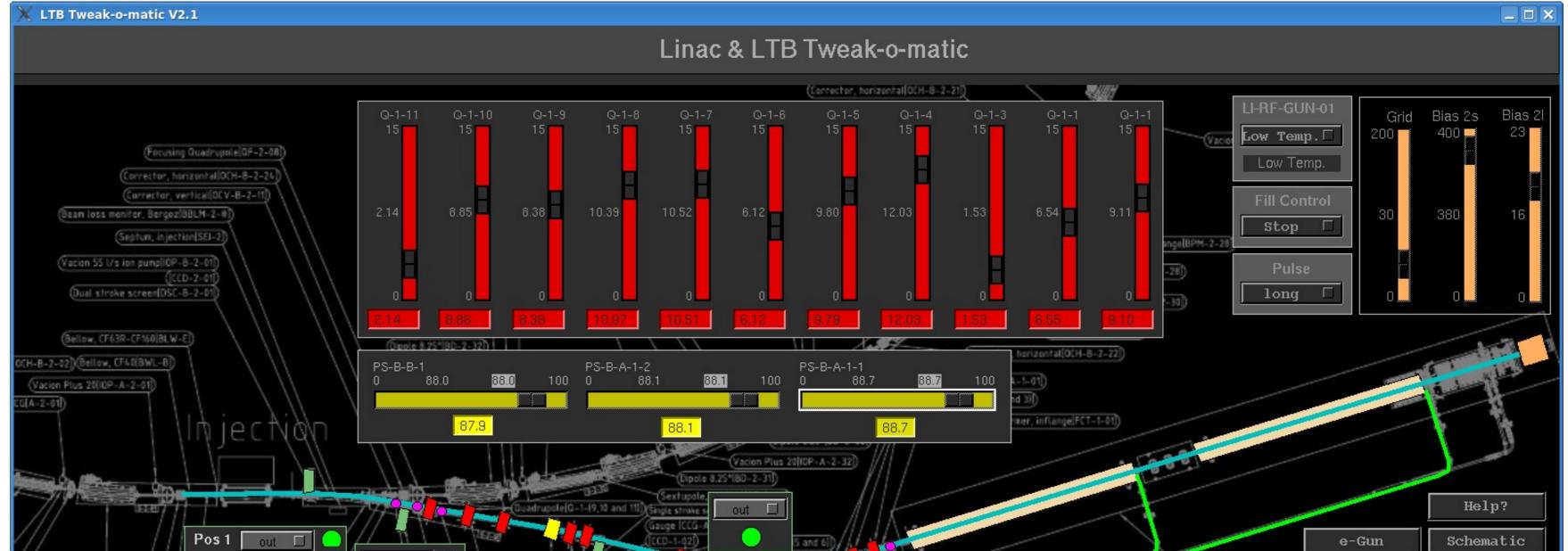
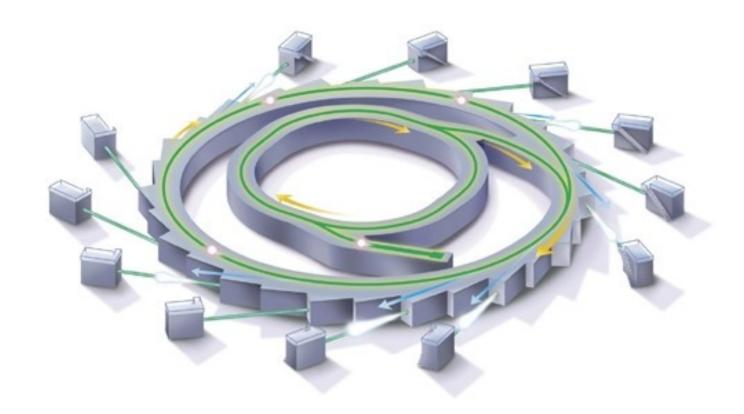


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#### Abstract

With the Australian Synchrotron now in full-time user operation mode the minimisation of unexpected beam down time is of high importance. Having easily accessible tools at the fingertips of the Operator to detect, diagnose and remedy the fault is vital. By using existing EPICS frameworks, such as the epics display manager and the alarm handler, it has been possible to create custom, intuitive and easy to use control and fault indicators. These frameworks were flexible enough to produce the desired tools, which now form part of a backbone for systems monitoring and injection system tuning.





#### Pos 2 Linac Mags Linac RF RF ILKS Vertical Correctors **RF Phase Shifters** e 8.25\*[80-2-01] Horizontal Correctors Heater jection System Scope LI-RF-AMPL-0 Heater -0.61 0.51 0.39 0.56 **Booster LLRF** Booster Camera

Figure 2: The Linac and LTB tweak-o-matic, showing magnet set-point sliders, screen insertion buttons and program launch buttons.

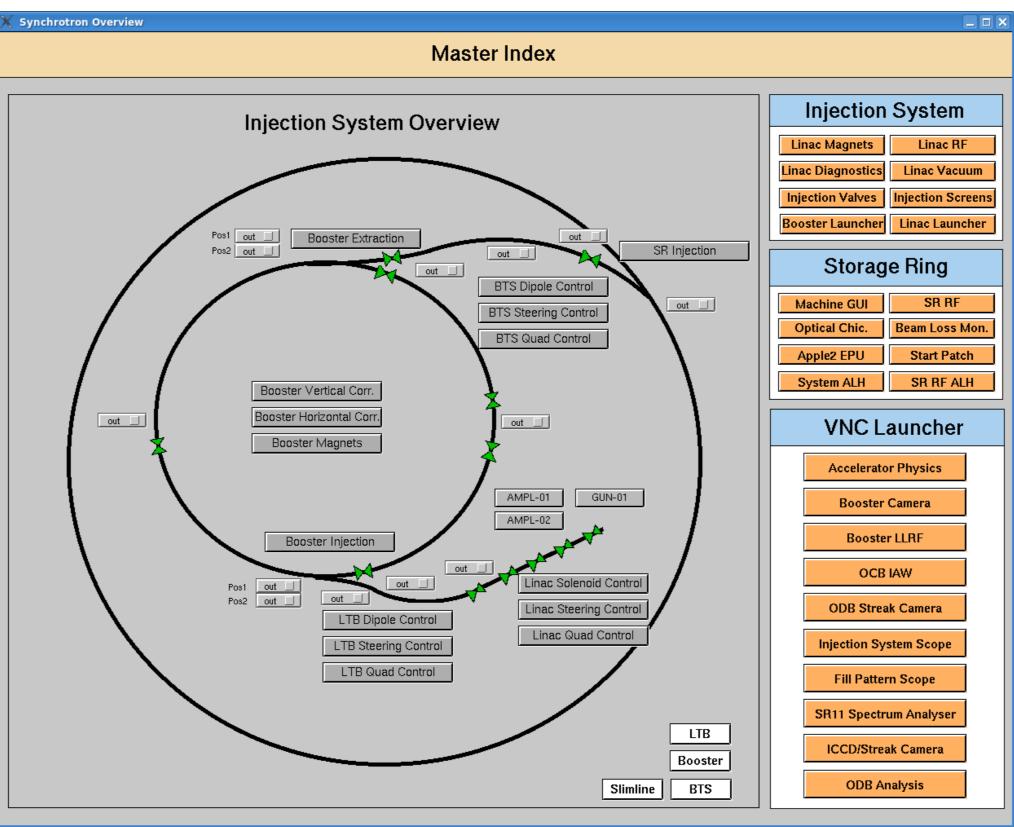
### **MACHINE OVERVIEW**

Located near Melbourne, Australia, the Australian Synchrotron is a 3<sup>rd</sup> generation light source. The facility has been open to users since April 2007. The storage ring is currently running with 200mA. A typical stored beam lifetime is in the order of 36 hours, with all insertion devices operating, this requires that we re-inject every 12 hours.

There is a suite of 9 beamlines, currently Infra-Red Spectroscopy, Protein Crystalography 1,

# **TWEAK-O-MATIC**

Before the birth of the Tweak-o-matic tuning GUI the interface consisted of large slabs of sliders, which for the purpose of commissioning worked well. A more visual display of the components and their relationships between each other was required to more intuitively and effectively tune the injection system.



## **ALARM HANDLER**

The EPICS Alarm Handler (ALH) is a critical systems monitoring software which provides a central point for the audio and visual display of all current alarms (figure 4), based on the EPICS process variable (PV) database file information.

The ALH is configured and the alarm tree built up using common text files. The simple syntax allows for the inclusion of a click-able guidance feature, which can be used to provide debugging information. The syntax also allows operators the ability to launch GUI applications to quickly reset any faults.

Powder Diffraction, X-Ray Absorption Spectroscopy and Soft X-Ray Spectroscopy are fully operational, Protein Crystalography 2, Microspectroscopy and Small/Wide Angle Scattering are under active commissioning and Medical Imaging is currently under construction.

The control system used for all accelerator systems is the Experimental, Physics, Industrial Control System (EPICS). Much of the injection system control interface is managed through the EPICS display manager EDM. All of the storage ring control interface has been developed inhouse by the Controls Group (figure 1). Matlab is also extensively used.

All Operator Interfaces (OPI's) are software identical. This means that any of the systems can be controlled from any of the OPI's. However, out of habit, certain interfaces are only used on certain OPI's. Figure 3: Injection system overview and launch interface. Provides a central location for many of the existing EDM GUI's.

There are 3 GUI's in tweak-o-matic range. The series starts with the overview of the injection system (figure 3), this is the launching pad for other programs and control GUI's. It also provides control and visual recognition of the state of the vacuum gate valves and the beam spot screens.

The Linac and LTB Tweak-o-matic was based around the construction layout schematic (figure 2).

Another extensively used feature of the ALH is the ability to log all faults detected. This information is placed in a daily log-file and is used to determine a sequence of events and to assist with the writing of fault logs.

In the control room there are many different programs that produce an audible beep; Matlab, system shells and ALH. An addition is currently under development to enable different sounds to be emitted according to the different levels of the alarm state.

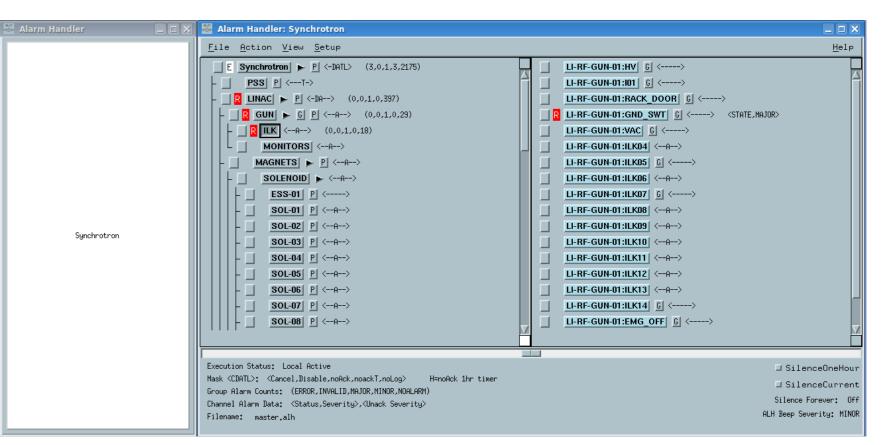


Figure 4: The facility alarm handler showing the electron

Stop       Start			Timin	g Control			· ?
Stop Start   Stop Start   Start Bucket   121   12	Injection Control			Master Oscillator			
Start       D Start       D Start       -1.8 dBn       -1.8 dBn       -1.8         121       A       121       25164       Trigger Phase         Fill Control       Stop       Stop       Stop       +00.0         Stop       Continuous       Stop       Stop       +00.0         One Shot       Pattern Fill       Injection Interlock       Insertion Device       3       5       8       12       13       14       Beam Current         Injection Warning Lights       Dif       On       Off       Setup       Setup       Insertion Readback       75       H0,075       A	Injection Trigger	Setpoint	Status	Set Point	Readback		
Start Bucket   121 <	Stop Start	Start		499,671,838 Hz	499,671,838 Hz	499,	671,838 A
Fill Control   Stop   Stop   Continuous   Stop   Fill Timer   Injection Interlock   Gun Enable/Disable   Disable   Enable   Injection Warning Lights   Off   On   Off   Setup     Set Point   Readback   Sync   +00.0        Miscellaneous   Insertion Device   Injection Warning Lights     Config     Setup     Set Point   Readback   Set Point     Readback     Set Point     Insertion Device   Set Point     Insertion Device     Insertion Device   Insertion Device   Insertion Device   Insertion Device   Insertion Device   Insertion Device   Insertion Device   Insertion Device   Insertion Device   Insertion Device   Insertion Device   Insertion Device   Insertion Device   Insertion Device   Insertion Device   Insertion Device   Insertion Device   Insertion				-1.8 dBm	-1.8 dBm	-1.8	A
Fill Control   Stop   Continuous   Stop   Continuous   Stop   Fill Timer   Injection Interlock   Injection Interlock   Disable   Enable   Injection Warning Lights   Off   On   Off   Setup     Set Point   Readback   Sync   Hiscellaneous   Insertion Device   Injection Interlock   Injection Warning Lights   Off   On   Off   Setup     Setup     Set Point   Readback   Sync   Hiscellaneous   Insertion Device   Injection Interlock   Injection Varning Lights   Off   On   Off   Setup     Long Pulse Width   Set Point   Readback   75   FB Buck   75   +0,075	121 🜩 A	121	25164	Trigger Phase			
Stop       Continuous       Stop       Stop         One Shot       Pattern Fill       Injection Interlock       Insertion Device       3       5       8       12       13       14       Beam Current         Injection Interlock       Injection Interlock				Set Point	Readback	Sync	
One Shot Pattern Fill   Dire Shot Pattern Fill   Injection Interlock   Gun Enable   Disable   Disable   Enable   Enable   Off   On   Off   Setup        Miscellaneous   Insertion Device   Insertion Device   Insertion Device   Set Point   Readback   75   RF   Buck   75   Ho,075	Fill Control					+00.0	A
One Shot Pattern Fill   Injection Interlock     Gun Enable   Disable   Enable   Injection Warning Lights   Off   On   Off   Setup     Insertion Device   3   5   8   1.4   Setup     Insertion Device   3   5   8   1.4   Beam Current   Injection Interlock   EPS 00S Status   Injection Warning Lights     Long Pulse Width   Set Point   Readback   75   FB Buck     Tot RF Buck	Stop Continuous	Stop	Stop	- Miscellaneous			
Gun Enable/Disable       Enable       Enable       Enable       Enable       EPS 00S Status       158.503 million         Injection Warning Lights       Off       Off       Setup       Cong Pulse Width       Feadback         75 RF Buck       75 +0,075       A	One Shot Rattern Fill	Fill Timer	1.4 secs		E 0 10 10	14	Baam Coment
Gun Enable       Enable       Enable       EPS OOS Status         Disable       Enable       EPS OOS Status         Injection Warning Lights       Set Point       Readback         Off       On       Off         Setup       75 RF Buck       75 +0,075		Injection Interlock			5 6 12 13	14	
Disable       Enable       Enable       Enable       Enable       Long Pulse Width         Injection Warning Lights       Off       Off       Set Point       Readback         Off       On       Off       Setup       75 RF Buck       75 +0,075       A	Gun Enable/Disable						158.505 MA
Injection Warning Lights Set Point Readback       Off     Off     Setup     75 RF Buck     75     +0,075     A	Disable Enable	Enable				-	
Injection Warning Lights       Off     Off     Setup     Set Point     Readback       75 RF Buck     75     +0,075     A				Long Pulse Width			
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						, ,	
28 Sep 08 16:11:5	5-						28 Sep 08 16:11:56

Figure 1: the timing control component of the Controls Group "Navigation GUI". All of the systems needed to run and adjust the Linac and LTB have been provided, or are linked to. One useful feature is that when the mouse is hovered over a visual magnet square a pop-up with an adjustable slider is seen.

The BTS Tweak-o-matic is based on the same principles as the Linac and LTB GUI. In addition this GUI also provides a graph of the storage ring current, injection efficiency and dose rate at the point of injection. The graph provides important feedback on the success or otherwise of magnet "tweaks". gun interlock group, with an acknowledged but active ground switch interlock.

#### CONCLUSION

The simplicity and ease of configuration of the ALH and the EDM has allowed for the custom set-up of alarm files and intuitive, easy to use GUI's for successful fault diagnosis and injection system tuning.

The tools available and the operators' expert use of them has enabled the Australian Synchrotron minimise the impact of un-expected down-time.