ELECS INDUSTRY CO., LTD.

HARDWARE CORRELATOR

High Speed and Broadband Signal Analysis Solution

K-3(NICT)
XF, 8Msps, 128lag, 1BL First operational correlator in Japan

1983

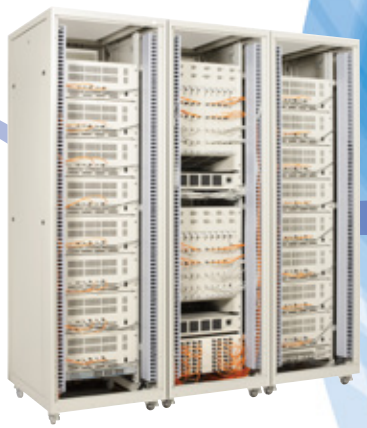
NAOCO(NAOJ)
XF, 128Msps 512lag, 1BL
Compact portable correlator

NRFD(JAXA)
XF, 256Msps, 4096lag, 1BL
Fringe detector for VSOP

UWBC(NAOJ)
XF, 4Gsps, 512lag, 21BL Ultra wide band correlator for Nobeyama Millimeter Array

2014

OCTAD-C(Ibaraki Univ.)
FX, 4Gsps, 32kch, 6BL Real time correlator with built in ADC for Takahagi telescope



VCS(KASI)
FX, 4Gsps, 256kch, 120BL Central correlator for KVN and VERA

BEARS(NAOJ)
XF,1Gsps,1024lag,25IF
25-beam wide band auto correlator for Nobeyama 45m telescope

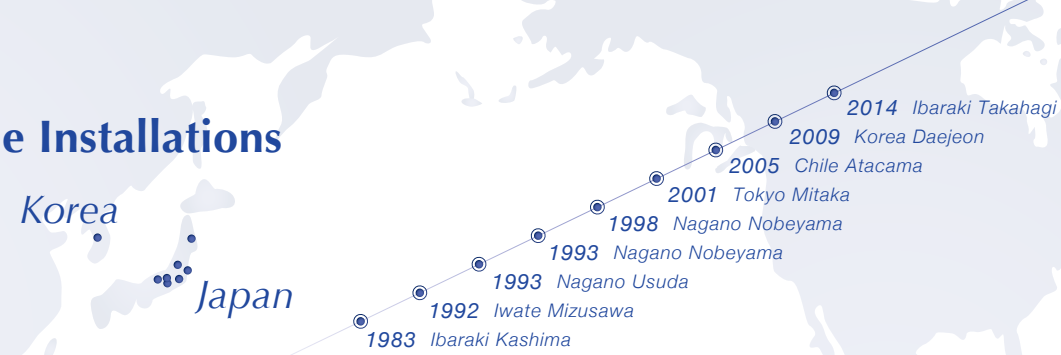
e-VLBI(NAOJ)
XF/FX, 1Gsps, 16kch, 3BL Real time correlator for optically-linked VLBI(OCTAVE)

WHSF(NAOJ)
F-FX, 4Gsps, 16kch, 2IF F-FX wide band auto correlator for ASTE telescope

Technical Advantages

- As a leading company of radio astronomy, Elecs has been developing Hardware Correlator over 30 years.
- Offer perfect technical supports for Proposal/Design/Manufacture/Test/Delivery/Operation.
- Provide up to 20 years long term maintenance contract (request basis).

Worldwide Installations



Key-Technology

Architecture	XF, FX
Data Input	10/40/100GbE, VDIF, VTP, VSI-H
Bit Weight	Weight table customization
Delay Compensation	Using a volume of DDR3/4 memory for correction of the delay from the Earth's center
Fringe Rotation	Time domain method, Frequency domain method
FFT	Original IP and XILINX IP
Fractional Delay(ΔW)	Apply to every FFT segment
Correlation	Special structure for huge baselines
Data Output	UDP/IP, TCP/IP
Parameter Calculation	Built in hard parameter generation, and delay prediction from star/station positions

Total System

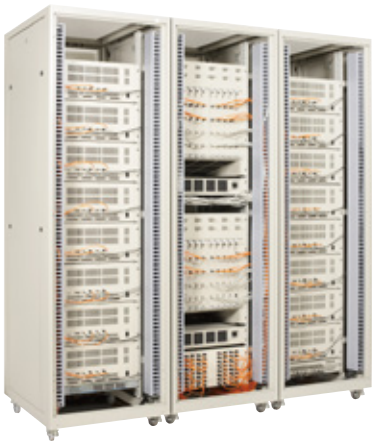
SAMPLER	VDIF output sampler with digital signal processing
VDIF VSI-H MC	VDIF ⇔ VSI-H Media Converter
DATA RECORDER	VDIF storage with removable storage module
Web GUI SOFTWARE	Equipment control/Data analysis software

Design Process

Specification	Best suited specification for the purpose of observation
Processing Logic	Verification of characteristic and error by simulation(MATLAB) Finds the best suited operation word length
FPGA	Altera, Xilinx High-End FPGA VHDL, SIMULINK assured implementation
Circuit Board	High Speed I/O(Max25Gbps) simulation Power integrity simulation Flexible board design
Firm ware	RTOS, Linux
Test	Cross checking with simulation Performance check by real observation data

Correlation System(example) -VCS for KJCC-

Number of stations	16 station
Number of input	512MHz(1024Msps-2bit)x4 IF
Number of correlation	120(cross)+16(auto)
Processing speed	4Gsps
Architecture	FX
FFT points, word length	256k-points, 20bits-complex



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