

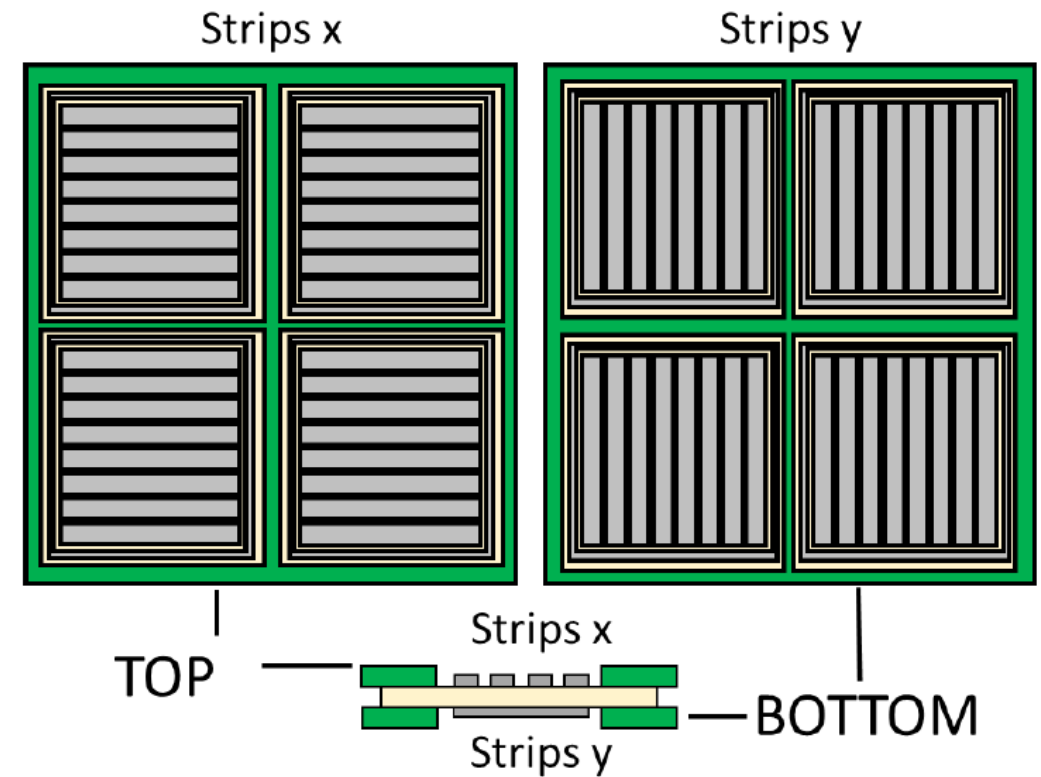
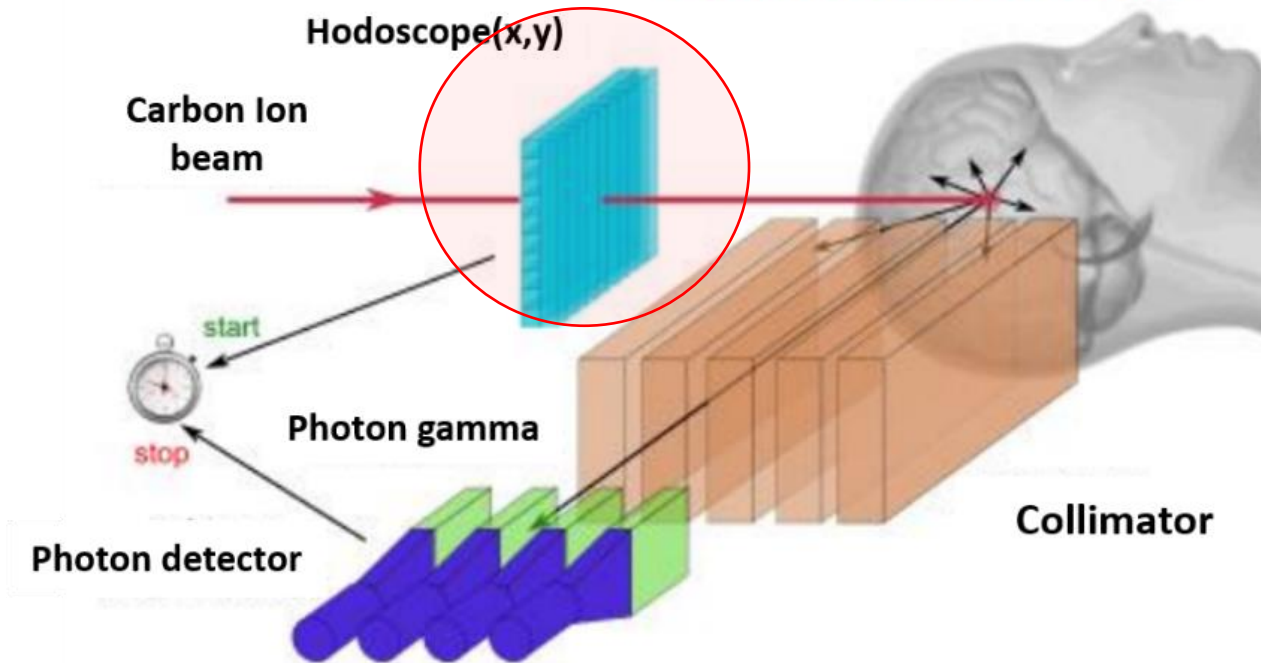
# Front-end electronics based on a CT $\Sigma\Delta$ ADC for energy measurements using diamond detectors

Directed by : - Olivier ROSSETTO  
- Fatah RARBI

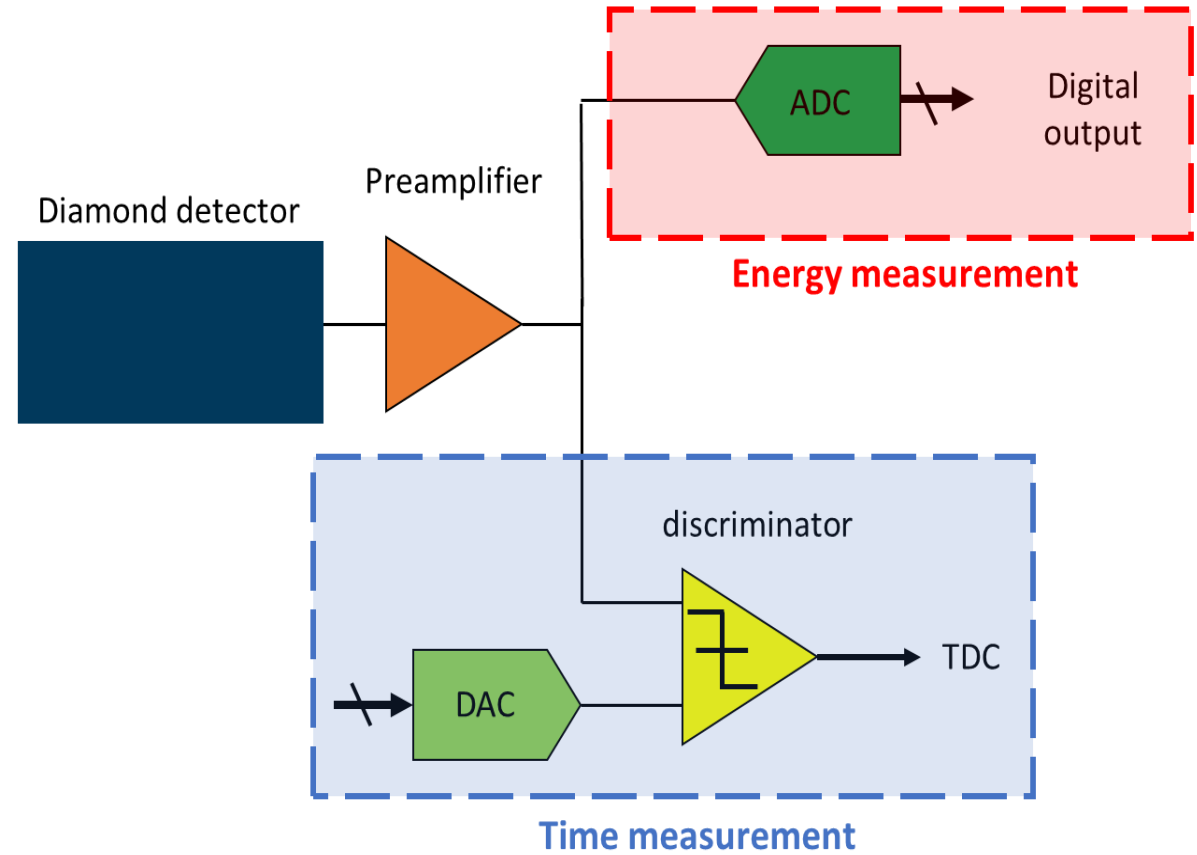
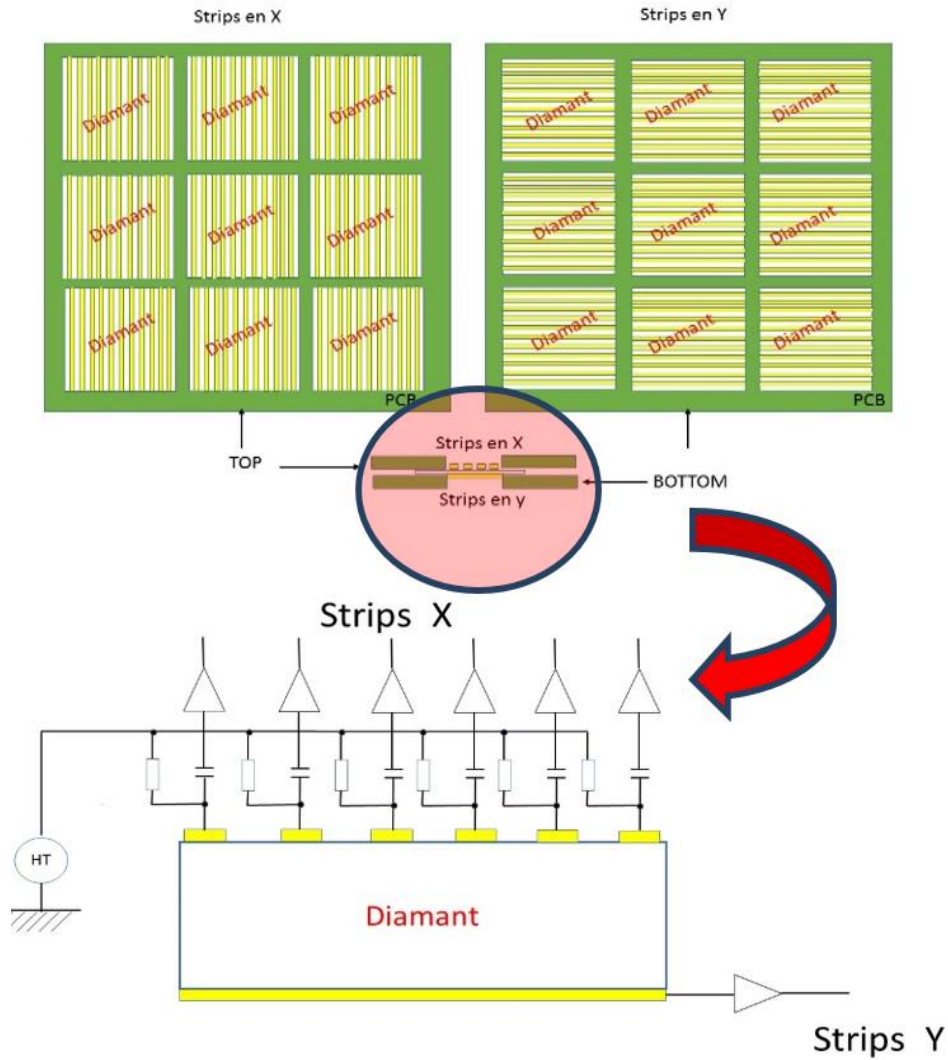
Presented par : - Abderrahmane GHIMOUZ -

# Context

## Gamma camera



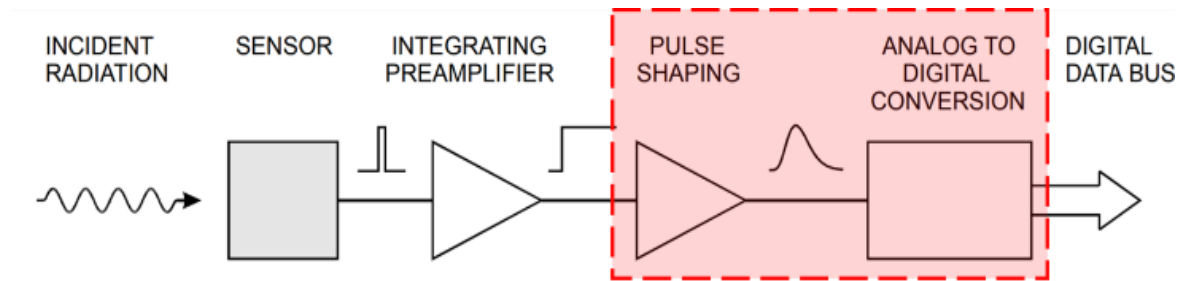
# Context



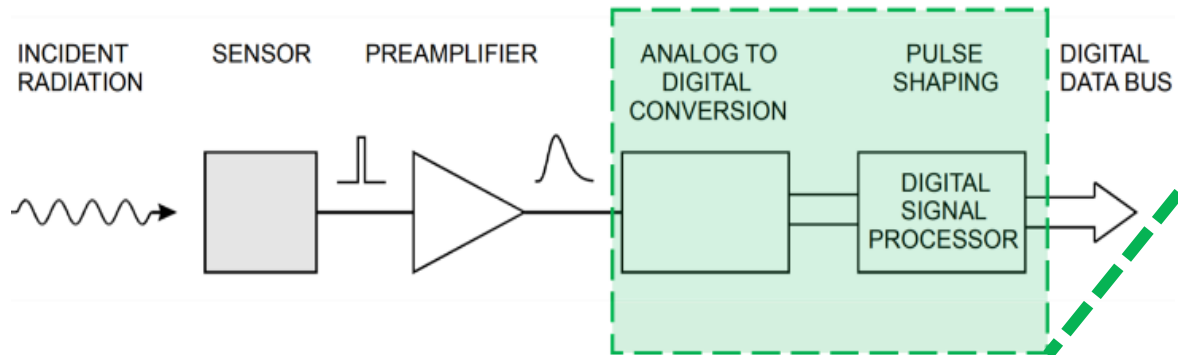
# BACKGROUND & MOTIVATION



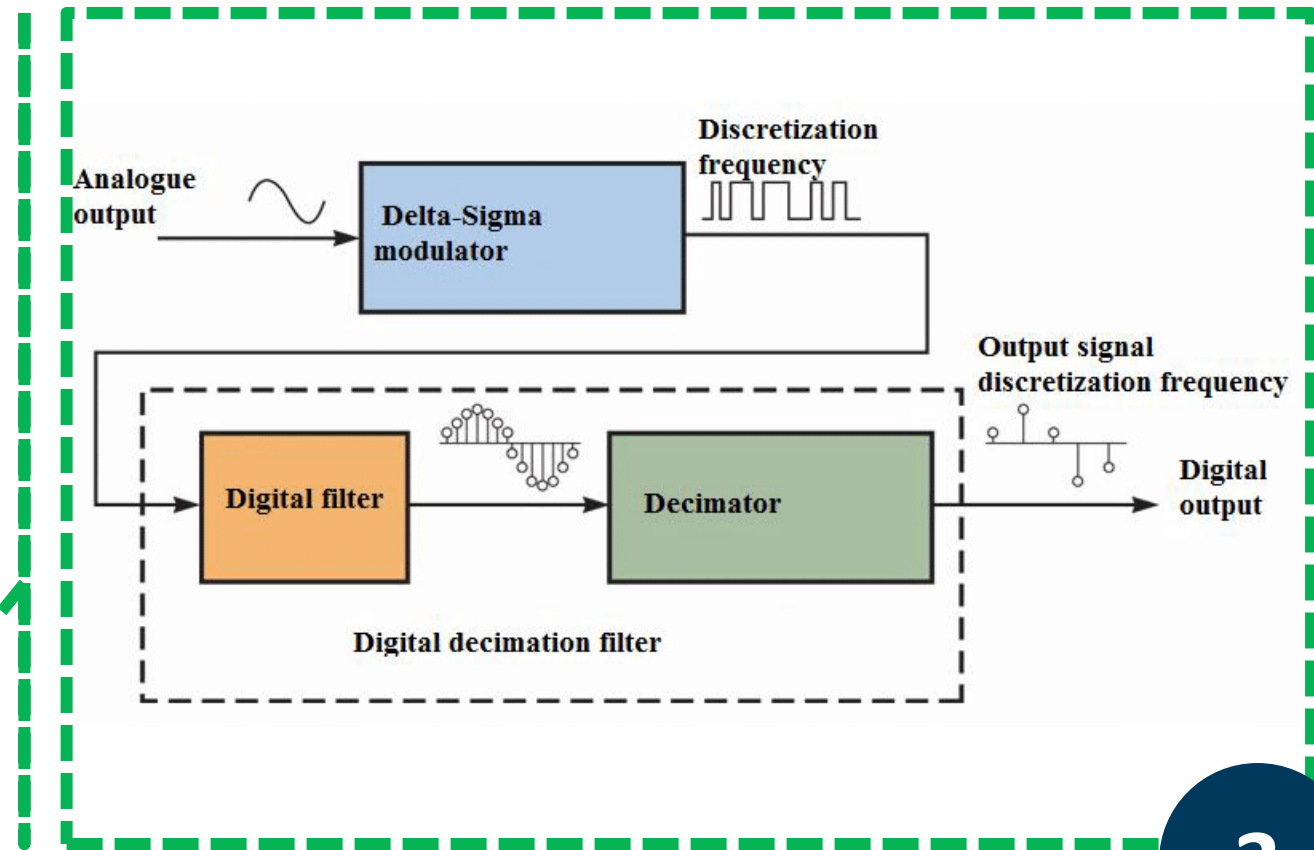
- **Introducing the benefits of CT delta-sigma ADC the field of designing electronics for particle detection.**
- **Digitizing the signal as soon as possible as demonstrated in figure 1 (b) in order to replace the analog shaper bloc shown in figure (1) a.**



(a)



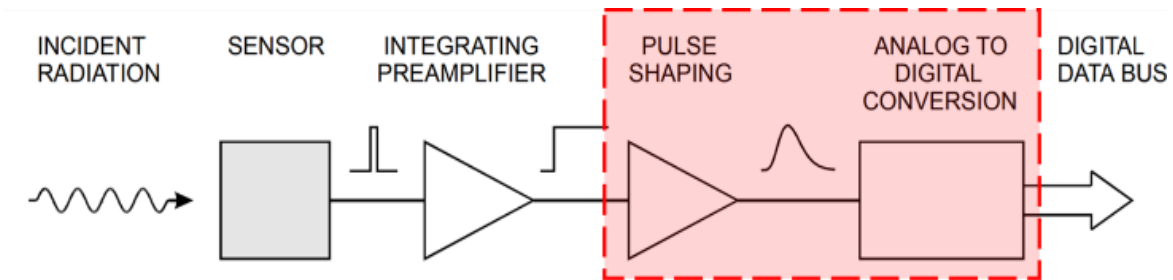
(b)



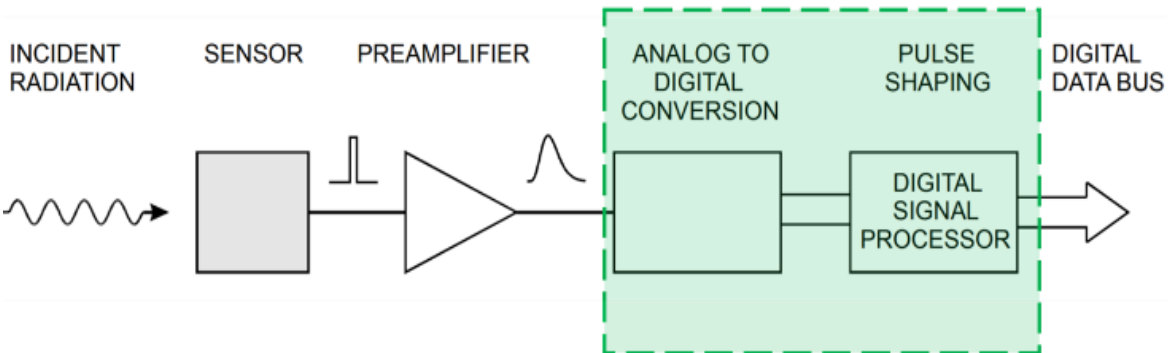
# BACKGROUND & MOTIVATION



- **Introducing the benefits of CT delta-sigma ADC the field of designing electronics for particle detection.**
- **Digitizing the signal as soon as possible as demonstrated in figure 1 (b) in order to replace the analog shaper bloc shown in figure (1) a.**



(a)



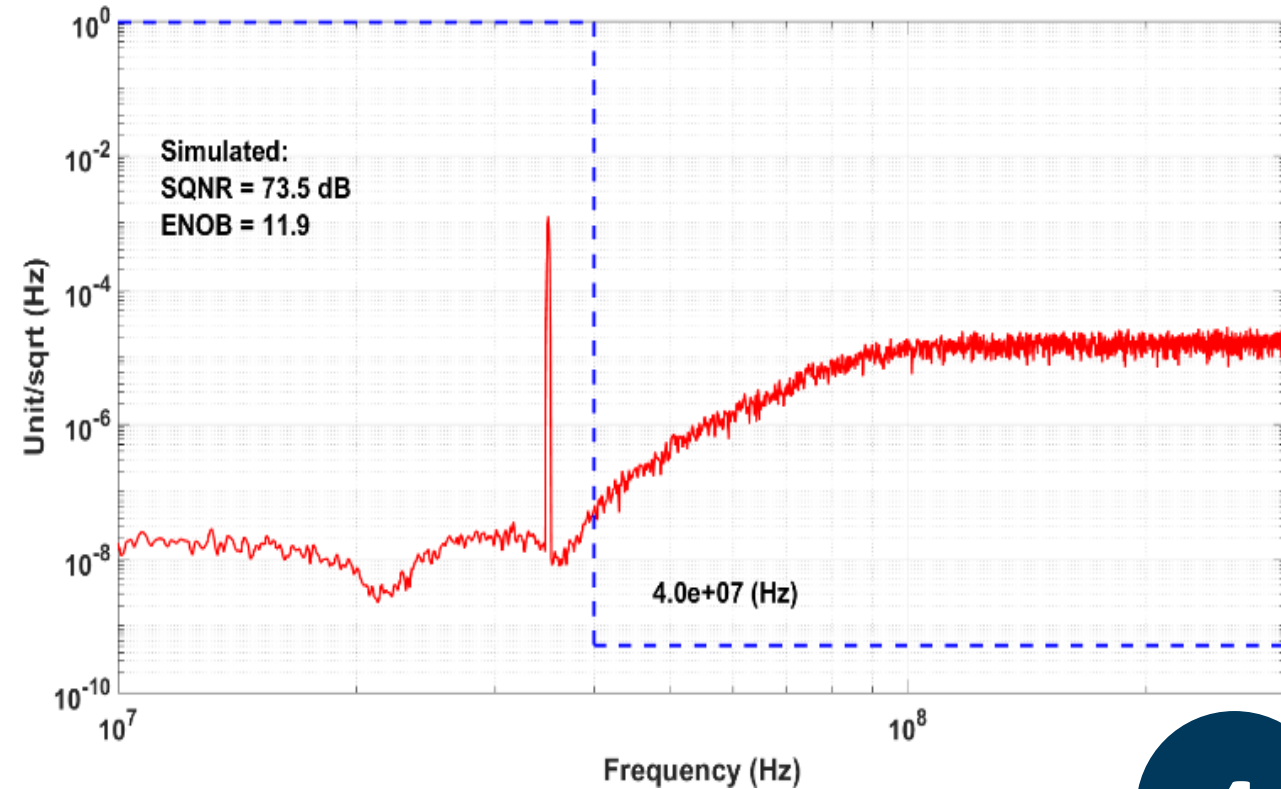
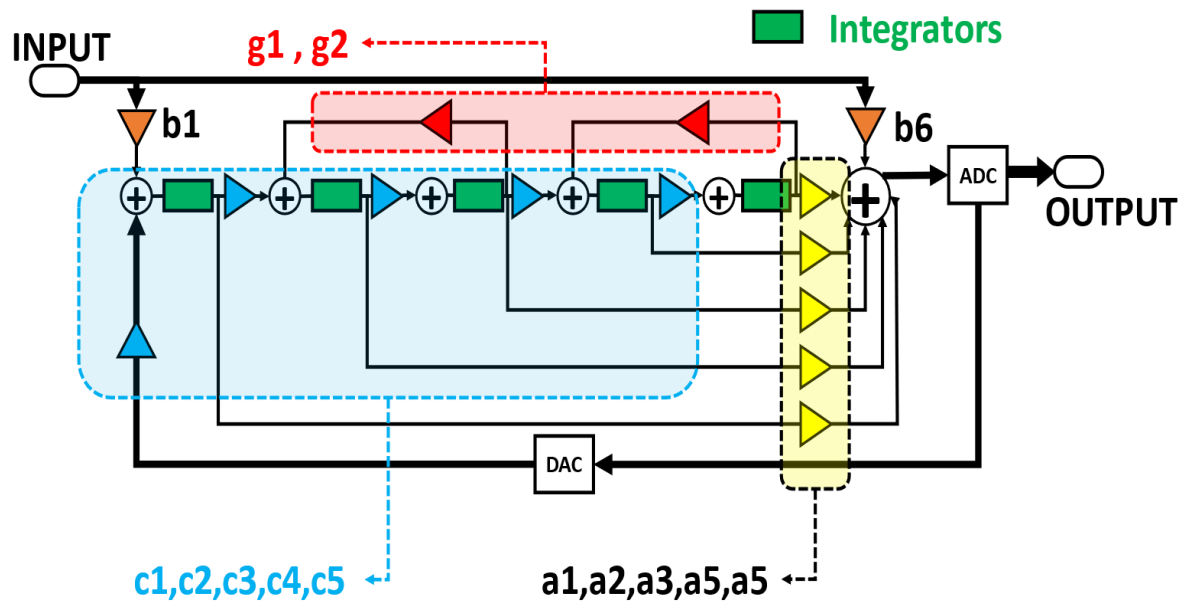
(b)

Parameters	Values
BW	$\sim 40 \text{ MHz}$
OSR	10
Filter's order L	5
Number of bits of the modulator N	3
Sampling frequency	$\sim 640 \text{ MHz}$
SQNR	$> 65 \text{ dB}$

# CONTRIBUTION



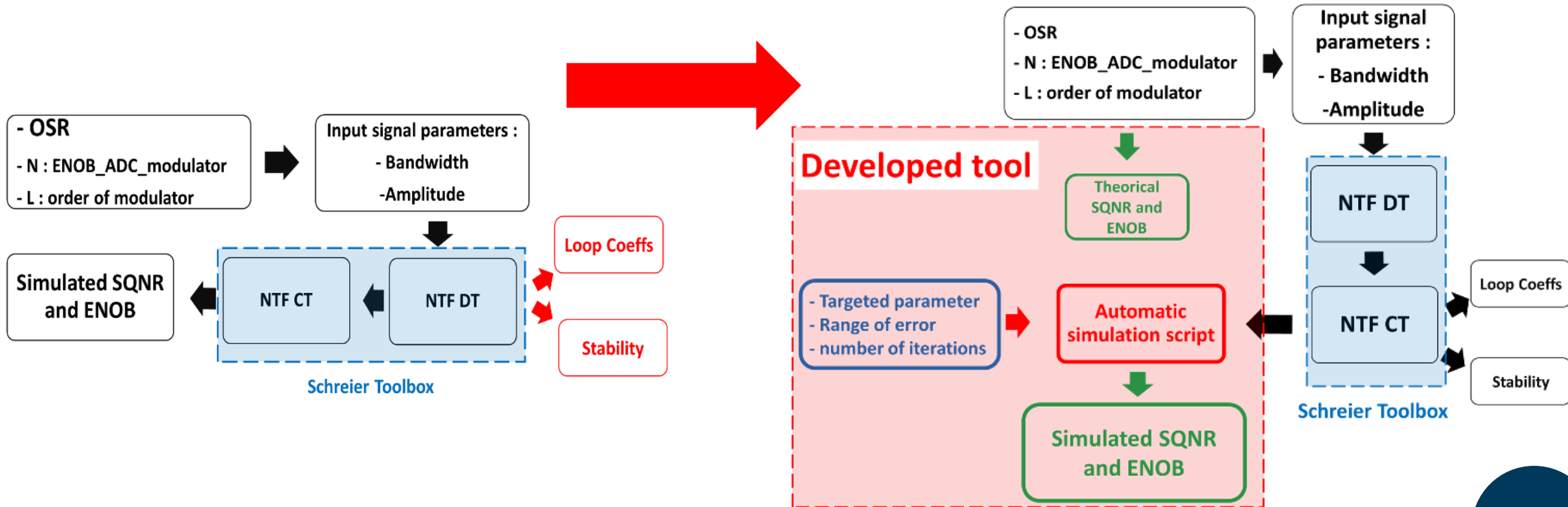
- The design of a custom ADC with a resolution of 10 bits and a bandwidth of 40 MHz based on CT Cascaded Resonators Feedforward architecture (CRFF) for particle identification.



# CONTRIBUTION



- *Building a simulation tool using Monte-Carlo like simulation to study in an early stage of the design flow, the impact of non-idealities of each block of the proposed topology.*

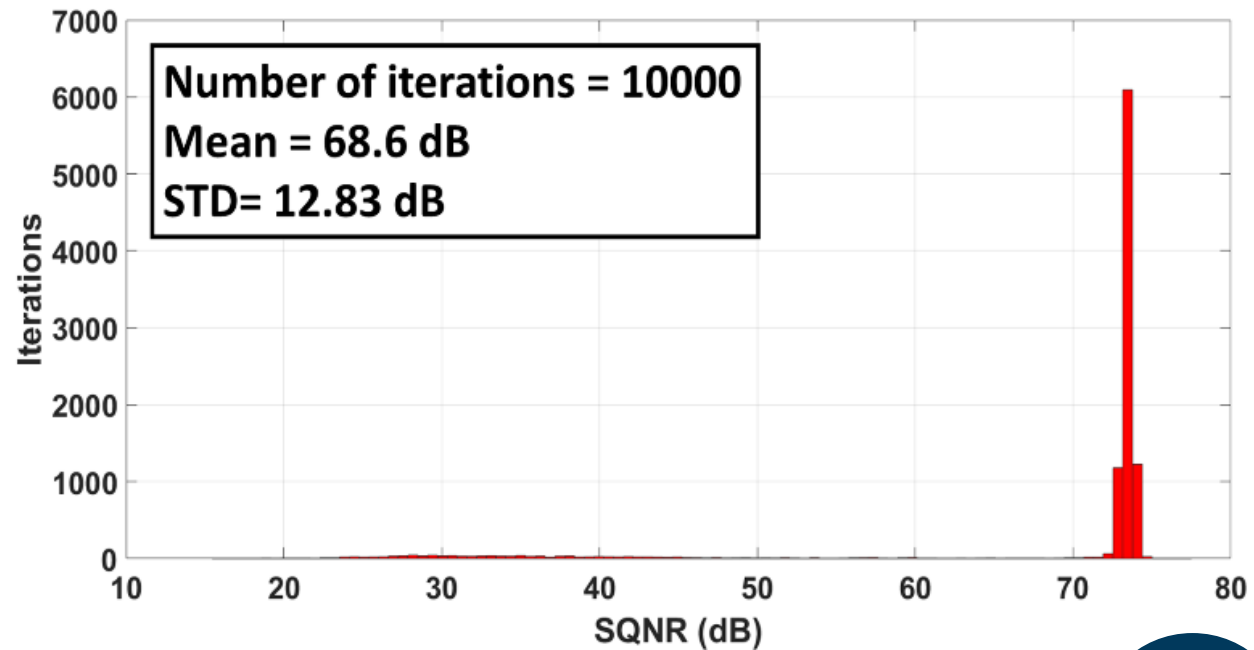
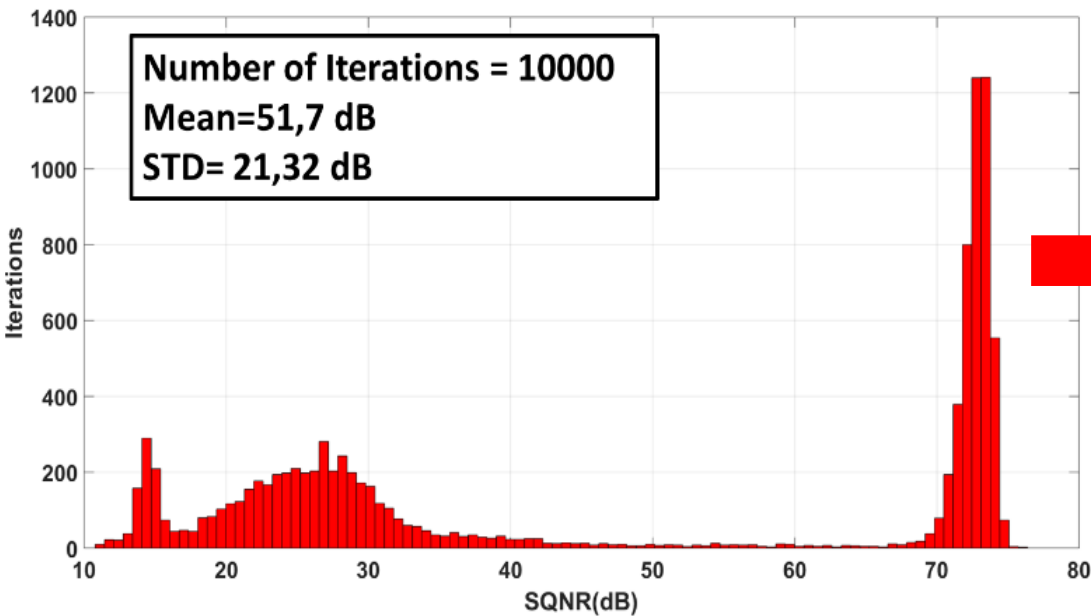




# RESULTS AND IMPACT



- *the study of the effect of the dispersion (due to fabrication process) of the loop coefficients using the developed simulation tool as shown in figure 4. First investigations are shown in order to reduce the impact of these dispersions.*





# SUMMARY & PERSPECTIVES



- *The use of the graphical behavioral tool and the optimization that we added to the flow of design of CT  $\Sigma\Delta$  modulators.*
- *The synthesis of a fifth order CT  $\Sigma\Delta$  modulator for 10-bit ENOB ADC based on a CRFF architecture.*
- *We presented the results of the study of the effect of the dispersion (due to fabrication process) of the loop coefficients. First investigations are shown in order to reduce the impact of these dispersions.*
- *More non-idealities will be added to the model to emulate more precisely its behavior, mainly the amplifiers finite GBW, noise and DAC non-linearity which allow us to estimate more precisely the SQNR and calculate more key performances as the SNDR. This extracted data will be used to design the building blocks using  $g_m/I_d$  methodology*

# Thank you for your attention