DAΦNE TECHNICAL NOTE

INFN - LNF, Accelerator Division

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Note: **V-7**

U10 BEAM LINE EXPERIMENT

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The experiment proposed in this note will simulate DAΦNE operating conditions, i.e., VUV photon flux will strike a copper absorber located in an alluminum chamber, and desorption will be produced in Al by photoelectrons created in the copper. The only differences are VUV critical energy of 500 eV rather than 208 and 330 eV in DAΦNE and exclusion of low energy photons. The latter will be remedied by opening the vertical aperture.

There are two possible set-ups differing in the angle of incidence:

A. 100 mrad in Fig. 1.

This apparatus already exists and many tests using different materials[1] have been performed on it. The only modification to be done is the replacement of a stainless steel tube with an aluminum tube.

B. Normal (90°) incidence in Fig. 2.

An existing, electrically isolated and water cooled Cu block would be inserted into an aluminum T including some instrumentation. The Cu block could also be tested as a glow discharge electrode.

There are 3 main points to be studied to help us make final decision concerning detail design of copper absorber-antechamber system. In addition, the experiment would substantiate the numbers used in pressure rise calculations[2] due to synchrotron radiation. Each experimental run will produce the following 3 sets of data concerning:

1) *Desorption coefficient and beam clean-up*.

This is a standard experiment done at many Synchrotron Light Sources with various types of materials, but Cu absorber-aluminum chamber run has not, to my knowledge, been done yet. Eventhough we can approximate the results from several sources, the experiment is important and should be carried out because it is simple and inexpensive. Using both A and B set-ups will give more information on desorption dependence on the angle of incidence.

FIGS. 1 – 2

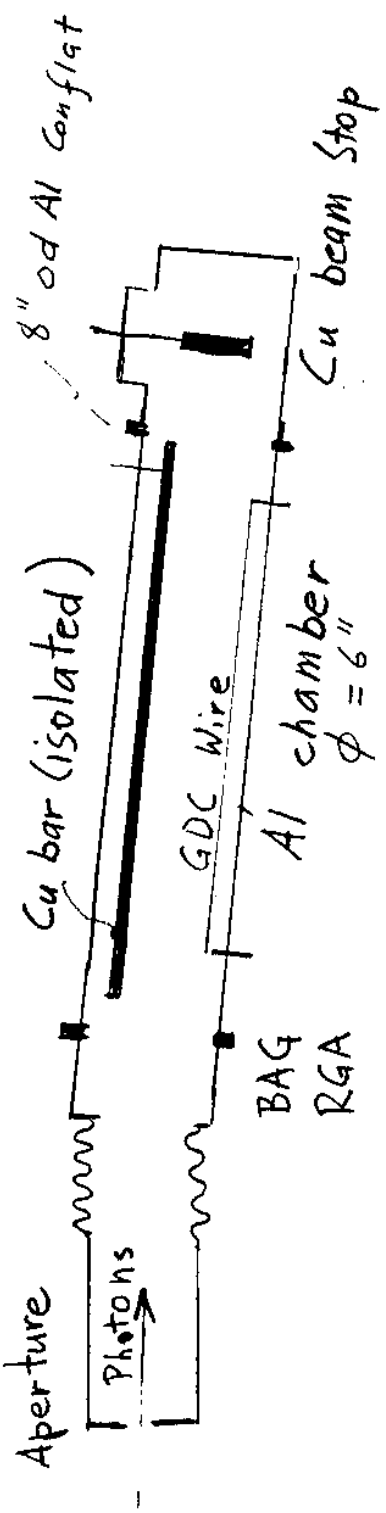

Fig 1

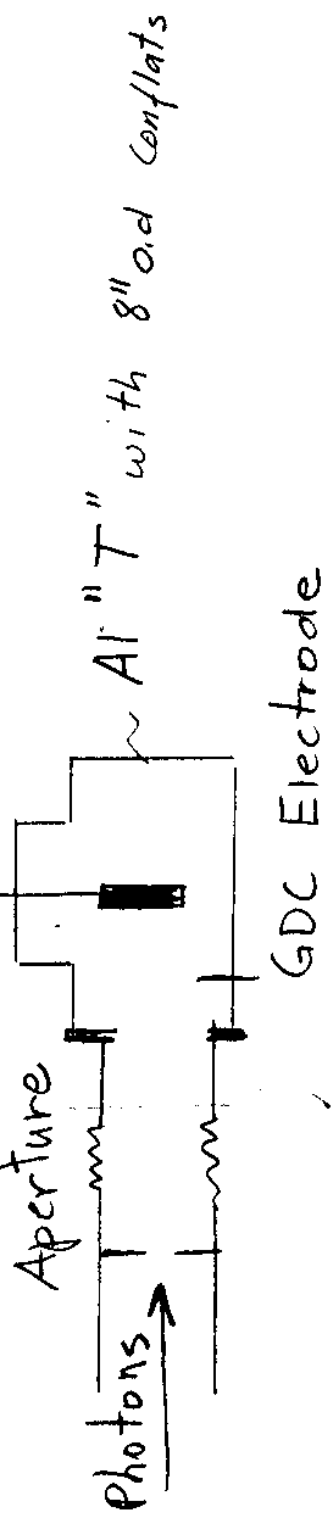

Fig 2

2) *In-situ glow discharge (GDC).*

A factor of 10 improvement in η was measured using this method in stainless steel system, where a separate wire was mounted in the chamber. Indeed we plan to install an electrode in each DAΦNE antechamber. If the absorber itself is isolated, it will be used as a GDC electrode.

3) *Applying + or - polarity to absorbers*.

Since the photoelectrons are responsible for photodesorption, we should be able to prevent photoelectrons from leaving the absorber by biassing it positively and thus lower the pressure rise. Due to low DAΦNE critical energy, 20 - 30 V should suffice. This conclusion presupposes low reflected photon flux which is reasonable in normal incidence. Conversely, by applying high negative potential to the absorber would expel all photoelectrons and speed up wall clean-up. In this way one could control the pressure during machine commissioning and achieve both optimum clean-up time and the lowest operating pressure with full beam.

SCHEDULE AND COST

Before we can start the experiment we have to procure the following hardware:
a) aluminum tube
b) aluminum flanges and to weld them to the tube
c) aluminum “T”
d) helicoflex gaskets.

In addition we would make a few minor modifications in the set-up, such as bigger aperture, and adding a feedthough.

Allowing 3 months to obtain the components for either A or B experiment, we could have it assembled in early January 92 and start data taking later in January. The entire program would take about 3 - 4 months to complete. NSLS would charge 10 K$ per month + hardware (a, b, c, d).

Acknowledgement

I would like to thank Pina for her expert typing of this note and for all the help so generously given to me during its preparation.

References

[1] C. Foerster and H. Halama, submitted to J.Vac.Sci.Technol.
[2] H. Halama, DAΦNE Technical Note # V-5 (Main Ring Vacuum System).