The Main Control Panel for the SSD

- For normal operations push

  “Turn SSD On” (5 minutes)

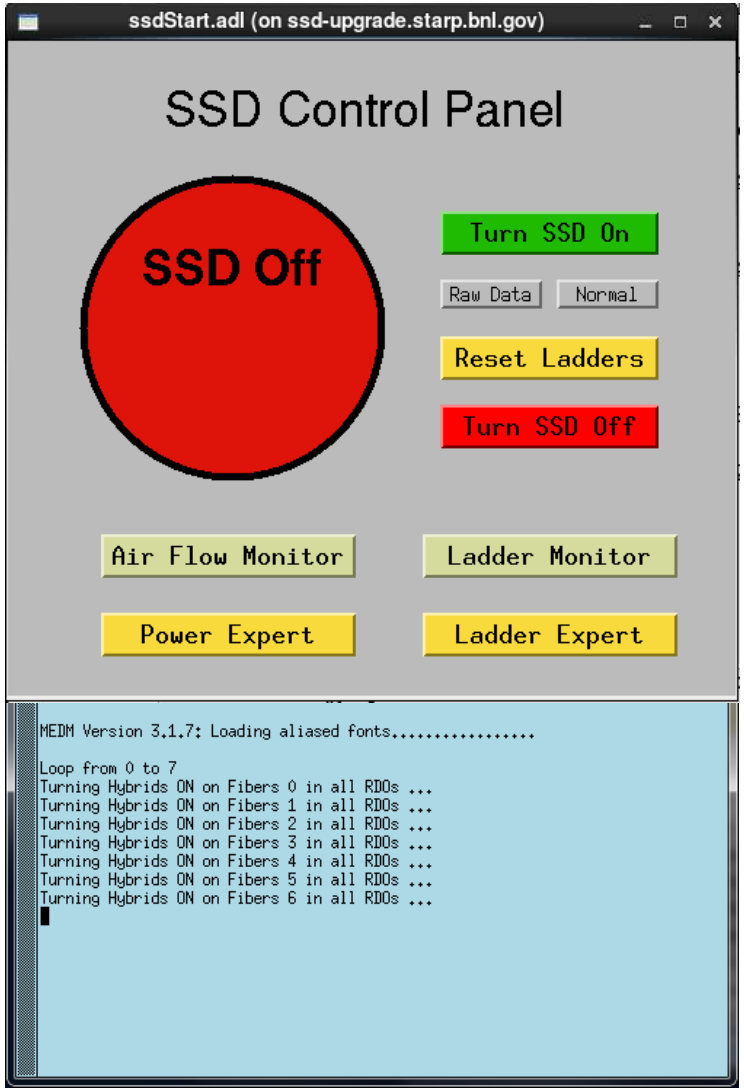
  or

  “Turn SSD Off” (3 minutes)

- Turn the SSD “ON” when beams are stable and ready for “Physics Running”
  - Include the “SST” in the run at the DAQ console
  - Include the “SST” trigger in the run
  - Start Run
  - Turn the SSD “OFF” in preparation for a beam dump
  - Turn the SSD “ON” for Pedestals or Cosmics then OFF again when done. See next page.

- The large circle will change Red / Yellow / Green
  - The detector is “ON” when the console screen says “SSD Detector is ON and configured for Normal Ops”
  - The detector is “OFF” when the console screen says “SSD Detector is OFF”

- Call an expert if you have questions



How to take a Pedestal run or a Cosmics run

- Cosmics are taken in “Raw Data” mode
- Ensure that the beam is off
- Turn the SSD “ON” (5 minutes)

  The detector is “ON” when the console screen says “SSD Detector is ON and configured for Normal Ops”. Wait for it.

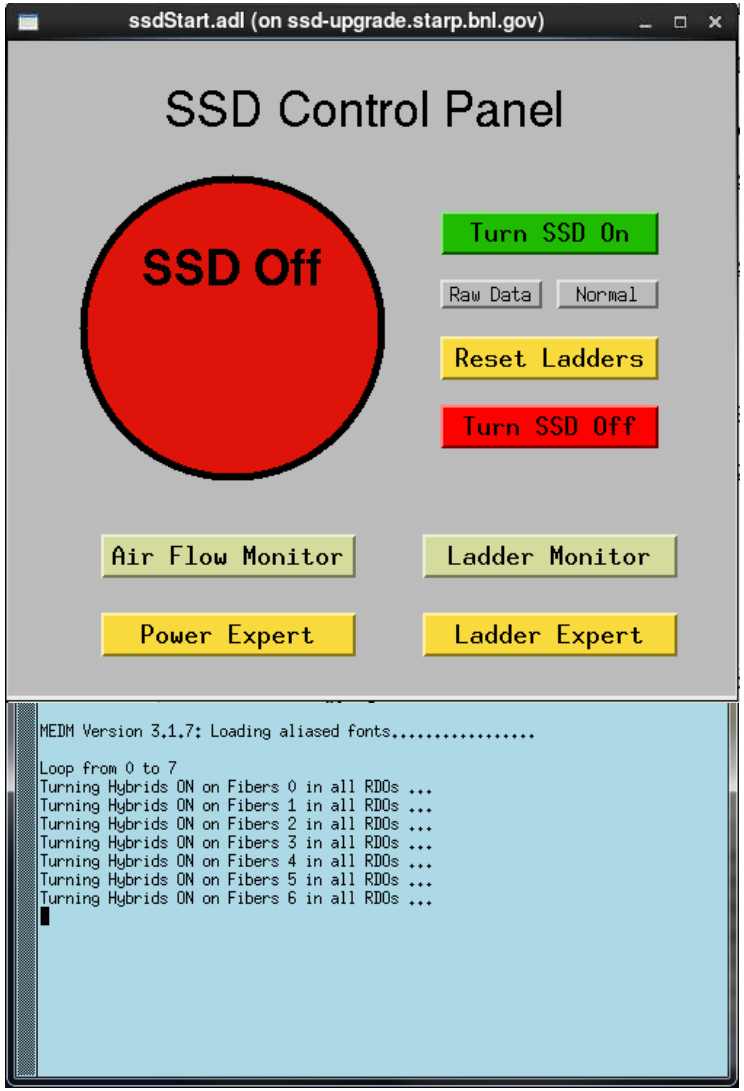
- Push the “Raw Data” button to switch to raw data mode when taking Pedestal runs and/or Cosmics

  Wait until console screen says “RDOs are ready to take RAW Data (e.g. for Pedestal files or Cosmics)”

- Set DAQ and Trigger for Pedestals or Cosmics, as required. Start run/take data

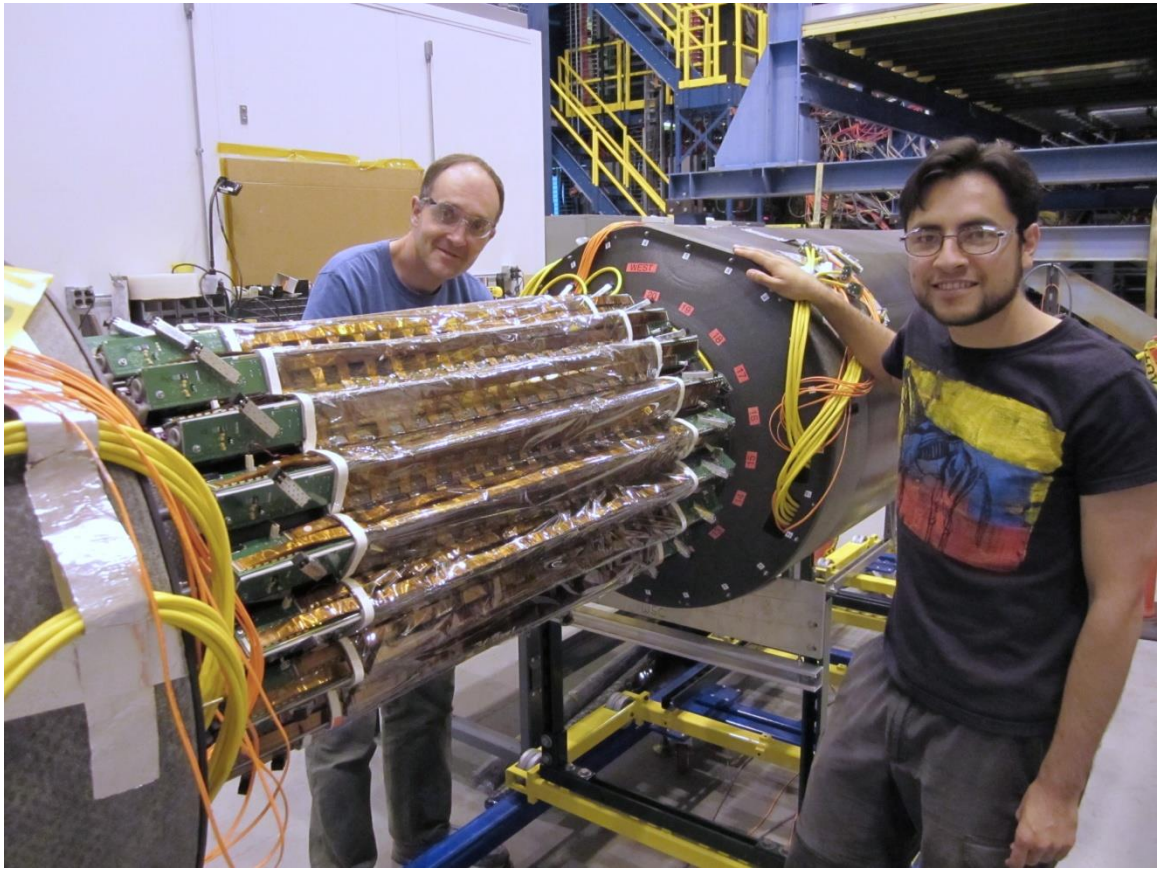
- Push the “Normal” button when done with pedestals and/or cosmics

  Leave the detector ON and in raw data mode if the next run will be a cosmic run. Otherwise, turn the detector off.



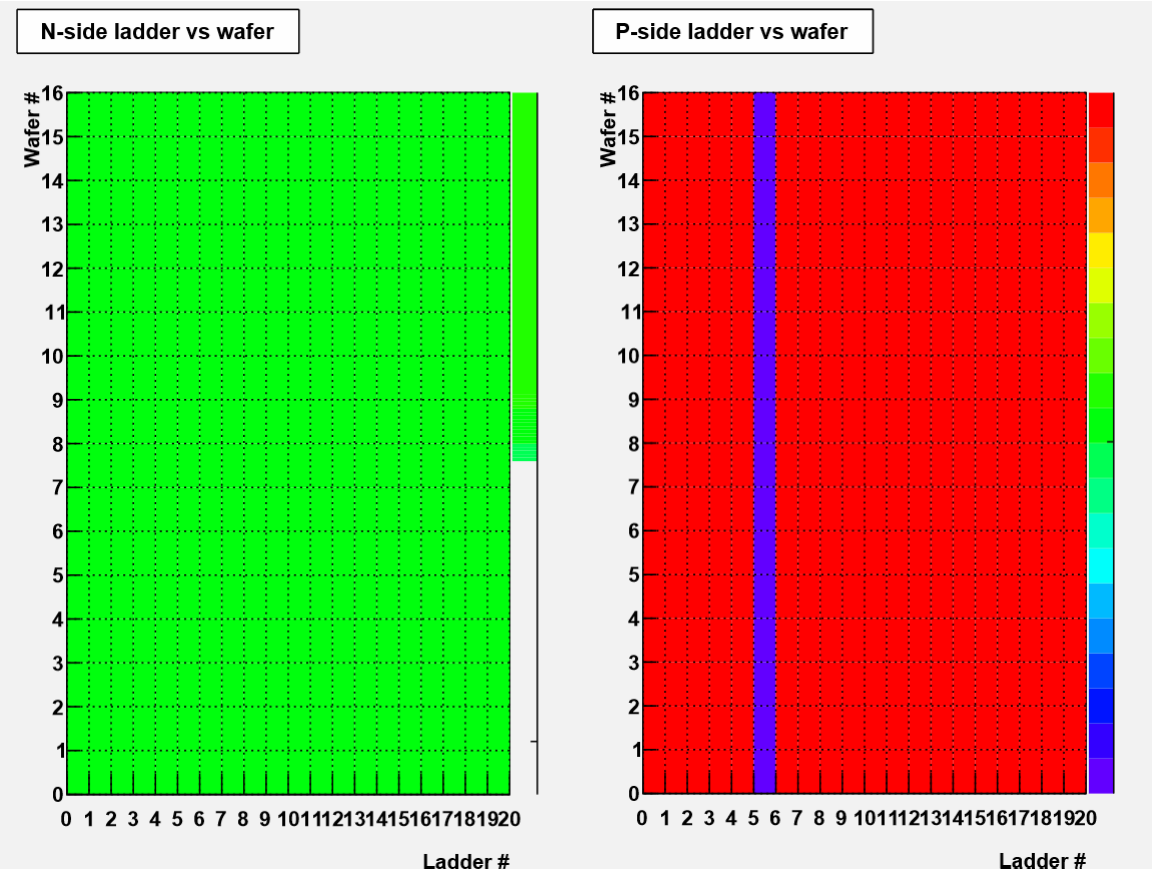
SSD Operations Notes

- The SSD should be on when the PXL+IST detectors are on (Unless otherwise instructed)
  - Usually, this means “Normal data taking” but also includes Cosmic, Pedestal and Raw Data runs



- You may reset bad ladders when they appear in the online plots or on the SSD console screen
  - Do not stop the run
  - Alternatively, check the SSD console at the end of each run. Good time to reset.
- Major issues can be resolved by power cycling the SSD
  - Stop the run and remove the SSD from DAQ. Start a new run without the SSD while cycling power. Start a new run with the SSD when ready.

SSD QA Plots



- Plots show the number of events recorded per ladder
- These plots are OK … if the Ladder Monitor is also OK

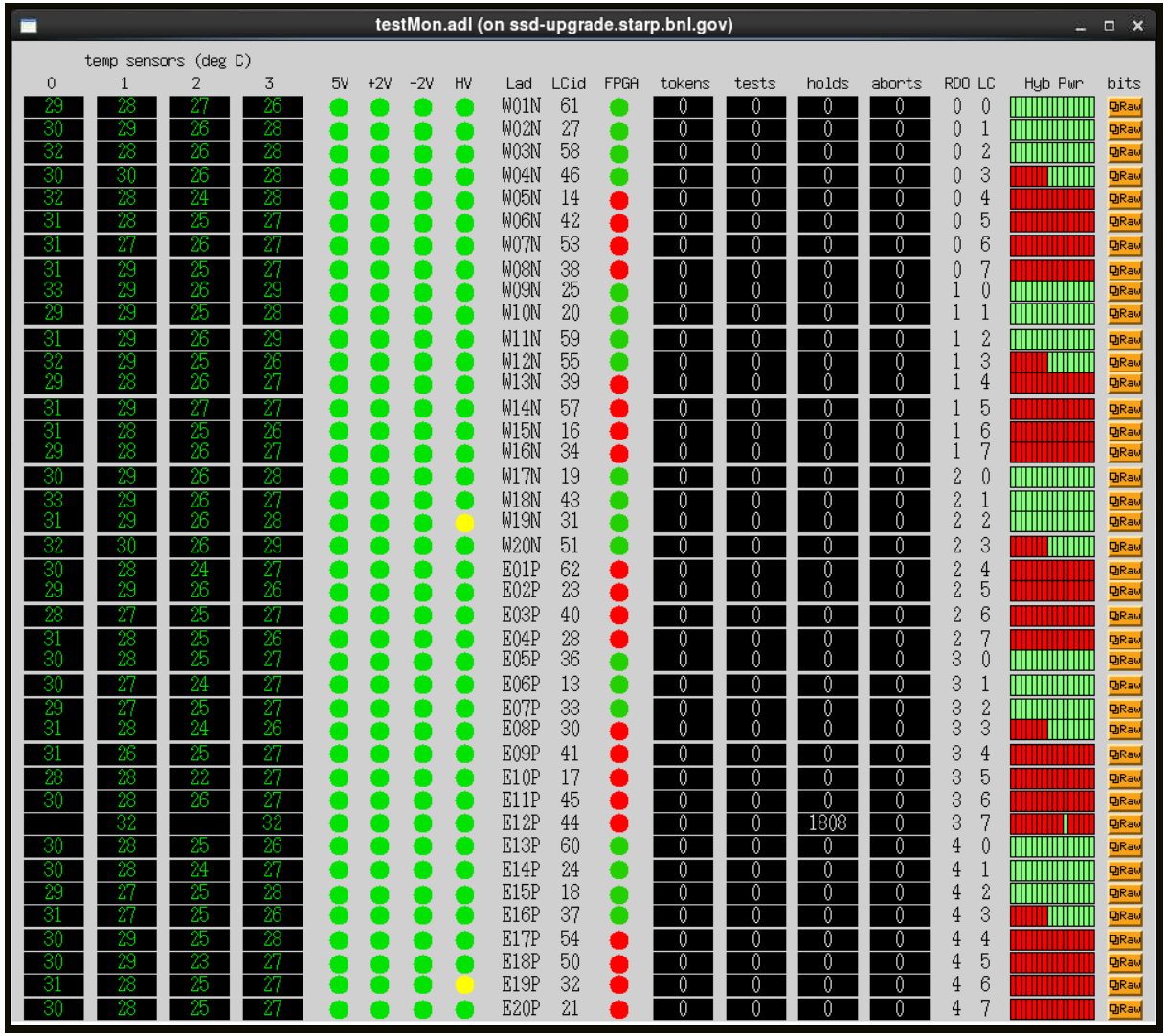
- The SSD is also known as the “SST”.
  - SSD is for hardware, SST is used by DAQ
- The SSD uses Si P/N junction diodes
  - The SSD reads data from both the P side and N side of the Si
- The right most bar on each plot is the vertical scale for the histogram
  - Note that the scale is zero suppressed and auto scaled
- Thus, the blue bar indicates fewer counts than red, but NOT zero

Starting the SSD Control Panel … if it is off

- Start or restart the SSD Computer and login
  - it's a windows box, so do windows things
  - User: .\ssd (the ".\" represents the local domain name)
  - Password: ask the shiftleader
- Start an ssh terminal session and connect to ssd-upgrade.starp.bnl.gov
  - Start "MobaXterm Personal Edition" (there should be a shortcut on the desktop)
  - Click on sessions tab (on left) and select "ssd-upgrade.starp.bnl.gov (ShiftCrew)" in the menu that contains a list of logon accounts
  - Wait for a terminal window to open and greet you with a prompt
  - You should be in the home directory for the ssd account, if not type "cd /home/ssd"
  - The ssd-upgrade machine is running Scientific Linux 5.9 … it even has ROOT, but it is the main EPICS & DAQ computer for the SSD so please don't use it for anything other trivial CPU activity
- Start the SSD main control panel
  - From the ssd home directory, type "sh ssdTop"
  - Wait for the Control Panel to pop up and then click "Ladder Monitor"
  - Done. This is the normal run-time configuration for the SSD.

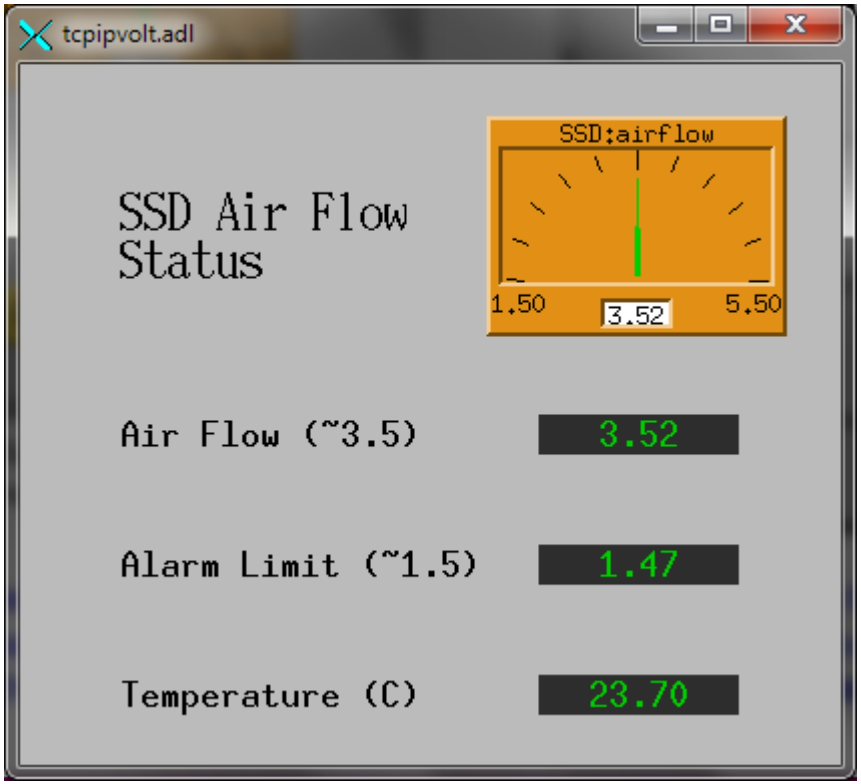
Ladder Monitor … shown during starting up

- If you see red alarms on the monitor screen
  - This is normal during startup and shutdown
  - But … push “Reset Ladders” on the start screen if you see red alarms while running
- Power Supply Voltages
  - Green = on, Red = off
- FPGA status
  - Green = on, Red = off
- RDO # … (0-4)
  - the SSD has 5 RDO’s
- LC # … (0-7)
  - 8 ladder cards per RDO
- Hybrid Power (16 total)
  - Status of the hybrids on each LC (red/green)
- Raw Bits
  - For expert analysis



Air Flow Monitor

- The air flow gauge monitors the cooling air flowing through the SSD ladders
  - Normal reading ~ 3.5
- The interlock system will shutdown the SSD if the air cooling fails.
  - No operator action is required to shutdown the system although many alarms will be activated.
  - Recovery after a cooling failure requires an expert.



- The temperature of the cooling air is not very sensitive to the temperature of the detector. The value shown here will rarely rise above room temperature. See the “Ladder Monitor” page for more useful temperature readings.

Ladder Expert

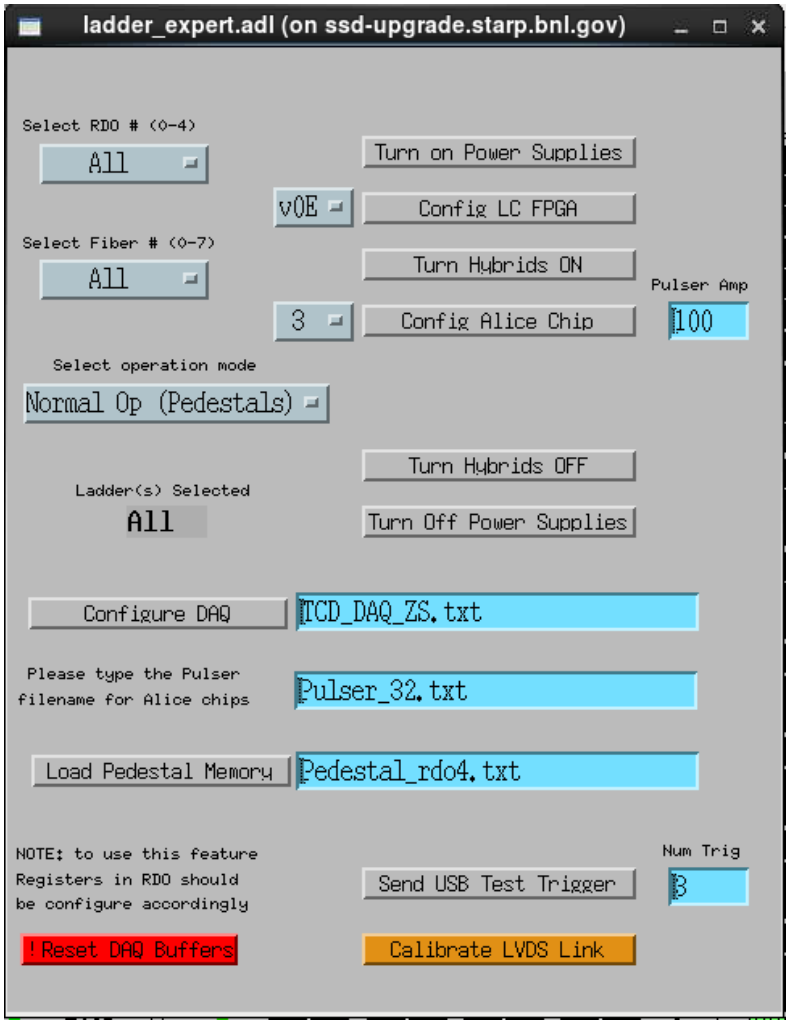
- Panel for configuring ladder cards EXPERTS ONLY!
- Power up the SSD by selecting “All” and “All” in the RDO and Fiber menu boxes
  - Push: 1.) Turn On Power 2.) Config LC 3.) Turn Hybds ON 4.) Config Alice
  - Important: wait for “done” in console window between each step
- RDOs and Fibers can also be configured (On/Off) one at a time.

(In this context, “fiber” is a synonym for “ladder card”)

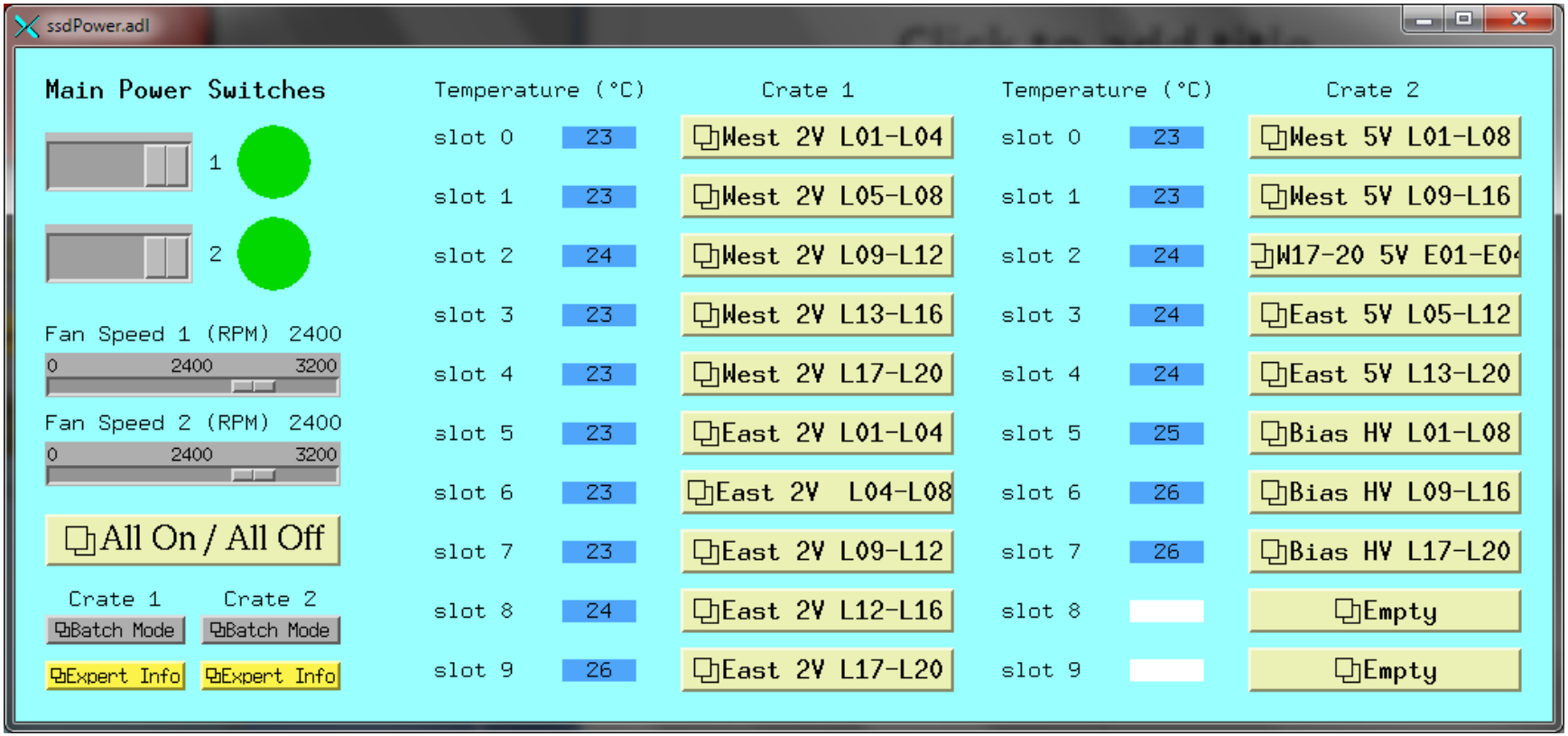
1.) Config LC 2.) Turn Hybrds ON 3.) Config Alice

“Turn On Power” is only done once per session, not per Fiber

- Configure DAQ is for superExperts
- Calibrate LVDS is for superExperts
- etc.

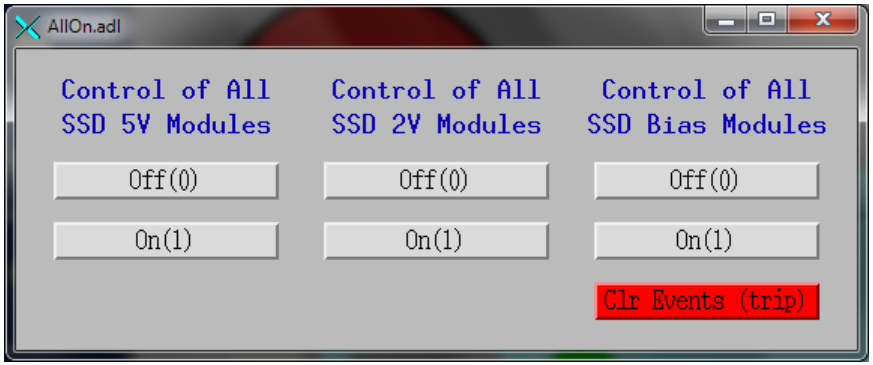


Power Expert



- The main power should never be switched off. Fans always at 2400 RPM.
  - Not even in an emergency. (SSD Interlocks will automatically switch off the power in case of emergency.)
- Experts only!
  - Use the “All On / All Off” to turn power on manually. On: 5V first, then ±2V, then Bias. Off: Reverse order

Power Expert: “All On” and “Batch Mode”

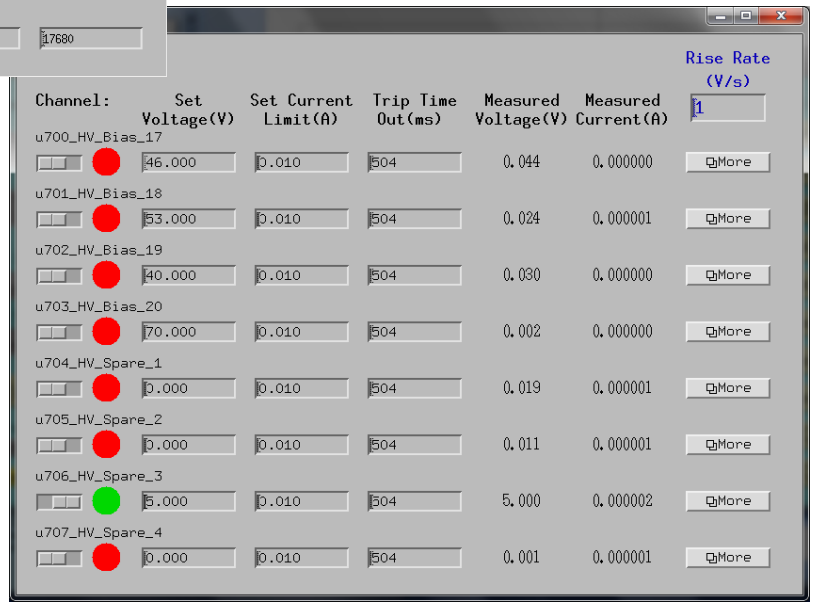


- All On / All Off
  - On: 5V first, then ±2V, then Bias.
    Off: Reverse order
- Clear Events (on HV trip)
  - Press Clr Events if an HV channel has tripped off. Reset HV channel manually to prescribed voltage.

- Experts only!
  - Note Crate_1 or Crate_2 controls
- Batch mode
  - For controlling groups of modules

Power Expert: Setting individual channels

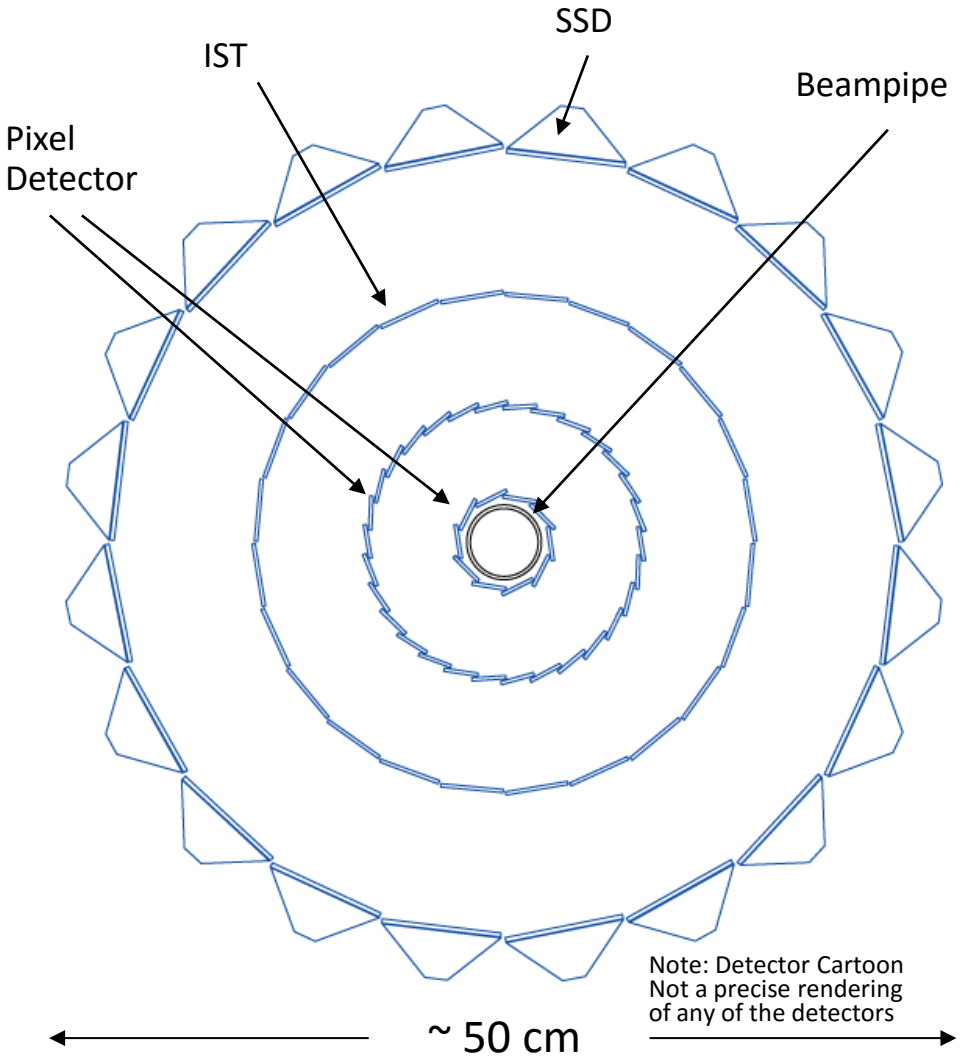
- Experts Only!
  - Note: complex mapping from channel # to SSD Ladder #
  - Highlight value to be changed, enter change and hit (CR)
  - (very important to hit (CR))
  - Changes made here are permanent



- For setting individual channels
  - On/Off
  - Set Voltage (target voltage)
  - Current limit
  - Rise rate (volts per second)
  - Supervision behavior (on trip)
  - “Sense” voltage is the actual voltage on the detector

Schematic Representation of the HFT

- The STAR Heavy Flavor Tracker – the full suite
- TPC – SSD – IST – PXL
- TPC pointing resolution at the SSD is ~ 1 mm
- SSD pointing at the IST is ~ 400 μm ε = 0.98
- IST pointing at PXL 2 is ~ 400 μm ε = 0.98
- PXL 2 pointing at PXL1 is ~ 125 μm ε = 0.93
- PXL1 pointing at the VTX is < 40 μm ε = 0.94
- ε = track matching efficiency



Annual Expert-Only Start-up Tasks

- STAR Global Interlocks OK. STAR inner field cage air ON.
- Check that SSD interlock permissive is OK (behind Wiener crates)
- Start SSD cooling air (industrial vacuum on North Platform)
- Wiener Power Crates plugged in and ON (rack 1C6) VME crate for RDO ON (rack 1C3, crate 97, see next page)
- USB hubs up and fibers OK
  - Two behind VME crate for RDO's, in control room (SSD desk) and DAQ room (behind ssd-upgrade)
- SSD computer in control room is up & ssd-upgrade.starp.bnl.gov is up
- Wiener LV Settings
  - 2.2 Volts @ 2 Amps Group 2 PWM = 3.5 Moderate Reg checked, Slow Reg checked, Enable inhibit checked
  - 2.5 Volts @ 4 Amps Group 2 PWM = 7.0 Moderate Reg checked, Slow Reg checked, Enable inhibit checked
  - 5.0 Volts @ 3 Amps Group 5 PWM = 4.6 Moderate Reg checked, Slow Reg checked, Enable inhibit checked
- Start IOCs on ssd-upgrade.starp.bnl.gov (/ioc/siocps > sh run, /ioc/siocftdi > sh run)
  - (Cntrl-A + Cntrl-D) to disconnect, screen –list to view running screens, screen –r #### to reconnect
- cd to /home/ssd and start SSD Control Panel with "sh ssdTop"
- Read, review and set HV Bias and Alarms settings with scripts in epics/ioc/siocps/head/scripts
  - sh SSDPower_Bias_Set
  - sh SSDPower_Bias_Alarm
  - sh SSDPower_Alarm_Set
- Calibrate LVDS link … you should see 0xFF…FF80400000 for all 5 RDO's if successful
  - a button under the Ladder Expert screen. Start SSD and perhaps do again, if necessary, and restart SSD
- Start SSD with special attention to Pedestal (Raw) versus Normal running

File Locations & VME Crate Numbers

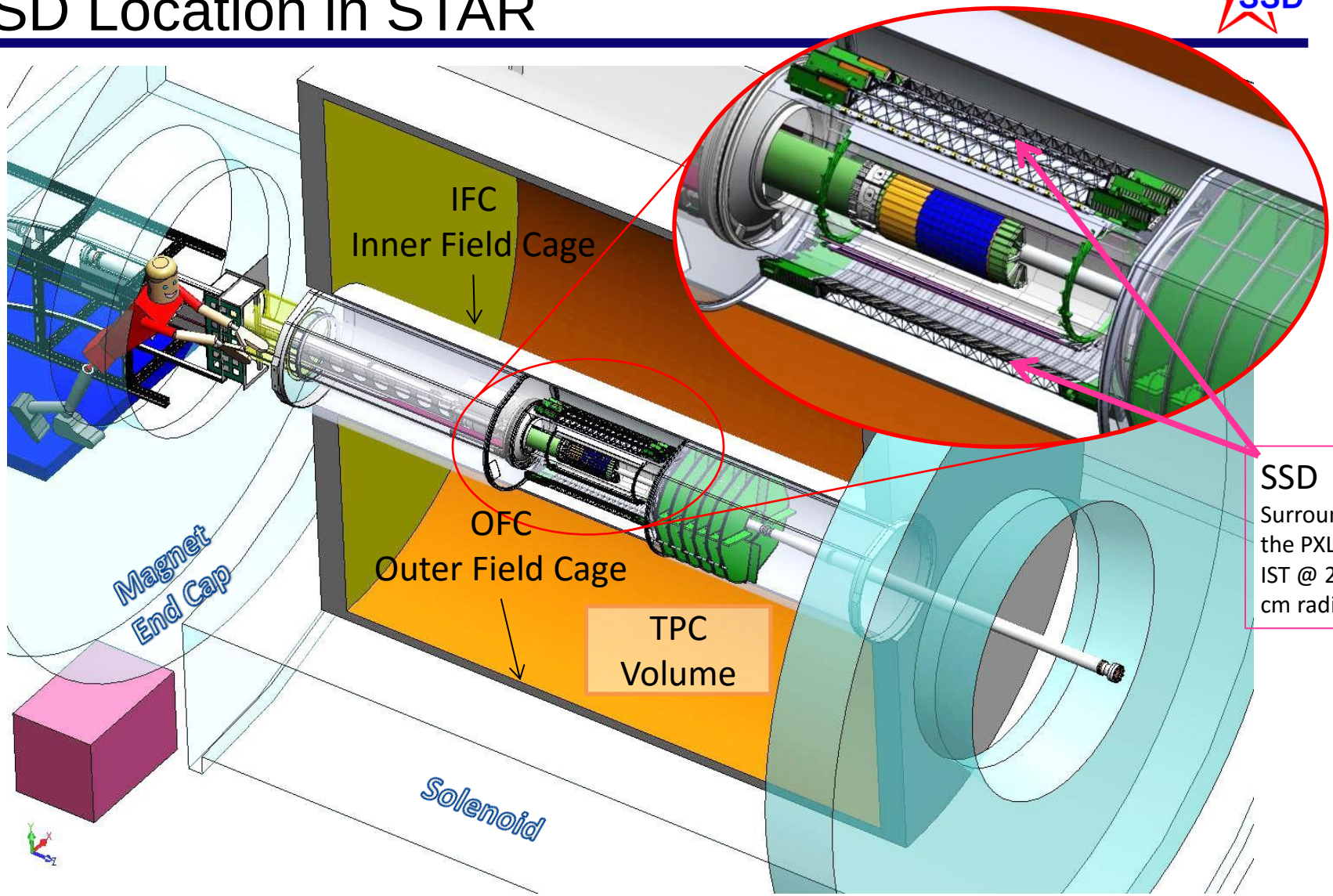
- Pedestal files from DAQ on ssd-upgrade.starp.bnl.gov
  - /data/PEDESTALS
- Pedestals to be installed in RDOs on ssd-upgrade
  - /usr/local/epics/ioc/siocftdi/head/scripts/cmd/PEDESTALS
- High resolution online plots … use ROOT TBrowser to view
  - /net/evp.starp.bnl.gov/a/jevp/rootfiles/*.root
- Cycle power on RDO VME crate 97 to reload firmware in RDO's
  - SSH to sysuser@sc5.starp.bnl.gov
  - type "vme_plat1" alias for "medm –x –cleanup /home/sysuser/GUI/vme/vme_1st_plat.adl &"
  - Select pink square on crate 97, mouse over and click vme 97
  - Click "Control Off", wait 3 minutes, click "Control On"
  - Check that fans ramp up to 3120 … bump up if necessary
- To load RDO firmware, go to MobaXterm \ssd account (on Windows)
  - Execute "/RDO_Config_BIT.sh -v 0039 -s 1" (and then 2). See page 7 of Luis's SSD operations manual, section 11, for more details.
- To start online plots, logon to rts05 and start jevp (ignore server tags on file menu(?))
- MPOD Crates for Wiener Power supplies: 130.199.60.11 and 130.100.60.15

Tuning a new MPOD or ISEG module

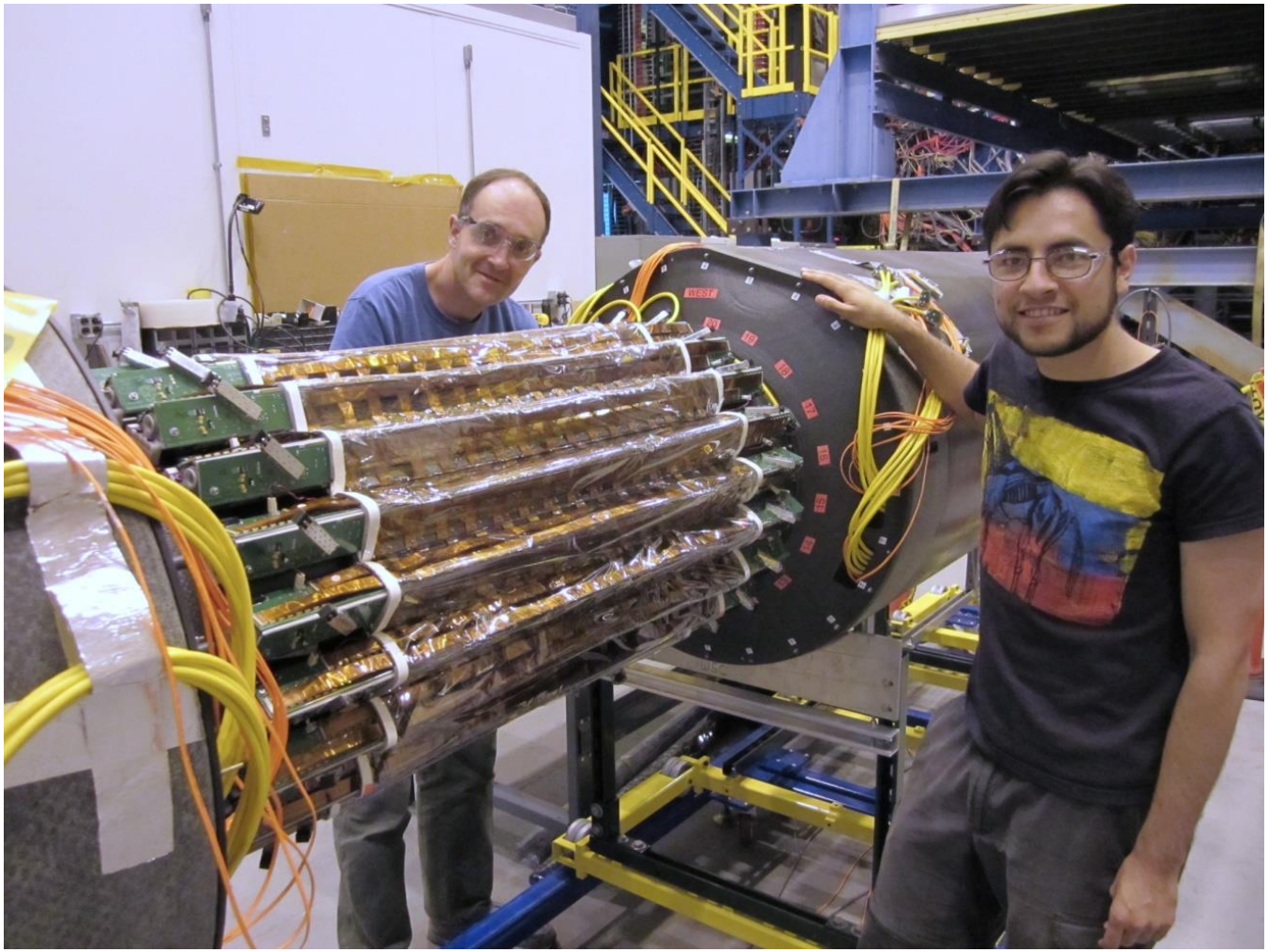
- Changes to MPV8016 “2” volt modules (all 8 channels)
  - Even Channels => 2.2 Volt Sense at 2 amps
  - Odd Channels => 2.5 Volt Sense at 4 amps
  - Untick internal reference, tick external, >1m and > 50m (3 tick boxes)
  - 10.0 Max voltage, 10.0 Max voltage
  - Group 2
  - PWM offset 3.5 for even channels, 7.0 for odd channels
  - Use Muse control Admin Mode to adjust PWM offsets
- MPV8016 “5” volt modules have different settings
  - 5.0 Volt Sense at 3 amps
  - Untick internal reference, tick external, >1m and > 50m (3 tick boxes)
  - 10.0 Max Voltage, 10.0 Max voltage
  - Group 5
  - PWM offset 4.6
- ISEG HV modules
  - Activate external safety loop with a jumper on the back of the module (!)

Backup Slides

SSD Location in STAR



The SSD before inserting into the TPC

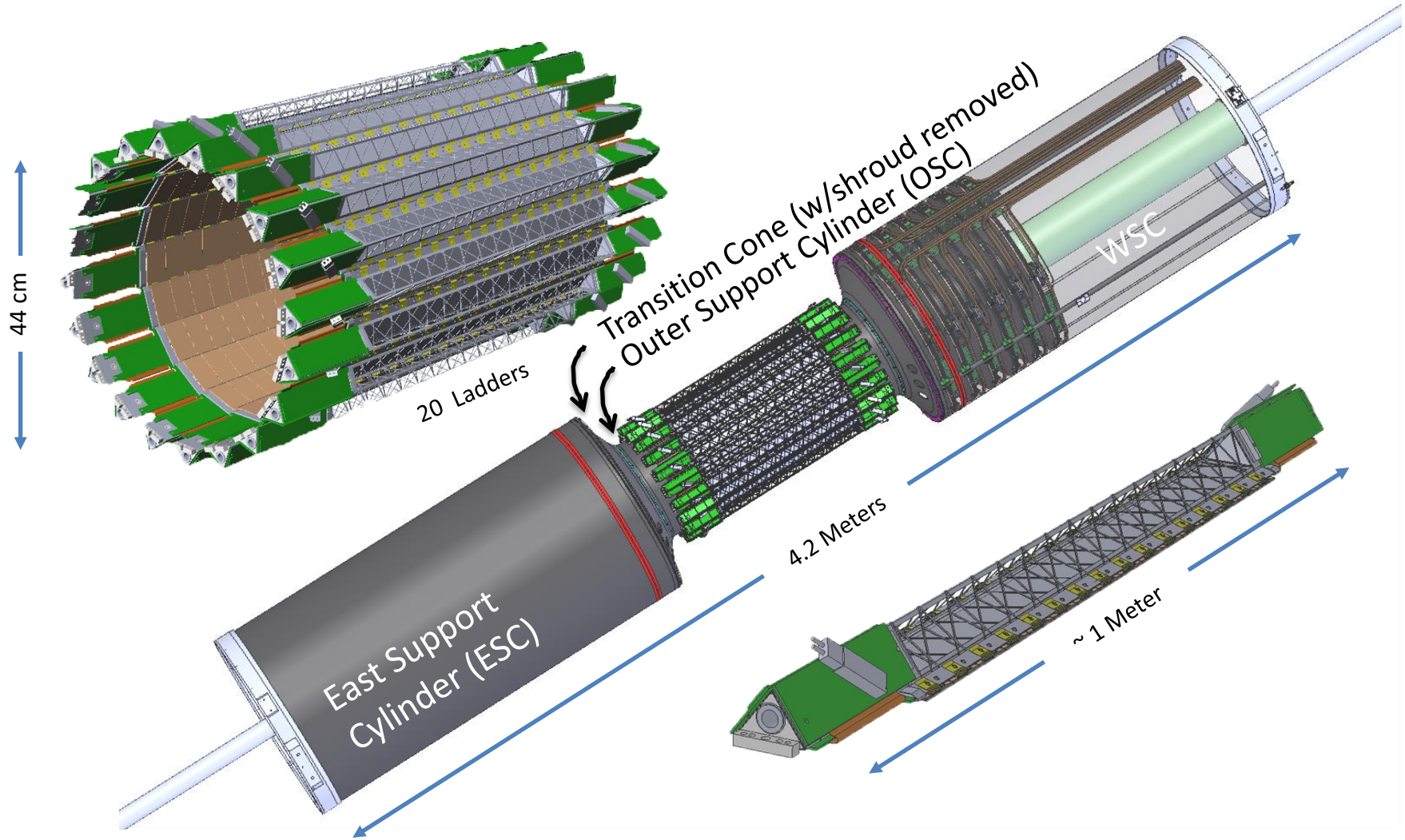


Special thanks to Thorsten and Luis for this small miracle

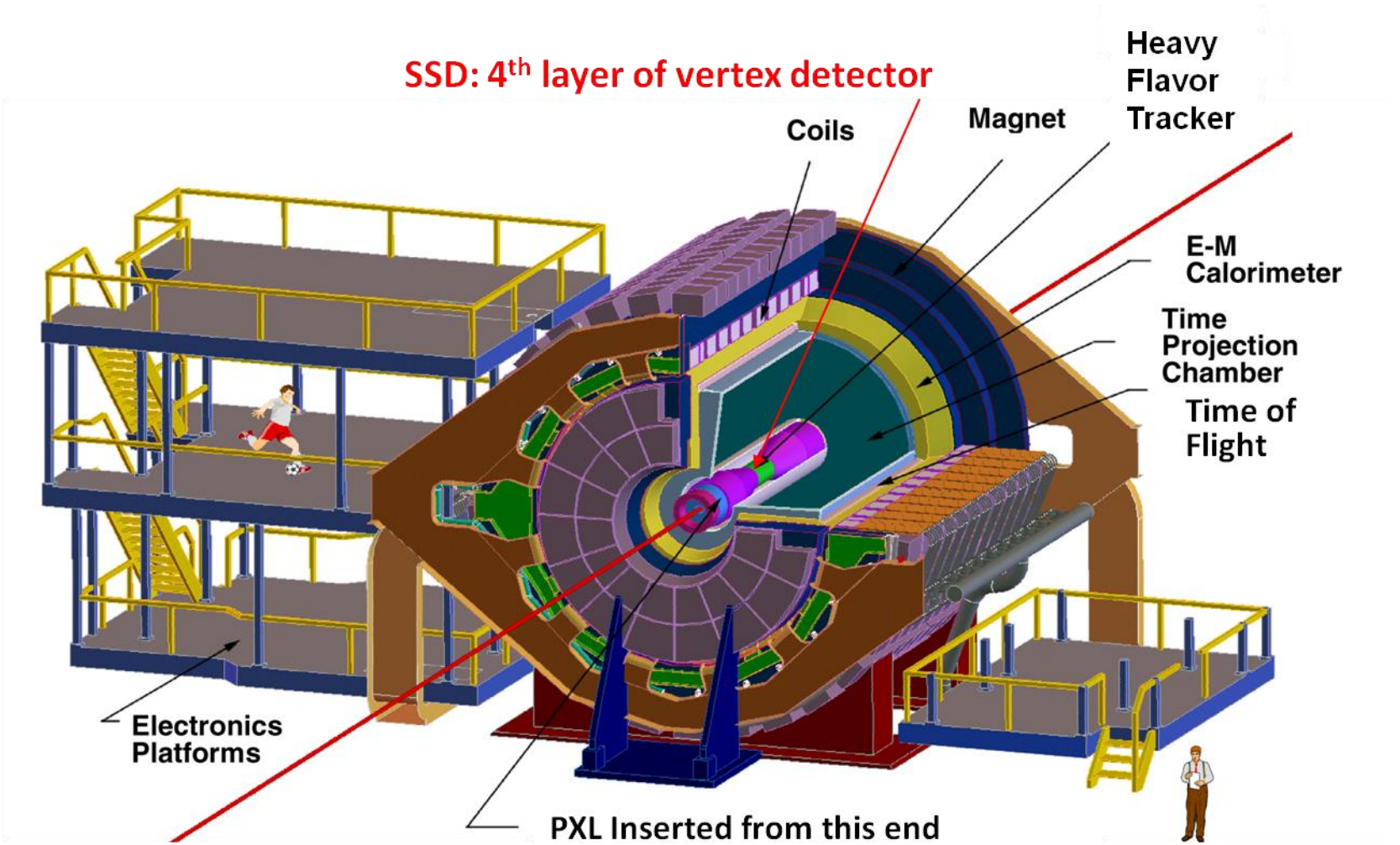
Ladder card performance is excellent

Performance of ladders is as good as it was in 2007 (i.e. 90-95% live modules)

SSD Overview – the SSD sits on the OSC



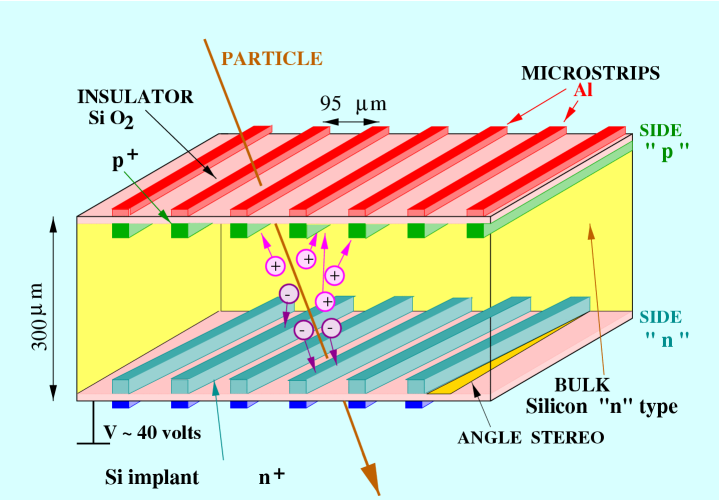
The STAR Silicon Strip Detector

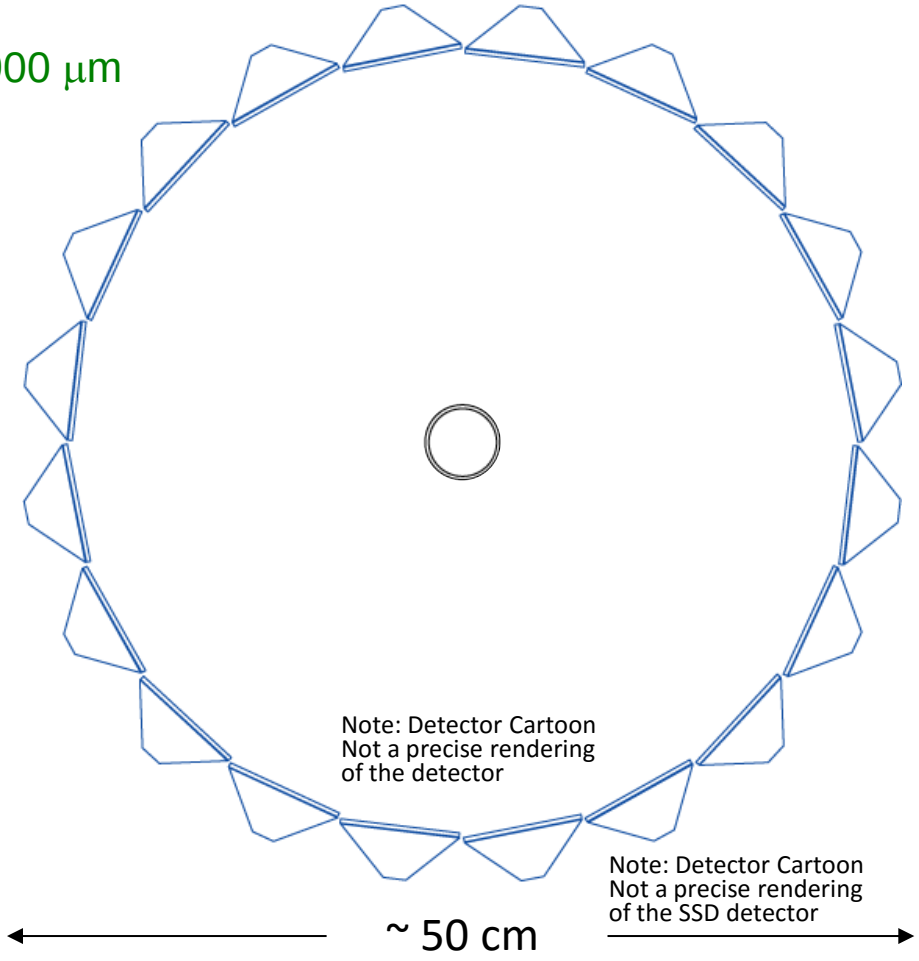


SSD Parameters

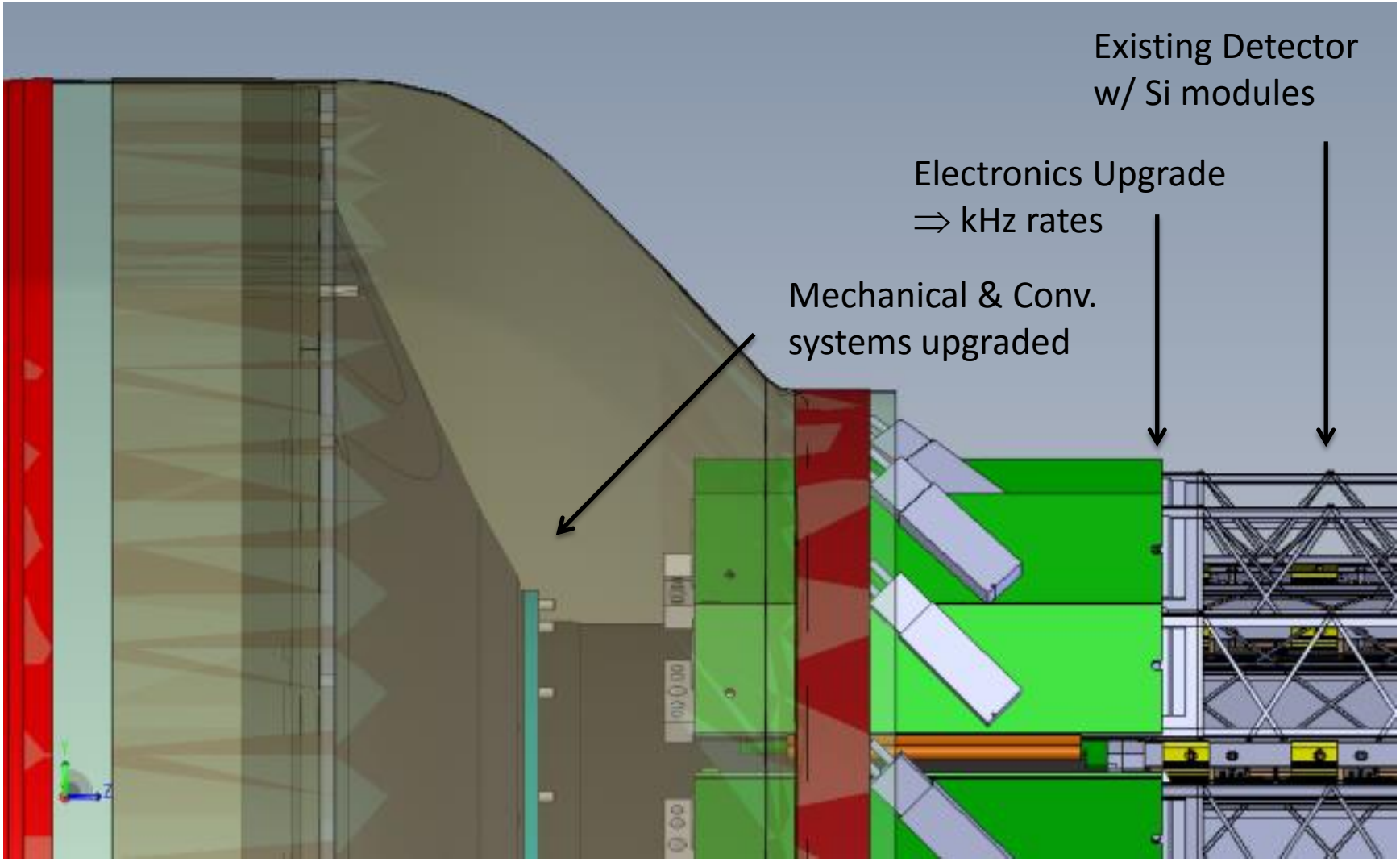
- Double sided Si wafers 300 μm thick with 95 μm strips that are 4.2 cm long
  - Strips crossed at 35 mrad

    effective resolution 30 μm x 900 μm
- Located at 22 cm radius
  - 20 ladders, 67 cm long
- air cooled
- $|\eta| < 1.2$
- 1 % radiation length @ $\eta = 0$

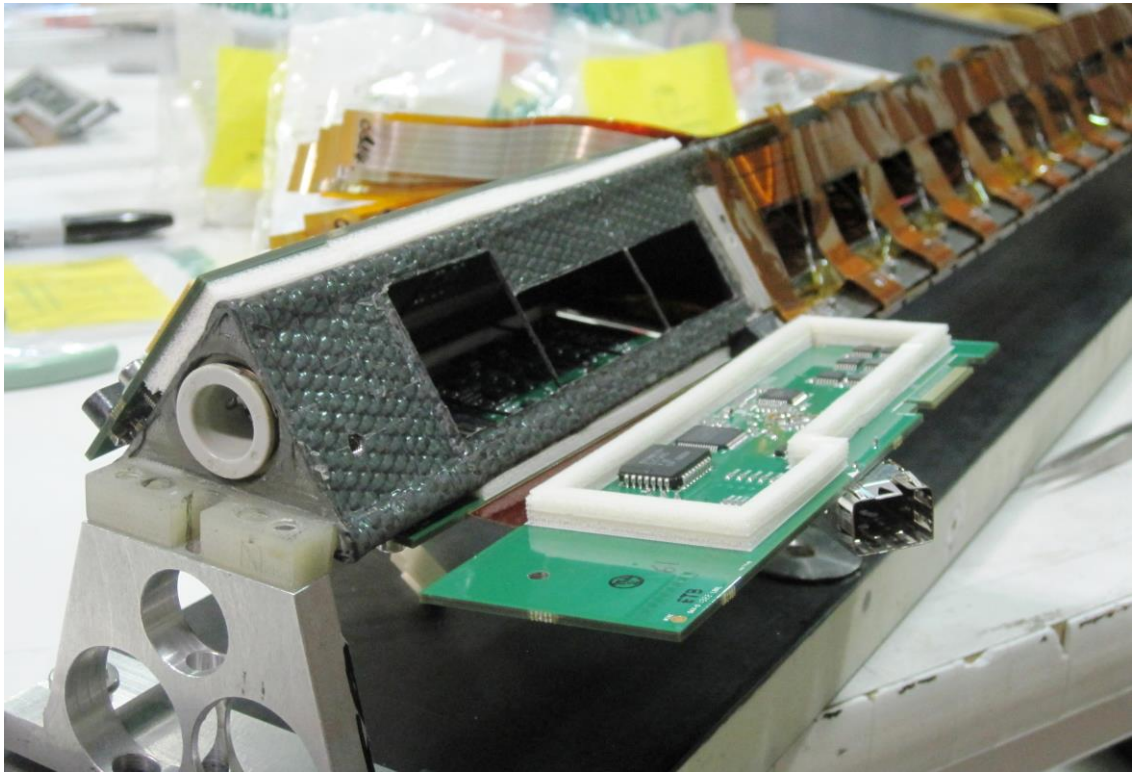




The SSD was an existing detector ⇒ upgrade

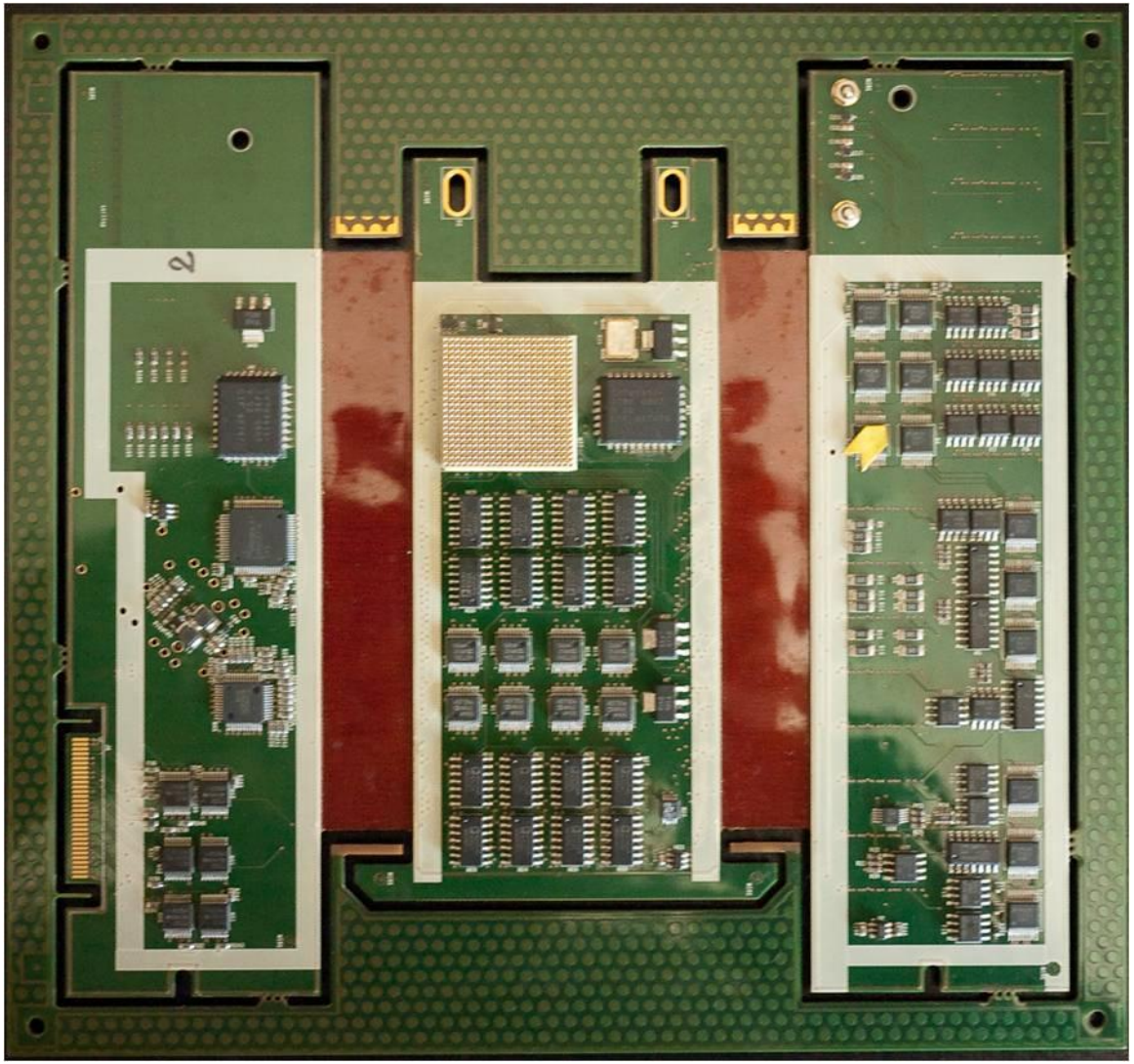


Ladders and Ladder Cards



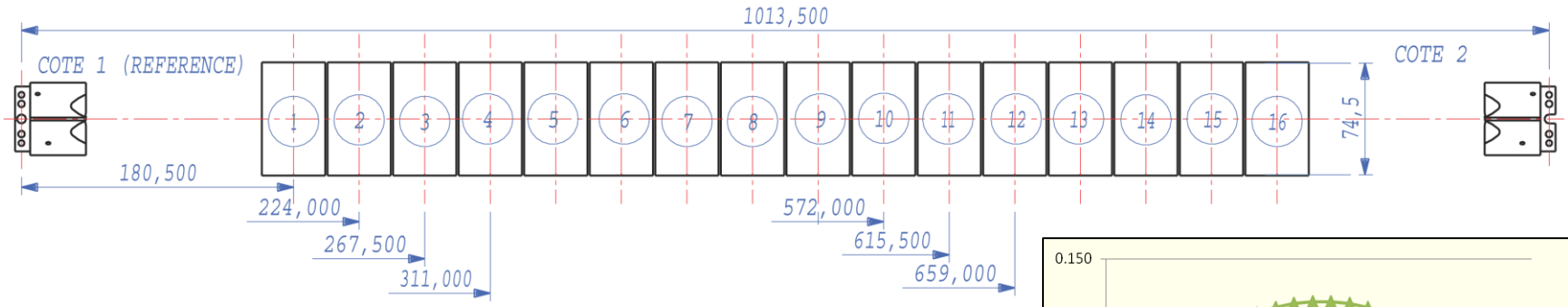
- Foam and Mylar wrap applied to Ladders and Ladder Cards
- Ladders installed and tested
- Analog performance is excellent (analog noise < noise from modules)
- JTAG communications work, T readback OK
- Power consumption is as expected for +5V, +2 V but -2V is a bit high … may be an issue with power supplies over long lines.

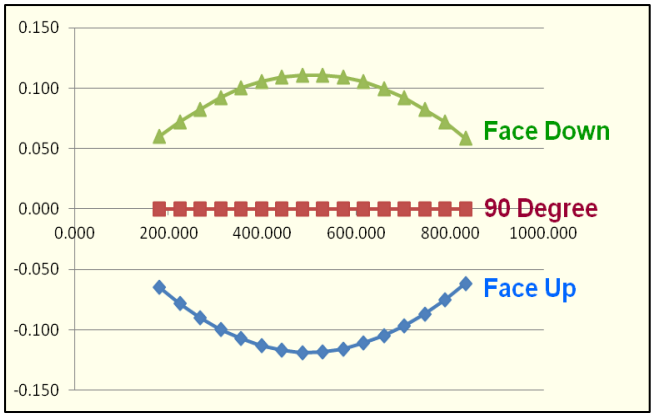
Ladder Cards

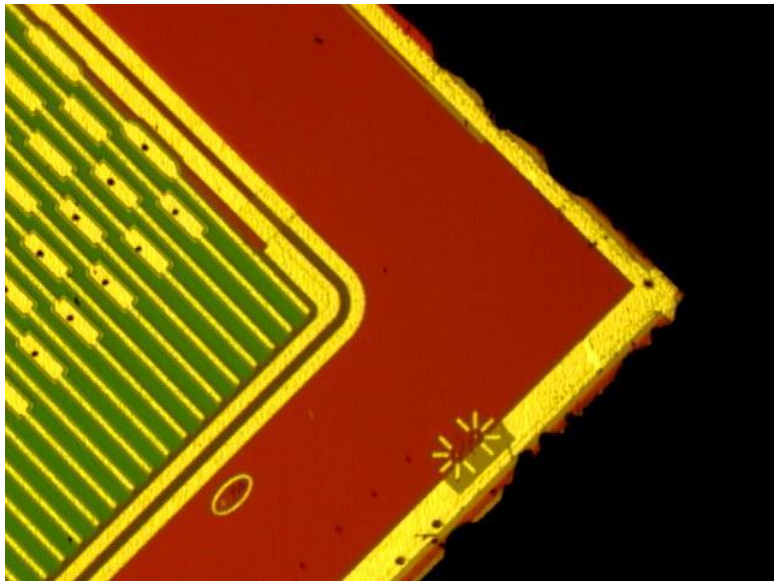


- The Ladder Card contains the ADC to read-out each of the Si modules
- On-board FPGA
- Faster, lower noise
  - 1 kHz (16% DT)
  - 10x lower noise

Survey







- Ladders were surveyed to ~10 μm precision
- Typically, the wafers are positioned < 50 μm wrt the goal, comparable to our resolution
- A small number of wafers are displaced ~1 mm
- The displacement due to gravity of each ladder has been measured