# *GNSS-Independent Positioning Using LEO Satellite Opportunistic Signals*

Shape the future of navigation

📍 Location: Saint-Louis (France), in the tri-border region of France, Germany, and Switzerland

📃 Contract: 3-year contract, extendable depending on university.

🕓 Working time: Full-time, with flexible working hours

**About this Position**

Do you enjoy developing navigation solutions that continue to function even when conditions are uncertain or degraded? Do you want to push the boundaries of science and technology in navigation?

At the **French-German Research Institute Saint-Louis (ISL)**, you will work on the frontier of research on robust and intelligent navigation systems. You will collaborate with experts in navigation signal processing, system prototyping, and embedded systems in an inter-disciplinary and multi-cultural team. Your mission will have a direct impact on European technological sovereignty and security.

**Your Mission**

Modern positioning relies heavily on fusing inertial measurement units (IMU) with GNSS, a combination that delivers high-accuracy navigation even with consumer-grade sensors. However, GNSS is prone to interference making a GNSS-independent navigation capability increasingly essential.

LEO-based positioning converges on four main axes

- **Dedicated navigation constellations**: Designing LEO constellations expressly for positioning (e.g., Xona's upcoming network) to achieve good coverage, precise and secure positioning.
- **Adding navigation services to existing telecom constellations:** Enhancing current LEO communication systems with timing/positioning data, as Satelles does on the Iridium network via its STL service, already demonstrating location and time transfer on Iridium bursts.
- **Passive use of operational LEO satellite signals (Opportunistic Signals, SOP)**: Leveraging "free" signals from constellations such as Iridium, Orbcomm, Starlink, and OneWeb. Here, the positioning is derived mainly from Doppler shifts, optionally fused with IMU, barometer, or magnetometer data. Recent experiments have shown that both time-of-arrival and carrier-phase measurements are feasible, and an augmentation service supplying orbit and clock corrections could yield precise, fully passive and free positioning. Future systems - Kuiper and IRIS² - can be applied to this approach.
- **Emerging concept – Fused LEO GNSS**. By broadcasting orbit and clock information to users, sat-com systems can provide a low-cost PNT service, turning their ubiquitous, frequency-diverse signals into a practical alternative to dedicated GNSS or purpose-built LEO-PNT systems.

The thesis aims to study and develop a positioning system that operate on low-Earth-orbit satellite signals. The resulting methods will be evaluated through experimental campaigns. A five-step research

plan has been defined to study a GNSS-independent positioning system based on LEO satellite communication signals:

- **State-of-the-Art Review**: Review of GNSS and inertial navigation, opportunistic signal positioning, and LEO constellation/signal characteristics (orbits, power levels, protocols).
- **Modelling:** Modelling of signals and measurements (observables such as Time-of-arrival, Doppler shift, etc.).
- **Processing Definition:** Define positioning system architecture (positioning method and mode, IMU coupling, etc.) and design signal processing and navigation algorithms.
- **Simulation and Performance Analysis:** Develop an end-to-end simulation and evaluate performance metrics such as accuracy, robustness, availability.
- **Experimental Validation:** Conduct tests on real-world signals and/or on a laboratory test-bed, benchmark with reference, and consolidate the contributions and identified limitations.

**How to apply**

👉 Learn more about ISL benefits and our research culture here:
📎 Why join us

🗓️ Start date: to be defined
🌐 Working language: English (French and/or German appreciated, language courses and casual multi-lingual coffee meetings available).

At ISL, your research builds the navigation technologies of tomorrow. Join us to make your mark.