



Target Status

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On behalf of the Target Team

CM 30

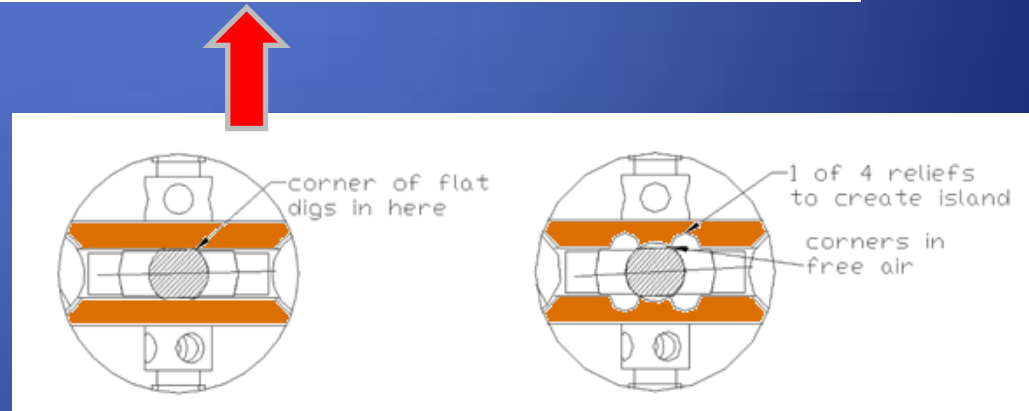
6th – 9th July 2011

University of Oxford

- Target 1 on ISIS was checked in January 2011 – no major issues.
- Target test 2.5 was underway and had completed 2.3 million pulses with little evidence of any bearing wear. The test was continuing.

Target Number	Design	Pulses (k)	Clearance um (Diameter)		Comments
			Top	Bottom	
2.1	DLC/DLC	1	50-80	50-80	Old DLC Bearing Design
2.2	DLC/DLC	80	50-80	50-80	Old DLC Bearing Design
2.3	DLC/VESPEL	2100	50-80	50-80	New Vespel Bearings but Poorly Finished Flat
2.4	DLC/VESPEL	1000	50-80	50-80	Improved Shaft, Minimal Dust, Wear in Corners
2.5	DLC/VESPEL	2300	30	30	Bearing Cutouts, Minimal Dust, Weekly Inspections

The development of a new stator was underway. The purpose of the redesign is to improve the construction tolerances/reproduction in manufacture.



- Further target tests in R78 have been successfully run.
- We now have a new baseline design of DLC shaft on Vespel bearings approved for use in ISIS. (ISIS/target workshop was on 13th May 2011.)
- No excessive dust production seen in any of the targets run in R78 - of which one has been operated up to 4 million actuations.
- This combination is reliably showing an operational target life in excess of 1 million actuations. Limitation is not due to excessive wear causing dust production but due to a slight increase in the frictional force causing 'stickiness' on target capture. Various approaches have been and are being tried to mitigate this.
- Phase 2 controller is now complete and being tested in R78.
- New Stator design underway – Geoff's talk.
- A new set of permanent magnets has been manufactured for use with the new stator – These have gone to Daresbury Labs for QA.

Target 1

- Target 1 on ISIS continues to perform, it worked through last weeks shifts with no issues.
- An oscilloscope on the target system needs replacing, but this is in hand and a replacement should be made available over the next week. In the mean time a spare scope has been borrowed.
- ISIS has repaired an extraction magnet during the shutdown. This appears to be causing the beam to be kicked more strongly towards the target during the last ms of an ISIS spill. Note that this is different to the proposed beam bump.
- This kick is giving an increase in rate that is independent of the position of the apex of the target – This could do with further study, possible along with the beam-bump, later on this year.

T2.5 (slide from last CM talk)



800 hours of
running

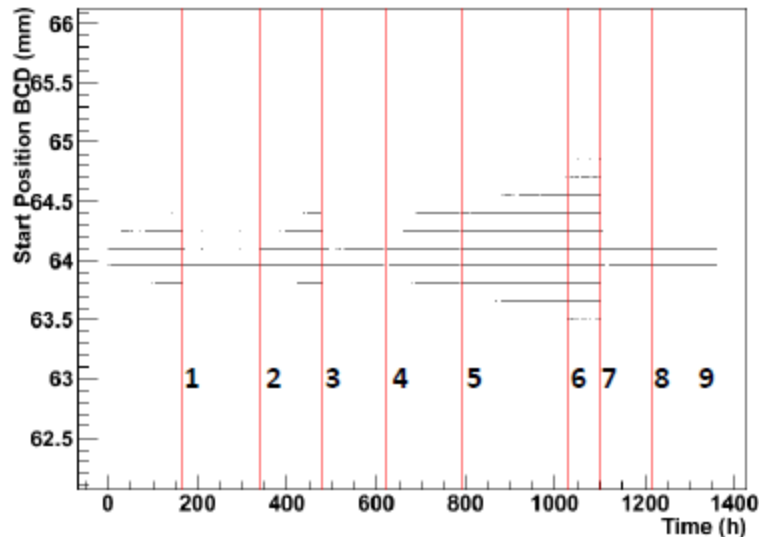


2.3 million
actuations



T2.5 – DLC/Vespel – 4.0 million pulses

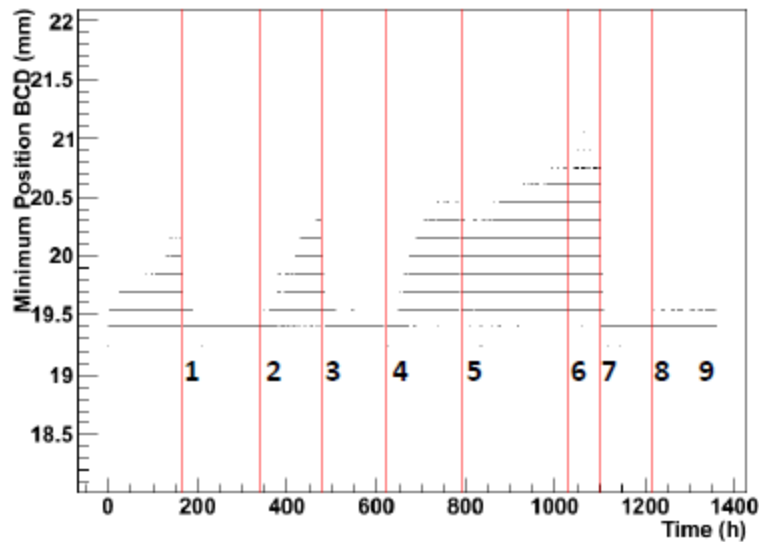
Raw Data from Start Pos BCD



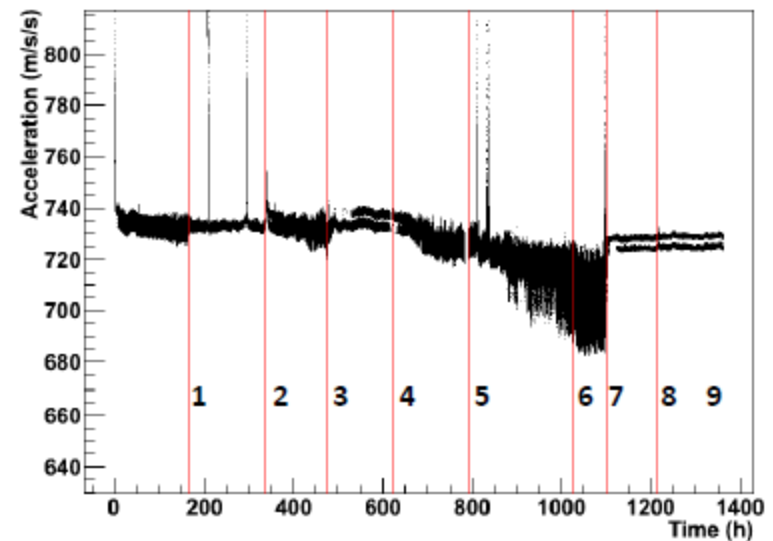
Stop Time | Actuators | Description

Stop Time	Actuators	Description
1 - 164	490960	Inspection 1 (14/12/2010)
2 - 338	512865	Pause for Christmas, Inspection 2 (5/1/2011)
3 - 476	412043	Inspection 3 (11/01/2011)
4 - 621	414325	Inspection 4 (18/01/2011)
5 - 790	482527	Inspection 5 (26/01/2011)
6 - 1026	701662	Test Pause in running park for 1hr. (attempt reset)
7 - 1101	219747	Inspection 6 (17/02/2011)(CM29)
8 - 1214	334982	Pause, DAQ pc full
9 - 1361	436588	Final Stop (no line, end of data)

Raw Data from Min Pos BCD



Acceleration to SP1



T2.6 – DLC/Vespel – 1.14 million pulses

Nominally identical to T2.5

Clearances around bearings changed

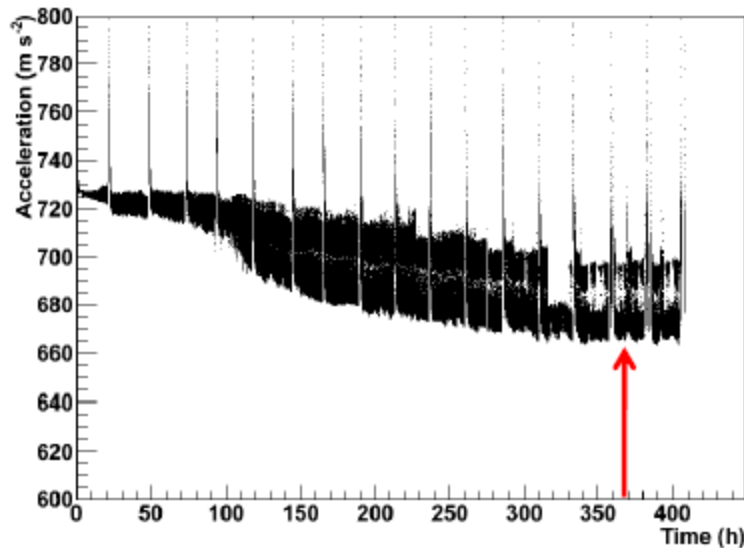
Changed inspection routine

No weekly inspections

1 hour stop every day

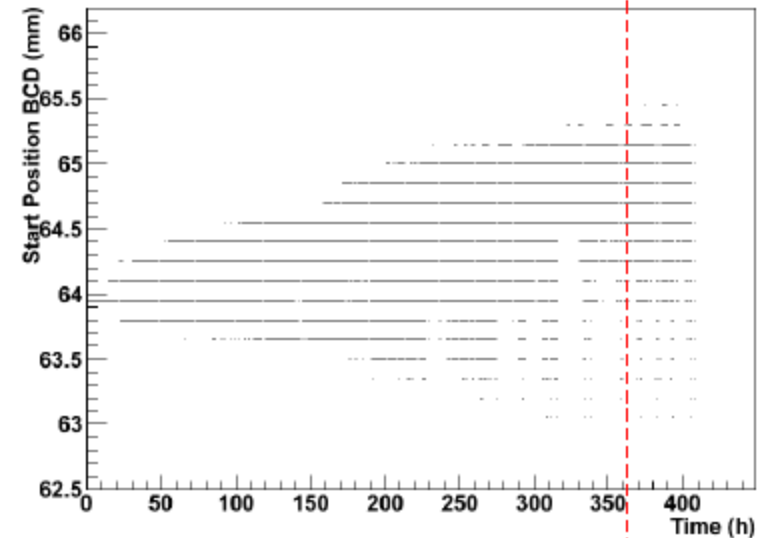
Several capture sticks occurred, +370 h

Acceleration to SP1



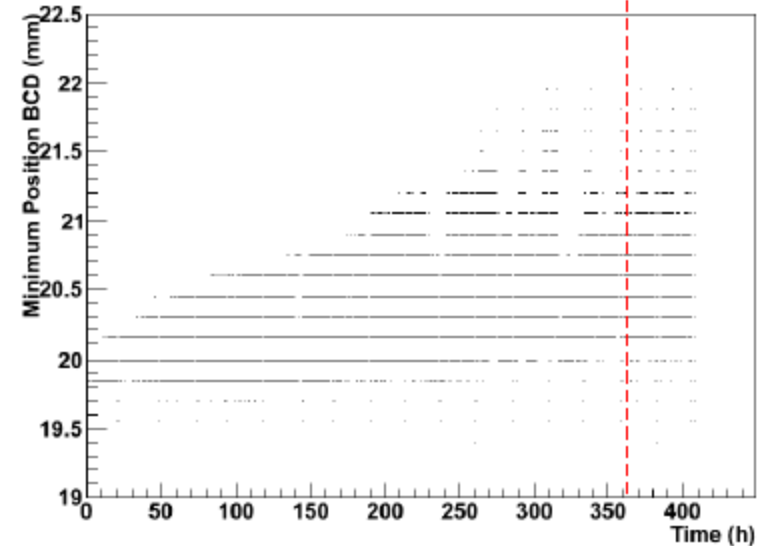
Raw Data from StartPosBCD

15/16



Raw Data from Min Pos BCD

15/16



T2.7 – DLC/Vespel – 1.28 million pulses

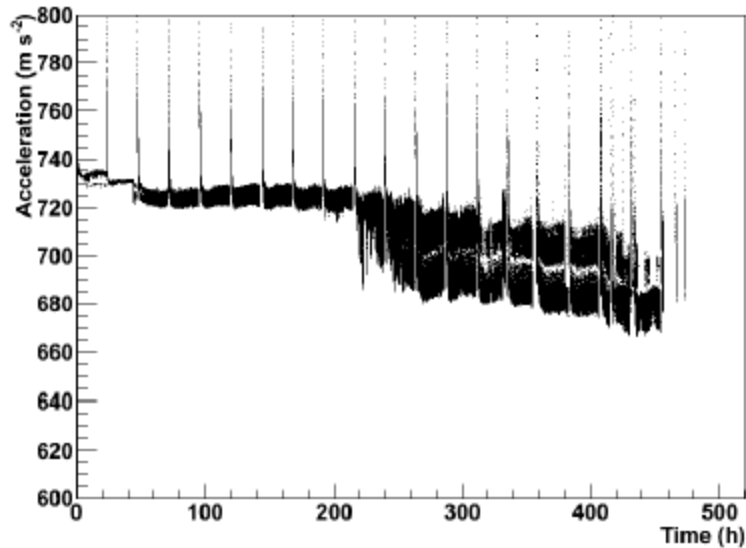
Clearances increased around bearings

Daily pauses as for T2.6

Again several capture sticks seen

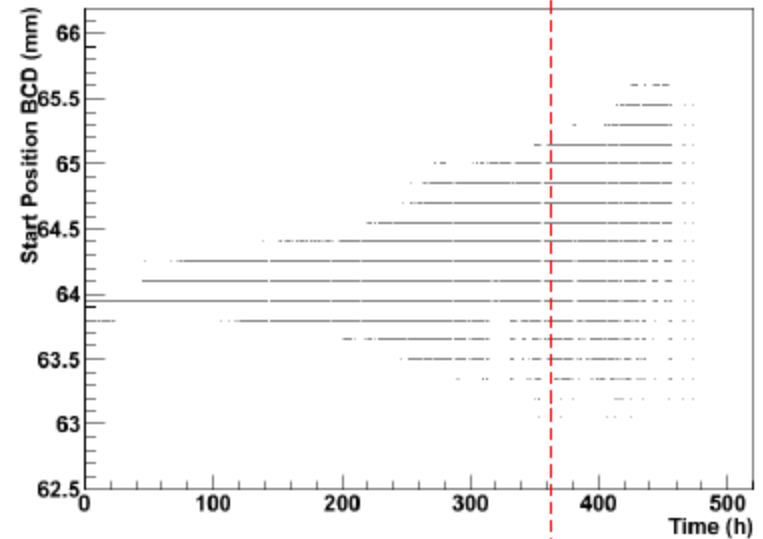
These began at 360 h

Acceleration to SP1



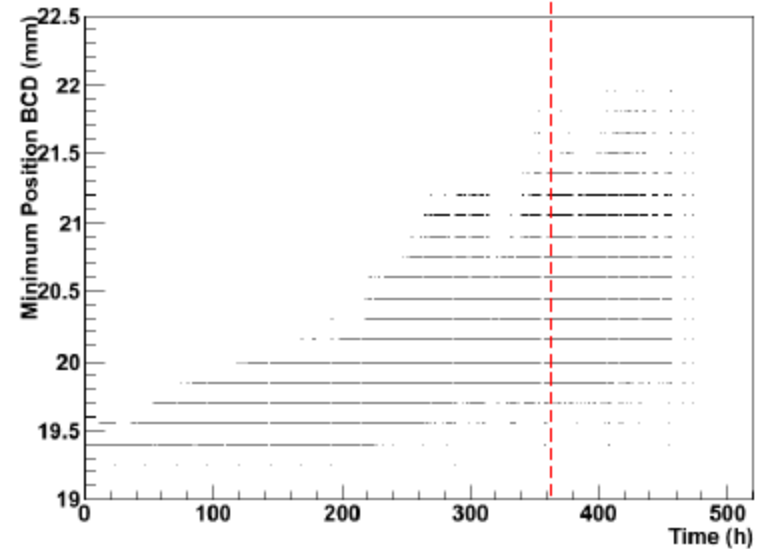
Raw Data from StartPosBCD

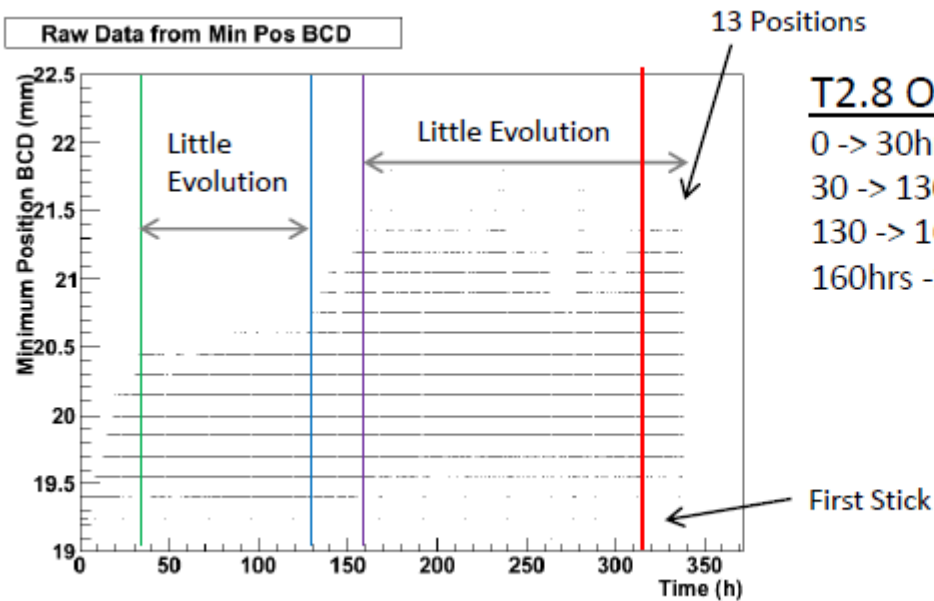
15/16



Raw Data from Min Pos BCD

15/16

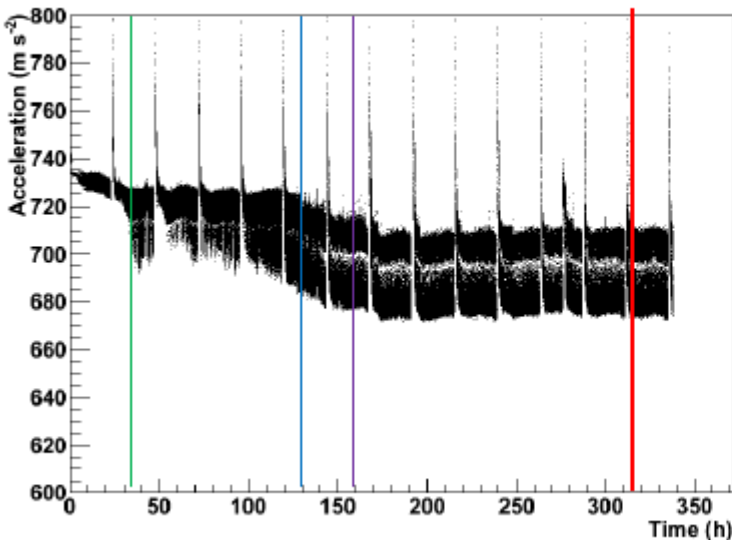




T2.8 Observations:

- 0 -> 30hrs: Rapid increase in number of minimum positions.
- 30 -> 130hrs: Little / no increase in start position
- 130 -> 160hrs: Rapid increase in number of minimum positions.
- 160hrs -> now: Apparent flat, some dips

Acceleration to SP1



T2.8 Observations:

- Acceleration shows continuous change unlike start and minimum positions.
- Double distribution appeared during flat period (30-130) in start, minimum positions.
- Now two distributions occurring in acceleration.
- At 270Hrs Spike in acceleration, performance during this period was close to performance at 10Hrs.

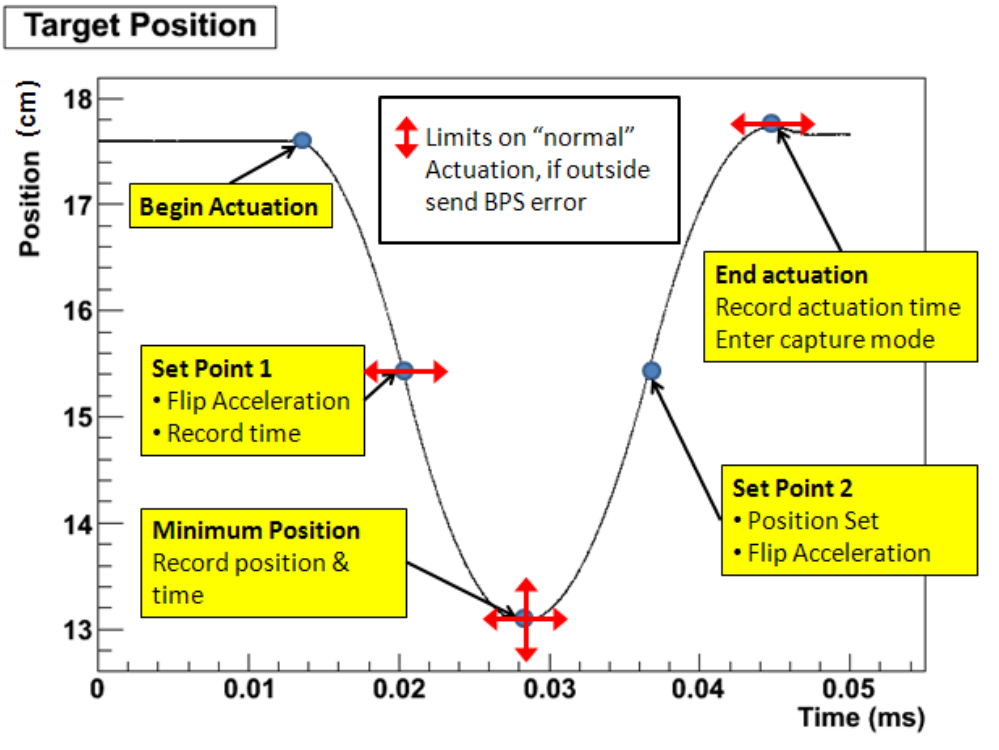
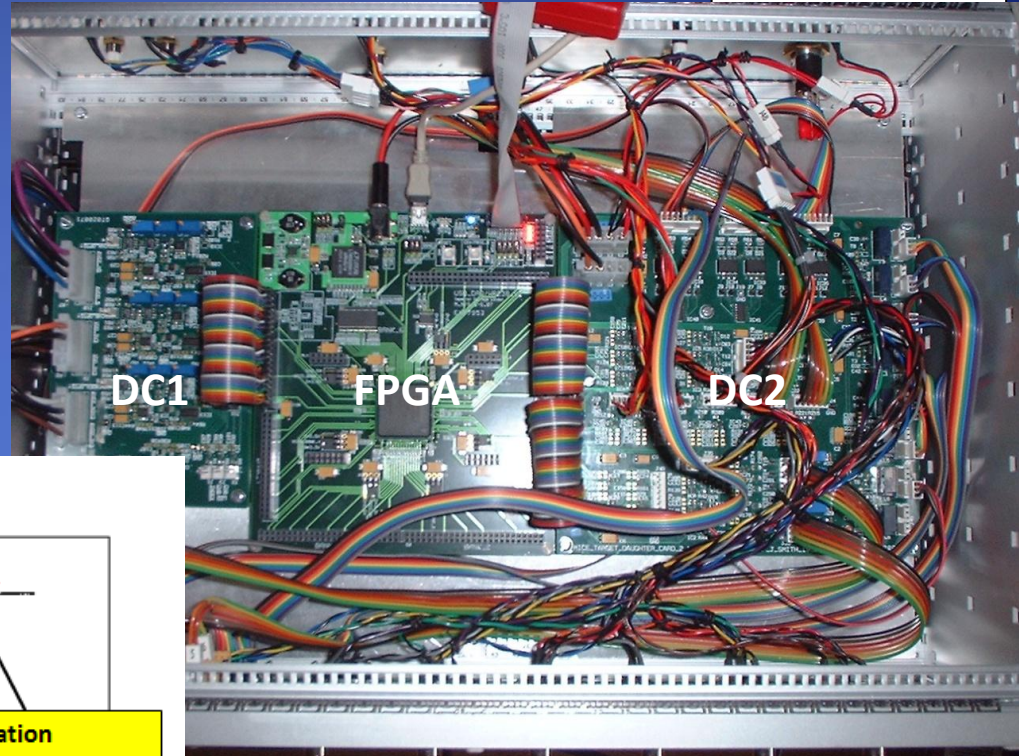


Target Controller



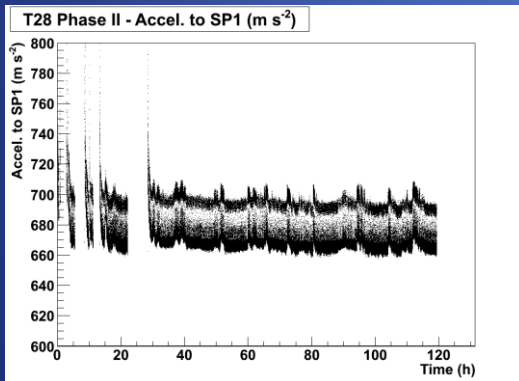
- The Phase 2 controller is now complete. Externally it looks identical to the Phase 1 controller, internally it is quite different – All the circuitry has now been integrated onto 3 PCBs and additional control functionality has been implemented.
 - One example is the ISIS BPS signal
- We are now in the process of making two identical copies of this controller. One in the MLCR, one in R78 and one for further development in Sheffield. Having three identical controllers will be a first!
- Now been moved to R78. Once the phase 2 controller has been proven:
 - Install either the phase 1 controller or one of the copies of the phase 2 controller (preferable) into the MLCR - Suspect that the old controller can be swapped out late August/Early Sept.
 - The new controller will require some commissioning time (1 shift?) after this date.
- We have possibly found a workaround for the phase 3 development (New target DAQ) using the existing DAQ system so it's not obvious whether the Phase 3 upgrade is required in the form that it was envisaged 2 years ago. Details TBC.

Most of the Controller is now “Fresh Air”. The entire controller unit is 9U high including PSU. (could fit comfortably in 6U but there is space left for expansion)

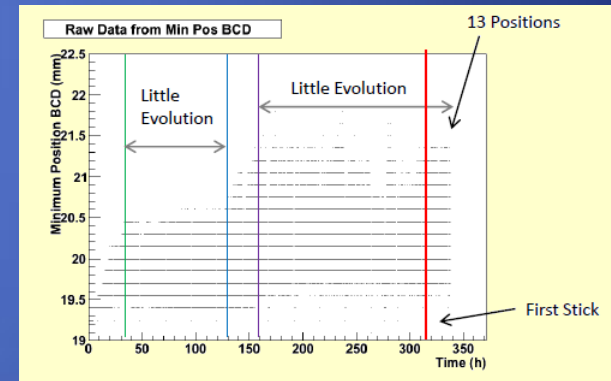
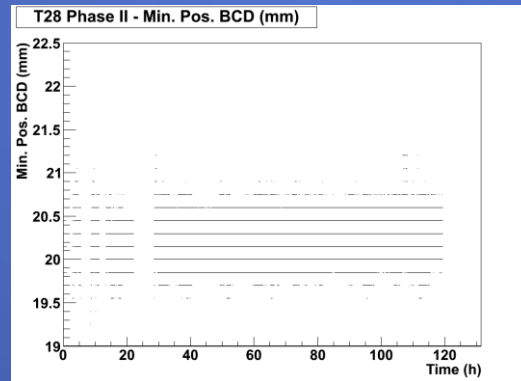


The BPS (Beam Protection System) tracks key parameters of the target trajectory to ensure that the target is operating normally on a pulse by pulse basis.

- A simple firmware change was made to the Phase 2 controller that permits a higher capture current during the first part of the capture. We hope that this will help alleviate the sticking/ reduce the start position spread.
- T2.8 is now being run under the phase 2 controller. (Started 29/06/2011) Note that T2.8 was not disturbed before this switchover.



T2.8 after Phase 2 controller upgrade



T2.8 before P2 Controller Upgrade

Not claiming victory yet – these plots are provided for early comparison only!

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2.4	DLC/VESPEL	1000	50-80	50-80	Improved Shaft, Minimal Dust, Wear in Corners
2.5	DLC/VESPEL	4000	30	30	Bearing Cutouts, Minimal Dust, Weekly Inspections
2.6	DLC/VESPEL	1100	15-17	20-23	No Weekly Inspections, Some Sticking
2.7	DLC/VESPEL	1300	20-25	35-40	Bearing Clearances Increased, No Inspections, Some Sticking
2.8a	DLC/VESPEL	1100	25-30	45-50	Bearing Clearances Increased, No Inspections, Some Sticking
2.8b	DLC/VESPEL	TBA!	25-31	45-51	New Controller - Using 2.8a - Will Capture Sticks be Reduced?

Further target test plans are dependent upon the outcome of Test 2.8b



Summary



- Great progress towards demonstrating reliable target operation.
- Dust production/migration has been demonstrably eliminated up to 4 million actuations.
- A New baseline VESPEL/DLC design has been approved for use in ISIS.
- The Phase 2 controller is now complete and under test. Two copies are being manufactured. Migration of a new controller to the MLCR is foreseen later this summer.
- Target Tests are continuing in R78 to further improve operational reliability and longevity.
- The New Stator Design is now well underway – More details in the next talk.