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MINUTES OF MEETING OF MTA ACCELERATOR COMMITTEE HELD APRIL 26, 1951

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Testing Accelerator

UNIVERSITY OF CALIFORNIA
RADIATION LABORATORY

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MINUTES OF MEETING OF MTA ACCELERATOR COMMITTEE HELD APRIL 26, 1951

E. D. Fleckenstein

Berkeley, California

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MINUTES OF MEETING OF MTA ACCELERATOR COMMITTEE HELD APRIL 26, 1951

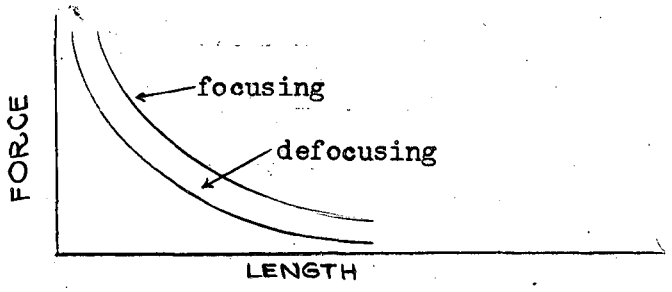
Present: UCRL: Alvarez, Brobeck, Farly, Gordon, Hernandez, Lofgren, Norton, Panofsky, Wallace

CR&D: Chaffe, Fossati, Maker, Hildebrand

AEC: Fleckenstein, Moore

Hildebrand, chairman for the meeting, asked Panofsky to present the problems for discussion at this meeting.

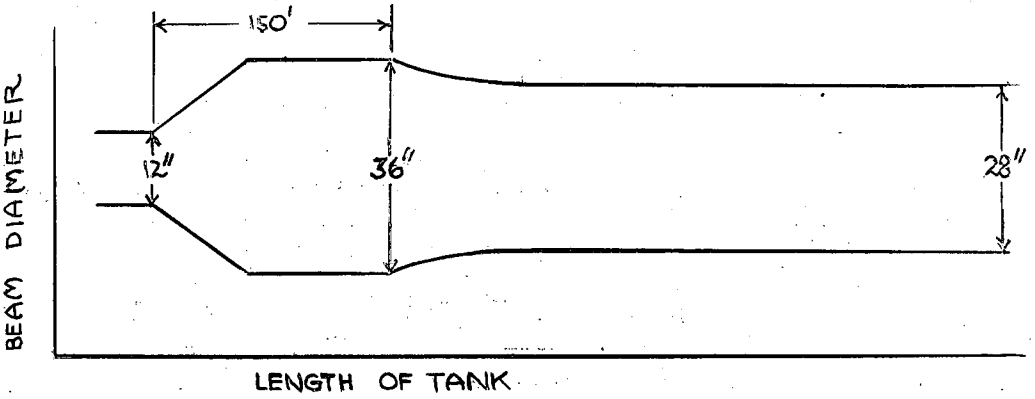
Panofsky stated that the present magnetic calculations for Mark II are preliminary and will remain so until the front end of the machine is designed and more data is available on the tailoring of the beam to fit the behavior of the accelerated particles at the high energy end.



Sketch 1.

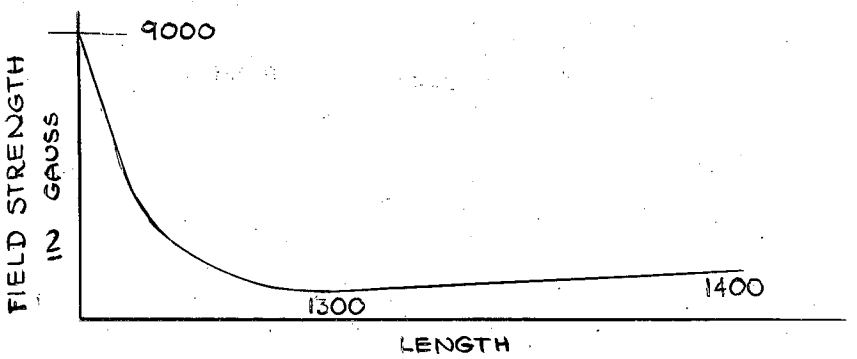
Panofsky pointed out some of the difficulties in determining the preliminary magnetic calculations. Sketch 1 shows a diagram of focusing and defocusing forces as a function of distance along the length. The focusing forces are so designed that they are always greater by a certain fixed amount than the defocusing forces. Therefore the focusing forces for the high energy portions of the curve are greatly dependent upon the input focusing forces which must be determined by differential analyzer computations. The preliminary calculations presented in the April 18 engineering notes, UCRL-1247, allow 25% difference between focusing and defocusing forces for Mark II at the point of Mark II corresponding to the output energy of Mark I. Focusing forces for Mark I are designed to be 18% greater than the defocusing forces. As it now stands, there is an equal chance that the present design for Mark II focusing forces will be changed and the change may be either an increase or decrease. Until the front end

calculations are completed, the changes necessary will not be known.



Sketch 2.

Tailoring of the beam follows a pattern such as Sketch 2 presents. The taper for tailoring ahead of the first 150 feet has not been determined and is dependent upon front end design. Sketch 3 shows the magnetic field as a function of distance along the tank.



Sketch 3.

Hildebrand asked for the design criteria for the 12-inch injection length aperture. Panofsky stated that 12 inches is the maximum diameter that would ever be considered for the entrance aperture and that certainly an 8-inch aperture would do for the Mark II as presently considered. Hildebrand inquired about the necessity for the 1500-foot tank and also the firmness of 12 megacycles as the operating frequency for Mark II. Panofsky pointed out that because greater than a quarter of an Mev per foot electric field gradient can be held in large evacuated tanks and also because the injection of ions of 500 ma milliamps in a 4-inch diameter beam are possible, it would seem that a closer look should be taken to re-evaluate the Mark II designs for 20 megacycles and 750 feet. [redacted]

Hildebrand stated that a change of design to 20 megacycles and 750 feet would reduce capital costs by a figure that would not be greater than $30,000,000. A rough estimate has been made which shows that the change in design for the mechanical parts would be in the order of $15,000,000. The remaining $15,000,000 of the $30,000,000 quoted is strictly a guess, since no estimates have been made for other factors that would be affected. The point to bear in mind is that the change would certainly bring no greater saving than $30,000,000, more likely $20,000,000, and this would be at the cost of at least a year's delay in the completion date. This saving is a small fraction of the total costs of the machine. Panofsky pointed out that the power losses in the skin are directly proportional to the square root of the diameter of the tank and inversely proportional to the length, which means that losses for the smaller tank would be greater. Gordon pointed out that the magnet design for the higher frequency tank is more difficult due to closer spacing of the drift tubes and their gap splitters. The principal conclusion is that both the choice of length and diameter is at present defined by the maximum permissible gradient.

For information, Alvarez pointed out that the X-rays in the test cavity had been reduced by about a factor of 10 by acid cleaning methods.

Panofsky discussed the placing of pre-exciters in the Mark II cavity. It has been found from experience with the 40-foot linac now operating at the Radiation Laboratory that the multipactoring effect with the attendant need for bias is dependent upon the location of the pre-exciter loop. If the loop is placed at the high energy end no biasing is required and the multipactoring effect is reduced at the low energy end, whereas placing the pre-exciter at the middle of the tank makes biasing necessary. The Radiation Laboratory would like to leave open the question of where to place the pre-exciters for Mark II until further information is available on this effect. No restriction exists as to placement of the main oscillators if they are distinct from the pre-exciters.

Panofsky discussed UCRL objections to the feasibility report now being prepared by CR&D. The Radiation Laboratory desires that the 100 milliamp CW non-expandable case be given the proper emphasis in the feasibility report. As the report now stands this case appears to be a subordinate of the 500 milliamp expandable case which the Radiation Laboratory believes does not express the consensus of the review committee, which is that the 100 milliamp CW case appears technically best of the 100 ma cases in view of the presently known data. The Radiation Laboratory also wishes to point out that the decision between the two 100 ma cases should rest on the power company's ability to supply power in sufficient time. An effort should be made to impress the power company with the requirements for CW operation. Hildebrand asked if the Radiation Laboratory would accept a change in the wording of the

summary part of the feasibility report to satisfy their objection to the subordination of the 100 milliamp non-expandable case instead of a substantial addition to the tables in the technical description of the report. Hildebrand pointed out that the report as being prepared is divided into a summary and individual technical descriptions of the accelerator, target assembly and processing plant. The Radiation Laboratory would prefer to see changes made in the technical description as well as the summary, but in view of the work necessary to modify the tables the change in the summary description will be satisfactory.

The Radiation Laboratory also objects to the wording used in connection with the period of 7 months described as "required for tuning the accelerator". The Radiation Laboratory prefers the wording to be changed to "required for debugging the accelerator" since tuning will require much less time than 7 months. "Debugging" more fittingly describes the many adjustments and tests necessary to produce satisfactory operation after the construction phase is completed. Hildebrand pointed out that CR&D in reviewing the data in the feasibility reports shows the 1/10 ampere case to be more costly than previously estimated, while the 1/2 ampere has remained about the same. From this comparison one might judge that the non-expandable cases--i.e., 100 ma PW and 100 ma CW--are not strong contenders for the Mark II machine.

Alvarez stated that no one is certain that 350 Mev is the best energy for a Mark II accelerator and it would seem that we should investigate the desirability of operating at other energies in view of the better information that is now available. It might be that 250 Mev would be better in the light of economic considerations. The change in energy of the accelerator would not affect the design of the power equipment now out for bid but would modify the number of units that will be required to attain this energy.

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