

Internship: characterization and implementation of 3D method of reconstitution of ionospheric layers from GNSS measurements

Syntony GNSS (Toulouse, France)

Engineering internship, 3 to 6 months

Key word: GNSS simulation, Software Defined Radio Architecture, GNSS receiver, earth observation, geostatistic and 3D reconstruction.

1 Introduction

Recognized throughout the world, Syntony GNSS is a Toulouse-based brand with the FrenchTech label focused on technological innovation in the field of GNSS.

Specialising in radio navigation and embedded systems, we are world leaders in our field and present in many high-growth markets.

Our simulators, receivers and indoor/outdoor positioning systems meet the growing needs of the aeronautics and space industries, as well as those of public transport, rail and mining as well as IoT

With a portfolio of prestigious customers (Airbus, OneWeb, Airbus Safran Launchers, Thales Alenia Space, Honeywell, Rockwell, Key Sight, Stockholm, New York, Munich metros, and many others), we are constantly innovating to anticipate their future needs, strengthen our leadership, and conquer new markets.

The core of our business revolves around 3 fundamental pillars:

- Innovation, to design the products and tools of tomorrow, in line with the real needs of our customers;
- Dynamism, to adapt our strengths and talent to the quality of our products and solutions;
- Open-mindedness, to remain attentive to our customers and partners while respecting our employees, with the aim of promoting Humanism and the richness of multiculturalism.

2 – Context and subject of the internship

As part of several of these products, Syntony has developed various spatialized GNSS receivers, as well as a GNSS signal simulator, based on a Software Defined Radio (SDR) architecture.

The subject of the internship proposed by SYNTONY consists in the realization of studies and prototyping of algorithms allowing the characterization of the ionospheric (Iono-Sensing, TEC map, scintillation,...) by a GNSS receiver in LEO orbit.

The 3D reconstruction of ionospheric layers based on ionospheric delay measurements is part of Syntony's medium- and short-term evolution objectives on several GNSS receiver product lines.

To this end, various studies have been carried out within the Syntony R&D team, the objective of the internship subject will be to carry out a state of the art on the methods of 3D reconstruction of the upper layers of the Earth's atmosphere and more particularly of the ionosphere via tomographic methods and/or geo-statistical approaches (kriging) from iono delay measurement (iono-free L1/L5 combination). For this purpose, CONSTELLATOR, Syntony's proprietary GNSS signal simulator, will be used.

Studies on the characterization and simulation of the lower layers of the atmosphere are also planned in addition to Syntony's Earth Observation activity (radio-occultation and signal processing estimator dedicated: Doppler measurement and bending angle estimation). Exchanges with university teams are also to be expected as part of the internship.

3 – Skills and qualities required

The profile requested corresponds to an end-of-study internship for a student leaving engineering school or at the end of a university master's degree. A student in the 2nd year of engineering school or in the 1st year of a master's degree with a good foundation in mathematics and a strong appetite for theoretical studies with experimental application may also be a good fit.

Required Skills:

- Data analysis (spatial and geostatistical data)
- Signal Processing / Estimation Method (Kalman Filter, Least Square)
- Knowledge of Navigation, GNSS System (GNSS receiver, positioning, orbitography, etc.) and Earth observation by satellites is a plus
- Matlab / Octave (optional)
- Technical curiosity, desire to learn, team spirit.
- 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).