

Design towards KLauS v2.0

(Kanäle für Ladungsauslese von SiPM)

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Overview

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improvements on KLauS

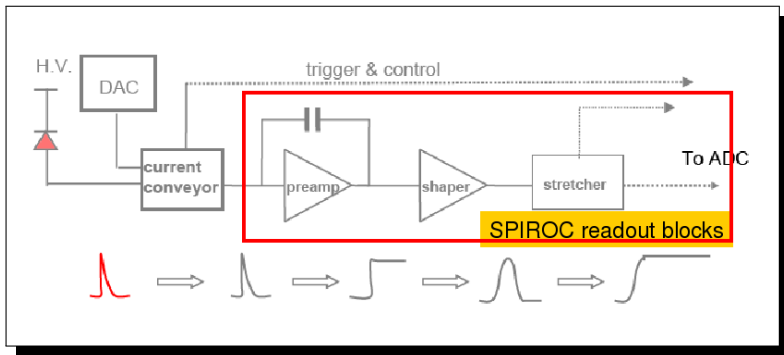
KLauS v1.0 features

- large S/N for low gain SiPM(> 10)
- sub-nanosec. discrimination($< 500\text{ps}$ @ p.e.)
- high dynamic range (up to 150pC)
- bias tune ($\sim 2\text{V}$ @ 3.3Vcc)

Room to improve :

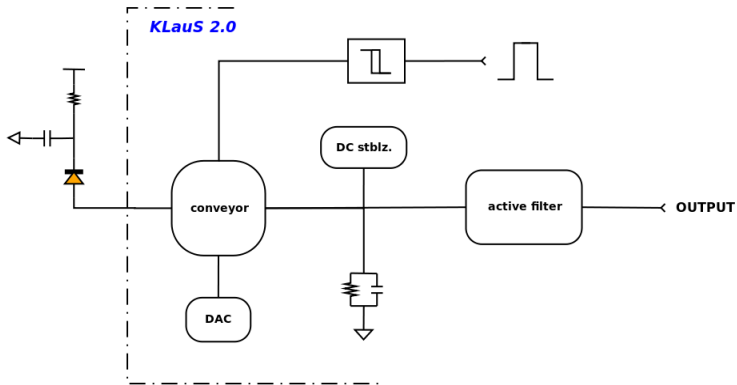
- better linearity (carefully designed amplifiers & subsidiaries)
- less digital noise (better layout)
- **less power, towards $25\mu\text{W}$ /ch**
- **power pulsing**

solution to power reduction



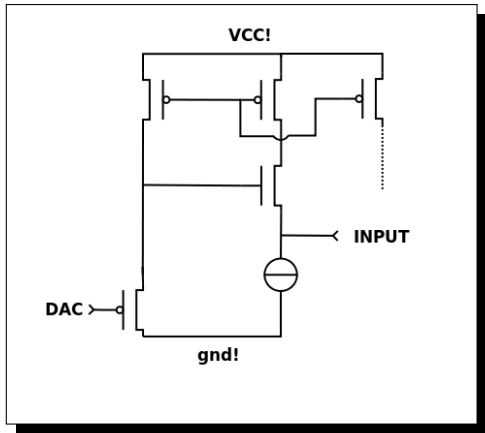
- v1.0 : preamplifier + 2 shaping stages
- v2.0 : ~~preamplifier + 1 shaping stage~~
 ⇒ 1 shaping stage (less units + reduced bias current)
 (how to cancel undershoot and pedestal stablization ?)

KLauS v2.0 channel diagram



passive integration + dc coupling (pdstl stblz.) + active filter

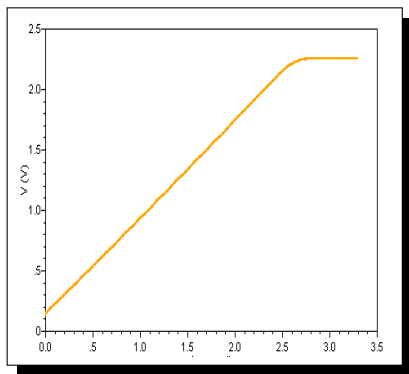
input stage - conveyor



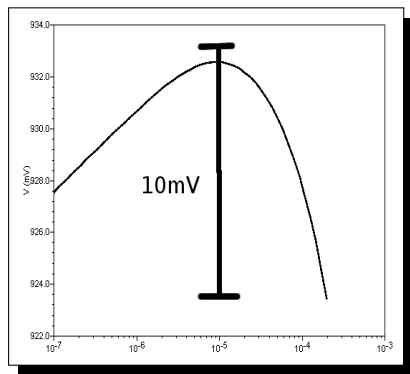
- current feedback
- 150 μA bias current
- bias voltage tunable with DAC
- power pulsing compatible

bias voltage scan & power down bias voltage

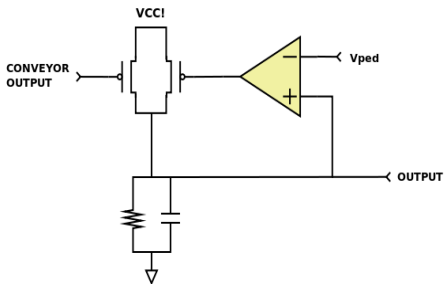
bias voltage scan - SiPM tune



bias current scan - power pulsing

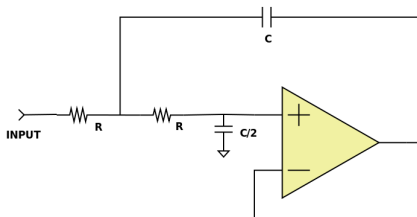


pedestal stabilization



- LF negative feedback with current source
- OTA biased @ 50nA
- pedestal set by V_{ped}

active filter with dc coupling



transfer function $H(\omega) =$

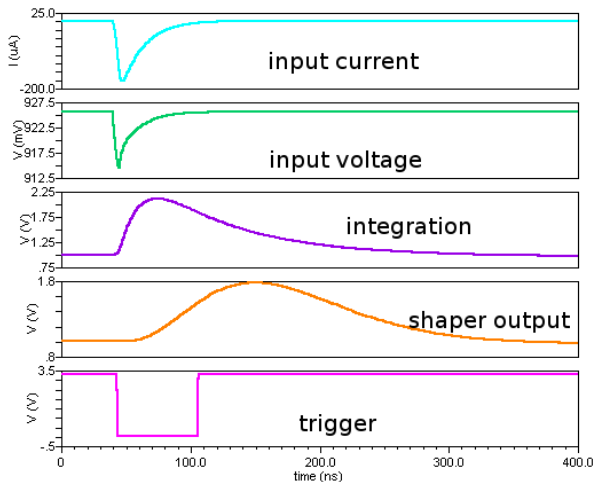
$$\frac{2/\tau^2}{(s + \frac{1}{\tau} + j \cdot \frac{1}{\tau})(s - \frac{1}{\tau} - j \cdot \frac{1}{\tau})}$$

pulse without undershoot !

$$V_{out} = \frac{Q}{C \cdot (s + \frac{1}{\tau})} \cdot \frac{2/\tau^2}{(s + \frac{1}{\tau} + j \cdot \frac{1}{\tau})(s - \frac{1}{\tau} - j \cdot \frac{1}{\tau})}$$



simulation



summary

- full channel designed
 - power pulsing added into KLauS
 - power less than 2mW / ch
- schematic ready to layout
 - fix layout rules with OMEGA @ Orsay
 - SiGe 0.35 μm AMS @ Nov. 2010
 - supposed to replace SPIROC analog part in the next SPIROC version