

# MEMO: The AMBER spectral shifts, in all modes

F. Millour<sup>a</sup>

<sup>a</sup>Max-Planck Institut Für Radioastronomie, Auf dem Hügel 69, 53121, Bonn, ALLEMAGNE

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## ABSTRACT

I investigate here the discrepancies seen between the shifts given in the ATF report and what is really used for the data reduction. I find that this discrepancy appear only in LR and HR, meaning that the shift is instrument-mode-dependent. Therefore, I propose a new table of shifts, that I introduced in the yorick interface to amdlib3, in order to get the fixed values from the ATF report, plus the ones presented in this memo, for the community.

**Keywords:** AMBER, VLTI, spectral shift, ATF report

## 1. INTRODUCTION

The ATF report (Malbet et al. 2008, astro-ph 0808.1315) has shown that the AMBER spectral shift, between the interferometric beam and the photometric beams, does not vary with time, except for when there is an intervention in the AMBER Dewar. These shifts can be found in the ATF report and on the AMBER website.

However, the tests made on observed data since this report show that the spectral shift effectively observed on the data can exhibit a large difference (up to 2 spectral pixels) compared to the values reported in the ATF report. Therefore, I investigated the effective value of this shift during the three periods identified in this report:

Date .....	Shifts as stated in the ATF report
• 2004 — Sept 2007 .....	0.873, 2.064, 0.472
• Sept 2007 — Feb 2008 .....	2.000, 2.576, -0.263
• Feb 2008 — present .....	3.008, 2.850, -1.319

This study is meant to set an usable table of spectral shifts for amdlib version 3, currently in development.

## 2. METHODOLOGY

In order to check for the spectral shifts, I used a self-made function called `amdlibChangeSpectralShift` in the `amdlibPipeline` script, which is freely available to anyone for verification.

This function load a raw data file together with its pixel bias map, and then display four panels. Three of them show the interferometric beam spectrum, over-plotted with beam, 1, 2, or 3. The last panel is made to change manually the spectral shift, using a GUI. On top of each plot, a  $\chi^2$  value, computed as

$$\chi^2 = \sum_j (I_j - P_j) / N_j$$

with  $I$  being the interferometric beam spectrum and  $P$  the photometric beam spectrum, and  $j$  the spectral channel index. After playing around with the GUI in order to minimize the  $\chi^2$ , the obtained spectral shift is written down together with the MJD, the date and the instrument mode. This procedure is repeated on several data-sets, randomly selected over the whole AMBER observing period, using the data I currently have (from 2004 up to 2008, I suppose the 2009 results will be the same as in 2008).

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Further author information: (Send correspondence to F.M.)  
F.M: E-mail: fmillour@mpifr.de, Telephone: +49 228 525 188

### 3. RESULT AND CONCLUSION

The resulting spectral shifts are shown in Table 1.

- First of all, it is important to note that this table unambiguously show that the spectral shift is instrument-mode dependent.
- The MR shifts seem to be in agreement with the ATF-reported ones, which means they can be used “as-is” in amdlib3 for MR data-sets. This seem in accordance with ATF shifts estimated with zero-order images of the slit using the MR grating. This may also mean that there is a slight change of the dispersion orientation relative to the detector orientation between the LR prism, the MR grating, and the HR grating.
- There seem to be more than three periods for the spectral shifts, which change by 1 spectral pixel in LR for example between MJD 53773 and MJD 53934. This has to be further investigated with more data at hand.

As a short conclusion, I strongly recommend using different pre-set spectral shifts for the different AMBER modes (LR, MR and HR), as shown in Table 2, which is what I implemented in the CVS version of the yorick interface of amdlib 3 as default values.

**Table 1.** Spectral shifts, as a function of instrument mode and observing period.

Date	MJD	LR			MR			HR		
2004-12-25	53365	3	3	1	1	2	0			
2005-02-25	53426				1.3	2.4	0.6	-1	1	0
2005-09-21	53635	2.6	3	0.9						
2006-02-07	53773	3	3	1						
2006-03-11	53805				1	2	0			
2006-07-18	53934	2	3	-						
2007-03-07	54166	1.5	2.7	1						
2007-08-08	54320	2	3	1						
2007-08-30	54342				1	2	0			
2007-09-07	54350	2	3	1						
2007-10-04	54377	4	3	1						
2007-10-13	54386	3.4	3.4	-0.2				-1	1	0
2008-01-06	54471	3.5	3.3	0.2						
2008-02-28	54525							1	2	-2
2008-10-14	54753	4	4	-1	3	3	-1			
2008-12-21	54821							0	2	-2
2008-12-23	54823	4	4	-1						

**Table 2.** Recommended spectral shifts to be used as a function of instrument mode and period.

MJD period	LR			MR			HR		
53360 — 54352	3	3	1	ATF values			-1	1	0
54352 — 54525	4	3	1	ATF values			1	2	-2
54525 — today	4	4	-1	ATF values			0	2	-2