High Power Hg Target Conceptual Design Review

Operating Scenario / Hg Handling / End-of-Test Handling

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## Preliminary Hg Target System Operation – Full Field (15 Tesla)

<table>
<thead>
<tr>
<th>Time (sec.)</th>
<th>Solenoid **</th>
<th>Power Supply</th>
<th>Target Pump System</th>
<th>Proton Beam</th>
<th>Optical Diagnostic</th>
</tr>
</thead>
<tbody>
<tr>
<td>minus 30</td>
<td>Magnet full of LN$_2$ @ 80ºK</td>
<td>Standby</td>
<td>Fill Hg supply line</td>
<td>Call for beam</td>
<td>Off</td>
</tr>
<tr>
<td>minus 10</td>
<td>Purge LN$_2$ with gaseous He</td>
<td>Standby</td>
<td>Standby</td>
<td>Wait for beam</td>
<td>Standby</td>
</tr>
<tr>
<td>0 to 9.5</td>
<td>Magnet full of He gas</td>
<td>Start ramp to full current</td>
<td>Ramp Hg to full flow</td>
<td>Wait for beam</td>
<td>Standby</td>
</tr>
<tr>
<td>8 to 9.0</td>
<td>Magnet full of He gas</td>
<td>Ramping to full current</td>
<td>Steady state Hg jet</td>
<td>Wait for beam</td>
<td>Turn on laser lighting</td>
</tr>
<tr>
<td>9.5 to 10.5</td>
<td>Magnet full of He gas</td>
<td>At full current</td>
<td>Steady state Hg jet</td>
<td>24 GeV, 1 MW</td>
<td>Operate high speed camera</td>
</tr>
<tr>
<td>10.5 to 11.0</td>
<td>Magnet full of He gas</td>
<td>Begin de-energizing</td>
<td>Shut down syringe pump</td>
<td>Standby</td>
<td>Turn off laser light and camera</td>
</tr>
<tr>
<td>11.0 to 15.0</td>
<td>Magnet full of He gas</td>
<td>De-energize to zero</td>
<td>Standby</td>
<td>Standby</td>
<td>Off</td>
</tr>
<tr>
<td>15.0 to 1800.0*</td>
<td>Fill magnet with LN$_2$ @ 80ºK</td>
<td>Cool down to ~80ºK</td>
<td>Refill syringe cylinder</td>
<td>Standby</td>
<td>Off</td>
</tr>
</tbody>
</table>

* Assumes a 30-minute dwell period.
** Solenoid power supply is in “Standby” for zero-field operation.
Magnet Operating Scenario

Parameters of Pulse Coil Precooled to 69 K and Energized at 600 V to 7200 A

Bob Weggel’s 10-14 analysis of the LN2 magnet operation
Plan For Handling Hg

Peristaltic pumping is considered to present the least risk of spillage for installing Hg
Hg Handling (cont.)

- Install and remove Hg with a peristaltic pump
Hg Handling (cont.)

- Use spare Hg from the TTF inventory (new Hg is ~$600 liter) ... ??
- Ship in 2-liter flasks
- Recover virtually all Hg at the end of tests; return the Hg to ORNL
Residual Radiation On Solenoid & Target Equipment (H. Kirk MARS Calculation)

- Assume:
  - 200 pulses
  - $16 \times 10^{12}$ protons/pulse average
  - 30 days running

- Then the contact radiation on the iron exterior will be:
  - After 1 hr  40 mrad/hr
  - After 1 day  21 mrad/hr
  - After 1 week 13 mrad/hr
  - After 1 mo.  5 mrad/hr
  - After 1 year 1 mrad/hr
Residual Radiation In Hg (H. Kirk)

- Assumptions:
  - 200 pulses
  - $16 \times 10^{12}$ protons/pulse
  - 4 weeks exposure time
  - 24 GeV proton beam
  - 1 cm diameter – 30cm long Hg target

- After 1 sec: 2.5 Curies
- After 1 month: $4.3 \times 10^{-3}$ Curies
- After 1 year: $4.9 \times 10^{-4}$ Curies
End Of Testing At CERN

- After last pulse, leave equipment in place for 1-2 weeks
- With minimal dismantling in situ, move equipment out of beam line
- Leave in tunnel area as long as CERN permits, up to 1 year ... ??