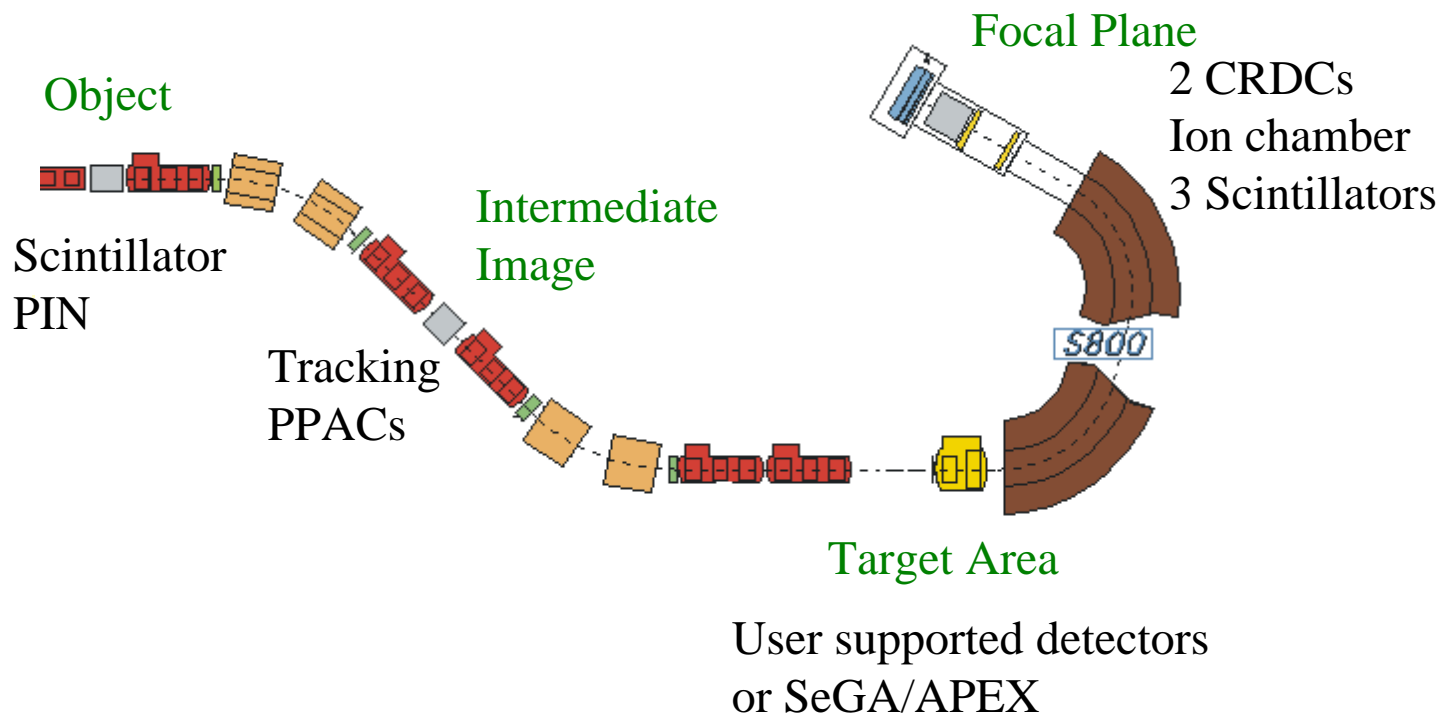


Hitchhiker's guide through the S800

J. Yurkon *et al.*, Nucl. Instr. Meth. **A422** (1999) 291.

D. Bazin *et al.*, Nucl. Instr. Meth. **B204** (2003) 629.



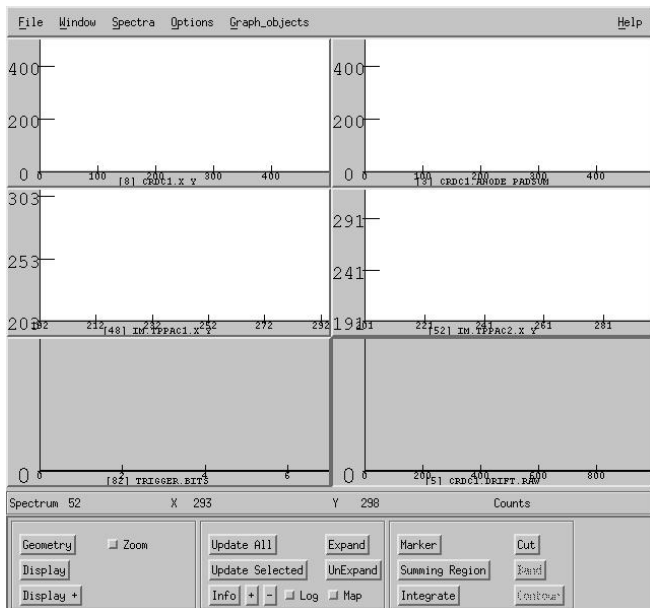
Running on the S800 dedicated Linux box (uxpc2):

- S800 SpecTcl
- S800 scalers
- DAQ Controls
- Alarm server and alarm monitors
- HV control for the gas-filled FP detectors and tracking PPACs
- NMR GUIs
- Barney

Started from ICONS on the uxp2 desktop!

S800 SpecTcl terminology

Xamine



GUI

Spectra Parameters Variables Gates

Spectrum type: 1D, 2D, Summary
 Bitmask, GammaP, Gamma1D, Gamma2D

Data type: Byte (8 bits), Word (16 bits), Long (32 bits)

Definition file: monkey5.tcl
 Load Save
 Cumulate Fallsafe

Spectrum name: [] Create/Replace Clear Delete Gate Apply
 Array All Duplicate Ungate

Parameter	Low	High	Bins	Unit	Y Parameter	Low	High	Bins	Unit	Gate
Name	Type	X parameter	Low	High	Bins	Y parameter	Low	High	Bins	Gate
azitaVScatter	2D	s800.fp.track.sca	0	300	2048	s800.fp.track.azi	0	7	1024	
crdc1.anode_drift.raw	2D	s800.fp.crdc1.an	0	4096	500	s800.fp.crdc1.dri	0	3000	500	
crdc1.anode_padsum	2D	s800.fp.crdc1.an	0	4096	500	s800.fp.crdc1.cal	0	5000	500	OneZ
crdc1.anode_tac	2D	s800.fp.crdc1.an	0	4096	500	s800.fp.crdc1.tac	0	4096	500	
crdc1.drift.raw	1D	s800.fp.crdc1.dri	0	3000	1000					
crdc1.pad.rows	Sum	s800.fp.crdc1.pac	0	4096	500					
crdc1.padsum_drift.raw	2D	s800.fp.crdc1.cal	0	5000	500	s800.fp.crdc1.dri	0	3000	500	OneZ
crdc1.x_y	2D	s800.fp.crdc1.x	-300	300	500	s800.fp.crdc1.y	-150	150	500	
crdc1.x_y_2	2D	s800.fp.crdc1.x	-300	300	500	s800.fp.crdc1.y	-150	150	500	Anode2
crdc1.xfit	1D	s800.fp.crdc1.cal	0	224	1000					
crdc1.xfit_drift.raw	2D	s800.fp.crdc1.cal	0	224	500	s800.fp.crdc1.dri	0	3000	500	
crdc1.xg	1D	s800.fp.crdc1.cal	0	224	225					
crdc1.xg_drift.raw	2D	s800.fp.crdc1.cal	0	224	225	s800.fp.crdc1.dri	0	3000	500	
crdc1.xg_yg	2D	s800.fp.crdc1.cal	0	224	224	s800.fp.crdc1.cal	0	512	512	
crdc1.xg_afp	2D	s800.fp.crdc1.cal	0	224	500	s800.fp.track.afp	-0.1	0.1	500	
crdc2.anode	1D	s800.fp.crdc2.an	0	4096	500					
crdc2.anode_drift.raw	2D	s800.fp.crdc2.an	0	4096	500	s800.fp.crdc2.dri	0	3000	500	
crdc2.anode_padsum	2D	s800.fp.crdc2.an	0	4096	500	s800.fp.crdc2.cal	0	5000	500	OneZ
crdc2.anode_tac	2D	s800.fp.crdc2.an	0	4096	500	s800.fp.crdc2.tac	0	4000	500	
crdc2.drift.raw	1D	s800.fp.crdc2.dri	0	3000	1000					

Update Spectrum List Spectrum mask * Clear

SpecTcl Control

S800 SpecTcl Control

Start Analysis
 Clear Spectra
 Help
 Exit

Crdc: **Arm** Gate: CrdcSnapshi Tppac: **Arm** TppacSnaps

Inverse Map: /user/02008/s800/Kr86.inv
 Title: S800 Spectrograph inverse map Kr86 02008

Order	Method	Mass	Charge	Brho
5	Gravity	1.0	1.0	3.0

Energy: [] Momentum: [] Inverse Map

Source:
 Run Number: 0
 Analyzed Buffers: 0

Attach Online Attach to Files Attach to File

Console

File Console Edit Interp Prefs History Help

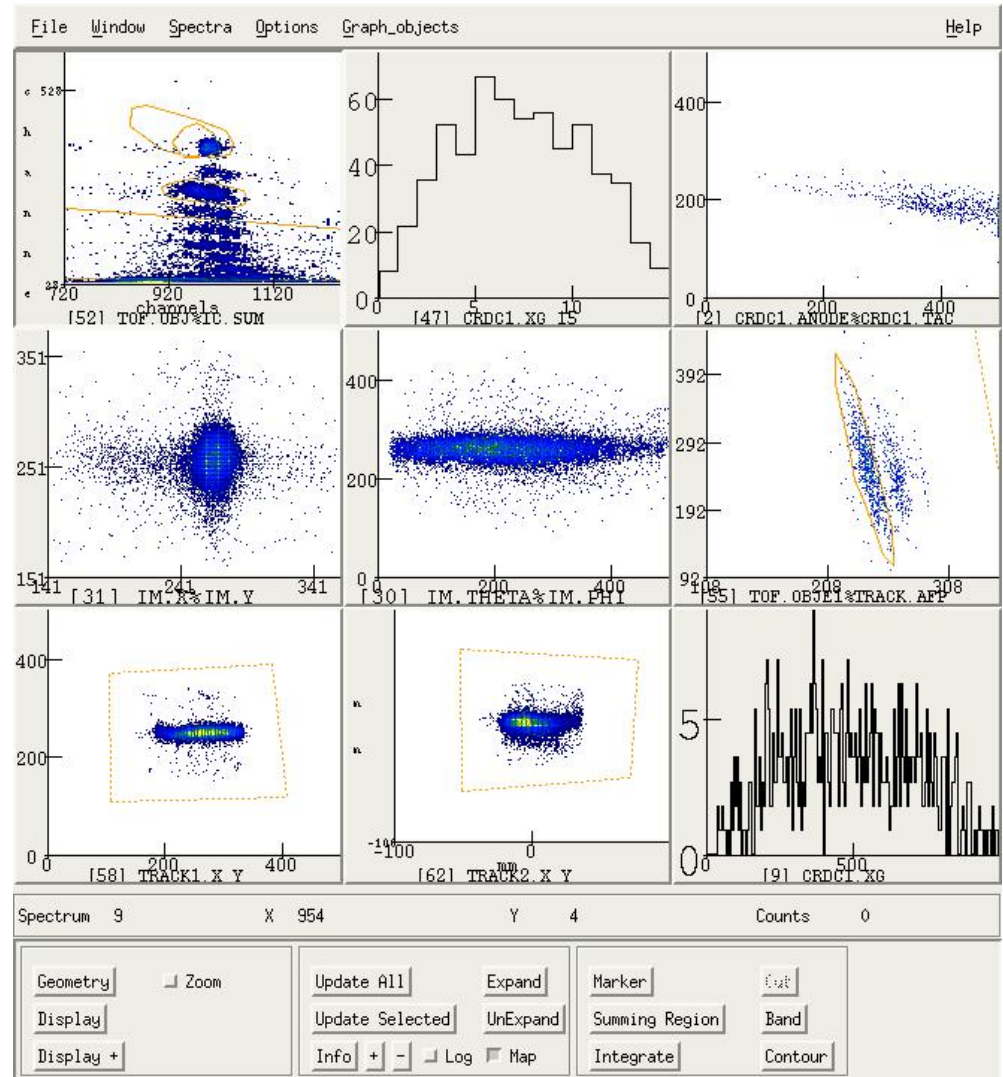
```

SpecTcl console display active
Done.
Loading SpecTcl GUI... Building SpecTcl GUI ...
SpecTcl GUI loaded.
Done.
>Main< (spectcl2.1) 1 %
  
```

Provided for experimenters:

- **Spectrum definition file** for SpecTcl (loaded with the GUI)
- **Window definition file** for Xamine (loaded from the “window” menu in Xamine)

→ **Reference spectra of PID** to check the consistency of the incoming data



Provided for the experiment:

Scaler readings of the extended focal plane scintillator of the A1900 and all S800 supported detectors (except for the TPPACs)

Advice

Ratios to monitor:

Object scintillator / extended FP (A1900)
(transmission between A1900 and S3 vault)

E1.up / object scintillator

(transmission through the analysis beam line and the spectrograph)

Scaler Name		Counts/s	Ratio	Counts (total)		Ratio	
Live.Trigger	Raw.Trigger	250	6556	0.038	13987	367504	0.038
Live.Clock	Raw.Clock	183	9538	0.019	10133	534671	0.019
S800.Source	S800.Trigger	6556	6556	1.000	367504	367504	1.000
Second.Source	Second.Trigger	0	0	1.000	0	0	1.000
Ext1.Source	Ext1.Trigger	0	0	1.000	21	0	n/a
Ext2.Source	Ext2.Trigger	0	0	1.000	0	0	1.000
Coinc.Trigger		0			0		
E1.Up	E1.Down	0	0	1.000	0	0	1.000
E2.Up	E2.Down	0	0	1.000	0	0	1.000
E3.Up	E3.Down	0	0	1.000	0	0	1.000
CRDC1.Anode	CRDC2.Anode	0	0	1.000	0	0	1.000
TPPAC1	TPPAC2	0	0	1.000	5	5	1.000
OBJ.Scint	XFP.Scint	0	0	1.000	0	0	1.000
OBJ.Si	XFP.Scint	0	0	1.000	0	0	1.000
S800.Source	OBJ.Si	6556	0	n/a	367504	0	n/a
S800.Source	OBJ.Scint	6556	0	n/a	367504	0	n/a
S800.Source	XFP.Scint	6556	0	n/a	367504	0	n/a
Bad CRDC	Live.Trigger	250	250	1.000	13987	13987	1.000

Dramatic and sudden changes might indicate a **magnet failure** (rare, and magnet status is monitored by the control room) and a slow change over time might imply **aging of the object and/or extended focal plane scintillator** due to high rate with heavy beams (experienced in the past)

Magnet failure: Insert the beam stop and follow instructions given by the operator in charge

Scintillator aging: Inform the S800 device physicists for the object scintillator and the A1900 physicists for the extended focal plane scintillator

Advice: Monitor the performance of the object and extended focal plane scintillators in SpecTcl. Apply a gate set on the ion chamber (s800.fp.ic.sum) to the respective time-of-flight spectra (s800.tof.obj and s800.tof.xfp). The ratio $\text{counts(icsum gated obj or xfp TOF spectrum)}/\text{counts in icsum gate}$ gives the efficiency of the scintillators relative to the ion chamber.

crdc1	crdc2	ic	tppac
Anode (+) 1070	Anode (+) 1050	Anode (+) 200	ppac1 (+) 620
Set HV	Set HV	Set HV	Set HV
1070	1050	200	620
0	0	0	0
Set I Limit	Set I Limit	Set I Limit	Set I Limit
5	5	5	20
HV Enabled	HV Enabled	HV Enabled	HV Enabled
Turn Off	Turn Off	Turn Off	Turn Off
Drift (-) 500	Drift (-) 500	Drift (-) 800	ppac2 (+) 620
Set HV	Set HV	Set HV	Set HV
500	500	800	620
11	11	64	0
Set I Limit	Set I Limit	Set I Limit	Set I Limit
20	20	80	20
HV Enabled	HV Enabled	HV Enabled	HV Enabled
Turn Off	Turn Off	Turn Off	Turn Off
<div style="display: flex; justify-content: space-around;"> Stop Log Disable Alarms Exit </div>			

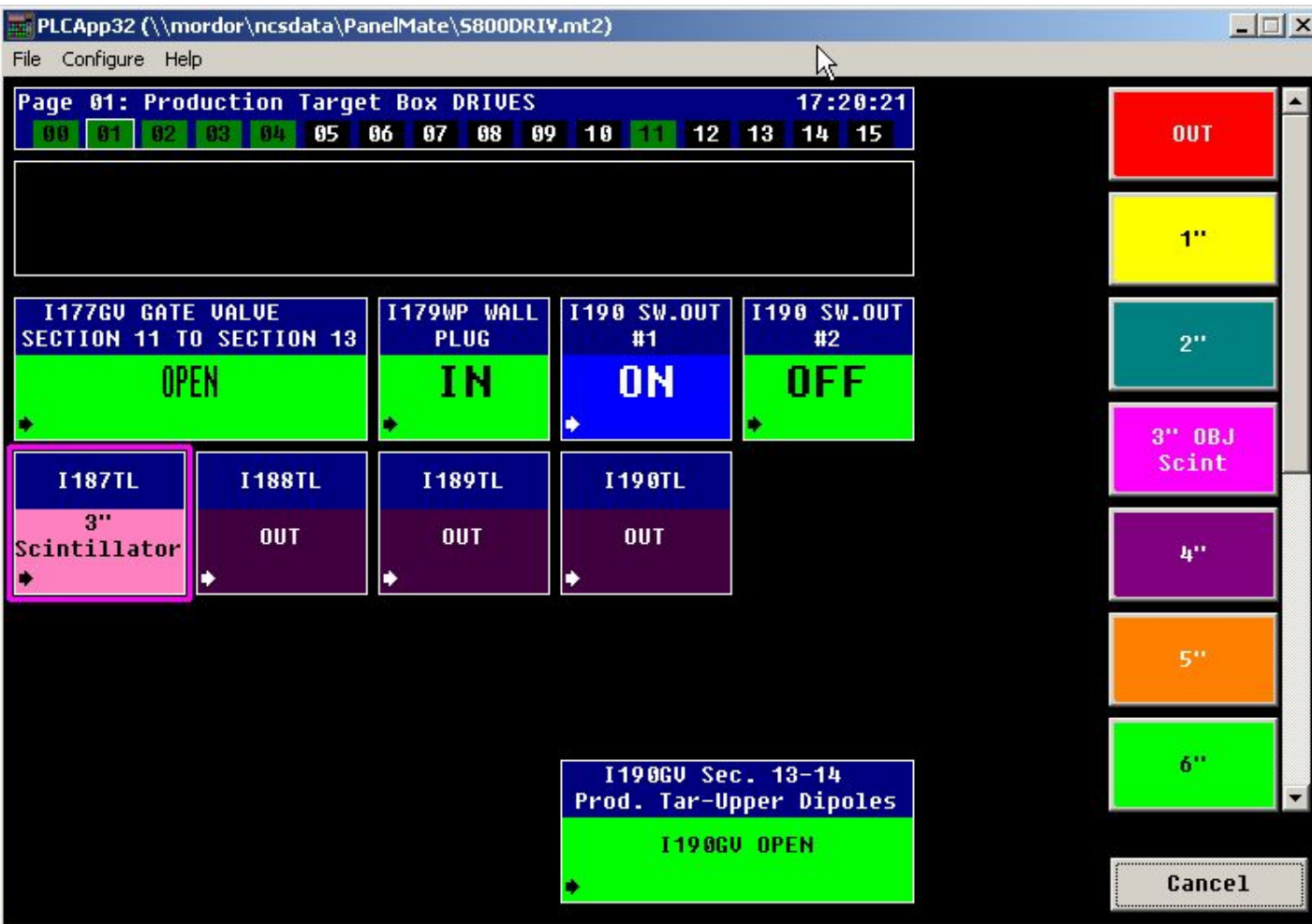
Control interface for the ISEG power supplies used for the CRDCs, IC and TPPACs

- turn detectors on and off
- set the HV
- shows read voltages and currents
- set current limit (HV trips if current is above the set limit)
- voltage readings are logged to file (/user/s800/experiment/current/hv.log)
- voice alarm if read voltage \neq set voltage

S800DRIV.mt2

On **page 1** of the S800 drives page:

The drive **I187TL** is used to insert and retract the object scintillator. Example on the left: Scintillator is inserted. The scintillator can be retracted by setting the drive to “OUT”



S800DRIV.mt2

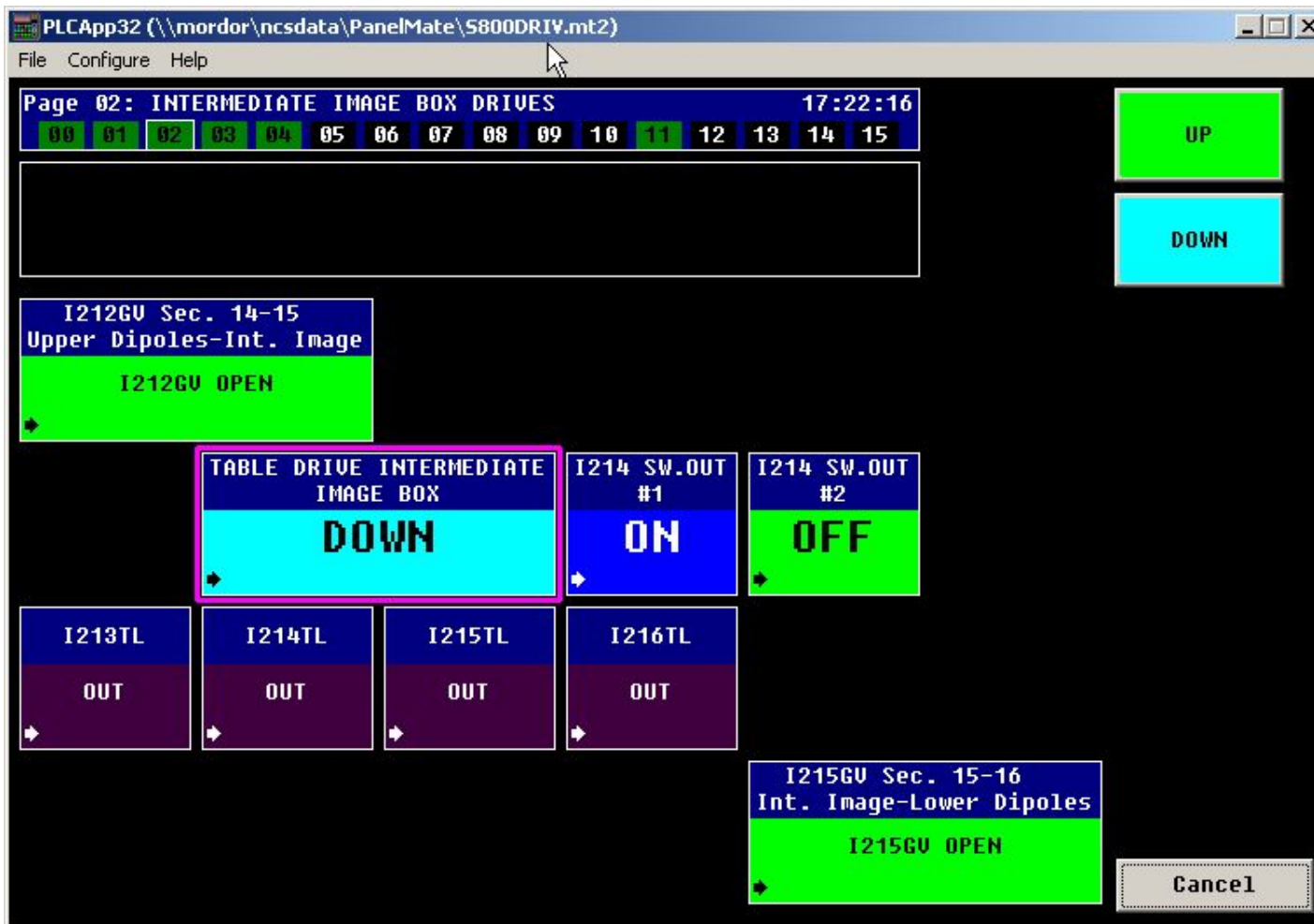
On **page 2** of the S800 drives page:

The “**table drive intermediate image box**” can be used to insert and retract the tracking PPACs.

Indicators

Down: PPACs **in**

Up: PPACs are **out**

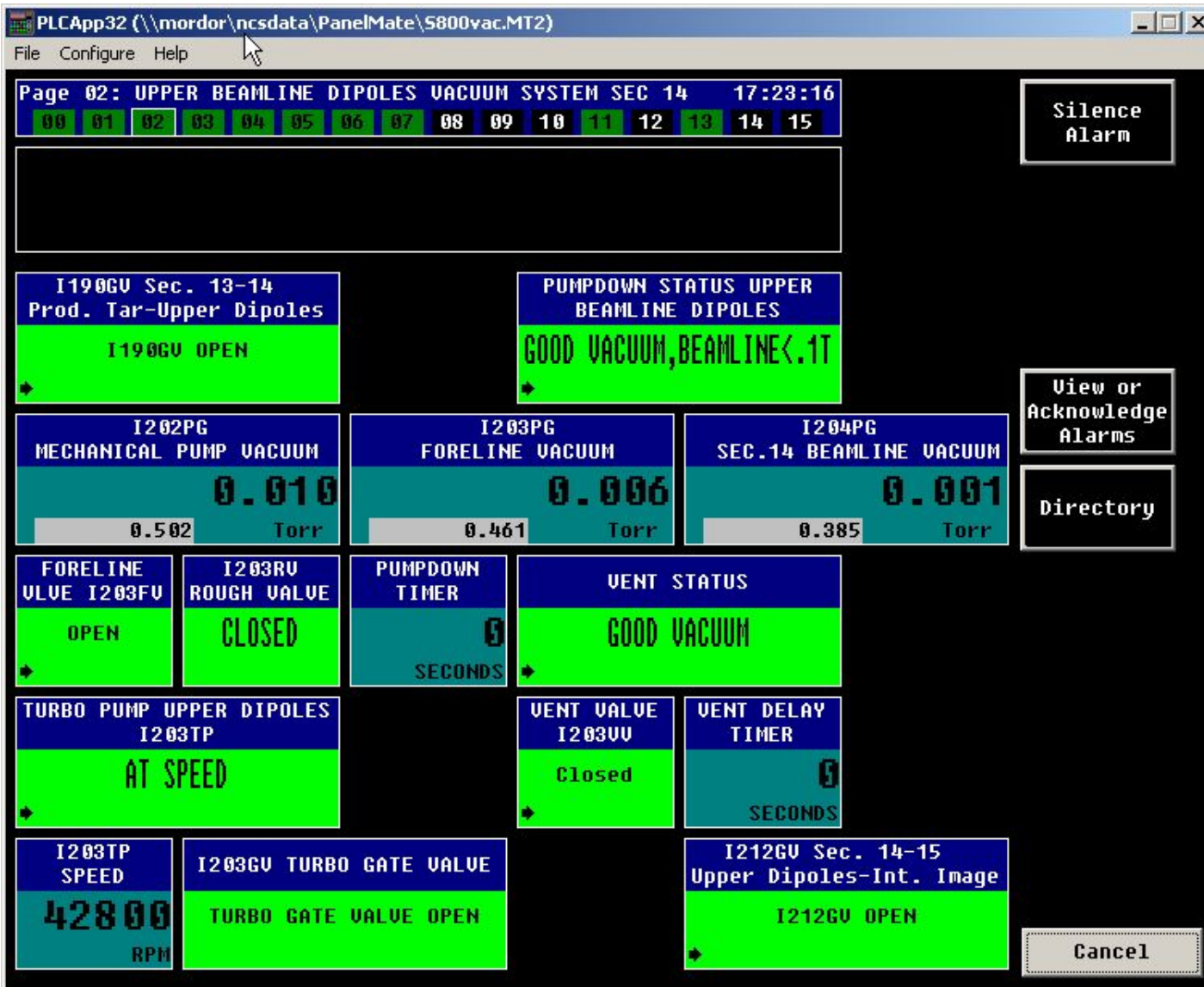


The screenshot shows a control interface for the S800 drives. At the top, the title bar reads "PLCApp32 (\\mordor\ncsdata\PanelMate\S800DRIV.mt2)". Below the title bar is a menu bar with "File", "Configure", and "Help". The main display area is titled "Page 02: INTERMEDIATE IMAGE BOX DRIVES" with a timestamp of "17:22:16". A row of 16 numbered buttons (00-15) is visible, with button 11 highlighted in green. To the right of the main display are two large buttons: a green "UP" button and a cyan "DOWN" button. The main display contains several indicator boxes:

- A box for "I212GV Sec. 14-15 Upper Dipoles-Int. Image" with a green "I212GV OPEN" indicator.
- A box for "TABLE DRIVE INTERMEDIATE IMAGE BOX" with a cyan "DOWN" indicator.
- A box for "I214 SW.OUT #1" with a blue "ON" indicator.
- A box for "I214 SW.OUT #2" with a green "OFF" indicator.
- A row of four boxes for "I213TL", "I214TL", "I215TL", and "I216TL", each with a purple "OUT" indicator.
- A box for "I215GV Sec. 15-16 Int. Image-Lower Dipoles" with a green "I215GV OPEN" indicator.

 A "Cancel" button is located at the bottom right of the interface.

S800vac.MT2



The screenshot shows a control interface for the S800 vacuum system. At the top, it displays 'Page 02: UPPER BEAMLINE DIPOLES VACUUM SYSTEM SEC 14' and a time of '17:23:16'. Below this is a row of 16 numbered buttons (00-15). The main area contains several status panels:

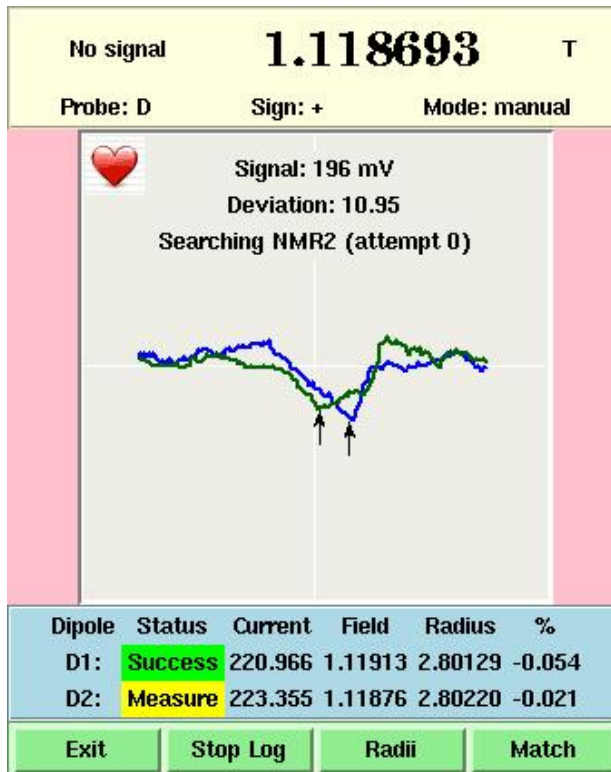
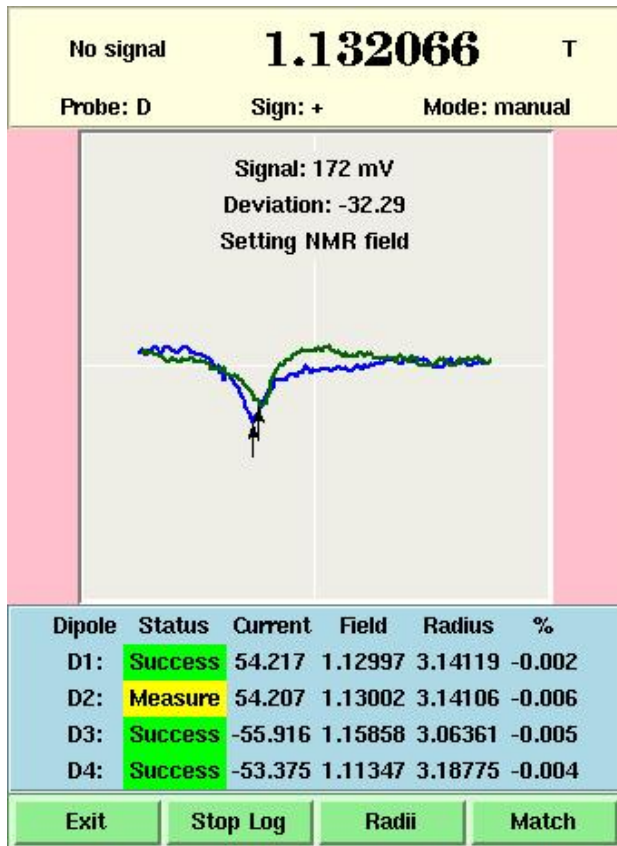
- I190GV Sec. 13-14 Prod. Tar-Upper Dipoles:** I190GV OPEN
- PUMPDOWN STATUS UPPER BEAMLINE DIPOLES:** GOOD VACUUM, BEAMLINE < .1T
- I202PG MECHANICAL PUMP VACUUM:** 0.010 Torr (setpoint 0.502)
- I203PG FORELINE VACUUM:** 0.006 Torr (setpoint 0.461)
- I204PG SEC.14 BEAMLINE VACUUM:** 0.001 Torr (setpoint 0.385)
- FORELINE VALVE I203FU:** OPEN
- I203RU ROUGH VALVE:** CLOSED
- PUMPDOWN TIMER:** 0 SECONDS
- VENT STATUS:** GOOD VACUUM
- TURBO PUMP UPPER DIPOLES I203TP:** AT SPEED
- VENT VALVE I203UU:** Closed
- VENT DELAY TIMER:** 5 SECONDS
- I203TP SPEED:** 42800 RPM
- I203GU TURBO GATE VALVE:** TURBO GATE VALVE OPEN
- I212GV Sec. 14-15 Upper Dipoles-Int. Image:** I212GV OPEN

Control buttons on the right include 'Silence Alarm', 'View or Acknowledge Alarms', 'Directory', and 'Cancel'.

Displays the status of the vacuum from the S800 object (“production target box”) page 1 to the focal plane on page 7. All gate valves can be controlled from there.

Important gate valves for experimenters:

I255GV and **I249GV** on page 4 separating the **target area** from the lower dipole section upstream and the spectrograph beam line downstream



Log files in:
/user/s800/experiment/current/
analysis.log
spectrograph.log

NMR GUIs:
Read, log to file and
communicate the settings of the
analysis and spectrograph beam
lines to Barney

Analysis beam line:

D1: I200DS

D2: I205DS

D3: I223DS

D4: I228DS

Spectrograph:

D1: I265DS

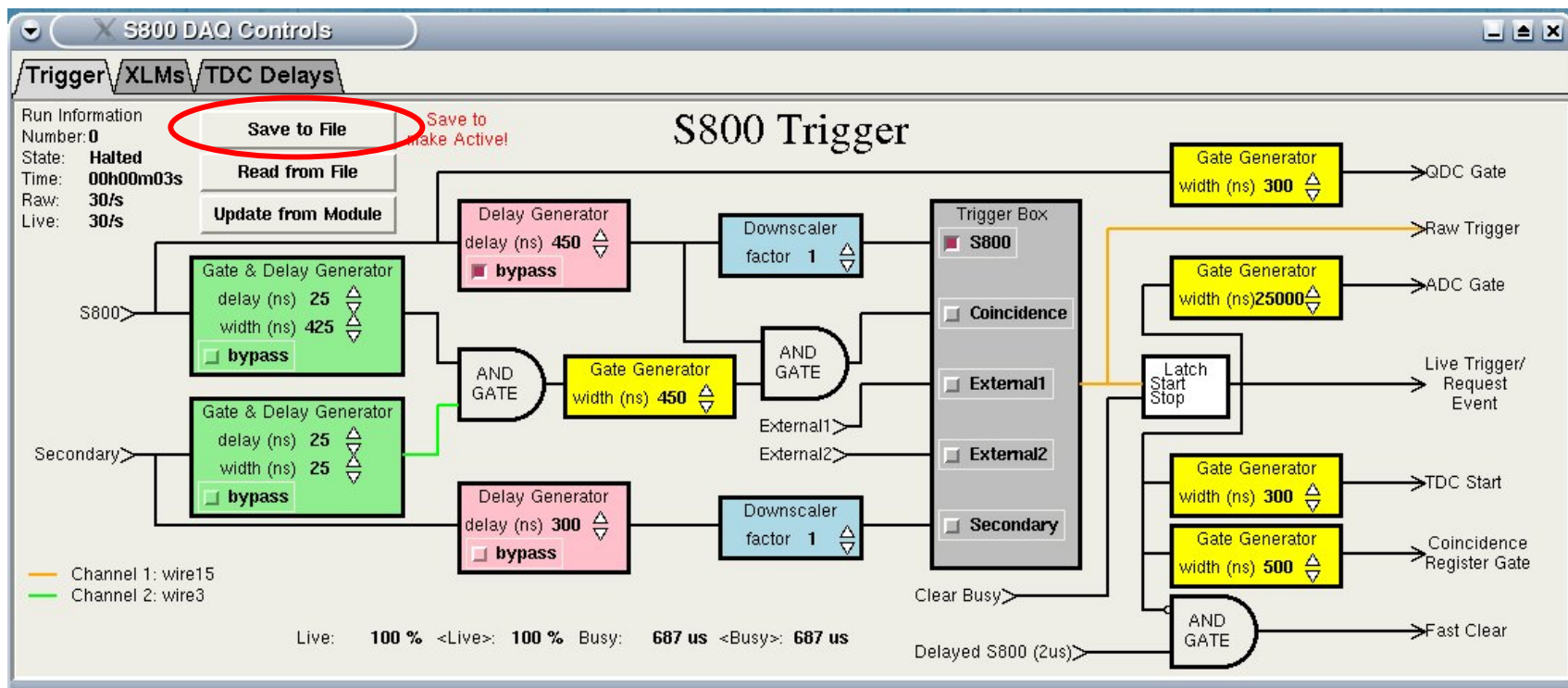
D2: I269DS

For crashes see troubleshooting section

<http://groups.nslc.msu.edu/s800/Users/How-to/troubleshooting.htm>

Allows to select and set the trigger condition, trigger timing and downscale values

For safety: changes can only be made when the **run is stopped**. The changes will take effect for the next run after being **“saved to file”**. The trigger GUI is locked while the DAQ is taking data. A log file with the trigger condition is saved run-by-run.



Started from the respective icons on UXPC2

Alarm server



Monitored by the alarm server:

- Isobutane, CF₄ (CRDCs) and P10 gas flows
- HV of CRDCs, IC, TPPACs

GHS monitor (FP gas handling system)



Alarm monitor

Alarm 1: Low P10 flow. Please check

Acknowledge

Exit

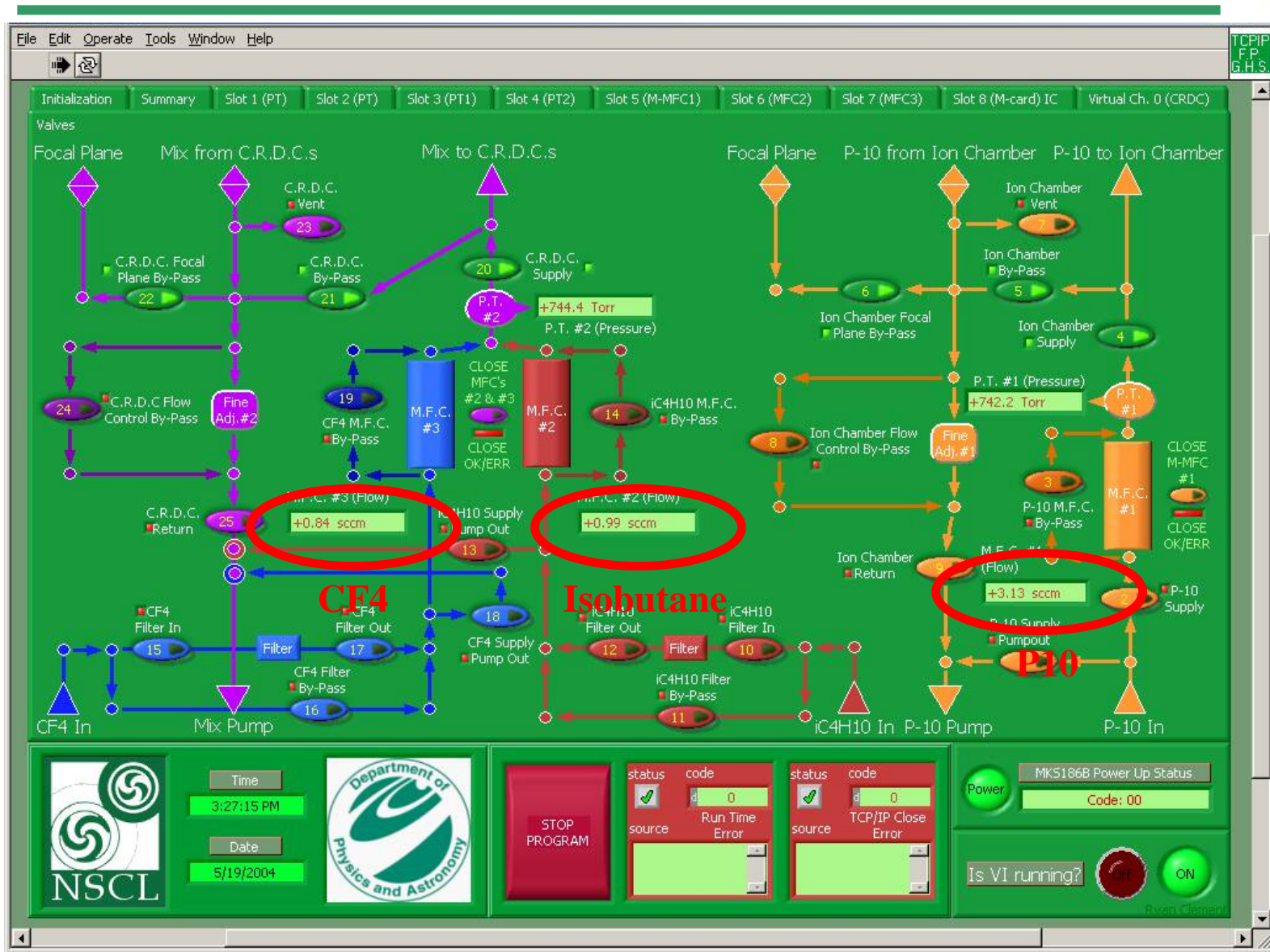
Response to alarms:

- **HV:** Check the set and read voltages on the HV GUI for the detector triggering the alarm. If a **PPAC** tripped, turn it back on. If the PPAC continues tripping:

lower the voltage by 5-10V or lower the beam rate on the detectors

If the drift or anode voltage of the **ion chamber** or the **CRDCs** tripped, stop the beam and **contact one of the S800 device physicists**

- **GHS:** Check the flow on GHS GUI on the dedicated GHS PC and compare to the expected range which will be communicated to the experimenters at the beginning of the experiment









Real GHS alarm: Stop the beam and inform one of the device physicists

Response to alarms:

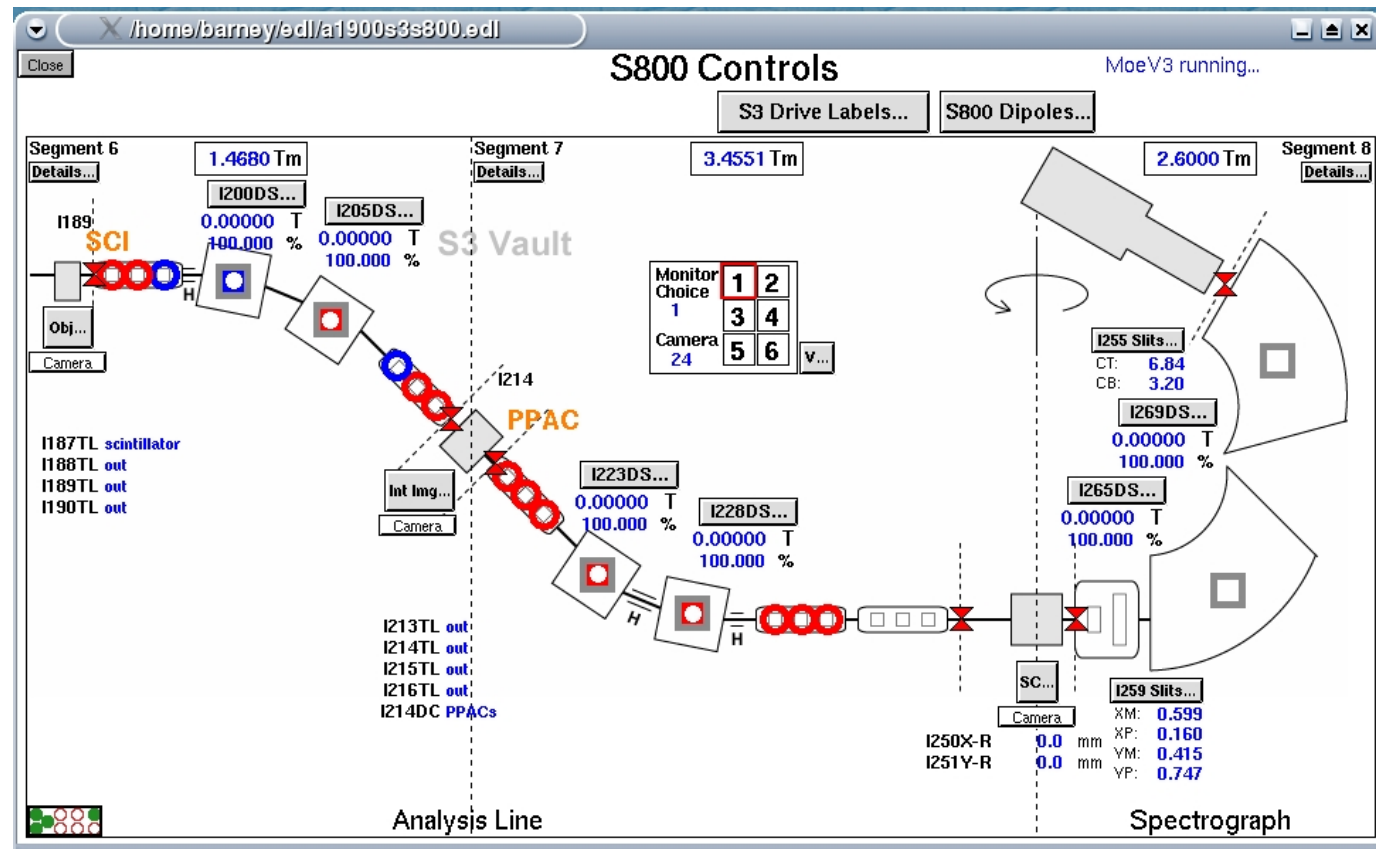
After a thorough check, if there is no apparent reason for the alarm, acknowledge the alarm on the alarm monitor. The alarm won't come back if it was false.

False HV alarms occur occasionally at the beginning of a run when the VME crate is busy and the voltages are not read back properly from the ISEG power supplies

False GHS alarms are due to network outages between the labview GHS program and the terminal server in the vault

-  NMR probes haven't read yet
-  Tolerance for |read-set| exceeded
-  Vacuum gate valve closed
-  Not well matched
-  Same as above, but additionally below a predefined threshold
-  Device is set to 0 but should be non-zero according to the optics file

Disclaimer:
 Barney is not supported by the S800 device physicists. Complaints and suggestions to M. Steiner



userv1/a1900.edl
MoeV1 running...

Exit
K500 rf ok
K1200 rf ok

A1900 Beamline Controls

Z001 TL out

Beam: 48 Ca^{20+}
@ 140.0000 MeV/A

New BRho: 3.7279 Tm
New vs. Now 0.000 %

Store	Rcl	4.2588
Store	Rcl	4.2588
Recall Line	Last	4.2588

Beamline Printouts:
wtrunkw1_color

Optics: G19S3V5Focus60x30.data

Seg 5: 3.7466 Tm

Seg 6: 3.7279 Tm

Seg 7: 3.7279 Tm

Seg 8: 3.3861 Tm

Print/Save

N2: B
N3: C
To N4: D
N4: D E P
To S3: I
S3: I
S2: G H
S1: F G

Set: Seg

1 1/2 1/10% Pct Scaling Apply BRho

D2 Answer from NMR Box: <L1.2847526T>

Seg1: 3.9942 Tm
NMR: 0.0000 Tm
Z015: 0.010 %

used: 3.091 m

Z013TL [0"] out
Z014TL [0"] out
Z015TL [7"]Be 1151
Z016TL [0"] out

Transfer Hall

Z037 WP

Z059

Upstream Mask out
Z059TL [4"]Al 450
Downstream Mask 2.0 pct (W 1")

Seg2: 3.9942 Tm
0.0000 Tm
100.000 %

Seg3: 3.7594 Tm
0.0000 Tm
100.000 %

Z082

Z082 Slits
xc (mm): 0.2
xg (mm): 200.4
yg (mm): 200.0

Z082 Drive out

Seg4: 3.7594 Tm
2.3808 Tm
0.046 %

Z104 SCI

Manual Slits installed, fully open
Si Stack
Z104 Drive PIN
Scintillator

D-Line BLT
F-Line PIN

Barney printouts usually go to the printer u1_color and are saved to disk automatically

http://groups.nsl.msu.edu/a1900/archive/barney/list_savesets.php?dir=BeamLines/I%20Line

Typical file name: Print11Apr05_16h34.txt

```
A1900 "Print11Apr05_16h34.txt"    Monday 16:34:35 2005-04-11  A1900
***                               54Ti to S800 FP ***
Expt: 03036 "Two-proton knockout near N=34" [Robert Janssens] Line: S800 [8]
Beam: 76 Ge 12+  11.59 MeV/nuc (K500) 27+ 130.00 MeV/nuc (K1200)
<Att  30>  ECR, Apertures: RTECR 50.0; 15.0; 50.0 mm RHVBI: 25.4900 kV
K500 a,b:   675 A,   651 A K1200:   812 A,   62 A RF:  22.49306 MHz
      A1900 Optics: G19S3V13_30x20Focus60x30.data
      Rigidity      Field      Radius      (live)  Difference (Field*Radius)
Seg 0:  4.32100 Tm
Seg 1:  3.68380 Tm  1.18875 T  3.09882 m   3.09889 m   0.00224 % (3.68372 Tm)
Seg 2:  3.68380 Tm  1.18771 T  3.10148 m   3.10160 m   0.00398 % (3.68365 Tm)
Seg 3:  3.38380 Tm  1.09280 T  3.09632 m   3.09644 m   0.00389 % (3.38367 Tm)
Seg 4:  3.38380 Tm  1.09347 T  3.09461 m   3.09454 m  -0.00234 % (3.38388 Tm)
Seg 5:  3.36480 Tm
Seg 6:  3.33163 Tm
Seg 7:  3.33163 Tm
Seg 8:  2.74982 Tm
```

Barney printouts are the responsibility of the experimenters

Barney printouts usually go to the printer u1_color and are saved to disk automatically

http://groups.nsl.msu.edu/a1900/archive/barney/list_savesets.php?dir=BeamLines/I%20Line

Typical file name: Print11Apr05_16h34.txt

```

----- Segment 6 -----
I191TA   5.115   17.844   1.025000   1.025000   23.1738   23.118   I191TA
I193TB  -5.273  -18.138   1.000000   1.000000  -23.6845  -23.722   I193TB
I195TC   2.536    8.356   1.000000   1.000000   10.2074   10.228   I195TC
I197DH   0.000    0.000   0.000-00   0.000-00   0.00000   -0.003   I197DH
I200DS   3.243   10.568   0.978272   0.978272   50.6012   50.600   I200DS
I205DS   3.243   10.529   0.974675   0.974675   50.3911   50.396   I205DS
I209TA   0.655    2.097   1.000000   1.000000    2.5624    2.537   I209TA
I210TB  -4.265  -14.353   1.000000   1.000000  -17.8451  -17.833   I210TB
I211TC   5.438   18.607   1.000000   1.000000   24.5704   24.566   I211TC
----- Segment 7 -----
I216TA   5.438   18.607   1.000000   1.000000   24.5704   24.576   I216TA
I217TB  -4.265  -14.353   1.000000   1.000000  -17.8451  -17.867   I217TB
I218TC   0.655    2.097   1.000000   1.000000    2.5624    2.577   I218TC
I223DS  -3.243  -10.827   1.002227   1.002227  -52.0221  -52.019   I223DS
I225DH   0.000    0.000   0.000-00   0.000-00   0.00000   -0.010   I225DH
I228DS  -3.243  -10.398   0.962542   0.962542  -49.7035  -49.751   I228DS
I231DH   0.000    0.000   0.000-00   0.000-00   0.00000   -0.003   I231DH
I232TA  -0.979   -3.085   1.000000   1.000000   -3.7675   -3.764   I232TA
I234TB   2.613    8.530   1.000000   1.000000   10.4214   10.415   I234TB
I236TC  -3.126  -10.422   1.000000   1.000000  -12.7598  -12.739   I236TC
I241TA   2.253    7.744   1.028000   1.028000    9.4587    9.511   I241TA
I243TB  -1.543   -5.194   1.000000   1.000000   -6.3439   -6.349   I243TB
I245TC   0.859    2.844   1.000000   1.000000    3.4733    3.489   I245TC
----- Segment 8 -----
I256QA  -5.847  -16.079   1.000000   1.000000  -46.2053  -46.219   I256QA
I258QB   3.603    9.907   1.000000   1.000000   44.1562   44.166   I258QB
I265DS   3.559    9.792   1.000521   1.000521  188.5185  188.922   I265DS
I269DS   3.559    9.816   1.002879   1.002879  189.2576  189.087   I269DS

```

Lists set and read values for all optics elements in the beam lines

Barney printouts are the responsibility of the experimenters

The S800 focal plane is **protected from excessive rate** by an interlock system (“**Big Brother**”) that **de-phases the cyclotron’s RF** whenever the count rate limit set by the device physicists is exceeded. This will trigger a **voice alarm in the control room** and the experiment has to continue with appropriate intensity.

The rate limit will be experiment specific since rate damage in the CRDCs has been observed to correlated with Z and rate/area.

How-To's with background information:

http://groups.nslc.msu.edu/s800/Users/How-to/Howto_frameset.htm

S800 troubleshooting:

<http://groups.nslc.msu.edu/s800/Users/How-to/troubleshooting.htm>

- Gas handling system voice alarms
- HV voice alarms
- NMR GUI beeps or “freezes”
- Resetting the S800 alarm monitor
- DAQ crashes that require a reboot of the VME crate
- How to restart everything when uxpc2 has to be rebooted

these steps'. Another sub-heading is 'The HV GUI triggers a voice alarm' followed by a paragraph of text: 'Check the read-back value of the voltage displayed above the "HV set" button for the detector that triggered the alarm. In the example shown below, the read-back equals the set voltage of 1000 V for the anodes of both CRDCs. If read and set voltages match and the scalers/spectra for this detector still increment, the alarm was false and shouldn't come back once acknowledged in the alarm monitor.' At the bottom, a partial table is visible with columns 'crdc1' and 'crdc2', and rows 'Anode (+)'." data-bbox="156 130 853 1000"/>

S800 Troubleshooting

The gas handling system triggers a voice alarm

Please follow [these steps](#)

The HV GUI triggers a voice alarm

Check the read-back value of the voltage displayed above the "HV set" button for the detector that triggered the alarm. In the example shown below, the read-back equals the set voltage of 1000 V for the anodes of both CRDCs. If read and set voltages match and the scalers/spectra for this detector still increment, the alarm was false and shouldn't come back once acknowledged in the alarm monitor.

crdc1	crdc2
Anode (+)	Anode (+)