**Title**
MINUTES OF MEETING OF MTA ACCELERATOR COMMITTEE HELD MAY 24, 1951



**Author**
Fleckenstein, E.D.

**Publication Date**
1951-05-24

UCRL-1321
C.2









UNIVERSITY OF CALIFORNIA — BERKELEY

# RADIATION LABORATORY

## DISCLAIMER

UNIVERSITY OF CALIFORNIA
Radiation Laboratory

Cover Sheet
Do not remove



INDEX NO. UCRL-1321
This document contains 9 pages
This is copy 16 of 31 series A



Issued to Information Division, UCRL


Classification

Each person who receives this document must sign the cover sheet in the space below.

| Route to | Noted by | Date | Route to | Noted by | Date |
|---|---|---|---|---|---|
| | R.B. | 9-11-51 | | | |
| | WC | | | | |
| | HWO. | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

UCRL-1321
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 MAY 24, 1951

E. D. Fleckenstein



Berkeley, California

| STANDARD DISTRIBUTION: Series A | Copy Numbers |
|---|---|
| Atomic Energy Commission | 1-5 |
| Carbide and Carbon Chemicals Division, Oak Ridge, Y-12 Site | 6 |
| Chicago Operations Office | 7 |
| Patent Branch, Washington | 8 |
| Technical Information Service, Oak Ridge | 9-13 |
| University of California Radiation Laboratory | 14-32 |

RESEARCH SERVICE BRANCH
Atomic Energy Commission
Berkeley Area
Berkeley, California

MINUTES OF MEETING OF MTA ACCELERATOR COMMITTEE
HELD MAY 24, 1951

Present: UCRL: Alvarez, Baker, Brobeck, Cooksey, Farly, Gordon, Lawrence, Lofgren, McMillan, Norton, Reynolds, Thornton, Van Atta

CR&D: Chaffe, Fossati, Hildebrand, Maker, McCrum, Myers

AEC: Fleckenstein, Moore

Brobeck announced that it is planned to start the vacuum tests for Mark I with the existing pumps and no liner in the tank. After these tests the stainless steel liquid nitrogen baffles will be installed as the liner is put in place. Fig. 1 shows the presently designed baffle system.

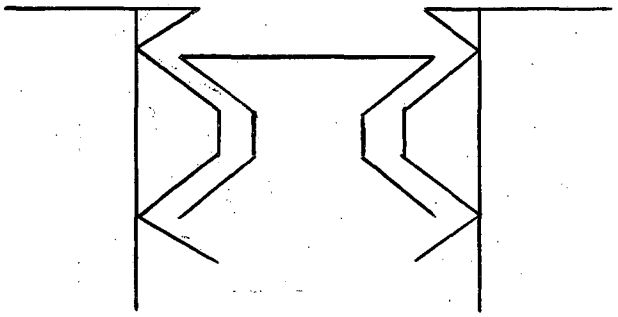

Fig. 1.

The baffles will require consumption of approximately 20,000 pounds per day of liquid nitrogen. With these baffles installed the pumping speed will be reduced to between 1/3 and 1/2 the present pumping speed. It is to be noted that the reduced speed is approximately the same as that obtainable with mercury diffusion pumps of the same size. An alternate baffle system (Fig. 2) has been suggested because of its simpler construction.

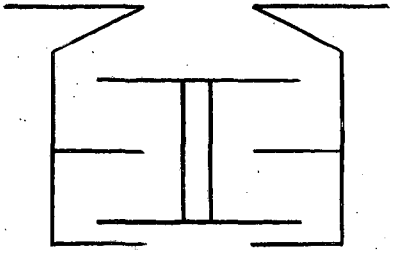

Fig. 2

CR&D will pursue both designs to determine which is the better considering ease of construction and the economics of copper or stainless steel fabrication taking into account the greater thicknesses of stainless steel necessary because of the large temperature differences in the various parts of the baffle. McMillan suggested the use of heat shields on all horizontal surfaces subject to radiation to reduce the amount of liquid nitrogen necessary for cooling. A liquid nitrogen baffle is to be installed in the B-1 test cavity to check the effectiveness of this baffle system.

Norton discussed the reasons the Radiation Laboratory and CR&D have dropped plans for the design of a cluster oscillator to power A-12. It was originally thought that transmission lines for a 1-megawatt tube and a cluster oscillator would be substantially the same and secondly it was believed that the circuitry would be simpler for a cluster oscillator than it would be for an equivalent number of individual oscillators. However, it has been determined that a transmission line for a single one-megawatt oscillator need be in the order of only 6 to 8 inches diameter, whereas originally lines of 18 to 24 inches in diameter were considered necessary. Since the tubes in the cluster oscillator are expensive items, precautions to prevent damage to each tube are considered necessary; hence the circuitry requirements would not be reduced measurably by clustering the tubes.

Baker explained that a smaller transmission line for the 1-megawatt tube is now possible because it has been found that large amounts of circulating power in the transmission line and tube circuits can be eliminated. This is made possible by the use of a 1/2 wave transmission line and flat coupling loop inside the cavity, thereby more tightly coupling the tube to the tank and eliminating the need for lumped circuit elements in the oscillator housing. Secondly, allowance for a 2-to-1 standing wave ratio is now considered adequate, whereas a ratio of 10-to-1 was considered necessary in designing the lines originally. For the 12-megacycle machine, the inner conductor will have an OD of $1\frac{1}{2}$ inches and the outer conductor will have an ID of $5\frac{1}{2}$ inches. These lines will be 40 feet long, with 20 feet under vacuum and 20 feet at atmospheric pressure. The vacuum seal will be an insulator placed as shown in Fig. 3, made of either quartz or other low loss material.

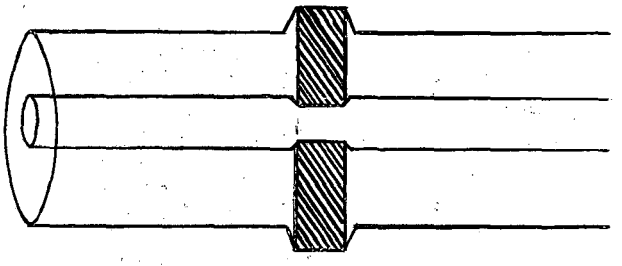

Fig. 3

With the 2 to 1 standing wave ratio zircon cannot be used. It will be noted in Fig. 3 that the insulators are mounted in recessed sections of the transmission line. These sections are necessary to provide field-free regions for the metal to insulator contacts and thereby reduce the sparking. The transmission line of the type described has been tested for some time on the B-1 cavity. It appears to be completely reliable even though there is a general concern about the use of insulators now considered. Baker pointed out that if by some chance insulator trouble does arise the 20-foot air section of the transmission line can be removed and the 20-foot vacuum section shorted out with a metal plate, thereby making it act as a quarter wave section with no effect on the operation of the machine. The metal plate also provides a vacuum seal. To check the reliability of insulators of this type, a system using an 8-inch quartz disc operating in a transmission line of 40,000 volts at 14 megacycles was run CW for a half day. No breakdown occurred during this time.

Tests on the A-2332 type tube and smaller transmission lines have led to consideration of substantial changes in transmission line design, the number of transmission lines necessary, the length of lines and oscillator positioning. All of the considerations reduce the complexity of the r-f system and building spare requirements. The changes in equipment and location brought about by these tests are being studied and the total effect should be known in about two weeks. Hildebrand asked that CR&D be advised as soon as possible since these charges materially affect the designs being prepared.

Myers discussed a cost analysis made comparing the large transmission lines to be used with the cluster oscillators and the proposed small transmission lines for individual tube use. Comparisons were based on a constant total rf power and it was determined that the size of the lines is proportional to the number of tubes in a cluster. It has been assumed that the weights of the lines are proportional to their diameters even though this will not be exactly true since greater amounts of material are required for structural reasons in the larger transmission lines. It has also been assumed that fabrication costs vary directly as the weights of the transmission lines involved. With these assumptions, it is shown that the use of many more smaller transmission lines is less costly than the use of large transmission lines and cluster oscillators. It is to be pointed out that in choosing the size of transmission lines standard sizes of pipes available from manufacturers were checked so that machining costs would be reduced to a minimum. In the case of the larger transmission lines some machining of the inner conductor would be necessary to obtain the proper impedance. It should also be pointed out that a complete analysis of all parts that may be affected by a change from cluster oscillators and large transmission lines to single tube oscillators using small transmission lines has not been made. It is believed that cost difference between the two will prove to be small enough so that a decision on which system to be used should be based

on electrical advantages. Such an analysis is in the process to determine accurately a good cost comparison.

Baker stated that the 1½% tolerance on impedance which has appeared in several discussions is a tolerance which is no longer necessary with the new half wave system and that something more in the order of ± 10% would seem adequate. This larger tolerance will allow greater leeway in choosing the sizes of pipes for transmission lines and also will reduce the machining necessary to obtain the characteristic impedance.

McCrum discussed the presently planned personnel safety measures for the Livermore Research Laboratory and requested that any necessary corrections or omissions in the distributed safety precautions be discussed. A copy of "Personnel Safety Measures for Livermore Research Laboratory" is attached as Appendix A.

High Voltage Equipment Discussion:

McMillan suggested that an automatic grounding device be included wherever there is a possibility that energy will be stored in condenser systems. Baker pointed out that grounding hooks should not be available for rf systems since the grounding hooks are a false sense of security in dealing with rf. Grounding for rf circuits should be done through the dc circuits in the oscillators generating the rf. Alvarez suggested that means should be provided for buggering the interlock systems in accordance with standard practice for experimental work.

Radiation Protection Discussion:

The general comment was that the wording should indicate that the protection is designed to prevent turning on the rf exciation and not the turning on of the beam, since there will be a radiation field with only the oscillators operating. It is considered necessary to be able to operate at some low level of radiation, such as is done with the 184" cyclotron. The protection system should allow for this type of operation. Thornton suggested that if two positions are to be monitored by remote reading electrometers the number of electrometers used should be 4, since it has been found that one unit at any one position cannot be relied upon completely. It is never known when that unit is not recording properly. Thornton suggested that instead of the two light system located outside the field doors a single magenta light for radiation warning is sufficient. Panofsky suggested that a gong should be audible in those areas known to have objectionable radiation level and that no general gong for all areas should be operated constantly. McMillan suggested a speaker system for general announcements such as used with the accelerators at the Radiation Laboratory, since such a system is very useful for announcing additional warnings about special conditions. Hildebrand suggested that an escape door opening from the inside only be provided for access from the tunnels. Thornton wished to correct the wording "portable radiation survey equipment" to read "movable or semi-portable radiation survey equipment", indicating that standard Radiation Laboratory area monitoring devices or similar

equipment is to be installed.

Protection for Personnel Entering Vessel Discussion:
It was generally agreed that the Standard Oil written pass system is certainly adequate since this company has had extensive experience in allowing people into large tanks containing many hidden areas.

APPENDIX A

PERSONNEL SAFETY MEASURES FOR
LIVERMORE RESEARCH LABORATORY

HIGH VOLTAGE EQUIPMENT

All high voltage equipment is provided with means for preventing contact with dangerous conductors by a combination of the following equipment:

1. Captive key switches which prevent opening enclosures for equipment until the source of power to the equipment has been turned off.

2. Door interlock switches which trip off the power source when the enclosure is entered.

3. Means for personnel to attach a ground conductor to the high voltage equipment involved.

RADIATION PROTECTION

To protect personnel from radiation inside the shielding the following has been proposed:

1. Provide switches on the shielding doors which will prevent beam application until doors are completely closed.

2. Provide a system of safety chain boxes with switches located throughout the area inside the shielding so that a box can be reached by a person in 30 seconds. Throwing the switch on the box will stop the beam and give notice to the control room of the location of the open switch preventing further beam application until this switch is closed.

3. Provide two remote reading electrometers to take radiation intensity readings inside shielding after the beam is off and before personnel enter shielded area.

   (Desirability of interlocking with shield door actuators to prevent doors being opened until a specified intensity is reached is in question.)

4. For purposes of warning personnel inside shielding that beam is to be put on the following proposal has been made.

(1) The beam application button will automatically sound a warning horn inside the shield for an interval of two minutes and start a time delay relay timing out before the beam actually is applied.

Simultaneously lights inside the shielded area will be dimmed and stay dim (2/3 normal voltage) so long as the beam is on. In addition a distinctive slow ringing gong will sound at all times when the beam is on.

(2) A two light signal will be located outside the shield doors at the door opening switch which will indicate by a red light when the accelerator is ready for beam application and will indicate by magenta light when the beam is on (Desirability of having lights of this type also inside the shielded area in addition to the other warning devices is in question.)

Portable radiation survey equipment together with air samplers will be used to measure and record radiation intensity outside the shielding at all times.

PROTECTION FOR PERSONNEL ENTERING VESSEL

It is proposed to use a system of written passes signed by the operating supervisor to allow entry into the vessel. All passes must be returned to the supervisor before the large vessel door can be closed. The desirability of including a key board which will require the return of all keys to the board before the vessel door can be closed is in question.