Wettzell VLBI Correlator

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Abstract The correlation facility of the Geodetic Observatory Wettzell (GOW) in Germany has undergone a significant upgrade 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 the small, old, and obsolete hardware. In the subsequent months all necessary software was installed, and performance and verification tests were done. 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 IVS correlation resources. A newly established IVS VGOS Intensive observation program between Wettzell and McDonald Geodetic Observatory (MGO) [1] was launched in December 2021 and correlated at Wettzell. Since December 2022, regular 24-hour VGOS sessions are scheduled for correlation at Wettzell.

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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 834 TB. Additionally, a Mark 6 unit is available for correlator usage. A dual-UPS protects against power failures. The internet line capacity is 5 Gbps, but the usable data rate for VLBI e-transfer is 4 Gbps for up- and downloading VLBI raw data.

Linux CentOS 7 is the operating system for the HPC-Cluster, and the IT automation software Ansible 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 3.23) and another for legacy S/X correlation (DiFX 2.6.3, HOPS 3.23).

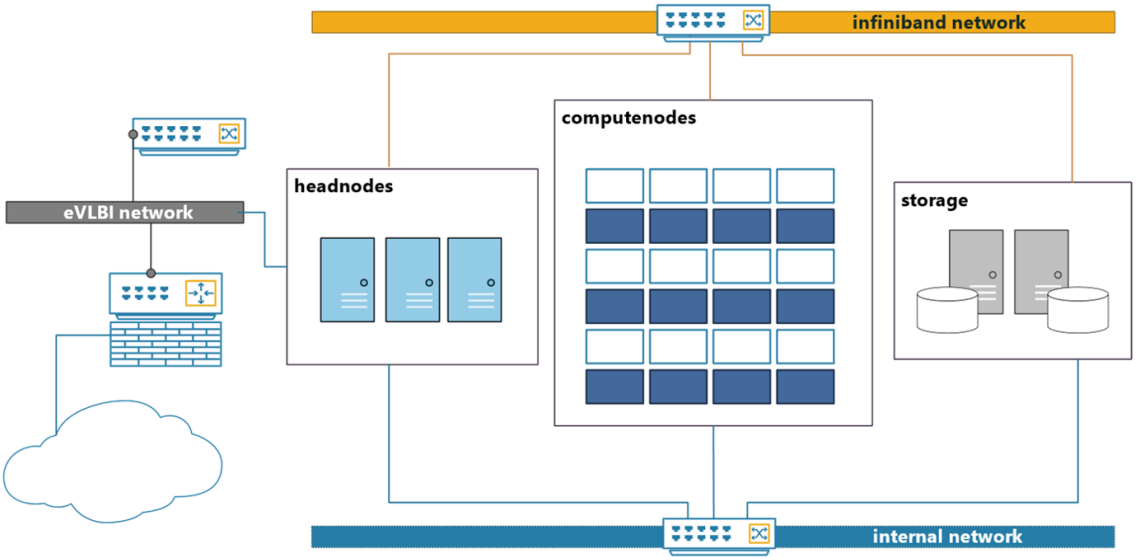

Fig. 1 Block diagram of the Wettzell VLBI Correlator HPC-cluster.

2 Activities during the Past Years 2021–2022

Within the report time period, a VGOS Intensive observation program was assigned to the Wettzell correlator. The IVS VGOS Intensive series between McDonald (Mg), located in Texas/U.S. and Wettzell (Ws) in Germany is observed on Tuesdays at 19:45 UT with a duration of one hour. After the regular VGOS Intensive session finishes, a short dedicated session is appended, which normally takes ten minutes. The purpose is to collect further insights in correlation, source, and slewing characterization of the involved radio telescopes. The raw data of the Wettzell network station are already onsite and thus are available almost instantly for correlation. Due to recent upgrades of the internet capability of Mg, its raw data are available at the following day in the morning (Wettzell time), and the correlation process can be started. This VGOS Intensive series started on December 7, 2021 with its first session. To date, there are 28 sessions completed. The workflow of scheduling, observing, correlation, and data analysis performs well. The session VO2336 scheduled in December 2022 was the first regular 24-hour session to be correlated by the VLBI correlator at Wettzell. In addition to processing the assigned IVS sessions, the new correlator at the GOW took over the duties of the old correlator.

Table 1 Staff members.

Name	Affiliation	Function	Mainly working for
Torben Schüler	BKG	head of the GOW	GOW
Christian Plötz	BKG	head of VLBI, correlator	RTW, TTW, correlator
Willi Probst	BKG	physicist	correlator
Michael Seegerer	BKG	IT engineer	correlator
Robert Wildenauer	BKG	IT engineer	correlator
Ben Fischaleck	BKG	IT administrator	IT adminstration
Alexander Neidhardt	FESG TUM	head of the group for microwave techniques, chief of operations group	RTW, TTW

3 Staff

The members of staff for VLBI correlation are summarized in Table 1.

4 Current Status

In December 2021 regular operations as an official IVS component started at the VLBI correlator in

Wettzell. The IVS sessions S2 and S2a were assigned to the Wettzell VLBI correlator in the time period between 2021 and 2022 and will be continued in the future. A main focus during the last year was the development of an automatic VGOS Intensive correlation workflow. Despite making good progress on that project, it couldn't be implemented to work on an operational basis until the end of 2022. 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. Recently, the processing of 24-hour VGOS network sessions began.

5 Future Plans

The current Internet bandwidth is 5 Gbps. An upgrade of the existing Internet bandwidth to 10 Gbps is planned, along with an adequate extension of compute nodes. The development of automatized correlation of VGOS Intensive sessions will be continued in order to reach an operational level. The first regular 24-hour VGOS session to be correlated at Wettzell took place in December 2022. Thus, the routine handling of 24-hour VGOS sessions must be implemented for the upcoming sessions. A storage extension of 2 PB is also planned in the near future to have the necessary capacity to process regular 24-hour VGOS sessions.

References

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