High Gradient R&D Coordinating Committee
November 21, 2000

Agenda

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

2. Test-Stand 1 ("Window-tron") Goals and Schedules (Sprehn)
Klystron Department Breakdown Study Summary

Goals: Find trends, help NLCTA, do science

Questions: Does X make a "difference"
Definition of difference involves reduced processing time required to reach a sustainable gradient

Diagnostics:
- Audio - not in place
- Visual - telescope with video camera looking at noses, optical filters R,G, and B with detectors
- Semivisual - IR and UV detectors in place, optical spectrometer in place
- Xrays - PMT's, scintillators and handheld meters used
- RF - standard stuff plus data logging of missing transmitted in %'s from average
- Vacuum - standard stuff plus extractor gauge
- Temperature - TC's on noses in-place, dT cavity losses in new windowtron
- SEM, EDX, Chemical analysis

Prior experiments with variable definitions and no automation:
1: Particle contamination - suggests micron-sized surface contamination not a big issue
2: Gas injection after processing - interesting, if cloudy, results
3: High field levels - some data, but confusing translation may indicate that these levels are, or are not, different than those seen in the NLCTA
4: Boundary outgassing - no vacuum-fire and no bake makes for trouble
5: Dark current - Reduction as processing continues, an indicator for processing?
6: Pulse-width - shows dependance but limit may not

Latest Experiments with common definition of breakdown, some automation:
1: "Lifetest" at 150 MV/m - done...will continue gathering data with future experiments
2: Xrays after processing - done up to 250 MV/m
3: Xrays during processing - will continue gathering data with future experiments
4: Lo Q cavity - On-test, currently at 200 MV/m

Upcoming Experiments with common definition of breakdown, more automation, new test set:
Processing:
- Bakeout temperature - some data available, new experiment planned
- Pulselength/processing - some data available, new experiment planned
- Heat/cool processing - new experiment planned
- Extra vac firing/H saturation/bakeout - experiment in queue
- Annealing - prior experiment confusing, true experiment not defined
- Vacuum - some data available, future experiments under discussion
- Gas Specie - some data available, can piggy-back on experiments?

Treatment:
- Electron bombardment treatment underway with FM technologies
- Laser treatment under discussion, lasers available with vac chamber

Materials & Surface: Surface finish - Diamond turned and poorly machined noses tips
- Cu plating - Research under way
- Cu-W - noses in-hand
- Glidcop - noses in-hand
- Low purity/High purity Cu - start with the low
- Single crystal Cu - material available
- Stainless Steel - material available, not possible on ring experiment
- Coatings - Previous experiments had low gradients obtainable

Bdwn Qs and exp plan.doc
**Goals:** Investigate effects of residual hydrogen, vacuum-firing, and group-velocity.

**S13 - Previous experiment:**
Hi Q cavity run to 200 MV/m and dropped to 150 MV/m for 200 hours.
Results: Approximately 90 events were noted (all but a handful which occurred during the initial run-up) and 90 marks were found.
Explanation: Each event (as measured by missing rf power) detected corresponds to material changes on the noses.
Additional: As with previous experiments, activity on the adjustable nose is much greater than that of the fixed nose (~80/20 split).
Explanation:
1) thermal capacity of adjustable nose is lower than the fixed nose,
2) the adjustable nose goes through an extra braze cycle (although both are vacuum-fired later).

**S14:**
Status: Currently under test.
Low Q cavity with approx. of processing scheme of previous Hi Q test.
Results to date: Less activity than previous cavity.
Possible explanations:
1) this cavity went through a vacuum bake,
2) Lo-Q (higher group velocity is better than Hi-Q...doubtful,
3) no statistical difference from previous cavity.

**Next 4 (or more) experiments will have:**
1) thermocouple wells close to the nose tips and at back side of flange.
2) vacuum-firing (this is customary for the last year)
3) vacuum-baking (this has been customary except when fast turnaround was desired as in the previous experiment)
4) "standard" machining, cleaning, handling of klystron dept.
5) either an extra braze cycle on the fixed nose or extra-long vacuum-firing of the adjustable nose (or both depending on state of nose prior to experiment).
6) Rapid turnaround (one is under bake while other is under test, alternating between a Hi-Q and Lo-Q windowtron).
7) Common processing protocol (established during S13 and S14).
TS1 "windowtron" current test plans through February 2001

S15:
Status: Currently in vacuum bake station-cooling.
Description: Same as S14 but Hi Q cavity and the fixed nose passes through dry H braze cycle to equalize number of runs through furnaces. This experiment will look to find if H cycling explains asymmetrical damage to opposing noses.

S16:
Status: Noses under fab (braze, clean, machine, fire...).
Description: Same as S15 but Lo Q cavity.

S17:
Status: Noses under fab (braze, clean, machine, fire...).
Description: Same as S15.

S18:
Status: Noses under fab (braze, clean, machine, fire...).
Description: Same as S15 but Lo Q cavity.

Possible variations of S17 and S18:
If S15 and S16 have symmetrical damage pattern, try to reverse previous damage pattern by additional vacuum-firing of adjustable nose.