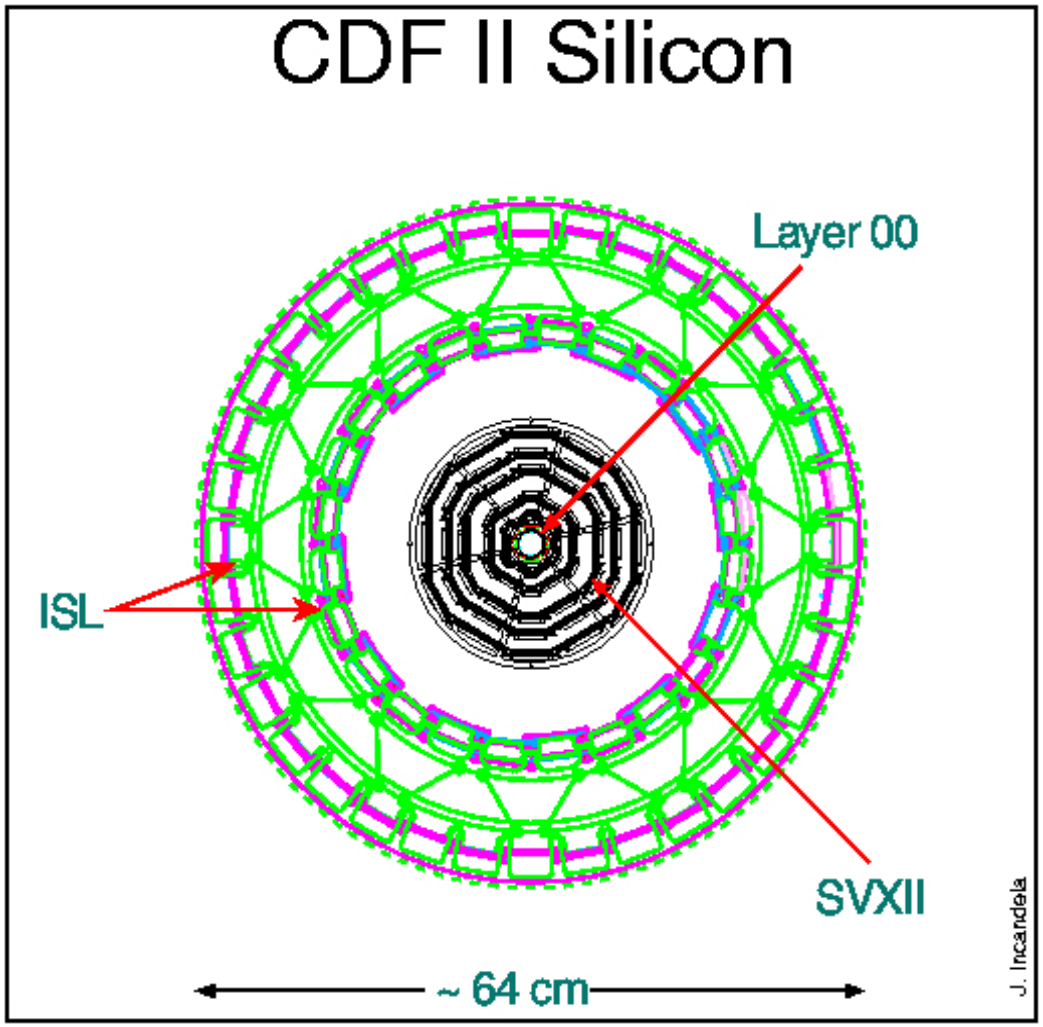
What You should know about the Silicon

Friendly Advice:

- Learning about how things work will save time, increase efficiency, and earn **Glory and Praise**
- Your SciCo is **NOT** an expert, so don't let them waste too much time theorizing, page a real expert

Introduction



- L00 (1 layer)
  - R = 1.35-1.65 cm
  - 13824 channels
- SVX (5 layers)
  - R = 2.5-10.6 cm
  - 405504 channels
- ISL (2 layers)
  - R = 20-28 cm
  - 303104 channels

Total: 722432 chnls

➢ Share same DAQ architecture

Introduction

The silicon detector can be permanently damaged by:

A. Powering (STDBY or ON) without adequate cooling
B. Large charge deposits (from unstable beam) while ON
C. Incorrectly powering

We minimize chances of incurring such damage by:

A. Employing PLCs to monitor status of silicon cooling
B. Employing various loss monitors to determine beam stability
C. Employing “clever” monitoring/control software

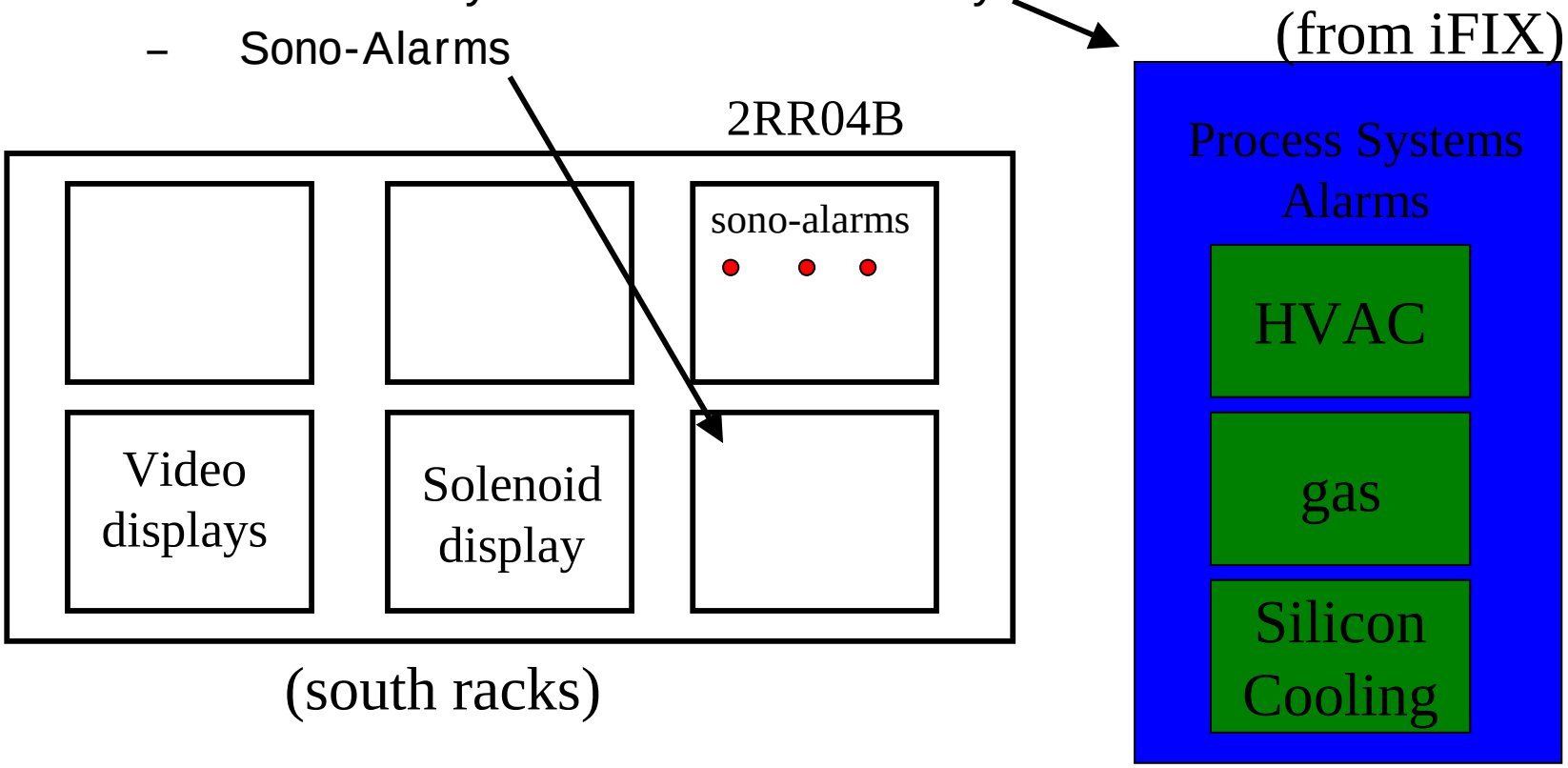
And as a final mitigating factor:

We rely on YOU to help quickly spot potential dangers.

Monitoring

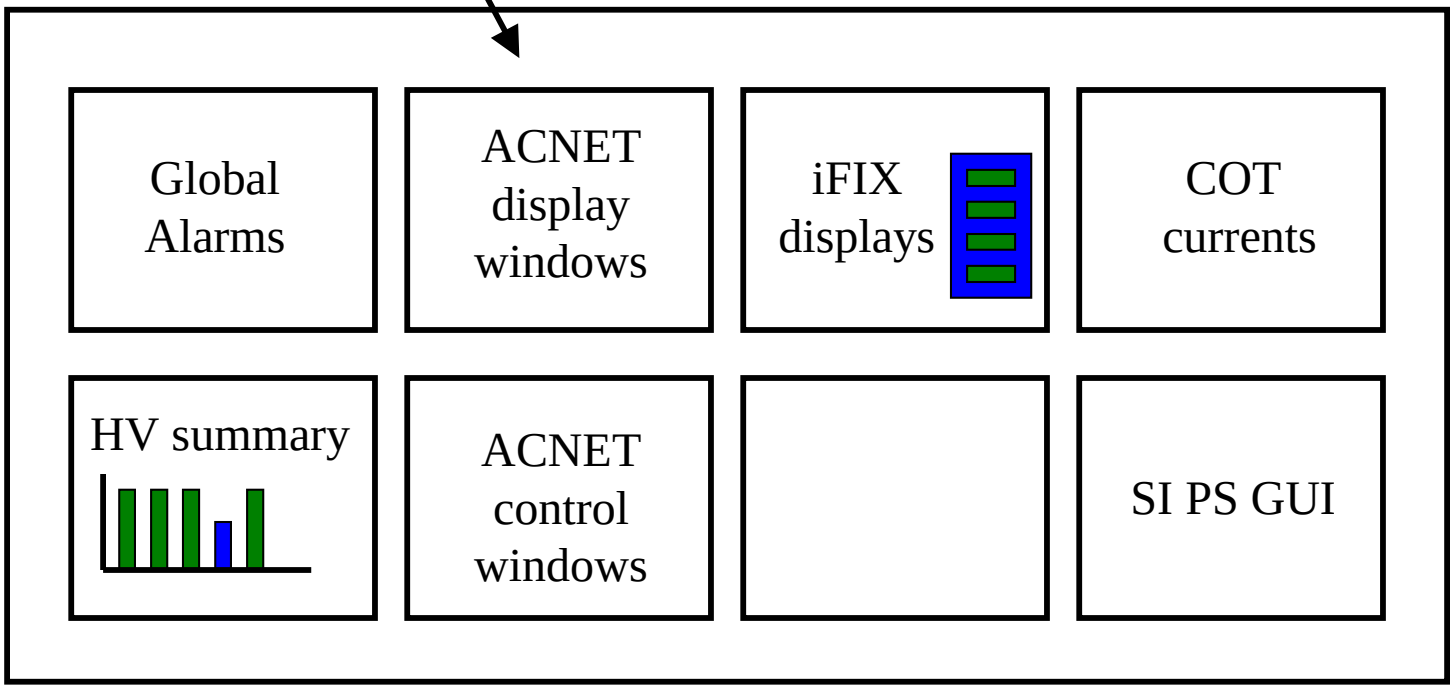
There is information available from a variety of places:

A. Silicon Cooling… overall status from
   - "Process Systems Alarms" summary
   - Sono-Alarms



Monitoring

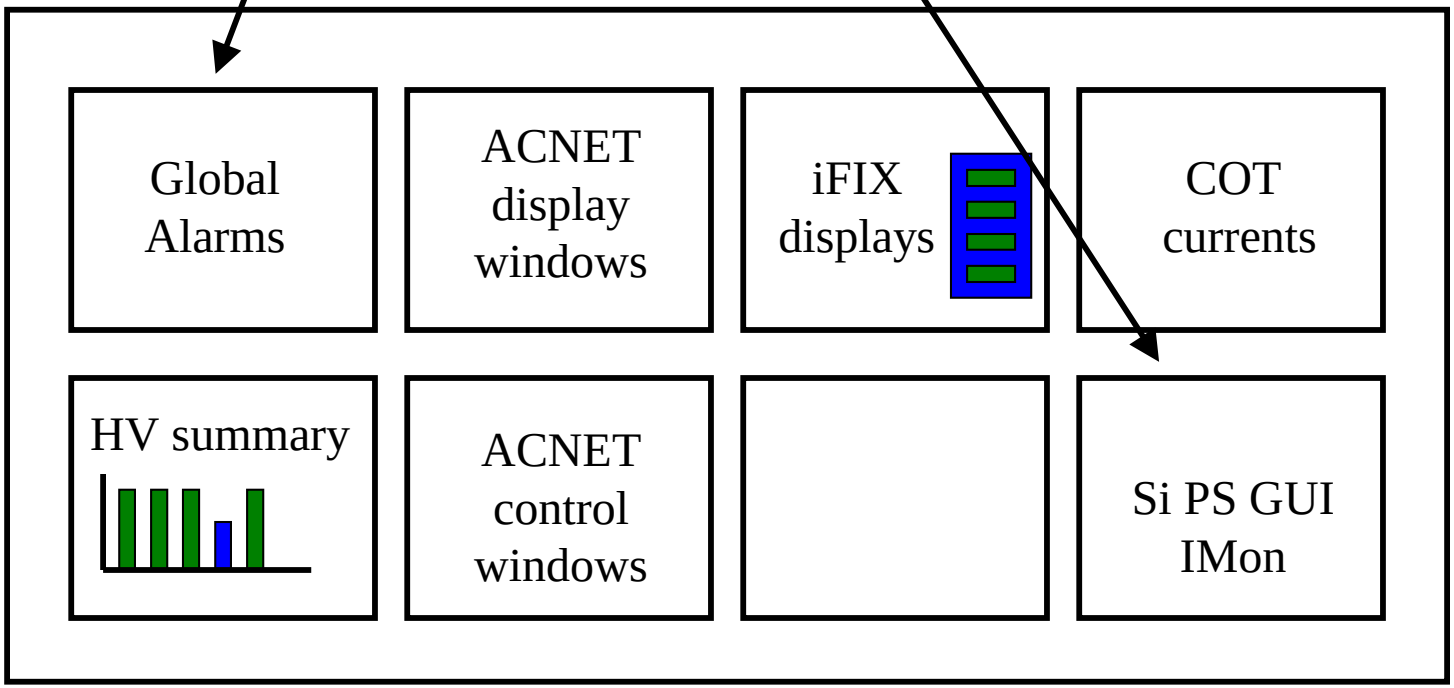
B. Beam losses from ACNET
- Losses (LOSTP, LOSTPB, etc…)
- SVXRAD plots



Monitoring

C. Power status

- Silicon Power Supply Control GUI
- HV Summary and Global Alarms



Monitoring

IF Silicon Cooling .and. sono-alarms (quiet)

- Cooling in good shape

Obey TevMon, ACNET Losses, SI_TEST1 and SI_TEST2 plots (put in e-log)

- Beam is stable

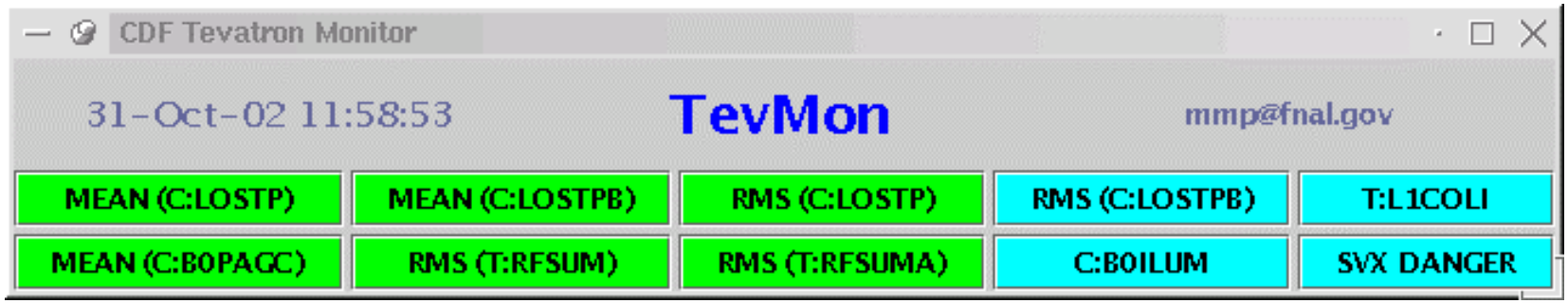
IF L00 .and. SVX .and. ISL on Global Alarms Sum'ry

- Powered wedges OK

THOU SHALT NOT OPERATE SILICON WITH BEAM UNLESS

- The electron lens is on
  - Monitor w/ ACNET variable T:L1COLI
- There is “normal” DC beam in the machine
  - Monitor w/ ACNET variables , C:B0PBSM and C:B0ABSM gated on abort gaps
  - No sudden unexplained longitudinal growth of beam (T:SBDMS)
  - No sudden unexplained change in luminosity (ΔC:B0ILUM > 10%)
- The Tevatron Radio Frequency (RF) system is stable
  - Monitor w/ ACNET variables , T:RFSUM and T:RFSUMA
- The Tevatron losses are minimal and stable
  - LOSTP, LOSTPB < 20 kHz, ΔLOSTP, ΔLOSTPB < 2.5 kHz/hour, No spikes > 25 kHz
- The Beams Division is not doing any “harmful” parasitic studies
  - When in doubt, page Silicon
- Silicon stays in STANDBY between stores unless Beam warrants “OFF”
  - Avoid excessive power cycling & associated thermal stresses
  - Hints that STANDBY safer than ON, but that STANDBY may not be totally safe
- No silicon use in DAQ/trigger tests without permission from silicon pager.

TevMon Beam Conditions Monitor



- Monitors ACNET variables for silicon safety
- One cell for each criterion in ACNET checks
  - plus one cell for overall decision on SVX Danger!
- If SVX Danger cell turns Red, follow ACNET incident rules (call MCR, page silicon)
- Before turning on silicon after scraping, check TevMon and then get expert's permission to turn on.
- TevMon is an essential process
  - check the time stamp to make sure that it is updating

Radiation Problems ("EEEEEEEE")

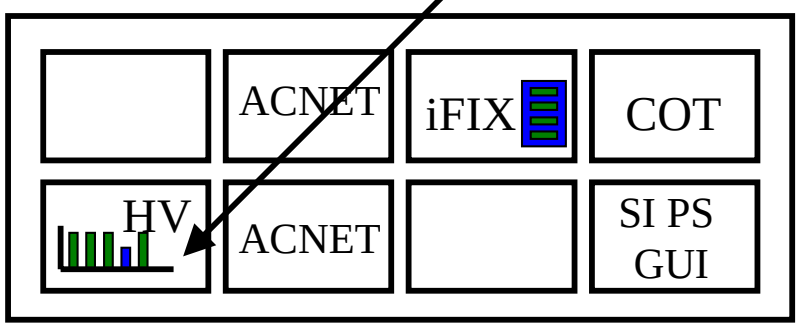
For SVXRAD plots, follow RADMon run rules.

On alarm, **page Si**:218.8227 and **RadCo**: 266.2713

IF any of the silicon specific ACNET variables are out of range (see monitoring ACE instructions) *or otherwise indicate unstable beam conditions*

Ask SciCo to notify MCR crew chief and find out why

- Meanwhile **page silicon**: 218.8227
- If you fear for safety of silicon: use HV Summary button to bring to STDBY (will take a few minutes)

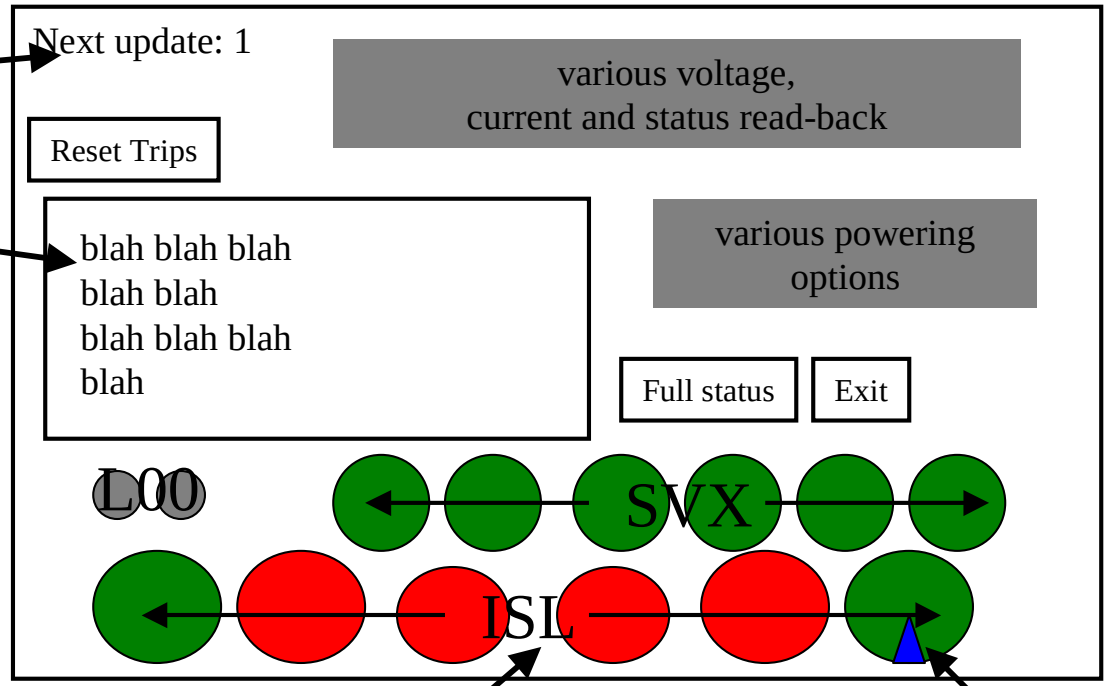


Quick SI-PS-GUI Tutorial

Labels: DBbWw-Ll (e.g. SB2W3-L3 = SVX brl-2 wdg-3 lyr-3)
D: S=SVX, I=ISL, L=L00 B: barrel number (0-5)
W: wedge number (0-11) L: layer number (0-4)

Check this is counting down

Message window reports problems (e.g. trips) and global actions (e.g. power ON of all silicon)



Only use GUI when coached by expert! (Use iFix for Most actions.)

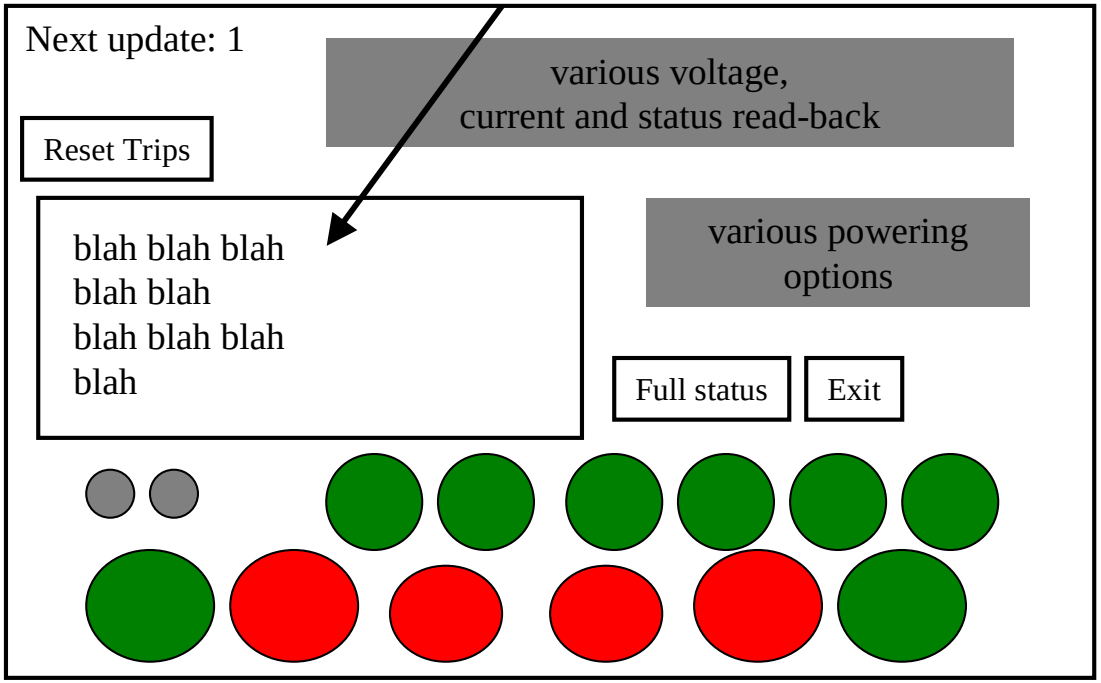
Wedge by wedge status:
yellow = STBY green = ON
red = OFF s/b ON black = OFF s/b OFF

Also, can select particular Wedge by clicking on appropriate "pie piece"; blue = selected

Cooling Problems ("OU-OO" or "EEE")

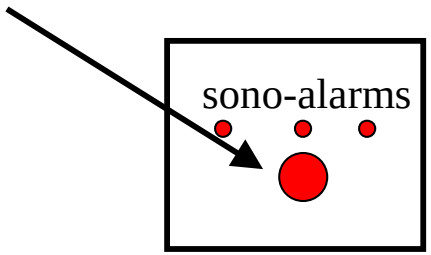
IF Silicon Cooling .or. sono-alarms (LOUD)

- Page 218.8227 (main pgr)
- Page 218.8626 (interlock pgr)
- Check GUI message window…



IF persistent (1 or 2 ok) "ALERT" .or. "ILLEGAL" messages (check time stamp):

Hit the Silicon Rack Power Crash Button



Si Power Problems/Trips ("Tweet")

IF L00 .or. SVX .or. ISL on Global Alarms Sum'ry

- Sometimes will clear themselves… otherwise:
- Go to HALT State, Page 218.8227
- Expert will either take care of it themselves, or, they may coach the Monitoring Ace through recovery

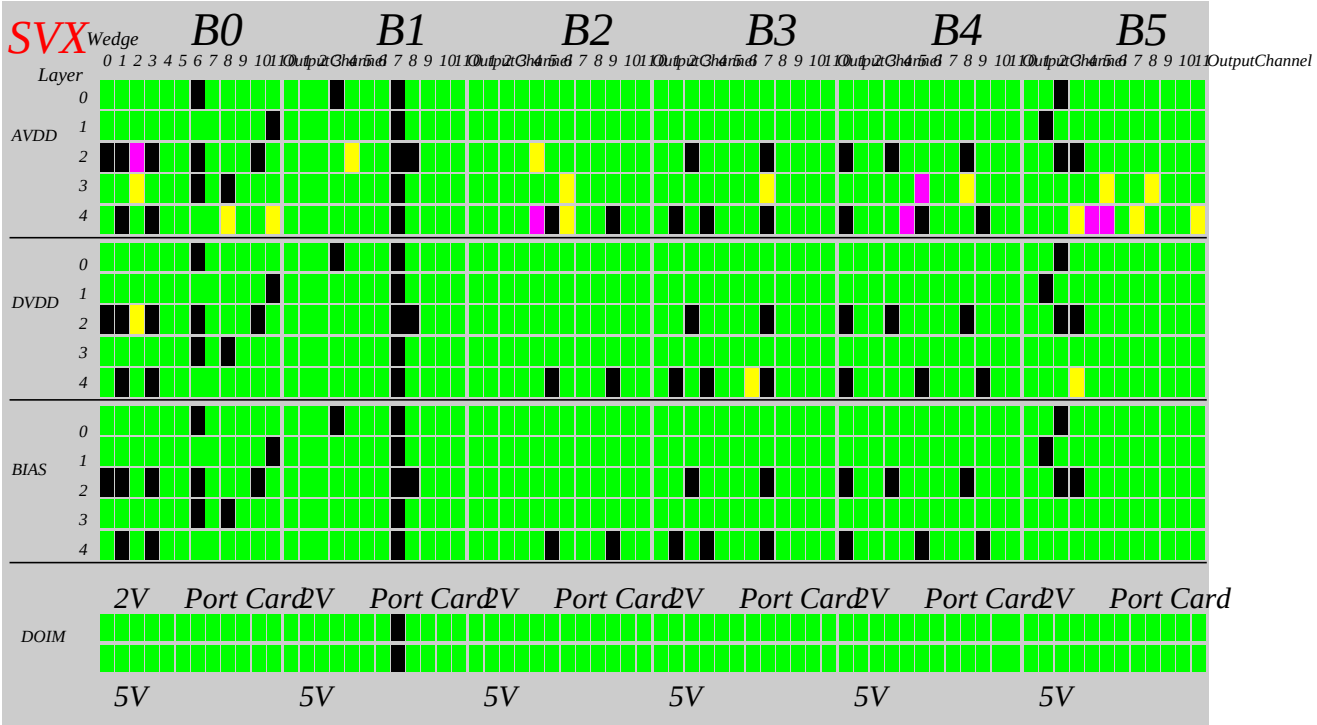
IF SI PS GUI stops Updating:

- Occasionally (1-2/shift) check that "Update" is counting down
- Be patient, gets "stuck" on "1" for 5-10s sometimes
- If recently changed voltage state (e.g. turned to STBY or ON), wait ~5 minutes and check again
- If really "stuck", follow directions to restart

(they're taped above the GUI screen)

Quick IMon Tutorial

- Tracks currents for experts by color:
  - GREEN = Normal
  - YELLOW = Warning
  - PINK = Alert
  - RED = Trip
  - BLACK = Not Powered
- ***We need your help monitoring these currents, which may signal imminent danger to the silicon.***



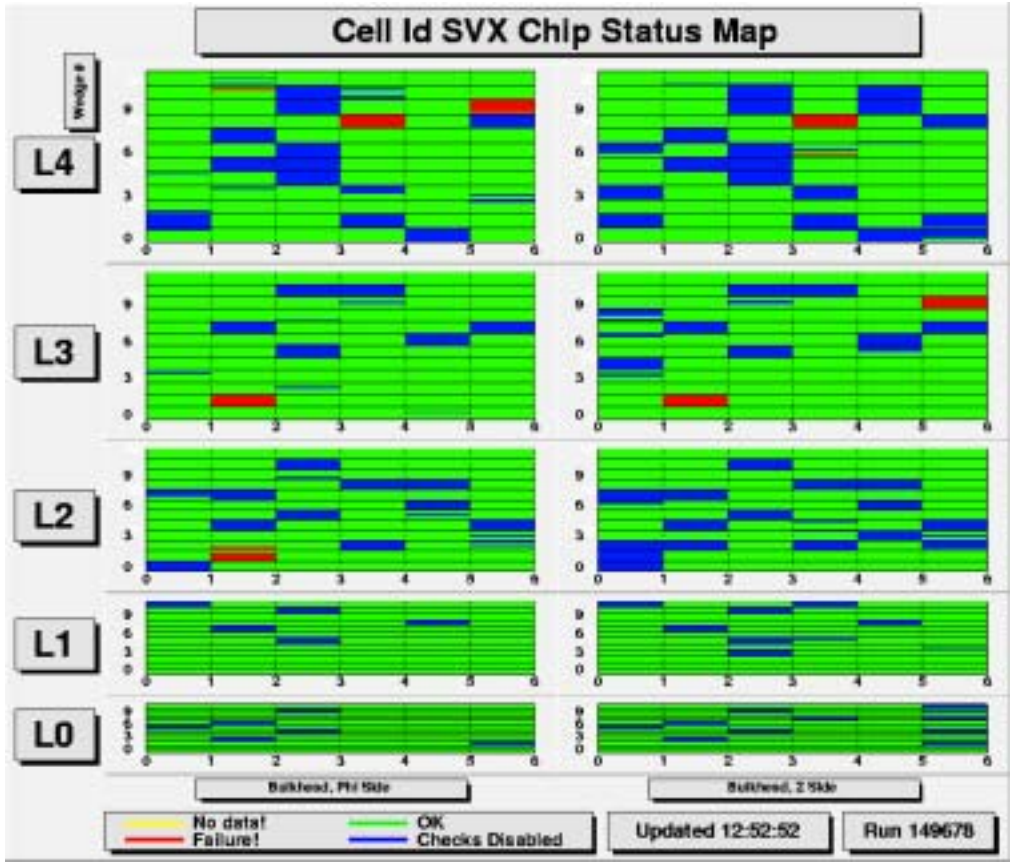
Instructions for restarting iMon are above the silicon terminal

Ace's IMon Responsibilities

- Aces should respond to *any* IMon cells that have turned pink **during data taking only.**
  - When data taking begins, Ace needs to unmark all IMon cells.
  - If cell is pink during data taking, ACE should:
    - Note the ladder and current which has latched.
    - Unmark cell.
      - If it turns green, document in e-log, nothing more.
      - If it remains pink, page silicon, use IMon to plot current history, click "Print", and paste plot in e-log.
    - Talk to CO, see if latched cell was correlated with data errors in SVXMon Cell Id Status plots.
      - If so, perform HRR if not performed automatically already.

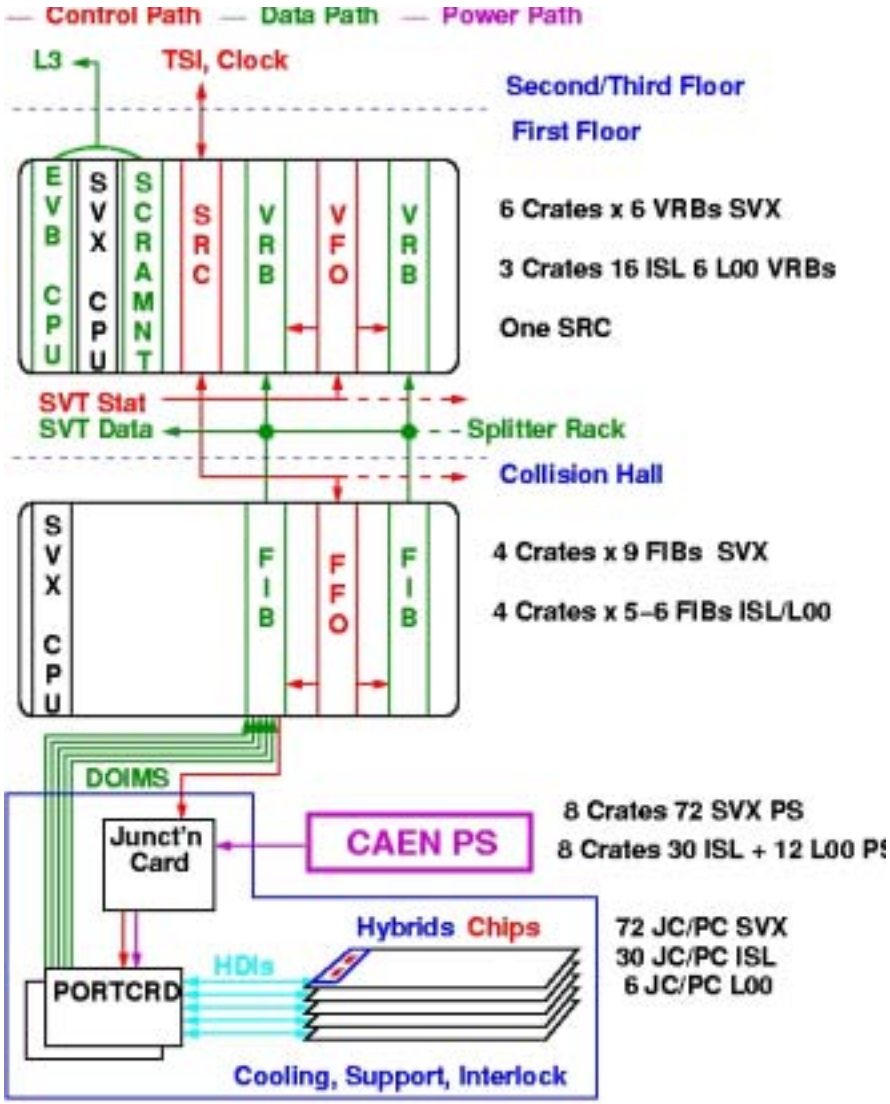
Quick SVXMon Tutorial

- SVXMon used for automatic checking of silicon data quality ***and to intervene w/ run control in certain cases***.
  - SVXMon generates auto-HRR in case of Cell Id errors (plot from SVXMon slides)
    - Max. rate every 2.5 mins.
  - Monitor history of automatic HRR with SvxErrorLogger
  - In case of constant HRR from SVXMon, page silicon
  - For unbiased silicon pop-up error windows
    - Follow instructions
    - Page Silicon



Silicon from the DAQ Perspective

- **Silicon is different**
  - 17 crates, but **ONE SRC** which talks to TSI
    - All `BUSY`, `DONE`, and `ERROR` timeouts come from it ***<u>though problem may be elsewhere</u>***
  - Due to SVT, Si reads out to VRBs after L**1**A (not L**2**A)
    - VRBs are crucial
    - `L1DONE` signal to TS indicating data transferred to VRB
  - CPUs play role only in initialization and monitoring
  - `b0svx**` crates shared with EVB



Silicon DAQ configuration

- Partitioning
  - `CrateSet`: All Vrb crates included, dropping Fib crates is OK.
  - Choose an `SvxSet` (e.g. `SVX_NO_PEDS`) (Si run dependent parameters)
  - TS settings to play nice with the SRC
    - `IgnoreBusy = false` else the TS ignores the VRBs.
    - `UseSrc = true` else the TS ignores L1 DONE
- Initialization
  - Fib crates also initialize ladders, which sometimes do not "readback" the init parameters correctly

    `b0fib02:Error Initializing HDI Slot 18 Chan 6: SB2W7`

    Re-issue COLDSTART for that Fib crate only, look for Trips. **Do not power cycle the crate, it will not help.** If persistent, page Si pager, who will either mask off or remove the ladder
  - **Only when a crate does not respond to RC signals does it justify rebooting it.**

Silicon DAQ Runtime Errors

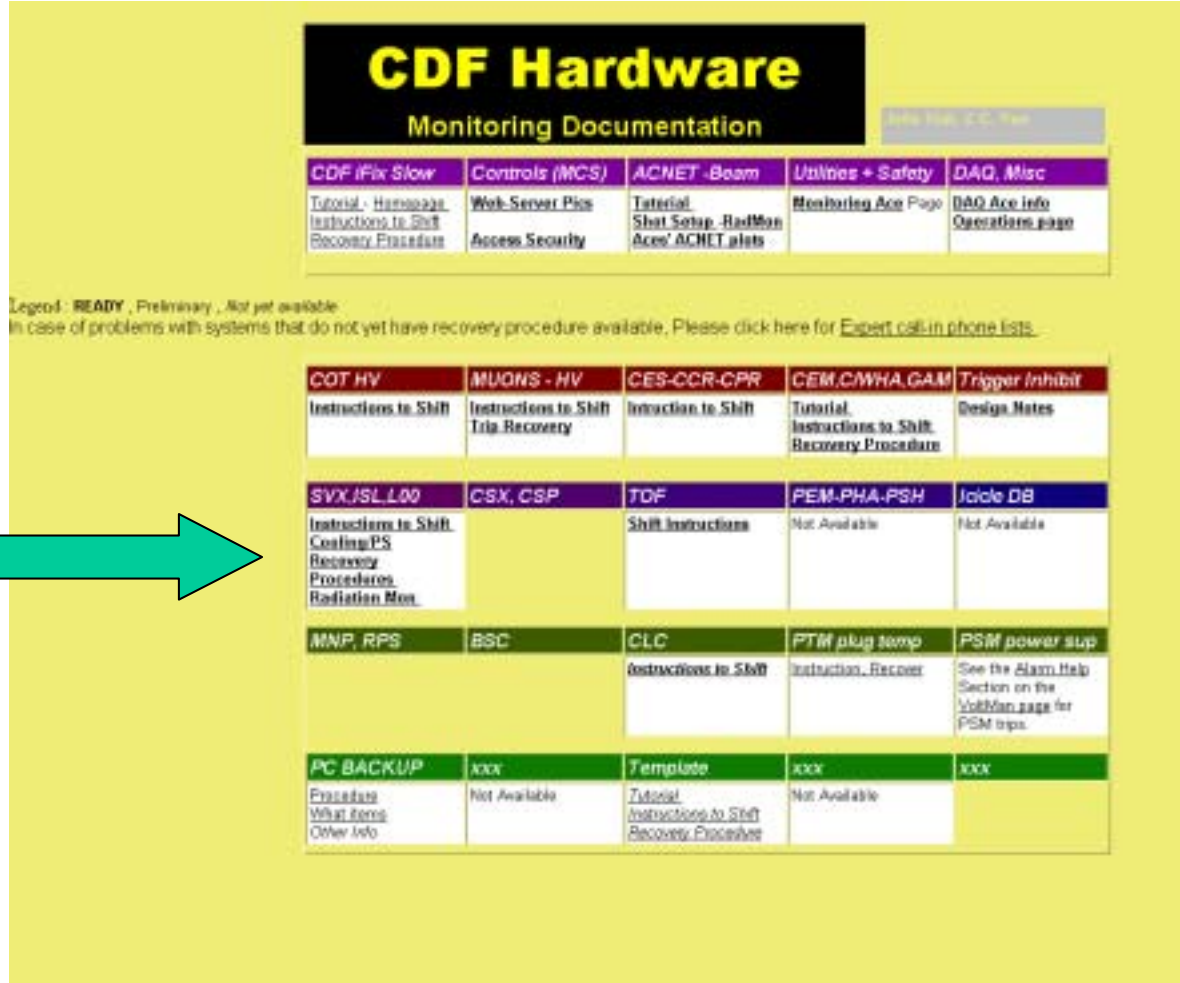
- Run Time Errors: `Halt-Recover-Run` is first line of defense. If anything persists, page Si pager
  - `HALT` ⇨ all Si crates query all boards and find potential problems

    `Silicon Timeout:BUSY- Slots: 10:fa00 12:fa20…`
  - `Done TO`: Data did not get sent to the Vrb. Very rare, usually means a VRB is bad.
  - `L1 Done TO`: TS has lost count of how many free buffers in Si Chips. Modulo fixed TS firmware, exceedingly rare
  - `Error`: Currently not pulled by SRC, but may be soon to prevent Silicon damage from high current/high occupancy states
  - `Busy TO`: Means VRB has no more space for events. Exceedingly common , as **EVB** stops when any data corruption is detected anywhere (normally **NOT** in a Silicon crate) and the Silicon VRBs fill up first. Find data corruption and page responsible group
  - `Done TO from TRIGGER_SCALERS_00 Rate too high`: L1A rate too high to safely operate silicon. Usually trigger table is corrupt or there's a hot trigger. Page Trigger, look at TrigMon

Web Documentation

www-cdfonline/mcs/mondoc.html

Silicon



CDF Hardware

Monitoring Documentation

CDF iFix Slow	Controls (MCS)	ACNET -Beam	Utilities + Safety	DAQ, Misc
Tutorial - Homepage Instructions to Shift Recovery Procedure	Web Server Pics Access Security	Tutorial Shot Setup -RadMon Aces' ACNET plots	Monitoring Ace Page	DAQ Ace info Operations page

Legend : READY , Preliminary , Not yet available

In case of problems with systems that do not yet have recovery procedure available, Please click here for Expert call-in phone lists.

COT HV	MUONS - HV	CES-CCR-CPR	CEM,C/WHA,GAM	Trigger Inhibit
Instructions to Shift	Instructions to Shift Trip Recovery	Intruction to Shift	Tutorial Instructions to Shift Recovery Procedure	Design Notes

SVX,ISL,L00	CSX, CSP	TOF	PEM-PHA-PSH	Jolcle DB
Instructions to Shift Cooling/PS Recovery Procedures Radiation Mon		Shift Instructions	Not Available	Not Available

MNP, RPS	BSC	CLC	PTM plug temp	PSM power sup
		Instructions to Shift	Instruction, Recover	See the Alarm Help Section on the VoltMan page for PSM trips.

PC BACKUP	xxx	Template	xxx	xxx
Procedure What items Other Info	Not Available	Tutorial Instructions to Shift Recovery Procedure	Not Available	

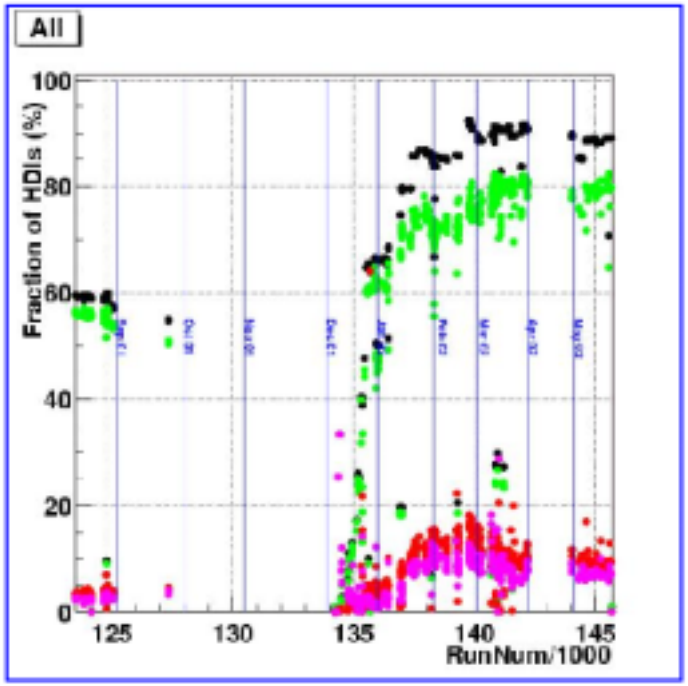
www-cdf.fnal.gov/internal/silicon/scc.html

CDF RUN II COMMISSIONING

Silicon Commissioning and Operations

Organizational authority for the silicon projects passed from the construction projects to operations when the Run2 silicon detector was installed inside the COT. The commissioning and operation of the silicon system in run 2 are organized as part of the operations group headed by Mike Lindgren.

The current SPLs (subproject leaders) for silicon are Gino Bolla, and Chris Hill.



Done

Internet

www-cdfonline.fnal.gov/~svxii/runii/ace_mon.html

CDF RUN II COMMISSIONING

CDF Monitoring Ace Silicon Instructions

As a monitoring ace, your silicon responsibilities are to:

1. MONITOR BEAM conditions using TeVMon and ACNET as follows:
   - Check SVX DANGER status in TeVMon:
     - If SVX DANGER is PINK page silicon (218-8227)
     - If SVX DANGER is **RED** bring HV to standby and page silicon (218-8227)
   - At least once per hour, make the following ACNET plots *and* place them in the e-log:
     - Shift Losses (C:LOSTP, C:LOSTPB, C:B0PLOS, C:B0ALOS)
     - S1-Test1 (T:L1COLI, T:RFSUM, C:B0PBSM, C:B0RAT4)
     - S1-Test2 (T:SBDMS, T:RFSUMA, C:B0ABSM, C:B0ILUM)
   - At least once per hour, check that the following criteria are satisfied:
     - The electron lens is ON (L1COLI > 0).
     - Losses are acceptable (LOSTP, LOSTPB < 20.0 kHz).
     - Losses are not growing rapidly (delta LOSTP, delta LOSTPB < 2.5 kHz/hour).
     - Losses are stable (NO spikes > 25 kHz).
     - There is no sudden increase/decrease in luminosity (delta B0ILUM < 10%).
     - RF is stable (delta RFSUM, delta RFSUMA < 0.25/min).

       If ANY of these criteria are *even momentarily* not satisfied, page silicon (218-8227).
2. CONTACT SILICON expert when anti-protons are being loaded.
   - Page 218-8227 (main silicon pager).
   - Alert silicon expert that store is in.
   - Report SVX DANGER status in TeVMon to silicon expert:
     - If SVX DANGER is GREEN silicon HV can be ramped up at silicon expert's discretion.
     - If SVX DANGER is **RED** or PINK silicon can not be included. Have SciCo call MCR to address problem.
   - If silicon expert decides beam conditions are ok, they will instruct you to ramp up HV.
3. REACT to loud noises and/or non-green color from 1Fix.
   - Be familiar with and follow the following specific recovery procedures:
     - Power supply alarm/trip
     - Cooling problems/interlock trip
     - Loss of HV monitoring
     - Loss of alarm monitoring
     - "Alarm: Heartbeat"

www-cdfonline/~svxii/runii/svx_recover.htm

CDF RUN II COMMISSIONING

Recovery Procedures for Silicon Cooling/Power

Note: in what follows, "Alarm List" refers to the iFix page that pops up when the "D" button on the Global Alarms page is clicked. Clicking the box that says "SVX," "ISL," or "L00" pops up something called an iFix Alarm Summary Object, which is a lot like an alarm list, except that it sucks.

1. **POWER SUPPLY TRIP**

   Symptom: A box goes red and tweets. IN ADDITION, the bars and status box on the HV summary page go red.

   What should you do? Check the Alarm List. From there you will be able to read what ladder has tripped (B1W2 L3, for a random example). Page 218 8227 armed with this information and the expert will help you recover. *Note: if, after recovery, the iFix alarms haven't cleared, try clicking "Reset Trips in CAEN" on the PS GUI.*

2. **COOLING PROBLEMS/INTERLOCK TRIP**

   Symptom: These are signalled by either of the following:

   1. The "SILICON Cooling" box on the iFix "Process Systems ALARMS" page goes red and LOUD sirens blare (can only be silenced by the cryo techs)
   2. The silicon sono-alarms (located on the patch panel in rack 2RR04B) emit a loud, sustained, annoying beep (can be silenced by flipping the switch beneath them)

   What should you do? The VERY FIRST THING YOU SHOULD DO is check the silicon PS GUI. If it is stuck (i.e. not counting down, see below), or if it is spewing out LOTS of messages like "ALERT" or "ILLEGAL," then **hit the Silicon Rack Power Crash Button** located underneath the sono-alarms.

   In any event, page 218 8227 and the on-call cooling/interlock expert at 218 8626. They will help you recover. At the end of it all, make sure the sono-alarm switches are returned to "NOT SILENCED" and the cryo techs have unsilenced the Process Systems alarms.

   Note: A non-severe cooling problem can be signalled by a red (or yellow) tweety iFix alarm that is not accompanied by a sono-alarm or a Process Systems alarm. These are rare enough that we would like you to page the on-call cooling/interlock expert at 218 8626 so we can understand the problem.

3. **LOSS OF HV MONITORING**

   Symptom: ALL THREE silicon boxes (SVX/ISL/L00) go red and tweet at the same time. The Alarm List shows "GUI/iFix communication: NOT OK." After some amount of time (could be seconds, could be minutes), the three silicon heartbeat boxes on the HV summary page go purple.

   What should you do? Check the silicon PS GUI and see if it is updating (look in the upper left corner of the window where it says "next update." It should count down from 7, stop for a few seconds at 1, then start counting down again). If it seems to be stuck,

   1. Wait a little longer, like 30 seconds. If you have just recently turned a bunch of power supplies on or off, wait even longer, like 5 minutes.
   2. If it's still stuck, restart the GUI by following these instructions (also posted on the GUI PC -- and they ought to be identical!)
   3. If the GUI does not restart gracefully, page the GUI expert at 266 0555.
   4. If the GUI restarted OK, the alarms should disappear. If they remain, or if the GUI never seemed to be stuck in the first place, page the on-call cooling/interlock expert at 218 8626. S/he will either take care of it or tell you how to take care of it.

4. **LOSS OF ALARM MONITORING**

Done (0.391 secs)

Useful DAQ Hints for ACEs

www-cdf.fnal.gov/internal/silicon/silicon_commission/daq/sidaq_sop.html

CDF RUN II Silicon

Silicon DAQ Standard Operating Procedures

Introduction

Here is the list of Standard Operating Procedures for running and maintaining the Silicon DAQ. They are geared toward Aces and Non-Expert Silicon people. In all cases you should make a note in the elog with run number and a snippet of the problem.

- Unresponsive Fib (b0fibXX) or Vrb (b0svxXX) crate
- Failed Warm/Cold Start from Fib
- Failed Warm/Cold Start from Vrb
- "No response from the Fib" when powering up Silicon wedges
- BUSY Timeout from b0svx02
- DONE Timeout from b0svx02
- High Rate of RF errors
- How to Decode a Fib Id
- How to Mask Init Readback on an HDI
- How to Chop a Chip Chain
- How to Download Sequences
- Power Outage

Who to Call?

Ran Out of time!

http://www-cdf/internal/silicon/silicon_commission/pager.html

(posted in the control room too)

Conclusion

Your main responsibility to silicon is to help keep it **safe**.

When in doubt, page 218.8227…
if no response, turn it to STANDBY
(or OFF if there's a cooling problem).