AMBER

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Subject : **Group Tracking with AMBER**

Presents :

This memo try to convince that group-tracking in AMBER :

- **is critical and should be considered in the short/medium term plan.**
- **does not require the instrument to be put in the RMN.**

1 – Context

In Low Spectral Resolution, the coherence length of AMBER is about 50μm, but the usable part of it is smaller. The `amdlib` software generally performs a frame selection and keep only frames within $\pm$10μm around the zero-opd position.

The amplitude of the atmospheric piston is generally much larger ($\pm$50μm), leading to important loss of frames. Moreover, small error in the OPD models leads to a constant drift of the fringes. As a matter of fact, astronomer try to do their best to keep manually the fringes within this range, by manually offsetting the DLs every few seconds. Improvement in the data quality has been demonstrated several times.

However, this is operationally not sustainable in the Paranal frame work:

- Staying in front of AMBER during all observations, the astronomer/TiO cannot perform adequately his other tasks (data quality check, preparation of the queues, writing PPRS, training...).
- The data quality depends on the "motivation" and ability of the astronomer/TiO to perform this group-delay tracking.

It is mandatory to find to way to re-center the fringes in AMBER, automatically and at a relatively fast rate.

2 – Script currently available (UNOFFICIAL)

I wrote a `yorick` script to perform this operation (see `~/jlebouqu/Scripts/startCoher` on the wamber machine). Quickly, this script implements the following functions:

- dbRead of the SNR and piston in the K-band computed by the amdiracq quicklook for each baseline, with the command:
  `dbRead "@wamber:Appl_data:AMBER:DCS:amdiracq:quicklook.piston12(0)"`
  `dbRead "@wamber:Appl_data:AMBER:DCS:amdiracq:quicklook.snr12(0)"`
- if the SNR is larger than 3, execute a DL offset with the following command:
  `msgSend wvgvlti issifControl OFFSOPD "-beam 1 -oplOffset value" 2000 &`

This is performed for fringes 12 and 23, at a rate of about 2s. Practically, I had to deal with several difficulties:

- The AMBER exposure crashes if an offset is sent while the exposure starts or ends. Therefore the script only send the offsets if the exposure is started for more than 4s and the remaining time is less than 4s (all information is read from the AMBER data-base).
- The ISS get stuck if the offsets is sent while ISS is not available. Therefore the script only send the offsets if ISS is available, looking at the point `@wvgvlti:Appl_data:VLTI:issprs:compAct.state`.

Performances

I used this script systematically during my 10 days turno, when using AMBER in LowRes without FINITO. This represents several full nights. Results are very encouraging:

- After having found the fringes at the acquisition, we did not have to click to maintain them during the several files of the exposure.
- The piston amplitude was clearly reduced, also a little overshooting may be seen. As a matter of fact, fringes were present in all single frames, and the number of processed frames is increased.
- Most importantly: the reduced data show the best transfer functions I had ever seen with AMBER. Although not spectacular (0.7 ± 0.05 RMS in average), it was nice to obtain such a good stability without any human intervention in AMBER.
- However, the script was not 100% robust. Even with extra caution (checking the state of AMBER and ISS in real-time), it sometimes killed the ongoing exposure (at the time of the ENDEX).

3 – Proposition

Here is a list of specifications. It should be well discussed between software and sci-ops before any tentative implementation. I believe that:

- It should run simultaneously during the execution. The offset rate should be better than 5s, but cannot be better than 2s (given the refreshing rate of the OPD in the data-base). The decision to sent or not the offset can be done based on the SNR.
- The system should be as stable as possible. Exposure should not be affected.
- Their is no need to send offset in between the exposures. It takes only few seconds to re-center them if they have slightly moved in between consecutive exposures.
- It should only run in AMBER low-resolution without FINITO.
- Ideally, the parameters on/off (on by default), SNR threshold and gain (with correct default values) should be accessible, even during an exposure.

This clearly cannot be executed by the template, and I don't know how it could be implemented within AMBER software. With a panel performing in real-time?? With an executable running in background from the execution??