

Analyzing VLBI interferometer characteristics using zero-baseline lab prototype and RASFX correlator

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The zero-baseline radio interferometer model based on the radio telescope RT-13 tri-band and ultra-wideband receivers, broadband data acquisition system (BRAS), and RASFX correlator was assembled in the IAA RAS in 2017. We carried out more than 100 sessions with the following setup: one channel with 512 MHz bandwidth, 2-bit sampling, X band (7.0-9.5 GHz). The session duration varied from single 5..20-minute scan up to 2.5 hour consisted of 300 10-seconds scans. To simulate celestial source the noise generator signal was injected to receivers through cryo unit directional coupler. Obtained with RASFX correlator fringe characteristics were analyzed: signal-to-noise ratio, delay, delay rate, fringe-phase and its standard deviations. The phase stability of the receiving systems was measured using R&S vector network analyzer, results were compared with PCal measurements. Allan deviation was calculated to find the character of phase and delay variations. The sinusoidal ripple of fringe delay due to the frequency inaccuracy of LO and overlapping spectra from Nyquist zones was revealed. It is shown that digital filtering of the band edges reduces the measured delay variation.