Comprehensive KLauS measurements & other issues

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outline

- KLauS reminder : channel diagram
- Steady state characterization :

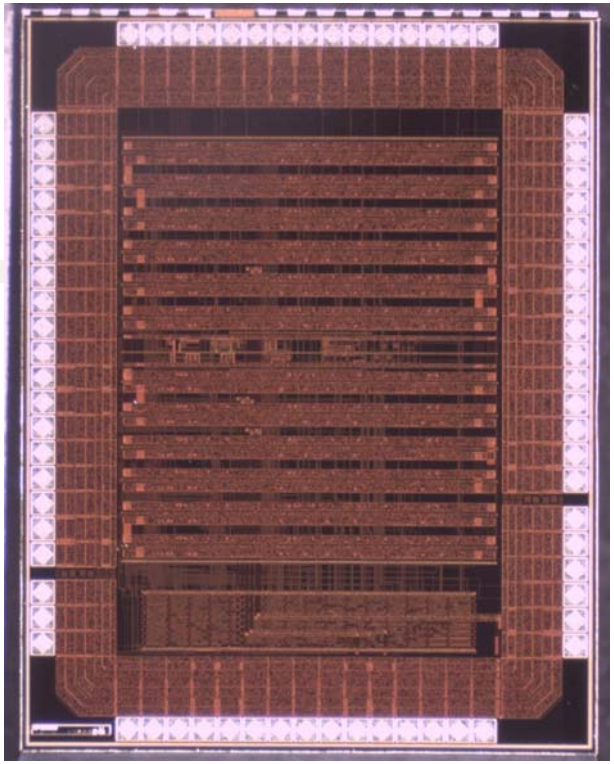
  DAC , dynamic range scan, trigger ...
- Power Pulsing

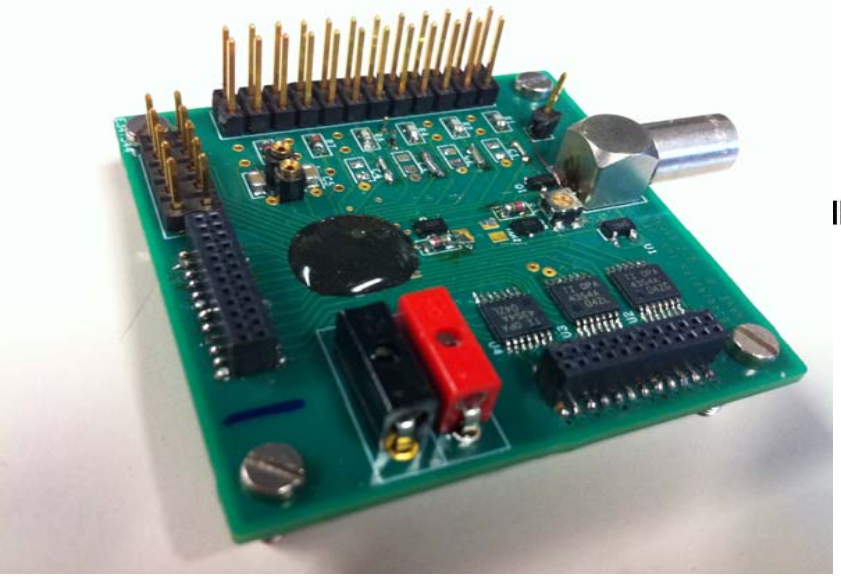
  noise, spectra quarlity
- Other issues

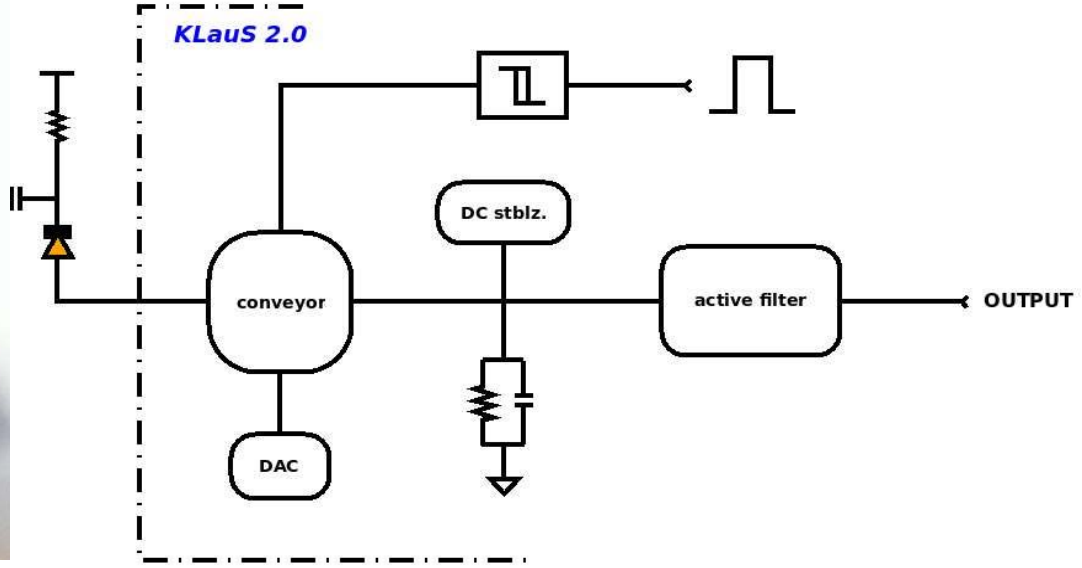
Reminder : KLauS channel

12 channels in AMS SiGe 0.35um

Designed in Nov. 2010



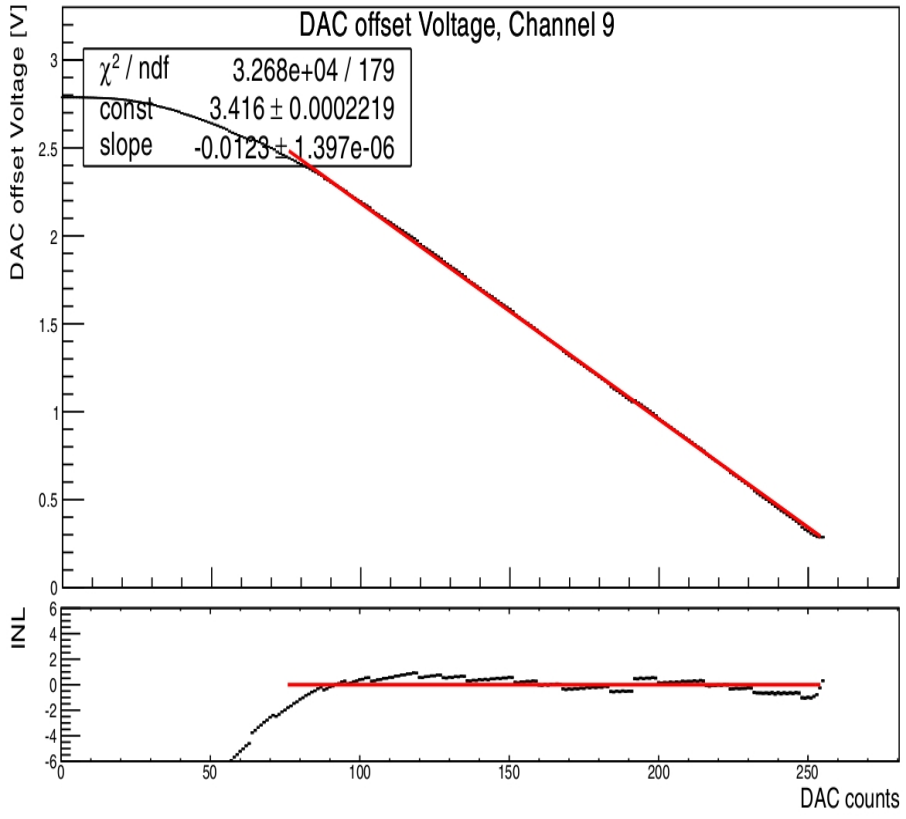




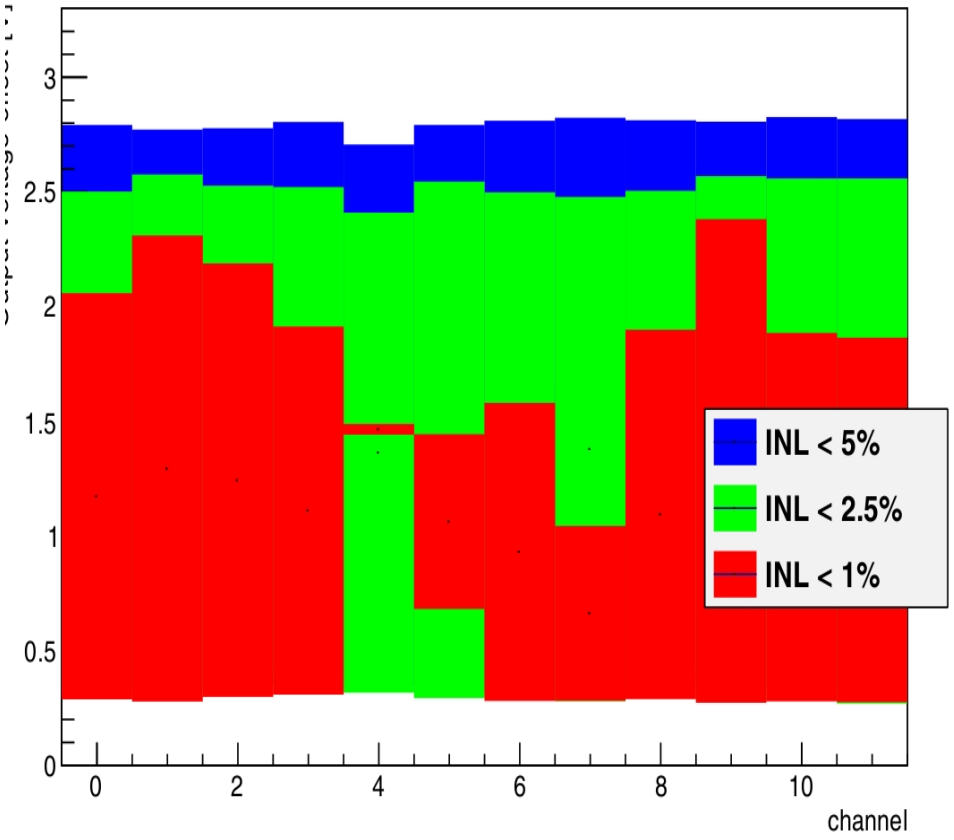
Input Digital to Analog Converter

Input voltage DAC

DAC scan

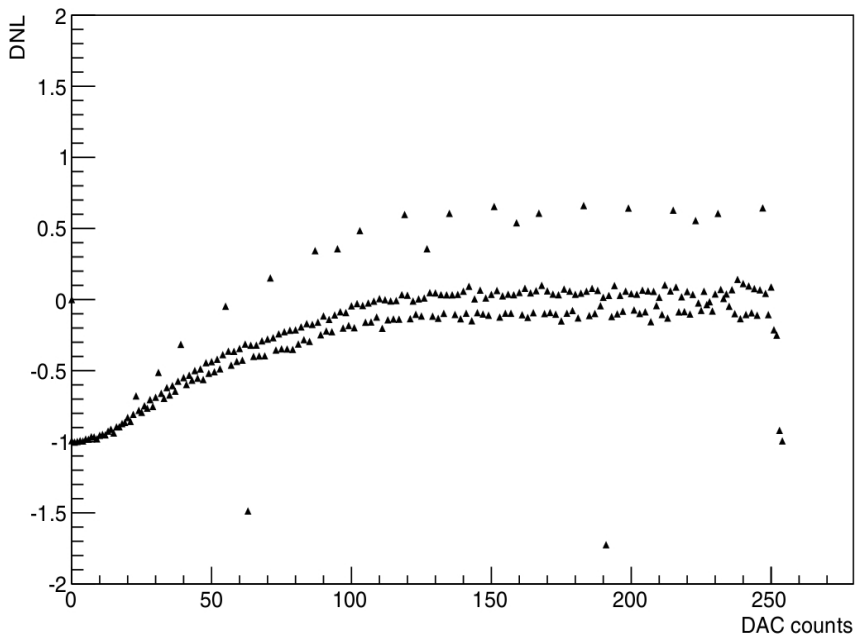


DAC tuning range > 2V

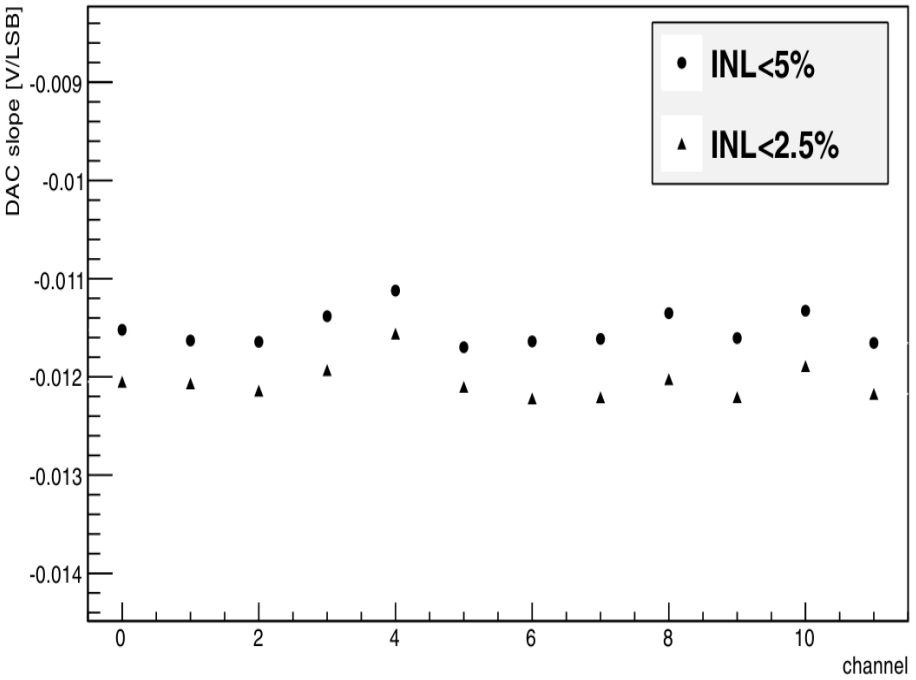


Input voltage DAC, linearity and slope

Differential Non-linearity

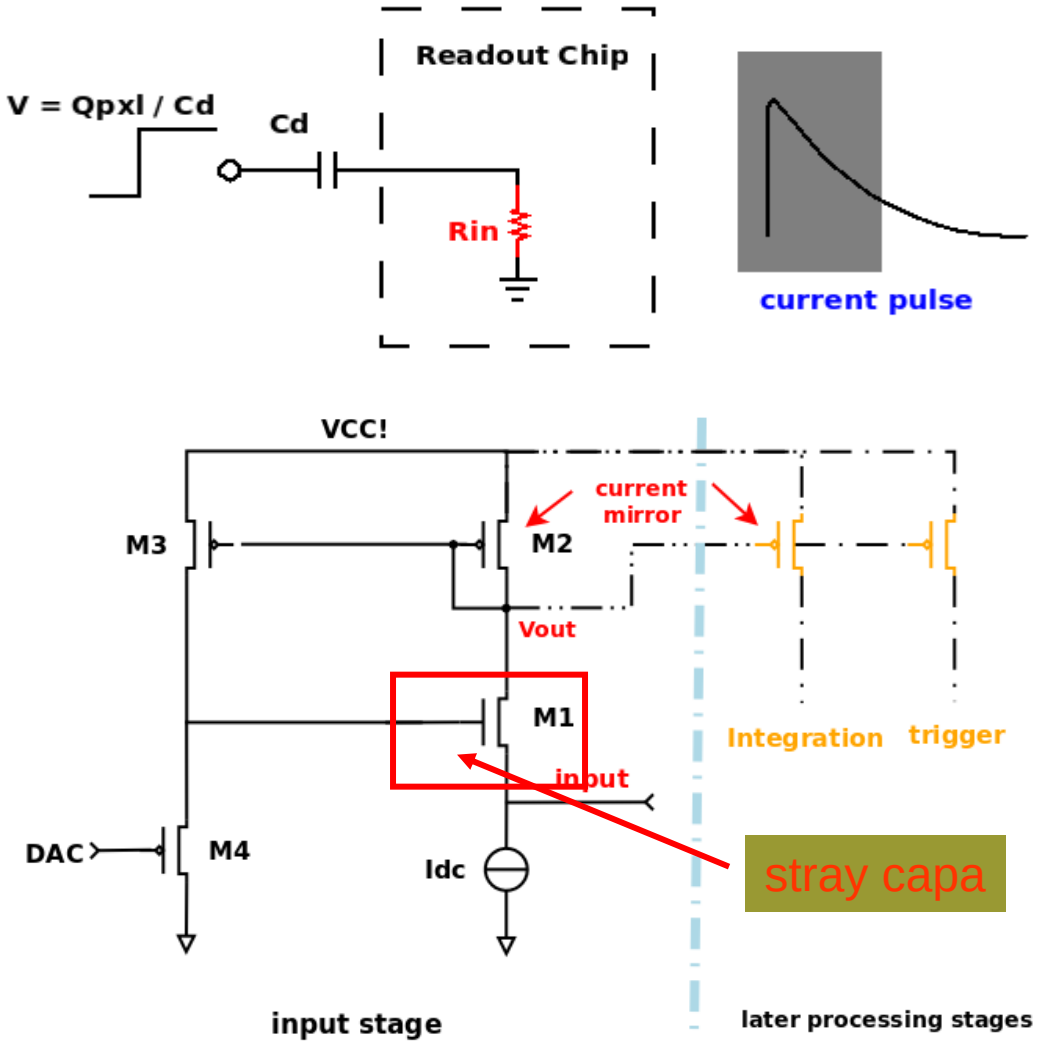


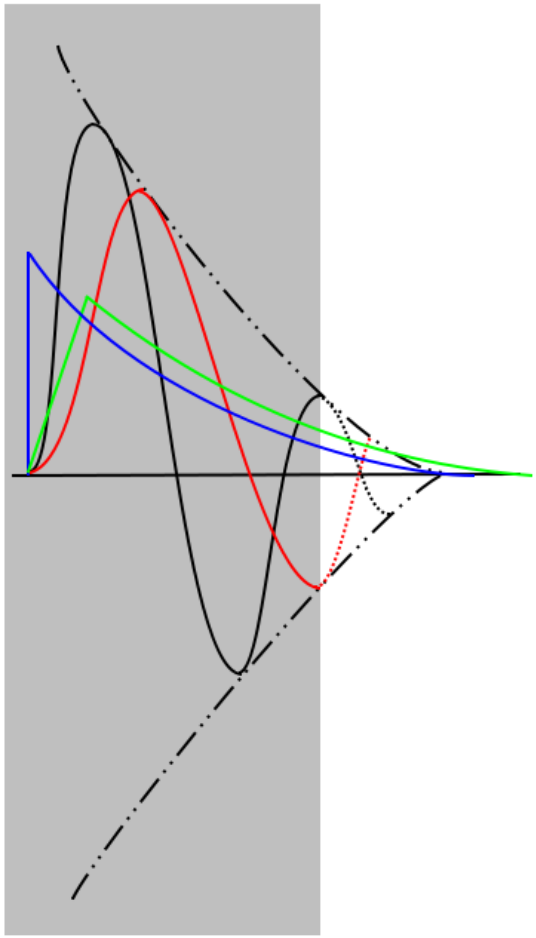
Channel slope uniformity



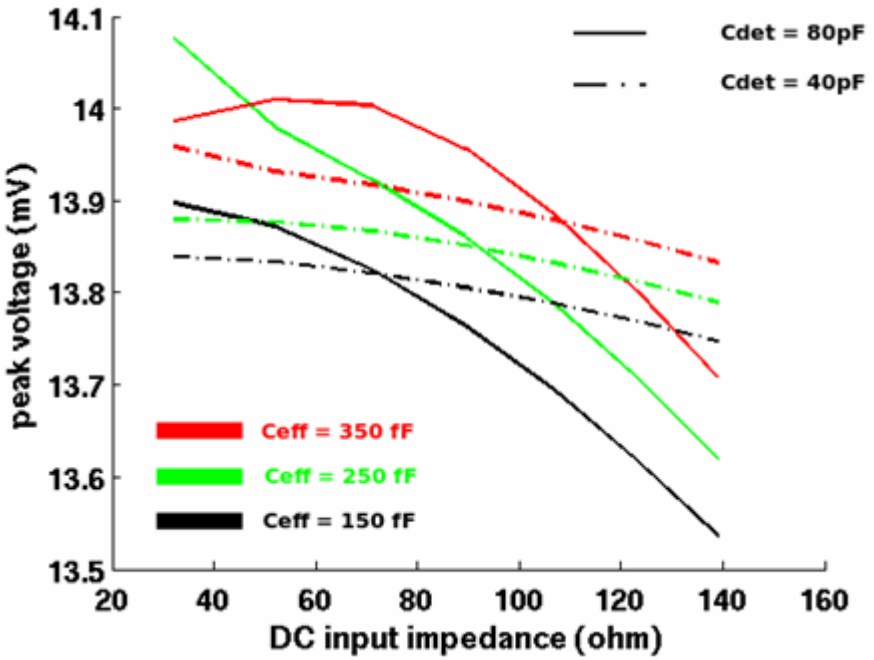
Q Convertion Factor

Input Stage and Q collection

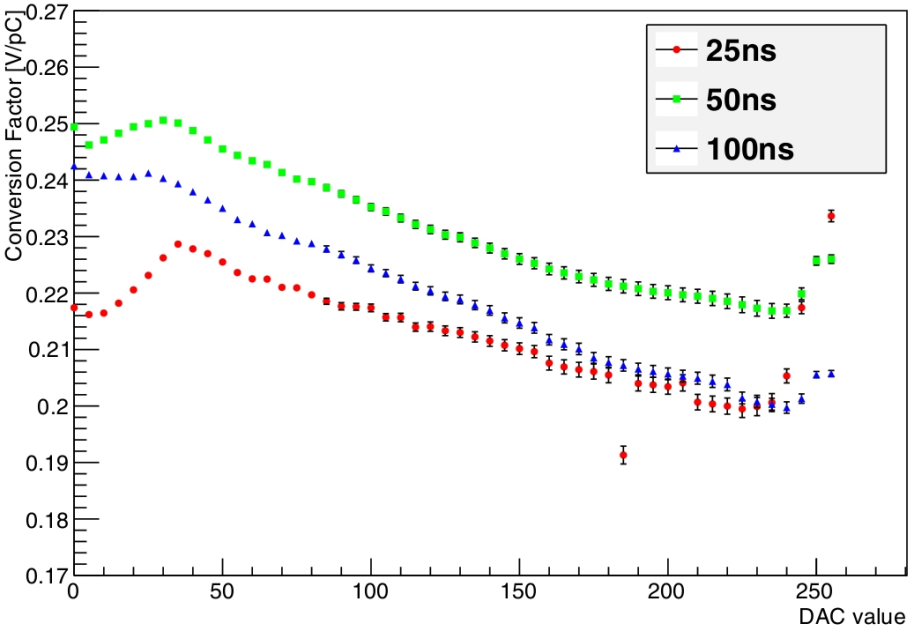




Q convertion factor



Simulation results



Q convertion :

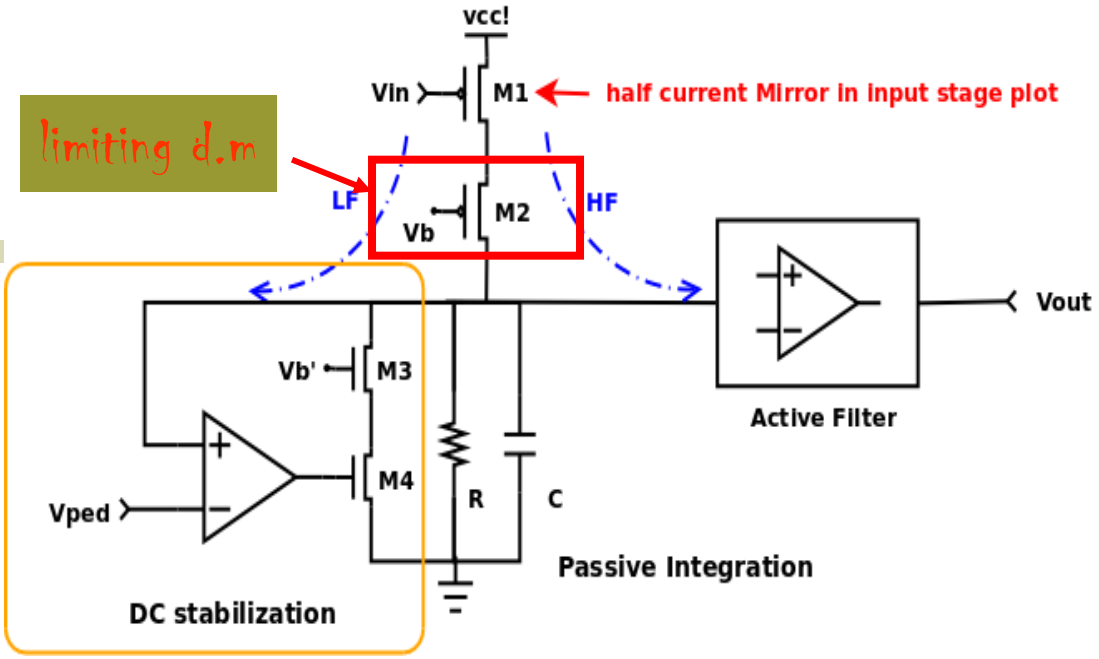
Cdet, stray capa, input impedancde

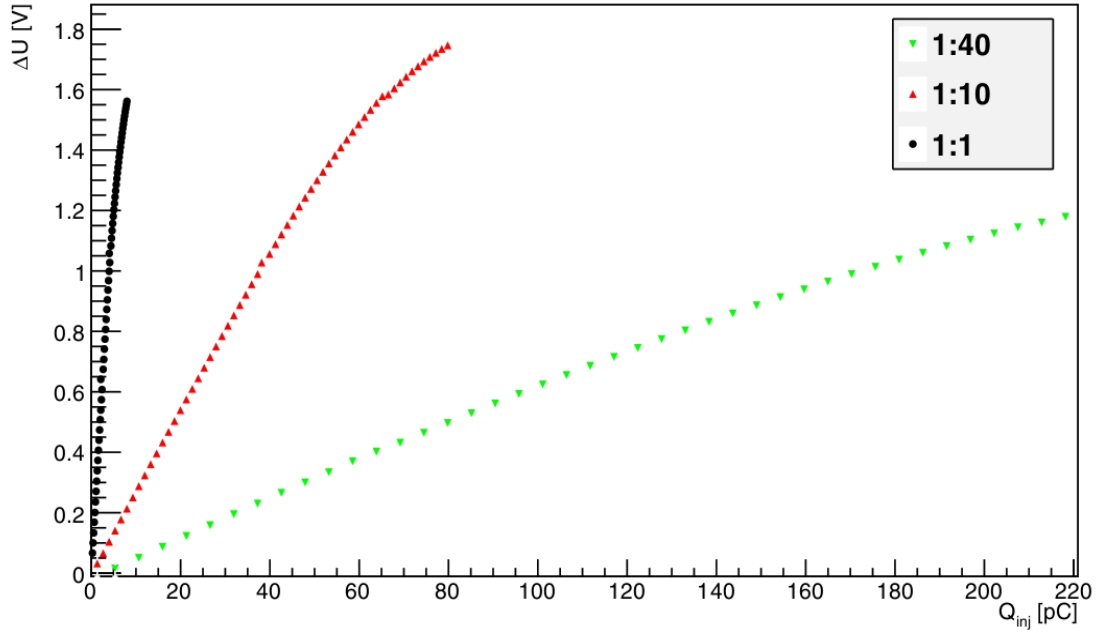
Gain Factor and uniformity

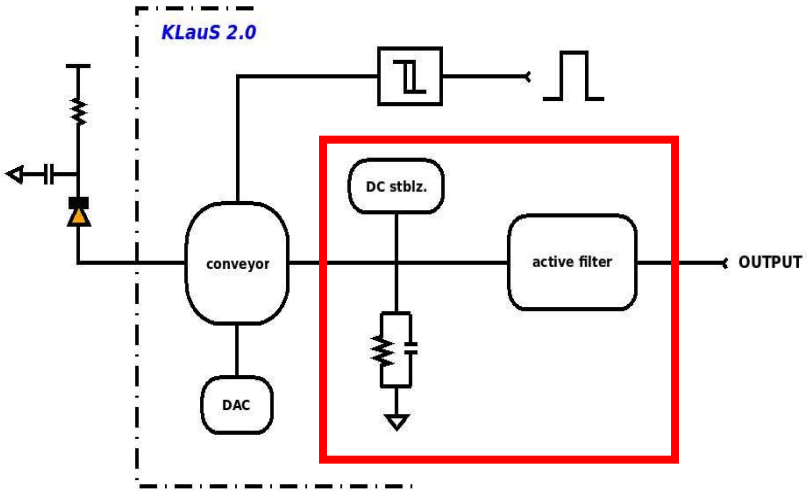
Gain factor scan

3 gain setting

(Scalling down)

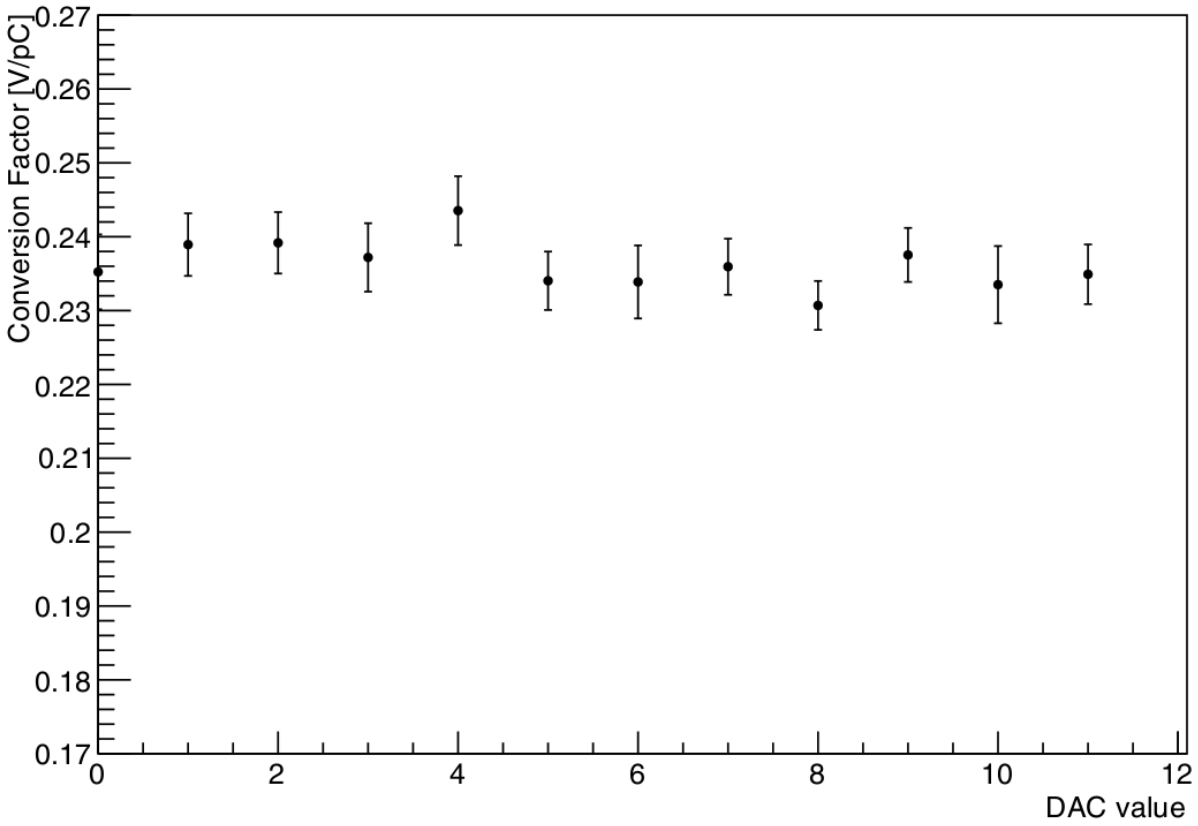






Gain uniformity

12 channels , gain uniformity (DAC 100)

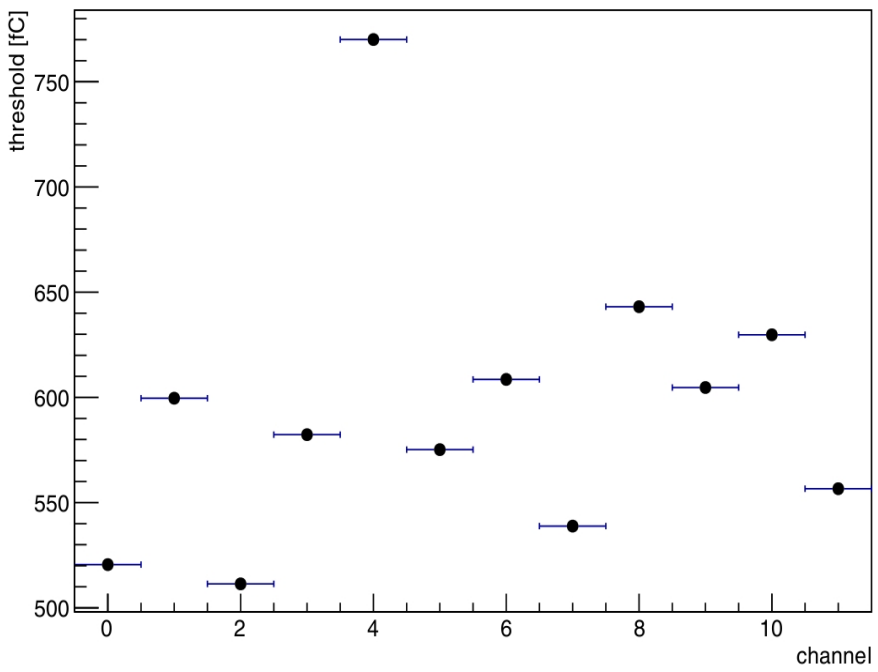


Trigger Quality

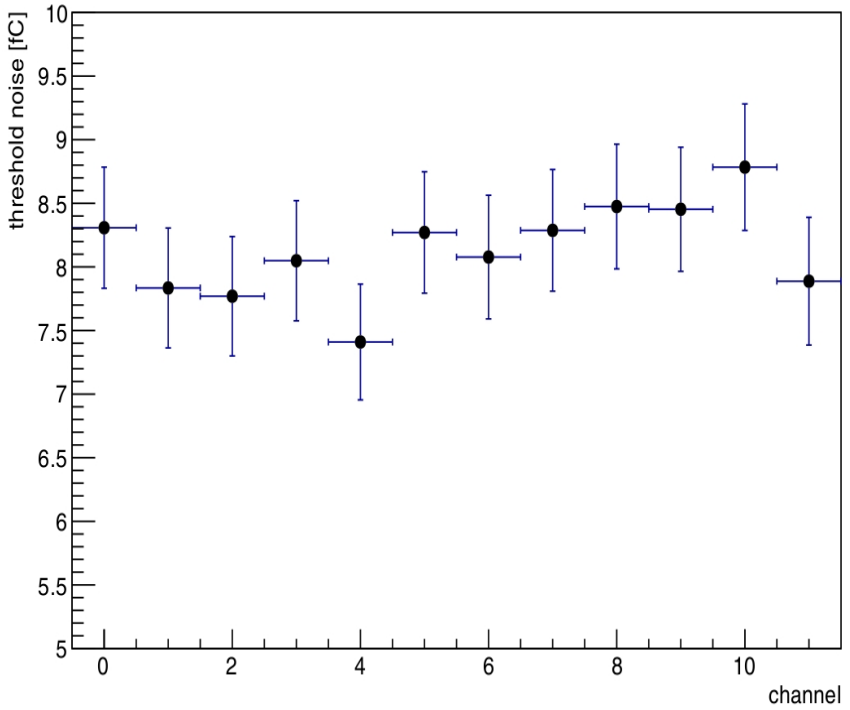
Threshold Uniformity & Trigger noise

M.I.P resolution : 50ps (1/4 Mio.) , 13 ps (1 Mio.)

Threshold Uniformity

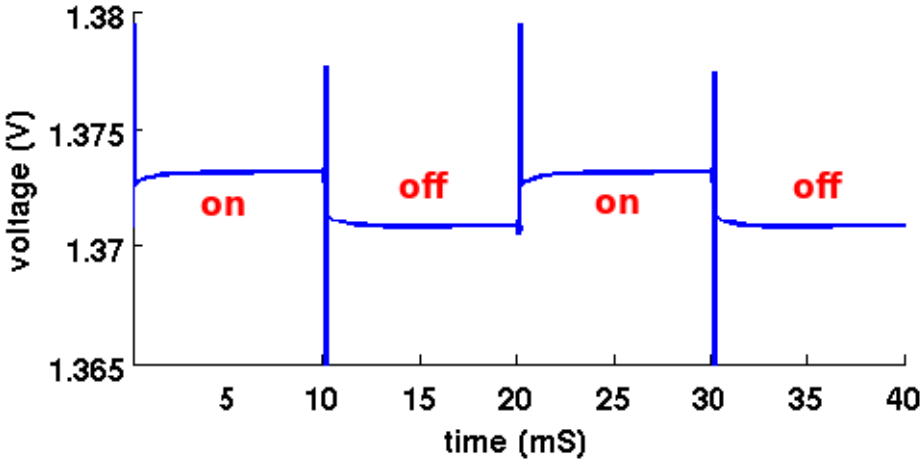


Trigger noise for 12 channels



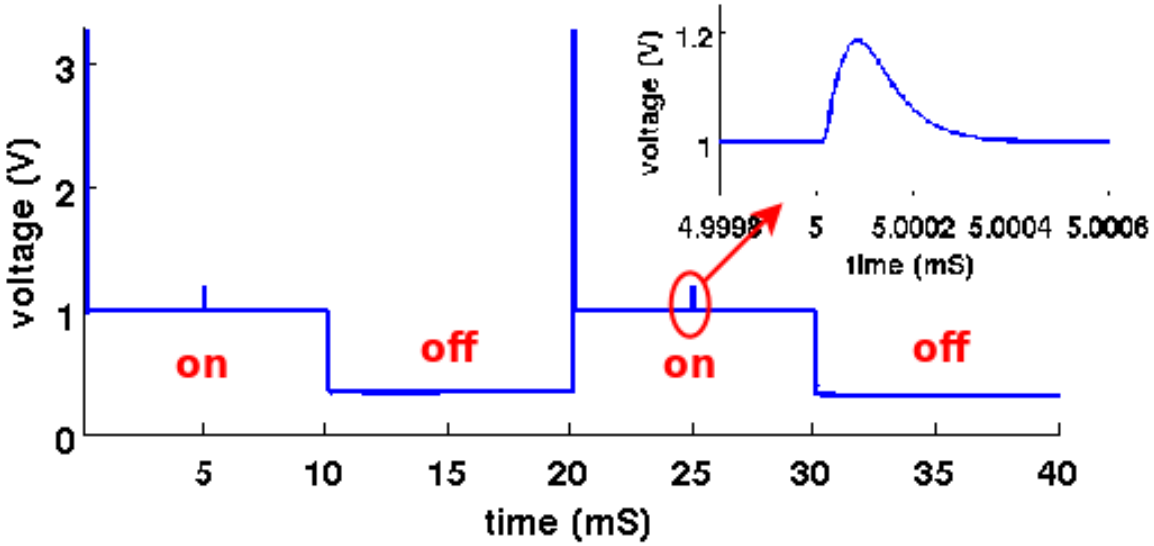
Power Pulsing

Power Pulsing in simulation

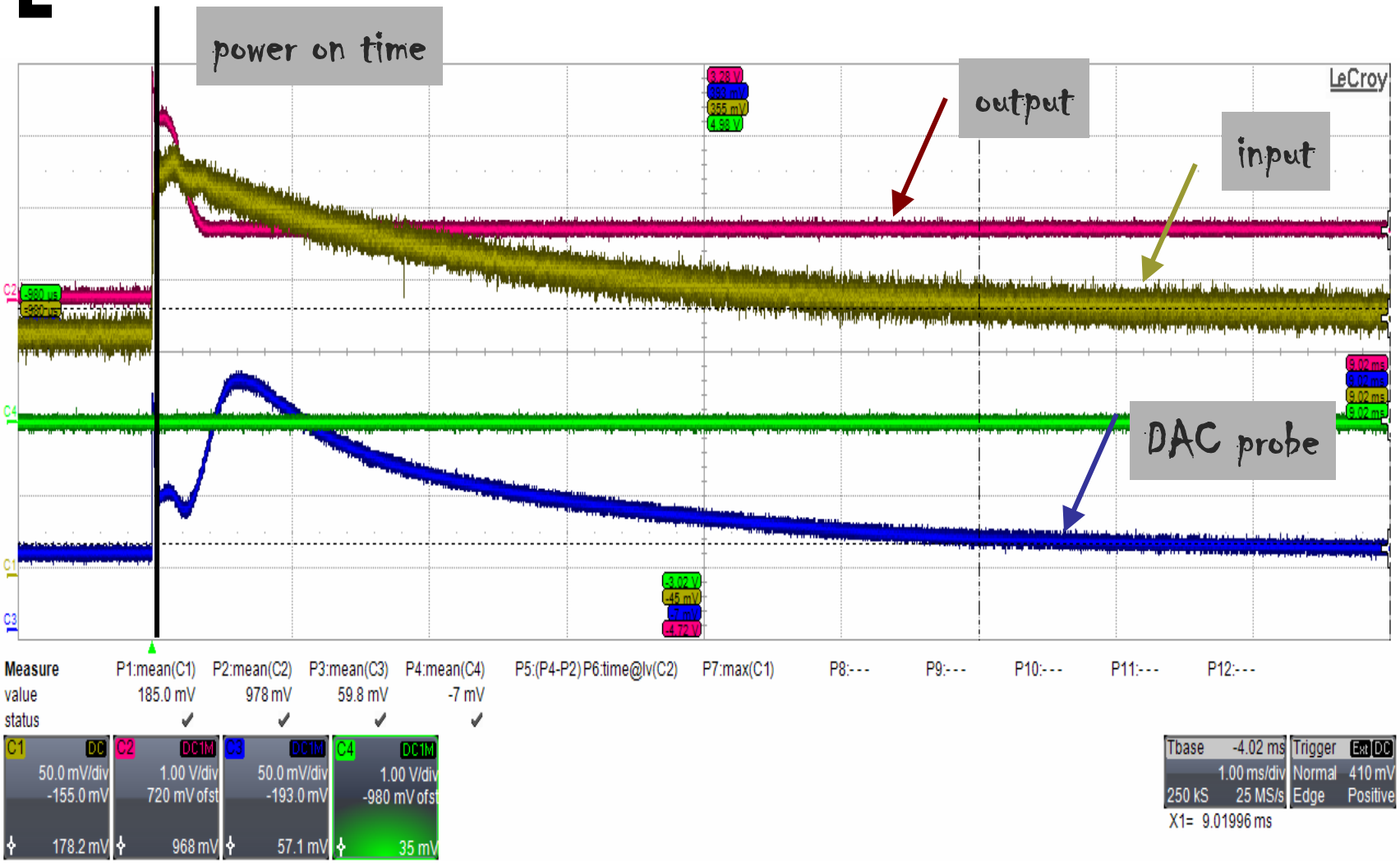


Input voltage

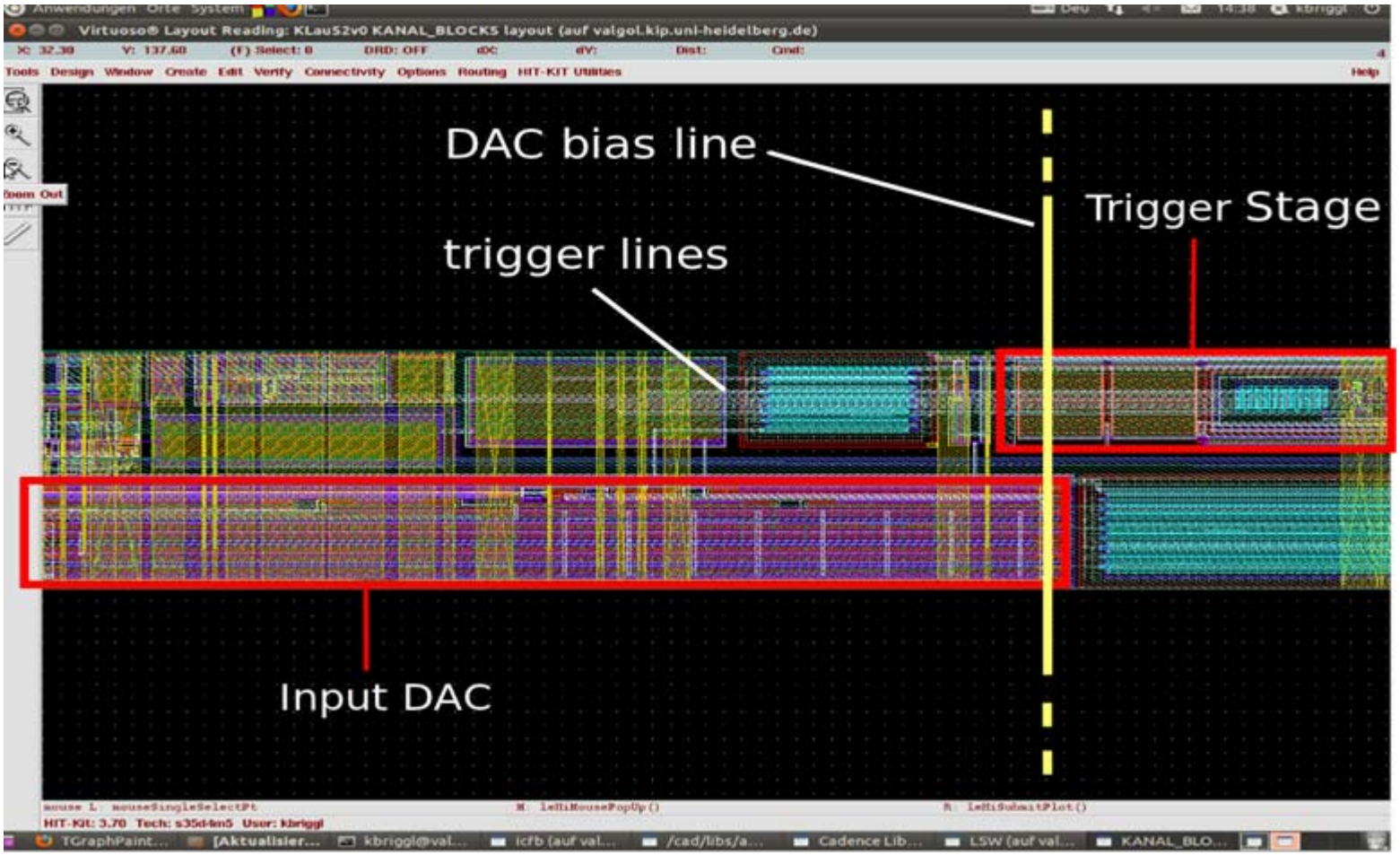
Output voltage



Power Pulsing (i) – recovery time

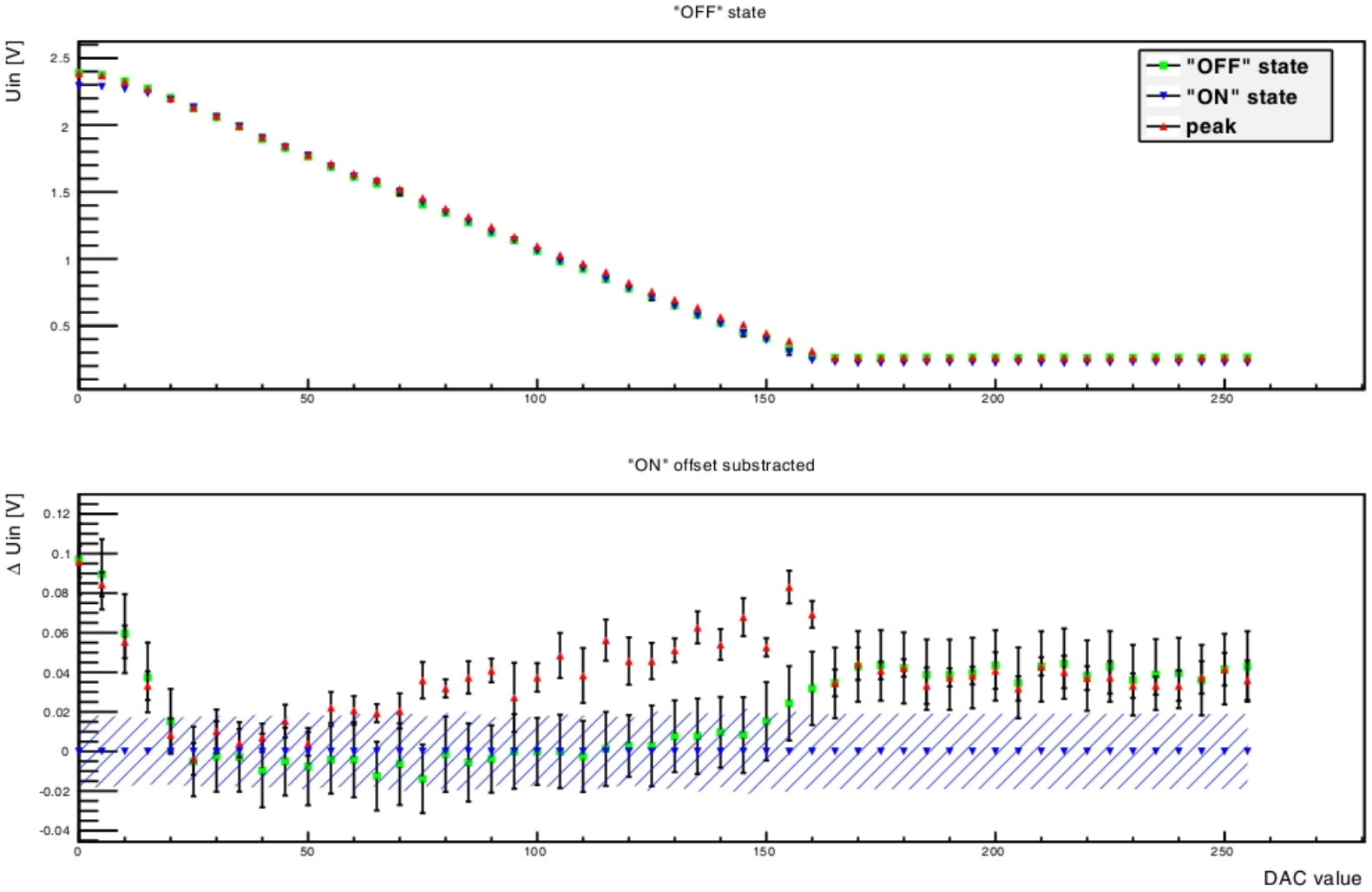


Power Pulsing (i) – recovery time , layout



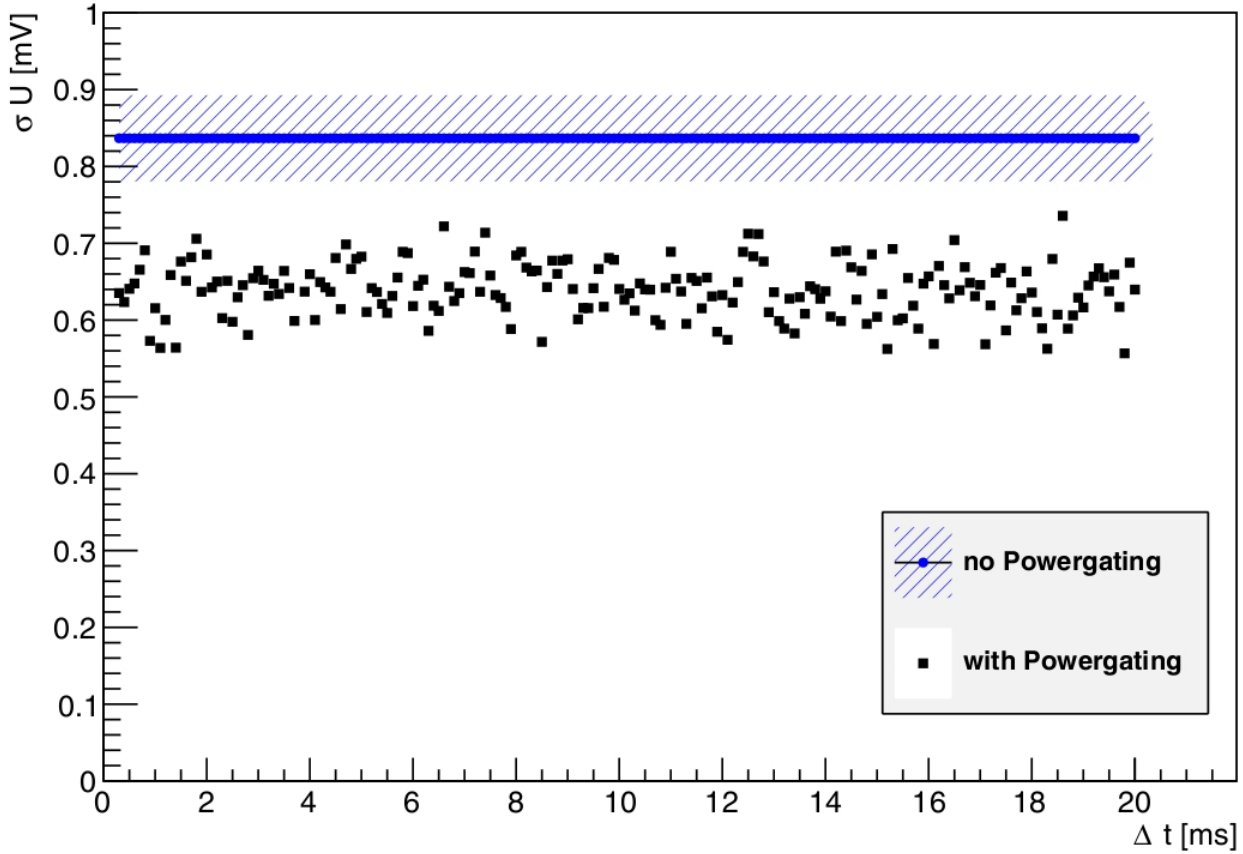
Power Pulsing (i) – recovery time , trigger off

Power Pulsing (ii) – Vin offset



Power Pulsing (iii) - noise

Noise aliasing effects confirmed , noise vs measerment time

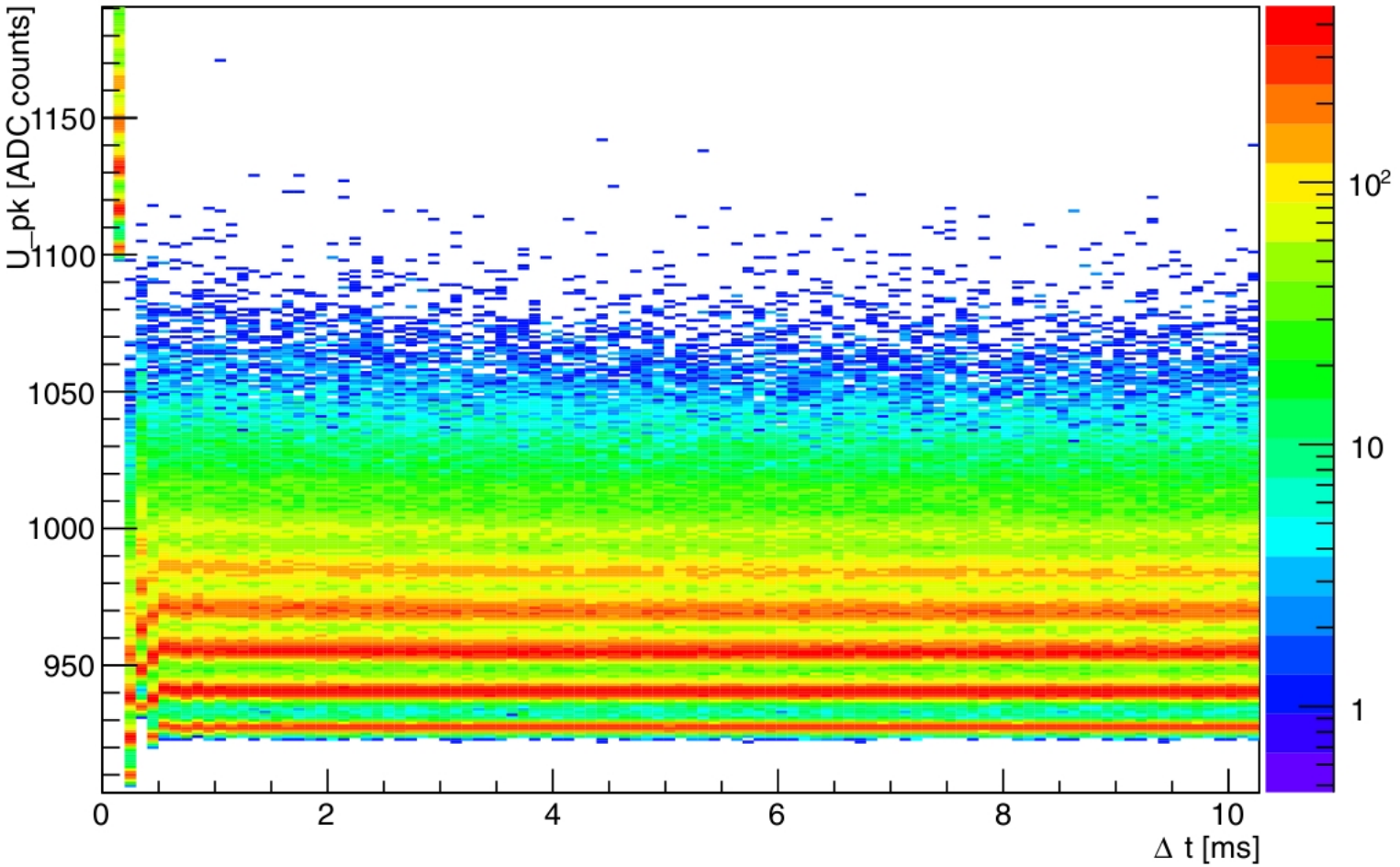


Pixel SNR

MPPC 1600 (1/4 Mio.)
~ 15

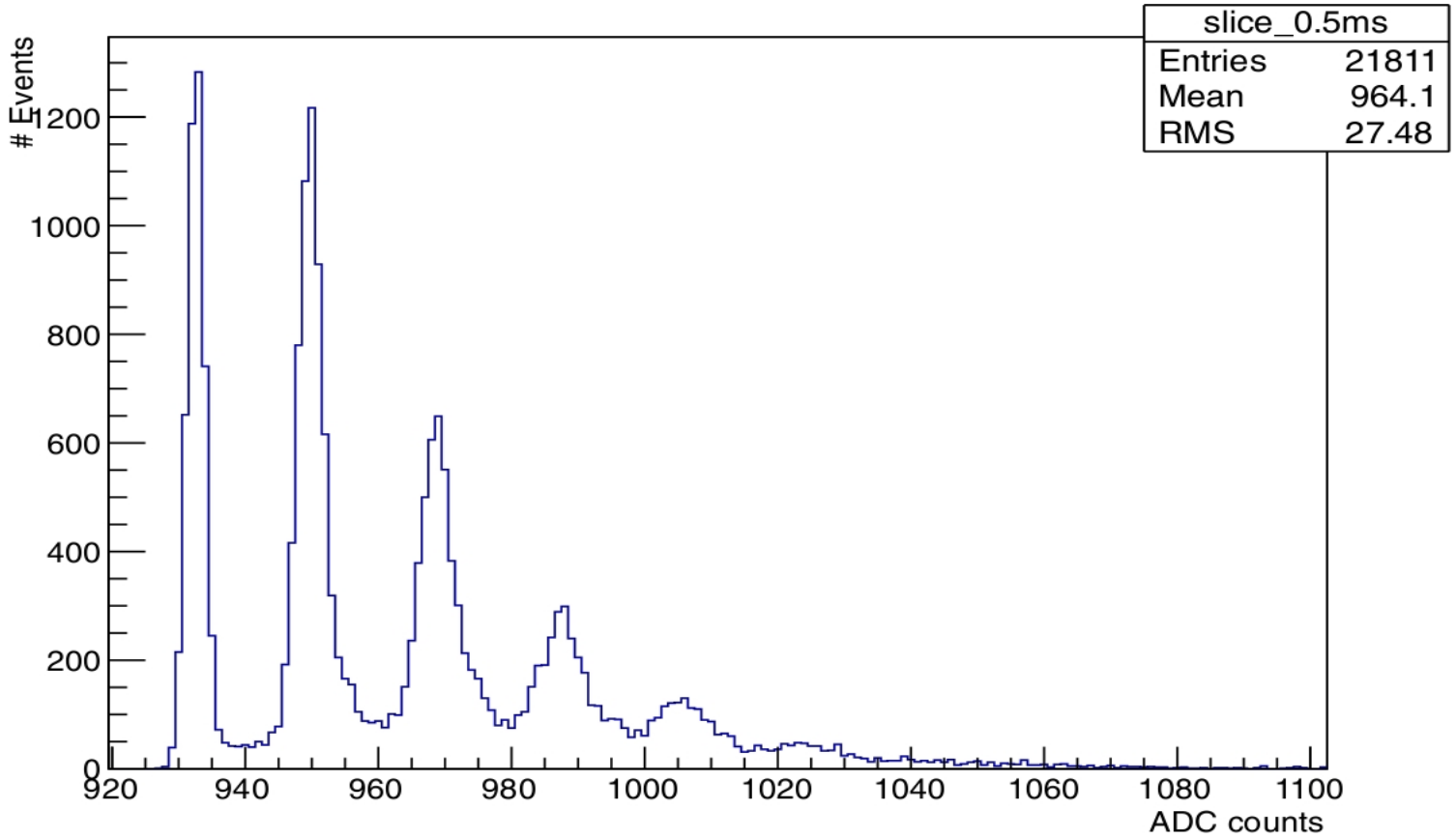
MEPhI SiPM (1 Mio)
~ 60

Power Pulsing (iv) – SiPM spectra



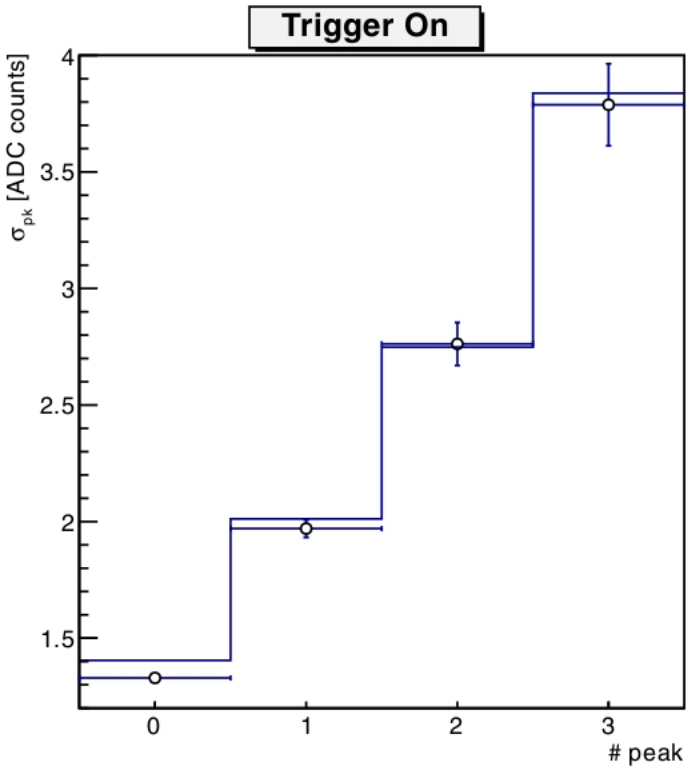
Power Pulsing (iv) – SiPM spectra

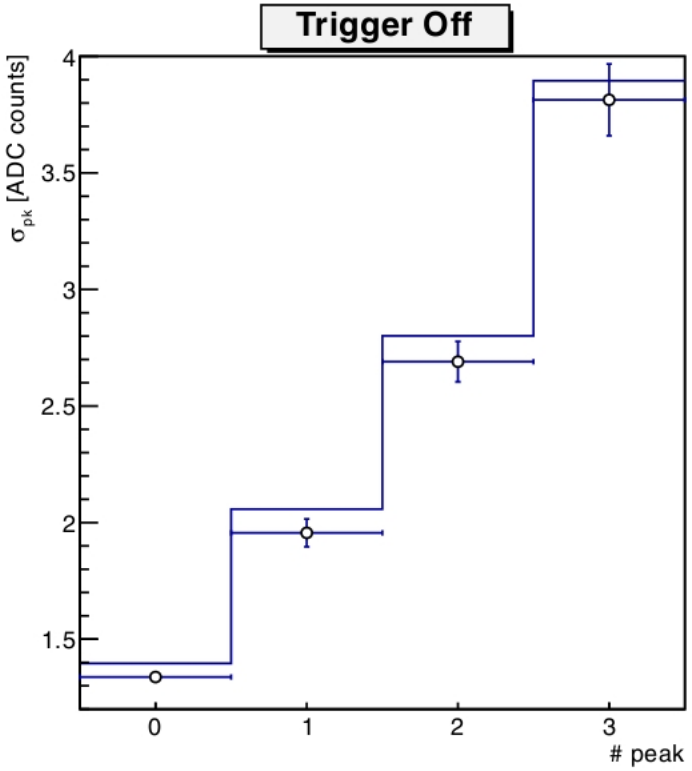
MPPC s10362-11-1600 (1/4 Mio. Gain)



Power Pulsing (iv) – SiPM spectra noise

circles are power pulsing results

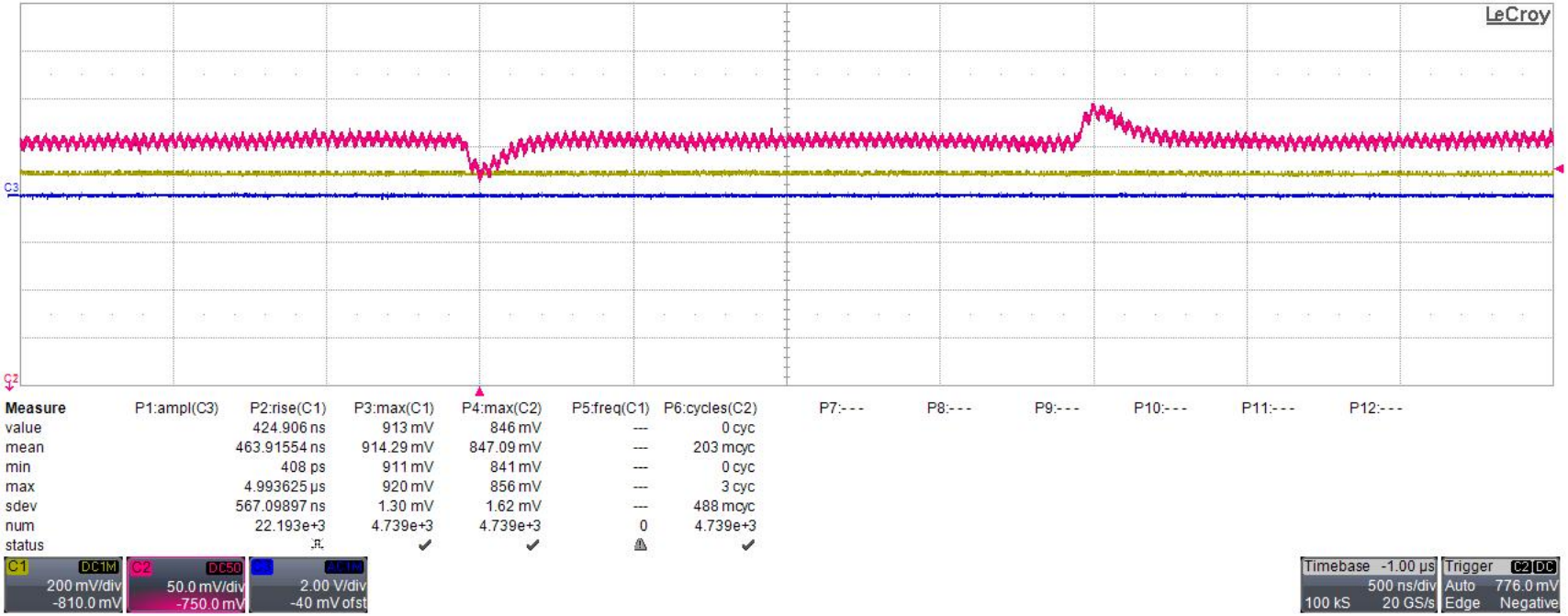




Remaining Issue

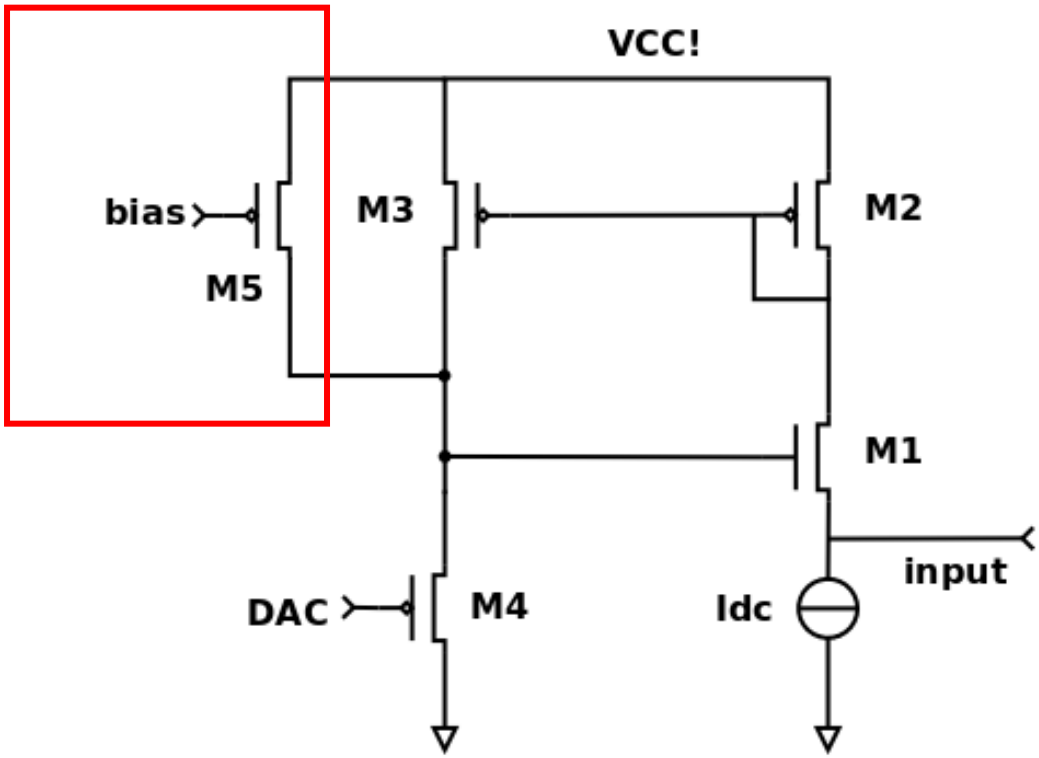
Process variation caused issue

Instability in a few channels for a few detectors



Process variation: reason & remedy

- Input impedance becomes negative
- $1/gm_1 - (gm_3/gm_2)*1/gm_4$
- PMOS outweighs NMOS
- Compensation path



Summary

- KLauS characterization finished
- Power pulsing works successfully
- 3 issues to be modified in next version
  - cascode votage to enhance dynamic range
  - DAC layout
  - input stage compensation
- Ready for integration into new SPIROC