



French-German Research Institute
of Saint-Louis

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ISL is offering a PhD Position

GNSS Independent Positioning Using LEO Satellite Opportunistic Signals

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.

Conditions to apply

- **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.
- **Contact for questions:** Dr DELMOTÉ - philippe.delmote@isl.eu
- Apply via our careers page by uploading your CV and a short motivation letter <https://www.isl.eu/jobs/>

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.

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.