



RADSAGA

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie-Sklodowska-Curie grant agreement number 721624.

ESR 06 WP2: Integrated Time-based Signal Processing Circuits for Harsh Radiation Environments

RADSAGA Training Workshop – March 2018

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ESR 06 WP2: Integrated Time-based Signal Processing Circuits for Harsh Radiation Environments

Supervisor: Prof. Paul Leroux (KU Leuven), **Co-supervisor:** Prof. Valentijn De Smedt (KU Leuven)

Project Deliverable & Milestones Lists:

- Report on technology selection and architecture definition.
- Report on the design and measurement of a radiation tolerant Time-to-Digital Converter.
- Report on the design and measurement of a radiation tolerant time based sensor readout circuit.
- Completed development of a radiation tolerant time based sensor readout circuit.

Planned Secondments [total: 8 months]:

- Magic Instruments (Dr. Y. Cao)[2m] For support in design and manufacturing of component.
- SCK•CEN (Dr W. de Cock): [2m] For neutron and gamma irradiation testing.
- CERN (Dr S. Danzeca): [2m] For mixed field radiation testing at CHARM.
- University of Montpellier (Dr V. Pouget): [2m] For SEE laser testing and hardening techniques.

Which One?

Ionizing Radiation!!



Ionizing

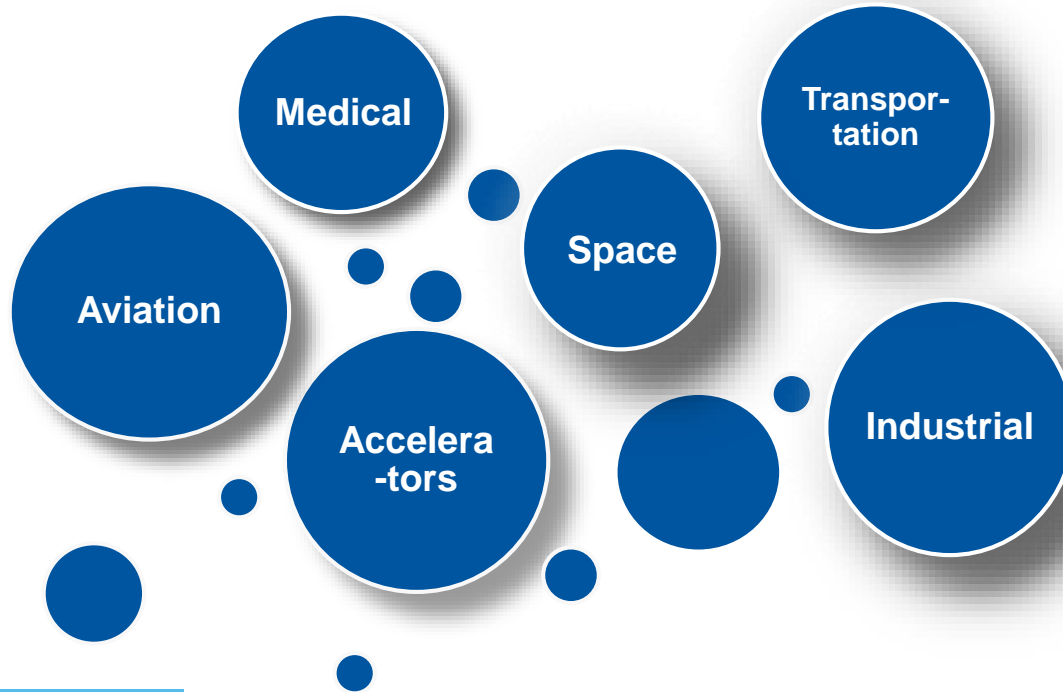


Thermal

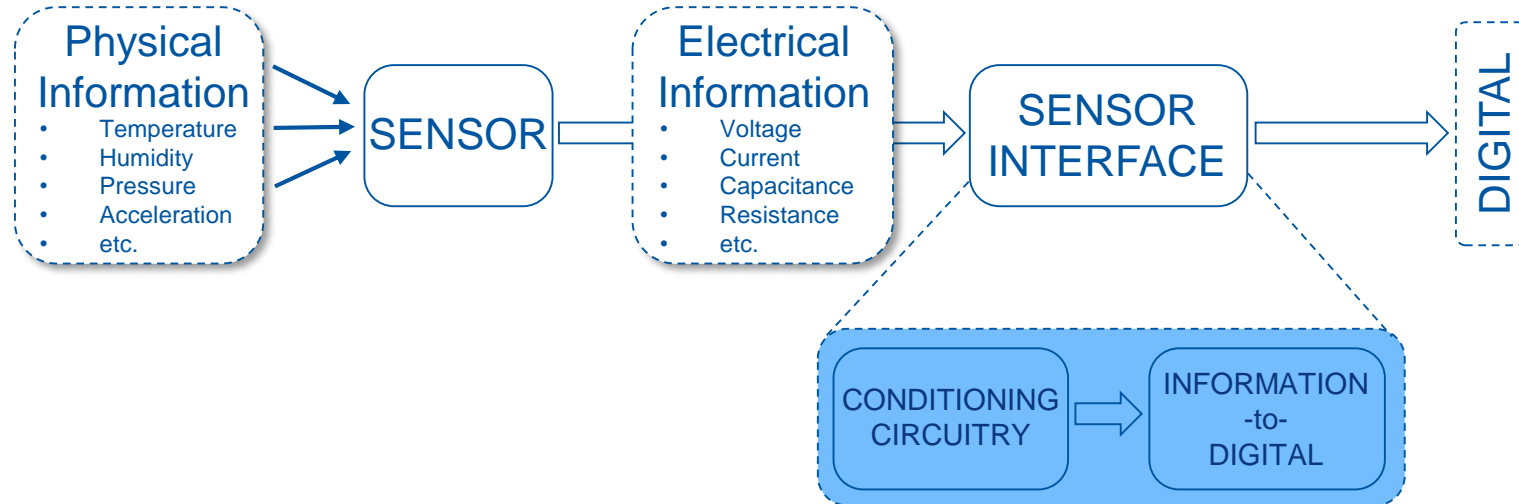


Electromagnetic

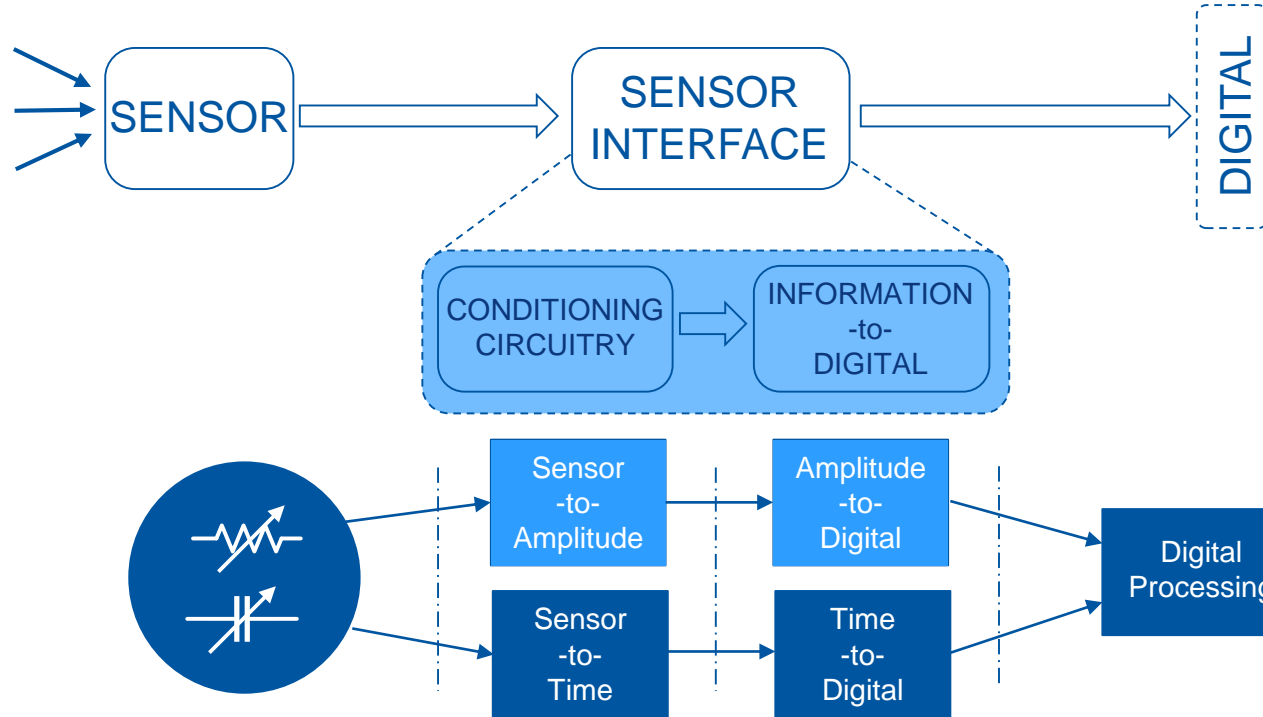
Radiation Affected Areas



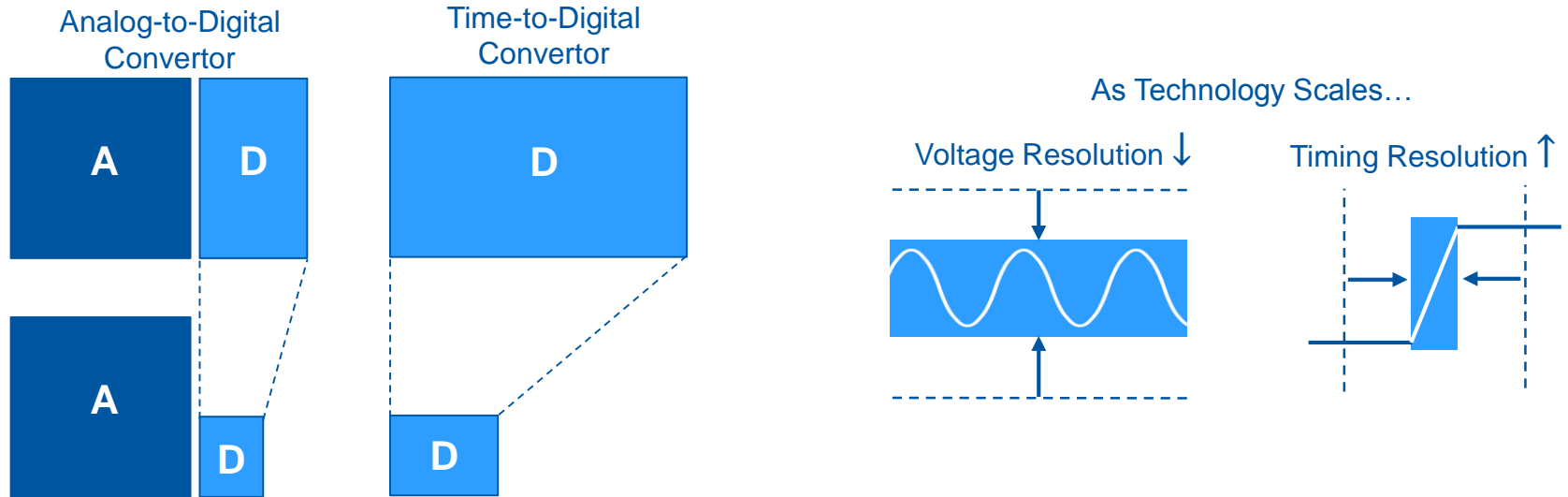
General Sensing Interface



General Sensing Interface

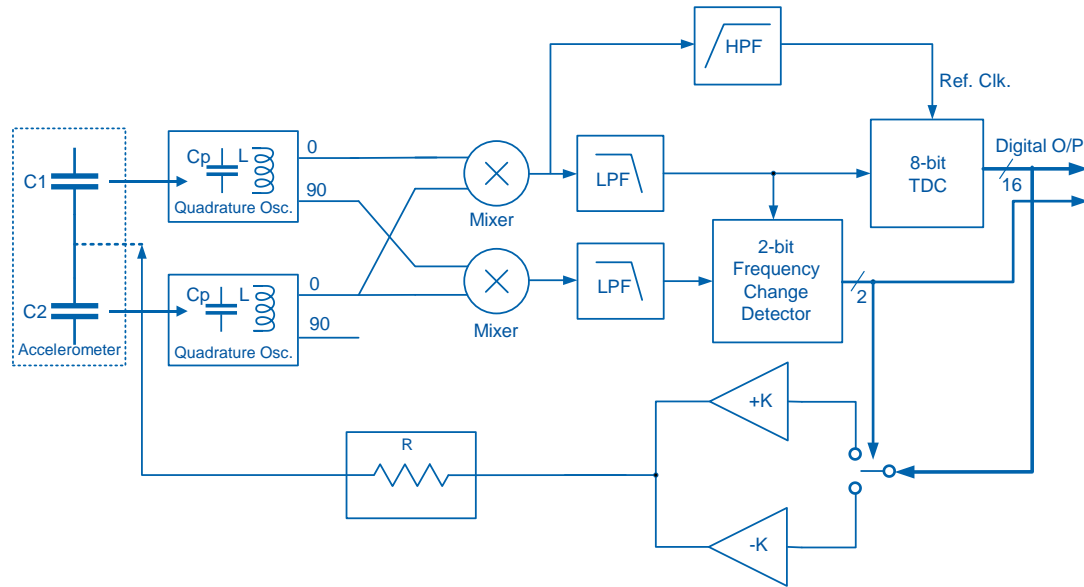


Amplitude vs Time-based Conditioning Circuits



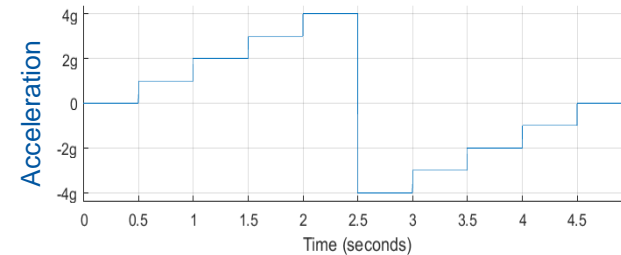
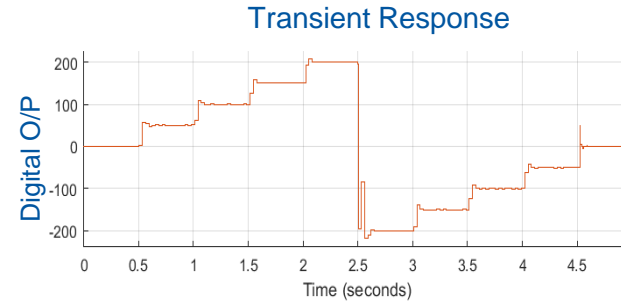
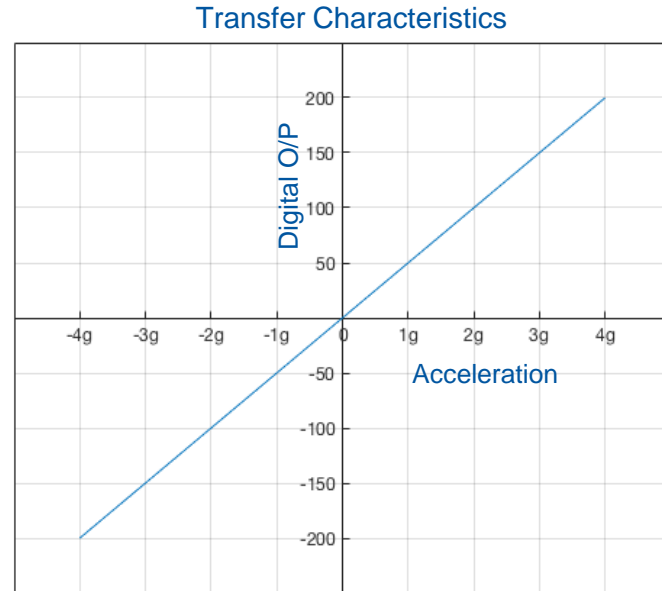
TDCs provides **Low-power**, **Area-efficient** and **Better Dynamic Range** compared to ADCs.

Rad-hard MEMS Accelerometer Readout Interface



- Acceleration (upto $\pm 4g$) \rightarrow $\pm \Delta x$ position of Capacitances' common plate.
- $(\Delta C \propto \frac{x}{d} C_{1,2}) \rightarrow$ change in Osc. frequencies (f_1, f_2).
- A TDC converts $\Delta f \propto \frac{\Delta C}{(C_P + C_{1,2})} f_{1,2}$ to a digital 8-bit output.
- Linearity of the response is improved by a forced feedback through resistance R.

Rad-hard MEMS Accelerometer Readout Interface



Thank you

Questions?

Contact me

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