

# **BeiDou Demonstration Project in Korea - Initial Results**



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**National GNSS Research Center**  
**Chungnam National University**

# Congratulations!

- ✓ Successful launch of the 16th Beidou satellite into space at 11:33 p.m. Beijing Time, October 25 2012



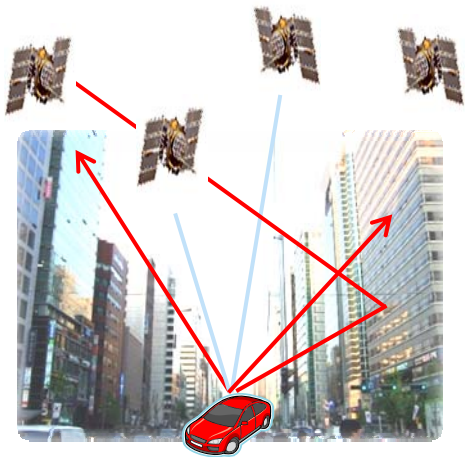
# BEIDOU Demonstration Project in Korea

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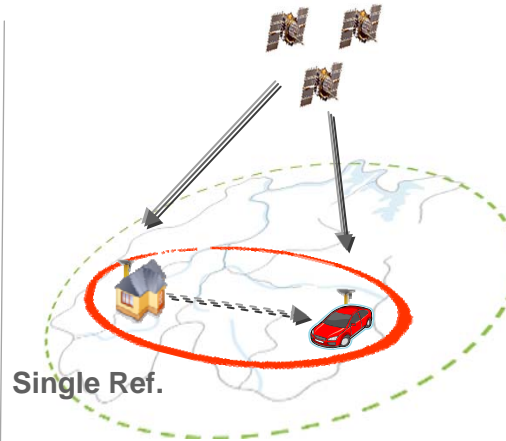
- ✓ **Assessment of Beidou performance in Korea**
  - A typical international cooperation for promoting BEIDOU
  - National GNSS Research Center
    - In cooperation with Shanghai Jiao Tong University
  - Supported by Beidou office(CSNO)
  
- ✓ **Three applications**
  - Navigation using CDGPS (NGRC, KARI)
  - Surveying/mapping (NGRC, KASI)
  - Timing (NGRC, KRISS)
  
- ✓ **Two-phase pilot project**
  - 1<sup>st</sup> phase: Basic assessment including feasibility study (2012)
  - 2<sup>nd</sup> phase: Detail assessment (2013)

# Performance Assessment of Beidou and/or GPS

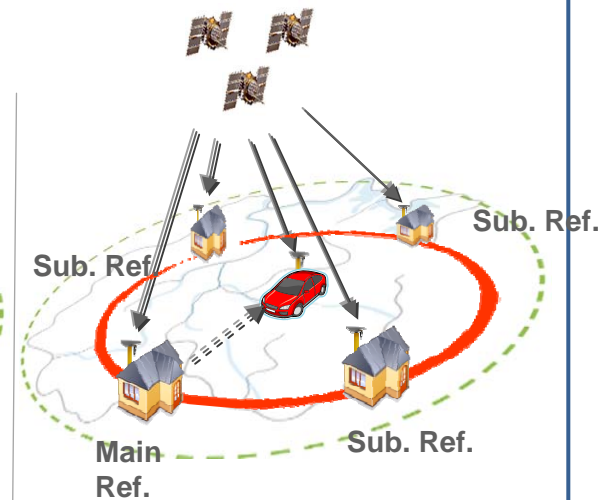
## Performance Evaluation of Beidou in the 1<sup>st</sup> phase



Signal Acquisition and  
Performance Analysis  
in Urban Valley

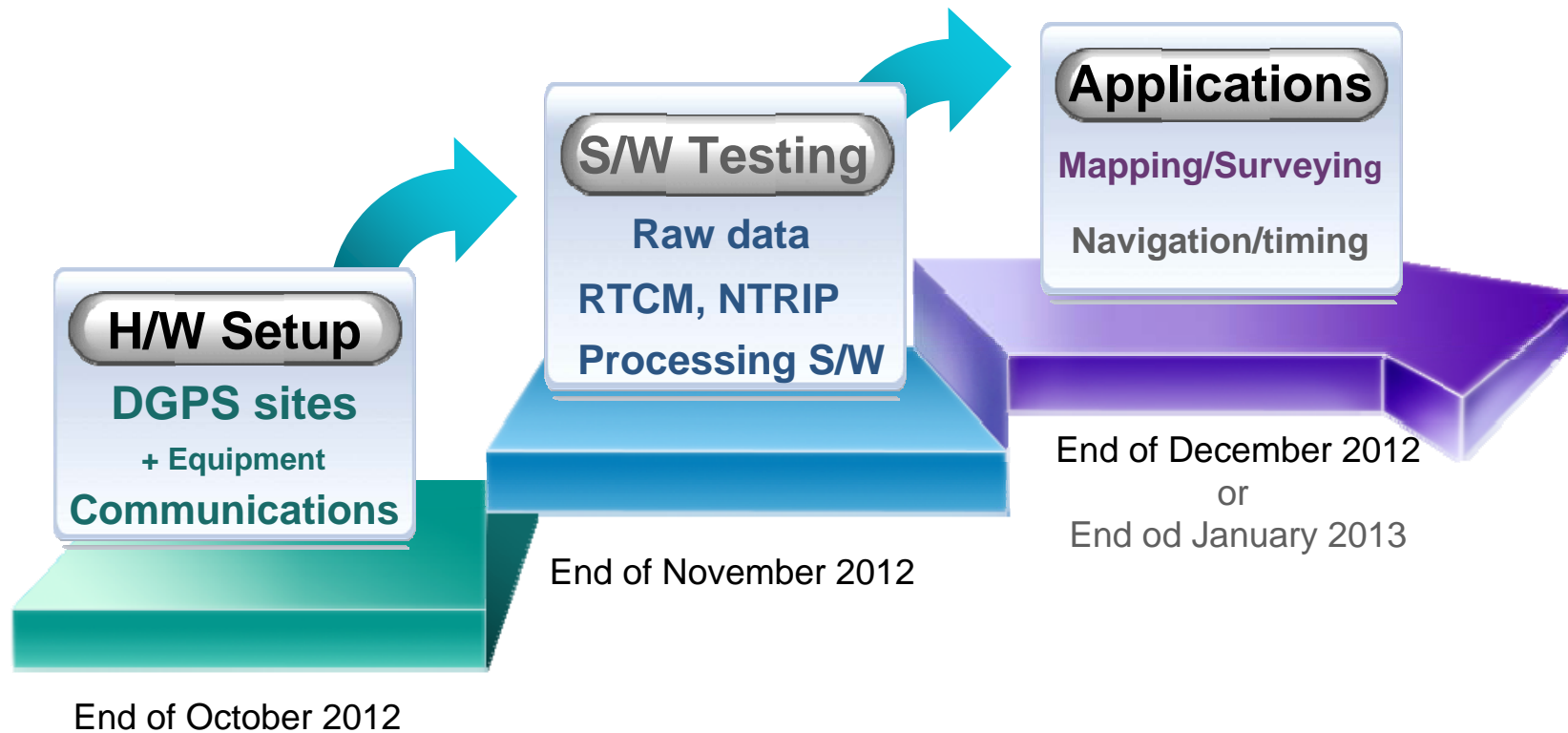


CDGPS  
using single Beidou RS



CDGPS  
using Beidou RS Network

# Plans for 1<sup>st</sup> Phase



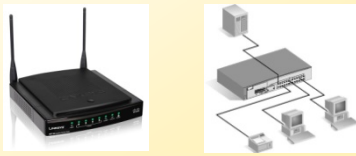
# System Configuration

## NDGPS Reference Stations (4)



## Communication Equipment

- VPN
- Router and Switch (>8 Port)
- TCP/IP Access via Internet



## Hardware Configuration

## Server (2 or 3)

- Server for Beidou data archiving
  - For providing post-time 1Hz data to SJTU
- Server for data processing
  - RTCM data to the NTRIP Caster
- Web server
  - Data contribution to GNSS users via Web access
- Server Cabinets (or Racks)



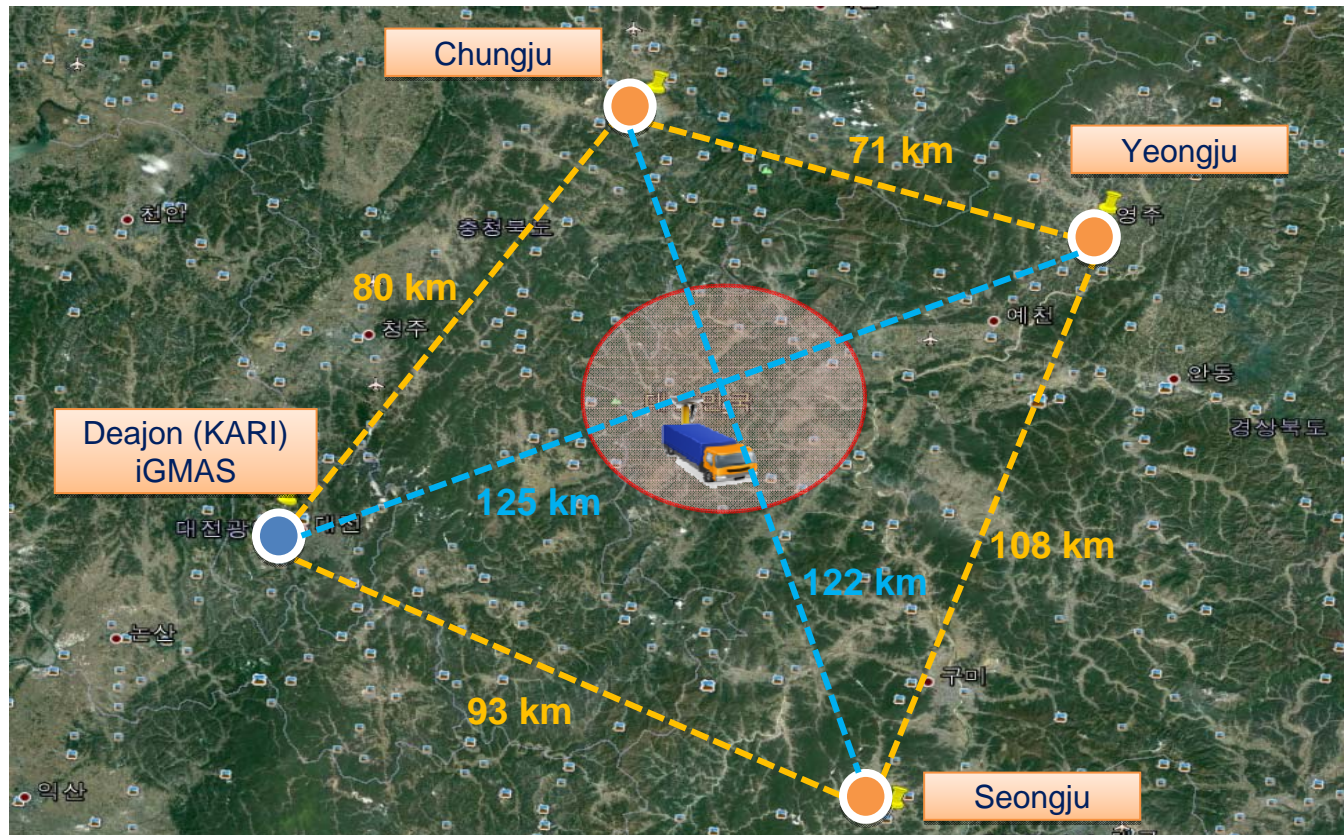
## Accessories

- UPS Rack Mount
  - to protect equipment



# Planned RS Network for Field Test

- ✓ The Distance between the NDGPS Reference Stations is 71km~108km
- ✓ iGMAS site at KARI or KASI (Daejeon)



iGMAS : International GNSS Monitoring and Assessment Service

# Zero baseline Test

- ✓ Receivers delivered on 25<sup>th</sup> October, 2012

## Receiver Spec.

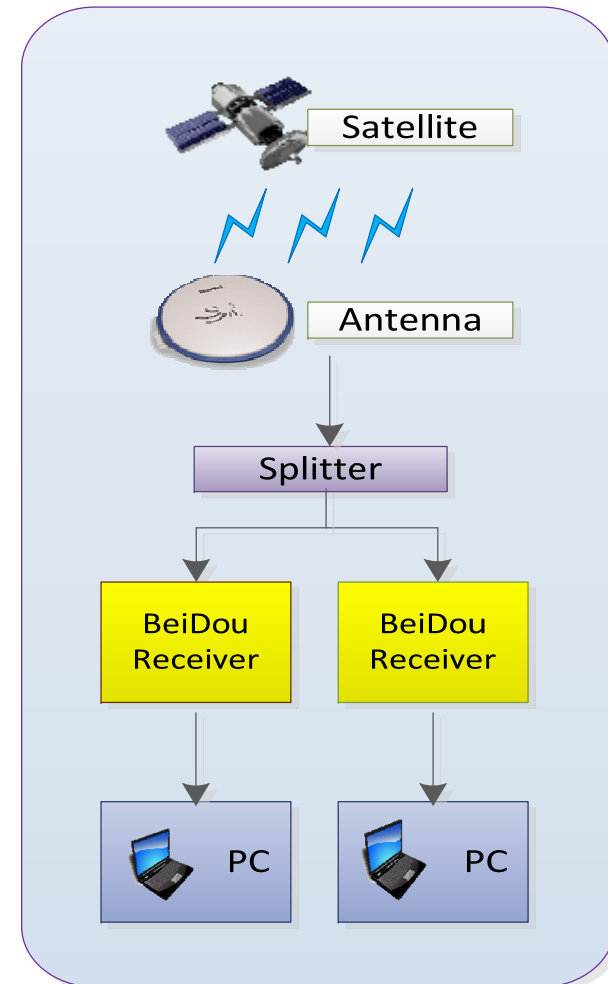
### BeiDou M300 GNSS



L1C/A, L1/L2P, B1/B2

Single Point Accuracy(RMS): <1.5m

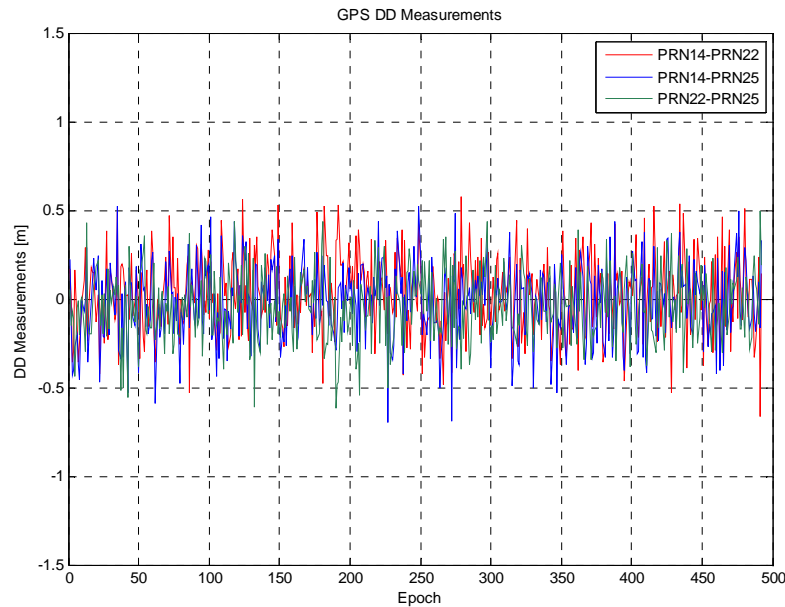
Static Differential Accuracy :  
(Horizontal)  $\pm(2.5+1 \times 10^{-6}D)$ mm  
(Vertical)  $\pm(5+1 \times 10^{-6}D)$ mm





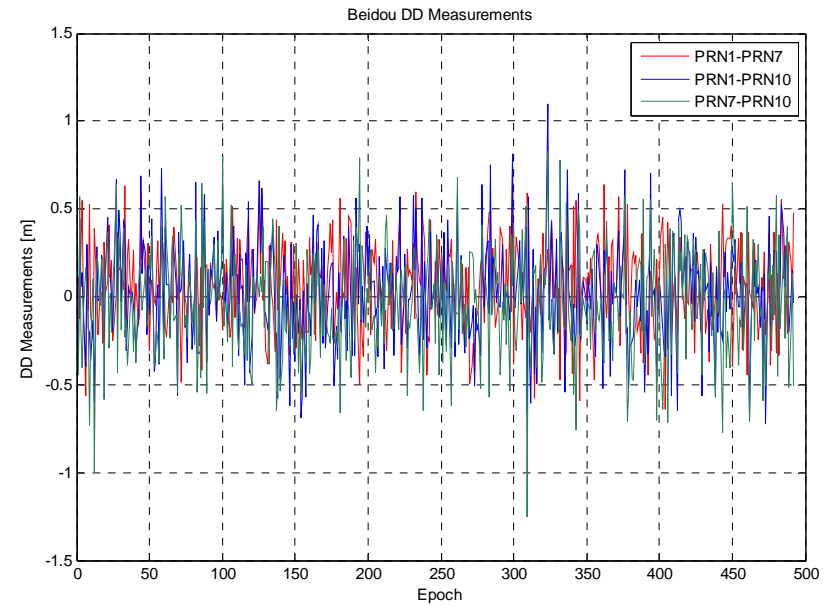
✓ Zero baseline test : DD code quality (L1, B1)

**GPS Code Measurement**



GPS	Mean [m]	Std. [m]
14-22	0.023	0.215
14-25	-0.018	0.210
22-25	-0.041	0.191

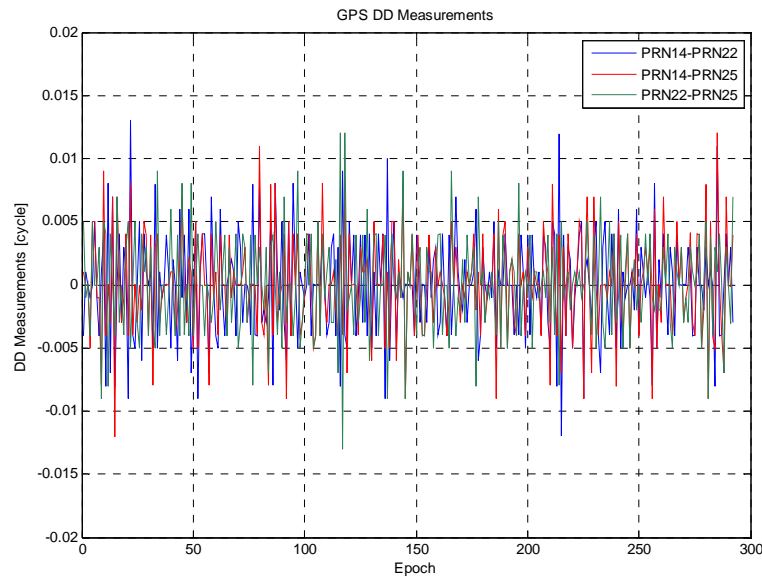
**BeiDou Code Measurement**



BeiDou	Mean [m]	Std. [m]
1-7	0.064	0.245
1-10	0.029	0.287
7-10	-0.035	0.303

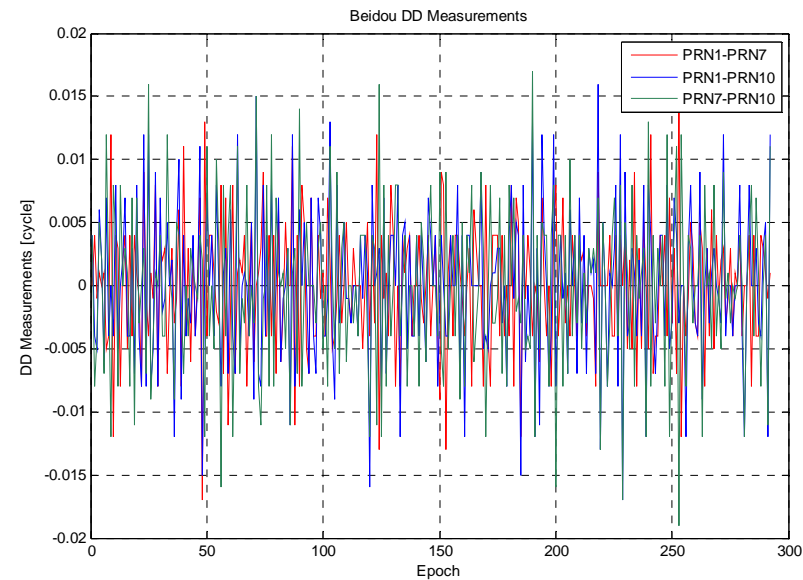
✓ Zero baseline test : DD CP quality (L1, B1)

**GPS Carrier Measurement**



GPS	Mean [m]	Std. [m]
14-22	0	0.004
14-25	0	0.004
22-25	0	0.004

**BeiDou Carrier Measurement**



BeiDou	Mean [m]	Std. [m]
1-7	0	0.005
1-10	0	0.006
7-10	0	0.007

# Short Baseline Test (static)

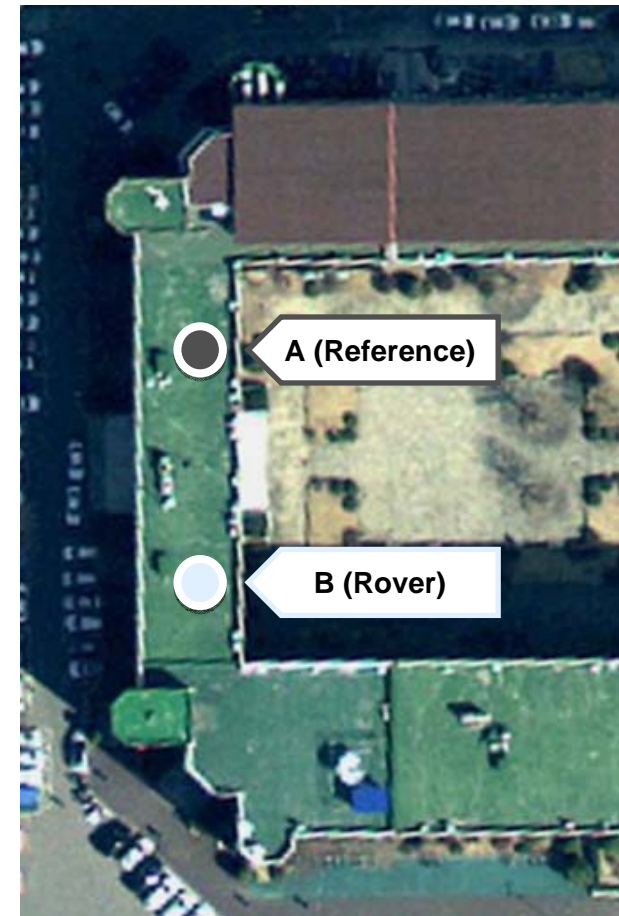
- ✓ On the roof of E2 building, CNU : about 50m baseline

## Reference position (A)

- ECEF: (-3119372, 4087994, 3760895)
- LLH : Latitude : 36.3645  
Longitude : 127.3457  
Altitude : 93.7988

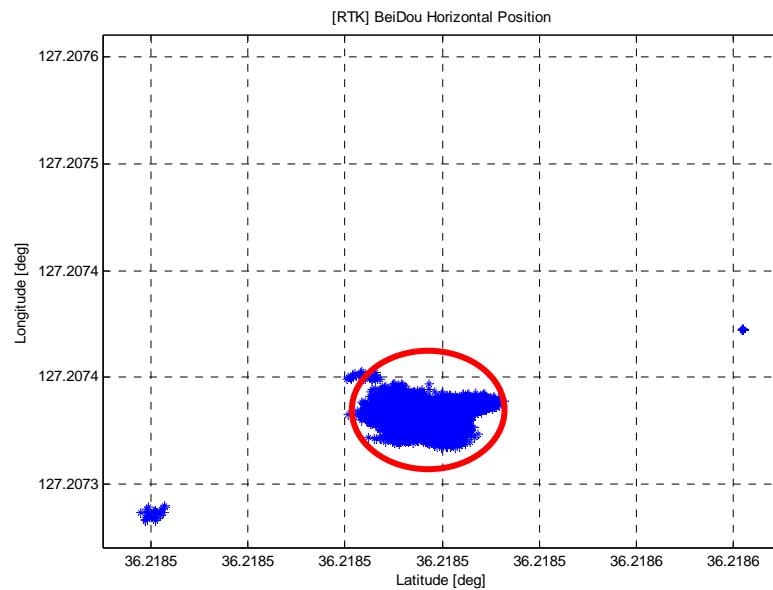
## Rover position (B)

- ECEF: (-3119381, 4088014, 3760866)
- LLH : Latitude : 36.3642  
Longitude : 127.3456  
Altitude : 93.7988

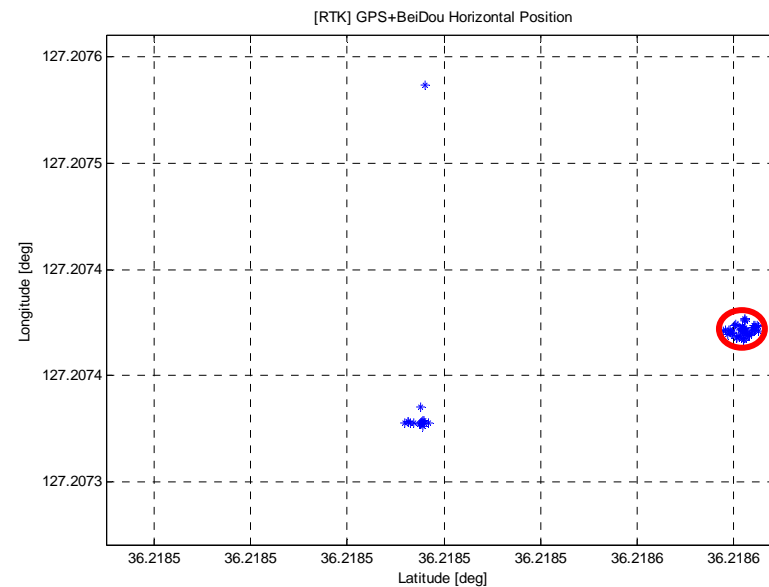


- ✓ Initial result of Short Baseline Test – dual frequency
- ✓ All the necessary information was not extracted from receivers

BeiDou Only

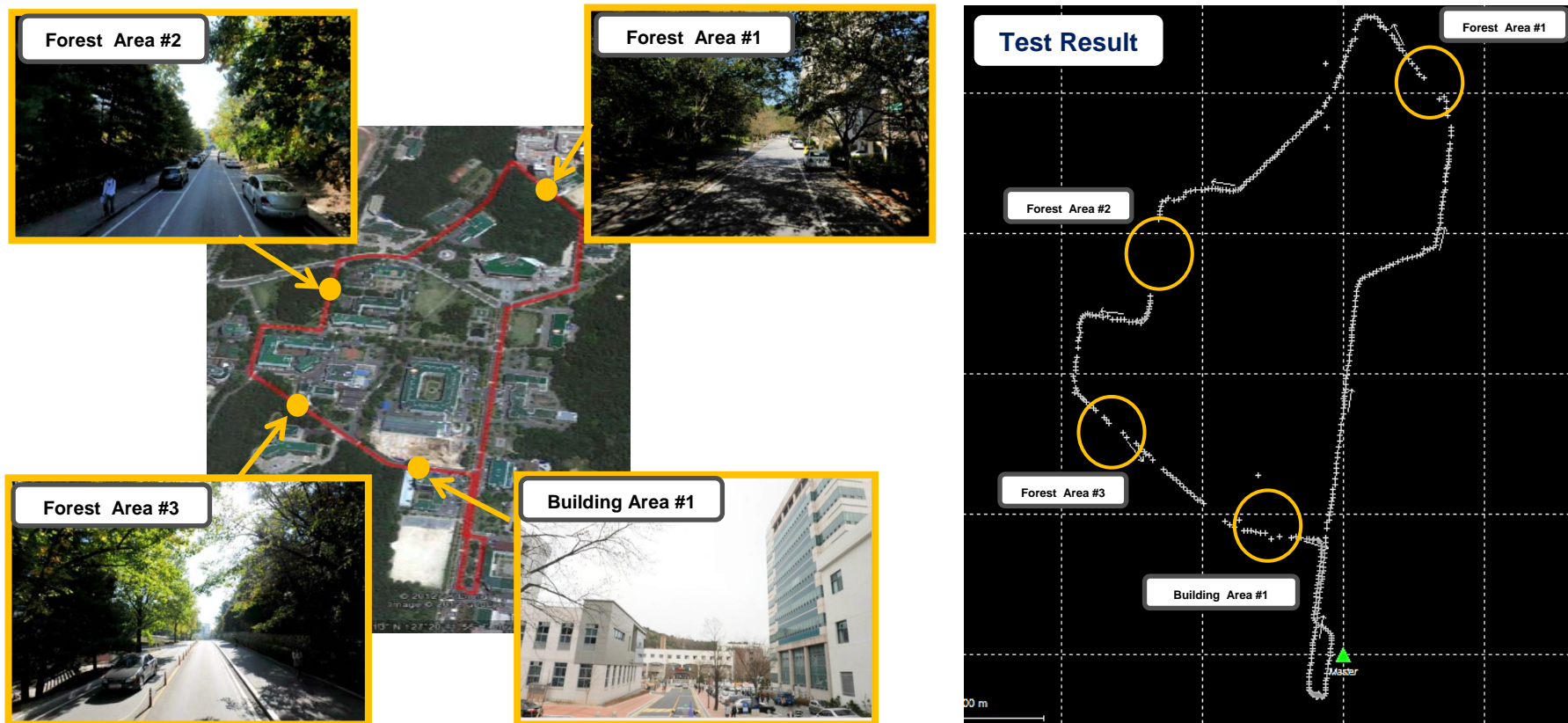


GPS + BeiDou



# Dynamic Test (urban canyon)

- ✓ Reference trajectory using NovAtel Receiver at CNU campus



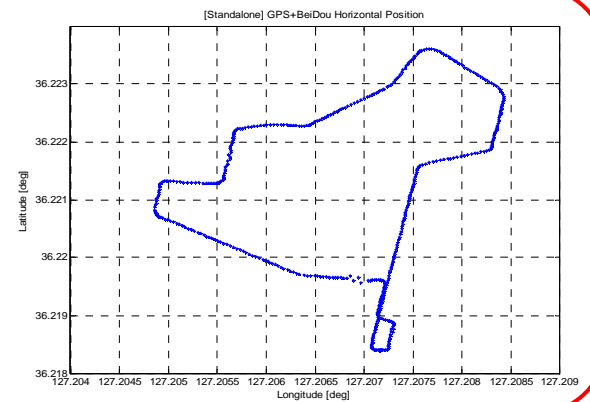
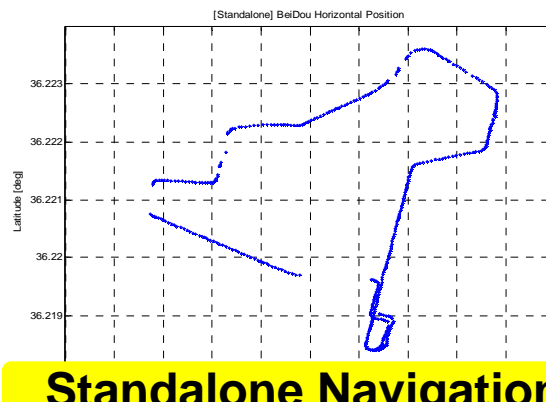
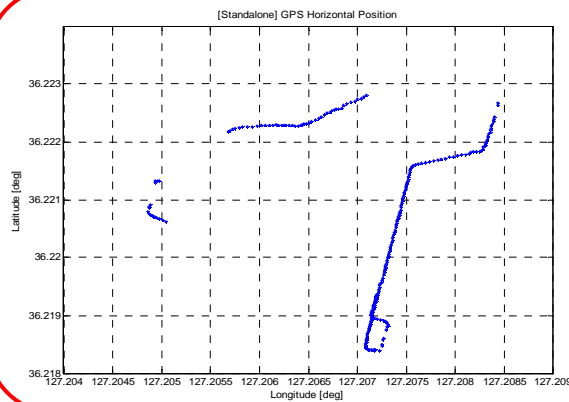
Receiver : Novatel Propak-v3, Post Process S/W : Waypoint

- ✓ Real time dynamic test using BeiDou Receiver – dual frequency
- ✓ The elevation angle of BeiDou SVs is higher

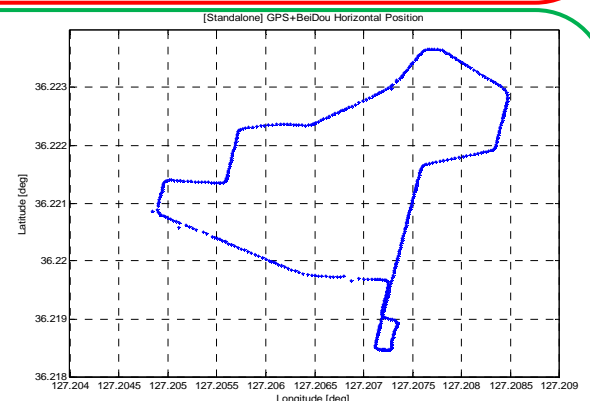
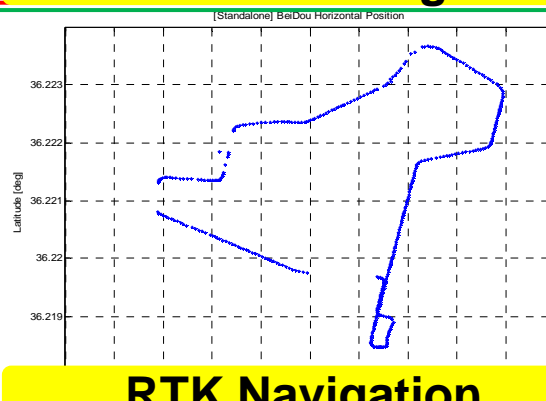
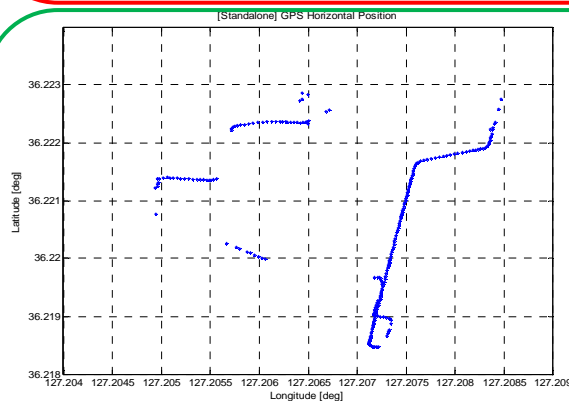
GPS Only

BeiDou Only

GPS + BeiDou



Standalone Navigation



RTK Navigation

# Concluding Remarks

- ✓ **Initial results of BeiDou demonstration in Korea**
  - Zero baseline test → signal quality of BeiDou & GPS
  - Static short baseline test → positioning performance of BeiDou & GPS
  - Dynamic test → navigation performance of BeiDou & GPS
- ✓ **Zero baseline test**
  - GPS signals looked like a little bit better than BeiDou signals but comparable
  - BeiDou is well operated
- ✓ **Static short baseline test, Dynamic test**
  - Complete analysis was not possible since all the necessary information was not available from receivers
  - Nevertheless, benefits of BeiDou is clearly seen as expected due to the increased number of SV, higher elevation angle
- ✓ **Phase 1 will be finished by December 2012**

**Expect contributions of BEIDOU  
to sustainable GNSS service  
through international cooperation**

**Thank you for listening !**