



IPIN 2020
ELEVENTH INTERNATIONAL CONFERENCE ON
**INDOOR POSITIONING
AND INDOOR NAVIGATION**

December 14, 2020, ONLINE



Summary of IPIN 2020 Competition Track6

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Why Track 6 ?

- **Key words of track 6:**
 - Today, **smartphone based vehicle navigation** has become a very popular navigation and positioning application.
 - **Indoor spaces** such as tunnels and garages, as well as **urban canyon** areas, are the biggest challenge facing vehicle navigation.

Goals

- **Explore the performance of smartphone-based vehicle indoor and outdoor positioning application.**
- **Communication on the methods of multi-sensor fusion positioning.**



Rules

- Data : Sensor data only from smartphone
 - GNSS, Magnetometer, Accelerometer, Gyroscope
 - Pressure, Light, AHRS, etc.
- Test environment :
 - Urban canyon with some satellite signal blocked (about **23 mins**)
 - Indoor environment without GNSS service (about **11 mins, including** parking).
 - The posture of the phone is fixed during the acquisition process.
- EvAAL Evaluation: Third quartile of **2D positioning error**
Altitude error is not considered in the final evaluation.



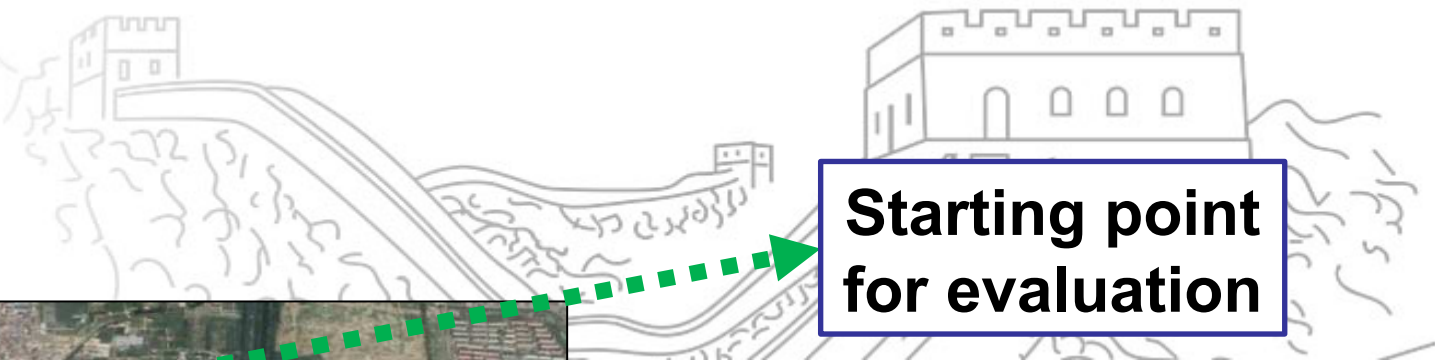
500m

70m



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**Starting point
for evaluation**



End

4.5Km for initial alignment.

**Starting point of
test path.**

14.35Km for Evaluation.



Data Collection

Initial alignment phase

- Sensor calibration
- Initial static state
- Several stops and turns

sensor calibration



dynamic alignment



Final evaluation ~ 35minutes



start



static alignment

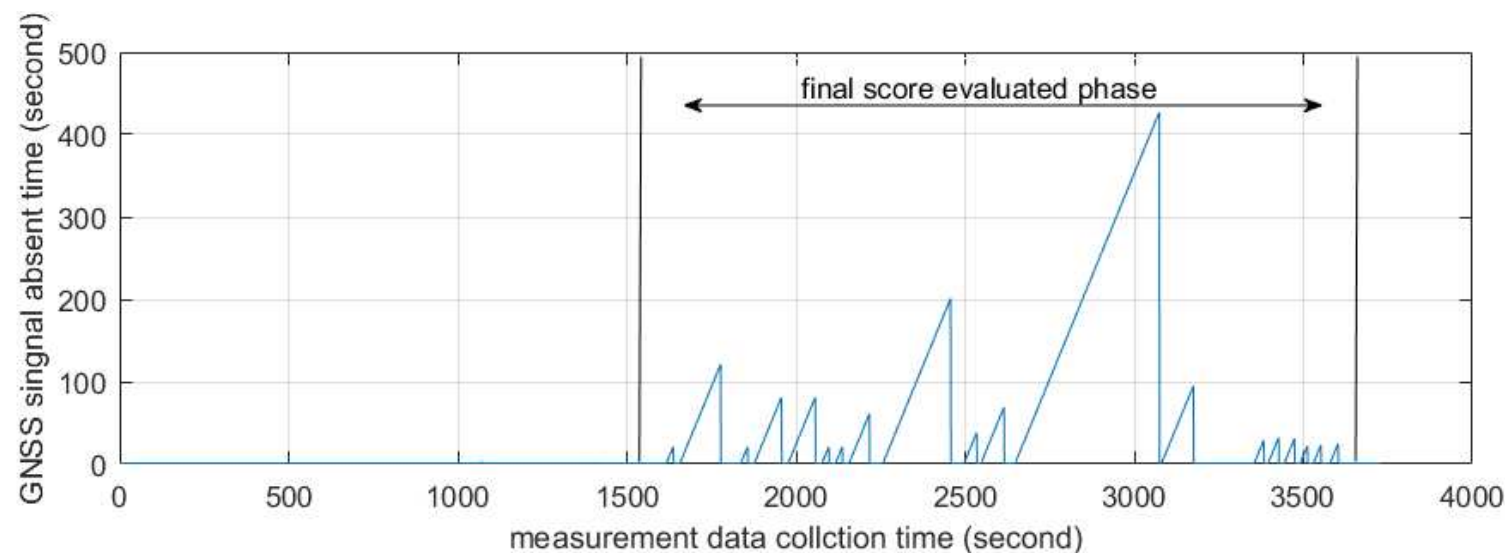


GNSS signal attenuation and interruption



Final score evaluated phase

- Frequent GNSS signal attenuation
- Several long-time GNSS signal interruptions
- Indoor parking



GNSS signal condition

Data Collection

- **Device Installation and Data Collection:**

A Huawei mate20 smartphone is fixedly installed at the front of the vehicle to record raw multi-sensor data.



Device Installation

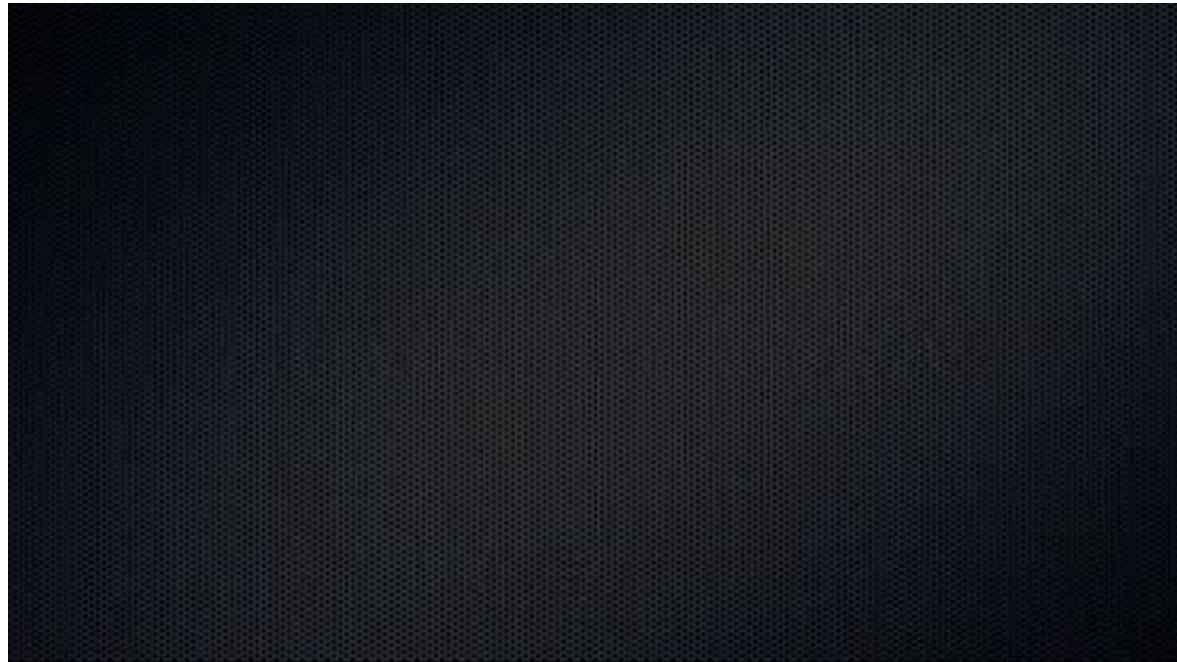


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September 7–10, 2020, Beijing, China

Data Collection

- **Device Installation and Data Collection:**

A Huawei mate20 smartphone is fixedly installed at the front of the vehicle to record raw multi-sensor data.





Challenging Points

No prior information, No external sensors

- no external aid-information----wheel speed- information from OBD.
- no prior mark information----the reference mark of Bluetooth and WIFI , road map .

Long-time no GNSS signal

- frequent GNSS signal attenuation
- long-time GNSS signal interruption

An irregular test route

- no structured roads, a random and irregular test route
- no map matching constraint



unfamiliar driving



smartphone-based alone



long-time no GNSS signal



irregular test route



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Competitors of Track 6

- **Team SZU Mellivora Capensis**

Shenzhen University

- **Team YAI**

Department of Electrical Engineering, Yuan Ze University and
National Ilan University

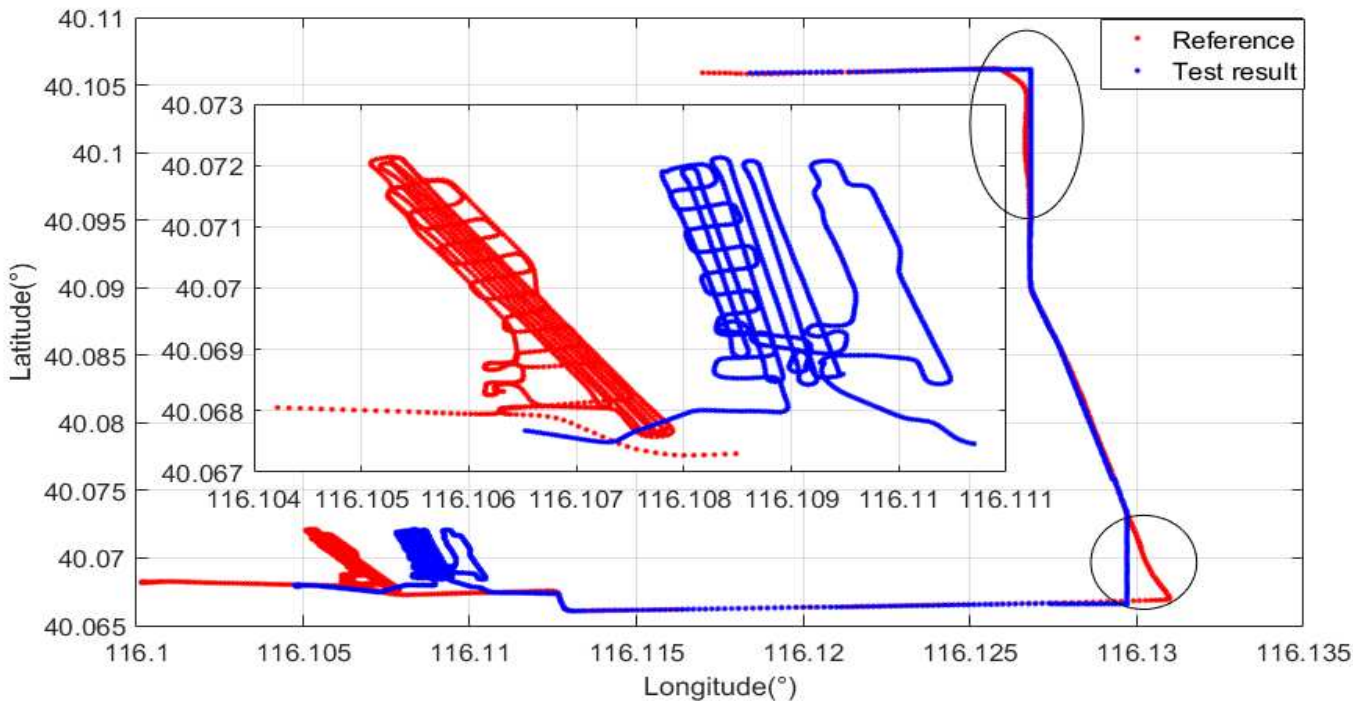
- **Team WHU-Autonavi**

Wuhan university, AutoNavi Software Co., Ltd.



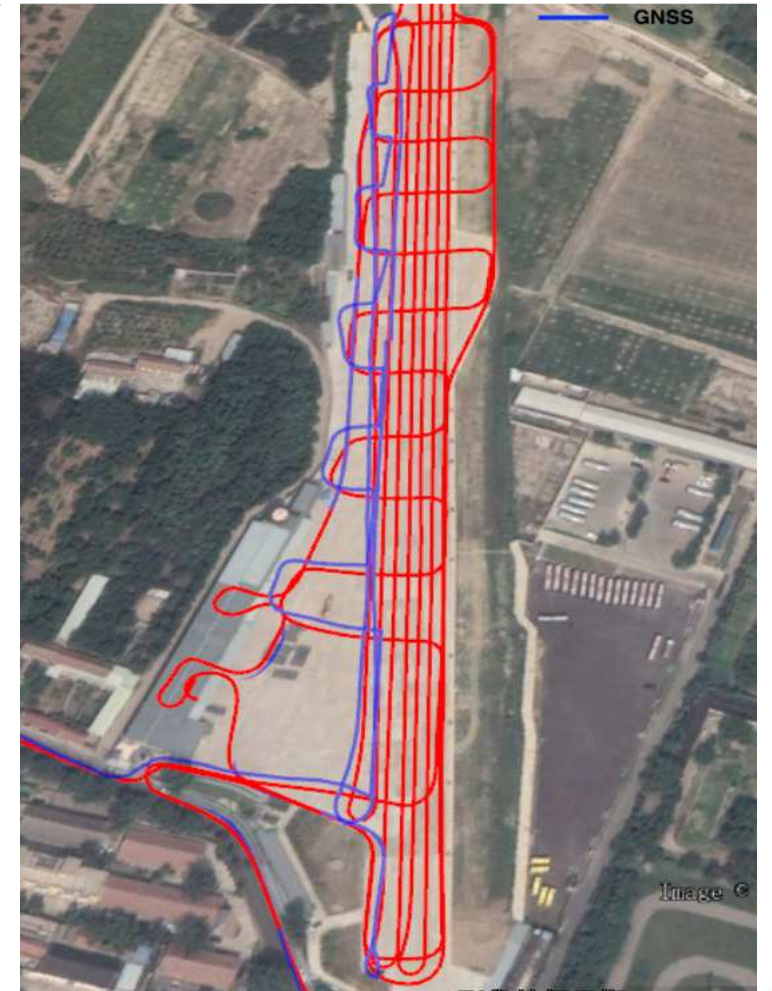
Team A

- Underutilized the GNSS positioning information
- Similar positioning trajectory shape to the reference



Positioning result trajectory

Results



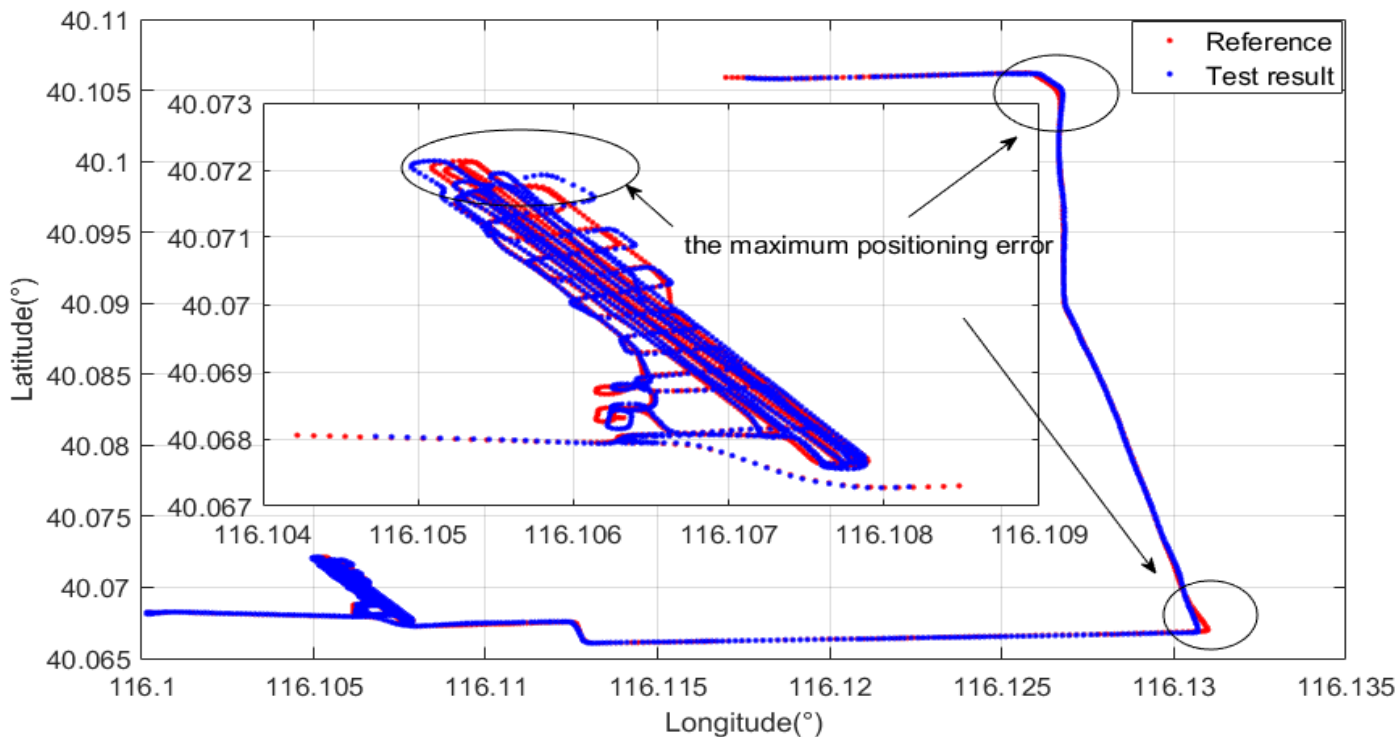
GNSS available condition



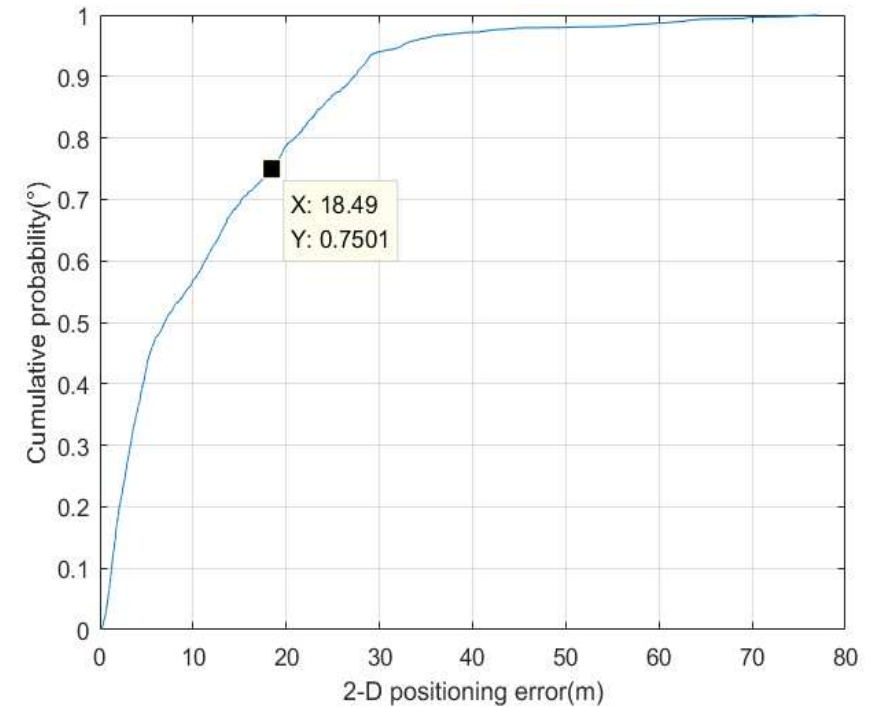
Results

Team B

- Positioning trajectory that about the same with the reference
- 2-D positioning error : 18.5m, 75 %



Positioning result trajectory



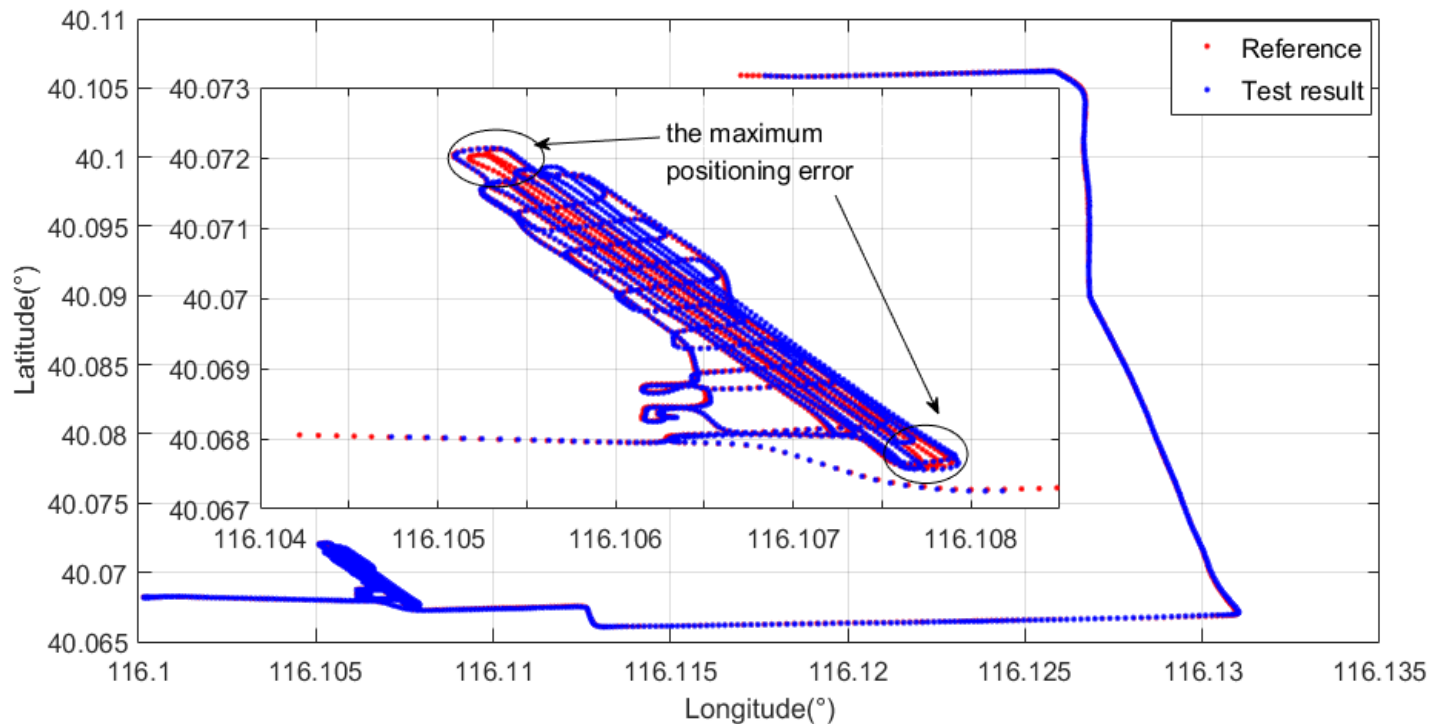
2-D positioning error distribution



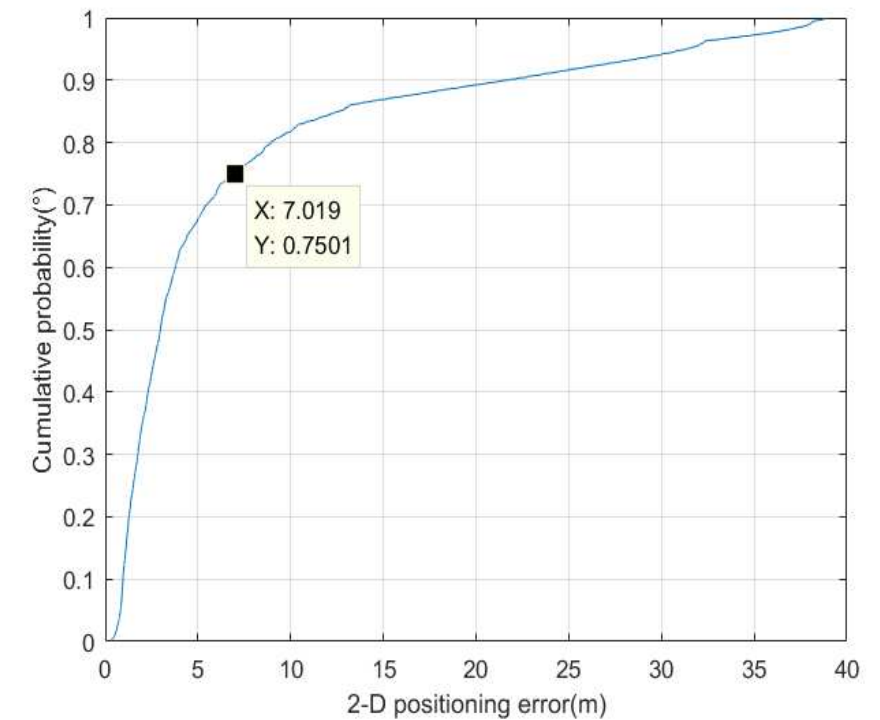
Results

Team C

- Positioning trajectory that almost the same with the reference
- 2-D positioning error : 7.0m, 75 %



Positioning result trajectory



2-D positioning error distribution



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Track 6

Team	Positioning error (m)



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Track 6

Team	Positioning error (m)
YAI	236.6





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Track 6



Team	Positioning error (m)
SZU Mellivora Capensis	18.5
YAI	236.6



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Track 6



Team	Positioning error (m)
WHU-Autonavi	7.0
SZU Mellivora Capensis	18.5
YAI	236.6



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7th IPIN Competition WINNER

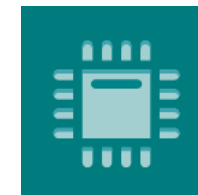
Track 6: On-Vehicle smartphone

WHU-Autonavi

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