Master's Internship – Join the Quantum Adventure!

Apply here!

🚀 Topic

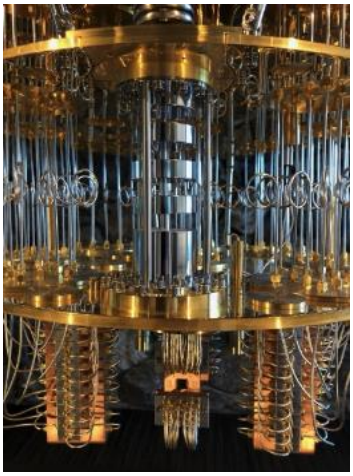
Design of an ultra-low power, wideband Analog-to-Digital Converter (ADC) to tackle the challenges of quantum technologies.

👉 Do you want to contribute to the design of innovative communication systems?
👉 Do you want to work in a world-class academic research group?
👉 Do you like these three words: integrated circuits, radiofrequency, and signal conversion?

If you're not afraid of hard work, of building systems, and turning theory into practical experience, then join IMS Laboratory!
https://www.ims-bordeaux.fr/

🔎 Context

Quantum technologies are emerging with applications in computing, cryptography, and communication. They are crucial and drive intense international competition. Their development requires highly precise radiofrequency signals across a wide frequency range (around 10 GHz), which currently demand expensive, limited, and non-scalable instrumentation — a bottleneck for progress and applications.



Flexibility and fast signal processing are essential to optimize the performance of quantum components. Major challenges include rapid programming, broadband signal acquisition and generation, and cryogenic electronics capable of operating at extremely low temperatures.

This internship aims to develop a circuit for analog-to-digital conversion within modular and programmable instrumentation to meet these challenges and enhance quantum technology applications.

We therefore propose to design a custom integrated circuit for cryogenic applications (ASIC), incorporating both the AWG (Arbitrary Waveform Generator) and the ADC. Current processor and FPGA architectures are limited by power consumption and latency. The new approach integrates an ADC and signal generator (AWG) into a cryogenic ASIC to minimize latency and energy consumption.

Key challenges include high-frequency signal acquisition and generation, thermal dissipation reduction, and memory management for efficient programming. Our system will be able to generate on-demand nanosecond-modulated pulses (Lorentzian, Gaussian, exponential, etc.) or frequency combs spaced a few MHz apart, and digitize signals over a wide frequency range.

A prototype of the AWG, called the Riemann Pump, was built in 2015. It validated the concept of a very low-power RF AWG (680 µW), providing an extended 4 GHz bandwidth in 65 nm TSMC CMOS technology.

The internship focuses on the study and schematic design of an ADC in STMicroelectronics 28 nm FDSOI technology, adopting an architecture similar to the AWG and using a Riemann Pump within its feedback loop, as conceived by Dr. François Rivet.

Missions

- Explore the scientific literature and identify cutting-edge architectures
- Design and model an ADC based on the Riemann Pump principle
- Simulate and analyze performance (bandwidth, power consumption, resolution, etc.)
- Identify potential risks and propose solutions
- Showcase your results through reports, patents, and publications

Profile Sought

Are you a Master's or engineering school student specializing in electronics or microelectronics with an interest in telecommunications?

👉 You enjoy tackling scientific and technical challenges
👉 You have a solid background in integrated circuit design
👉 You are proficient with simulation tools (Matlab, Cadence, etc.)
👉 You are curious, independent, and motivated

Then this internship is for you!

What You'll Gain

- A unique experience within a major scientific project
- The opportunity to collaborate with prestigious partners (Greenfield Technology, CEA…)
- Skills highly valuable for pursuing a PhD or a career in quantum technologies
- A stimulating, multicultural research environment

Partnerships

This internship is part of a network of high-level collaborations:

- Greenfield Technology
- CEA-Saclay

Practical Information

Duration: 6 months (February 1 – July 31, 2026)
Location: IMS Laboratory, Talence (Tram B – Peixotto stop)
Allowance: ~€600/month
Supervisor: Dr. François Rivet

How to Apply

Send your CV + transcripts (S5–S8) to francois.rivet@ims-bordeaux.fr
Before Friday, November 14, 2025, at 5:00 PM

References

[1] Yoan Veyrac, François Rivet, Yann Deval. Experimental demonstration of a Riemann Pump RF–DAC in 65 nm CMOS. 23rd IEEE International Conference on Electronics Circuits and Systems (ICECS), Dec 2016, Monaco. pp. 241–244, 10.1109/ICECS.2016.7841177.
[2] Yoan Veyrac, François Rivet, Yann Deval. Noise shaping Riemann: an energy efficient data conversion scheme. Analog Integrated Circuits and Signal Processing, 2017, pp. 1–9. 10.1007/s10470–017–0980–9.
[3] François Rivet, Yoan Veyrac, Yann Deval. The Riemann Pump: a Technique For Carrier–Aggregation Radio–Frequency Transceivers. IEEE International Conference on Integrated Circuits, Technologies and Applications (ICTA), Nov 2018, Beijing, China.