Slow Control and Online Monitor of FST

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FST Crate Slow Control

- Re-use of old IST slow control.
  - FST use the same crate and readout system as IST => a natural choice to re-use old IST slow control system.
- GUI for Shift Crew
  - Operation is based on a set of shell script => each button connects to a shell script with snmp command to control the MPOD Crates.
  - Monitor and alarm are though sequencer.
  - Need to modify old IST sequencer for FST setup => adjust HV setting and current limit for FST.
  - Need to modify old IST GUI for FST => adjust naming and pictures.
- GUI for Expert
  - Operation, monitor and alarm are all based on sequencer.
  - Need to modify old IST sequencer for FST setup => same database shared with shift crew GUI.
  - Need to modify old IST GUI for FST => adjust naming and pictures.

Shift Crew GUI

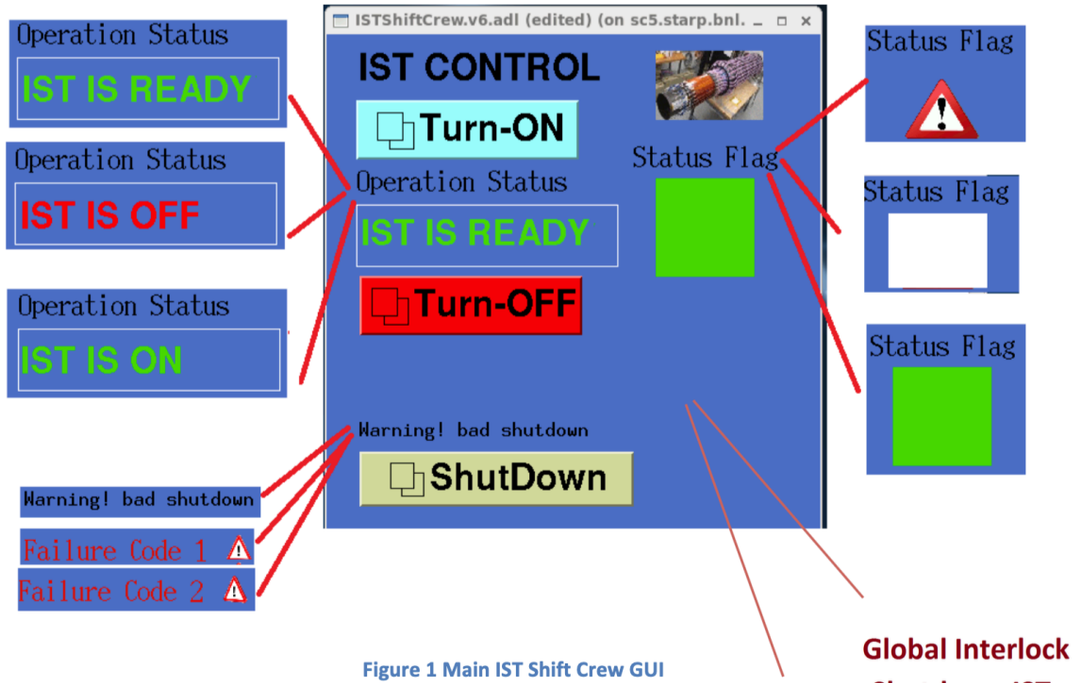
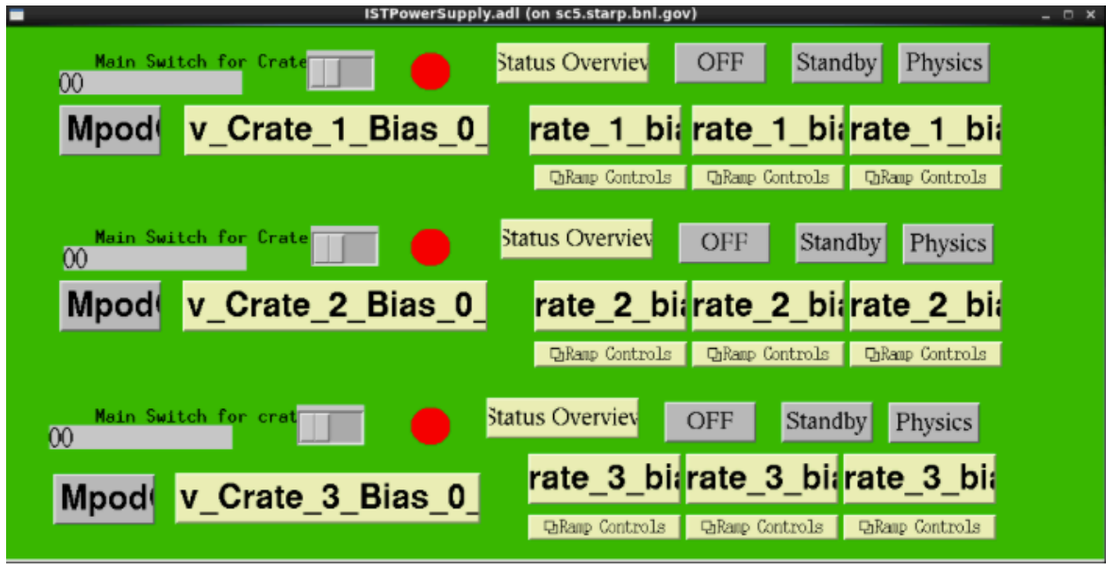


Figure 1 Main IST Shift Crew GUI

Expert GUI



FST Crate Slow Control Status

FstOn.sh

```
-------------------------------------------
 TURNING CRATES ON
-------------------------------------------
Power Status is = off Now TURNING ON ....
Power Status is = on Now
Wait 10 seconds.....
Wait 9 seconds.....
Wait 8 seconds.....
Wait 7 seconds.....
Wait 6 seconds.....
Wait 5 seconds.....
Wait 4 seconds.....
Wait 3 seconds.....
Wait 2 seconds.....
Wait 1 seconds.....
channelCount= 8
u0 u1 u2 u3 u4 u5 u6 u7
SetVoltage for channel u0 to 70.0V
SetCurrent for channel u0 to 10uA
VoltageRiseRate for channel u0 to 5.0V
VoltageFallRate for channel u0 to 5.0V
SetVoltage for channel u1 to 70.0V
SetCurrent for channel u1 to 10uA
VoltageRiseRate for channel u1 to 5.0V
VoltageFallRate for channel u1 to 5.0V
SetVoltage for channel u2 to 70.0V
SetCurrent for channel u2 to 10uA
VoltageRiseRate for channel u2 to 5.0V
VoltageFallRate for channel u2 to 5.0V
SetVoltage for channel u3 to 70.0V
SetCurrent for channel u3 to 10uA
VoltageRiseRate for channel u3 to 5.0V
VoltageFallRate for channel u3 to 5.0V
SetVoltage for channel u4 to 70.0V
SetCurrent for channel u4 to 10uA
VoltageRiseRate for channel u4 to 5.0V
VoltageFallRate for channel u4 to 5.0V
SetVoltage for channel u5 to 70.0V
SetCurrent for channel u5 to 10uA
VoltageRiseRate for channel u5 to 5.0V
VoltageFallRate for channel u5 to 5.0V
SetVoltage for channel u6 to 70.0V
SetCurrent for channel u6 to 10uA
VoltageRiseRate for channel u6 to 5.0V
VoltageFallRate for channel u6 to 5.0V
SetVoltage for channel u7 to 70.0V
SetCurrent for channel u7 to 10uA
VoltageRiseRate for channel u7 to 5.0V
VoltageFallRate for channel u7 to 5.0V
```

```
HV outputs are  on Now truning ON ....
The HV-channels' Voltage are ramping up
Ramping up the high voltage. Current high voltage: 0.060830
Ramping up the high voltage. Current high voltage: 0.060830
Ramping up the high voltage. Current high voltage: 0.060830
Ramping up the high voltage. Current high voltage: 9.503280
Ramping up the high voltage. Current high voltage: 14.823406
Ramping up the high voltage. Current high voltage: 20.139395
Ramping up the high voltage. Current high voltage: 25.086199
Ramping up the high voltage. Current high voltage: 30.043146
Ramping up the high voltage. Current high voltage: 35.346828
Ramping up the high voltage. Current high voltage: 40.306118
Ramping up the high voltage. Current high voltage: 45.617260
Ramping up the high voltage. Current high voltage: 50.564358
Ramping up the high voltage. Current high voltage: 55.874786
Ramping up the high voltage. Current high voltage: 60.830929
Ramping up the high voltage. Current high voltage: 65.784393
Ramping up the high voltage. Current high voltage: 69.962128
Ramping up the high voltage. Current high voltage: 69.968475
Ramping up the high voltage. Current high voltage: 69.972260
Ramping up the high voltage. Current high voltage: 69.972992
Ramping up the high voltage. Current high voltage: 69.976410
Ramping up the high voltage. Current high voltage: 69.977264
Ramping up the high voltage. Current high voltage: 69.977264
Ramping up the high voltage. Current high voltage: 69.977264
Ramping up the high voltage. Current high voltage: 69.977753
Ramping up the high voltage. Current high voltage: 69.978973
Ramping up the high voltage. Current high voltage: 69.980682
Ramping up the high voltage. Current high voltage: 69.982758
Ramping up the high voltage. Current high voltage: 69.998138
Ramping up the high voltage. Current high voltage: 69.997894
Ramping up the high voltage. Current high voltage: 69.999359
Ramping up the high voltage. Current high voltage: 69.999969
Ramping up the high voltage. Current high voltage: 70.001312
-------------------------------------------
WARNING Please wait to stablize the HV outputs
Wait 10 seconds.....
Wait 9 seconds.....
Wait 8 seconds.....
Wait 7 seconds.....
Wait 6 seconds.....
Wait 5 seconds.....
Wait 4 seconds.....
Wait 3 seconds.....
Wait 2 seconds.....
Wait 1 seconds.....
-------------------------------------------
-------------------------------------------
FST is AWAKE, let's do some BigBang
-------------------------------------------
-------------------------------------------
```

FstOff.sh

```
Power Status is = on
-------------------------------------------
 TURNING CRATES OFF
Set all HV off
-------------------------------------------
OK Dude All HV outputs is setting to off NOW
-------------------------------------------
The HV-channels' Voltage are ramping down
Ramping down the high voltage. Current high voltage: 70.025330
Ramping down the high voltage. Current high voltage: 65.833969
Ramping down the high voltage. Current high voltage: 60.882816
Ramping down the high voltage. Current high voltage: 55.594112
Ramping down the high voltage. Current high voltage: 50.646397
Ramping down the high voltage. Current high voltage: 45.363811
Ramping down the high voltage. Current high voltage: 40.421856
Ramping down the high voltage. Current high voltage: 35.458782
Ramping down the high voltage. Current high voltage: 30.178055
Ramping down the high voltage. Current high voltage: 25.232582
Ramping down the high voltage. Current high voltage: 19.587442
Ramping down the high voltage. Current high voltage: 14.655784
Ramping down the high voltage. Current high voltage: 9.361171
Ramping down the high voltage. Current high voltage: 4.437953
Ramping down the high voltage. Current high voltage: 0.060830
Wait 10 seconds before FST turned off
Wait 10 seconds. To TURN OFF FST ..
Wait 9 seconds. To TURN OFF FST ..
Wait 8 seconds. To TURN OFF FST ..
Wait 7 seconds. To TURN OFF FST ..
Wait 6 seconds. To TURN OFF FST ..
Wait 5 seconds. To TURN OFF FST ..
Wait 4 seconds. To TURN OFF FST ..
Wait 3 seconds. To TURN OFF FST ..
Wait 2 seconds. To TURN OFF FST ..
Wait 1 seconds. To TURN OFF FST ..
Power Status is = on Now truning OFF ....
Power Status is = off Now
-------------------------------------------
-------------------------------------------
-------------------------------------------
FST went to Sleep Bye Bye :))
-------------------------------------------
-------------------------------------------
-------------------------------------------
```

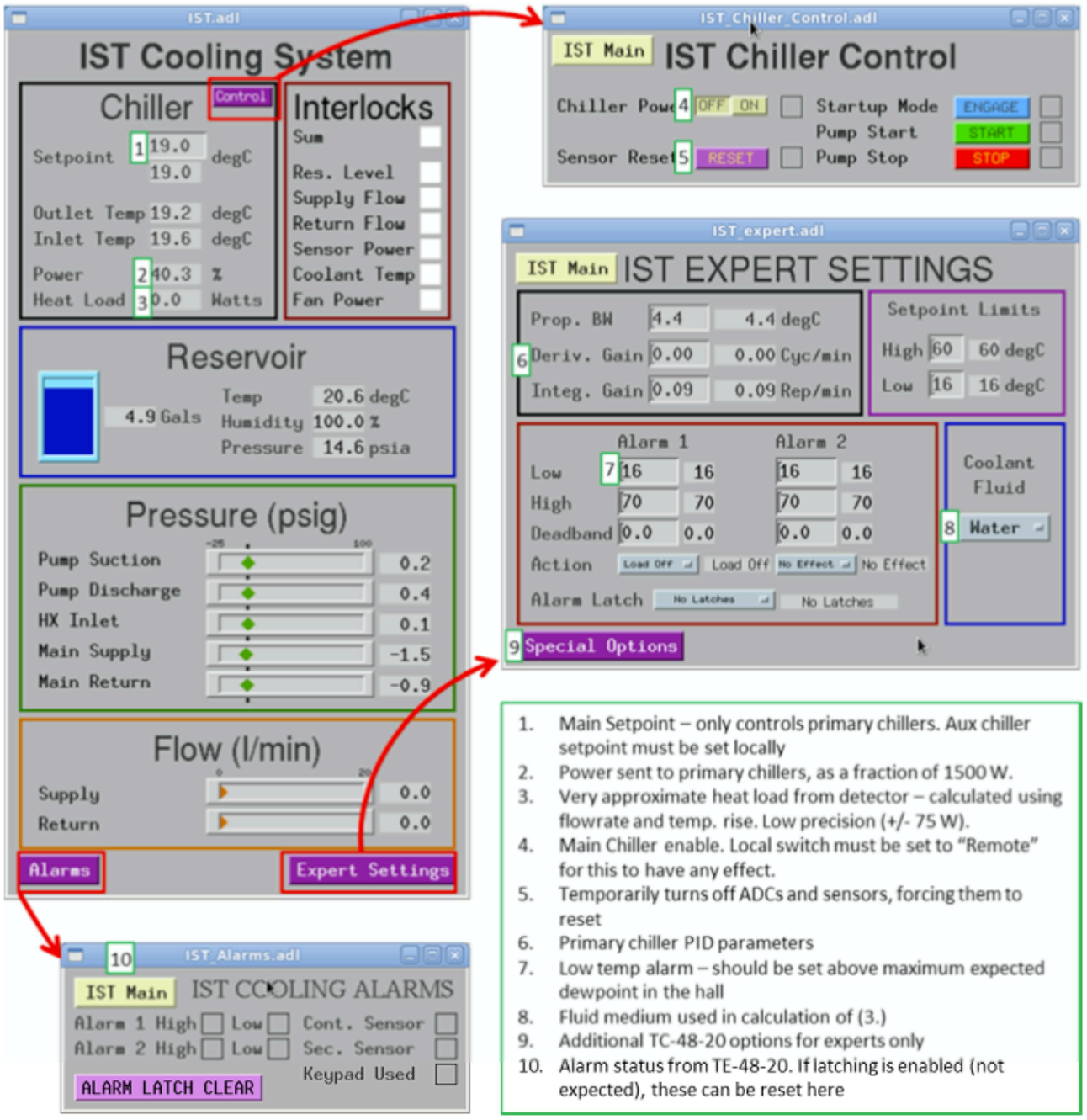
- The scripts are updated for FST and tested on BNL local test stand.
- The scripts are also tested on softioc4 and used in the DAQ integration test.
- Next step is to update sequencer.

FST Crate Slow Control Status

- The base of EPICs, ASYN and Sequencer (same as GMT) are compiled on softioc4 => with the help of David and Jarda.
- Old IST software are compiled with the base.
- Cannot turn on the IOC for IST/FST (crashed with memory corruption)
  - May relate to the conflict between software and SL7.
  - Same for GMT which needs to be ready before the run 21 start.
- Will move forward for FST HV slow control update after IOC issue got fixed => David and Jarda are working on that now.
- Expect 1~2 weeks to complete the update to FST after IOC issue fixed.
  - May need to keep FST MPOD Crate on in the beginning of the run 21 (with interlock cheater or STAR interlock?).

FST Cooling Slow Control

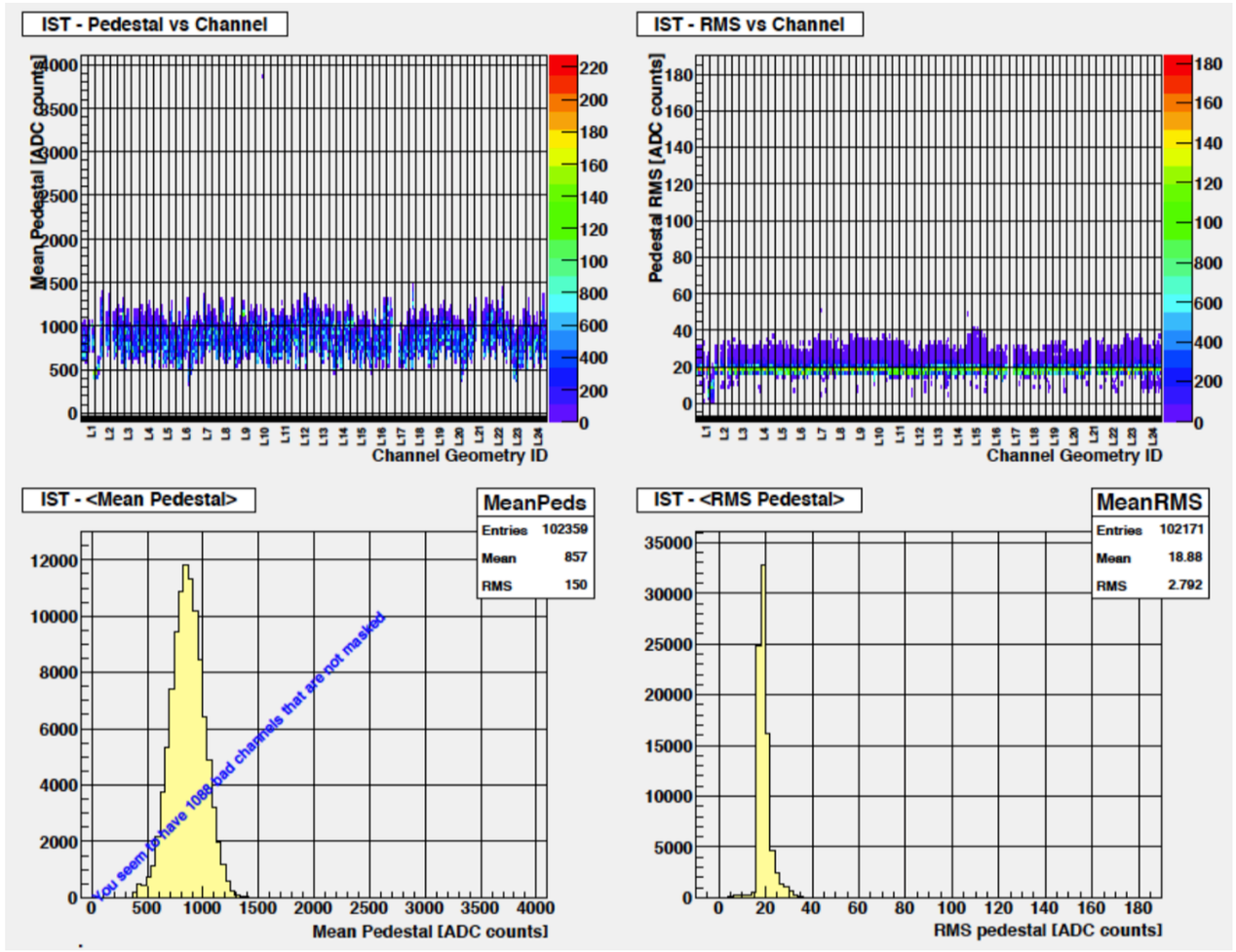
EPICS Interface

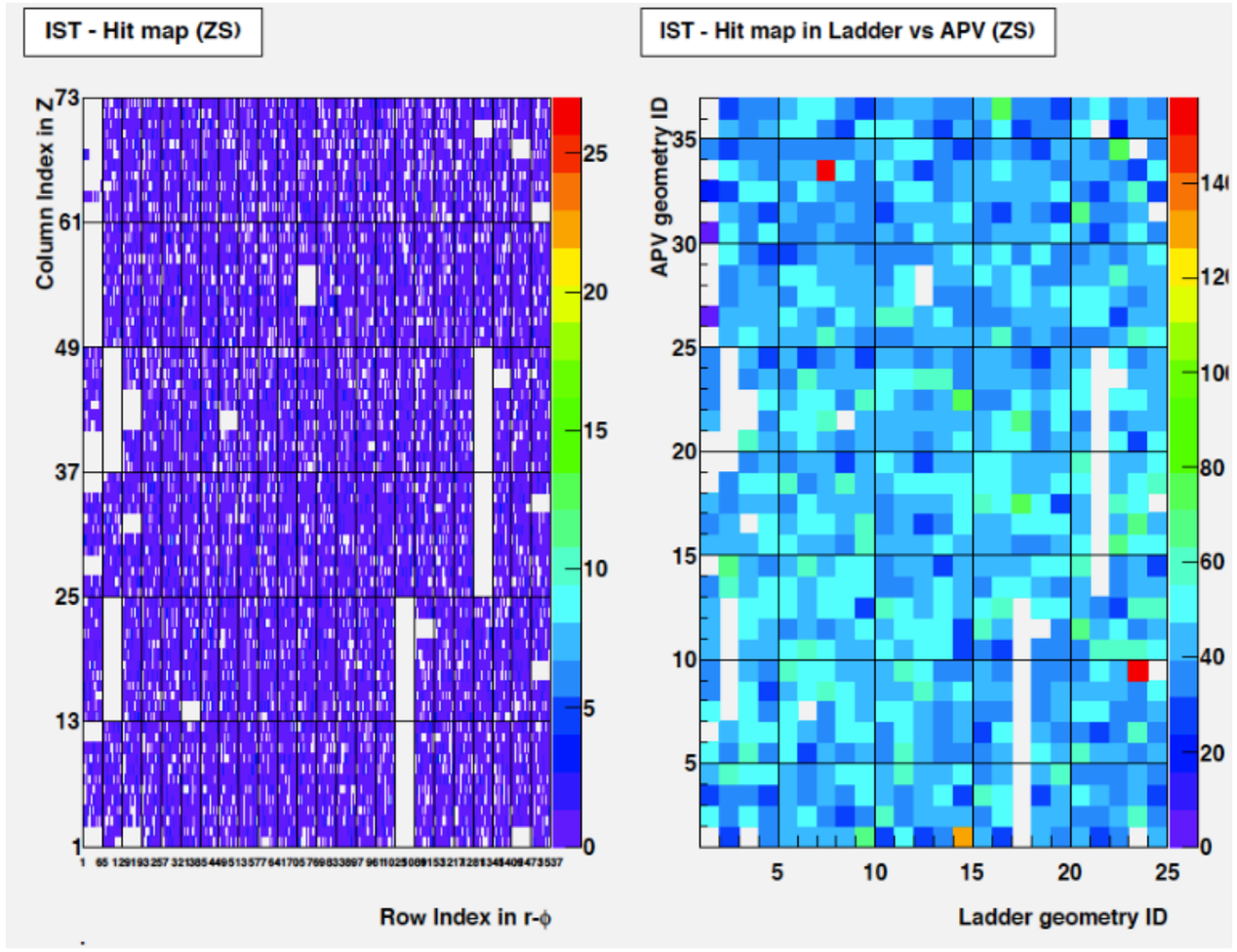


1. Main Setpoint – only controls primary chillers. Aux chiller setpoint must be set locally
2. Power sent to primary chillers, as a fraction of 1500 W.
3. Very approximate heat load from detector – calculated using flowrate and temp. rise. Low precision (+/- 75 W).
4. Main Chiller enable. Local switch must be set to "Remote" for this to have any effect.
5. Temporarily turns off ADCs and sensors, forcing them to reset
6. Primary chiller PID parameters
7. Low temp alarm – should be set above maximum expected dewpoint in the hall
8. Fluid medium used in calculation of (3.)
9. Additional TC-48-20 options for experts only
10. Alarm status from TE-48-20. If latching is enabled (not expected), these can be reset here

- Re-use of old IST cooling slow control.
  - FST use the same cooling system as IST => a natural choice to re-use old IST cooling slow control system.
- GUI for Expert
  - Operation, monitor and alarm are all based on sequencer.
  - Need to modify old IST sequencer for FST setup => adjust flow speed limits
  - Need to modify old IST GUI for FST => adjust naming and pictures.
- Updates will start after the IOC issue got fixed and cooling system back online.
  - May need to keep FST cooling system on in the beginning of the run 21.

Online Monitoring





- Re-use the old IST online QA plots with modification for FST.
- Able to check out and compile old IST code.
- Need to update to FST geometry.
- Will test with the data collected in the DAQ integration test, then send to Jeff for implementation.

Summary and Outlook

- Slow Control - High Priority
  - The base and IST software are compiled.
  - The shell scripts are ready for HV Shift Crew GUI.
  - Need to update the sequencer for both HV and Cooling slow control system.
  - The sequencer and GUI updates will start after the IOC issue fixed.
- Online Monitor
  - The code is checked out and compiled.
  - Will start the updates after the updates of slow control system.

Testing Schedule at FNAL/UIC

Goals: assembly and test 48 FST modules.

Test Schedule and Manpower:

- Xu Sun
  - Jan 2021: setup test stand at Fermi Lab SiDet => Installed DAQ software with the help of Tonko.
  - Jan - March 2021: train Shenghui and test first batch of module at FNAL.
- Shenghui Zhang
  - Jan - May 2021: test the rest of modules at FNAL.
- Zhenyu Ye
  - Will be around if additional man power is need.
- Andres Aguilar and Gavin Wilks
  - Cosmic ray and laser testing at UIC on a fraction of modules.

Installation Schedule at BNL

Test Stand for Cooling Integration Test

- Modules (48) will be tested with the test stand after arrived at the BNL and after installed on the support structure.
- All installed modules (36) will be tested with STAR DAQ after full installation.

Goals: test 48 FST modules and install 36 FST modules to the support structure.
Test Schedule and Manpower:

- UIC
- Xu Sun
  - Will go to BNL in the end of March (early April) with 1st batch of FST modules (6).
  - Set up test stand and assembly space in the clean room => will be the same as the one used in cooling integration test.
  - Stationed at BNL until the detector is fully installed and commissioned.
- Zhenyu Ye & Gavin Wilks
  - Will come to BNL in middle of May (when the spring semester is over) and stay until end of August (when the Fall semester starts).
- BNL
- Prithwish Tribedy & Yu Hu
  - Will be around all the time.
  - Set up the test stand and test the FST modules.