Wavelength accuracy of ISOCAM's CVFs

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ABSTRACT

This is a preliminary report on the absolute wavelength calibration of ISOCAM's Long Wave Circular Variable Filter.

1. The experiment

We have used CVF data obtained on the HII region M16. This HII region is quite extended – it is clearly visible by all pixels in ISOCAM's LW detector. Besides, the [Ne III] line at 15.55 μm is strong enough to afford a gaussian fit over all pixels.

The data was obtained using a single descending wavelength scan of the CVF element, i.e. longer wavelengths observed first.

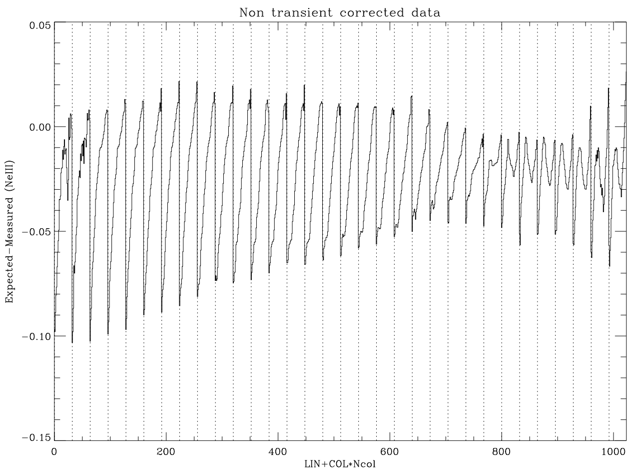

Figure 1. Wavelength shift over the detector determined from a gaussian fit to the [Ne III] for each of the 32×32 pixels of the detector. The shift is expressed in microns, as the expected NeIII wavelength minus the measured wavelength. The X–axis represents the ordinal number of the pixel; the dashed lines represent detector lines 1, 2, etc. Here and in the next Figure, we plot the median value of the shift using a three element box (.i.e. the median value of three consecutive detector lines).

We have then fitted a gaussian to the [Ne III] line for each of the 1024 pixels of the camera. Fit free parameters are the line's wavelength, strength, and width. Also a straight line was fitted representing the baseline.

We have used two variants of the M16 data set:

1. A data set with no transient corrections, and
2. the same data transient corrected (as described by Abergel and Coulais).

Figure 1 summarizes the results of the gaussian fit applied to the non transient corrected data set.

The quantity plotted is

$$Shift = TheoreticalWaveLength - MeasuredWaveLength$$

The idea is to correct the observed wavelength by adding $Shift$ to the observed wavelength.

The most striking feature of the fit experiment is that we find that there is a continous shift in wavelength within a detector line, i.e. across detector columns. The shift is quite regular from lines 3 to 20; outside these lines it behaves in a seemingly caotical way. In fact there is a turn over point were the shift ceases to increase, diminishes in amplitude and then there is a second turn over point were the shift continues to increase.

Figure 2 is like Figure 1 except that we have used the transient corrected data set.

The second striking feature visible in Fig. 2 stems from the application of the transient correction to the data set: whereas the measured wavelength is almost always larger than the expected [Ne III] wavelength for the non corrected data set, the measured values are even larger (i.e. a more negative shift) for the corrected data set.

We believe that the reason is that the observation was performed scanning down in wavelength. The correction algorithm corrects the lag in response of the detector output and thus produces a data set were the full intensity of the [Ne III] line occurs earlier in time and thus assigns a *larger* wavelength to the ionic line.

In order to check this hypothesis, the same experiment should be done on CVF observations that have

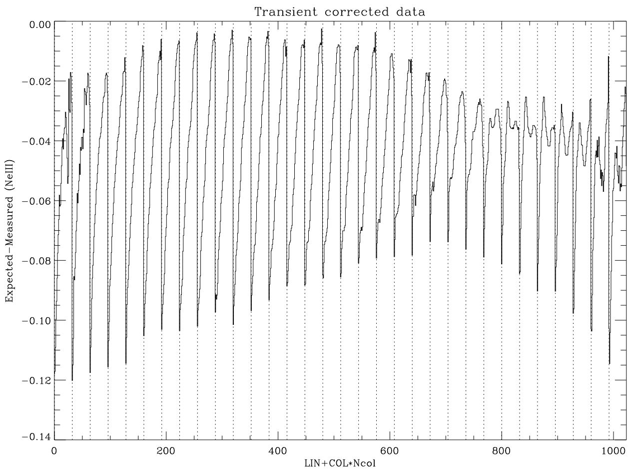

Figure 2. As Figure 1 but based on the transient corrected data set.

been scanned back and forth, and that show strong ion emission lines. Unfortunately, my own M17 data is not amenable for this purpose: the emission is too strong and clumpy for the Fouks–Schubert corrector to succeed.

The M17 data can be used, however, to demonstrate the lag between sky signal and detector response as speculated above. Figures 3 and 4 show the up–going and the down–coming legs of the M17 full CVF scan.

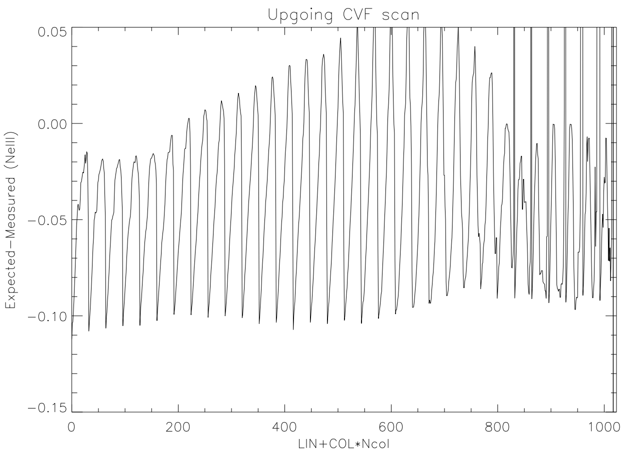

Figure 3. Up going wavelength observation of M17.

For the up going scan, the detector "sees" the Ne III line later, i.e. a *higher* wavelength indication; hence the observed wavelength is larger than the expected one and the error is more negative than for the down coming scan.

Comparison of figures 1 and 4 (both down coming observations of M16 and M17 respectively) reveal a rather unclear behaviour: whereas the wavelength shift is quite comparable for the first 400 pixels (all columns from lines 0 to 13), the shift tends to be-

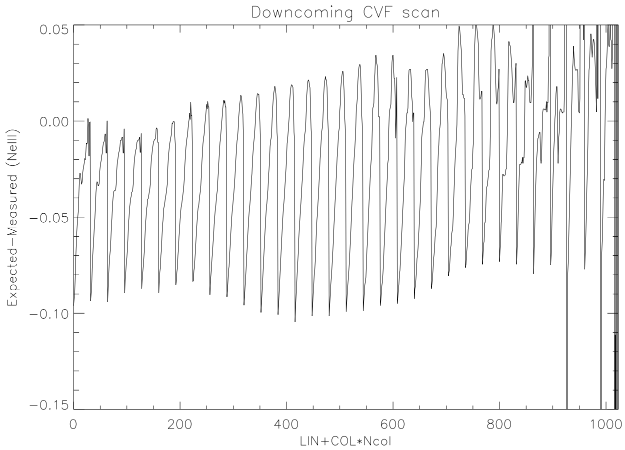

Figure 4. Down going wavelength observation of M17.

come smaller for M16 but continues to grow for M17. Clearly this behaviour has to be understood before devising a wavelength correcting algorithm.