VLTI Memo

AMBER

Orig. : J.-B. Le Bouquin, S. Stefl.
Dest. : all AMBER
Copy to :
Date : 05-12-2008
Version : 1.0

Subject : **AMBER Med_Res closure-phase accuracy and stability.**

Presents :

Scope of this memo

This memo summarizes the test made the night 2008-12-02 in order to explore the closure-phase accuracy and stability over the night for AMBER in MedRes_K mode. These tests have been done with FINITO-H100.

Note: The data have been obtained AFTER the change of polarizer inside AMBER.

Data reduction and analysis

Data have been taken between 2008-12-03T03:02 and 2008-12-03T08:40, with AMBER in MedRes_K mode, with FINITO-H100 and with the baselines D0-H0-G1. FINITO/OPDC setup was standard (complete, 5fringes, 0.5ms). We observed the calibration stars from the Merand catalogue: HD43636 (K= 3.0), HD44891 (K= 2.9) and HD44225 (K= 2.7). All observation were made with DIT x NDIT=1s x 70 (expect the first 5 files taken with 0.5s x 120).

FINITO was working very-well during the night because of good weather condition and the use of relatively bright targets. It leads to an good contrast on the AMBER fringes, almost always larger than $V^2 > 0.5$ even with the use of long DIT.

Concerning the data-reduction, we used the standart package `amdlib-2.2`. We averaged 80% of the best frames sorted by SNR, file by file. We extract the closure-phase value from the files OIFITS_AVG. As a second strategy, we append all OIFITS_RAW files obtained consecutively on the same target and we perform the same frame selection (80% best SNR).

We plot the results in two ways. The closure-phase measurement are plotted versus time for several spectral bins (8 different bins + 1 averaged band) in Fig. 1. The closure-phase measurement are plotted versus lambda in Fig. 2. We also add the RMS(λ) obtained over all points of night, as well as the estimated error bars estimated by `amdlib`.

Results and discussion

Appending consecutive files significantly reduces the jitter of the closure-phase over the night. The gain in RMS (≈ 2) is compatible with the increase of the integration time ($\sqrt{5\text{files}} = 2.2$). Therefore larger integration (more files) may possibly lead to even smaller dispersion. Deeper tests in terms of integration time are probably required to reach the fundamental limit of the closure-phase calibration capability of AMBER MedRes_K.

Conclusions

- We demonstrate the good stability versus time and target of the AMBER closure-phase in MedRes_K. Therefore this mode provides useful closure-phases with the offered sequence SCI-CAL.
- Achievable accuracy on bright stars with FINITO working well is around $\pm$1deg for the standard, offered sequence of 5 files on SCI and CAL.
- Better accuracy is achievable by integrating more. We were able to reach $\pm$0.5deg, without being able to prove that this would be the fundamental floor.
- `amdlib` is apparently providing conservative error bars for this data set. However, we cannot conclude if this is a systematic effect of if this is related to the good observing conditions. Therefore we encourage to use the dispersion among consecutive files (or group of files) to estimate the uncertainty. This pushes for the use of CAL-SCI-CAL sequences as default.
- **Further studies should be done to explore the accuracy and stability of: a) the differential-closure-phase, b) the differential-phase, and c) the differential-visibility.**

Note: The demonstrated accuracy of 0.5deg corresponds to the detection (3 sigma) of a 10^{-2} companion at 10mas of a bright unresolved star, considering the baseline A0-K0-G1 and the best geometrical projection case.

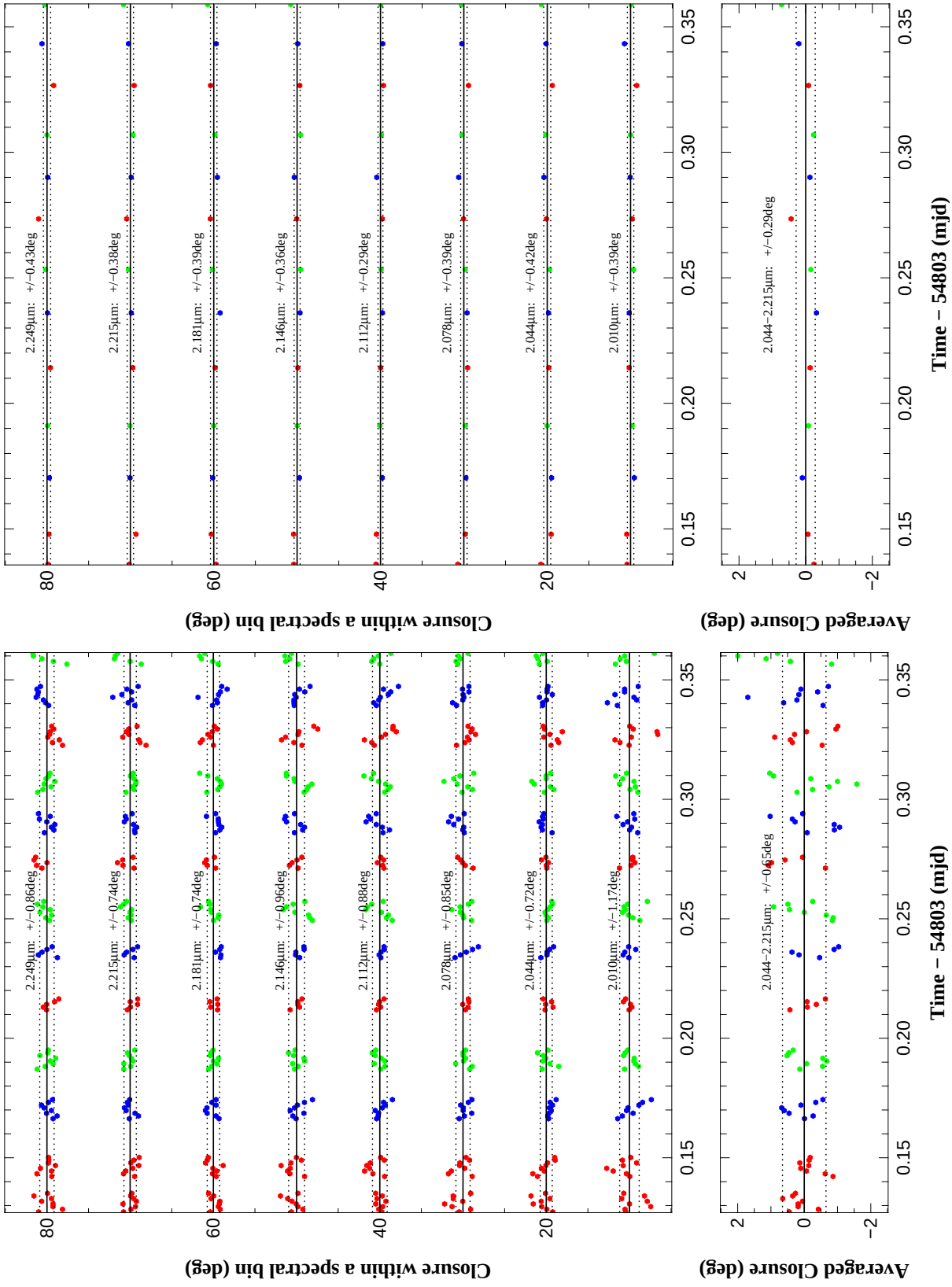

Figure 1*: Closure-phase versus time for 8 spectral bins and 1 average band. Colors are for stars. The average and RMS over the night is plotted as solid and dotted lines. Left/bottom shows individually all files of the night. Right/top shows the results form opening all consecutive files on the same star with* `amdlib`.

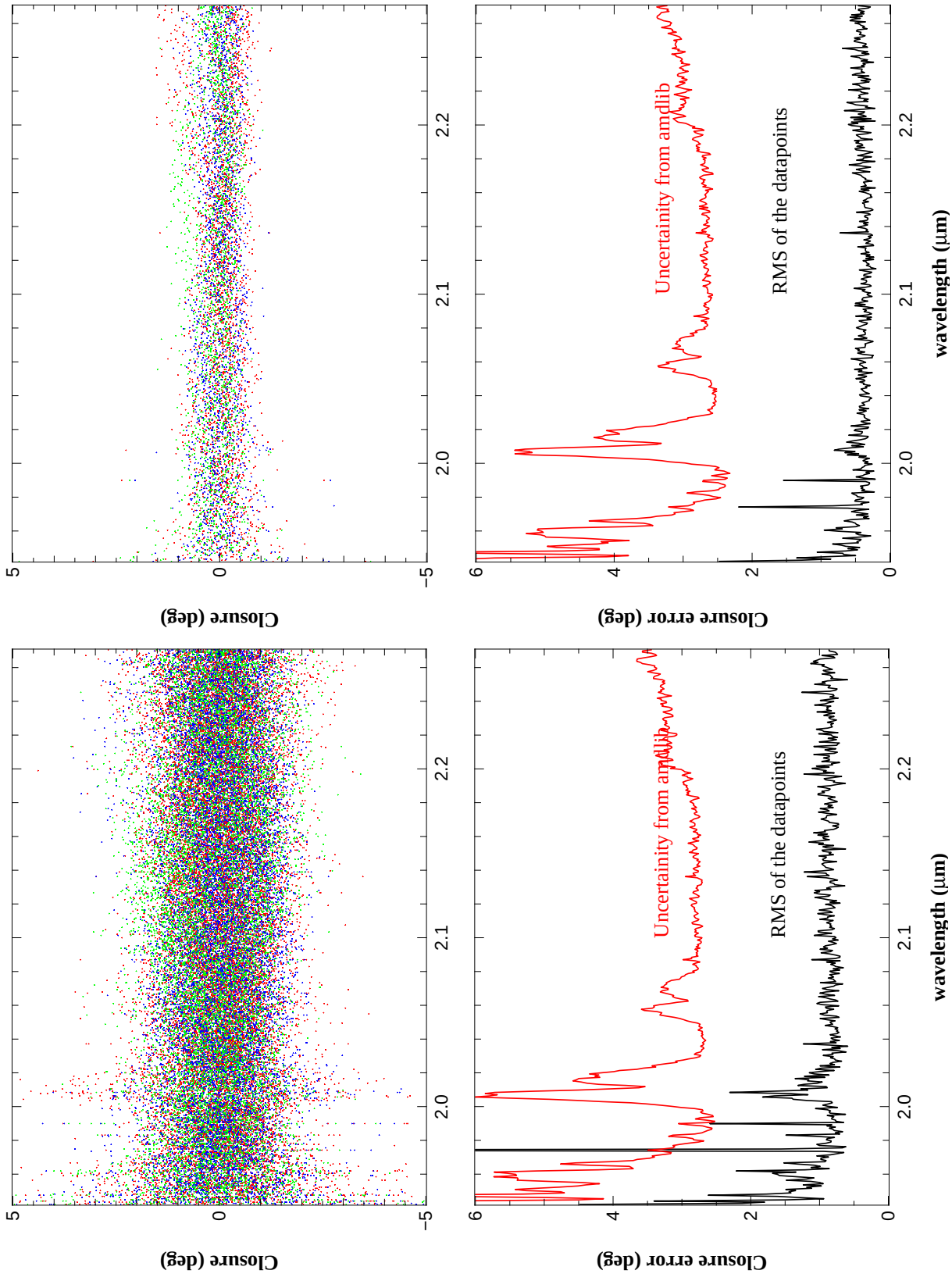

Figure 2*: Closure-phase versus lambda, RMS over the night and uncertainty estimated by* `amdlib`*. Colors are for stars. Left/bottom shows individually all files of the night. Right/top shows the results form opening all consecutive files on the same star with* `amdlib`*.*