

# ISIS Electronic Developments 2007-8

The work shown in this presentation  
represents the efforts of all of our team.

Dennis Cowdery (presenting the talk)

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# Advancing science at ISIS with better tools.

Motion Control      Thermometry  
Experiment Control   Instrumentation



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# Motion Control

Galil based system made in a modular style.

Enormous benefits for wiring installers.

Enormous benefits for computer group.

Easy to commission.

Versatile in application – most motor types can be used.

Only 300mm wide – easy access.



# Motion Control

**Beam lines using this system (TS1) –  
CRISP, SURF, MERLIN, INES, ROTAX, LOQ**

Total installed axes = 200+

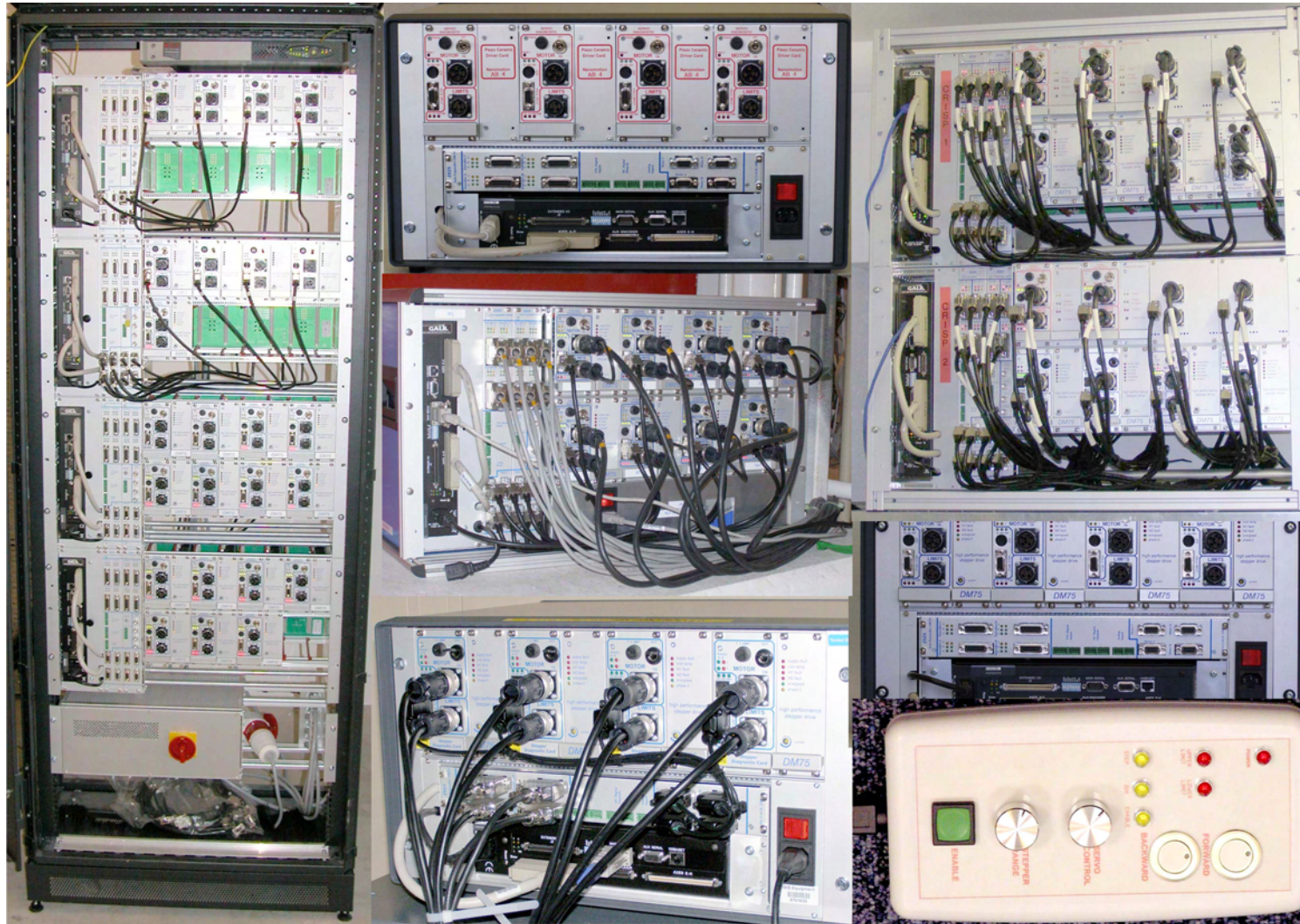
**Beam lines being constructed (TS2)-  
Nimrod, Offspec, Sans2D, Wish, Let, Inter and Polref.**

Total axes involved = 260+

Mix of stepper, dc servo, ac servo, piezo



# Motion Control



# Motion Control

Failures that have occurred been SMPS.

In total we have lost 3 PSU's in about 25 machine years use.

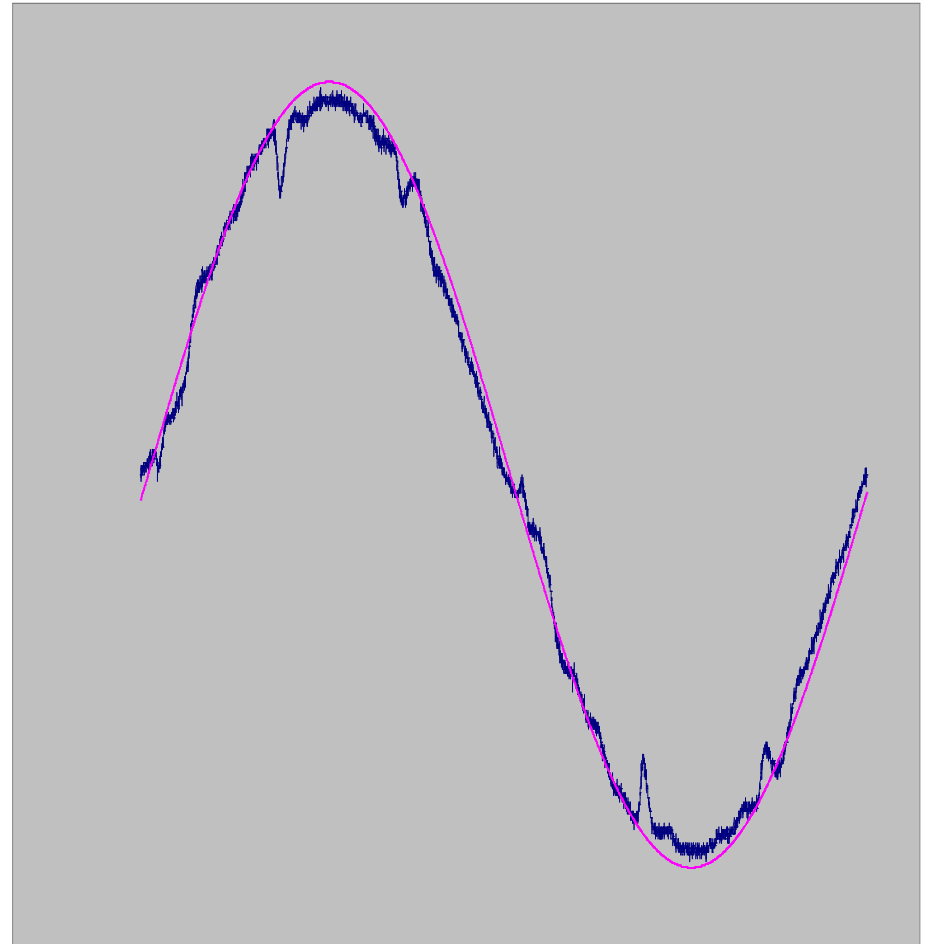
Additionally we have lost one through stupidity.

The mains waveform shown is one of the better ones.

Things can be helped by:-

Improved Supply

UPS isolation



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# Motion Control

## 5 axis Goniometer for Ancient Charm

Movements:           X: 140 mm  
                          Y: 120 mm  
                          Z: 250 mm  
                          rotation: 200 degrees

Hardware datum at centres of the X, Y, Z stages.

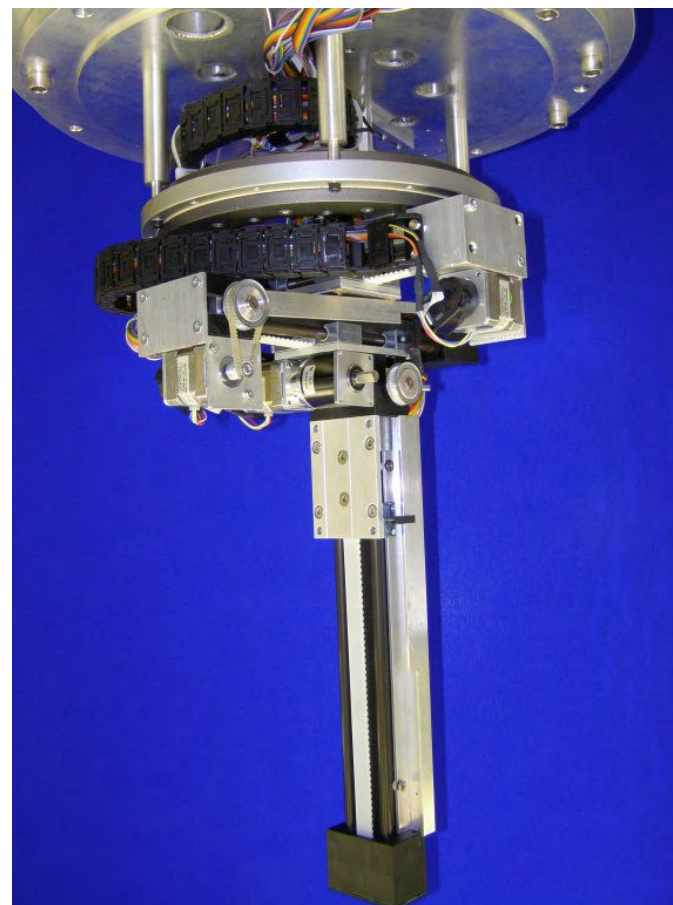
End-limit hardware switch for  $\omega$ -rotation stage.

Encoders at the back of each motor.

Variable software limits.

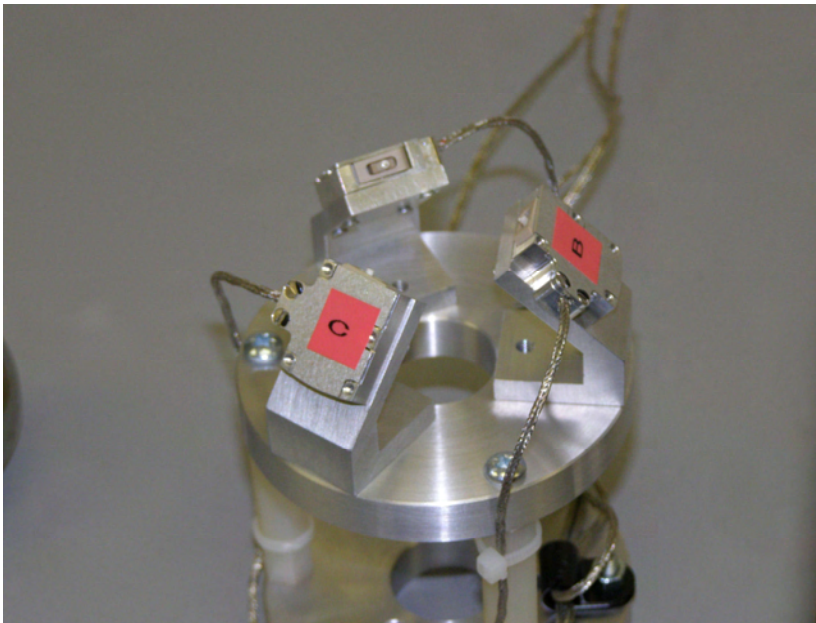
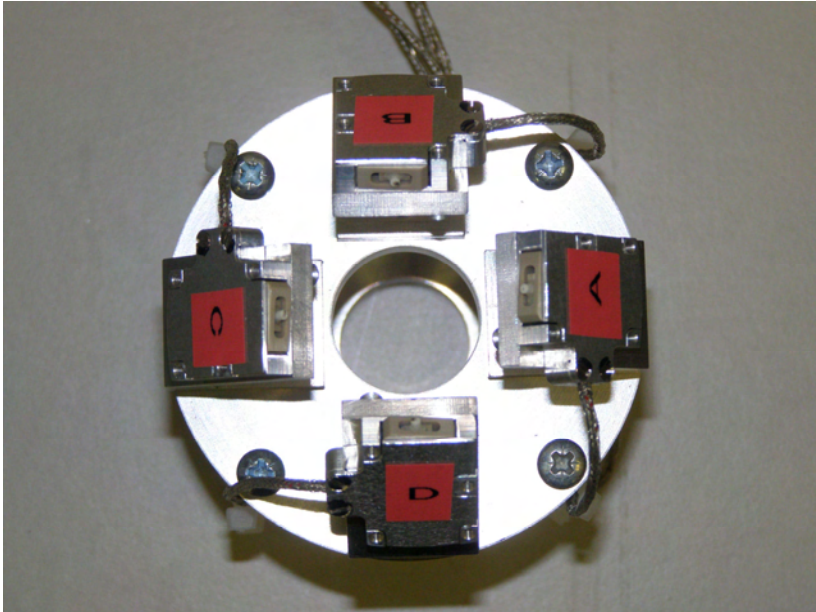
LabView interfaces for PC control of xyz and  $\omega$  stages  
have been produced.

Integration into ISIS acquisition system.



# Motion Control

Spinning Ball video - playtime



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# Thermometry

Always an ongoing issue with scientists.

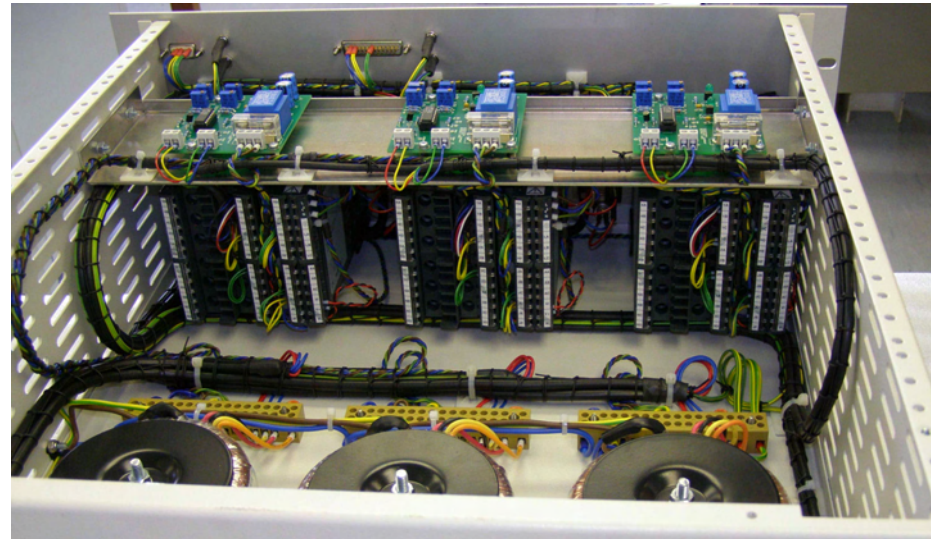
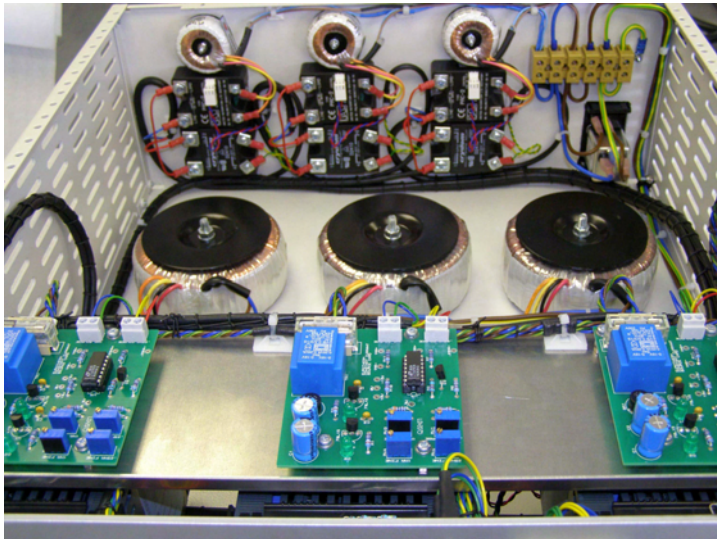
Need to equip TS2 and update TS1.

New and improved model Eurotherm 3504 – has a 5 digit display –

Measures the temperature of the sensor more accurately – a pity about the sample temperature!



# Thermometry



# Thermometry

## Features –

Three galvanically isolated channels.

2  $\mu\text{V}$  resolution. This equates to a theoretical resolution of 4mK at 4degK and 20mK at room temperature.

200 watts/channel heater power.

1ma and 250  $\mu\text{A}$  sensor excitation.

Dual serial communication links.

Novel low power control to ease use with cryostats





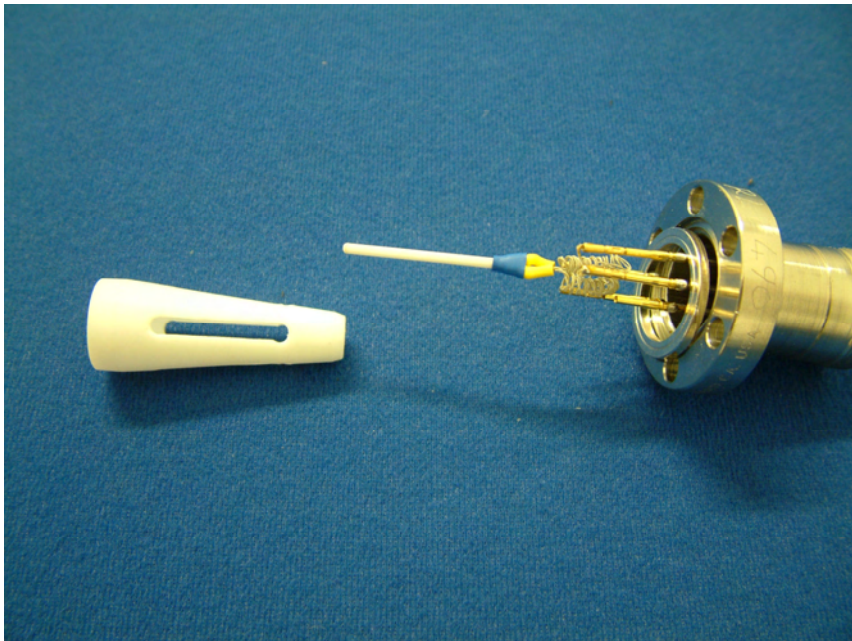
# Thermometry

Unusual application of a PT100 platinum sensor in para-hydrogen gauge.

Run the PT100 with constant power control – 200~300mw.

Read back excitation voltage to give gas temperature – related to gas thermal conductivity.

Beth Evans has a detailed poster on this system – see her for details



# Experiment control

New requirement to accommodate NIM inputs from the Data Acquisition Cards.

These signals will form a trigger to SE equipment of many varieties, each with its particular quirks.

An opportunity to design an electronic telephone exchange between different hardware types.

Types chosen-

NIM    TTL    RS232    Fibre    Relay

Sane internal programming language – 'C'



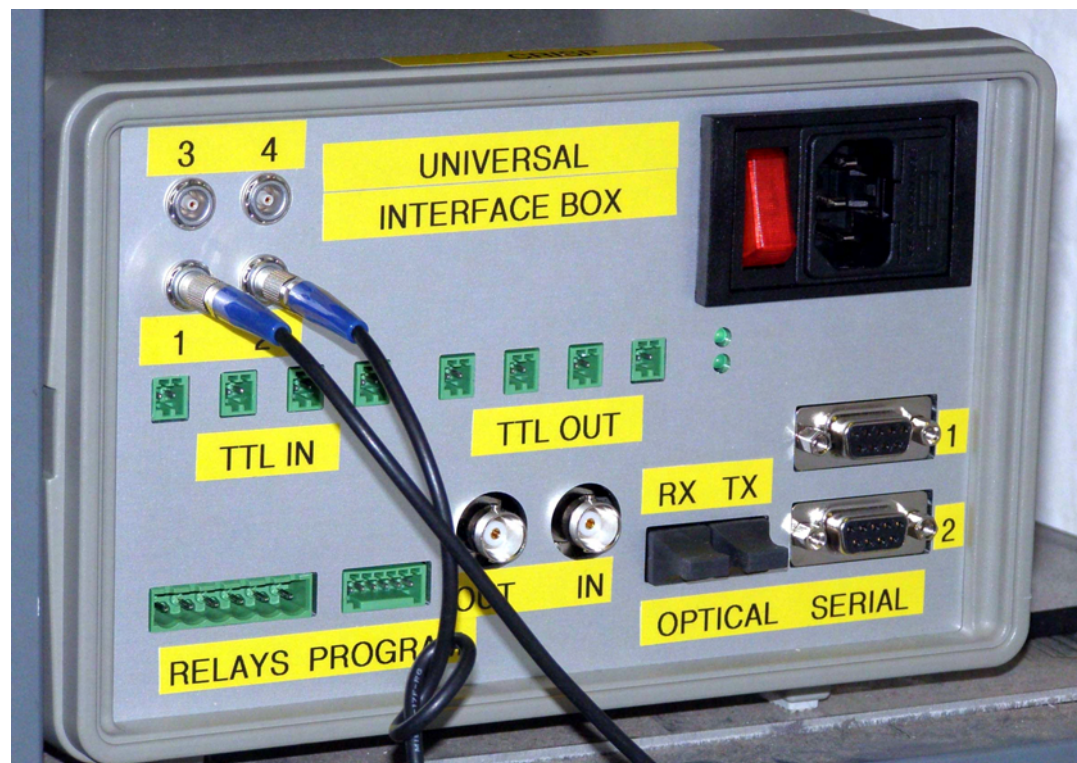


# Experiment control

*Urgent prototype* needed to read 4 NIM inputs from our new period card for DAQ and create ASCII strings and analog values.

Software is being written to allow configuration from a host script file.

Additionally a 4-20ma driver facility is fitted.



# Instrumentation

Vibration of pulse tube cryopumps is a subject of great interest at ISIS.

This is a very difficult measurement to make.

Fundamental frequency is about 1Hz.

Displacements of 5 microns.

Hostile environment.

What can we use??



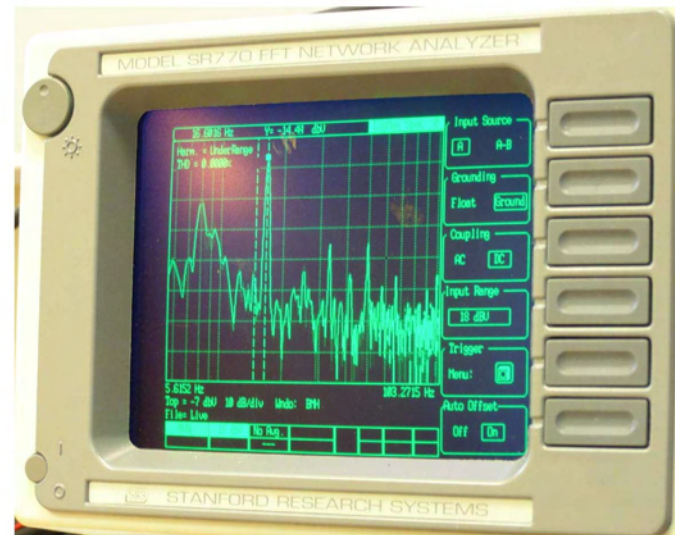
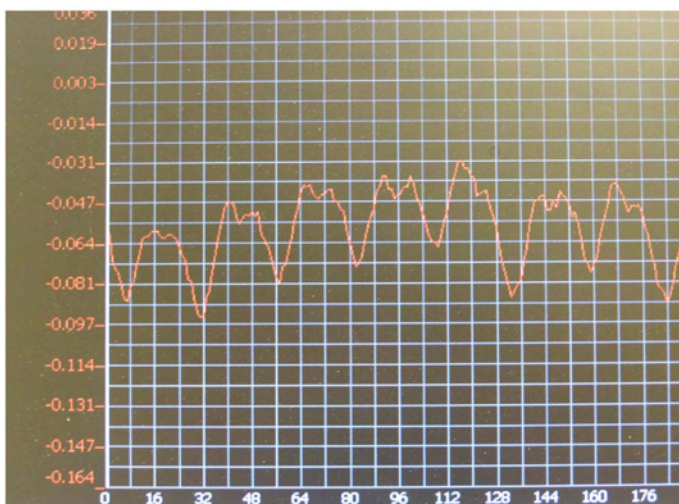


# Instrumentation

Laser triangulation measurement - Works down to 0hz from 1kHz.

Non contact - No wires - Line of sight needed

## Low frequency vibration analysis



Vibration analyser calibration values

The unit is based on dBv  $dBv = 20 \cdot \log(V/1V)$  1V pk (2v pk-pk 0.707v rms) = 0dBv

microns pk-pk	volts pk-pk	V pk	dBv	Vrms
2000	20	10	20	7.071
1900	19	9.5	19.55447	6.71745
1800	18	9	19.08485	6.3639
1700	17	8.5	18.58838	6.01035
1600	16	8	18.0618	5.6568
1500	15	7.5	17.50123	5.30325
1400	14	7	16.90196	4.9497
1300	13	6.5	16.25827	4.59615
1200	12	6	15.58303	4.2426
1100	11	5.5	14.80725	3.88905
1000	10	5	13.9794	3.5355
900	9	4.5	13.06425	3.18195
800	8	4	12.0412	2.8284
700	7	3.5	10.88136	2.47485
600	6	3	9.542425	2.1213
500	5	2.5	7.9588	1.76775
400	4	2	6.0206	1.4142
300	3	1.5	3.521825	1.06065
200	2	1	0	0.7071
100	1	0.5	-6.0206	0.35355
90	0.9	0.45	-6.93575	0.318195
80	0.8	0.4	-7.9588	0.28284
70	0.7	0.35	-9.11964	0.247485
60	0.6	0.3	-10.4576	0.21213
50	0.5	0.25	-12.0412	0.176775
40	0.4	0.2	-13.9794	0.14142
30	0.3	0.15	-16.4782	0.106065
20	0.2	0.1	-20	0.07071
10	0.1	0.05	-26.0206	0.035355
9	0.09	0.045	-26.9357	0.03182
8	0.08	0.04	-27.9588	0.028284
7	0.07	0.035	-29.1186	0.024749
6	0.06	0.03	-30.4576	0.021213
5	0.05	0.025	-32.0412	0.017678
4	0.04	0.02	-33.9794	0.014142
3	0.03	0.015	-36.4782	0.010607
2	0.02	0.01	-40	0.007071
1	0.01	0.005	-46.0206	0.003536
0.9	0.009	0.0045	-46.9357	0.003182
0.8	0.008	0.004	-47.9588	0.002828

Based on LK-G402 laser head  
1mm = 10 vdc  
1um = 10mv dc



# Instrumentation

Modern borescopes fit where thermocouples will go.



1.9mm dia by 900 mm long, stainless steel sheath, vacuum proof, glass fibre.

TV camera mount, illumination capability



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# Instrumentation

Examination of a 5.5Kbar ZrTi cell with a bore of 7mm and depth of 70mm.

Study of damage caused by use and manufacturing marks.





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## The End

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