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MINUTES OF MTA PROGRESS MEETING
TUESDAY, SEPTEMBER 19, 1950

Present: UCRL: Alvarez, Brobeck, Cooksey, Dexter, Farly, Gordon, Hansen, Judd, Lawrence, Lofgren, Longacre, Martin, McMillan, Norton, Panofsky, Reynolds, Serber, Sewell, Street, Thornton, Twitchell, Van Atta

CRDC: Cope, Crandall, Gleason, Hansen, Kent, Maker, Powell, Robertson

G.E.: Dunlap, Edwards, Webster

AEC: Ball

Brobeck discussed a preliminary design for the disposition of various components associated with the current measuring target for Mark I. These elements are shown schematically in Figure I below:

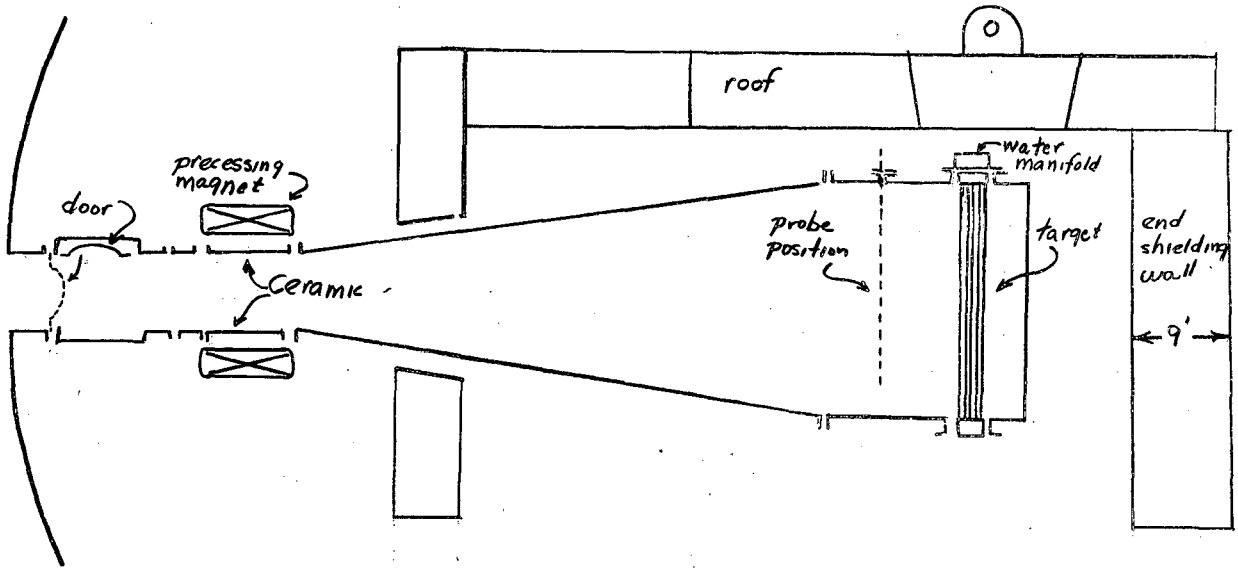

Figure I

Brobeck said that they are assuming a ratio of peak to average intensity at the center of the beam as 50/1 and a 1-foot minimum diameter for the beam leaving the accelerator. The beam will be swept by the magnetic precessor so as to provide a maximum heat transfer rate from the stainless steel tubing of the target to the

water of 1 KW/in.^{2}. This would provide a maximum tube temperature of about 160° C. At this temperature the circulating water pressure of 85 psig would be certain to prevent boiling. The target proper would be composed of two layers of tubes made of 20-mil stainless steel. Lofgren suggested that titanium might be used for fabricating the tubes and would result in a reduction in the heating of the metal tube itself. Brobeck said that if titanium tubing were available it might reduce the required size of the target. Brobeck said the beam would be rotated by the precessing magnet to cover a 7-foot diameter area on the target. This would provide about 70 μa/in.^{2} on the target surface. With the presently conceived pattern of the water flow through the stainless steel tubes the water requirement would be 160 gpm at a pressure of 200 psi. Brobeck said there were two situations being considered for sweeping the beam--the first would have a beam of 1-foot diameter upon leaving the accelerator. This beam would expand to two feet by the time it reached the target. Sweeping the center of this beam along a 4-foot diameter circle would cause it to cover an area 6 feet in diameter. The second case would be for a beam having a diameter of 3 feet at the accelerator and 6 feet at the target. The center of this beam would need to be swept along a 1-foot diameter circle to cover a target area 7 feet in diameter. Crandall said that it would simplify their problems if the beam could have a diameter of about 3 feet in passing through the precessor. McMillan and Serber said there is probably no way the beam could be expanded to that diameter upon leaving the tank without the loss of a great deal of beam on the drift tube surfaces. They said the only way to obtain that diameter beam for the precessor would be to place the precessor at a greater distance from the accelerator.

Maker suggested that the quick closing door shown in the above sketch might better be one which moves vertically rather than being hinged as shown; this would have the advantage of more rapid action, as well as reducing the space required for the door. This would in turn allow the precessing magnet to be placed closer to the tank. McMillan said that if more space is available for the magnet it might be advisable to lengthen the magnet, thereby reducing the field strength and power required. Brobeck said lengthening of the magnet would probably not prove effective because of the expansion of the beam which would occur within the magnet itself and hence require an increase in its diameter and cost. This would probably offset the advantages McMillan suggested. Alvarez suggested that consideration be given to the use of a DC magnet which would be mechanically rotated to cause precession of the beam. Brobeck said this would probably prove undesirable because of the very large bearings required. Brobeck said that the closing gate will be designed to close within 1/2 second.

Street said that a previously unused Mark I current measuring target would, after a one-hour bombardment, contain about 10^4 curies. This activity would decay within a few hours to a residual half life of about 18-hr. due to Co^{55}. This same target after a one-month bombardment would likewise have approximately 10^4 curies which within about one hour would decay to ca 3 x 10^3 curies. Decay beyond this point would be slow since the predominant activities would then be 72 d Co^{56} and 270 d Co^{57}. One hour after shutdown following a long bombardment the shielding requirement would be 4" of lead to allow workers 20 minutes to receive a daily tolerance dose at a distance of 20 feet.

McMillan suggested that the target could be handled under water to avoid the

necessity of a long cooling period before dismantling.

Brobeck said that Lofgren had suggested the use of a small rotating target in the center of the beam to diffuse the high intensity center peak and then provide a separate target to utilize the remainder of the beam.

McMillan suggested that consideration be given to the elimination of the precessing magnet by increasing the distance between the accelerator and the target and allowing the normal expansion of the beam to reduce the unit intensity of the target to a usable figure. With the beam distributions expected this distance would be excessive. Alvarez said it would also be possible to reduce the intensity at the center of the beam by at least a factor of 2 by providing for a hole in the ion source.

Norton reported that the testing of the RCA 5831 tube in Building 52 has progressed to the point that the load has been increased to 650 KW using 14 KV on the plate of the tube. He said they are now investigating the cost of charging the vessel with pure freon which would allow the attainment of higher voltage gradients and hence a greater load.

Sewell said that the 10th-scale model of Mark I now has metallic supports for the drift tubes and that measurements of the shunt impedence and Q will be started shortly.

Thornton said that by the use of shims the magnetic field for the electron accelerating cyclotron model had been corrected to approximately the desired pattern and that an electron beam has been satisfactorily accelerated. The beam was detected by allowing the electrons to hit a copper target. A Geiger counter was then used to measure the X-rays produced. By this means the beam was followed out to a 13.5-inch radius. Although the beam could not directly be followed to radii greater than this there is evidence that it was satisfactorily accelerated to the full energy of the machine. Lawrence said that the acceleration was obtained using 500 volts on the Dee and the operation was very successful and remarkably stable. He said that with filament emission of 200 μa they obtained about 20 mr per hour of X-rays. He added that by increasing the oscillator plate voltage from 1200 to 1800 volts the beam current was increased only about 30%. This indicates that little loss of beam occurs during acceleration. McMillan cautioned against the use of thin windows with this accelerator because of the possibility of electrons escaping through such windows and causing burns to personnel.

Lofgren reported on work to determine the analysis of the ion beam from the injector. He said that through the use of collimators a $\frac{1}{4}$-inch diameter beam was run through an analyzing magnet. He said that by varying conditions the ratio of H_1^+ ions to $H_2^+ + H_1^+$ varied from 0.5 to better than 0.9. He said that the introduction of the collimators and the magnet within the source housing introduces complications of discharges and current drain which are not otherwise present. One result of these effects is apparently to produce a large component of low energy ions which at times exceed the proton intensity by as much as 3 or 4 to 1. He said no way has yet been devised to analyze the

beam without introducing aberrations which by secondary effects increase the low energy component of the beam.

He said that Woodyard has been testing various cathode structures to obtain one which can be used in the full-scale CW ion source. The details of two such structures that have recently been tested is as follows:

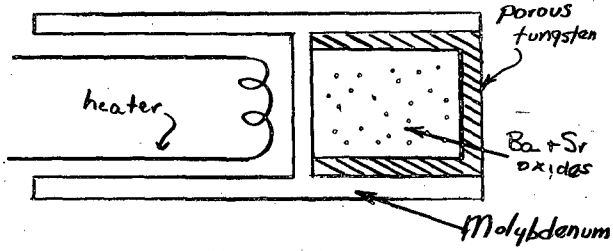

Figure 2.

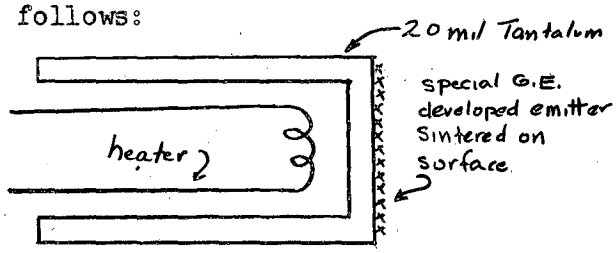

Figure 3.

The anode structure shown in Figure 2 is a development of the Phillips Company while that shown in Figure 3 is a General Electric Company development. Sources of both types have been run in a hydrogen atmosphere for several hours with surface temperatures between 1000° - 1600° C and arc currents between 10-100 amperes. Both sources have held up well so far and both are considered worthy of continued investigation.

Longacre said that they have not yet been able to obtain a satisfactory beam from the electron accelerating model of Mark I due to gas discharge problems. These problems arise because the field strengths required for the electron acceleration are in the range where gas discharges are troublesome. This problem would have no counterpart in the MTA itself because of the higher operating voltage gradients. McMillan suggested that if the discharges were arising between the drift tubes and the tank wall it would be useful to bias all of the drift tubes and ion source together. Alvarez said the usual discharges occur between adjacent drift tubes, in which case this biasing would do no good and that substantial biasing of individual drift tubes is not possible without deflecting the electron beam.

Russell H. Ball

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