Highly-Accurate Positioning Experiment System using QZSS at ENRI

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1. Outline of ENRI Experiment system
2. Development Schedule
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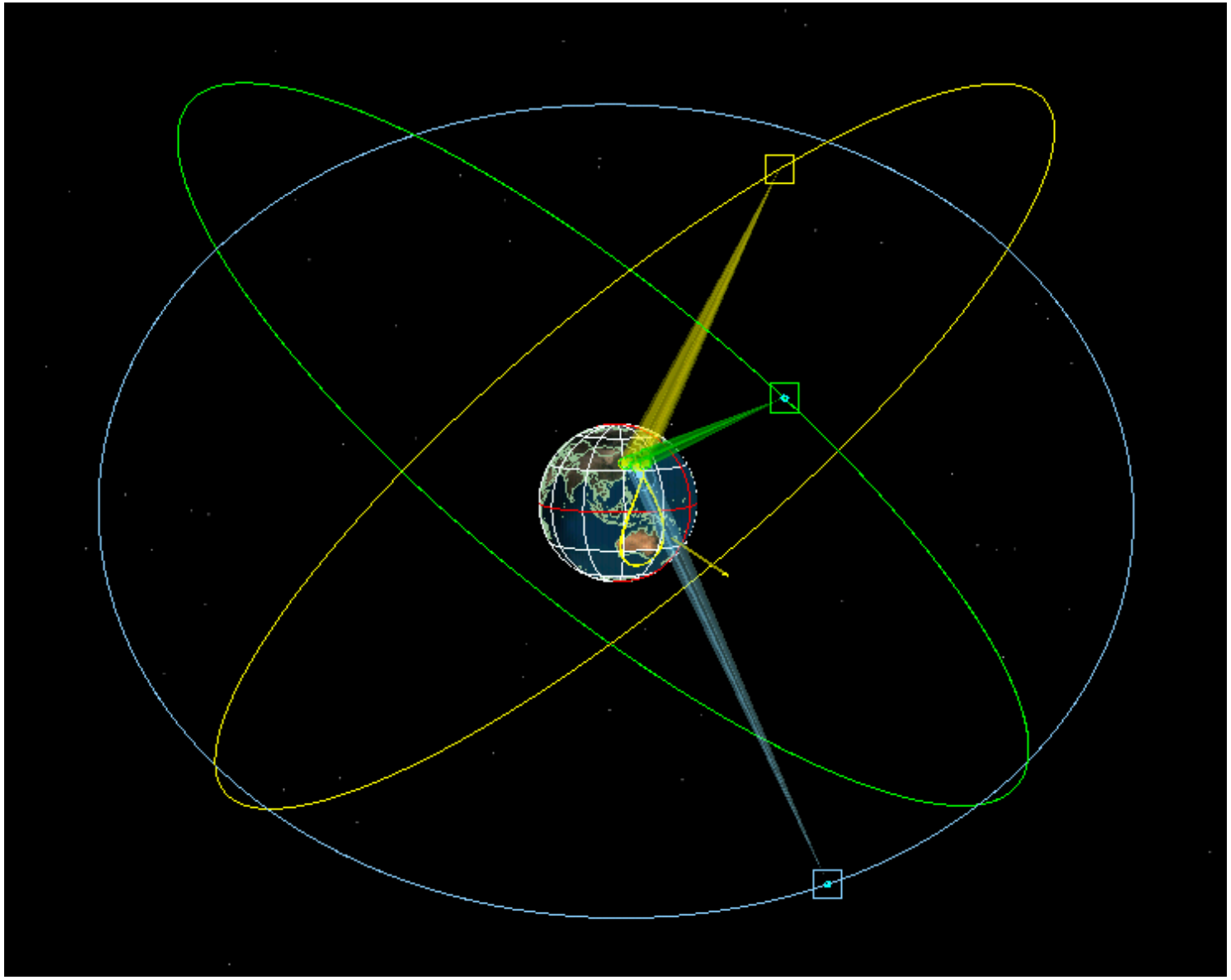
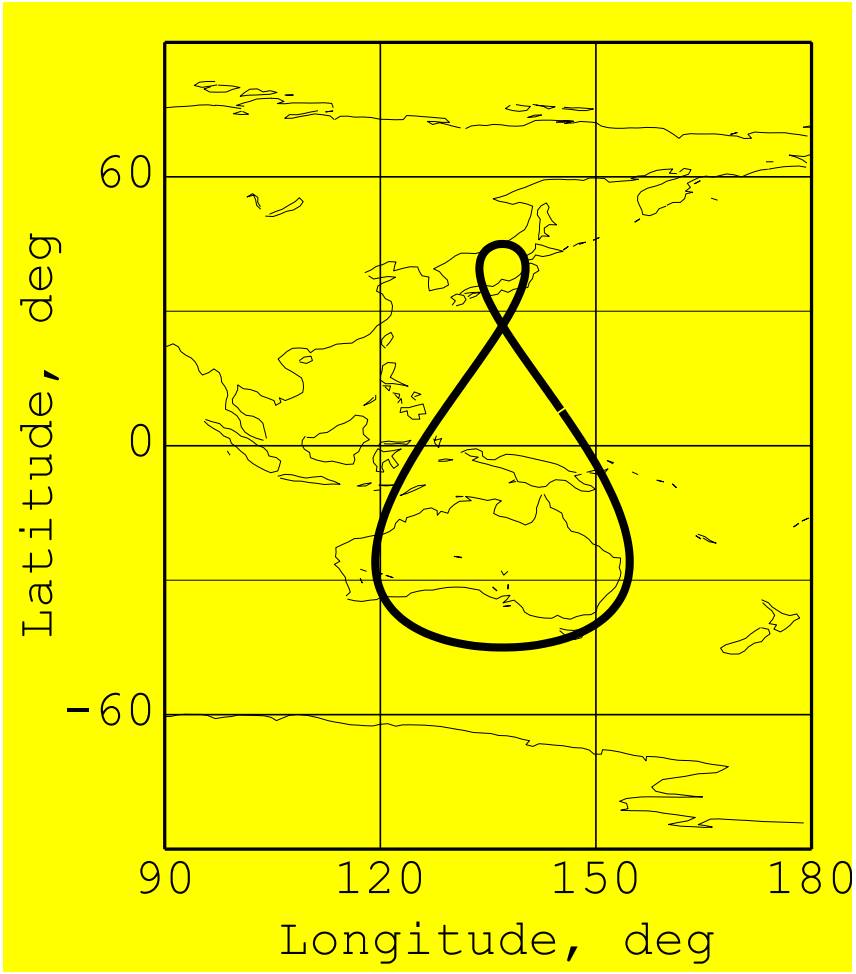
QZSS (1)

- QZSS:
  Quasi-Zenith Satellite System
  constellation consisted of several satellites orbiting in inclined orbital planes with GEO-synchronous period



Example of QZS orbit



QZS：Quasi-Zenith Satellite

QZSS (2)

- minimum elevation angle :
  higher than about 70 (deg) through 24 H in service areas when there are three or more satellites
- One of satellites in QZSS :
  visible near zenith at any time

QZSS (3)

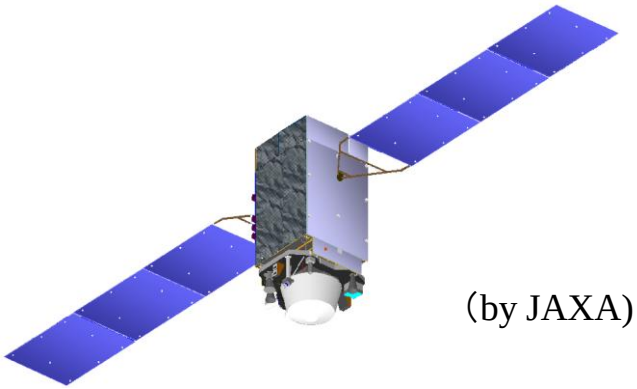
- Development of QZSS : 2003 ～

- missions of QZSS
  - GPS Complement
  - GPS Augmentation

QZSS design policies

- a) to preserve and improve existing GPS user benefit and convenience
- b) to develop and demonstrate highly accurate and reliable satellite positioning technology

Outlook of QZS



（by JAXA)

mass：4,100kg
lifetime：10 years
size：
2.9m(D)×25.3m(W)×6.0(H)
power：above 5300W

Launched on September ,2010

ENRI experiment

- FY2003 – FY2010
- Production of Messages for highly accurate positioning and integrity monitoring with QZSS and GPS
  => target accuracy : ***one-meter***
- Use of a ***L1-SAIF*** signal
- Coverage : Japan

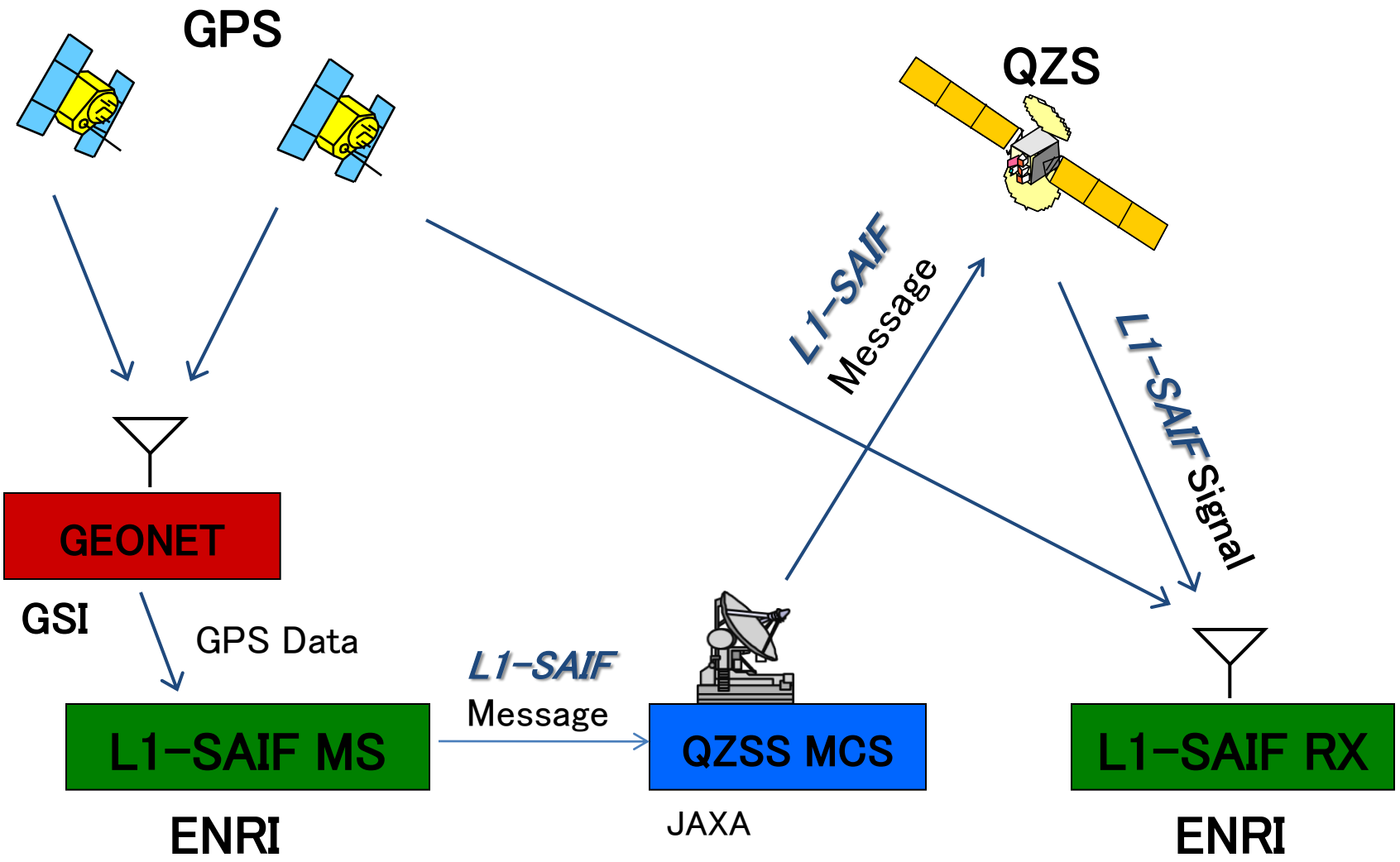
L1-SAIF Signal

- ***SAIF*** : Sub-meter Augmentation with Integrity Function
- Including ***L1-SAIF*** message: 250bps
- Including GPS-like ranging function
- Transmitted on GPS L1 frequency
- Based on SBAS

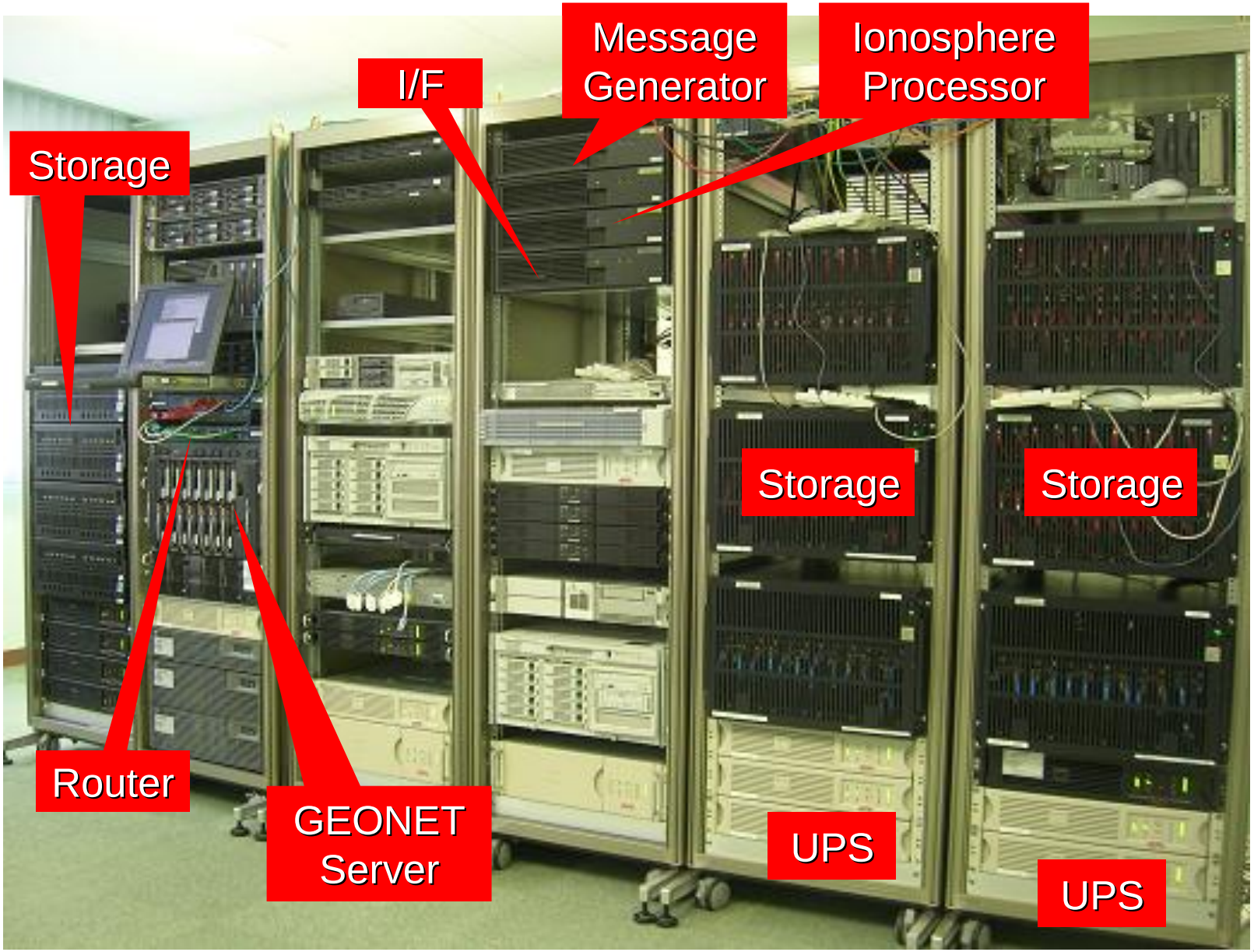
L1-SAIF Messages

- differential GPS corrections
  : estimated separately for individual sources of ranging error
- integrity information using GPS reference stations
- SBAS compatible messages and extended messages

ENRI Experiment System



L1-SAIF Master Station



L1-SAIF Receiver (prototype receiver)

Development Schedule (1)

- *FY2003-FY2004*

  algorithm for production of ***L1-SAIF*** messages

- *FY2005-FY2007*

  development of a real- time production system of ***L1-SAIF*** messages and ***L1-SAIF*** receiver

Development Schedule (2)

- *FY2008*

  ground test using a satellite simulator and on-line data from GPS reference stations

Development Schedule (3)

- *FY2009-FY2010*

  (1)interface test between JAXA and ENRI

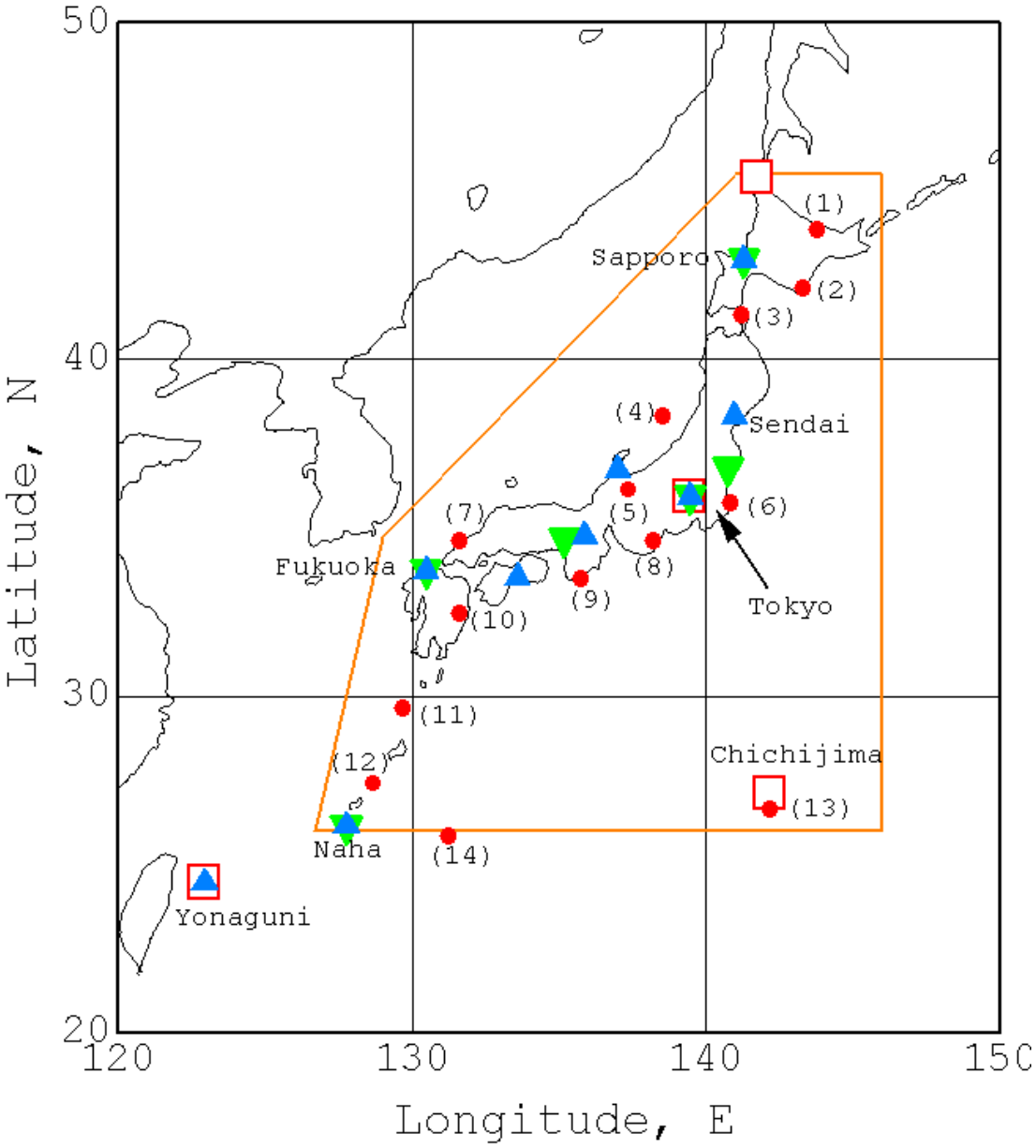
  (2)validation test using a QZS

Example of Positioning Errors(1)

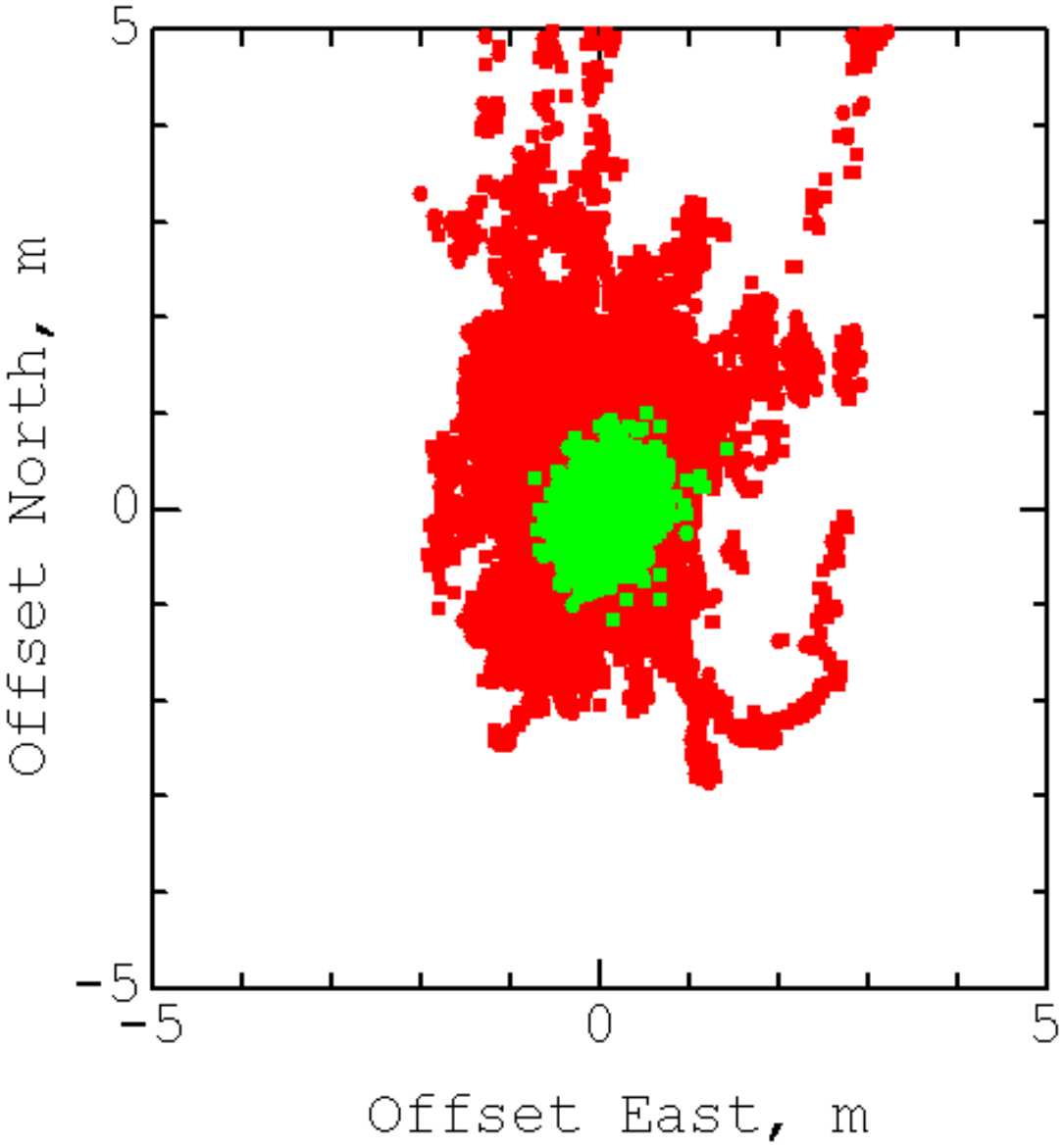
- User position error measured at GEONET site 40058 (Takayama at the center of Mainland of Japan);
- Period: Jan. 19 to 23, 2008 (5 days).

NOTE: This result is obtained by the survey grade antenna and receiver.

Monitoring Stations and Test Sites



Example of Positioning Errors(2)



●:GPS + *L1-SAIF*
=>0.29m(RMS)

●:GPS only
=>1.45m(RMS)

Summary

1. ENRI Experiment system
   : ***L1-SAIF*** Signal
2. Development Schedule
3. On-line Test Results