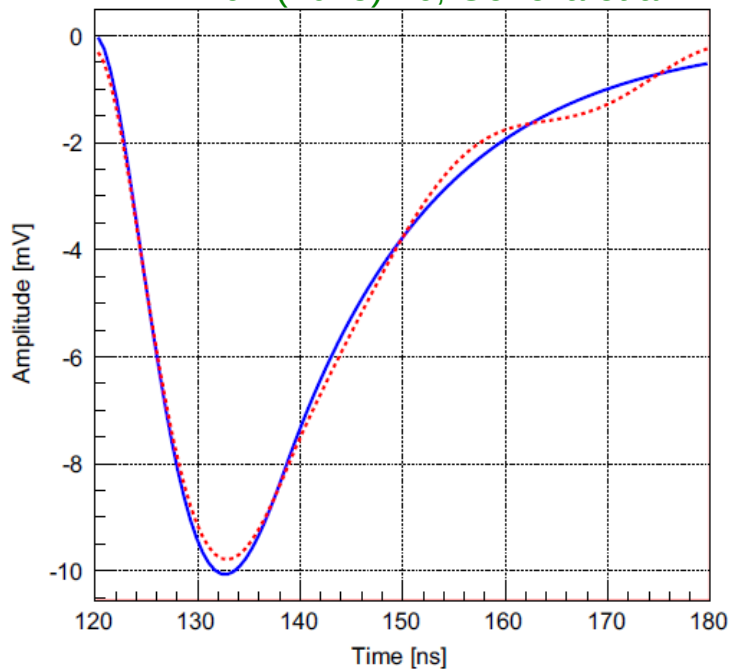
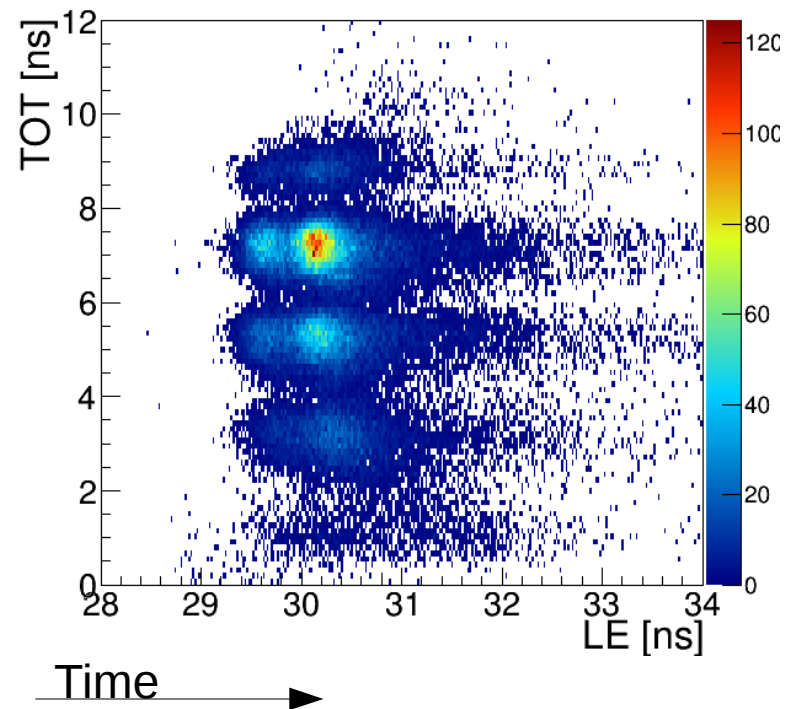
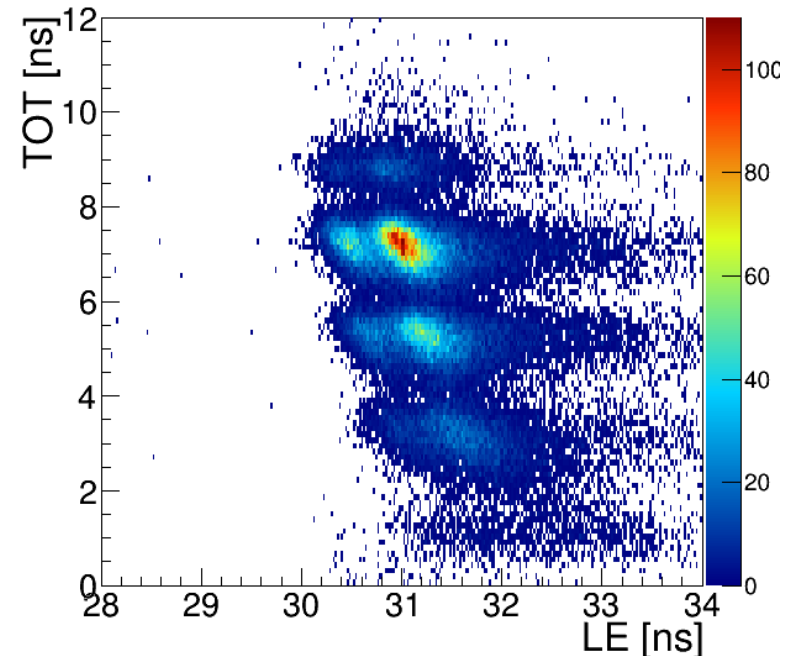


Fig. 5. Simulated shape of the output signal of the system lead-glass block – PMT without (solid curve) and with addition of 300 μV noise at 40 MHz frequency (dashed curve).

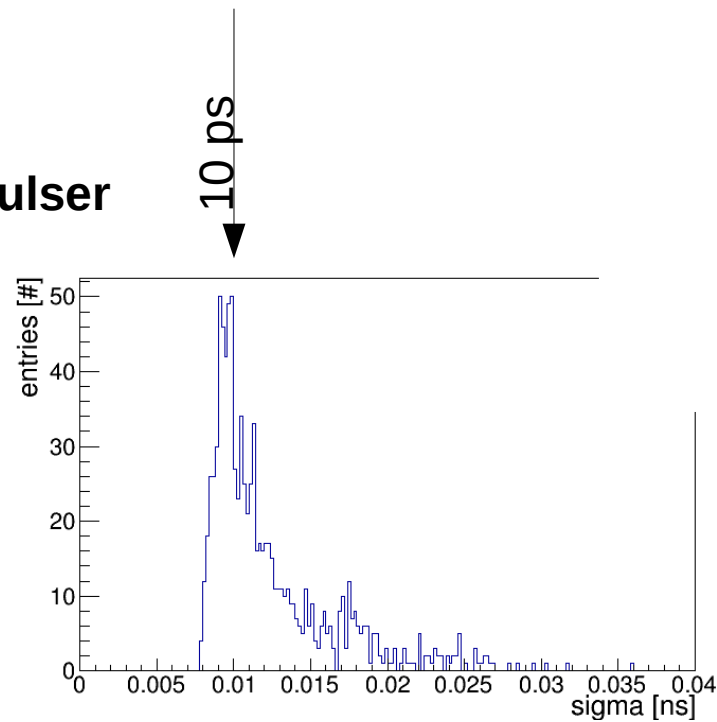
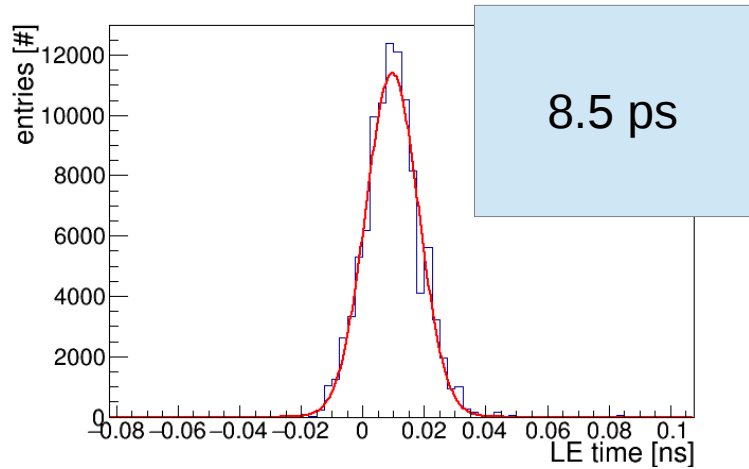


Amplitude ↑

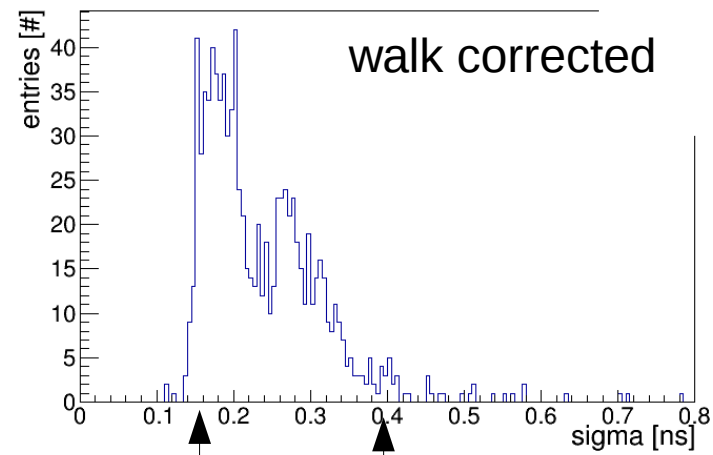
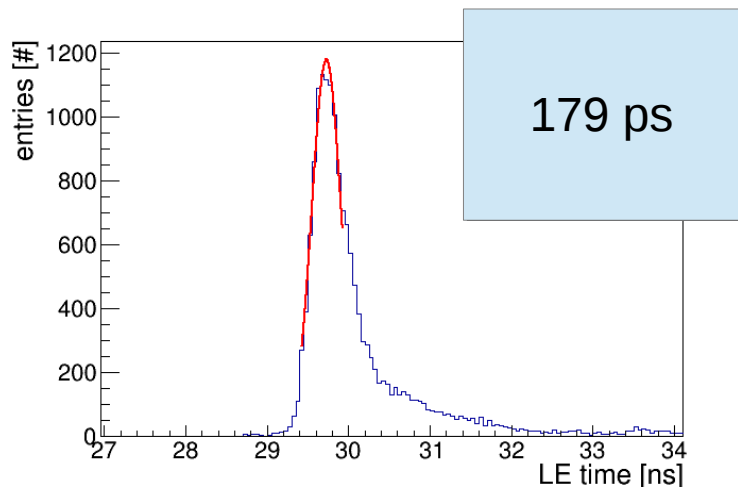
Time →

Time resolution

TRB: TDC channels with **internal pulser**



Chain: PMT-PADIWA -TRB with **Picoquant-laser** (80ps)



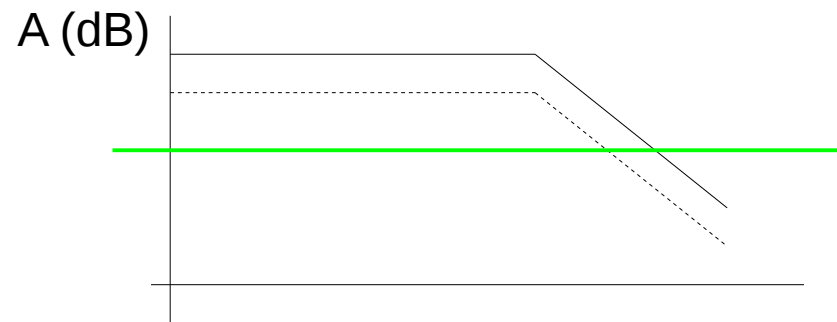
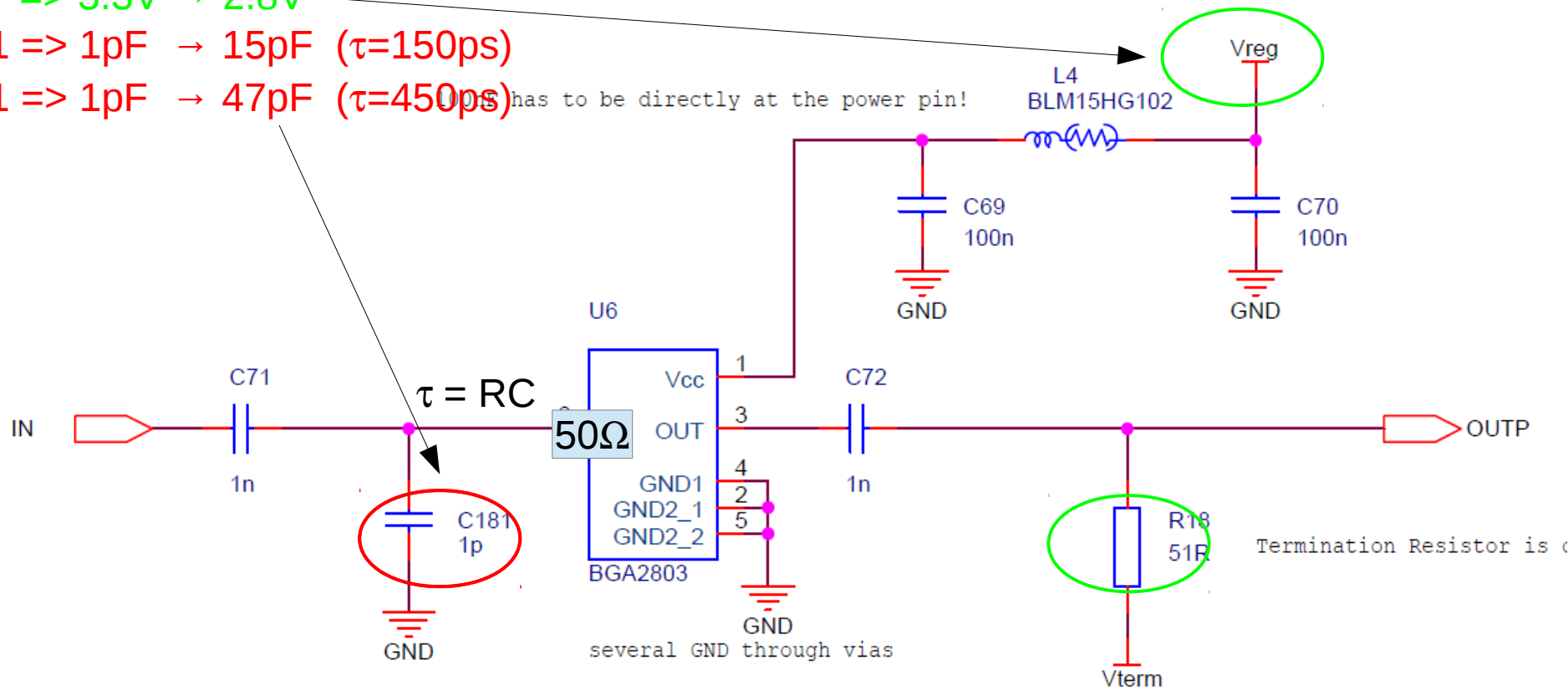
Largest
Contribution:
PADIWA
Discriminator

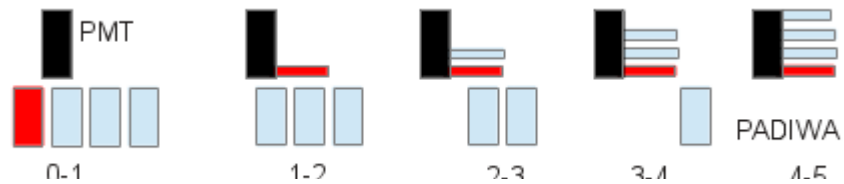
Bandwidth reduced PADIWA:

Vreg => 3.3V → 2.8V

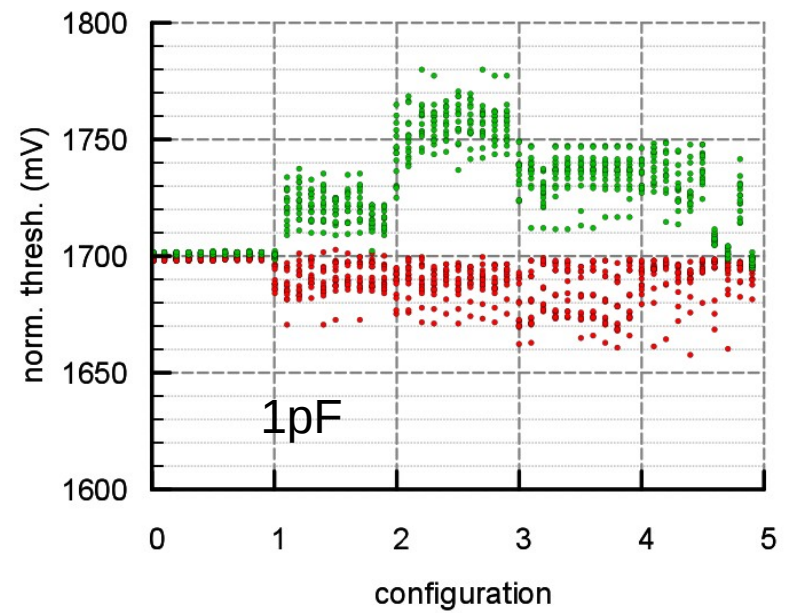
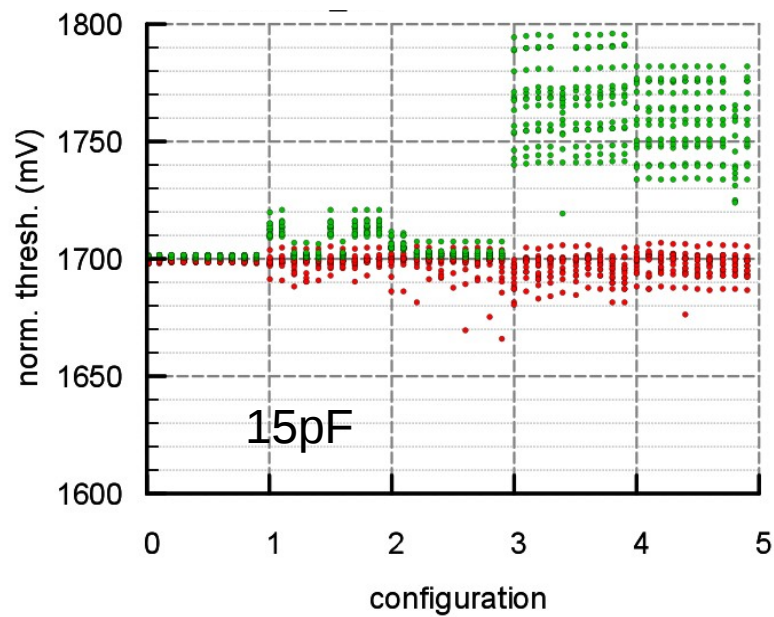
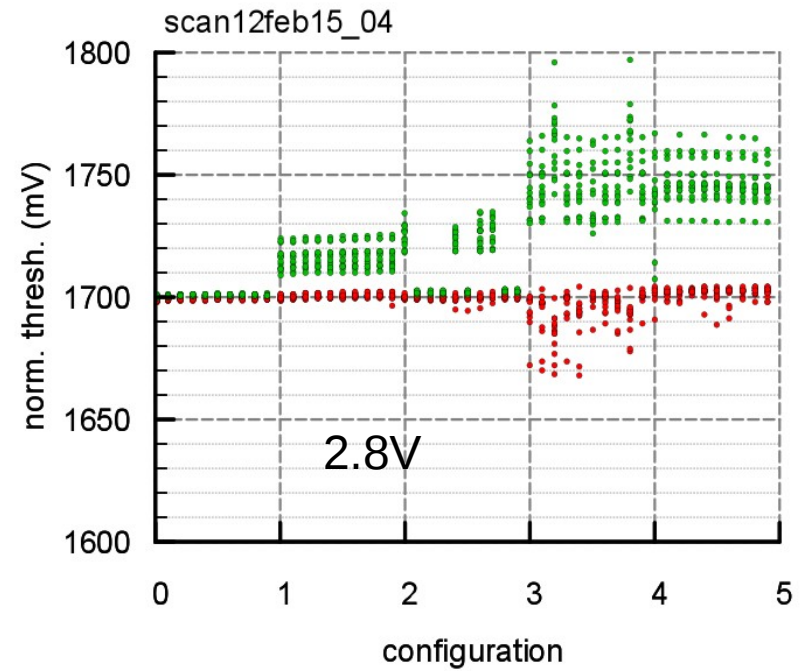
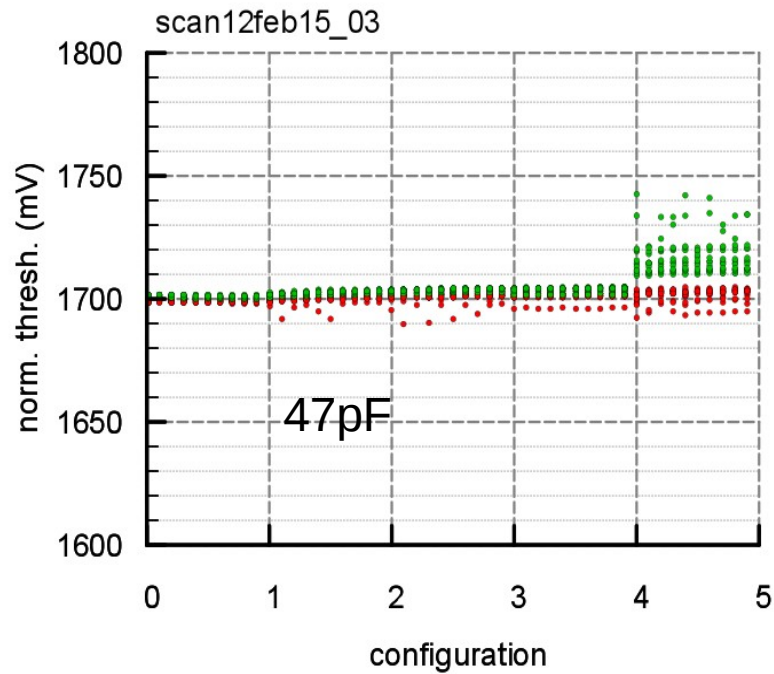
C181 => 1pF → 15pF ($\tau=150ps$)

C181 => 1pF → 47pF ($\tau=450ps$)

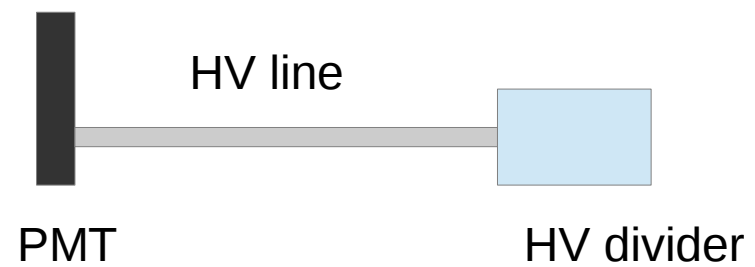


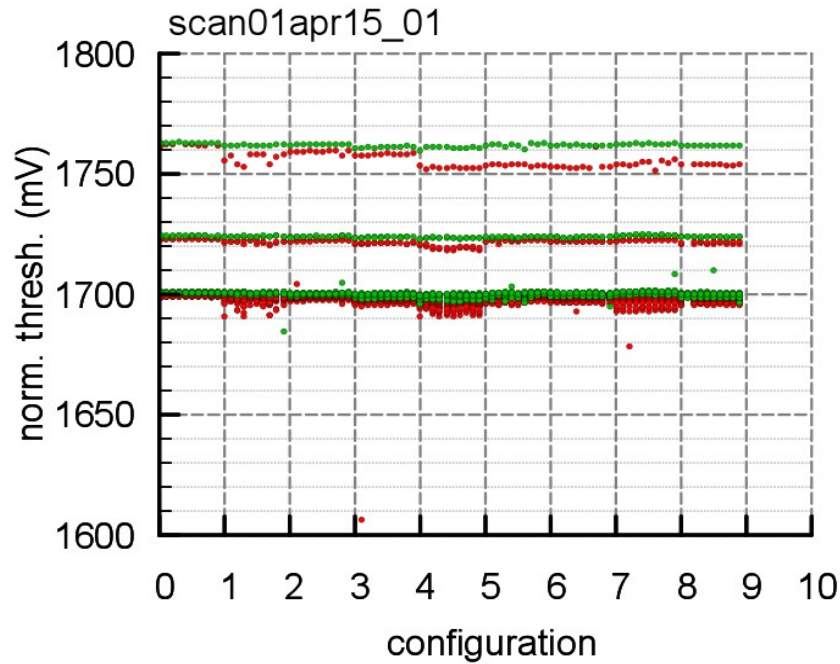


PADIWA noise bands



HV lines shielded by grounded braid





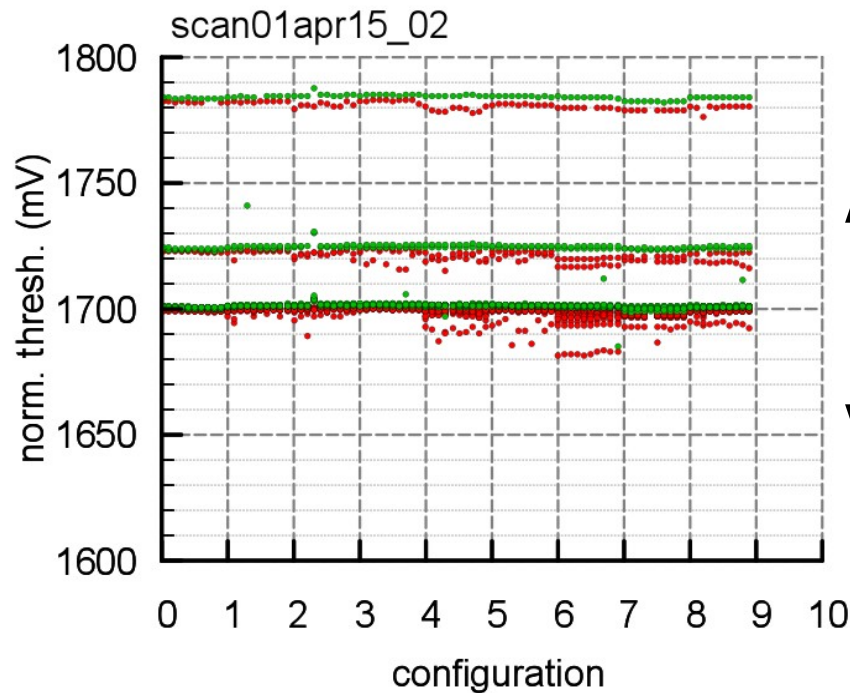
On tube 1 (no HV shielding)

← Normalized to 1700mV

#57 has noiseband at 2200mV!

#163, #165 (Prototype boards)

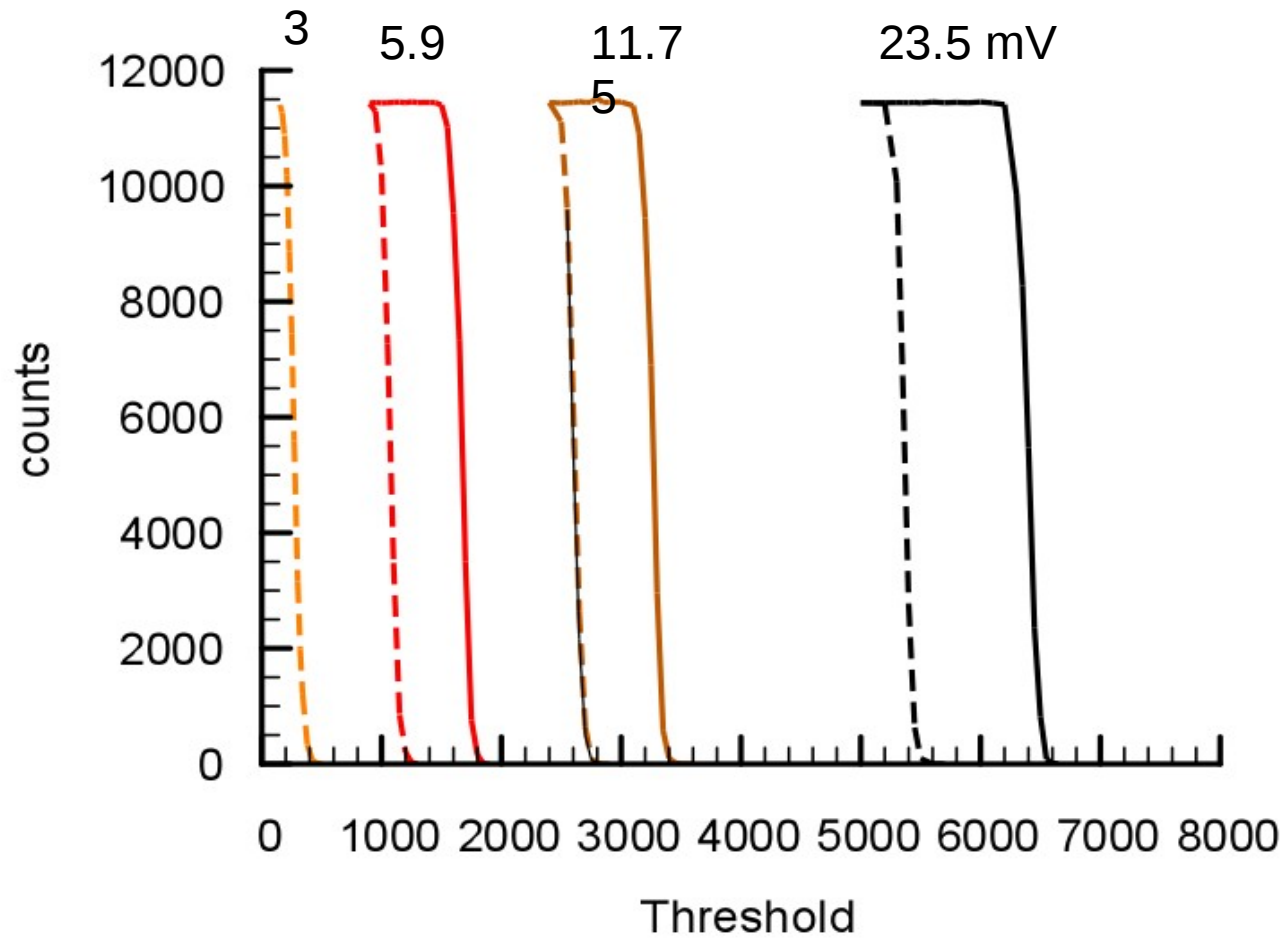
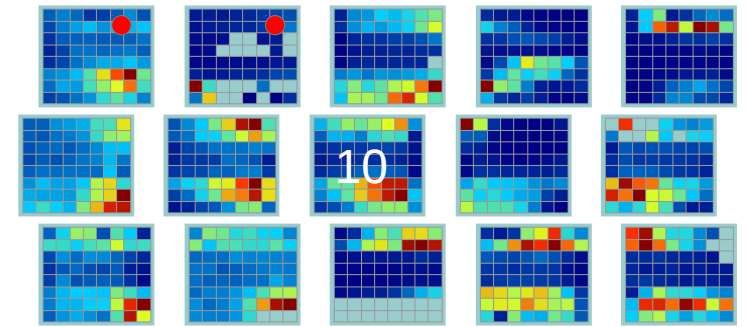
#188 have noiseband at 1700 mV



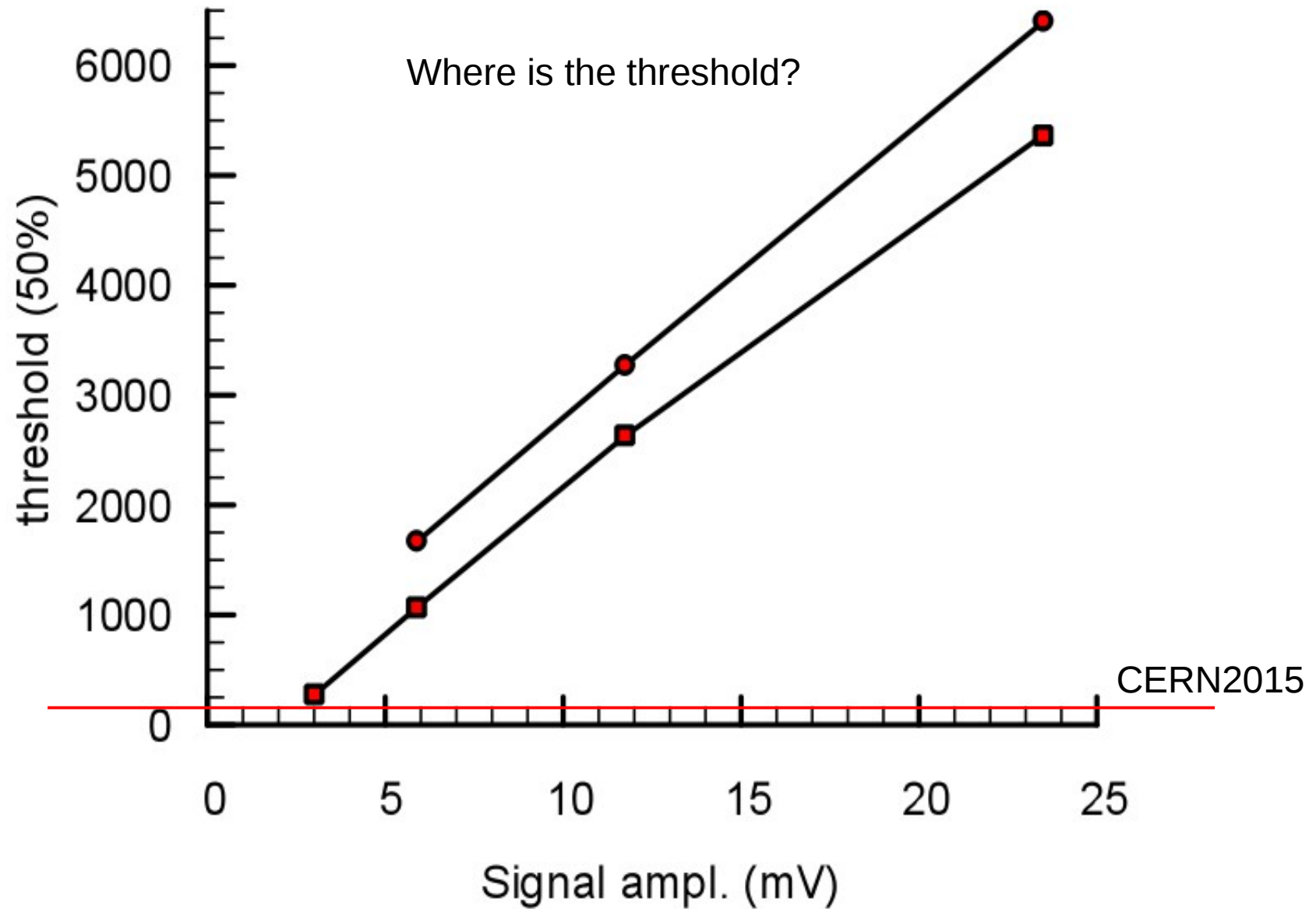
On tube 2 (with HV shielding)

0.5mV @ 20dB

Threshold for 2 channel (2003/2/13, 2007/2/13)



Threshold for 2 channel (2003/2/13, 2007/2/13)



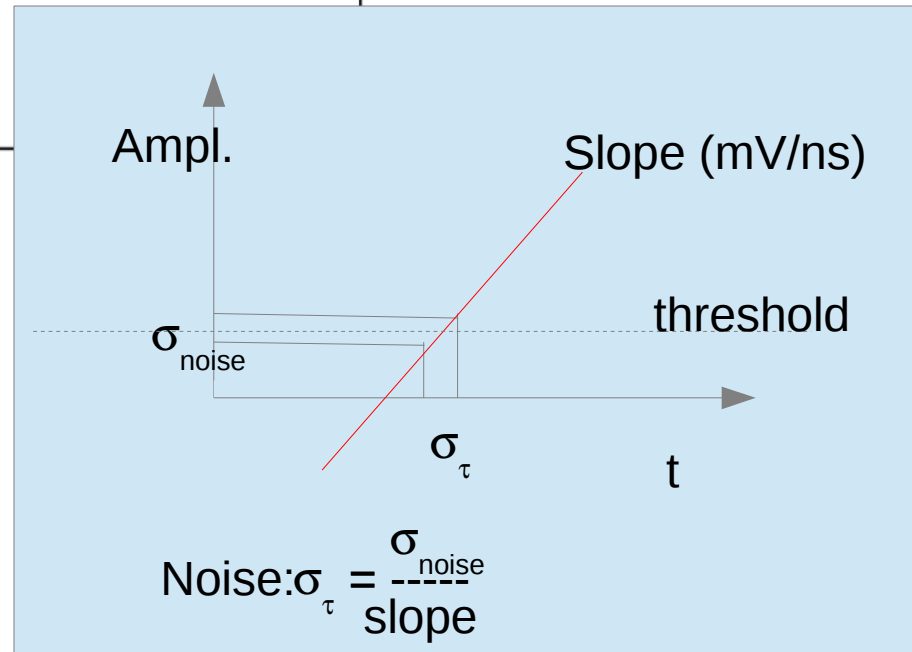
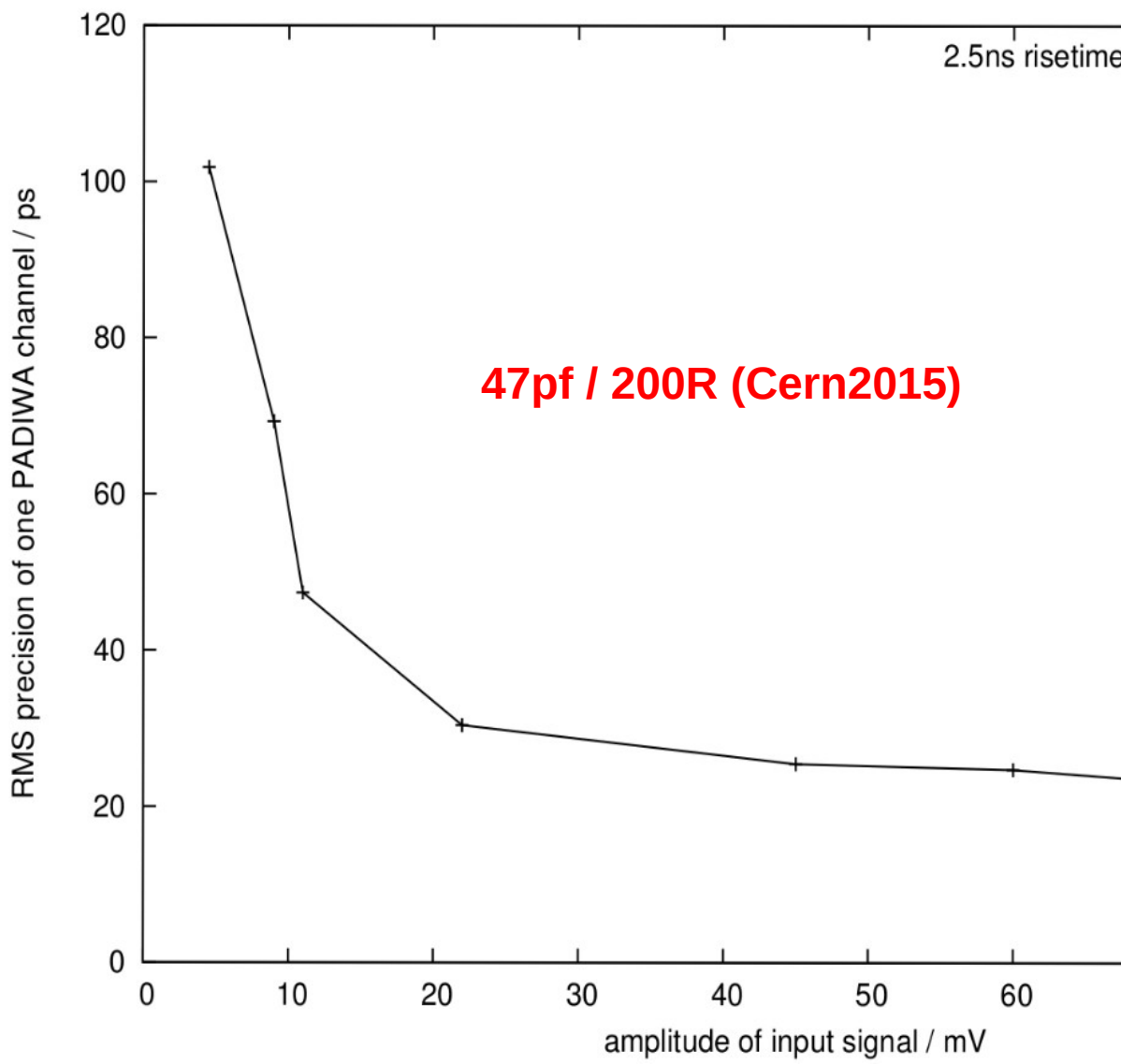
performance of PADIWA with pulser input

2.5ns risetime, 2.5ns falltime

Measured by
Michael Traxler

Tektronix AFG

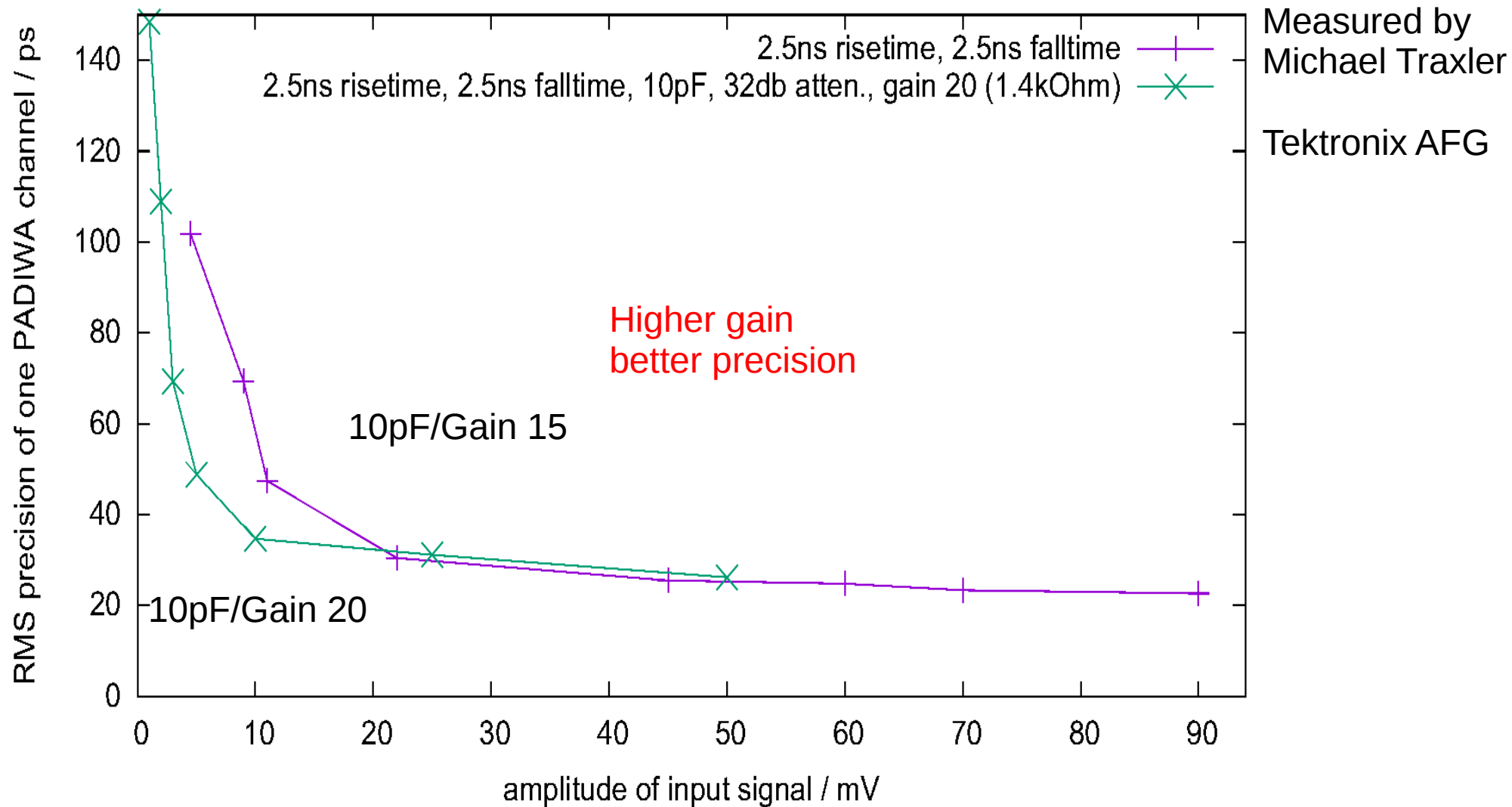
47pf / 200R (Cern2015)



Noise from outside?

Padiwa3 amplifier generating noise?

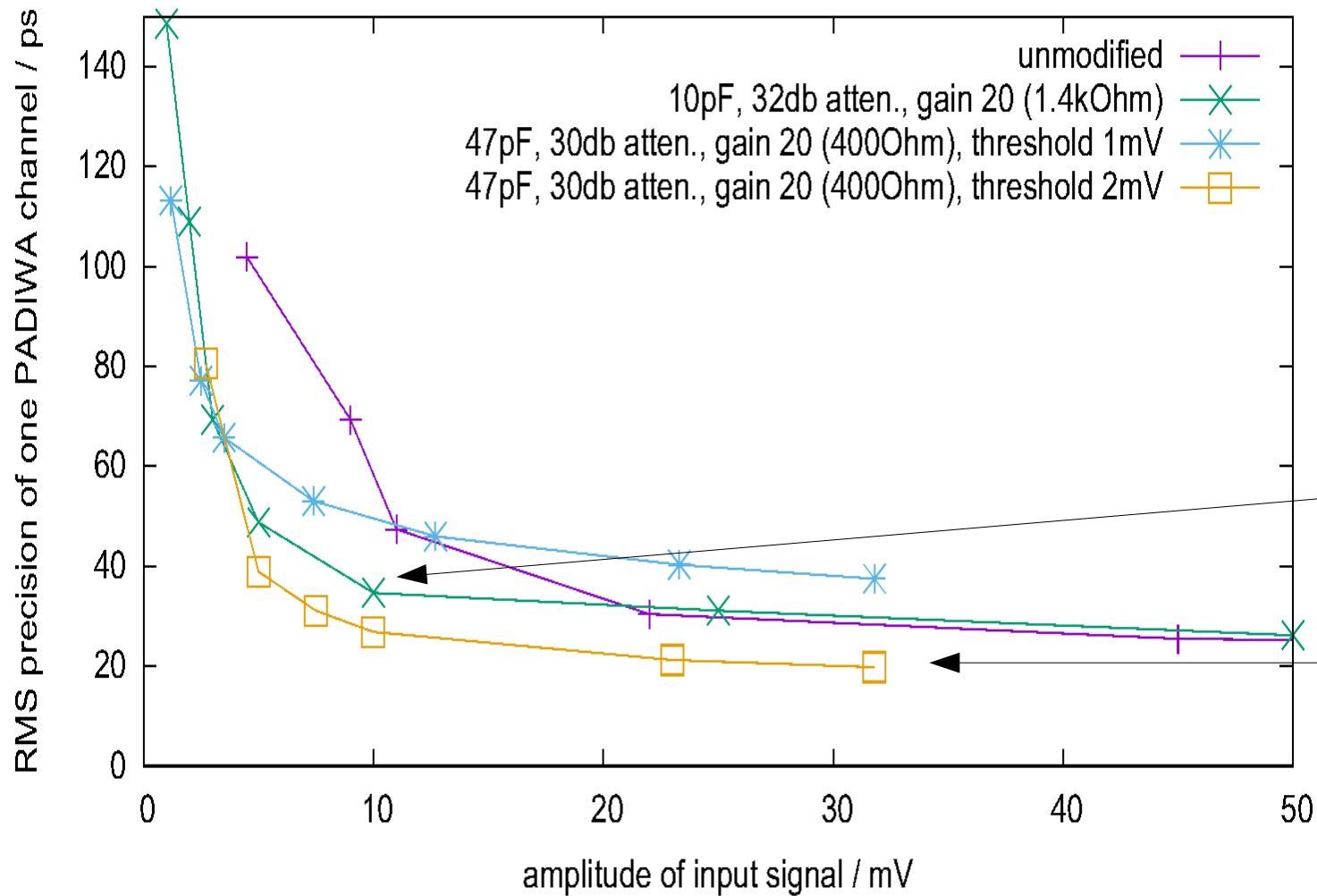
timing performance of PADIWA with pulser input



timing performance of PADIWA with pulser input
2.5ns risetime, 2.5ns falltime

Measured by
Michael Traxler

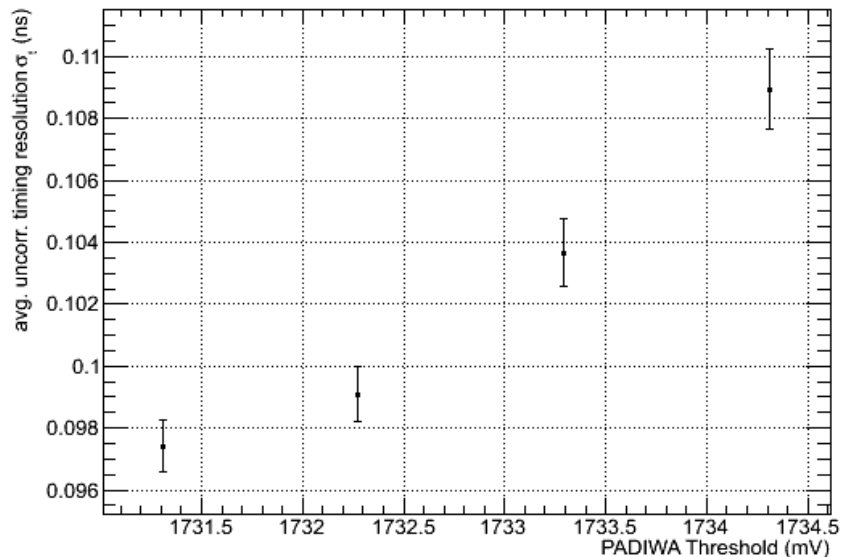
Tektronix AFG



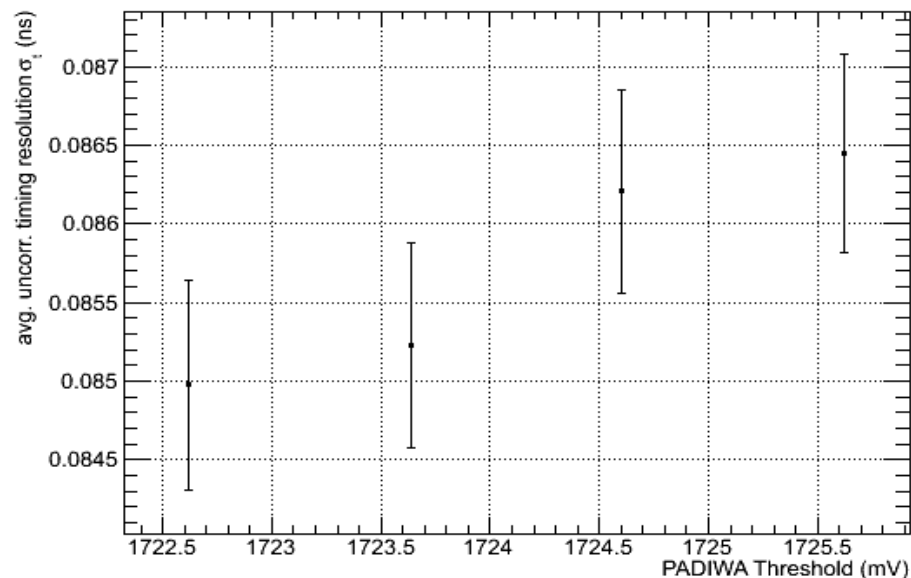
Lower capacity
better precision

Higher threshold
better precision

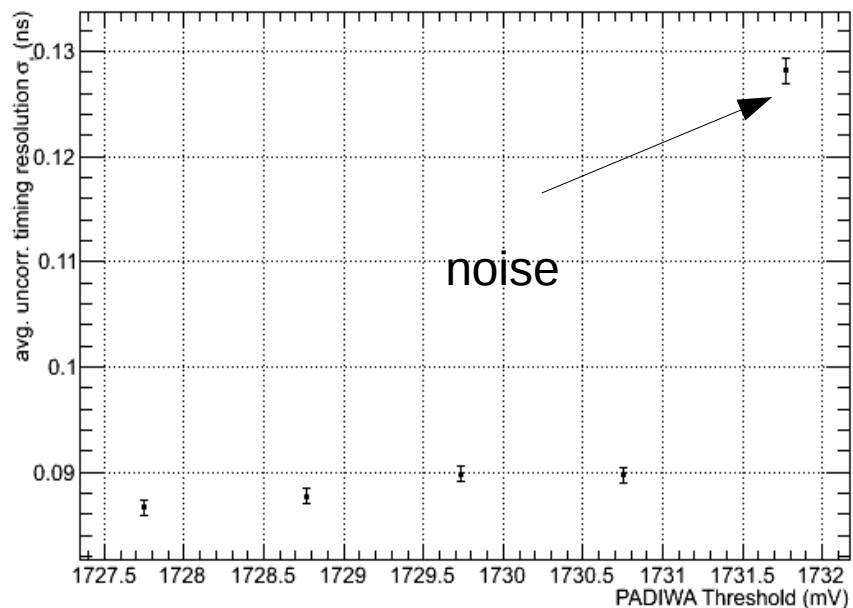
PADIWA Time resolution - 47pF



PADIWA Time resolution - 10pF



PADIWA Time resolution - 1pF



High threshold
better precision



Low threshold
worse precision

Matthias Hoek: Pilas measurement,
single photon

Can we measure with

10pF and
60 Padiwa
2 mV ???

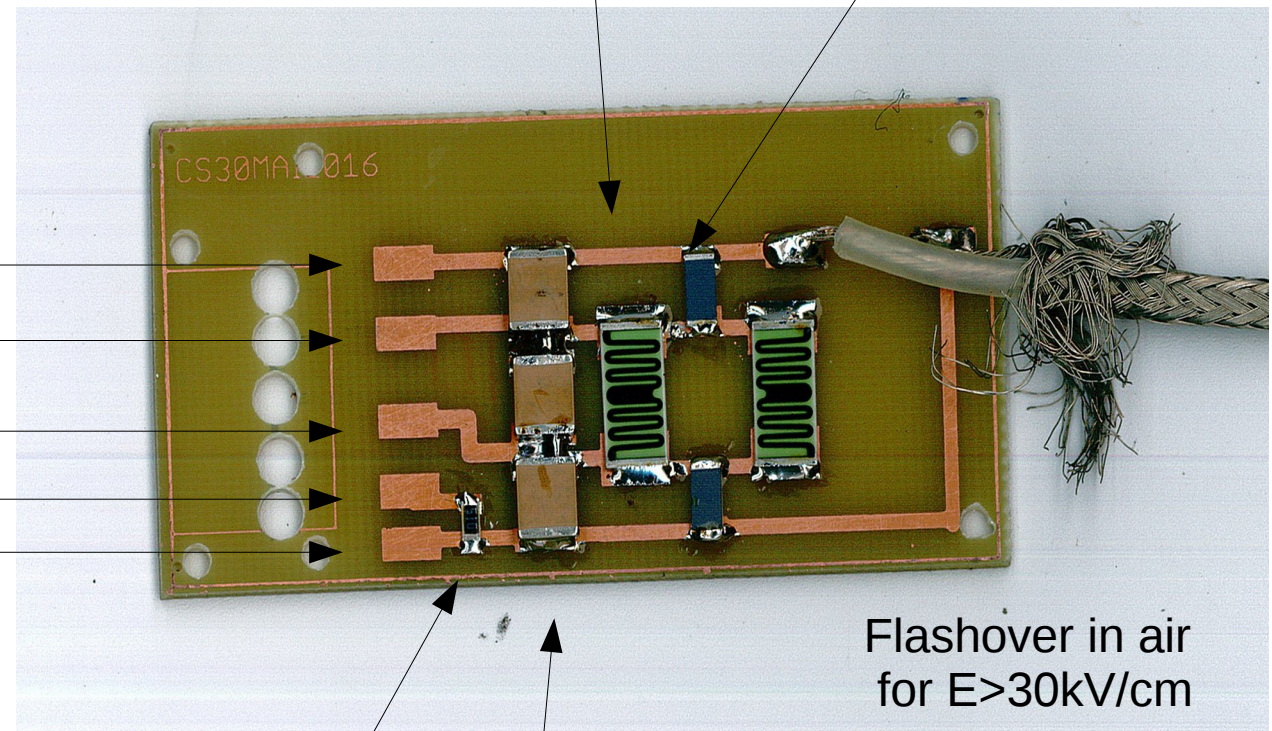
Measurement with the lage setup

Eliminate the HV divider as suspect

SMD HV-divider

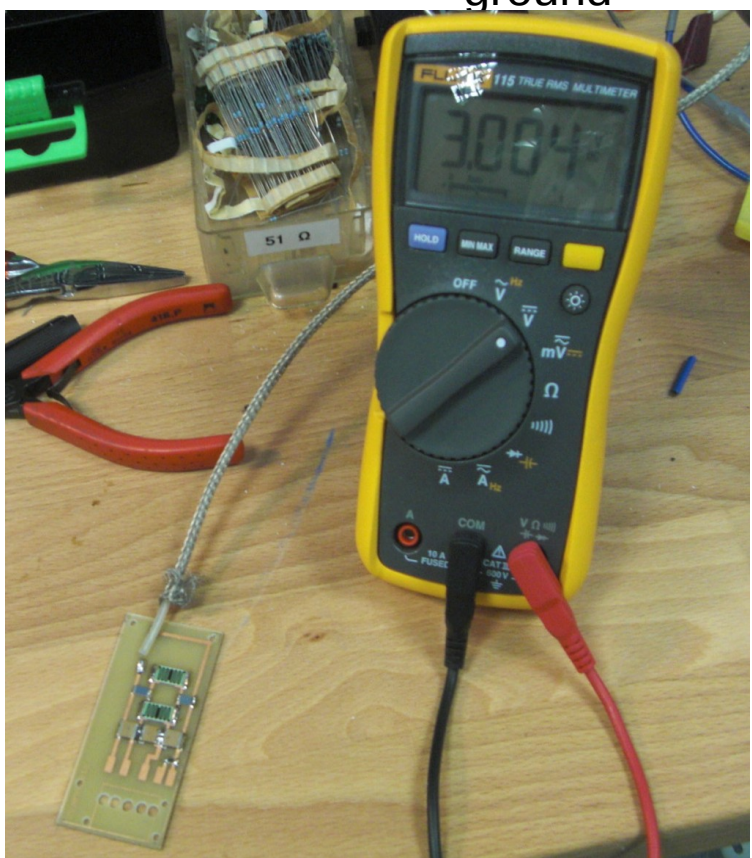
2 x 10M 1.5W 4kV 2 x 470k 0.5W 2kV

cathode
plate
plate
sum signal
ground

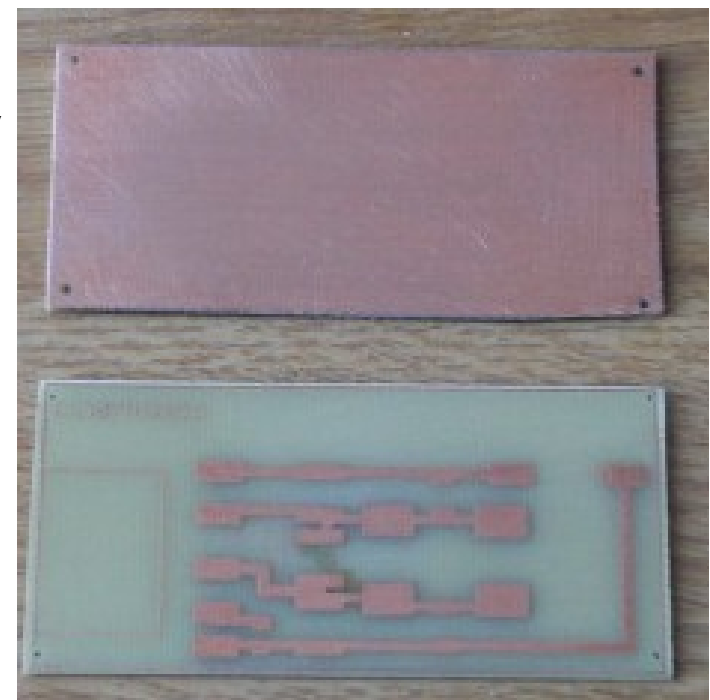


Flashover in air
for E>30kV/cm

50R
3 x 5.6nF 3kV

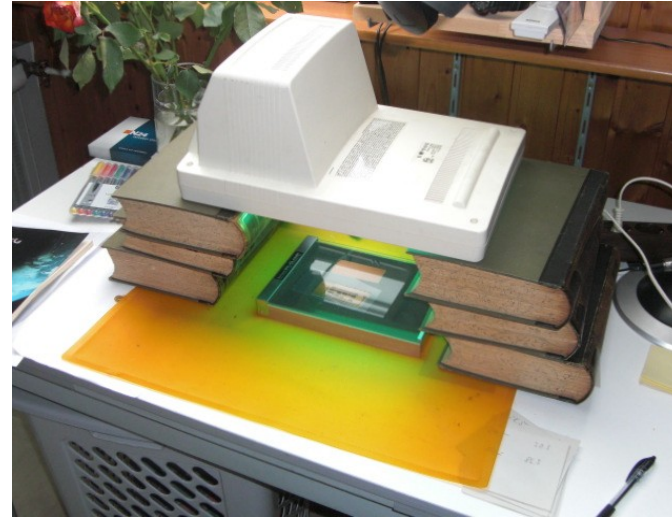
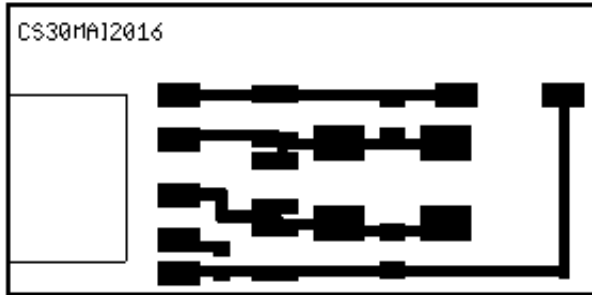


Tested up to 3 kV
No measurements yet



HV divider: production

Produce mask



Irradiate mask on board with photosensitive varnish with UV



Remove irradiated varnish with NaOH + water

(base)



Etch away copper with NaS_2O_8 + water at 45+-5 deg.

(acid)

Summary/Discussion

Timing precision depends on

Line noise

Cable routing
HV line/divider noise pickup

Slope of signal at discrimination

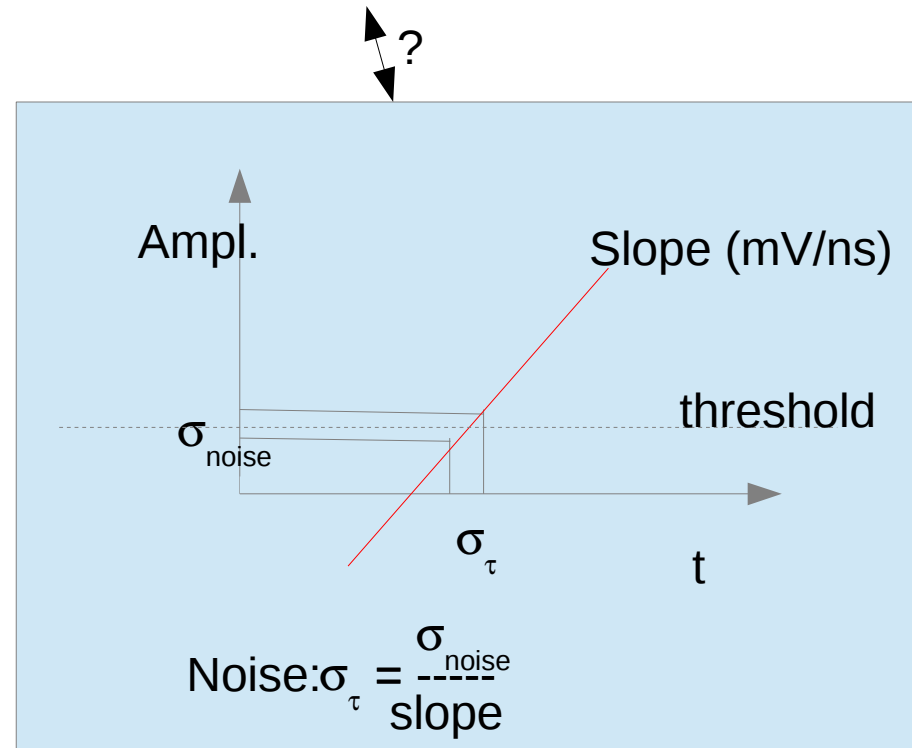
Assuming perfect discrimination & TDC measurement

Bandwidth capacitor
Amplification
Threshold

Efficiency depends on

Threshold

Setup stability
Oscillations



Improvement due end of June...