NOEMA receivers: Upgrade for simultaneous dual-band observations

A-L. Fontana *, D. Maier, J. Reverdy, M. Parioleau, M. Rival and V. Jubard[1]

[1]*IRAM, 300 rue de la piscine, 38400 Saint Martin d'Hères, France*
*Contact: fontana@iram.fr

Abstract—NOEMA (Northern Extended Millimeter Array) is the successor of the IRAM interferometer located on the Plateau de Bure. Currently composed of eight 15-m diameter antennas, it is still under construction and will consist in twelve antennas in the next future. All the antennas are equipped with state of the art wide band SIS heterodyne receivers.

Each NOEMA receiver comprises, in a single cryostat, four dual-linear polarization side band separating SIS modules covering the frequency bands 72-116GHz, 127-179GHz, 200-276GHz and 275-373GHz and reaching excellent noise performances. Each of these modules delivers four 4-12GHz IF signals.

The construction of the receivers for the 12 antennas is almost finished, and IRAM is already working on the future upgrade of these receivers. The goal of this upgrade is to observe simultaneously the same point of the sky with two different frequency bands (currently, the four dual polarized beams of each receiver are separated by 4 to 6 arc minutes on the sky, depending on the bands considered). To co-align the different receiver bands, several design options are envisaged. The band combination can be made at room temperature, or at cryogenic temperature. For this last option we are developing dual band, dual polarization cryogenic side band separating SIS receiver modules. In each of these modules, a common (for two frequency bands) optics, composed of two focusing mirrors, is used to have a frequency independent illumination of the sub-reflector. Inside the module, the two bands are diplexed by a dichroic filter (developed by QMC Instruments, Cardiff University) operating at 4K. Each beam is then re-directed into a dual polarization feed horn coupled to a waveguide Ortho Mode Transducer (OMT) used to diplex the two polarizations of the band considered. Each OMTs output is then connected to a side band separating SIS mixer, delivering two 4-12GHz IF signals.

The different options envisaged for the dual band upgrade will be presented, and in particular, the design and first tests results of a 72-116GHz/127-179GHz and of a 72-116GHz/200-276GHz cryogenic dual band module will be detailed. The future perspectives of this work, in particular the way to offer several band combinations, will also be discussed.