Introduction:
The objective of the ADAPT project funded by the European Space Agency is to study, characterize, implement, simulate and ultimately assess the benefits of different adaptive tracking techniques for navigation signals in Global Navigation Satellite System (GNSS) receivers. In order to ensure the correct characterization of the adaptive techniques and their applicability to different scenarios, a number of different changing environments and channel models are considered. Moreover, to maximize simulation performance and improve overall efficiency, we are implementing and testing our algorithms in Matlab using a semi-analytical approach.

The main project activities include the following studies/developments:

- **Adaptive tracking techniques**: Perform a critical review of the state-of-the-art time-varying adaptive tracking techniques, supported on previous results available and sensitivity analysis where applicable, and present a preliminary study on their benefits and trade-offs.

- **Scenarios and channel models**: Characterize the challenges in GNSS signal processing in terms of the environment and propagation channel, focusing on varying environment conditions.

- **Simulation platform**: Implement and integrate the most promising techniques in a simulation platform that allows for the characterization and analysis of the performance of each technique. This proposed software platform will provide means to configure the scenarios and techniques in various ways, and collect the required observables from the processing loops, and post-process them accordingly, by means of univocal metrics that capture the key aspects of the behavior.

**Main research goals for EPFL:**

1. To perform a detailed analysis of the existing adaptive switching schemes, including the characterization of their theoretical and practical performance.
2. To develop a platform for the adaptive tracking concept simulation based on the semi-analytical approach and design an adaptive switching scheme between single, double and full band processing techniques to be applied to BOC(15, 2.5), CBOC and BOC(10, 5) signals.
3. To test the designed adaptive switching scheme in different scenarios and difficult conditions and show its robustness in terms of probability of losing lock, probability of false lock, and code tracking error.

**Preliminary Conclusions:**

- The two-Step adaptive switching has shown good results improving the overall probability of losing the lock and probability of false lock, and is therefore recommended when \( \frac{C}{N_0} \) drops. For high \( \frac{C}{N_0} \) and no interference and signal attenuation, the full band tracking is preferable.

- In the event of severe multipath, the adaptive switching scheme can greatly reduce the probability of losing lock and the probability of false lock, and hence preserve a stable tracking behavior. Therefore, it is highly recommended to use adaptive switching in this case.