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NO. 4 OF 13 COPIES. SERIES A.

MINUTES OF MTA PROGRESS MEETING
TUESDAY, JUNE 13, 1950

Present: UCRL: Baker, Brobeck, Cooksey, Gordon, Latimer, Lofgren, Longacre, Martin, Norton, Panofsky, Reynolds, Richardson*, Serber, Sewell, Street, Twitchell, Van Atta*

CRDC: Cope, Hildebrand, Kent, Powell

AEC: Fleckenstein

* Consultants

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Sewell reported the forces between the drift tube magnets are being measured. They are also checking the fields of the magnets and the stray fields between the drift tubes. Stray fields between the drift tubes amount to about 1000 gauss, which may affect the ability of the drift tubes to hold voltage due to the trapping of electrons. The loads on the support for the drift tubes cannot be calculated until the actual forces between drift tubes are measured. Brobeck thinks that balancing magnets to equalize the forces on the end drift tubes will not be necessary.

Sewell reported that there is nothing significant to mention on the 1/10th scale cavity because they are still determining the proper drift tube placement. The drift tube stems are to be placed at the nulls. There are 3 positions of nulls, depending upon which condition one desires to satisfy: minimum frequency shift, minimum voltage across the outer end of the drift tube stem, or total power loss in the stem. The final position will probably be a compromise of the three positions.

Panofsky reported on the field data obtained by using the differential analyzer at UCLA. The data was obtained by using actual values for the first three drift tubes and theoretical values for the rest. In summarizing the data from the differential analyzer it can be seen that the present drift tube spacing is not quite correct and respacing calculations will be made for the 30 Mev machine. Sewell asked if the drift tube shapes would have to be changed as well as the spacing and Panofsky indicated that the drift tubes would have to be made slightly smaller. The data also indicates that the beam diameter during acceleration will not exceed 6 times the diameter at the entrance. Beyond 30 Mev the diameter will decrease slowly. Panofsky showed data from a -40° starting phase angle to a $+40^{\circ}$ starting phase angle which indicated that particles within these limits would be accelerated. Brobeck questioned the ability to get a convergent beam in this machine. Panofsky indicated that the calculations for convergent and divergent beams were made so that by averaging these two the data for a parallel beam is

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obtained. Some of the particles in a parallel beam would of course be convergent and others divergent and these calculations would hold for them. Panofsky reported that other calculations indicate that there is not a uniform beam distribution across the aperture; in fact, there is a very high beam density near the center. This is due to the fact that the oscillating paths in different planes cross near the center and add to give a greater density at the center.

Brobeck mentioned that the electron accelerating model is being designed; however, no parts have been ordered. It is hoped that within six weeks to two months the model will be running.

Lofgren reported on the injector work. For the DC injector they have obtained 1/3 of an ampere over approximately 3/4 of an inch diameter area; however, since only the maximum intensities are measured the area of the beam is porbably more like $1\frac{1}{2}$ inches in diameter. This beam was estimated to be made up of approximately 90% protons of 40 Kev. For the rf system 130 milliamperes of a DC beam have been obtained and of this only 8 milliamperes were determined to be molecular ions. As far as Lofgren knew, this is the highest percentage of singly charged ions obtained from an arc. The arc used was 90 amps at 860 volts. With the rf on, 150 milliamperes peak to peak was measured. The RF current included the effects of both energy and intensity modulation; however, the percentage of modulation of each type is not known. A double ion catcher will have to be devised to determine the percentages. Lofgren presented some of the present thoughts on the types of injection systems possible. The ions have to be accelerated to 300 Kev for acceptance in the first drift tube. Combinations of source and methods of acceleration are as follows: (See minutes of May 9, 1950 meeting for descriptions of methods.)

Number	Type of Source	Acceleration
1	DC	DC
2	AC	DC
3	DC	AC
4	AC	AC

No. 1 is a dirty way of obtaining ions of 300 Kev; however, the fact that one is not compelled to make the path short allows more freedom in design than in the second system. No. 2: The bunching needed for this system does not seem to be practical because of the short accelerating path required. Panofsky remarked that because of space charge the injected ions are debunched. Ions in a 90° bunch will in $1\frac{1}{2}$ feet become a 180° bunch. These calculations were made for one ampere distributed over a 6-inch diameter. It is not believed that the voltage can be held. Of the four systems, the second is the worst alternative. No. 3: If an AC acceleration is possible then an AC source instead of a DC source might just as well be used; hence, no further consideration will be given to this method. No.4: It is suggested that one or

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MINUTES OF JUNE 13 MEETING

more drift tubes be placed prior to the present design drift tubes to get the particles up to 300 Kev. This would be a linear accelerator injector. There is some hope (though nothing firm) that it may be possible to keep the diameter of the injected beam down to something in the order of two inches instead of the present six inches. Some of the ion source measurements would indicate that this is possible.

Brobeck reported that Van Atta will now be working full time on the target design.

Martin indicated that viewing windows will be placed in the vacuum tank at those locations which will enable one to view each gap between drift tubes and also the points where the drift tubes are joined to their supporting stems. He requested comments on additional places for windows. Baker requested a window so that the spark plug for sparking down the tank might be visible. Panofsky would like to see the coupling loops on the transmission lines. Sewell requested that windows be placed in the ends. Brobeck suggested that more windows be placed in the tank than were considered necessary at the present time because they are an inexpensive item and may save a great deal of time later on in getting the machine running. It was generally agreed that windows should be placed to get a good general view of the interior of the tank. Baker explained the need for the spark plug at the request of Alex Hildebrand. This need is somewhat the same as that for the crow bar which was designed into the power supply equipment. The spark plug is a protective device to prevent the stored energy of the tank from feeding back through the rf system in the event of malfunctioning of the oscillator system. The principal components to be protected are the $8000 oscillation tubes. The spark plug will arc the tank and dump its energy harmlessly.

Russell H. Ball

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