

KVN-VERA test observation

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Contents

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- Detected fringes
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Baseline Sensitivity

- *Point Source Detection Threshold*
- $SEFD = \frac{2\kappa T_{sys}}{\eta_A A}$
- $\Delta S_{ij} = \frac{1}{\eta_s} \frac{\sqrt{SEFD_i} \sqrt{SEFD_j}}{\sqrt{2 \times \Delta\nu \times \tau_{ff}}}$
- *Continuum Fringe detection limit* (10σ) ~ 80 mJy

Frequency	22 GHz	43 GHz	86 GHz	129 GHz
T_{sys}	70	140	250	300
η_A	0.7	0.7	0.6	0.5
SEFD (Jy)	797	1594	3320	4781
ΔS_{cont} (mJy)	7.9	15.9	33.1	47.6
ΔS_{line} (Jy)	0.51/0.72	1.02/1.44	2.12/3.00	3.05/4.31

Table: 128MHz and τ_{int} 60s, for line sensitivity 31.25, 15.625 KHz used



Image Sensitivity of KVN(+VERA) array

- Image Plane Noise Limit
- $$\Delta I = \frac{1}{\eta_s} \Sigma \left(\frac{\sqrt{2 \times N_{ij}^{baseline} \nu \times \tau_{int}}}{\sqrt{SEFD_i \times SEFD_j}} \right)^{-1} \text{ Jy/beam}$$
- comparable to FIRST survey (NRAO VLA) @1.4 GHz
- Strong 'in-beam' or phase ref source necessary

Array	KVN		EAVN	
Frequency	22 GHz	43 GHz	22 GHz	43 GHz
$SEFD(VERA)$	797	1594	1093 (1500)	2187 (3000)
ΔS_{img} (mJy)	0.59	1.18	0.19	0.38

Table: Image Sensitivity of KVN and KVN + VERA, $\tau_{int} 60min$



Description of Observations

- KVN-VERA fringe detection test
- *Image sensitivity test and pilot scientific operation*
With DIR-1000 and Mitaka correlator (BW 32 MHz)
Unknown parameters → KVN telescopes

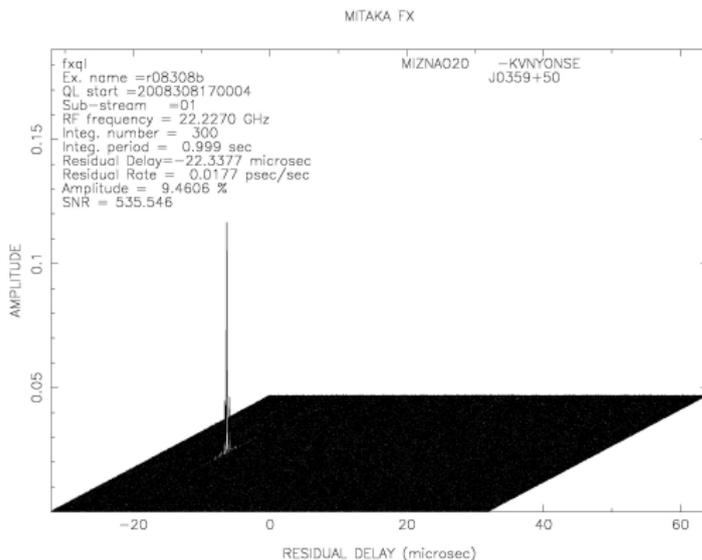


first day of KVN VLBI observation



Fringe detections

- Fringes detected at all baselines with all observed sources

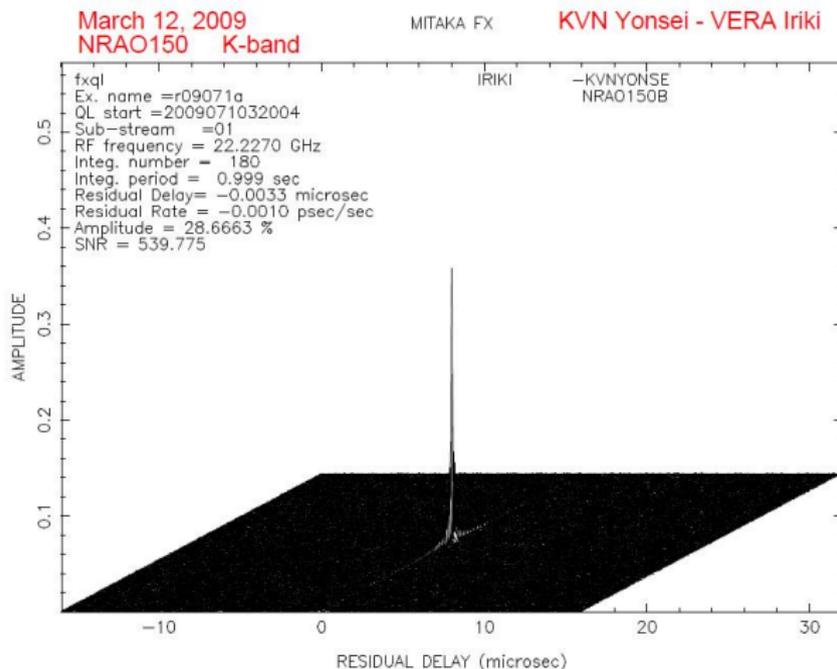


NRAO150(J0359+5057) BL Lac object at K-band, 3rd Nov. 2008



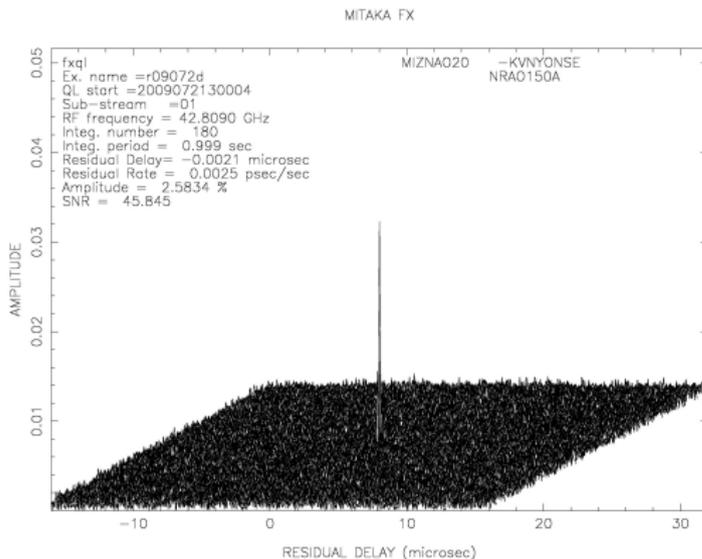
Fringe detections

- Fringes detected at all baselines with all observed sources



Fringe detections

- Fringes detected at all baselines with all observed sources



NRAO150(J0359+5057) BL Lac object at Q-band, 13th Mar. 2009



Fringe detections

- Fringes detected at all baselines with all observed sources
- **November 2008**
- LL detected at KVN 'RCP'-VERA LCP
due to \rightarrow odd number of mirrors in KVN quasi-optics
- Residual delays are relatively huge, $|\Delta| > 18\mu\text{sec}$, at MIZ-YS
- Residual delay difference is also huge, *KVN problem?*

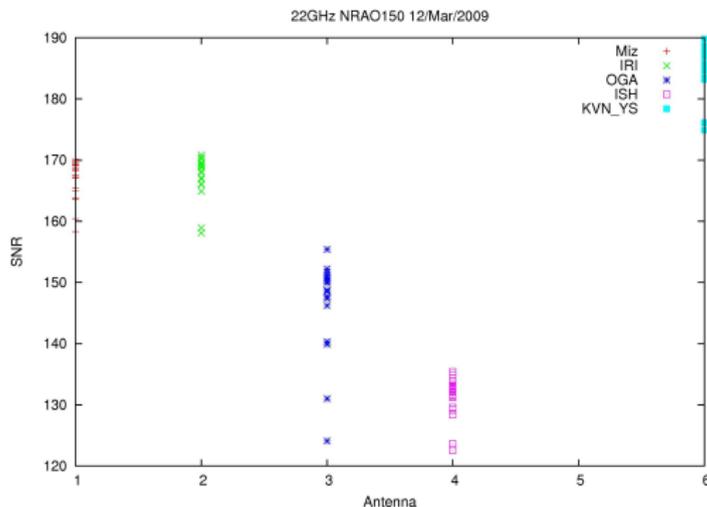


Fringe detections

- Fringes detected at all baselines with all observed sources
- **March 2009**
- Huge Residual delays disappear
- Residual delay is also small
- Problem in correlation parameter in 1st experiment?
- Problem in Ogasawara in 2nd experiments
- Fringes are detected at K and Q bands



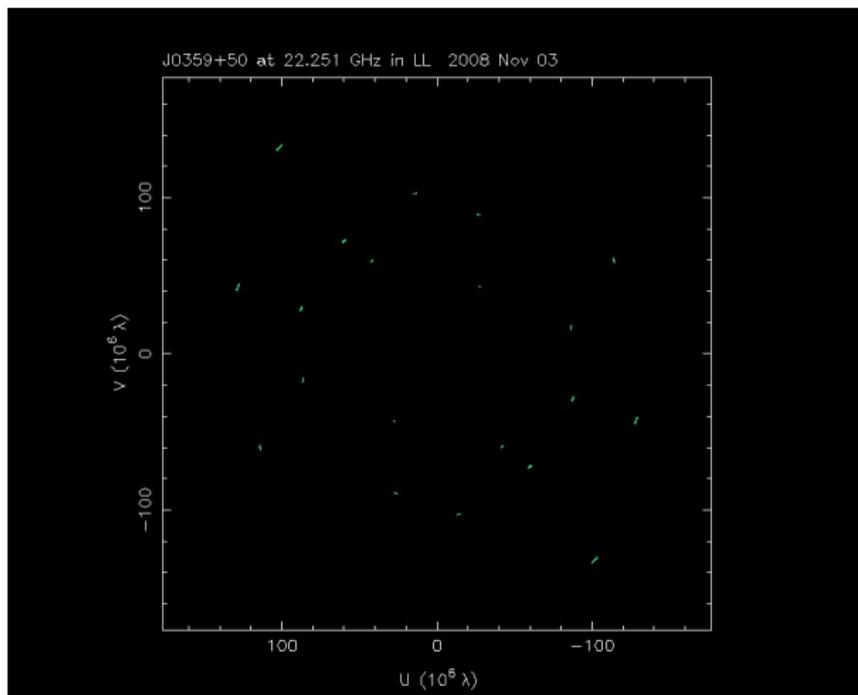
Baseline SNR comparison of March 2009 observation



at K-band KVN better than VERA, but as as good as its SEFD products



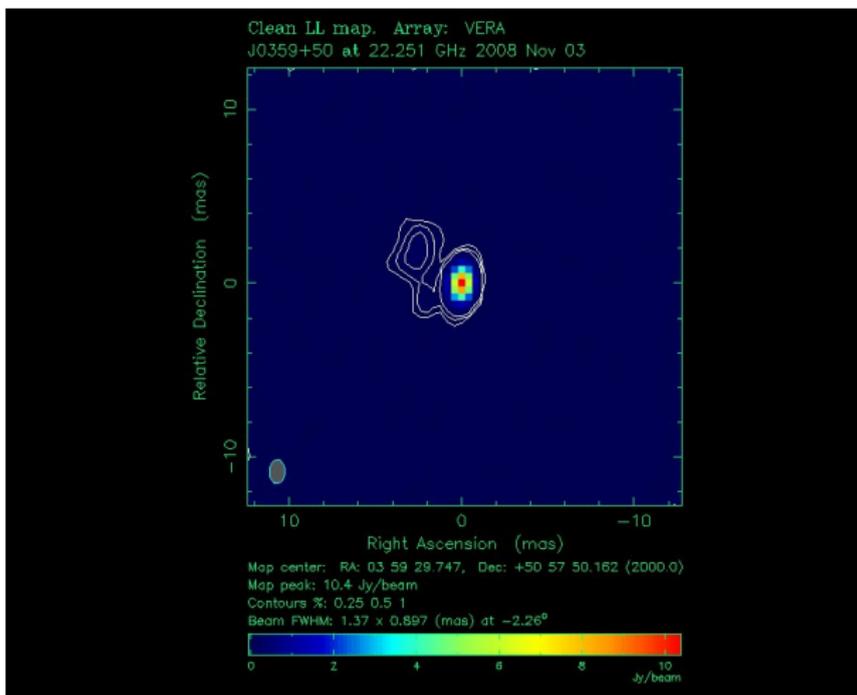
Snapshot of NRAO150 on 3rd Nov. 2008



UV coverage of 10 min. observation on NRAO150



Snapshot of NRAO150 on 3rd Nov. 2008



NRAO150 at K-band (3 Nov. 2008), $\sim 10 \text{ mJy/Beam}$ RMS noise

Are the structures real? KVN-VERA test Monitoring began



Summary of KVN-VERA K-band fringe test

- Successful fringe detections at K-band with all observed sources
- Further fringe detection test at K and Q band, 12/13 March 2009
- RCP \rightleftharpoons LCP
- Higher visibility phase noise at KVN baselines
- Bright source imaging feasible
- Pilot Scientific Operation?
 - ~ 10 mJy/beam with 5 telescopes and 32MHz bw in 10 min.
 - No cable calibration at KVN, hard to utilize phase referencing yet
 - *Monitoring of powerful sources, Image sensitivity study*



KVN-VERA K/Q band experiments

1st fringe test at K-band on 1st/3rd of Nov., 2008

- Maser: W49N, Ori-KL, Cont: J2148+0657, NRAO150(10 min per scan)
- Maser(LCP)-Maser(RCP)-AGN(RCP)-AGN(LCP); VERA LCP
- **fringes detected from all observed sources; K band**

2nd fringe test at K/Q band on 12/13th of March, 2009

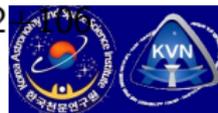
- After re-installation of 22 and 43 GHz receivers
- **fringes detected from all observed sources; K/Q bands**
- **Sheshan participated on 12th, failed**

Image sensitivity experiment on 18th April, 2009

- good UV-coverages and 1 hour of observation per source
- NRAO150, 4C39.35, J0646+4451, 3C236 at K-band

Image sensitivity experiment on 20/22th May, 2009

- good UV-coverages and 1 hour of observation time per source
- NRAO150, J0646+4451, 3C236, KV2327+1524, J1502 at K-band
- **Sheshan participated, first EAVN fringe!**, bad weather



Things to be improved

- Higher RMS than estimation
 - optimistic VERA SEFD in my estimation?
 - KVN system problem (cable cal., wet Feeds)?
- KVN Station log will be improved
- DIR-1000 bandwidth limitation 32MHz (MK5B 256MHz)
- KVN cable cal. system and KJJVC for optimal operation

