



Recent Progress of Korean VLBI Network (KVN) Project

2006. 10.

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Characteristics of Korean VLBI Network



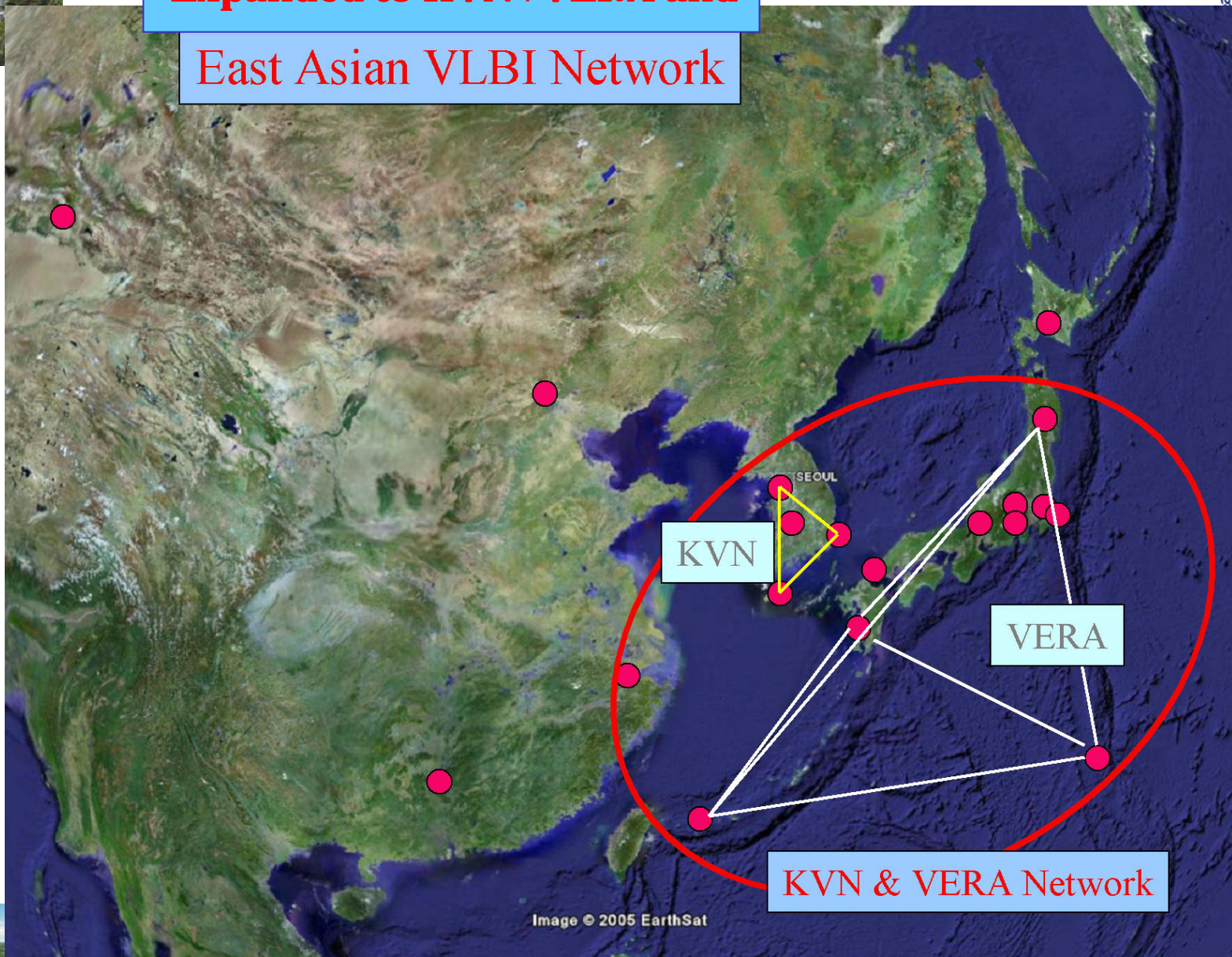
- **National Facility dedicated to exclusive mm-VLBI (KVN 21 m x 3+TRAO 14 m)**
- ***Simultaneous* multi-frequency observation from 22GHz up to 129GHz**
- **Multi-frequency phase-referencing and fast-switching phase-referencing capabilities**
→ **Faint sources, weak lines at mm wavelengths**
- **Compact network with a few hundred km baselines**



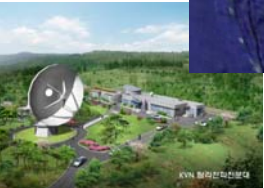
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Expanded to KVN+VERA and East Asian VLBI Network



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KVN Expectation Schedule

■ Observatory Building

- Ulsan and Yonsei obs. building was completed
- Tamna obs. building will be completed within this autumn

■ Antenna Installation

- First antenna at Ulsan observatory
 - Started on Sept. 18 and will be finished until about end of 2006
 - Test observation and acceptance as a single dish : within March 2007
- Second antenna at Yonsei observatory
 - Installation and acceptance will be finished within Sept. 2007
- Third antenna at Tamna observatory
 - Installation and acceptance will be finished within end of 2007



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■ Receiver Development and Installation

- Three sets of 22, 43 GHz band receivers at 1st stage will be developed and installed within 2008
- At least, one set of 2/8 GHz receivers will be developed within 2008
- 86, 129 GHz band receivers at 2nd stage
 - Design work will be started in 2007 (Development budget was approved by government this year)
 - Development and installation will be completed until 2010

■ Correlator Development and Installation

- Completion of specifications, Korea-Japan working group, and review committee
- Assemble whole correlator system in 2008 and start of experimental operation in 2009
- Practical use for KVN and K-J joint VLBI network in 2010



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KVN Ulsan Observatory



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KVN Yonsei Observatory



Observatory building was completed now

- KVN Research Center moved to High Tech. Science and Technology Building of Yonsei Univ. in Sept. 2006.

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KVN Tamna Observatory



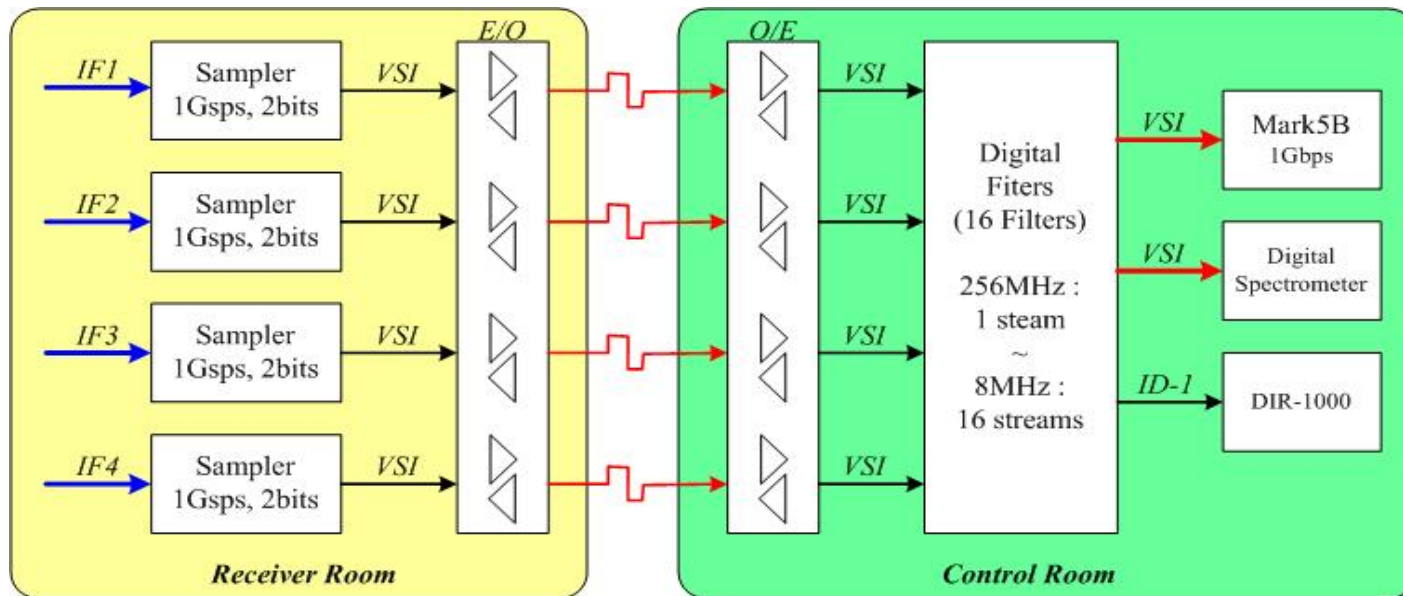
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Receiver system & DAS

Freq. Band	S Band	X Band	K Band	Q Band
Freq. Range	2.2 ~ 2.8 GHz	8 ~ 9 GHz	21.5 ~ 23.5 GHz	42 ~ 44 GHz
Rx Noise	< 25 K	< 25 K	< 30 K	< 50 K
1 st IF / BW	2.5G/600MHz	8.5G/1GHz	8.5G/2GHz	8.5G/2GHz
IF Power	-20 dBm	-20 dBm	-20 dBm	-20 dBm
Polarization	LCP/RCP	LCP/RCP	LCP/RCP	LCP/RCP

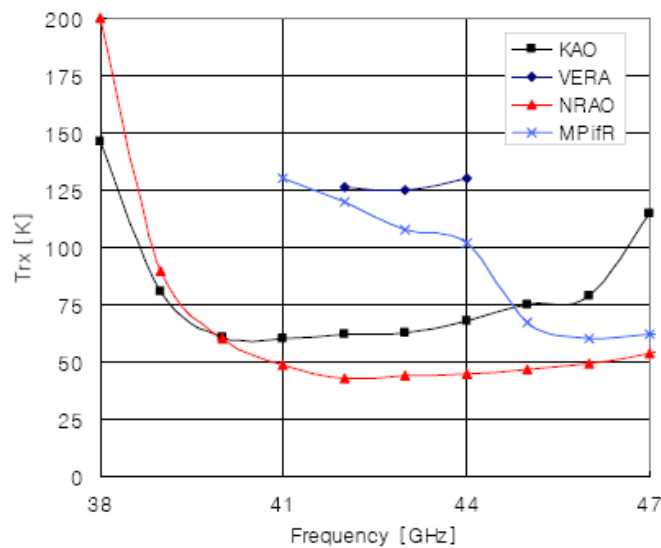
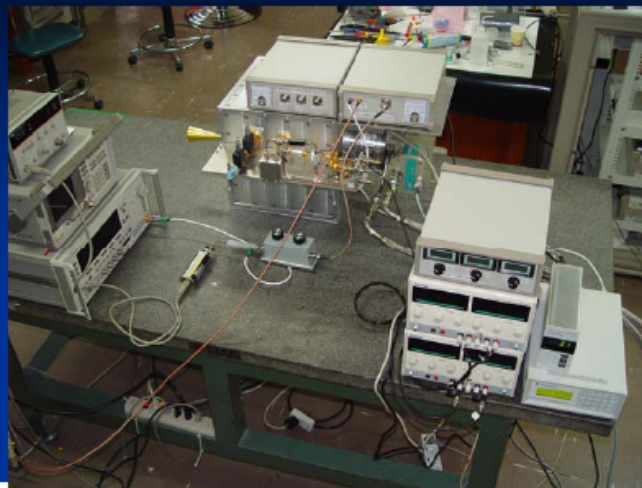
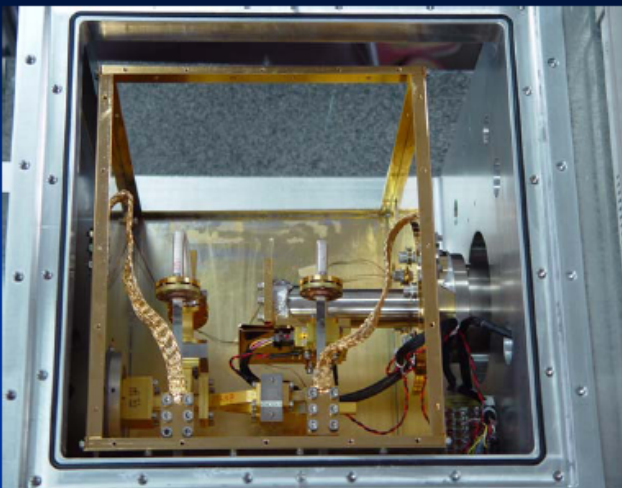


* 86, 129 GHz Receivers will be installed within 2010.

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Proto-type of KVN 43GHz HEMT receiver

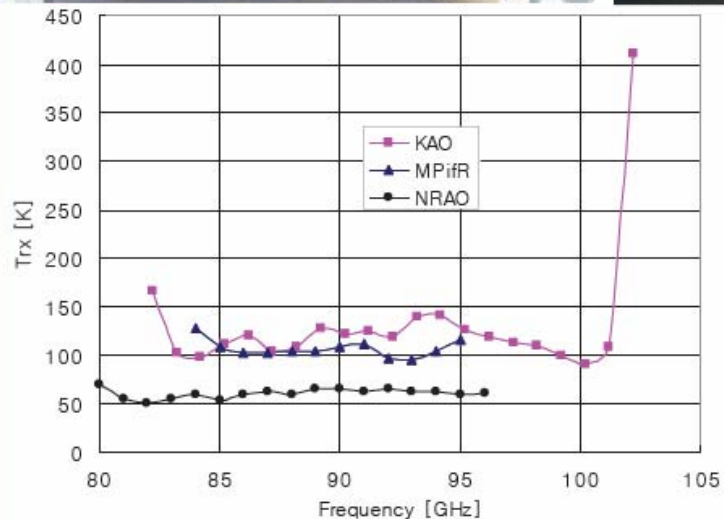
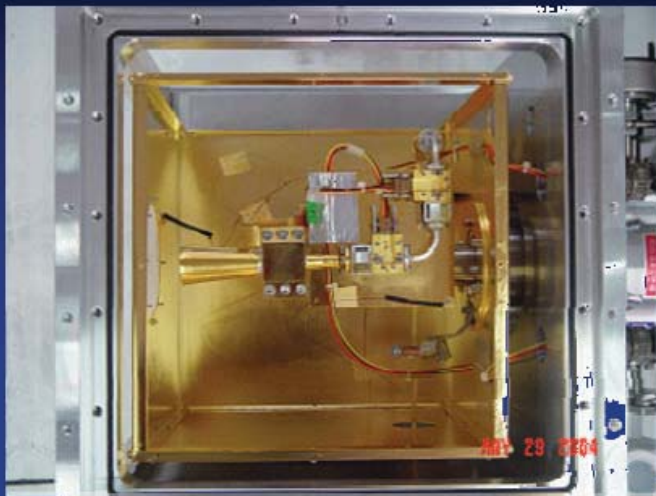


Developed : June 2003

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Proto-type of KVN 86GHz HEMT receiver



Developed : June 2004

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Quasi Optics Mounting on Receiver Plate and Test



RX Group (S. T. Han, M. H. Jung & D. H. Je)



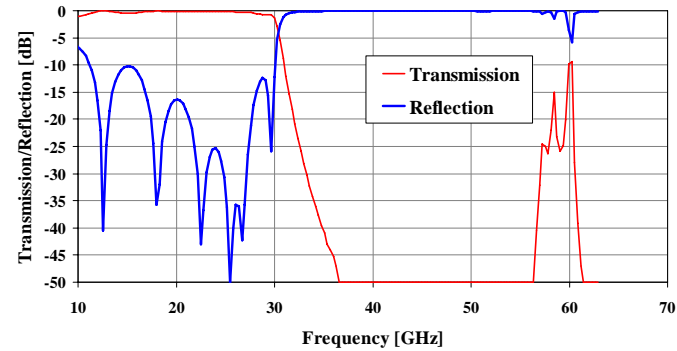
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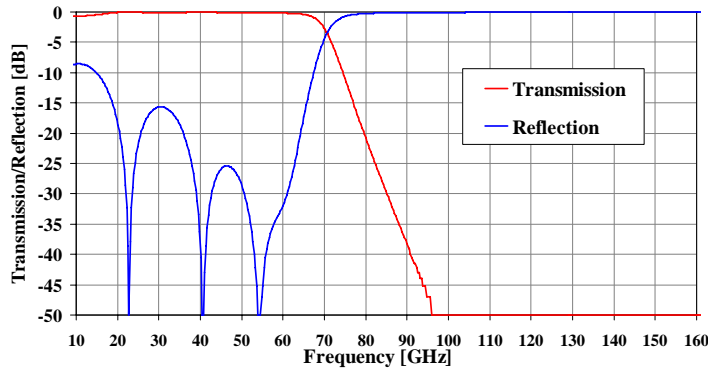


Dicroic Low-pass filter

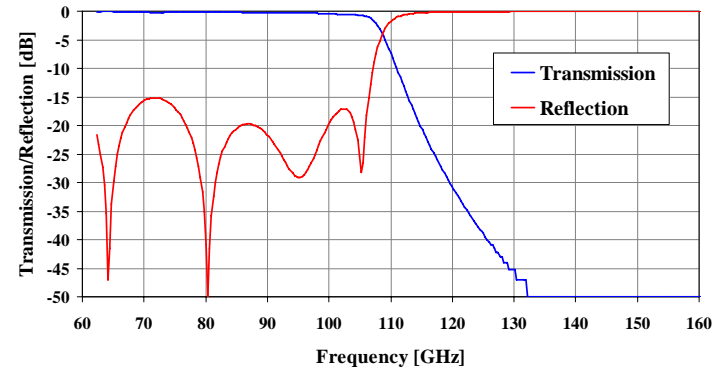
Low -pass filters : Meter-mesh (Thomas Keating)



- 22GHz/43GHz channel



- 22 and 43GHz/86 and 129GHz channel



- 86GHz/ 129GHz channel



to EAVN

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K band Ortho-Mode-Transducer test



C. Kim & Je

A.R. vs frequency



GHZ

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Time Schedule of K-J Correlator

2005	Requirements, Specification Start of Technical Design
2006	Completion of Technical Design and Contract Start of Manufacturing (each parts)
2007	Manufacturing (each parts) Development of Control & Operation Software
2008	Assemble into Whole Correlator System Test and Debug the Correlator System (HW & SW)
2009	Start of Experimental Operation Completion of Archive System
2010	Practical Use for Korea-Japan Joint VLBI Network Establish the K-J Joint Correlation (Data) Center

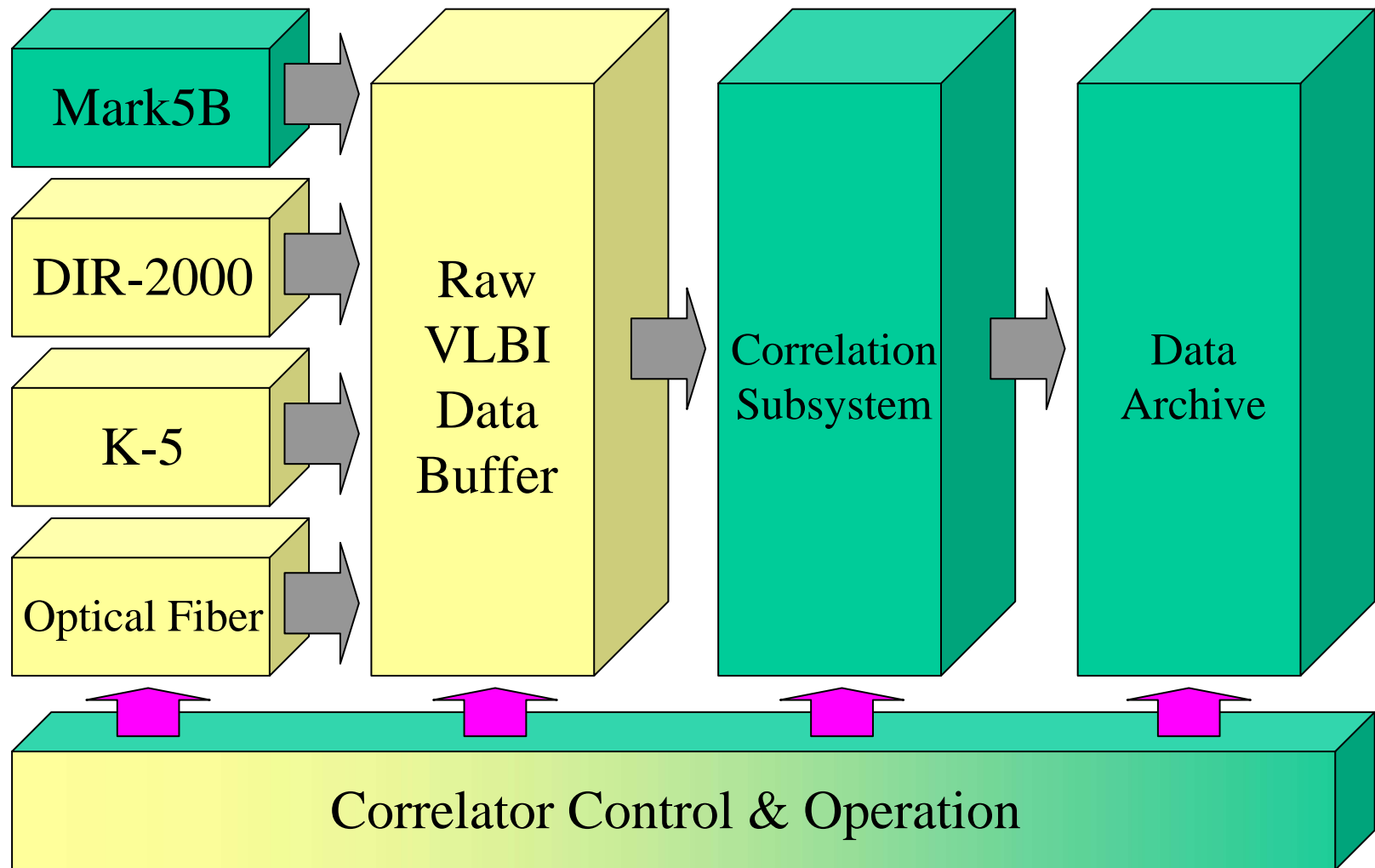


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Framework of K-J Joint Correlator



Responsible to KASI Responsible to NAOJ





Observation Mode



Mode	#IF	Bandwidth [MHz]	Max. #Chan	#Bits	Max. Data Rate [Mbps]	Recorder	VERA Modes
1	1	256	1	2	1,024	Mark5B	VLBI1
2	1,2	128	2	2	1,024		VERA1, VLBI2
3	1,2,3,4	64	4	2	1,024		VERA2, VLBI3
4	1,2,3,4	32	8	2	1,024		VERA4, VSOP1
5	1,2,3,4	16	16	2	1,024		VERA7, VERA9, Geo1, Geo2, VSOP2
6	1,2,3,4	8	16	2	512		Geo3, Geo4, K4-1
7	1,2,3	64/128	2/1	2	1,024		VERA3
8	1,2,3,4	32/64/128	2/1/1	2	1,024		VERA5
9	1,2,3,4	32/128	4/1	2	1,024		VERA6
10	1,2,3,4	16/32/128	2/3/1	2	1,024		VERA8
W4	1,2,3,4	512	4	2	4x2,048	Mark5B+ Fiber	



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Summary of Specifications

# of Antennas	16
# of Inputs / Antenna	4 bands (4Fx1P, 2Fx2P, 1Fx2P+2Fx1P)
Max. # of Correlations / Input	120 Cross + 16 Auto
Subarray	2 case (12 + 4, 8 + 8)
Bandwidth for each Input	512 MHz
Digitization for each Input	1 Gbps by 2bits/sample
Clock for Input data	128 MHz
Max. Delay compensation	32,000 km
Max. Fringe Tracking	860 kHz
FFT points	1,048,576, w.r.t. multi-channel stream
Word length in FFT	16+16 bits fixed point for real & imag. Re-quantization to 4+4 bits fixed point
Integration	< 25 msec
Data compression (Flexible Binning)	8,192 channels



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K-J Correlator in 2006

- **Establishment of K-J WG and K-J correlator review committee**
 - **First review committee meeting in June, Seoul**
 - **Reviewing correlator manufacturing plan and specification etc.**
- **Contraction of correlator design work with Elecs company in Aug.**
- **Submit a public tender in Oct. for the contraction of correlator manufacture based on design work**
- **Second review committee meeting in Nov., Ulsan (KVN Ulsan Observatory) during K-J regular VLBI meeting**



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KVN Science

- **Multi-frequency and multi-epoch observational study for**
Star forming region, late-type stars, Galactic center, AGN, detection of core shift, variability of microquasars, gravitational lens objects

- **Maser mini workshop : July 2006 at KASI**
- **AGN mini workshop : Aug. 2006 at KASI**
by KVN Science WG

- ***KVN Science Advisory Committee***
 - **Reviewing KVN Key Science**
 - **KVN Science meeting in 2008/2009**



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Basic Research for KVN SiO Maser Study

■ SiO J=2-1 & J=3-2 Observations towards Late-Type Stars with TRAO 14m Telescope

- o SiO J=2-1 & J=3-2 line survey and statistical study I. II. → Cho et al. 1998, 2006 ApJS
- o Simultaneous time monitoring observations of SiO J=2-1 & J=3-2 masers (1999~2001) → Kang et al. 2006 ApJS
- o First detection of the SiO $\nu=3$, J=2-1 maser emission from χ Cyg → Cho et al. 2006 ApJ

■ SiO J=2-1 & J=3-2 Observations toward Orion KL with TRAO 14m Telescope → Cho et al. 1999 AJ

- ▶ Connection to KVN Science in SiO Maser Study

