

## Track4 "Foot-Mounted IMU based Positioning (off-site)" special features

### Organizational aspects:

#### Database/dataset access

- As initiated last in Spain last year, we decide to use new rules: even if Track4 is still an off-site track, we will ask to competitors to process data **as if they were in real time**. To do so, a new interface based on a web API has been developed: EvaalAPI. This API will be used by competitors for sending position estimates and reading the sensor readouts:  
<https://evaal.aaloo.org/evaalapi/>
- In the context of this EvaalAPI framework, two "scoring trial" ("scoring trial#1" and "scoring trial#2" described later) are proposed to competitors. **Each of these scoring trial will be usable only once**. Competitors have thus two trials, for the evaluation.
- In order to help competitors to be prepared for the evaluation, a "testing trial" is proposed. This "testing trial" is fully accessible or reloadable (ie not restricted to a single usage as scoring trials). GroundTruth positions are included in the "testing trial" under the POSI label, for validation purpose.
- Participants can still download data usable for sensors bias estimation. Files will be accessible at the following URL:  
"testing trial": <http://evaal.aaloo.org/images/2021/track4/>  
"scoring trials" : coming soon
- For information, competitors can find training datasets\* of previous Track4 edition on Zenodo:  
IPIN2018-Track4: <https://zenodo.org/record/3228012>  
IPIN2019-Track4: <https://zenodo.org/record/3937220>  
IPIN2020-Track4: <https://zenodo.org/record/4668618>  
IPIN2021-Track4: coming soon  
\*:2018,2019,2020 are based on a different sensor than 2021 & 2022.

#### Submission of the processed results

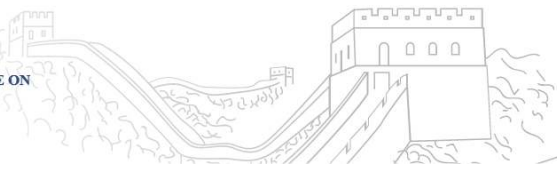
- As mentioned earlier, results have to be submitted via a web API. See above.
- A participant team can run the process up to 2 times. This lets a chance to catch-up if any issues happen. Although the competition organizers will evaluate the two scoring trials, only the best one will be considered for the contest. For the first evaluation, dataset of "scoring trial#1" will be used. For the second trial, dataset of "scoring trial#2" will be used. These two datasets correspond to two different data collection performed on the same path but not at the same time.

#### Important deadlines:

- Datasheet, some useful LogFiles and GNSS files will be published the: **JUNE 30<sup>th</sup>, 2022**
- "testing trial" is accessible through web API the: **JUNE 30<sup>th</sup>, 2022**
- "scoring trial#1" and "scoring trial#2" will be accessible the: **JULY 13<sup>th</sup>, 2022**
- The deadline for submitting the post-processed results is: **AUGUST 2022**
- Proclamation of winners: **SEPTEMBER 7<sup>th</sup>, 2022**

### Scope

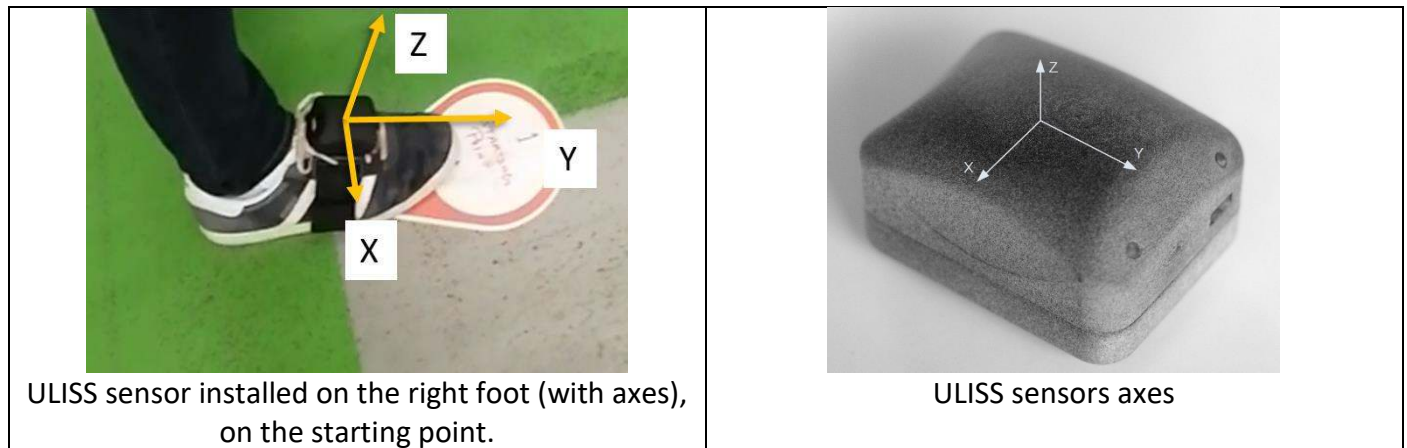
Many indoor navigation systems have been developed for pedestrians and assessing their performances is a real challenge. Benefiting from a reference solution that is accurate enough to evaluate other indoor navigation systems and assist novel research is of prime interest. According to ISO18305:2016 two different ways can be used for assessing indoor localization system: "Off-line surveyed test point" that is commonly used, or "reference system" with an accuracy at least one order of magnitude better the system you want to test. The scope of this track4 is clearly focused on the second way of assessing.



This track4 is based on the same equipment named “ULISS” as previous competition hold during IPIN2021.




### Competition Goal

The goal of this competition is to evaluate how good up-to-date INS algorithm is. Each competitor will have access to a dataset logged with ULISS (Ubiquitous Localization with Inertial Sensors and Satellites), a state-of-the-art Inertial Navigation System producing IMU data, MAG data, PRESSURE data & GNSS data, without the help of any maps.



### Description of Datasets

Data is recorded from 3 different sensors:

<p>Xsens Mti-7</p> 	<p>IMU-Mag sensor:          -3D accelerometer          -3D gyrometer          -3D magnetometer</p> <p><a href="https://www.xsens.com/mti-7">https://www.xsens.com/mti-7</a></p>
<p>BMP280 sensor</p> 	<p>Operation range: Pressure: 300...1100 hPa          Absolute accuracy : <math>\sim \pm 1</math> hPa          Relative accuracy : <math>\pm 0.12</math> hPa (typical)</p> <p><a href="https://www.bosch-sensortec.com/products/environmental-sensors/pressure-sensors/bmp280/">https://www.bosch-sensortec.com/products/environmental-sensors/pressure-sensors/bmp280/</a></p>
<p>Ublox ZED-F9P dual freq. receiver</p> 	<p>Multi GNSS Receiver : BeiDou, Galileo, GLONASS, GPS / QZSS          Number of concurrent GNSS 4          Dual GNSS Bands : L1C/A, L2C, L1OF, L2OF, E1B/C, E5b, B1I, B2I</p> <p><a href="https://www.u-blox.com/en/product/zed-f9p-module">https://www.u-blox.com/en/product/zed-f9p-module</a></p>

Unit and meaning of the sensors outputs of ULISS are the following ones:

Column	Xsens MTi-1 (accelerometer)	Comments
1	Acceleration label	“ACCE”
2	GPS Time of Week (ToW) in second	GPS Time of Week (ToW) in second



<b>3</b>	Acc X (m/s <sup>2</sup> )	
<b>4</b>	Acc Y (m/s <sup>2</sup> )	
<b>5</b>	Acc Z (m/s <sup>2</sup> )	

Sample strings for accelerometer data

```
ACCE,314410.003952000,-1.25709,-4.34142,8.75831
ACCE,314410.008947000,-1.23771,-4.28408,8.72497
ACCE,314410.013942000,-1.26714,-4.3795,8.72491
ACCE,314410.018937000,-1.26167,-4.29823,8.71566
ACCE,314410.023932000,-1.25662,-4.26479,8.71095
```

Column	Xsens MTi-1 (gyrometer)	Comments
<b>1</b>	Gyrometer label	"ROTA"
<b>2</b>	GPS Time of Week (ToW) in second	GPS Time of Week (ToW) in second
<b>3</b>	Gyro X (rad/s)	
<b>4</b>	Gyro Y (rad/s)	
<b>5</b>	Gyro Z (rad/s)	

Sample strings for gyrometer data

```
ROTA,314410.004573000,0.00275338,-0.000805736,0.006387
ROTA,314410.009578000,-0.00576329,-0.00401807,0.00535798
ROTA,314410.014582000,0.00813067,0.00989926,0.00747764
ROTA,314410.019587000,0.00594413,-0.00079453,0.00529695
ROTA,314410.024591000,0.00488472,0.00237882,0.0117271
```

Column	Xsens MTi-1 (magnetometer)	Comments
<b>1</b>	Magnetometer label	"MAGN"
<b>2</b>	GPS Time of Week (ToW) in second	GPS Time of Week (ToW) in second
<b>3</b>	Mag X (a.u.)	a.u. = arbitrary unit according to Xsens.
<b>4</b>	Mag Y (a.u.)	Tips : multiply by 0.49*1000,
<b>5</b>	Mag Z (a.u.)	In order to get milliGauss (mG)

Sample strings for magnetometer data

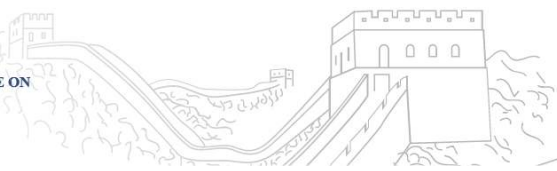
```
MAGN,314410.005162000,0.224368,0.435266,-1.14962
MAGN,314410.015162000,0.22387,0.434764,-1.14766
MAGN,314410.025162000,0.222876,0.438141,-1.1481
MAGN,314410.035162000,0.223393,0.433828,-1.14817
MAGN,314410.045162000,0.224333,0.431291,-1.1413
```

Column	BMP280 (pressure)	Comments
<b>1</b>	Pressure sensor label	"PRES"
<b>2</b>	GPS Time of Week (ToW) in second	GPS Time of Week (ToW) in second
<b>3</b>	Pressure (Pa)	

Sample strings for pressure data

```
PRES,314410.005162000,101144
PRES,314410.025162000,101152
PRES,314410.045162000,101138
PRES,314410.065162000,101151
PRES,314410.085162000,101151
```

Column	Temperature (temperarure)	Comments
<b>1</b>	Temperature sensor label	"TEMP"
<b>2</b>	GPS Time of Week (ToW) in second	GPS Time of Week (ToW) in second
<b>3</b>	Temperature (Degree Celsius)	



Sample strings for temperature data

```
TEMP,314410.025162000,44.1914
TEMP,314411.025162000,44.1758
TEMP,314412.025162000,44.1758
```

Column	Ublox F9P GNSS receiver (SBS)	Comments
1	GNSS SBAS information label	"GSBS"
2	GPS Time of Week (ToW) in second	GPS Time of Week (ToW) in second
3	Hexadecimal WORD	Corresponds to EGNOS SBAS Message Format*

\*: [https://gssc.esa.int/navipedia/index.php/The\\_EGNOS\\_SBAS\\_Message\\_Format\\_Explained](https://gssc.esa.int/navipedia/index.php/The_EGNOS_SBAS_Message_Format_Explained)

Sample strings for SBS (SBAS – EGNOS) data

```
GSBS,315499,9A494C00000000000000400001F00003F80003FC0003FE0001FF0001FF80
GSBS,315618,5363FBFFDC000000000000197BBBAA01848160A0580B185BFDDEF980900
GSBS,315619,9A0A8003FE4027FFBFC7FEFFD4003FEC000003FB800395959797BA380
```

Column	Ublox F9P GNSS receiver (SBS)	Comments
1	GNSS Observation label	"GOBS"
2	GPS Time of Week (ToW) in second	GPS Time of Week (ToW) in second
3	Observation data	Observation file based on RINEX 3.04 format <a href="http://rtcm.info/RINEX_3.04.IGS.RTCM_Final.pdf">http://rtcm.info/RINEX_3.04.IGS.RTCM_Final.pdf</a> Only data after header* is used in the context of IPIN2021-Track4.

\*Header of "OBSERVATION DATA" file under Rinex 3.04 format are given later in each session specific parts (headers are slightly different).

Sample strings for OBS (observation file, based on RINEX 3.04 format) data

```
GOBS,314856.199000000,G04 24066762.037 8 126471694.10925 -3666.900 39.000
GOBS,314856.199000000,G09 21204418.682 8 9 -2579.258 24.000
GOBS,314856.199000000,G06 21843663.561 9 9 -3361.335 14.000
GOBS,314856.199000000,C24 24066200.488 4 9 -1496.777 42.000
GOBS,314856.199000000,C09 41038802.886 9 213699815.76337 -1391.943 30.000
GOBS,314856.199000000,R10 20885796.375 8 111333055.23728 -1125.414 35.000
GOBS,314856.199000000,R17 21027399.505 9 112521861.85837 1.771 31.000
GOBS,314856.199000000,G16 24420695.497 9 9 -607.284 34.000
GOBS,314856.199000000,E25 26416183.541 9 9 1623.139 22.000
GOBS,314856.199000000,R09 23641111.957 9 9 -3901.952 26.000
GOBS,314856.199000000,E24 27240945.515 8 9 -857.287 38.000
GOBS,314856.199000000,E05 27154158.133 8 9 -2871.781 35.000
GOBS,314856.399000000,G04 24066902.088 8 126472426.50726 -3656.825 35.000
GOBS,314856.399000000,G09 21204516.880 8 9 -2576.887 25.000
GOBS,314856.399000000,G06 21843791.401 9 9 -3361.335 14.000
GOBS,314856.399000000,C24 24066258.112 4 125319321.10437 -1491.643 44.000
GOBS,314856.399000000,C09 41038856.136 8 213700093.52228 -1387.629 30.000
GOBS,314856.399000000,R10 20885839.907 8 111333279.85427 -1119.290 37.000
...
GOBS,316465.400000000,G09 22053796.355 9 7 -2965.625 42.000 22053774.011 9
9 -2311.088 23.000
GOBS,316465.400000000,G06 22958748.483 8 9 -3890.580 43.000 22958742.892 9
9 -3018.360 18.000
GOBS,316465.400000000,G04 25190987.721 9 9 -3672.705 35.000
GOBS,316465.400000000,G20 20618874.632 4 9 1326.448 48.000
GOBS,316465.400000000,G07 20956968.745 8 9 -528.696 32.000
GOBS,316465.400000000,C14 26537412.626 9 9 -3269.531 39.000
```



**IPIN 2022**  
TWELFTH INTERNATIONAL CONFERENCE ON  
INDOOR POSITIONING  
AND INDOOR NAVIGATION  
SEPTEMBER 5-7, 2022, BEIJING, CHINA



Version 1.1  
(July 5th, 2022)



Column	ground truth position	Comments
1	ground truth position label	"POSI"
2	GPS Time of Week (ToW) in second	GPS Time of Week (ToW) in second
3	WGS84 longitude in decimal degrees	
4	WGS84 latitude in decimal	
5	Floor Number in integer	0 : Ground Floor, -1, 1, 2
6	key point number index	

#### Sample strings for ground truth position data

```
POSI,308945.294,-1.6313191524195993,47.22617430160391,-1,1  
POSI,308960.836,-1.6310604539849840,47.22612380681056,-1,2
```

Note1: POSI frame is only used twice in scoring trials. For the very first point (Key Point n°1) and the second point (Key Point n°2).

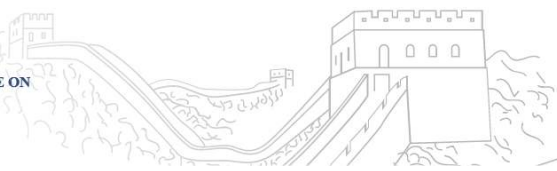
Note2: POSI frame is used in testing trial to help competitors to tune their algorithm.

#### Inputs given to competitors for "testing trial"

The materials and methods provided by the competition organizers are:

- **"Testing trial" of IPIN2022 is based on "Scoring trial#1" of IPIN2021; following links pointing to IPIN2021 are ok.**
- **Datasheet of each individual sensors can be downloaded here:**
  - Xsens MTI-1 :  
[http://evaal.aaloo.org/images/2021/track4/MTi-7\\_Leaflet.pdf](http://evaal.aaloo.org/images/2021/track4/MTi-7_Leaflet.pdf)
  - Ublox ZED F9P GNSS Receiver:  
[http://evaal.aaloo.org/images/2021/track4/ZED-F9P\\_ProductSummary\\_\(UBX-17005151\).pdf](http://evaal.aaloo.org/images/2021/track4/ZED-F9P_ProductSummary_(UBX-17005151).pdf)  
[http://evaal.aaloo.org/images/2021/track4/RINEX\\_3.04.IGS.RTCM\\_Final.pdf](http://evaal.aaloo.org/images/2021/track4/RINEX_3.04.IGS.RTCM_Final.pdf)
- **LogFiles to download and to use before evaluation (for both testing trial ONLY):**
  - 2021.09.02\_ULISS\_AllanVariance.zip : static logfile of more than 15 hours that can be used for sensors bias estimation  
[http://evaal.aaloo.org/images/2021/track4/2021.09\\_ULISS\\_AllanVariance.zip](http://evaal.aaloo.org/images/2021/track4/2021.09_ULISS_AllanVariance.zip) :
    - acceleration.csv
    - rotation.csv
    - magnetic.csv
    - pressure.csv
    - temperature.csv
  - 2021.09.15\_ULISS\_MagCalib.zip: logfile of about 1 minute that can be used to calibrate the magnetometer sensor  
[http://evaal.aaloo.org/images/2021/track4/2021.09.15\\_ULISS\\_MagCalib.zip](http://evaal.aaloo.org/images/2021/track4/2021.09.15_ULISS_MagCalib.zip)
    - acceleration.csv
    - rotation.csv
    - magnetic.csv
- **GNSS Navigation files that contain ephemeris for those who want to use GNSS sensor:**



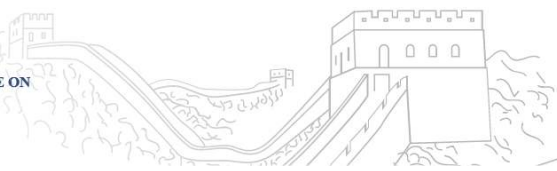


- testing\_trial\_gnss.nav: GNSS Navigation file for testing trial (format RINEX 3.04)  
[http://evaal.aaloo.org/images/2021/track4/session1\\_gnss.nav](http://evaal.aaloo.org/images/2021/track4/session1_gnss.nav)
- **Coordinates of Key Point n°1:**
  - WGS84 longitude in decimal degrees: -1.631319152
  - WGS84 latitude in decimal degrees: 47.226174301
  - Floor Number in integer: -1
- **Coordinates of Key Point n°2:**
  - WGS84 longitude in decimal degrees: -1.631060453
  - WGS84 latitude in decimal degrees: 47.226123806
  - Floor Number in integer: -1
- **Note about Maps use**
  - Even if maps may be allowed in others tracks, for this one, **it is NOT**. Track chairs, in such a case, could cancel contributions of competitor.
  - Algorithms are not supposed to embed or access maps to enhance positioning.

#### Inputs given to competitors for the 2 “scoring trials”

The materials and methods provided by the competition organizers are:

- **Datasheet of each individual sensors can be downloaded here:**
  - Xsens MTI-1 :  
[http://evaal.aaloo.org/images/2021/track4/MTi-7\\_Leaflet.pdf](http://evaal.aaloo.org/images/2021/track4/MTi-7_Leaflet.pdf)
  - Ublox ZED F9P GNSS Receiver:  
[http://evaal.aaloo.org/images/2021/track4/ZED-F9P\\_ProductSummary\\_\(UBX-17005151\).pdf](http://evaal.aaloo.org/images/2021/track4/ZED-F9P_ProductSummary_(UBX-17005151).pdf)  
[http://evaal.aaloo.org/images/2021/track4/RINEX\\_3.04.IGS.RTCM\\_Final.pdf](http://evaal.aaloo.org/images/2021/track4/RINEX_3.04.IGS.RTCM_Final.pdf)
- **LogFiles to download and to use before evaluation (for both scoring and testing trials):**
  - **XXX\_ULISS\_AllanVariance.zip** : static logfile of more than 15 hours that can be used for sensors bias estimation  
[http://evaal.aaloo.org/images/2022/track4/XXX\\_ULISS\\_AllanVariance.zip](http://evaal.aaloo.org/images/2022/track4/XXX_ULISS_AllanVariance.zip) :
    - acceleration.csv
    - rotation.csv
    - magnetic.csv
    - pressure.csv
    - temperature.csv
  - **XXX\_ULISS\_MagCalib.zip** : logfile of about 1 minute that can be used to calibrate the magnetometer sensor  
[http://evaal.aaloo.org/images/2022/track4/XXX\\_ULISS\\_MagCalib.zip](http://evaal.aaloo.org/images/2022/track4/XXX_ULISS_MagCalib.zip)



- acceleration.csv
  - rotation.csv
  - magnetic.csv
- **GNSS Navigation files that contain ephemeris for those who want to use GNSS sensor:**
    - testing\_trial\_gnss.nav: GNSS Navigation file for testing trial (format RINEX 3.04)  
[http://evaal.aaloo.org/images/2022/track4/testing\\_trial\\_gnss.nav](http://evaal.aaloo.org/images/2022/track4/testing_trial_gnss.nav)
    - scoring\_trial1\_gnss.nav: GNSS Navigation file for scoring trial#1 (format RINEX 3.04)  
[http://evaal.aaloo.org/images/2022/track4/scoring\\_trial1\\_gnss.nav](http://evaal.aaloo.org/images/2022/track4/scoring_trial1_gnss.nav)
    - scoring\_trial2\_gnss.nav: GNSS Navigation file for scoring trial#2 (format RINEX 3.04)  
[http://evaal.aaloo.org/images/2022/track4/scoring\\_trial2\\_gnss.nav](http://evaal.aaloo.org/images/2022/track4/scoring_trial2_gnss.nav)
  - **Coordinates of Key Point n°1 (same for both session 1 and 2):**
    - WGS84 longitude in decimal degrees: -1.631319152
    - WGS84 latitude in decimal degrees: 47.226174301
    - Floor Number in integer: -1
  - **Coordinates of Key Point n°2 (same for both session 1 and 2):**
    - WGS84 longitude in decimal degrees: -1.631060453
    - WGS84 latitude in decimal degrees: 47.226123806
    - Floor Number in integer: -1
  - **Note about Maps use**
    - Even if maps may be allowed in others tracks, for this one, **it is NOT**. Track chairs, in such a case, could cancel contributions of competitor.
    - Algorithms are not supposed to embed or access maps to enhance positioning.





Testing trial: dataset recorded around 15h45 (local time), the 15<sup>th</sup> of 2021

- **Timing of expected Key Points:**

- 83 key points will be evaluated in Track4 : from 3 to 85
- Key Points timestamps are expressed in GPS Time of Week in seconds (s), hereafter in the table.

Key Point	GPS Time of Week (s)	Key Point	GPS Time of Week (s)	Key Point	GPS Time of Week (s)
1*	308945.294	30	309778.168	59	310502.561
2*	308960.836	31	309881.752	60	310567.480
3	308976.111	32	309893.883	61	310580.113
4	308990.088	33	309906.198	62	310592.378
5	309002.014	34	309917.817	63	310601.509
6	309014.780	35	309972.535	64	310615.558
7	309022.926	36	309984.353	65	310628.286
8	309029.910	37	309993.111	66	310676.329
9	309039.174	38	310002.843	67	310688.873
10	309145.224	39	310024.502	68	310699.335
11	309186.323	40	310039.365	69	310783.689
12	309202.144	41	310054.263	70	310810.773
13	309207.260	42	310071.496	71	310823.555
14	309225.605	43	310087.427	72	310980.767
15	309250.396	44	310106.513	73	311008.253
16	309263.674	45	310173.810	74	311035.611
17	309279.550	46	310183.035	75	311052.397
18	309291.084	47	310205.504	76	311064.380
19	309305.375	48	310258.708	77	311094.500
20	309320.843	49	310293.343	78	311282.676
21	309330.410	50	310306.095	79	311361.069
22	309512.491	51	310324.789	80	311390.255
23	309527.796	52	310343.358	81	311412.163
24	309556.105	53	310353.269	82	311418.497
25	309568.216	54	310363.170	83	311428.756
26	309594.479	55	310372.852	84	311439.655
27	309677.148	56	310446.256	85	311460.997
28	309755.879	57	310476.495		
29	309768.646	58	310485.099		

\*: coordinates given (see above)

The output format is described in the chapter “Description of the Output File” here after.





Scoring trial#1: dataset recorded around XXhXX (local time), the XX<sup>th</sup> of XXXX

• **Timing of expected Key Points:**

- 83 key points will be evaluated in Track4 : from 3 to 85
- Key Points timestamps are expressed in GPS Time of Week in seconds (s), hereafter in the table.

Key Point	GPS Time of Week (s)	Key Point	GPS Time of Week (s)	Key Point	GPS Time of Week (s)
1*	309029.294	30	309778.168	59	310502.561
2*	309030.294	31	309881.752	60	310567.480
3		32	309893.883	61	310580.113
4		33	309906.198	62	310592.378
5		34	309917.817	63	310601.509
6		35	309972.535	64	310615.558
7	309984.353		309984.353	65	310628.286
8	309029.111		309993.111	66	310676.329
9	309039.174		310002.843	67	310688.873
10	309145.224		310024.502	68	310699.335
11	309186.323		310039.365	69	310783.689
12	309202.144		310053.063	70	310810.773
13	309207.260			71	310823.555
14	309225.605	43		72	310980.767
15	309250.396	44		73	311008.253
16	309263.674	45		74	311035.611
17	309279.550	46			311052.397
18	309291.084	47	310258.111		311064.380
19	309305.375	48	310258.111		311094.500
20	309320.843	49	310293.343		311282.676
21	309330.410	50	310306.095		311361.069
22	309512.491	51	310324.789		311390.255
23	309527.796	52	310343.358	81	311412.163
24	309556.105	53	310353.269	82	311418.497
25	309568.216	54	310363.170	83	311428.756
26	309594.479	55	310372.852	84	311439.655
27	309677.148	56	310446.256	85	311460.997
28	309755.879	57	310476.495		
29	309768.646	58	310485.099		

Coming soon

\*: coordinates given (see above)

The output format is described in the chapter “Description of the Output File” here after.



• Header of GNSS "OBSERVATION DATA" file under Rinex 3.04 format

```

3.04 OBSERVATION DATA M: Mixed RINEX VERSION / TYPE
RTKCONV demo5 b34c 20210930 154220 UTC PGM / RUN BY / DATE
format: u-blox UBX COMMENT
log: D:\IPIN2021\ 'on\2021.09.15_15h30_Acqui1\ULISCOMMENT
MARKER NAME
MARKER NUMBER
MARKER TYPE
OBSERVER / AGENCY
REC # / TYPE / VERS
ANT # / TYPE
APPROX POSITION XYZ
ANTENNA: DELTA H/E/N
4337853.3676 -1235. 0.0000 0.
G 8 C1C L1C D1C S1C C2X SYS / # / OBS TYPES
R 8 C1C L1C D1C S1C C2C L2C SYS / # / OBS TYPES
E 8 C1X L1X D1X S1X C7X L7X L SYS / # / OBS TYPES
S 4 C1C L1C D1C S1C SYS / # / OBS TYPES
C 8 C2I L2I D2I S2I C7I L7I D7I S, SYS / # / OBS TYPES
2021 09 15 13 48 01.207000 OF FIRST OBS
2021 09 15 14 33 04.207000 LAST OBS
G L1C SE SHIFT
G L2X -0.25000 SHIFT
R L1C SHIFT
R L2C SHIFT
E L1X 0.00000
E L7X 0.00000
S L1C
C L2I
C L7I
12 R01 1 R02 -4 R07 5 R08 6 R09 -2 R10 -7 R11 0 R16 -1 GLONASS
R17 4 R22 -3 R23 3 R24 2 GLONASS SL #
C1C 0.000 C1P 0.000 C2C 0.000 C2P 0.000 GLONASS COD/LS
END OF HEADER

```

*Coming soon*



Scoring Trial#2: dataset recorded around XXhXX (local time), the XX<sup>th</sup> of XXXX

• **Timing of expected Key Points:**

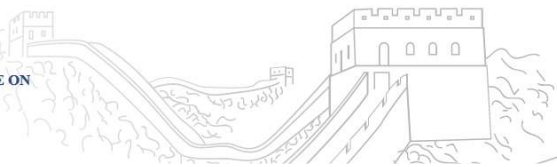
- 83 key points will be evaluated in Track4 : from 3 to 85
- Key Points timestamps are expressed in GPS Time of Week in seconds (s), hereafter in the table.

Key Point	GPS Time of Week (s)	Key Point	GPS Time of Week (s)	Key Point	GPS Time of Week (s)
1*	314464.119	30	315298.217	59	316002.074
2*	314470.990	31	315405.177	60	316067.544
3	314477.861	32	315417.901	61	316079.626
4	314484.732	33	315430.545	62	316092.067
5	314491.603	34	315441.137	63	316100.796
6	314498.474	35	315498.639	64	316115.968
7	314505.345		315511.795	65	316131.648
8	314512.216		315523.122	66	316177.077
9	314554.000		315534.042	67	316189.403
10	314653.472		315556.677	68	316200.670
11	314690.208		315573.167	69	316284.229
12	314704.715		315589.657	70	316309.169
13	314709.778		315606.147	71	316319.587
14	314726.705		315622.637	72	316477.414
15	314751.531	44	315639.127	73	316506.845
16	314763.828	45	315655.617	74	316534.418
17	314779.473	46	315672.107	75	316550.102
18	314791.153	47	315688.597		316559.894
19	314805.333	48	315705.087		316587.909
20	314820.570	49	315799.417		316791.764
21	314830.328	50	315812.175		316885.342
22	315014.273	51	315830.200		316909.820
23	315029.267	52	315846.496		316926.458
24	315059.662	53	315855.041	82	316933.781
25	315071.840	54	315863.442	83	316944.035
26	315092.353	55	315872.961	84	316955.015
27	315196.607	56	315947.424	85	316976.482
28	315276.853	57	315974.505		
29	315288.742	58	315984.551		

Coming soon

\*: coordinates given (see above)

The output format is described in the chapter “Description of the Output File” here after.



• Header of GNSS "OBSERVATION DATA" file under Rinex 3.04 format

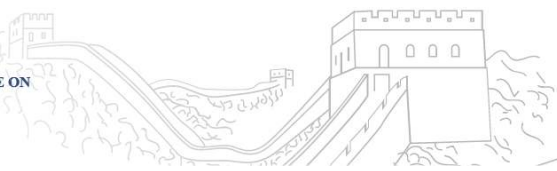
```

3.04          OBSF
RTKCONV demo5 b34
format: u-blox U
log: D:\IPIN202

M: Mixed          RINEX VERSION / TYPE
                20210930 154548 UTC PGM / RUN BY / DATE
COMMENT
15_17h15_Acqui2\ULISCOMMENT
MARKER NAME
MARKER NUMBER
MARKER TYPE
OBSERVER / AGENCY
REC # / TYPE / VERS
ANT # / TYPE
APPROX POSITION XYZ
ANTENNA: DELTA H/E/N
# / # / OBS TYPES
# / OBS TYPES
# / OBS TYPES
# / OBS TYPES
# / TYPES
# S
2021 09 15 15 20 09.1990000 GPS
2021 09 15 16 03 42.4000000 GPS
G L1C
G L2X -0.25000
R L1C
R L2C
E L1X 0.00000
E L7X 0.00000
S L1C
C L2I
11 R01 1 R02 -4 R08 6 R09 -2 R10 -7 R11 0 R12 -1 R17 4 GLONASS SLOT / E. #
R18 -3 R23 3 R24 2 GLONASS SLOT / FRQ #
C1C 0.000 C1P 0.000 C2C 0.000 C2P 0.000 GLONASS COD/PHS/BIS
END OF HEADER
  
```

Coming soon





### Description of the Output stream to return by competitor

For each trial, competitor is asked to give processed data with the following format:

- 5 fields :
  - Field 1: Timestamp in seconds
  - Field 2: WGS84 longitude in decimal degrees with at least 9 decimal digit resolution
  - Field 3: WGS84 latitude in decimal degrees with at least 9 decimal digit resolution
  - Field 4: Floor Number in integer (0 : Ground Floor, -1, 1, 2)
  - Field 5: index in integer (key point number from 1 to N. 0 represents no key point. Each specific integer represents the specific key point)
- Comma ("," ) used as data delimiter

#### Example 1:

```
314479.680,141.346908569,43.070758819,-1,0
314531.177,141.346893310,43.070755004,-1,0
314704.715,141.346893310,43.070755002,-1,0
314805.333,141.346893308,43.070755003,-1,0
315014.273,141.346893310,43.070755004,-1,1
315071.840,141.346908569,43.070758819,0,0
315276.853,141.346908570,43.070758817,0,0
315405.177,141.346908579,43.070758819,0,0
315534.042,141.346908569,43.070758815,1,2
315573.167,141.346908565,43.070758819,1,0
315695.036,141.347000132,43.070770263,1,0
315830.200,141.347000142,43.070770261,2,0
315947.424,141.347000152,43.070770262,2,3
316100.796,141.347000162,43.070770263,2,0
```

Estimated position for  
key point 1

Estimated position for  
key point 2

Estimated position for  
key point 3

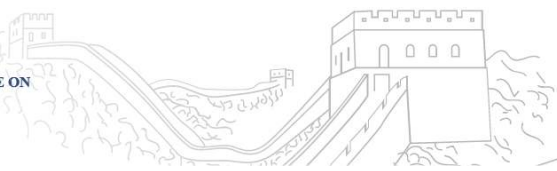
Evaluation will only take into account the estimated position at each indexed key point position, so that each track is considered as a series of key point positions (from 1 to N).

In others words : column 1 will not be assessed, and thus can be slightly different from the expected time.

What is important is to put correctly the right key point id in field n°5. For instance, returning following stream (example2) is equivalent to the previous example1 from evaluation point of view

#### Example 2:

```
315014.273,141.346893310,43.070755004,-1,1
315534.042,141.346908569,43.070758815,1,2
315947.424,141.347000152,43.070770262,2,3
```



### Evaluation criterion

The final metric will be based on the accuracy for the correct floor detection and the horizontal positioning error. In particular, the score for comparing the different location systems will be based on the following equations:

$$\text{Accuracy Score} = 3\text{rdQuartile}\{\text{SampleError}(R_i, E_i)\}, \forall \text{ groundtruth reference in all final test sets}$$
$$\text{SampleError}(R_i, E_i) = \text{Distance}(R_i, E_i) + (\text{penalty} \times \text{floorfail})$$

where:

- “3rdQuartile” is the third quartile error, in meters, of a cumulative error distribution function, i.e., the error value that includes 75% of estimations (sample errors) with a lower error.
- $R_i$  is the actual position (ground truth).
- $E_i$  is the predicted position by the method proposed by the contest participant.
- floorfail is the absolute difference between actual floor and the predicted one.
- penalty is used to penalize errors in estimating the floor. penalty is set to 15 m.
- $\text{Distance}(R_i, E_i)$  calculates the Euclidean distance between coordinates (longitude and latitude) of  $R_i$  and  $E_i$ .

The team with the lower “Accuracy Score” wins.

### Contact points and information

For any further question about the database and this competition track, please contact to:

- Miguel Ortiz ([miguel.ortiz@univ-eiffel.fr](mailto:miguel.ortiz@univ-eiffel.fr)) at the University Gustave Eiffel, France.
- Ni Zhu ([ni.zhu@univ-eiffel.fr](mailto:ni.zhu@univ-eiffel.fr)) at the University Gustave Eiffel, France.

### Introduced changes

For any further question about the database and this competition track, please contact to:

Version 1.0	June 10 <sup>th</sup>	First version
Version 1.1	July 5 <sup>th</sup>	Testing Trial added, based on last edition of IPIN Link is : <a href="https://evaal.aaloo.org/files/2022/IPIN2020_T4_Trials.7z">https://evaal.aaloo.org/files/2022/IPIN2020_T4_Trials.7z</a>