

VLTI Memo

Memo Number: ???

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Copy to :
Date : 06-06-2009
Version : 0.1

Subject : **Using a single fiber for AMBER RAS/CAU**

Presents :

Scope of this memo

The goal of this memo is to present the tests made in June 2009 in order to explore the possibility of using a unique J,H,K fiber for the AMBER CAU. This work was triggered by the recommendations of the ATF run report from February 2008 (VLT-TRE-AMB-15830-7120, v.1.2): *We recommend to remove the CAU dichroic and to use only one fiber as the one for the CAU bypassing the 2 dichroics of the calibrations sources (RAS and CAU).* The triggers for such proposition can be found in Section F1 of the ATF report:

1. The difficulty to keep the AMBER J/H/K band aligned together comes from the use of different sources in the CAU for J/H and K bands.
2. The CAU-dichroics is the origin of the flux oscillation seen in Medium_K.
3. Using the K-band fibers only allows a proper illumination of the J/H/K bands. If the CAU-dichroic is replaced by a mirror, then the flux in all bands are sufficiently balanced with a suitable transmission and P2VM could be performed (Here the hypothesis is probably that the bad-looking P2VM in J and H bands originate from the CAU-dichroic, in used in reflection at the time of the ATF tests).
4. Even if the core of the K band fiber can be resolved by the AMBER setup in the J and H bands, this effect is properly taken into account by the calibration procedure of the P2VM.

Experience of Paranal operation confirm point 1). The work presented in this memo confirms point 2). However this work partially refutes point 3) and completely refutes point 4).

The different explored setup are summarized in Section and in Figure 1. Resulting P2VM are displayed in Figures at the end of the memo.

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Conclusions

- Comparing Fig. 6 and Fig. 7, we confirm that RAS-dic is indeed responsible for the flux oscillation across K-band.
- Looking at Fig. 3, we conclude that Setup A cannot be used in operation, as already reported by ATF.
- Comparing Fig. 3 and Fig. 4, we confirm that CAU-dic is responsible for some weird absorption bands seen by ATF in J and H. **However, CAU-dic is not responsible for the lost of contrast for $\lambda < 1.9\mu\text{m}$.**
- Looking at Fig. 8 (flux rise and contrast drop) we strongly suspect that the K-band fiber has a single- to bi-mode transition at $\lambda = 1.9\mu\text{m}$. We conclude that Setup B cannot be used in operation because the effective contrast below this limit is very poor (and probably unstable).
- Looking at Fig. 5 we conclude that Setup C cannot be used in operation because of the strong silice cutoff of the J/H-fiber for $\lambda > 2.1\mu\text{m}$.

Recommendations

- The tests have been intensive enough and made in the sufficiently cleaned way to allow to conclude. Only strongest modification of the hardware could potentially allow to build a RAS/CAU with a unique fiber.
- The J/H band fiber is apparently single mode from 1.15 to $2.1\mu\text{m}$ (where it has a strong flux cutoff). It should be explored if a carefully selected fluoride fiber could cover the 1.15 to $2.55\mu\text{m}$ region. A cover of the region 1.2 (or even 1.25) to $2.5\mu\text{m}$ would also be acceptable since the beginning of the J-band is of very poor scientific quality.
- The use of LMA fibers (supposed to be single-mode and transmissive over a wide wavelength range) should be explored.
- Some preliminary test with the MARCEL source (K-band fiber and blackbody source) shows: a very little flux in H and J band, as well as reduced contrast in H and J band. Even if this solution can be better studied, it does not provide an obvious, simple solution.

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Performed tests

Before the tests, AMBER has been carefully checked to be properly aligned in J, H and K bands, both in OPD and injection. Setup 0 (current one) is to have a reference. Setup A (ATF-like) is to recover the ATF discoveries. Setup B and Setup C allow to bypass both the RAS-dichroic and the CAU-dichroic, as recommended by the ATF.

Setup 0 (current 2-fibers)

- RAS setup : HalogenRAS connected, RAS-dichroic to feed the J/H-fiber and the K-fiber
- CAU setup : normal (K-fiber on K-mount, J/H-fiber on J/H-mount and CAU-dichroic in place)
- Data : P2VM LowRes, P2VM Medium_K (perhaps P2VM Medium_H, to be checked)

Setup A (K-fiber only, ATF-like)

- RAS setup : HalogenExtern on K-fiber, HalogenRAS disconnected
- CAU setup : normal (K-fiber on K-mount, and CAU-dichroic in place)
- Data : P2VM LowRes, P2VM Medium_K, P2VM Medium_H
- **Results: cleaned transmission in K, weird transmission in J and K (CAU-dichroic effect), very poor contrast below $1.9\mu\text{m}$.**

Setup B (K-fiber only)

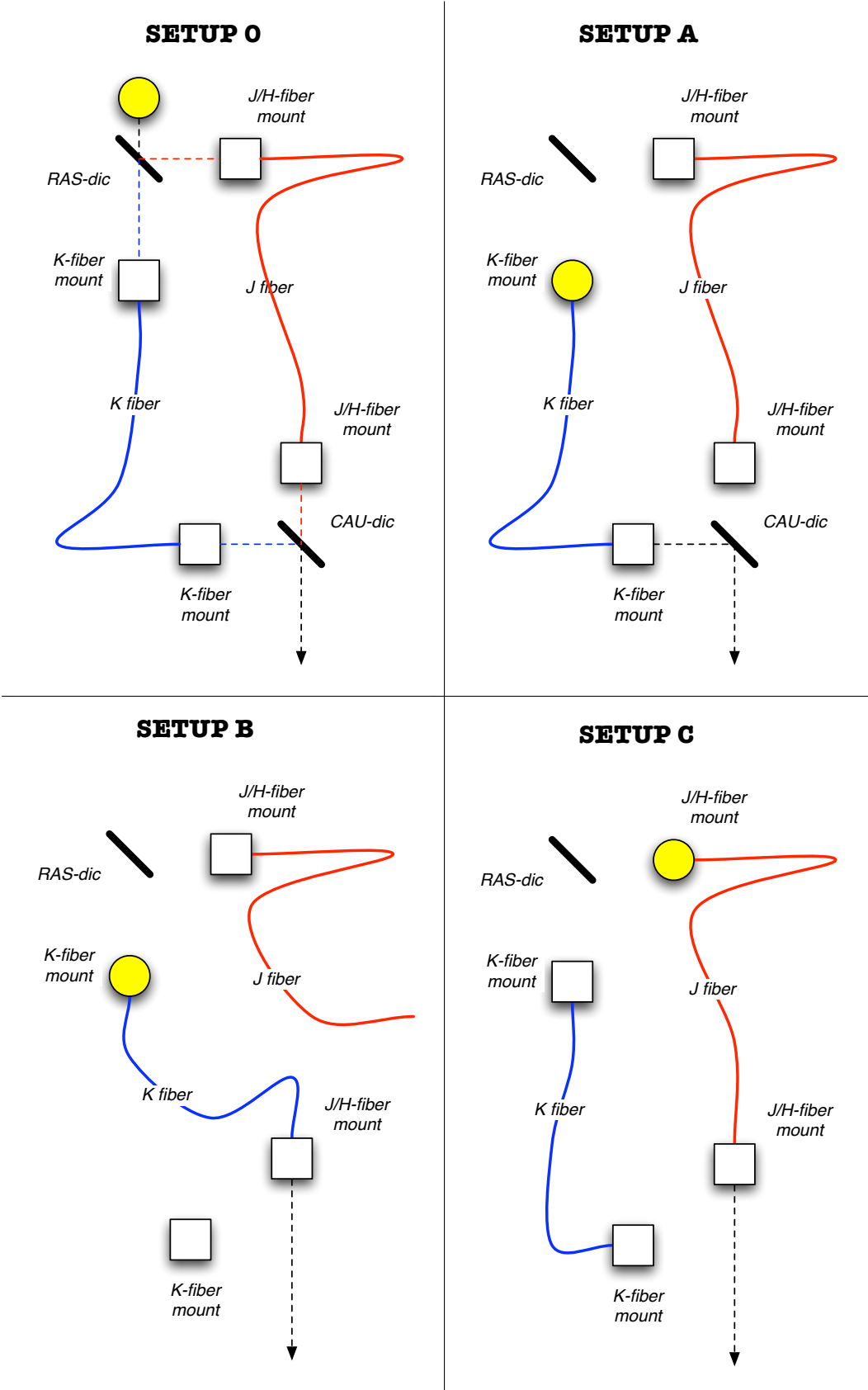
- RAS setup : HalogenExtern on K-fiber, HalogenRAS disconnected
- CAU setup : K-fiber connected in JH-mount, CAU-dichroic dismantled
- Data : P2VM LowRes
- **Results: cleaned transmission in K, very poor contrast below $1.9\mu\text{m}$. Looking at the drop in contrast and the increase in flux when passing below $1.9\mu\text{m}$, first suspicion is that the K-band fiber becomes multimode.**

Setup C (J/H-fiber only)

- RAS setup : HalogenExtern on JH-fiber, HalogenRAS disconnected
- CAU setup : JH-fiber connected in JH-mount, CAU-dichroic dismantled
- Data : P2VM LowRes
- **Results: no flux for $\lambda > 2.1\mu\text{m}$ (silice cutoff).**

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Figure 1: Conceptual drawing of the different RAS/CAU setup made. In each picture, the RAS is top of the fibers and the CAU is bellow.



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Figure 2: *SETUP 0 : J/H-fiber and K-fiber (current setup).*

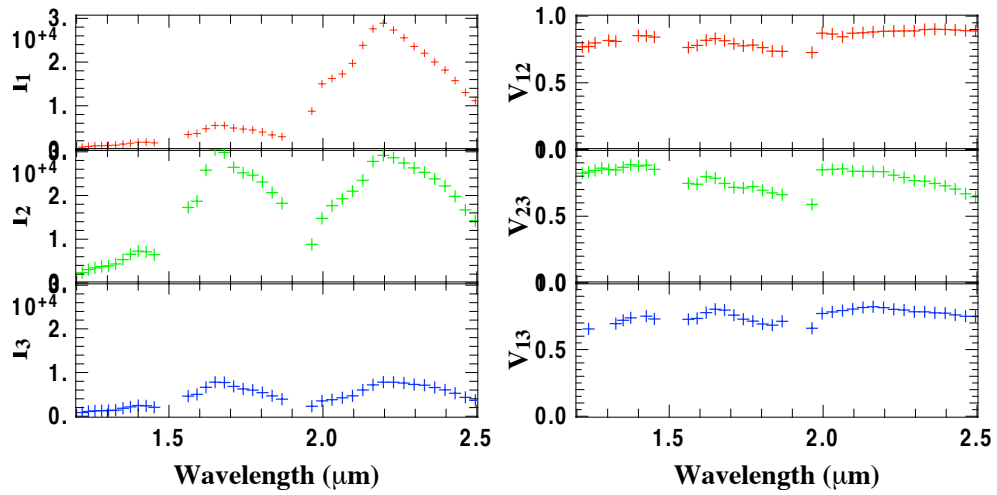


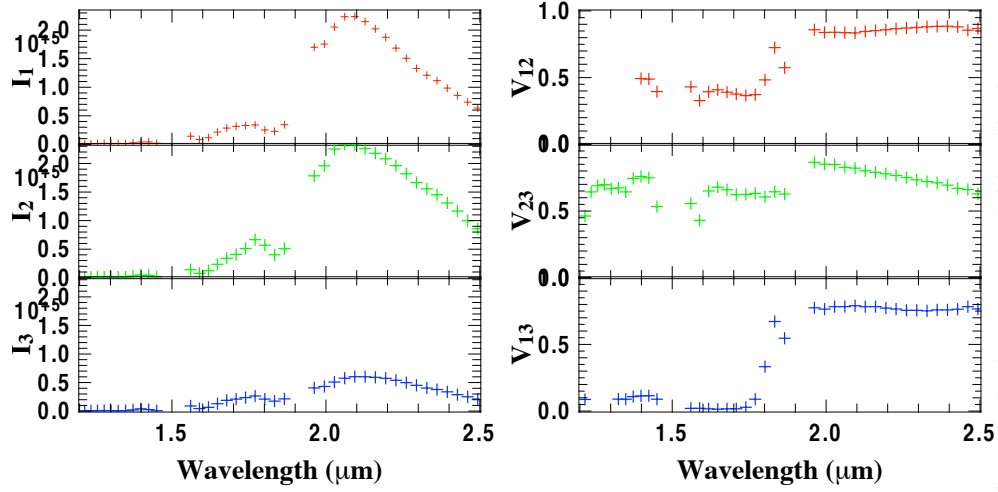
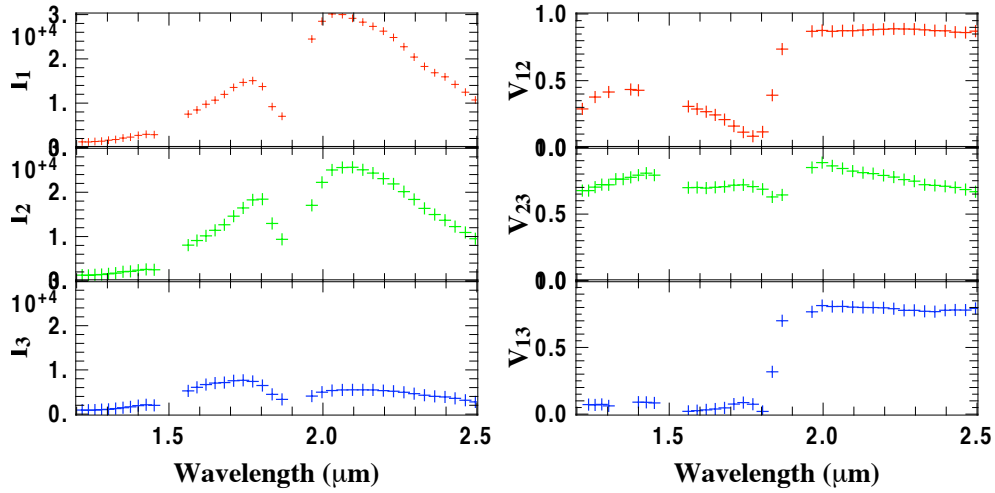
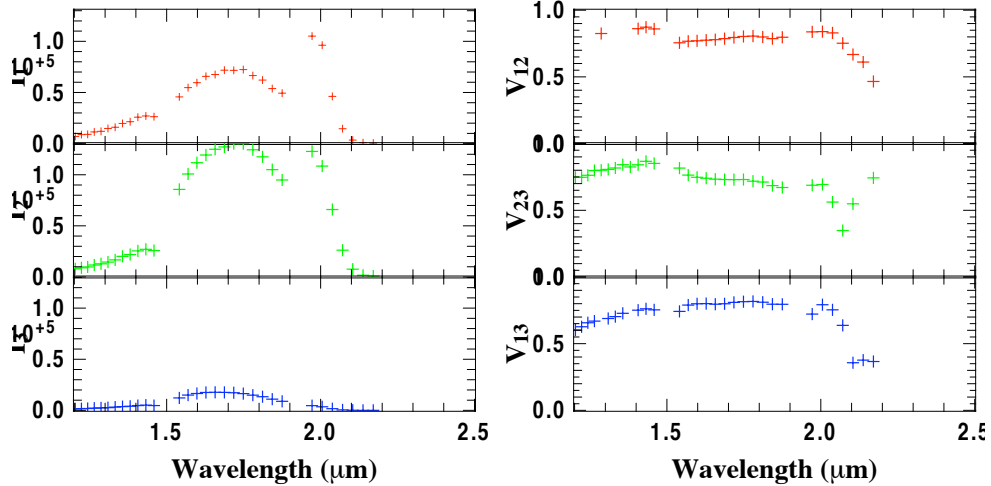
Figure 3: *SETUP A : K-fiber only, with CAU-dic in reflection (ATF like).*

 Figure 4: *SETUP B : K-fiber only, with CAU-dic bypassed.*

 Figure 5: *SETUP C : J/H-fiber only, with CAU-dic bypassed.*


Figure 6: *SETUP 0 : J/H-fiber and K-fiber (current setu).*

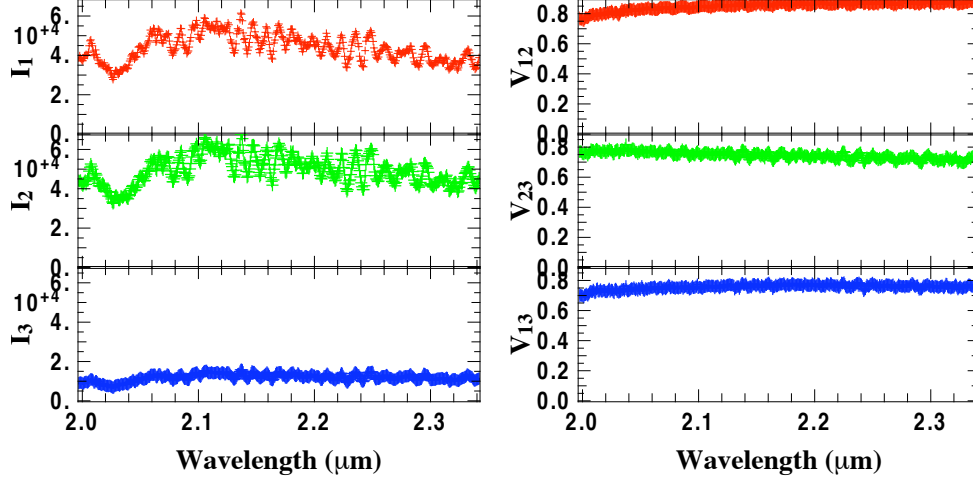


Figure 7: *SETUP A : K-fiber only, with CAU-dic in reflection (ATF like).*

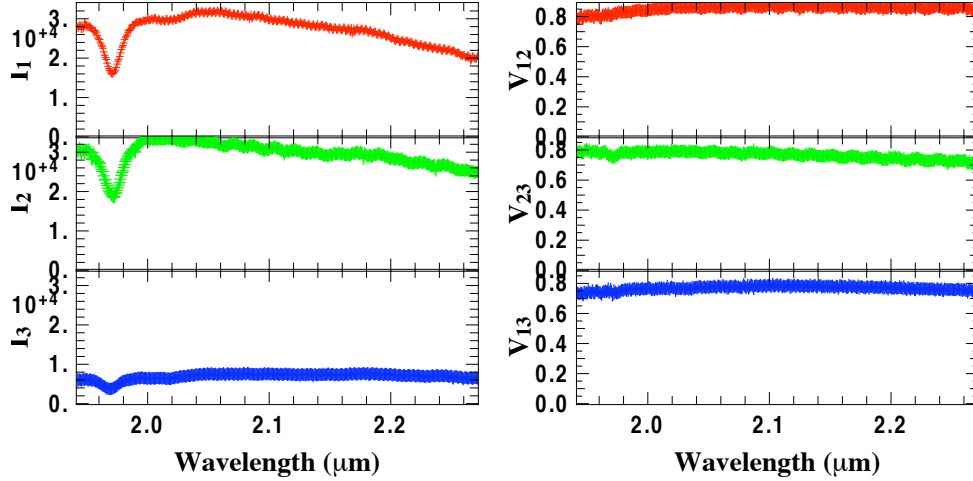


Figure 8: *SETUP A : K-fiber only, with CAU-dic in reflection (ATF like).*

