10/19/88
Q.A.Kerns
Fermilab

LINAC UPGRADE

Trip report for Oct. 11,12 re SLAC assistance to FNAL upgrade.

1) Burton Richter assigned Greg Loew to locate building space for FNAL people and test equipment in the event FNAL needs to tune 805 MHz accelerating structures at SLAC. Greg Leow was concerned at first that FNAL would use the services of SLAC people (already loaded up with work) to do the tuning. I assured Richter and Leow that we only needed space- we would provide people and test equipment. Leow agreed the space could be found.

2) Matt Allen picked T.G. "Terry" Lee as the SLAC member of a Klystron review team that would visit the vendor (e.g. Litton) from time to time and evaluate their progress toward successful completion of the contract.

3) Matt Allen himself offered to sit on a review panel that will look at the overall plan for the FNAL linac upgrade and make recommendations to us.

4) I visited Norman Dean, Assistant Director for Mechanical Systems, to discuss SLAC hydrogen brazing facilities. SLAC has both pit furnaces and base furnaces. Norman Dean was the one who rescued the klystron production from a 14% yield and turned it around to 95+% by attention to every detail. Dean reports to K. Lathrop. Dean is highly respected by all the SLAC persons I talked to. His comments about our job:

"Sending copper pieces through a hydrogen anneal to see if they blister or swell, as an acceptance test for OFE grade, is way off the mark (downright idiotic!). So is the bend test. You can't be serious.....! If you wish to test, you send the copper piece through the hydrogen anneal, slice off coupons from representative places, polish and examine under a metallurgical microscope. What you will see is a network of crystals, of course, but also numerous tiny pits (holes, actually) where oxygen was but is now gone because it reacted with hydrogen. The question whether you have OFE Grade 1, or 2, or3, or junk- just depends on the hole count per square mm."

"AMAX copper used to be good, but not now because there is a lot of recycled copper like old telephone wires etc being added to the melt. We have some old AMAX in storage that we are hanging on to because it is of excellent quality but we will not buy it new-it's nothing but trouble. You want Hitachi copper-they have good delivery and are agreeable to providing the billet sizes we ask for-very accommodating. It's ironic-the Hitachi plant is absolutely modern and efficient, and the reason is that the AMAX people went over there and put it up for Hitachi ! AMAX knows exactly what to do to make good copper but they aren't doing it.

Yes, the Chinese have a brazing facility and we helped them set it up. We do brazing for Brookhaven and for the ALS in Berkeley. Normally we like to go over the prints first before accepting a job- and we have been known to refuse jobs we don't think will work. Forging? For your job, forging is not needed at all and may make the copper worse because it introduces contaminents."

Norman Dean introduced me to Carl Rago, acting department head of the mechanical fabrication department. Carl gave me a tour of the brazing facility. Carl heads one of the five groups under Dean and is the person at SLAC modernizing their collection of CNC machines.

The next page has some pictures taken at SLAC.

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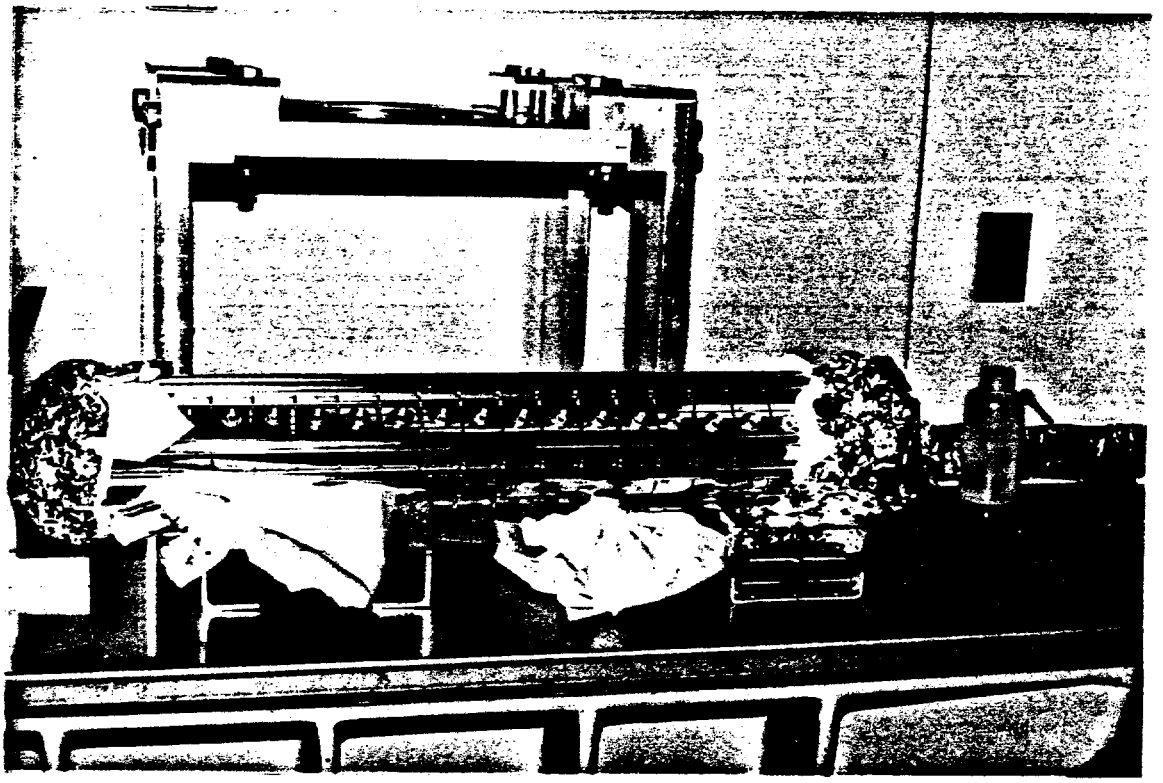
Pictures taken at SLAC

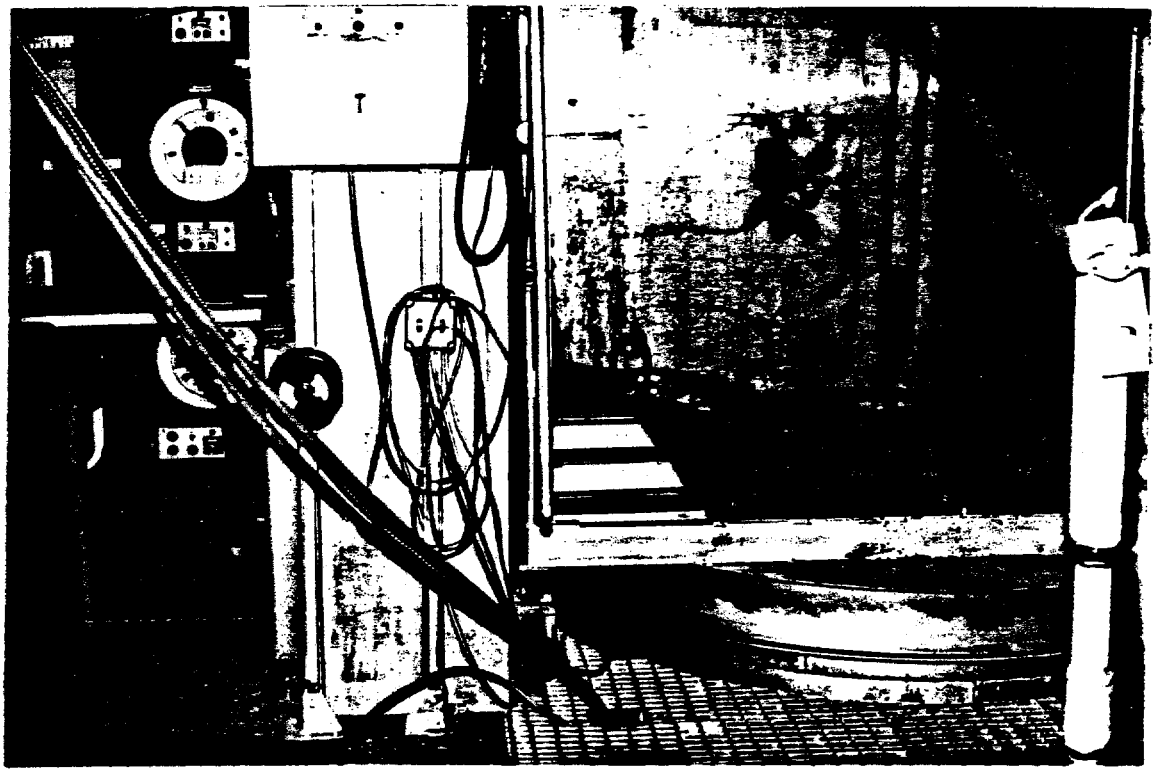
This shows Carl Rago on the left and Don , the expert who runs the brazing furnaces, on the right.

The copper item is the third embodiment of a high-gradient disc-loaded guide section that goes immediately downstream of the positron target. The first two died for various reasons; one problem was severe sparking due to poor vacuum, since corrected. The entire power of one SLAC klystron goes into this two meters- that accounts for all the water cooling lines running lengthwise.

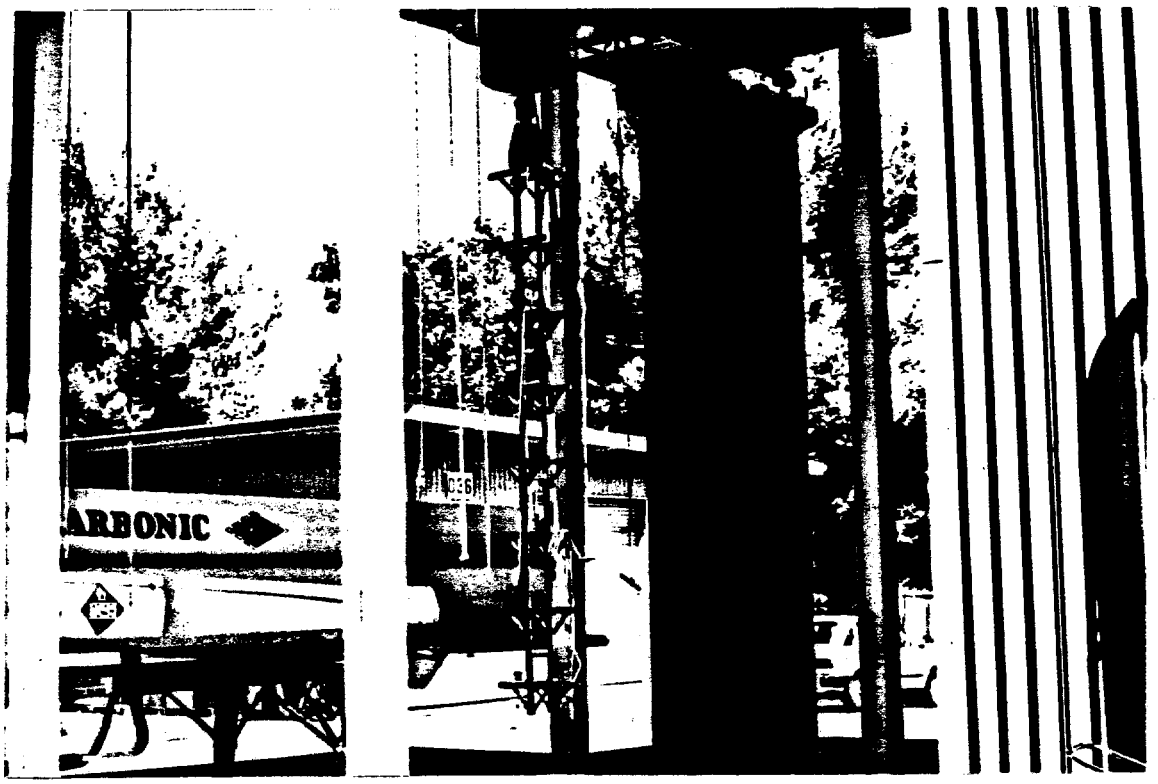
This is a section of the disc-loaded guide for the Advanced Light Source in Berkeley. Instead of disc and tube geometry, it is nesting cup. Each cup has two end-milled thin spots for tuning-that's where one sees the row of stainless nuts that will be brazed on to allow dinging in or pulling out. There's another row on the back side out of sight. Carl Rago believes he can turn out the cups so accurately on his CNC machines that with a little experience, the need for tuning adjustments will go away. In this picture, the water pipes and tuning nuts are yet to be brazed on.



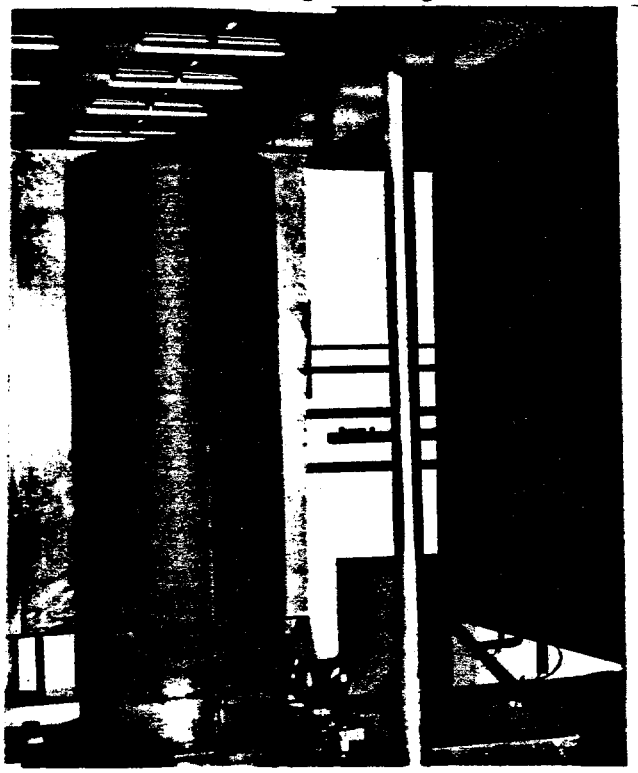
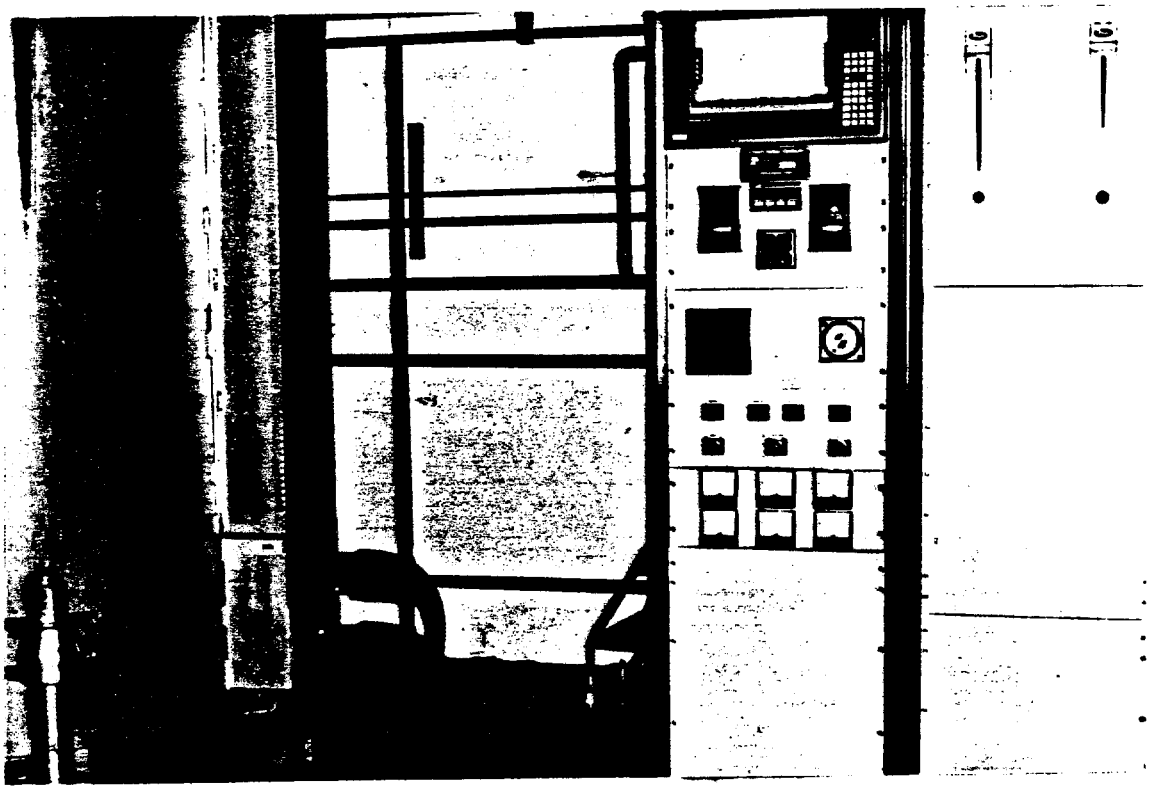
Pit furnace. Extends about 20' down.



Support Hanger (foreground) and cans (further back) that go down into the pit. The support hanger can handle a maximum of 300 pounds. The cans are too small in ID for our work.



Base furnace. Interior of can is big enough for an object 24" d. x 5' high. Weight is no problem.



Heating element shroud and controls. Temperature profile is maintained veru constant over the entire height of the furnace according to Carl's measurements. The control panel is smart: the entire temperature cycle over time can be programmed in at the beginning and requires no operator attention until time to remove the finished product.