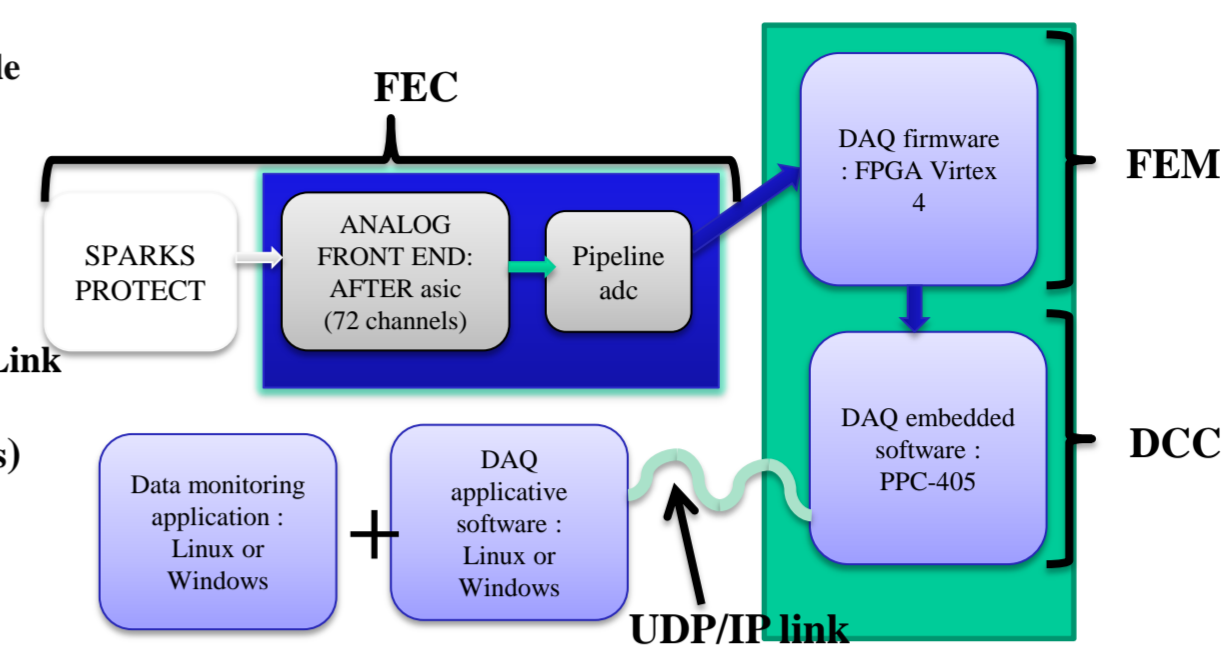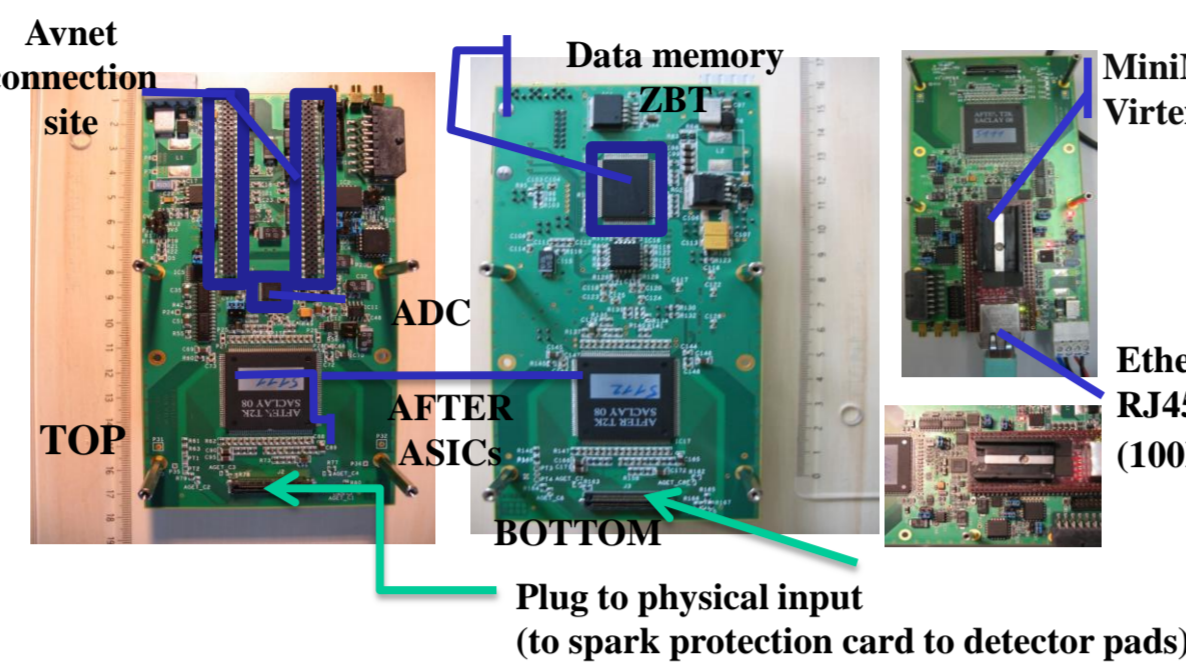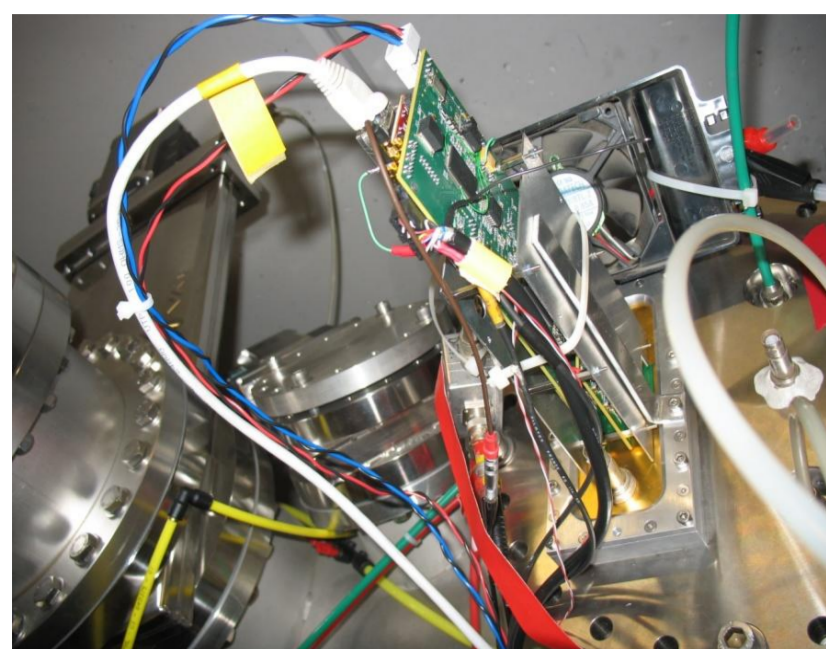# A Multi-Channel Complete Data Acquisition system for solid state and gaseous detector

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AFTER-SED : a 144-Channel Data Acquisition system

AFTER-SED in situ (GANIL Beam)

- Based on the T2K280m electronic system
- External board for sparks protection (3 schematics available).
- External Trigger and generator inputs.
- Use in gaseous detector development for beam tracking
- Use for futur Super Spectrometer at GANIL
- Use for solid state detector development

MODULE 144 Channel

- 2x AFTER Asic with 72 channels (4 gains, 16 shaping time values, 512 cells analog memory.)
- AD9229 pipeline ADC (120Mbit/s)
- AVNET minimodule (Xilinx virtex 4 FX12 + SRAM + Ethernet link (100Mbit/s)
- Jtag firmware and software programming
- CENTRUM Time Stamping system (GANIL)
- *70 mW/channel (10W)*

DaqT2K & DATA MONITORING

2 Softwares developped for controlling and monitoring the acquired data :
- DaqT2K.exe using Qt framework (TrollTech) and CompoundConfig (configuration manager developped by IRFU) based on C++ language.
- FEMSTUC_DATA_DISPLAY to visualize events and to analyse noise contribution, baseline calibration and data meaning. It is developped in Java with JFreeChart package for data display.
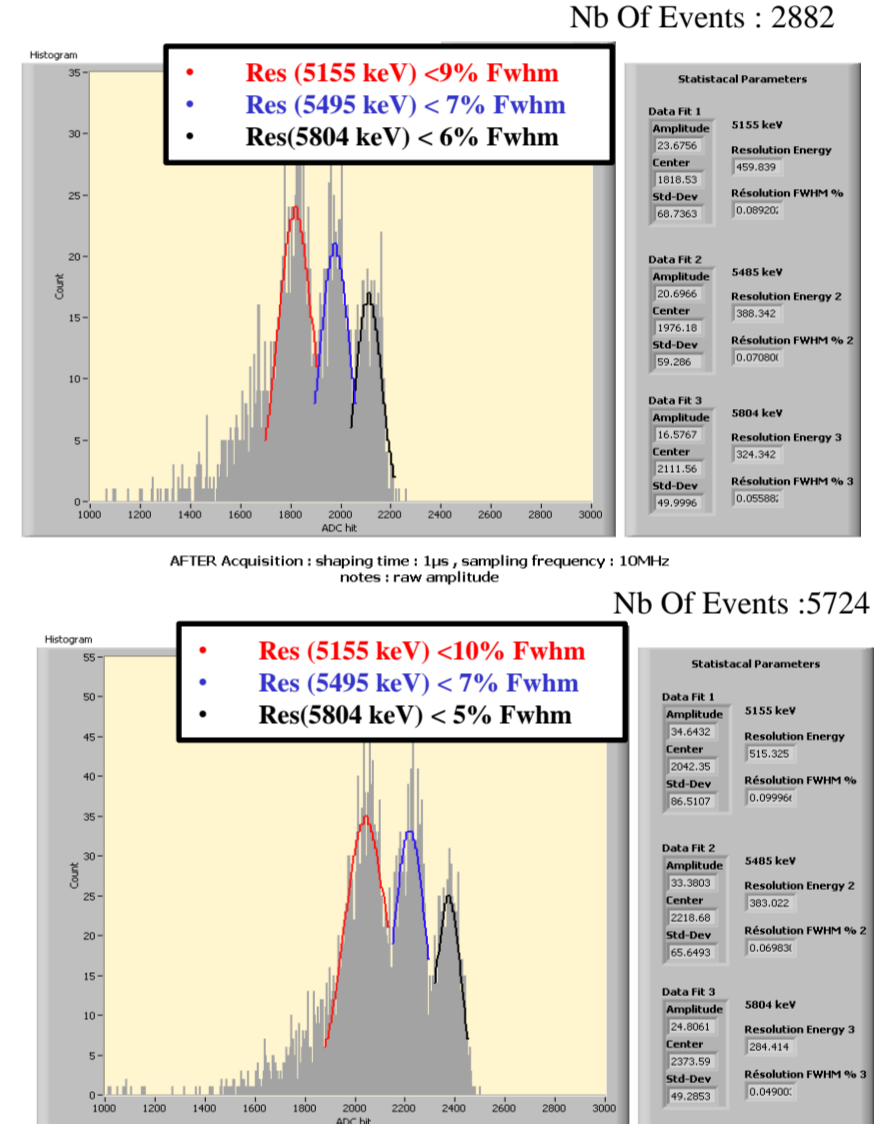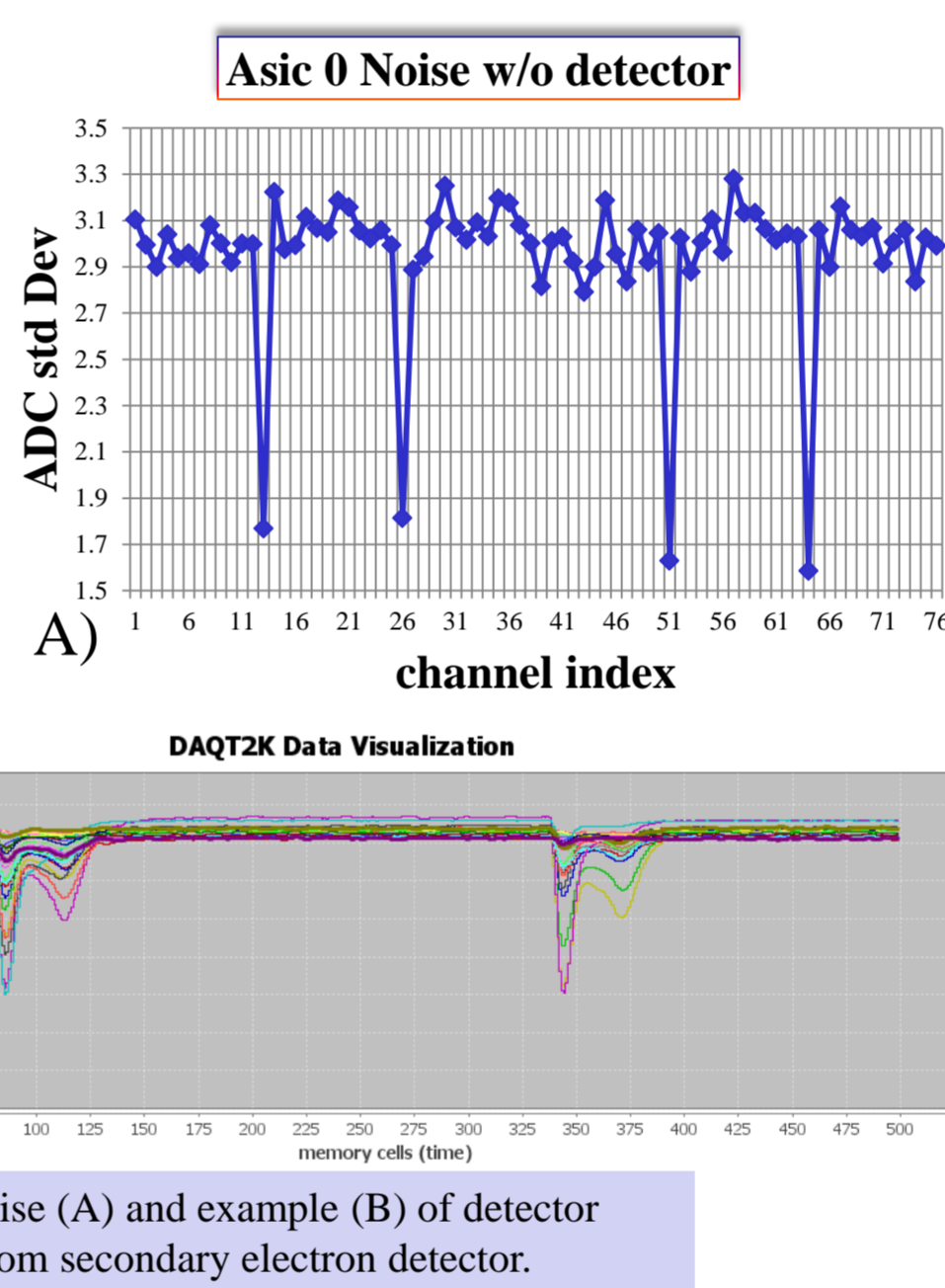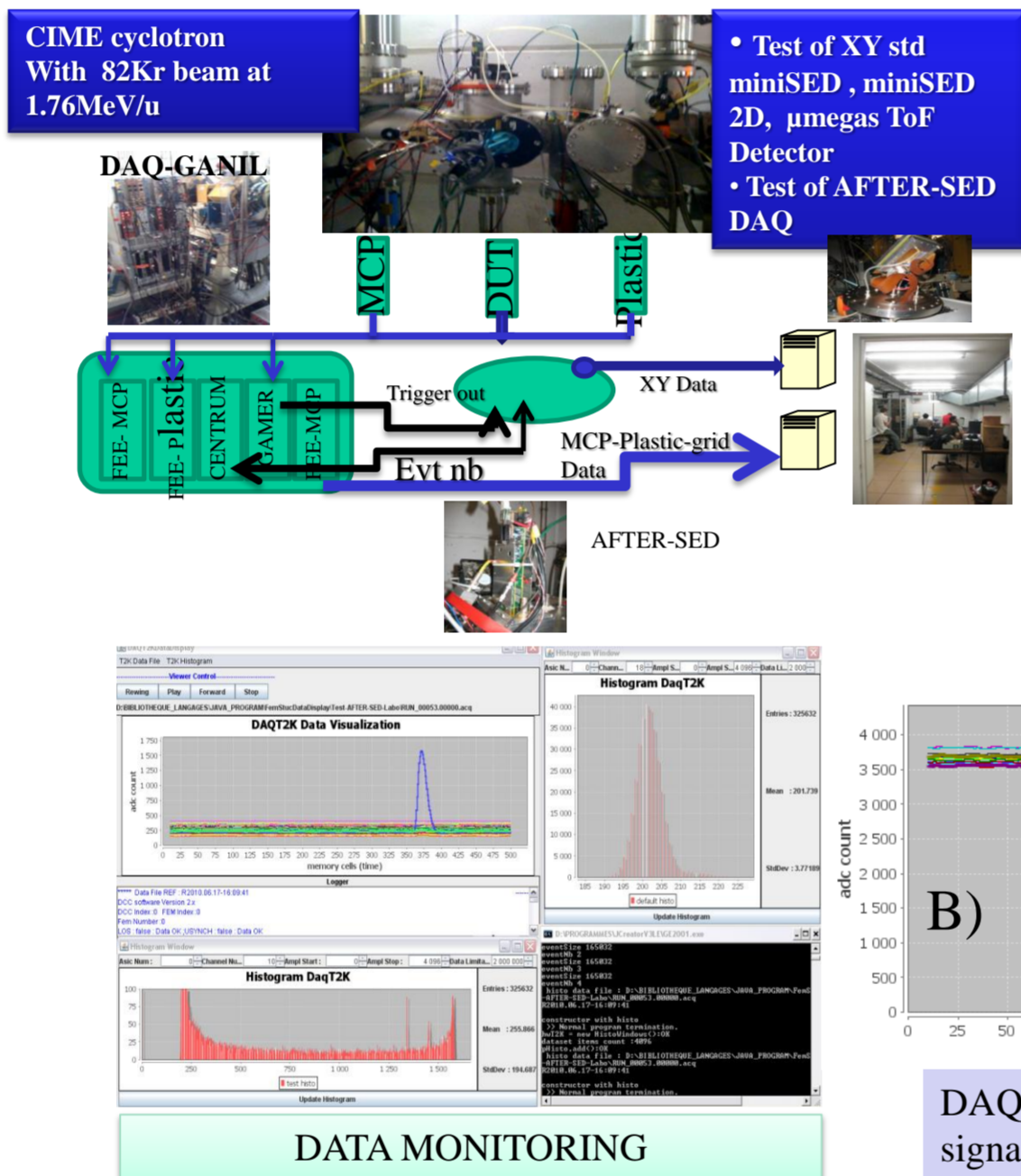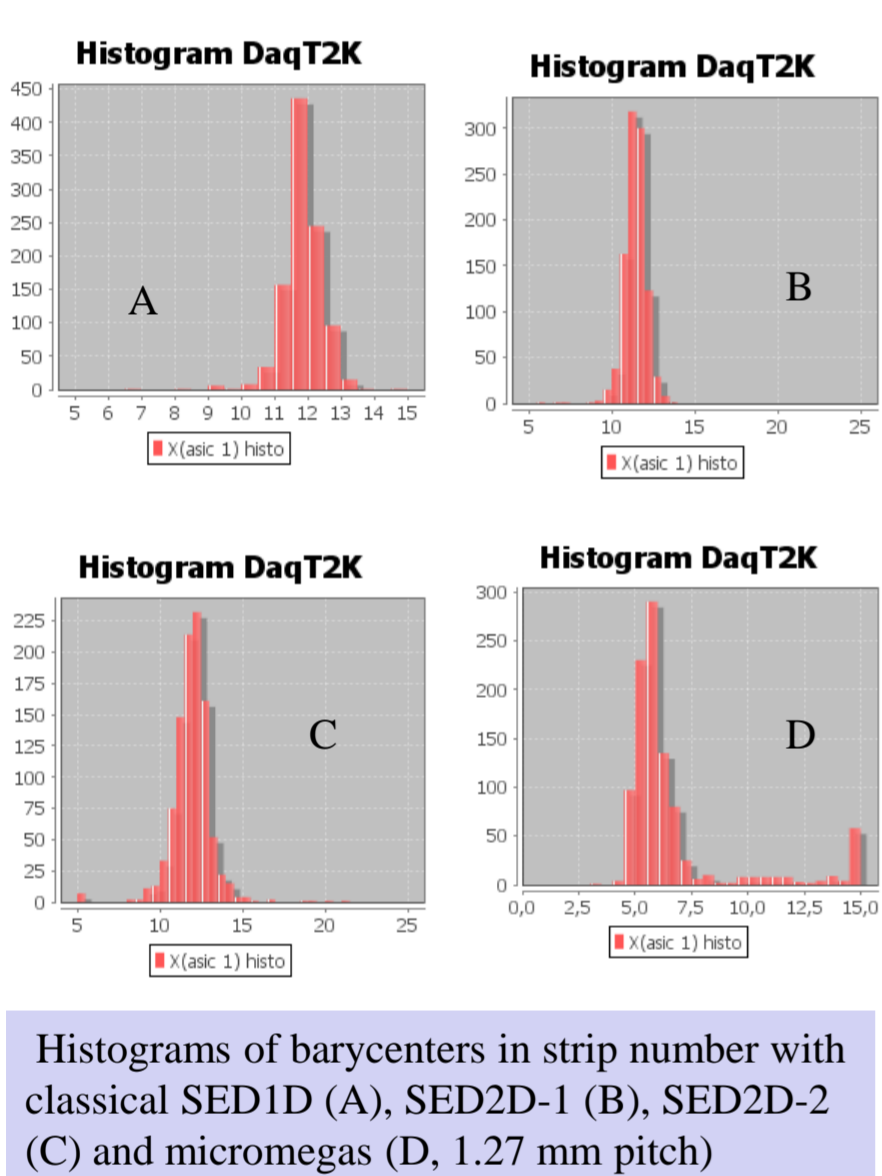
Results

Histograms of barycenters in strip number with classical SED1D (A), SED2D-1 (B), SED2D-2 (C) and micromegas (D, 1.27 mm pitch)

DATA MONITORING

DAQ noise (A) and example (B) of detector signal from secondary electron detector.

AFTER-SED FOR SOLID STATE DETECTOR R&D (FIRST RESULTS):
- 3-PEAK SOURCE IN AIR, HALF-DEPLETED DETECTOR
- RESOLUTION < 10% (NO OPTIMIZATION)

AFTER-SED: RESULTS OF THE IN-BEAM TESTS OF SECONDARY ELECTRONS DETECTORS ON CIME AT GANIL

Colonne1	SED1D	SED2D-1	SED2D-2	µmega
dead layer+drift gaps	1.2+1.6+1.6	0+0.8+1.6	0+3.2+1.6	0+2.3
FWHM [mm] LC	3.5	3.3	4.9	1.9
FWHM [mm] HC	4.4	3.5	7.3	*

AGET-SED : a 128-Channel Data Acquisition system

AGET: 64 channel with shaper, discriminator and analog sampler (1MHz to 100MHz)
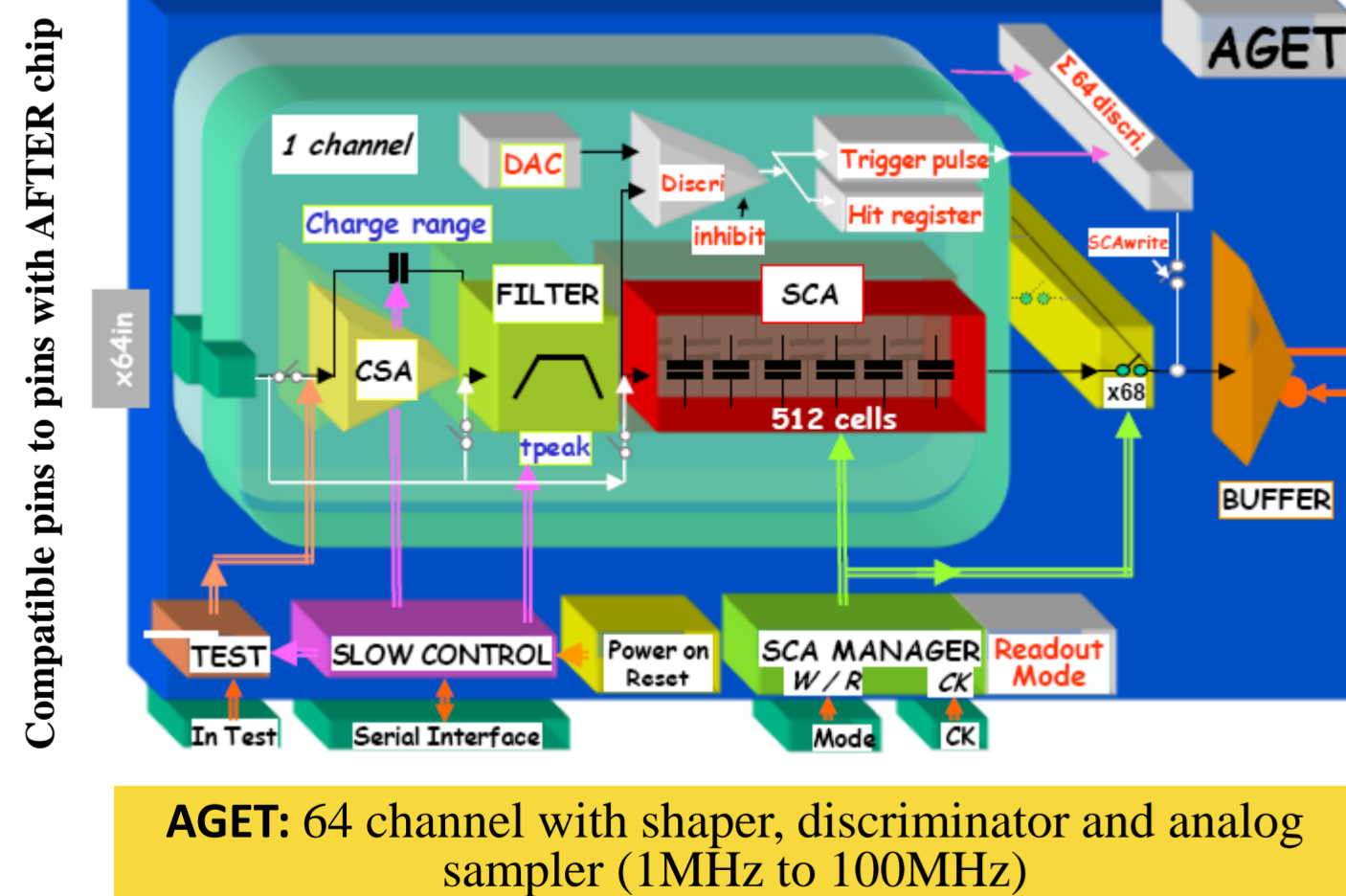
- 4 Gains (120fc to 10 FC)
- 16 shaping time values (50ns to 1 µs).
- 512 sampling memory cells (2MHz to 100 MHz sampling clock).
- Could split memory in two equal part.
- 3 Readout Mode : all channels; hit channels only; selected specifics channels.
- 2 polarity available for wired chamber or gems/µmegas detector.
- *Could by pass PAC and shaper*
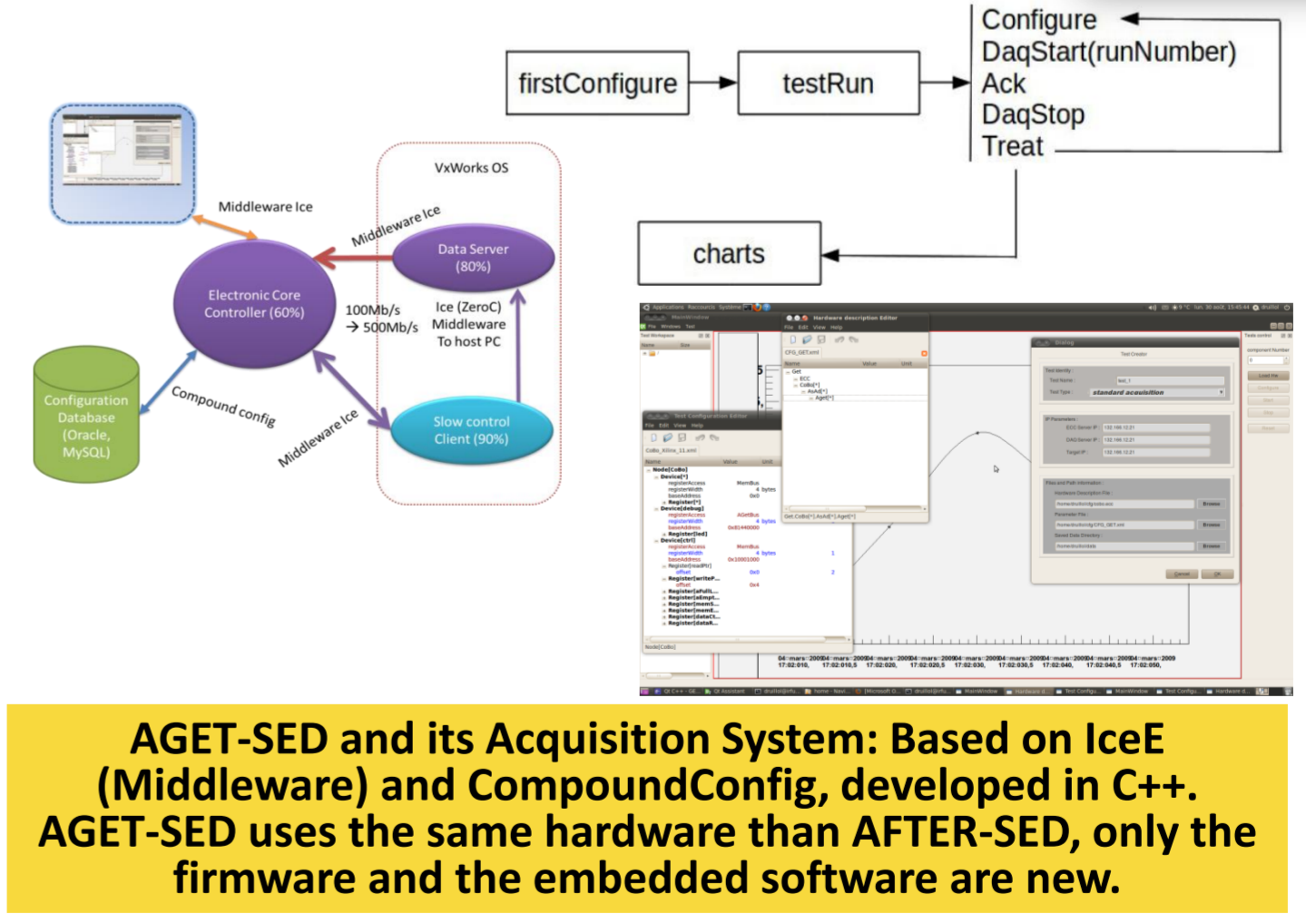
AGET-SED and its Acquisition System: Based on IceE (Middleware) and CompoundConfig, developed in C++. AGET-SED uses the same hardware than AFTER-SED, only the firmware and the embedded software are new.

Functional test results (Preliminary)
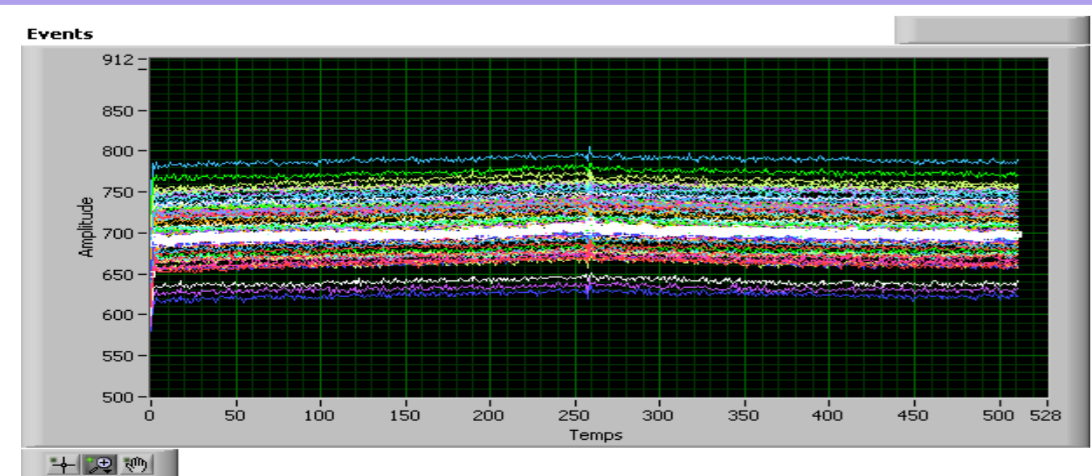
AGET: 64 base lines. We could notice the shape, proof of the double memory function. The noise level is arout 2.4 ADC bin rms(12 bits ADC).
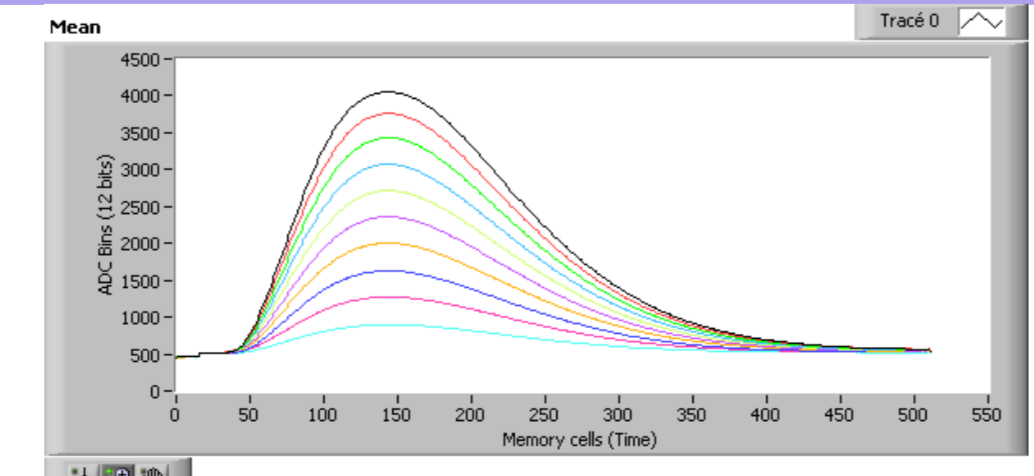
AGET: Injection on channel 3 of different pulse amplitude.
- Gain : 120fC linearity (1µs)   < 0.7%
- Gain : 120 fC linearity (200 ns) < 0.5%

CONCLUSION: A fully compact system based on AFTER circuit is operational for instrument. It has been use for gaseous detector R&D.

A new system is under development to improve the dead Time .
It is based on a new ASIC, AGET and a new software architecture based on Qt framework and IceE middleware.
The compact system (128 channels) will be used for r&d ans S3 project. A bigger system, called GET, will be used for TPC readout in nuclear physics experiment.

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