Section 10

Appendix 9: Electronics Test Report

9 Electronics Test Report

9.1 BSM Electronics: Position Sensor Output Noise

9.1.1 INTRODUCTION

In order to investigate sightline noise in the single-axis BSM prototype, the output from the position sensor and its preamplifier was captured using a XXXX oscilloscope, but without closing the BSM control loop.
Therefore the noise measured was due to the sensor and its associated electronics (current source and preamplifier) only. The measured noise was analysed in the frequency domain using the FFT function. If the noise had a flat spectrum, it would be sensible to anti-alias filter it to remove the high frequency element that would be folded down into the control loop bandwidth by the subsequent 10 kHz sampling process.

9.1.2 RESULTS

Figure 1 shows the sampled noise. The RMS value is approximately xxx V.

Figure 2 shows the frequency spectrum. As can be seen from the figure the spectrum is …..

9.1.3 CONCLUSION

9.2 BSM Electronics: Motor Torque Constant

9.2.1 INTRODUCTION

The motors used for the BSM are constructed from parts used in the MPIA-designed PACS system. Though the MPIA motors were designed in a thorough manner, UKATC has neither the expertise nor necessary magnetic modelling software to follow a similar process to produce a space-qualified motor.
Based on simple calculations, it was concluded that two coils and one magnet (from the PACS three-coil two-magnet design) would give the required torques for our lower inertia BSM system.
Therefore the motor 'design' task was limited to simply verfiying this conclusion.

In order to establish the motor torque constant, the single-axis prototype was tested with various applied voltages, and the subsequent angular movement measured using the 'C.D.L.' Tilt Measurement Apparatus (TMA).
As the axis was restrained by the flex pivot mountings, which have a known spring constant, the angular movement could be converted to an equivalent force, and the motor torque constant derived.

9.2.2 RESULTS

Firstly, the TMA was calibrated using a simple laser reflection against a fixed scale.

The following results were obtained :

Mirror distance to TMA = 8.30E-02 m

Beam Movement	TMA o/p	angle	Scale Factor rad/pixel
1.00E-04	262	2.00E-03	7.63E-06
2.00E-04	525	4.00E-03	7.62E-06
3.00E-04	787	6.00E-03	7.62E-06
4.00E-04	1045	8.00E-03	7.66E-06
5.00E-04	1316	1.00E-02	7.60E-06

Average Scale factor = 7.63E-06 Rad/pixel

The following test data was obtained by applying a range of voltages to the motor, and using the following measurements and catalogue data :

Resistance of coils + series resistor	=	1720	ohm
Flex pivot scale factor (2 off)	=	6.40E-02	N-m/Rad
Mirror distance to TMA	=	8.30E-02	m
Micrometer-to-pivot distance	=	5.00E-02	m
Magnet distance from centre of rotation	=	1.70E-02	m

Volts	Current	TMA o/p	angle	Torque	Kt Nm/A	Kf N/A
5	0.002906977	655	5.00E-03	3.20E-04	0.109972917	6.47E+00
4	0.002325581	522	3.98E-03	2.55E-04	0.109553173	6.44E+00
3	0.001744186	390	2.97E-03	1.90E-04	0.109133429	6.42E+00
2	0.001162791	259	1.98E-03	1.26E-04	0.108713685	6.39E+00
1	0.000581395	130	9.91E-04	6.34E-05	0.109133429	6.42E+00
-1	-0.000581395	-132	-1.01E-03	-6.44E-05	0.110812405	6.52E+00
-2	-0.001162791	-265	-2.02E-03	-1.29E-04	0.111232149	6.54E+00
-3	-0.001744186	-398	-3.04E-03	-1.94E-04	0.111372064	6.55E+00
-4	-0.002325581	-532	-4.06E-03	-2.60E-04	0.111651893	6.57E+00
-5	-0.002906977	-662	-5.05E-03	-3.23E-04	0.1111482	6.54E+00

		Kt Nm/A	Kf N/A
AVERAGE VALUES	=	0.110272334	6.486607909

9.2.3 CONCLUSION

The tests indicate that an avarage motor torque constant of 0.11 Nm/A can be obtained for the BSM Chop axis motor. This will be subject, of course, to manufacturing variations.

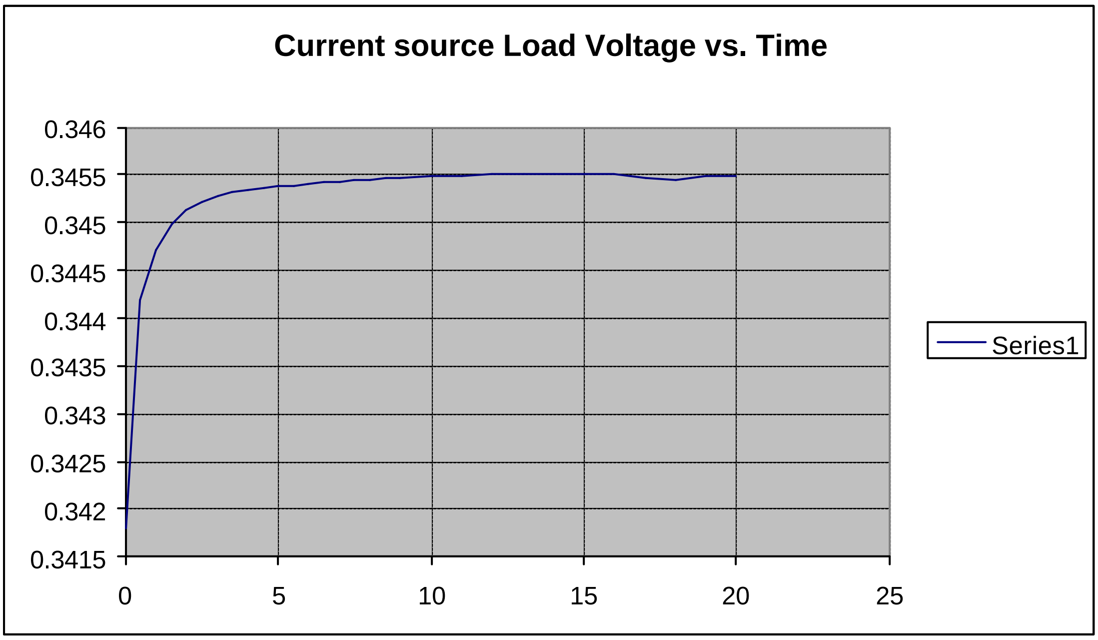
9.3 SPIRE: Current Source Test B.Stobie UKATC 24/01/01

Description :
In order to verify the current source stability with time, the ISOPHOT current source design (which is used on the SPIRE BSM), built with 1% resistors and a 0.1% 333 ohm load, was tested by measuring the load voltage over time using an H-P 3478A multimeter.
Voltage supplies were maintained at +/- 15.1V.

The following results were obtained.

Time – min.	Load Voltage	% variation from start
0	0.34180	0
0.5	0.34418	0.696314
1	0.34472	0.854301
1.5	0.34499	0.933294
2	0.34513	0.974254
2.5	0.34522	1.000585
3	0.34528	1.018139
3.5	0.34532	1.029842
4	0.34535	1.038619
4.5	0.34537	1.04447
5	0.34538	1.047396
5.5	0.34539	1.050322
6	0.34541	1.056173
6.5	0.34542	1.059099
7	0.34543	1.062025
7.5	0.34544	1.06495
8	0.34544	1.06495
8.5	0.34546	1.070802
9	0.34547	1.073727
10	0.34548	1.076653
11	0.34549	1.079579
12	0.34550	1.082504
13	0.34550	1.082504
14	0.34550	1.082504
15	0.34550	1.082504
16	0.34550	1.082504
17	0.34546	1.070802
18	0.34545	1.067876
19	0.34548	1.076653
20	0.34549	1.079579

The results are also plotted in the following table:



It is clear (assuming the there is negligible variation in the 0.1% precision resistor) that the source current, after an initial warm-up period, settles to a value that is constant to about 30 ppm.