Track 8: “5G Positioning (off-site)” Special features

Organizational aspects:

Database/dataset download

- Participants can download the measured samples from this site:
  http://xx
  Datasets are available since xxx.
  Competitors can only use the data provided for the competition in the website. Performing any additional on-site calibration is not allowed.

Submission of results

- Despite being an off-site track, we will ask to competitors to process data as if they were streamed in real time. To do so, a new interface based on a API has been developed: EvaalAPI. This API will be used by competitors for sending position estimates and reading the sensor readouts: https://evaal.aaloa.org/evaalapi/
  We provide 8 validation logfiles (V01_03, V01_04, V02_03, V02_04, V03_03, V3_04, V04_03, V04_04,) via the EvaalAPI to allow the competitors to get to the new interface.
- A participant team can run the process up to 3 times. This lets a chance to catch-up if any issues happen. Although the competition organizers will evaluate the three trials, only the best one will be considered for the contest. For the first evaluation trial, the logfile EvaluationRun01 will be used. For the second trial, the logfile EvaluationRun02 will be used. For the last trial, the logfile EvaluationRun03 will be used. These three logfiles correspond to three different data collection sessions.

Submission deadline of the post-processed indoor coordinates

- Data will be published in website (train/val) and EvaalAPI (val/evaluation): xxx 2022
- The deadline for submitting the post-processed results is: xxx 2022
- Proclamation of winners: xxx 2022

Scope

5G is being deployed in large-scale markets for both general commercial cases as well as industry verticals. A demand request is to provide location information to track person, factory wares, assets, or cars. 5G positioning utilizes the measurements based on 5G reference signals from either base-station (BS) or user equipment (UE). The dominate 5G solution is to deliver the measurements to location server which estimates the UE location based on the positioning measurements, called 5G network-based localization. This track to testing and comparing the performances (accuracy and robustness) under a common dataset and evaluation framework.

Competition Goal

The goal of the competition track is to evaluate the performance of different positioning solutions based on the common dataset received in a given area.

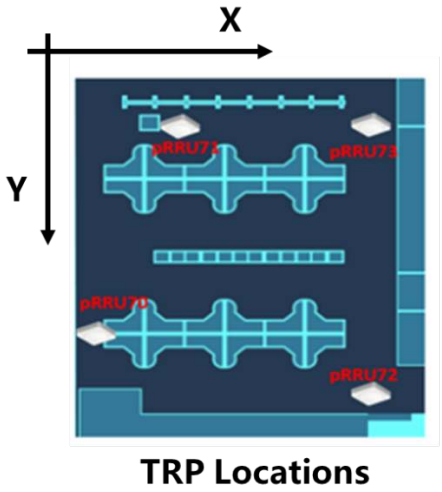
Main features of the competition

This track is done off-site, so all data for calibration is provided by competition organizers before the celebration of the IPIN conference. The competition teams can calibrate their algorithmic models with several files. Finally, each team will compete using additional files, but in this case, the ground-truth reference is not given and must be estimated by the competitors. This is an off-line competition where all competitors have the same data of the testing environment and custom on-site calibration is not allowed.

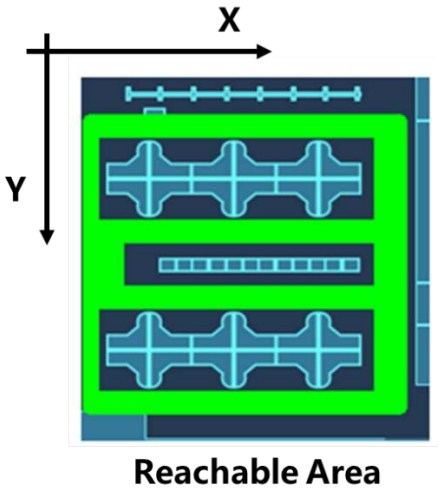
Measurement environment (novelty in 2022)

Four TRPs (pRRUs) with known locations are mounted on the ceiling of a typical open office. A User Equipment

(UE) acts as a transmitter and moves at a slow speed (0.2~0.5m/s) in the reachable area with a constant height of 1.2m.



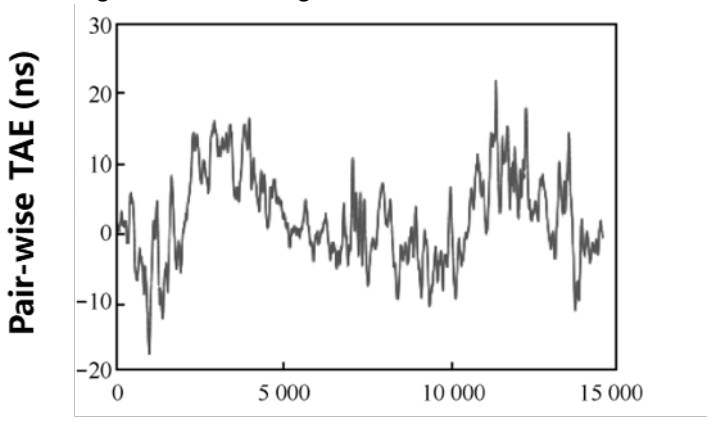
TRP Locations



Reachable Area

Measurement information (novelty in 2022)

The UE sends sounding reference signal (SRS) to all TRPs. The Time of arrival (ToA) and the signal strength (RSRP) are measured and logged at each TRP at a rate of 100ms~200ms for a total period of 3000 seconds. The ToA is measured using the MUSIC algorithm with a known accuracy of 1ns tested in a LoS environment. The pair-wise timing alignment errors (TAEs) of the TRPs are unknown and continues drifting at a slow pace (As demonstrated on the figure below). Each TRP is equipped with two cross polarized antennas. The ToA and the RSRP are measured using the combined signals from two antennas.



Desired localization approaches

- Self-Localization for UL-TDOA: In this case UE locations and TAEs are both unknown, however it is can be shown that with 4 or more TRPs and enough TOA measurements at different locations, a unique solution for UE locations and TAEs exist. Such solution can be found using two-dimensional search
- RSRP assisted self-localization for UL-TDOA: Similar to the aforementioned case, whereas the coarse locations of the UE can be firstly estimated using RSRP measurements to reduce the search space.
- Any other innovative approaches: other approaches include but not limited to Artificial intelligence (AI) positioning, UE tracking using Kalman filter, and etc.

Description of Datasets (logfiles)

The logfile is a .csv file containing multiple columns with different types of data as shown in the figure below. Each row represent a complete set of a single measurement.

	A	B	C	D	E	F	G	H	I
1	Time Stramp(s)	TOA 70 (ns)	TOA 71 (ns)	TOA 72 (ns)	TOA 73 (ns)	Rsrp 70 (dBm)	Rsrp 71 (dBm)	Rsrp 72 (dBm)	Rsrp 73 (dBm)
2	0.00	190	202	216	223	-100.5	-107.9	-110.7	-113.1
3	0.12	190	201	215	223	-100.1	-107.9	-110.6	-113.1
4	0.20	190	202	216	223	-100.1	-107.9	-110.6	-113.4
5	0.28	191	203	217	224	-99.7	-107.9	-110.4	-113.4
6	0.40	190	202	216	223	-99.7	-107.9	-110.4	-113.4
7	0.40	190	202	216	223	-99.9	-108	-110.5	-113.4
8	0.48	191	203	216	224	-100.1	-107.9	-110.5	-113.2
9	0.56	191	203	217	224	-100.3	-108	-110.7	-113.2
10	0.68	190	202	216	223	-100.3	-108	-110.7	-113.5
11	0.76	190	202	216	224	-99.9	-107.9	-110.5	-113.4
12	0.84	187	199	213	220	-99.9	-107.9	-110.5	-113.7
13	0.96	190	202	215	222	-100.1	-107.8	-110.5	-113.3
14	1.04	189	202	216	223	-100.3	-107.8	-110.6	-113.3
15	1.12	190	202	216	223	-100.5	-107.7	-110.6	-113
16	1.24	188	200	214	222	-100.1	-107.8	-110.5	-113.1
17	1.32	189	201	214	222	-100.1	-107.8	-110.5	-113.4
18	1.40	189	201	215	222	-99.8	-107.8	-110.4	-113.4

- Column A: Logged time stamp
- Column B to E: Uncalibrated ToA measurements at each TRP (TRP 70, TRP 71, TRP 72, TRP 73) in nanoseconds
- Column F to I: Measured received signal strength at each TRP in dBm

The TRP locations are shown in the table below:

TRP ID	X (m)	Y (m)	Z (m)
70	1.75	20.2	3.2
71	4.85	11.25	3.2
72	12.48	21.85	3.2
73	9.75	12.48	3.2

UE height is held constant at 1.2m.

Description of the output

The estimated 2-D location (x,y) of the UE at every given time stamp. The candidate with smaller 75% CDF positioning error wins.

Evaluation criterion

Organizer provides the true UE location, and calculate the location errors.

Contact points and information

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