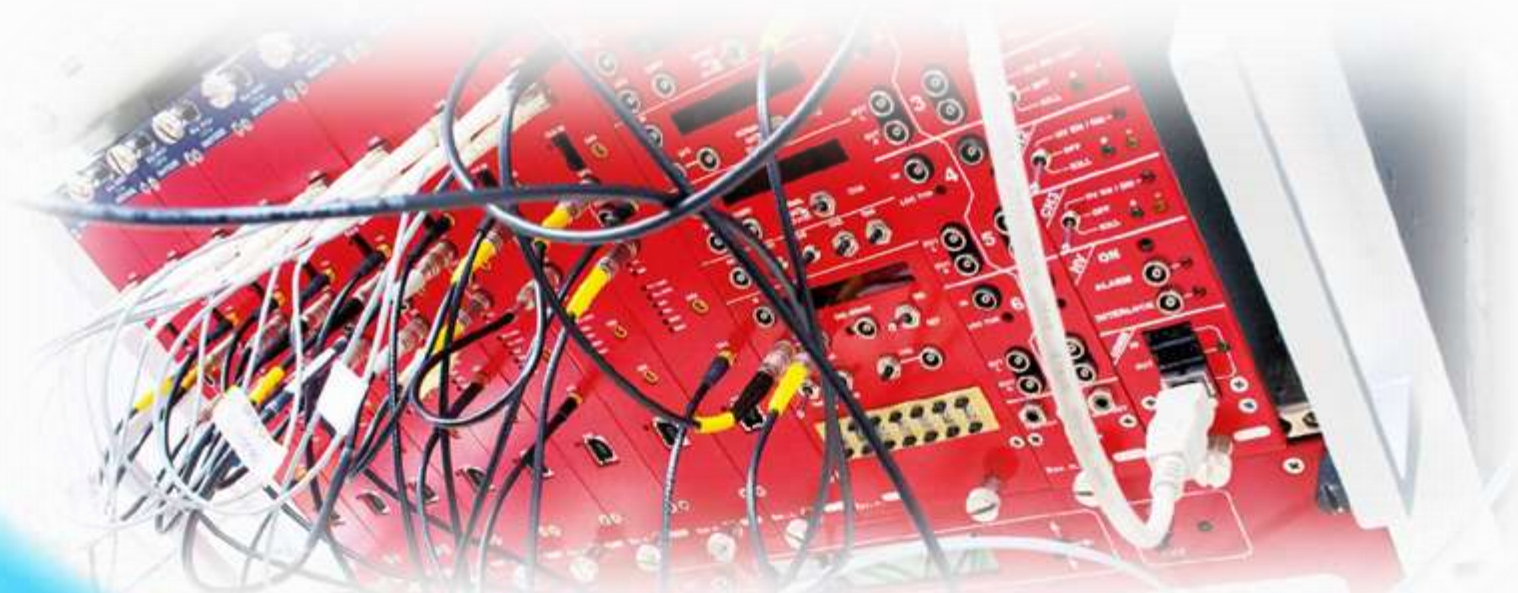


Digital systems for Multi-Parametric analysis in Physics Applications



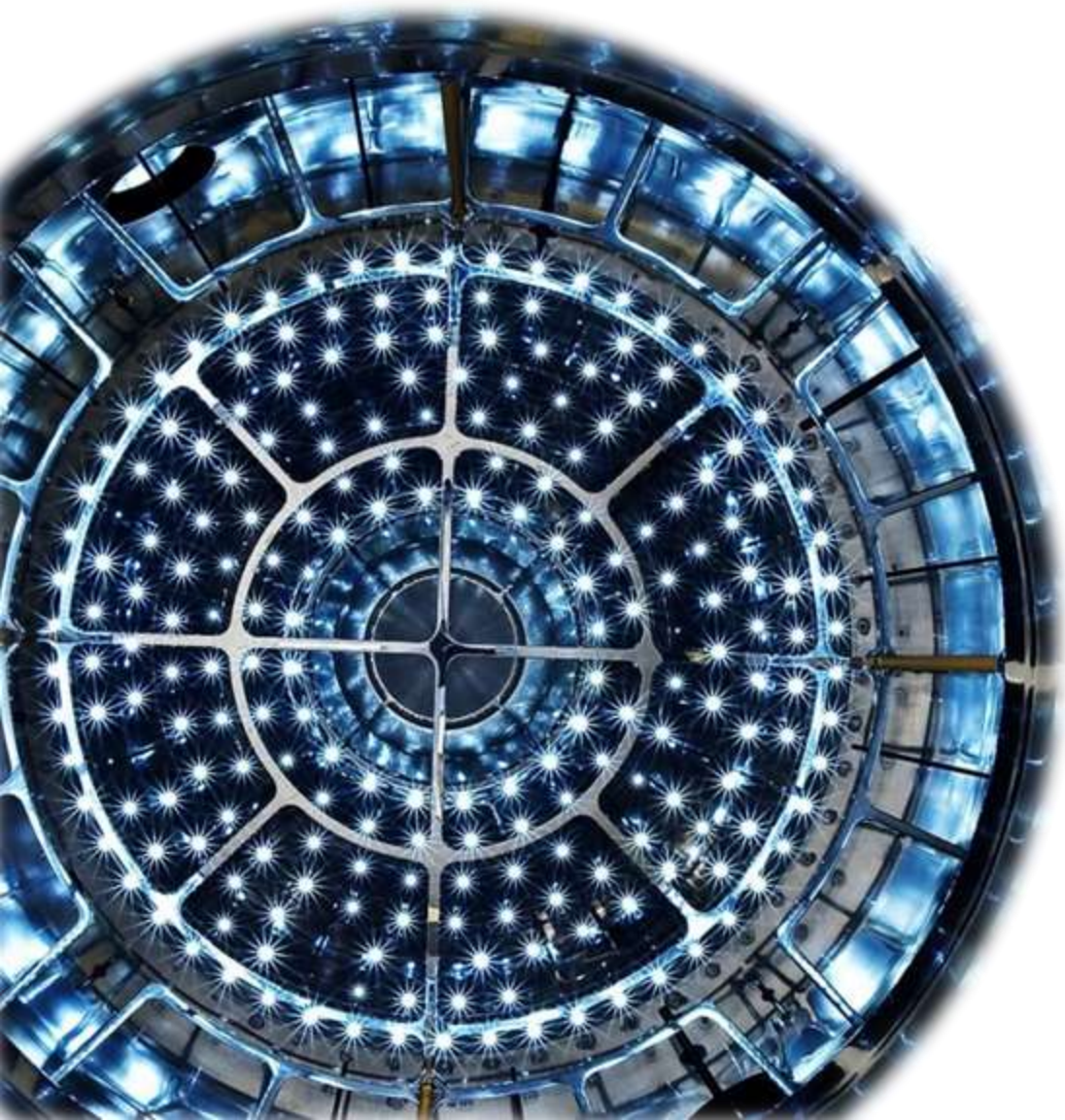
Ivan Bredikhin, Gammatech LLC

40 years of innovation

For almost 40 years CAEN has been providing Scientists and Engineers with the most advanced electronic instrumentation for any particle or radiation detectors

Strong of an extremely close collaboration with the world major research laboratories CAEN is proud to produce the best tools for:

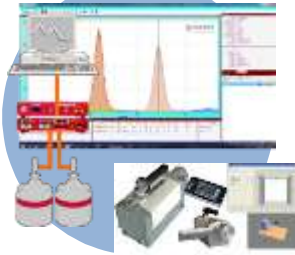
- > High Energy Physics
- > Astrophysics
- > Neutrino Physics
- > Dark Matter Investigation
- > Nuclear Physics
- > Material Science
- > Medical Applications
- > Homeland Security
- > Industrial Applications



**Unmatched proprietary
technology portfolio for
radiation and particle
detection measurements**

- **World-class technology
development:> 80
Engineers/Physicist**
- **Global manufacturing
capabilities**
- **Worldwide service**

Spectroscopy



**Mobile
Laboratories**



**D&D Technologies,
Systems, Expertise**



**Site Access
Control**



**Fuel Assembly
Verifications**



**Health Physics
Equipment**



**Very Low Background
Whole Body Monitoring**



- > HV : 100 B – 15 KB (detector power supply)
small currents (-milli & -micro amps)
with nAmp precision.
LV: for electronics
- > Channels : from 1 to 768 per crate
- > One interface for all boards
- > NIM, VME, Desktop, Mainframe
architectures support



Traditional electronics

CAEN offers a wide selection of **Traditional Electronics** in **NIM** and **VME** form factors and crates

- Discriminators
- Amplifiers
- Logic units
- Fan-in/Fan-out
- Scalers
- Peak Sensing ADC
- QDC
- TDC
- VME bridges
- **Pre-amplifiers**



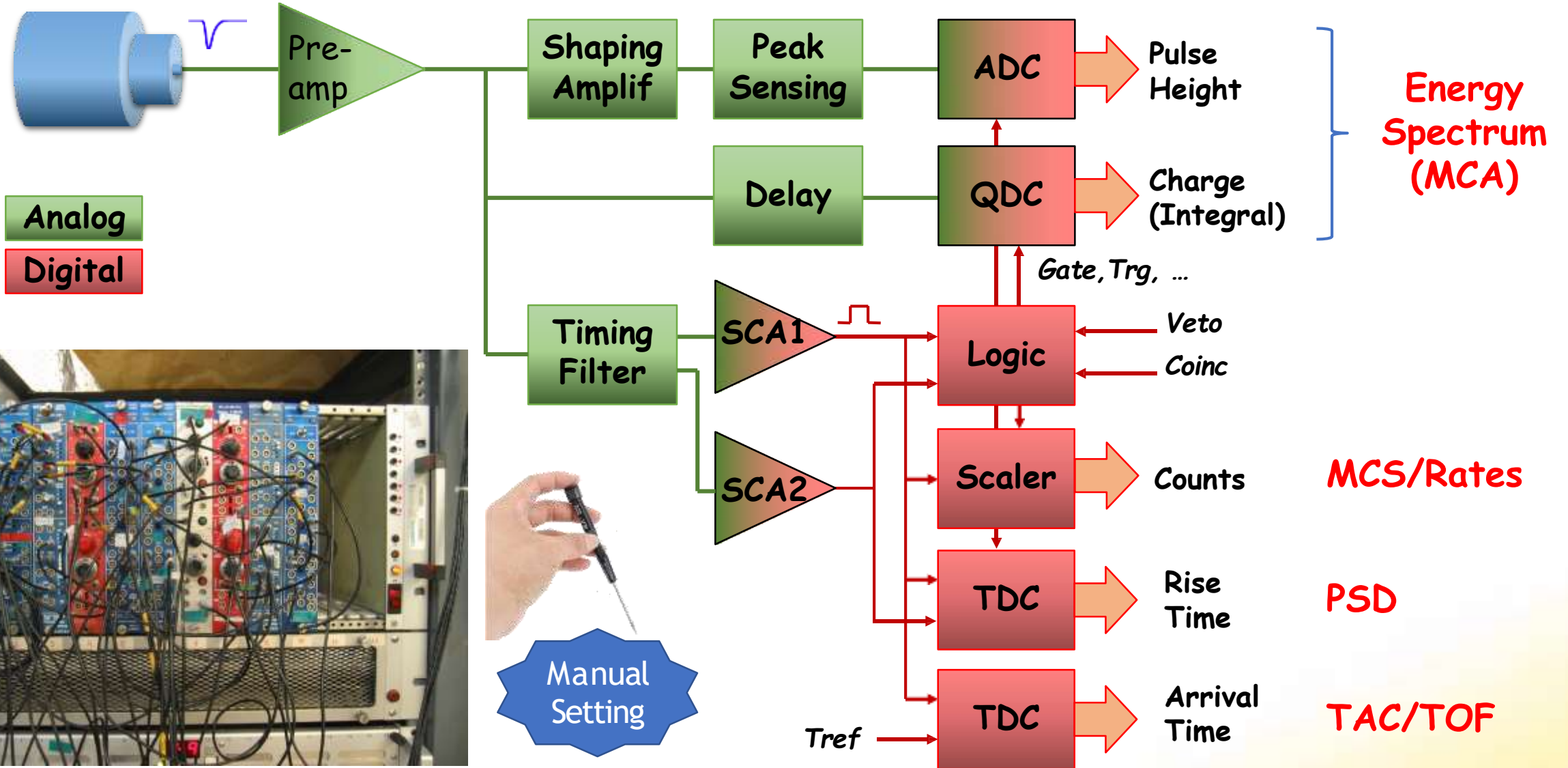


Traditional readout system

Detector

Many analog
modules and cables

A/D conversion
at end of chain

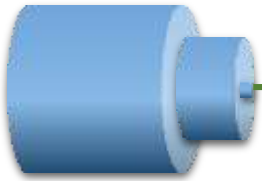


Digital Readout: all-in-one

FPGA



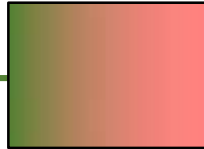
Detector



V

Pre-amp

early A/D conversion



streaming
01100101

Shaping

BLR

Peak Sensing

PHA

Energy Spectrum (MCA)

Delay

BLR

Integral

QDC

Double Integral

Fast/Slow

PSD

Timing Filter

Discr

Logic

Gate, Veto and Coincidences

Scaler

Counts

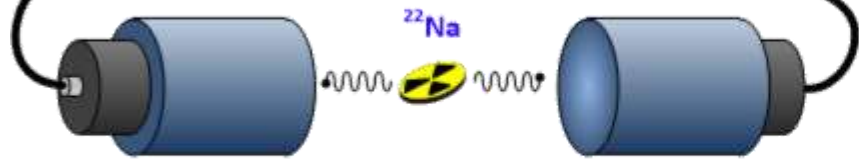
MCS/ICR

Sync

TDC

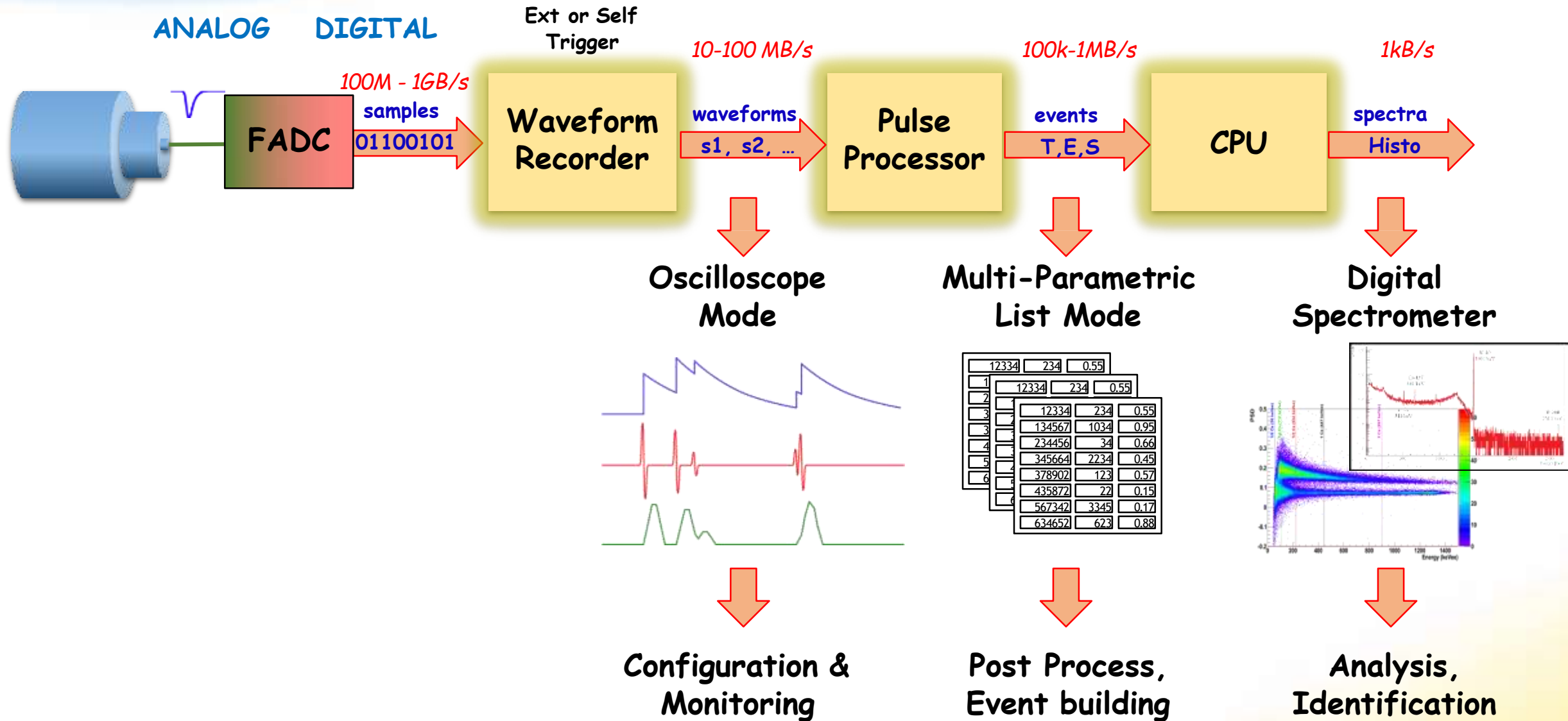
Time

TAC/TOF



Software Setting

Digital Acquisition Chain



Tabletop



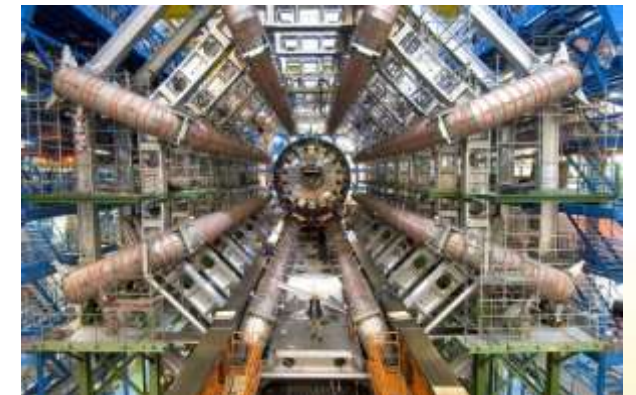
1-10 ch.

Mini-Crates



10-100 ch.

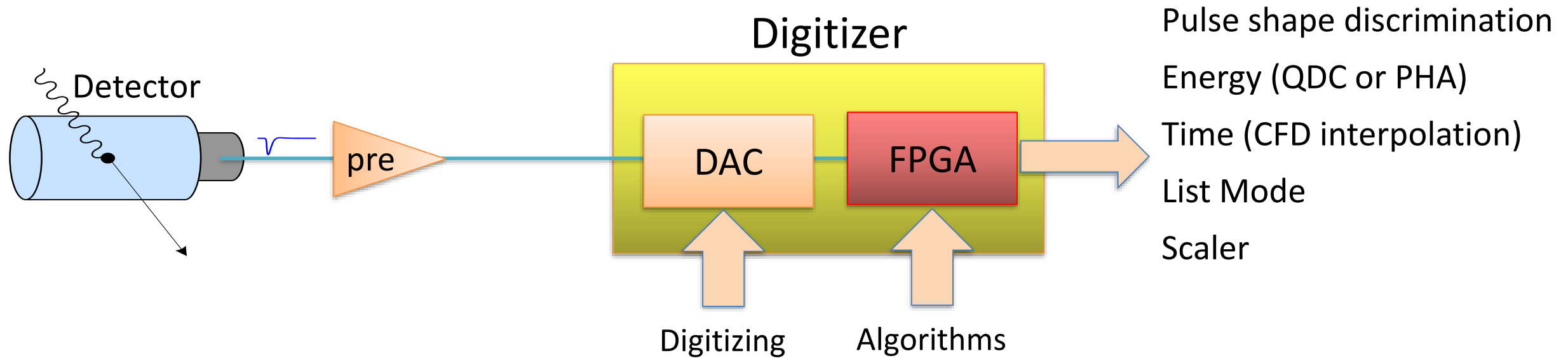
Crates / Racks



100-10000 ch.

MODEL ⁽¹⁾	Form Factor	# channels	Sampling Frequency (MS/s)	# Bits	Input Dynamic Range (Vpp)	Bandwidth (MHz)	Memory (Msample/ch) <i>Record Lenght</i>		DPP firmware ⁽⁴⁾
							small	big	
x724	VME	8	100	14	0.5 - 2.25 - 10	40	0.5	4	PHA
	Desktop/NIM	4					500μs	4ms	
x720	VME	8	250	12	2	125	1.25	10	CI, PSD
	Desktop/NIM	4					5ms	40ms	
x730	VME	16	500	14	0.5 and 2 ⁽⁵⁾	250	1.25	10	PHA, PSD ⁽⁶⁾
	Desktop/NIM	8					250μs	2ms	
x725	VME	16	250	14	0.5 and 2 ⁽⁵⁾	125	1.25	10	PHA, PSD ⁽⁶⁾
	Desktop/NIM	8					500μs	4ms	
x731	VME	8/4	500/1000	8	2	250/500	2/4		-
	Desktop/NIM	4/2					2ms		
x751	VME	8	1000/2000	10	1	500	1.8/3.6	14.4/28.8	PSD, ZLE
	Desktop/NIM	4					1.8ms	14.4ms	
x761	VME	2	4000	10	1	1000	7.2	57.6	-
	Desktop/NIM	1					1.8ms	14.4ms	
x740	VME	64	62.5	12	2 - 10	30	0.19	1.5	QDC
	Desktop/NIM	32					3ms	24ms	
x742	VME	32+2	5000 ⁽²⁾	12	1	600	0.128 ⁽³⁾		-
	Desktop/NIM	16+1					200ns		
x743	VME	16	3200 ⁽²⁾	12	2.5	500	0.003 ⁽⁷⁾		CM
	Desktop/NIM	8					640ns		

Benefits of the digital approach



Aim of the Digital Pulse Processing (DPP) – is to obtain «fully digital» analogue modules: shaping amplifiers. Discriminators, QDC, DAC, TDC, Scalers, coincidence/anti-coincidence/veto modules etc...

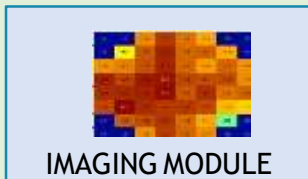
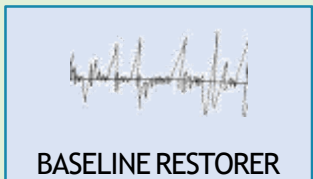
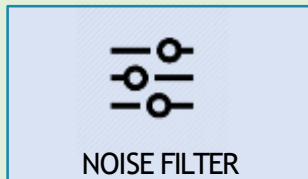
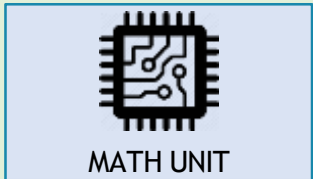
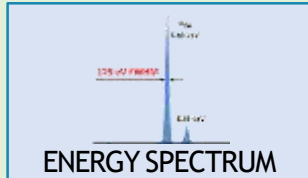
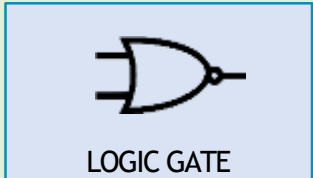
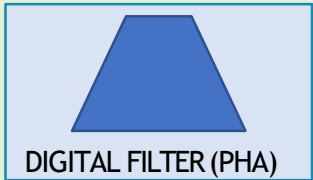
CAEN DT5550 / DT5550SE

Fully programmable digitizer

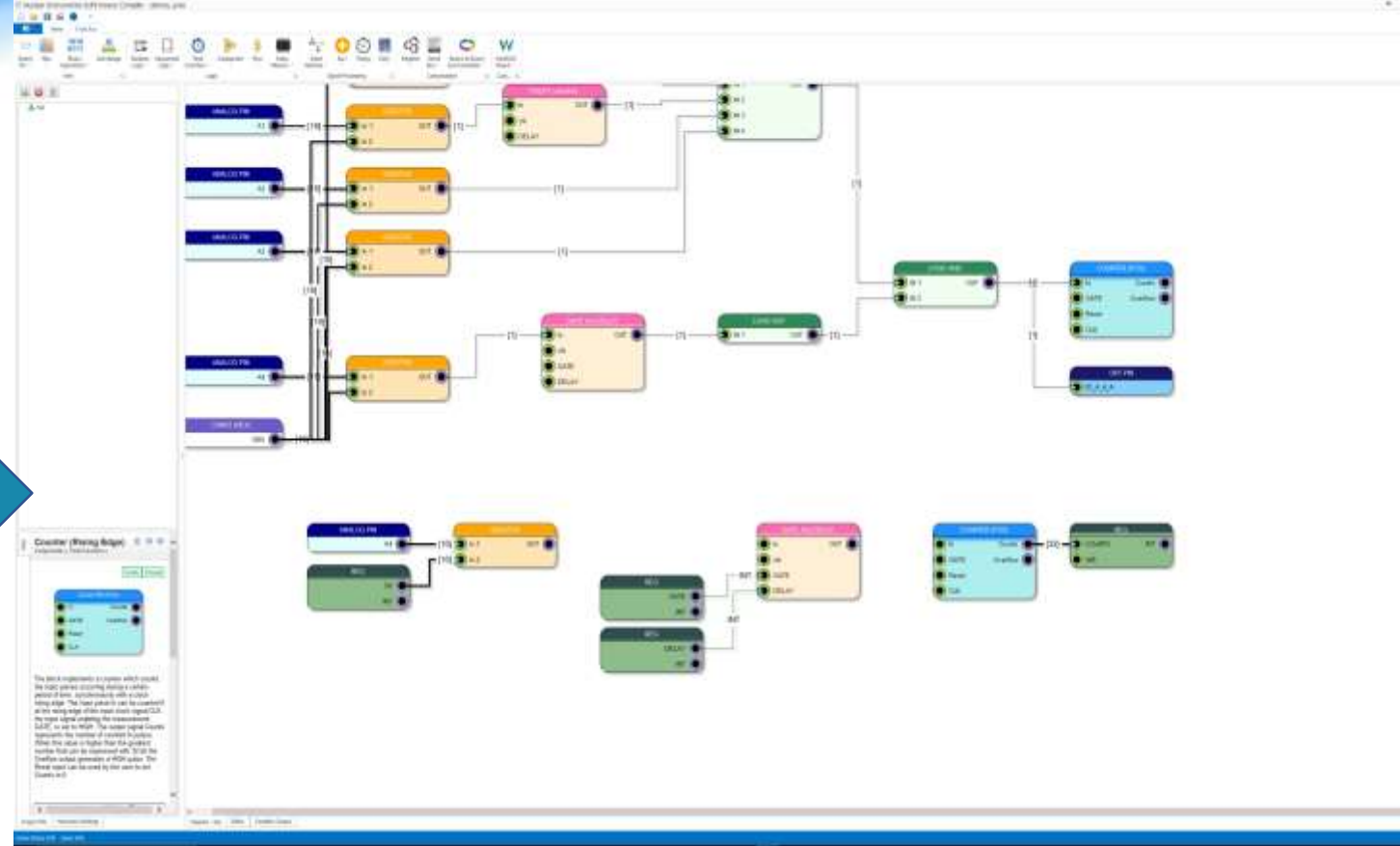
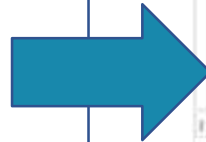


- 32 analog independent channels
- 80 MSPS, 14 bit ADC
- More than 90 digital I/O (CMOS/LVDS)
- Digital LEMO connector on back
- Digitizer, Charge Integration and PHA
- Fast USB3 connection
- AFE: 32 single ended input channels





> 120 virtual instruments



FIRMWARE



Automatic C-code
generation

Drivers, library's,
software



CITIROC 1A

Scientific instrumentation SiPM read-out chip

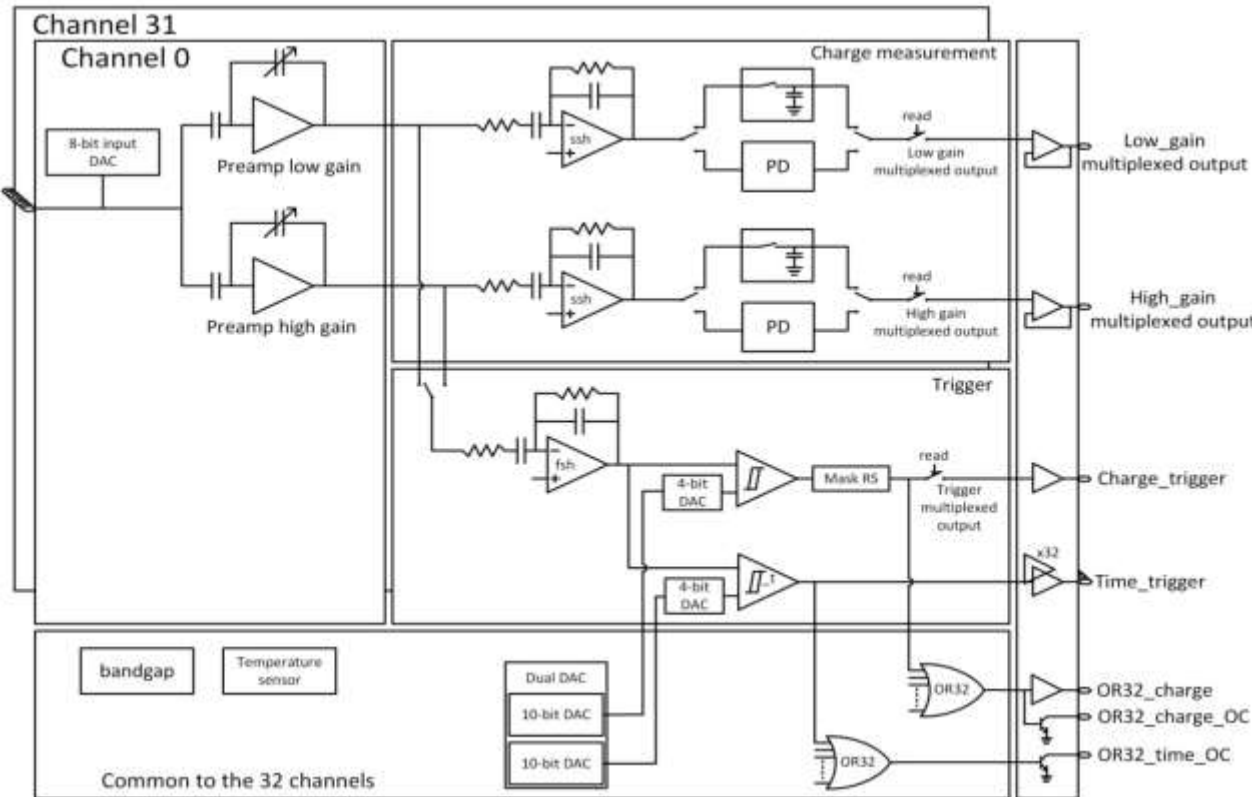


weeroc

High-end Microelectronics Design

CITIROC 1A

Scientific instrumentation SiPM read-out chip

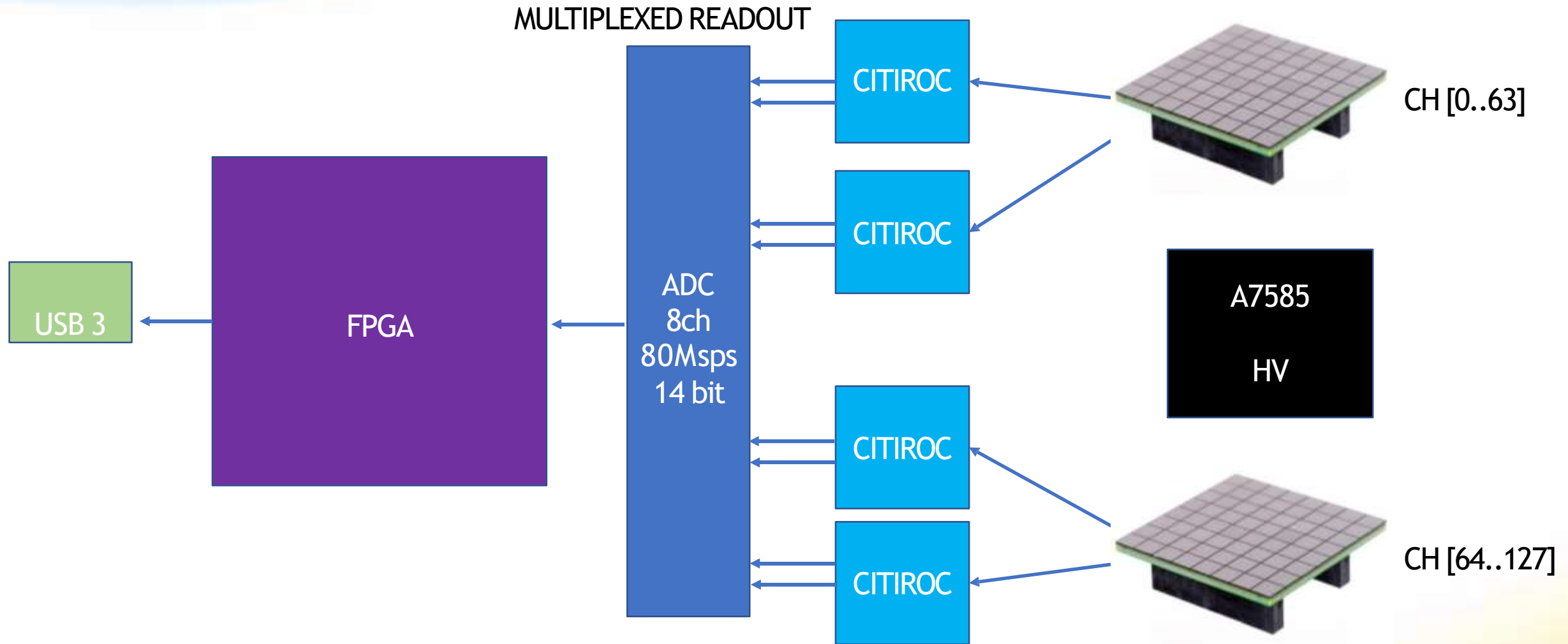


weeroc

High-end Microelectronics Design

Detector Read-Out	SiPM, SiPM array
Number of Channels	32
Signal Polarity	Positive
Sensitivity	Trigger on 1/3 of photo-electron
Timing Resolution	100 ps RMS on single photo-electron
Dynamic Range	0-400 pC i.e. 2500 photo-electrons @ 10^6 SiPM gain
Packaging & Dimension	LQFP 160 – TFBGA353

DT5550^W: ASIC based DAS



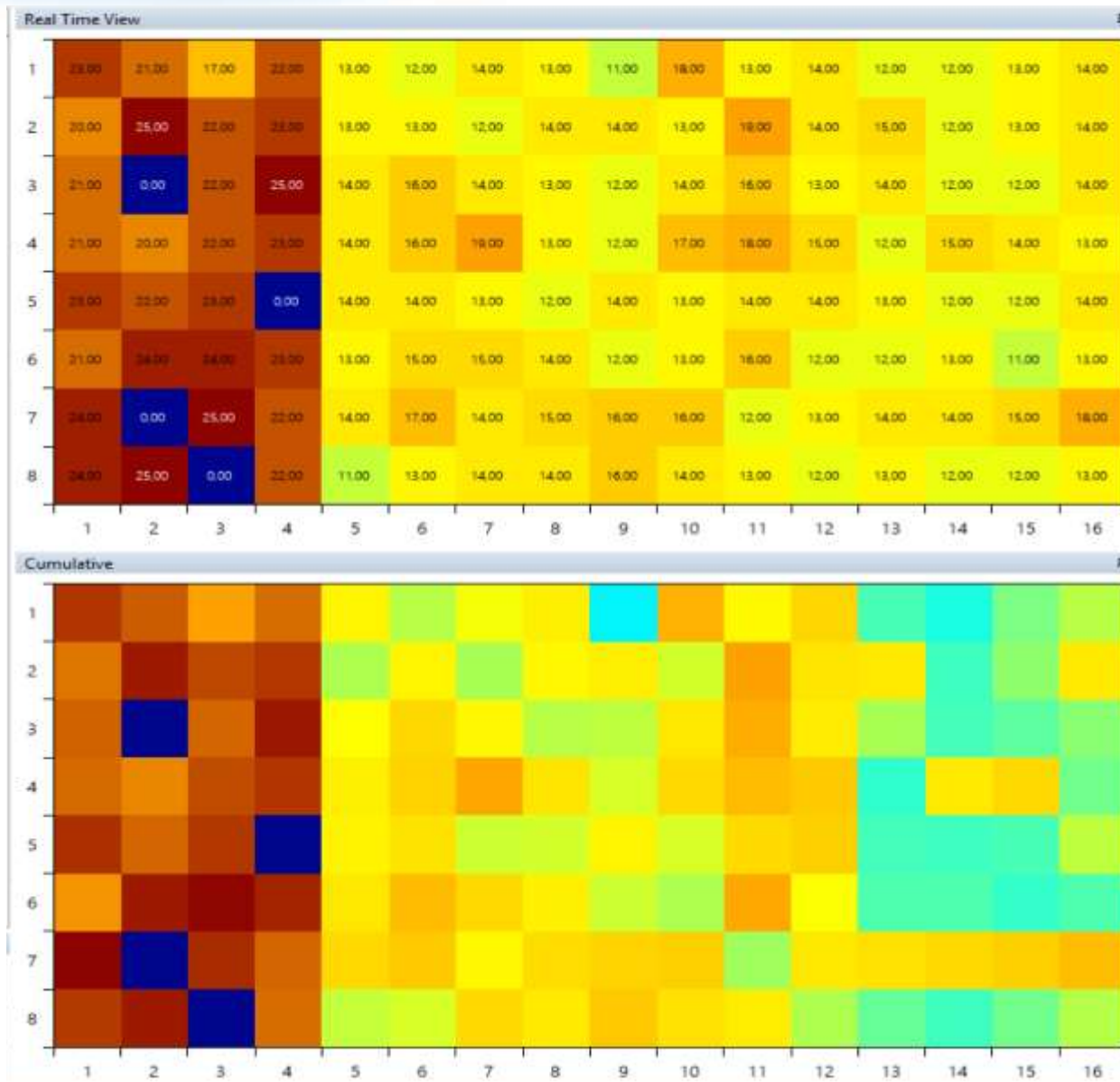
DESIGNED TO READOUT MULTIPLEXED-OUT ASIC

I.E.: A SINGLE DT5550 CAN READOUT 32 CITIROC
FOR A TOTAL OF 1024 SiPM DETECTOR

Provide Bias to SiPM between 20 and 85V 10mA
individually regulable

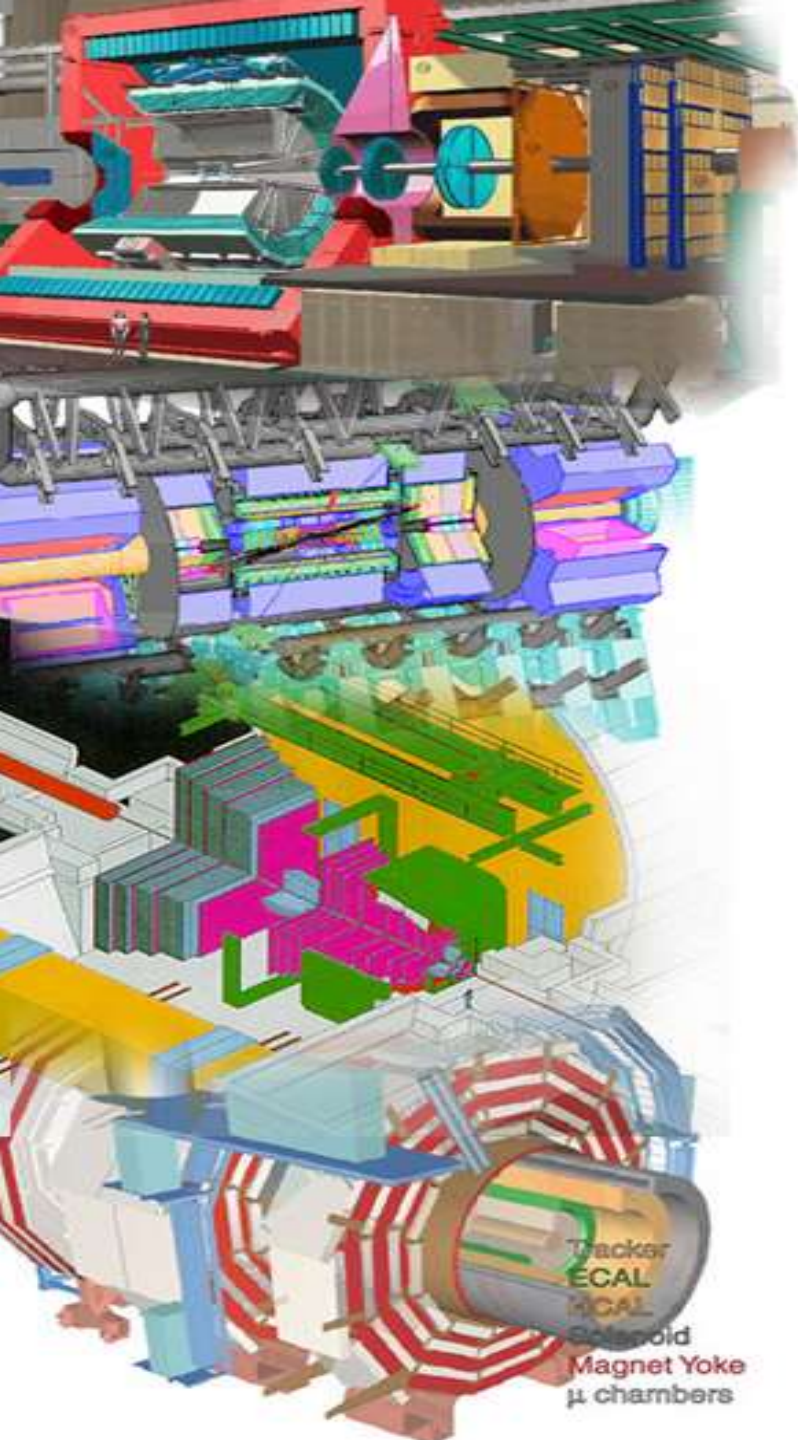
Simultaneous readout of 128 channels in low and high gain mode

DT5550W :ASIC based DAS



- Configure ASIC parameters
- List mode output (channel/time/energy)
- Imaging
- Hit per channels
- Energy Spectrum
- Time of flight spectrum
- Channel remapping in order to be used with any shape detector
- Export all results as data files or images

Direct compatible with a ready-to-use Hama matrix 8x8 Detector



We are open for a new projects!



If you don't find the Product you need in our Catalog, or if you are starting a new experiment and require a completely new design,
CAEN will help you at any stage of your project.



GAMMATECH

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