Slow Controls vs Dune Detector Safety System

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Outline

- The following slides provide a discussion of what is under the control of slow controls and what is controlled by the DDSS, as well as what is monitored directly through slow controls, and cases where the monitoring information is send from DDSS to slow controls

Low Voltage Supplies

- WIENER PL506 (6 channels, 1 per APA), 25 modules
  - All settings are controlled from Slow Controls
    - Non expert menu allows users to turn on/off individual channel
    - All other settings (ramp speed, voltage settings, thresholds for warnings/alarms, action to be taken in case of interlock failures) are restricted to expert users
    - Monitored by slow controls
  - Receive interlock signal from DDSS
    - Assume that monitoring information for interlock signal is sent from DDSS to slow control via the main PLC computer
    - Not sure this can also be monitored from the PL506 as well

Bias Voltage Power Supplies

- WIENER MPOD (5 crates) with 45 ISEG modules total
  - All settings are controlled from Slow Controls
    - Non expert menu allows users to turn on/off individual channel
    - All other settings (ramp speed, voltage settings, thresholds for warnings/alarms, action to be taken in case of interlock failures) are restricted to expert users
    - Monitored by slow controls
  - Receive interlock signal from DDSS
    - Assume that monitoring information for interlock signal is sent from DDSS to slow control via the main PLC computer
    - Not sure this can also be monitored from the MPOD as well

WIB / PTC

- The WIBs are entirely under the control of Slow Controls and DAQ
- The WIB can receive interlock signals (via the PTC) from the DDSS, assume that these are monitored from DDSS, but could also be monitored via the WIB-SC connection
- The WIB sends information used to build interlock signals (via the PTC) to the DDSS. Assume that the detailed monitoring of currents, voltage, temperature on the WIB (and status of the FEMBs) is sent directly from the WIBs to SC. Assume that the DDSS will send only monitoring information at the level “WIB xxxx is interlocked”
- The same applies also for the PTC

OPC UA Endpoint

- OPC UA is the protocol used for Slow Controls
  - Endpoint is software block that runs somewhere that controls the hardware
  - Each WIENER MPOD (*5) and each WIENER PL506 (*25) is a OPC UA endpoint
- It is not yet clear to me whether
  - We deploy 900 OPC UA endpoints (1 per WIB/PTC) on the Zynq CPUs inside the FPGAs on the WIBs/PTC
  - We deploy fewer OPC UA endpoints (1 per row of APAs ?, only 1 per far detector module) in the computer(s) that run the slow controls program(s) for the TPC electronics
  - This is an architecture decision for the DAQ/SC group
  - Need input from the DAQ/SC group

Temperature on the CE flange

- We have 4 RTDs on each of the 150 flanges, only 2 of them are actually connected to the readout modules (Beckhoff EL3202-0010)
  - Information from the RTDs is used in the PLC logic to decide whether to turn on/off the heaters
  - This information should also be transferred from the PLC to slow controls for monitoring

Humidity sensors

- We have 2 dedicated humidity sensors on the top of the cryostat that are read out through the Beckhoff EL3052 connected on the central PLC panel
  - Information from the humidity sensors is used in the PLC logic to decide whether to turn on/off the heaters
  - This information should also be transferred from the PLC to slow controls for monitoring

Status of heaters/fans (i)

- Each flange has 4 heaters / fans
- Slow control should have an overall “flange on/off” command
  - Sent from SC via PLC computer
  - Turns off all heaters and fans for that flange, which then generates interlock signal for low voltage and bias voltage supplies
    - This is essentially a “switch off the flange command”
  - Enable power to heaters and fans, at which point DDSS takes over their operation and the generation of interlock signals for the low voltage and bias voltage supplies

Status of heaters/fans (ii)

- Information available for each heater
  - Power: ON/OFF (decided by the PLC)
    - Should slow control be able to
      - Enable/disable heaters (if enabled will turn on/off according to PLC logic) independently from the fans ?
      - Turn on/off heaters and override the corresponding PLC logic ?
- Information available for each fan
  - Power: ON/OFF (decided by the PLC)
    - Not sure we want to have same control for fans as for heaters
    - Could be useful for repairing / replacing individual fans without turning off entire flange
  - Spinning: ON/OFF (PLC readout via Beckhoff EL3202-0010)
- This information should be sent from the PLC to Slow Controls

Conclusion

- It would be preferable to present all the slow control information in a single GUI, independent of whether this come directly from the OPC UA endpoint on the detector (WIENER MPOD and PL506, WIBs, PTCs) or whether it comes through the DDSS/Slow Control interface (OPC UA endpoint on the central PLC)
  - This should also integrate the display of the status of interlocks (and possibly expert level interface to enable / disable interlocks ?)
- Full access to PLC should be via separate GUI