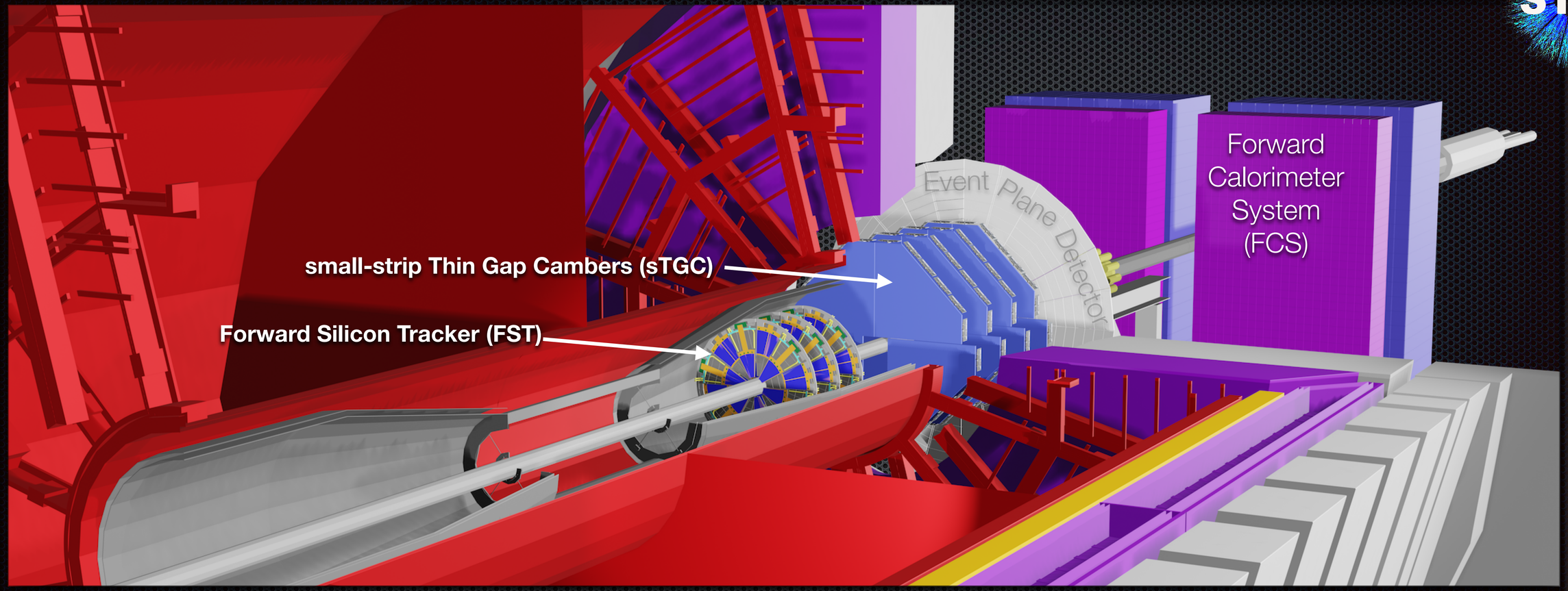


New Hardware Controls for the STAR Experiment at RHIC

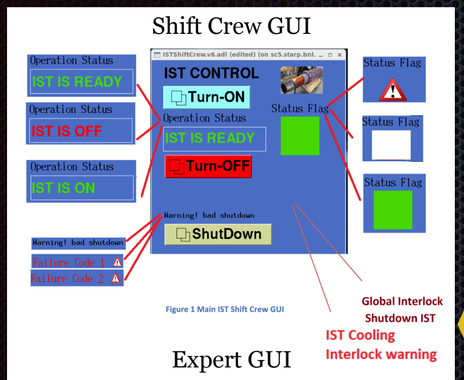
David Tlusty (Creighton University)

Supported in part by:

U.S. DEPARTMENT OF ENERGY | Office of Science

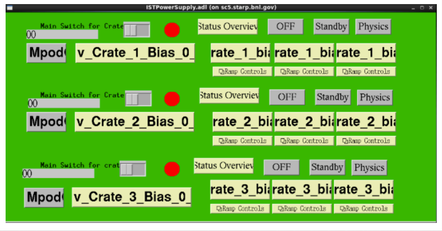
FST Controls and Monitoring

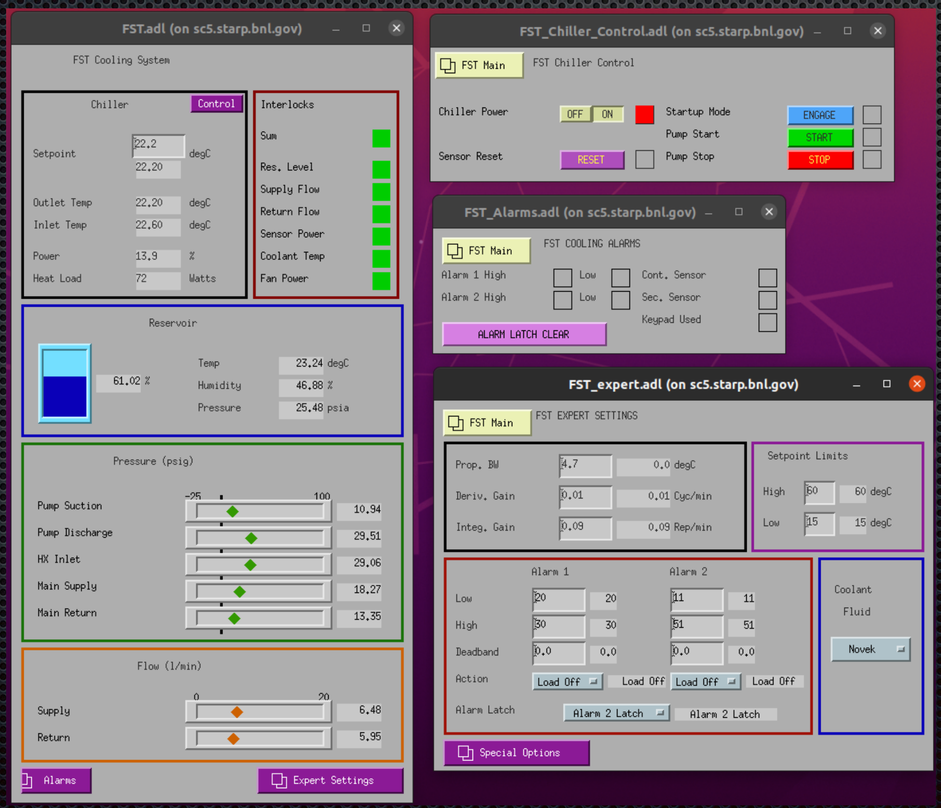
- Forward Silicon Tracker (FST) is powered by Wiener PL512 power supplies. Control and monitoring done via SNMP protocol using EPICS base, ASYN and Sequencer.
- Crate Slow Controls (EPICS DTYP “Snmp”, OUT/INP “@$ (HOST) seCrET WIENER-CRATE-MIB::<parameter>



RJ-45 connection SNMP protocol

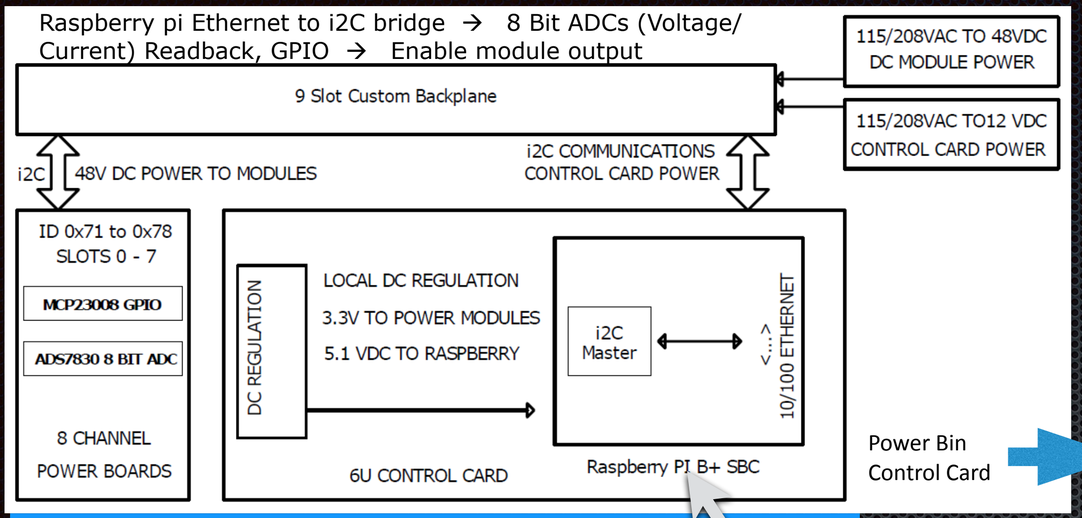
EPICS



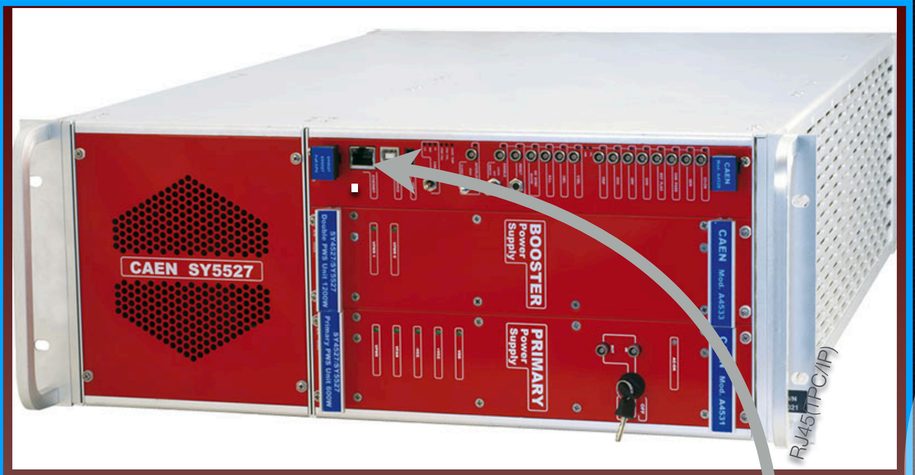


- **Cooling** uses Novek 7200 coolant medium (3M)
- Devices use RS232, TCP/IP, Modbus RS485. List of devices:
  - Analog I/O (ADAM-6017)
  - Digital I/O (ADAM-6052)
  - Flow Meters (Omega FTB, DPF series)
  - Pressure (Omega DPi32)
  - Humidity (Omega HX86PA)
  - Level Sensor (Omega LVR31)
  - Pressure Transducer (Omega PX209)
  - TEC Thermistor (TE MP-3193)
  - TEC Controller (TC-48-20)

sTGC Powering and Readout



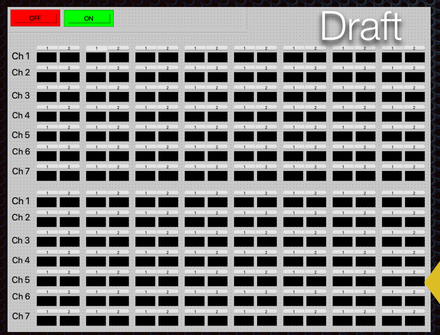
Power Bin Control Card



Specifications

- 25 Watts/ Channel DC Output 0 - 12V 200W Total
- Vout ramp up time: ~1V / 15us
- Current Limit: Fixed @ 2.0ADC, Output fuse protected
- Over Voltage: Clamping Diode
- Regulation: < 1%, Full load ripple: 0.5% (50mv p-p 150MHz [<10mv p-p 20MHz])
- EMI Shielded
- Monitoring over Ethernet: V out, I out [8-bit resolution], bin temperature and interlock state
- Control over Ethernet: Remotely turn on/ off channels

RJ45(TCP/IP SOCKET)



python™

IOC (Python `softioc`)[1]

sTGC is gas detector operating in proportional regime

- High Voltage (2.9kV) brought by CAEN SY5527 A7435 boards - accessed by Python `ctypes` library using CAEN HV Wrapper Library version 5.82. IOC
- Low Voltage (signal readout front end electronics energizing) Boards - accessed through TPC IP socket directly from PC. Communication based on ASCII messages. The boards custom made by Timothy Camarda (BNL)
- GUIs designed by qt designer for caQtDM

CAEN HV Wrapper Library

python™

IOC (Python `softioc`)[1]

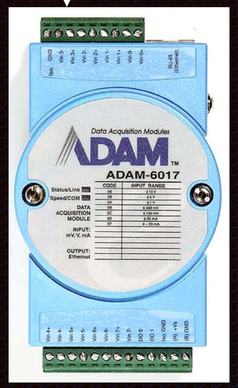
sTGC Gas System

The sTGC Gas System (including pressure transmitters, thermocouples, flow meters, a controlled evaporation mixer, and pentane sniffers) is designed to deliver gas mixture consisting of 55% CO2 and 45% Pentane. The system is monitored and controlled by python softIOC modules on Linux PC.

Most devices communicate using MOXA and Modbus RTU, while the pressure transmitters communicate using Modbus TCP

6x Pressure Transmitters

analog signals



6x Thermocouple

Modbus RTU chain

MOXA Nport 5150 server

Flow Meters and Controlled Evaporation Mixer

Modbus RTU chain (19.2 kbaud)

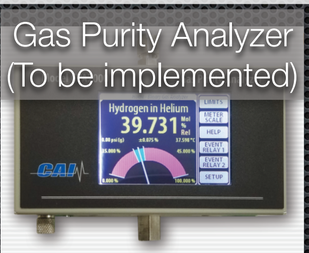
MOXA Nport 5150 server

2x Beacon 410A: Pentane Sniffers

Modbus RTU chain (9.6 kbaud)

MOXA Nport 5150 server

Gas Purity Analyzer (To be implemented)



The gas purity analyzer will be implemented in order to provide continuous gas purity measurements with an accuracy of 0.1%. It will communicate using Moxa NPORT 5130A server, with RS232 protocol.

RJ45(Modbus TCP)

RJ45(TCP/IP)

RJ45(TCP/IP)

RJ45(TCP/IP)

python

IOC (Python softioc)[1]

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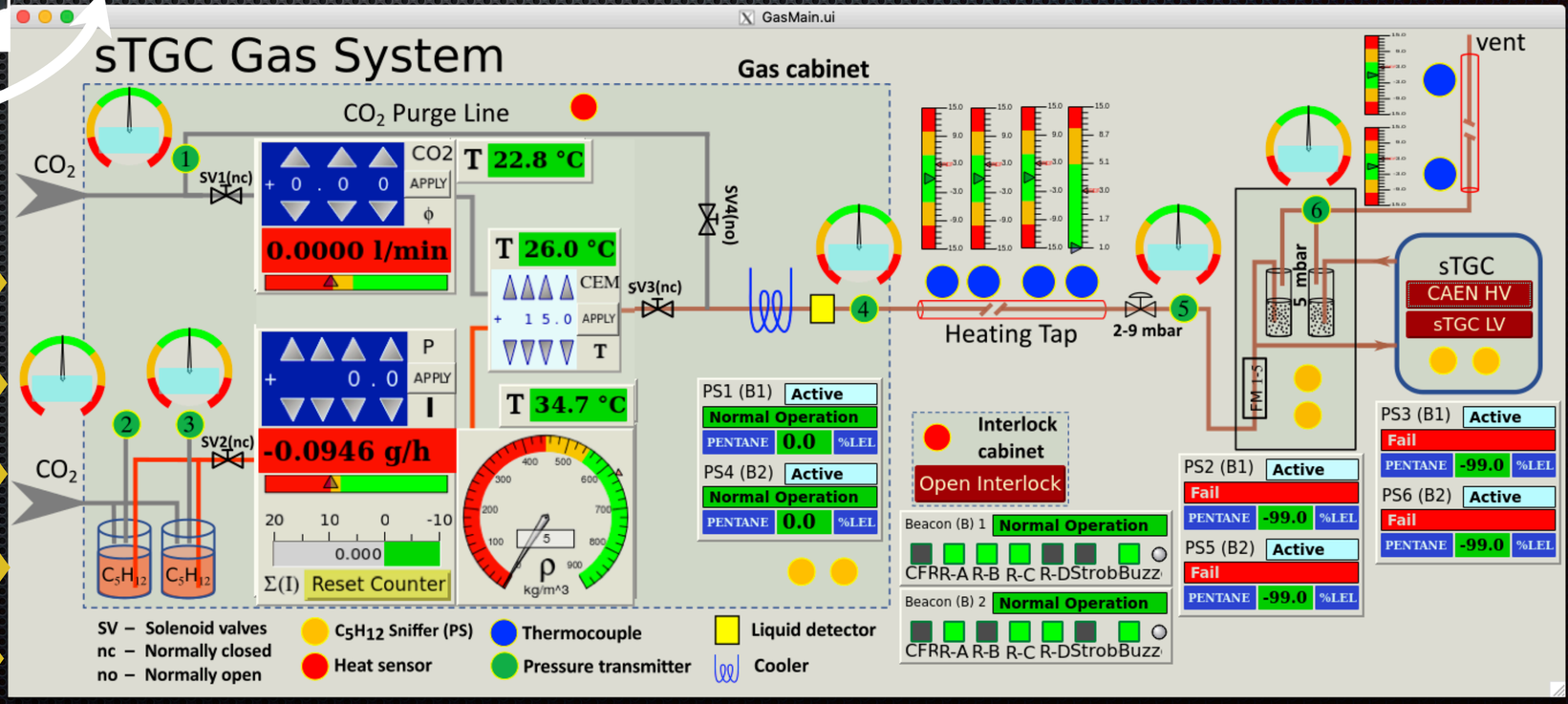
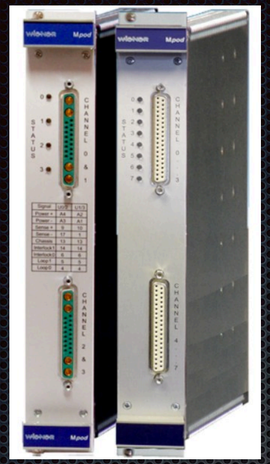


FCS Monitoring and Control

Wiener MPOD crate + 5x Wiener MPV8016i



- controlling 40 channels of low voltage power for the hadron (HCAL) and electron (ECAL) calorimeters
- communication utilizes the SNMP protocol to monitor voltage, current, temperature, and status of each channel

- Monitoring and logging is provided for FCS front end electronics.
  - 16xHCAL + 48xECAL DEP boards
  - 260xHCAL + 187xECAL FEE boards
  - 11 control computers
  - Each board and device has many parameters which are logged and can be displayed including configuration, current, voltage, and status
  - Electronics communicate this data to slow controls through MQTT messages and log files