Target Design Meeting

Nozzle & Hg Collection Tests, Design Requirements, Instrumentation, Containment, Windows, Diagnostics, Controls, Base Support Structure, …

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Topics/Issues For Discussion

• Need an interpretation of the requirements in ISO 2919, Table 2, Class 2
  – Temperature: -40°C to 80°C
  – External pressure: 25 kPa (4 psi) to atmospheric
  – Impact: 50 grams from 1 meter
  – Vibration: 3 X @ 10 minutes; 25-500 Hz @ 49 m/s²
  – Puncture: 1 gram from 1 meter

• Position of the nozzle relative to the PB line
  – Can the jet be above the PB line with a 60-cm interaction length?
  – Must the jet have a 100 mrad angle with the B-axis?
Topics/Issues For Discussion (cont.)

• Containment (air activation)
  – air atmosphere in the primary and secondary containments, not He in the solenoid bore (~0.3 m³ of air)

• Stray magnetic fields
  – Can the base support structure be carbon steel?
  – Will the motor/magnet operate properly in modest fields, for example
    • impeller at 1750 rpm in a ~0.1 T field (#3 in next slide)
Magnetic field distribution: the axes are in meters; the rectangle is one half of the solenoid.

The volume within the conductor is > 9.6 T (red), > 6.1 T (orange).
The field at Z=0, R=0.6 is > 0.6 T, at R=1.0 (base support structure), B> ~0.2 T.
The field at Z=-2.5, R=0.4 (pump motor) is 0.03<B<0.07 T.
Topics/Issues For Discussion (cont.)

- Can the G-10 cylinder support the target insert tube and the contained Hg?
- What are the dimensional tolerances for the tube?
- Diagnostic windows
  - Viewing locations: how many and where?
Topics/Issues For Discussion (cont.)

• Assembly/Installation
  – Need for fiducials (optical targets) on the solenoid and the target system for precise alignment of target, magnet, and beam line

• Installation at CERN
  – What are the constraints for lowering components into the tunnel area
  – What is the maximum “foot print” for maneuvering components into the TT2A tunnel
  – Control room layout
  – Others …
• Hg Target System Instrumentation:
  – Vapor monitor in secondary containment, 5 minute sampling rate; remote readout (Jerome)
  – Flow meter (venturi ??) to monitor velocity in supply tube; remote readout
  – Temperature to monitor sump tank; remote readout
  – Level sensor to monitor sump tank; remote readout
Topics/Issues For Discussion (cont.)

- **Electrical Requirements**
  - 3-Phase, 460 VAC/90 A, 5060 Hz for the pump drive motor
  - Variable frequency drive, manual or computer controlled
  - Interfaces with solenoid control system and proton beam control system
  - Emergency shut off coupled to PB line emergency shutoff, as well as manual override
# Hg Target Operating Scenario

## Preliminary Hg Target System Normal Operating Scenario

<table>
<thead>
<tr>
<th>Time (sec.)</th>
<th>Solenoid</th>
<th>Target</th>
<th>Proton Beam</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-30.0</td>
<td>-</td>
<td>Ramp to 20 m/s</td>
<td>-</td>
</tr>
<tr>
<td>30.0-39.5</td>
<td>Ramp to full current</td>
<td>Maintain 20 m/s</td>
<td>-</td>
</tr>
<tr>
<td>39.5-40.5</td>
<td>Maintain full current</td>
<td>Maintain 20 m/s</td>
<td>24 GeV, 1 MW</td>
</tr>
<tr>
<td>40.5-41.0</td>
<td>Begin de-energizing</td>
<td>Shut down pump</td>
<td>-</td>
</tr>
<tr>
<td>41.0-45.0</td>
<td>De-energize to zero</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>45.0-1800.0</td>
<td>Cool down to ~80°K</td>
<td>Stand by</td>
<td>Stand by</td>
</tr>
</tbody>
</table>
Princeton Tests Using 20-Hp Pump

• Assess nozzle characteristics
  – Change velocity at nozzle (10, 15, 20, 25, … m/s), plot jet profile

• Assess Hg “catcher” configurations for
  – Turbulence
  – Back splash
  – Volumetric recovery

Test Data Is Needed ASAP!