DAΦNE TECHNICAL NOTE

INFN - LNF, Accelerator Division

Frascati, January 21, 1994

Note: **V-12**

NOTES ON SOME "TECHNOLOGICAL" TOPICS

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1) KLOE Be Chamber

Assuming ρ = 4.6 x 10^{-6} Ω cm, the total power absorbed in the Be shield is ~ 4 Watts, which results in ΔT across the 50 μm shield of ~ 50 °K at full current. Due to beam mis-steering or higher ρ, the temperature could be higher, but in any case it should be O.K. In order to prevent any buckling during bake-out, or glow discharge ~ 4 longitudinal cuts in the foil seem adequate.

When the chamber is delivered, the Be sleeve should be thermally cycled many times to check Be brazes and to ascertain that no buckling will occur. A heater can be inserted as shown in Fig. 1 and ~ 10 W applied; say 2 hrs on 2 hrs off for several days. Then open and examine!

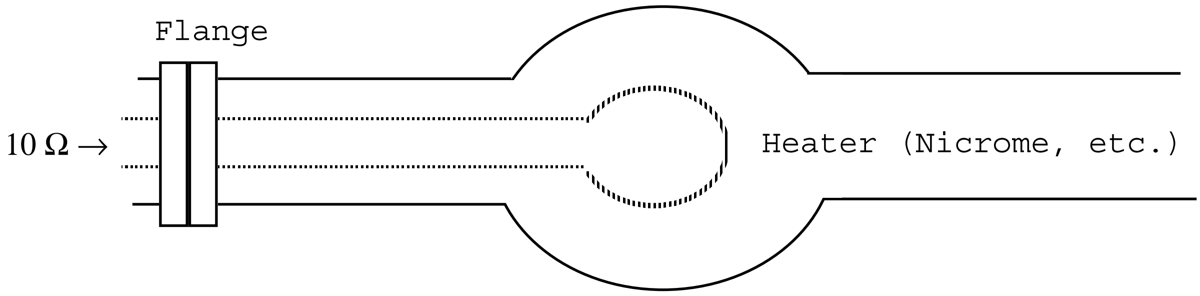
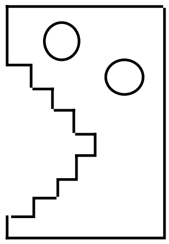


Fig. 1

2) Arc Chambers

a) For all leak checking minimum detectable leak method (AVS standards) should be used. The calibrated He leak is inserted into the chamber.
The combination of TMP pumping station and Leak Detector should be used.

b) Cu Absorbers



c) Glow Discharge
TSP cartridges can be used as electrodes or a SS or Cu rod can be inserted into TSP flange. Bleed to O_2 and reinsert TSP.
Ion pumps should have screens to measure low pressures.

d) Each arc chamber should include:
- Cold cathode gauge
- High pressure gauge (Convectron)
- 2 3/4" all metal valve (Varian)
- Bleed valve.

For roughing one 6 cm diam. manual gate valve minimum (10 cm diam. max) or if you like (and have enough money) two 6 cm valves can be used in each end of the arc chamber.

3A) Ti Nitriding (Ti N)

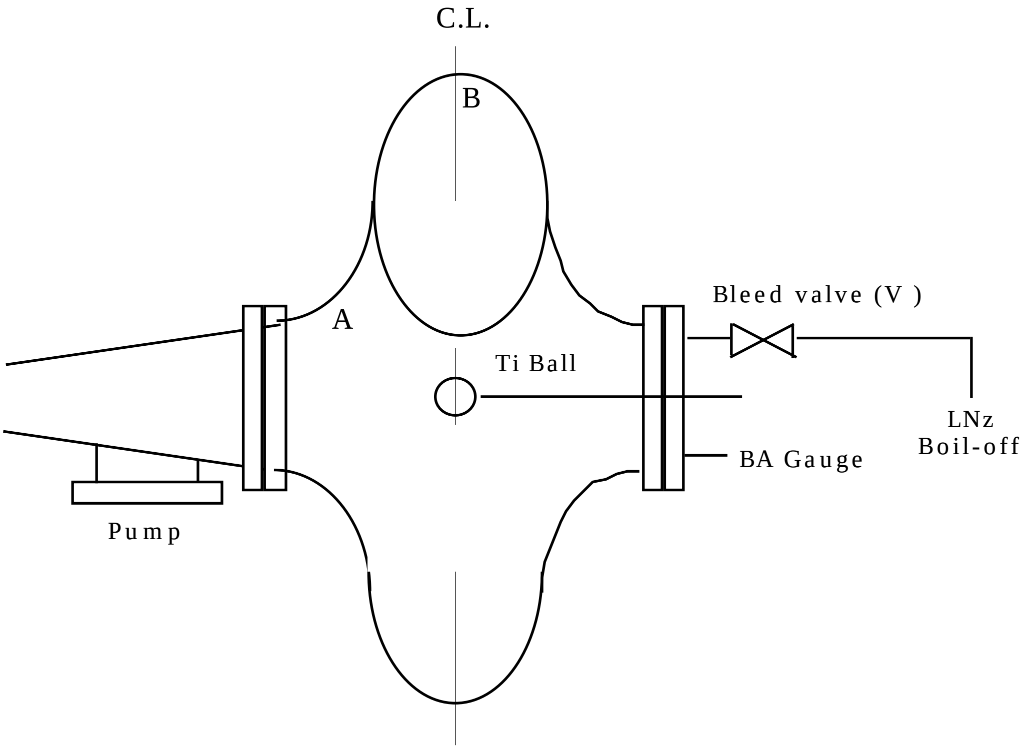
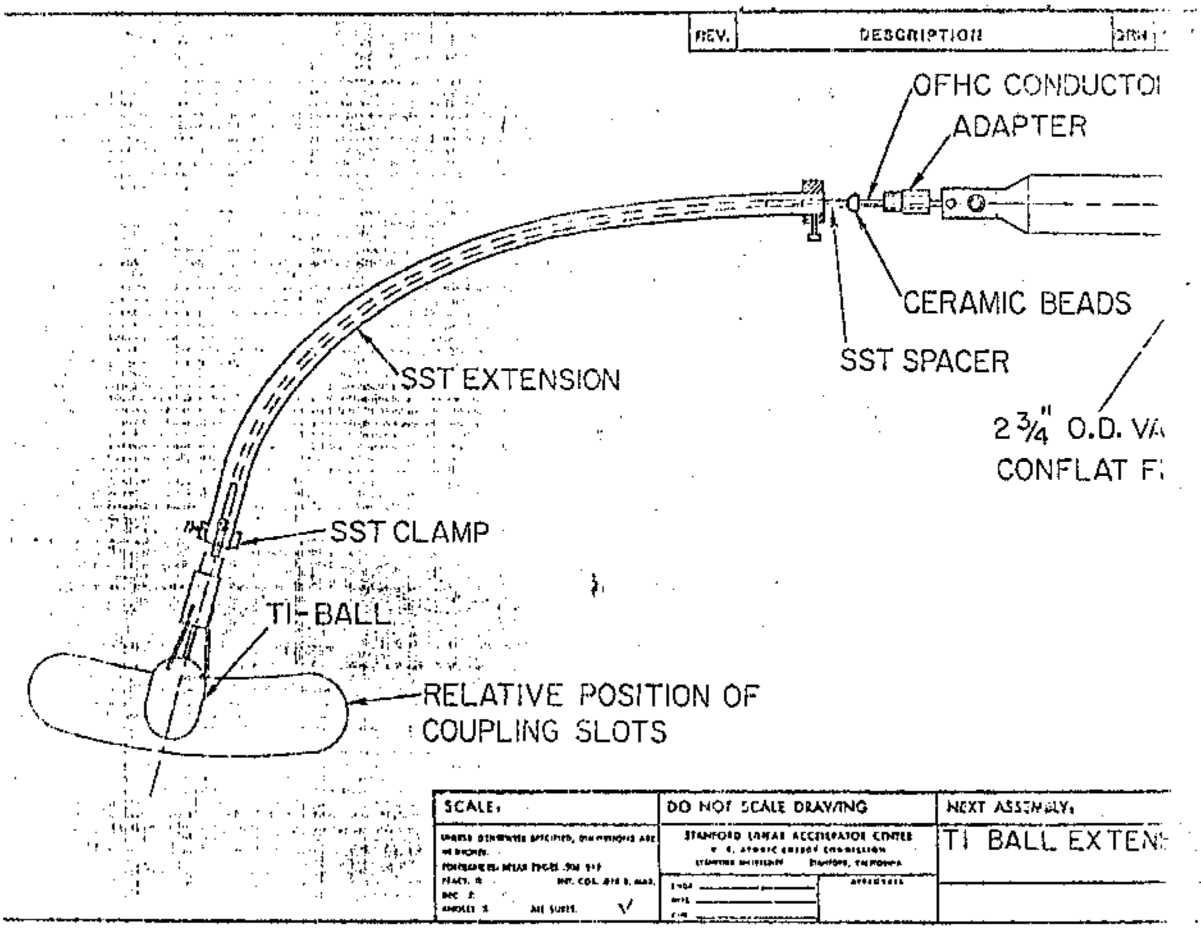


Fig. 2

Add 1 oil free TMP (needed during nitriding against pressure run-away).

In case of multipactoring, remove 1 tapered section and cover with a flange in Fig. 2. Standard Ti Ball holder has to be extended to reach the center of the cavity (Fig. 3).

SLAC Ti N Coating Apparatus



E.W. Hoyt and W.P. Schulz, SLAC-TN-75-3 (1975)

Fig. 3

Follow the steps:

a) Bake (150-200 °C) ~24 hrs, operate Ti Ball in "stand-by mode" for 1 hr.

b) Switch-off bake. When T ≈ 1 x 10^{-7} Torr switch Ti Ball to stand-by for 15 min.

c) Valve off or switch off all ion pumps. Only the TMP with a valve is now on; adjusted for a small throughput.

d) Bleed in 2-4x10^{-5} Torr N_2 (from LN_2 boil-off); the N_2 line should be thoroughly purged to make sure there is no air inside.

e) Turn Ti Ball Power Supply to 0.1 gram/hour rate. Adjust the bleed valve V_1 to the correct N_2 pressure $2\text{-}4 \times 10^{-5}$ Torr (TMP is adjusted also for a small through-put or off). Operate Ti Ball for 1.25 hours (this will produce Ti N film between 450 (max(A)) and 270 (min(B)) Å thick.

f) Switch off Ti Ball Power Supply and gauge valve off TMP. Slowly bleed the cavity to nitrogen. Wait ~ 12 hrs at least.

g) Reassemble the cavity.

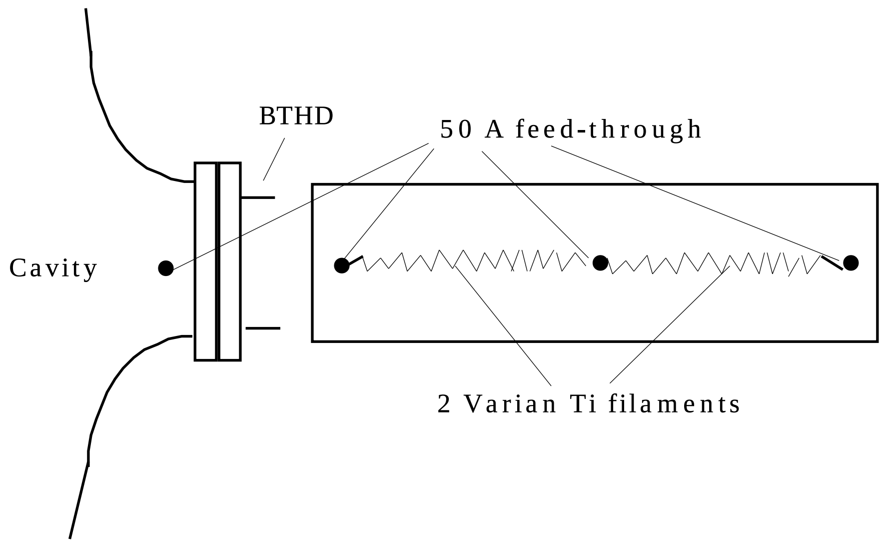
The whole procedure should take about 2 days.

3B) Nitriding - High Order Mode Suppressors

Will require 2 separate operations:

a) BTHD which will be delivered before the Cu cavity. If BTHD's multipactor, the method to coat them with Ti N will have been developed by Cristina and can than be implemented. Due to the complicated structures including a 6 mm gap between the ridges of the waveguide, much work is required to obtain correct deposition rates from Ti filaments. In any case, the coatings in small gaps will be very thin at best. Chemical plating with Ti should be investigated (if it is at all possible). Cristina is aware of all the problems (both the rate measurements and the selection of various Ti filaments, and their positions in BTHD). In my experience Ti films can vary greatly in thickness (factor of 5) and still be effective.

b) The transition from the cavity to the flange to which BTHD mates.



Once the Ti filaments are installed and the devices evacuated, Ti coating will proceed in the same way as outlined on **3A**, a)÷g).

The current and deposition times are set according to previously determined deposition rates.

According to SLAC work the resulting film thickness can be between 100-1000 Å to be effective.

4) Ion Clearing

a) Heating in long CEs in the wigglers should be calculated. If too high Bo0 insulator can be used.

b) Other CEs should be of F. Caspers design with rf filters etc.
The size should be maximized according to available space.
If possible use one electrode not a pair.

5) Miscellaneous

a) Every flange in the ring should be checked for impedance and heating.

b) The outgassing rate of 5×10^{-13} Torr l/s cm^2 for the ethanol machined chamber represents an excellent result and this type of finish should be seriously considered. Alberto Clozza's experiment using electron desorption to compare ethanol and oil machining should be carried out soon.

c) Cristina should visit CERN to:

   i) discuss our proposed clearing hardware with F. Caspers, A. Poncet and Y. Baconnier;

   ii) obtain the drawing of the EPA and AA clearing electrode system including connectors, filters, and power supplies to implement similar system in DAΦNE;

   iii) get the names of manufactures of ceramics, resistive coating and coating shops.