URSI GASS 2023, Sapporo, Japan, 19 – 26 August 2023

E-KVN GPU Correlator Development Status

Jae-Hwan Yeom(1), Se-Jin Oh(1), Duk-Gyoo Roh(1), Chungsik Oh(1), Hyo-Ryoung Kim(1), Dong-Kyu Jung(1), and Young-Sik Kim(1)

(1) Korea Astronomy and Space Science Institute, South Korea

The Korea Astronomy and Space Science Institute (KASI) currently operates the Korean VLBI Network (KVN), which consists of three radio telescopes, and operates the Daejeon hardware correlator[1] and the DiFX software correlator[2] at the Korea-Japan Correlation Center (KJCC). The Daejeon correlator is a hardware correlator based on FPGA, and can support up to 16 stations with maximum 8 Gbps observation data. And it is used for making correlation on KVN and VERA array (KaVA), and East Asian VLBI Network (EAVN). The DiFX correlator is a software correlator composed of CPU-based clusters, and is mainly used for making correlation on KVN data. Since 2020, the extended KVN (E-KVN)(Figure 1) project is being promoted to further enhance KVN's radio observation research capabilities. The E-KVN project is a project to expand KVN consisting of a total of 4 radio telescopes by constructing an additional radio telescope, and to expand the observation speed of KVN from 8 to 32 Gbps. In addition, the Sejong Radio Telescope of the National Geographic Information Institute (NGII) is actively participating not only in geodetic observations but also in astronomical observations in close cooperation with KVN, so the domestic VLBI observation network will consist of 5, including Sejong. The KVN will be mainly used with dual-polarization (RCP/LCP) mode in all observations. Therefore, at the time when the radio telescope newly built in the E-KVN is put into operation (2024), at least 5 stations and 32 Gbps correlation processing capacity are required, but this capability is so exceeding the processing power of the Daejeon hardware correlator and the DiFX software correlator, so a next generation correlator development is needed. The E-KVN project started in 2020 with the development of a next-generation correlator capable of real-time correlation processing for 5 stations, 32 Gbps observation speed, and dual-polarization observations based on GPU (Graphics Processing Unit) and network, and recently developed a 16 Gbps GPU correlation core(Figure 2). In this year, the design and development of a 32Gbps GPU correlation core will be completed, and the correlation processing for E-KVN will be started in 2024, and normal operation is planned. In this presentation, we would like to introduce the design, construction, and progress of the next generation GPU correlator for E-KVN.

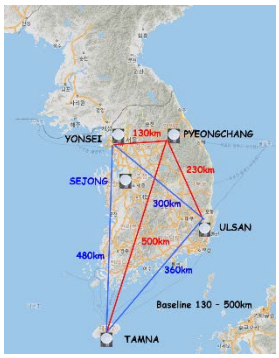

Figure 1. Extended KVN.

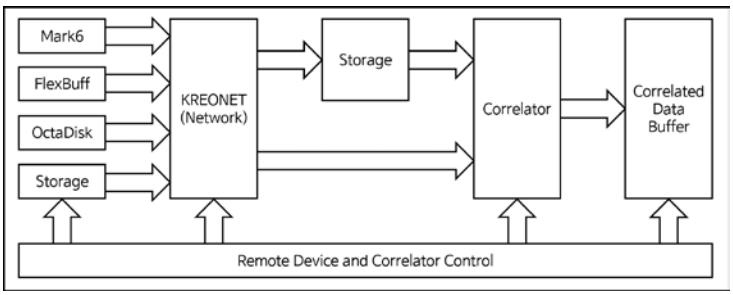

Figure 2. Conceptual block diagram of E-KVN GPU Correlator

References

[1] S. -J. Oh, D. -G. Roh, J. -H. Yeom, C. Oh, H. -R. Kim and D. -K. Jung, "8192 Mbps wideband correlation for the KaVA," 2016 URSI Asia-Pacific Radio Science Conference (URSI AP-RASC), Seoul, Korea (South), 2016, pp. 1434-1437, doi: 10.1109/URSIAP-RASC.2016.7601387..

[2] A.T. Deller, W.F. Brisken, C.J. Phillips, J. Morgan, W. Alef, R. Cappallo, E. Middelberg, J. Romney, H. Rottmann, S.J. Tingay, and R. Wayth,, "DiFX-2: A More Flexible, Efficient, Robust, and Powerful Software Correlator," 2011, Publications of the Astronomical Society of the Pacific (PASP), 123, 275. doi:10.1086/658907.