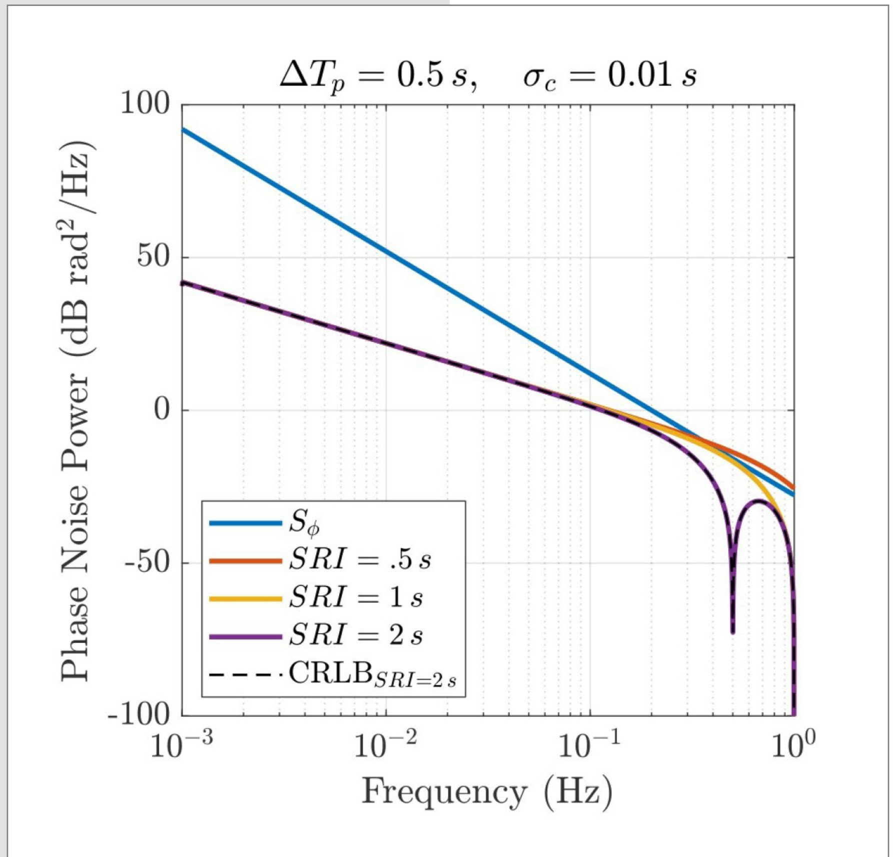
PROJECT SYNC-MRN

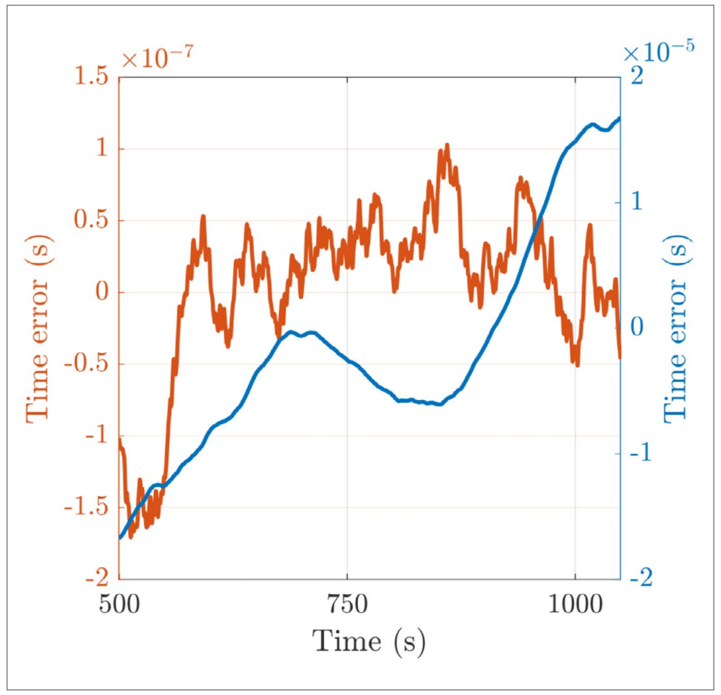
Synchronization of Multistatic Radar Networks

Modern warfare is increasingly relying on autonomous Unmanned Ground Vehicles (UGVs) and Unmanned Aerial Vehicles (UAVs). As a result, enhancing Situational Awareness capabilities has become crucial for executing effective military operations. The MoMuRaN project aims to tackle this problem by studying and developing a Mobile Multistatic Radar Network for surveillance applications in urban environments to provide support to military operations. The key feature of this system is its adaptive nature, which is needed to deal with the highly dynamical battle scenarios. The network, being mobile, will have its radar nodes installed on Unmanned Ground Vehicles (UGVs). This mobility brings forth significant challenges in terms of the system's size and power requirements. The network's mobile nature and the unique characteristics of operational environments also affect the quality of the wireless channel, hence appropriate modulation techniques must be adopted to address these challenges. Furthermore, as the system is multistatic, it requires stringent synchronization across the network to enable coherent processing and maintain a certain standard of performance.
Our laboratory's research is focused on the task of synchronization, which in radar applications often imposes very precise timing. This is typically accomplished using optical fibres. However, for this particular and demanding application, only wireless synchronization protocols have been investigated. Initial simulations indicate that combining these protocols with highly stable oscillators could deliver the necessary performance. During this first year of the project, the research has been focused on a comparative analysis of the results achieved by using the proposed approach with different oscillator models.

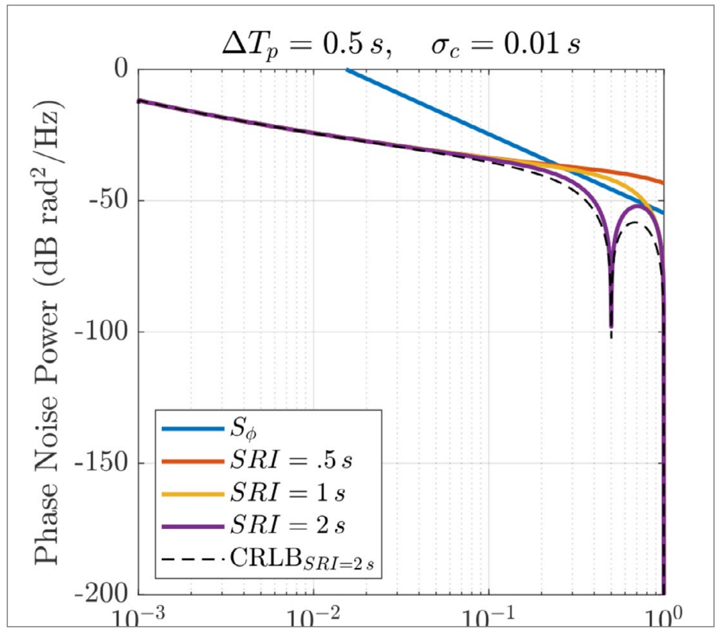
Technical Sheet
Funding institution:
Rheinmetall S.p.A.
Project partners
Rheinmetall S.p.A.
Project duration
November 2022 - November 2025
Involved countries
Italy



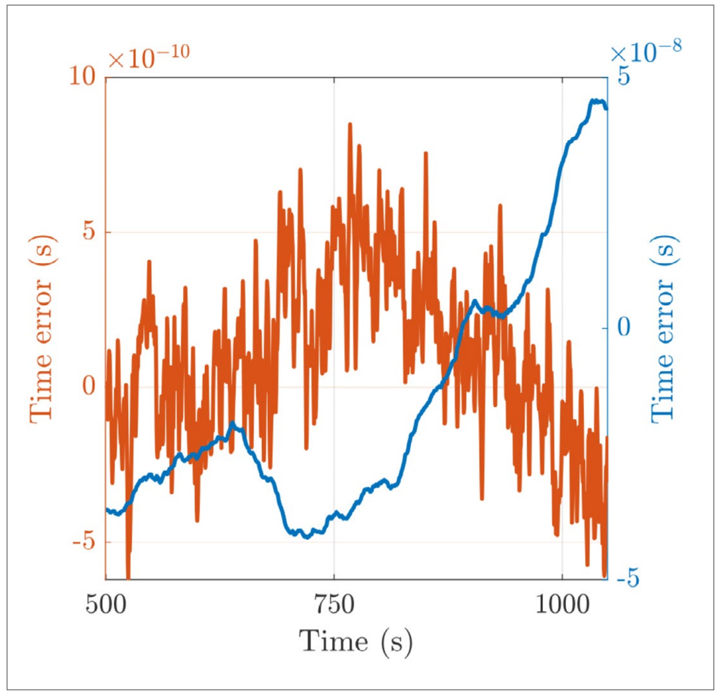
(a) Phase Noise Power Spectral Density (PSD) of the USRP E312 oscillator (blue curve) compared to the Phase Noise PSD post-synchronization by adopting the proposed approach. The Synchronization Repetition Interval (SRI) indicates the time between two consecutive synchronization epochs



(b) Timing error realizations obtained by using the USRP E312 oscillator model (blue curve) and the same model postsynchronization (orange curve)



(c) Phase Noise Power Spectral Density (PSD) of the ULN-8R oscillator (blue curve) compared to the Phase Noise PSD post-synchronization by adopting the proposed approach. The Synchronization Repetition Interval (SRI) indicates the time between two consecutive synchronization epochs



(d) Timing error realizations obtained by using the ULN-8R oscillator model (blue curve) and the same model post-synchronization (orange curve)