weeroc

High-end Microelectronics Design

ATMX150RHA building blocks

May 25th 2021

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SYSTEM CERTIFICATION ISO 9001 SGS

About Weeroc

- French Start-up company issued from IN2P3

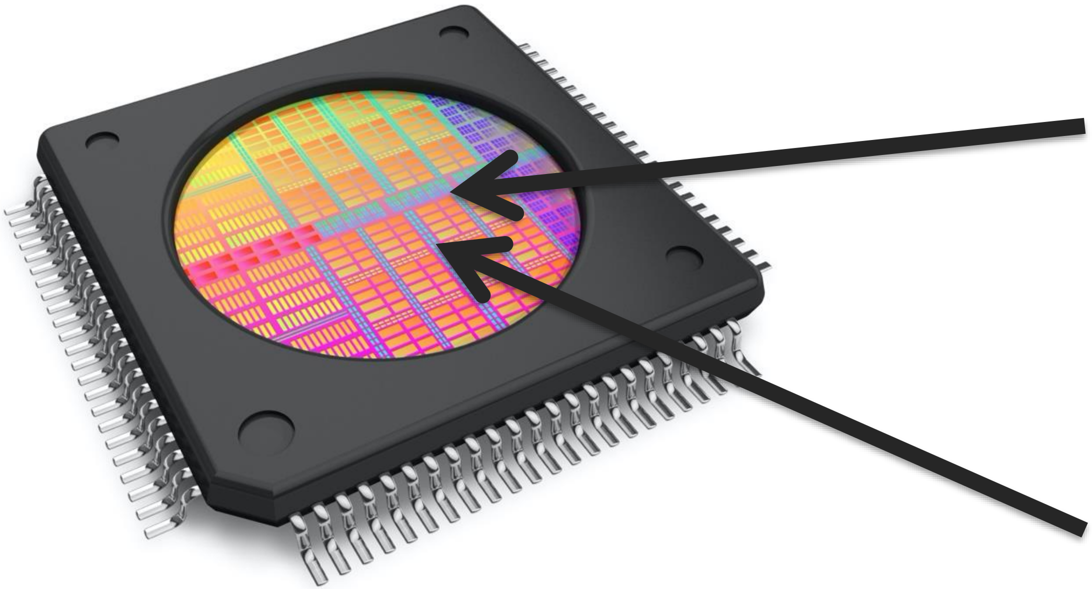
  IN2P3 : French National Institute for Nuclear Physics and Particle Physics

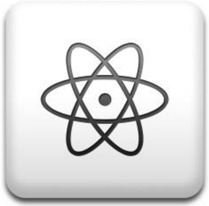
- Created February 2012 → 9-year old
- ISO9001 certified
- Missions :
  - Microelectronics engineers → We design & sell ASICs
  - Embedded system engineers → We integrate our ASICs in systems
  - Application engineers → We support our customer building products with our ASICs

Weeroc Activity &Expertise

Design and sell Analogue & mixed microelectronics ASIC
to read-out photodetectors and particle detectors

and for radhard application



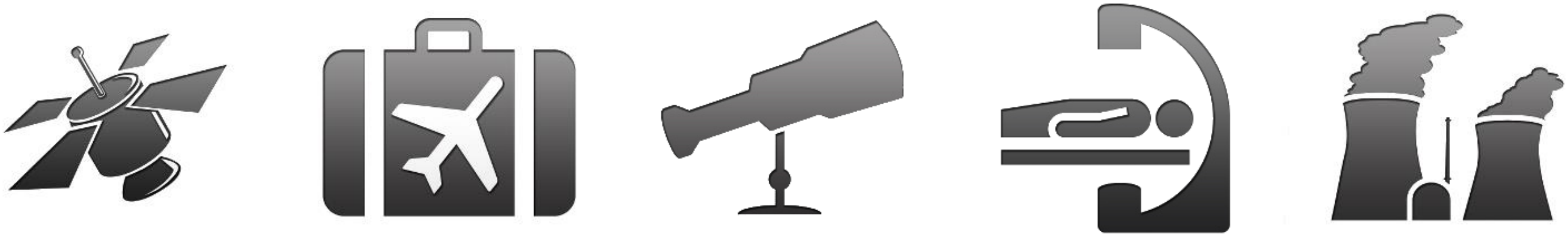


Radhard design

Low-noise, low power, analogue and mixed signal circuits

Particle detection

Weeroc offer : application fields



Aerospace Industry

Homeland Security

Scientific Instrumentation

Medical Imaging

Nuclear Industry

Project Framework

→Build an analog/mixed IP library in spce-qualified ATMX150RHA technology to reduce risk in complex mixed signal design.

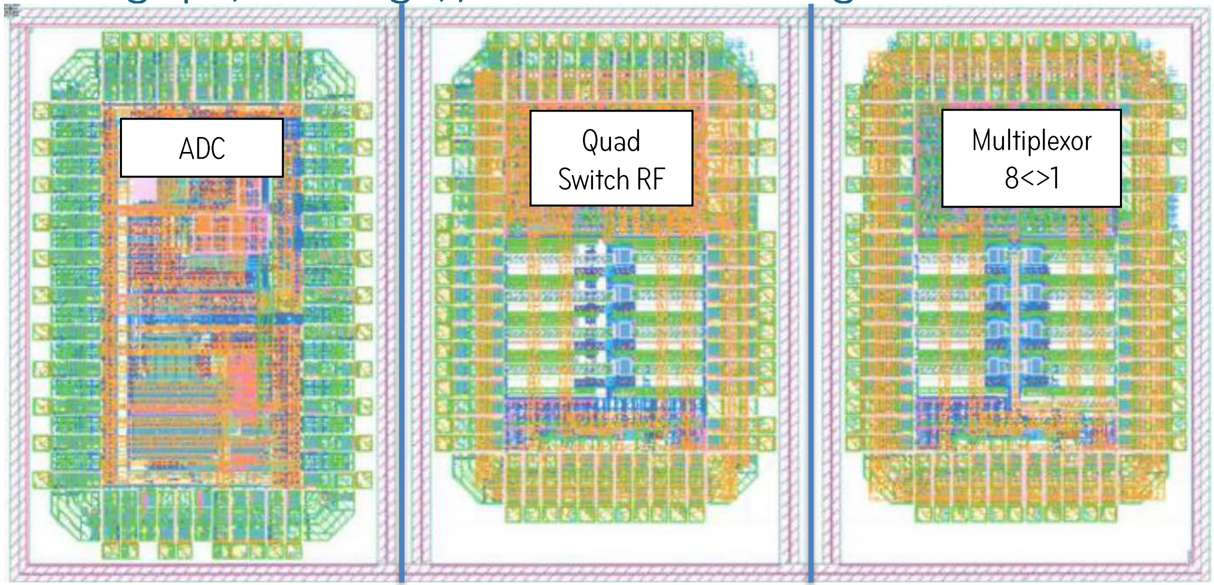
- Mini-circuit foundry funded by CNES
- Test of the mini-circuit funded by CNES

Block list based on end-user need assessment.

Work continuation of previous talk (AMICSA Leuven June 2018)

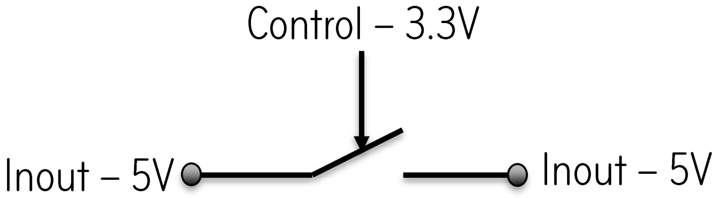
Test Vehicle Presentation

- Three small test vehicles including :
  - A high-bandwidth 5V / 500MHz analogue CMOS switch in a quad-switch configuration & 8→1 multiplexor
  - A 10b ADC with internal bandgap (2 configs), internal linear regulator



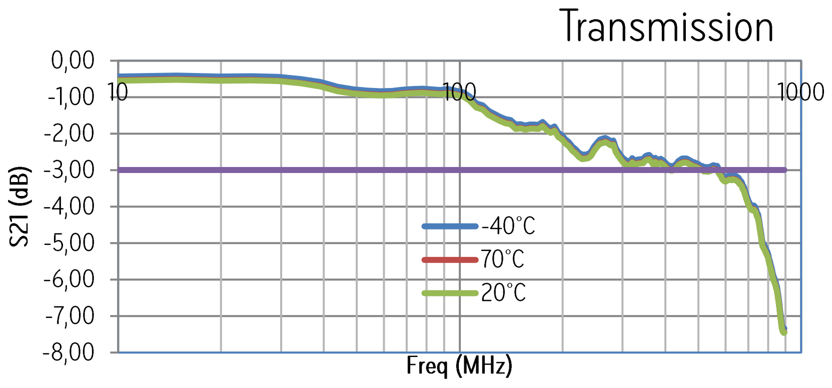
High bandwidth switch

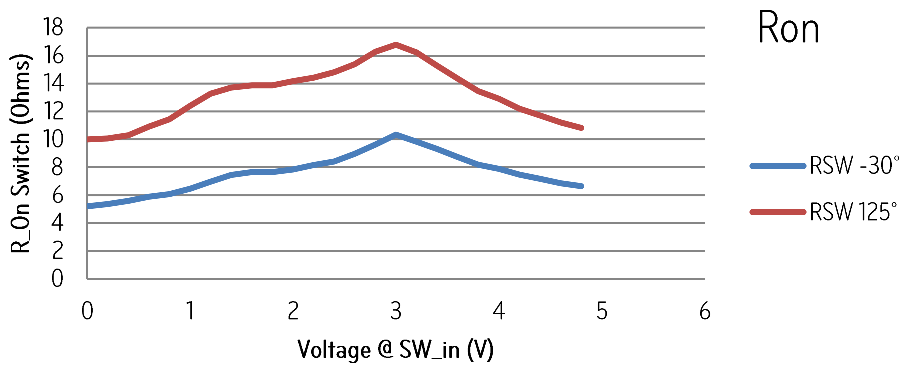
- A high-speed CMOS switch with low latency
- Design of small test vehicle to ensure low bonding inductor

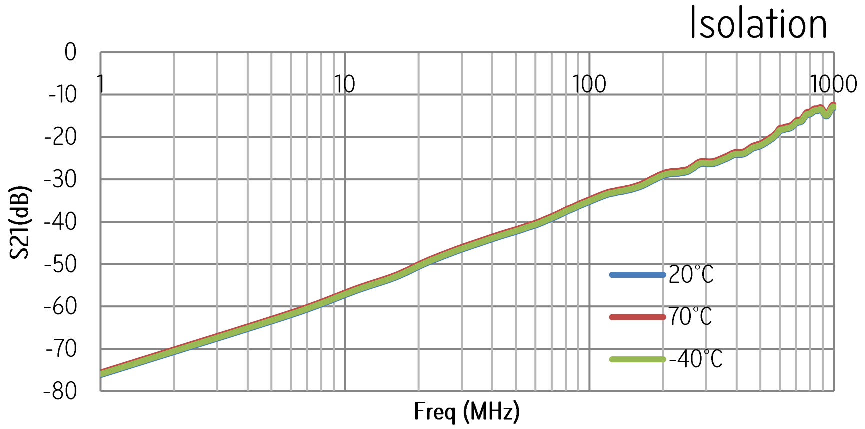


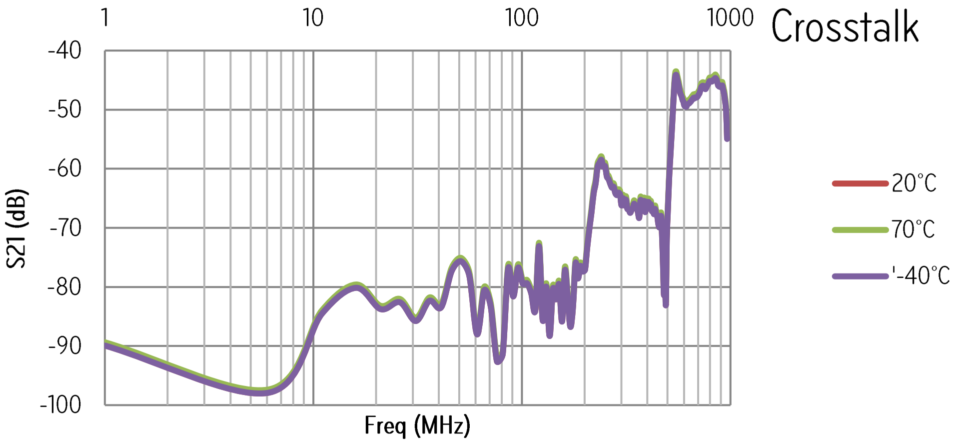
Parameter	Min	Typ	Max	Unit	Meas
R_{ON}			20	Ohm	12
Commuting latency ON & OFF		20		ns	8,6
3dB bandwidth	500			MHz	509,5
crosstalk		60		dB	>60

Electrical & temperature performances

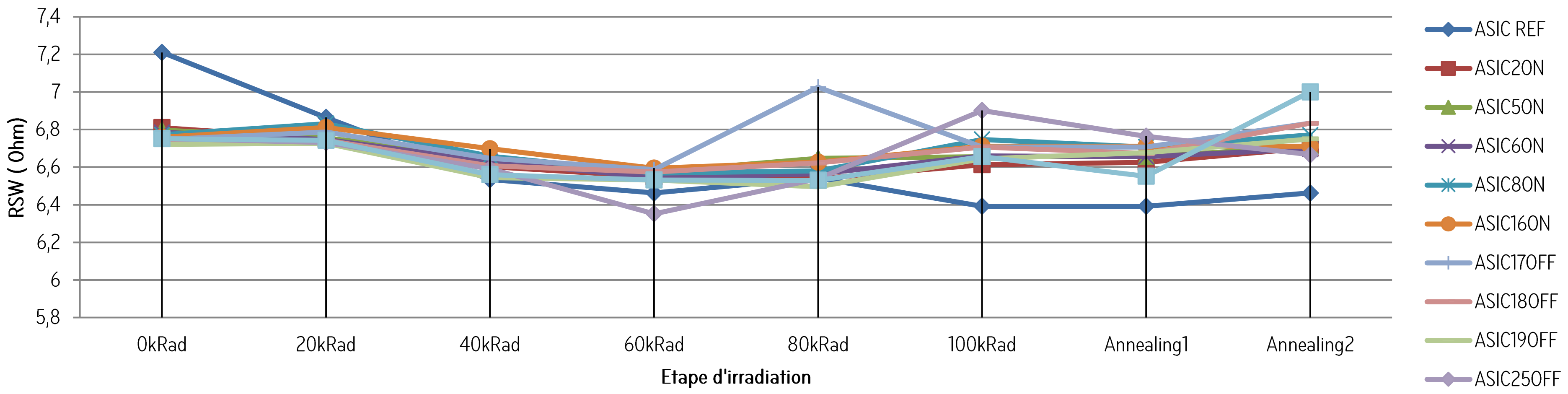


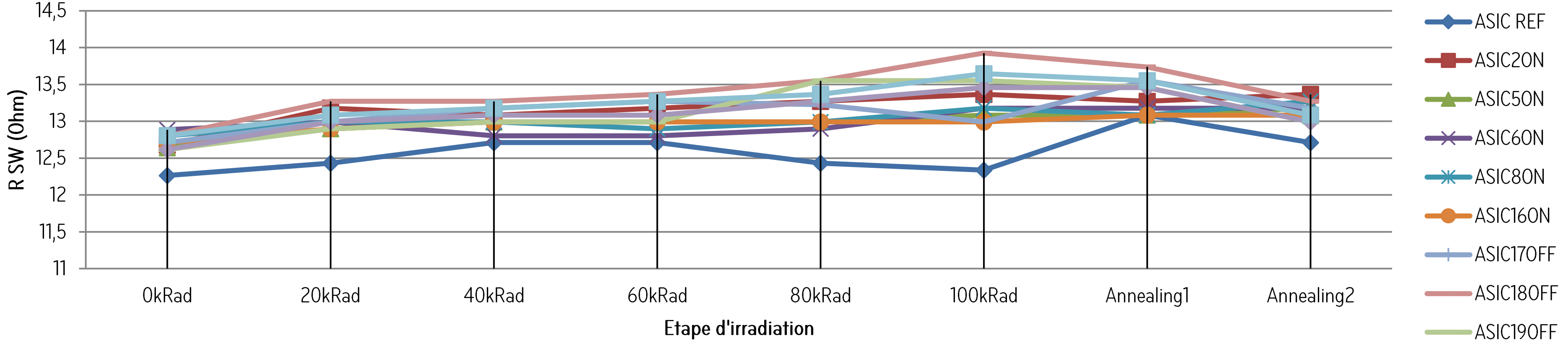






Switch : Radiation Measurement

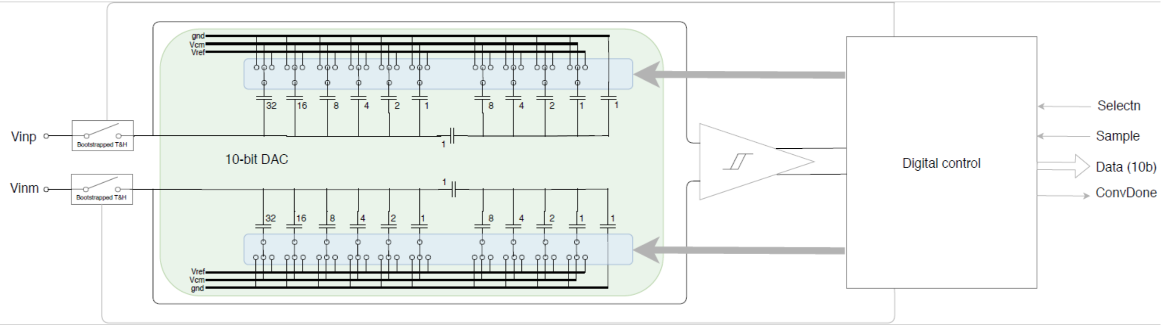




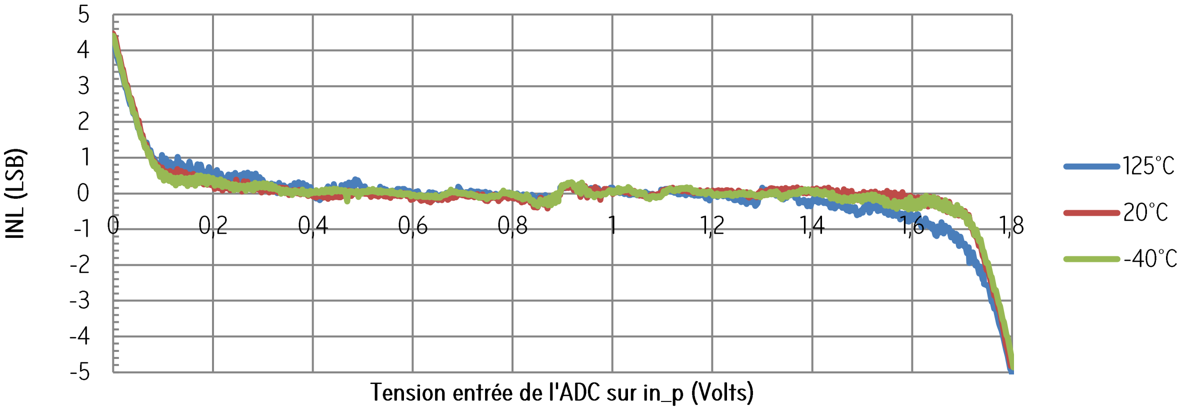
10b ADC

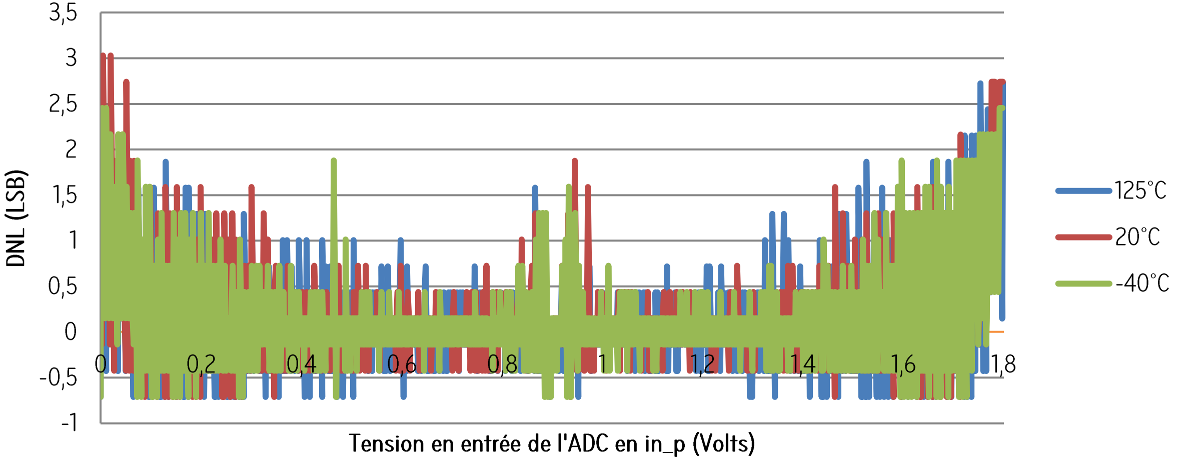
- A 10-bit 10-MSPS full asynchronous SAR ADC

Mesure	Min	Typ	Max	Unité	Meas
Missing code		None			Missing code at MSB
Gain error		1%		FSR	4,4%
Offset			1%	FSR	2,2%
INL	-1		1	LSB	-5 à 5
DNL	-1		1	LSB	-0,7 à 3
Sampling Rate	10			MHz	14

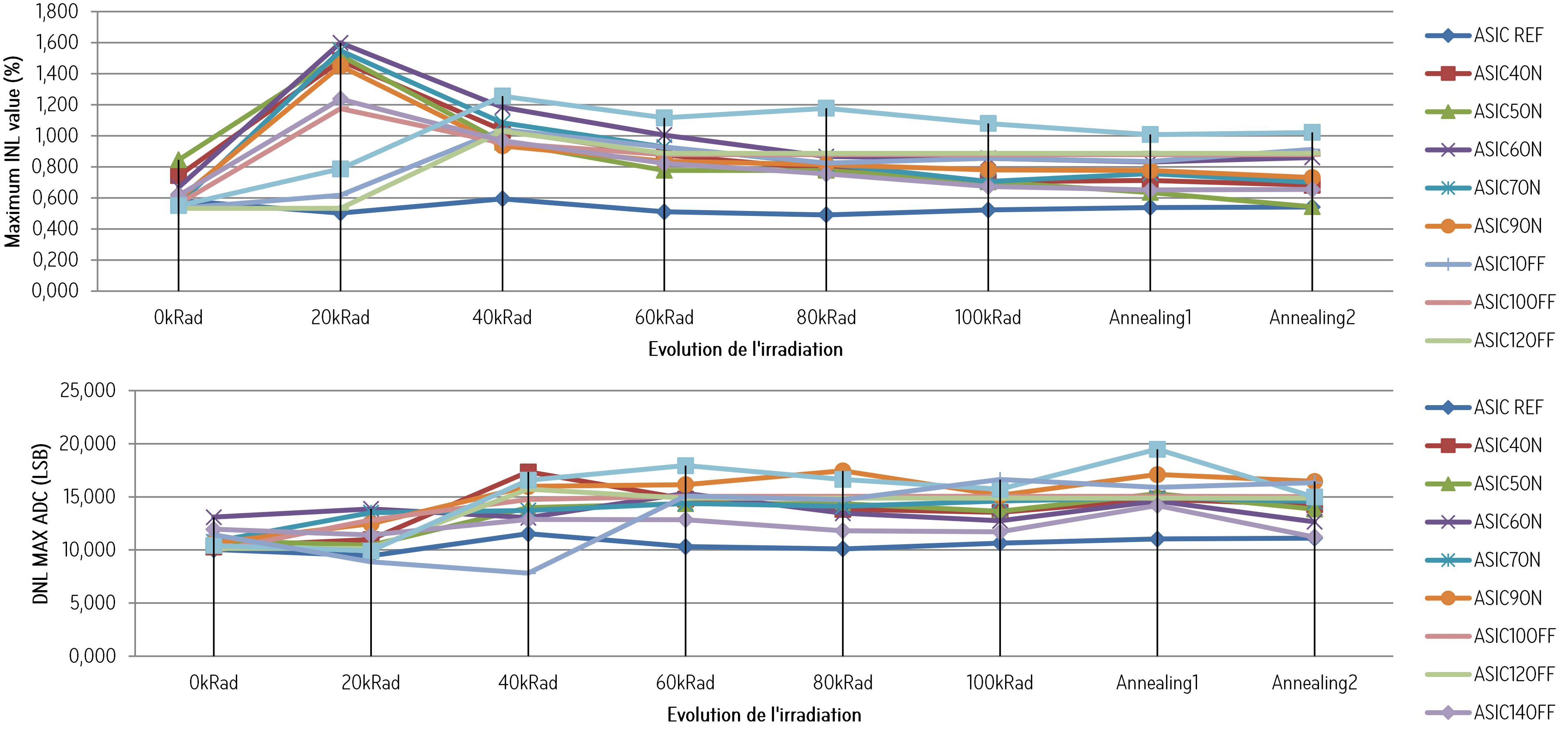


10b ADC electrical & temperature performances





10b ADC : Radiation Measurement

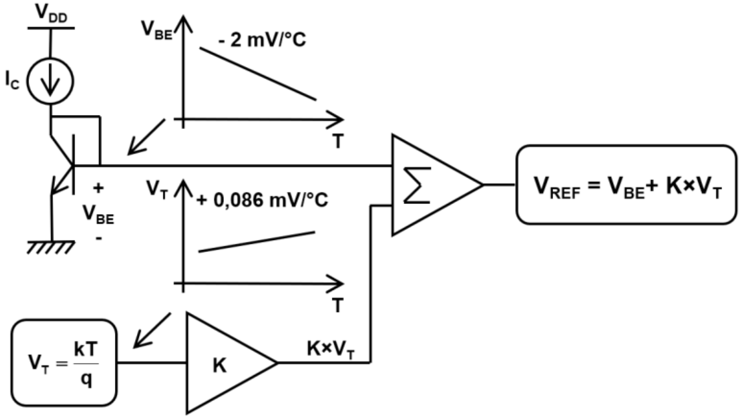


Bandgaps

- Two different approach of bandgaps :

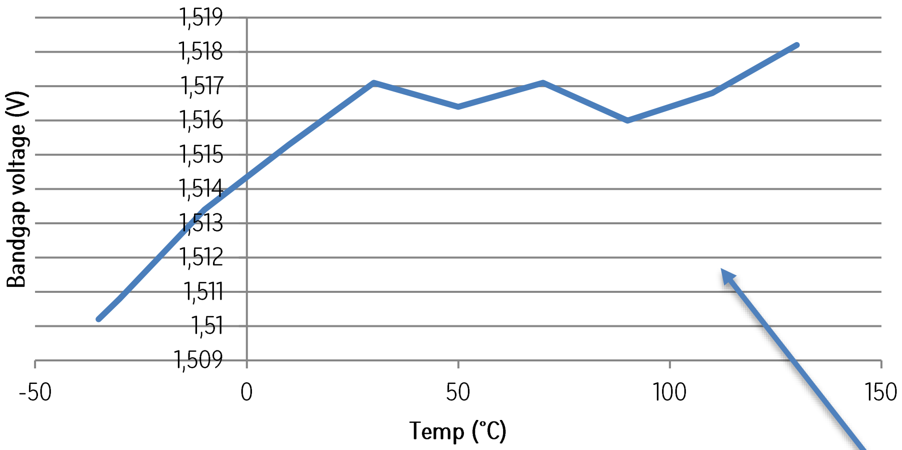
- One low silicon occupancy w/ trimmable features

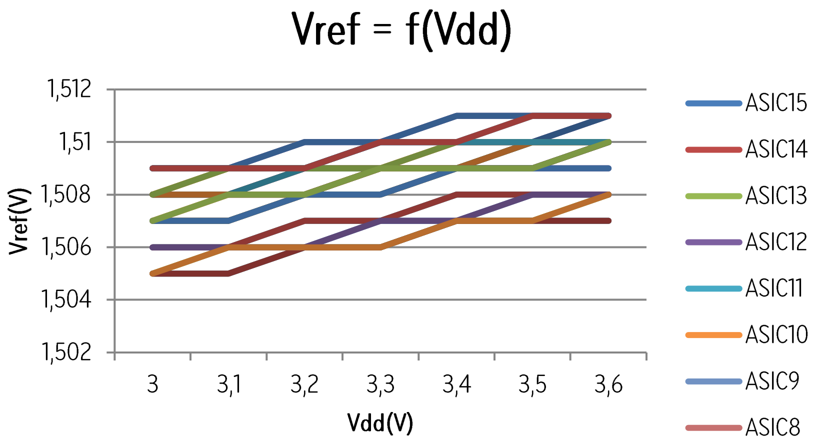
- One mismatch optimized not trimmable

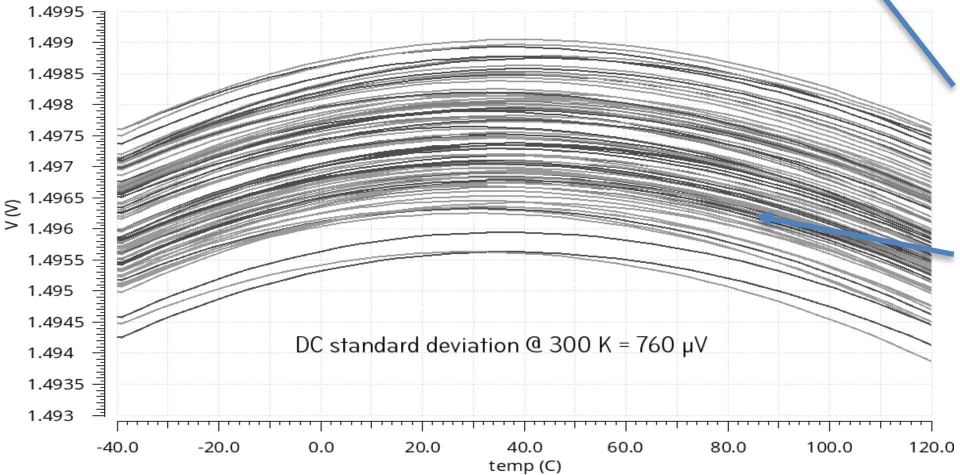


Parameters	Min	Typ	Max	Unité	Meas BG1	Meas BG2
Output deviation from -40 to 125° C			1,5	mV	7	10,5
Output deviation from -3V to 3,6V			1,8	mV	0,775	1,61
Bandgap voltage		1,25		V	1,251	1,22 to 1,3

Bandgap1 electrical & temperature performance



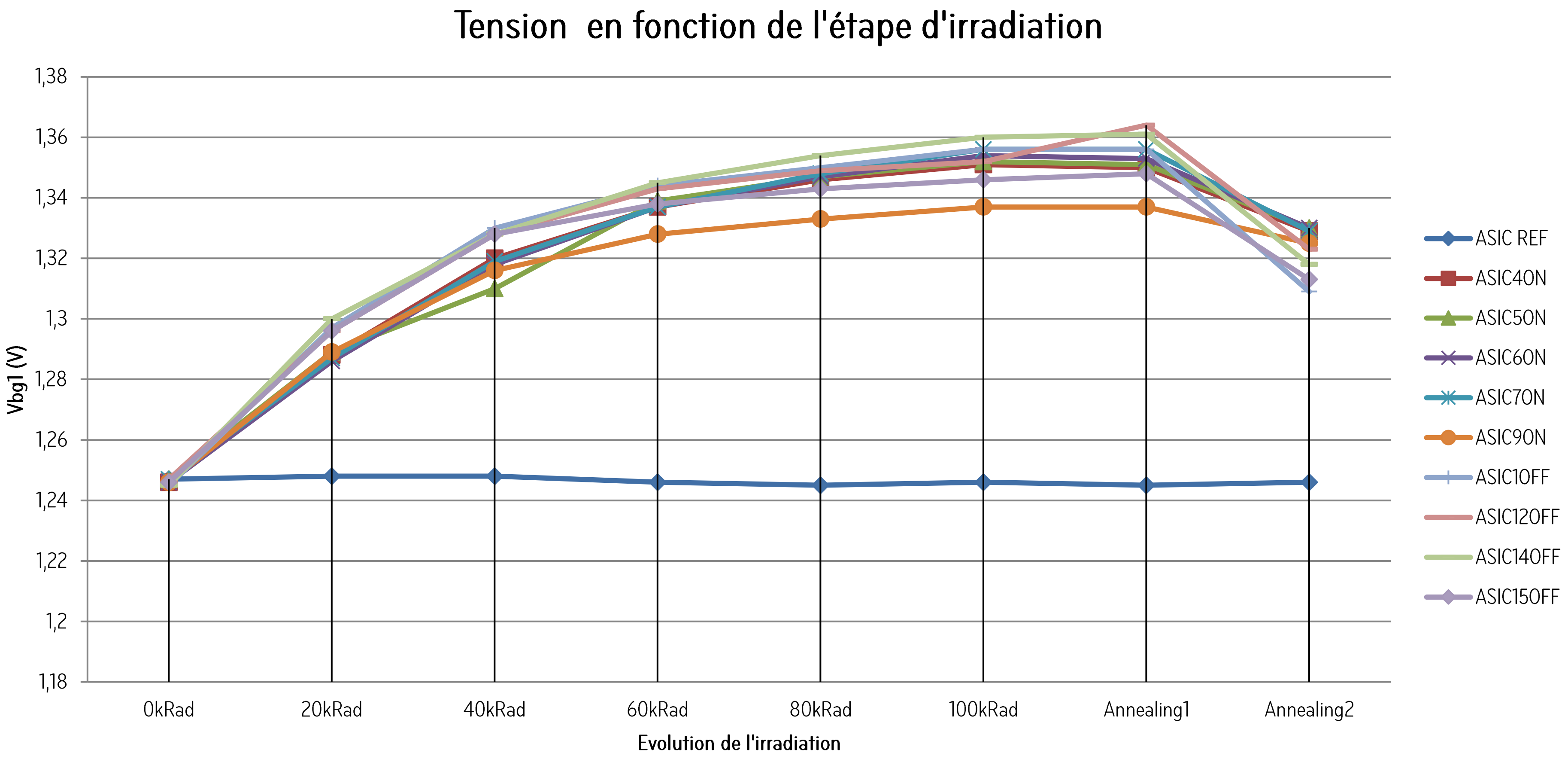




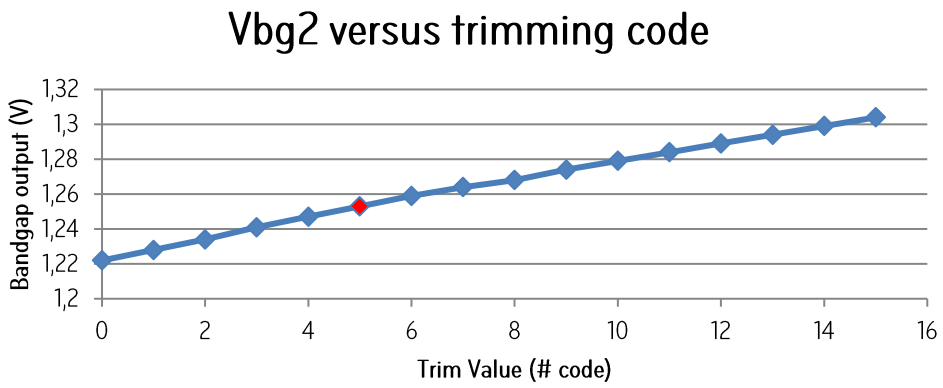
Measurement

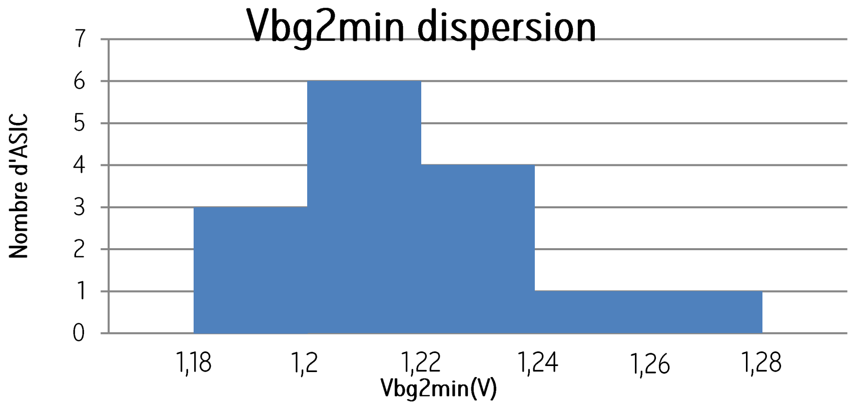
Monte Carlo simulation

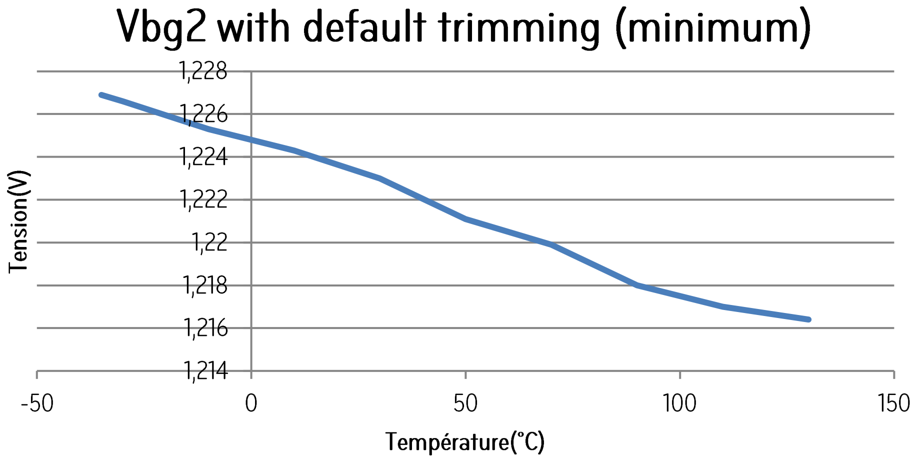
Bandgap 1 : irradiation measurement



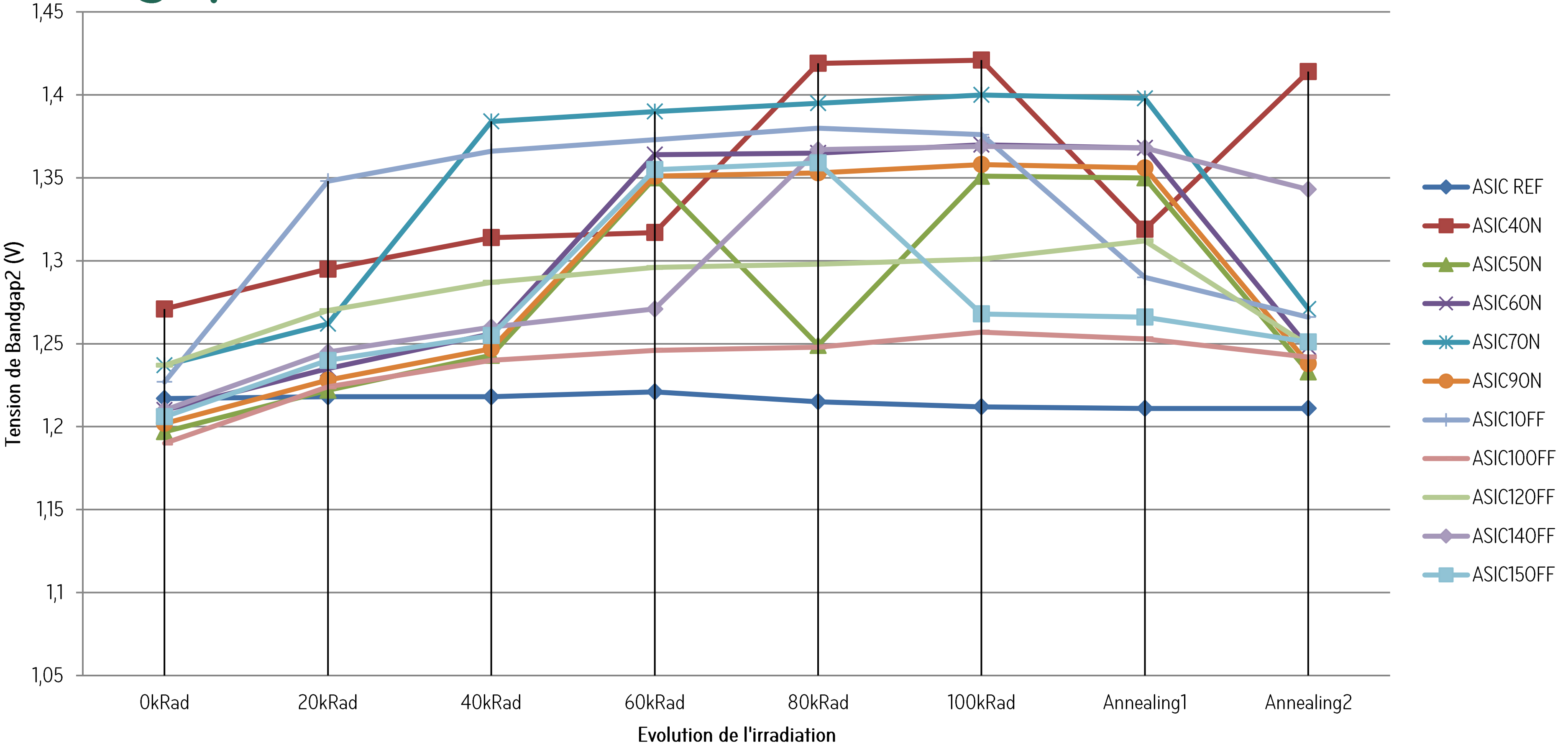
Bandgap2 electrical & temperature performance







Bandgap2 : irradiation measurement



Conclusion

- Several IP block has been designed and prototyped in ATMX150RHA technology
- These blocks has been tested and are in (or close to) specifications
- Bandgap are drifting by 100mV (8%) during lifecycle, to be included in EOL simulations
- Some blocks to be used in upcoming Weeroc design.

Thank you

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