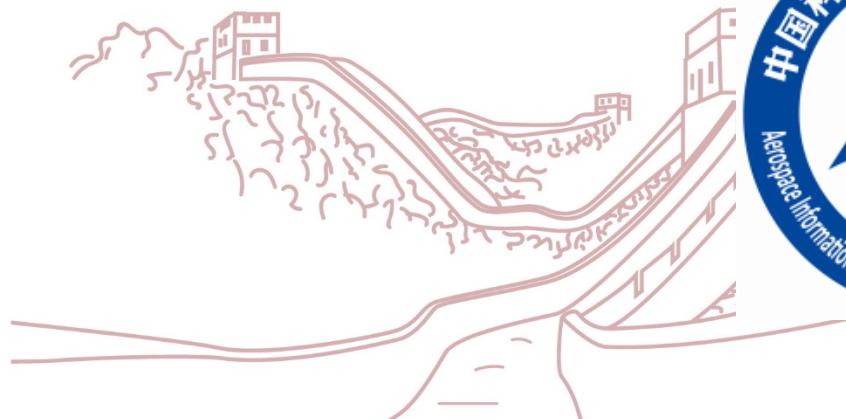
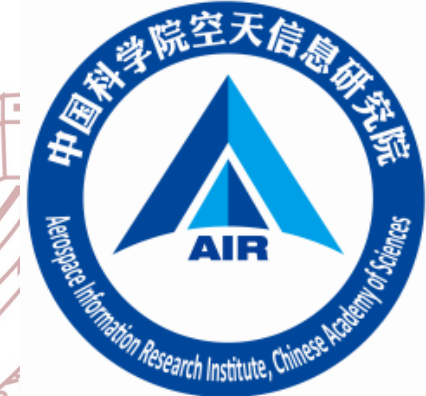




IPIN 2022

TWELFTH INTERNATIONAL CONFERENCE ON

**INDOOR POSITIONING
AND INDOOR NAVIGATION**



Summary of IPIN 2022 Competition Track6

Track Chairs: Xinchun Ji , Wenchao Zhang (AIR-CAS)



Aerospace Information Research Institute,
Chinese Academy of Sciences





Track6 Summary



- **Key words :**

- 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**.





Track6 Summary



- **Goals :**

- **Exploring smartphone-based vehicle performance in indoor and outdoor scenarios.**
- **Communication on the methods of multi-sensor fusion positioning.**
- **Promote the continuous advancement of smartphone-based vehicle positioning technology.**





Track6 Summary



- **Rules :**
- **Data: All sensor data only from smartphone**
 - GNSS, Accelerometer, Gyroscope , Magnetometer, AHRS, etc
- **Test scenarios :**
 - Urban canyon with frequent signal blocked (about **30 mins**)
 - Indoor environment without GNSS service (about **10 mins**, **including** parking, passenger getting on and off).
- **Localization approach :**
 - Only **real-time** positioning algorithm is admitted.
- **EvAAL Evaluation Rules:** Third quartile of **2D positioning error**

- **Device Installation:**

A Huawei mate20 Pro smartphone is installed at the front of the vehicle to record raw multi-sensor data. The installation of smartphone is not completely firm.



Chinese Academy of Sciences
smartphone Installation

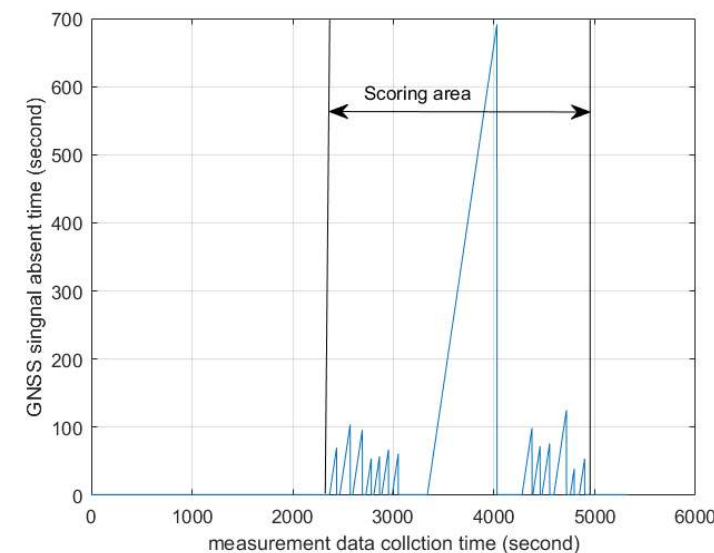
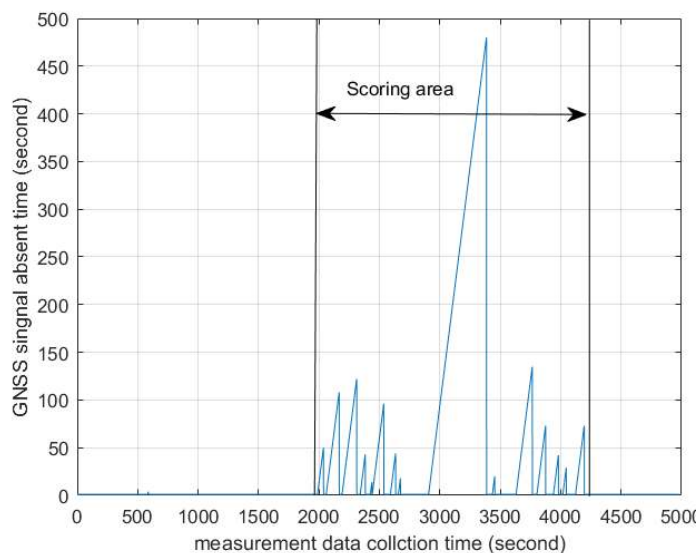
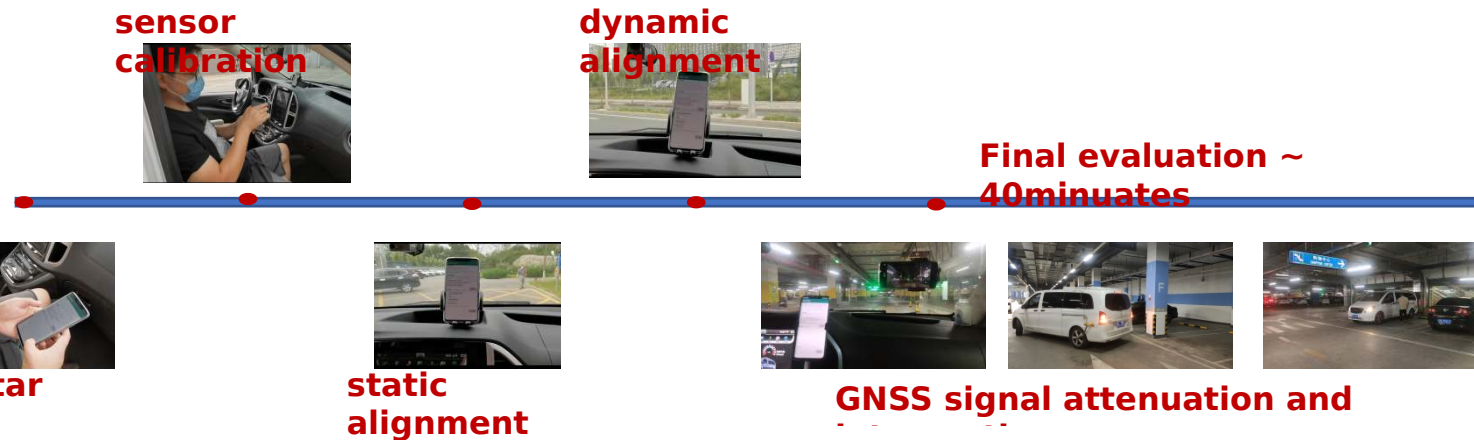
• Data Collection:

Initial alignment phase

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

Score evaluated phase

- Frequent GNSS signal attenuation
- Several long-time GNSS signal interruptions
- Indoor parking and passenger getting on and off



GNSS signal condition (route1&route2)



Track6 Summary



- **Data Collection:**



• 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
- ✓ **Complex motion (New Challenging)**
- frequent reversing and parking
- passengers getting on and off



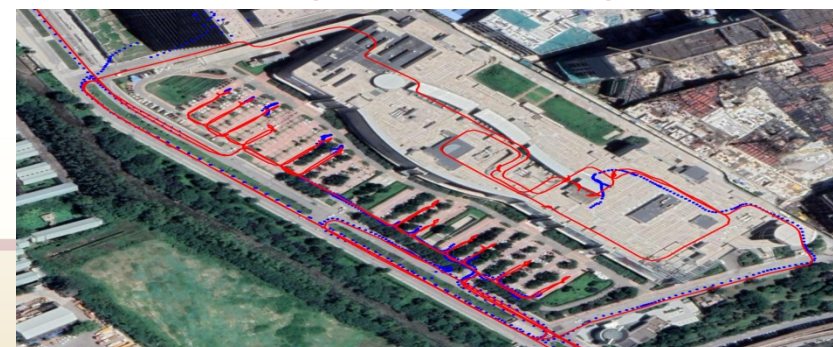
unfamiliar driving



smartphone-based alone



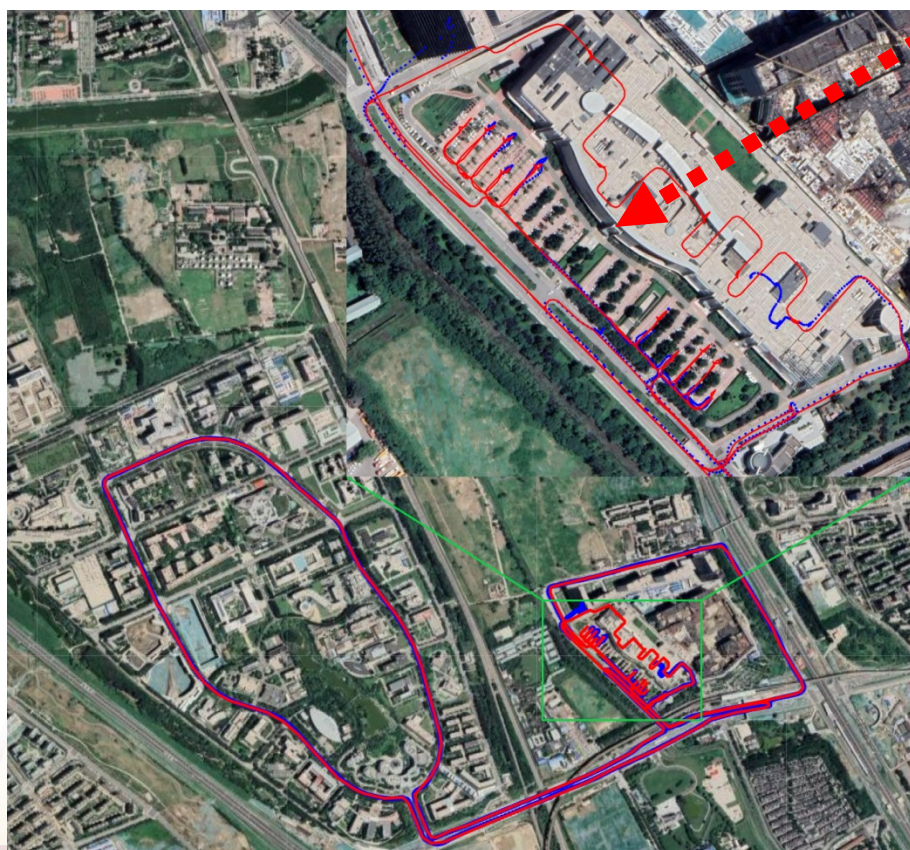
long-time no GNSS signal



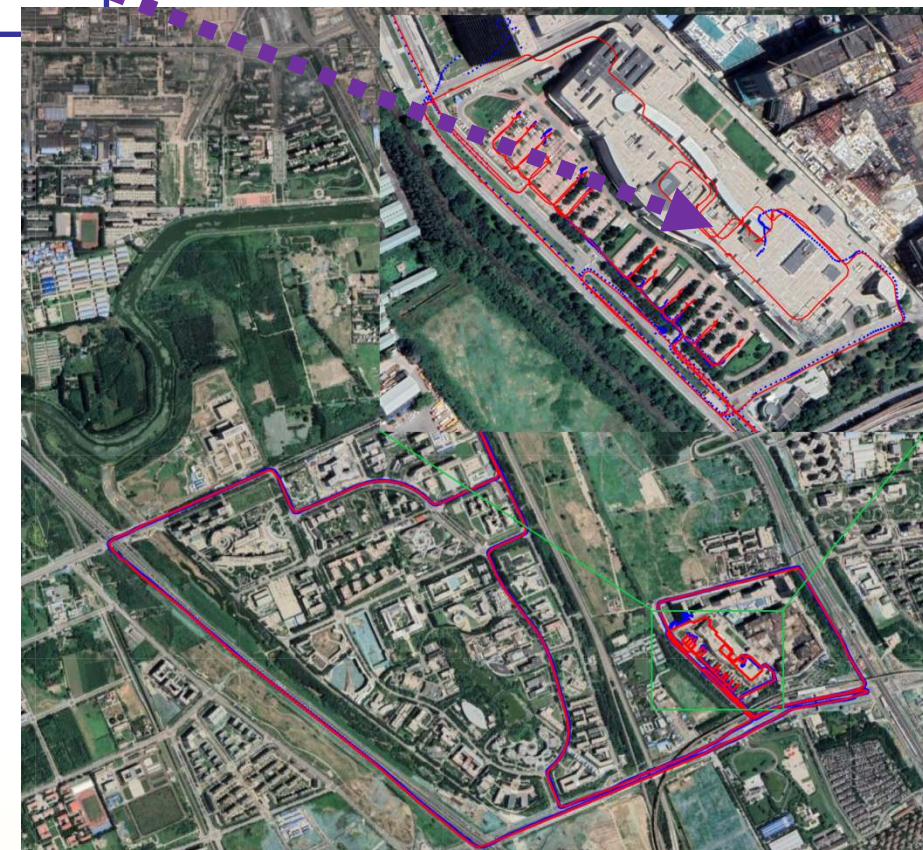
irregular test route

- Data Evaluation:**

Evaluation area



Test Route 1



Test Route 2



Test route 2 is more challenging with more **complex trajectory and GNSS signal conditions.**



Track6 Summary



- **Competitors: 4 Teams**

- **Team: WHU-GD**

GNSS Center, Wuhan University, China; Gaode Map Company, China.

- **Team: team708**

School of Software Engineering, Beijing Jiaotong University

- **Team: Leviathan**

Huawei Technologies

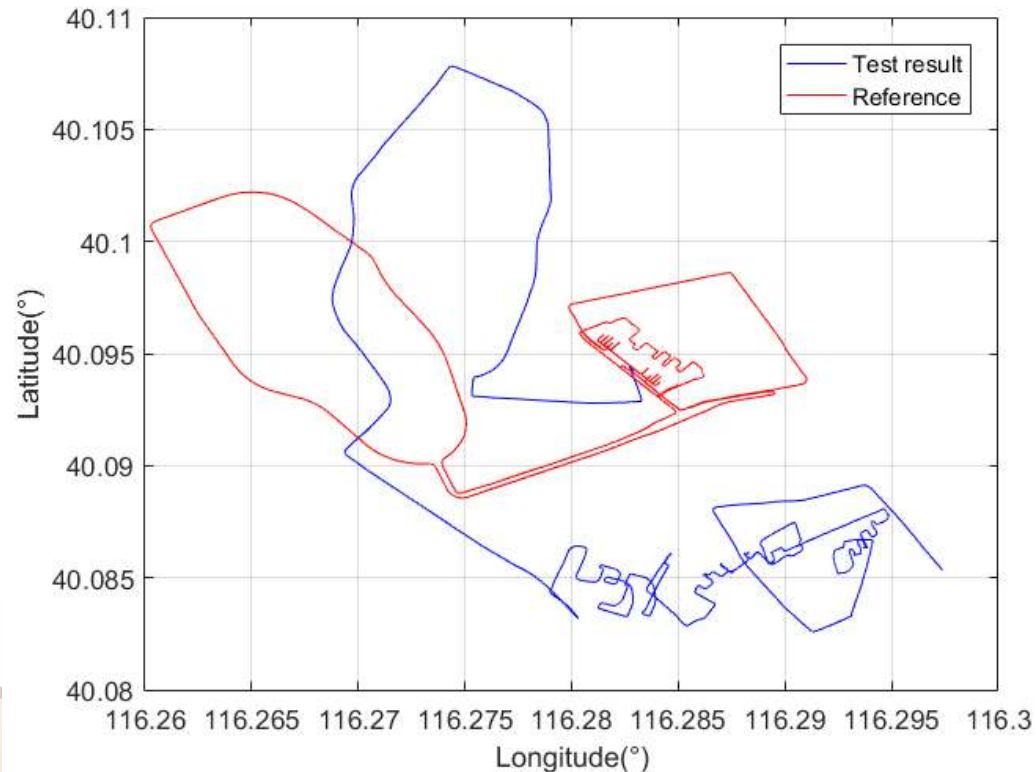
- **Team: ict**

ICT

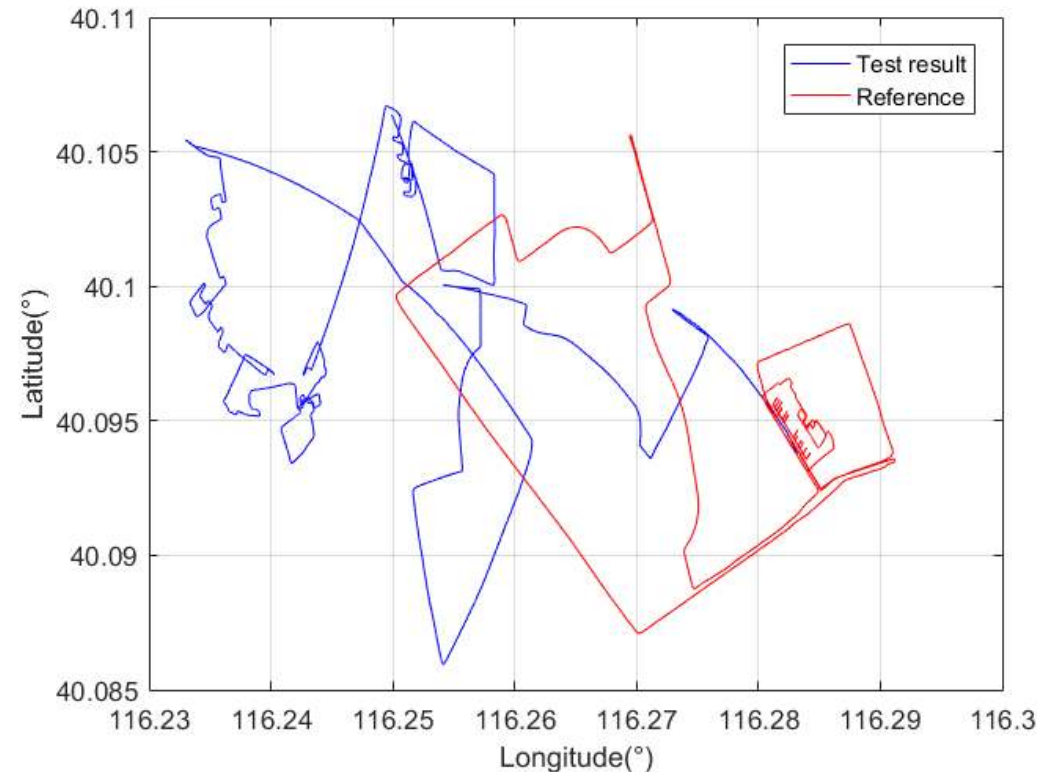


• Results: Team A

- A **data processing error** has occurred and the GNSS information has not been used effectively
- Similar positioning trajectory shape to the reference



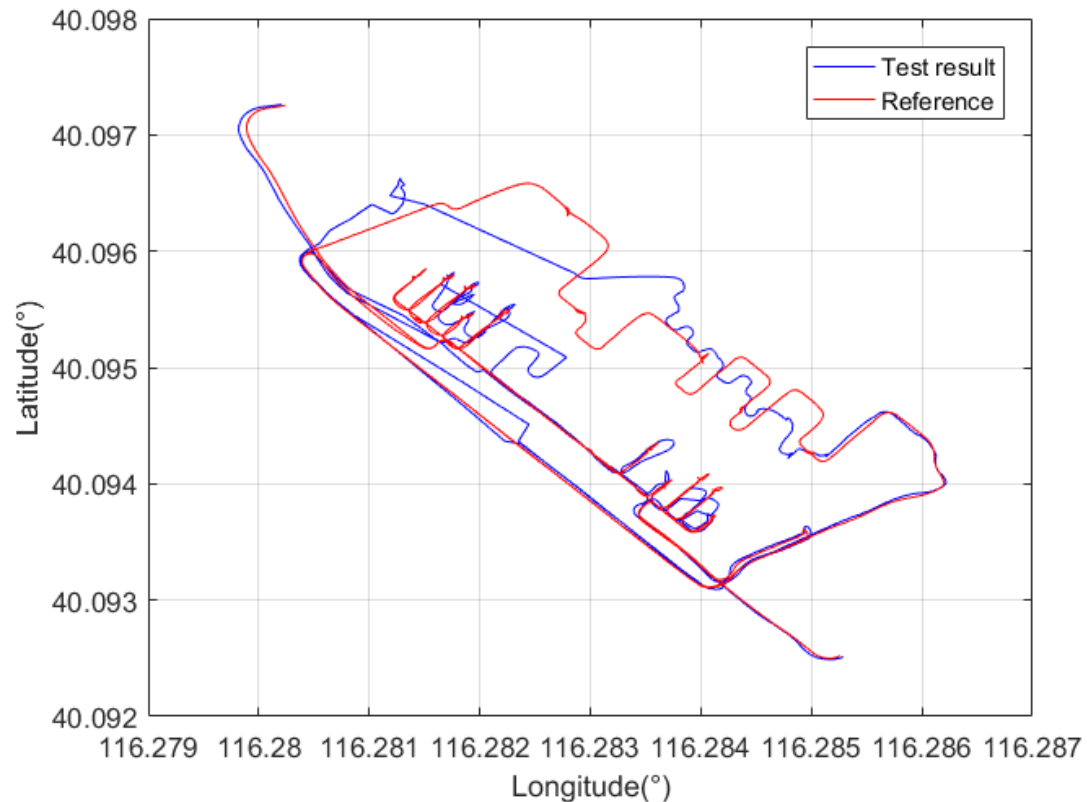
Positioning result trajectory of route 1



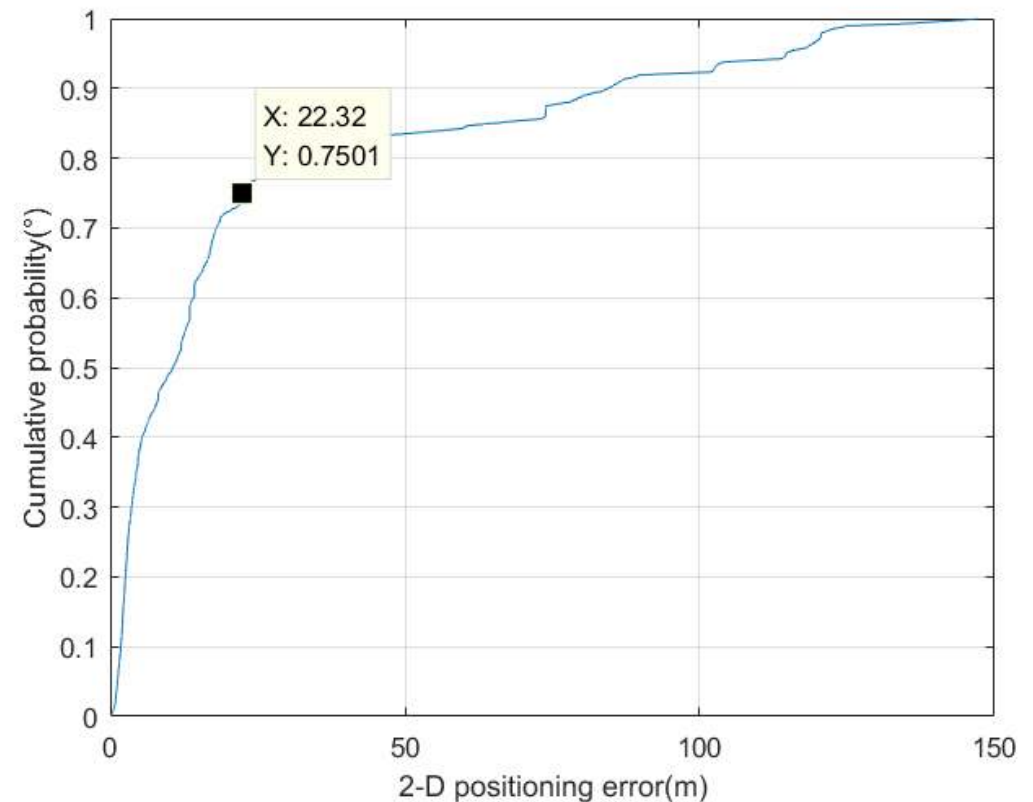
Positioning result trajectory of route 2

• Results: Team B

- Positioning trajectory that about the same with the reference
- 2-D positioning error : **22.3m, 75 %** @ route 1(route 2: no valid results)



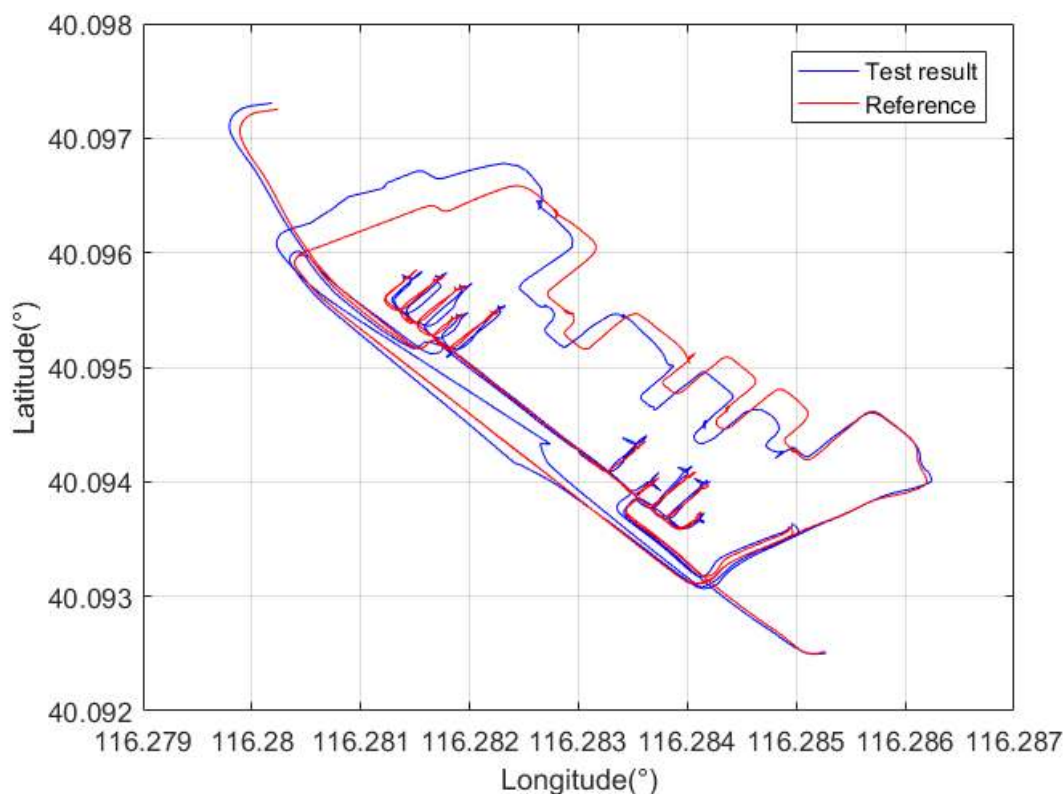
Positioning result trajectory of route 1



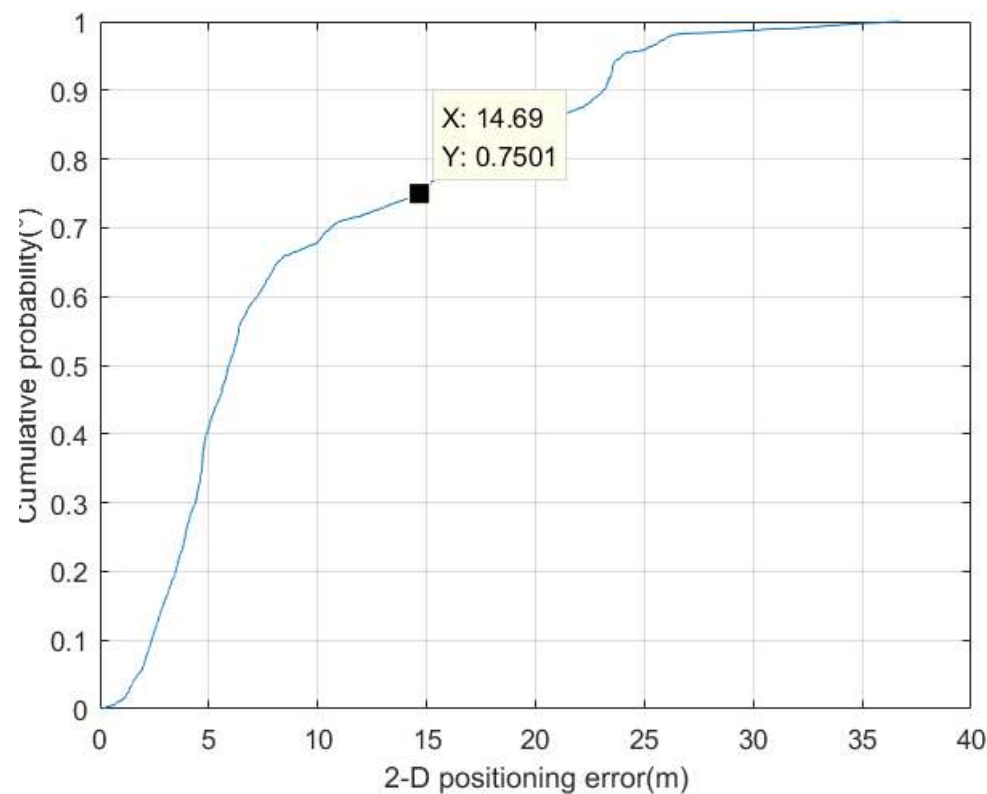
2-D positioning error distribution of route 1

• Results: Team C

- Positioning trajectory that almost the same with the reference
- 2-D positioning error : **14.7m, 75 %** @route 1 (route 2: 19.26m , 75 %)



Positioning result trajectory of route 1



2-D positioning error distribution of route 1



Track6 Summary



- Results**

Maximum error limit: 40m

Track 6

Team	Positioning error (m)



Track6 Summary



- Results**

Maximum error limit: 40m

Track 6

Team	Positioning error (m)
Leviathan	>40



Track6 Summary



• Results

Maximum error limit: 40m

Track 6

Team	Positioning error (m)
Team708	22.3



Satellite Navigation



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Sat Nav
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Track6 Summary



- Results**

Maximum error limit: 40m

Track 6

Team	Positioning error (m)
WHU-GD	14.7
Team708	22.3



Satellite Navigation



Sat Nav
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CHCNAV



Track6 Summary



9th IPIN Competition WINNER

Track 6: On-Vehicle smartphone

WHU-GD

**Yan Wang, Longyang Ding, Jian Kuang, Xiaobing Zhang, Zhi Dou,
Chaoqun Yang**

**GNSS Center, Wuhan University, China; Gaode Map Company,
China.**

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Track6 Summary



9th IPIN Competition Runner-up

Track 6: On-Vehicle smartphone

team708

shuli zhu, xue yi, long zhang, liu feng, xueqi li, keja li, jiayao liu
School of Software Engineering, Beijing Jiaotong University

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IPIN 2022

Thanks

