



# European Test Centre for Receiver Performance Evaluation

David Jiménez (ESA/ESTEC TEC-ETN)

# ***Structure***

---

- **Introduction**
- **Description of tests**
- **Testing tools**
- **Results**
- **Calibration and results publication**
- **GNSS User Equipment testing covering future modernisations**
- **Conclusions**

# Introduction

---

- **Main Objective of EUTERPE is to:**
  - provide the receiver manufacturers with a “statement of compliance” and in this way
  - offer them the support needed for the compatibility of the receivers with European GNSS
  - Provide users with the assessment from an independent laboratory of the performances of EGNOS receivers available on the market
- **In an initial phase this centre is being setup at ESTEC within the facilities of the European Navigation Laboratory**



# ***Introduction***

---

- **Challenges:**

1. Limited availability of information to application designers
  - Lack of Standardization has translated into a difficult work when comparing receivers
2. Future objective: testing of all kinds of EGNOS and Galileo receivers

- **EUTERPE Approach:**

1. Validated test plan and procedures
2. Comprehensive and easy-to-compare Review of Rx
3. GPS/EGNOS Rx for non-SoL applications
4. Testing tools: Spirent STR4760 simulator and Euterpe Tools software.

# ***Introduction***

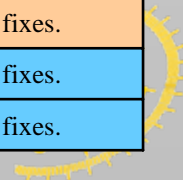
---

- **Baseline for GPS/EGNOS Rx for non-SoL applications:**
  - Testing of compatibility of the GNSS receivers with the EGNOS system, i.e. proper implementation of EGNOS message processing algorithms
- **Extension of Tests depending on manufacturers needs:**
  - Positioning errors
  - Acquisition and tracking thresholds
  - Performance under interfering scenarios
  - Multipath and near-far mitigation
  - Indoor performance
  - etc.

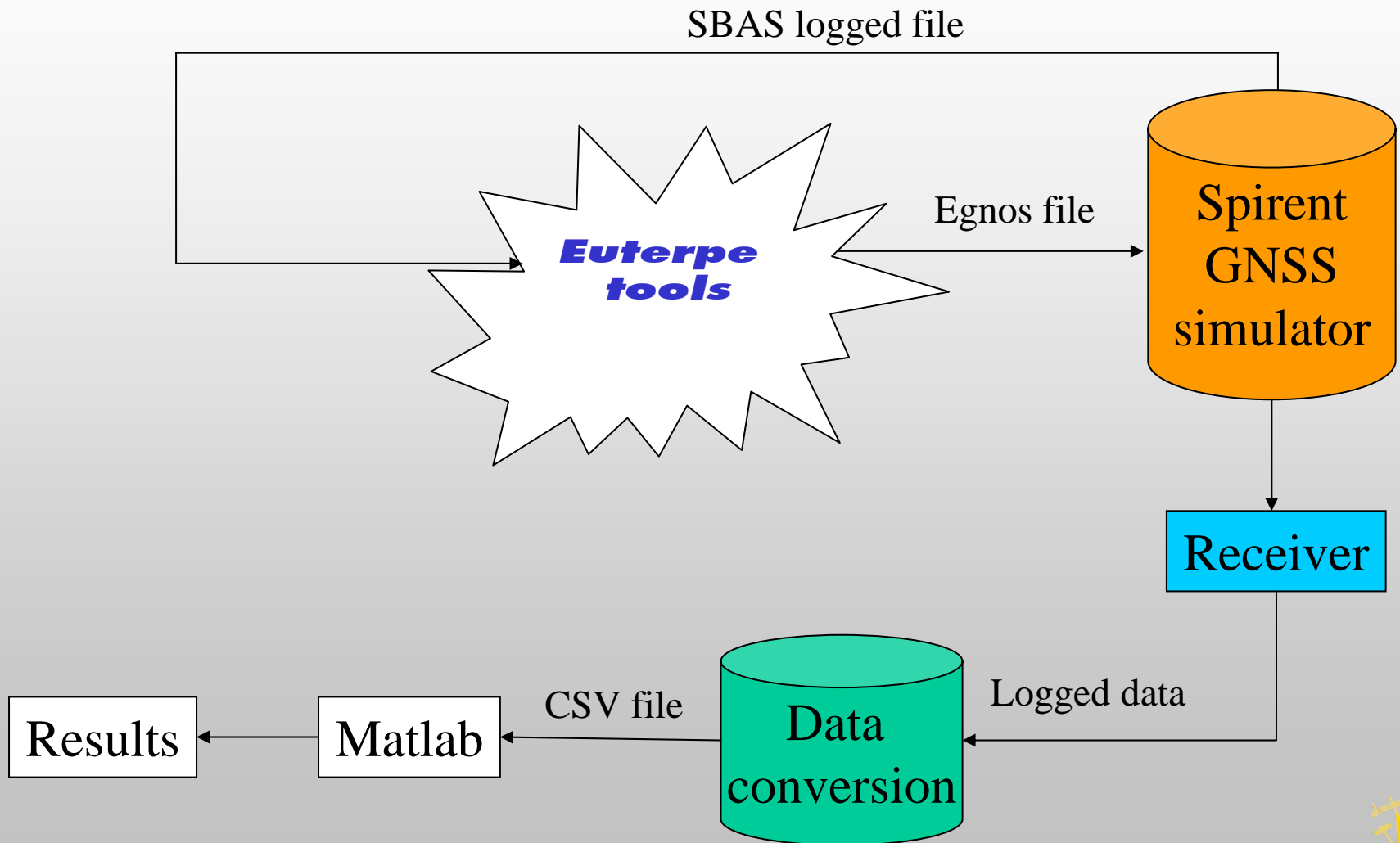
# Description of tests

- **Testing the compatibility of Rx with EGNOS broadcast from an end user point of view**
- **End-To-End Testing of correct algorithms implementation to decode the EGNOS messages**
- **Indirect Algorithm Testing –changes in EGNOS message should affect the position fix**

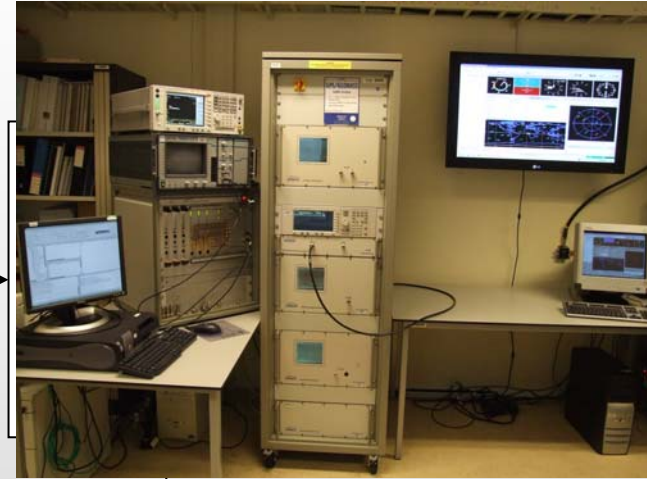
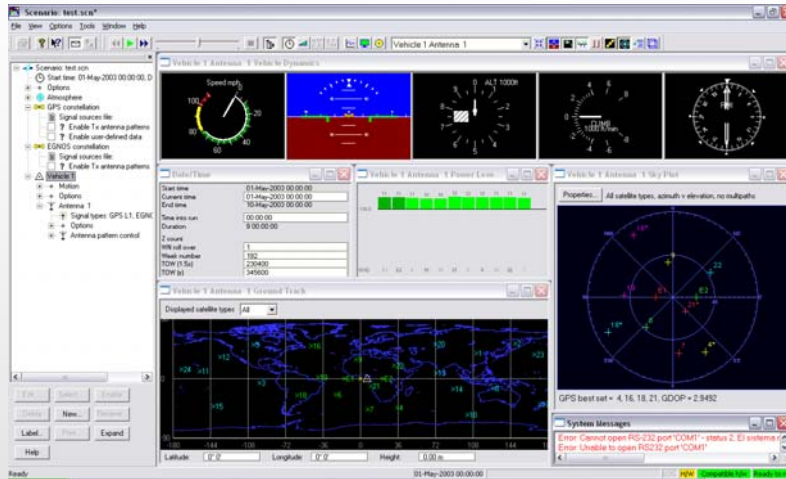
Test	SBAS Message	Title	Type of result
1	MT1	PRN Mask assign. and monitored SV.	Implicitly taken care in test 4 & 10.
2	MT2-5	Fast corrections (Use of PRC /RRC).	Position fixes.
3	MT2-5	SV “do not use” / “not monitored”.	Position fixes.
4	MT2-5	Use of IODP (Fast Corrections).	Position fixes.
5	MT2-5	Time out of fast corrections.	Position fixes.
6	MT6	Satellites set to “do not use” or “not monitored” in MT6.	Position fixes.
7	MT6	Use of IODF.	Position fixes.
8	MT25	Use of slow corrections.	Position fixes.
9	MT25	Use of velocity code.	Position fixes.
10	MT25	Use of IODP (Slow corrections).	Position fixes.
11	MT25	Time out of slow corrections.	Position fixes.
12	MT24	Use of mixed fast and slow corrections.	Position fixes.
13	MT18	Ionospheric grid definition. Change in monitored grid points.	Implicitly taken care in test 16.
14	MT26	Use of GIVD.	Position fixes.
15	MT26	Grid “do not use” / “not monitored”.	Position fixes.
16	MT26	USE of IODI.	Position fixes.
17	MT26	Time out of ionospheric corrections.	Position fixes.
18	MT2-5	Switching GEO Satellites.	Position fixes.
19	MT2-5	Switching SBAS Operator	Position fixes.



# Test procedure



# Testing tools



Euterpe Tools v.0.1 - Nav data converter

**EUTERPE Tools - Nav Data converter**

EGNOS file:

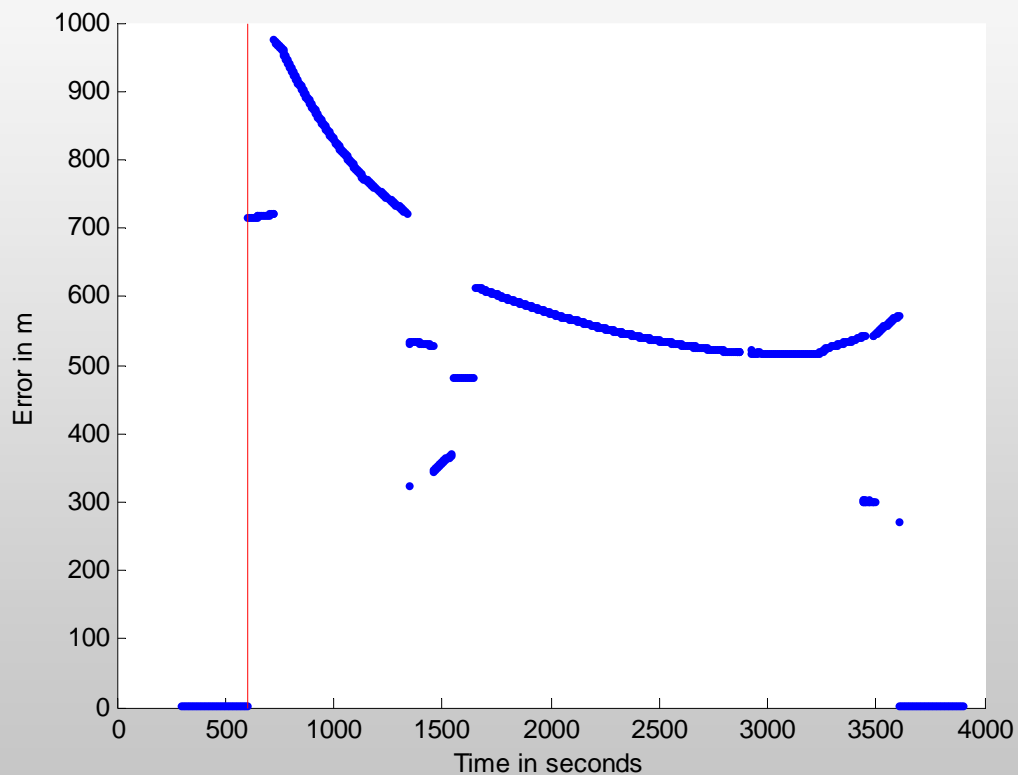
Message	Preamble	MT ID	Data field	Party	
1	C6	0	800000001800000000000001F00000002000000E4EE4EEEEE	22300	Edit
2	06	06	00600000000000004EEEEE2402404C0630014F09040702DF90	22300	Edit
3	9A	18	53000000000000000000F00000F0000FF00007F00007E	000000	Edit
4	0B	3	8FFFFFD0AFF8000009FF00000000000A0004448E4EE4E	03CAF4	Edit
5	53	0	00000001800000000000020000000003000000E4EE4EEEEE	22300	Edit
6	9A	24	00700000000000004EEEEE2609A8503217008850FB10CB6F50	03CAF4	Edit
7	0B	7	30FFFFFFF00	419006	Edit
8	53	3	0FFFFFD0AFF8000009FF000000000100A0004448E4EE4E	03CAF4	Edit
9	9A	0	40000001800000000000001E00000000000000000E4EE4EEEEE	03CAF4	Edit
10	C6	24	00700000000000004EEEEE200A1A848E64CFD0367057F069F90	780001	Edit
11	53	17	1F041CB91AD6FD000436A7F307F540000000157204601400000A9	017C31	Edit
12	9A	3	4FFFFFD0AFF8000009FF000000000100A0004448E4EE4E	03CAF4	Edit
13	C6	0	80000001800000000000A0F00000000000000000E4EE4EEEEE	77500	Edit
14	53	24	00700000000000004EEEEE240C4F0A41038FE4BEE000001F88	0C00A	Edit
15	9A	12	00	03CAF4	Edit





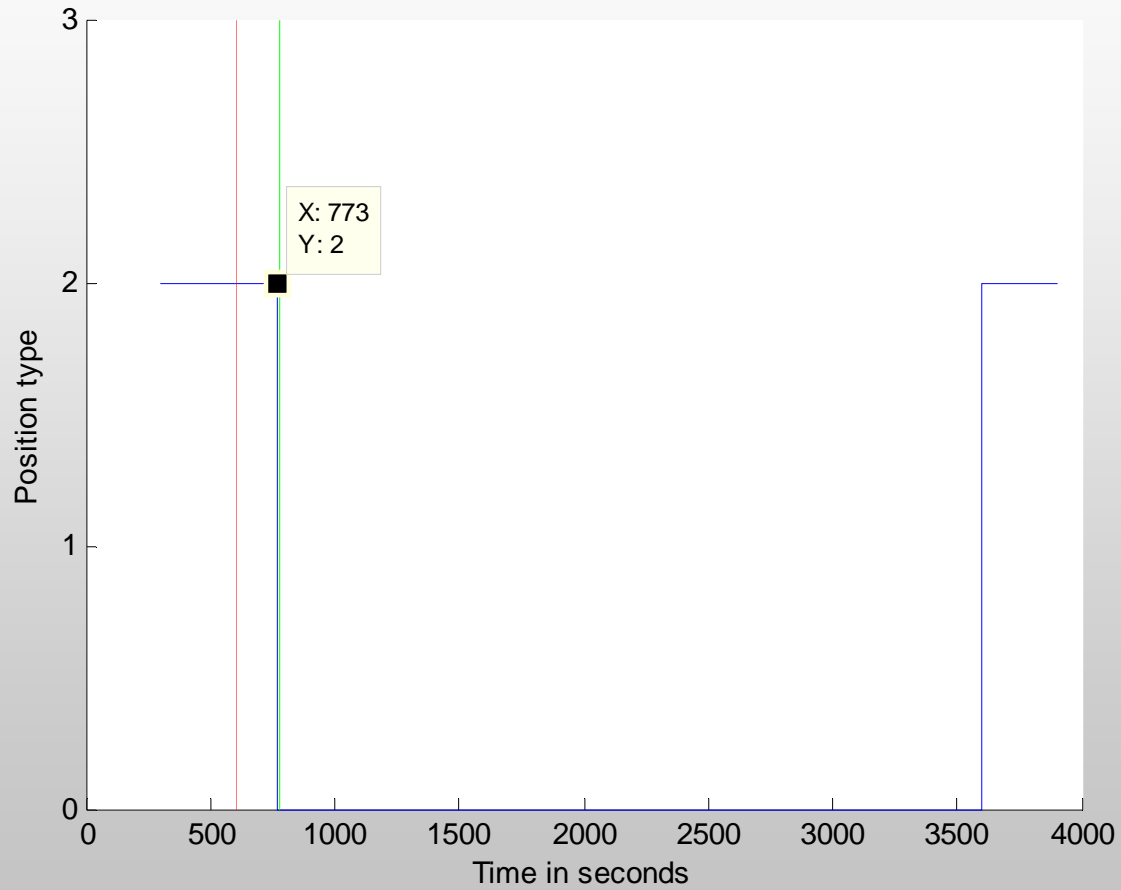
# Example result - Test 2 : Fast corrections

---



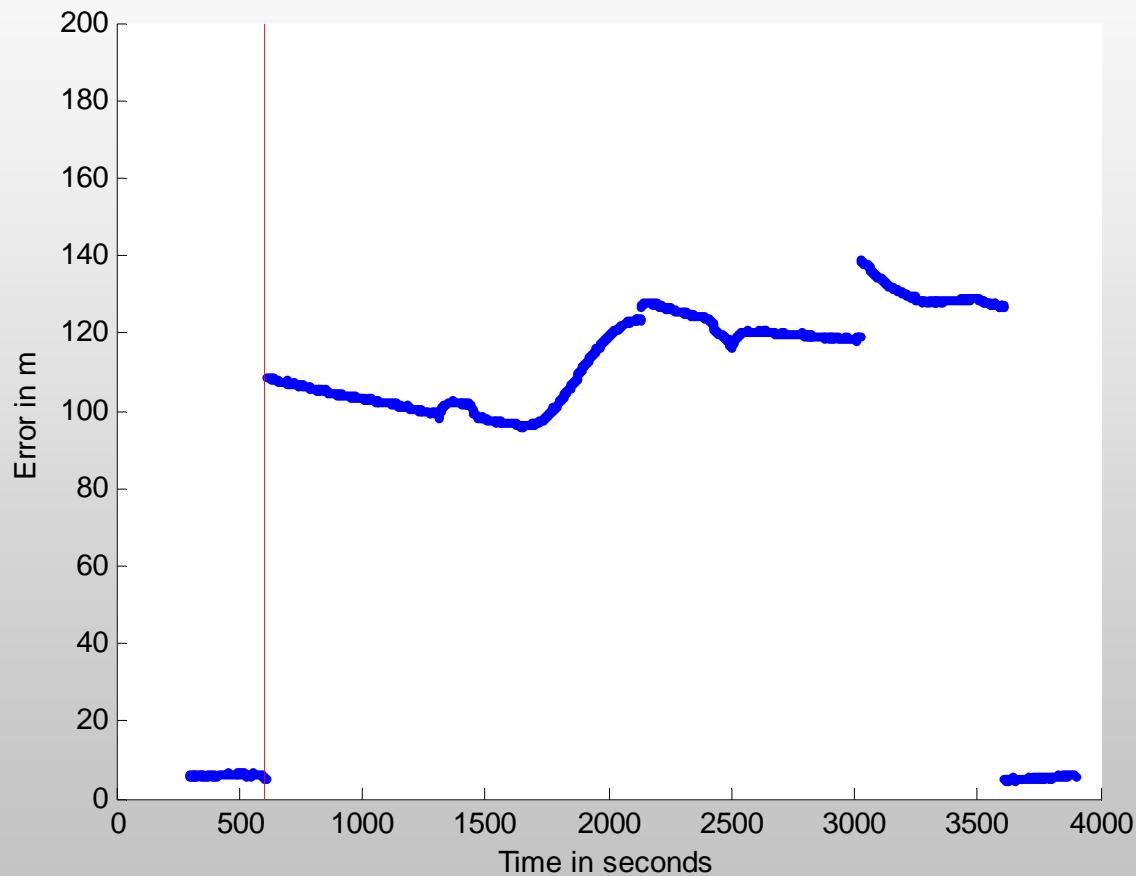
# Example result - Test 5: FC Time out

---



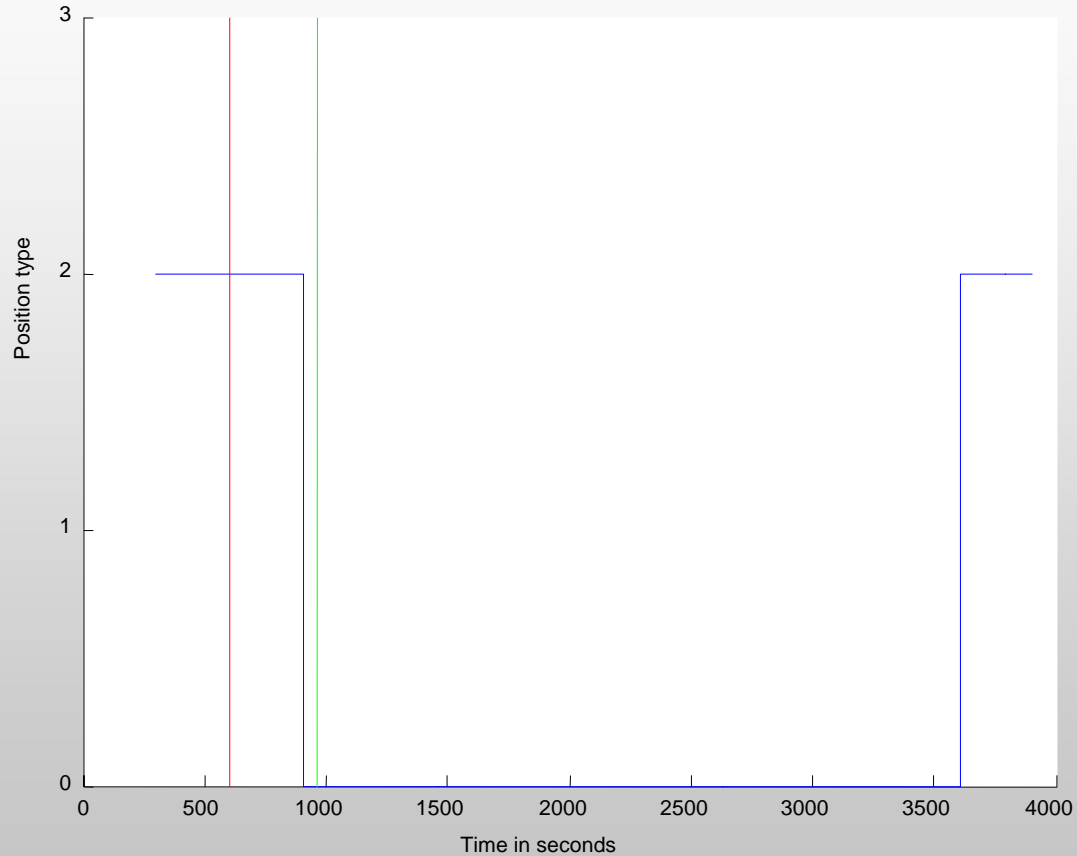
# Example result - Test 8: Slow Corrections

---

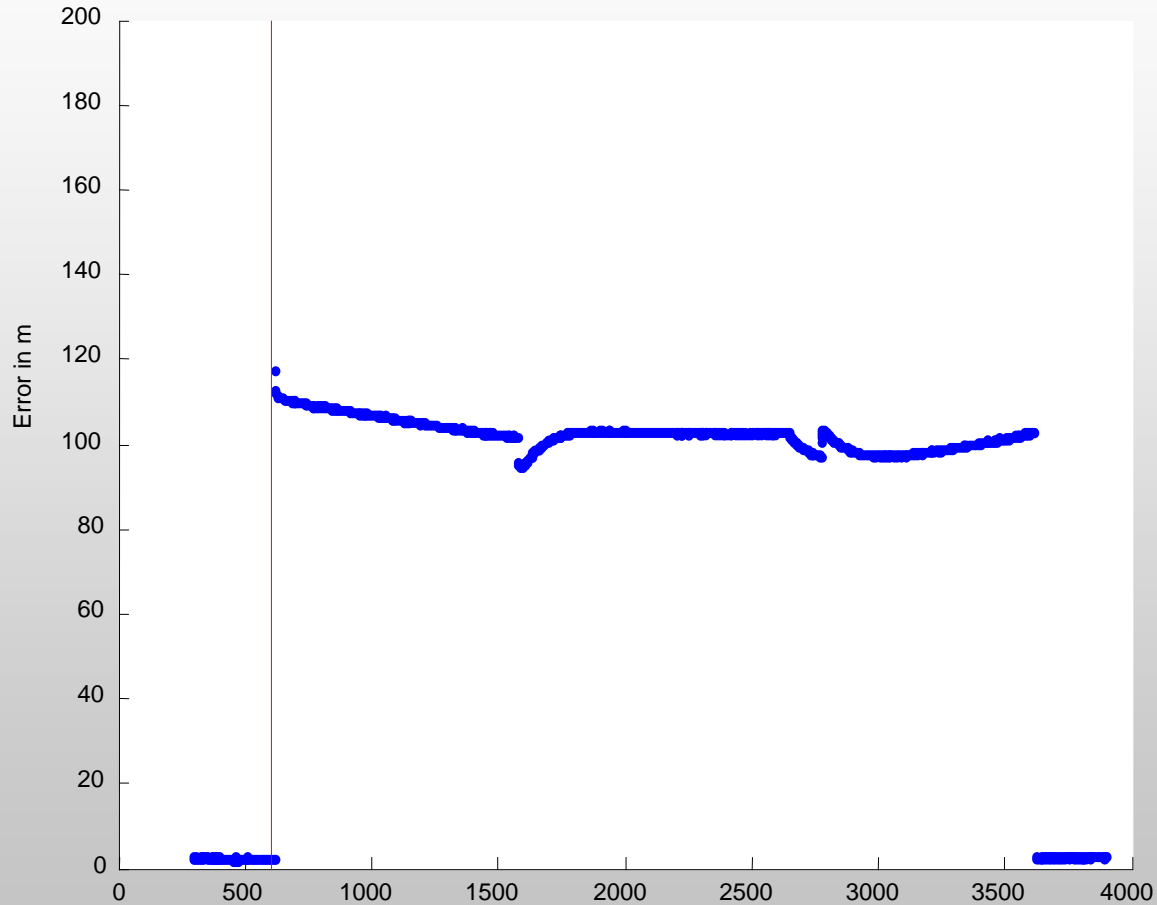


# Example result - Test 11: SC Time out

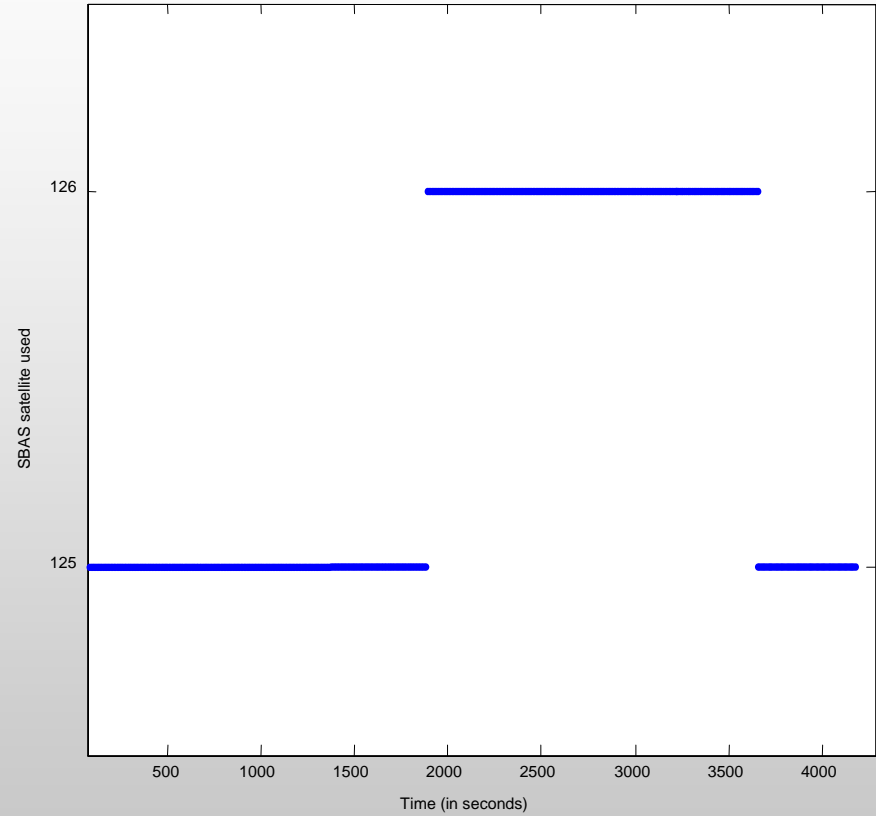
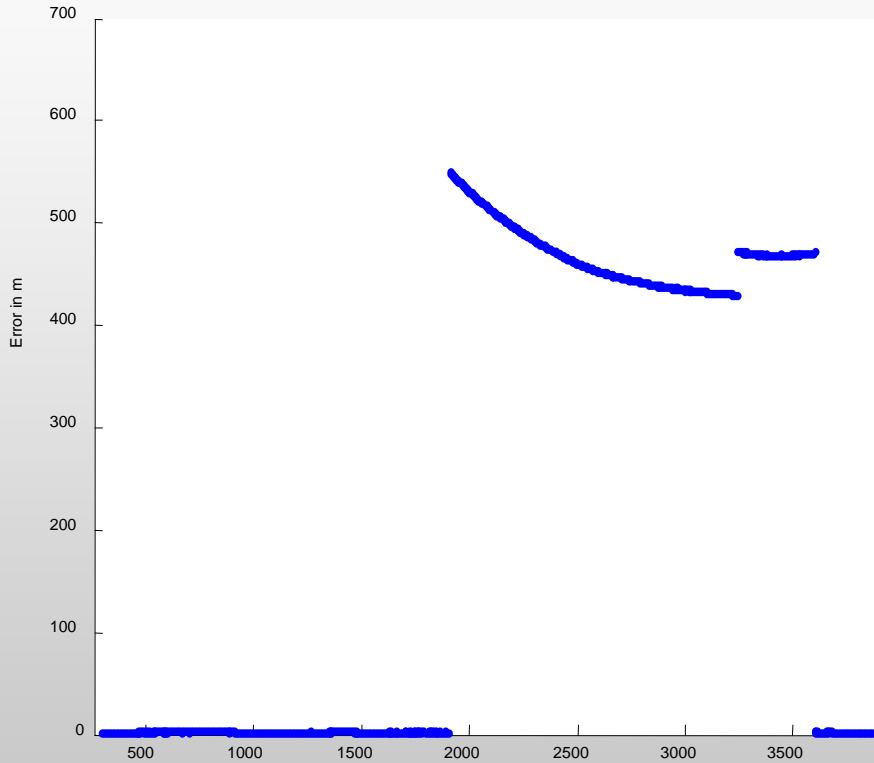
---



# Example result - Test 14: Ionospheric Corrections



# Example result - Test 18: Geo Change



# ***Calibration and results publication***

---

- **Key element: Collaboration with manufacturers**
- **Results are discussed with the manufacturers before their publication**
- **Calibration and validation of the equipment and testing tools to achieve consistency**
  - Crosschecking the results
  - Periodical calibration tests
  - the STR4760 simulator is tested and calibrated periodically by the manufacturer Spirent communications Ltd.

# Conclusions

---

- **Sophisticated tools and a consolidated test strategy is a must for comparing Rx**
- **Reducing human interaction**
  - Eliminate subjectivity as much as possible (the tests are either a pass or a not pass)
- **Interaction with manufacturers**
  - Maintain good relations
  - Remain independent
  - Identify receivers to test and discussing the results has proven useful for both parties
- **Service to the users**
- **Galileo receiver testing in the coming years**



---

# Thank you for your attention

For further information on  
Euterpe:  
[david.jimenez.banos@esa.int](mailto:david.jimenez.banos@esa.int)