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MINUTES OF MEETING OF MTA REVIEW COMMITTEE HELD AUGUST 28, 1951

E. D. Fleckenstein

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MINUTES OF MEETING OF MTA REVIEW COMMITTEE
HELD AUGUST 28, 1951

Present: UCRL: Alvarez, Brobeck, Latimer, Lawrence, Lofgren, McMillan, Norton, Panofsky, Reynolds, Thornton, Twitchell

CR&D: Mayer, Miller

AEC: Ball, Fidler, Fleckenstein

Brobeck stated that a request for authorization to spend money on the Long Drift Tube Test in Mark I should be forwarded to Washington soon in the event that Mark I start-up goes at the optimistic pace. An early authorization is necessary if the required materials are to be obtained to meet an early schedule. Engineering designs are essentially completed and cost estimates have been prepared showing that approximately $85,000 is required for materials and a total of $195,000 for the entire job. Lawrence suggested that submission of the request for this expenditure be delayed until Powell returns.

Alvarez stated that tests by Kilpatrick on drift tube conditioning to reduce the X-ray level and the amount of sparking are very encouraging. Both chemical cleaning and heating have been tried and it is found that the cleaning will reduce the X-rays to a low level; however, heating in addition is necessary to relieve the sparking condition to any great extent. With both cleaning and heating the X-ray level is reduced to an extremely low level. Because the present design of drift tubes as used in Mark I and contemplated for A-12 will not stand the temperatures used by Kilpatrick in the tests it appears advisable to consider now the changes that may have to be made to provide for heating the Mark I drift tubes before operation.

The design and changes are complicated and require considerable thought. The present magnets cannot take the temperatures used in the tests. It may be satisfactory to heat at lower temperatures for longer periods but this is not known for certain. Methods of external heating are to be studied.

The test cavity (B-2) used by Craig Nunan is being converted to mercury pumping to provide test facilities that duplicate the conditions used by Kilpatrick (B-3 cavity). The Baker cavity (B-1) is not suitable for heating tests; however, the chemical treatment will be used in this cavity to study on a large scale the effects on the X-rays.

The encouraging results on the ability to reduce the X-ray and sparking levels by drift tube treatments leads one to consider another drift tube design whose geometry is at first sight less favorable from a sparking standpoint, but more favorable from an efficiency standpoint. These tubes reduce the RF power requirements appreciably. These drift tubes would be smaller in diameter than those presently considered and may be envisioned as long cylinders with larger diameter central sections to house the magnets. The bore diameter would be the same as for the presently designed drift tubes.

In the design of drift tubes, the two important quantities that must be considered in determining the gap length are the shunt impedance of the cavity (Z) and the transit time (T) of the particles. Z is a measure of the power required to produce a given voltage in the cavity while T is a measure of the amount of this voltage that goes into the beam as an energy gain.

Efficiency is gained in the "stove pipe" geometry because gap lengths will be shortened and tank diameter will be increased. Shortening the gap length increases the amount of energy transferred to the beam and increasing the tank diameter reduces the energy lost in the cavity for a given voltage. It may be possible to realize a power saving of between 30-50%. The ability to hold a higher voltage gradient means that the tank for A-12 can be shortened when compared with present designs.

The use of thin drift tubes will increase X-rays by a factor of 2 to 3 which is insignificant when one considers the reduction of 10^9 in X-ray level that has been realized in the drift tube processing. One feels intuitively that the tendency to spark will be increased by the use of thin drift tubes but our present theories of high voltage RF sparks in vacuum predict that the sparking could be reduced in this geometry. This is because the varying magnetic field could spray the emitted electrons over a large surface area and reduce the possibility of gap breakdown by sparking. It should be emphasized that these ideas have so far not been checked by experiment.

If all of the present thinking about thin drift tubes is correct, it may be advantageous to go to higher energies than the presently talked about 350 Mev since the higher energies might be obtained with a shorter tank than the present design calls for.

Brobeck discussed some long range considerations for A-12 design. The first design consideration in this category is a cellular type structure containing many cavities instead of one long cavity. The cells would be formed by placing diaphragms in the cavity as shown in figure 1.

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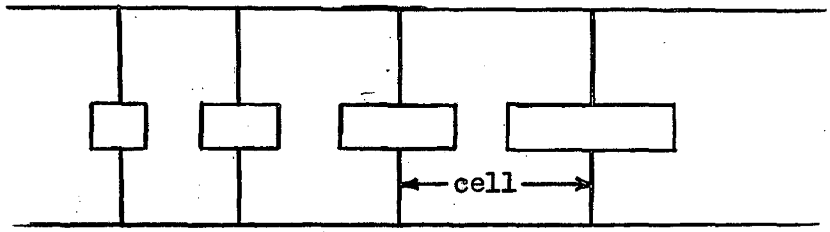

Figure 1

The drift tubes would be about half the length of the previous drift tubes. The particles would get twice as many kicks as before. The advantage of such a system is to lower the voltage gradient in the gap. The same energy of particle is gotten for the same tank length when compared to the present system. If the voltage gradient in the gap proves to be a dilemma, this may be a way out.

A second consideration involves changing the diameter of the A-12 tank in a step fashion. That is to make the first section of the tank essentially a Mark I while the rest of the tank would be smaller in diameter to resonate at 24 megacycles. Phasing of the oscillations in the two sections can probably be accomplished by using a master oscillator and a frequency doubling system. Such a design would result in a reduction of tank construction costs but would increase the magnet power requirements.

Both schemes depend on development of a satisfactory method of tuning a cavity to resonance with an independent oscillator.

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