

GOME WAVELENGTH CALIBRATION LAMP DEGRADATION ANALYSIS

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ABSTRACT

The GOME instrument (a spectrometer with a wavelength range 240 nm - 790 nm) contains a hollow cathode gas discharge lamp for in orbit wavelength calibration. The lamp is filled with Neon, and for the cathode a Platinum with 10% Chromium alloy is used. The intensities of selected emission lines in channel III were analysed over instrument life time to study a degradation of the wavelength calibration lamp of GOME.

1. DATA ANALYSED

Out of all lamp calibration measurements (~7000 products) that were performed during a monthly calibration sequence (4-5 Orbits), following information was extracted:
channel III lamp lines at 427.6 nm (pixels 152 - 158), 437.25 nm (pix. 198 - 203), 460.2 nm (pix. 307 - 313); lamp voltage, lamp current, calibration unit temperature, predisperser prism temperature;

used sequences: Nov95, Apr96, Aug96, Jan97, Jun97, Oct97, Dec97, Feb98, Jun98

The analysis was restricted on the three lines for which DLR, Oberpfaffenhofen, pointed out a possible degradation.

All three investigated lamp lines are Cr emission lines (Ref.1)

2. ANALYSIS OF DIFFERENT METHODS

- Assume that the value of the max pixel (e.g. 155, 200, 310) of each line represents the line intensity. problem: empirical tests showed that this assumption is not valid
- use a gauss fit for the pixel readouts (6 to 7 are sufficient) that are representing each line position and calculate the intensity as the gauss integral; problem: the gauss fit lowers the actual maximum line intensity (see Fig. 1)
- use a parabolic fit for the three max pixel, representing one line (e.g. 154-156, 200-202, 309-311); line intensity = maximum of the parable (see Fig. 2)

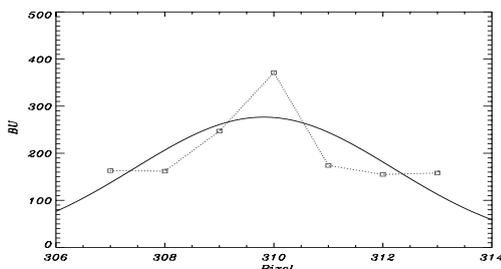


Figure 1. Gauss Fit (solid line) compared to measurements (dotted line)

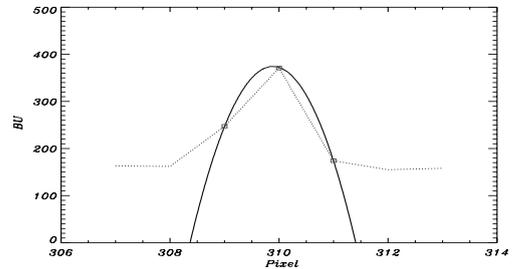


Figure 2. Parabolic Fit (solid line) compared to measurements (dotted line)

3. METHOD USED - PARABOLIC FIT

- Dark Current Correction: the raw data are corrected with respect to their time dependent leakage current signal
- Data Filtering: The complete set of about 7000 products (monthly calibration lamp measurements) was reduced for the start up period of the calibration lamp, where the voltage is still unstable as well as the lamp line intensities. See Figures 3 and 4.
Products above the South Atlantic Anomaly area (big standard deviation for line intensities) were discarded as well.
- The Mean Value over the remaining products (~4000 prods.) represents the intensity for a selected lamp line of one calibration day
- Trend Analysis over the data sets Nov95, Apr96, Aug96, Jan97, Jun97, Oct97, Dec97, Feb98, Jun98 (see Fig. 3) using a linefit

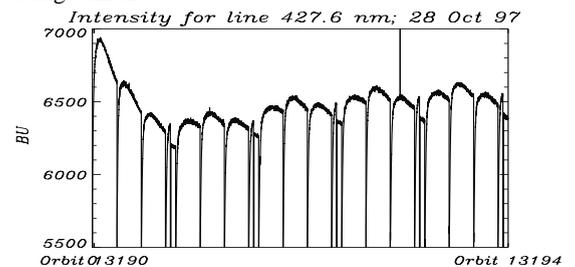


Figure 3. intensity (line 427.6 nm) of all products in monthly calibration mode of 5 orbits 28/10/1997, no data filtering

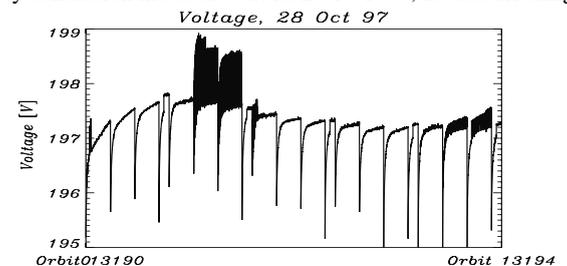


Figure 4. voltage of all products in monthly calibration mode of 5 orbits 28/10/1997, no data filtering

4. RESULT

The result is shown in Fig. 5. Within about 3.5 years the intensities degrade as follows:

line positions	decrease
427.6 nm	-2.47%
437.25 nm	-4.17%
460.2 nm	-0.07%

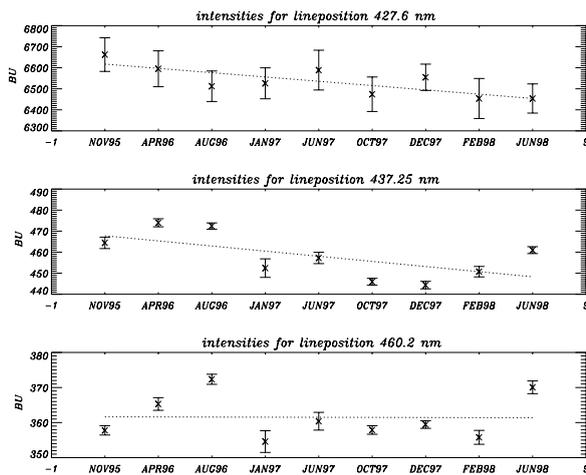


Figure 5. Trend analysis for line positions Nov. 95 - June 98

5. CONCLUSION

The line at position 427.25 nm decreases from November 95 to June 98 by ~2.5%. The lamp line at 437.25 nm decreases by ~4.2%. The lamp line at 460.2 nm remains approximately stable.

No significant degradation for the investigated GOME calibration lamp line intensities was found.

6. FURTHER ACTIONS

Investigate more line positions in other channels.

REFERENCES

1. Vol. 29, No 19, 1990, *Applied Optics*