

The Australian synchrotron

A minor status overview and pictures from down under.

Delivered by S Hunt, Occasional consultant to the AS and to many other facilities.

Richard Farnsworth and Team at the AS, who have depended on the community for support, software and assistance over the last four years.

**The Australian Synchrotron uses Linux throughout
Real-time Linux low down and Softer on up.
Various flavours, inc Redhat and Debian.**

**All IOCs are Linux Based, and there is little VME
hardware, except for timing and the Beamlines,
where a PCI to VME bridge is used.**





initial suite of beamlines

X-ray diffraction

For structural analysis of solid state structures

Spectroscopy

For analysis of bonds and electronic organisation of molecules

Imaging

For high contrast imaging of objects from small animals through to engineering components and minerals

Polarimetry

For determining the secondary structure of proteins and other biological molecules

Micromachining

For manufacturing micro-devices with very high depth to width ratio and excellent surface finish

Overhead



**Australian Synchrotron site
from the air, June 2006**

From a tiger moth





*Aerial view of the Australian Synchrotron with
Melbourne CBD skyline*

Storage ring circumference:
216m

Electron energy: 3 GeV

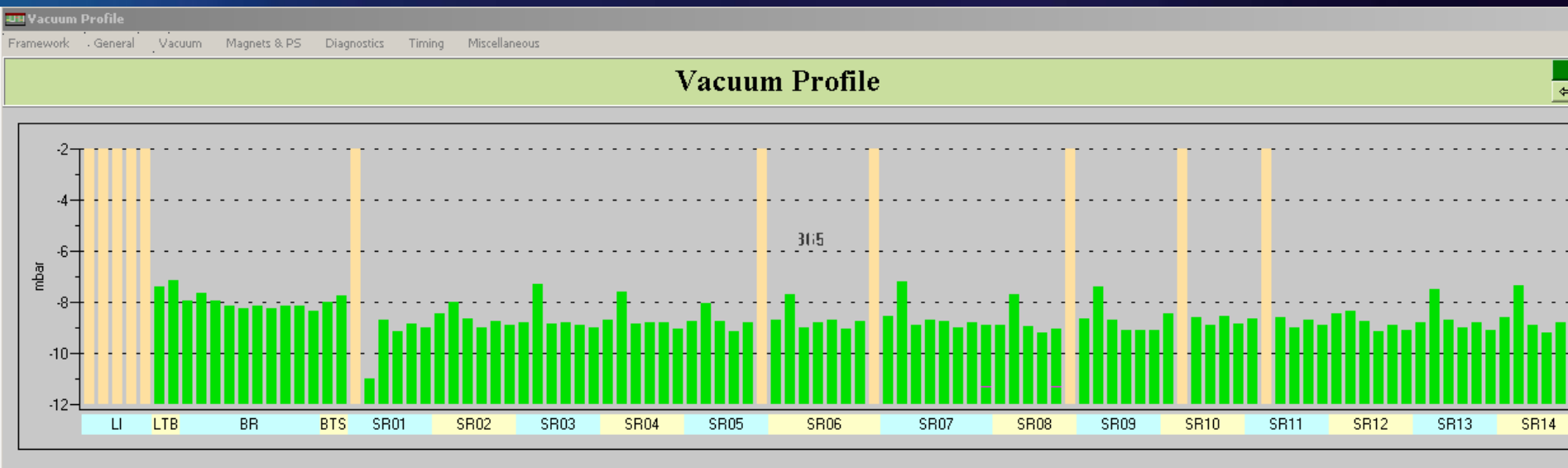
Commencing operation: 2007

Initial suite of 9 beamlines

Capacity for at least 30
beamlines in the long term

The instrumentation and control system for the Synchrotron accelerator systems are built using EPICS. No other single major control systems are used, although there are pockets of things such as Labview and a few dedicated controllers. This is true for both accelerator and Beamlines. We used a combination of EDM, MEDM and our own GUI, shots follow

Vacuum Profile



Vacuum Control - Sector 1

Select by Sector

- 01
- 02
- 03
- 04
- 05
- 06
- 07
- 08
- 09
- 10
- 11
- 12
- 13
- 14

Valve Control

	Valve 1	Valve 2
Open/Close Status	Opened	Opened
Allow Open	Enabled	Enabled
Open/Close Setpoint	No Action	No Action
Open/Close Control	Open Close	Open Close
Move Failure Status	Ok	Ok
Move Failure Reset	Reset	Reset

Compressed Air

Status **Ok** Pressure **714 kPa**

Pumps and Gauges

Name	Status	Pressure
Pirani Arc	Low	1.0E-03 mbar
Pirani Straight	Low	1.0E-03 mbar
Cold Cathode Arc 1	Ok	2.1E-09 mbar
Cold Cathode Arc 2	Ok	1.4E-09 mbar
Cold Cathode Straight	Low	0.0E+00 mbar
Ion Pump Arc 1	Running	7.2E-10 mbar
Ion Pump Arc 2	Running	9.7E-10 mbar
Ion Pump Straight	Interlock	1.0E-11 mbar

Storage Ring Vacuum Status

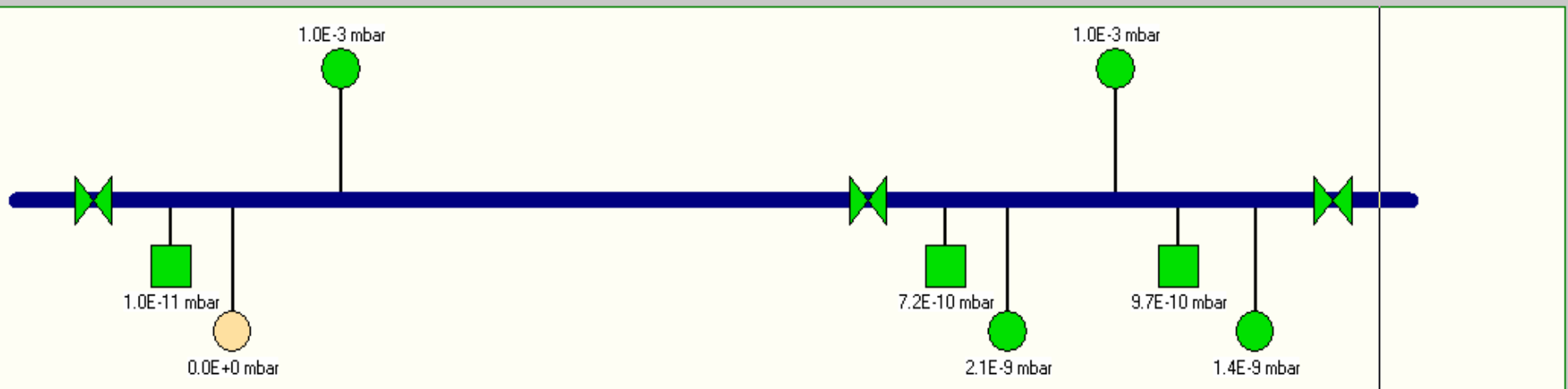
Straight	Ok
Arc	Ok

Front End 1 Vacuum Status

Front End 2 Vacuum Status

Front End 3 Vacuum Status

IR Front End Vacuum Status



Multipole Control - 1
X

Framework General Vacuum Magnets & PS Diagnostics Timing Miscellaneous

Multipole Control - Sector 01 - Quadrupole Focussing A1

Select by Sector

01	02	03	04	05	06	07	08	09	10	11	12	13	14
----	----	----	----	----	----	----	----	----	----	----	----	----	----

Select by Magnet

QFA1	QDA1	QFB1	QFB2	QDA2	QFA2	
SFA1	SDA1	SDB1	SFB1	SDB2	SDA2	SFA2
HCM1	VCM1	VCM2	HCM2	VCM3	VCM4	HCM3
SKQ1	SKQ2					

Magnet Status

Temp Status	LCW Status	LCW Flow Rate
Ok	Ok	14.08 l/min

Power Supply Status

On/Off	Remote	EPS Inhibit	Current	Voltage
On	Remote	Enabled	135.69 Amps	37.60 Volts
Temp Compensation	+15 Volts	+5 Volts	-15 Volts	In Service
-1.0 deg C	14.1 Volts	4.8 Volts	-13.8 Volts	

Summary Interlock Status

AC Line Interlock Status

Ground Leak Interlock Status

Magnet Flow Interlock Status

Fan Fault Interlock Status

Out Volt Interlock Status

Door Interlock Status

Over Temp Interlock Status

Magnet Fault Interlock Status

Rack LCW Interlock Status


Control

Active Set Point 135.732 Amps


Set Point	Readback	Sync	
135.732 Amps	135.69 Amps	<input checked="" type="checkbox"/>	<input checked="" type="radio"/> Adjust Current
1.679 / m²	1.679 / m²	<input checked="" type="checkbox"/>	<input type="radio"/> Adjust Strength

0.0	20.0	40.0	60.0	80.0	100.0	120.0	140.0	160.0	180.0
<div style="display: flex; align-items: center; justify-content: center;"> <div style="border: 1px solid gray; width: 100%; height: 20px; position: relative;"> <div style="background-color: #e0ffe0; width: 100%; height: 100%;"></div> <div style="position: absolute; top: -10px; left: 50%; transform: translate(-50%, -100%);">135.732</div> </div> </div>									
<input type="button" value="S"/> <input type="button" value="R"/>		Current (Amps)		<input type="button" value="←"/> <input type="button" value="↔"/> <input type="button" value="→"/>		<input type="button" value="←"/> <input type="button" value="↔"/> <input type="button" value="→"/>		<input type="button" value="E"/> <input type="button" value="A"/>	

Continuous Apply



06 Dec 06 15:26:42



Dipole Control

Power Supply Status

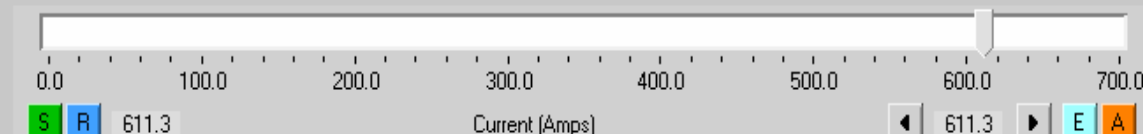
On/Off	Local / Remote	EPS Inhibit	Current	Voltage	
On	Remote	Enabled	611.5 Amps	756.0 Volts	
Ripple Current 1	Ripple Current 2	Ripple Current 3	Ground Current	Circuit Breaker	Inlet Water Temp
7.70 Amps	5.30 Amps	14.70 Amps	2.800 mA	Closed	24.8 deg C

- Summary Interlock Status
- Phase
- Water Pressure
- DC Fuse
- DCCT
- XFMR Fuse
- SCR Fuse
- Outlet Temp
- Water Leak
- SCR Temp
- EPS
- DC Voltage
- XFMR Temp
- PSS
- Filter Cap Ripple Current
- Choke Temp
- Ground
- Breaker Trip
- Water Flow
- Door
- Breaker Open
- Emergency Off Pressed

Control

Active Set Point **611.3 Amps**

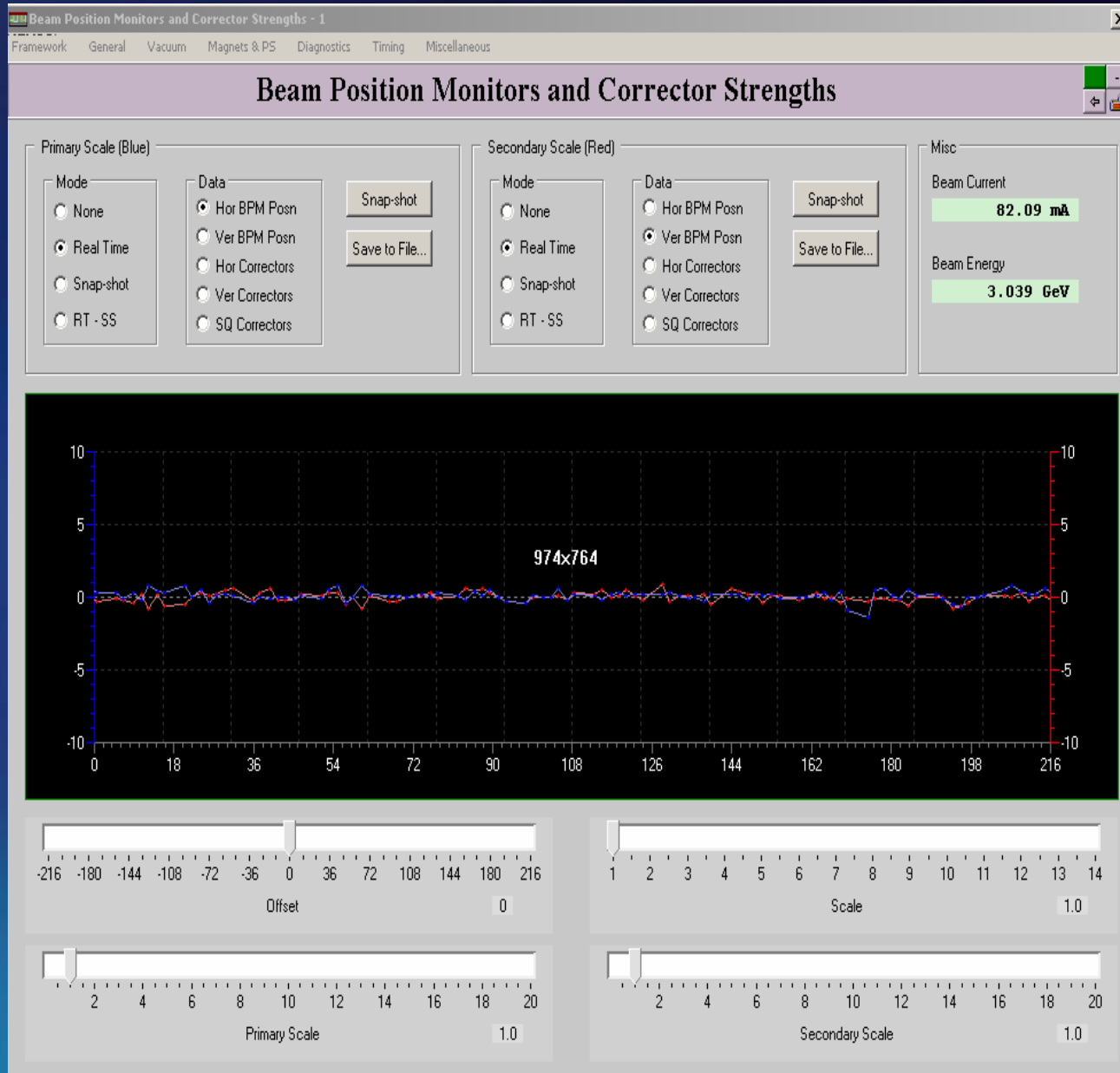
Set Point	Readback	Sync	<input checked="" type="radio"/> Adjust Current
611.3 Amps	611.5 Amps	<input checked="" type="checkbox"/>	<input type="radio"/> Adjust Energy
3.038 GeV	3.039 GeV	<input checked="" type="checkbox"/>	



Continuous Apply

Magnet Status

	Temp Status	LCW Status	LCW Flow Rate
SR01DM01	0k	0k	26.11 l/min
SR01DM02	0k	0k	25.31 l/min
SR02DM01	0k	0k	25.86 l/min
SR02DM02	0k	0k	25.31 l/min
SR03DM01	0k	0k	25.39 l/min
SR03DM02	0k	0k	25.48 l/min
SR04DM01	0k	0k	26.67 l/min
SR04DM02	0k	0k	24.70 l/min
SR05DM01	0k	0k	25.73 l/min
SR05DM02	0k	0k	25.08 l/min
SR06DM01	0k	0k	25.55 l/min
SR06DM02	0k	0k	26.19 l/min
SR07DM01	0k	0k	25.64 l/min
SR07DM02	0k	0k	25.22 l/min
SR08DM01	0k	0k	25.61 l/min
SR08DM02	0k	0k	25.81 l/min
SR09DM01	0k	0k	24.89 l/min
SR09DM02	0k	0k	25.77 l/min
SR10DM01	0k	0k	25.83 l/min
SR10DM02	0k	0k	26.58 l/min
SR11DM01	0k	0k	24.42 l/min
SR11DM02	0k	0k	25.64 l/min
SR12DM01	0k	0k	26.19 l/min
SR12DM02	0k	0k	25.66 l/min
SR13DM01	0k	0k	22.00 l/min
SR13DM02	0k	0k	23.61 l/min
SR14DM01	0k	0k	25.75 l/min
SR14DM02	0k	0k	24.08 l/min



Diagnostics Beam Current / Lifetime

Framework · General · Vacuum · Magnets & PS · Diagnostics · Timing · Miscellaneous

Diagnostics Beam Current / Lifetime

Beam Current

81.99 mA

Beam Lifetime

11.25 Hrs

Lifetime x Current

0.922 AHrs

Integrated Current

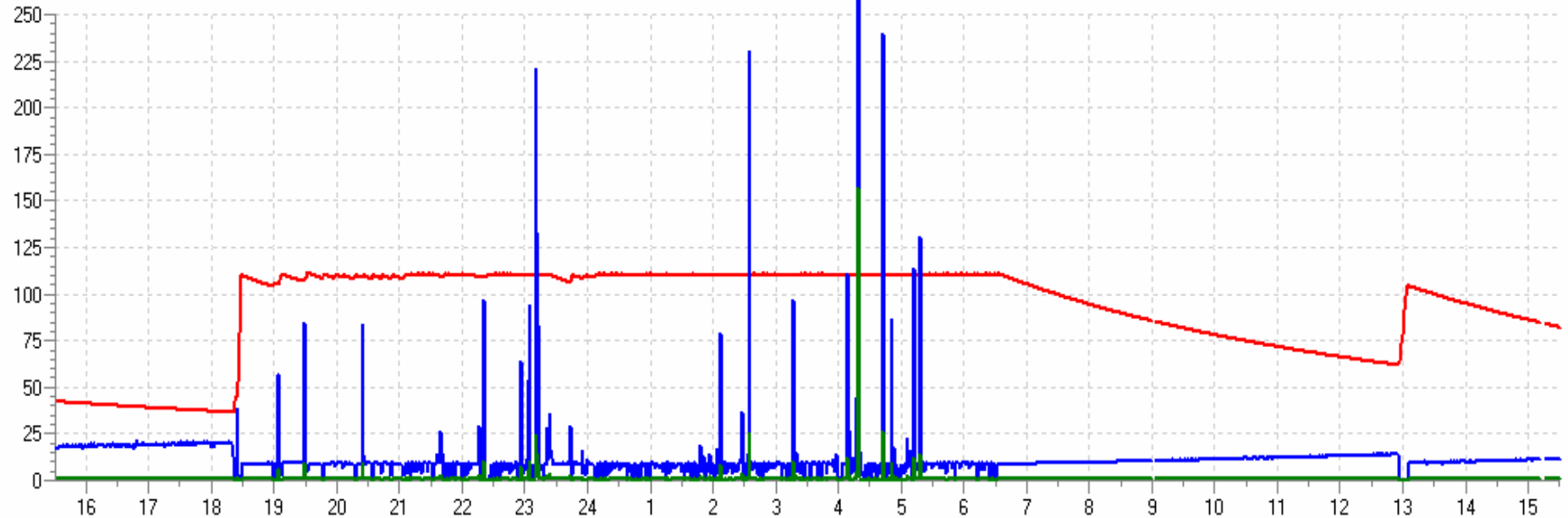
19.620 AHrs

Beam Energy

3.039 GeV

Fill Control Status

Stop



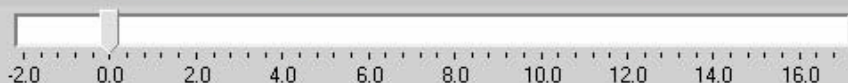
Beam Scraper Control

Framework General Vacuum Magnets & PS Diagnostics Timing Miscellaneous

Beam Scraper Control

Upper Blade

Set Point **0.00 mm** Readback **0.00 mm** Sync █



S R 0.00 Upper Beam Blade (mm) ◀ ⇐ 0.00 ⇒ ▶ A

Disabled

Continuous Apply

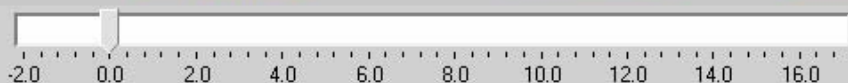
Disable Enable Reset Home Stop

Motion Status Error Status Positive Limit Negative Limit

Ready Ok Inactive Inactive

Lower Blade

Set Point **0.00 mm** Readback **0.00 mm** Sync █



S R 0.00 Upper Beam Blade (mm) ◀ ⇐ 0.00 ⇒ ▶ A

Disabled

Continuous Apply

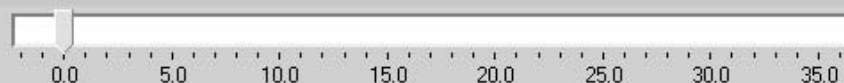
Disable Enable Reset Home Stop

Motion Status Error Status Positive Limit Negative Limit

Ready Ok Inactive Inactive

Inner Blade

Set Point **0.00 mm** Readback **0.00 mm** Sync █



S R 0.00 Upper Beam Blade (mm) ◀ ⇐ 0.00 ⇒ ▶ A

Disabled

Continuous Apply

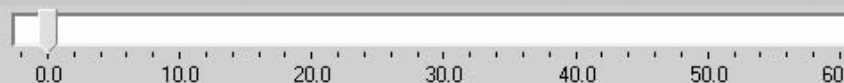
Disable Enable Reset Home Stop

Motion Status Error Status Positive Limit Negative Limit

Ready Ok Inactive Inactive

Outer Blade

Set Point **0.00 mm** Readback **0.00 mm** Sync █



S R 0.00 Upper Beam Blade (mm) ◀ ⇐ 0.00 ⇒ ▶ A

Disabled

Continuous Apply

Disable Enable Reset Home Stop

Motion Status Error Status Positive Limit Negative Limit

Ready Ok Inactive Inactive

Beam Current **81.89 mA**

Beam Loss Monitor Control

Index	Modify	On	Off	On/Off	Counts	Sensor A	Sensor B	Mode	LOF	HIF	More
401	Modify	On	Off	ON	16	DISABLED	DISABLED				
402	Modify	On	Off	ON	0	DISABLED	DISABLED				
503	Modify	On	Off	ON	16	DISABLED	DISABLED				
104	Modify	On	Off	ON	0	DISABLED	DISABLED				
105	Modify	On	Off	ON	8	DISABLED	DISABLED				
106	Modify	On	Off	ON	8	DISABLED	DISABLED				
107	Modify	On	Off	ON	0	DISABLED	DISABLED				
208	Modify	On	Off	ON	0	DISABLED	DISABLED				
209	Modify	On	Off	OFF	3520	DISABLED	DISABLED				
310	Modify	On	Off	ON	0	DISABLED	DISABLED				
311	Modify	On	Off	ON	0	DISABLED	DISABLED				
312	Modify	On	Off	ON	0	DISABLED	DISABLED				
313	Modify	On	Off	ON	0	DISABLED	DISABLED				
414	Modify	On	Off	ON	0	DISABLED	DISABLED				

Index	Counts
1	10
2	1
3	10
4	10,000,000
5	10
6	10
7	1
8	1
9	10,000,000
10	1
11	1
12	1
13	1
14	1

SR01BLM04

Port: Address:

Sensor A: DISABLED

Sensor B: DISABLED

Reset:

Low Limit:

High Limit:

1 - Val/Min:

Max/Val - 1:

Temperature:

Timing Control



Trigger Control

	Setpoint	Status
Injection Trigger	Stop	Stopped
Start Bucket	1	1
Fill Control	Stop	Stop

Buttons for Injection Trigger: Stop, Start
 Buttons for Start Bucket: 1, A
 Buttons for Fill Control: Stop, Continuous, One Shot, Pattern Fill

Master Oscillator

Set Point	Readback	Sync	Value	Unit
499,670,328 Hz	499,670,328 Hz	<input checked="" type="checkbox"/>	+499,670,328	A
-1.8 dBm	-1.8 dBm	<input checked="" type="checkbox"/>	-1.8	A

Trigger Phase

Set Point	Readback	Sync	Value	Unit
0.0 mSec	0.0 mSec	<input checked="" type="checkbox"/>	+0.0	A

Miscellaneous

Beam Current	81.10 mA	Injection Inhibit	
--------------	----------	-------------------	--

Programmable Delay Generator Control - DLY_1



DLY_1 DLY_2 DLY_3 DLY_4 DLY_5 DLY_6 DLY_7 SR00PDG01

Channel A - Linac Rack 01 PB1

Delay Set Point

Delay Readback

Edit/Apply

0.000,010,000,000 s

0.000,010,000,000 s

+0.000,010,000,000

A

Channel B - Linac Rack 01 PB2

Delay Set Point

Delay Readback

Edit/Apply

0.000,010,000,000 s

0.000,010,000,000 s

+0.000,010,000,000

A

Channel C - Linac Rack 01 PB3

Delay Set Point

Delay Readback

Edit/Apply

0.000,020,000,000 s

0.000,010,000,000 s

+0.000,020,000,000

A

Channel D - Linac Rack 01 PB4

Delay Set Point

Delay Readback

Edit/Apply

0.000,010,000,000 s

0.000,020,000,000 s

+0.000,010,000,000

A

Personnel Safety System Monitor

Framework General Vacuum Magnets & PS Diagnostics Timing Miscellaneous

Personnel Safety System Monitor

Note: The colour scheme employed here is opposite to that used on the SAGE PSS Control Panel.

PSS Status

PSS 1 Status **On Line**

PSS 2 Status **On Line**

Search Zones

Search Zone 1 Status **Enabled**

Search Zone 2 Status **Enabled**

Search Zone 3 Status **Enabled**

Search Zone 4 Status **Enabled**

Search Zone 5 Status **Enabled**

Search Zone 6 Status **Enabled**

Injection System

Electron Gun **Enabled**

Linac RF Modulator 1 **Enabled**

Linac RF Modulator 2 **Enabled**

Booster Injection Kicker Outputs **Enabled**

Booster Magnet PSU Outputs **Enabled**

Booster RF PSU Outputs **Enabled**

Booster Extraction PSU Outputs **Enabled**

Storage Ring

Power Feed to Equipment Suite 1	Enabled	Power Feed to Equipment Suite 8	Enabled
Power Feed to Equipment Suite 2	Enabled	Power Feed to Equipment Suite 9	Enabled
Power Feed to Equipment Suite 3	Enabled	Power Feed to Equipment Suite 10	Enabled
Power Feed to Equipment Suite 4	Enabled	Power Feed to Equipment Suite 11	Enabled
Power Feed to Equipment Suite 5	Enabled	Power Feed to Equipment Suite 12	Enabled
Power Feed to Equipment Suite 6	Enabled	Power Feed to Equipment Suite 13	Enabled
Power Feed to Equipment Suite 7	Enabled	Power Feed to Equipment Suite 14	Enabled
Storage Ring RF	Enabled	Storage Ring Kicker Status	Enabled
Pwr Feed to Str Ring Dipole PSU	Enabled	Storage Ring Septum Status	Enabled
Master Shutters Enable Switch	Closed		

Plant Monitor
X

Framework
General
Vacuum
Magnets & PS
Diagnostics
Timing
Miscellaneous

Plant Monitor

LCW Circuits

Name	Pressure	Conductivity	Oxygen Level	Temperature	Flow Rate
Power Supplies Temp	635.70 kPa	5.26 uS/cm	1.00 ppb	24.98 deg C	14.10 l/s
Storage RF Temperature	360.53 kPa	6.15 uS/cm	2005.00 ppb	24.98 deg C	52.52 l/s
Injection Temperature	652.43 kPa	3.78 uS/cm	1.38 ppb	25.16 deg C	22.85 l/s
SR LCW Temperature	747.53 kPa	5.62 uS/cm	0.75 ppb	24.98 deg C	44.92 l/s

Storage Ring LCW Circuit - Additional

Return Temperature	29.50 deg C	Heat Exchanger 3 Control Valve	23.05 %
Heat Exchanger Outlet Temperature	24.94 deg C	Heat Exchanger 3 Temperature	24.92 deg C
Trim Heater Control Valve	0.27 %	Heat Exchanger 3 Temperature Set Point	24.92 deg C
Trim Heater Temperature	24.98 deg C	Heat Exchanger 4 Control Valve	3.09 %
Trim Heater Temperature Set Point	25.00 deg C	Heat Exchanger 4 Temperature	24.92 deg C
		Heat Exchanger 4 Temperature Set Point	24.95 deg C

Tunnel Temperatures

Name	Temperature	Name	Temperature	Name	Temperature
Storage Ring	22.01 deg C	Storage Ring	22.13 deg C	Booster Ring Q3 & Q4	23.72 deg C
Storage Ring	22.05 deg C	Storage Ring	21.98 deg C	Booster Ring Q1 & Q2	23.61 deg C
Storage Ring	22.01 deg C	Storage Ring	21.99 deg C		

Compressors

Name	Status	Air Pressure	Name	Status	Air Pressure
Access Doors	Running	805.16 kPa	Controls	Running	738.44 kPa

Air Handling Unit Heat Exchangers				Chilled Water	
Name	Control Valve	Temperature	Temp Set Point	Name	Temperature
Air handling unit 1 - Controller 1	63.55 %	22.01 deg C	22.01 deg C	Chilled Water 01	6.27 deg C
Air handling unit 1 - Controller 2	61.81 %	22.01 deg C	22.00 deg C	Chilled Water 02	5.40 deg C
Air handling unit 2 - Controller 1	88.42 %	22.04 deg C	22.04 deg C		
Air handling unit 2 - Controller 2	59.46 %	22.04 deg C	22.00 deg C		
Air handling unit 3 - Controller 1	31.72 %	22.01 deg C	22.01 deg C		
Air handling unit 3 - Controller 2	65.95 %	22.01 deg C	22.00 deg C		
Air handling unit 4 - Controller 1	66.80 %	22.13 deg C	22.13 deg C		
Air handling unit 4 - Controller 2	43.44 %	22.13 deg C	22.00 deg C		
Air handling unit 5 - Controller 1	68.08 %	21.98 deg C	21.98 deg C		
Air handling unit 5 - Controller 2	71.17 %	21.98 deg C	22.00 deg C		
Air handling unit 6 - Controller 1	68.88 %	21.99 deg C	21.99 deg C		
Air handling unit 6 - Controller 2	54.76 %	21.99 deg C	22.00 deg C		

Facility Status Monitor

<http://www.synchrotron.vic.gov.au> Static version

<http://vbl.synchrotron.vic.gov.au/fsm/> Java

