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PROGRESS REPORT NUMBER EIGHT OF THE RESEARCH DIVISION
OF THE LOS ALAMOS PROJECT

April 1, 1945

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GROUP R-1 MONTHLY REPORT, R. R. Wilson, Group Leader - April 1, 1945

JOB AND PERSONNEL

PROGRESS

3. P.M.

Anderson, Lavatelli,
Snyder, Woodward

An external beam of 3 μ a was focused on to a target in a 1" O.D. tube 5 meters from the cyclotron. This beam has been modulated such that a neutron pulse was produced which was .5 μ sec at half width. Preliminary tests using a BeO tamper indicate that the detecting equipment is satisfactory to measure reaction time of the order of .2 μ secs. A critical assembly of 25 in a WC tamper will be available in building X from April 20-23 during which time α will be measured using the fast modulation of the cyclotron and by the Rossi method which uses the same detecting equipment.

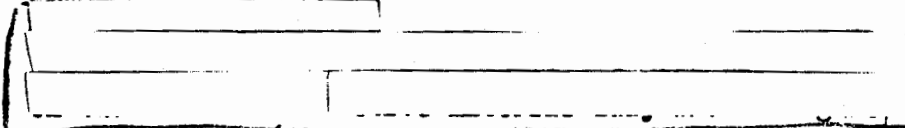
9. Model Experiment.

Anderson, Snyder, Sutton

The following runs have now been completed:

A. Target Assembly. Measurements were made to determine how much active material can be placed in the target before criticality is reached.

DOE 6(3)



For one series (the result of which was reported last time) the counter was covered with 0.050 in. gold, for the second with 0.030 in. of gold, and for the third with no gold. For each series data were taken of decay time as a function of diameter of "active" cylinder. To find the critical point, measurements were taken of the decay time of tamped spheres of "active" material as a function of sphere diameter. The decay times measured with 0.050 in. and 0.030 in. of gold on the counter agreed with one another within experimental error; those measured with no gold differed by 6 percent or less. However, the result as to how much active material can be placed in the target in order just to be critical does not seem to depend very much on these differences. The results are 1.34, 1.37, and 1.30 crits for the 0.050, 0.030 and no gold data, respectively. Here and in the following it is a WC tamped crit that is referred

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9. (Continued)

B. Gun Assembly. Measurements were made to determine how much active material could be placed in the gun barrel before it became critical.]

DOE b(3)

[
These measurements indicated that 2.4 crits can be put in the barrel.

C. Prodetonation. With the counter in the position it occupied in series A a curve was taken of decay time vs distance of projectile from its seated position. The area under the curve (proportional to prodetonation probability) agreed well with that which had been previously calculated.]

DOE b(3)

[
]

D. Miscellaneous.

DOE b(3)

1.]
[
]

2. The decay time for an active cylinder at the side of the cavity was compared to the decay time for the cylinder at the center. The measurement indicated that although the difference was small the assembly was less critical with the cylinder on the side.

Various effects such as the curvature of the decay curves, the manner in which the decay period depends on counter position, etc., are not well understood. A discussion of these effects will be given in a forthcoming report.

10. Measurement of α_0 of the test gadget.

Bridge, DeWitt, Sutton, Wilson

Tests which have been made on the use of electron multiplier tubes indicate that they are sensitive and fast enough to be used as detectors for the gamma rays accompanying the early stages of neutron multiplication. A modified oscilloscope tube [a scope]

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10. (Continued)

to measure the rate of multiplication has been constructed and partially tested. Cables for transmitting a signal from the a scope which is located at the gadget to the recording station 800 yards away have been procured and tested. A square pulse of .08 μ sec rise time can be transmitted down 800 yards of R.G.8U coaxial cable. Photographic recording of the oscillograph pulses has been tested. A check method for measuring a has been worked out and successful instrumented.

Sub Group R-1a

Arc Source D-D Initiator.
Cornog, Wilson

Further tests have been made and the results were sufficiently discouraging that further work has been abandoned. Although the source did not work, none of the tests indicated the reason for its failure.

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GROUP R-2 - MONTHLY REPORT, J. H. Williams, Group Leader, April 1, 1945

JOB AND PERSONNEL

PROGRESS

- | | |
|---|--|
| 10. Conversion of long tank to D-D operation.

Blair, Bush, Klena,
Seagondollar, Taschek, Turner | Preliminary tests with 2 mev deuterons have been made on the D2 gas target of about 100 kv stopping power, using a 400 kv aluminum foil between the gas chamber and vacuum system. These tests indicate that, (1) The D-D yield at 0° will be approximately the same as that from a 30 kv lithium target; (2) The background yield from the Al foil is about 25 percent of the D-D yield. Attempts are being made to secure foils of higher atomic number metals which will give a lower background; (3) Carbon is deposited on the foil from decomposition of oil vapor at an intolerable rate. A liquid air trap is being put on the target tube near the target to minimize this. |
| 13. $\sigma_p(25)$ as $f(E_n)$.

Bailey, Frisch, Taschek,
Turner | No further work. |
| 18. The efficiency of detection of various fast detectors.

Tank operations crews | No further work. |
| 21. The energy degradation experiment.
Hanson | LA in preparation. |
| 25. Measurements of scattering cross sections of various tamper materials in cooperation with Group R-3.

Long tank crew | No further work. |
| 33. Determination of the capture cross section of various tamper materials in the form of spheres with the Y-Be, Ra-La-Be, Ra-Be and mock fission sources and long counter detectors.

Hanson, Williams | LA in preparation. |

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- 38. v_{49}/v_{25} as a function of the energies of the neutrons emitted and the energy of the neutrons causing fission. No further work.

Blair
- 39. Cloud chamber investigation of low energy portions of spectra. Postponed because of TR measurements.

Richards
- 40. Mock fission sources of small dimensions. Measurement of spectrum of source no. 3 almost completed.

Richards
- 41. Inelastic scattering of 25 by the photo-plate investigation of degraded spectra. Measurements in progress on plates exposed to M.P. source no. 3 surrounded by 4-1/2" beta stage spheres.

Richards
- 42. Measurement of $\overline{v-1-a}$, $\overline{\sigma_f}$, and possibly critical mass with a metal sphere and mock fission source. LA in preparation.

Bailey, Hanson, Hush, Klerma, Krohn, Seagondollar, Williams
- 47. External initiator source. No voltage was observed across accelerating gap due presumably to too rapid spreading of the ga when the wire was flashed. A straight discharge chamber is now being tried. This chamber is so designed that the bulk of ions must come from a shielded region. It is hoped that currents can be held to low enough rise so that the lead inductance will not absorb too much of the volt

McKibben
- 48. Electron collection in argon and argon-gas mixtures. CaH₂ and TiH₄ + Mg give reproducible results in counters if first heated with H₂ over compound. TiH₄ + Mg can give a rapidly reversible vapor, pressure of H₂ up to 30 cm at 500° if initially kept in H₂ atmosphere; the VP is a function of time of vacuum preheating.

Klerma, Taschek

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48. (cont'd.)

In the test counter used at a total of about 35 lbs gauge pressure.

- 1) Pure argon multiples before saturation;
- 2) 66 percent H₂ + 33 percent A gives saturation with no multiplication above 1000 V;
- 3) \leq 0.1 percent H₂ in A at 35 lbs. gives about 90 percent saturation at 200 V;
- 4) Increasing amounts of H₂ up to 66 percent increases saturation voltage continuously;
- 5) At the lowest H₂ concentrations used (\ll 0.1 percent) the saturation appears to be argon-like but this small amount of H₂ completely inhibits the multiplication.

49. Scattering cross section of H, C and U for neutrons of energy less than 500 Kev.
Frisch

Report in preparation. Richman is recalculating $\sigma_H(E)$ on basis of 20.8 barns epithermal cross section. Agreement good with Chicago data on σ_C and σ_U . Equipment to be used on experiment no. 300.1.

50. The energy of neutrons emitted from photo-neutron sources.
Hanson.

Report delayed because of a discrepancy in the comparison of maximum energy of ²³²Th-D neutrons and Li(p,n) neutrons. An additional check with ²³²Th-Be neutrons is planned.

51. Measurements on 49 spheres to determine multiplication and $(\nu-1-\alpha)$ for fast neutrons from a mock fission source.
Hanson, Hush, Seagondollar, Williams.

No further work until larger sphere is available

DOE 6/2

52. Measurements on tamped 25 spheres of large diameter to determine multiplication and tamper effects in order to determine the tamped critical mass.

Measurements completed. density about 17.5, 76 percent 25 are:

Multiplication (Bare)	2.01 \pm .02
" tamped in WC	4.35 \pm .08
" tamped in U	3.32 \pm .06

Bailey, Hanson, Hush, Williams

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[REDACTED]

53. Measurements of the flux of neutrons for $\sigma_f(25)$ in the energy from 2 to 6 Mev.

Bailey, Klema, Tasehek, Turner

Electron collection counter to work at 15 atm is ready for test with internal α source. Compensated ionization chamber is essentially instrumented for this purpose, and data can be taken whenever time is found and the long tank is in running order.

55. Neutron spectrum from fast fission of 49.

Richards

No further work.

100. 49 mass spectrometer.

Bartlett, Swinehart

Mass spectrometric examination of a sample of plutonium (CW1B) reirradiated in the Hanford pile was made. The ratio of the peak heights 240/239 was measured giving a value of 0.00651 \pm 0.00020. A peak was found at the 241 mass position. The ratio of this peak to that at 240 was not constant with temperature showing that the particles responsible for the 241 peak are not isotopic with plutonium. The identity of the 241 ion is still uncertain.

200. Isotopic Analysis for 25.

Dudley Williams, Yuster

The following analyses were made:

Sample	Mass Percent 25	X-Site Value
BF-85	83.0 percent	82.6 percent
Omega Material	14.0	14.06*

*Previous measurements here and at X.

201. Detection of rarer components.

Dudley Williams, Yuster

A. 24 - The following S values were obtained:

Sample	S = 25/24
BF-85	157
Omega Material	141

B. 26 - Irradiated samples from X and W have been obtained and prepared for analysis. The analysis will be performed in the near future.

C. 23 - Isotopic analysis of a 20 mg sample of 23 yielded the following results for the U content:

Mass Percent of 23	Mass Percent of 28
97.2 percent	2.8 percent

The amount of the sample recovered was 87 percent of the original sample.

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300. Measurement of total neutron flux from TR test. Three blast shelters for detecting equipment being installed at TR. Development work on boron counters, amplifiers and recorders is well along. Gold foil technique nearly instrumented.
Blair, Friedman, Frisch, Hush, Klema, Krohn, Richards
301. Total scattering cross sections of liquid nitrogen and oxygen and of TR earth. Instrumentation complete. Will take data in 10 KV - 600 KV range.
Frisch, Richards
302. Intensity of delayed neutrons from fast excitation. Instrumentation almost complete for slow (mechanical) modulation of short tank beam, with repetition rate of 10 to 100 seconds; gate widths in detecting circuit will be in the range 0.1 to 1.0 second. A 10 channel recording circuit will be used and the delayed neutron intensity will be observed from < 0.1 to ~ 10 seconds.
Perry.
Instrumentation for electrical modulation is also under way. Repetition rate will be in the range 0.01 to 20 seconds, on time for the beam 0.5 to .0005 second. This equipment will be used in experiments by Moon and Deutsch to determine delayed gamma ray intensity; may also be used for delayed neutron measurements.
303. Proposed integral mock-up of TR setup. It is proposed to fill a cylindrical container with approximately 4 tons of liquid air to study the time and space distribution of delay neutrons from fast excitation of 49. This would give the number of counts in a BF_3 detector of known sensitivity per 49 fission, and the various gamma measurements could be calibrated also. This large a tank gives a 96 percent approximation to infinite air. It is estimated that inclusion of a layer of TR earth can give the ground correction to better than 75 percent.
Frisch, Richards

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GROUP REPORT, J. H. Manley Group Leader - April 1, 1946

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JOB AND ASSIGNMENT

PROGRESS

- 28. Scattering of com. materials - Barschall and Shiff See List 1
- 29. Source measurement - Walker, Davis
 Work done on source measurement of ^{241}Am and ^{241}Pu sources. Report on 1/45
 "Solid state" ^{241}Am source
 $\epsilon = 1.1 \times 10^4$ n/hrs 70 percent on 2/29/46
- 52. Multiplication of - Walker, Shiff
 With 25 detector $\epsilon = 1.1 \times 10^4$ n/hrs
 50 percent
 Measured $\epsilon = 1.1 \times 10^4$ n/hrs - detector certain distance = 100 inches
- 53. Source scattering - Barschall and Shiff See List 1
- 58. 25 Gadget distribution - Bright, E. Graves
- 59. 25 multiplication detector - Coon, Lobley, G. W.
 See List 1

TRINITY JOBS

- 1001. Pluto Blast - Walker, Kyer, Kupferberg, Pappas
 Calibration of gauges in progress. Serials of gauges used in calibration, new amplifiers.
 First run of gauges in progress. Calibration of gauges in progress. Hood's data to 2 percent agreement. Gauges cannot be used as planned because of temperature conditions. Gauges cannot be used for this job. Possible thermal stabilization is being investigated.

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1002 Condenser Gauge Blast
Measurements
Bright

Quartz gauges of Reynolds design show better stability. Crystals are available and assembly and calibration proceeding on 23 quartz gauges.

Field mounts for gauges and preamps designed and fabricated.

First unit unsatisfactory with regard to mechanical and temperature stability.

C I T unit investigated with Waldman, Alvarez appears satisfactory. Some units to be modified for higher pressure range.

1003 Box Blast Gauges
Hoogterp

Various hole diameters and thicknesses of aluminum foil have been studied. 0.7 mil foil is very reproducible - spread less than 0.1 psi on blast tube break tests. Present boxes with twelve holes from 7/16 to 3-1/2 inch diameter will cover a range of 1 - 8 psi in approximately 0.5 psi steps.

Time of break was investigated with a piezo gauge detecting reflected blast wave. The amplitude with a breaking foil was intermediate between a completely closed hole and an open hole for the 3-1/2" size, and the decay starts within a fraction of a millisecond after the rise.

All constructional details should be completed by April 20.

1004 Impulse Gauge
Jorgensen

British design modified for higher range and construction of one unit promised for April 25.

New design employing fluid flow tested with special blast chamber. Tests to date show satisfactory operation if timing mechanism will withstand air blast. Six instruments requested for April 24 from shop. Development continues.

1005 Excess Velocity Measurement
Barschall, Martin, Davis

GR - 3 - C sound ranging equipment originally procured by X 2 C was investigated by consultation trip to users. Decision resulted that it was unsatisfactory and completely new equipment to be built. This is in progress with assistance from Elmore. Permanent magnet speakers as microphones, amplifier, oscilloscope, G R camera will be the equipment. Field tests have been carried out at 2-Mile which confirm expected behavior of equipment and show that wind motion will reduce accuracy at distant stations but not seriously.

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1006 Geophone Earth Measurements

Houghton, Coon, Nobles

Same situation on amplifiers as Job 1001.

New design has flat frequency response 1 - 40 cycles per sec, and field tests show that shock mounting is adequate to remove microphonics. 14 amplifiers under construction. Control relay not yet available.

All geophone magnets now procured. 15 units should be assembled by April 23. Shake table for horizontal and verticle calibration nearly complete. Fairly complete vertical tests show velocity response independent of frequency down to 1 c.p.s.

1007 Crater dimensions and permanent earth displacement

Houghton, Coon, Nobles

Stakes procured. It has been agreed that W. J. Penney will assume responsibility for this job.

1008 Chimneys

Abandoned.

1009 Wiring; summary

E. Graves

Completed for "Z" shot.

1010 Location summary

E. Graves

Completed for "Z" shot.

1011 Power requirements

E. Graves

In process.

1012 Shelter space

E. Graves

In process.

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GROUP E-4 - MONTHLY REPORT - E. Segre, Group Leader - April 1, 1945

JOB AND PERSONNEL

- 1. Spontaneous fission.
Chamberlain, Farwell, Wiegand

PROGRESS

Several shipments of Manford material were measured. They gave the following results:

	f/gr hr	%AO
2 W	$4.69 \pm 6\% \times 10^3$	0.290
3 W	$4.83 \pm 7\% \times 10^3$	0.298

The work on 25 is finished and it gives 1.3 ± 0.6 f/gr hr. This number takes into account all our work and is corrected for cosmic ray effect.

We give here a summary of all spontaneous fission data available up to now:

Substance	f	mg x hr of observation	f/gr hr
22	3	4.5×10^{-2}	67
23	0	1360	<0.74
24	0	33.7	< 30
25			1.3 ± 0.6
26			600 ± 1000
28			24.8 ± 0.9
37	1	91.2	(11)
48			1.1×10^7 (12, 13y)
49	12	347	35
40	-	-	1.62×10^6
11	17	417	41
02	90		<0.15
00	2	184	(11)

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3. Capture cross sections at various energies.

Linenberger

Two additional values of cross sections for Ag complete the tables given in LAMS-193 and LAMS-222:

Energy	Ag ¹⁰⁷ σ	(2.3 m.) σ	Ag ¹⁰⁸ σ	(22 s.) σ
Thermal	23	0.13	46.6	0.27
+ 5 195 - 20 kv	0.258	3.64	0.286	4.05
+ 5 390 - 20 kv	0.122	2.44	0.160	3.20

9. α emitted on fission.

Nothing to report.

10. Isotopic Analysis.

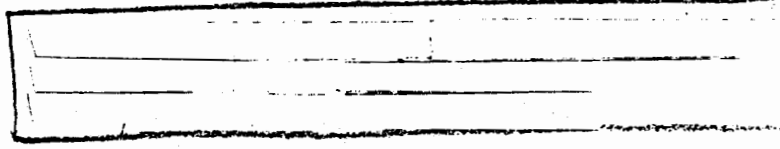
Three analyses have been reported this month.

Chamberlain

DOE b(3)

13. Initiator tests (with O-1)

Farwell



14. Range and α measurements.
Linenberger

Half-life of "23".

Considerable difficulty has been experienced in obtaining foils which show a consistent specific activity. Four foils (two plated, two evaporated) which do show consistency give a half-life of 1.68×10^6 years. However, this cannot be taken as final because we are not yet completely sure of the chemical purity of the samples. More plates are in preparation.

22. Calibration of nvt of reirradiated samples.

Deutsch, Kahn, Miskel

Further work has been done to remove some of the difficulties encountered in the chemical procedures. Definite results on two irradiations of 26 are expected within about two weeks.

A sample of 25 irradiated with a short, intense bombardment in the P-9 pile was obtained in order to observe the decay on our ionization chamber.

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24. Fragments and ν of spontaneous fission of 40. A provisional value for ν spontaneous of 40 is 2.4 ± 0.4 . The experiment is not yet finished.
Segrè, Wiegand
25. Measurements of heat production of 49. Calibration showed slight inconsistencies that are being worked out.
Jones and Stout in X-4.
26. α/σ_f Ratio for reirradiated and Berkeley 49. Slight indication that the slow neutron fission cross section for a given alpha activity of 40 is less than the same quantity for 49. The experiments are being pursued.
Farwell
27. TR tests. A large part of the activity of our group has been devoted to preparations of the γ ray measurements at TR. The general plan has been frozen. The building of the equipment is under way. Chamberlain is in charge of designing the mechanical parts and shelters; Deutsch is in charge of the ionization chambers and tests concerning radiation; Wiegand is in charge of the electrical part.
Whole group.
28. Neutron Assays. The plan calls for equipment able to measure γ rays over a factor 10^3 of intensity with the resolving time of 10^{-2} seconds.
Several laboratory calibrations on the γ intensity emitted after fission as a function of time and on the absorption and scattering of γ by air are needed and in progress.
Eight neutron assays, mainly for Mr. Jette, have been made this month.
Wiegand

Mr. W. Nobles was added to our group during this month and T/3 Wahlig has been temporarily transferred to R-3.

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