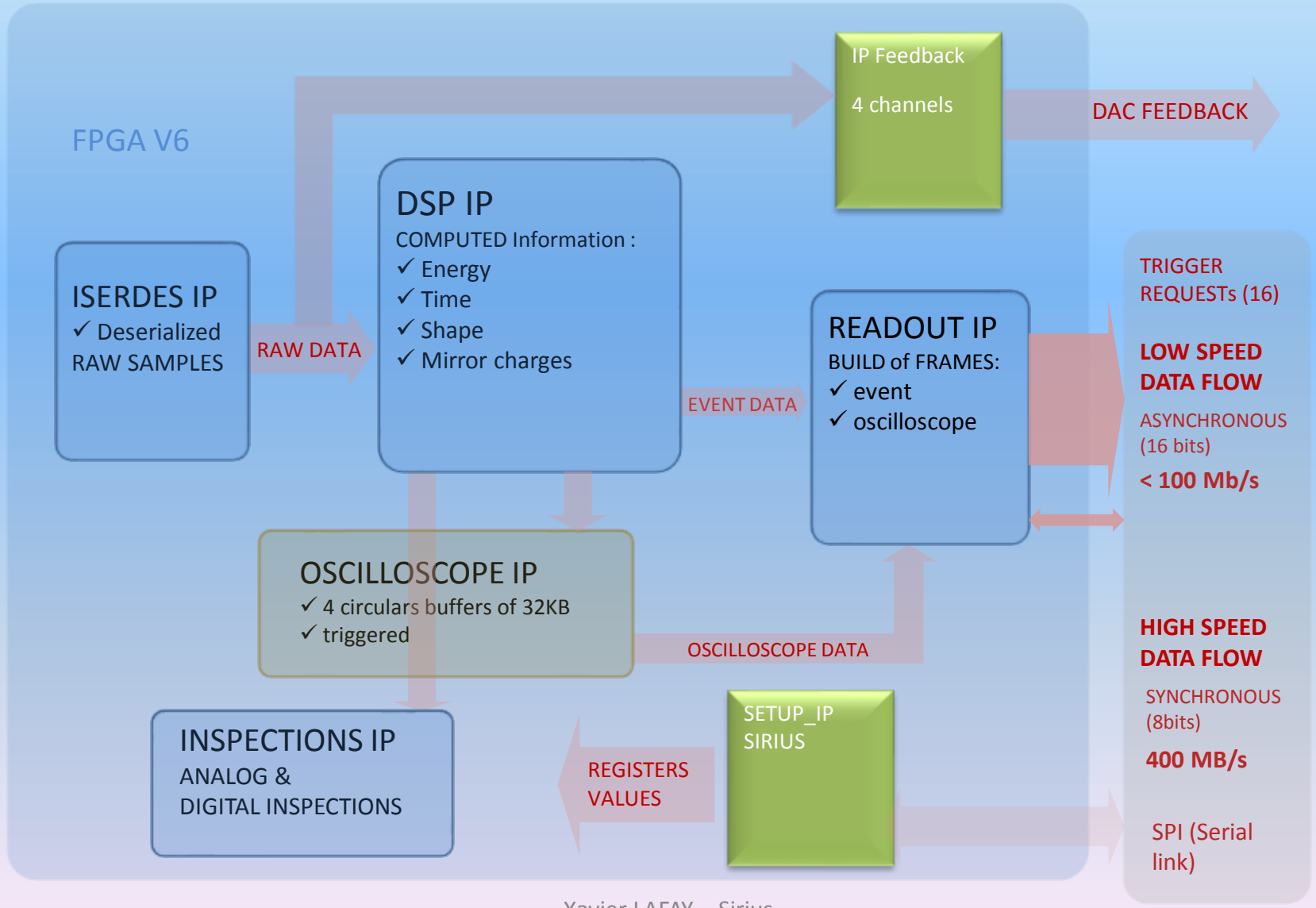
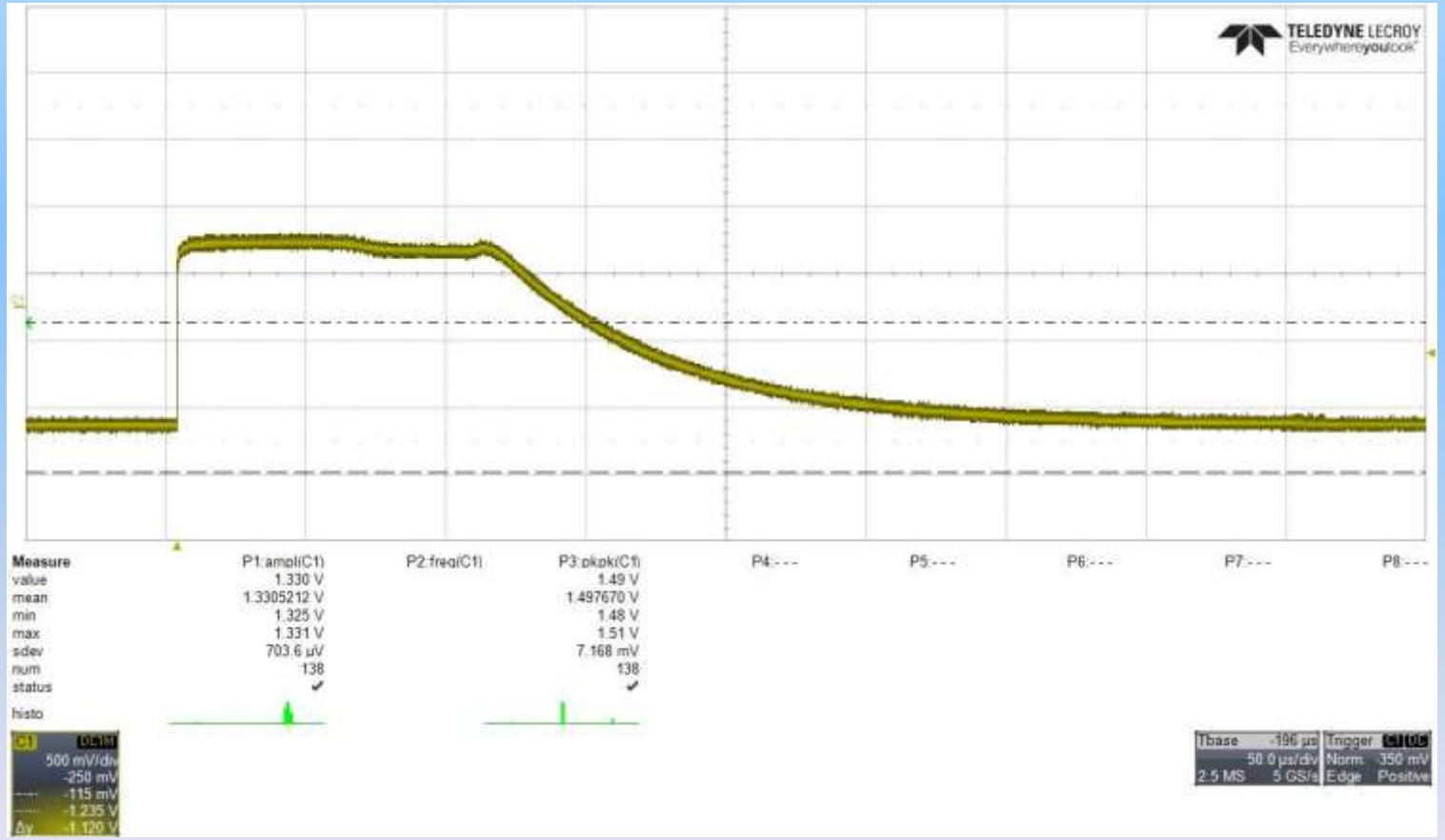
Firmware tunnel

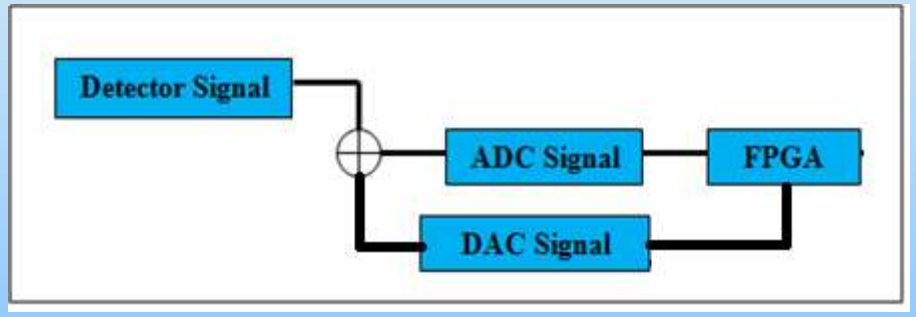
Firmware numexo2 + ADC_feedback

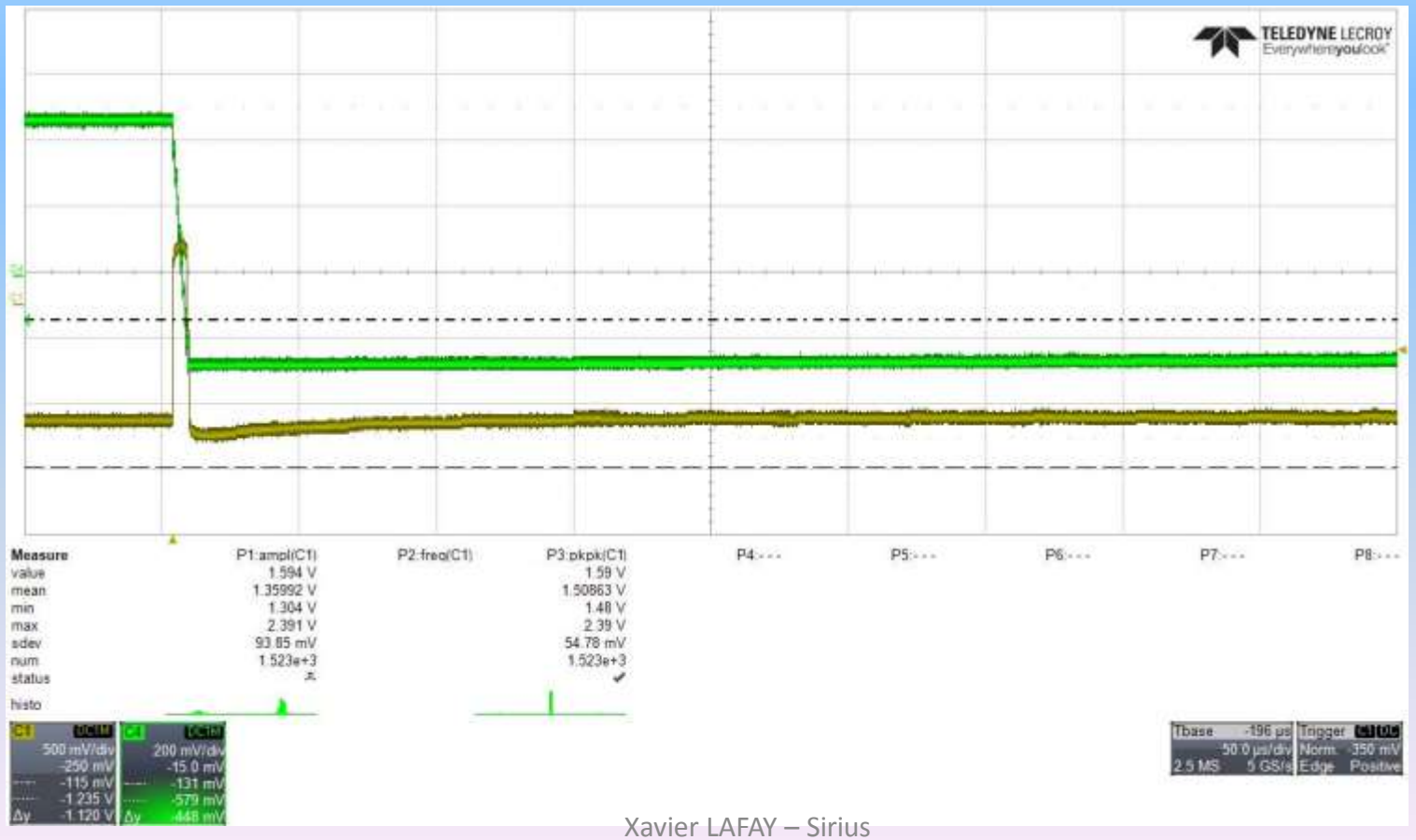
Firmware modifications



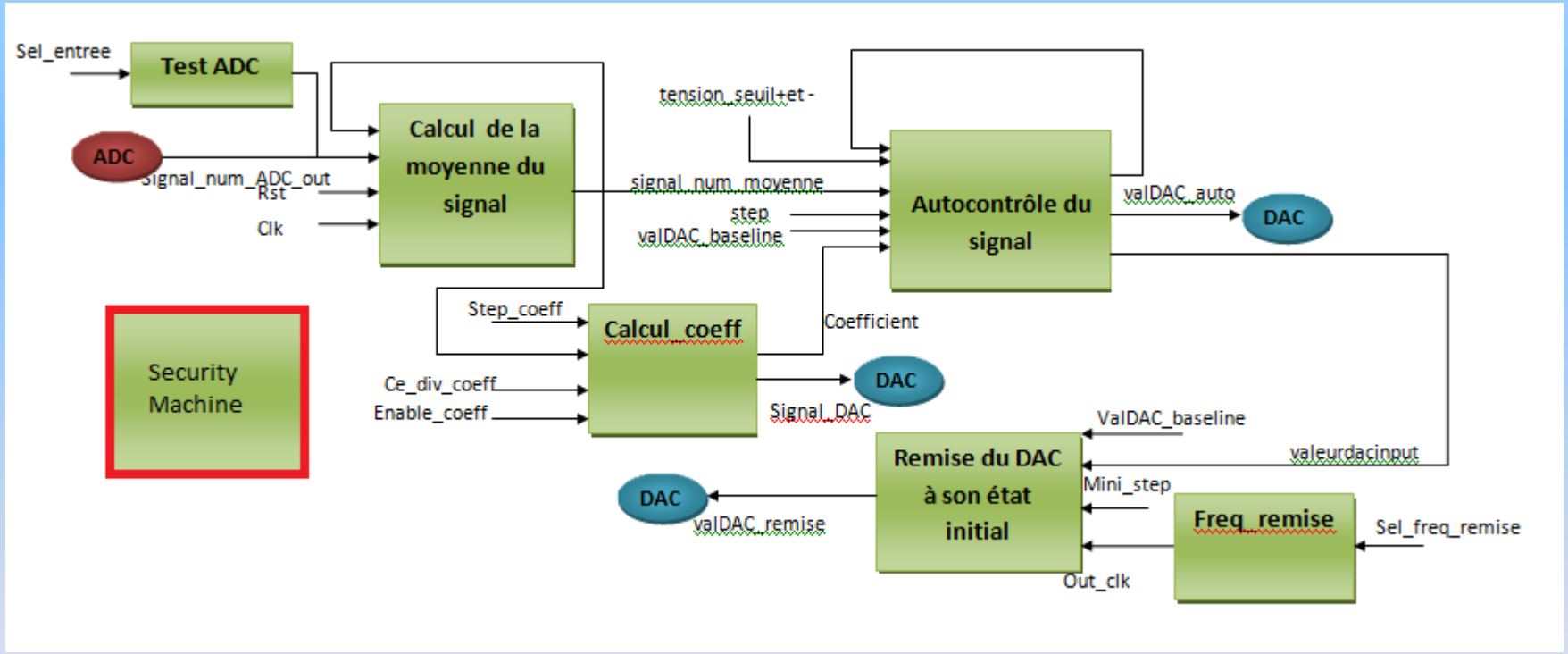
IP feedback


TELEDYNE LECROY
Everywhereyoulook
Measure
value
mean
min
max
sdev
num
status
histo
P1:ampl(C1)
1.330 V
1.3305212 V
1.325 V
1.331 V
703.6 µV
138
P2:freq(C1)
P3:pkpk(C1)
1.49 V
1.497670 V
1.48 V
1.51 V
7.168 mV
138
P4:---
P5:---
P6:---
P7:---
P8:---
C1
500 mV/div
-250 mV
-115 mV
-1.235 V
Δy -1.120 V
Tbase -196 µs
50.0 µs/div
2.5 MS 5 GS/s
Trigger
Norm 350 mV
Edge Positive


Detector Signal
ADC Signal
FPGA
DAC Signal

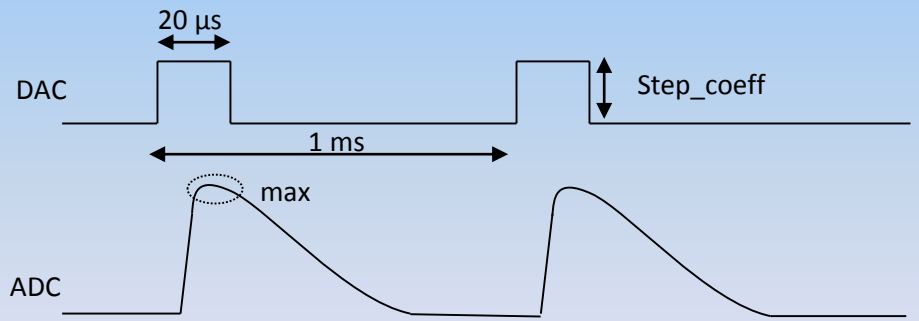

TELEDYNE LECROY
Everywhereyoulook
Measure
value
mean
min
max
sdev
num
status
histo
P1:ampl(C1)
1.594 V
1.35992 V
1.304 V
2.391 V
93.85 mV
1.523e+3
P2:freq(C1)
P3:pkpk(C1)
1.59 V
1.50863 V
1.48 V
2.39 V
54.78 mV
1.523e+3
P4:- - -
P5:- - -
P6:- - -
P7:- - -
P8:- - -
C1 DC1M
500 mV/div
-250 mV
-115 mV
-1.235 V
Δy -1.120 V
C2 DC1M
200 mV/div
-15.0 mV
-131 mV
-579 mV
Δy -448 mV
Tbase -196 µs
50.0 µs/div
2.5 MS 5 GS/s
Trigger C1 DC
Norm -350 mV
Edge Positive

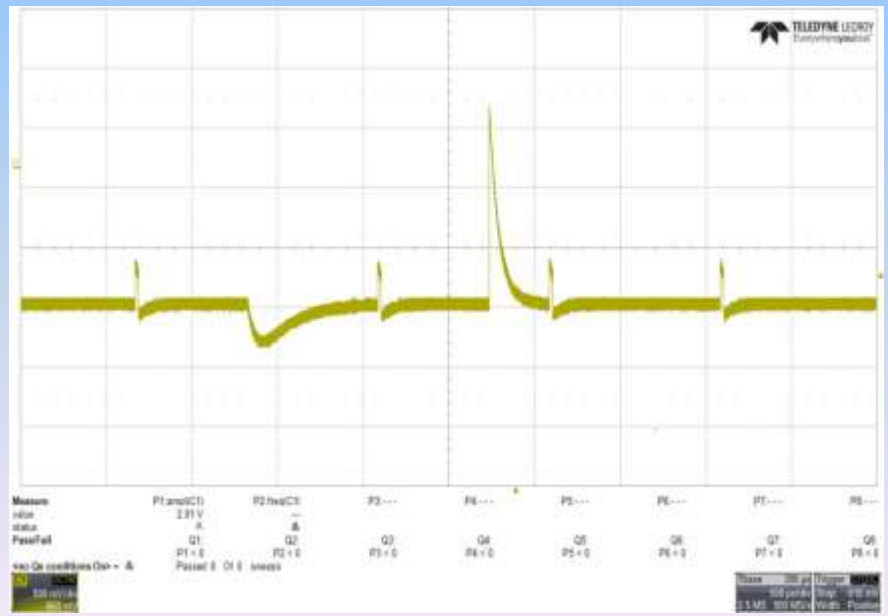
IP feedback


Sel_entree
Test ADC
ADC
Signal_num_ADC_out
Rst
Clk
Calcul de la moyenne du signal
tension_seuil+et -
signal_num_moyenne
step
valDAC_baseline
Autocontrôle du signal
valDAC_auto
DAC
Security Machine
Step_coeff
Calcul_coeff
Coefficient
Ce_div_coeff
Enable_coeff
DAC
Signal_DAC
ValDAC_baseline
valeurdacinput
Remise du DAC à son état initial
Mini_step
DAC
valDAC_remise
Freq_remise
Sel_freq_remise
Out_clk

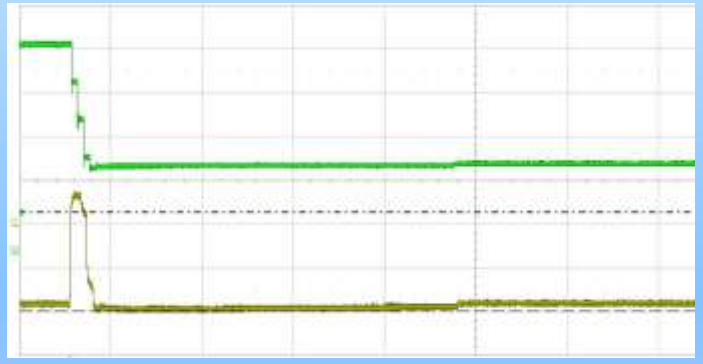
Calcul coeff

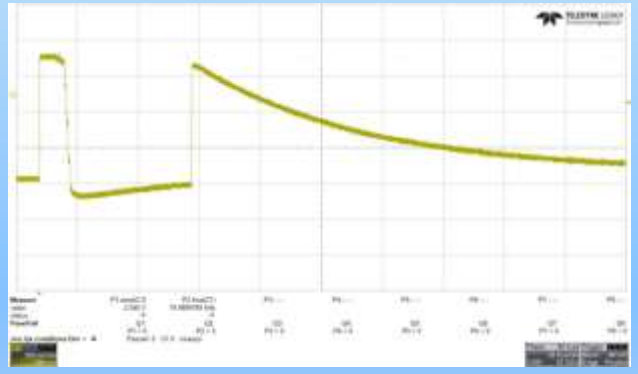
- 8192 step_coeff => 8192 max => moyenne_max
- Coeff = step_coeff / moyenne_max

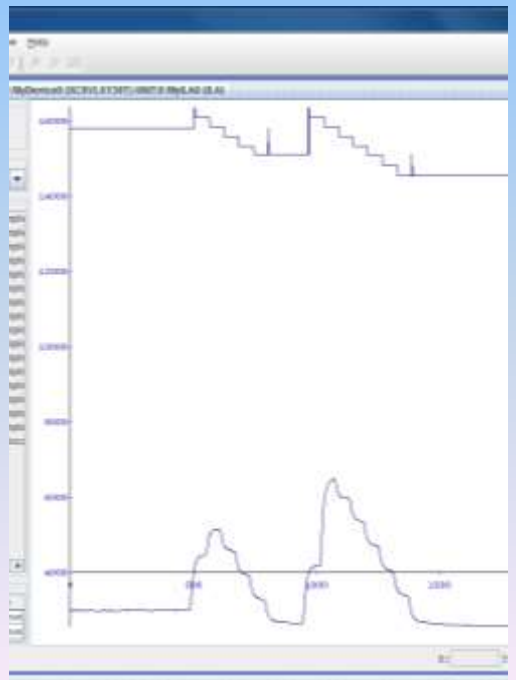


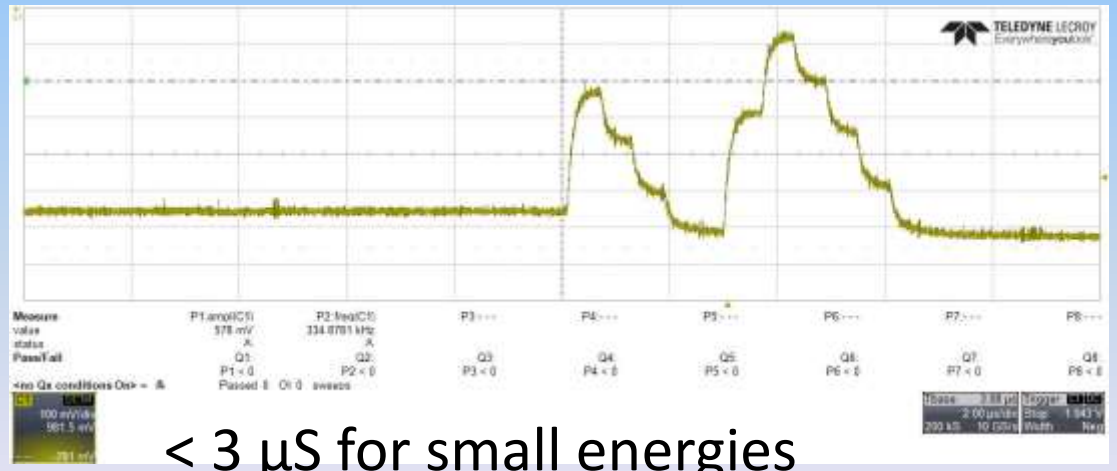


Remise du DAC à son état initiale





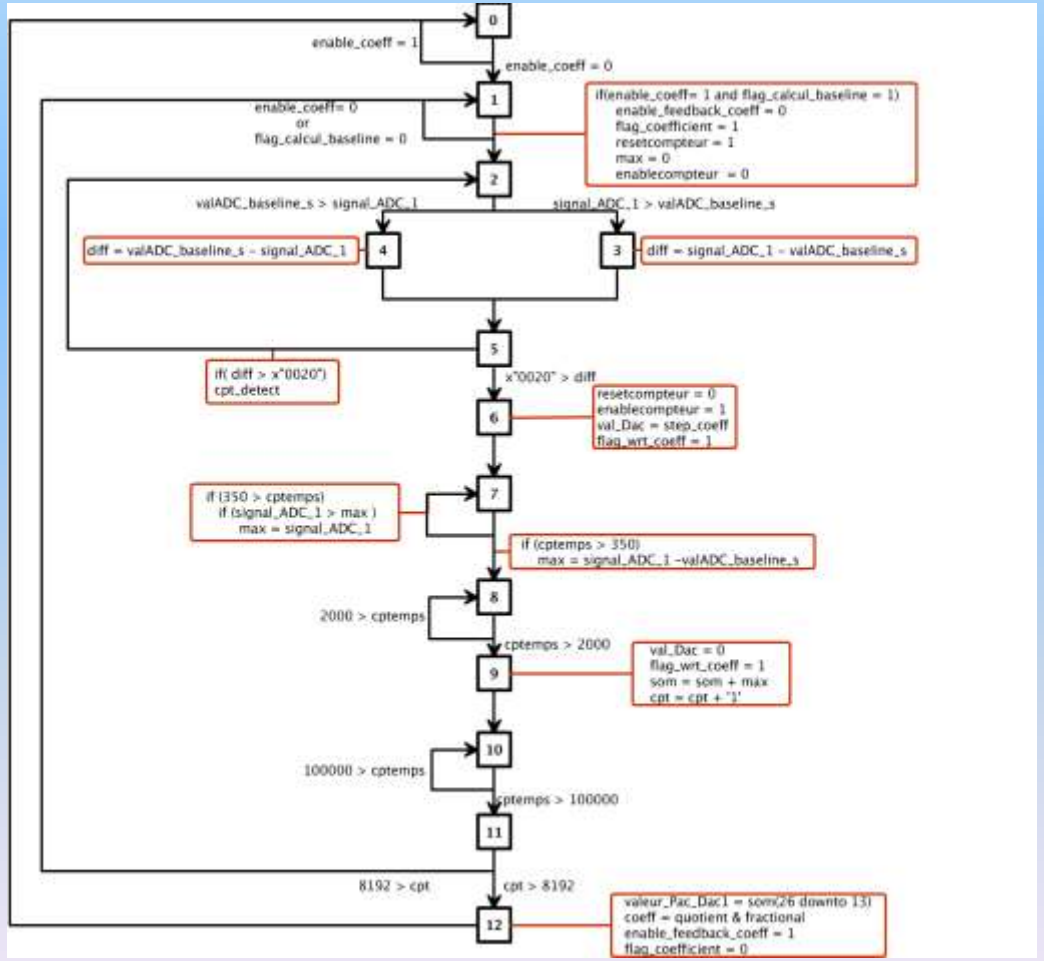


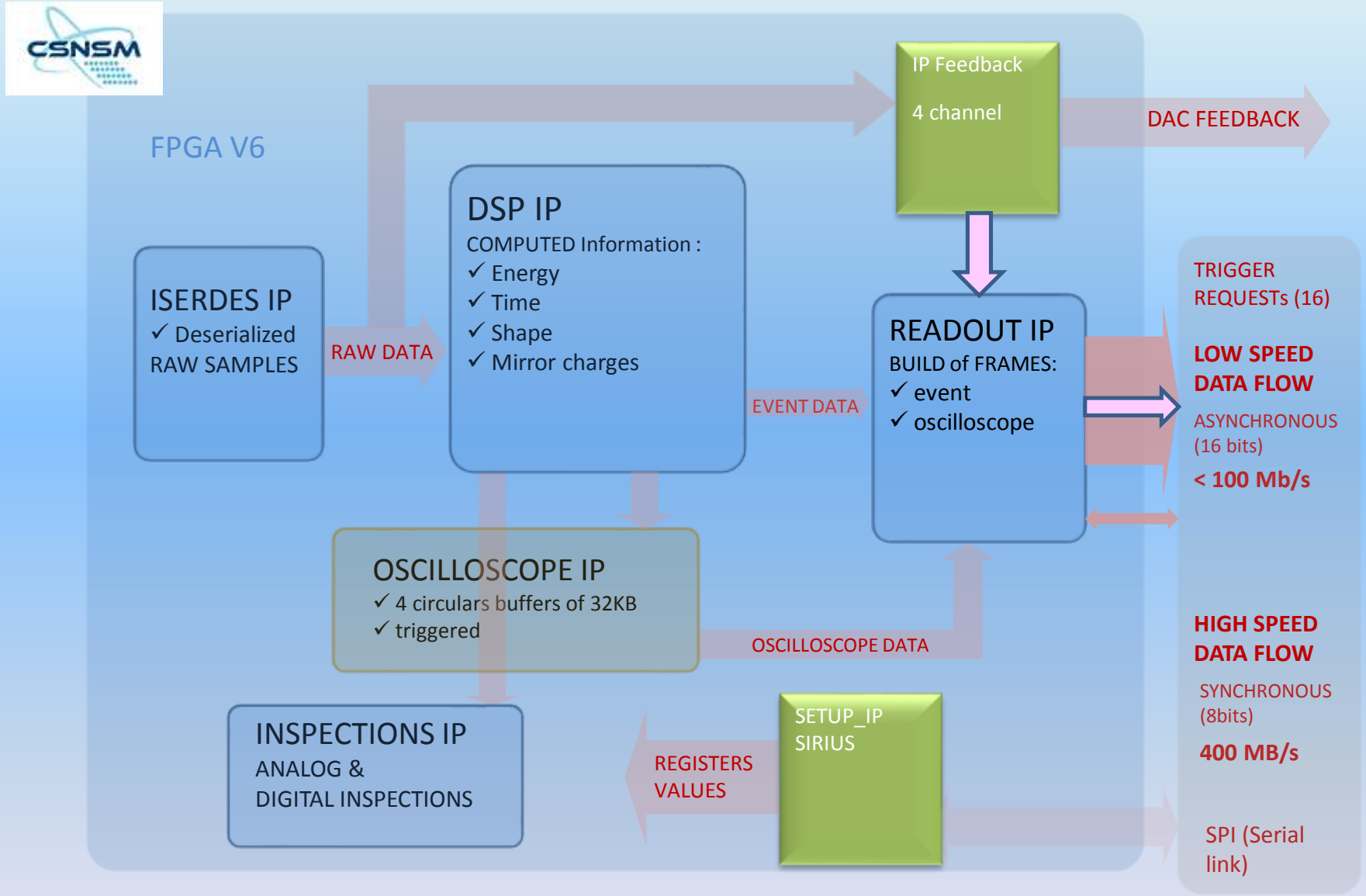


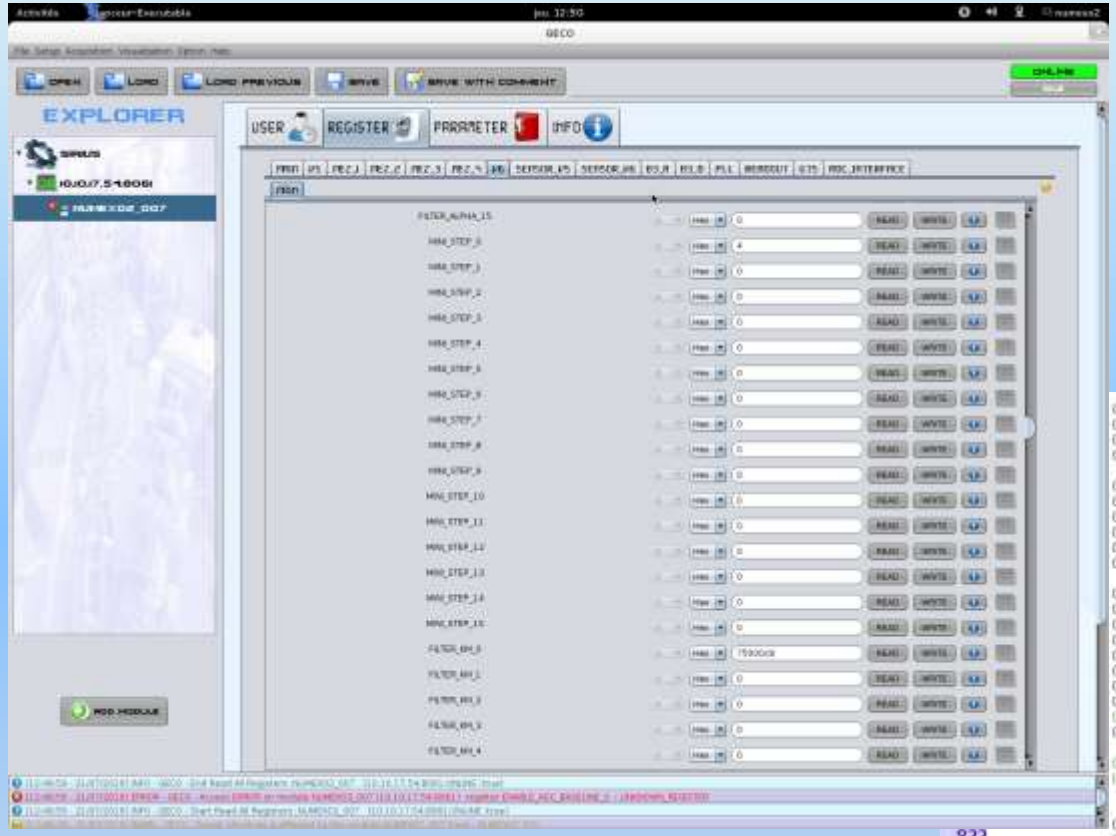
< 3 µS for small energies

< 10 µS for high energies

Security machine




FPGA V6
IP Feedback
4 channel
DAC FEEDBACK
DSP IP
COMPUTED Information :
✓ Energy
✓ Time
✓ Shape
✓ Mirror charges
ISERDES IP
✓ Deserialized
RAW SAMPLES
RAW DATA
EVENT DATA
READOUT IP
BUILD of FRAMES:
✓ event
✓ oscilloscope
TRIGGER
REQUESTs (16)
LOW SPEED
DATA FLOW
ASYNCHRONOUS
(16 bits)
< 100 Mb/s
OSCILLOSCOPE IP
✓ 4 circulars buffers of 32KB
✓ triggered
OSCILLOSCOPE DATA
HIGH SPEED
DATA FLOW
SYNCHRONOUS
(8bits)
400 MB/s
INSPECTIONS IP
ANALOG &
DIGITAL INSPECTIONS
SETUP_IP
SIRIUS
REGISTERS
VALUES
SPI (Serial
link)



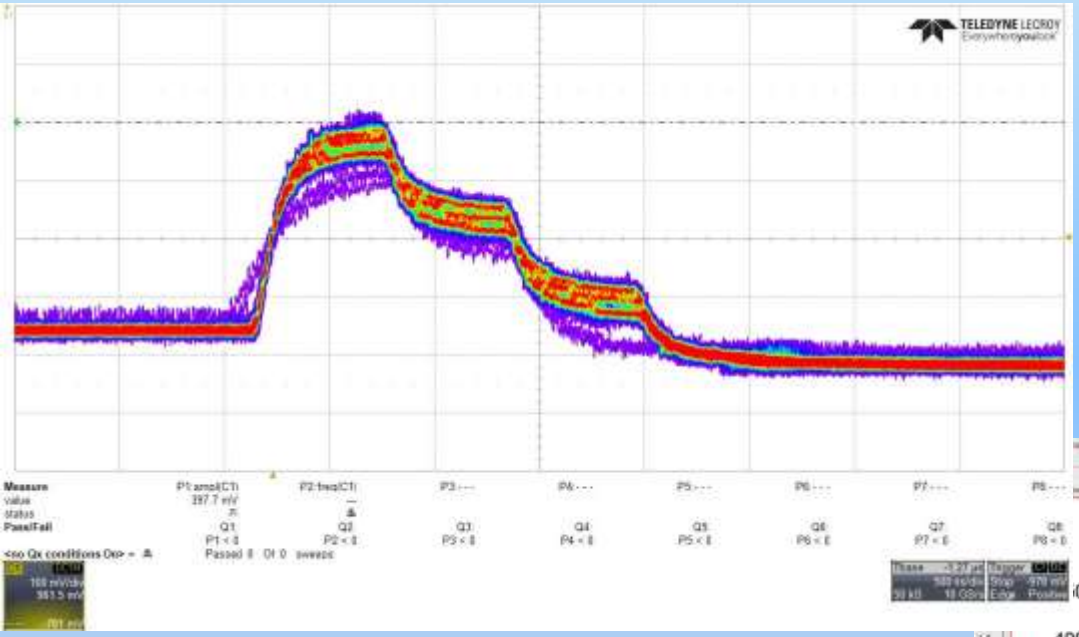

```
(15'h400):  data_spi_read = {16'd0,seuil_bgo_csi};
(15'h401):  data_spi_read = filtre_alpha_bgo_csi;
(15'h402):  data_spi_read = filtre_km_bgo_csi;
(15'h403):  data_spi_read = {16'd0,calcul_energie_bgo_csi};

(15'h500):  data_spi_read = {16'd0,inspec_num_1};
(15'h501):  data_spi_read = {16'd0,inspec_num_2};
(15'h502):  data_spi_read = {16'd0,inspec_num_3};
(15'h503):  data_spi_read = {16'd0,inspec_num_4};
(15'h504):  data_spi_read = {16'd0,inspec_analog_1};
(15'h505):  data_spi_read = {16'd0,inspec_analog_2};

(15'h600):  data_spi_read = {16'd0,voie_oscilloscope_1};
(15'h601):  data_spi_read = {16'd0,voie_oscilloscope_2};
(15'h602):  data_spi_read = {16'd0,voie_oscilloscope_3};
(15'h603):  data_spi_read = {16'd0,voie_oscilloscope_4};
(15'h604):  data_spi_read = {16'd0,pretrig_buffer_1};
(15'h605):  data_spi_read = {16'd0,pretrig_buffer_2};
(15'h606):  data_spi_read = {16'd0,pretrig_buffer_3};
(15'h607):  data_spi_read = {16'd0,pretrig_buffer_4};
(15'h608):  data_spi_read = {16'd0,VETUP_BUFFERS};
(15'h609):  data_spi_read = {16'd0,STATUS_OSCILLOSCOPE};

(15'h1000): data_spi_read = {12'd0,on_off_voies_comptages}; /// utilisé par le firmware de Charles et
(15'h1001): data_spi_read = {12'd0,raz_voies_comptages};


(15'h800): data_spi_read = config_tunnel_0_chan [70 : 55]; //trigger_threshold
(15'h801): data_spi_read = config_tunnel_0_chan[57 : 40]; //filter_alpha
(15'h802): data_spi_read = config_tunnel_0_chan[39 : 16]; // filter_km
(15'h803): data_spi_read = config_tunnel_0_chan[15 : 0]; //calcul_energie
(15'h804): data_spi_read = config_autocontrole_0_chan[1 : 0]; //sel_test
(15'h805): data_spi_read = config_autocontrole_0_chan[15 : 2]; //signal_constant
(15'h806): data_spi_read = config_autocontrole_0_chan[29 : 16]; //signal_rampe
(15'h807): data_spi_read = config_autocontrole_0_chan[30]; //sel_entree
(15'h808): data_spi_read = config_autocontrole_0_chan[31]; //cu_div_coeff
(15'h809): data_spi_read = config_autocontrole_0_chan[32]; //cu_div_auto
(15'h80a): data_spi_read = config_autocontrole_0_chan[46 : 33]; //step
(15'h80b): data_spi_read = config_autocontrole_0_chan[60 : 47]; //seuilh
(15'h80c): data_spi_read = config_autocontrole_0_chan[74 : 61]; //seuilp
(15'h80d): data_spi_read = config_autocontrole_0_chan[88 : 75]; //mini_step
(15'h80e): data_spi_read = config_autocontrole_0_chan[91 : 89]; //sel_freq_remise
(15'h80f): data_spi_read = config_autocontrole_0_chan[105 : 92]; //step_coeff
(15'h810): data_spi_read = config_autocontrole_0_chan[106]; //sel_tension
(15'h811): data_spi_read = config_autocontrole_0_chan[108 : 107]; //sel_clk
(15'h812): data_spi_read = config_autocontrole_0_chan[109]; //enable_coeff
(15'h813): data_spi_read = config_autocontrole_0_chan[123: 110]; //valDac_baseline
(15'h814): data_spi_read = config_autocontrole_0_chan[124]; //enable_autocoeff
(15'h815): data_spi_read = config_autocontrole_0_chan[125]; //select_coeff
(15'h816): data_spi_read = config_autocontrole_0_chan[139 : 126]; //coeff_reg
(15'h817): data_spi_read = config_autocontrole_0_chan[155 : 140]; //time_reg
(15'h818): data_spi_read = config_autocontrole_0_chan[169 : 156]; //valADC_baseline
//(15'h819): data_spi_read = config_autocontrole_0_chan[] //signal_sum_adc_out
(15'h81a): data_spi_read = config_autocontrole_0_chan[170]; //enable_correction
(15'h81b): data_spi_read = config_autocontrole_0_chan[171]; //enable_adc_baseline
(15'h81c): data_spi_read = config_autocontrole_0_chan[172]; //sel_adc_baseline
(15'h81d): data_spi_read = config_autocontrole_0_chan[177 : 173]; //registre_reset
```

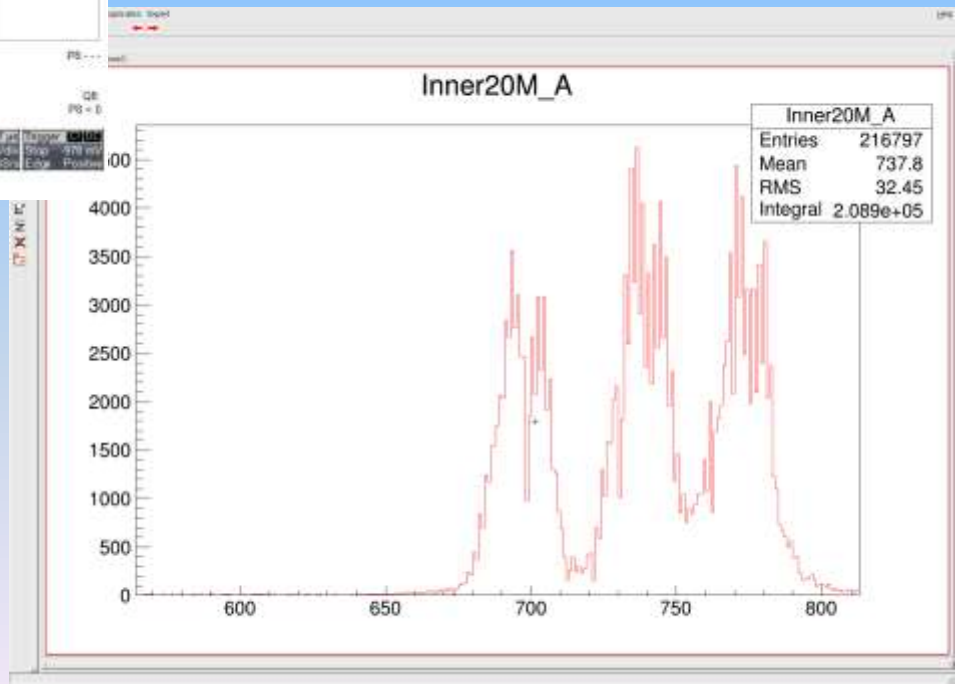
Initialisation

- Initialise Numexo2 by default then :
  - Initalise Feedback registers (script)
  - Calculation of ADC_baseline
  - Calculation of coefficient

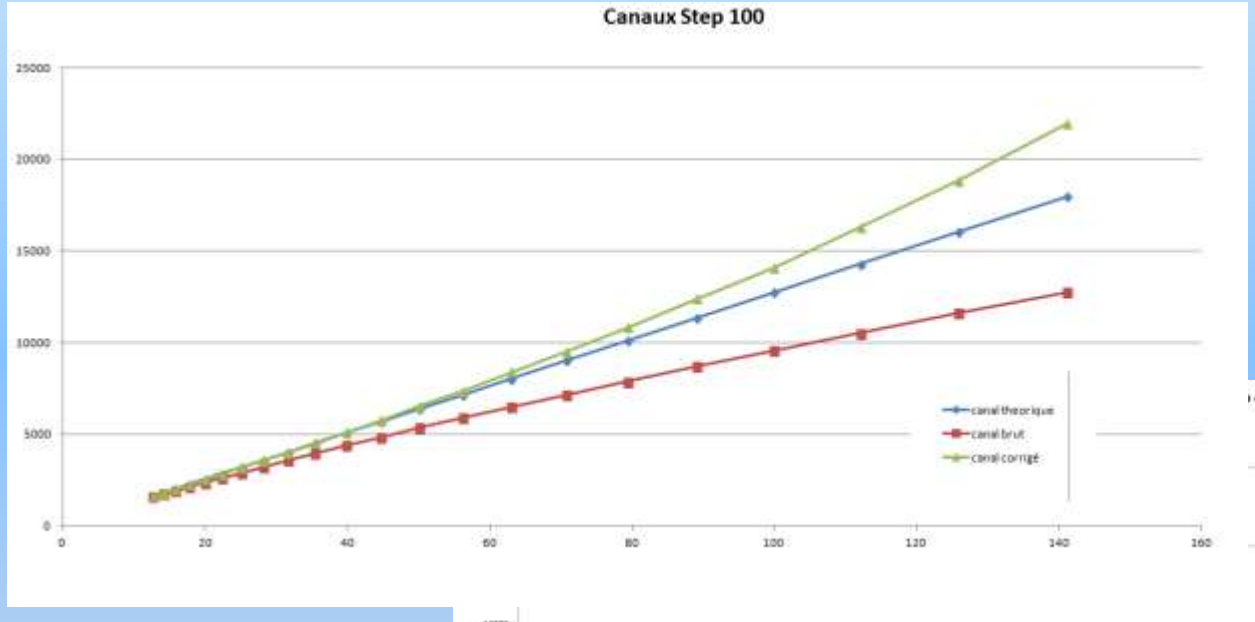
  - Launch Autocontrol

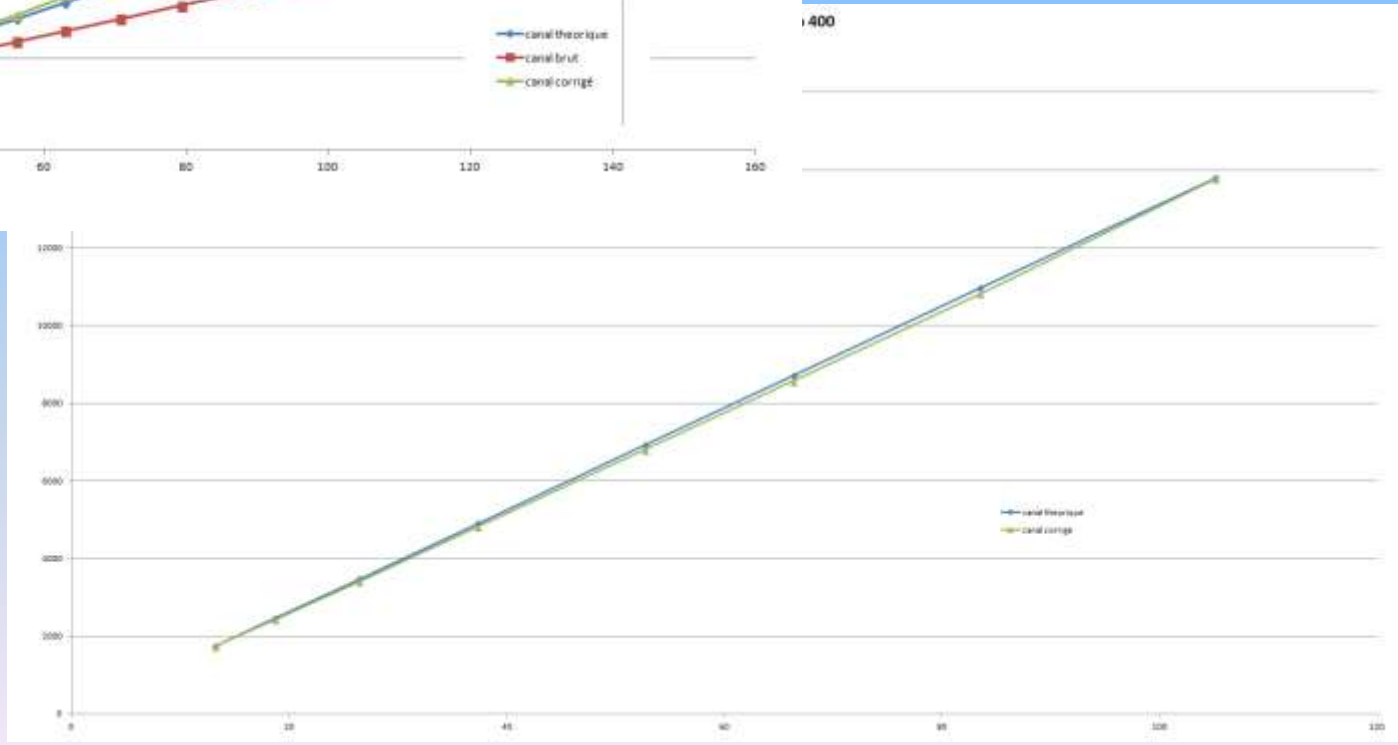
Tests avec détecteur





Test linéarité (entre 15 et 100 MeV)





TO DO

- Alpha decay event
- 16 channels
- 16 Trigger request
- Traces on MFM frame
- 15th bit on energy
- Value of the DAC on MFM
- Timing constraints

Compare FADC mezzanine and FADC-DAC

FADC

FADC DAC