DSG Hall C Projects

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Detector Support Group
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DSG Projects Overview

Detector Support Group

Hardware

Ansys

NPS

Phoe bus

DSG

RICH

SoLID

ECAL

GEM

Phoe bus

Phoe bus

Ansys

track ing

Ansys

2/10/22
Mary Ann Antonioli

EIC

R&D

FCAL
Neutral Particle Spectrometer

Detector Support Group

- Terminal blocks
- Beamline
- Crystal zone
- Electronics zone
- HV board
- HV cables from CAEN crate to HV board
- SAMTEC to SAMTEC flat twisted pair cables
- HV divider cables to PMTs
- Signal cables
- HV interface board
- Detector Back
- Scintillator Paddles for Cosmic Readings
- Detector Front
• **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

- 600+ films shaped

Shaped film
Hardware Interlock System Layout

- NPS
  ~180 sensors

- Keysight measurement unit

In the DSG room

- LabView display
  Hall, Counting house, DSG rooms

- National Instruments

- IOC Software

- Phoebus Software

- Phoebus display
  (nothing on WEDM now)

- Used for readout of temperature, humidity, flow, and pressure signals

- Used for hardware monitoring and interlock system

- 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

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

Set chiller temperature subVI

Read chiller temperature subVI
**Hardware Monitoring LabVIEW Program**

Values shown are randomly generated for testing and debugging

Averages are rolling average of 100 values

Standard deviation calculated for each new average

<table>
<thead>
<tr>
<th>Crystal Zone</th>
<th>Electronics Zone</th>
<th>Chiller</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front Temperatures</td>
<td>Back Temperatures</td>
<td>Cooling Circuit Temperatures</td>
</tr>
</tbody>
</table>

### Front Crystal Zone Temperatures [°C]

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

**Condition**

<table>
<thead>
<tr>
<th>Status Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temp. over high-high limit</td>
</tr>
<tr>
<td>Temp. between high-high and high-low limits</td>
</tr>
<tr>
<td>Temp. in operating range</td>
</tr>
<tr>
<td>Temp. between low-high and low-low limits</td>
</tr>
<tr>
<td>Temp. below low-low limit</td>
</tr>
</tbody>
</table>
• Live plots of front and back crystal zone average temperatures (random numbers)
3. Hardware Monitoring LabVIEW Program

- Blocks show temperatures
- Temperatures randomly generated

<table>
<thead>
<tr>
<th>Condition</th>
<th>Status Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>temp. ≥ high-high limit (20°C)</td>
<td>Red</td>
</tr>
<tr>
<td>high-high (20°C) &gt; temp. ≥ high (18°C)</td>
<td>Yellow</td>
</tr>
<tr>
<td>temp. in operating range (16°C &lt; temp. &lt; 18°C)</td>
<td>Green</td>
</tr>
<tr>
<td>low (16°C) ≥ temp. &gt; low-low (13°C)</td>
<td>Yellow</td>
</tr>
<tr>
<td>temp. ≤ low-low limit (13°C)</td>
<td>Red</td>
</tr>
</tbody>
</table>
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

**Detector Support Group**

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

```
<table>
<thead>
<tr>
<th>All Mod. Chs. ON</th>
<th>All Channels On</th>
<th>All Channels Off</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-35</td>
<td>12-35</td>
<td>13-35</td>
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<tr>
<td>11-34</td>
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<td>13-26</td>
</tr>
<tr>
<td>11-25</td>
<td>12-25</td>
<td>13-25</td>
</tr>
</tbody>
</table>
```
Ansys Thermal Analysis of Crystal Array

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]

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

• DSG is contributing to all phases of detector development