DSG Hall C Projects

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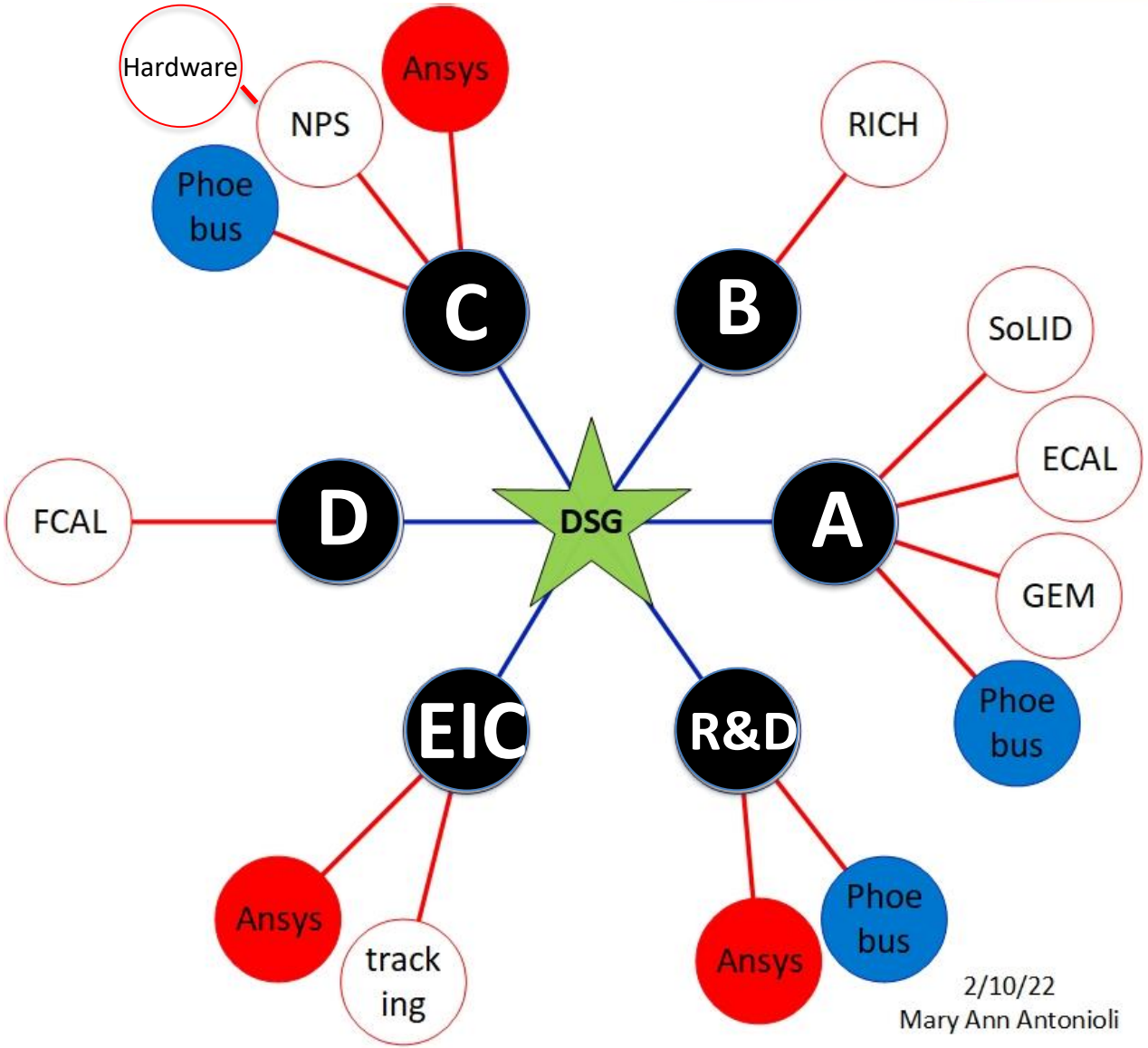
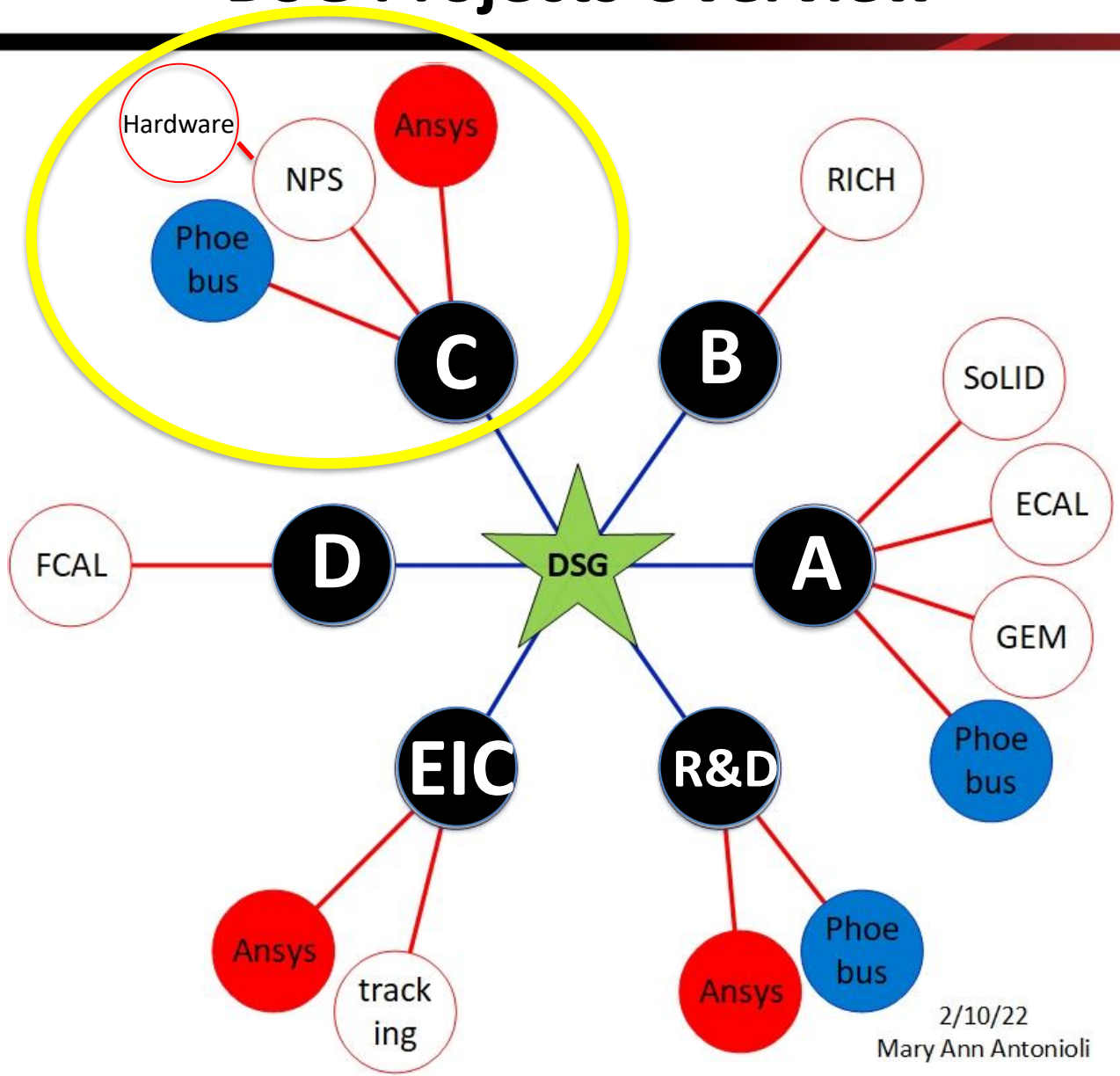
Detector Support Group
March 1, 2022

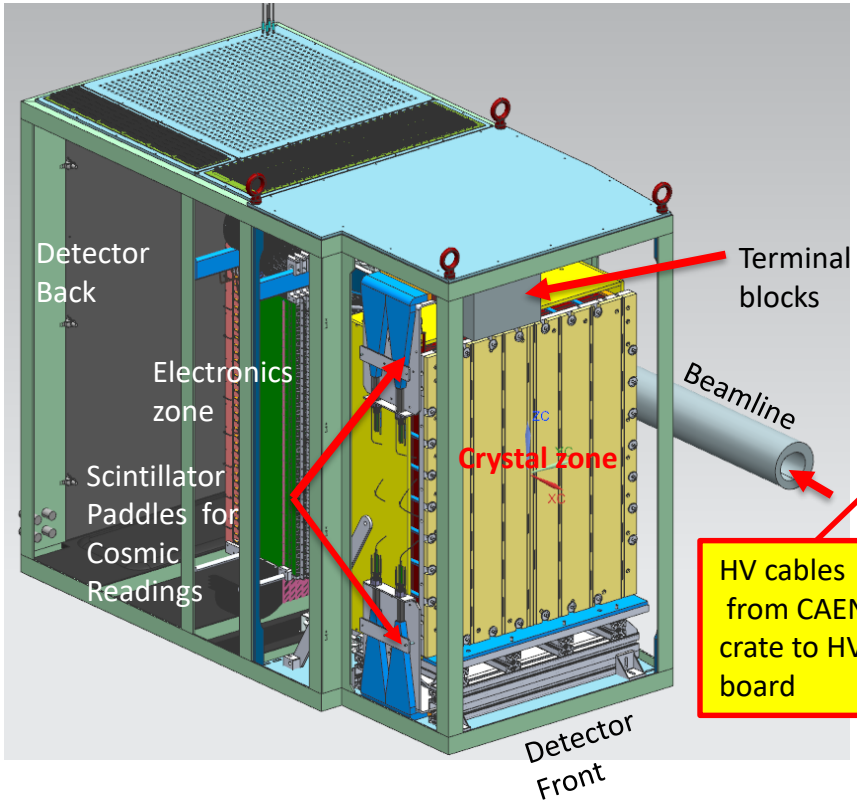
DSG Projects Overview

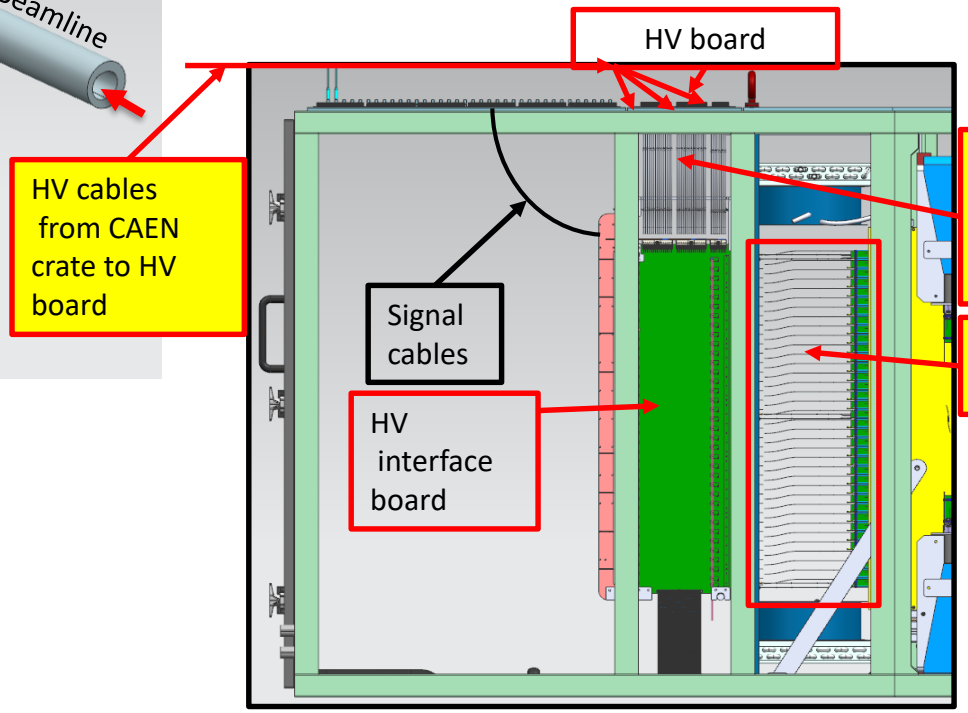


DSG Projects Overview



Neutral Particle Spectrometer

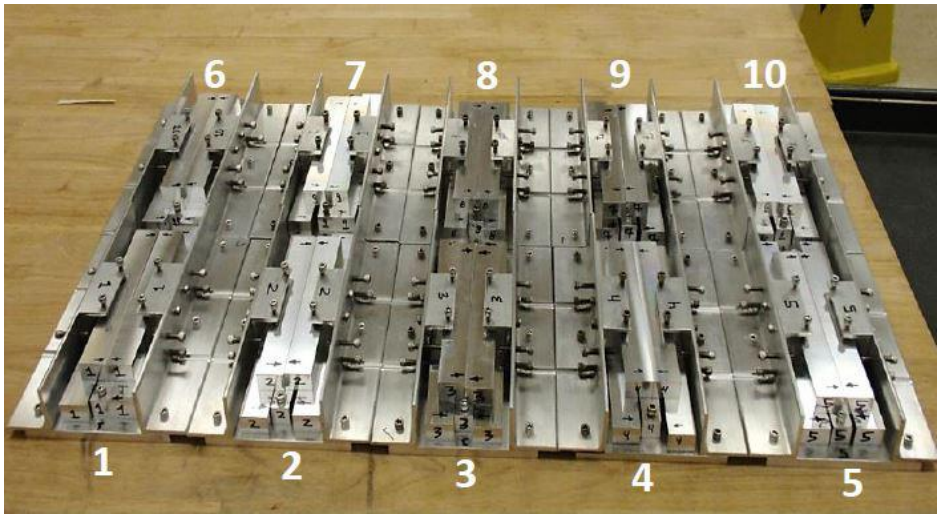




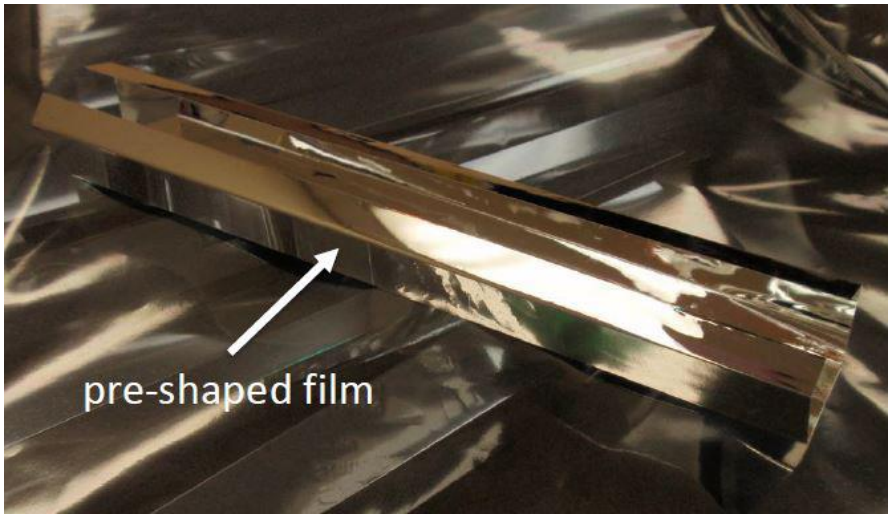
DSG Contributors

- Testing & Analysis
  - Testing 34 (A7030TN) CAEN HV modules and two SY4527 crates: COMPLETE
  - Testing HV Supply Cables: COMPLETE
- Fabrication
  - HV Divider Cables: 1100 TOT ALL fabricated and labeled
  - Multi-conductor HV supply Cables: COMPLETE
  - Enhanced Specular Reflector (ESR) Films: COMPLETE (part done by DSG)
- EPICS Controls & Monitoring System → Moving to Phoebus
  - Developed EPICS CSS-BOY screens for 1080 PMT HV (voltage and current readback for each PMT): COMPLETE
- Environment Monitoring & Interlock System (on-going)
  - System monitors and interlocks (if needed) humidity, gas flow, temperature, chiller status, and fan speed
- Ansys thermal Analysis (on-going)

Shaping of Enhanced Specular Reflector (ESR) Films



Jigs to shape ESR film



Shaped film

- 600+ films shaped

Hardware Interlock System Layout

2/11/2022
Mary Ann Antonioli

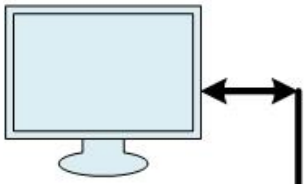
NPS
~180 sensors

used for readout of temperature, humidity, flow, and pressure signals

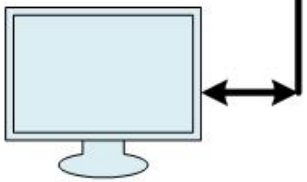
In the DSG room

Keysight measurement unit

used for hardware monitoring and interlock system



LabView display
Hall, Counting house, DSG rooms

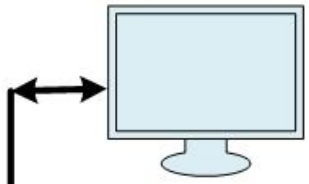


cables

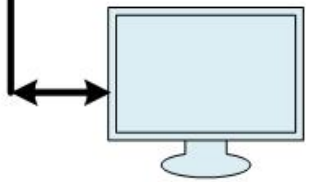
National Instruments

IOC **Software**

Phoebus **Software**

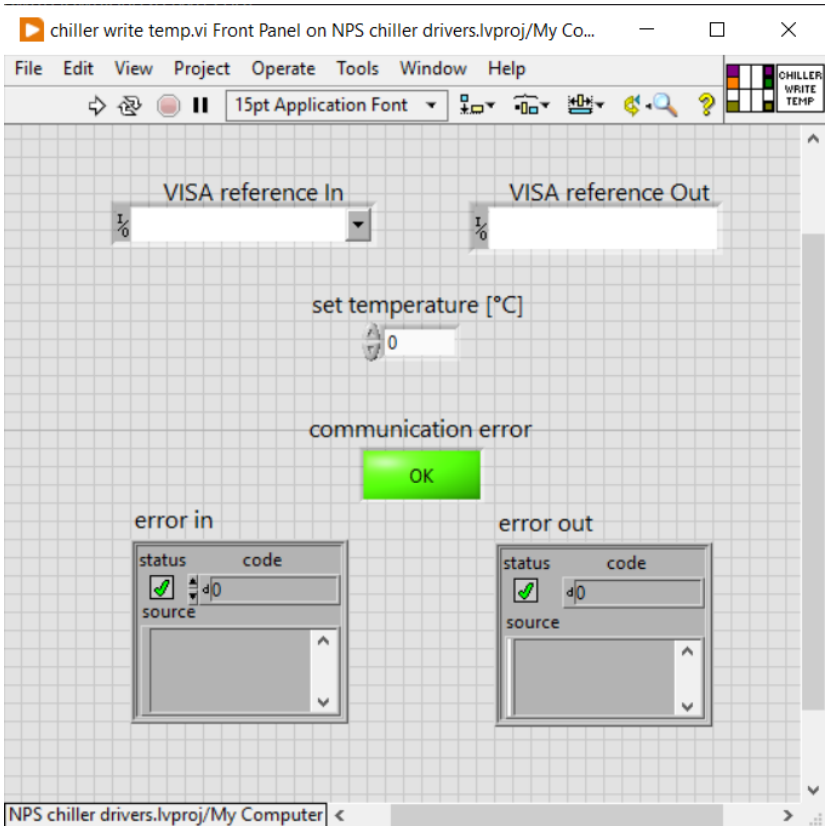


Phoebus display
(nothing on WEDM now)

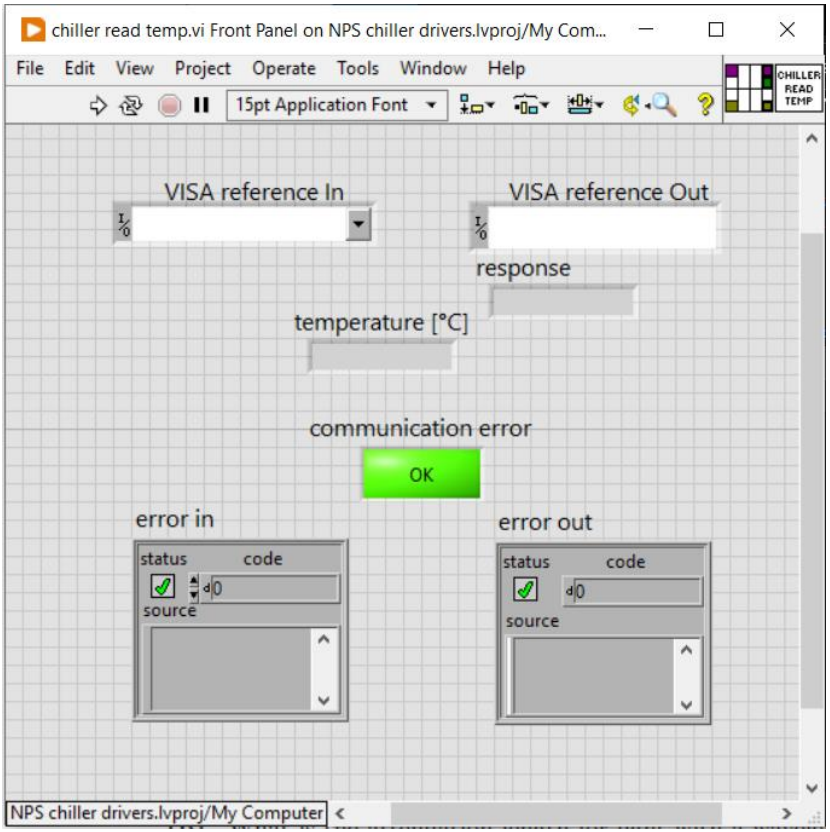


- **Drivers to read the values from Keysight** (~ 30 Drivers) **work in progress**
- **Program to process the values** (so far done only for the crystal temperature) **work in progress**
- **Display the results** (Labview & EPICS/Phoebus) **work in progress**
- **Interlock program work in progress**

Device Driver Library Development



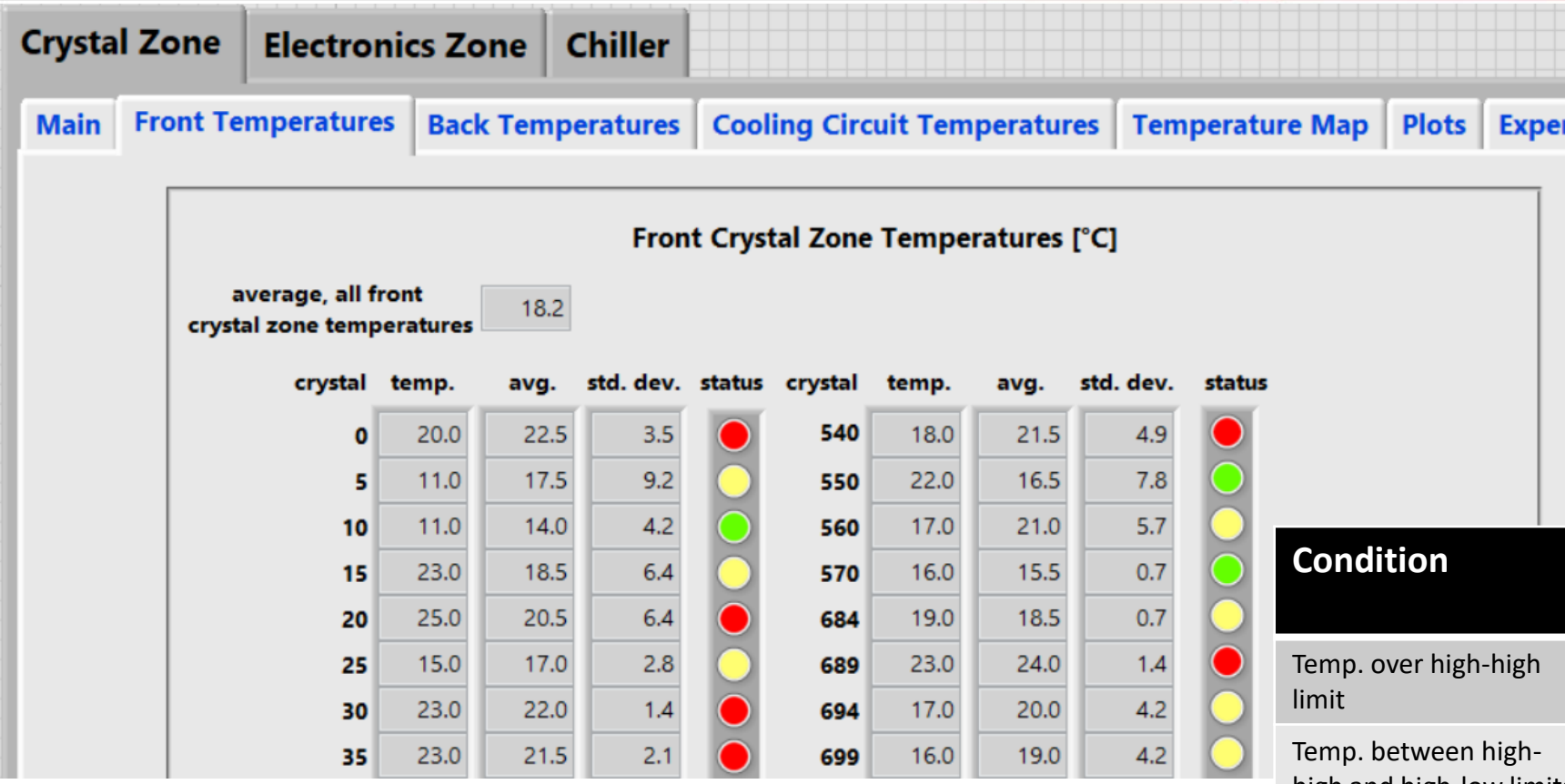
Set chiller temperature subVI



Read chiller temperature subVI

- Developing LabVIEW subVIs to communicate with chillers via RS232 for both hardware interlock and hardware monitoring programs

Hardware Monitoring LabVIEW Program

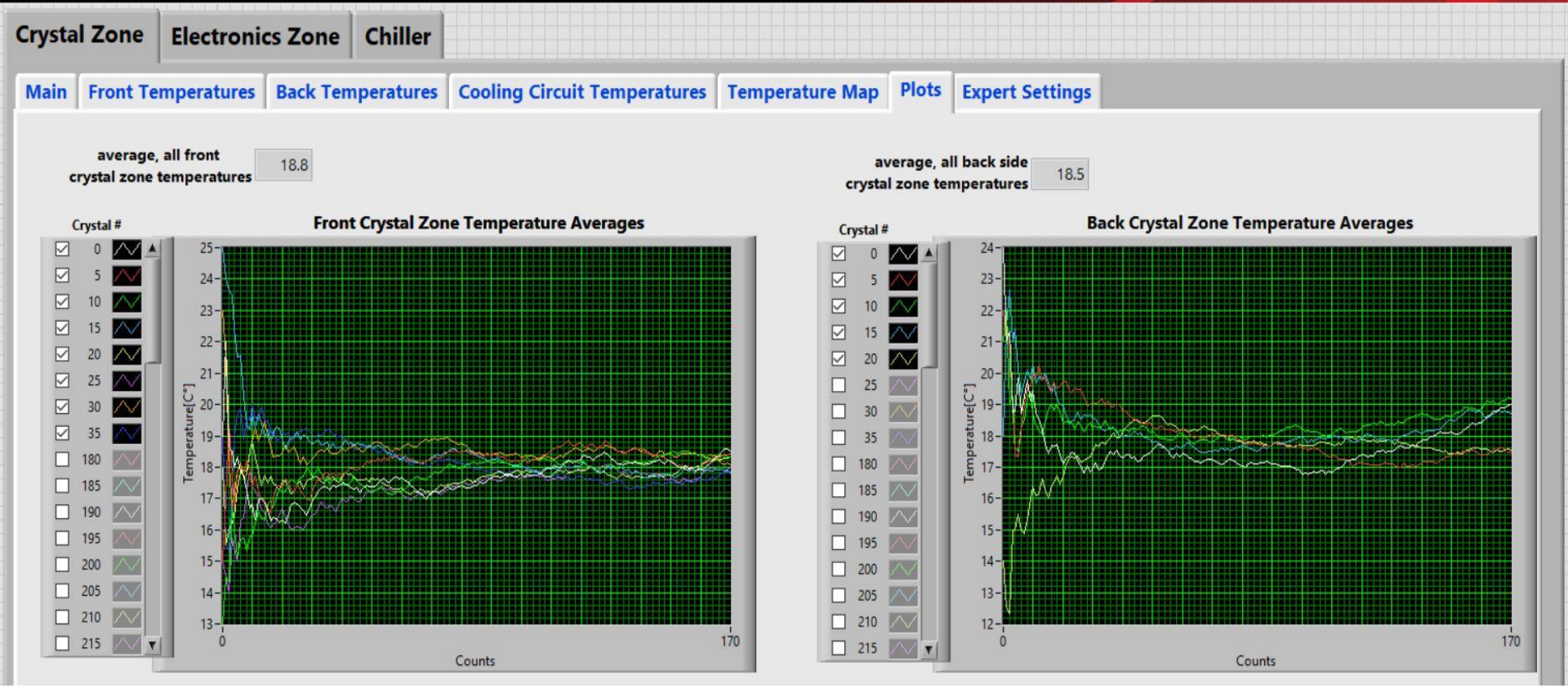


crystal	temp.	avg.	std. dev.	status	crystal	temp.	avg.	std. dev.	status
0	20.0	22.5	3.5		540	18.0	21.5	4.9	
5	11.0	17.5	9.2		550	22.0	16.5	7.8	
10	11.0	14.0	4.2		560	17.0	21.0	5.7	
15	23.0	18.5	6.4		570	16.0	15.5	0.7	
20	25.0	20.5	6.4		684	19.0	18.5	0.7	
25	15.0	17.0	2.8		689	23.0	24.0	1.4	
30	23.0	22.0	1.4		694	17.0	20.0	4.2	
35	23.0	21.5	2.1		699	16.0	19.0	4.2	

- Values shown are randomly generated for testing and debugging
- Averages are rolling average of 100 values
- Standard deviation calculated for each new average

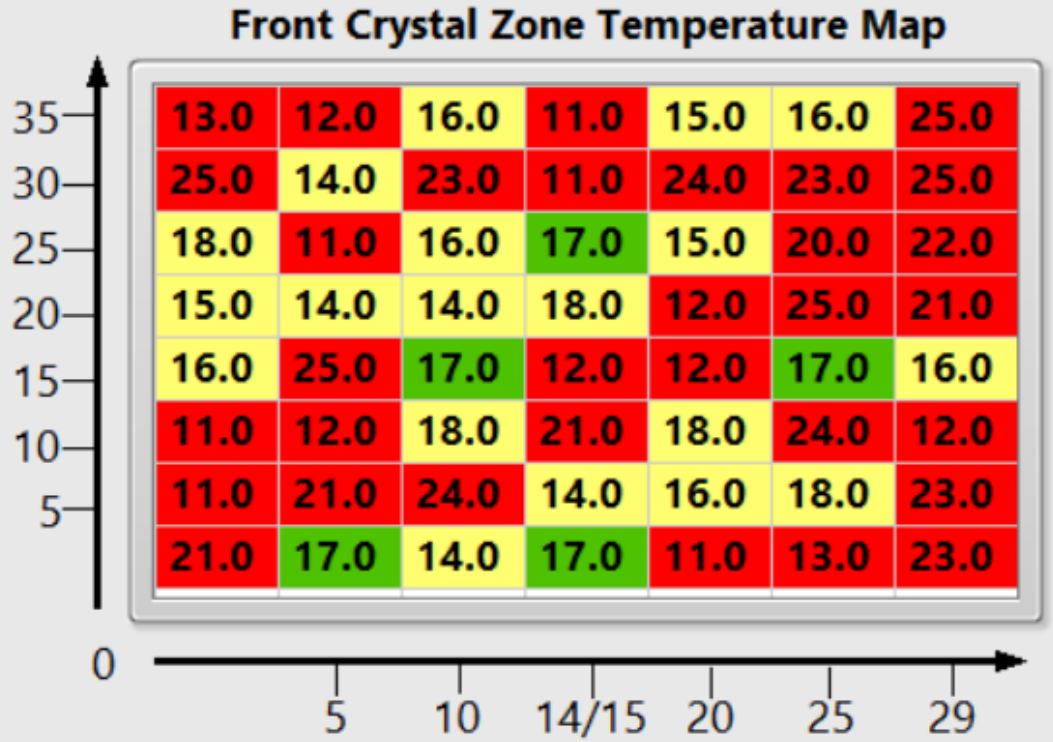
Condition	Status Color
Temp. over high-high limit	Red
Temp. between high-high and high-low limits	Yellow
Temp. in operating range	Green
Temp. between low-high and low-low limits	Yellow
Temp. below low-low limit	Red

Hardware Monitoring LabVIEW Program



- Live plots of front and back crystal zone average temperatures (random numbers)

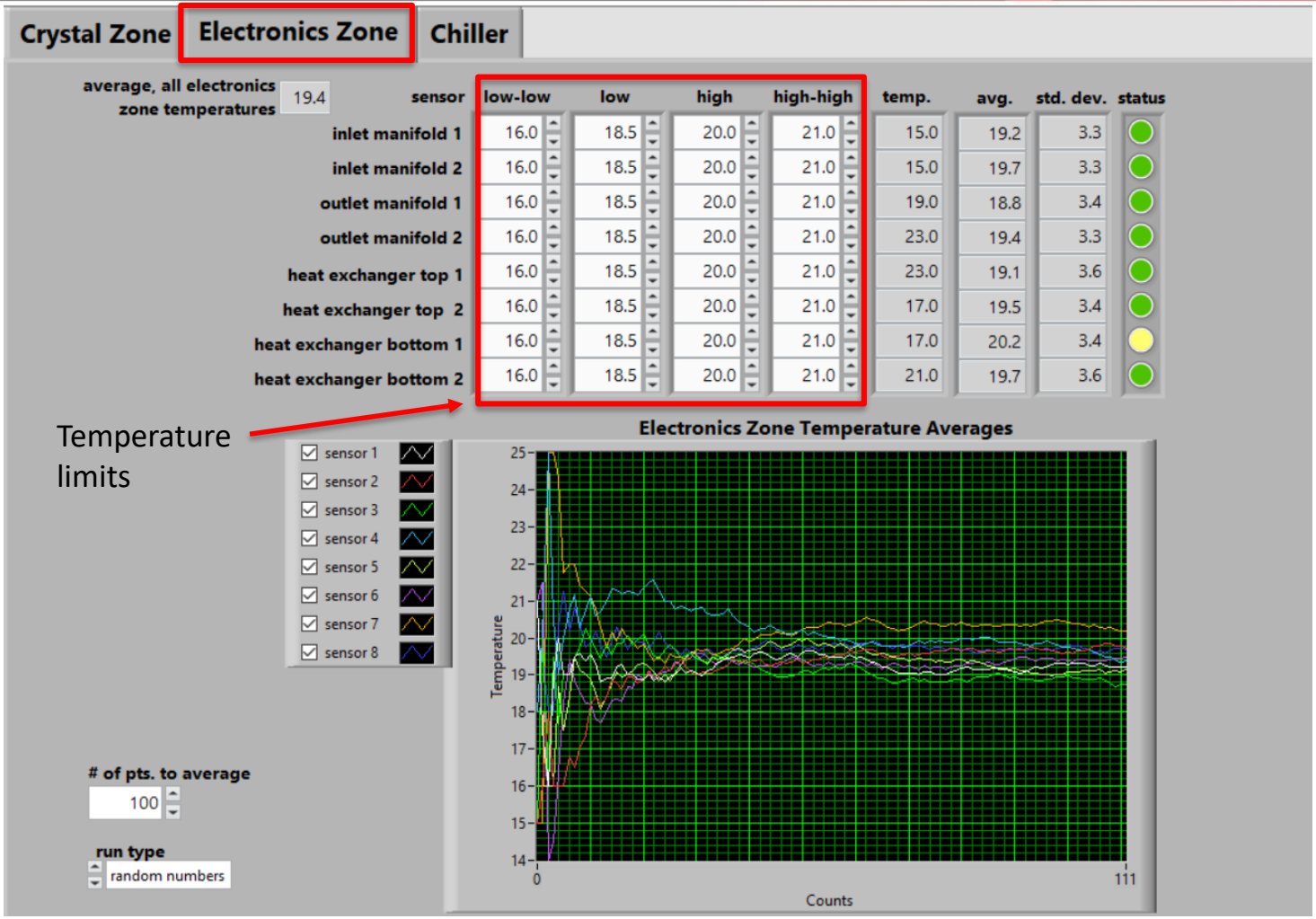
3. Hardware Monitoring LabVIEW Program



Condition	Status Color
temp. ≥ high-high limit (20°C)	Red
high-high (20°C) > temp. ≥ high (18°C)	Yellow
temp. in operating range (16°C < temp. < 18°C)	Green
low (16°C) ≥ temp. > low-low (13°C)	Yellow
temp. ≤ low-low limit (13°C)	Red

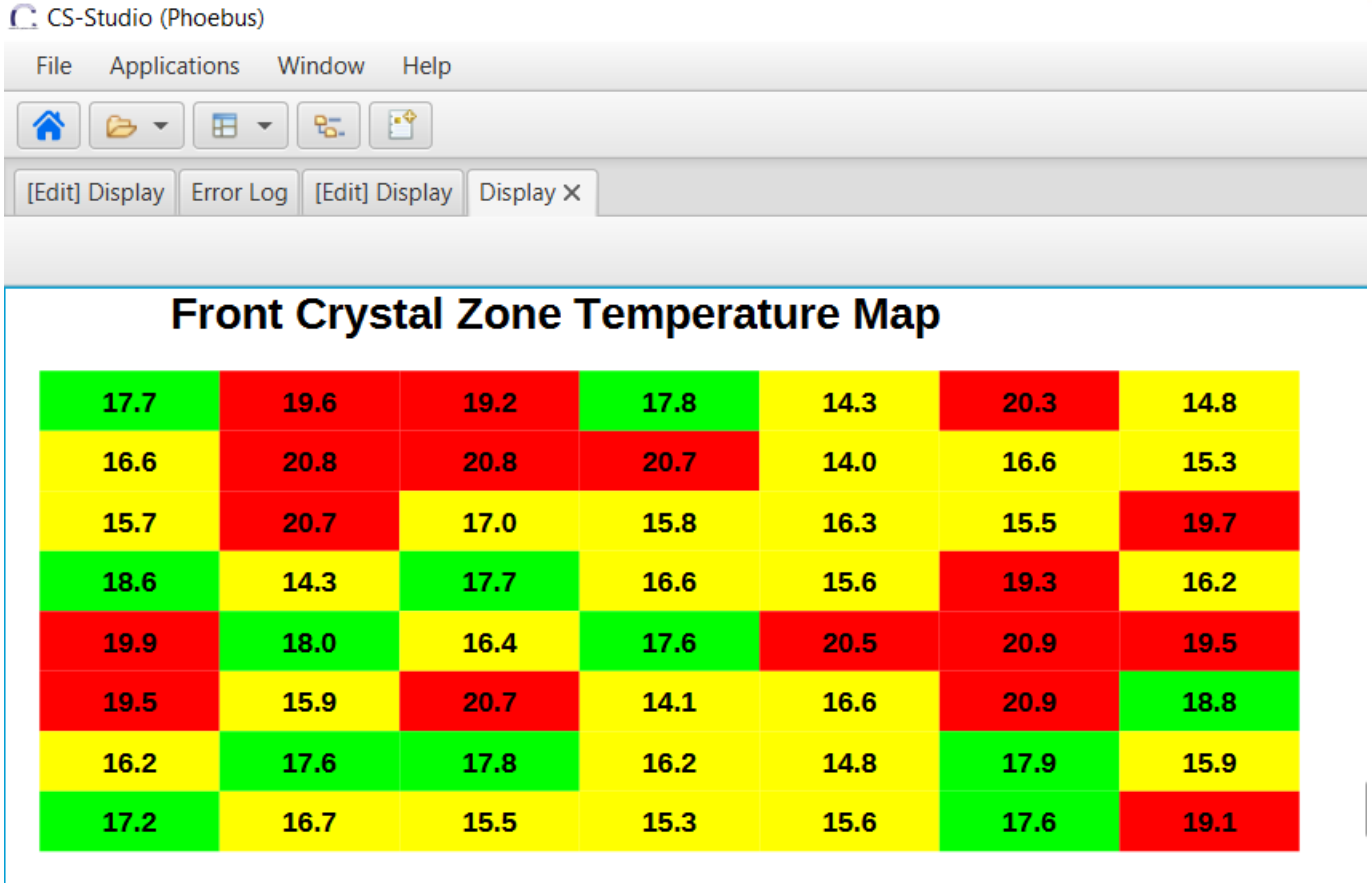
- Blocks show temperatures
- Temperatures randomly generated

Hardware Monitoring LabVIEW Program



- Electronics zone tab with temperature limits and averages
- Random numbers generated for testing and debugging

CSS Phoebus Temperature Mapping



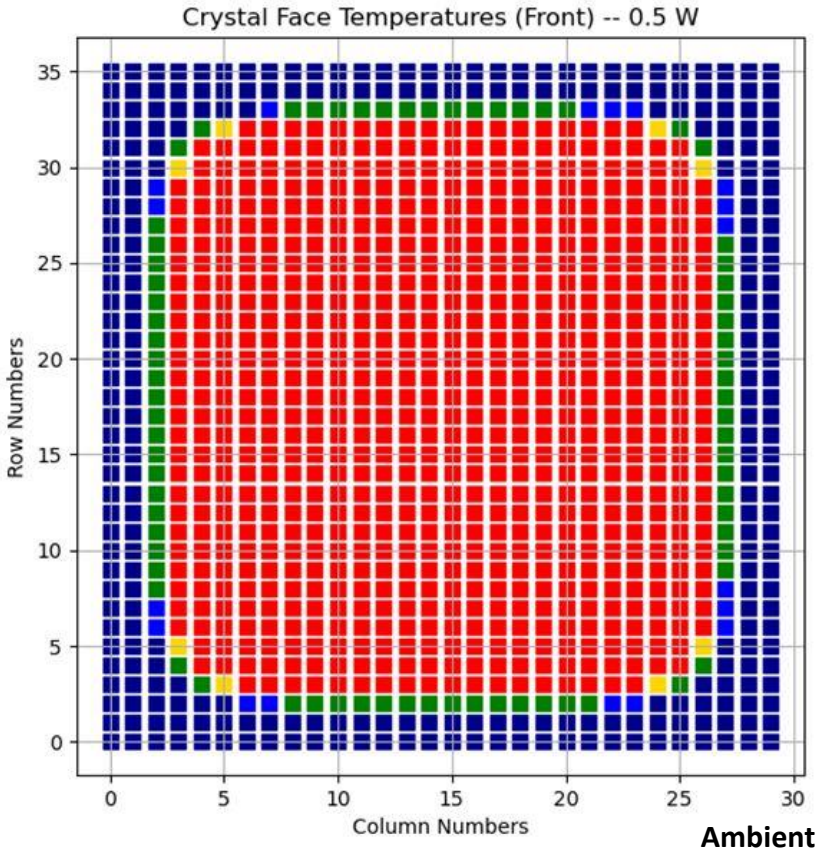
- EPICS temperature map created using Phoebus
- Temperatures randomly generated via embedded JavaScript
- All EPICS screens will be created using Phoebus

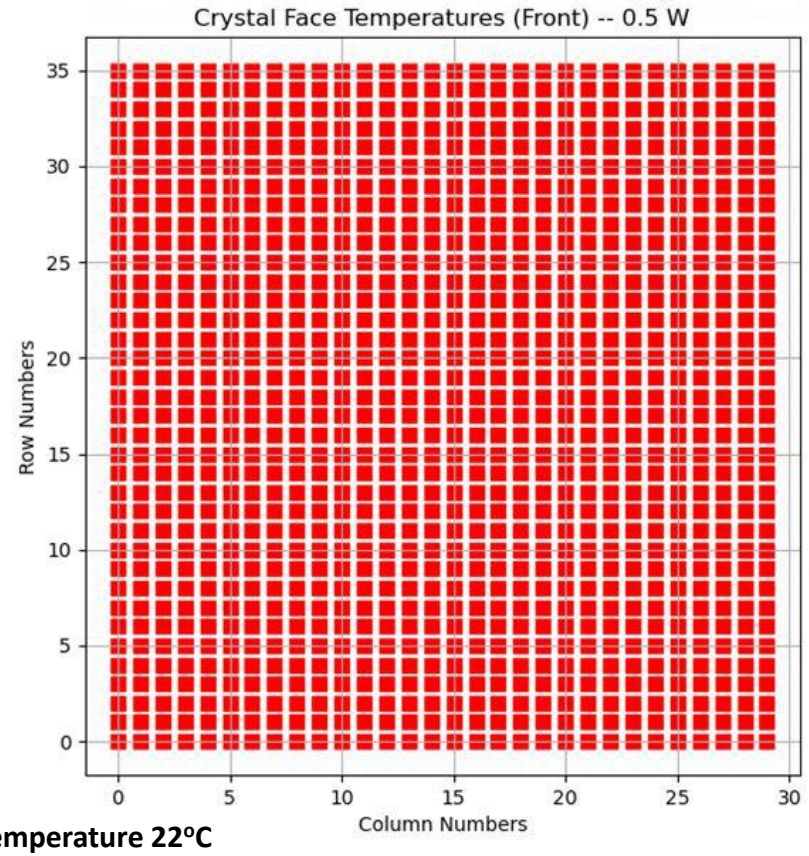
CSS Phoebus Screen Development

			All Channels On		All Channels Off				
All Mod. Chs. ON	All Mod. Chs. ON	All Mod. Chs. ON	All Mod. Chs. ON	All Mod. Chs. ON	All Mod. Chs. ON	All Mod. Chs. ON	All Mod. Chs. ON	All Mod. Chs. ON	All Mod. Chs. ON
All Mod. Chs. OFF	All Mod. Chs. OFF	All Mod. Chs. OFF	All Mod. Chs. OFF	All Mod. Chs. OFF	All Mod. Chs. OFF	All Mod. Chs. OFF	All Mod. Chs. OFF	All Mod. Chs. OFF	All Mod. Chs. OFF
11-35	12-35	13-35	14-35	15-35	16-35	17-35	18-35	19-35	20-35
11-34	12-34	13-34	14-34	15-34	16-34	17-34	18-34	19-34	20-34
11-33	12-33	13-33	14-33	15-33	16-33	17-33	18-33	19-33	20-33
11-32	12-32	13-32	14-32	15-32	16-32	17-32	18-32	19-32	20-32
11-31	12-31	13-31	14-31	15-31	16-31	17-31	18-31	19-31	20-31
11-30	12-30	13-30	14-30	15-30	16-30	17-30	18-30	19-30	20-30
11-29	12-29	13-29	14-29	15-29	16-29	17-29	18-29	19-29	20-29
11-28	12-28	13-28	14-28	15-28	16-28	17-28	18-28	19-28	20-28
11-27	12-27	13-27	14-27	15-27	16-27	17-27	18-27	19-27	20-27
11-26	12-26	13-26	14-26	15-26	16-26	17-26	18-26	19-26	20-26
11-25	12-25	13-25	14-25	15-25	16-25	17-25	18-25	19-25	20-25

- CAEN channel, module, crate ON/OFF screen (for experts only)

Ansys Thermal Analysis of Crystal Array





Ambient Temperature 22°C
Heat load for each crystal 0.5 W

Chiller cooling set at 10°C

Red : [22.00°C, 18.50°C)
Light Blue: [18.50°C, 18.25°C)
Green: [18.25°C – 17.25°C)
Yellow: [17.50°C , 17.25°C)
Dark Blue: [17.25°C, 10.00°C)

Chiller cooling set at ambient 22°C

No temperature differential between adjacent crystals

Crystal array temperature determined by ambient temeprature.
Need insulated cooled hut like Hall D's (HallD's ambient temp ~10°C

Conclusion

- DSG is contributing to all phases of detector development