Current Status of KVN

Chungsik Oh (KASI)
VERA User’s Meeting 2017 @ Mizusawa
Outline

• Operation in 2016 and 2017
• New Capabilities
• Upgrade Activities
  – Wideband Backend
  – Wideband Receiver Project
  – pre-study of Extended KVN
KVN and KaVA (KVN and VERA Array)

**(KVN and VERA Array)**

**KVN**
- 22/43/86/129GHz
- $\theta \sim 1$-$6$ mas

**KaVA**
- 22/43/(86/129)GHz
- $\theta \sim 0.5$-$1$ mas
Operation Summary in 16B & 17A

- VLBI ~ 4000h / yr  (~2000 h in 17B)
- KVN Key Science, KaVA Large Program from 2015
  - + PaGAN (KSP), MASK, ToO
- EAVN, EVN 22/43GHz + GMVA 86GHz > 300h / yr
Common Use Observations

- KVN ~ 300h, KaVA ~ 250 h / semester
- Proposal Deadline: Jun 1 (B) & Nov 1 (A)
- Global Open (KVN S/D Domestic Only)
- Target of Opportunity, KVN Filler Proposal (< ~8h)
SCI(E) Publications

- VLBI papers are increasing
- S/D papers from 86 & 130GHz bands and Polarizations
New Capabilities : 8Gbps Operation

- 4 x 512MHz BW
- 3 times higher SNR
- ~200 h in 2017A
- Open for common use

by S.-S. Lee
New Capabilities: 130GHz Polarization

- Polarization Calibration up to 130GHz - JH Park
New Wideband Sampler: OCTAD

• 4 ADC (4 x 16Gsps) + DBBC(DFB)
  • 4 IF x 2GHz BW (max 32Gbps)
• Installation : 2017. 8, Test : 17B, 18A
• Field Test at Yonsei
  • 2 IF x 8Gbps (2GHz BW : 8-10 GHz)
  • 43 & 86GHz

Elecs co. (Japan)
KVN Wideband Backends (2018 - )

4 x [Divider + BPF]

22 GHz FE

43 GHz FE

86 GHz FE

29 GHz FE

10P4T IF Switch

Input Freq : 8–16GHz

22 GHz FE

43 GHz FE

86 GHz FE

29 GHz FE

DBBC

Input Freq : 8–16GHz

OCTAD (32Gbps)

4 x 16Gbps

4 x 8Gbps

4 x 2Gbps

fila10g

4 x [Divider + BPF]

4 x [Divider + BPF]
**wideband Rx Project**

- **Term:** 2017 – 2019
- **Upgrade current Rx by replacing narrow band components**
  – LNA, Feed Horn, Polarizer, LO etc

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<thead>
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<th>Freq(GHz)</th>
<th>Trx(K)</th>
<th>Installation</th>
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<tbody>
<tr>
<td>K</td>
<td>16–26</td>
<td>&lt; 40</td>
<td>2017 – 18</td>
</tr>
<tr>
<td>Q</td>
<td>35–50</td>
<td>&lt; 50</td>
<td>2018 – 19</td>
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<tr>
<td>W</td>
<td>85–115</td>
<td>&lt; 80</td>
<td>2018 – 19</td>
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<tr>
<td>D</td>
<td>125–172</td>
<td>&lt; 60</td>
<td>2019</td>
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Upgraded 22GHz Rx for Yonsei

- Compact Feed Horn
- Wideband Compact Polarizer
- New LNA
- RF 18 - 26.5GHz
- IF 8 - 16GHz
- Tunable 1st LO
First Light with upgraded 22GHz Rx

88602; 2 HM20188+3928 23694 KYS21M22R 0:30–AUG–2017 R:30–AUG–2017
RA: 20:20:39.30 DEC: 39:37:52.0 Eq 2000.0 Offs: +0.0 +0.0
Unknown tau: 0.137 Tsys: 103. Time: 20. min El: 73.2
N: 1023 I0: 512.250 V0: 2.000 Dv: 0.1977 LSR
F0: 23694.5060 Df: -1.5625E-02 Fi: 41953.4940

NH3 Line at 23.7GHz
KVN-Extended : KVN 4th & 5th Sites

- Why new KVN sites?
  - More baselines 3 -> 6, 10
  - Amplitude self calibration
  - 3 times better imaging
  - Better success rate & sensitivity

- Baselines : 40 - 500 km
  * Longer baselines (> 500km) from international collaborations

- Frequency : 18 - 172 GHz
- Construction Period : ~3 yrs
- Budgets : ~15M USD / site

KVN 초기 사업계획 (2002 IVS Proceedings)
UV Coverage (Example)

- KVN + Daegu, Sokcho at 86 - 94GHz / 1h Step

Dec = -25

Dec = -50
Science Cases

- AGNs
  - AGN Core-Jets, High-z AGN, LLANGs
  - AGN Feedbacks, Absorptions
  - Magnetic Field
- SFR & Evolved Stars
  - Faint & extended maser features
  - Water & SiO, 44/95 Class I Methanol -> Kinematics & Magnetic Field
- Microquasars, Pulsar, SNe, ..
- + S/D Sciences

Any ideas and/or suggestions are welcome
KVN + Sejong

- 22-m Diameter
- Frequency: 2/8/22/43GHz
- Location: ~20km North from Daejeon
- Baselines between SJ-KVN

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<th>TN</th>
<th>SJ</th>
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<td>–</td>
<td>305</td>
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- 2017: Geodesy ~ 100h (2Gbps)
  VLBI ~ 200h (1/2Gbps)
- 2018: > 300h
  - KaVA Geodesy or KVN+Sejong
- Common use from 2018B?
Summary

- KVN KSP + KaVA Large Program era
  - VLBI Operation ~ 4000 h/yr
  - Publications are increasing
  - International Collaboration ~ EAVN, EVN, GMVA
- Upgrade Activities
  - 8Gbps Mode & 130GHz Polarization are available
  - Wideband Backend & Receivers
- pre-study of KVN-Extended Project
  - Any ideas and/or suggestions are welcome