Progress of Process Automation at Tsukuba Correlator/Analysis Center

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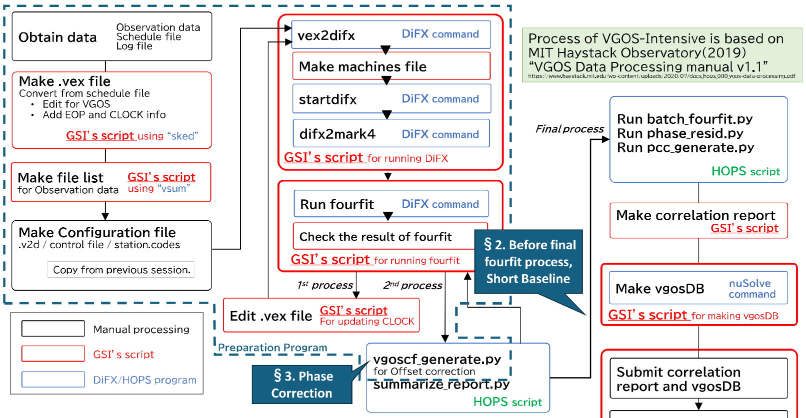
§ 1. Status of Tsukuba Correlator

Tsukuba Correlator / Analysis Center, located in Tsukuba, Japan, is operated by GSI. We are responsible for the correlation of one of 24-hour sessions & three series of intensive sessions(chart below). In VGOS-INT-B and C sessions, the process until 2nd fourfit process (see right figure) is automatically executed and finished by Monday morning, while manual processing by operators is still necessary for half of all process. INT-2 correlation is fully automated without any trouble.

Session	Stations	Software	Status of Automation
AOV	Hb, Is, Ke, Km, Kv, Sh, Sy, Ur, Vm, Ww, Yg	DiFX/HOPS	Manual processing
INT-2	Wz, Mk	K5	Fully automation
VGOS-INT-B&C	Is, Oe, Ow	DiFX/HOPS	Automation half of the process ; until 2nd fourfit process
VGOS-INT-G	Is, S6, Sa, Yj	DiFX/HOPS	Manual processing

We report our approach for process automation on the VGOS -INT B and C in the following sections.



Process of VGOS-INT Correlation

HOPS: https://www.haystack.mit.edu/haystack-observatory-postprocessing-system-hops/

§ 2. Process of Short Baseline

2-1 Correlation of Twin Telescopes

ISHIOKA, ONSA13NE and ONSA13SW are involved in VGOS-INT-B&C. Due to the distance between ONSA13NE and ONSA13SW is within 100 m, observed VLBI data includes **P-cal signals** and **noise caused by the local environment** of both telescopes which cause pseudo fringes as well as signals from quasar. We adopted software notch filter and developed automation program of channel selecting (figures below).

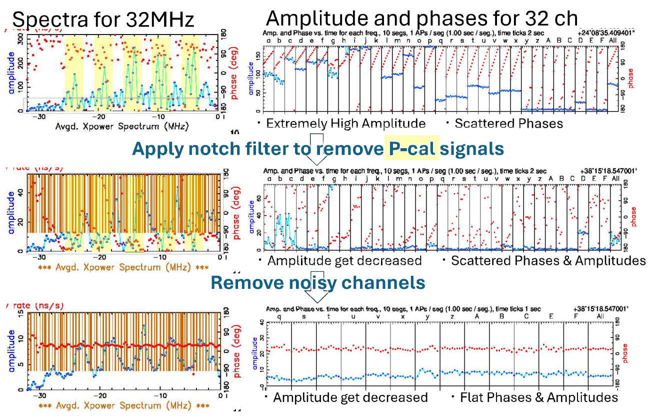


Figure : Outline of short baseline process

2-2 Automated Program

We manually screen out some of the channels by checking stokes fourfit results. Removed channels are automatically chosen with a script (right flowchart). We usually set [?] in the right flowchart around 50% so that QFs of most of the scans are 5 or better. This process takes approximately 10 minutes to select channels to be removed, which is faster than manual processing by an operator.

◆ Dilemma in removing channels

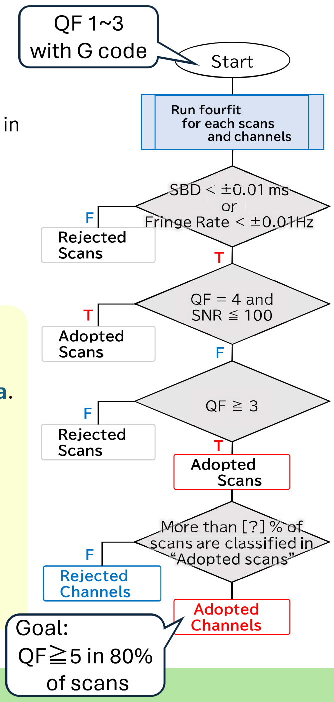
When we **remove many** channels,
QFs get **better** & we **waste most of data**.

Which is better?

When we **remove a few** channels,
QFs get **worse**, we **waste a little data**.

◆ Future Development:

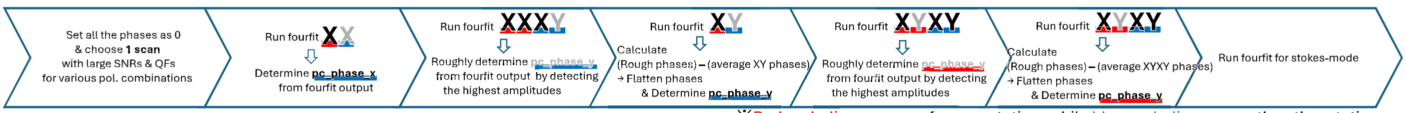
Reconsideration of notch filter
→ Change the width of notch filter for each 32 channels?



§ 3. Original Way of Phase Correction

3-1 Status of Phase Correction

We usually use HOPS scripts for offset correction. However, it sometimes fails to offset correction and sometimes causes sub-ambiguity when we copy the same kinds of parameters from the previous control file. Then we tried to carry out offset correction by using original way(called "GSI method" hereafter) with initial phase value at "0". Following figure shows the process of our method for one baseline. In general, pc_phase_x of reference station are 0 and estimate the other pc_phase_x/y.



※Red underlines mean reference station, while blue underlines mean the other station.

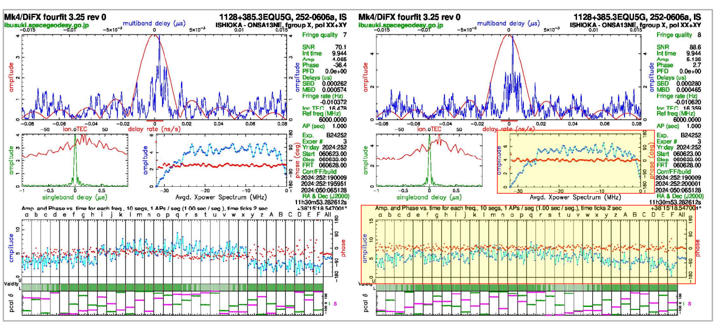


Figure: Fourfit outputs of without(left) and with(right) the roughly phase correction

Figure above shows fourfit XXXY output with and without the rough phase correction in b24252

・Enhance amplitude ・Flatten phases

In b24252, GSI method could improve SNR and QF in 47 and 10 scans, respectively and these results were almost same as that of HOPS.

3-2 Compared with HOPS and Future Development

We compared the GSI method with HOPS in the chart below.

	HOPS	GSI
Number of used scans	5~10	1
Probability of changing phases in short period	Low	High
Duration	20 ~ 30 min.	10 min.

We apply the GSI method in parallel to HOPS programs. GSI method is currently in the comparative study phase and is not applies to correlation result submitted to IVS as long as HOPS method is successful. In 3-1, I referred to pc_phase_x/y only.

Under development of estimating......
◆ pc_phase_offset_x/y ◆pc_delay_offset_x/y