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MINUTES OF MTA PROGRESS MEETING
TUESDAY, MAY 9, 1950

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Present: UCRL: Alvarez, Brobeck, Cooksey, Farly, Gordon, Latimer, Lawrence, Lofgren, Martin, MacMillan, Norton, Panofsky, Powell, Reynolds, Sewell, Street, Thornton, Twitchell

CRDC: Cope, Crandall, Hildebrand, Kent, Powell

AEC: Ball, Fidler, Pitzer

O.R.: Normand

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Lofgren reported on the status of his work on the development of the ion source. He said one piece of apparatus being built is a DC unit which resembles superficially a large Van de Graaff type ion source with a hot cathode discharge columnated by a magnetic field. The ions are drawn off along the axis of the magnetic field. The intention is to develop this source up to the range of one or two amperes. After the source has reached this stage of development attempts will be made to pulse the beam. The general ideas presently in mind for pulsing the source are to use electrostatic lenses which would focus the beam, the central section of the lens being so designed that a pulsed voltage could be applied which would periodically cause the beam to defocus. Another scheme is to modulate the ions to begin with--that is, draw them from the arc with an rf potential. This has the advantage that one does not have to dissipate energy of a stray beam. This system is somewhat like putting a radio frequency potential on the first accelerating slit of a calutron unit. On the day before the fire in Building 8 he had such a model going and did modulate the beam at a 12-megacycle rate. So far as is known here, no previous attempts have been made to modulate such a beam at a frequency much in excess of three megacycles. This piece of equipment is now in the process of being re-built, since it was entirely destroyed in the fire.

Sewell reported the status of the 120-megacycle cavity, one-tenth scale model of the 60-foot section with all of the drift tubes in it. The external part of the cavity will be finished early next week. The drift tubes for this unit will be completed by the middle of next week. The unit should be assembled in about two weeks. This unit will be set up in a warehouse by itself so that frequency measurements made in conjunction with the BB test can be made without interference, since for this test the frequency must be constant to an accuracy of one part in a million.

Sewell further reported that measurements have been made on a one-sixth scale model of the drift tube magnets for the last four drift tubes. The

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tests appear satisfactory in that the ampere turns used give about 10 percent more than required for the integral of H^2dl, which is a measure of the focusing properties of the magnet. It is hoped by next week that the power requirements of most of the remaining three drift tube magnets will be known.

Alvarez explained the operation of the BB test for measuring the electric field along the axis of the drift tubes. The shift in frequency of a resonant cavity is proportional to the square of the electric field which is removed, so that if one pulls a metallic BB down the axis of the drift tubes it will remove the electric field from the volume it occupies and by measuring the frequency as a function of its position it is possible to calculate accurately the electric field along the entire ion trajectory. Sewell mentioned that Don Gow has developed a new oscillator for use in conjunction with the BB tests. This is an oscillator where the feed back actually couples through the cavity.

Panofsky outlined what would be done with these field measurements when they are available. We don't have much confidence in the calculations which determined the positions of the first few drift tubes. Arrangements have been made with Dean Boelter at UCLA to use the differential analyzer. Some people from UCLA are coming here Thursday (May 11) and they will be given a sample plot of the electrical field similar to the one which is expected to result from the BB test, so that they can practice with this on the differential analyzer and see if it agrees with the hand computations made here. The advantage of the differential analyzer is that it will probably be able to handle the complete coupled equation. That is, it will handle the solution of the radial and phase equations simultaneously and should give more accurate results than those obtained by manual calculations.

Alvarez pointed out that we are also designing a one-twentieth scale model which will be used for electron acceleration, in which measurements of the beam losses on each drift tube, space charge effects, and so forth, can all be measured accurately. Panofsky said that in order to measure accurately the effect of space charge with the twentieth scale electron accelerator the scale factor for beam intensity is 1/4000.

Panofsky mentioned that recent investigations by Ken Street in connection with materials for surfacing of drift tubes where they are struck by the beam indicate that at an energy below two Mev one has nothing to worry about, but above two Mev carbon is the preferred material and that no advantage is to be gained by using other special materials for the surfacing of certain drift tubes. The reason for this is that, although there are materials which have a threshhold of greater than two Mev for neutron production by the Oppenheimer-Phillips d,n reaction, such materials also have a relatively high capture cross section for neutrons and result in the production of undesirable radioactivity. It therefore appears that it will be best to use copper liners for the first two drift tubes and graphite liners for the rest.

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Alvarez outlined the primary considerations which will determine the choice of material to surface the drift tubes in the region of high electric field. The effect of greatest concern is that of field emission which would lead to excessive loading of the oscillators and the production of a high x-ray background. Of secondary concern is the electron multiplication at low voltages, which could be eliminated by proper biasing if materials giving a low multiplication factor can be found.

Panofsky mentioned that he has calculated the required sizes of by-pass condensers to transfer the rf currents from the drift tube stems to the tank liner in the event insulation of the stems is required for biasing, and has found the condensers to be of convenient size.

Hildebrand said that bids are due to be received on the tank by Friday morning. They are due on the oscillator power supply by Wednesday afternoon, and they are due on the diffusion pumps next Monday.

Cope said that P. G. and E. has submitted three proposals for supplying power at the Livermore site. The first proposal is for installation of 12.5 KV transformers which are available from P. G. and E. The total cost would be $400,000 and would require a deposit of $165,000. This has the advantage, although it requires more equipment than proposal 2, of offering an interim source of power. The second proposal is for the installation of 13.8 KV transformers which would have to be purchased, and would not provide for any interim power. This would cost $358,000 and require a deposit of $150,000. The third proposal, which is not favorably considered, is to provide for interim power with the second proposal.

Reynolds said that following his recent trip to Oak Ridge he discussed with Walter J. Williams (Director of Production, Washington) the availability of vacuum and electrical equipment from that site. Williams is willing to recommend that the Commission release for our use the large Kinneys and 32" diffusion pumps which we require for the 60-foot section. There are also available several 500 KVA transformers. There is also one 35,000 KVA transformer which with new primary windings would serve for installation at Livermore and considerably reduce the cost figures given by Cope. Dr. Pitzer stated as his opinion that any equipment we want from Oak Ridge and which is not actively required at that site will be made available to us.

Norton and Alvarez said that there is a possibility of obtaining from the Air Forces a 5-megawatt power supply developed at Wright Field which is now surplus. They are now working through the Rand Corporation to obtain data on this power supply.

Norton mentioned that RCA has developed, in addition to the 1-megawatt 5831 tube, a grounded cathode tube which will be available in the near future. However, we will not be in a position to test it until August or September.

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This latter tube has the advantage of requiring only one large transmission line to the tank and other important circuit simplifications.

Martin presented the following data on liquid nitrogen traps and their effective pumping speeds,

Speed of pumps into tank	380,000 liters/sec.
" " " through liner	307,000* " "
Estimated speed of N_2 traps for H_2O vapor	1,300,000** " "

* This figure revised from that given at meeting, which was 350,000 liters/sec.

** This figure revised from that given at meeting, which was 500,000 liters/sec.

Russell H. Ball

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