



Vista Controls Vsystem* at the ISIS pulsed neutron facility

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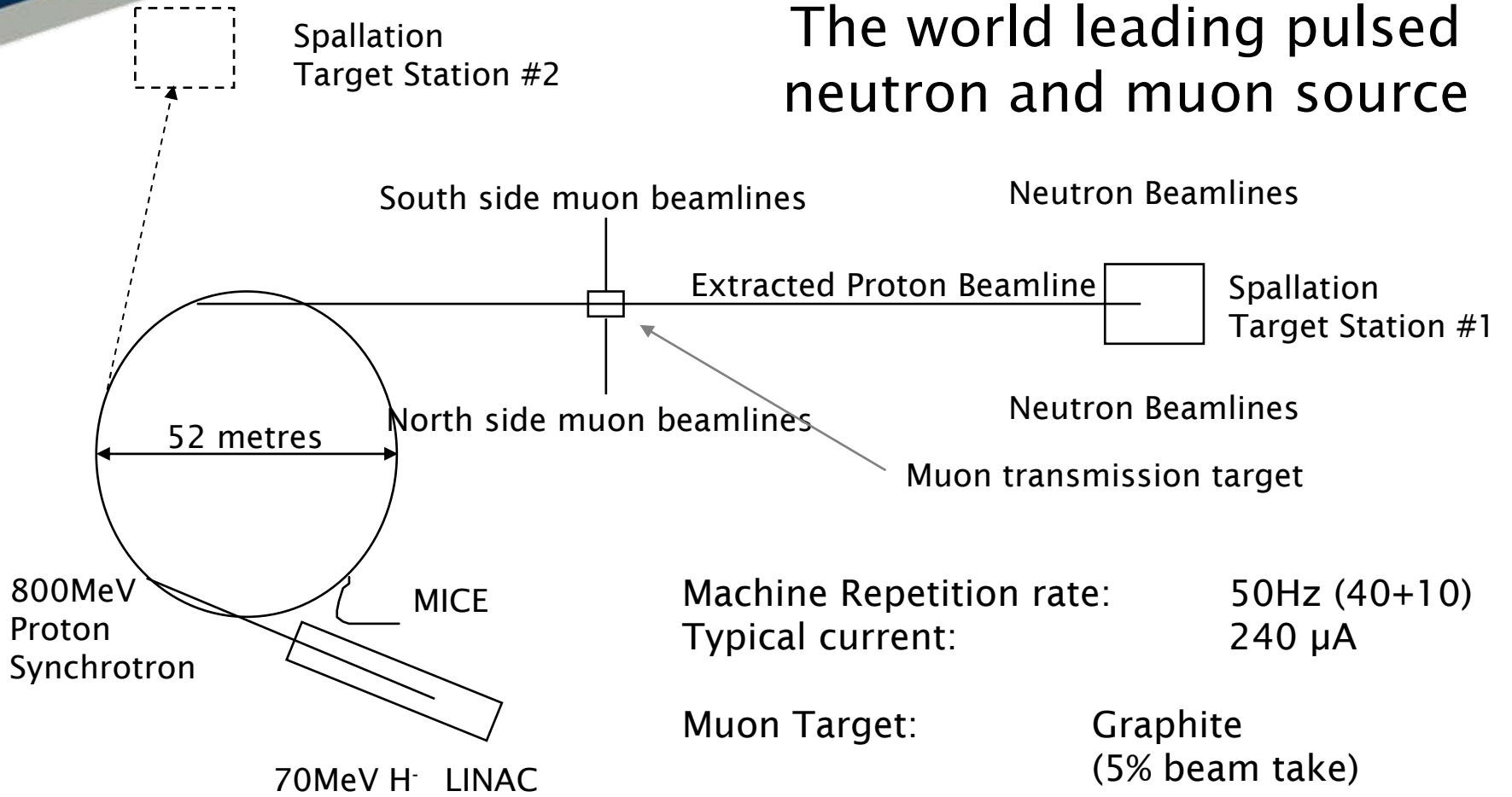


Rutherford Appleton Lab.



ISIS

The world leading pulsed neutron and muon source



Machine Repetition rate: 50Hz (40+10)
 Typical current: 240 μ A

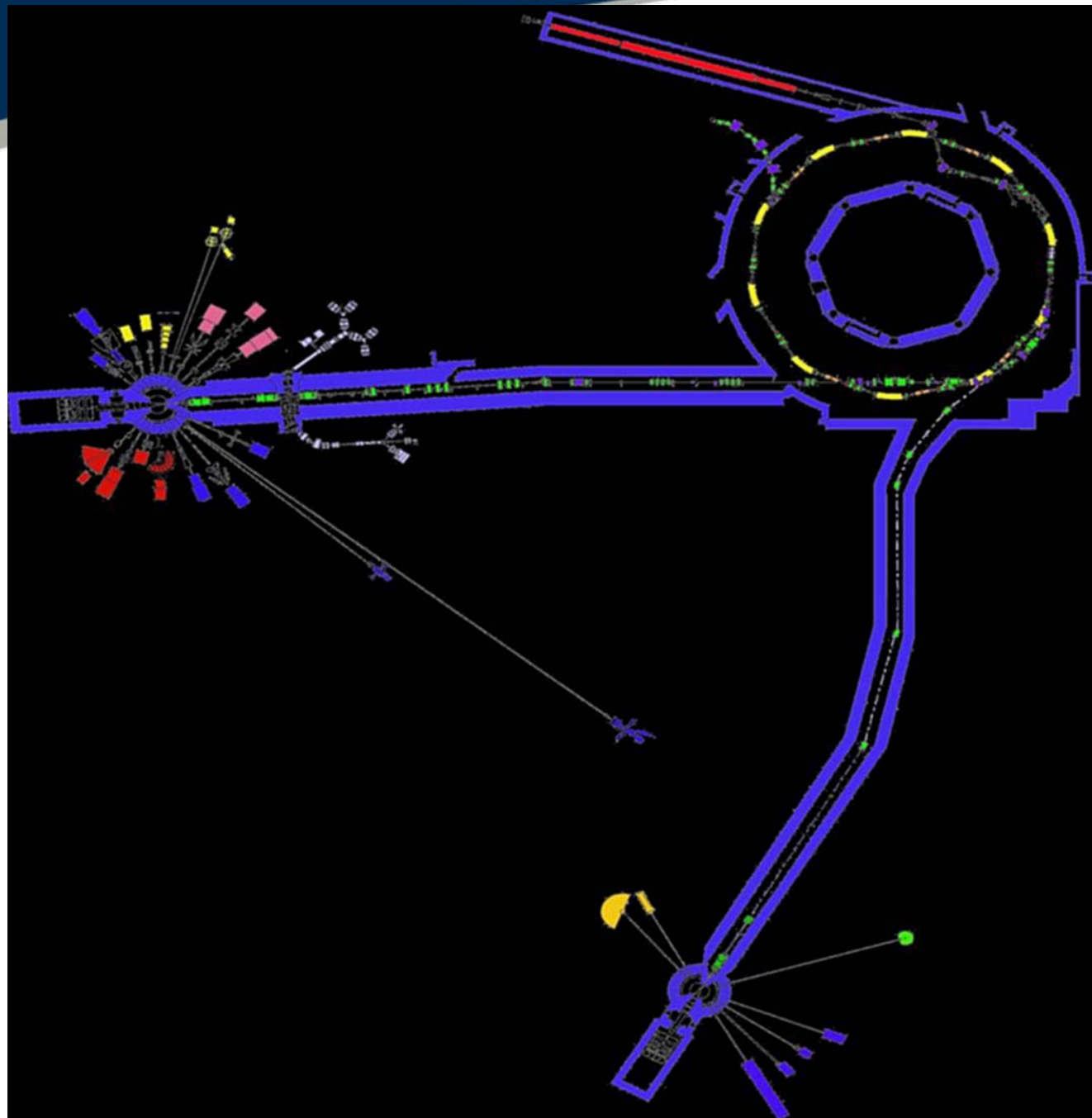
Muon Target: Graphite
 (5% beam take)

Neutron Target: Tantalum
 Target moderators: Methane and Hydrogen



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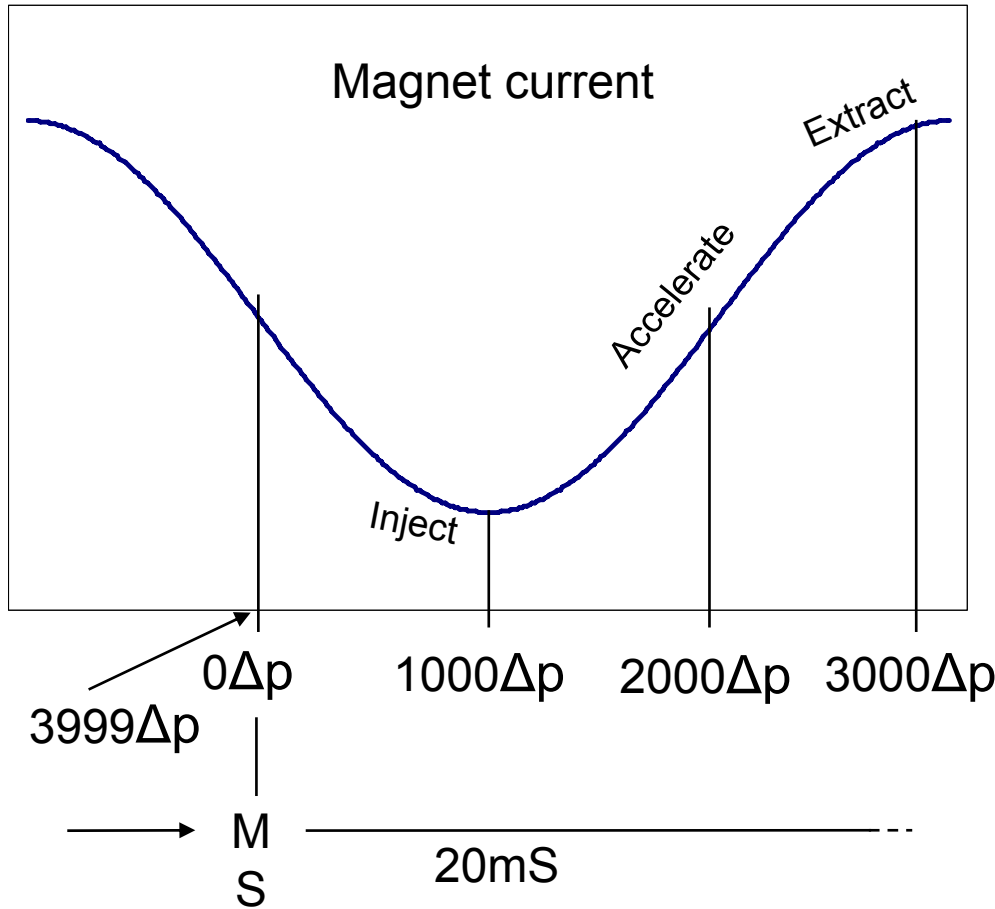
ISIS







ISIS timing - primary signals



Permanent timing pulses

- MS: Machine Start.
2.5 μS pulse every 20mS at $0\Delta p$
- Δp : Delta-p train.
Square wave - 5 μS period

These primary signals are phase locked to the magnet current/field waveform. From these other signals are derived...





The ISIS Facility

- A staggering variety of ancient (50 years max.) and modern equipment with various interface requirements: RS232, RS485, IEEE488, Ethernet, DC Analogue, TTL, BCD digital panel meter outputs, Function generators requiring ISIS timing signals, GPIB instruments, PLC systems, other proprietary embedded systems.
- Over 10000 identifiable parameters which may require control or monitoring (a smaller subset are generally accessed).
- The control system interface electronics consists of about 500 modules in 50 crates of our original multiplex system (GPMPX), 30 installed installed STEbus embedded systems, 20 or so LabView PXI systems, and our replacements for the STEbus systems based on CompactPCI



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ISIS Controls - original

- Classical late 70's/80's approach using minicomputers (GEC 4000 series) with CAMAC, driving our own multiplex system (GPMPX).
- Semi-compiled interpretive language (GRACES)
- Data modules (equipment routines) based on CERN SPS model
- CAMAC based man-machine interface on control desk
- LAN between machines but no external access



ISIS Controls - current

- Ethernet linking control computers (OpenVMS and XP workstations), terminals, programmable knobs, CAMAC, STEbus and all new proprietary processor systems (PLC, PXI/PCI etc)
- Purchased project license for Vista control software with built in graphics package, logging, trending, alarm handling as well as user application programs in C, FORTRAN, BASIC and IDL.
- Equipment handlers and readers written in-house
- X-windows displays and programmable knob units on desk

Vsystem licensed nodes

- 4 OpenVMS nodes running control desk and accelerator equipment, disk serving, backups etc. (HP DS/10)
- 1 OpenVMS node dedicated to accelerator physics work (HP DS/10)
- 2 OpenVMS nodes for development and non-critical user access (HP DS/10)
- 2 OpenVMS Itanium systems to replace above (HP Integrity RX2660)
- 2 XP nodes for development work + 6 XP Vaccess only licences
- Most Vsystem products used/licensed EXCEPT Vscript
- ALL OpenVMS nodes running Vsystem 4.3/OpenVMS 8.3



ISIS run time databases

- 98 Databases, >1 0000 channels (more to come!).
- Databases updated by mixture of Vscans/homebuilt readers – XML used for newer systems
- Complex startup files define database mapping and different restart modes
- “LOCAL” database with copies of common data on all nodes to save on network traffic/access servers



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Database definition

```
DECterm 1
File Edit Commands Options Print Help
$PLATES:FM102_HITRIP
  HITRP  PLATES:FM102
$PLATES:FM102_LOTRIP
  LOTRP  PLATES:FM102

$PLATES:FM102
  label          "TARGET CHANNEL #2 INLET FLOW"
  GEN_PARAMS
  GEN_FLOW       0.06
  BLOCKCHAN     53
  SADDRESS       %X4400000
  CARD_CHAN      %X1
  H_TRIP_LEVEL  190.0
  L_TRIP_LEVEL  70.0
  lw            90.0
  uw            175.0
  la            70.0
  ua            190.0

$PLATES:FM103_HITRIP
  HITRP  PLATES:FM103
Buffer: ISIS_TCRIT.ADB | Write | Insert | Forward
```



Database viewer

The screenshot shows a software window titled "Db_view" with a menu bar (Database, Channel, Options, Help) and a toolbar (Add/Filter, Next, Previous, Refresh, Apply). On the left is a tree view of channels, with "PLATES:FM102" selected. The main area displays configuration for this channel:

- Type: Real (dropdown), Out (dropdown)
- Name: PLATES:FM102
- Tabbed interface: Main (selected), Alarms, Limits, Hardware, Conversion, Misc, Interest
- Label: TARGET CHANNEL #2 INLET FLOW, Channel Index: 157
- Units: l/min, Format: F6.1, Soft, Constant
- Array Size: 1, Timestamp: Single (dropdown), Update Disable
- External: 0.0, Internal: 0.0, Timestamp: 23-SEP-2002 14:51:37.035

At the bottom right, there is a "DECIMAL" button.

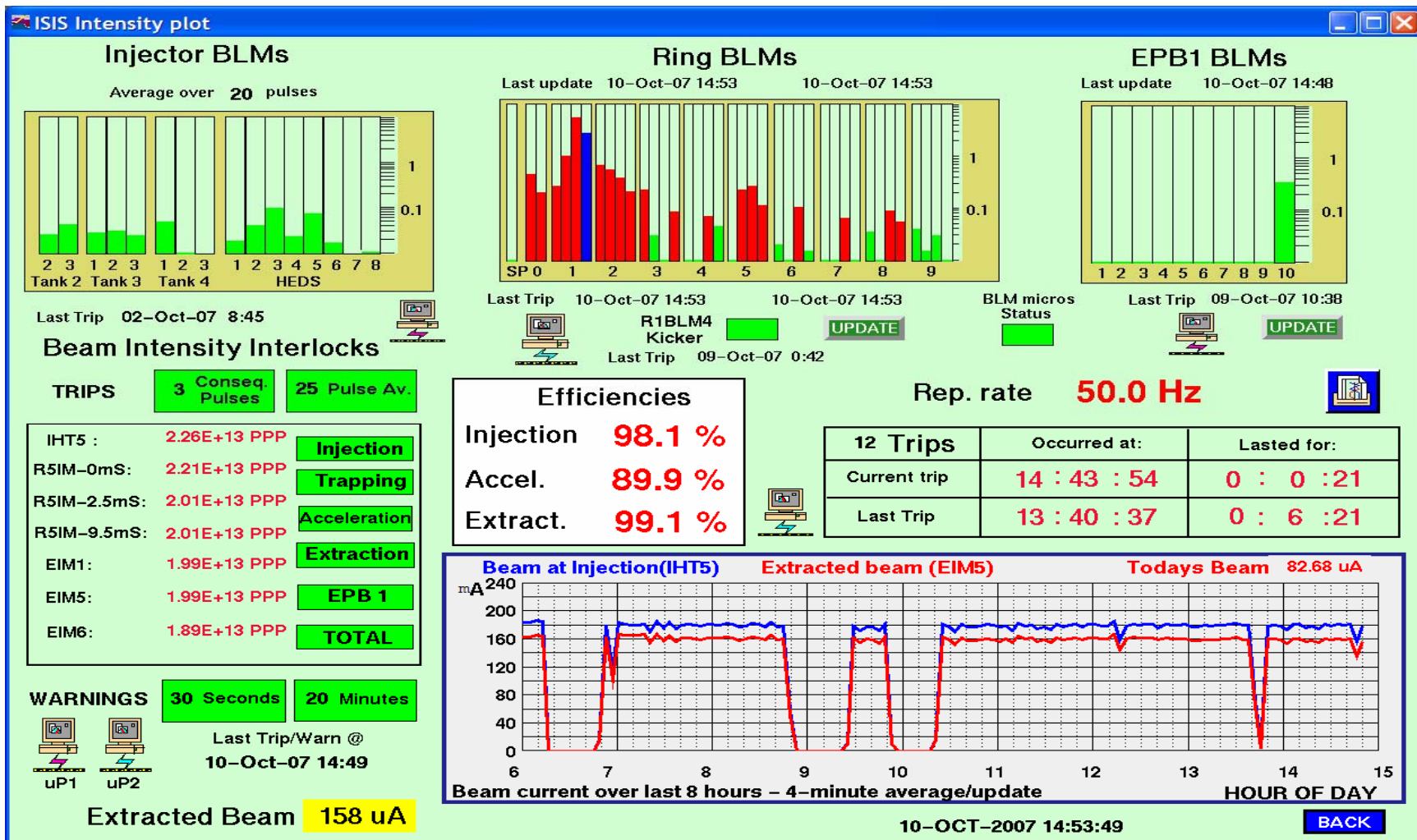


Simple API

```
%include "con_include:conlib.bas"  
rs=read_chan("local::beam:synchrotron",x)  
print using "ISIS Beam ###.#  $\mu$ A",x
```



Control windows





Control Windows

ISIS Controls - Window ACTIVE
_ □ ×

Injection Dipole Control

1.0E-04 Injection Straight Vacuum 10-OCT-2007 17:19:17

1.0E-08
Freeze Control Panel

Injection dipole-driving function

Driving function only – use AWS to monitor output

Dipole ON ●

External Interlocks ●

Internal Interlocks ●

ON/OFF & Timing Control

S1 PRESSURES

1	1.0E-07	DO NOT RUN INJECTION DIPOLE IF ANY PRESSURE IS GREATER THAN 1.0E-06
2	1.6E-07	
3	1.5E-07	
4	1.5E-07	

RAISE	LOWER	CURRENT
1000 A	1000 A	12200 A
500 A	500 A	Click left or above
100 A	100 A	Limit 13500

RATE: MS/2^k k= 0 0=MS 2=MS/4
1=MS/2 3=MS/8..

STARTdP: 858 (4290 us) Limits 880 820

-1
+1
3A

BACK
ROOT



Control windows

ACTIVE

INJECTOR ANALOGUE WAVEFORM SELECTION (IAWS) SYSTEM

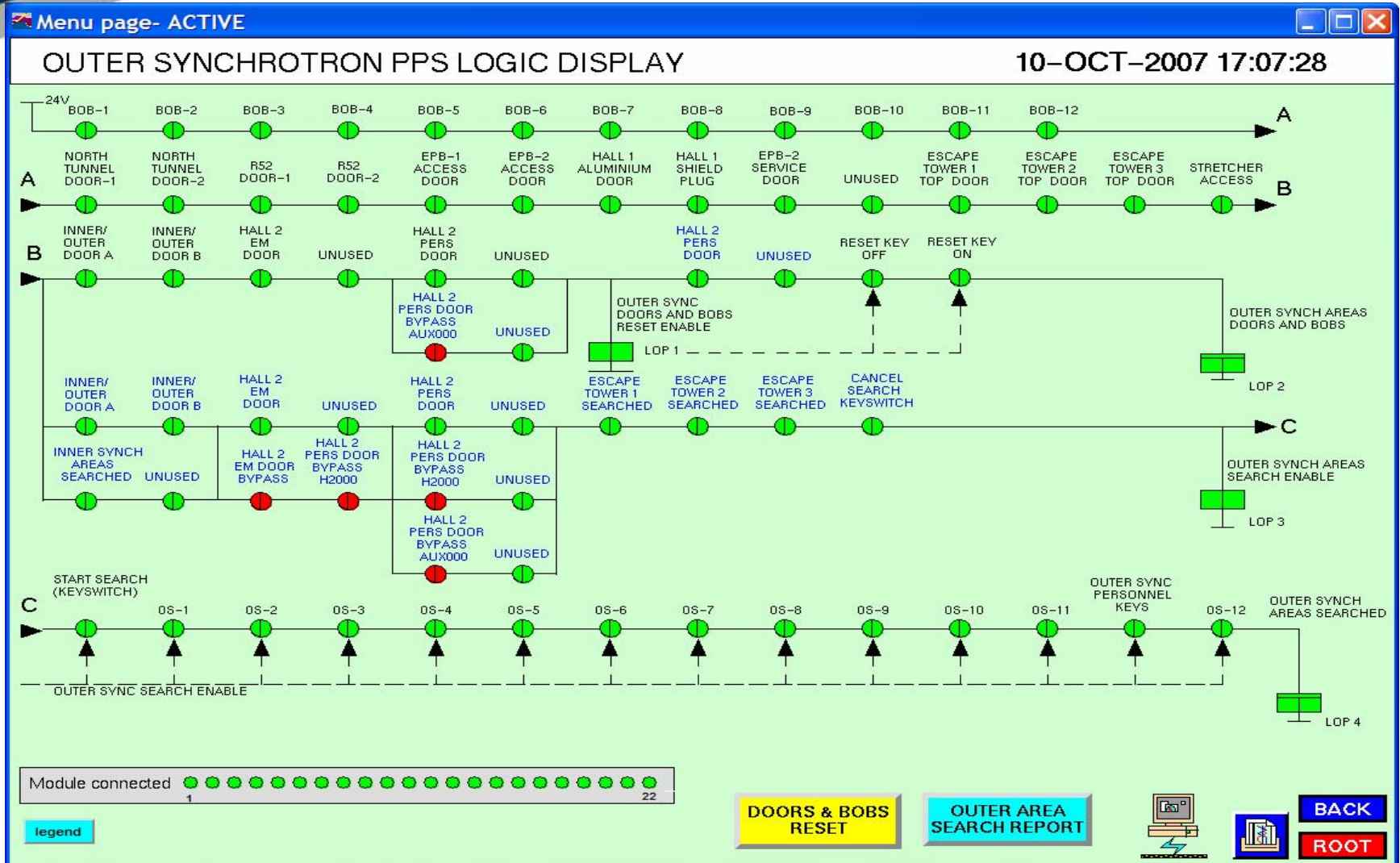
INJECTOR AWS ANALOGUE CHANNELS	TANK 1 RF
GENERAL CLEAR	TANK 2 RF
PRE-INJECTOR	TANK 3 RF
ION SOURCE	TANK 4 RF
BUNCHER/DEBUNCHER	SYSTEM 1 RF
BEAM LOSS MONITOR TANKS 2 TO 4	SYSTEM 2 RF
BEAM LOSS MONITOR HEDS	SYSTEM 3 RF
BEAM TOROIDS	SYSTEM 4 RF

ION SOURCE

ANALOGUE SIGNAL	ANALOGUE CHANNEL
EXTRACT VOLTAGE	1
EXTRACT CURRENT	2
ARC VOLTAGE	3
PULSED ARC CURRENT	4
DC ARC CURRENT	5
GAS VALVE VOLTAGE	6

BACK

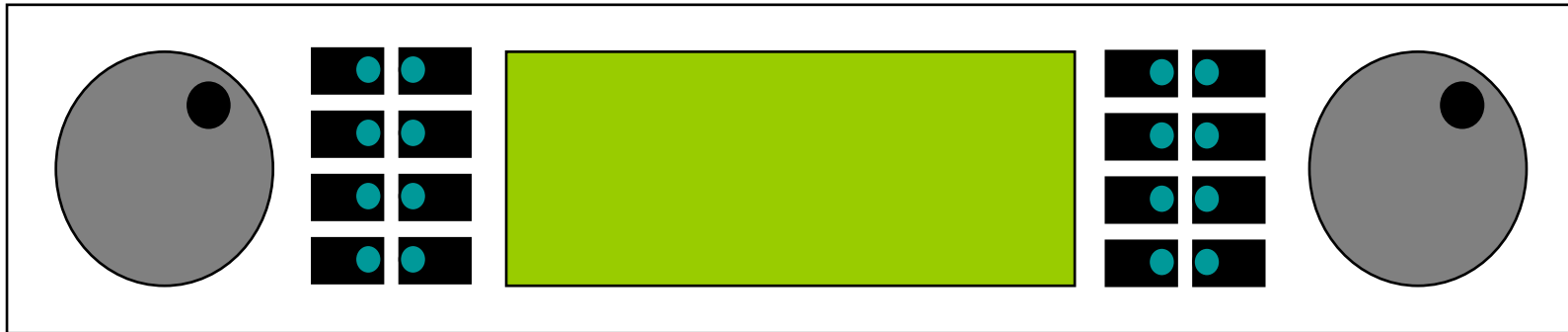
Control windows







Control windows



Programmable knob



- | | | |
|------------|---|------------|
| Coarser |  | Nudge up |
| Finer |  | Nudge down |
| Enable |  | Mark |
| Disconnect |  | Restore |



Vsystem conclusions

- OpenVMS - but we have no evidence that different conclusions would be reached on other operating systems.
- Support has always been excellent
- Since version 2.7, downtime caused by software has been 99% in our own software and other third-party software, not in Vsystem
- Upgrading early versions (up to 2.7) could be problematic. Recent upgrades (now stable at 4.3) have been happy experiences.
- Vista have hosted user-group meetings where user requests can be channelled effectively into Vsystem development
- Vsystem suits an organization that cannot afford the highest levels of software expertise but which wants to do its own system development.



Vsystem conclusions

- We felt it necessary to write our own front-end, user-friendly channel access functions (“read_chan, write_chan”) but this is not hard to do. Using Vscript would remove some of this requirement.
- For high-level imaging of data, Vsystem is not suitable but should be used in conjunction with another package (IDL in our case).
- Vsystem fell out of favour in the accelerator world, due to EPICS being developed for accelerator physics and control as a collaborative venture between the participating laboratories.
- Vsystem is now more successful in the commercial world, where support rather than a chance to participate in software development is more important



World Vsystem

- Power utilities
- Alumin[i]um & Steel forge & rolling facilities
- Cyclotron control, Synchrotron control
- Aviation engine testing (civil and US military)
- Weapon test telemetry (US military)
- Industrial motor drives
- Water management utilities
- Satellite broadcasting



Vsystem advantages

- Controls Group cheaper
 - Smaller, less (expensive) expertise, no need for “gurus”
- Support and development from Vista
 - Single source with tracking, not collaborative
- Cheaper overall
- QA accreditation/verification
- Source protected in escrow



Vsystem disadvantages

- Not part of accelerator “family”
- Equipment doesn’t come with drivers
- Less accelerator-specific product
- Have to take what you get to a certain extent but always access to code through Vsystem API.



The Vsystem “experience”

- We didn't really have an experience just a need and a solution
- “Experiences” are interesting, challenging, fulfilling and can be....expensive!