High Gradient R&D Coordinating Committee
December 12, 2000

Agenda

1. High Gradient R&D Schedule - (Attached)
   a. Review and Discussion (Burke)

2. Process and Installation Plans for T20VG5N and T105VG5N
   (Cornuelle/Fant/Rago/Pearson)

3. Review of Cleaning R&D Plans (Cornuelle)

Upcoming: Dec 19 Review of Structure High-Temperature Processing Plan (Pearson)
Process and Installation Plans for T20VG5N and T105VG5N

Color legend:
Yellow: Caution: Pay attention to
Red: Potential damage steps
Green: Suggested course of action
Blue: Needs more evaluation

1. Wet fire in H₂ at ~750°C
2. Exposed to Air
3. Dry fire in H₂ at ~900°C
4. Exposed to Air
5. Placed in 304L stainless steel can with cupronickle eyelets and a Ø1-1/8" copper pinch off, vacuum bake at 650°C for ~2 weeks.
6. Leak check can and pinch off. Can’t leak check pinch-off and no pumping on can, could draw in air if under vacuum with leak. May be storing can up to two weeks.
   Post vacuum atmosphere options:
   a. Leave under vacuum
   b. Atmosphere with nitrogen
7. Move can to the clean room adjacent to plating shop. Clean room Class unknown.
8. Vent can to nitrogen.
   Ed Garwin will see if Gerry Collet can adapt or modify the standard tool they use to perform this operation in the PEL. It involves puncturing the tubulation with a sharp point and then allowing them to meter the rate at which gas flows back into the can. It includes a pressure gauge. If the PEL tool is not feasible, then there should be a pressure gauge or some equivalent device that enables us to meter the rate at which nitrogen flows back into the can. This will prevent a rapid movement of gas that could stir up dust in the can.
   Feasibility of the PEL tool must include ease of use and potential delay to the project and should be evaluated by a small group [2-3 people] before implementation.
   Nitrogen is from boil-off and transported through building manifold to clean room and is submicron filtered. The filter for the nitrogen backfill gas should be at the can end of the nitrogen line and not at the wall side to prevent loose particles in the line from being drawn into the can.
9. Eyelets are cut with shears and lifted out into clean room air. Structure weight >70 lbs.
   Selection of this option needs additional evaluation by Chris Pearson.
   Lifting options
   a. Lift by hand
   b. Use clean chain fall
   c. Extend clean room and use adjacent pit.
   d. Use clean cherry picker
10. After the can is opened:
   Dust-free latex gloves should be used to handle the structure.
   Nitrogen purge should be established as quickly as possible. Purge is to have a controlled entrance at one end of the structure consisting of a conflat flange with a sub-micron filter and hard plumbed (swaglock) copper line. All other ports will be covered with aluminum foil only, no lint free paper until further assembly. Flange ports are to be assembled one at a time wherever possible.

11. Assemble structure on strong back in clean room air.
   Assembly Options: What gets put on at this stage?
   There are 6 possible open ports, 2 beam line, 2 input and 2 output
All assembly components will have conventional clean handling and a 150°C bake but will have been vented to nitrogen and will most likely have a high particulate content.

Option 1: Standard procedure (6 “open” ports at installation)

a. Attach beam phase monitor with window, cross assembly with ion and convectron gauge and beamline spool and bakeable valve to one end of accelerator. Attach blank flange to other end of accelerator.
b. Attach four blank WR90 flanges to the input and output waveguide flanges.

Option 2: (3 “open” ports at installation)

a. Same as a. above.
b. Attach input waveguide bends, magic tee and one blank WR90 flange to input end. Not normally transported with these items, will require addition of sufficient support system.
c. Attach output waveguide bends, directional coupler, ion pump ports, ion pumps and loads to output end. Not normally transported with these items, will require addition of sufficient support system.

Option 3: (0 “open” ports at installation)

a. Same as a. above, except attach an inline or gate valve at both ends of beamline assembly. Valves need to be acquired and system modified to provide space for them in beamline.
b. Same as b. above, except replace blank flange with x-band high power window assembly. Window(s) need to be acquired and system modified to provide space for them.
c. Same as c. above.

Option 4: Add RGA to assembly

Assume this suggestion is for in-situ use:

Is this for one or both of the structures planned for the next installation?
Need to locate or purchase RGA head and electronics for long term (months) use.
Need to modify beamline layout and/or find space to accommodate this additional equipment, which will include vacuum port, valves and ion pump.

After assembly above is complete, system will be leak checked (possibility of drawing in clean room air) and either left under vacuum or vented to nitrogen and valved off ready for alignment.

12. Align:

a. Accelerator needs to be aligned to +/- .04". This tolerance to be confirmed by Chris A. Chris P. will have tooling ball welded on flanges prior to assembly. Should this be done on CMM or by alignment group?
b. Other components need to be aligned on strongback prior to installation in NLCTA.

13. Transport:

Accelerator assembly will travel on a cushion in a truck-bed to the NLCTA, and moved with a bridge crane once in the NLCTA building. It will be moved on rolling carts into the tunnel.

14. Install:

a. For option 1 or 2 from step 10, system will be vented to filtered nitrogen from a dewar. Portable cleanroom (shower curtain) will be installed over installation area. This may require modifications.

Evaluation of portable cleanroom or portable clean room in NLCTA is required. This should be done by a small group of 2-3 people. It is estimated that it may take 10 weeks to evaluate the options and 1-2 months to implement the choice. It will most likely cost more than $20K.
b. Flanges will be removed one or two at a time as required by assembly. Structure will be connected to beamline and new waveguide run, but not SLED system until after successful leak check.
c. Structure will be pumped down and leak checked. Possibility of drawing in tunnel air and helium if leak exists.
d. Structure will be vented again to filtered nitrogen and interconnection to SLED will be made. Final pump down and leak check. Again there is a possibility of drawing in tunnel air and helium if leak exists.
15. In situ Bake:

Evaluation of options for in-situ bake in NLCTA is required. This should be done by a small group of 2-3 people. Any option selected that has not been done before should be pre-tested on a dummy structure. It is estimated that it may take 1-2 month to evaluate and test the options.

What gets baked?

a. Nothing
b. Structure only
c. Structure and new components

What temperature?

a. Everything at 150°C (or structure only at 150°C)
b. Everything at 200°C (or structure only at 200°C)
c. Structure at 200°C, everything else at 150°C

What method?

a. Heating with induction heater in tunnel.
   Need power for two 30 amp, 208 volts in tunnel.
b. Hot air
d. Other?
Mfg and QC Subgroup Status

- Enhanced “Standard” Cleaning
  - Water Samples Taken (Particle Counts)
  - Filters and Pumps Available
  - Researching Maintenance Contract for Room
  - Particle Counter and Ultrasonics/Megasonics Needed

- Glow Discharge Cleaning
  - Work Order Written
  - Vacuum Group Has Preliminary Design for Small Tests
  - Transition to Full-size Structure Being Planned
  - Material List Being Assembled

- Ultrapure Water Cleaning
  - Leaking Tank Identified and Removed
    - Work Order Written to Replace Tank
  - System Reconfigured
  - Broken Fitting Needs Replacement
  - System Needs Flushing and Evaluation
  - Reaction Chamber Needs Identification/Implementation
### RF Breakdown - Manufacturing and QC Sub-Group Tasks

**Cost and Schedule (Principal Items Only)**

($000)

<table>
<thead>
<tr>
<th>Completion Date</th>
<th>M&amp;S</th>
<th>FTE's</th>
<th>Cu</th>
<th>Nb</th>
<th>SS</th>
</tr>
</thead>
</table>

#### 1. Gas Load (Surface and Bulk) Reduction

- **T20VG5N Structure As Is**
  - Vacuum Firing at $= 1000 \, ^\circ\text{C}$
  - In-Situ Bakeout in NLCTA at $\sim 220 \, ^\circ\text{C}$

- **T20VG5N Structure With Windows (No Air Exposure)**
  - Vacuum Firing at $= 1000 \, ^\circ\text{C}$
  - Vacuum Bakeout at $450 \, ^\circ\text{C}$
  - In-Situ Bakeout in NLCTA at $\sim 220 \, ^\circ\text{C}$

- **T105VG5N Structure**
  - Vacuum Firing at $= 1000 \, ^\circ\text{C}$
  - In-Situ Bakeout in NLCTA at $\sim 220 \, ^\circ\text{C}$

#### 2. Removal of Carbon Compounds

- Wet H$_2$ Fire Windowtron Nose
  - Dec-00
- Wet H$_2$ Fire T20VG5N
  - Nov-00
- Wet H$_2$ Fire T105VG5N
  - Dec-00

#### 3. Understand Asymmetry in Arcing in Windowtron Noses

- Double H$_2$ Fire Both Noses
  - Dec-00
- Measure/Equalize Nose Temperatures
  - Jan-01

#### 4. Remedial Surface Particle Removal (Post-Brazing)

- Particle Counts on Travelers/Sample Parts, SEM/EDX, 10 Units
  - Mar-01
- XPS Travelers, 1 hr/traveler, 10 units
  - Mar-01
- Evaluate SLAC Low Pressure Ultrapure Water
  - Feb-01
- Evaluate SLAC Gun Cleaning Setup (Mulhollan Equipment)
  - Jan-01
- Weigh, AFM, XPS, SEM Cu,Nb,SS, 1 each rinsed, one control
  - Jan-01
- Cu,Nb,SS Coupons - High Pressure Water Rinsing at Cornell and DESY
  - Apr-01
- Weigh and AFM Surface Finishes, 11 Before/8 After Rinsing
  - Apr-01
<table>
<thead>
<tr>
<th>Description</th>
<th>Date</th>
<th>M&amp;S</th>
<th>FTE's</th>
<th>Cu</th>
<th>Nb</th>
<th>SS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rinsing at Cornell/DESY, 8 coupons (2 Cu, 1 Nb, 1 SS)</td>
<td>Mar-01</td>
<td>$10</td>
<td>0.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>XPS Coupons at SLAC 11 Before/8 After Rinsing</td>
<td>Apr-01</td>
<td>$4</td>
<td>0.012</td>
<td>0.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEM/EDX Particles on Coupons at SLAC 11 Before/8 After Rinsing</td>
<td>Apr-01</td>
<td>-</td>
<td>0.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ultrasonics/Megasonics at SLAC</td>
<td>Apr-01</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acquire/Install Megasonics Unit</td>
<td>Jan-01</td>
<td>$15</td>
<td>0.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weigh and AFM 5 Coupons' Surface Finish, Before/After Sonic</td>
<td>Mar-01</td>
<td>$1</td>
<td>0.01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Megasonic 5 Coupons</td>
<td>Mar-01</td>
<td>$1</td>
<td>0.2</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>XPS 5 Coupons Before/After Sonic</td>
<td>Apr-01</td>
<td>$2</td>
<td>0.012</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEM/EDX Particles on 5 Coupons, Before/After Sonic</td>
<td>Apr-01</td>
<td>-</td>
<td>0.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auger Scans for Non-Copper at Breakdown Sites</td>
<td>Dec-00</td>
<td>$1</td>
<td>0.006</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>XPS, AES 2 Cornell Samples</td>
<td>Dec-00</td>
<td>-</td>
<td>0.005</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEM/EDX 2 Cornell Samples</td>
<td>Feb-01</td>
<td>$1</td>
<td>0.005</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auger Windowtron Nose (1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**5. Produce "Chevy/Cadillac" Particle-Free Structure**

<table>
<thead>
<tr>
<th>Description</th>
<th>Date</th>
<th>M&amp;S</th>
<th>FTE's</th>
<th>Cu</th>
<th>Nb</th>
<th>SS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design and Assemble Test Vehicle</td>
<td>Jan-01</td>
<td>$5</td>
<td>0.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design and Assemble Process (Equipment and Fixturing)</td>
<td>Feb-01</td>
<td>$15</td>
<td>0.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perform Tests; Select Process(es)</td>
<td>Apr-01</td>
<td></td>
<td>0.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perform Process on NLCTA-Testable Structure</td>
<td>Jun-01</td>
<td></td>
<td>0.1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total**                                                                   |       | $91  | 4.176 |    |    |    |