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UCRL-1106
Technology - Materials
Testing Accelerator

UNIVERSITY OF CALIFORNIA
RADIATION LABORATORY

Contract No. W-7405-eng-48

CALIFORNIA RESEARCH & DEVELOPMENT COMPANY
Contract No. AT(11-1)-74

MINUTES OF MTA PROGRESS MEETING HELD JANUARY 23, 1951

Russell H. Ball

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RESEARCH SERVICE BRANCH
Atomic Energy Commission
Berkeley Area
Berkeley, California

MINUTES OF MTA PROGRESS MEETING
HELD JANUARY 23, 1951

Present: UCRL: Brobeck, Brown, Byerly, Cork, Dimmick, Farly, Gordon, Kilpatrick, Latimer, Lofgren, Longacre, Martin, McMillan, Norton, Sewell, Street, Twitchell, Wallace

CR&D: Crandall, Davis, Hansen, Hildebrand, Maker, Robertson

G.E.: Webster

Westinghouse: Andrews, Hulse

AEC: Ball

Norton said that February 5 is the date on which injector construction will be completed in Building 51.

Sewell said that the integration of the magnetic field required for the calculation of the Q of the tenth-scale model has been more accurately performed and has led to an improved agreement between Q measurements made on the model with and without drift tubes.

The difference between the calculated and measured values of Q is now 8% for the unloaded cavity and 9% with the drift tubes present. This indicates that the losses estimated for the drift tubes is essentially correct. Longacre said part of the existing discrepancy may be due to an error in the assumed value for the RF conductivity of copper. Sewell said he thought most of the remaining difference was due to power losses at soldered joints which could be overcome if the cavity were plated with either silver or copper. Sewell said the interior of the cavity was carefully polished before these measurements were made, being sure that the polishing was done in the direction of current flow. He said there is some experimental evidence from other laboratories that the direction of polishing strokes makes a measurable difference in the Q of a resonant system.

Hildebrand said that Baker will be supplied with 4-inch by 5-ft. strips of the copper which will be used for the Mark I liner so that he can determine the conductivity of the copper. He stated that an order has been placed for 1200 tons of copper-clad steel to be used for the construction of the Mark II tank. This order has been placed on the basis of 12-meg acycle operation and a 700 ft. tank. If the tank length ends up at 1000 feet, as now appears probable, it will be necessary to order more of this material. He said it will also be necessary to place orders soon for the structural steel for the Mark II tank. Maker said that the copper lining on the clad steel will be 50 mils and the over-all thickness will be 1/2 inch. Hildebrand said that the other limiting

item on Mark II is the design of the drift tubes and ordering of material for their construction. Brobeck said it is still hoped to decide, on or about February 1, 1951, on a consistent set of assumptions upon which to base a tentative Mark II design.

Hildebrand said there is a very tight schedule on the design and construction of the Mark I proton drift tubes. They would also like to firm-up as soon as possible the requirements for test probes for use in conjunction with the Mark I current measuring target. He said the test target and its connecting cone went out for bid yesterday. Brobeck said Panofsky and Martinelli are now studying the probe requirements. There are now positions for 7 probes which will probably be sufficient.

Brobeck said there is still considerable uncertainty as to whether Mark II will operate at 12 or 20 mc. Hildebrand said they are proceeding with the Mark II design on the basis of 12 mc operation. Should this later be changed to 20 mc it will be necessary to design the cavity to utilize the copper-clad steel and structural steel which will already have been ordered.

Norton said that shielding is being added to the B-1 test cavity. The shielding has now been built up to cover about 2/3 of the cavity. McMillan said that examination of the sphere inside the B-1 cavity failed to show any obvious rough or contaminated areas corresponding to the 30 or so local sources of X-rays which were evidenced by the X-ray photographs taken recently. There were 4 glyptal spots on the sphere which showed evidence of charring, but it was not possible to correlate them with any particular spots on the X-ray photographs. McMillan has recommended that the sphere be polished with fine grade carborundum to remove a thin surface layer in the hope that this will eliminate the surface conditions responsible for the present X-ray production.

Martin discussed the present status of tests on the XC to determine the RF voltages which can be maintained in the presence of strong magnetic fields. The geometry of the set-up is sketched in Figure 1.

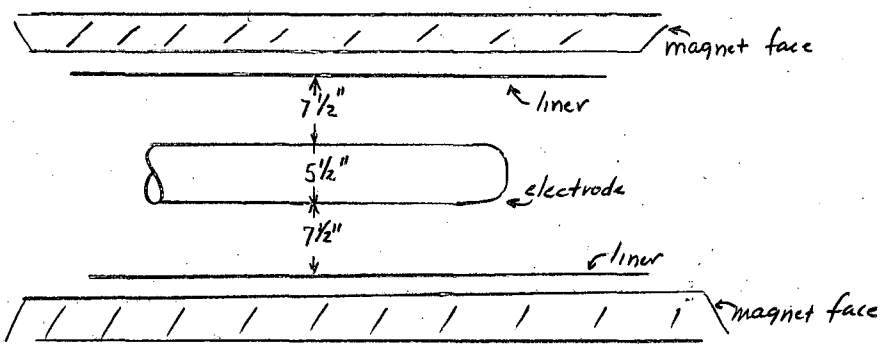

Figure 1.

It has been possible in the absence of the magnetic field to hold 1.2 million

volts. However, sparking occurs in the presence of the magnetic field which sharply reduces the voltage which can be held. The present voltage limit at 8000 gauss is 700 KV. Several steps have been taken in an attempt to prevent the sputtering of copper which accompanies the sparking in the presence of the magnetic field. The first tried was the installation of water-cooled copper sections on the tank walls adjacent to the electrode in the hope of preventing the melting and sputtering of the copper during sparking. This measure did not result in any noticeable improvement. Also a soft solder seam in the tank liner was eliminated without beneficial effect. Over the last weekend, experiments were run with the XC at reduced magnetic fields to determine whether this type of collimated sparking is likely to pose a serious problem in Mark I where voltage gradients of this same magnitude occur in the presence of magnetic fields of the order of 300 gauss. It was found that at field of 1000 gauss it was possible to hold 900 KV with no trouble, so that difficulties from this source in Mark I do not appear probable. The difficulties encountered on the XC tests, however, may be a serious problem in the operation of the Mark III high current Thomas-type cyclotron. There would be a large stored energy in a full-scale Mark III cyclotron with the result that sparking would be expected to be both more frequent and more severe. It has been calculated that if all of the stored energy of the XC machine were dissipated in a single spark it would melt about 6 mm^3 of copper. A Mark III machine would have 10 to 20 times this amount of stored energy. Two possible solutions have been suggested for the sparking problem. One is to install a refractory conductor of graphite or tantalum between the electrode and the tank wall. The other suggestion is to insert an additional electrode between the present one and the tank wall which would be connected to an inductance and serve as a voltage divider and hence reduce the energy dissipated in a single discharge. A third possibility is to reduce the magnitude of the dee voltages required to a value below the threshold of this phenomenon by constructing the magnet pole faces so as to conform very closely with the optimum theoretical shape.

Gordon reported on a new X-ray cavity, which will be referred to as B-4 and is to be constructed in Building 51. The purpose of the new cavity will be the same as that of the X-ray cavity in Building 10, namely, to permit a determination of X-ray production as a function of such variables as drift tube materials, surface contamination, drift tube temperature, geometry and voltage gradient. He said that, although no detailed design has yet been started, the basic design being considered would involve a tank with octagonal end faces about 54 inches in diameter with the tank to be 4 or 5 feet long. There would be a removable circular section on each end face and removable sections on each of the 8 rectangular sections along the length of the cavity. There would be a manifold attached to the top of the cavity connecting it with a 20-inch diffusion pump with one gate valve for the test cavity and one for the diffusion pump. Between the valves would be a trap with 100 percent geometry liquid air trapping to eliminate as completely as possible any oil vapor from entering the test cavity. Lofgren suggested that since this cavity is being specially designed for an oil free vacuum it would be desirable to eliminate the use of a hydraulically operated gate valve for the cavity, since this type of valve is known to be a source of considerable

oil vapor. He suggested instead the use of rotating mechanism for movement of the valve for the test cavity. McMillan said that the design suggested by Gordon had the disadvantage of requiring too many gaskets. He suggested either a redesign so as to sharply reduce the number of gaskets required, or the use of metal gaskets, or of designs in which the rubber gasket cannot degas into the cavity volume. The B-4 X-ray cavity is being made somewhat longer than the Building 10 model in order to eliminate multipactoring between the end faces of the cavity.

In answer to questions regarding the coding now used to designate various machines and power supplies connected with the MTA program Brobeck listed the data shown in Table 1.

Code	Machine
Mark IA*	Mark I with deuteron drift tubes
Mark IB*	" " " long drift tube for testing Mark II geometry
Mark IC*	" " " proton drift tubes
B-1	One megawatt test cavity in Building 52
B-2	X-ray test cavity using magnetron tank in Building 10
B-3	Electron accelerating model of Mark I, now in Building 51
B-4	X-ray test cavity with oil free vacuum. To be built in Building 51.
Power Supplies	
#1	Oscillator power supply
#2	Drift tube magnet power supply
#3	" " " " "
#4	" " bias " "
#5	Beam precessor " "
#6	Sub-exciter " "
#7	Injector

Table 1.

* Subsequent to the meeting it has been found that the term "Mark I-A" has had prior use in connection with the Mark I budget to denote certain items of expenditure found necessary since the original Mark I proposal. Accordingly the use of the designations 1A, 1B, and 1C will not be adopted as indicated above.

Hansen said most of the copper plate and tubing has been received by the Oscar Krenz Company, and work is now proceeding to straighten the tubing prior to soldering it to the liner sections. The large furnace for soldering the tubes to the liner sections is scheduled for completion by next Monday. The company is getting their work well organized but their schedule is still longer than we can accept. Consolidated Western Steel Company is not promising the vessel until March 15. If we assume that the vessel could be completed by March 1 and be vacuum tested in two weeks, then installation of liner panels could begin

about April 1, thereby indicating a date of about June 1 for completion of the liner. Twitchell said that their working schedule for completion of the deuteron drift tubes is June 1, but that a more realistic date for delivery of the complete set to CR&D is July 1, 1951. Hansen said that steel has been erected for seven of the eleven bays of the accelerator building. The structural steel has been completely erected for the north and south wings. The decking on the north side of the second floor will start next Monday. Foundations for the Kinney pumps will be started very shortly. Five of the booster pumps are being assembled in the pit. All of the ribs of the vessel have now been installed and about 50 percent of the liner plates have been installed in the tapered section between ribs No. 13 and 14. Power distribution system and power supplies are on schedule, all foundations have now been poured for motor generator sets, and contracts have been let for the installation of all of the machinery and for all of the principle conduits and power leads for power supplies 1 through 4. The foundation and basin for the cooling tower are complete.

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