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The Removal of Jabba from Carnarvon in 2006 November

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Abstract

Ian Barnes, Brek Miller, and Barry Jackson visited Carnarvon late in 2006. Jabba was removed from the mount, the weather cabling was replaced, all of the dome rollers were replaced, the cloud detector LDR was replaced, some mount limit switches were replaced, the computer was replaced, the temperature monitor was reconfigured to monitor different things, the PMTEB was replaced, and the autoguider was realigned.

Contents

1 Introduction

Ian Barnes, Brek Miller, and Barry Jackson visited Carnarvon in 2006 November. We all arrived on November 16. Barry stayed a little over one week — he left on November 25. Ian and Brek stayed for two more weeks and left on December 11. The main tasks that were planned for this trip were:

- Removal of the Jabba spectrometer and return to Birmingham for refurbishment and upgrade.
- Installation of a new computer and upgrade of the zoo software.

- Replacement of all dome rollers.
- Reconfiguration of the Carnarvon Temperature Monitor due to the removal of Jabba.
- Replacement of the Mark V Electronics Box (PMTEB) for the second generation PMTEB Mark II unit.
- Test the webcam to see if the problem was the old computer or the webcam itself.

2 Jabba Spectrometer

Jabba has been beset by a number of problems over the past couple of years. Jabba received a thorough soaking in 2005 May when the rain detector failed. Although the site was visited a few days following the flood [1], the damage was too extensive and the station had to remain closed for a couple of months whilst new equipment was designed and built in Birmingham.

Jabba was a casualty of the flood and some of the detectors inside the unit were damaged by the rain water that fell onto the spectrometer through the open roof. A new detector was hurriedly designed and built in Birmingham. The JDET [2] was installed into Jabba during a second trip to Carnarvon during 2005 [3]. During the trip it was found that there were problems with the JDET and that it didn't function as well as intended.

Finally there has always been a footprint with the data obtained from Jabba. Klaus is a similar instrument to Jabba and that spectrometer doesn't suffer from the footprint problem. The main difference between Klaus and Jabba is that Jabba is attached to a mount, whilst Klaus sits on a bench. The theory is that Jabba is flexing on the mount and this is causing the footprint in its data.

The decision was taken to remove Jabba from the mount in Carnarvon and return the spectrometer to Birmingham for refurbishment. Once complete, the unit will then be shipped out to Izaña where it can sit on a bench to either confirm or disprove that flexing on a mount is causing the footprint in the Jabba data.

Jabba was removed from the mount and the mount was rebalanced. There were insufficient lead counterweights in the dome. We made new counterweights at Les Schultz's house. There was some spare lead flashing and some dive weights. These were melted down in a loaf tin using an oxyacetylene torch. After a few minutes of natural cooling the tin was soaked by cold water from a hose and the new lead counterweight simply fell out of the tin.

Jabba's temperature controllers were removed from the shelves behind "the computer room" next to the water tank. The 2DGM electronics were also removed — this unit had not worked for several years. The shelves were removed to create more space within the dome. The Pockels-cell drivers were also removed and the shelf that was holding them was also taken down.

Signals from Jabba also used a lot of channels on the scalers. As Jabba was being removed from Carnarvon it made sense to remove the unused scaler cards and return them to Birmingham as spares. Only one scaler card was needed for the Mark V data. The remaining slots for the scaler cards needed filling with special shorting plugs.

When Jabba was originally shipped out to Carnarvon it was sent in a couple of aluminium crates. Although the crates were stored on site in one of the OTC buildings they have since gone missing. Instead new wooden crates were made by Les and his nephew David in order to ship Jabba and its associated electronics back to Birmingham.

3 Weather Arm Wiring

There were a number of problems with the weather arm wiring in Carnarvon. The weather cable was originally made too short, and so this was extended by using a die-cast box with terminal block inside as a splice. A small PCB was added next to the shutter for the cables coming from the weather arm, but this did not make it any easier to re-wire the weather arm sensors. Whilst inspecting the wiring of this PCB the shutter started to close unexpectedly indicating that there were some loose connections in the wiring. Finally there was insufficient documentation regarding the wiring, and there were also mistakes in the wiring diagram as featured in BTR-260. It was therefore decided that we should re-wire the weather arm, make a new weather cable, and also create new documentation that was accurate.

In Carnarvon there are several components mounted on the weather arm these are:

- Vaisala WAA15 Anemometer.
- Vaisala DRD-11A Rain Detector.
- GPS Antenna.
- Cloud Detector.

On the dome skin there are two 9-pin and one 3-pin Buccaneer connectors. Inside the dome these connectors are housed within a die-cast box that is referred to as the weather arm junction box.

The original idea was that the two 9-pin connectors would be used for the rain and wind sensors and the 3-pin connector for the cloud detector. The cable for the GPS antenna is fed through the dome using a cable gland, and hence does not need a connector. The 9-pin connectors could handle both the rain and the wind sensors, however there were insufficient pins for this to work properly and so the heater element of the rain detector was left disconnected.

It was decided to have dedicated connectors for rain and wind sensors and thus we could connect up the heater on the rain detector. Another improvement would be to have a connector just inside the dome which would allow the weather cable to be changed without having to re-wire the whole weather arm.

Adopting this approach would mean that there are several cable assemblies that make up the weather arm wiring. Figure 1 shows how the weather arm sensors are now connected to the weather module.

The Carnarvon weather system as shown in Figure 1 contains several cable assemblies. There are basically four cable assemblies that are associated with the Carnarvon weather system with a further three cables associated with the cloud detector. The cable assemblies that are associated with the weather system are summarized in Table 1.

Table 1: Carnarvon Weather System — Cable Assemblies

Drawing	*Figure*	*Page*
Anemometer Cable	3	6
Vaisala DRD-11A Rain Detector	4	6
Weather Wye Cable	5	7
Weather Cable	6	7

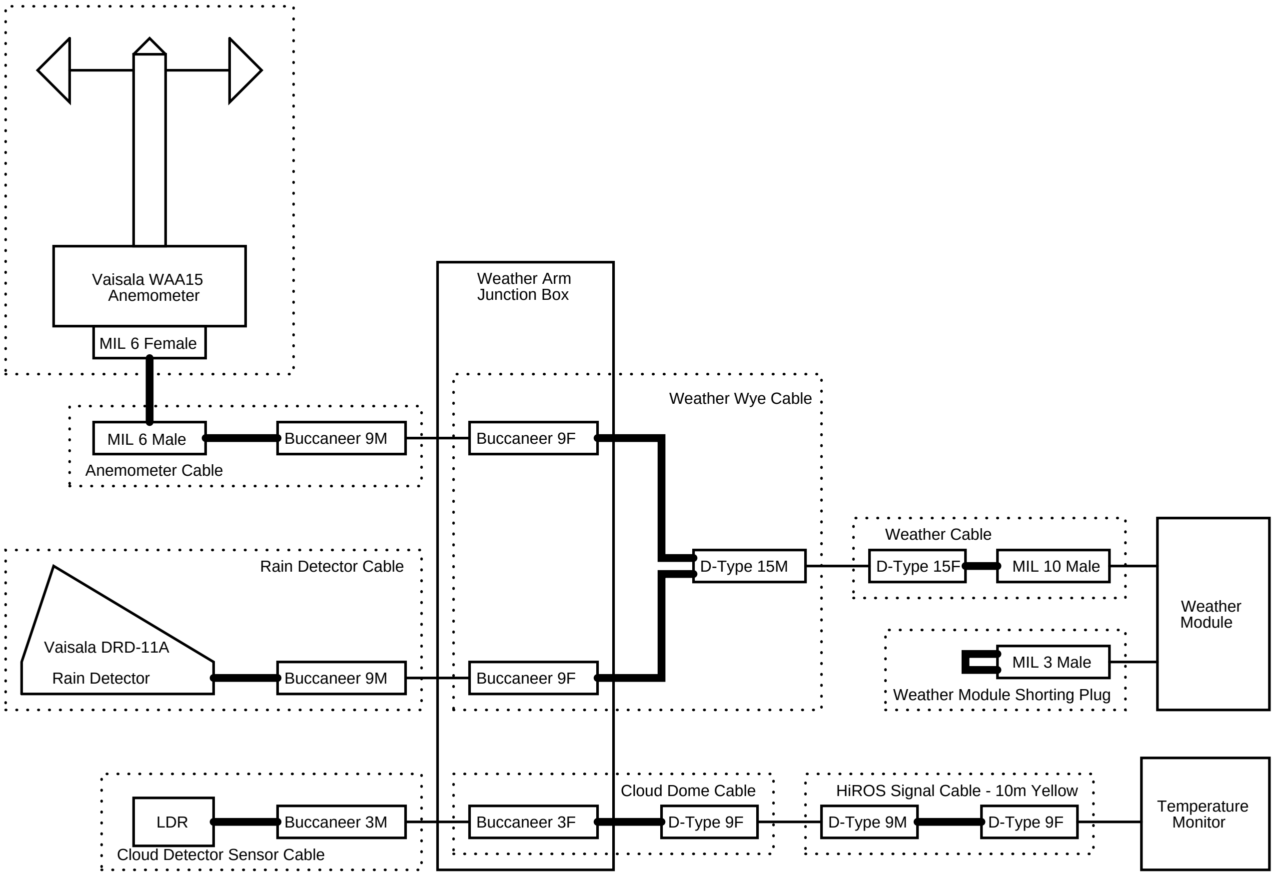

Figure 1: The Weather System Block Diagram.

The cloud detector will no longer be connected to the weather module in Carnarvon and instead it will be connected to the Temperature Monitor and so the cloud detector cable assemblies will be discussed in the Cloud detector section of this report.

The weather arm junction box is located near to the shutter and contains the three Buccaneer connectors for the wind, rain, and cloud sensors. Figure 2 shows the layout of the weather arm junction box.

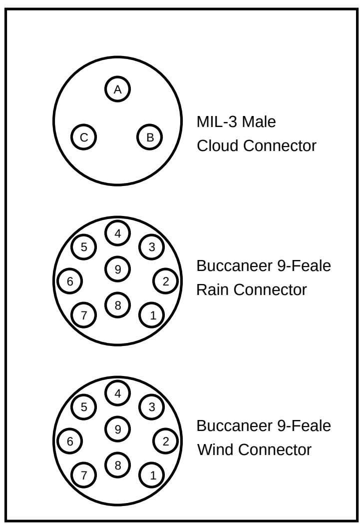

Figure 2: The Weather Arm Junction Box.

In Carnarvon the wind speed is measured using a Vaisala WAA15 anemometer which is also used at other stations within BiSON. The WAA15 has a male 6-pin MIL connector located on the base of the unit. The pin-out of this connector is given in Table 2.

Table 2: Anemometer Connector

Pin	*Label*	*I/O*	*Description*
A	+12V		+12V Power
B	GND		Signal Ground
C	Wind	O	Wind Signal
D	+12V HTR		Heater Power
E	GND HTR		Heater Ground
F	NC		Not Connected

The anemometer cable connects the anemometer to the weather arm junction box which is located inside the skin of the dome. Figure 3 shows the cable assembly.

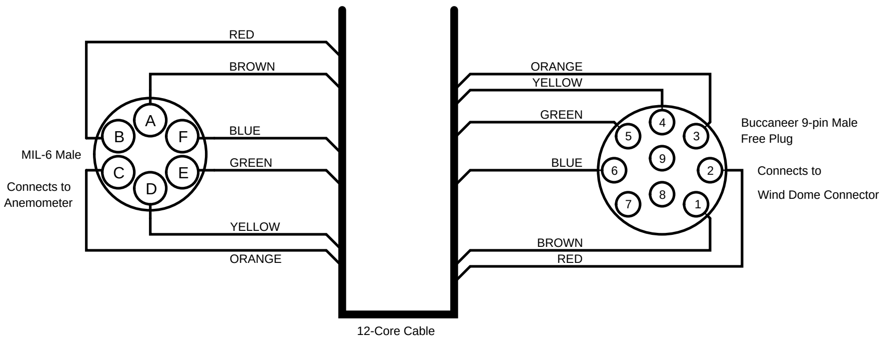

Figure 3: The Anemometer Cable.

The rain detector that is used in Carnarvon is a Vaisala DRD-11A unit. Several rain detectors of this type are used within BiSON. Figure 4 shows how the rain detector is wired.

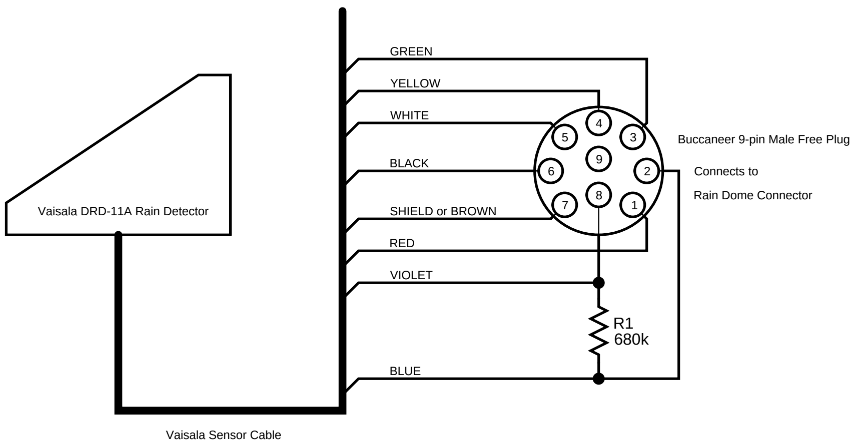

Figure 4: The Rain Detector Cable.

The weather wye cable combines the rain and wind sensor signals into a single connector so that it can be connected to the weather module. This cable assembly is partly housed within the weather arm junction box. Figure 5 shows the weather wye cable assembly.

The weather cable connects the rain and wind sensors to the weather module of the main electronics rack. The weather cable is shown in Figure 6.

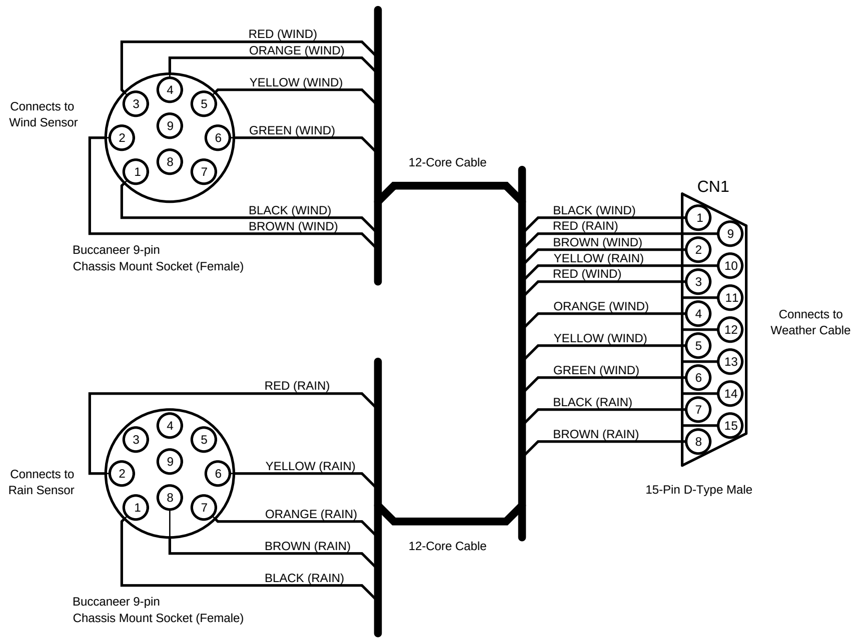

Figure 5: The Weather Wye Cable.

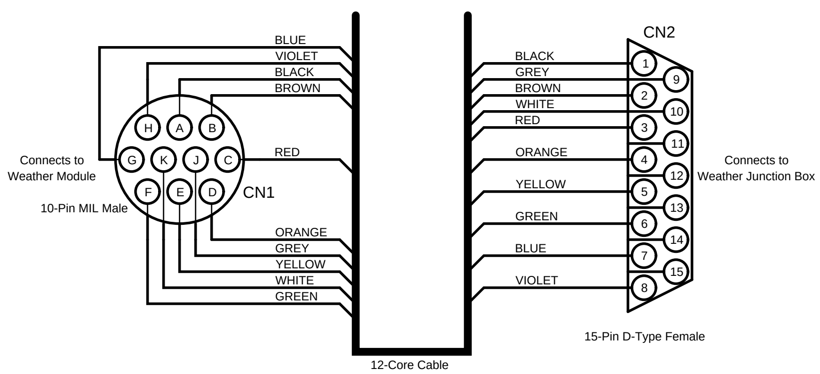

Figure 6: The Weather Cable.

4 Dome Rollers

The rollers were scheduled to be changed in 2005 May, having been in place since the dome became operational in 1985. However some of the nuts had rusted onto the bolts and wouldn't come off at all. So in 2005, only about half of the dome rollers were actually changed.

Barry came along on this trip with proper tools and more mechanical experience to get the dome rollers changed. Barry managed to get all of the rusted nuts off and changed all of the dome rollers. The old weather strip was scrapped and replaced with a new one.

5 Cloud Detector

The cloud detector in Carnarvon was not working on arrival. The reason for this soon became apparent when looking around in the dome. The cloud detector cable that was situated in the main umbilical bundle had become very tight at some point and in fact had snapped in half.

The cloud detector in Carnarvon was originally connected to the weather module, although it did not work very well and so very often was overridden. The cloud detector in Sutherland was connected to the Sutherland Temperature Monitor [4] and it was decided that the same approach should be adopted in Carnarvon. The changes required to do this were pretty straight forward.

The cloud detector on the weather arm was inspected and was found to be damaged by UV light, the lens of the LDR had turned "milky" in appearance. The LDR was therefore changed as was the cable.

The wiring of the weather arm was changed on this trip and the weather system wiring diagram is given in Figure 1 on page 5. There are basically four cable assemblies that are associated with the cloud detector, these are summarized in Table 3:

Table 3: Cloud Detector — Cable Assemblies

Drawing	*Figure*	*Page*
Weather Module Shorting Plug	7	9
Cloud Detector Sensor	8	9
Cloud Detector Dome Cable	9	9
HiROS Signal Cable	10	10

5.1 Weather Module Shorting Plug

The existing cloud detector cable that had been pulled tight and snapped was removed from the dome wiring. The cloud detector cable uses a 3-pin male MIL connector to connect to the weather module. Rather than modifying the circuitry of the weather module; the best thing to do was to short the two wires within the cloud detector cable together. This would "fool" the weather module into thinking that it was glorious sunshine and not cloudy at all. This cable assembly is referred to as the weather module shorting plug and this is shown in Figure 7.

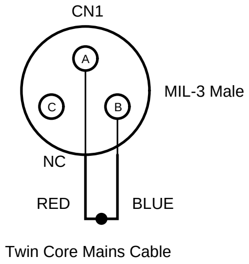

Figure 7: The Weather Module Shorting Plug.

5.2 Cloud Detector Sensor Cable

Previously the cloud detector cable passed through the dome skin via a cable gland. However this was changed to use a spare buccaneer connector that was already fitted to the skin of the dome. Figure 8 shows the wiring of the cloud detector cable on the weather arm.

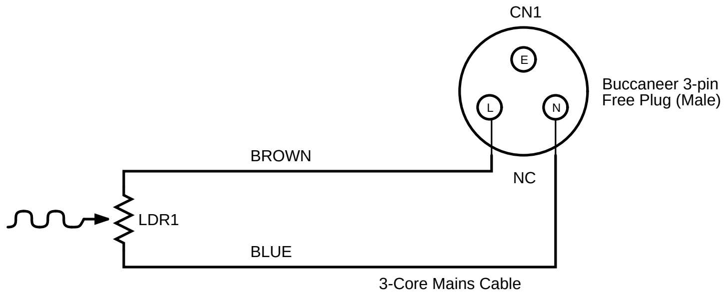

Figure 8: The Cloud Detector Cable.

5.3 Cloud Detector Dome Cable

The Buccaneer connector for the cloud detector is mounted on the dome skin. Inside the dome the rear of this connector is covered by the weather arm junction box. A cable assembly was needed to bring the signal from the Buccaneer connector onto a suitable connector inside the dome. This cable assembly is the cloud detector dome cable and this is shown in Figure 9.

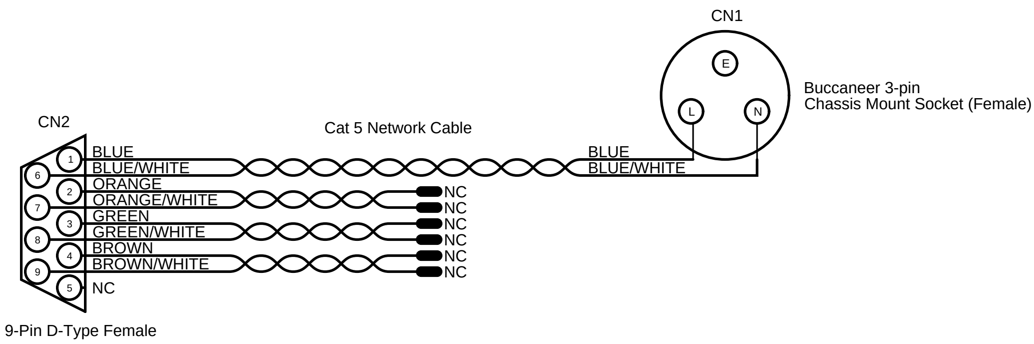

Figure 9: The Cloud Detector Dome Cable.

5.4 HiROS Signal Cable

The final stage of attaching the cloud detector to the Carnarvon Temperature Monitor [5] was to get the signal down from the cloud detector dome cable mounted in the weather arm junction box to the temperature monitor unit located in the main electronics rack. This was done using a standard HiROS signal cable as used on most temperature monitor units in BiSON stations. Figure 10 shows the wiring of the HiROS signal cable.

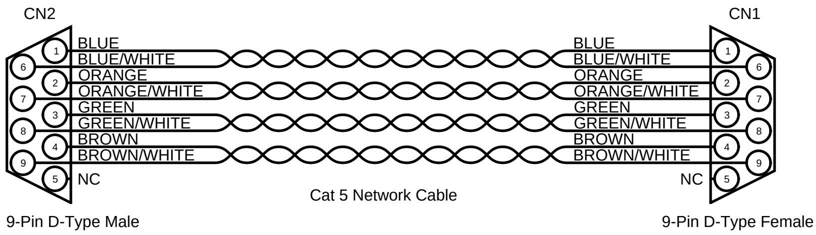

Figure 10: The HiROS Signal Cable.

6 Limit Switches

Whilst testing the mount it was noticed that there was quite a bit of damage to some of the limit switches. Some of the switches had bits of the plastic body missing and some of the levers were also bent. So it was decided to change all of the broken or damaged switches.

The limit switches that were changed were:

- Declination Up limit
- Declination Down limit
- Hour angle power switch

The switches used single core cable and this was also changed to use 4-core shielded cable to make the wiring neater.

7 New Computer and Zoo Installation

The old computer in Carnarvon also had evidence of damage due to the flood in 2005 May but it was not replaced on the second trip. It was decided that this time a new computer should be built and installed on-site.

Seeing as the computer was being changed it was decided to upgrade the DIO splitter cards in Carnarvon as well. These were the first cards ever installed and the cables used complicated wye cables that were bulky and very time consuming to make. The latest version of the DIO Splitter card [6] was installed.

The old computer was running low on serial ports. It used to have a USB device that contained four serial ports but this was destroyed in the flood of 2005 May. The new computer features a PCI card that contains eight serial ports which will provide several spare ports for any new equipment.

8 Temperature Monitor Reconfiguration

The Carnarvon Temperature Monitor [7] was installed in 2005 May [1]. The original configuration used up all 16 of the available channels, of which 13 were associated with Jabba. As Jabba was being removed from Carnarvon it seemed a good opportunity to change the configuration of the unit so that we can measure some parameters that we were not able to monitor before. Table 4 shows the new channel allocation for the Carnarvon Temperature Monitor.

Table 4: Temperature Channels

0	Water Tank Temperature
1	External Ambient Temperature
2	Room Ambient Temperature
3	Dome Ambient Temperature
4	Cloud Detector
5	—
6	—
8	—
9	—
10	—
11	—
12	—
13	—
14	—
15	—

Also this was a good chance to improve the safety of the unit by fitting a heatshrink boot over the terminals of the power switch to prevent accidental electric shock. Further information regarding the reconfiguration of the Carnarvon Temperature Monitor can be found in BTR-285.

Figure 11 shows the block diagram of Carnarvon Temperature Monitor system.

9 Mark V Spectrometer

The Mark V spectrometer also suffered damage during the flood of 2005 May, resulting in the majority of the electronics for this unit being destroyed.

During the second trip to Carnarvon in 2005, the PMTEB [8] was installed to get Mark V running again. The PMTEB was designed and built very quickly and as a result the unit contained several mistakes. A new unit was designed and built and sent out to Carnarvon.

The PMTEB Mark II [9] was radically different to its predecessor. The new unit had the same functionality as before but it also contained 24-bit ADCs which would also be used to generate the Sum, Difference and Transmission Monitor data. Comparisons could then be made between the method using the scaler data and the ADC data to see which approach was actually better.

The PMTEB Mark II works in conjunction with another new sub-system of the Mark V electronics. The PMTAmp [10] sits on the back of Mark V and does the I/V conversion of the

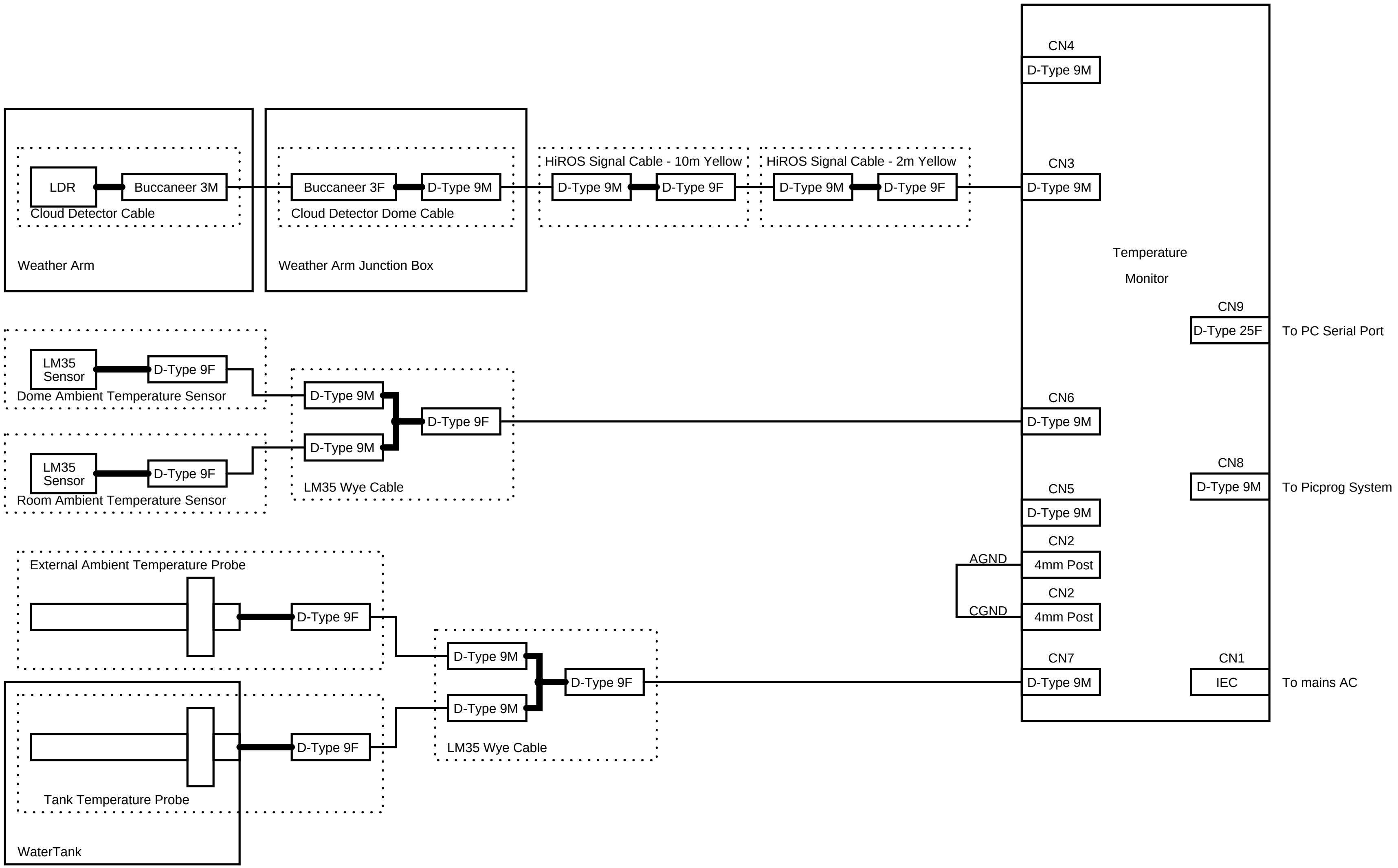

Figure 11: Carnarvon Temperature Monitor System.

signals from the PMT and the transmission monitor. This analogue signal is then driven along twisted pair cables to the PMTEB for measurement. Figure 12 shows the rear of Mark V and the location of the PMTAmp.

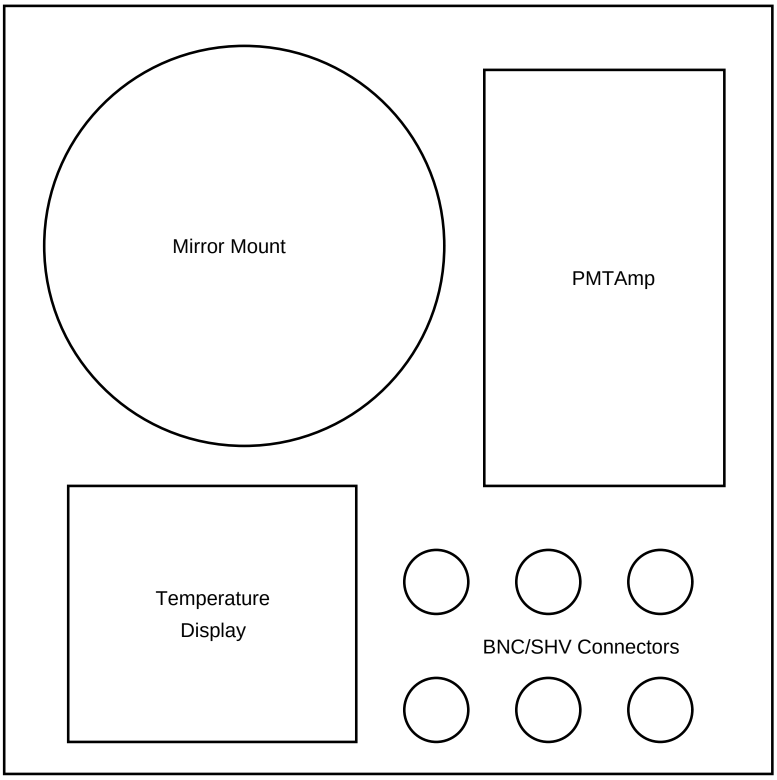

Figure 12: Rear view of Mark V.

Figure 13 shows the system wiring diagram for the PMTEB. This covers all of the measurement electronics associated with the Mark V spectrometer.

10 2DGM and Autoguider

The Two-Dimensional Gradient Monitor (2DGM) in Carnarvon has not worked for several years, but it has been left connected because it also contains the autoguider telescope.

Following the removal of Jabba and all of the associated electronics, the 2DGM electronics were also removed. When the 2DGM was built, it was foreseen that you may want to disable the gradient monitoring yet retain the autoguider. Because of this, the system was designed so that the autoguider section of the 2DGM could be powered from either the 2DGM electronics or the main crate. To be more honest, this feature was implemented so that the autoguider would continue to work even if the 2DGM electronics failed.

The cable that was used to power the autoguider section of the 2DGM was extremely bulky — it carried other 2DGM signals. The arrangement of the cables is shown in Figure 14. It was decided that a new, smaller autoguider power cable be made from scratch. It is shown in Figure 15.

A standard autoguider telescope is on-site in Carnarvon in the aluminium storage crate. There was also a matching autoguider cable in the crate, but this was damaged and hence

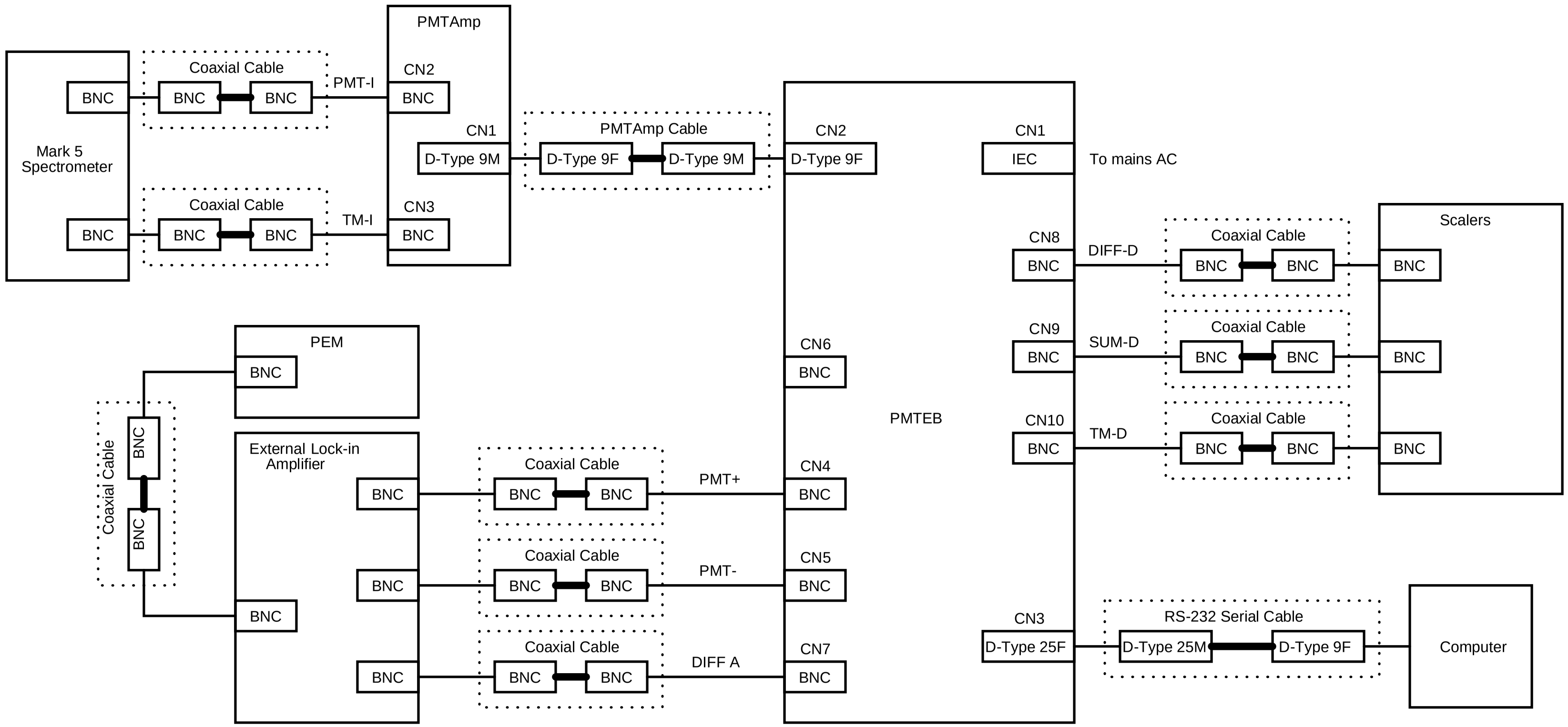

Figure 13: PMTEB system diagram.

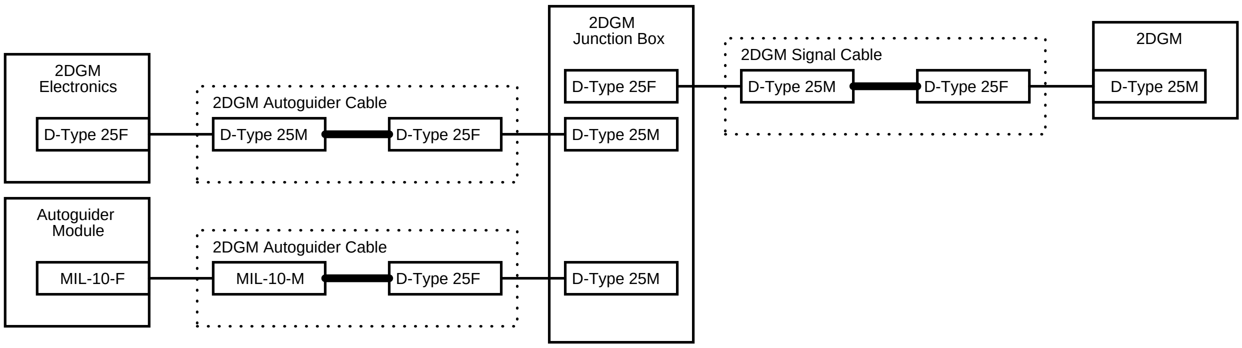

Figure 14: The old 2DGM wiring.

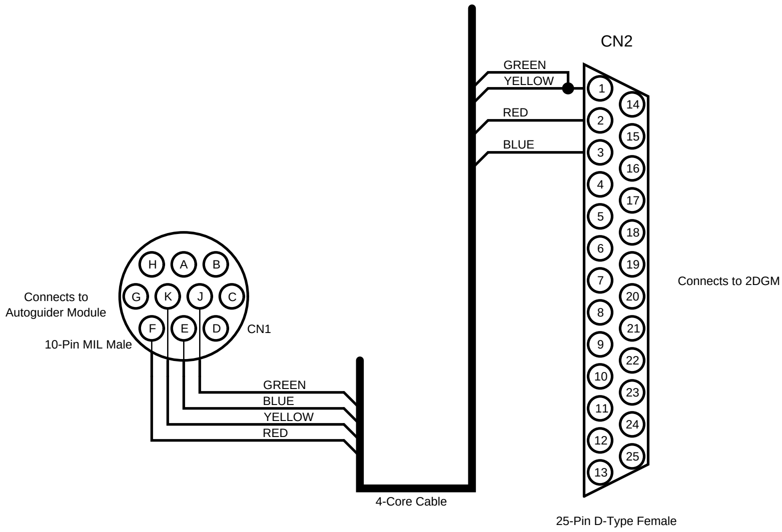

Figure 15: Current autoguider power cable.

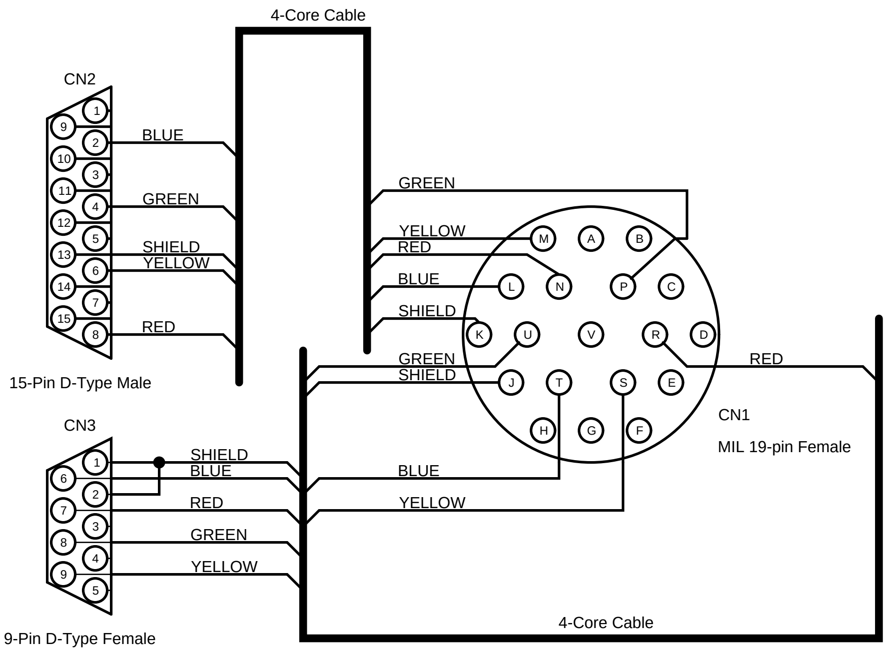

Figure 16: Autoguider telescope power cable.

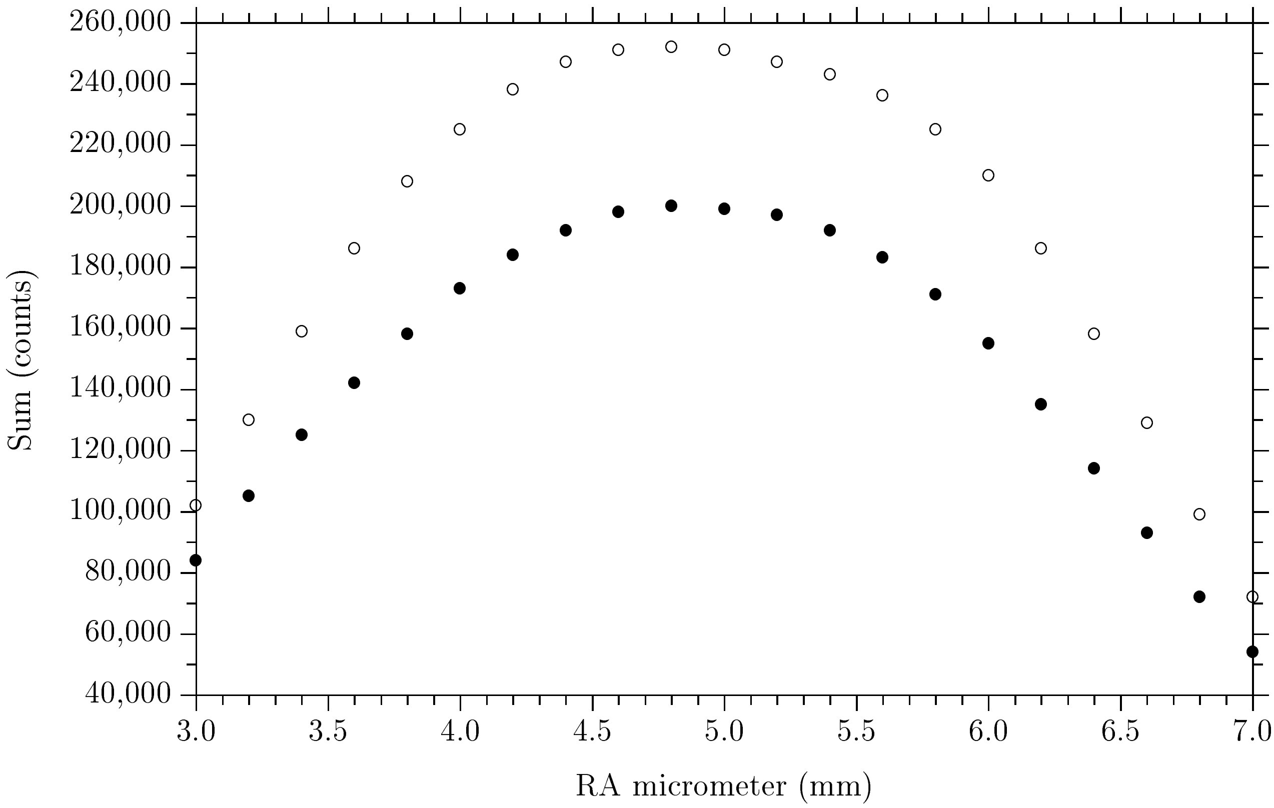

Figure 17: Mark V intensities from a right-ascension autoguider scan. The plot shows how the sum (•) and the transmission monitor (○) varied. This scan was done with the declination micrometer set at 2.25 mm.

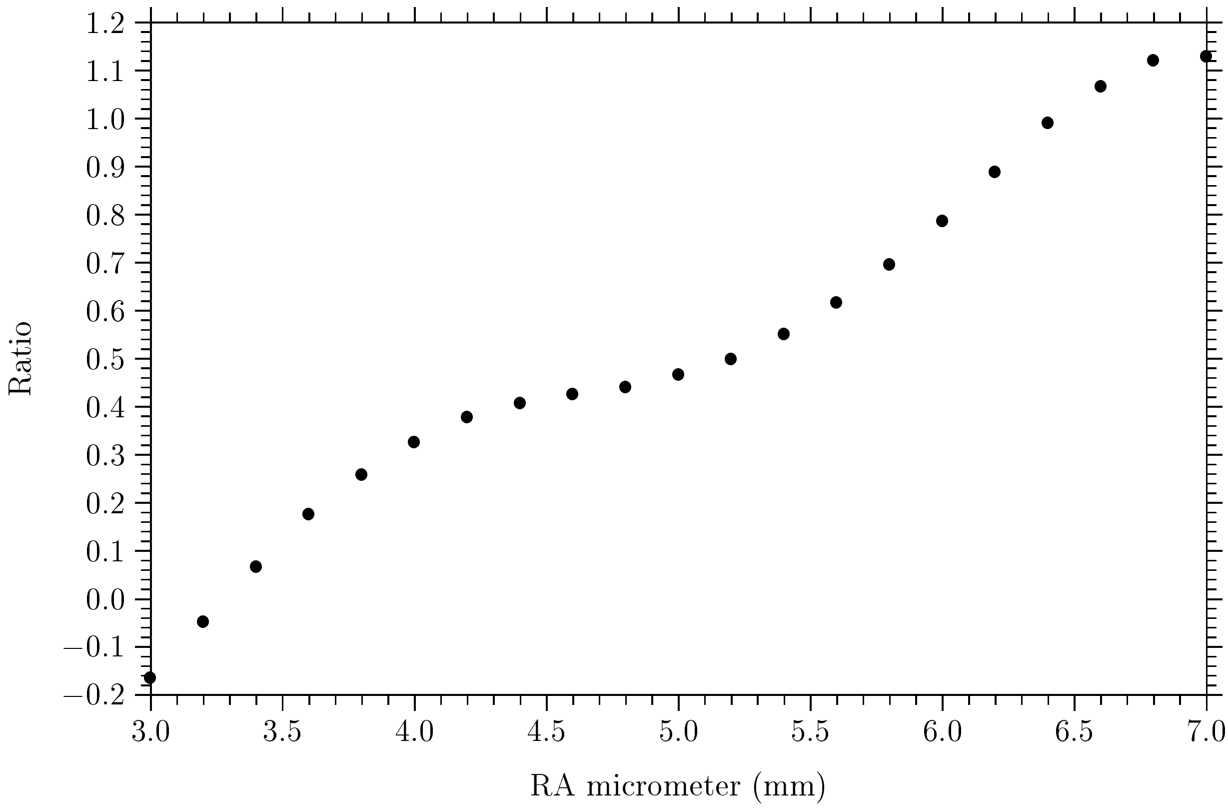

Figure 18: Mark V ratio from a right-ascension autoguider scan. The plot shows how the ratio varied during the scan. This scan was done with the declination micrometer set at 2.25 mm.

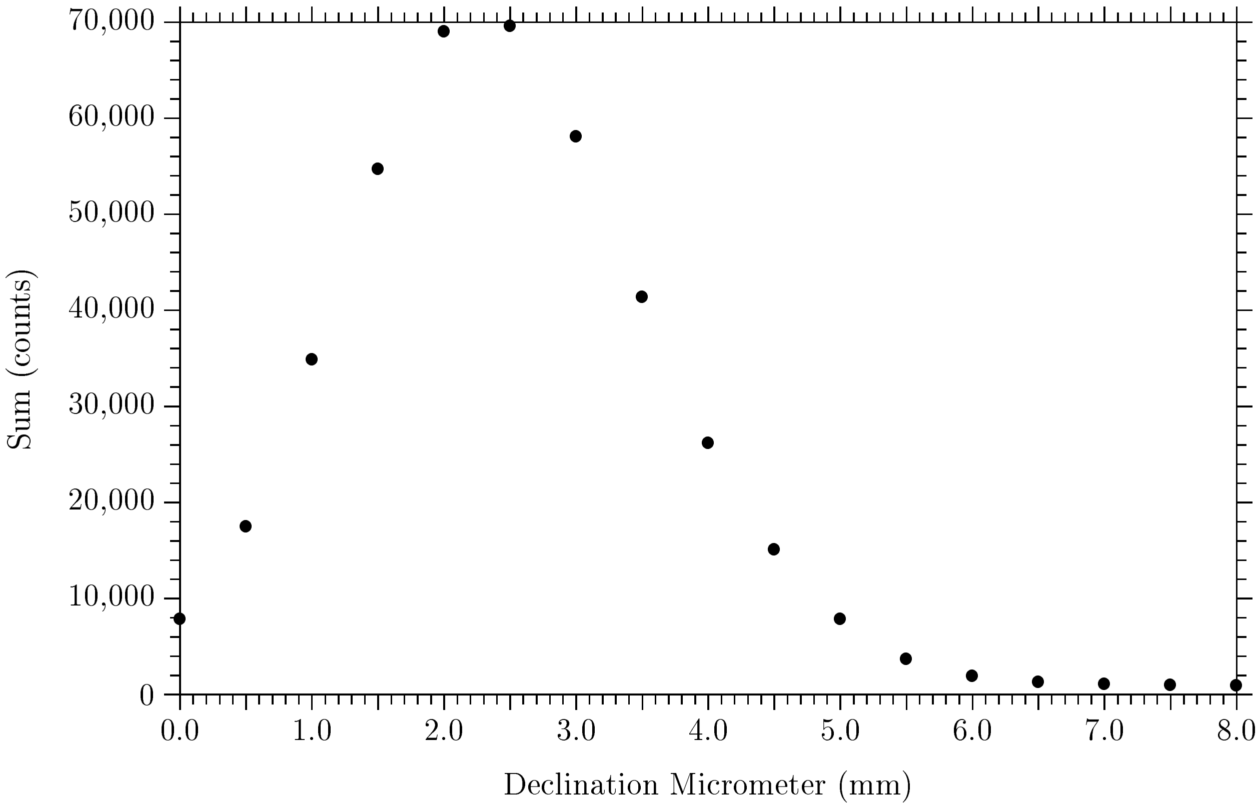

Figure 19: Mark V intensities from a declination autoguider scan. The plot shows how the sum varied during the scan. This scan was done with the right-ascension micrometer set at 4.75 mm.

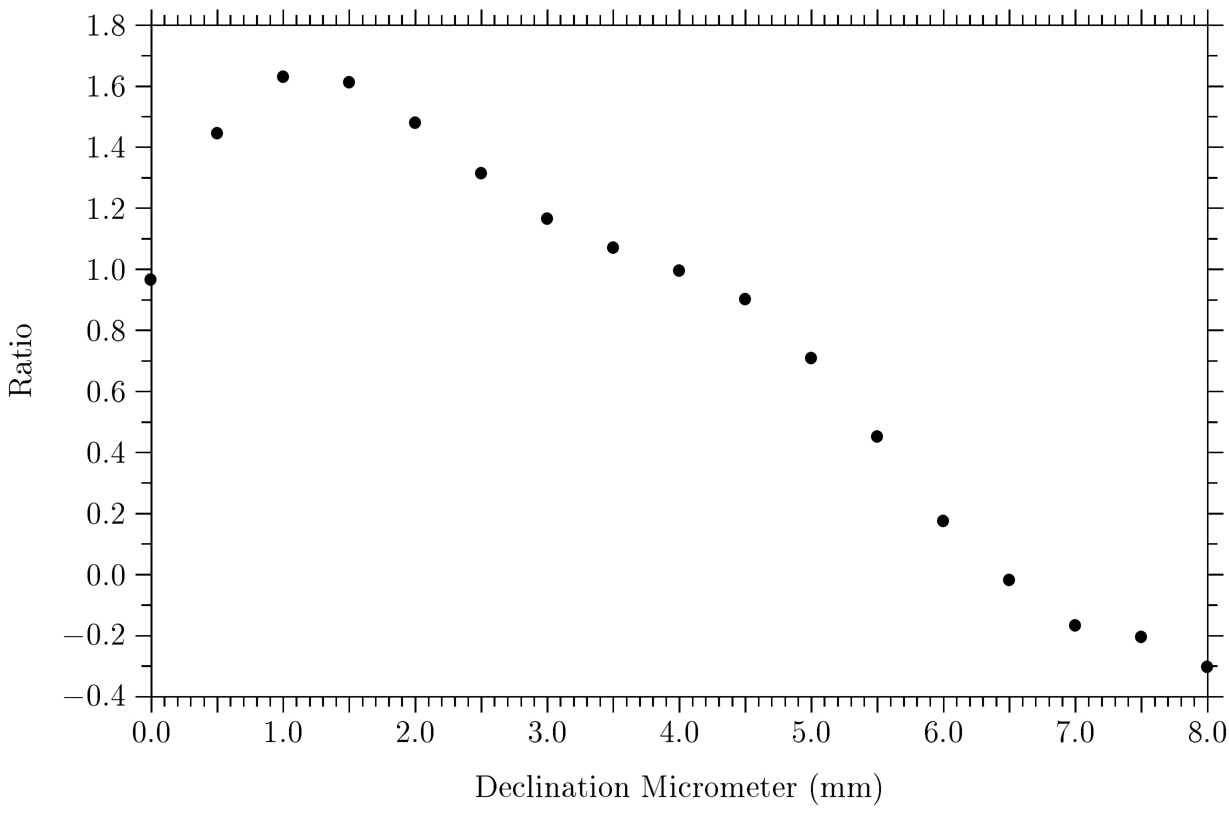

Figure 20: Mark V ratio from a declination autoguider scan. The plot shows how the ratio varied during the scan. This scan was done with the right-ascension micrometer set at 4.75 mm.

thrown away. Figure 16 shows the old autoguider cable. A new cable will need to be made in order to get the standard telescope working again.

Following the removal of Jabba, the autoguider was found to be misaligned and so an autoguider scan was performed to improve the performance of the autoguider. The results are shown in Figures 17 to 20. We left the right-ascension micrometer set to 4.5 mm and the declination micrometer set to 2.25 mm.

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