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UCRL-1388  
Technology - Materials  
Testing Accelerator

UNIVERSITY OF CALIFORNIA  
RADIATION LABORATORY  
Contract No. W-7405-eng-48

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CALIFORNIA RESEARCH & DEVELOPMENT COMPANY  
Contract No. AT(11-1)-74

MINUTES OF MEETING OF MTA REVIEW COMMITTEE  
HELD JUNE 26, 1951

Russell H. Ball

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RESEARCH SERVICE BRANCH  
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MINUTES OF MEETING OF MTA REVIEW COMMITTEE  
HELD JUNE 26, 1951

Present: UCRL: Alvarez, Brobeck, Bradner, Dimmick, Latimer, Lofgren,  
McMillan, Norton, Panofsky, Reynolds, Thornton,  
Van Atta

CR&D: Cope, Frankel, Hildebrand, Powell

AEC: Ball, Campbell, Derry, Fidler, Fleckenstein, O'Donnell,  
Platt

Hildebrand announced that the Mark I tank had been evacuated to a pressure of  $3 \times 10^{-5}$  millimeters before leak hunting was started on the vessel. A crack was found in one of the welds attaching the circular head to the west end of the vessel. It was decided to magnaflux the other weld to see if other flaws could be found and several flaws were detected in so doing. The circumferential weld on both heads is now being X-rayed. The X-ray is expected to be complete in two or three days.

Powell said that thirty days have been allowed between the delivery of the last liner panel and completion of the liner installation. The magnet for Drift Tube 8 has been tested. Tubing had been soldered in place on the heads for the drift tube shells and it appears that the soldering problem can be solved. August 15 is the scheduled completion date for assembly of the injector for use at Livermore.

Two of the six liquid nitrogen baffles newly installed on the B-1 test cavity have developed internal leaks and have resulted in difficulty in holding an adequate vacuum. There was found to be some water remaining in the vessel following the last cleaning operation. The oil will be changed in the diffusion pumps and an attempt made to achieve an operating vacuum.

Lofgren said the grid is a central part of the injector and this is also one of the weakest links since it is heated by the beam and becomes a source of secondary electrons. He said an attempt is being made to achieve focusing of the beam by using a solenoid magnet in place of the grid. Present indications are that the magnetic focusing will be satisfactory but at the present time a magnet of sufficient strength is not available. A run has been made using a magnet of one-half the desired strength and the injector has operated reasonably well.

Alvarez said they now have a test vessel equipped with mercury vacuum pumps to investigate X-ray loading. It is as yet too early to say whether the X-ray production is better or worse.

Brobeck said according to the present trend Mark II (12 megacycles, 1500-foot) design will be continued in San Francisco. The Radiation Laboratory will continue to furnish the basic information on the rf system and beam dynamics. However, the Radiation Laboratory will stop construction of the electron model of Mark II until we come nearer to the time that the model tests will be needed. There will be plenty of time to obtain these model tests after a decision has been made on whether to proceed with that design. Continuation of these Mark II model tests would interfere at the present time with the X-ray loading experiments. By the first of August the design of the inside of the cavity and the magnets should be known. Alvarez said we are also giving up studies on the 20-megacycle design and 300-KV injection.

Powell said the present situation is that, as far as the Mark II program is concerned, it remains the same as the approved money and program which the Commission recently approved, allowing 16 to 17 megabucks combined effort. There is no money in that budget for optimization of 20 megacycles.

Derry said this bears back on our discussion of May 6 when this topic was discussed with the Commission. He said he thinks the Commission is under the impression that these studies were intended to be carried on with the Mark II research and development studies by the Radiation Laboratory, but apparently, according to Reynolds, this is not now included in the budget. It was not included in any budget tables or any descriptions in the analysis and was not therefore carried through any approvals of the Commission on June 13, so there is therefore no money for this. Likewise, at a meeting of Lawrence and Powell with the Commission a week ago Friday (June 15, 1951), there was, in fact, no decision except to ask for a report on the feasibility of Mark III. There is no change in emphasis or changes in any programs whatsoever.

Alvarez said it was not clear what is the optimum energy for Mark II.

Panofsky asked about abandoning the model work on Mark II. He said the way the picture was presented to him was that the emphasis was shifting from Mark II so that it would be necessary to drop some of the model program. Derry said the Commission does not understand that there is any change in program or emphasis as yet. Alvarez said this shifting emphasis is merely Laboratory planning. Derry said the Commission would like to obtain from the Laboratory a report on what shifts in emphasis are desirable. Brobeck said that at the moment the Laboratory is tapering off on some of the Mark II alternatives, but one which is going ahead is studies on the shape of the drift tubes.

Brobeck said he understands the Commission wants essentially two reports on Mark III--one covering a machine to be built at Livermore to test the Thomas cyclotron principle and the other report to be on the practicality and economics of this type of production machine to compare with Mark II.

Thornton said the XC is the only major additional model test for Mark III which it will be necessary to get underway in the near future. He said the tests that have been made so far with dee voltages in the region of 1,000,000 volts and have shown that the sparks developed in the presence of the magnetic field are particularly destructive because of collimation of the arc discharge. The aspect of these tests which is disturbing is that they have been run on a system of relatively small stored energy. We need additional experimental evidence to determine whether we can get by with copper surfaces or whether it will be necessary to use graphite or refractory metal surfaces in the region of these discharges. It will therefore be necessary to build at the XC magnet an rf system having a substantial amount of stored energy to put more destructive power behind the sparks. There is presently available in the XC building about one megawatt of rf power. It appears that it will be necessary to approximately double the power available. Alvarez suggested that consideration be given to installing a magnet for use in conjunction with the B-1 test cavity, which facility is already supplied with sufficient rf power for these tests. He felt it might be better to equip B-1 with a magnet than to build additional rf power for XC. It was the consensus of the group that this suggestion should be studied. Alvarez proposed an alternate suggestion that a magnet be constructed for use with the L-2 cavity at Livermore.

Thornton said additional tests are being planned with the 20-inch injector cyclotron to gain experience with 3-phase operation and problems of beam acceptance in a 3-phase rf field. It is also planned to continue the electron model studies. It is planned to add a dog house to one side of the tank and attempt to remove and focus the beam--i.e., to get a well defined beam at a suitable distance from the machine. New poles are to be installed on the electron model to provide a more precisely shaped field.

Van Atta said it is hoped to get some neutron production measurements at Chicago with 250-Mev deuterons. (Present measurements have been limited to 190 Mev deuterons). It is presently planned to conduct these measurements during August. They are now in the process of tracing out the paths of the scattered beam. By the end of this week they should have an idea as to the optimum scattering angle of the beam obtainable and the target thickness to use. If it proves possible to scatter out  $10^{-6}$  of the circulating beam we can perform our experiments satisfactorily. Attempts will be made first to get a satisfactory beam by scattering. If this method should not work they will consider using the regular beam ejector. Bradner said that on the Nevis cyclotron they did a careful job of figuring where to put a

scatterer and found they got along better without a scatterer than with one.

Thornton said he has heard a rumor to the effect that one might think seriously of using a light Z target material. Van Atta said there have been several tests with these materials to determine their relative advantages for use in primary target. The present indications are that if one uses beryllium as a primary target and backs it up with uranium in the secondary the neutron yield would be about 80% of that obtainable from a pure uranium target. This would require the use of a foot or more of uranium in the secondary target. The yield from a thorium primary - uranium secondary combination would be about 90%. Van Atta said no information is available on the yield from low Z targets as a function of beam energy but some of the work at Chicago will indicate this behavior because it is planned to use both low and high Z materials in the yield experiments at Chicago.

Thornton said the question has been raised regarding the classification policy. He said there has been little, if any, attempt to hold information on light element reactions, as has been done with the heavy elements. These problems become quite important in considerations of optimizing Mark II as regards beam energy and in comparing the economics of Mark II and Mark III. If the energy curve is less steep for this type of target than for the thorium-uranium target this would be a very important point to know.

McMillan asked how the neutron yield was for intermediate elements. Van Atta said the yield is relatively low for intermediate elements. The yield is high for the very light elements. It is a matter of competition between stripping and other types of event that can dissipate deuteron energy. With light Z targets one is much more dependent upon multiplication in the secondary target. Van Atta said that, if one settles for 250 Mev, a beryllium target may have the edge when consideration is given to all of the problems involved. When one goes to high energies where the target power distribution goes to greater depths then high Z materials will be advantageous. Platt asked if there were really a rise in neutron yield at low Z or if the yield with beryllium is due to the presence of an available neutron in beryllium. Van Atta said there is a rise in yield with such elements as lithium and beryllium. It was found that lithium, beryllium, and LiD all had about the same neutron production and if used with enough secondary target all have a rather high yield.

Ball said that he received information last week from Dalzell, of the Reactor Development Division in Washington, to the effect that the Sylvania Electric Products Company has been turning out test specimens of sintered uranium slugs already canned in either zirconium or aluminum. The sintered slugs are as dense as the present slugs and when subjected to thermal cycling tests which resulted in severe

growth to the present-type slugs the sintered slugs have shown no detectable growth. He suggested an investigation of the use of sintered uranium in the primary target. Van Atta said that as the time schedule for Mark II stretches out the probability of using uranium in the primary target increases because it is certainly the element we would like to use.

Brobeck asked whether there was an estimate of the yield with a lead secondary target--that is, from a target which contains no uranium. Van Atta said a thick lead target gives a neutron yield about 50% of that available from a thick uranium target.

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