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UCRL-1364
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 MEETING OF MTA ACCELERATOR COMMITTEE HELD JUNE 14, 1951

Russell H. Ball

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RESEARCH SERVICE BRANCH
Atomic Energy Commission
Berkeley Area
Berkeley, California

MINUTES OF MEETING OF MTA ACCELERATOR COMMITTEE
HELD JUNE 14, 1951

Present: UCRL: Baker, Brobeck, Dimmick, Farly, Gordon, Lofgren, Norton, Reynolds

CR&D: Hildebrand, Eifrig

AEC: Ball, Fleckenstein

Hildebrand announced that the vacuum vessel at Livermore has been evacuated to a pressure of 170 microns as of last night. It was then let down to air to remove some nitrogen traps. He said they have been delayed considerably by the numerous leaks found in the piping of the booster pumps received from DPI. It will be necessary to rebuild the oil piping on all 5 of these booster pumps. When a pressure of 170 microns was reached the vessel was shut off and allowed to sit for a time and there was no significant change in pressure, indicating that there are no serious leaks present.

The strength test without the drift tube load is now complete. At the present time concrete shielding blocks are being placed along the top of the vessel to simulate the drift tube loading and the vessel will be pumped down again tonight for the final strength test. The strain gauge readings were comfortably below the design values on all gauges, the difference being presumably due to conservative assumptions made in the calculations. Yesterday one strain gauge read 10,000 pounds too high and additional strain gauges were put on the tank and were found to give normal readings. It is assumed that this one erratic reading was due to a welding strain which relieved itself. During the evacuation all the strain gauges except the one mentioned above gave readings proportional to pressure, indicating that we are within the elastic limit. The deflections of the vessel as observed from the survey points were also satisfactory. The reference points for these transit surveys are on the support columns of the building. There is an uncertainty of about 1/16 inch in the readings obtained with these transits due to uncertainties in the average temperature of the building columns and vessel supports.

Lofgren asked if the intake line for letting the vessel down to air is provided with a filter. Hildebrand said that it does not have one at the present time but this is being worked on as rapidly as possible and the filter should be provided in time for the third let down. Lofgren pointed out that the dust introduced with each let-down accumulates in the vessel so that care should be taken from the very beginning in avoiding the introduction of dust into the vessel.

Hildebrand said the large motor generator sets supplying the oscillator plate power has been turned over to test phase sequence and phase rotation.

Hildebrand said they are about to go out for bids for material to close in the east end of the accelerator building. He said that finished oscillators could be stored under canvas in the accelerator building or in the AR building pending the closing of the east end of the building.

Hildebrand said that CR&D has put its own superintendent on the liner fabrication at the Oscar Krenz Company. They have made some personnel changes and rearranged things somewhat. Four of the liner panels have been completed and 4 more are scheduled fro completion this week. There is considerable optimism that fabrication techniques can be improved considerably and make up some of the time that has been lost. Brobeck said that there has been one change in the design of the liner sections in order to get them out of the bottleneck with Krenz. This change was to eliminate the requirement for soldering of the return bends of the tubing that cover the liner panels. This change will result in a temperature rise of 35° C at the ends of panels where the return bends are not soldered compared to the original design temperature rise of 10° C. In answer to a question by Lofgren, Brobeck said that the tubing on the liner sections has been vacuum-tested with freon but not with helium. Hildebrand said that leak testing will be done on each section at Livermore as they are delivered. Brobeck said authorization has been given Krenz to omit the addition of copper reinforcements in the region of the return bends (to increase the thermal conductivity of the liner panel in these regions) if trouble is encountered in their installation.

Reynolds said that Lofgren wants a 300-KV injector test set up at Livermore and has questioned the desirability of duplicating the 100-KV test section at Berkeley. Lofgren has proposed that we do not set up separate 100-KV test equipment but rather use the equipment which would form one of the 3 stacks of the 300-KV unit. Tests could be run from this set-up for a considerable time. Lofgren emphasized that he will require high head room in the building to house the 300-KV installation. Hildebrand suggested adding more head room to their present building instead of moving into the drill hall. Lofgren agreed to supply Hildebrand with a rough estimate of the required head room. Lofgren said that for the first several months of operation at Livermore repaired injectors will have to be checked out on the main power supply.

Lofgren said that there are initial injector tests to be conducted at 100 KV of importance to Mark II--for instance, trying to focus the beam entirely by magnetic focusing. The only possibility of getting answers to this question in the next few months is to leave the present injector equipment undisturbed at the Radiation Laboratory. A meeting was scheduled for Monday, for Hildebrand, Reynolds, and others interested, to draw up a schedule for moving the injector equipment to Livermore.

Gordon said that they have made some layout studies with a model of A-12. The particular case studied has been the large injection aperture required for a gradient of 23 Mev per foot. This geometry has been worked out in detail at the injection end up to 30 Mev, which is equivalent to about 170 feet of length full-scale and contains a total of 28 drift tubes. The first drift tube is about $7\frac{1}{2}$ inches in length full-scale. A table of full-scale dimensions and also 1/20 scale for operation at 12 megacycles and 94 KV injection energy has been distributed to interested persons. The first drift tube is very thin, the ratio of bore diameter to length being almost unity, so that one has difficulty in installing a magnet to produce the required magnetic field. At the present time they have a model of the magnet which consists of 20 turns of 1/16-inch copper tubing arranged in pancakes. The dimensions of this drift tube are similar to the one required for 20-megacycle operation at 30-KV injection energy. Calculations are also being made to determine the advisability of using a refrigerated cooler for the windings of the first drift tube. They are also trying to determine the practical upper limit for the design of the drift tube magnets by using the maximum allowable pressure drop and refrigerated coolants. The support stem for the first drift tube is 4 inches outside diameter (full scale) at the surface of the drift tube. Baker suggested that the magnetic force on the first drift tube could be carried by a quarter-wave stub running out through the end of the vacuum tank. The power loss from such a stub would amount to several kilowatts. Lofgren said that when one wants to push the design of a magnet it is generally desirable to go to high currents and fewer turns because this requires the insulation of fewer layers and for smaller voltages. One can therefore devote more space to conductor and less to insulation.

Gordon said the the electron model is carried to 30 Mev it will be 9 feet in length. They will have to determine whether to build a new vacuum system for this model or whether they can use the vacuum system for the present electron model which is now being used for emission studies. As the beam radius decreases, the magnetic field must become more intense. The plot which Martinelli has worked up for 20 megacycles is for the drift tube proportions used in Mark I, where the field is about 2500 gauss in the last drift tube. A field of about 20,000 gauss will be required for apertures of 4 or 5 inches, which is the limiting case.

For A-12 the larger drift tubes are planned to be of constant diameter. There is a variation of G/L but the liner tapers to keep the resonant frequency of the unit cells constant. The shunt impedance of the high-energy end could be improved by reducing the drift tube diameter and increasing the diameter of the liner. The problem encountered in reducing the drift tube diameter is that associated with the reduced space for the magnet and the higher magnetic fields required to maintain the beam at the reduced diameter. They are now studying the magnet power versus drift tube dimensions. These will then be related to rf power on the basis of the impedance that is associated with these

reduced diameters. One soon runs into an impasse, since one requires a finite clearance around the inside of the magnet for cooling of the drift tube shell. As the limit is approached we get into magnets which are of the solenoid type and which are not as efficient as the short iron-clad designs used today. They have not investigated the effect of the change in the ratio of bore to outside diameter of the magnets. The present drift tubes are 100 inches in outside diameter with a 36-inch aperture. For the 20-megacycle case the outside diameter will be 61 inches and the aperture would be 22 inches. They are now studying the effects of reducing these dimensions in proportion.

Gordon said another variation on this theme is to consider drift tubes having odd shapes--that is, drift tubes that have small apertures and fiarly small outside diameters except for a section near the middle in which the magnet can be placed. On the basis of preliminary measurements made some weeks ago, it looks as though this modification may not increase rf power losses.

Gordon said there are so many variables involved in the designs of these magnets that they are faced with the problem of deciding what variables to investigate. They are now studying drift tubes of the present proportions and reducing their diameter only.

Baker said that three of the six pumps are now mounted on the B-1 cavity and the other three pumps should be installed by late today. The cleaning of the ball will be undertaken immediately after installation of the pumps. They are using a plastic cloth to keep dust out of places where they don't want it, so that cleaning of the ball should proceed rapidly. It is expected to have a vacuum in the B-1 cavity by tomorrow. Baker said they have been making tests on the new oscillator system. The evidence indicates that it will work all right and that it is probably better and more simple than the old system. They have taken all the parts except the transmission line, the tube, and the blocking resistor off the oscillator. This system is applicable to the RCA 2332 and will also work with grounded grid operation. The system does not parasite when tied to a half-wave line. The current modulation tests indicate that it will work.

Hildebrand said the question has come up as to how many oscillators can be supplied from one power cubical. The consensus of the following discussion was that 4 to 6 oscillators could be supplied from one cubicle.

Baker said that if the transmission line is long enough they can eliminate the ballast resistor since the crowbar can be made to fire before a sufficient number of reflections can be passed back and forth through the transmission line to seriously overload the tube.

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