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The Replacement of the Shaft Couplers in Las Campanas in 2008 March

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2008 April 23

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The Replacement of the Shaft Couplers in Las Campanas in 2008 March

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Abstract

All shaft couplers were replaced. The front filter mounts on both instruments were replaced and the alignment checked.

Contents

1 Introduction

Steven Hale visited Las Campanas from 2008 March 17 to 28. The main goal for the trip was to replace all the shaft couplers on the mount. The coupler on the RA axis was consistently coming loose and slipping, causing very poor guiding performance. It was decided that it was best to replace all the couplers rather than just the one causing the problem, and so hopefully eliminate similar problems occuring in future.

2 Loose Shaft Couplers

The coupler on the output shaft from the gearbox on the RA axis was slipping, and resulting in the mount being unable to guide properly. After several failed attempts by the on-site staff at Las Campanas to tighten the coupler, it was decided that a replacement was required.

As a precautionary measure, all seven shaft couplers were replaced on this trip. The new style coupler grips the shaft all the way around rather than relying on one single grub-screw to bite into the shaft, and so should be more reliable.

3 Autoguider Gain

With the loose shaft couplers replaced, the autoguider now has greater authority over the mount. The guider started to oscillate in RA, suggesting that the gain was too high.

On the front panel of the autoguider there are two digital controls, one for each axis, controlling the gain from zero to nine. Zero is minimum gain, and nine is maximum gain. The initial setting was 55, producing medium gain for both axes.

Generally when setting the gain of a servo system the procedure is to turn the gain up until the system oscillates, and then back it off a little. This gives the highest gain possible to reduce drift, whilst not inducing oscillation. In order to eliminate oscillation on the RA axis the gain had to be near minimum. A full day of data was collected with the gain set to three on 2008 March 22.

There is a school of thought that suggests that turning the gain up high and accepting any oscillation produces better guider performance. To test this, another full day of data was collected with the gain set to nine on 2008 March 23.

Comparing the two days, there does not appear to be much difference. It was decided to leave the gain set to five for both axes.

4 Alignment Scans

The front filter mount of both spectrometers were changed on March 19. On a previous trip they had been updated with a prototype tilted red-filter, and these have now been replaced with the final design. Although in theory it should be a like-for-like swap, it is likely that slight differences in the angle of the filters or the position of the lens will have caused the spectrometer alignment to change.

Two autoguider scans were performed on March 20 in order to check the alignment of the mount. The results of the right-ascension scan are shown in Figures 1 and 2. It looks like Hannibal is centered when the right-ascension micrometer is set to 4.25 mm and Ivan is centered at 3.25 mm. A compromise of 4.0 mm seems to be the best, slightly favouring Hannibal the primary instrument. The initial setting was in fact 4.0 mm and so no improvement was made here.

The results of the declination scan are shown in Figures 3 and 4. It looks like Hannibal wants the declination micrometer set to 2.5 mm while Ivan wants 1.5 mm. The best compromise here seems to be a setting of 2.0 mm. The initial setting was 2.25 mm and so a slight improvement was made.

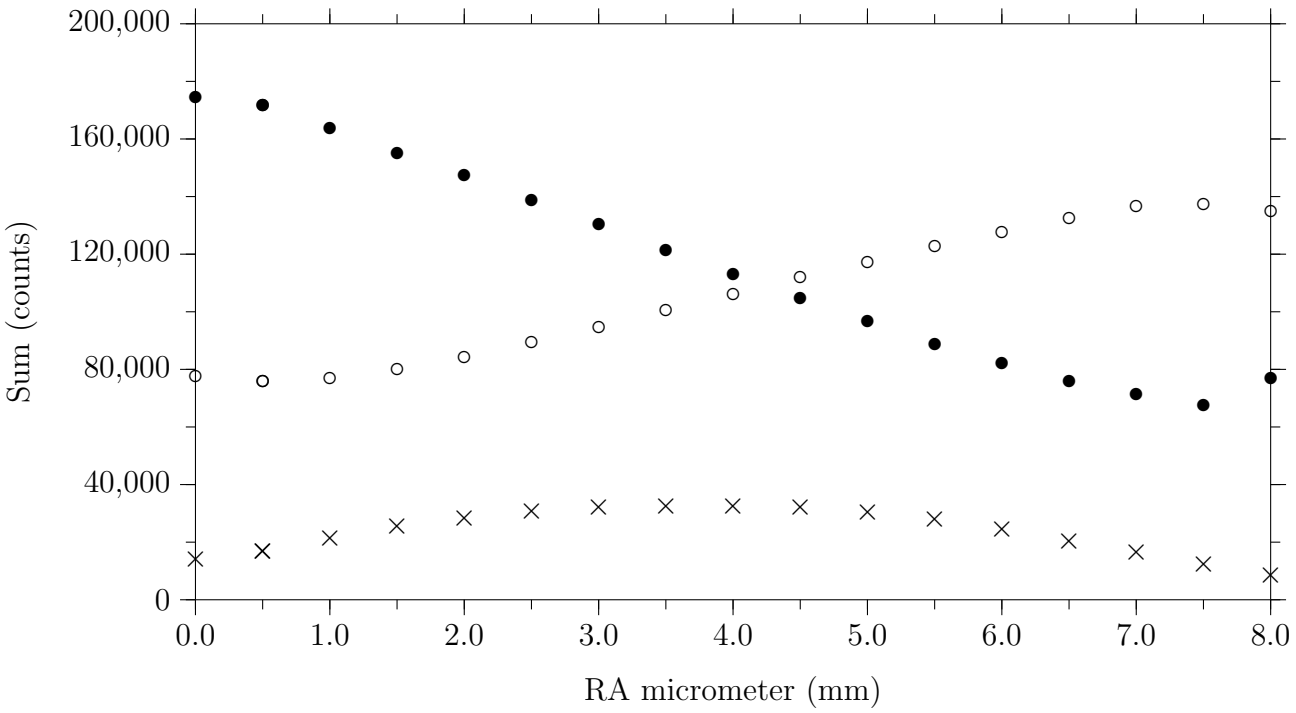

Figure 1: RA scan (Hannibal) - The guider was scanned right ascension. The plot shows how the starboard sum (•), port sum (○), and the transmission monitor (×) varied. This scan was done with the declination micrometer set at 2.25 mm and the cell hot.

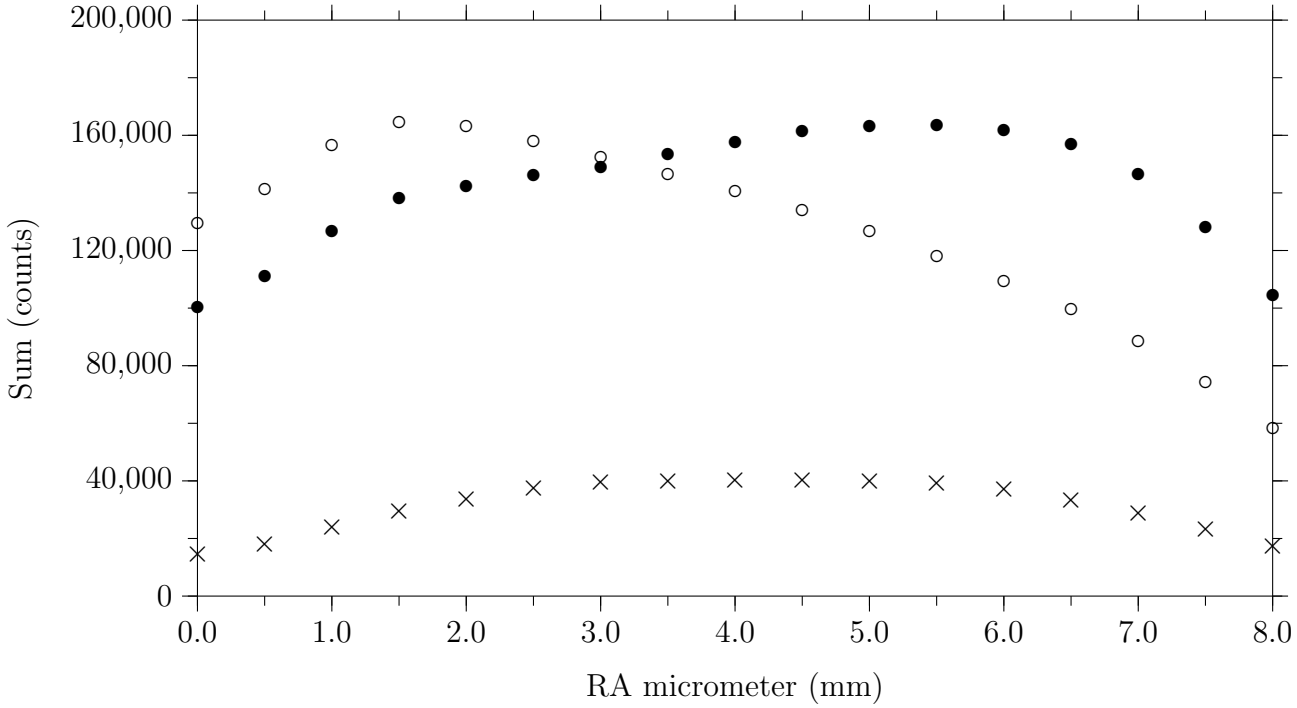

Figure 2: RA scan (Ivan) - The guider was scanned right ascension. The plot shows how the starboard sum (•), port sum (○), and the transmission monitor (×) varied. The transmission monitor data have been divided by ten. This scan was done with the declination micrometer set at 2.25 mm and the cell hot.

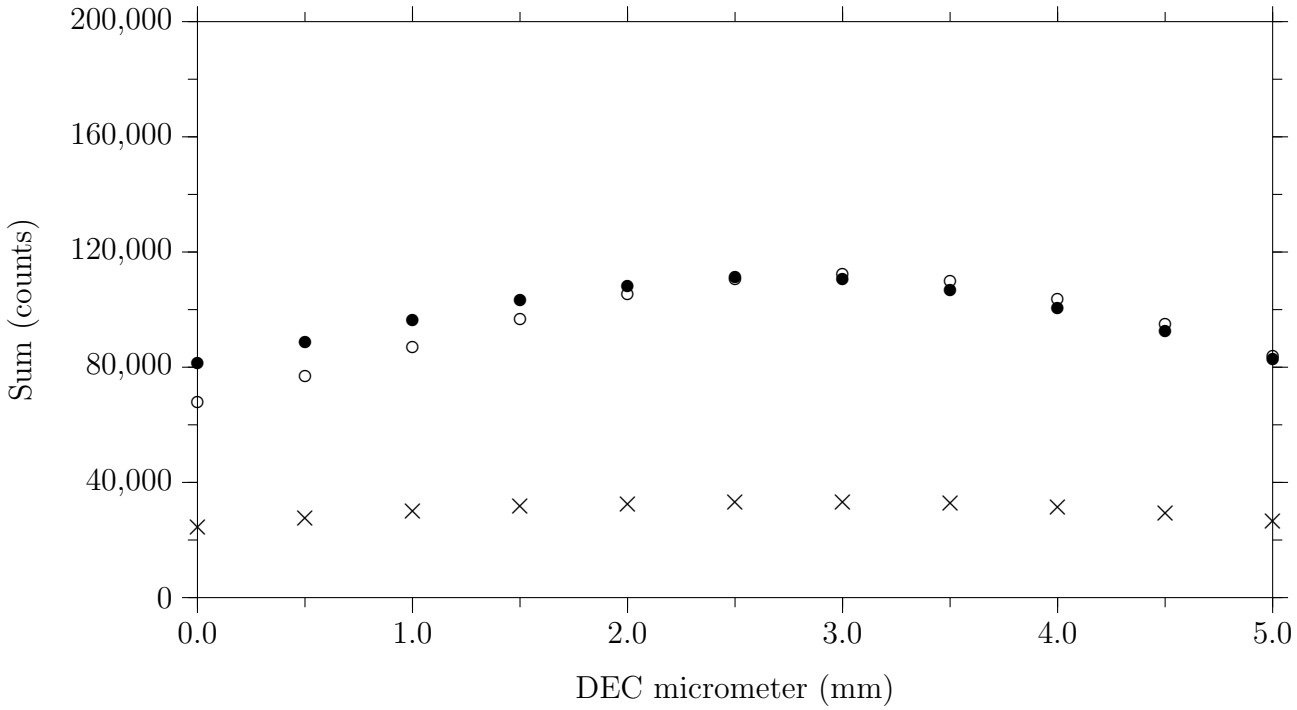

Figure 3: DEC scan (Hannibal) - The guider was scanned declination. The plot shows how the starboard sum (•), port sum (○), and the transmission monitor (×) varied. This scan was done with the right ascension micrometer set at 4.0 mm and the cell hot.

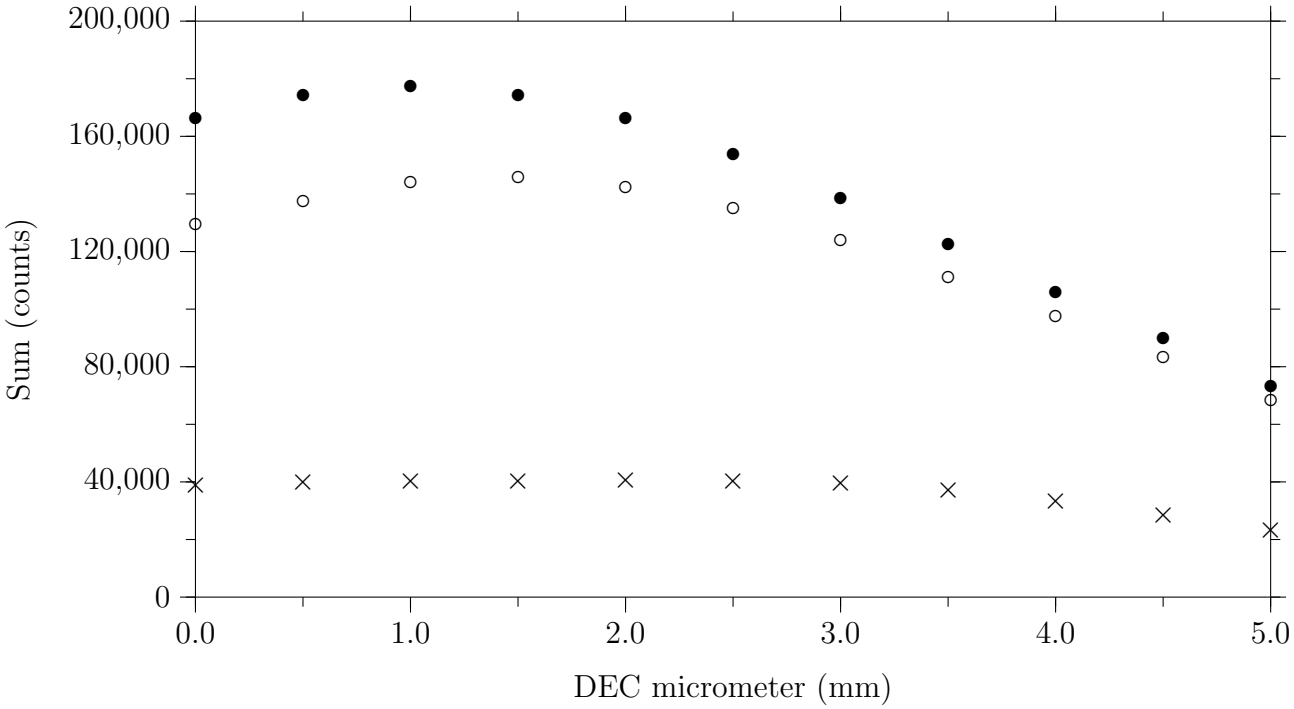

Figure 4: DEC scan (Ivan) - The guider was scanned declination. The plot shows how the starboard sum (•), port sum (○), and the transmission monitor (×) varied. The transmission montior data have been divided by ten. This scan was done with the right ascension micrometer set at 4.0 mm and the cell hot.

5 Spectrometer Performance

The front filter/lens assembly of both spectrometers were replaced on March 19, and the mount re-aligned on March 20. Table 1 shows the change this made. On March 25 the ovens were cooled and the hot-to-cold ratios measured. The results are shown in Table 2.

Table 1: Results of filter change and alignment.

	Sum (Counts) Before	Sum (Counts) After	
Hannibal Starboard	133,000	109,000	-18%
Hannibal Port	108,000	107,000	-1%
Hannibal Transmission	37,000	36,000	-3%
Ivan Starboard	156,000	175,000	+12%
Ivan Port	142,000	148,000	+4%
Ivan Transmission	379,000	410,000	+8%

Table 2: Hot-to-Cold Ratio.

	Sum (Counts) Cold	Sum (Counts) Hot	Ratio
Hannibal Starboard	11,500	109,000	9.5
Hannibal Port	11,200	107,000	9.5
Hannibal Transmission	35,000	36,000	1
Ivan Starboard	12,600	175,000	14
Ivan Port	6,700	148,000	22
Ivan Transmission	410,000	410,000	1

6 Ivan Step

During the day there is a small step in the data collected from Ivan. This usually indicates something has become loose inside the spectrometer and is slipping as the mount moves throughout the day.

On a previous trip the interference filter was removed from Ivan. Initially there was a small piece of foam inserted between the IF and the bulkhead that helped to stop the IF from rotating. This was not replaced when the IF was reinstalled. It was thought that this is what was causing the step.

Unfortunately, after the piece of foam was replaced the small step still appears. There does not appear to be anything else loose that may be causing this problem.

7 Mains Controller

The mains controller has eight channels, controlled by eight solid-state relays (SSRs). The relays are similar to the ones used in the relay-box, the only difference being a higher voltage rating. On a previous trip [1] two of the SSRs in the relay-box were damaged, and so replacements were scavenged from the mains controller.

On this trip two new SSRs were installed in the mains controller and so it now has the full complement of eight channels available for use again.

References

[1] Brek A. Miller. Repairs to the Las Campanas autoguider in 2007 December. *BISON Technical Report Series,* Number 300, High-Resolution Optical-Spectroscopy Group, Birmingham, United Kingdom, March 2008.