2014 CAP Conference

Pietro Giampa
Queen’s University

DEAP-3600 Resurfacer Underground Deployment and Testing
OUTLINE

1) DEAP-3600
2) Background Reduction
3) Resurfacer Concept
4) Gas Purge System
5) Current Status @ SNOLAB
6) Final Goals
7) Conclusions
DEAP-3600

Experiment

- Single Phase LAr Detector.
- Ar allows for great pulse-shape discrimination
- 255 PMTs, R5912 HQE 8”.
- 3.6T of LAr, 1T of Fiducial Volume.
- Sensitivity of $10^{-46}$ cm$^2$ (SI) for 100 GeV WIMP.
Background Reduction

- The acrylic used for the AV was carefully fabricated in a low Rn environment, with a control to $<10^{-20}$ g/g $^{210}$Pb from Rn exposure.
- The ultimate goal for the resurfacer is to remove 1mm of acrylic from the inner vessel.
- $^{210}$Pb $< 10^{-19}$ g/g, resulting in 0.05 events/3 years.
- To achieve that were extra careful with all the materials used for the resurfacer, to make sure no extra radioactive backgrounds are introduced. We performed a Rn emanation test on all the component materials (very methodical).

<table>
<thead>
<tr>
<th>Component</th>
<th>Date of Measurements</th>
<th>Measured Rn Rate</th>
<th>Rn Decay Rate in AV</th>
<th>Scale Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Bearings</td>
<td>Dec, 9 2012</td>
<td>0.04+/-0.04 mBq</td>
<td>0.41+/-0.41 mBq</td>
<td>11</td>
</tr>
<tr>
<td>3/8” UPW Hose</td>
<td>Sep, 4 2012</td>
<td>0.24+/-0.07 mBq</td>
<td>2.94+/-0.82 mBq</td>
<td>12</td>
</tr>
<tr>
<td>Teflon Lip Seal</td>
<td>Feb, 12 2013</td>
<td>0.27+/-0.02 mBq</td>
<td>0.27+/-0.02 mBq</td>
<td>5</td>
</tr>
</tbody>
</table>

Few examples from the Rn emanation tables for the Resurfacer components, table includes results from more than 60 different components.
Background the Resurfacer is focused on reducing Rn on inner surfacer of the Acrylic Vessel (AV).
Resurfacer Concept

Aiming to remove 1 mm from the acrylic inner surface of the detector.

Actuator  Motor  Bearings  Sanding Pad
Resurfacer Concept

- Rotating Coupling Head
- Electronics Connections
- UPW inlet hoses
- Theta Motor
- Rotating Gear
- Phi Motor
Gas Purge System

**Concept**

- U.L. of 1 mBq of 222Rn inside the AV.
- Need 0.39 mBq/m3 of Purge Ultra-Purified N2 Gas.
- Need a flow of 2.3 m3/Hr, to balance the in/out of UPW.
- ~100L of ultra-purified N2 Gas per day.

Gas Purge System

**Apparatus**

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>5</td>
<td>8.33</td>
<td>0.1895</td>
<td>40.2</td>
</tr>
<tr>
<td>15</td>
<td>75.0</td>
<td>1.3956</td>
<td>4.3</td>
</tr>
<tr>
<td>30</td>
<td>300</td>
<td>4.3761</td>
<td>1.7</td>
</tr>
</tbody>
</table>

Table 1: Display of the flushing rate of ultra-purified N2 from the dewar and the running time (from full fill) of the dewar based on the set power of the dewar.
Current Status @ SNOLAB

Started by assembling all the mechanical components vertically. Rotating head to sanding arms, with extension tube.

Rotating Head
Extension Tube
Sanding Arms

20-06-2014
Resurfacer fully secured onto the deployment frame.

Placed the resurfacer in its deployment frame. Started preparing all the internal hosing for the inlet and outlet UPW and all electrical wiring.
Finished setting up the rotating coupling head. Currently testing the Resurfacer response to compare it with sanding results obtained at Queen’s University. Test is performed on two plates that are made of the same acrylic used for the AV.
Final Goals

- Finishing testing all Resurfacer features. (end of June)
- Deploy Resurfacer inside the AV. (end of June/beginning of July)
- Start running Resurfacer. (July)
- Sanding till we remove 1 mm of Acrylic from the AV. (analyzing the sanded acrylic as we are sanding along)

Background the Resurfacer is focused on reducing Rn on inner surfacer of the Acrylic Vessel (AV).
Conclusions

1) We introduced the concept of the resurfacer and how resurfacing is handled for the DEAP-3600 experiment.
2) We discussed the complementary ultra-purified nitrogen gas system.
3) We elaborated how the resurfacer comes into play for background reduction.
4) We gave an update of the current status at SNOLAB
5) Defined the goals.