# LOCALIZATION, NAVIGATION AND SMART MOBILITY
Project presentation A.Y. 2022/2023

- Project mark
  - July 2023 up to **4 points**
  - September 2023 up to **4 points**
  - January 2024 up to **3 points**

- The project can be done individually or in group (up to 4 members).
  The project data are available in WeBeep

- Students can request assistance in case of issues or doubts while working on the project, we can schedule dedicated meeting either individually or by merging more than one group.

- Evaluation strategy: **presentation** of the results (please also deliver the matlab code and the slides/ppt), a report is optional.

- The exact day of presentation will be provided.

AP6 AP5 AP4

AP1 AP2 AP3
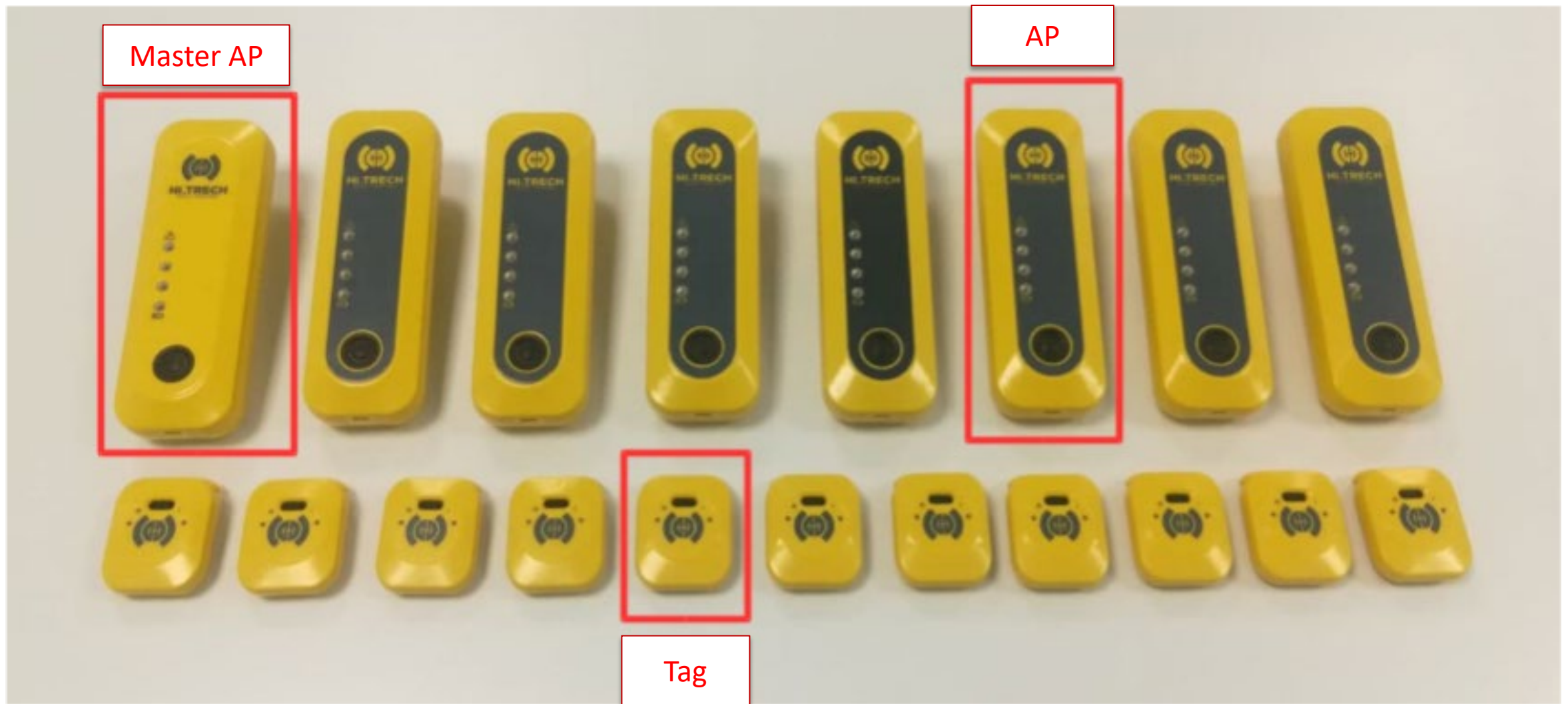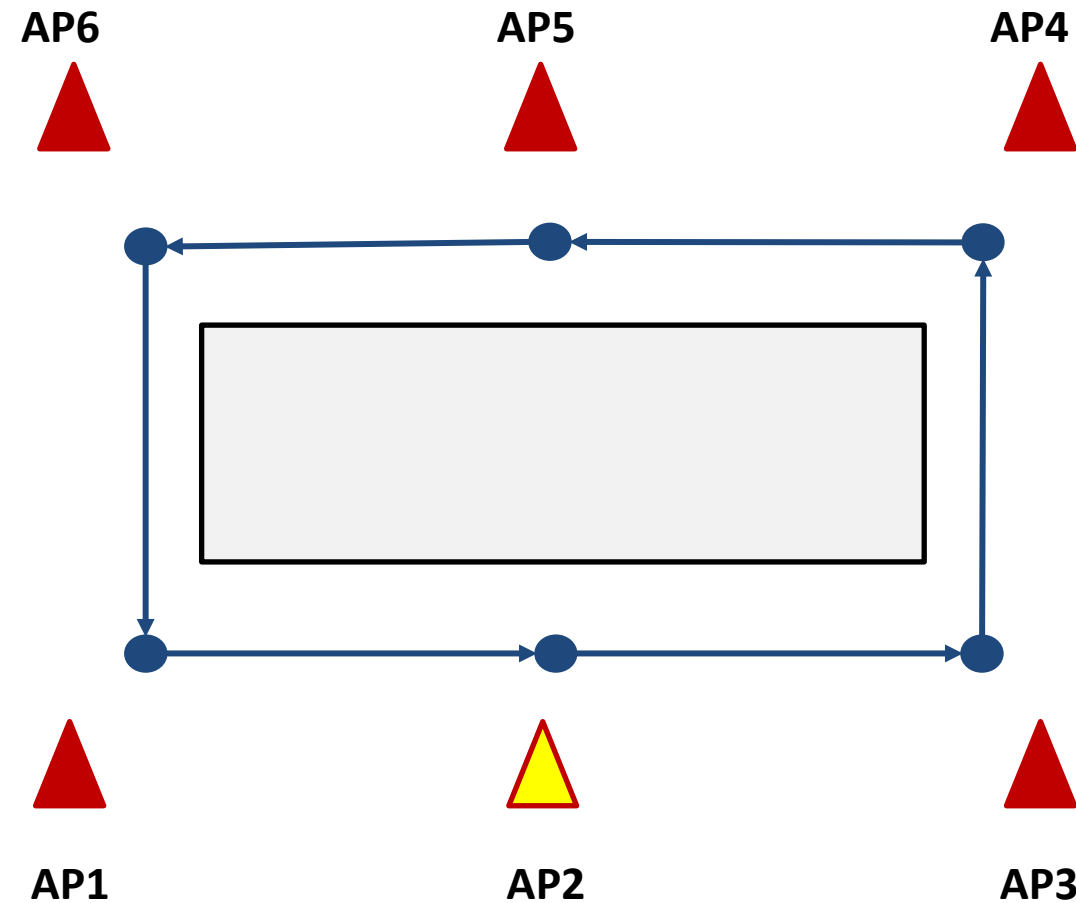
4 UWB tags
6 APs
5 TDOA measurements, nominal sampling rate 10 Hz.
TDOA are computed w.r.t. master AP #2

TDOA is 3D!

AP positions

Master AP

AP		
6x3 double		
1	2	3
0	0	1.8600
2.8800	0	1.8700
5.7600	0	1.8800
5.6900	3.3500	1.8500
2.8700	3.3500	1.8300
0	3.3500	1.8400

x   y   z

Data structure – TDOA measurement

TDOA

	rho		4x1 cell
		1	
1	5x269 doub...		
2	5x665 doub...		
3	5x666 doub...		
4	5x665 doub...		

Tag1
Tag2
Tag3
Tag4

rho | rho{2, 1}

rho{2, 1}

	1	2	3	4	5	6	7	8	9	10	11	
1	NaN	2.1768	2.1040	2.1343	NaN	1.8773	1.9977	1.8048	1.8353	1.6394	1.5065	TOA_ MasterAP - TOA1
2	-2.6611	-2.1570	-2.4021	-2.2936	NaN	-2.6196	-2.3016	-2.1996	-2.2733	-2.2980	-2.4804	TOA_ MasterAP - TOA3
3	-3.8727	-3.8395	-3.8793	-2.8102	NaN	-4.1379	-2.7816	-2.8966	-2.8278	-3.0102	-3.1251	TOA_ MasterAP - TOA4
4	-1.2427	-1.3719	-0.4090	-0.4779	NaN	-0.6274	-0.6108	-0.7311	-0.5993	-0.7847	-0.9268	TOA_ MasterAP - TOA5
5	0.3882	0.4370	0.3867	0.2402	NaN	0.1201	0.1501	-0.0585	-0.0633	-0.2561	-0.3847	TOA_ MasterAP - TOA6
6												

6 APs -> 5 TDOA meas., each column is a timestep

Each TDOA meas. is computed as rho = TOA_MasterAP - TOA_AP

The master AP is AP2

The TDOA is already converted into meters

Pay attention to NaN and outliers (it's a real system...)
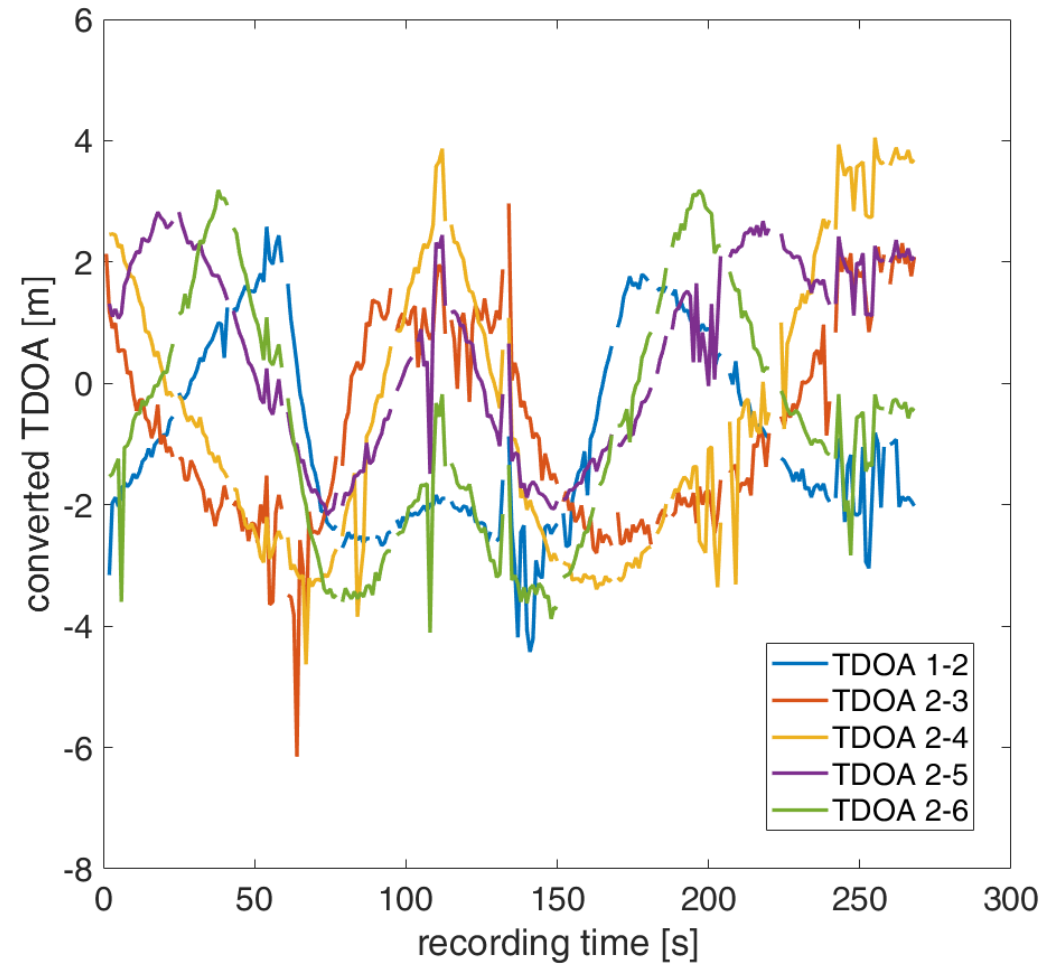
1. **Load and analyze data**

   E.g., statistics, coherence, availability, outliers, missing, etc.

   If you find something that seems not to be ok, detail how you address the specific issue.

2. **Localization algorithms implementation**

   Implement one localization algorithm and one tracking filter that use TDOA measurements to estimate the UE position. Compare and visualize the results.
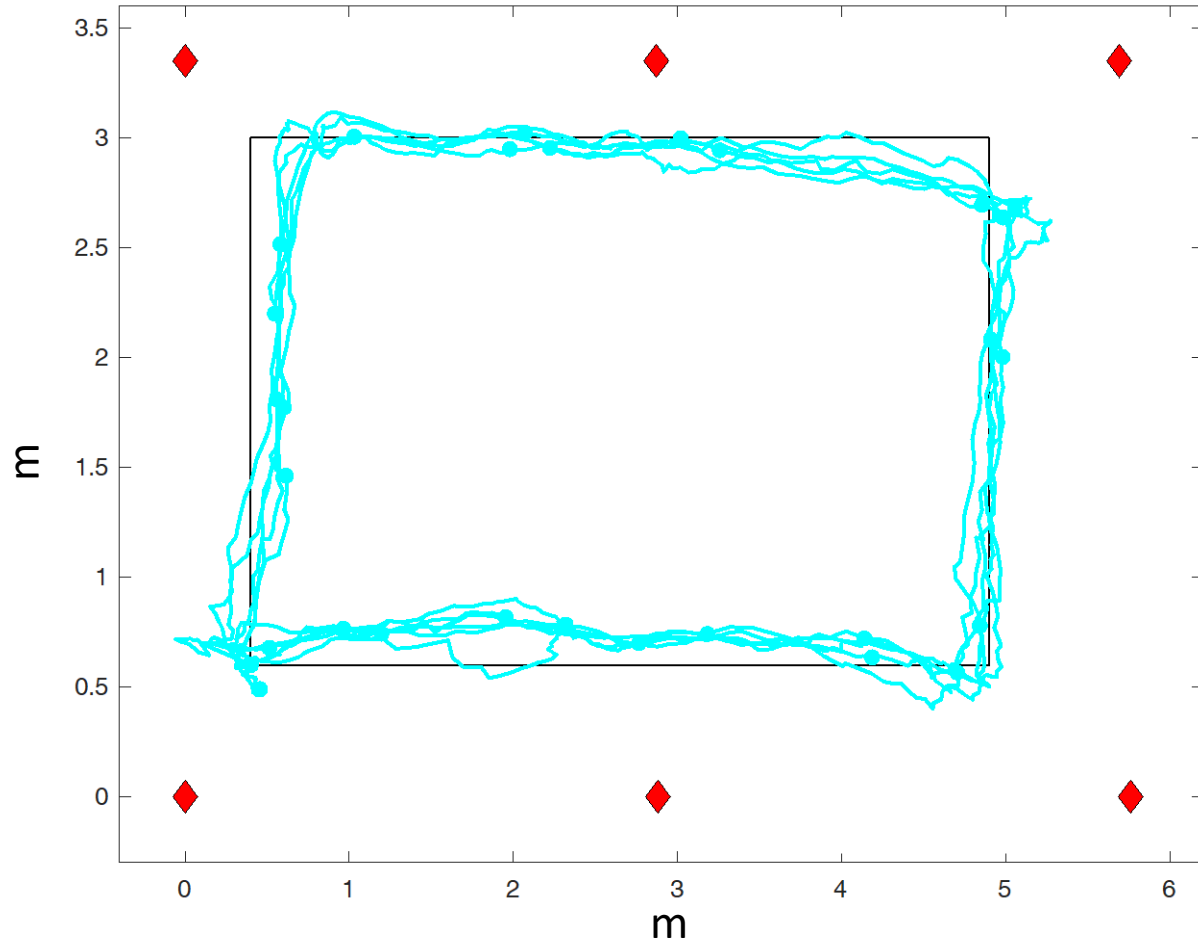
3. **Tune the tracking filter**

   Compare the performance of the developed tracking filter by varying filter parameters trying to obtain the best estimated trajectory.
   Compare and visualize the results.

   NOTE: CAREFULLY SELECT THE WAY TO PRESENT THE RESULTS

Example of estimated trajectories

Configuration A

Configuration B