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Experience in Creating Schedules of KVAZAR VGOS Antennas

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Abstract:

While legacy geodetic VLBI observations using the large and heavy radio telescopes are still carried on, a number of the new VGOS radio telescopes with 13-m dishes have been built and run into operation. There are several fully developed scheduling software packages exist already, some people start a development of a new one, but SKED and SCHED software are still remain actual and can be adopted for VGOS purposes with external wraps and internal patches. Within this contribution we will concentrate on scheduling process for two-element radio interferometer of the KVAZAR VLBI-network.

Introduction

In November 2015 KVAZAR VGOS two element radio interferometer “Zelenchukskaya” and “Badary” have started everyday X/S observations. Number of session varied from 2 to 7 sessions in a day to estimate intraday Universal Time using VLBI technique. Prior to this in March 2015 we have started the first observation tests of the new radio telescopes with 32-m antennae. Different observational setups and schedule strategies were tested and some limitations of previous systems and software were investigated.

Zelenchukskaya RT-13 (Zv), Russia

Badary RT-13 (Bv), Russia

Observations Setup

Both 13.2-m radio telescopes are equipped with the Tri-band dual circular polarization S/X/Ka-receiver, the BRoadband Acquisition System (BRAS) capable of 8 IFs of 512 MHz bandwidth each in DSC mode, and the Data Recording System (DRS) to record up to 16 Gbps data rate on each site in VDIF format.

First advantage of the new VGOS telescopes comes from their 13.2-m antenna size: they have very fast slew speed compared to the legacy 32-m antennae: 12 °/s vs 1.2 °/s in azimuth and 6 °/s vs 0.8 °/s in elevation. This allows to observe more scans during the same time or the same number of scans in lesser time.

Next advantage and disadvantage in the same time is the new receiving and recording system: a number of wideband 512 MHz IFs with 2 Gbps data rate each are recorded and transferred to Correlator Center for further processing. But at present there is no native support in various software for such observational modes and equipment.

Scheduling

Geodetic scheduling was performed with a modified version of the SKED software (version 2007Feb13). On source times ranged from 6 to 180 s which depended on VLBI network and a target SNR from 15 to 45 dB in X- and S-band. The scan's sequence was optimized to estimate UT1-UTC.

SKED software was developed in 80th of previous century. It is complexed with catalog files which contained information on equipment and frequency setups for legacy radio telescopes across the world. Support of newest is added for example for DBBC, but naturally DBBC have been developed to have backward compatibility modes to work with Mark IV systems and other common systems of big slow antennas. Support of perspective modes, i.e. DSC, is not implemented.

Scan’s choosing algorithm is rather universal and depends on target SNR, what is the property of antenna, its equuipent, and frequency setup. And using appopriate parameters one can use SKED to obtain an optimized scan’s sequence. Final skd-file will not be fully compatible with Field System and thus additional editing of control files are required.

NRAO SCHED key-files were prepared with the frequency setup and the scans sequence from the skd-file was later added.

Most common equipment setup for Bv and Zv are included 3 channels in X-band of 512 MHz bandwidth covering the range between 7568 and 9104 MHz, and 1 channel in S-band covering 2164-2676 MHz bandwidth in right circular polarization.Several experiments.

Data correlation in the IAA

Data were correlated with DiFX 2.4.1 in the Correlator Center in St. Petersburg.

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PIMA software was used to produce NGS-card files for the analysis in the “Quasar” software suit.

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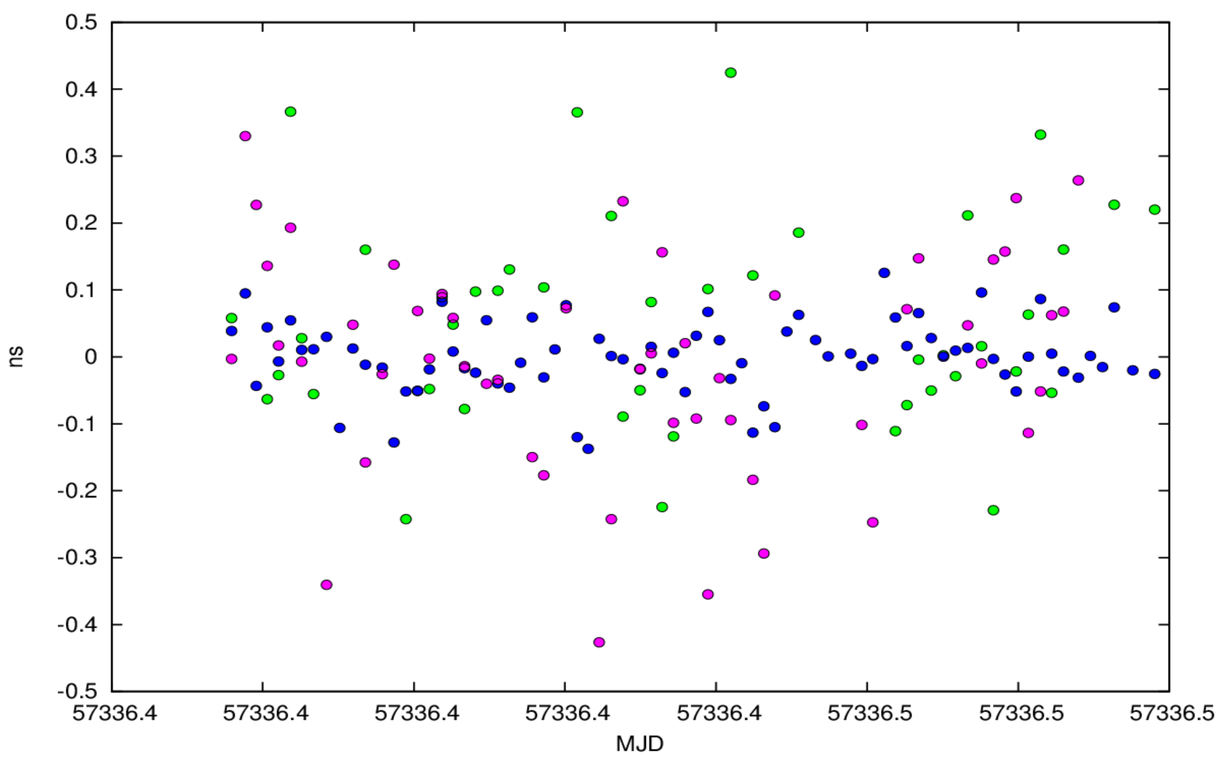
RU0179 RU0180 RU0181	X	9072	9008	8944	8880	8816	8752	8688	8624
	S	2612	2580	2548	2388	2356	2324	2292	2260
RU0191	X	9076	9044	8980	8916	8852	8788	8724	8660
	S	2612	2580	2548	2388	2356	2324	2292	2260
RU0192	X	8964	8948	8932	8916				
	S	2324	2308	2292	2276				
RU0222 RU0224 RU0263	**X**	9076	9044	9012	8980	8948	8916	8884	8852
	S	2612	2580	2548	2388	2356	2324	2292	2260

Analysis in the IAA

Solution parameters:

- Linear ZWD
- Quadratic clock
- UT1-UTC offset



Conclusions

- First session with 136 scans/hour rate was succesfully done on VGOS network.
- Normal scan's rate to obtain target SNR is about 120 scans per hour.