

Report of East Asian VLBI

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2011, Nov.,7

EACOA@Kyoto

March 11th Earthquake effects

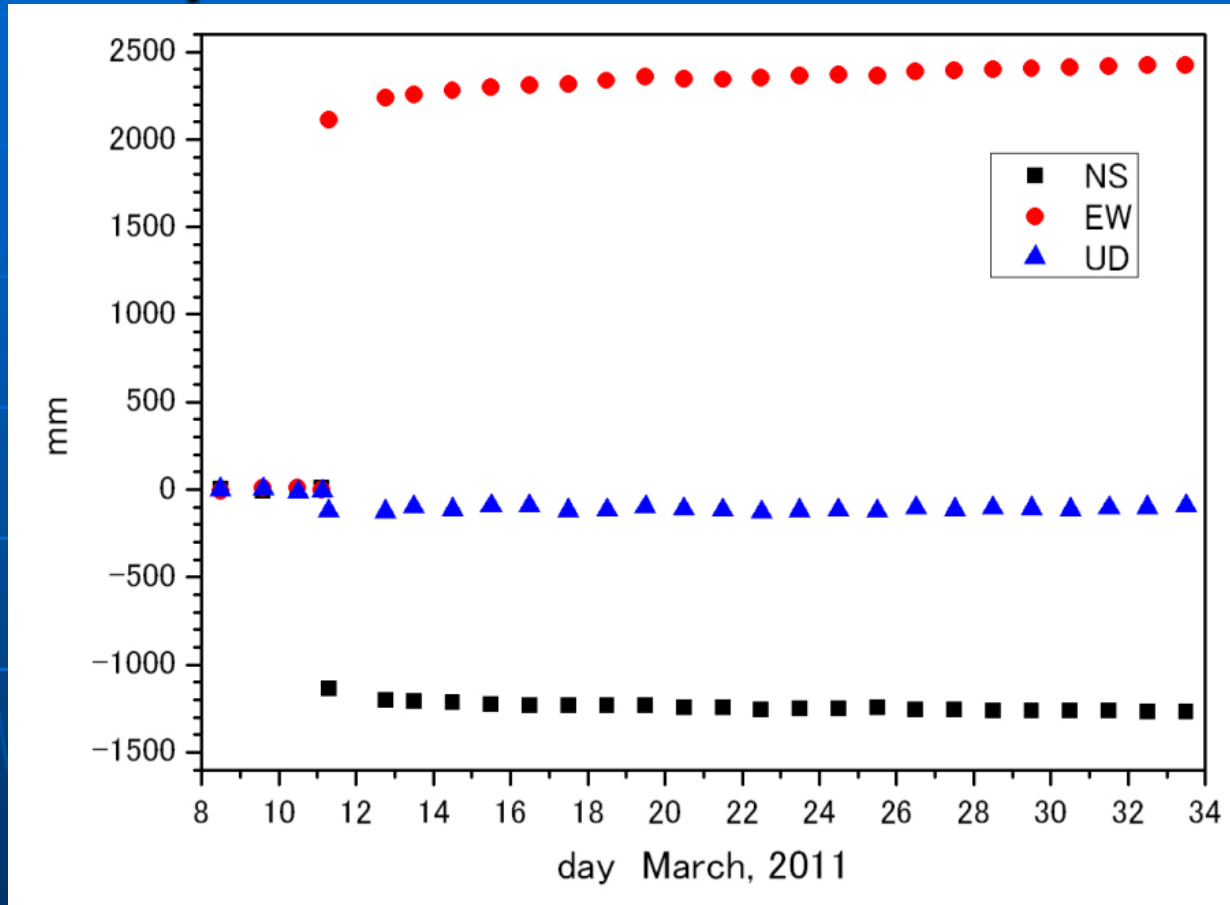


Mizusawa(VERA) ; Collision of
Elevation gear and housing



Ibaraki station damages

Displacement of Mizusawa



~3m displacement of the station

ASTRO-G Mission

Dual pol. @ 8, 22, 43 GHz

Phase-referencing capability

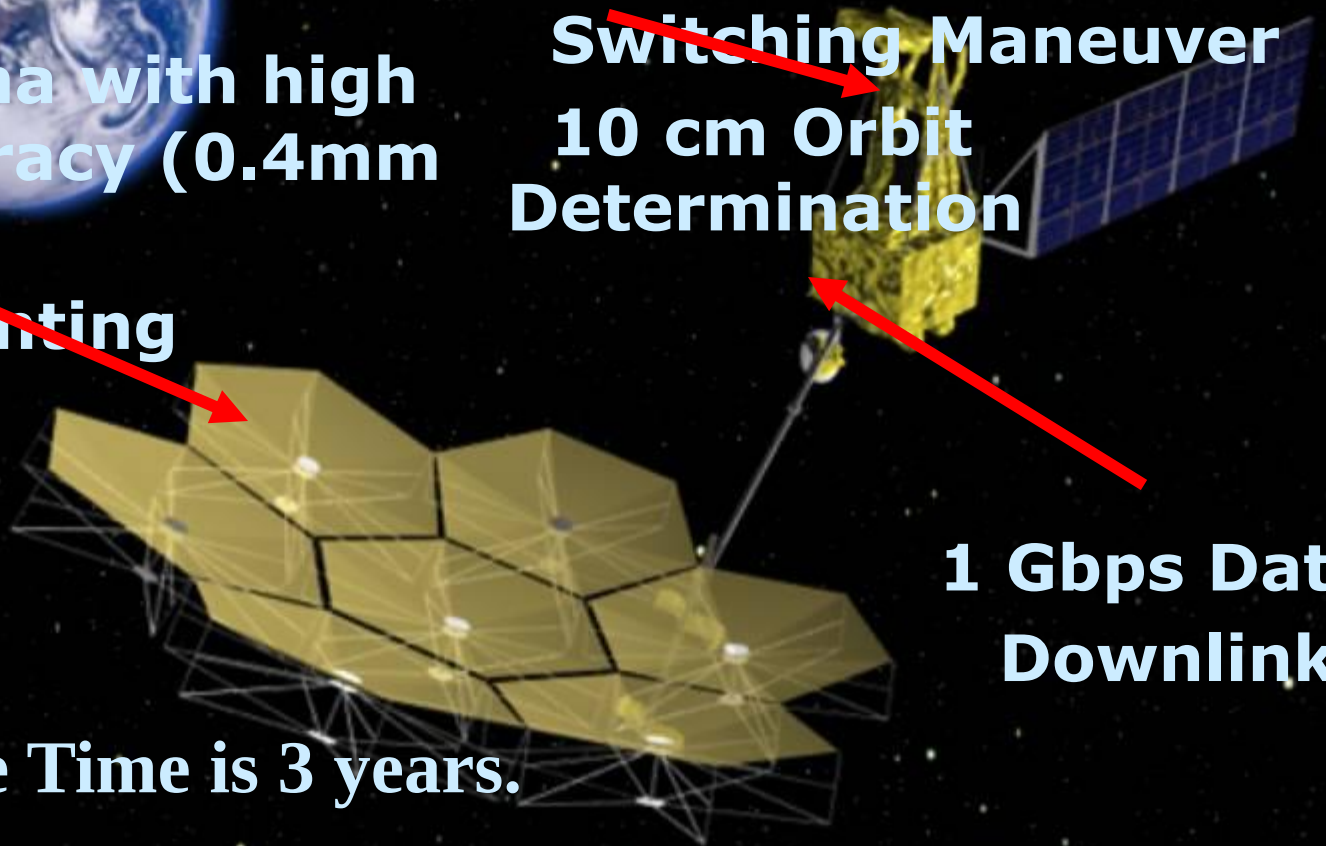
Switching Maneuver
10 cm Orbit Determination

9.3 m Antenna with high surface accuracy (0.4mm rms)

precision pointing (0.005deg)

1 Gbps Data Downlink

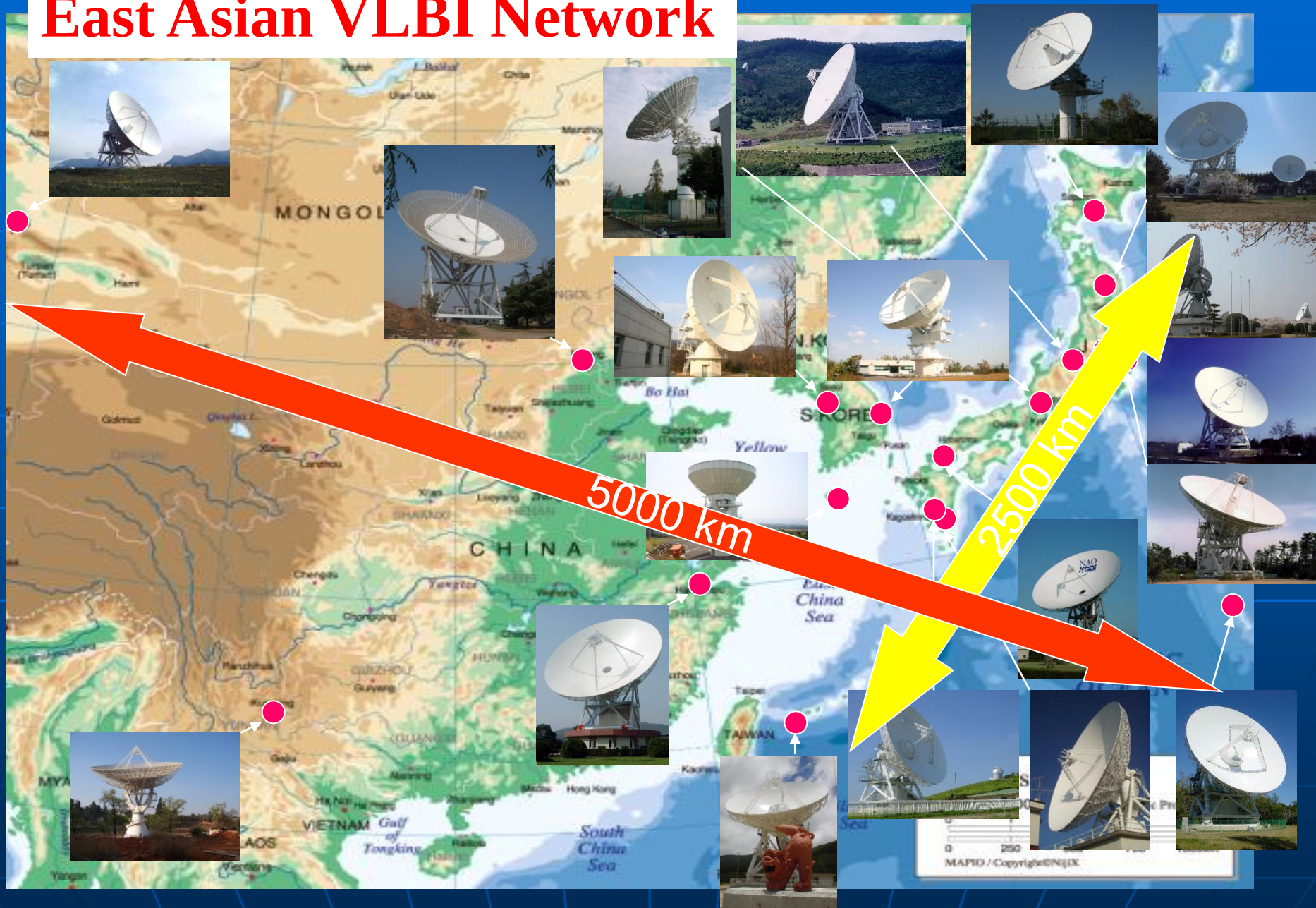
Target Life Time is 3 years.



Cancellation of Astro-G

- 2009.3-7 PDR
 - Uncertainty of deployment antenna repeatability
 - Problems of surface accuracy (thermal conditions, radiation conditions)
- 2009.7-2010.8 Tiger team activity
 - Only 1mm rms is achievable.
 - Cost will overrun more than 50% of initial cost.
- 2010.9 ISAS Science council recommended the cancellation.
- 2010.12 ISAS advisory council also recommended it.

East Asian VLBI Network



Current working VLBI stations in Eastern Asia

- Japan(13)
 - VERA(4), Kashima, Tsukuba, Yamaguchi, Nobeyama, Usuda, Tomakomai, Gifu, Uchinoura, Takahagi, Hitachi
- Korea(3)
 - KVN (3) Yonsei, Ulsan, Tamna
- China(4)
 - Shanghai, Urumqi, Beijin, Kumming
 - Shanghai 65m

Feature of East Asia VLBI network

- Largest number of VLBI stations
 - 8GHz 13 stations
 - 22GHz 19 stations
 - 43GHz 8 stations
 - S/X geodesy 13 stations
- Phase referencing
 - VERA 2 beam system
 - KVN multi-frequency + fast nodding
- Good UV coverage
 - Minimum baseline length ; 50 km
 - Maximum baseline length ; 5000 km

Observation features

- Phase referencing observations
 - VERA 2 beam
 - KVN multi-frequency
 - Nodding
 - > high sensitivity observations for low Tb objects (RQQ, SNR, Galactic objects)
 - > astrometry for maser sources (H₂O, SiO, CH₃OH..)
- High dynamic range observations
- Ground array of VSOP-2

Total effective aperture and baseline length

VLBI array	EAVN	VLBA	EVN
No. of Stations	20	10	12
Baseline length	5,000km	8,000km	2,000km-8,000km
Effective Aperture 8 GHz	9,000m ²	3,700m ²	9,800m ²
Effective Aperture 22GHz	4,900m ²	3,200m ²	4,900m ²
Effective Aperture 43GHz	1,400m ²	2,900m ²	1,800m ²

EAVN observtaions

- KVN/VERA : Some scientific verification observations are on going.
 - 22GHz/43GHz mapping
 - Geodesy
 - 43GHz SgrA* etc.
- CVN(Shanghai)/JVN
 - Methanol(C band) observations and X band mapping test are on going.

VERA

<http://veraserver.mtk.nao.ac.jp/index.html>

Antenna Diameter 20m (250 μ m)

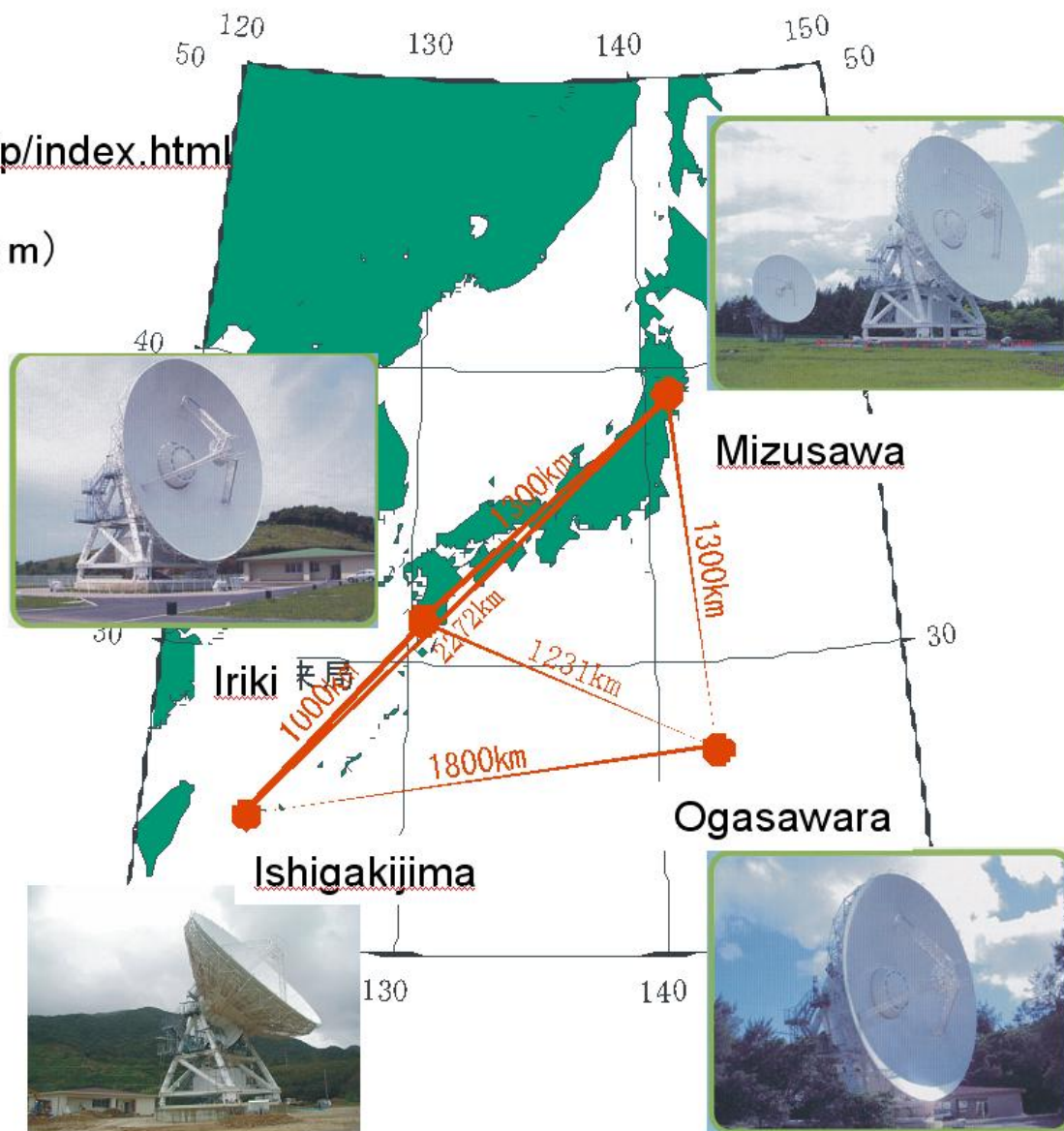
Observing band 2,8,22,43GHz

Maximum baseline 2273km

Minimum baseline 1000km

2 beam phase referencing

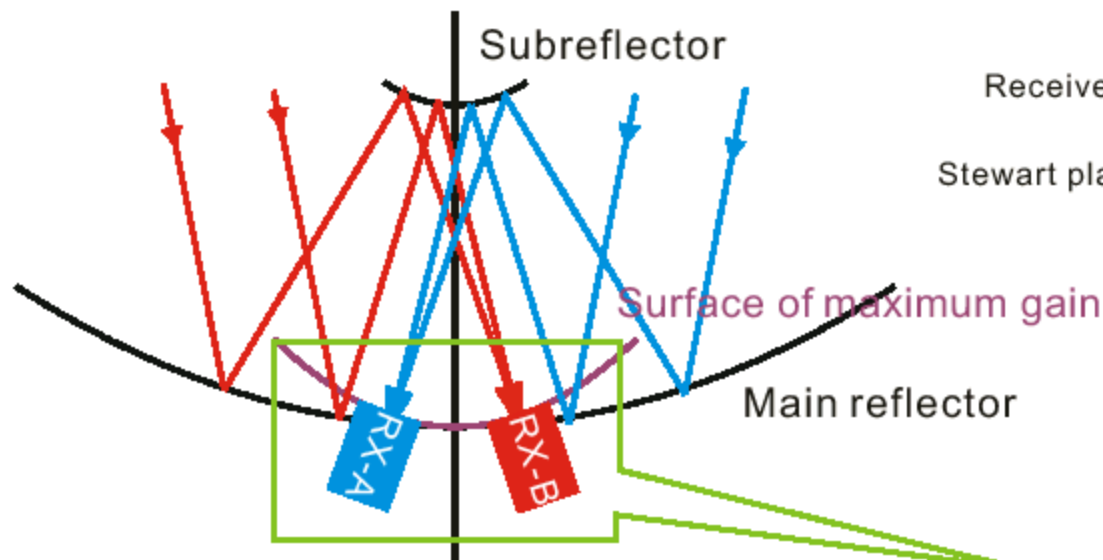
→ Inst. Path error <0.1 mm



Target source
(maser source)

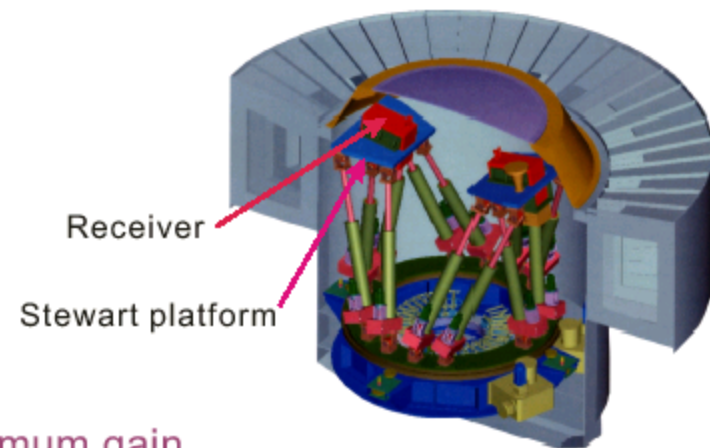


Reference source
(QSO)

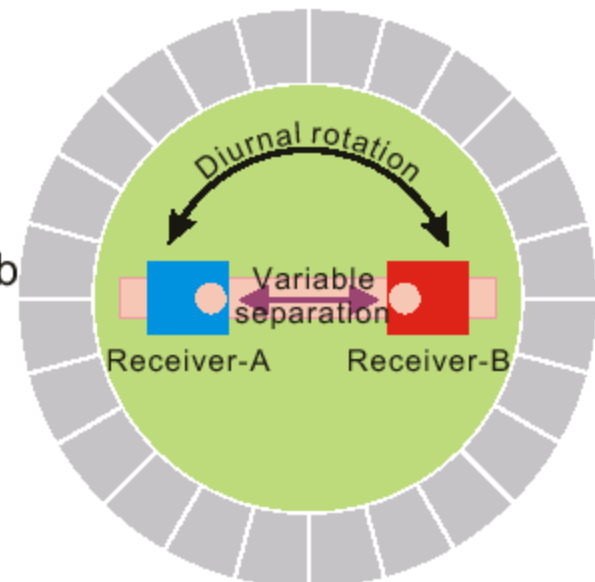


Concept of the dual-beam
receiving system

Sectional view of the center hub

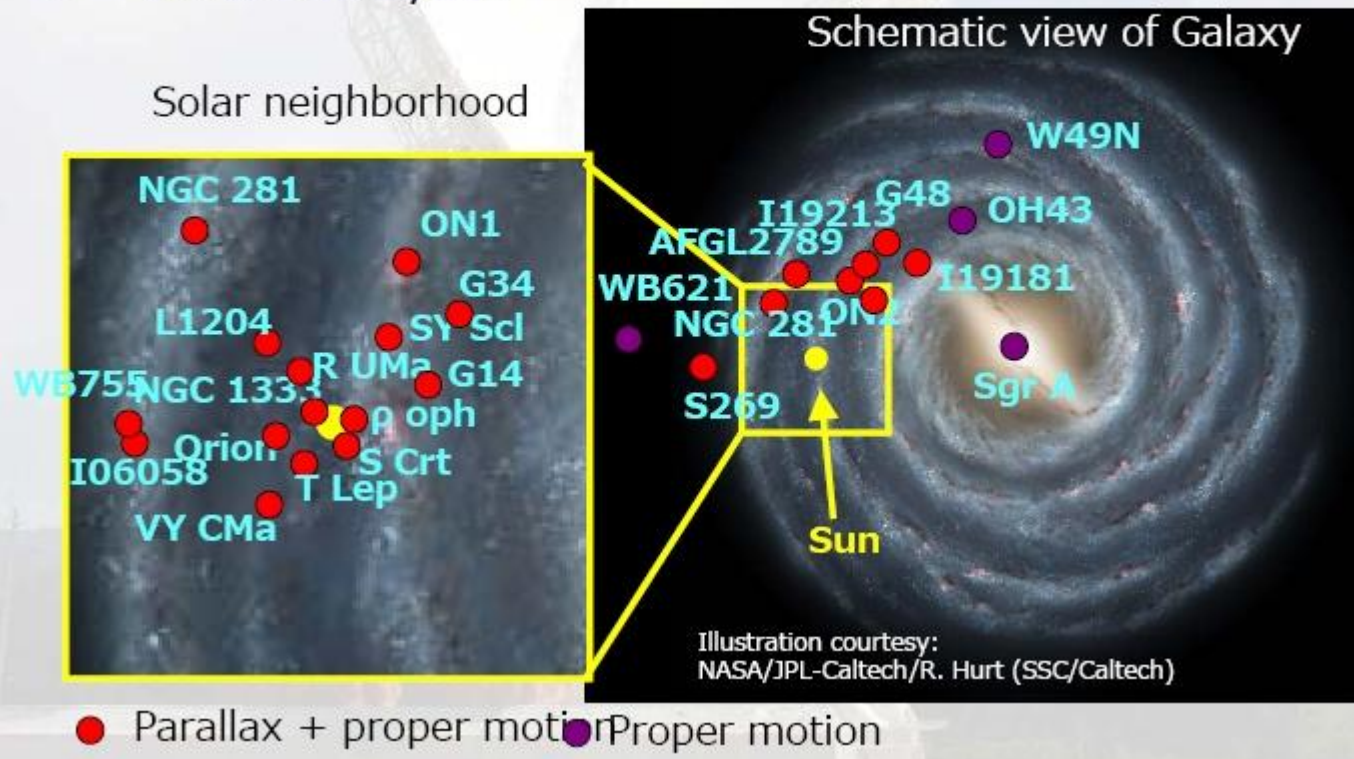


Top view of
the center hub



Current status of astrometry with VERA

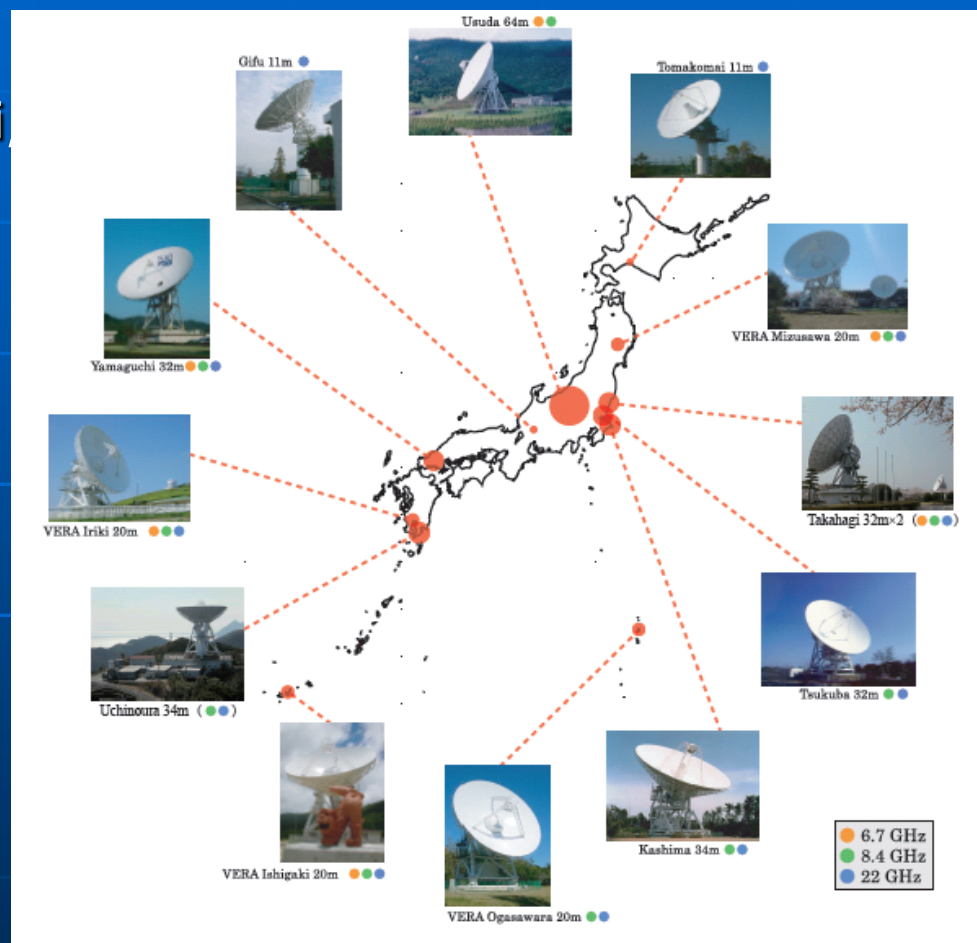
- ◆ ~100 sources have been monitored
- ◆ ~25 are analyzed



$$R_0 = 8.35 \pm 0.44 \text{ kpc}$$

Japanese VLBI Network (JVN)

- Collaboration
 - NAOJ (VERA)
 - Hokkaido, Ibaraki, Tsukuba, Gifu, Osaka-Pref, Yamaguchi, Kagoshima university
 - JAXA, NICT, GSI
 - 13 telescopes (11m ~ 64m)
- Purpose
 - A new, characteristic VLBI array
 - A Base of East-Asian VLBI
- Progress
 - Started in 2004
 - Steady Observation in 2005
 - First Paper published in 2006
 - Observing time ~200 hr/yr
 - **EAVN test observation**

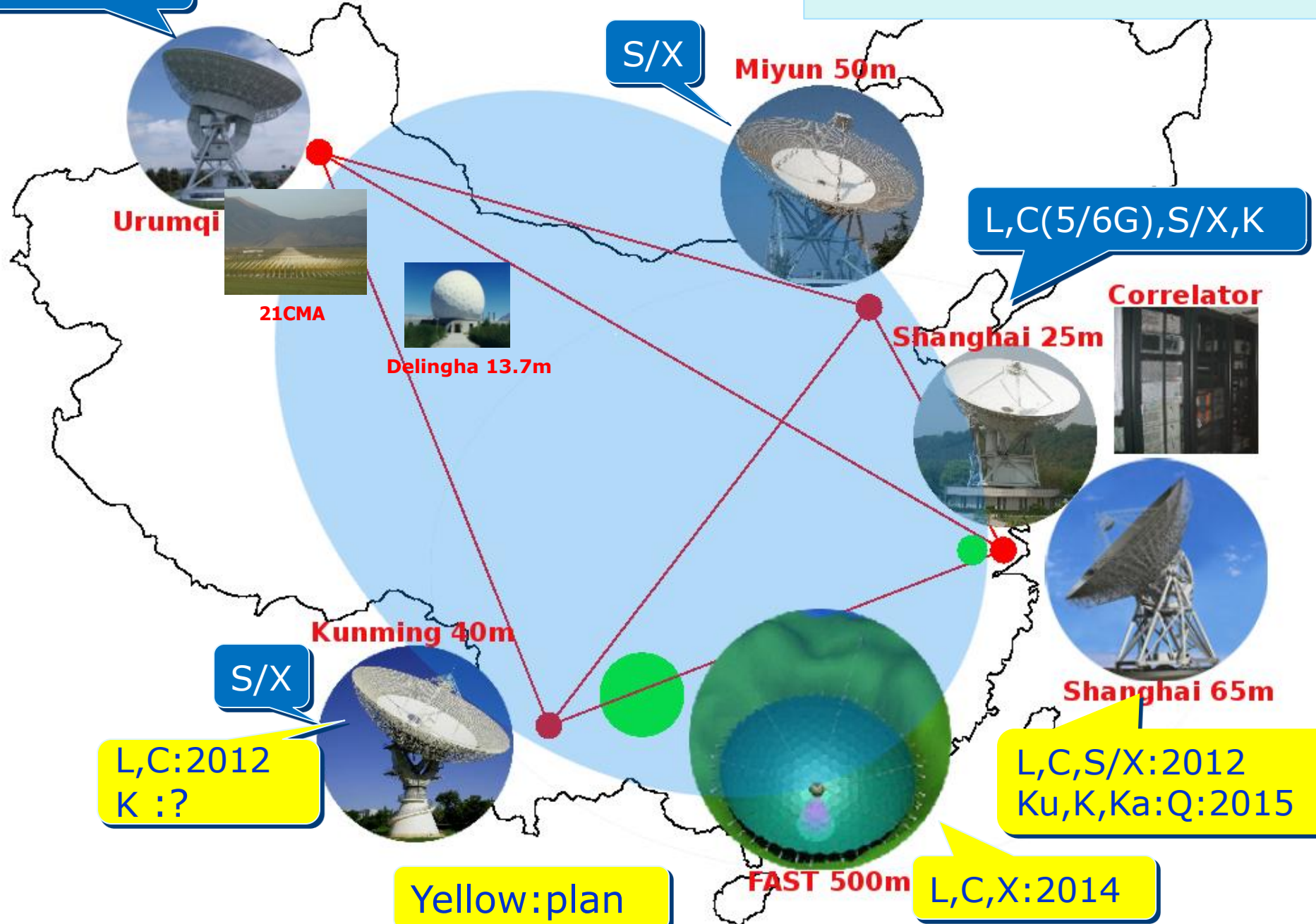


VLBI in China

L,C,S/X,K

S/X

L,C(5/6G),S/X,K

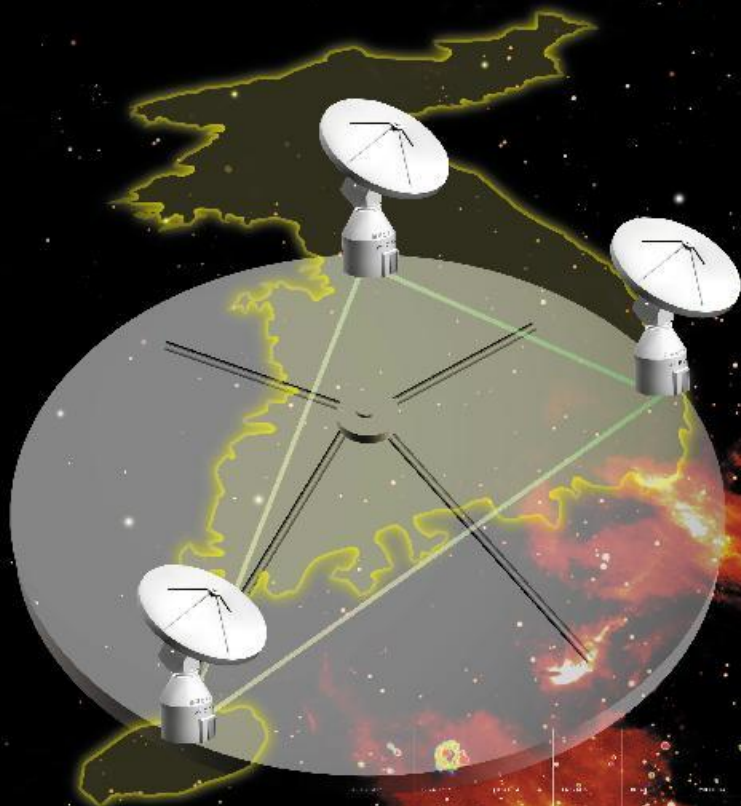


Taiwan

- Project of Submillimeter VLBI
 - ALMA prototype antenna (12m, $\sim 30\mu\text{rms}$) will be moved to **Greenland**.
 - 230/350 GHz VLBI
 - ALMA, SMA, LMT, CARMA.....



KVN 한국우주전파관측망 Korean VLBI Network



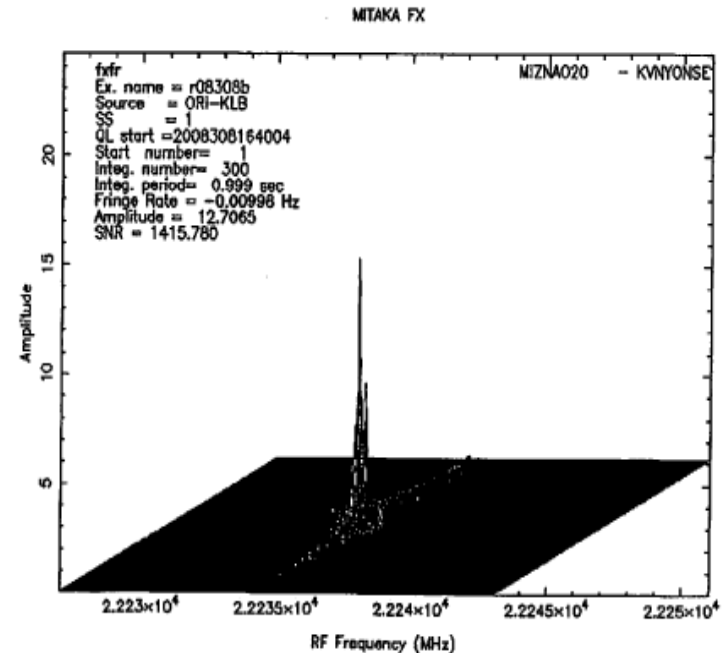
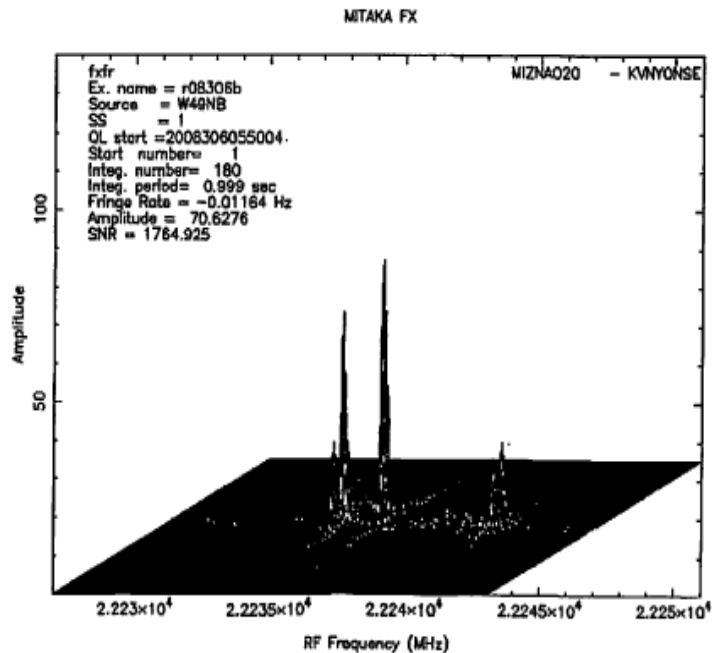
한국천문연구원
내셔널파인본네 KVN사업부



Constructions of three stations
were completed on Dec. 2008 !

Simultaneous Multi-Frequency Obs. -
Phase Compensation, mm-VLBI

First fringe between Seoul and VERA@2008,308d



Seoul VLBI correlator center



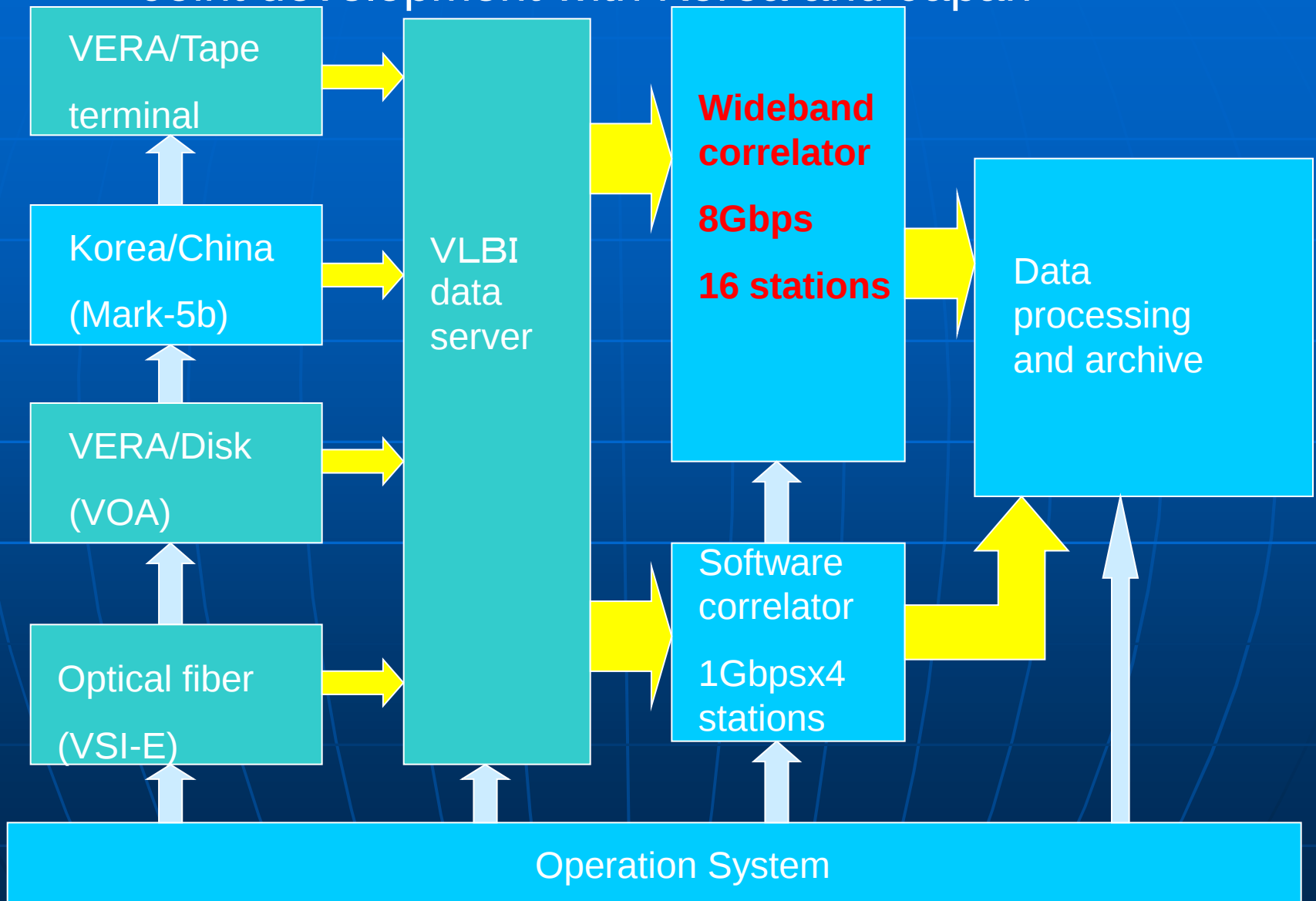
8Gbps x 16 station
Largest VLBI
correlator

Opened on May 13th,
2010



New Correlator at Seoul

-Joint development with Korea and Japan -



Science WGs

■ KVN + VERA

- Astrometry Nagayama
- Star formation Kim Kee-Tae, Hirota
- Late type star Cho Se-Hyung, Imai
- AGN Kino, Sohn Bong Wong
- Galactic center Oyama, Kim

■ CVN + JVN

- Fujisawa (Yamaguchi Univ.)
- Shen (Shanghai Observatory)

Schedule

■ 2011

- Test Observations with VERA+KVN
- Start of science observations with Japan (VERA,JVN) /Korea (KVN), and Japan(JVN)/China(CVN).

■ 2012

- Start of science observations with Japan, Korea and China

Conclusion

- East Asian VLBI Network is organizing with Japan, Korea and China.
- Science targets are precise astrometry and high sensitivity imaging with high spatial resolution.
- From 2012, full array observation with Japan, Korea, and China is expected.
- VSOP-2 will be cancelled.