



POLITECNICO
MILANO 1863

DIPARTIMENTO DI ELETTRONICA
INFORMAZIONE E BIOINGEGNERIA



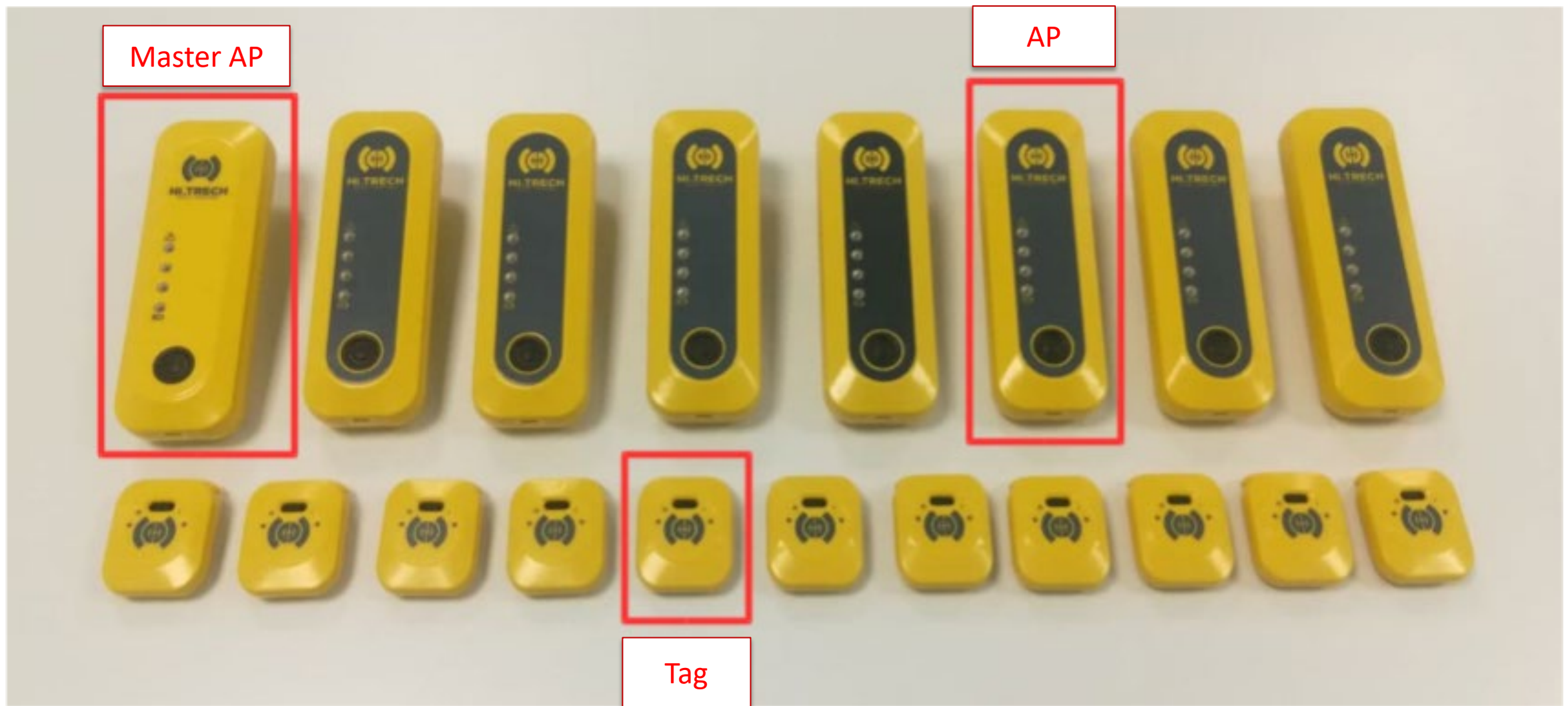
LOCALIZATION, NAVIGATION AND SMART MOBILITY

Project presentation A.Y. 2021/2022

- Project mark
 - July 2022 up to **4 points**
 - September 2022 up to **4 points**
 - January 2023 up to **3 points**
- The project can be done individually or in group (up to 4 members).
The interested students should send me an email stating their willingness to do the project and I will give you the data.
- 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.

UWB localization area





AGV tracking



Experiment details



4 UWB tags

6 APs at known positions

5 TDOA measurements, sampling rate 10 Hz.
TDOA are computed w.r.t. master AP #2

AP positions

Master AP

AP			
6x3 double			
	1	2	3
1	0	0	1.8600
2	12.7320	1.1027	1.8700
3	25.0211	1.0951	1.8800
4	21.8370	35.4947	1.8500
5	10.6439	36.0768	1.8300
6	-1.0956	36.0768	1.8400
7			

Data structure – TDOA measurement

TDOA

rho															
5x924 double															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	-3.8655	-3.9198	-3.9779	-3.6766	-3.8303	-3.8069	-3.8370	-3.7501	-3.8467	-3.8237	-3.8640	NaN	-3.8111	-3.7232	-3.7139
2	-3.8948	-3.7051	-3.6034	-3.8842	-3.5092	-3.5392	-3.4291	-4.2083	-4.2362	-3.9369	-3.9521	-3.5965	-3.8926	-3.7975	-5.7034
3	6.7630	5.4254	5.8666	6.6376	5.2016	6.7326	5.7967	7.6165	7.4448	7.6220	7.1190	5.6785	8.1012	8.0259	6.4846
4	8.5407	8.4928	9.6453	9.6033	9.7552	9.7542	9.7375	9.6520	9.7175	9.6386	9.7960	9.8999	9.9660	10.0924	10.0060
5	5.3084	5.2325	5.2053	NaN	5.5002	5.5984	5.4425	5.5381	5.5275	5.6221	5.6074	5.6156	5.4774	5.5364	5.6049
6															

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

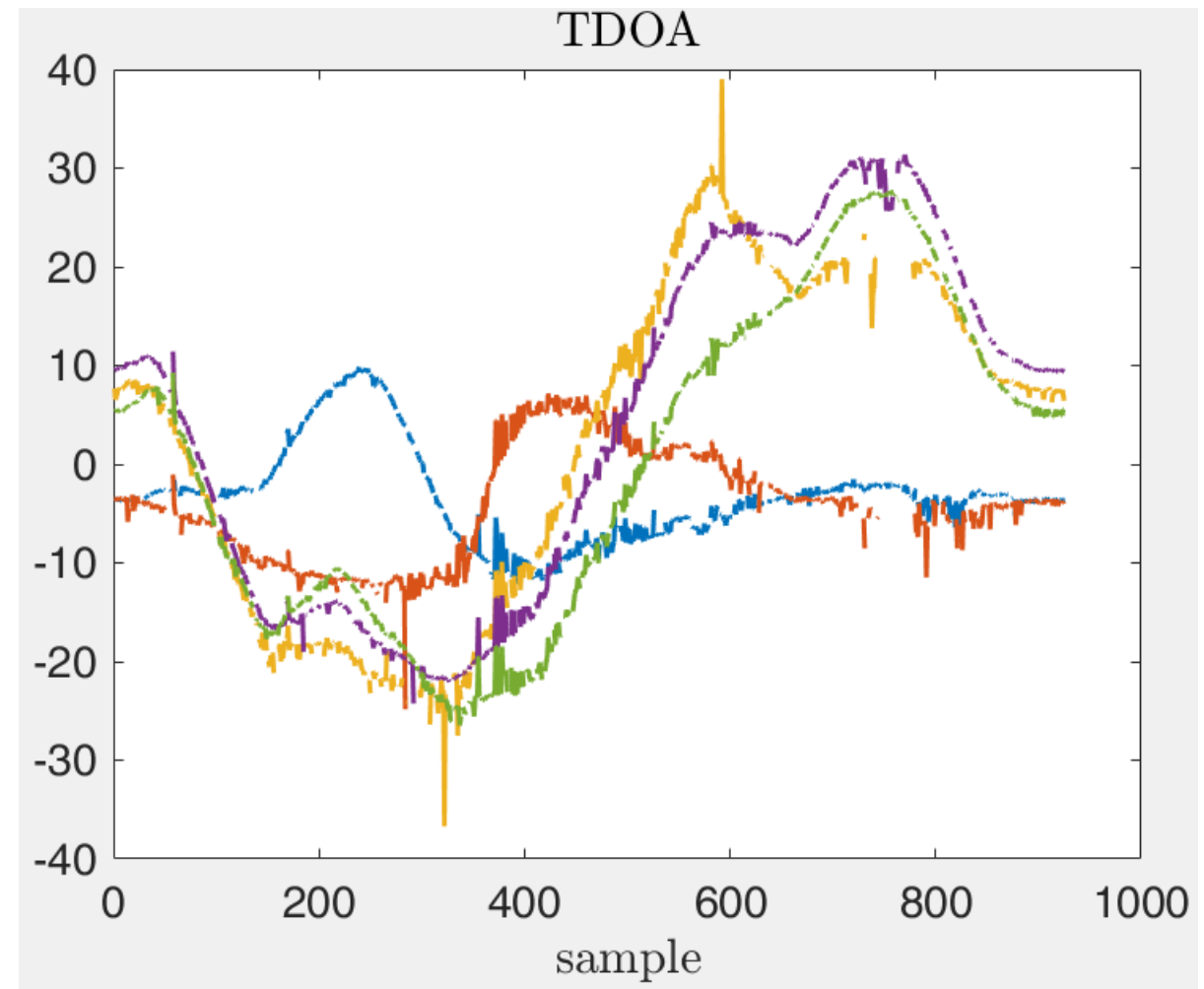
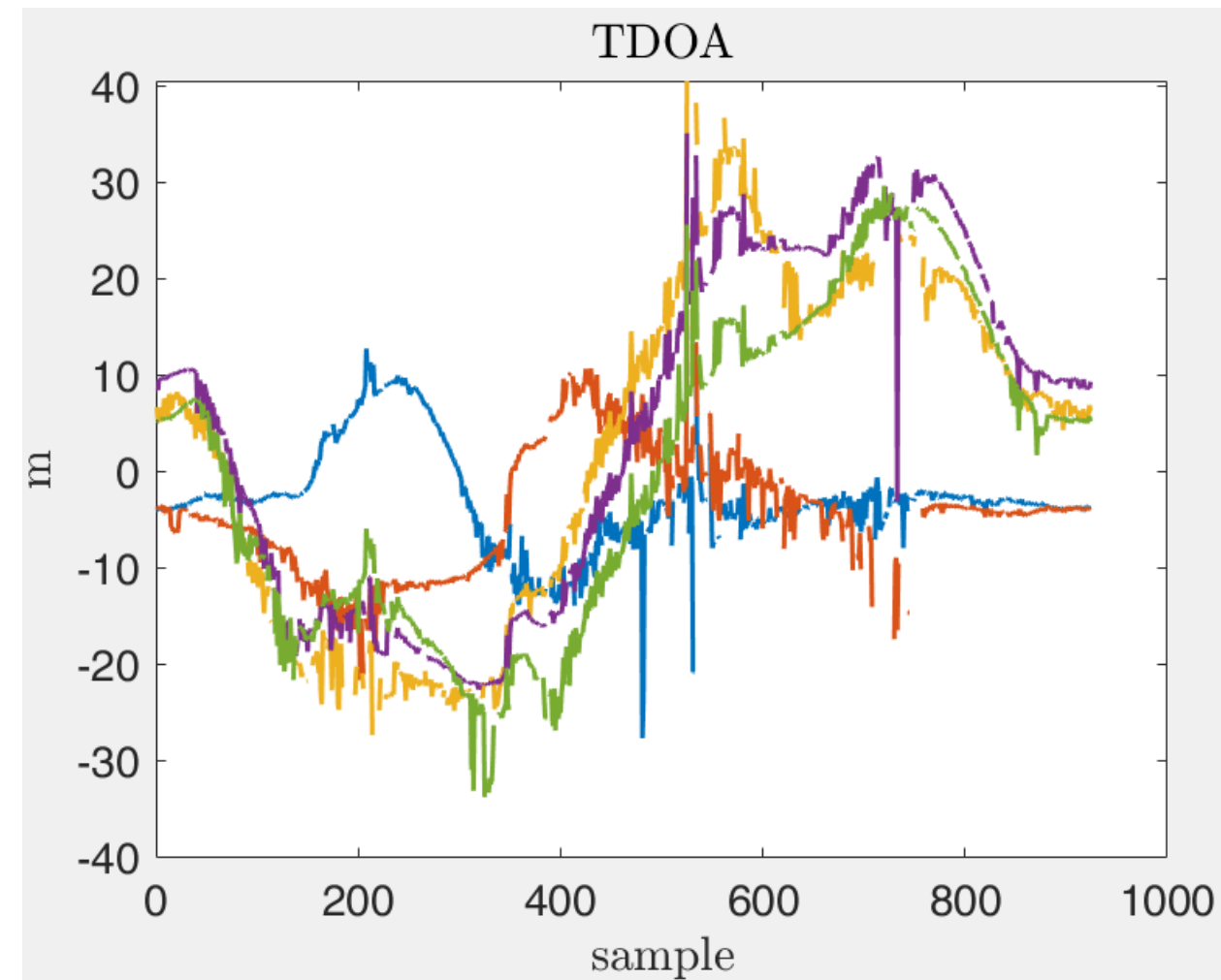
Each TDOA meas. is computed as $\rho = \text{TOA_MasterAP} - \text{TOA_AP}$

The master AP is AP2

The TDOA are already converted into meters

Pay attention to NaN and outliers (it's a real system...)

Examples of TDOA meas.



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. Snapshot localization: localize the AGV by NLS or other algorithms at each time step

Implement the algorithm which uses TDOA measurements at each time step and estimate the AGV position. Select result metrics and plots.

3. Track the AGV by KF/EKF

Implement a KF/EKF to track over time the AGV position (maybe also the velocity). Select result metrics and plots. Compare the tracking with the snapshot localization.

NOTE: CAREFULLY SELECT THE WAY TO PRESENT THE RESULTS

Example of position estimate

