Wettzell VLBI Correlator

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Abstract The correlation facility of the Geodetic Observatory Wettzell (GOW) in Germany continued its enhancement of capabilities during the period of this report. An initial DiFX-based correlator was operated between 2016 and 2020 for the evaluation of local short-baseline interferometry measurements between the three VLBI radio telescopes of the GOW (Wz, Wn, and Ws) and VLBI experiments with the station AGGO (Ag). In December 2020, a new (High-Performance Cluster) HPC-based DiFX VLBI correlator was installed at the GOW, replacing small, old, and obsolete hardware. In the subsequent months, all the necessary software was installed, as well as performance and verification tests. The new installation also offers the performance to properly handle VGOS observations. Since late 2021, the VLBI correlator at Wettzell has been acknowledged as an official IVS correlation component (WETZ) contributing to the IVS correlation resources. The IVS VGOS Intensive Observation program between Wettzell and McDonald Geodetic Observatory (MGO) [1] was launched in December 2021 and correlated in Wettzell. Since December 2022, regular 24-hour VGOS sessions are also scheduled for correlation in Wettzell. In 2023 and 2024, the VGOS Intensive correlation program as well as the 24-hour VGOS-OPS program were established in routine correlation operations.

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1 General Information

The hardware topology was specified as a High-Performance Cluster (HPC) configuration. There are three head nodes (one of them acts for data transfers) and 24 compute nodes available. An Infiniband bus system interconnects all related hardware units. The complete system is illustrated as a block diagram in Figure 1. The HPC cluster has a storage capacity of 2 PT. In addition, a Mark 6 unit is available for correlator usage, i.e. handling shipped Mark 6 modules from external VLBI stations. A dual-UPS protects against power failures. The internet line capacity is 10 Gbps, but the usable data rate for VLBI e-transfer is up to 9 Gbps for up- and download of VLBI raw data.

Ansible automation software is the software tool for provisioning, configuration management, and application deployment. DiFX [2] is used as the software correlation application, and the Haystack Observatory Postprocessing System (HOPS) is used for the subsequent fringe fitting process. In order to manage different users and configurations for all correlation duties, the workload manager SLURM (Simple Linux Utility for Resource Management) and the Environment Modules package (https://modules.sourceforge.net/) were introduced. Two basic configuration sets are mainly used, one for VGOS correlation (DiFX version 2.5.4, hops 3.24) and another for legacy S-/X-correlation (DiFX 2.6.3, hops 3.24).

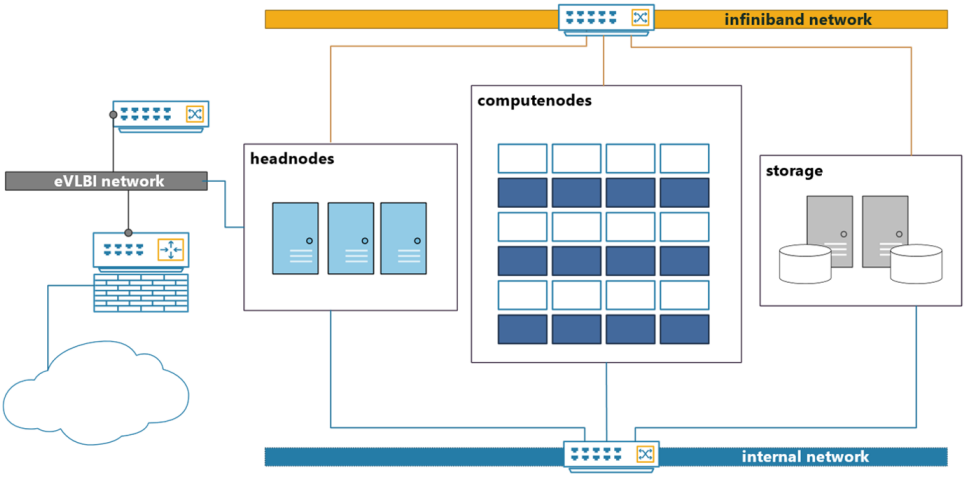

Fig. 1 Block diagram of the Wettzell VLBI correlator HPC cluster.

2 Activities During 2023–2024

Within the reporting time period, an Intensive VGOS observation program was processed at the Wettzell correlator. The IVS VGOS Intensive series between McDonald (Mg), located in Texas/US, and Wettzell (Ws) in Germany is observed on Tuesdays at 19:45 UT with a duration of one hour. The raw data of the Wettzell Network Station are already onsite and thus are available almost immediately for correlation. Due to upgrades of the internet capability of Mg, its raw data are available the following day in the morning (Wettzell time), and the correlation process can be started. This VGOS Intensive observation series started on December 7, 2021 with its first session. By the end of 2024, there were around 70 sessions completed. Furthermore, during the reporting years 2023 and 2024, eleven VGOS-24INT-S sessions and seven VGOS-OPS sessions were successfully processed.

3 Current Status

The VGOS-INT-S Intensive sessions were assigned to the Wettzell VLBI correlator during the time period between 2023 and 2024 and will continue in the future. The configuration and setup management of the HPC-based VLBI correlator is done with the common and well-established software tool-chains of Ansible and SLURM. The general design of the VLBI correlator hardware enables scalability, as it will be needed for future enhancements of the correlation resources. The operational processing of a 24-hour VGOS network session with more than partly ten VGOS stations has been established.

4 Future Plans

The development of automated correlation of VGOS Intensive sessions will continue in order to reach an operational level. An extension of the storage capacity is foreseen in 2025, with a capacity up to 4 PT to be prepared for the processing of all Wettzell-assigned 24-hour VGOS-OPS sessions within the IVS network.

References

1. M. Schartner, L. Petrov, C. Plötz, et al. VGOS VLBI Intensives between MACGO12M and WETTZ12M for the rapid determination of UT1-UTC. *REFAG2022 proceedings*, (submitted to IAGS).
2. A. T. Deller, W. F. Brisken, C. J. Phillips, J. Morgan,W. Alef, R. Cappallo, E. Middelberg, J. D. Romney, H. Rottmann, S. J. Tingay & R. Wayth. DiFX-2: A More Flexible, Efficient, Robust, and Powerful Software Correlator, PASP, 2011, 123, 275–287.