

CONTRIBUTION OF THE CLS CONTROL SYSTEM TO THE CLS ACCELERATOR SYSTEM RELIABILITY

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Abstract:

The control system software plays an increasingly important role in achieving overall accelerator system reliability, in this regard the CLS control system is no different. This paper reviews the two aspects of control system reliability (1) the reliability of the control system itself and it contribution to system reliability and (2) the use of the control system as a tool to aid in predicting and localizing system failure therefore providing an indirect impact on mean-time-between-failure and mean-time-to-repair. The paper provides a survey of metrics used at the CLS to evaluate system reliability, several failure modes that have been localized and removed from the system design to contribute to overall reliability. Recently CLS has deployed a new approach to alarm annunciation and fault location based on voice

Goals:

Reliability in the context of an accelerator is the extent to which an experiment, test, or measuring procedure yields the same results on repeated trials.

Our first goal: to reliability delivery beam when scheduled for the length of time scheduled.

Our second goal: to reliably reproduce the electron beam orbit and focusing to produce x-ray beams of constant energy, position and intensity. The beam position is determined by the reproducibility of the storage ring dipole magnets and the effectiveness of the orbit correction system. Beam intensity depends on the source size which in turn relies on reproducible beam focusing from the quadrupole and

annunciation and nested dashboard display screens.

sextupole magnets





Dashboards



Control System



Operating Data

Trips





CLS as a relatively new synchrotron has progressively been increasing the number of hours of operation over the past five years. For scheduling purposes the CLS divides the calendar year into six month cycles and maintains two extended outages per year for major installation and maintenance activities. When brining a new machine online an equally important metric is the integrated stored current (amp-hours). During the early commissioning amphours were limited due to the need for beam-based vacuum conditioning of the storage ring and ongoing installation of beamlines and other components.

Drill Down Into EDM Screens

- ✓ Indicator matrix a snap shot of the big picture
- ✓ Sub-screens display components info in a sub-system
- Related displays links to other EDM screens







Storage Ring User Beam Reliability

Problem/Event/Change tracking integrated into Configuration Management System

Se	ssion	Submit	View Actions		• Tool	s 💽 Help	T	
Que	wy: E	SMIT	Node: list <u>detail split</u> Go	To Item: Results: 1 - 44 o	f 44 ↓	Search: 1	J	⇔⇒ & ⊗ ∆ ø
	<u>5401</u>	Problem Report	BMIT ACIS POE-3 Lamacoid	Implementation	High	11 HSE/ACIS/BMIT	I Grant Cubbon (cubbong)	Jun 5, 2009 4:29:11 PM
	<u>5447</u>	Problem Report	BMIT ACIS - PLC CPU Change RAM to ROM Card	Implementation	Urgent	11 HSE/ACIS/BMIT	🎲 Grant Cubbon (cubbong)	Mar 31, 2009 1:38:37 PM
	<u>5448</u>	Problem Report	BMIT ACIS - CANNOT DOWNLOAD TO PLC	Implementation	Urgent	11 HSE/ACIS/BMIT	I Grant Cubbon (cubbong)	Apr 1, 2009 9:53:30 AM
	<u>5603</u>	Problem Report	TM 2406-1, 02 , and 03 exist on two different sets of drawings - One set needs the sequence number changed	Assessment	Low	🔄 /26 BMIT	🎲 Mike McKibben (mckibbm)	May 1, 2009 1:04:05 PM
	<u>5616</u>	Problem Report	Implement P2VP in BMIT BM	Assessment	Low	105 SR1/FrontEnds/BMIT BM	🆫 Hao Zhang (zhangh)	May 4, 2009 9:46:57 AM
	<u>5617</u>	Problem Report	Implement P2VP in BMIT ID	Assessment	Low	105 SR1/FrontEnds/BMIT ID	🎲 Hao Zhang (zhangh)	May 19, 2009 11:45:34 A
	<u>5650</u>	Problem Report	BMIT POE-3 ACIS SSH Limit Switches	Implementation	Urgent	11 HSE/ACIS/BMIT	1 Grant Cubbon (cubbong)	May 12, 2009 2:23:34 PI
	<u>5661</u>	Problem Report	Install mechanical parts for door actuators for BMIT POE-3 and SOE-1	Identification	Low	T11 HSE/ACIS/BMIT	1 Peter Thorpe (thorpep)	May 12, 2009 3:58:54 Pt
	<u>5734</u>	Problem Report	BMIT ID LOCKOUT switch crowbars SR1 cavity high voltage	Assessment	Urgent	11 HSE/ACIS/BMIT	- Grant Cubbon (cubbong)	Jul 15, 2009 8:51:09 AM
	<u>5768</u>	Problem Report	Interlock BM POE-1 SSHs if Neither ID Mode Selected in POE-2	Assessment	Urgent	A /11 HSE/ACIS/BMIT	Mohamed Benmerrouche (benmerm)	Sep 13, 2009 3:58:53 PN
	<u>5804</u>	HSE Task	090625 BMIT ID Penetration survey	Open		/11 HSE/ACIS/BMIT	1. Grant Cubbon (cubbong)	Jun 25, 2009 9:07:23 AM
	<u>5850</u>	Problem Report	Varian Multi gauges don't return pressure reading from TCG boards	Identification	Low	🔄 /26 BMIT	🎲 Glen Wright (wrightg)	Jul 15, 2009 7:44:38 AM
	<u>5966</u>	Problem Report	Unable to open PSH-2 on BMIT	Implementation	Low	/05 SR1/FrontEnds/BMIT ID	🦫 Glen Wright (wrightg)	Aug 18, 2009 5:05:18 PN
	<u>6024</u>	Problem Report	Remove Temporary Machine Protection Simulator from BMIT	Identification	High	🔄 /26 BMIT	🏇 Mike McKibben (mckibbm)	Sep 4, 2009 8:47:09 AM
	<u>6040</u>	Problem Report	Install BMIT ID machine protection	Identification	Low	(26 BMIT)	🎲 Mike McKibben (mckibbm)	Sep 4, 2009 8:48:38 AM
	<u>6041</u>	Problem Report	Install BMIT ACIS	Identification	Low	🔄 /26 BMIT	🎲 Mike McKibben (mckibbm)	Sep 4, 2009 8:49:46 AM
	<u>6050</u>	Problem Report	BMIT SSH Status Not Available	Implementation	Medium	11 HSE/ACIS/BMIT	. Mohamed Benmerrouche (benmerm)	Sep 8, 2009 2:11:06 PM
	<u>6117</u>	Problem Report	BMIT ACIS V&V REV 6 P1605.3-01 Relays Unusually warm	Assessment	Medium	a /11 HSE/ACIS/BMIT	🎲 Robby Tanner (tannerr)	Oct 2, 2009 12:33:09 PN
	<u>6118</u>	Problem Report	BMIT ACIS V&V REV 6 SOE EOS tests gave contrary results	Implementation	Medium	11 HSE/ACIS/BMIT	🕼 Robby Tanner (tannerr)	Oct 2, 2009 12:29:48 PN
	6119	Problem Report	BMIT ACIS V&V REV 6 TYPOS	Implementation	Low	11 HSE/ACIS/BMIT	🎡 Carl Finlay (finlayc)	Sep 28, 2009 10:42:24 A





One specific area that was targeted between cycle 6 and 7 was vacuum trips. This was accomplished by modifying the control system to better debounce minor vacuum transients as well as implementing a staged response to beamline front-end vacuum transients. The results in this targeted approach can be seen in the overall increase in the MTBF and the number of user shifts delivered without trip, as shown in Figure 4. In earlier cycles (not shown) target areas included improvements how flow switches are debounced as well as human factors for machine injection. This approach permits us to use metrics as a tool to focus resources on areas that provide the most benefit.



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