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UCRL-1413
Technology - Materials
Testing Accelerator

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UNIVERSITY OF CALIFORNIA
RADIATION LABORATORY
Contract No. W-7405-eng-48

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MINUTES OF MEETING OF MTA REVIEW COMMITTEE HELD JULY 24, 1951

Russell H. Ball

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MINUTES OF MEETING OF MTA REVIEW COMMITTEE
HELD JULY 24, 1951

Present: UCRL: Bradner, Brobeck, Cooksey, Latimer, Lawrence, Lofgren, Martin, McMillan, Norton, Reynolds, Van Atta

CR&D: Davis, Hansen, Hildebrand, Powell

AEC: Ball, Fidler, Fleckenstein, Derry, Houghey

Bradner summarized the information available from work done at Berkeley and elsewhere on the general problem of maintaining high voltages over gaps of varying lengths with both DC and rf voltages. Los Alamos has reported that they have found empirically that the function $\frac{V^2}{D}$ has an approximately constant value of three when the voltage is expressed in millions of volts and the distance in feet.

The following table summarizes the behavior of a number of machines with regard to this empirical relationship:

Instrument	Frequency	Gap	Voltage (Mv)	$\frac{V^2}{D}$
Trump and Van de Graaff Sphere Gap	D.C.	0.125"	.18	2.9
		2.756"	.68	1.9
Dimond X-ray Tube (via Panofsky)	D.C.	1.0"	.30	1.1
Berkeley Synchrotron Injector (L. Cook)	Pulsed D.C.	0.10"	.15	2.7
Pandora's Box (F. Schmidt)	13 mc	0.048"	.04	0.4
XC (M. Martin)	13 mc	6.93"	1.00	1.7
B-1 Cavity (Baker)	13 mc	30"	2.3	2.0
Berkeley 40' Linac (last gap)	200 mc	3.49"	1.1	4.2
B-3 Cavity (J. Franck)	200 mc	2.0"	1.22	9.0 *
B-2 Cavity (C. Nunan)	200 mc	2.29"	1.07	6.0 *
Yale Electron Linac (H. L. Schultz)	600 mc	7"	1.67	5.0 *

(continued)

Instrument	Frequency	Gap	Voltage (Mv)	$\frac{V^2}{D}$
Stanford Electron Linac (via Panofsky)	3000 mc	1.03"	0.208	0.5 *

* $\frac{V^2}{D}$ not limited by sparking

The voltage gradient used in the table is the average gradient and the surface gradient may exceed the value used by a factor of 1 to 4, depending upon the particular geometry involved. Bradner emphasized that he knows no theoretical basis for this empirical relationship, so that it is not possible to assign any significance to the fact that the value of $\frac{V^2}{D}$ attainable with present equipment lies in the range 1-10 while the value required for full voltage gradient in Mark I will be 27. At half gradient, as required for proton acceleration, this index will be 6.7.

Bradner said that it will be very useful in case sparking difficulties develop with Mark I to have available at Livermore a clean vacuum system of a structure similar to the B-1 cavity for test purposes. Some design changes may be necessary in the L-2 cavity as now planned to meet the current standards of "cleanness," i.e., smoothness.

Bradner reported on the results recently obtained by Nunan on a 200-megacycle cavity. The cavity used comprises a cylindrical steel vacuum chamber containing a copper liner. The interior surface of the vacuum chamber has been sprayed with aluminum. Initial operation after cleaning the drift tubes and tank surfaces was satisfactory, but after letting the tank down to air and re-evacuating it was not found possible to attain high voltage gradients and the X-ray level was higher by a factor of 50 than it had been before the application of the sprayed aluminum coating. The aluminum coating in this test cavity is quite dusty and it has not been possible to clean it to the point of eliminating all of the dust.

There followed an extensive discussion relative to the desirability of treating the present aluminized surface of the Mark I vacuum tank and of various alternative coating materials which might be used either to cover or to replace the present aluminum coating. It was agreed to call upon the Aluminum Company of America for expert advice as to steps which might be taken to improve the present surface. It was decided to proceed immediately with the insertion of test specimens of various coating materials in Nunan's test cavity. It was also decided to survey appropriate companies for recommendations on vacuum paints other than Glyptal. Recommendation was made that material suitable for application over the

present aluminum surface be investigated but there was a rather general feeling that it is improbable that a satisfactory job could be done by this means and that removal of the present aluminum coating by sand blasting might well be required.

Hanson estimated that the time required for complete removal of the present coating by sand blasting would involve approximately a month's time if complete removal would necessitate the removal, sand blasting, and re-installation of the large number of flanges and nozzles presently attached to the vessel. He stated that considerable time could be saved in sand blasting the vessel if it would be permissible to leave the present aluminum coating on the few percent of vessel surface associated with the flanges and nozzles.

Lofgren again recounted his experience at the Radiation Laboratory with several vacuum cavities constructed of bare steel in which, after prolonged use, frequent let-downs to air, and occasional flooding with water have not produced significant rusting.

Lawrence suggested that it might be possible to stabilize the present aluminized surface by vacuum evaporation of a fresh aluminum layer. [Ed. Note: Bradner suggested after the meeting that there is some evidence that sparking is aggravated by the oxide or other inclusions in the electrode surfaces. Should this be so an evaporated aluminum or gold coating on the drift tubes might be useful.]

Powell estimated that approximately two weeks remain before vacuum tests on tank will be completed so that installation of the liner could begin. An early decision as to the type of interior surface desired for the Mark I cavity should be made to minimize this additional delay to the liner installation.