VERA status and future

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VERA

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

Antenna Diameter 20m (250 μ m)

Observing band 2,8,22,43GHz

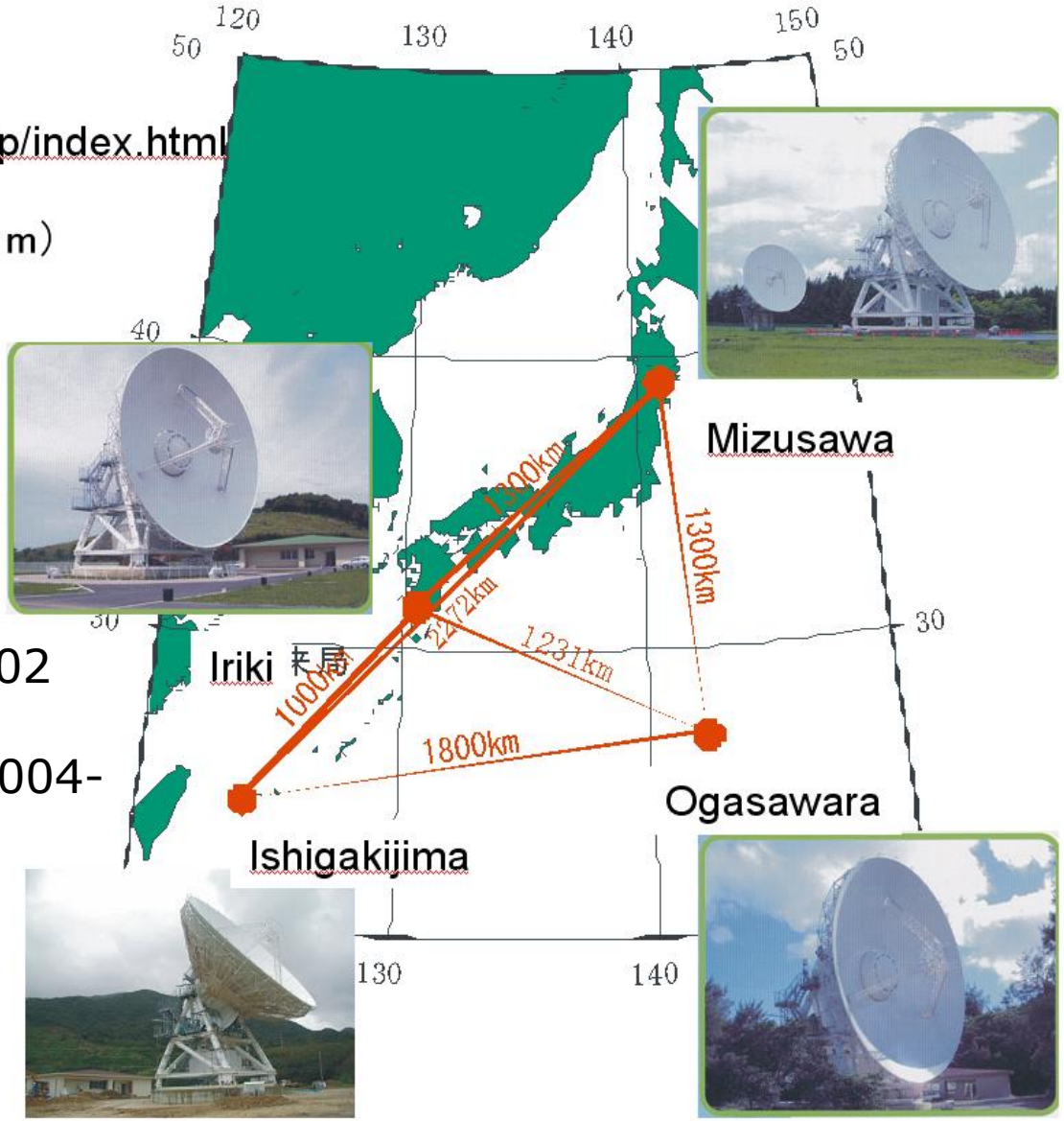
Maximum baseline 2273km

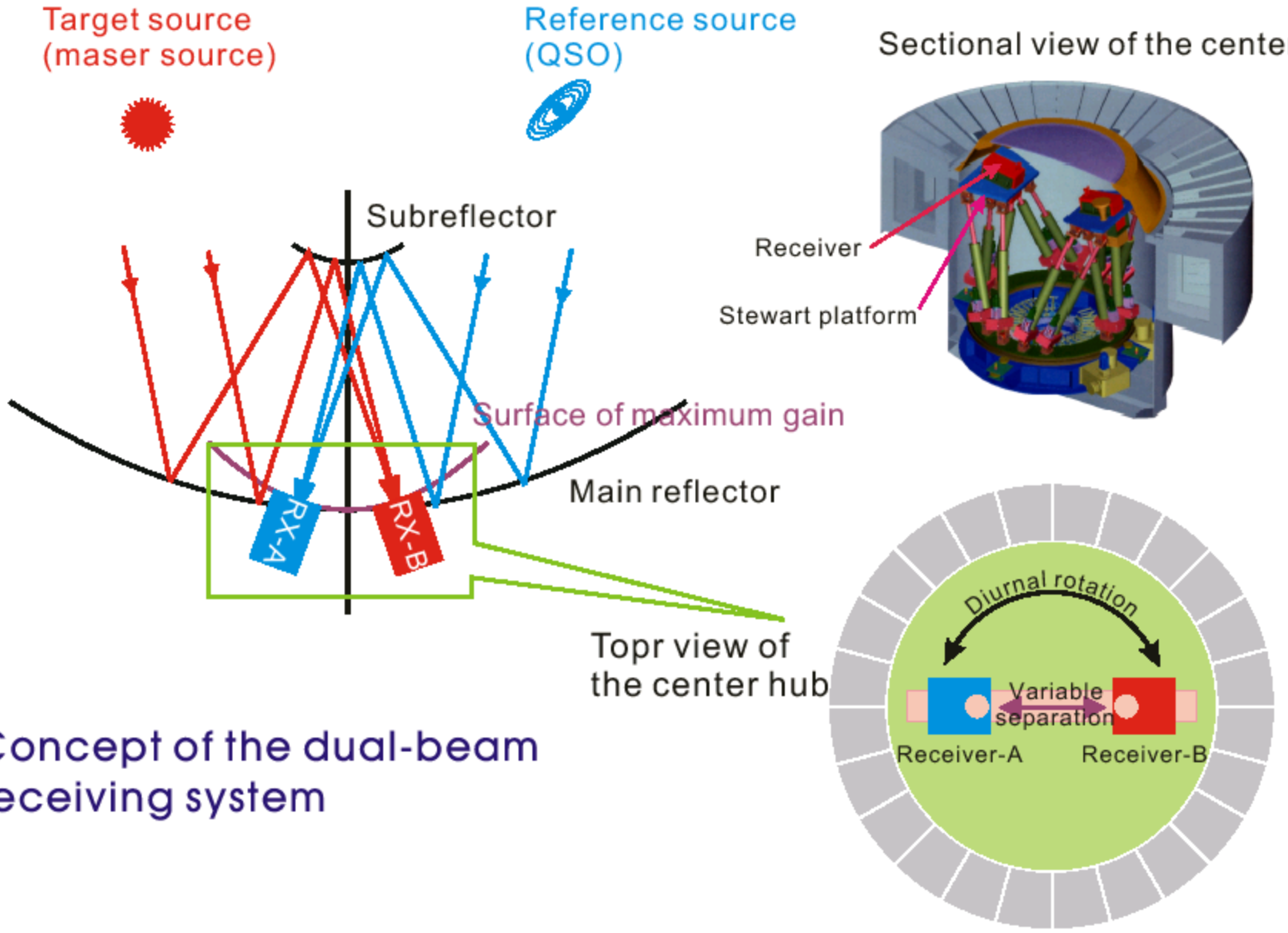
Minimum baseline 1000km

2 beam phase referencing

-> Inst. Path error <0.1 mm

Construction: 2000-2002
Operation: 2002-
Regular observation: 2004-

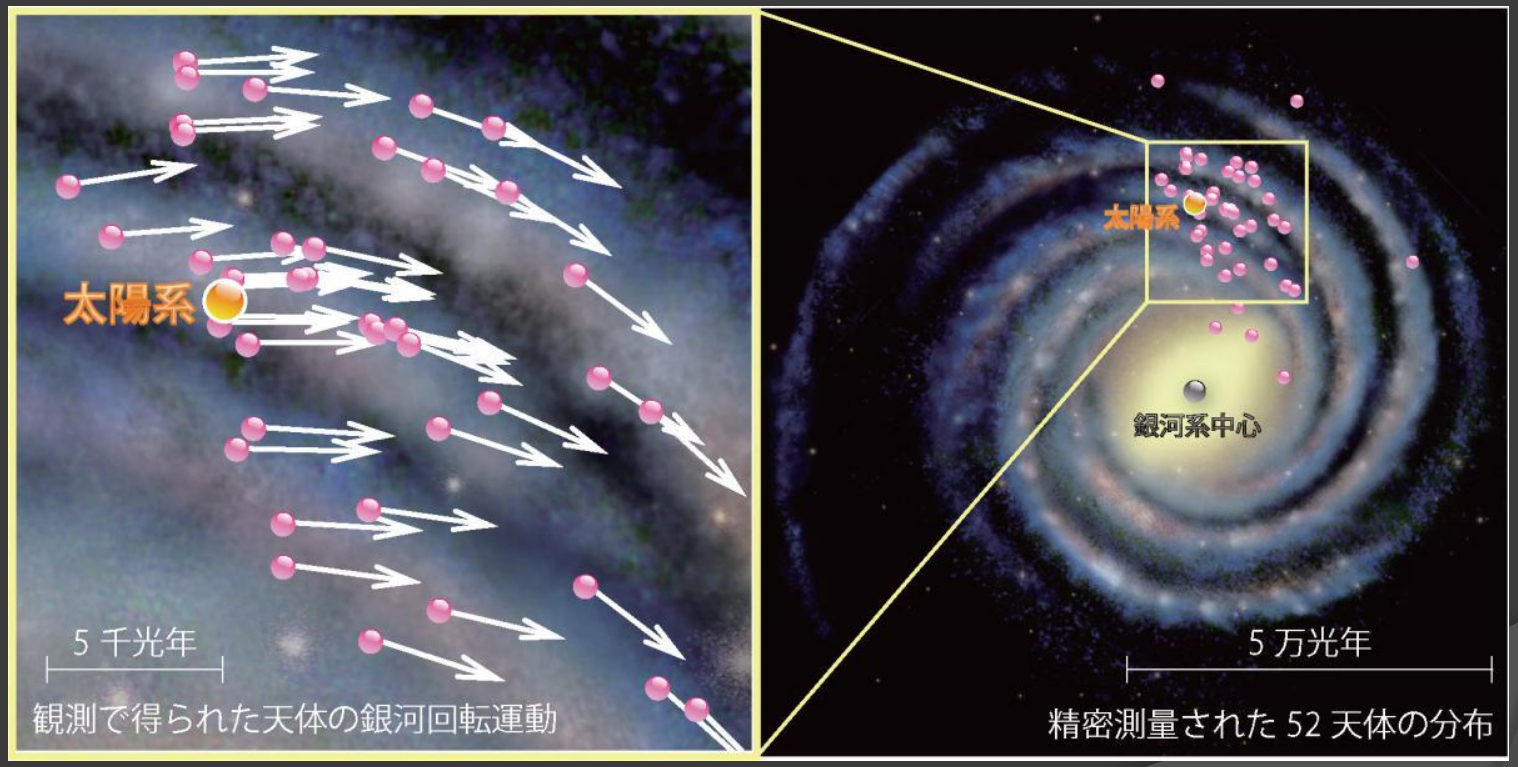




Concept of the dual-beam receiving system

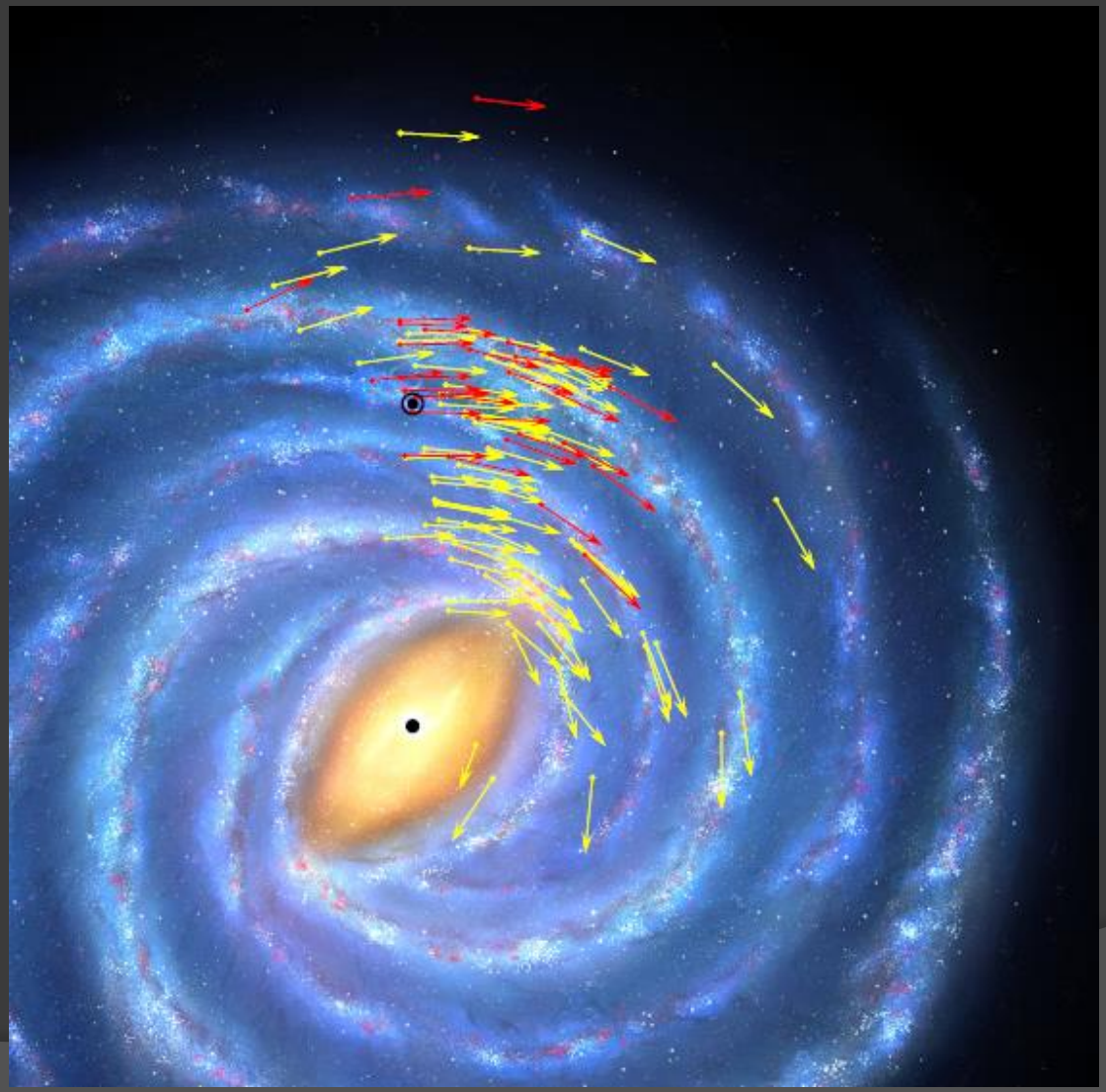
Galactic astrometry in 2012

- Combined with VLBA/EVN data, we have determined Galactic parameters using 52 sources.



Galactic parameter can be determined by using more than 50 sources with VLBI astrometry

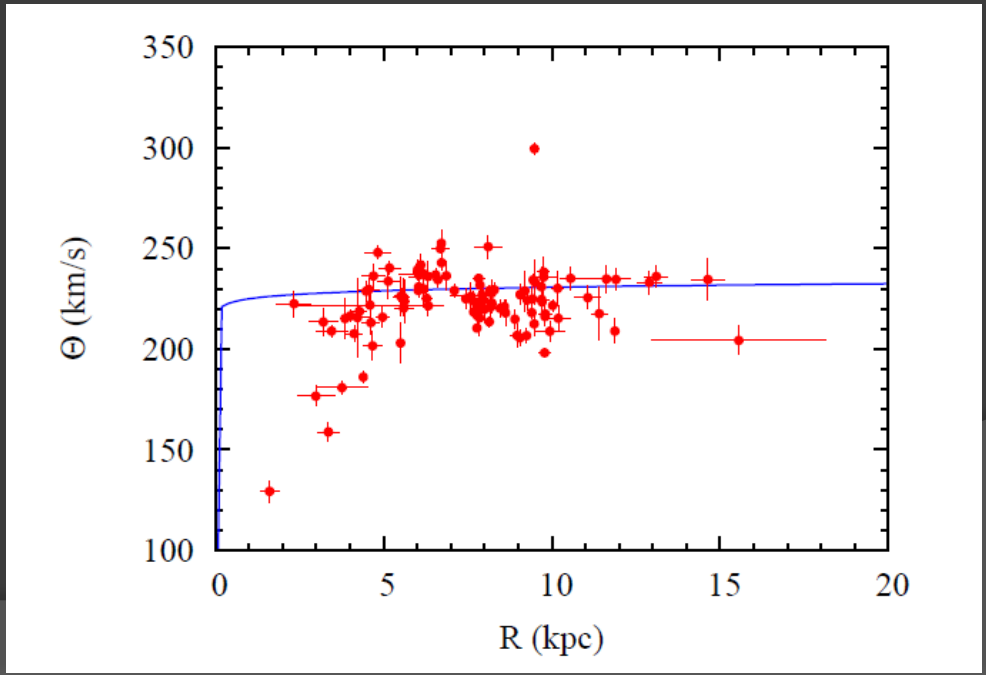
VLBI astrometry results for Galactic masers



→ VERA
→ VLBA&EVN

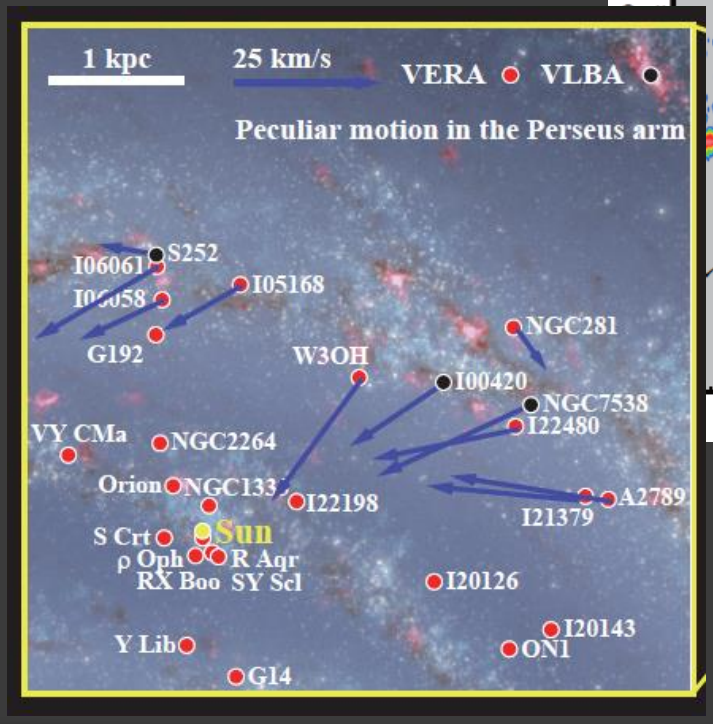
Revising Galactic constants

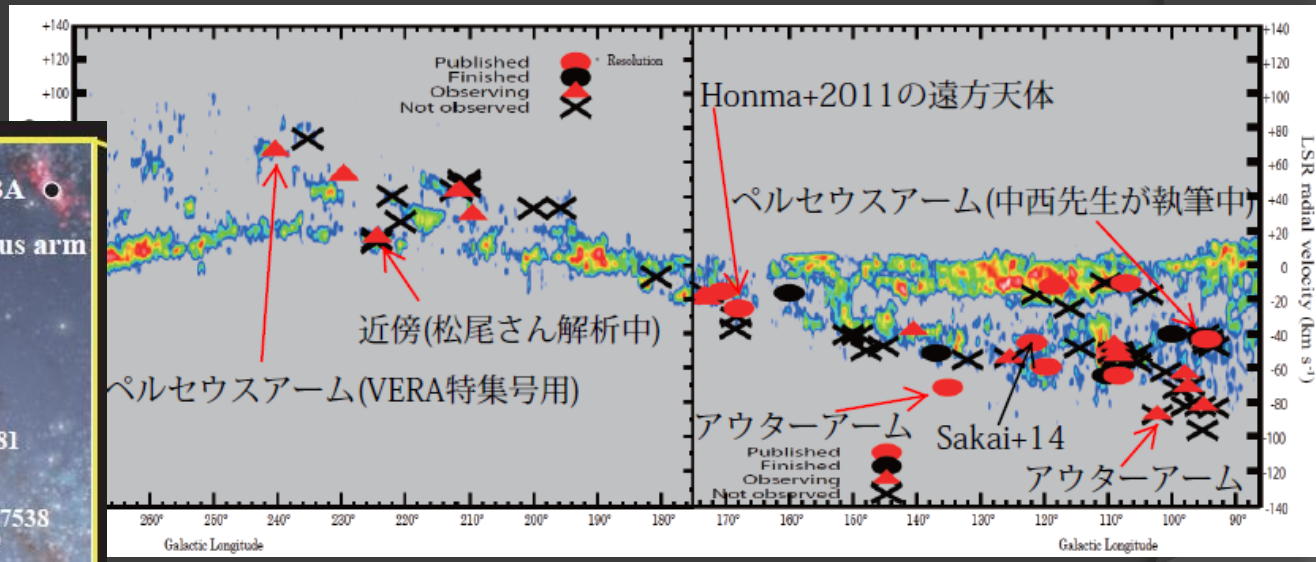
New (preliminary) (Honma+12)	Previous
N_{src} 114 sources	(52 sources)
R0 = 7.95 +/- 0.21 kpc	(8.05+/-0.45 kpc)
Ω0 = 28.95 +/- 0.43 kpc	(29.57 +/- 0.78 kpc)



Spiral Arms

Location and non-circular motion in spiral arm





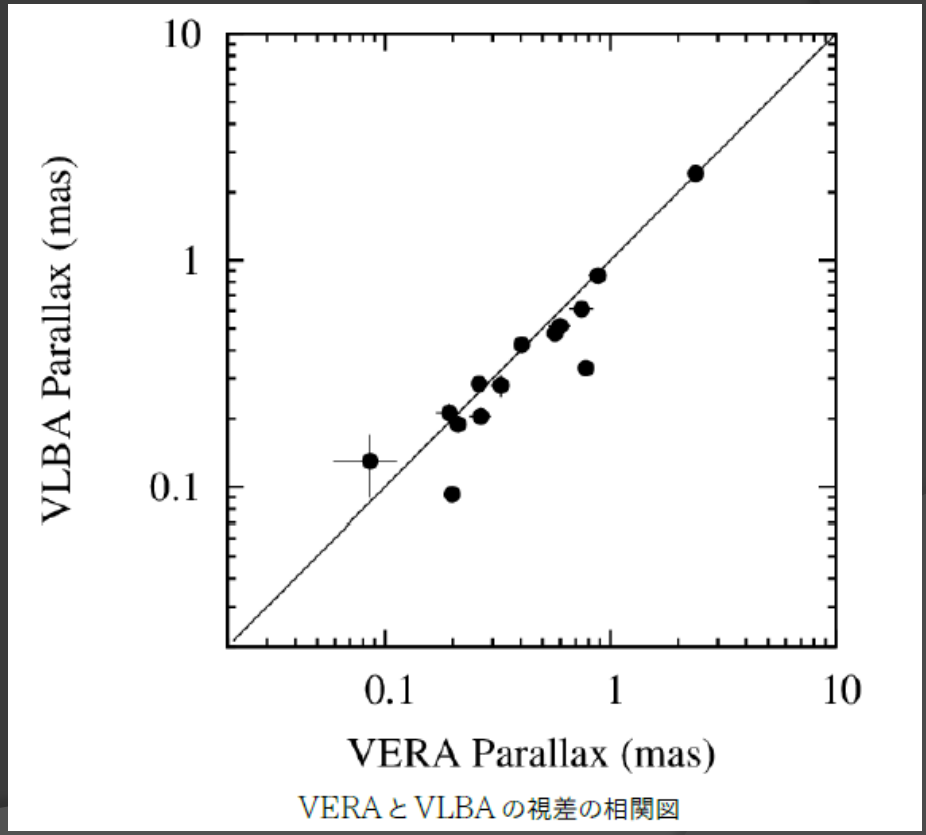
Outer galaxy objects (in l-b diagram)

VERA vs VLBA in parallax

- ~10 sources observed with both VERA and VLBA
  (in some cases different bands)

- Generally consistency, no systematic offset

- Discrepancy seen in a few sources. Needs to be checked.

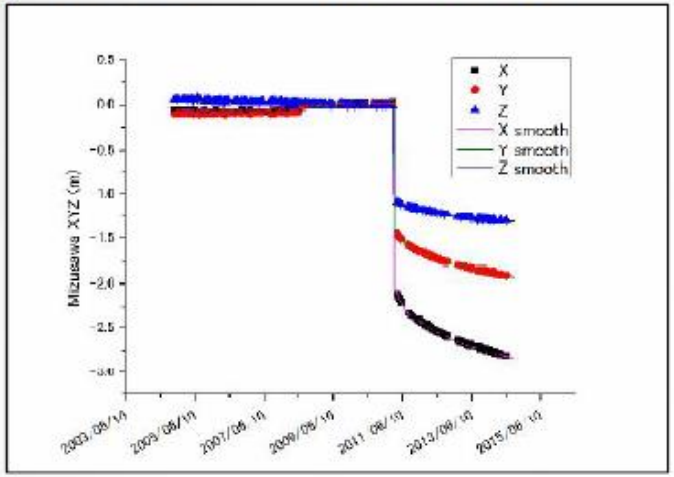


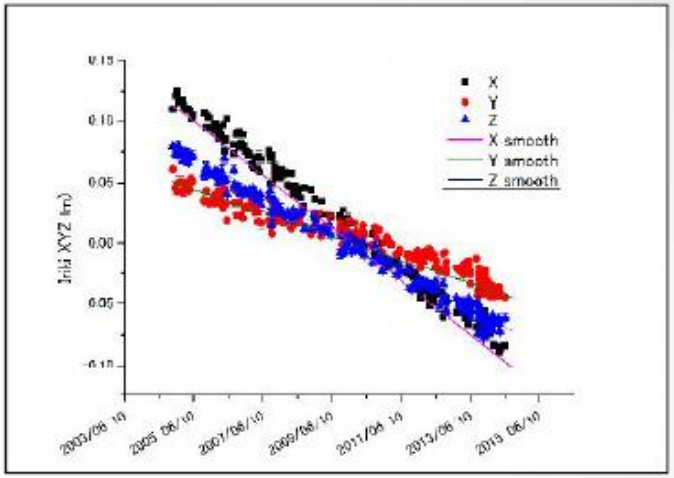
VERA と VLBA の視差の相関図

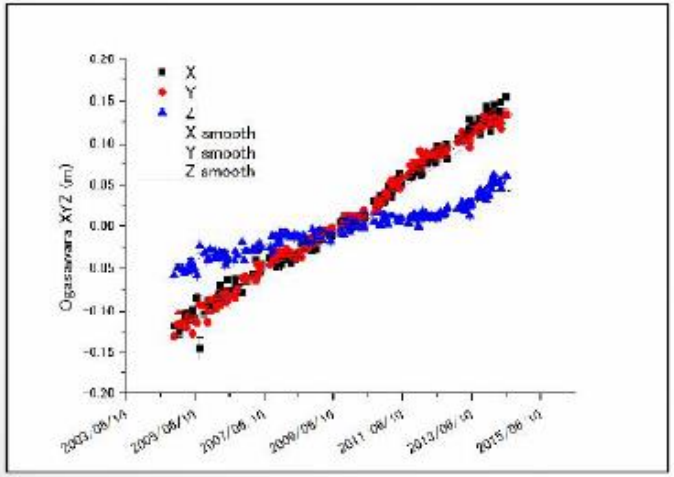
Motion of VERA station

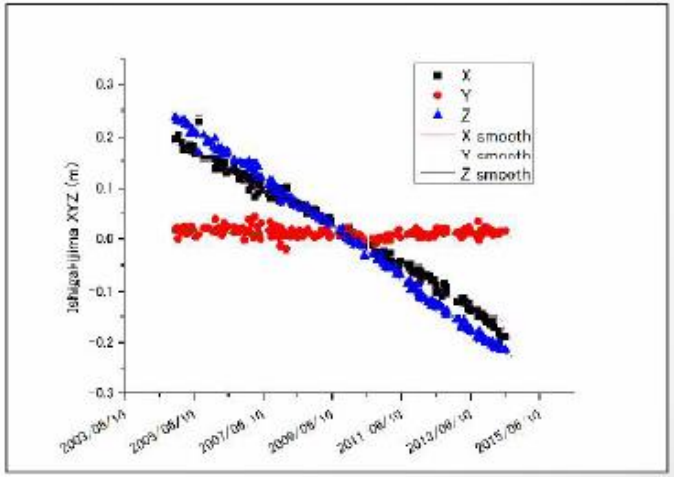
地心座標系でのVERA各局の座標変化

Epoch=2010.0の座標に対する差

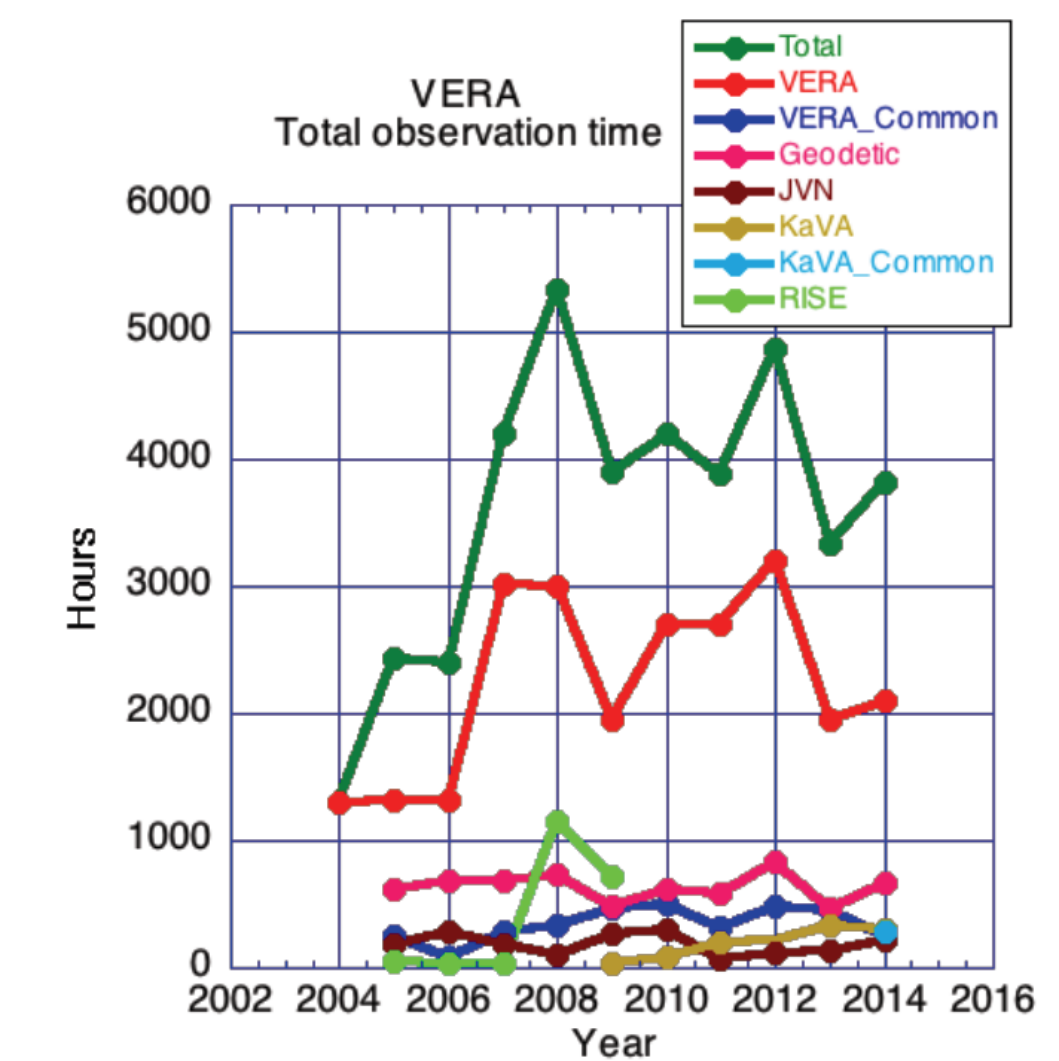








Operation time of VERA

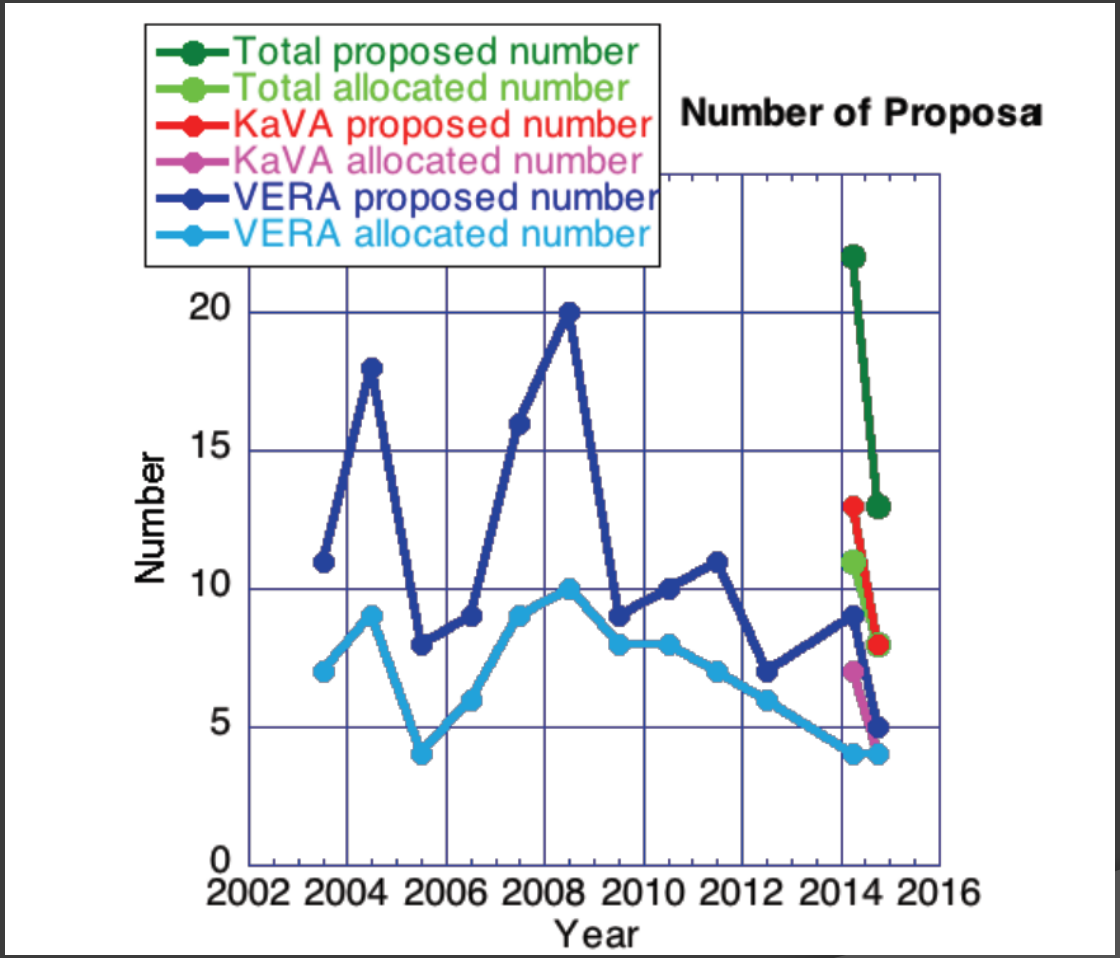


Open use

- VERA with Nobeyama(45m) and Kashima(34m) is opened for global users.
  - Open time is 700 hours/year including KaVA.
- KaVA (KVN and VERA array) is opened to East-asian astronomy communities at current stage, which will be open to the world near future.
  - Current open time is 500 hours/year.
- Deadline of proposal is twice per year.

http://veraserver.mtk.nao.ac.jp/restricted/index.html

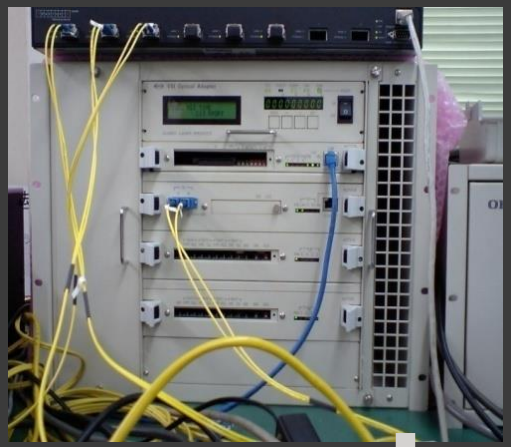
Number of proposals for VERA and KaVA

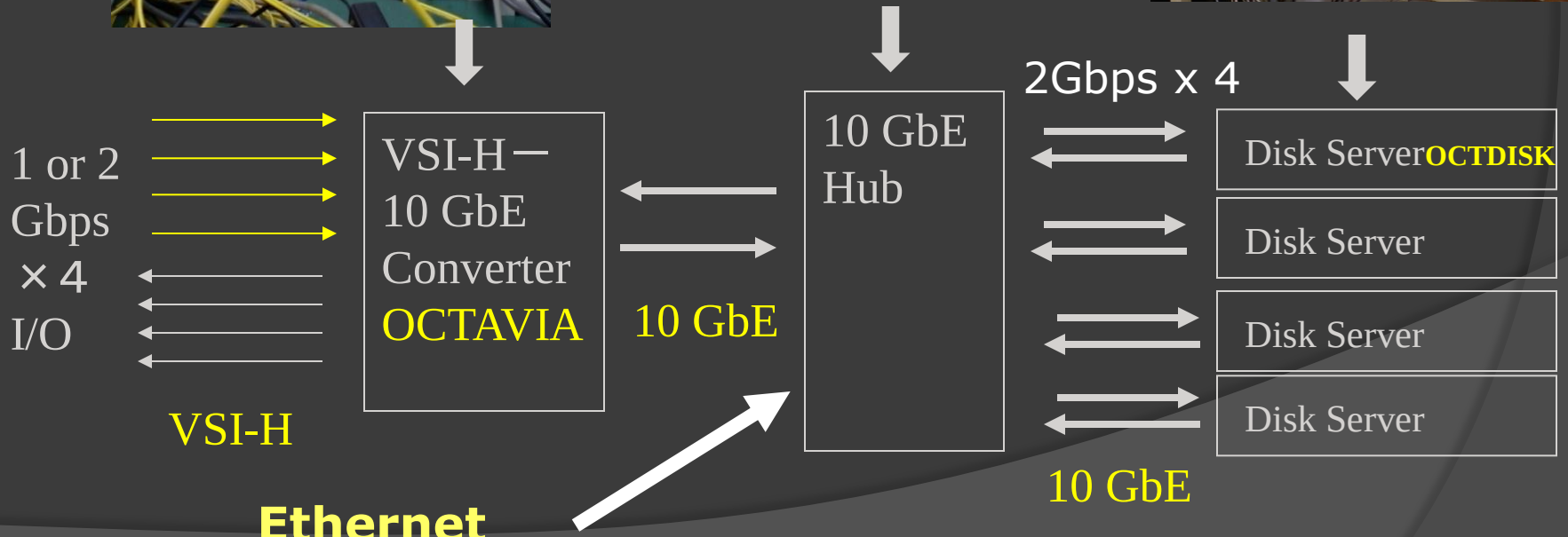


Developments

- **High speed data recording using disk system**
  - Usual operation of OCTAVE system + Soft Corr (1～8Gbps) will be started at 2015.
  - VSREC (12Gpbs by PC recording) is under developing.
- K/Q dual polarization is under testing.
- Ultra high speed sampler (<50GHz) is under studying.
- K/Q simultaneous receivers are under studying under the collaboration with KVN.

OCTAVE
(8Gbps Disc recorder)
-> 3 times sensitive

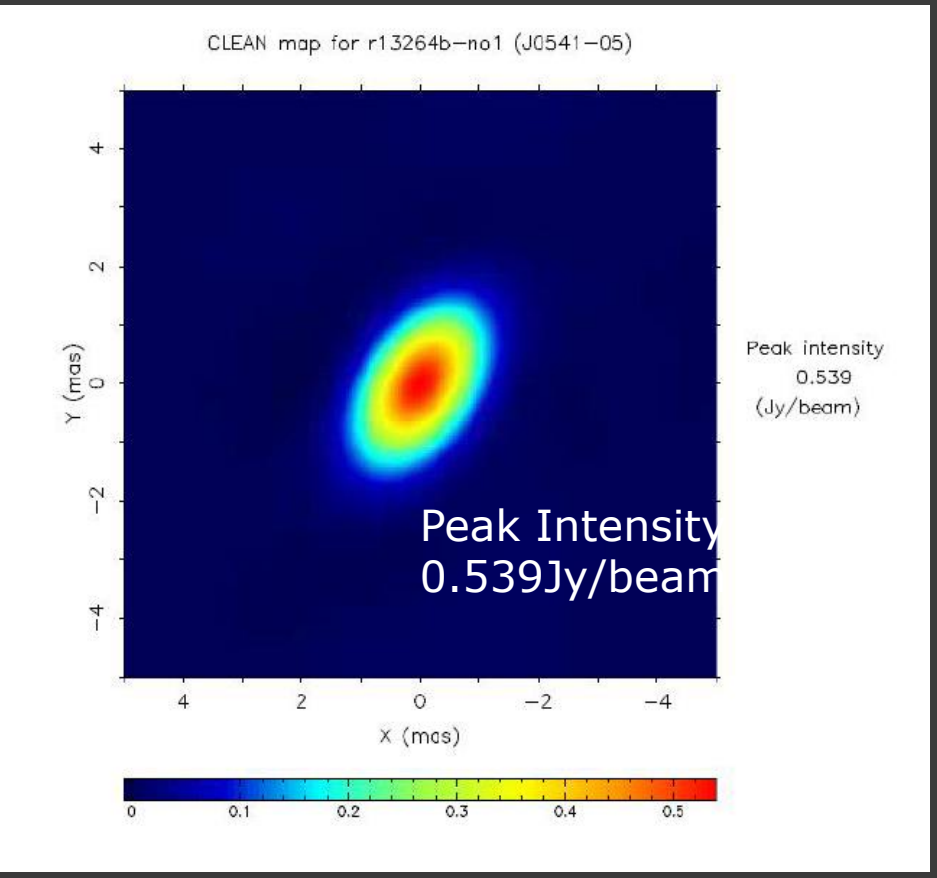




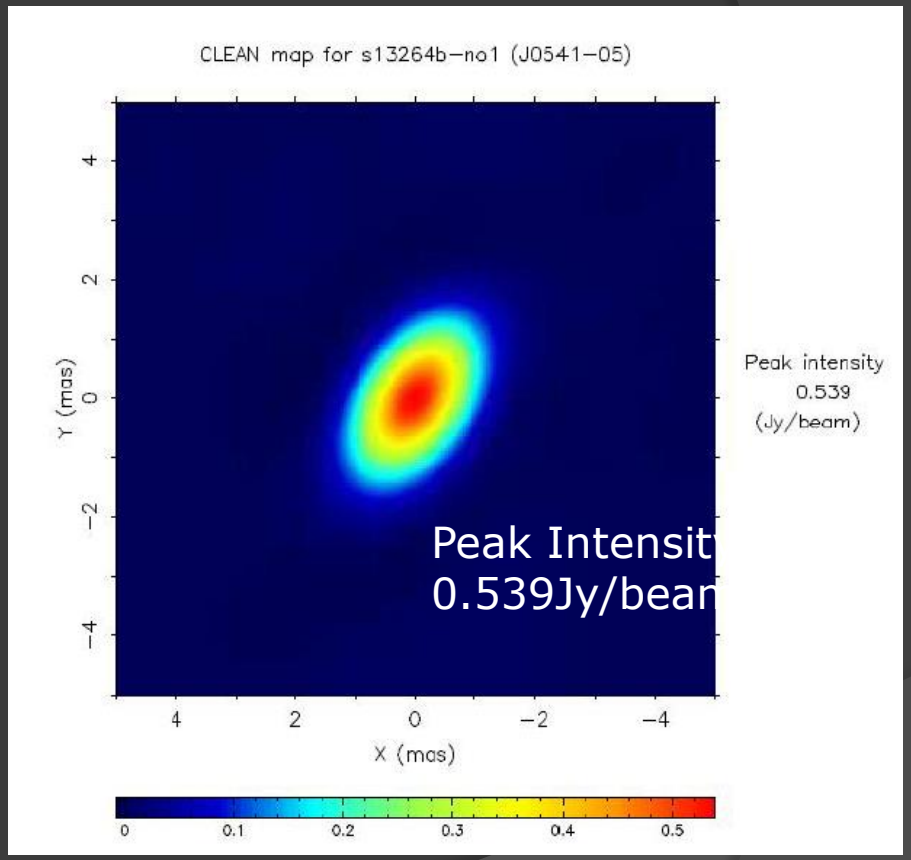
New observing mode by using Disk systems

	Recording rate	Recorder	HDD	Correlator	KJJVC	2beam（phase-ref）
VERA（KaVA)	1 Gbps	OCTADISK	All	Mitaka-FX Soft corr	◎	○
VERA	4 Gbps（A=B=2G）	OCTADISK	80h	Soft corr	○	Under testing
VERA（test）	12 Gbps（A=2G, B=10G）	VSREC	100h	Soft corr	○	Under development
NRO45	4 Gbps（1Gbps）	OCTADISK	50h	Mitaka-FX Soft corr	○	
JVN-OCTAVE	2 or 4 Gbps	OCTADISK K5VSI		Soft corr	○	

Verification of software correlator



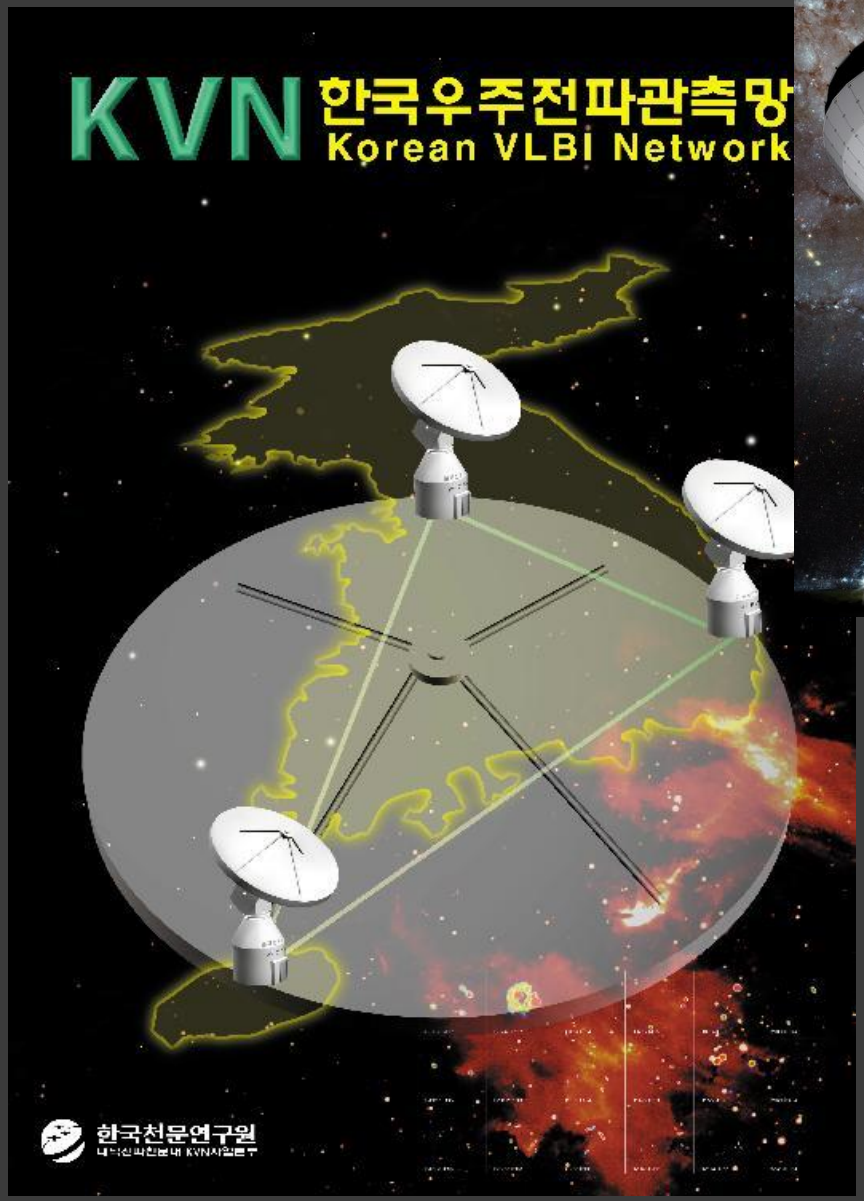
Tape > Mitaka-FX

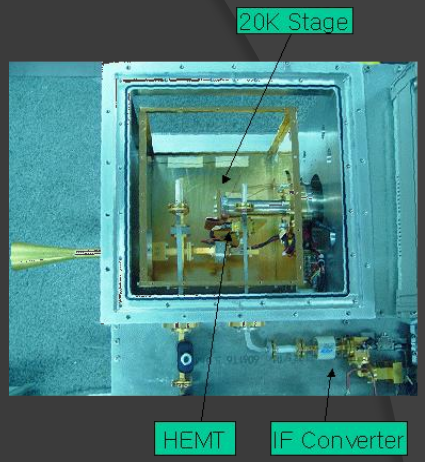


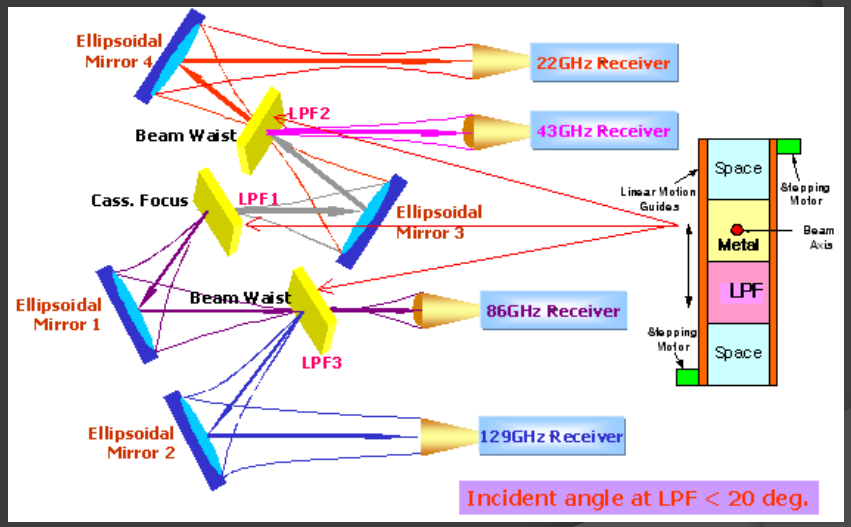
Tape > Soft corr

Correlator

- Software correlator is almost verified with comparison current hardware correlator(Mitaka-FX).
- It will be moved to Mizusawa until 2015 Mar. and started regular operation.
- Mitaka-FX correlator will be closed in 2015 which means no correlation of tape based recording such as DIR1000 and 2000.







Constructions of three stations were completed on Dec. 2008 !

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

East Asian VLBI Network array

Future Plan

- NAOJ Director General requires the intensive review of VERA project at 2022, which should consider the termination or continuation of VERA program.
- After 2023, Mizusawa VLBI observatory is required a new project including VERA continuation.
- Possibility of future plans are
  - East Asian VLBI network will extend to Pacific and Global array.
  - Joining SKA

Summary

- VERA is powerful tool for astrometry and made a significant contribution for Galactic parameter determinations.
- High speed disk recording and correlation system will be operational shortly and more wide band system is under deveoplments.
- KaVA observation is operational and EAVN is testing.
- Discussion of future plan is just started seriously. It is also needed with the Japanese VLBI community.