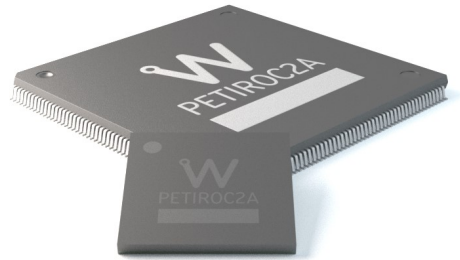# Petiroc 2A

SiPM read-out for time-of-flight PET

Petiroc2 is a 32-channel front-end ASIC designed to readout silicon photomultipliers (SiPMs) with both polarities for particle time-of-flight measurement applications. Petiroc2 combines a very fast and low-jitter trigger with accurate charge and time measurements. Energy and time are digitized internally with a 10-bit ADC and 40ps-bin TDC.

The concept of the ASIC is to combine two measurement lines that won't interfere one with each other to measure both first incident photon timing measurement and whole crystal light charge integration.

An adjustment of the SiPM high voltage is possible using a channel-by-channel input DAC. It allows a fine SiPM gain and dark noise adjustment at the system level to correct for the non-uniformity of SiPMs.

The power consumption is 6 mW/channel, excluding buffers used to output the analogue signals. The main application of Petiroc 2 is PET time-of-flight prototyping but it can also be used for any application that requires both accurate time resolution and precise energy measurement.

Detector Read-Out	SiPM, SiPM array
Number of Channels	32
Signal Polarity	Positive or Negative
Sensitivity	Trigger on first photo-electron
Timing Resolution	~ 35 ps FWHM in analogue mode (2pe injected) - ~ 100 ps FWHM with internal TDC
Dynamic Range	3000 photo-electrons (10^6 SIPM gain), Integral Non Linearity: 1% up to 2500 ph-e
Packaging & Dimension	TQFP208 – TFBGA353
Power Consumption	Power supply: 3.3V 192mW Analogue core (excluding analogue outing buffer), 6mW/ch
Inputs	32 voltage inputs with DC adjustment for SiPM HV tuning
Outputs	Digital output (energy on 10 bit, time on 10 bit - 40ps bin) 32 trigger outputs 1 multiplexed charge output, 1 multiplexed hit register 2 ASIC trigger outputs (Trigger OR on 32 channels, 2 levels)
Internal Programmable Features	32 HV adjustment for SiPM (32x8b), trigger threshold adjustment (10b), charge measurement tuning, 32 trigger masks, internal temperature sensor, trigger latch

They are using Petiroc 2A

Industrial applications
Cannot be disclosed

More about Petiroc 2

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Petiroc 2A

SiPM read-out for time-of-flight PET

weeroc

Data_out

Multiplexed_charge

OR32_charge

32 trigger outputs

OR32_time

Outputs

Digital

Time<0>

Time<i>

Charge<i>

Charge<31>

out_discri_charge

OR32

OR32

ADC ramp

ADC ramp

Time to amplitude converter

Vth_charge

hold

SCA

RS latch

Time measurement

Charge measurement

Vth_time

6-bit DAC adjustment

pa

preamplifier

Positive or negative input

8-bit input DAC

Channel 31

Channel 0

10-bit DAC

Vth_time

Temp sensor

8-bit delay box for hold generation

hold

Bandgap

ADC ramp

Common to the 32 channels