Atmospheric Phase Monitoring System Evolution for the NOEMA interferometer

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Abstract— **After having adapted the Smithsonian Astrophysical Observatory (SAO) atmospheric phase monitoring system that was developed for the Submillimeter Array (SMA), IRAM is currently refining the concept for an implementation on the NOEMA site.**

I. Introduction

In this paper, we present the development of the atmospheric phase monitoring system and show the latest results obtained on the NOEMA site. The final goal of this project is to provide a permanent monitoring system of the observing conditions on the plateau de Bure. After first onsite observations with simple antennas in 2018, later acquisitions took place during 2019 and 2020 autumns with improved infrastructure. Studies are currently ongoing to make the system compliant with the site harsh weather conditions.

II. System Description

The atmospheric phase monitoring system is based on two off-axis aluminium satellite dishes (Fuba DDA 110: 1090 x 991 mm^2) that receive a broadband white noise-like Ku Band (~11.85 GHz) signal from a geostationary satellite and focus it to the center of the feed. The Low Noise Blocks (LNB) that down convert this signal to the Intermediate Frequency (IF) one (~1.2 GHz) have been modified to be fed with a common Local Oscillator signal source.

The IF signals are then amplified, filtered and transported through optical fibers down to the building where they are processed by a commercial analog correlator (IQ demodulation card) that produces the phase delays between pairs (only one so far) of antennas from the I & Q signals. Then the data are further processed by a LINUX pc that runs software, which calculates a least squares sin fit to the unwrapped phase, subtracts that from the unwrapped phase, calculates the RMS values from the residuals and also provides the correlated power.

III. System Implemetation

After the first autumn 2018 data acquisition session on the plateau de Bure, some infrastructure optimizations were implemented in order to minimize environmental hazards. The second trials on the plateau with antenna sheltered under a radome, in parallel with the NOEMA interferometer confirmed the good agreement between the two systems. A new infrastructure is being developed for future more permanent installation on site.

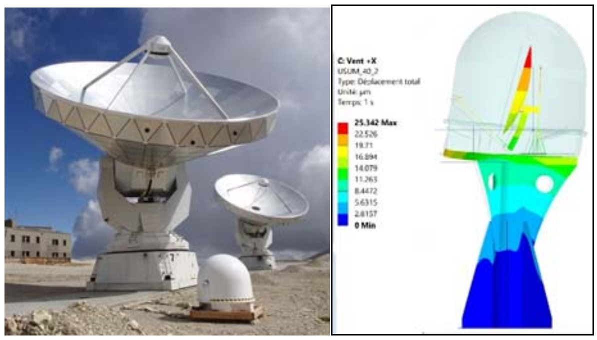

Fig. 2. Left) Phase Monitoring Antenna in a radome in front of two NOEMA antennas, Right) Finite Element Analysis study of mechanical stand under 40km/h of wind.

IV. Conclusion

This abstract has briefly described the phase monitoring system work that has been ongoing for the past three years at IRAM. More detailed description of the system will be provided during the conference, together with up-to-date results and analysis.

References

[1] Robert S. Kimberk & All "A Multi-Baseline 12 GHz Atmospheric Phase Interferometer with One Micron Path Length Sensitivity", May. 2012.

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