Study and comparison of Galileo E5 AltBOC signal processing methods

End-of-studies internship in the Engineering cycle

Syntony GNSS is a human-sized company with an international dimension, based in Toulouse and with the **FrenchTech label,** specializing in **Global** Navigation Satellite Systems (GNSS).

Our ambition: To provide our customers with relevant, innovative, reliable and robust solutions.

World leaders in radio navigation and embedded systems, we are present in fast-growing markets, such as aeronautics, space, road and rail transport, mining and IoT (Internet of Things). We have developed a range of products (simulators, receivers, indoor/outdoor location systems) that meet the growing needs of these industries.

Keysight, Airbus, Airbus Constellation, Hitachi Rail, Thales Alenia Space, Honeywell, Rockwell, MDA, or the Stockholm, New York and Toronto metros... So many partners who trust us and push us to always go further.

With passion, we constantly evolve our solutions to anticipate their needs and perfect our know-how.

At Syntony, we offer a pleasant and stimulating work environment, where the quality of life at work and the availability of our employees promote fulfillment and collaboration. Intellectual stimulation is omnipresent through innovative and varied projects.

We work on a variety of subjects, ranging from aeronautics to space, transport, mining and the environment.

Thus, Syntony vibrates around three fundamental values:

Benevolence:

Together, we cultivate listening, respect and empathy in our interactions, while also valuing the multiculturalism that enriches our exchanges.

We contribute to a positive environment where everyone feels valued and supported. We enrich each other by building strong relationships, both internally and externally.

Excellence:

Together, we strive for excellence in everything we do. Through our commitment, our high standards and our sense of responsibility, we guarantee quality, efficiency and performance. It is through our collective rigour that we meet challenges and provide sustainable solutions.

Adaptability:

Together, we are flexible in the face of the changes around us.

By combining creativity, collaboration and resilience, we find innovative solutions and move forward efficiently. Our agility allows us to evolve in line with our environment.

From students to qualified professionals, help develop future navigation solutions in partnership with our team of experts. Evolve in a caring environment where your ideas take flight and your contributions strengthen the synergy of the company.

Internationally, we meet the challenges of today and tomorrow, supporting our customers throughout the entire process: from the initial vision to development, to delivery and the collection of their satisfaction.

The Context

The internship is in the field of GNSS (Global Navigation Satellite Systems), and more particularly in the study of Galileo signals in the E5 band. These signals are based on an advanced modulation, the AltBOC, which has a wide spectrum (51,150MHz) and allows to obtain a finer resolution in phase and code estimation.

In a context where receiver bandwidth may be limited, it is essential to investigate how E5 signals (E5a and E5b) can be exploited separately. This can be done by considering this AltBOC signal as 2 BPSK(10) signals, E5a and E5b.

What you'll accomplish with Syntony GNSS

As part of this internship, it will be a question of processing and studying this signal in different ways:

- AltBOC using high bandwidth (>51.150MHz)
- 2 BPSK(10) signals independently (separately and then recombined) using a wide bandwidth (>51.150MHz)
- 2 BPSK(10) signals independently (separately and then recombined) using a reduced bandwidth (20MHz)

The work will take place in 3 stages:

1. Generation and theoretical studies of AltBOC modulation
2. Receive AltBOC signals using high bandwidth
    - By treating this signal as AltBOC
    - By treating this signal as 2 BPSK(10)
        - Study the phase of each of these signals
        - Recombine them post-correlation to reconstruct an AltBOC correlation
    - Compare the results of different treatments
3. Receive AltBOC signals using reduced bandwidth
    - By treating this signal as 2 BPSK(10)
        - Study the phase of each of these signals
        - Recombine them post-correlation to reconstruct an Alt-BOC correlation
    - Compare the results with the previous approach

These different steps will be done in simulation as well as using a Syntony GNSS receiver.

The technical skills we are looking for:

- Data analysis
- Signal processing
- Knowledge of Navigation, GNSS System (GNSS receiver, positioning, orbitography, ...) is a plus
- Matlab / Python / C/C++ (optional)
- Fluency in technical English and good writing skills English / French
- A taste for experimentation and analysis of real data is a plus (critical thinking, autonomy, writing)

About you

Currently in the last year of the Engineering cycle or the end of a University Master's degree, with a good foundation in mathematics and/or a specialization in space systems, GNSS, signal processing, telecommunications, etc., you are looking for a 6-month internship at the end of your studies. A strong appetite for theoretical studies with experimental application is also sought.

Your technical curiosity, your desire to learn and your team spirit will be the assets necessary for the success of your mission.

Ready to get on board with us? 🚀 ✨

Send us your CV under the reference ENG-654-EN: jobs@syntony.fr.