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UCRL-1008
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 NOVEMBER 14, 1950

Russell H. Ball

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RESEARCH SERVICE BRANCH
Atomic Energy Commission
Berkeley Area
Berkeley, California

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MINUTES OF MTA PROGRESS MEETING
HELD NOVEMBER 14, 1950

Present: UCRL: Alvarez, Baker, Brobeck, Brown, Byerly, Chupp, Cooksey, Cork, Farly, Gordon, Hanson, Judd, Kilpatrick, Latimer, Lofgren, Longacre, Martin, McKissen, McMillan, Norton, Panofsky, Powell, Reynolds, Serber, Sewell, Thornton, Twitchell, Van Atta, Wallace

CRDC: Chambers, Davis, Hansen, Hildebrand, Maker

AEC: Ball, Spedding, Wilhelm

G.E.: Webster

Westinghouse: Hulse, Kresser

Brobeck said that in a meeting yesterday with Professor Lawrence the date of February 1, which was mentioned last week as the approximate date by which the major design features of Mark II would be decided, was discussed. The Laboratory wanted it made clear that only very tentative design specifications will be available by that date. It was decided that we will not proceed now with the development of the 300-KV DC injector which was discussed last week, since there are other ways of obtaining the advantages of high energy injection such as decreasing the transit time loss in the first few gaps or the use of a grid on the first drift tube.

Brobeck emphasized that both the Mark I MTA and the L-1 test cavity are of equal importance in the Mark II MTA program. The Mark I machine will be used to obtain data on the behavior of the low energy end of Mark II, while the L-1 test cavity will supply data on the behavior of the high energy end. Hildebrand added that the schedule for the construction of L-1 will remain several months behind the Mark I schedule even though it will be possible to use the Mark I power supply for initial operation of L-1. Alvarez pointed out, and after considerable discussion it was the consensus of the meeting, that the design specifications for Mark II cannot be made more definite than they are at the present time until Mark I is in actual operation.

Brown reported on calculations to estimate the loss of neutrons by resonant capture in the primary target. The primary target is expected to be composed of either uranium or thorium. During operation, neutrons of 1 to 2 Mev will enter the moderator from the primary target. During moderation the neutrons pass through a resonance region in which there is a relatively high probability of capture by either thorium or uranium. Although the loss of neutrons

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through this process is not complete, since the production of plutonium or U-233 respectively will result, it will be desirable to keep the resonance capture in the primary target at a minimum in order to concentrate the production of product material in the slugs in the lattice region. Estimates of the neutrons which are lost through resonance capture (expressed as a percentage of the total neutrons produced) depend on the moderator material, being 24% for graphite, 18% for beryllium, 13% for D_2O, and 4.5% for H_2O.

These figures are much too high and can be materially reduced by placing between the primary and secondary targets a blanket of beryllium, H_2O, or D_2O. By using a 2-centimeter blanket of H_2O the loss by resonance capture of neutrons diffusing back to the primary target is reduced to less than 1%. By using a 5-cm blanket of D_2O this resonance capture loss becomes 2%, while a 7.5 cm beryllium blanket makes this loss 5%. The blanket material described above is effective in reducing the loss by resonance capture since these blanket materials are much more transparent to the fast neutrons leaving the primary target than they are to the moderated resonance energy neutrons which diffuse back into the primary target. The use of a water blanket is not as advantageous as the above figure of 1% would indicate, since it has a large capture cross section for thermal neutrons and the resultant loss of neutrons by thermal capture in the water blanket would amount to about 10%. For this reason only D_2O and beryllium are suitable as blanket material. In the case of blankets of the latter two materials there is some loss of thermal neutrons in the primary target which is essentially offset, however, by the production of neutrons by thermal fission in the uranium of the primary target. About 2 tons of heavy water would be required for a target 6 feet in inside diameter and 15 feet long.

Brown said a model graphite lattice is being built in order to test the basic soundness of calculations on neutron economy in the target. This model will have a diameter of about 5 feet and will be about 5 feet long. It will have provision for the use of a primary target of either thorium or uranium as well as for the insertion of appropriate blanket materials. The graphite bed will be provided with aluminum tubes through which will flow CCl_4. The CCl_4 has about the same capture cross section per unit volume as does a 5% lithium-aluminum alloy or uranium. The total neutron absorption by the CCl_4 will be determined by the measurement of the Cl^{36} activity produced and will therefore duplicate the diffusion properties of these target materials. Provision will be made for holes through the graphite lattice so that flux distribution of neutrons of various energies can be determined by the insertion of foils of metals which have resonance capture in the desired regions. Resonance and thermal capture in the uranium will be measured by the use of cadmium-covered and bare uranium foils, respectively, in which the neptunium activity will be determined. The graphite lattice in this test target will be made from C-18 graphite, of which there is an ample supply in store at the Laboratory.

Baker said the one megawatt oscillator is working well. It is now yielding

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an output of one megawatt at a plate voltage of 17.5 KV and with an efficiency of 78%. The resonant load (B-1) is now being pumped down to vacuum. It has been pumping for the past 3 days. Several leaks will have to be repaired before operating vacuum can be obtained. The X-ray production experiments in Building 16 have been continued. The voltage on the electrodes under CW operation has reached 1.05 megavolts. This produced an X-ray intensity of 90 R as measured through a 1-inch lucite window at the top of the tank. It appears that the X-rays are produced predominantly at the bottom of the tank near the rear instead of in the region of the high voltage electrodes. Alvarez pointed out that the X-rays originate where the electrons terminate their trajectories rather than where they originate. Brobeck asked Baker what his plans were with regard to pre-exciters. Baker said that a preliminary design of the pre-exciter housing has been made and that engineering drawings of this are now being made. Baker also said that the use of low-level excitation is still considered advisable. In the event that the ion locking problem proves serious, however, it will be necessary to augment this with high-level pulsed pre-excitation. He said that the XC unit has been known to operate occasionally without pre-exciters but only after prolonged and intensive operation which has allowed a very thorough bakeout of the tank. Panofsky said that with the 40-foot linear accelerator, also, the problem of pre-excitation becomes simpler after prolonged operation. Panofsky said that in initial operation of the 40-foot linac it was found necessary to pre-excite the high energy end of the tank because multipactoring occurred at the low energy end. However, after operating for some time it is possible to move the pre-exciter to the low voltage end.

Longacre said that it is still necessary to get the power from the more powerful oscillator into the electron model cavity in order to overcome the operational difficulties which are unique to this model. Also, a new injector, required to simulate more closely the injector designed by Lofgren, has been built and will be tested.

Hansen said that the 10th reinforcing ring is scheduled for erection tomorrow. The steel erection for the vessel is now about 25% complete. The east-west tunnel on the south side of the building will be started this week. The Contra Costa Electric Company has installed the foundation for the 40,000 KVA transformer and have about 60% of the excavation done for the underground conduit. P.G. & E. has now erected all of its power poles and is stringing insulators. Thomas and Rosenfeld are fabricating manifolds and working over the Kinney pumps. Bids on the power supply building are now being analyzed. Two companies are working on bids for the liner but satisfactory bids have not yet been received from either of them. In answer to a question from Twitchell he said that all of the sheet copper for fabrication of the liner is now in storage at Livermore.

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