Southern African Large Telescope

Title: **SALT Atmospheric Dispersion Compensator: check the result of its work**

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ABSTRACT

In this report I present results of study the work of SALT Atmospheric Dispersion Compensator (ADC). My results certainly prove that SALT ADC works in the way it was designed for.

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1 Introduction

It is well known, that when light passing through the atmosphere it gets dispersed, similar to the light passing through a glass prism. The magnitude of dispersion depends on the zenith distance. This effect has name "Atmospheric Dispersion" and plays important role in the long-slit spectroscopy, since atmospheric dispersion results to the lose of some amount of red and/or blue part of obtained spectrum. To exclude this effect for spectral observations SALT has Atmospheric Dispersion Compensator (ADC hereafter), which was installed very soon after SALT starts to work.

I have studied result of SALT ADC work and prove that it really works in the way it was designed for.

2 Method

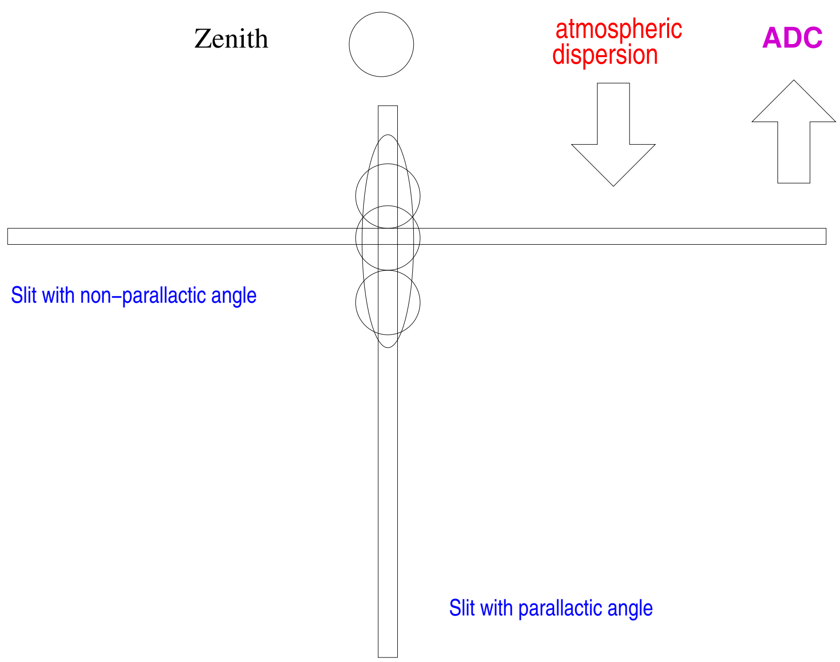

Figure 1: The basic diagram of my test.

Figure 1 shows the basic diagram of my test. The stellar image, which is located at the zenith (zenith distance 0) looks round. The stellar image, which is located not at the zenith (zenith distance > 0) gets dispersed and starts to be elongated. Dispersed image consist of amount of monochromatic images and looks like a spectrum, which consist of blue, middle and red parts. When ADC works, it compensates the atmospheric dispersion effect and all stellar images looks round at any zenith distances.

From this point of view, I planed to test different situations:

- Case A, **ADC is located IN the beam**:

- – if (1) ADC **works** properly and (2) I will take two long-slit spectra of the same source – one in the parallactic angle and another one in the perpendicular direction to the parallactic angle (parallactic+90 hereafter) – I **will not see any** difference in obtained spectral distributions.
- – Otherwise, if (1) ADC **does not work** and (3) I will take two long-slit spectra for the same source in two different angles – I **will see** the difference in obtained spectral distributions, because spectrum taken in the parallactic+90 angle will lose some parts of energy in red and/or blue ends.

- Case B, **ADC is out OUT the beam**:
  - – Since (1) ADC **does not work** and (3) I will take two long-slit spectra in the two different angles; I **will see** the difference in their spectral distributions.

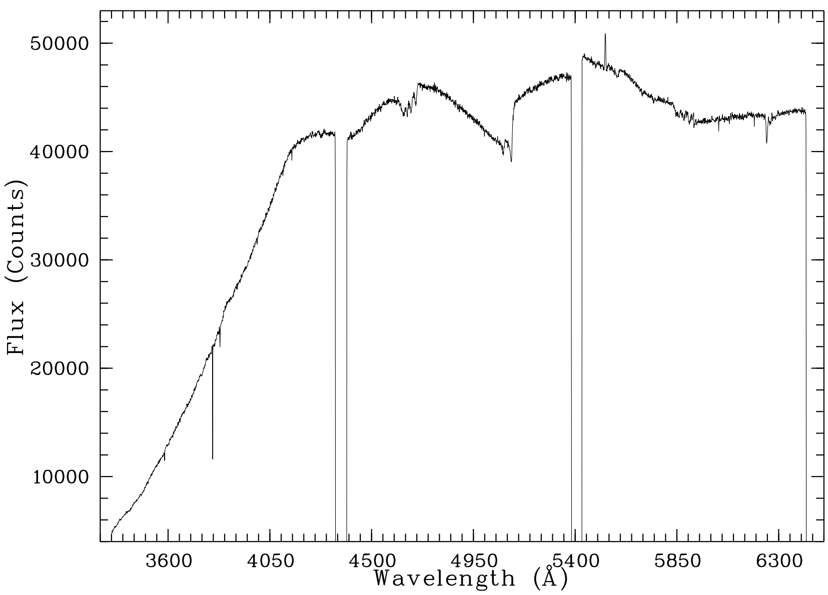

Figure 2: The observed energy distribution of the spectrophotometric standard LTT 4364 in the parallactic angle, when ADC was IN.

3 Observations

Since the atmospheric dispersion effect works stronger in the blue compare to the red (Filippenko, 1982), I have selected blue spectral configuration with grating GR900, AA=25.75 and GA=12.875, which covers spectral region 3350–6450 Å. To obrain more signal in the blue, I have selected spectrophotometric standard LTT 4364 since most of the spectrophotometric standards are white dwafs or blue stars. Observations were done with nice weather conditions, but for the each position angle (parallactic and parallactic+90) observations were repeated with 1, 2 and 4 arcsec slit width. Observations were done during two consecutive nights, where ADC was IN the beam during the first night and was removed OUT during the second one.

The primary reduction was done by SALT pipeline (Crawford et al., 2010), after that all data were wavelength calibrated and subtracted to 1d. Finally, we were need to see just the difference in the energy distribution.

4 Results

Figure 2 shows observed energy distribution of the spectrophotometric standard LTT 4364 in the parallactic angle, when ADC was IN.

Figure 3 shows the ratio between energy distributions of LTT 4364 obtained in parallactic+90 and parallactic angles, when ADC was IN. In this case energy distribution taken in the parallactic+90 angle starts to lose energy starting from 4500 Å to the blue direction and lost maximum about 4%.

Figure 4 shows the ratio between energy distributions taken in parallactic+90 and parallactic angles, when ADC was OUT. In this case the difference is tremendous, where the energy distribution taken in the parallactic+90 angle loses energy everywhere starting from 6500 Å and lost up to 90% at the bluest end. It is vey interesting to point out here, that slit view images were done with SDSS-r filter of SALTICAM. This results to the situation, where observations in parallactic+90 and parallactic angles show equal ratio at about 6500 Å only, since this is very close to the effective wavelength for the SDSS-r filter!

5 Conclusions

In this report I have studied result of SALT ADC work and prove that it really works in the way it was designed for:

- I practically do not see ANY difference in the energy distributions for the same standard star observed in the parallactic and parallactic+90 degrees, when ADC was IN the beam.
- The difference for the same type of observations is tremendous, when ADC was OUT of the beam.

References

Crawford S. M. et al., 2010, in Silva D. R., Peck A. B., Soifer B. T., Proc. SPIE Conf. Ser. Vol. 7737, Observatory Operations: Strategies, Processes, and Systems III. SPIE, Bellingham, p. 773725

Filippenko A., 1982, PASP, 94, 715

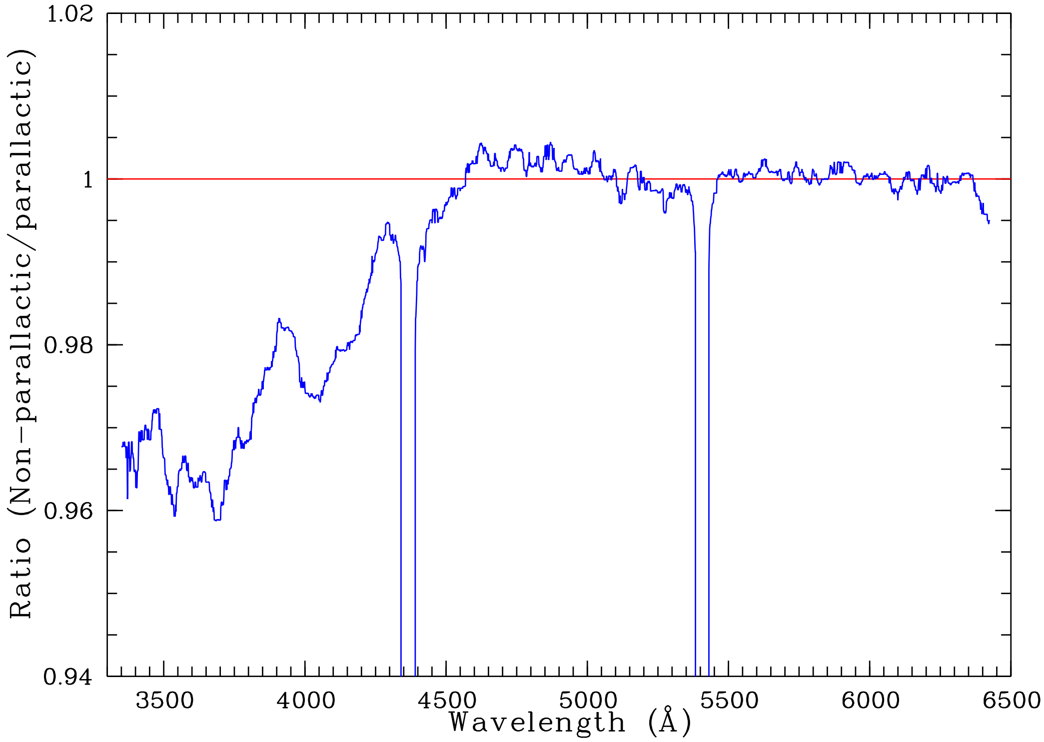

Figure 3: The ratio between energy distributions taken in parallactic+90 and parallactic angles, when ADC was IN.

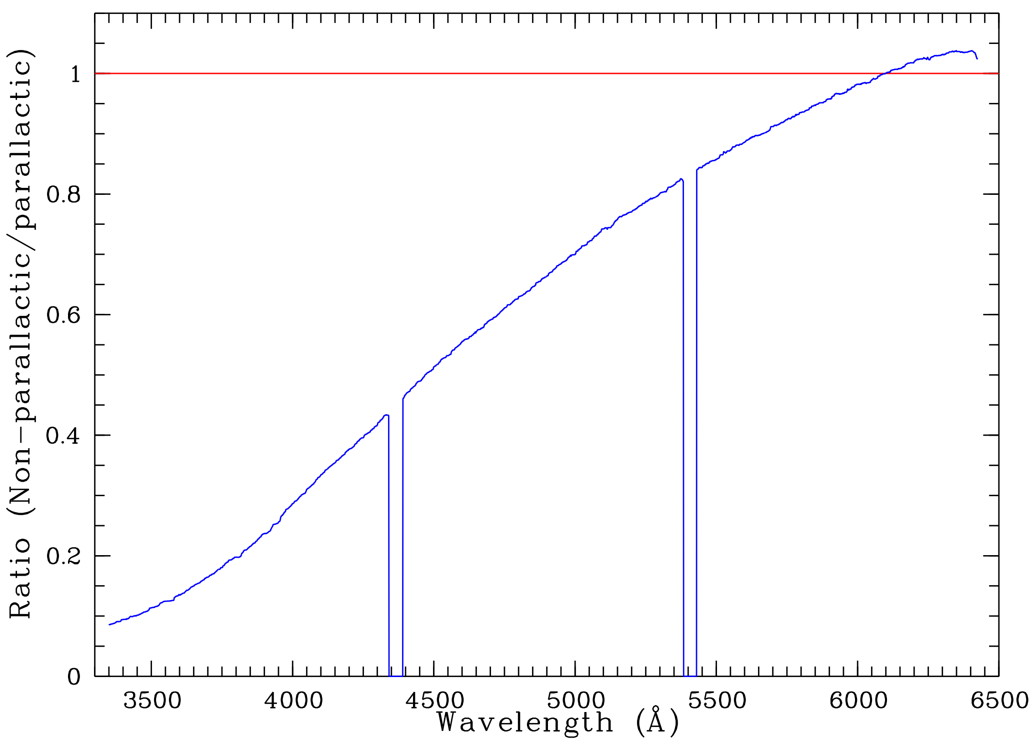

Figure 4: The ratio between energy distributions taken in parallactic+90 and parallactic angles, when ADC was OUT.