New Fast Wire Scanners in 4L1 and 11L1
- Vacuum outgassing measurements and vacuum pressure simulations –
(Friederike Salveter, Jose Antonio Ferreira Somoza, Paul Demarest, Alice Ingrid Michet, Jan Hansen)
Layout of the PSB ring

Simulation 11L1

Position of the new Wirescanners

Simulation 4L1
Outgassing tests on wire scanner components were conducted in 2013 and 2014.

- The highest value of the sum of the measured outgassing:
  \[ Q_{10h} = 1.34 \times 10^{-5} \text{ mbar} \cdot \text{l} \cdot \text{s}^{-1} \]

- An outgassing test of an assembled SPS wire scanner was done in 2014:
  - Outgassing of this Wire scanner:
    \[ Q_{10h} = 8.1 \times 10^{-5} \text{ mbar} \cdot \text{l} \cdot \text{s}^{-1} \]
  - Pumpdown:
    \[ P \propto 1/t^{0.5} \]

- No contamination observed.

=> The tested components don’t explain the outgassing observed.

=> Proposal: test all the possible sources (non-metal) before building the next wire scanners.

*Curtesy of Jose Antonio Ferreira Somoza*
Tests of the new Fast Wire Scanners components

<table>
<thead>
<tr>
<th>Component</th>
<th>Outgassing, 10h (mbar l s⁻¹)</th>
<th>Pollution</th>
</tr>
</thead>
<tbody>
<tr>
<td>The arm</td>
<td>8.4x10⁻⁷</td>
<td>Sulfur</td>
</tr>
<tr>
<td>The optical fibre</td>
<td>6.8x10⁻⁶</td>
<td>Presence of air</td>
</tr>
<tr>
<td>The nut</td>
<td>2.6x10⁻⁶</td>
<td>Presence of oil</td>
</tr>
<tr>
<td>The ferrites</td>
<td>Estimated to 2.0x10⁻⁷</td>
<td>None</td>
</tr>
</tbody>
</table>

- The optical fiber has the highest gas load
  - 2 types of optical fibers available (tested in November 2013)
  - It is recommended to use the one with the lower outgassing rate

- The sulfur detected in the arm is not acceptable in a vacuum system

- Not all the components that will be installed in the wire scanners have been received for the measurements

Curtesy of Alice Ingrid Michet
Pressure simulation - Current pumping

### Parameter used in the simulation

<table>
<thead>
<tr>
<th>Parameter used in the simulation</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>4</td>
<td>Weeks</td>
</tr>
<tr>
<td>Outgassing Stainless Steel</td>
<td>2x10^{-11}</td>
<td>mbar l s^{-1} cm^{-2}</td>
</tr>
<tr>
<td>Total outgassing of 1 Wire scanner</td>
<td>1x10^{-5}</td>
<td>mbar l s^{-1}</td>
</tr>
<tr>
<td>Current Pumping Speed Ion pump 1 &amp; 2</td>
<td>400</td>
<td>l s^{-1}</td>
</tr>
<tr>
<td>Current Pumping Speed Ion pump 3</td>
<td>270</td>
<td>l s^{-1}</td>
</tr>
<tr>
<td>Pumping speed Titanium Sublimation Pump (TSP)</td>
<td>1000</td>
<td>l s^{-1}</td>
</tr>
<tr>
<td>Simulated Gas</td>
<td>N_2</td>
<td>-</td>
</tr>
</tbody>
</table>
Pressure simulation - Current pumping

Solid graphs:
• No wire scanners
• TSPs not sublimated

Dashed graphs:
• No Wire scanners
• TSPs sublimated

⚠️ Due to the amount of simulations only the green slopes will be shown as reference in the following graphs
Pressure simulation - with Wire Scanners

Outgassing per Wire scanner:
1 \times 10^{-5} \text{ mbar s}^{-1}
Pressure simulation - with Wire Scanners

Solid graphs:
- Wire scanners in place
- TSP not sublimated

Dashed graphs:
- Wire scanners in place
- TSP sublimated

+ ca. 1.2 decades!
Pressure simulation - additional pumping

Additional pumps installed on the wire scanner:
- 1 NEG pump (SAES Nextorr® D-1000-10) at each wire scanner (320 l s⁻¹ for N₂)
Pressure simulation - Wire Scanners & additional pumping

Solid graphs:
- Wire scanners in place
- Add. pumping of 320 l s⁻¹ per Wire scanner
- TSP not sublimated

Dashed graphs:
- Wire scanners in place
- Add. pumping of 320 l s⁻¹ per Wire scanner
- TSP sublimated

BASELINE without Wire scanners:
- TSP not sublimated
- TSP sublimated

With Wire scanners:
- TSP not sublimated + WS
- TSP sublimated + WS

< 1 decade
+ ca. 1.2 decades!
Summary (pressure after 4 weeks)

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>8.0x10^{-8} mbar</td>
<td>7.9x10^{-8} mbar</td>
</tr>
<tr>
<td></td>
<td>Sublimation</td>
<td>5.2x10^{-8} mbar</td>
<td>4.7x10^{-8} mbar</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>4x320 l s^{-1}</td>
<td>No</td>
<td>2.9x10^{-8} mbar</td>
<td>3.1x10^{-8} mbar</td>
</tr>
<tr>
<td></td>
<td>Sublimation</td>
<td>2.7x10^{-8} mbar</td>
<td>2.6x10^{-8} mbar</td>
<td></td>
</tr>
</tbody>
</table>

Conclusion:
- With the current high outgassing additional pumping at the wire scanners is required to meet the vacuum specifications
  - Extra costs (pumps, cabling, controls)
  - Proposal: Use a manifold for 4 Wire Scanners
  => One big pump could be used instead of four small ones
- The outgassing of the different components should be reduced whenever possible