BOOK 109

Notes:
“10143” on bottom spine

Blank pages: inside front cover, 1, 4, 5, 6, 23, 43, 49, 53, 64, 71, 146, and 147.

Page 14 has 2 8.5x11 sheets stapled to it

Scanned by:
Sheila Finch
RSICC/Oak Ridge National Lab.
January 9, 2001
<table>
<thead>
<tr>
<th>EXP.</th>
<th>PAGE</th>
<th>TAMPER</th>
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<th>COMMENTS</th>
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<td>T</td>
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<td>T</td>
<td>1/2</td>
<td>60% Molar Density</td>
<td>1828 1850 27.8</td>
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<tr>
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<td>128</td>
<td>T</td>
<td>1/2</td>
<td>60% Molar Density</td>
<td>1525 1510 23.2</td>
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<tr>
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<td>U</td>
<td>4/1</td>
<td>720 464 7.13</td>
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</tr>
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<td>38</td>
<td>137</td>
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<td>1/1</td>
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<td>113 118 17.2</td>
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<tr>
<td>39</td>
<td>139</td>
<td>U</td>
<td>1/2</td>
<td>2850 2810 43.2</td>
<td>14x14x17</td>
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<tr>
<td>40</td>
<td>142</td>
<td>U</td>
<td>1/1</td>
<td>Separation 03 C.M.</td>
<td>123 123 18.9 14x13x13/3</td>
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</tbody>
</table>
Sept 25.

Experiment no. 1.

Unramped, Unmoderated. 30% Material. 12 x 12 x 12. Location of source: 2 x 2 x 2.

Chief Experiment - C. Beck.


Vern. - control.

Collette, Williams, Honey, some parts from B. Schmidt, Island, Tiber - instruments.

Stacking finished 3:58 PM.

Instrument: Monitoring

Date: Condit. | Units? | Time | Rows |
---|---|---|---|
3 | 252 x 10 64 | 2 | 3:55 assembled. 9 32" apart |
2 | 151. 10 |
3 | 260 7/64 | 2 | 3:55 9:05 |
3 | 277 3/64 | 2 | 4:10 |
3 | 274 7/64 | 2 | 4:15 |
3 | 266 5/64 | 2 | 4:20 |
2 | 174. 10 |
3 | 248 7/64 | 2 |
2 | 232 3/64 | 2 | 4:25 |
3 | 223 3/64 | 2 |
2 | 131. 10 | 4:26 |
3 | 205 3/64 | 12. 2 | 4:33 |
3 | 198 3/64 | 10. 2 | 4:36 |
3 | 272. 2 |

Disassembly started at 5:00 PM.
0. Prop. 19

Location of Instrument

---

Move to

[Diagram with circles and numbers]

---

0. Prop. count

---
Sept 26,

Experiment #2.

Unwrapped, Unmoderated, 30% Natural
12 x 12 x 12, cubes.

Source: 7 from bottom,
6 from right,
6 from west.

People Present

Culbertson - chief experimenter, controls.
Beck - Williams - calculator.
Vanni - data taking.
Schmidt - Theis - instruments.

Instruments rearranged. 5% directly under source.

<table>
<thead>
<tr>
<th>Count</th>
<th>Min.</th>
<th>Count</th>
<th>Min.</th>
<th>Time</th>
<th>Rearr.</th>
<th>Scale</th>
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<td>50</td>
<td>2</td>
<td>231</td>
<td>2</td>
<td>4:15</td>
<td>Assembled</td>
<td>32⅛&quot; + ½&quot;</td>
</tr>
<tr>
<td>51</td>
<td>2</td>
<td>239</td>
<td>2</td>
<td>4:22</td>
<td></td>
<td>29&quot; - ½&quot;</td>
</tr>
<tr>
<td>50</td>
<td>2</td>
<td>231</td>
<td>2</td>
<td>4:25</td>
<td></td>
<td>26&quot; + ½&quot;</td>
</tr>
<tr>
<td>31</td>
<td>2</td>
<td>238</td>
<td>2</td>
<td>4:27</td>
<td></td>
<td>23&quot; - ½&quot;</td>
</tr>
<tr>
<td>53</td>
<td>2</td>
<td>244</td>
<td>2</td>
<td>4:31</td>
<td></td>
<td>19&quot; - ½&quot;</td>
</tr>
<tr>
<td>54</td>
<td>2</td>
<td>265</td>
<td>2</td>
<td>4:55</td>
<td></td>
<td>11&quot; + ½&quot;</td>
</tr>
<tr>
<td>59</td>
<td>2</td>
<td>282</td>
<td>2</td>
<td>4:39</td>
<td></td>
<td>7&quot; + ½&quot;</td>
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<tr>
<td>62</td>
<td>2</td>
<td>289</td>
<td>2</td>
<td>4:45</td>
<td>Instruments checked, OK.</td>
<td>5&quot; + ½&quot;</td>
</tr>
<tr>
<td>68</td>
<td>2</td>
<td>311</td>
<td>2</td>
<td>4:49</td>
<td></td>
<td>4&quot; + ½&quot;</td>
</tr>
<tr>
<td>62</td>
<td>2</td>
<td>301</td>
<td>2</td>
<td>4:47</td>
<td></td>
<td>3&quot; + ½&quot;</td>
</tr>
<tr>
<td>69</td>
<td>2</td>
<td>306</td>
<td>2</td>
<td>4:59</td>
<td></td>
<td>2&quot; + ½&quot;</td>
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Magnet uncoupled
Cable separated
67 other fall in frame.
Location of Instruments

Exp. 2

[Diagram showing two squares with numbers 4, 3, 2, 1]
Sept. 27, 1946. Experiment No. 3

Untamped, unmoderated material, 30%.
12 x 12 x 12 cube.

Persons present:
- Calahan - Experimenter in charge.
- Hupp - record experimenter - Recording data.
- Schmidt - at controls.
- Young - assistant in stacking.
- Rykine - Instrumenter. We Smith.

All have John Ridg's dosimeter.

chance made - energetic disassembly in chamber 4 OK.
- chamber 2 OK.
- power failure OK.
- air failure OK.

Source check of both counter and ion chambers.

spread report is perfectly placed.

Red light at 11:45 a.m.

Center office notified. Both Cuts + Knob out. Secretary took message.

Time out for lunch. Red light on again at 12:25 p.m.

stacking began at 12:35 p.m.

Location of instruments:
- #3 Counter set on top
- of table.

Readings taken on #3 at 2-min. intervals. Source in behind the jig at about
- #1 click continuously in experimental room. 5" above table, 1' back.
- #2

9.9
2.87
233
157
157
151
160
331
386
429
407
496
511
502

Instrument click 4+ layers.

Almost 6 layers.
Source moved into position 7 from bottom, 6 from west, 6 from east.
Bake the paste in place behind the stack on marble table.

Table for measurement:

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<tr>
<th>Height (in.)</th>
<th>Measurement</th>
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<td>32.5&quot;</td>
<td>35</td>
</tr>
<tr>
<td>22&quot;</td>
<td>53</td>
</tr>
<tr>
<td>17&quot;</td>
<td>58</td>
</tr>
<tr>
<td>9&quot;</td>
<td>64</td>
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<td>6&quot;</td>
<td>68</td>
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<td>4&quot;</td>
<td>73</td>
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<td>81</td>
</tr>
<tr>
<td>0.5&quot;</td>
<td>86</td>
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</tbody>
</table>

Attempts to open the magnet hit the pole 1/2" from base. Repeated the attempt with a large magnet inside the building, and found the pole still effective. Abnormality noted that the pole hit the center of the table at a small distance from the magnet. Repeated several times with the pole.

Magnet pulled out at 6" from:

<table>
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<td>1&quot;</td>
<td>55</td>
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<td>0.87&quot;</td>
<td>76</td>
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Revised table:

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<th>Measurement</th>
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<td>50</td>
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<td>478</td>
<td>12</td>
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</table>
Sept. 30, 1946.

Exp. 4

Unirradiated, un-modified, 30%.

People present:

Chief investigator
Chief experimenter
Second experimenter
Records.

Joe Brown
Smith

Located 8 meters west same as Exp. 3.
All have film badges & dosimeters.

<table>
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<td>307</td>
<td>No etalon on Yable</td>
</tr>
<tr>
<td>10:38</td>
<td>310</td>
<td>Source in position</td>
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<tr>
<td>10:39</td>
<td>329</td>
<td>Front ½&quot; Al tube 6&quot; long.</td>
</tr>
<tr>
<td>11:03</td>
<td>328</td>
<td>Table 6, gel.</td>
</tr>
<tr>
<td>11:10</td>
<td>366</td>
<td>No etalon on Yable</td>
</tr>
<tr>
<td>11:45</td>
<td>356</td>
<td>Source in position</td>
</tr>
<tr>
<td>12:15</td>
<td>364</td>
<td>Front ½&quot; Al tube 6&quot; long.</td>
</tr>
</tbody>
</table>

Table check

Counts check:

Dial indicator check:

Stocking is vertical

Source moved into position: 9 from bottom, 6 from center, 6 from side.

<table>
<thead>
<tr>
<th>Time</th>
<th>Counts/min</th>
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</thead>
<tbody>
<tr>
<td>12:37</td>
<td>329</td>
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<td>12:42</td>
<td>421</td>
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<tr>
<td>1:02</td>
<td>416</td>
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</table>

12 X 12 X 1/2" agar. 3/12" x 1/16" aperture.

The counters checked.
9/30/46.

View from SW corner.

Source in $x=6$, $y=6$, $z=7$.
Calculations: 99 bad cubes on top

\[ \frac{12}{225} \]
\[ \frac{14}{750} \]
\[ \frac{28}{5} \]
\[ 3 + 0.05 \]
\[ \frac{32}{4} \]
\[ 1.5 \]
\[ 32.98 \]
**Experiment No. 5**

October 2, 1926

Temps: 115
twirler, 80%.

9 x 8 x 8

Present:

- Chief Experimenter
- Assisting Stacking
- Instruments recording
- Recalling data

Sodium: instruments same as Exp. No. 3 (p. 11)

Check List: see p. 148

All data separations given here do not include the 1/16 in. Al.

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<th>Counts/min, No. 3</th>
<th>Remarks on setup, etc.</th>
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<td>1141</td>
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<td></td>
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<tr>
<td>1201</td>
<td>21%</td>
<td>Inst. check: all O.K.</td>
</tr>
<tr>
<td>1205</td>
<td>21%</td>
<td>Stacking, 3rd layer</td>
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<td>22%</td>
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<tr>
<td>1209</td>
<td>24%</td>
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<td>26%</td>
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<td>1240</td>
<td>27%</td>
<td></td>
</tr>
<tr>
<td>1242</td>
<td>27%</td>
<td></td>
</tr>
<tr>
<td>1244</td>
<td>27%</td>
<td></td>
</tr>
<tr>
<td>1246</td>
<td>27%</td>
<td></td>
</tr>
<tr>
<td>1248</td>
<td>27%</td>
<td></td>
</tr>
</tbody>
</table>

*Notes:*
- Inst. check: all O.K.
- Stacking, 1st layer
- Inst. check: all O.K.
- Stacking, 3rd layer
- Inst. check: all O.K.
- Stacking, 6th layer
- Inst. check: all O.K.
- Placing tamp in final position.
- Placing source in final position.
- Tamping
<table>
<thead>
<tr>
<th>Finish Time</th>
<th>60 Counts/min, No. 1 per min</th>
<th>No. 3 per min</th>
<th>Remarks on setup, etc</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Tamping</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Removed tamper from</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mov. table tampered</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Tamping</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Shot table completely</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mov. table untampered</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[Inst. check: all O.K.]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mov. table tampered on</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2 sides</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Tamping</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mov. table tampered on</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3 sides</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ALL TAMPING COMPLETE</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inst. check: all O.K.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Table separation: 32 3/8 in</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot; &quot; 20 in</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot; &quot; 20 in</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot; &quot; 12 in</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot; &quot; 6 in</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot; &quot; 2 in</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Scale Rdg: 88 div.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inst. check: all O.K.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scale Rdg: 56 (1 in)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot; &quot; 100 (3/4 in)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inst. check: all O.K.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rebuilding: Source in position</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot; &quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot; &quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tamping beginning; Source moved</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>No. 1 Counts/min</td>
<td>No. 1 Recip.</td>
<td>No. 3 Counts/min</td>
</tr>
<tr>
<td>-------</td>
<td>------------------</td>
<td>--------------</td>
<td>------------------</td>
</tr>
<tr>
<td></td>
<td>15.25</td>
<td>5.3</td>
<td>15.28</td>
</tr>
<tr>
<td></td>
<td>15.31</td>
<td>4.2</td>
<td>15.34</td>
</tr>
<tr>
<td></td>
<td>15.37</td>
<td>3.4</td>
<td>15.41</td>
</tr>
<tr>
<td></td>
<td>15.44</td>
<td>3.4</td>
<td></td>
</tr>
<tr>
<td>15.47</td>
<td></td>
<td></td>
<td>15.50</td>
</tr>
<tr>
<td>15.52</td>
<td></td>
<td></td>
<td>15.55</td>
</tr>
<tr>
<td>16.17</td>
<td></td>
<td></td>
<td>16.22</td>
</tr>
<tr>
<td>16.28</td>
<td></td>
<td></td>
<td>16.48</td>
</tr>
</tbody>
</table>
Oct. 2, 1946  Experiment C
Purpose: to determine
October 3 1956

Experiment No. 6

Tamped 1" mixture: (30%) U5 & polyethylene. (11 x 11 x 11 stack)
Silica separators do not include Alundum. 6.66 cubes green
6.66 cubes black
6.66 cubes white

People present:

Chief Experimenters: Callahan
Other: Beck
Other: Knece
Constant: Vinner
Instruments: Lyons, Smith

Location & instruments: Same as Exp. No. 3 (p. 11)
Check list: see p. 148

<table>
<thead>
<tr>
<th>No. 1</th>
<th>Finish Time</th>
<th>No. 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 a.m. Recip.</td>
<td>9:21 a.m. Recip.</td>
<td>Remarks, etc.</td>
</tr>
</tbody>
</table>
10 36 12 52 |
10 38 12 58 |
10 40 13 4 |
10 43 13 3 |
10 45 13 3 |
10 47 13 3 |
10 49 13 7 |
10 51 13 9 |
10 53 13 9 |
10 55 17 4 |
10 57 17 9 |
11 00 18 2 |
11 02 18 6 |
11 04 19 4 |
11 06 19 4 |
11 08 19 5 |
11 10 20 1 |
11 12 20 2 |
11 13 20 2 |
11 15 21 0 |
11 17 20 9 |
11 20 21 2 |
11 22 21 1 |
11 24 22 9 |
11 27 17 2 |
11 30 19 5 |

Stacking 1st layer
Stacking 2nd layer
Stacking 3rd layer
Stacking 4th layer

Inst. Check: All a.k.
Stacking 5th layer
Stacking 6th layer & 7th layer
Stacking 8th layer
Stacking 9th layer

Inst. Check: All a.k.
Stacking 10th layer
Stacking 10th to 11th layers

Source was moved during count
<table>
<thead>
<tr>
<th>Time</th>
<th>Recip</th>
<th>Remarks, Etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 30</td>
<td>194</td>
<td>Stacking Completed 11x11 XII; Beginning.</td>
</tr>
<tr>
<td>11 34</td>
<td>208</td>
<td>Tamping</td>
</tr>
<tr>
<td>11 38</td>
<td>205</td>
<td>Source moved</td>
</tr>
<tr>
<td>11 40</td>
<td>202</td>
<td>&quot; &quot;</td>
</tr>
<tr>
<td>11 42</td>
<td>241</td>
<td>&quot; &quot;</td>
</tr>
<tr>
<td>11 45</td>
<td>297</td>
<td>&quot; &quot;</td>
</tr>
<tr>
<td>11 47</td>
<td>405</td>
<td>&quot; &quot;</td>
</tr>
<tr>
<td>11 50</td>
<td>415</td>
<td>Source in position; Stat. Table being tampered.</td>
</tr>
<tr>
<td>11 52</td>
<td>440</td>
<td>Tamping Continues.</td>
</tr>
<tr>
<td>11 54</td>
<td>377</td>
<td>&quot; &quot;</td>
</tr>
<tr>
<td>11 56</td>
<td>94</td>
<td>&quot; &quot;</td>
</tr>
<tr>
<td>11 59</td>
<td>77</td>
<td>&quot; &quot;</td>
</tr>
<tr>
<td>12 01</td>
<td>79</td>
<td>&quot; &quot;</td>
</tr>
<tr>
<td>12 05</td>
<td>81</td>
<td>&quot; &quot;</td>
</tr>
<tr>
<td>12 07</td>
<td>80</td>
<td>&quot; &quot;</td>
</tr>
<tr>
<td>12 10</td>
<td>80</td>
<td>&quot; &quot;</td>
</tr>
<tr>
<td>12 14</td>
<td>80</td>
<td>&quot; &quot;</td>
</tr>
<tr>
<td>12 16</td>
<td>82</td>
<td>&quot; &quot;</td>
</tr>
<tr>
<td>12 19</td>
<td>77</td>
<td>&quot; &quot;</td>
</tr>
<tr>
<td>12 22</td>
<td>76</td>
<td>&quot; &quot;</td>
</tr>
<tr>
<td>12 27</td>
<td>80</td>
<td>&quot; &quot;</td>
</tr>
</tbody>
</table>

**TAMPING COMPLETED**

| 26 | 770 | 12 26 | 75 | 267 |
| 12 40 | 73 | 274 |

**TABLE SEPARATION** 32 1/2 in. 32 1/2 in.

**Inst. check: All O.K.**

| 43 | 465 | 12 47 | 96 | 208 |
| 44 | 755 | 12 50 | 101 | 198 |
| 12 60 | 11 6 | 17 72 | 17 16 |

**Inst. check: All O.K.**

| 49 | 408 | 12 55 | 11 6 | 17 72 |
| 49 | 13 26 | 12 8 | 15 6 |
| 64 | 31 3 | 13 21 | 17 5 |
| 84 | 23 8 | 13 32 | 22 9 | 87 4 |
| 96 | 20 8 | 13 41 | 27 2 | 70 2 |
| 13 6 | 14 7 | 13 49 | 42 0 | 47 6 |
| 17 7 | 11 3 | 13 54 | 53 9 | 37 1 |
| 28 8 | 69 0 | 14 01 | 90 4 | 22 1 |
| 43 1 | 14 12 | 13 59 | 3 146 |

**Scale Rdg 032 – Source Jerk – Slow**

| 43 5 | 46 0 | 14 15 | 13 69 | 1 146 |

**CRITICAL**

| Scale Rdg 034 5 | Counts Maintained |
No. 1

<table>
<thead>
<tr>
<th>%AM</th>
<th>Recip</th>
<th>Finish Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>800</td>
<td>1603</td>
</tr>
<tr>
<td>38</td>
<td>527</td>
<td>1606</td>
</tr>
<tr>
<td>39</td>
<td>513</td>
<td>1611</td>
</tr>
<tr>
<td>45</td>
<td>444</td>
<td>1615</td>
</tr>
<tr>
<td>55</td>
<td>364</td>
<td>1619</td>
</tr>
</tbody>
</table>

No. 3

<table>
<thead>
<tr>
<th>%AM</th>
<th>Recip</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>66</td>
<td>303</td>
<td>1625</td>
</tr>
<tr>
<td>81</td>
<td>241</td>
<td>1630</td>
</tr>
<tr>
<td>120</td>
<td>167</td>
<td>1635</td>
</tr>
</tbody>
</table>

Rebuilt to 11x11x10 & Tamp

Inst. Check: All O.K.

Table Separation 32½" in.

TABLE SEPARATION 32½" in.

Inst. Check: All O.K.

Scale 021 (1¾"

039 (1"

048½"

053"

060 (3¼"

061"

062"

064"

065 Source OK

066 No 4 Study

067

068 CRITICAL

Table Separation: 32½" in.

Inst. Check: All O.K.

TABLE SEPARATION: 7 in.

Scale Rdg. 088 (2"

000 (about ½"

036 (1"

076 (½"

087 (3/8"

092 S.J. Falling

093 Source Out

095 (¼"

CRITICAL

Rebuilt to 11x10x10 & Tamp

550 green & 550 white

15 1938 1927

16 1256 1785

16 1256 1740

24 824 1749

25 800 1753

27 741 1758

28 715 1808

36 591 1808

79 253 1814

1823 CRITICAL
Experiment No. 7

Tamped and moderated: notes of 1:1 cubes. 

Purpose: to find more accurately the value of M, (previously ~ 510 by extrapolation)

Benno
Murray
Usagi
J. Keen

Chief Experiments: stacking

2nd Experiments: stacking

Instrs. book

Location of instruments: 10 cm to Exp. 3. (p. 11)

Stacking started 2:20 PM 


First assembly 10 x 10 x 10

Sep. of Tare: 1st corner 2nd corner 3rd corner 

32 1/6 - 311 1942 7 layers

337 44
345 46
334 49
337 51
338 53
335 55
289 58
242 1500
245 04
245 07
207 09
211 11
156 14
141 16
189 17
260 20
264 23
271 25
249 27
181 30
55 33
24 35
26 37
24 48

The above data were taken in the process of tamping.
<table>
<thead>
<tr>
<th>Separation of tabs</th>
<th>#1 counter</th>
<th>#3 counter</th>
<th>Time</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>inches</td>
<td>dial</td>
<td>c/2min.</td>
<td>recip.c</td>
<td>c/2min.</td>
</tr>
<tr>
<td>32 1/16</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>24</td>
</tr>
<tr>
<td>20</td>
<td>-</td>
<td>21</td>
<td>48</td>
<td>25</td>
</tr>
<tr>
<td>7</td>
<td>-</td>
<td>29</td>
<td>34</td>
<td>30</td>
</tr>
<tr>
<td>5</td>
<td>-</td>
<td>30</td>
<td>33</td>
<td>32</td>
</tr>
<tr>
<td>3</td>
<td>-</td>
<td>29</td>
<td>34</td>
<td>34</td>
</tr>
<tr>
<td>2.79</td>
<td>29</td>
<td>34</td>
<td>36</td>
<td>27.8</td>
</tr>
<tr>
<td>2.28</td>
<td>32</td>
<td>31</td>
<td>44</td>
<td>22.8</td>
</tr>
<tr>
<td>1.125</td>
<td>41</td>
<td>24.5</td>
<td>58</td>
<td>17.2</td>
</tr>
<tr>
<td>1.9375</td>
<td>54</td>
<td>18.5</td>
<td>75</td>
<td>13.3</td>
</tr>
<tr>
<td>1.625</td>
<td>74</td>
<td>13.9</td>
<td>105</td>
<td>9.5</td>
</tr>
<tr>
<td>1.375</td>
<td>118</td>
<td>8.9</td>
<td>164</td>
<td>6.1</td>
</tr>
<tr>
<td>1.125</td>
<td>188</td>
<td>5.3</td>
<td>260</td>
<td>3.9</td>
</tr>
<tr>
<td>0.75</td>
<td>201</td>
<td>5.0</td>
<td>280</td>
<td>3.6</td>
</tr>
<tr>
<td>Contd.</td>
<td>odd 1/16 of inch gage.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.2</td>
<td>18</td>
<td>56</td>
<td>27</td>
<td>37.2</td>
</tr>
<tr>
<td>2.0</td>
<td>21</td>
<td>48</td>
<td>27</td>
<td>37</td>
</tr>
<tr>
<td>1.75</td>
<td>29</td>
<td>34.5</td>
<td>31</td>
<td>32.3</td>
</tr>
<tr>
<td>1.5</td>
<td>31</td>
<td>32.3</td>
<td>33</td>
<td>30.3</td>
</tr>
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<td>1.25</td>
<td>30</td>
<td>33.3</td>
<td>36</td>
<td>27.8</td>
</tr>
<tr>
<td>1.0</td>
<td>34</td>
<td>29.4</td>
<td>45</td>
<td>22.2</td>
</tr>
<tr>
<td>0.75</td>
<td>47</td>
<td>21.3</td>
<td>64</td>
<td>15.6</td>
</tr>
</tbody>
</table>
Oct. 8, 1916  Experiment #8

Conditions: Tamped, Moderated, Ratio H/T cube = \( \frac{1}{2} \)

Initial trial dimensions 10\( \times \)9\( \times \)9

Persons present:  Callikan - chief experimenter, stacking
               Murray - experimenter, records
               Viner - stacking
               Williams - assist in stacking
               Smith - instruments

Location of instruments: Same as in experiment 3, p. 11.
Stacking started at \( \approx \) 10:25 AM.

Method of construction:

Bottom layer composed of alternating rows of these types:

\[
\begin{array}{cccccc}
T & H & T & H & T & H \\
\end{array}
\]

Stationary table

\[
\begin{array}{cccccc}
H & T & H & T & H & T \\
\end{array}
\]

Novable table

\& of tables

Successive layers composed of alternating rows, in the vertical plane, of the same two types.
When assembled, complete layers look as follows:

**Layers 1, 3, 5, 7, 9**

- $T's = 60$
- $\frac{1}{2} H's = 60$
- $(H's = 30)$
- Total = 90

**Layers 2, 4, 6, 8**

- $T's = 60$
- $\frac{1}{2} H's = 60$
- $(H's = 30)$
- Total = 90

Array as a whole:
- No. of layers = 9
- $T's = 540$
- $\frac{1}{2} H's = 540$
- $(H's = 270)$
- Total = 810 = $9 \times 9 \times 10$
Counts while initial stacking in progress:

Instrument #3, time interval 2 min., counts x 64.

<table>
<thead>
<tr>
<th>Time</th>
<th>C</th>
<th>Time</th>
<th>C</th>
<th>Time</th>
<th>C</th>
<th>Time</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:30</td>
<td>315</td>
<td>10:51</td>
<td>363</td>
<td>11:17</td>
<td>167</td>
<td>11:43</td>
<td>139</td>
</tr>
<tr>
<td>10:32</td>
<td>308</td>
<td>10:53</td>
<td>364</td>
<td>11:19</td>
<td>164</td>
<td>11:45</td>
<td>143</td>
</tr>
<tr>
<td>10:37</td>
<td>333</td>
<td>10:58</td>
<td>373</td>
<td>11:24</td>
<td>165</td>
<td>11:50</td>
<td>75</td>
</tr>
<tr>
<td>10:37</td>
<td>(source moved)</td>
<td>11:00</td>
<td>374</td>
<td>11:26</td>
<td>168</td>
<td>11:44</td>
<td>143</td>
</tr>
<tr>
<td>10:39</td>
<td>354</td>
<td>11:03</td>
<td>380</td>
<td>11:29</td>
<td>175</td>
<td>11:49</td>
<td>143</td>
</tr>
<tr>
<td>10:41</td>
<td>356</td>
<td>11:05</td>
<td>381</td>
<td>11:31</td>
<td>171</td>
<td>11:51</td>
<td>75</td>
</tr>
<tr>
<td>10:44</td>
<td>357</td>
<td>11:08</td>
<td>381</td>
<td>11:33</td>
<td>164</td>
<td>11:53</td>
<td>75</td>
</tr>
<tr>
<td>10:46</td>
<td>366</td>
<td>11:10</td>
<td>384</td>
<td>11:38</td>
<td>171</td>
<td>11:57</td>
<td>75</td>
</tr>
<tr>
<td>10:48</td>
<td>363</td>
<td>12</td>
<td>386</td>
<td>11:41</td>
<td>173</td>
<td>11:59</td>
<td>75</td>
</tr>
</tbody>
</table>

Separation of tables: #1 counter, #3 counter, Time PM

<table>
<thead>
<tr>
<th>Inches</th>
<th>Diameter</th>
<th>C/2 min</th>
<th>Recip. C</th>
<th>C/2 min</th>
<th>Recip. C</th>
<th>Time PM</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.2</td>
<td>77.4</td>
<td>19</td>
<td>26</td>
<td>12:35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td>79.4</td>
<td>24</td>
<td>28</td>
<td>12:42</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>79.0</td>
<td>28</td>
<td>30</td>
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<td>0.3</td>
<td>77.5</td>
<td>32</td>
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<td></td>
<td></td>
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<td></td>
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<tr>
<td>0.116</td>
<td>77</td>
<td>26</td>
<td>37.0</td>
<td>10:45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>77.5</td>
<td>26</td>
<td>37.5</td>
<td>10:45</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Conditions
- Taken apart.
- Exp. 8A
- Source removed.

Tabled apart. Exp. 8A & 8B

Additional 2 layers, each containing 60 T's, 60 1/2 H's to whole assembly. Now 660 T's, 660 1/2 H's or total of 990 = 11 x 9 x 10.
Assembly complete. Ready checked.

Tablet strongly 6-yellow.

NOT CRITICAL

1:18 Magnet detected.

Tablets separated.

NOT CRITICAL
<table>
<thead>
<tr>
<th>Time (pm)</th>
<th>#1 counter</th>
<th>#2 counter</th>
<th>#3 counter</th>
<th>Indexes dial</th>
<th>Slam min</th>
<th>Slam recip</th>
<th>T/min</th>
<th>C/min</th>
<th>recipc</th>
</tr>
</thead>
<tbody>
<tr>
<td>115.8</td>
<td>11.3</td>
<td>31.6</td>
<td>3.1</td>
<td>28.9</td>
<td>2.86</td>
<td>3.26</td>
<td>3:22</td>
<td>3:45</td>
<td>3:19</td>
</tr>
<tr>
<td>171.9</td>
<td>3:45</td>
<td>3:45</td>
<td>3:45</td>
<td>4:45</td>
<td>4:45</td>
<td>4:45</td>
<td>4:45</td>
<td>4:45</td>
<td>4:45</td>
</tr>
</tbody>
</table>

**Added 3 layers to side 1.6 containing 220 Tl, 220* Hg**

*Expanded the stationary tables each containing 887 Tl, 887* Hg. Now, Hg 171.6 = 11 x 12.10 by Hg 171.6 by a total of 1320 = 4 x 12 x 10 with As.**

**Tables separated**

**Conditions**

**Expt. 9**
Conclusions: The critical mass of a tamped, moderated assembly composed of H cubes and T cubes in the ratio of 12/1 is, in Tube units, $1184 \pm 2$. Result determined by reaching criticality with complete closure (18") assembly had 1184 T's.

$1184 \frac{1}{2} H's$ (592 H spaces)

Total 1776 cube units = $12 \times 13 \times 11 \frac{5}{13}$

E-W N-S height

This is about 18.3 kg of X.

18.3 kg

Assume assembly would be critical at zero closure with 10 green cube lens -

$C_m = 1174$ green cubes $= 18.13$ kg 0.235 \(\checkmark\)
Experiment 9
Oct. 9, 1946.

Stacking started 9:30 A.M.

Conditions: Tamped, modified. H/T cube ratio = 2/1
Initial dimensions: 12 x 12 x 12

Person Present:

Pecor, Hall, Vizini, Williams, 

Location of Instrument
Same as in Experiment 3, p.11.

Successive layers are built by advancing the previous layer one row to the East.

No. of cubes, as initial assembly,

4 x 12 = 48 T cubes per layer
48 x 12 = 576 T cubes in assembly
96 H cubes for layer
1152 H cubes for entire assembly
Counts while central plugging in progress

Instrument B 3. Yat entered
<table>
<thead>
<tr>
<th>Separation of plates (inches)</th>
<th>81 Counters / 1000</th>
<th>82 Counters / 1000</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8</td>
<td>28</td>
<td>39</td>
<td>11:10</td>
</tr>
<tr>
<td>10</td>
<td>38</td>
<td>44</td>
<td>11:15</td>
</tr>
<tr>
<td>7</td>
<td>58</td>
<td>54</td>
<td>11:18</td>
</tr>
<tr>
<td>5</td>
<td>66</td>
<td>66</td>
<td>11:22</td>
</tr>
<tr>
<td>4</td>
<td>75</td>
<td>75</td>
<td>11:25</td>
</tr>
<tr>
<td>35</td>
<td>193</td>
<td>193.3</td>
<td>11:30</td>
</tr>
<tr>
<td>114</td>
<td>227</td>
<td>227.3</td>
<td>11:35</td>
</tr>
<tr>
<td>114</td>
<td>61</td>
<td>61</td>
<td>11:40</td>
</tr>
<tr>
<td>114</td>
<td>215</td>
<td>215.9</td>
<td>11:45</td>
</tr>
</tbody>
</table>

**EXPERIMENT 9A**

- Assembly 12x12x12 completed.
- 516 T cubes at 8.8 kg x 110 = 1152 H cubes at 8.8 kg.

**Critical Details:**

- Removed top layer and weak layers on each side. Removed 92 T cubes.

**Experiment 9B:**

- Removed 2 layers on south side.
- Removed 30 T cubes and 162 H cubes.

**New containers:**

- 404 T cubes at 8.2 kg x 110 = 444 H cubes.
- Assembly complete.

- Removed 71 T cubes; one layer from top.
- 140 H cubes; one layer from west side.
<table>
<thead>
<tr>
<th>Operation of Tables.</th>
<th>#1 Counter</th>
<th>#2 Counter</th>
<th>#3 Counter</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>New assembly</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>373 T-cubes</td>
<td>666 H-cubes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>28</td>
<td>35.7</td>
<td>32</td>
<td>14:20</td>
</tr>
<tr>
<td></td>
<td>90</td>
<td>32.3</td>
<td>37</td>
<td>14:24</td>
</tr>
<tr>
<td></td>
<td>0.37</td>
<td>23.3</td>
<td>51</td>
<td>14:27</td>
</tr>
<tr>
<td></td>
<td>0.58</td>
<td>12.3</td>
<td>170</td>
<td>14:30</td>
</tr>
<tr>
<td></td>
<td>0.38</td>
<td></td>
<td>5.9</td>
<td>14:36</td>
</tr>
<tr>
<td>CRITICAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Removed, one layer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>from west edge of table.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Removed 320 T cubes.</td>
<td>40 H cubes.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New assembly contains.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 high</td>
<td>10 N-S</td>
<td>9 E-W moveable; 10 E-W stationary.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3&quot;</td>
<td>26</td>
<td>38.5</td>
<td>33</td>
<td>14:55</td>
</tr>
<tr>
<td></td>
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<td>32.3</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td></td>
<td>47</td>
<td>21.3</td>
<td>63</td>
<td></td>
</tr>
<tr>
<td></td>
<td>107/6</td>
<td>15.9</td>
<td>15:06</td>
<td></td>
</tr>
<tr>
<td>CRITICAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Removed 10 T-cubes</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>from west half of stationary table.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>and replaced with 10 T-cubes.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New assembly contains.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 high</td>
<td>10 N-S</td>
<td>9 E-W moveable; 10 E-W stationary.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2&quot;</td>
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<td>40.0</td>
<td>35</td>
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</tr>
<tr>
<td>1/2&quot;</td>
<td>39</td>
<td>25.7</td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>1/4&quot;</td>
<td>97</td>
<td>14.1</td>
<td>99</td>
<td></td>
</tr>
<tr>
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<td>114</td>
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<td></td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td>4:16</td>
</tr>
<tr>
<td>Exp. 9F</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>303 T cubes</td>
<td>470 Kg</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRITICAL</td>
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<td></td>
</tr>
<tr>
<td>Closed table can approach considered Critical.</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
Conclusions of Experiments 9 A-F

30.3 I units with moderator \( H/T = 21 \) will go critical with \( 1/16 \) in. between tiles.  

Really determined by approaching within \( 3/64 \) of closure with 30.3 I units and reaching the verge of instability.  

All points taken lie on a straight line (c.f. vs. separation of fission).
Experiment 10

Oct 10, 1946

Conditions: Tamped, moderated, ratio $4/1 = 7/1$

Initial trial dimensions $14 \times 14 \times 14$

Persons present
- Callahan - chief experimenter
- Murray - experimenter
- Visser
- Williams
- Smith - instrument

Location of instruments same as experiment 3, p. 11.

Method of construction

Consider a cubical array of 8 cubes (2x2x2) as the “unit.” Four types of units were used, each having a bottom layer of 4 all white, with the top layers having the green cube in the 4 possible orientations.

![Diagram of types A, B, C, D](attachment:image)

This view is as from the control room, i.e., “Layers” are composed of arrangements of these units in a horizontal plane.
the initial array was thus

"layers" 2, 4, 6
each contains 49 T's
7 x 49 = 343 H's
total of 392 = 2 x 14 x 14 cubes

"layers" 1, 3, 5, 7
each contains 49 T's
7 x 49 = 343 H's
total of 392 = 2 x 14 x 14 cubes

Array as a whole contains
7 x 343 T's = 343 T's
7 x 343 H's = 2401 H's
2744 total cubes
= 14 x 14 x 14 (cubee units)^3
H & w N-S
Counts on instrument #3 during stacking:
(2-minute intervals) started 10:54 A.M.

<table>
<thead>
<tr>
<th>Time</th>
<th>C</th>
<th>Time</th>
<th>C</th>
<th>Time</th>
<th>C</th>
<th>Time</th>
<th>C</th>
</tr>
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<td>59</td>
<td>16:41</td>
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<td>15:02</td>
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<td>15:04</td>
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<td>16:45</td>
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<td>16:49</td>
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<td>10:36</td>
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<td>41</td>
<td>15:50</td>
<td>59</td>
<td>17:31</td>
<td>23</td>
</tr>
</tbody>
</table>

Crew assembled at 3:05 pm.
<table>
<thead>
<tr>
<th>Separation of tabs</th>
<th>#1 counter</th>
<th>#3 counter</th>
<th>Time (pm)</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>inches</td>
<td>dial</td>
<td>1/2 min. recip. c</td>
<td>1/2 min. recip. c</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>117.5</td>
<td>16</td>
<td>23</td>
<td>305</td>
</tr>
<tr>
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</tr>
<tr>
<td>0</td>
<td></td>
<td>113</td>
<td>31</td>
<td></td>
</tr>
</tbody>
</table>

very far from critical. decided to tear down and colone, owing to the lateness of the hour.
## Experiment 10, October 10, 1946

<table>
<thead>
<tr>
<th>Separation of tabs</th>
<th>#1 counter</th>
<th>#3 counter</th>
<th>Time</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>inches dial</td>
<td>c/2min recip.c.</td>
<td>c/2min recip.c.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


EXPERIMENT 10B

Oct. 11, 1946

Conditions: Tamped, Moderator ratio H/T = 7/1

Initial dimensions for day:
- N-S = 16
- E-W = 16
- Height = 16 (effective)

Persons Present:
- Hull - Chief Engineer
- Callahan - Second Engineer
- Wren - Assay
- Williams - Instrument
- Them

Location of Instruments: Page a exp. 3, p. 11.

Method of construction:

The type of cube units (8 cubes) described p. 38 and p. 10, were used.

The first layer 7 white cubes were omitted, and the transfer on the bottom was considered as also omit or a layer of white moderator.

Layers are composed of arrangements of cube units:

S

- Layers 1, 3, 5, 7, 9
Counts on Instrument #3 during stacking
2 minute intervals.

<table>
<thead>
<tr>
<th>Counts</th>
<th>Time</th>
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</thead>
<tbody>
<tr>
<td>314</td>
<td>09:15</td>
</tr>
<tr>
<td>287</td>
<td>09:25</td>
</tr>
<tr>
<td>297</td>
<td>09:36</td>
</tr>
<tr>
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<td></td>
</tr>
<tr>
<td>314</td>
<td>09:56</td>
</tr>
<tr>
<td>269</td>
<td>10:03</td>
</tr>
<tr>
<td>120</td>
<td>10:11</td>
</tr>
<tr>
<td>122</td>
<td>10:17</td>
</tr>
<tr>
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<td>10:28</td>
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<td>154</td>
<td>10:33</td>
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<tr>
<td>225</td>
<td>10:35</td>
</tr>
<tr>
<td>209</td>
<td>10:37</td>
</tr>
<tr>
<td>188</td>
<td>10:39</td>
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<tr>
<td>196</td>
<td>10:41</td>
</tr>
<tr>
<td>186</td>
<td>10:43</td>
</tr>
<tr>
<td>182</td>
<td>10:45</td>
</tr>
<tr>
<td>218</td>
<td>10:47</td>
</tr>
<tr>
<td>302</td>
<td>10:51</td>
</tr>
<tr>
<td>295</td>
<td>10:53</td>
</tr>
<tr>
<td>320</td>
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<tr>
<td>151</td>
<td>10:57</td>
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<tr>
<td>151</td>
<td>11:00</td>
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<tr>
<td>331</td>
<td>11:03</td>
</tr>
<tr>
<td>340</td>
<td>11:05</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>11:09</td>
</tr>
<tr>
<td>22</td>
<td>11:12</td>
</tr>
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<td>23</td>
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<td>24</td>
<td>11:17</td>
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<td>21</td>
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<td>22</td>
<td>11:21</td>
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<tr>
<td>22</td>
<td>11:23</td>
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<tr>
<td>22</td>
<td>11:25</td>
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<tr>
<td>22</td>
<td>11:32</td>
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<tr>
<td>23</td>
<td>11:37</td>
</tr>
<tr>
<td>23</td>
<td>11:39</td>
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<tr>
<td>24</td>
<td>11:41</td>
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<td>22</td>
<td>11:43</td>
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<td>23</td>
<td>11:45</td>
</tr>
<tr>
<td>22</td>
<td>11:47</td>
</tr>
<tr>
<td>24</td>
<td>11:49</td>
</tr>
</tbody>
</table>

Stacking completed.

Tamping started.

Source moved.

Counts on Instrument #1
Stacking completed.

Primary Source removed.

Assembly finished.
<table>
<thead>
<tr>
<th>Top Layer of each table</th>
<th>64 T</th>
<th>48 T</th>
</tr>
</thead>
<tbody>
<tr>
<td>New assembly contains</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Vertical layer</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Estimated 111 on dial</td>
<td>0.06</td>
<td>0.04</td>
</tr>
</tbody>
</table>

**Experiment 10 B**

**Dialed Check OK.**

**Conditions:**

- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.
- Dis assembled.

**Exp. 10 B.**

- Check OK.
- Checked, cold, check cable after rechecked.
- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.

**Exp. 10 C.**

- Dialed Check, OK.
- Power check, cold check.
- CRITICAL, Dis assembled.

**Exp. 10 D.**

- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.

**Exp. 10 E.**

- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.

**Exp. 10 F.**

- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.

**Exp. 10 G.**

- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.

**Exp. 10 H.**

- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.

**Exp. 10 I.**

- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.

**Exp. 10 J.**

- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.

**Exp. 10 K.**

- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.
- CRITICAL, Dis assembled.
Conclusions:

For a Tanged assembly moderated at a ratio of $N/N_0 = 7/1$, the critical mass is estimated at 406 T metric $\approx 6.29$ Kg. With a $\frac{1}{16}''$ al sheet at assembly.
Experiment II

Oct 12, 1946

Conditions: Tamped moderately, ratio $H/T = \frac{20}{47}$

Initial Trial dimensions: $12.5 \times 5.5$

Persons Present:
- Callihan: Thief, experimenter
- Beck: Experimenter - stacking
- Schmidt: Stacker
- Smith: Instrument
- Williams: Recorder

Locations of instruments same as Experiment 3, p. 11

Method of construction:

The layers, from bottom up, were as follows:

1. Talke
2. Half Shell
3. Heubé

Layers 1 and 11

N

1st layer

Stationary Table

Movable Table

2nd layer
Counts on No. 1 instrument during stacking:

<table>
<thead>
<tr>
<th>Time</th>
<th>Counts per 2 min</th>
<th>Remarks</th>
<th>Time</th>
<th>Counts per 2 min</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>0838</td>
<td>7</td>
<td></td>
<td>1035</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>0841</td>
<td>6</td>
<td></td>
<td>1037</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>0855</td>
<td>42</td>
<td>Source on Table</td>
<td>1042</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>0858</td>
<td>40</td>
<td></td>
<td>1046</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>0905</td>
<td>37</td>
<td>Stacking</td>
<td>1049</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>0911</td>
<td>37</td>
<td></td>
<td>1050</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>0918</td>
<td>40</td>
<td></td>
<td>1054</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>0921</td>
<td>40</td>
<td></td>
<td>1100</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>0932</td>
<td>41</td>
<td>Layng 6th layer</td>
<td>1603</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>0937</td>
<td>40</td>
<td></td>
<td>1606</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>0942</td>
<td>41</td>
<td></td>
<td>1606</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>0942</td>
<td>41</td>
<td></td>
<td>1606</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>0959</td>
<td>42</td>
<td></td>
<td>1606</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>1001</td>
<td>42</td>
<td></td>
<td>1606</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>1007</td>
<td>43</td>
<td></td>
<td>1606</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>1012</td>
<td>43</td>
<td></td>
<td>1606</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>1012</td>
<td>42</td>
<td></td>
<td>1606</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>1024</td>
<td>34</td>
<td>Stacking Comp: Tamping began on source in plates</td>
<td>1606</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>1032</td>
<td>34</td>
<td></td>
<td>1606</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Separation of Layers</td>
<td>#1 Counter</td>
<td>#2 Counter</td>
<td>#3 Counter</td>
<td>Time</td>
<td>Remarks</td>
</tr>
<tr>
<td>----------------------</td>
<td>------------</td>
<td>------------</td>
<td>------------</td>
<td>-------</td>
<td>---------</td>
</tr>
<tr>
<td>Inches</td>
<td>Dial</td>
<td>/2 min.</td>
<td>/2 min.</td>
<td>/2 min.</td>
<td></td>
</tr>
<tr>
<td>3 1/2</td>
<td>22</td>
<td>27</td>
<td>30</td>
<td>33.3</td>
<td>Exp. 1A</td>
</tr>
<tr>
<td>7</td>
<td>26</td>
<td>38.5</td>
<td>30</td>
<td>33.3</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>28</td>
<td>35.7</td>
<td>32</td>
<td>31.3</td>
<td></td>
</tr>
<tr>
<td>1&quot;</td>
<td>38</td>
<td>83</td>
<td>12.05</td>
<td>79</td>
<td>11:41AM</td>
</tr>
<tr>
<td>0.67&quot;</td>
<td>64</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exp. 11 B</td>
<td>21</td>
<td>77.6</td>
<td>28</td>
<td>55.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>23</td>
<td>43.5</td>
<td>27</td>
<td>37.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>34</td>
<td>29.7</td>
<td>35</td>
<td>29.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>85.25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exp. 11 C</td>
<td>22</td>
<td>43.5</td>
<td>27</td>
<td>37.1</td>
<td>12:28PM</td>
</tr>
<tr>
<td></td>
<td>19</td>
<td>52.6</td>
<td>25</td>
<td>40.0</td>
<td>1:40PM</td>
</tr>
<tr>
<td></td>
<td>19</td>
<td>52.6</td>
<td>24</td>
<td>41.0</td>
<td>1:54PM</td>
</tr>
<tr>
<td></td>
<td>115</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exp. 11 D</td>
<td>270</td>
<td>112.5</td>
<td>112.5</td>
<td>112.5</td>
<td>2:20PM</td>
</tr>
<tr>
<td></td>
<td>104.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>112.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Remarks:
- Exp. 11 A
- 330° = total T's
- 125° + 170° = 48°
- \( N_m \div N_x = 114/9 \)

30° fine adjusted gain South side. North
- gain is 11 x 12
- Instrument check 016

1:16 P.M. Critical

- Removed 36° T cube gain West side of harry.
- (Replaced T cube with He boil)
- 1 ins. check 0.5

- Ins. T. Av. check 0.5
- Not critical (indicating that it was almost critical)

- Replaced 6° T cube with 6° T cube in west side in original T cube position
- 2:20 Ins. T. Av. check 015
- 2:30PM Critical
Conclusion:

For a flooded, moderated assembly with a

$1/8$ in. Al. The critical mass as determined by the

approximation of the "Ne vs Dist. of Separation" curve is

265 50% c/a on 4.1 Kg of X when separated

by a $1/4$" Al Sheet.
Tempest, Medicated, 1:2 white: green.
Project: Furred.
Back Murray - Chief Experimenter.

A. Beginning Assembly 16x16 X 16 (Height)

In each successive tier, the E-throw shall shift from North.

EW row 1 contains 13 greens, 3 whites
2 " 12 " 4 "
3 " 12 " 3 "
4 " 12 " 3 "
5 " 13 " 3 "

Tier 1 contains 91 greens, 21 white + 108 64th white = 259 greens, 57 white
2 " 91
3 " 78+120 18+40
4 "
5 "
6 "
794
3175 T cube.

Count monitoring during staging (2 min each)

Time
1st count
1 st 27 48.78. Company
1245 32
1308 45 15th Stage: Source removed
1345 44 5th Stage: Count continued
<table>
<thead>
<tr>
<th>Separation of Tables (inches)</th>
<th>#1 counter</th>
<th>#3 counter</th>
<th>Time</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>32½</td>
<td>25</td>
<td>36</td>
<td>29</td>
<td>65.9</td>
</tr>
<tr>
<td>15.24</td>
<td>36</td>
<td>36</td>
<td>34</td>
<td>68.2</td>
</tr>
<tr>
<td>7.2</td>
<td>41</td>
<td>33</td>
<td>43</td>
<td>66.5</td>
</tr>
<tr>
<td>3.2</td>
<td>49</td>
<td>49</td>
<td>68</td>
<td>29.4</td>
</tr>
<tr>
<td>1½</td>
<td>124</td>
<td>16.1</td>
<td>17.1</td>
<td>15.26</td>
</tr>
<tr>
<td>3</td>
<td>101</td>
<td>3.2</td>
<td>30.6</td>
<td>15.48</td>
</tr>
<tr>
<td>9</td>
<td>5.9</td>
<td>3.9</td>
<td>50.7</td>
<td>15.55</td>
</tr>
</tbody>
</table>

**Experiment 12 A**

16 x 16 x 16

---

**Critical**

Disassembled

---

**Removed 568 Torsion**

Two layers from top; one layer from south.

2606 Torsion

2.40 K z X

Instrument check: OK.

14 x 15 x 16

---

**Critical**

Disassembled

---

**Removed 121 Torsion**

One layer from top.

2485 Torsion: 38.5 K z X

2.48 K z X

Instrument check: OK.

14 x 15 x 15

---

Table 2430

May: Clutch released. Offset

1830

---

Table 2430

Magnet engaged.

1830

---

Table 2430

Clutch disengaged.

1840

---

Back estimated.

24.95 Torsion as critical.
Conclusion.

For a lumped assembly, moderated at a ratio of $H/L$ value = $1/2$, the critical mass is estimated at 24.93 cubic by extrapolation of CH $\alpha$ moderation curve.

\[ \text{9.77 kg/m}^3 \]

Solution for the fuel = 24.50 cubic = 37.7 kg U 235

\[ \text{DO} \]
Experiment 13  Thursday Oct. 17, 1946

Tamped, moderated, H/T cubes = 1/7
Initial dimensions, 15 x 15 x 16.

Present - Callihan  Chief experimenter
Murray  experimenter
Williams
Visner
Smith  instruments

In view of the belief that the array could not be made critical, a source was put inside the pile, and multiplication extrapolation measurements planned.

Construction of assembly:

Alternate layers, all green, T cubes, i.e. 1, 3, 5, 7, ....
Alternate layers 2, 4, 6, 8, ... one white H cube for each 3 green T cubes, in four configurations

\[
\begin{array}{cccc}
\text{W} & \text{W} & \text{W} & \text{W} \\
\text{D} & \text{A} & \text{C} & \text{B}
\end{array}
\]

See p. 61 for diagram of these layers

Composition of assembly

8 All green layers each with 16 x 15 = 240 T's
7 mixed layers, each with 180 T's, 60 H's

to preserve 1/7 ratio, should consider that a part of the paraffin is the necessary moderator

\[
\begin{array}{c}
\text{total T's} \\
\text{total H's}
\end{array}
\begin{array}{c}
1260 \\
420
\end{array}
\]

\[
\begin{array}{c}
1820 \\
0
\end{array}
\]

\[
\begin{array}{c}
3180 \\
420
\end{array}
\]

\[
\begin{array}{c}
3179 \\
420
\end{array}
\]

\[
16 \times 15 \times 15 = 3600
\]
Experiment: 13 (cont)  Oct. 12, 1946

Tamped, modified. 1/7 cube ratio 4/1.

People present:
- Callihan
- Murray
- Verno
- William
- Smith

Location of Counters:

<table>
<thead>
<tr>
<th>N</th>
<th>4</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>①</td>
<td>②</td>
<td>③</td>
</tr>
<tr>
<td>Table Top.</td>
<td>Stationary</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#1 Counter (cpm)</th>
<th>#3 Counter (cpm)</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>243</td>
<td>155</td>
<td>10:36</td>
</tr>
<tr>
<td>77</td>
<td>164</td>
<td>10:43</td>
</tr>
<tr>
<td>124</td>
<td>177</td>
<td>10:56</td>
</tr>
<tr>
<td>168</td>
<td>182</td>
<td>11:09</td>
</tr>
<tr>
<td>165</td>
<td>188</td>
<td>11:14</td>
</tr>
<tr>
<td>161</td>
<td>183</td>
<td>11:16</td>
</tr>
<tr>
<td>165</td>
<td>188</td>
<td>11:20</td>
</tr>
<tr>
<td>162</td>
<td>187</td>
<td>11:22</td>
</tr>
<tr>
<td>162</td>
<td>189</td>
<td>11:26</td>
</tr>
<tr>
<td>179</td>
<td>202</td>
<td>11:34</td>
</tr>
<tr>
<td>175</td>
<td>205</td>
<td>11:36</td>
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<tr>
<td>177</td>
<td>211</td>
<td>11:39</td>
</tr>
<tr>
<td>170</td>
<td>204</td>
<td>11:44</td>
</tr>
<tr>
<td>171</td>
<td>209</td>
<td>11:51</td>
</tr>
</tbody>
</table>

Background Count:

<table>
<thead>
<tr>
<th>#1 Count Time</th>
<th>#3 Count Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:30</td>
<td>10:30</td>
</tr>
</tbody>
</table>

Source alone; in position 8 be occupied during experiment.

<table>
<thead>
<tr>
<th>Source Time</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:54</td>
<td>11:56</td>
</tr>
<tr>
<td>11:58</td>
<td>12:00</td>
</tr>
<tr>
<td>12:23</td>
<td>12:03</td>
</tr>
<tr>
<td>12:10</td>
<td>12:06</td>
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<tr>
<td>12:19</td>
<td>12:17</td>
</tr>
<tr>
<td>12:23</td>
<td>12:05</td>
</tr>
<tr>
<td>12:30</td>
<td>12:25</td>
</tr>
</tbody>
</table>

13:05 opened window to count No.
Mixed H27 cubes in alternate layers

<table>
<thead>
<tr>
<th>Type D</th>
<th>Type A</th>
<th>Type B</th>
</tr>
</thead>
<tbody>
<tr>
<td>W</td>
<td>W</td>
<td>W</td>
</tr>
<tr>
<td>W</td>
<td>all same as corner group</td>
<td>W</td>
</tr>
<tr>
<td>W</td>
<td></td>
<td>W</td>
</tr>
<tr>
<td>W</td>
<td></td>
<td>W</td>
</tr>
<tr>
<td>W</td>
<td></td>
<td>W</td>
</tr>
</tbody>
</table>

layers 2, 6, 10, 14...

<table>
<thead>
<tr>
<th>Type A</th>
<th>Type B</th>
</tr>
</thead>
<tbody>
<tr>
<td>W</td>
<td>W</td>
</tr>
<tr>
<td>W</td>
<td>all same as edge group</td>
</tr>
<tr>
<td>W</td>
<td>W</td>
</tr>
<tr>
<td>W</td>
<td>W</td>
</tr>
<tr>
<td>W</td>
<td>W</td>
</tr>
<tr>
<td>W</td>
<td>W</td>
</tr>
</tbody>
</table>

layers 4, 8, 12...

Location of source:
<table>
<thead>
<tr>
<th>Separation inches dial</th>
<th>#1 counter</th>
<th>#2 counter</th>
<th>#3 counter</th>
<th>Time pm</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>32</td>
<td>47</td>
<td>45</td>
<td>45</td>
<td>3 25</td>
<td>N.G.</td>
</tr>
<tr>
<td>32</td>
<td>45</td>
<td>45</td>
<td>3 20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>27</td>
<td>31</td>
<td>3 40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>28</td>
<td>33</td>
<td>3 45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>23</td>
<td>33</td>
<td>3 50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>25</td>
<td>45</td>
<td>3 52</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>29</td>
<td>67</td>
<td>4 03</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/2</td>
<td>32</td>
<td>87</td>
<td>4 07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 10 2</td>
<td>36</td>
<td>106</td>
<td>4 20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Recip multi = 1.05
- Recip multiplier = 3.35

- Removed south face - 1 9 3 T's. total cubes 235 = 15 x 15. Put white cubes back in.
- In view of the discrepancy between counts on #3, replaced the 1 9 3 T's, is made the assembly as originally.
Experiment 14
Friday, Oct. 18, 1946

Timed, moderated
1/1 cube = 2/3
30% "25."

Initial dimensions
11" Vertical 11" N-S 10" E-W

9" on stationing
5" on moving

14 A as shown
606 cubes U
14 B U cube out of cubes 3, 3, 9, 6, 11 in south face.
574 cubes
14 C all south face off (11x10x10) 550 cubes

Persons present:
Caldiron - Chief Experiment
Verme - Experimenter - Data
Williams - Instrument - Telephone

Used Visitors Left after 14A was finished

<table>
<thead>
<tr>
<th>Scale distance</th>
<th>Count #1</th>
<th>Rec.</th>
<th>Count #3</th>
<th>Rec.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>32&quot;</td>
<td>22</td>
<td>45.5</td>
<td>31</td>
<td>32.3</td>
<td>Time 11:25 AM</td>
</tr>
<tr>
<td>15&quot;</td>
<td>44</td>
<td>41.7</td>
<td>37</td>
<td>37.0</td>
<td></td>
</tr>
<tr>
<td>10&quot;</td>
<td>26</td>
<td>38.5</td>
<td>42</td>
<td>23.8</td>
<td>Magnet pulled out at 4&quot;. Puffin clamp hit cable support. Aligned &amp; stretched over.</td>
</tr>
<tr>
<td>7&quot;</td>
<td>27</td>
<td>37.0</td>
<td>38</td>
<td>36.3</td>
<td>Critical</td>
</tr>
<tr>
<td>3&quot;</td>
<td>30</td>
<td>33.3</td>
<td>47</td>
<td>71.3</td>
<td>Within out for foam. Starting 12:40 PM</td>
</tr>
</tbody>
</table>

Critical

Conclusions:
(1) The critical mass for a 1/1 cube ratio is 53.4 cubes.
(2) Removal of cubes along the edges of the array affects the criticality. Less steel removal of cubes from the center of a face?
To further test effect on C.M. if inhomogeneity in obtained array by testing what is been tested in group 7.

Four tests:

30% 7/35
Finally 4/45.

Persons:
Hull - Chief Exp.
Gallois - Barkman.
Nelzen.
Smith - Instruments.

Y + 4 tables.

Legend:
- Green \{ In 1st, 3rd, 5th tiles. \\
- White \{ In 2nd, 4th, 6th tiles. \\

Table 1:

<table>
<thead>
<tr>
<th>E</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

5.

Dimensions:

- N-S - 11 units.
- E-W - 11 units.
- U-D - 11 units (actual array had 12" fits all white).

Contents:

- 6 layers (odd) each containing 61 green cubes = 366
- " " " " 60 white. = 360
- 5 " (even) " 60 green = 300
- " " " " 61 white = 365

Totals: 666 green, 665 white.

Instruments located as shown on pg 60.
Exp. 15 (cont.)  10/10/46

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:01A</td>
<td>52&quot;</td>
<td></td>
</tr>
<tr>
<td>10:21V</td>
<td>79.30 = 0.5</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- Started exp.
- Critical - disassembly.

**15B**
- Removed south face - i.e., removed 61 green cubes - replacing them with white cement, 605 green cubes.
- Temperature check - Critical - disassembly.

**15C**
- Removed 16 green cubes from top tier leaving 589 green cubes.
- Top tier now in.

As the hot zone, the activity was allowed to simmer for ca. 2 min until the emergency disassembly mechanism stopped the fan platforms. Three minutes after this disassembly, the S radiation at the exposed face of the stationary array was measured by the ion gauge chamber to be only 0.4 R/3 h.

As the time of disassembly, the A chamber, located 16' from the center of the pile, showed radiation in excess of 0.13 R/8 h. The mesh being well off scale.

The emergency disassembly mechanism operated at the predicted radiation level.
Exp 15 (cont.)

Conclusion: 
1. Extrapolation of the CM-separation of criticality line gives 5.8 green cubed ( = 8.8 kq75) as the critical mass when the halves of the assembly are separated by 1/4 in.

2. The counting level disassembly mechanism was tested and by allowing the activity to increase. The mechanism operated satisfactorily and at the predicted level of radiation.

3. The activity at the face of the separated pile 3 min after separation was measured by the A chamber and found to be 0.4 kR / 8 hrs.

4. The CM-separation at criticality curve is quite linear; this may be due to the more judicious selection of the cubed remove between points, i.e. first a whole face was removed, then the cubes removed from an edge of a tin.
Experiment 16, 10/21/46

Purpose: To further test the effect of
inhomogeneity on critical mass.

Conditions: Tamped, moderated H/T cube ratio: 8/8

Personnel:
Bach: Chief Experimenter
Caldwell: Second
Vern: 
Williams: 

Fork Assembly

N.S. 12
E.W. 11
High - 11

N. Layers 1, 2, 5, 6, 8, 10

Stacking and tamping completed at 10:45.
<table>
<thead>
<tr>
<th>DISTANCE APART</th>
<th>Counter 1</th>
<th>Counter 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/4&quot; 98.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>151&quot; 76.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Experiment 16A</th>
<th>724 Tubs</th>
</tr>
</thead>
<tbody>
<tr>
<td>11/08</td>
<td>CRITICAL assembly</td>
</tr>
</tbody>
</table>

Experiment 16B

Added top layer 66 Tubs
Assembly new

NS - 12
E-W - 11
N-S - 12

11/27 Instrument Check

11:30 Critical - Disassembly

<table>
<thead>
<tr>
<th>Removed top layer</th>
<th>Experiment 16C</th>
</tr>
</thead>
<tbody>
<tr>
<td>also 30 cubic feet</td>
<td></td>
</tr>
</tbody>
</table>

| Removed total of  |
| 96 Tubs           |

<table>
<thead>
<tr>
<th>New assembly</th>
<th>694 Tubs</th>
</tr>
</thead>
<tbody>
<tr>
<td>NS - 11 1/2</td>
<td></td>
</tr>
<tr>
<td>E-W - 11</td>
<td></td>
</tr>
<tr>
<td>N-S - 11</td>
<td></td>
</tr>
</tbody>
</table>

12:00 Instrument Check

CRITICAL Disassembly
Conclusion of Exp. 16.

1. Extrapolation of the CH reparation curve gives 65.8 Tcubes as critical for a tamped assembly, moderated H/I cube ratio = 3/8 with a 1/2" Al sheet in the center.

2. The values of CH for various compositions, using 30% material are about 2% lower than the value to be expected from the J.A (85%) data, for the same H/I cube ratio.
Experiment 17 10/22/46

Test of inhomogeneity on tamped, moderated array
H/I = 1/2 Initial array 13 x 13 x 13. (See exp 8 for H/I)

Present - Murray - Books - Chief experimenter
Likens - instruments
Visser - stacking
Williamson - stacking
Callahan - experimenter

Started stacking 9 am
Counts 1/2 min

#3
5 c/2 min 902
64 c/2 min 918
61 918
69 925
69 927
80 942 No change
93 995 Noted on
107 950 record
115 953
127 1015
126 1028 Stacking finished
106 1030 Tamping started
1055 Tamping completed
Construction of assembly - the reverse of Exp. 9, P. 33.

\[ \text{\(TS = 113\)} \]
\[ \text{\(HS = 56\)} \]
\[ \text{Total = 169} \]

Layers 1, 4, 7, 10, 13

Form successive layers by shifting one to the east (left as viewed).

\[ \text{\(TS' = 112\)} \]
\[ \text{\(H = 57\)} \]
\[ \text{Total = 169} \]

Layers 2, 5, 8, 11
Complete array

H's: \[9 \times 56 = 504\]
\[4 \times 57 = 228\]
\[\frac{732}{732}\]

T's: \[9 \times 113 = 1017\]
\[4 \times 112 = 448\]
\[\frac{1465}{1465}\]

Total: \[2197 = 13^3\]

\(T's = 113\)
\(H's = 56\)
\(total = 169\)

layers 3, 6, 9, 12

\(\text{cf. Exp. 8} \quad \text{II} \pm T's \pm \frac{1}{2} L\)

increase is 2.8176, or 21.7%
<table>
<thead>
<tr>
<th>Scale</th>
<th>Separation</th>
<th>Counter 1</th>
<th>Counter 2</th>
<th>Counter 3</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/32</td>
<td>32 / 15</td>
<td>20 / 24</td>
<td>33 / 38</td>
<td>47 / 10</td>
<td>Exp 17A-orig assembly</td>
</tr>
<tr>
<td>6/32</td>
<td>64 / 27</td>
<td>16.6 / 15</td>
<td>9.3 / 9.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Exp 17B:** Removed 148 T5, north face (118) and face on movable table (55) from T5 = 1319, H5 659, T5 1916
- **Exp 17C:** Removed 65 T5, top layer (96) and face on stationary table (68) from T5 = 1152, H5 576, T5 1728
- **Exp 17D:** Added 20 T5, E face, stationary table from T5 = 1172, H5 586, T5 1758
- **Exp 17E:** Removed 10 T5, E face, stationary table from T5 = 1162, H5 581, T5 1793
- **Exp 17F:** Added 447 3s E face stationary table, bring the face to 39 T5 from T5 = 1206, H5 603, T5 1809
Exp 17

Conclusion -

Critical mass at tangred, $\frac{117}{7} = \frac{1}{2}$ in 1 cubic

$= 11.55 \pm 4$, i.e. $\approx 17.9$ kg or $X$

Comparison with $\frac{1}{7}$, 29 less (118)

At zero pressure $-$ $Cm = 11.9$ Cm

$= 17.5$ kg or $X$ de $41.6$
Experiment 18
10/23/46

Test of inhomogeneity, a tamped, moderated away

17 cm = 7/4 Initial Amy 13 N-3
13 E-0

(Four green cubes + 2 white cubes in)
12 14.7 h

Present: Bury, Hull, Visser, Thomas

Instrument arrangement same as Exp 13 p. 60.

Construction of assembly:

\[ \square = \text{white cube} \]

Layers:

1, 7
2, 8
<table>
<thead>
<tr>
<th>Time</th>
<th>Signal Dial</th>
<th>Count #1</th>
<th>Count #3</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:20</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>11:50</td>
<td>16</td>
<td>16</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

Experiment 18 A
- Tube: 1352 (+3?)
- N-5 = 13
- E-W = 13
- Nigh: 12
- Instrument check: CRITICAL

1300
- 90 46

Experiment 18 B
- Added two complete layers on YD
- New setup contains 15 tubes (+3?)
- Instrument check: CRITICAL

1400
- 0.56 73

Experiment 18 C
- Took - YD, one top layer (137)
- New assembly contains 1465T
- CRITICAL
- fuel allowed to increase to point where damming.

14:05
- Counted 2 activity

Experiment 18 D
- Removed: 1 layer from 1.5" X 6" 9 in. YD assembly, equivalent to 0.9% of fuel
- Same cube as range used as in 18 C
- Counted checked

14:15
- 0.53 75

Total:
- 6 X 6 = 36" of assembly equipped with no
- 1 layer. Equivalent to 3.6% of fuel missing

- Argon chamber in control room read 35*3.4 X 10^-5 while counter 2 read 20 dw (cemetry = 1)
Extra Experiment:

To determine the radiation level at various locations as measured by the argon counter for the same multiplication as measured by counter no. 2.

Exp. 18 F

Removed total of 9 x 6 = 54 in. Y tarpur.

1919
102

Critical

Exp. 18 G

Removed total of 12 x 6 = 72 in. Y tarpur.

2019 109

Critical

Exp. 18 H

Covered exposed assembly (72 in.²) with 1/2" white cube. Flipping (covered assembly with 1/2" tarpur.

<table>
<thead>
<tr>
<th>Dial</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>98</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Critical
<table>
<thead>
<tr>
<th>Pressure Temp Measured (kg/cm²)</th>
<th>Critical C.M. for Separately Fully Tamped at 2'' Separ.</th>
<th>% Increase in C.M.</th>
<th>Δ C.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.56</td>
<td>1465</td>
<td></td>
</tr>
<tr>
<td>0.9</td>
<td>0.53</td>
<td>1457</td>
<td>0.82</td>
</tr>
<tr>
<td>3.6</td>
<td>0.34</td>
<td>1402</td>
<td>4.3</td>
</tr>
<tr>
<td>5.3</td>
<td>0.19</td>
<td>1353</td>
<td>7.3</td>
</tr>
<tr>
<td>7.1</td>
<td>0.11</td>
<td>1335</td>
<td>8.9</td>
</tr>
</tbody>
</table>

**Conclusions**

1. For an extreme inhomogeneity of 2/4, C.T. ratio in all directions (i.e., the critical mass for the tamped assembly is 1306 Tons) (with 3/8" at.)

2. Over a range of 0% to 7% in untamped surface, the ratio of % increase in C.M. % surface of assembly that is completely untamped (center visible), is 1.27.
Conditions: Tamped, moderated, $\frac{4}{11}$ cubes = $\frac{1}{11}$, cadmium shielded, by means of 0.020" sheets stacked between the pile and the tamper.

Basic array $13 \times 13 \times 13$

Present - Callihan, Chief Exp.
          Murray, exp, records
          Visner
          Williams
          Macklin

\[ S \]
\[ \uparrow \]
\[ \square = T \text{ cube} \]
\[ T's = 85 \]
\[ H's = 84 \]
\[ \text{total} = 169 \]

Layers: 1, 3, 5, 7, 9, 11, \ldots
other layers formed by shifting everything one to the left.


$T$ cubes have = 514. assuming a 1.8 effect of $0.025$ should go critical with present array at 925.
$T_5 = 87$

$H_5 = 85$

$\text{Total} = 172$

Layers 3, 4, 6, 8, 10, 12

Total array contains $T_5$, $6 \times 85 = \frac{570}{510}$

$+ 6 \times 84 = \frac{504}{1094}$

$+ H_5$, $6 \times 84 = \frac{504}{510}$

$+ 6 \times 85 = \frac{510}{1094}$

Total $= 2147 = 13\frac{3}{2028} = 13 \times 13 \times 12$

Experiment 19A - original conditions.

Critical at 1/8" separation

Experiment 19B

Removed 19 T's, etc. from movable table, top layer,

moved 3 rows. Assembly now 95 T cubes.

Critical at 1/16" separation

Conclusion - estimate of no. of T cubes that would be critical at $H/T = 11$, with Cd. Shielding

$= 975.$

$\text{cd} \over \text{no. cd} = \frac{975}{506} = 1.93$
Experiment 20.

Conditions:
- Tamped, moderated, $\frac{N}{T} = 4/1$
- Cadmium shielded by means of sheet of cadmium 0.1 inch between pile and ranger.

Initial array:
- $\varepsilon - W = 14$
- $N - S = 15$
- $N\times T = 14$

Present: Callahan, Murray, Harris, Williams.

Diagram:
- Layer 1:
  - $T = 47$
  - $N = 163$
- Layer 2:
  - $N = 169$

Note: $\square = green, T$. 

- Layer 1, 11
Layer 3, 13  
\[ T = 46 \]
\[ H = 164 \]

Layer 4, 14  
\[ T = 51 \]
\[ H = 169 \]

Layer 5, 15  
\[ T = 47 \]
\[ H = 163 \]

Layer 6  
\[ T = 40 \]
\[ H = 170 \]
Monitoring of cracking

<table>
<thead>
<tr>
<th>Counts</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>51</td>
<td>205</td>
</tr>
<tr>
<td>52</td>
<td>208</td>
</tr>
<tr>
<td>56</td>
<td>216</td>
</tr>
<tr>
<td>61</td>
<td>219</td>
</tr>
<tr>
<td>58</td>
<td>221</td>
</tr>
<tr>
<td>61</td>
<td>223</td>
</tr>
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<td>61</td>
<td>228</td>
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<td>60</td>
<td>230</td>
</tr>
<tr>
<td>60</td>
<td>232</td>
</tr>
<tr>
<td>??</td>
<td>235</td>
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<td>60</td>
<td>237</td>
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<td>64</td>
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<td>118</td>
<td>256</td>
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<td>35</td>
<td>259</td>
</tr>
<tr>
<td>47</td>
<td>305</td>
</tr>
<tr>
<td>24</td>
<td>308</td>
</tr>
</tbody>
</table>

Experiment 20A

Critical at dial setting 103 (that is 125 division from the near closure value of 103)

\[
\begin{align*}
\frac{117}{103} & = 1.13 \\
\frac{14}{125} & = 1.12 \\
\frac{139}{80} & = 1.74
\end{align*}
\]
Experiment 20B

Removed north two faces, top on N, not movable table, 8 & Ts, +12 total 94 cubes, 368 whites removed
array now 13 x 14 x 13 8/13

total Ts = 516 ; H_s = 1962 total 2478

critical at 0.9", ie 45.5 on dial.

Experiment 20C

Removed remaining part of top layer, on stationary table. 237, 89 Hs
also one layer on west side, both tables, replacing all protruding green cubes with 1/2 white cubes.

This took out 51 Ts, of which 17 were protruding, and then took with them an additional 1/2 vacant space.

array now 13 x 13 x 13

total Ts = 442 ; H_s = 1755 ; total 2197

critical at 0.9" ie 91 on dial.

Conclusion:

Critical number of T cubes with H/t = 4/1
(actually slightly less) with Cd shielding 0.020" thick,

is 405 ± 5 cubes (est.)

\[
\frac{Cd}{n_{cd}} = \frac{405}{265} = 1.53
\]
Experiment 21.

Conditions:

Sungod moderated, \( \frac{1}{3} = \frac{1}{3} \) in all directions.

21A: \( N^3 = 18 \) cards

\( E-W = 15^\circ \) 780 green

\( N-D = 15^\circ \) S

[18 cards]
Assembly. Motion level began here at 12:20, 2:31 P.M.

Cathodic at 47.5, galvanic (last round).

\[
\frac{47}{80} = \frac{7}{8}''
\]

21B: 15 EW, 15 & 14 NS, 2520 cubic.

2 layers taken from end of 21A. One layer to run at 16''.

Critical at 102 = 0.19''.

Conclusion: From these two points, the extrapolated Me for 2520 cubic feet is 36.7 KPH.

\[\text{Initial} \quad \text{21B}\]
Experiment 22.

Purpose: To determine the effect of geometry on c.h.

Conditions: Tampered, modified H/T cube ratio: 2/1

Critical chord dimension: L-W = 9

N = 52
N = 9
5 hours on movable.

Persons Present:

Beck, Chief Exp
Murray, Exp
Vinson
Williams

Layers: 1, 4, 7

Layers: 2, 5, 8

38° T per layer.

First assembly contains 551 T cubes.

Layers 3, 6, 9.

Stacking started at 09:00
Experiment 22 A

Initial array, \(9 \times 9 \times 13\) – 357 T-cubes.

Critical at 82, i.e. 0.42".

Experiment 22 B

Removed South face (37 T-cubes)

New assembly contains 324 T-cubes.

\[N-S = 12,\]
\[E-W = 9,\]
\[Height = 9.\]

10:05 - Instrument check.

Critical at 103/4, i.e. 0.162".

Conclusion: C.41 estimated at 309 T-cubes by extrapolation.

Experiment 22 C

\[N-S = 20,\]
\[E-W = 8,\]
\[Height = 8.\]

Assembly contains 426 T-cubes.

Critical at 79, i.e. 0.46".

Time 10:55.
Experiment 22 D.

Removed two faces on South. (42 T cubes).

New assembly: 384 T cubes.

N = 3
E-W = 8
N-E = 8

Instruments checked at 11:08.

Critical at 10^4 = 0.15.

Conclusion: C.H. estimated at 364 T cubes.

Exp. 22 E. 7x8 cross section.

Removed one face from West.

N-S = 30
E-W = 7
N-E = 8

Instruments checked at 12:20.

Critical at 94 = 0.40" at 12:30.

Experiment 22 F

Removed 3 faces from South. (56 T cubes)

N-S = 27
E-W = 7
N-E = 8

Instrument checked at 12:43.

Critical, 112 = 0.05".

Experiment 22 G.

Removed 1 layer from height.

N-S = 5.5
E-W = 7
N-E = 7

Instrument checked at 14:10.

Critical, 115, not critical.

Scale = 115

Size of specimen:

8 in 2 mm
326 x 8 mm.

Specimen removed.

@ C. shield.

119.2.

Size of counter:

#1 counter: #3 counter.

8 in 2 mm: 326 x 8 mm.
Experiment 22 H.

Added 4 foeces to No.22 (65 Term.)

New array.

N-S - 59
E-W - 7
High - ?

962 Terms.

Deal
11/9/72.

#3 counter
345 - 2 min.
Al. shield removed

Not Critical

Conclusions:
Tanpred moderated $A/B = 2/1$

The following arrays are critical:

$9 \times 10 \times 10.1 = 303$ Terms
$9 \times 9 \times 14.37 = 307$ Terms
$8 \times 8 \times 17 = 364$ Terms
$8 \times 7 \times 26.45 = 496$ Terms
$7 \times 7 \times 59 = 962$ Not Critical; High multideo
Experiment 23.  
10/29/46.

Tamped, H/Tubes = ½, parallelepiped.
Initial array 11 x 11 x 18.  (9 on stationary table, 8 on movable)

Persons - Murray C.E.
        Callahan E.
        Williams
        Visner
        Smith

[Diagram of white cubes arranged inayers 1, 4, 7, 10, 2, 5, 8, 11, and 3, 6, 9]
Experiment 23A

Initial Array: 11x11x17
1371 Ts', 686 H's, 2057 total
Critical at 92 - .55"

Experiment 23 B

took off back layer and 5/12 layer (on stationary table) is 121 Ts'
Array now 11x11x15 1/2.
1250 Ts', 625 H's, 1875 total
Critical at 99 - .21"

Critical mass estimated at 1175 Tubes for O separation

Experiment 23 C

Removed West side of both assemblies, extended length to 24 cubes, removed top (12 on each in length)
Array now 10x10x24.
1600 Ts', 800 H's, 2400 total.
Critical at 71 - .56"

Experiment 23 D

Removed 2 3/4 layers on Nd end (stationary table). (185 Ts')
Array now 10x10x21 3/4.
1415 Ts', 707 H's, 2132 total
Critical at 101 - .19"

Critical mass estimated at 1320 Tubs for O separation
Experiment 23E

Removed top layer, west face on both tables.
Extended array to 37 in length: 18 on stationary, 19 on movable.
Array now 9 x 9 x 37 (Each layer vertically, now has 5475, 2775)
19975's, 999 H's, 2997 total
Not critical at 114 - 0" as almost completely closed.

Experiment 23F

Added 14 vertical layers, 8 to stationary, 6 to movable.
Array now 9 x 9 x 51
2754 Ts', 1377 H's, 4131 total
Critical at 84. 4'

Experiment 23G

Removed 7 vertical layers from movable table, i.e.
375 Ts.
Array now 9 x 9 x 44
2376 Ts', 1188 H's, total 2654
Critical at 106 0.125"

Critical mass estimated at 2230 tiles for one portion.

Conclusions: the following arrays of tamped parallelepipeds at H/T = 1/2 were critical:

12 x 12 x 12 1155 Ts'
11 x 11 x 14.6 1175 Ts'
10 x 10 x 19.8 1320 Ts'
9 x 9 x 41.3 2230 Ts'

It is very unlikely that 9 x 8 would go with any extension.
Experiment 24.

95% Material.

Initial array: 9x9x9.

Conditions: Tamped, Modified 1/1 cultivated.

Purpose: To check the S.A. value of C.H. under these conditions.

People Present:

Peck, C.E.
Murray, F.
Vann
William
Smith (30 minutes)

1 0: green

Layers: 1, 3, 5, 7, 9

F.M. Layers: 2, 4, 6, 8.

Alternate green white.
Experiment 24A.

365 T cubes. 364 H cubes.

N-S - 9
E-W - 9
N=H - 9.

10:04 Instrument Check

80.5
81. 54

Experiment 24B.

Removed 18 T cubes (replaced with H).

from Removed top layer of moving table.

New assembly.

N-S - 9
E-W - 9
N=H - 8 5/9

10:20. Instrument Check

92. 92 = 0.30. Critical

Experiment 24C.

Removed 8 T cubes from top layer. (227 cubes)

New array

N-S - 9
E-W - 9
N=H - 8.

10:37. Instrument Check

113 8.04 Critical

Conclusions:

The critical mass for the assembly is estimated at 321 T cubes.

for 116 of reformation of 314 T cubes

for zero reformation. This agrees within

2.7% with the J.A. value.
Experiment 25  
10/31/46

Purpose: to find Mc with cadmium shielded, stamped

$H/T = \frac{1}{2}$. Initial array 16 E-W
16 N-S
15 height

Present - Murray AE.
Beck CE.
Williams AE
Vicma AE

Each layer has

10 x 16 = 160 T's
15 layers = 2400 T's
Total cube = 3600

Exp. 25A
Critical at 95. 26"

Exp. 25B
Removed 90 cubes from SE face, stationary table
Array 15 x 15 x 15 1/16, 2290 T's.
Critical at 112 05"

Conclusion: Critical no of T cubes with Cd shielding

$H/T = \frac{1}{2} = \frac{22.65}{1.0} \quad \text{Cd} = 196$
Purpose: To study Hg for an array consisting of 1 white, 1-30% and 1-95%, cube units, simulating a
N/T cube ratio of 1/2 for 60% X.

Conditions: Tampered, modified N/T = 1/2.

Present: Beck, Callahan, Lutkin, Smith, versus, Williams

Initial Array

- N-S = 11
- E-W = 11
- High = 12

Layers: 2, 5, 8, 11.

Layers 1, 4, 7, 10.

- 4 = 40
- 30 = 40
- 95 = 41

Total: 484 (11) - 95%
484 (4) - 30%
484 - white

Layers 3, 6, 9, 12.
Experiments 26 A.

10:03.

Instruments checked.

983 - T95
985 - T30
484 - White
N-S = 11
E-W = 11
Height = 12.

48 = 0.85"

CRITICAL

Experiments 26 B.

Removed complete 24th layer

New array:

\begin{align*}
N-S &= 11 \\
E-W &= 11 \\
Height &= 11
\end{align*}

887 T

10:28 AM.
Instrument checked

77 = 0.49"

CRITICAL

Experiments 26 C.

Removed complete 24th layer

New array:

\begin{align*}
N-S &= 10 \\
E-W &= 11 \\
Height &= 11
\end{align*}

806 T

10:48 AM.
Instrument checked

Assembly = 109 dia = 0.09"

CRITICAL

Conclusions:
The crit. for simulated 60% X

camped assembly, unmod. H/t cube ratio

is 1/2.

786 T cube,

24.4 Kg X
Experiment 29. 11/1/46

Purpose: To find \( y_c \) for an array consisting of \( H/T(30) \) \( T(95) \) cube ratios = 3/1/1

simulating a cube ratio of \( H/T = 3/1 \)

for 60% T.

Conditions: Tampered, moderated \( H/T = 3/1 \).

Present:

Beck, Collection
Cullen, Veater
Williams.

\[ \begin{array}{c}
\square \quad \text{White} \\
\blacklozenge \quad T(30) \\
\times \quad T(90)
\end{array} \]

Layer: 1, 3, 5, 7, 9.

25 - T(30) per layer

Layer: 2, 4, 6, 8, 10.

25 - (T 95) per layer

\[
\text{Total} \left\{ \begin{array}{l}
125 + 12 \times T(30) \\
125 - 2 \times T(95)
\end{array} \right\}
\]
Experiment 27A

\[
\begin{align*}
N-S &= 10 \\
E-W &= 10 \\
Height &= 10
\end{align*}
\]

\[
\frac{127}{133} \quad \frac{T(95)}{T(30)} \quad \frac{250}{T}
\]

12:58 Instrument check.

52": 0.80” CRITICAL

Experiment 27B.

Removed. 20 T(95) and 15 T(30), from south faces (13/5 feet).

New array:

\[
\begin{align*}
N-S &= 8 3/5 \\
E-W &= 10 \\
Height &= 10
\end{align*}
\]

\[
\frac{105 - T(95)}{110 - T(30)} \quad \frac{215}{T(95 + 30)}
\]

13:16 Instrument check.

\[
\begin{align*}
101 &= 0.19 \\
\end{align*}
\]

CRITICAL

Conclusion:

\[
\text{For estimated 60% \( X \)}
\]

\[
\text{tamped assembly modified } N/4 \text{ cube ratio } = 3/1, \quad \text{i.e. 204 T(95+30) cube.}
\]

\[
6.6 \text{ Kg. } X
\]
Experiment 28. Oct 4, 1976

Purpose: To check the T.A. value of C.A.

Type of cube: 9.5%

Condition: Tanged, moderate; H/T cube ratio: 1/2.

People Present:
- Buck
- Murray
- Vinat
- Williams

Initial array:

N = 8
E = 8
N = 8
H/T = 10

Layers 1, 4, 7, 10:
67 T per layer

Layers 2, 5, 8:
67 T per layer

Layers 3, 6, 9:
67 T per layer

White cubes:

Successive layers were made by shifting one row over.

$\text{Symbol for white cube}$
Experiment 28 A.

10:04. Instrument Check

59", 61, 62", 64", 66

74 = 0.53" CRITICAL

Experiment 28 B.

Moved West face from stationary table (107).
New array:
N-S = 10
E-W = 9.4
100' = 9

96 = 0.25" CRITICAL

Experiment 28 C.

Moved West face from movable table (27).
New array:
N-S = 10
E-W = 9
h' = 10


116 = 0.0" CRITICAL

Conclusions: For 95% N, length, maximum
M' = 1/2. The c.m. is 600 T-cu.
with 10% e. The Extrapolated c.m. will
no e. Separation is 594 T-cu.
Their value is only 1% lower than
the S.A. value.
Experiment 29. 

Purpose: To check the J.A. value of C.M.

Type of Cube: 95%.


People Present:
- Beck, C.E. (left after shaking)
- Murray, C.E.
- Nevin
- Williams

Initial Array:

<table>
<thead>
<tr>
<th>N-S</th>
<th>10&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-W</td>
<td>9&quot;</td>
</tr>
</tbody>
</table>

600 T cubes 540 564
600 1/2 while 564

Legend:
- Open box = Tuber.

Layers: 1, 3, 5, 7, 9

Layers: 2, 4, 6, 8, 10

60 T per layer.
Exp. 29A.
12:30. Instrument check

115.

Exp. 29B.
12:50 added 36 cube to top of stationary array. Now 600 T's.
Array 10x10x9.

III critical = 0.02".

Exp. 29 C.
Added 1 face to west on stationary table. (30)

Array. N-S = 10
E-W = 9% 630 T's.
High = 10

13:12 Instrument check.

83.2° 0.4% CRITICAL.

Conclusion: For 95% x, tampud, moderated
H'X: 1/2, 1/2, 5% Tenax with 1/4" Al,
or 5.88 T's with 200 Al.
This value is 12% higher than LA value.

Examination of assembly revealed that
assembly on stationary table was 1/2" off center.
Is 1/2" too far? & etc.
Part 29D.

Rallied assembly.

14:10 commencement clock.

85: Critical

What have

what have

What have

What have

Previous conclusion p. 108

Still valid S.V. 1/27/43.
Purpose: To find critical mass of X, tamped, unmoderated, of largest assembly possible, 30% + 90% cubes.

Present: Murray Callahan
           Visner Williams
           Lykins Smith

Array initial dimensions 17 x 16 x 16
N-S height E-W

3248 of 30%
1104 of 95%
4352 = 16 x 16 x 17

\[ 3248 \times 15.5 = 5011 \]
\[ 1104 \times 48.8 = 5459 \]
\[ \geq 10459 \]
Used bad 30% cubes in layers 1, 5, 7, 9, 11, 13, 15 of 14th layer, store movable table.

Since $\frac{3248}{1083} \approx 3.0$, have 25 extra 95% cubes, which lie along the back row of the 16th layer, stationery table.

Actual array

<table>
<thead>
<tr>
<th>95%</th>
<th>1108</th>
<th>30%</th>
<th>3248</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>1105</td>
<td>-2</td>
<td>3246</td>
</tr>
</tbody>
</table>

$3246 + 1105 = 4351 + 30\text{ source space} = 4352$.

$Kg\times = 53.88\text{ Kg} + 49.89 = 103.77$

$49.92 = 103.80 \text{ Kg}_23$
Experiment 30 A

13:02. Instrument check

<table>
<thead>
<tr>
<th>Count #1</th>
<th>Count #3</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.9 = 0.05&quot;</td>
<td>713</td>
</tr>
<tr>
<td>C/15 min</td>
<td>1.395</td>
</tr>
<tr>
<td>Rec.</td>
<td>722</td>
</tr>
</tbody>
</table>

Experiment 30 B

Removed 5/16 green cubes - 146 of 95%, 36.6 of 30%, two north faces of movable table.

Actual array:

95% = 959 + 30% = 2530 = total = 3839

Planimeter space gives 3840 = 15x16x16.

Kg X = 96.261 + 0.07266 = 91.03

13:50 Instrument check

<table>
<thead>
<tr>
<th>Count #1</th>
<th>Count #3</th>
</tr>
</thead>
<tbody>
<tr>
<td>111 = 0.03&quot;</td>
<td>588</td>
</tr>
<tr>
<td>C/15 min</td>
<td>5.89</td>
</tr>
<tr>
<td>Rec.</td>
<td>589</td>
</tr>
<tr>
<td>3.914</td>
<td></td>
</tr>
</tbody>
</table>

Experiment 30 C

Removed top of array (both sides), and west face both sides. i.e. 465 green cubes, 115 of 95%, 350 of 30%.

Actual array:

95% = 844 + 30% = 2530 = 3374

plus source space gave 3375 = 15 x 15 x 15

Kg X = 41.153 + 38.886 = 80.039

14:35 Instrument check

<table>
<thead>
<tr>
<th>Counter #1</th>
<th>Counter #3</th>
</tr>
</thead>
<tbody>
<tr>
<td>110 = 0.09&quot;</td>
<td>494</td>
</tr>
<tr>
<td>C/15 min</td>
<td>4.49</td>
</tr>
<tr>
<td>Rec.</td>
<td>2.215</td>
</tr>
</tbody>
</table>
Experiment 30D

Removed top plate, both sides, and rear face both sides,
 i.e. 435 green cubes, 106 of 95%, 327 of 30%.
Actual array.

95% = 736 + 30% = 2201 = 2939

plus source space gain: 2410 = 14 x 14 x 15

kg x 35.867 x 33860 = 69.747

15:20 Instrument check

Counter #1        Counter #3
<15 min rec.  <15 min rec.

110.5 = 04''

357

356

2805

148

145

6.826

Experiment 30E

Because of curvature of 1/e/sec. curve, decided to repeat exp. 30A. Restacked cubes as originally.

Counter #1        Counter #3
<15 min recip. <15 min recip.

110.5 = 04''

702

701

1425

142

303

306

3.284

Conclusion: Tamped unmoderated mass of X (30+85) is 125 kg, probably around 160 kg.
(See graph 9) multiplication extrapolation.
Experiment 31

Purpose: To determine the effect of density on CH.

Assay: 30% X.

Conditions: Tamped, moderated:

Y. H.: 1 T. 1 A.

Personnel:

Bock
Hill
Wall
Williams

Initial Array: N. S. 15 E. W. 15 N. E. 15 W. S. 15

Successive arrays made by moving one row to South:

Layer 1, 7, 13

Layer 2, 8, 14
Odd layers
40 T
35 Qn.
150 H

Even layers
35 T
40 Qn.
150 H

Experiment 31 A.

13:26 Instrument check.

93. = 1.77" CRITICAL

Experiment 31 B.

Remove complete face from North (40.7 cubic)
New array:
N-S = 19
E-W = 15
High = 15

525 T cubes
525 Qn.

120. = 1.45" CRITICAL

Experiment 31 C.

Removed 1 layer from top. and 1 from West (68.7 cubic). (40 Qn).
New assembly:
N-S = 19
E-W = 14
High = 14

457 T cubes
515 Qn.

14:45 Instrument check.

43. = 0.875" CRITICAL

Experiment 31 D.

Removed 1 layer from top and 1 from South (65.7)
New assembly:
N-S = 13
E-W = 14
High = 13

392

15:26 Instrument check.

101 0.13" Critical
Conclusion

Chap. 31

The CH for a tempered modified assembly consisting of 4H : 1T : 1air

cube ratio is

381 Tons (with %6 Al)

378 Tons for 0.5% Al

5.81 kg.

CH (4:1) & 1 air

CH (4:1) = 1.47.
Experiment 32.  9/3/46.

Purpose: To find CM for a tamped assembly.

Moderated H/T cube ratio = 1/7.
(Repetition of Exp. 13)

Present:
Callihan
Schnied
Vogan
Williams

Location of counter: same as p. 60.

Initial array:

<table>
<thead>
<tr>
<th>N-S</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-W</td>
<td>15</td>
</tr>
<tr>
<td>H</td>
<td>15</td>
</tr>
</tbody>
</table>

Same array as in Exp. 13 p. 61

Source burned in pile

Location of source

Layer 8 from bottom
Row 9 from North
Cube 8 from east
Removed one green cube.

Layers: 1, 3, 5, 7, 9, 11, 13, 15.

Layers: 2, 4, 6, 8, 10, 12, 14.

contain: 16x15 = 240 T.

60 H + 180 T

8 x 240 = 1920
7 x 180 = 1260
------------
3180 - 1 = 3179

-29 ft

2782
### Experiment B2A

**13:50.**

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Check</th>
</tr>
</thead>
<tbody>
<tr>
<td>Counter #1</td>
<td></td>
</tr>
<tr>
<td>2/5 mm.</td>
<td>Recip.</td>
</tr>
<tr>
<td>215</td>
<td>x1000</td>
</tr>
<tr>
<td>2.85</td>
<td>3.53</td>
</tr>
<tr>
<td>2.82</td>
<td>1.72</td>
</tr>
</tbody>
</table>

### Experiment B2B

Removed 2 faces from North (328.7) cm²

109. New assembly

\[
\begin{align*}
&15 - EW \\
&15 - NS \\
&15 - High
\end{align*}
\]

2781 T

### Experiment B2C

1500 Instrument Check

<table>
<thead>
<tr>
<th>Counter #1</th>
<th>Counter #3</th>
</tr>
</thead>
<tbody>
<tr>
<td>2/5 mm.</td>
<td>2/5 mm.</td>
</tr>
<tr>
<td>215</td>
<td>126</td>
</tr>
<tr>
<td>218</td>
<td>128</td>
</tr>
</tbody>
</table>

16:10 Instrument Check

<table>
<thead>
<tr>
<th>Counter #1</th>
<th>Counter #3</th>
</tr>
</thead>
<tbody>
<tr>
<td>2/5 mm.</td>
<td>2/5 mm.</td>
</tr>
<tr>
<td>248</td>
<td>142</td>
</tr>
<tr>
<td>246</td>
<td>146</td>
</tr>
<tr>
<td>Column 1</td>
<td>Column 2</td>
</tr>
<tr>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>155/1500</td>
<td>92/1000</td>
</tr>
<tr>
<td>159.637</td>
<td>93.108</td>
</tr>
</tbody>
</table>

Conclusion:

The extrapolated value of C17 by multiplication experiment is 69 kg x.

For a Tempeh assembly, moderated 1/7 = 1/3, 30% enrichment.
Experiment 33

Purpose: To further determine the effect of density on C.H. (compare with Exp. 31 p. 116).

Array: 30 x

Conditions: Tamped, moderate, 4H:1T:1/2 air.

Personnel:
- Callahan
- Hull
- Winer
- Williams

Initial Array

□ = 1/2″ air
□ = White
□ = Green

Face 7 from North: (first on N as stationary)
Successive faces toward south are made by shifting previous face vertical means & East.

\[ N - S = 13 \quad \{ \begin{align*} & 378 \text{ T cubes}, \\ & E - W = 13 \\ & \text{Height} = 13 \end{align*} \]

Eqn. 33A


98% = 0.39” CRITICAL

Repeat to check reproducibility.

99% ± 1/2

Experiment 33B.

Removed one face from north \((227 \text{ T cubes/face})\)

New Array \[ N - S = 12 \quad \{ \begin{align*} & 351 \text{ T cubes}, \\ & E - W = 13 \\ & \text{Height} = 12 \end{align*} \]

1:45 Instrument check.

105 0.06 CRITICAL

Conclusion: The CH for a ramped moderated assembly, consisting of \(4N + 1T \div \frac{1}{2} \text{ air}\),

cube root is 346 T cubes (with \(\delta = 0\))

341 m.o.a. \(= 5.24 \text{ lb} \)

CH \((4:1)\) to \(\frac{1}{2} \text{ air}\) \(= 3.24 \text{ lb} \)

CH \((4:1)\) \(= 3.87 \)
Each layer contains \(168T + 42H = 210\) cubes

14x14x15 array \[\{2352\} Turbo\]
\[\{587\} HinKis\]
Experiment 348.

156 Teeth removed - replaced with white.

Replaced new blade pair in counter #3.

Table position = 108.5 divisions

---

Experiment 349.

Removed north face of assembly and replaced with white cube.

157 Teeth removed - new 14.0-3, 13 E-W, 13 N-S.

Table position: 108 divisions

---

Experiment 34D

Removed north face of assembly, did not apply with white.

146 Teeth removed - new 14.0-3, 13 E-W, 13 N-S.

Table position: 108 divisions

---
Experiment 34E

Removed top (14") layer - replaced with white cubes
Removed 13" T-buck. New 13 x 13 x 13

1758 Tubs
= 27.0 kerg25

Table position = 108° clockwise

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>380</td>
<td>201</td>
<td></td>
</tr>
<tr>
<td>399</td>
<td>204</td>
<td></td>
</tr>
<tr>
<td>389.5 = 2.57</td>
<td></td>
<td></td>
</tr>
<tr>
<td>202.5 = 4.94</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Experiment 34F

Removed top, wood and north face - no seed white leaves now.

1383 Tubs
= 21.3 kerg25

Run over 375 T-buck - now 12 x 12 x 12
Instrument circle = 145" P.

Table position = 108° clockwise

<table>
<thead>
<tr>
<th></th>
<th>131</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>240</td>
<td>176</td>
<td></td>
</tr>
<tr>
<td>241</td>
<td>126</td>
<td></td>
</tr>
<tr>
<td>240.5 = 4.16</td>
<td>128.5 = 7.78</td>
<td></td>
</tr>
</tbody>
</table>

Counts taken with Perkin, cubical, paraffin, etc as in 34F except with tables 30° apart:

<table>
<thead>
<tr>
<th></th>
<th>116</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6.4</td>
<td>86</td>
<td></td>
</tr>
</tbody>
</table>

Conclusion:

1. Extrapolation of multiplication data from masses of from 55% to 95% of Me gives Me to within ±4%, of the mass extracted from critical areas having 1/1 cube ratio = 7%, tangential.

2. Indications are that above 75% critical of the multiplication curve is linear - over a wide range of masses, the curve is such as to give a low extrapolation from low masses, a value of Me which is too small.
Experiment 35  11/14/46

Purpose: To further determine the effect of density on C4H4.

Assay: 30% X.

Conditions: Tamped, moderated.

\[ 25 : 1 \text{ air cube ratio} \]

14 : 27 : 1 air

Personnel:

Reed

Wills

Initial Array:

- EW = 16
- NS = 16
- Mg2 = 16

Odd Layers:

For even layers, in 2 air change E-W rows.
Assembly contains:

- 2048 T. cubes
- 1024 A. spacers
- 1024 P. cubes

Exp. 35 A

11:15
- Instrument check

6.2 → 0.61

Exp. 35 B

- Removed complete face from wall
  - also top layer on movable table
  - Removed 1824 T. cubes
  - New array:
    - E-W = 16
    - N-S = 15
    - H = 15

11:40
- Instrument check

103 → 0.1

Conclusion:

The CH for a ramped, moderated assembly with a cube ratio of 11:21:14:2
is 1828 T. cubes for 1/16" al sp. or 1907 for no al. (2726 Kg x)

\[
\frac{CH (1/2) \times 1 \text{ cm}}{100} = \frac{1907}{1140} = 1.69
\]
Experiments 36

Purpose: To further determine the effect of density on CM.

Assay: 30% X

Conditions: Tamped, moderated
1H: 2T: 1/2 A

People Present
Beck
Vanc
Williams
Callahan
Felsch
Vorfor
Rutger

Initial Assembly

Sections 1, 3, 5, 7, 9, 11, 13
from North

Sections 2, 4, 6, 8, 10, 12, 14
from N
3 W 4 = 112 Tons
" per E-W face.
53 N
50 3/4 Air

N-S = 14°
E-W = 14°

787 Tons
784 1/2 Air cells

Experiment 36B.


99. 0.015" CRITICAL.

Exp. 36 B.

Added one complete face on South
(112 Tons) 56 H, 56 sec 3/4 Air

14:10 Instrument check.

New array.

N-S = 15°
E-W = 14°
High - 14°

68. = 0.54" CRITICAL.

Exp. 36 C.

Inserted 1/8" AL between tables

63 1/2. = 0.59.

Exp. 36 D.

Report Exp. 36 B, (Removed AL. 68.)
Conclusions:

1. The CM for a tamped, moderated assembly with a cube ratio of 1H:2:7.5:2 and 1525 T cubes with 1/8" al. or 1510 T cubes without al. (23.22 kg) is 23.22 kg.

2. The effect of introducing an aluminum sheet between the two assemblies is to lower the CM by 34% for 1/8" al. sheet.

3. \[
\frac{cm (1:2)}{cm (1:2)} \times \frac{1 atm}{1400} = \frac{1510}{1140} = 1.32.
\]
Experiment 37.

**Purpose:** To determine the CM of an unvarnished assembly.

**Assembly:** 30% X.

**Conditions:** Unvarnished, moderated.

**Cube ratio:** H/T = 4/1.

**People Present:**
- Beck
- Null
- Vima
- Williams
- Smith

**Initial Array:**
- N-S: 15
- E-W: 15
- Night: 15

**Final Array:**

1. **Layers:** 1, 10
2. **Layers:** 2, 12

![Diagram of an assembly with layers marked 1 and 10, and 2 and 12.](image)
Experiment 37 A.

10:55 Instrument check.

113. N 1°54.4" CRITICAL

Exp. 37 B.

Removed complete face from South. (48 T cubic)

New Assembly:

N.S. 1°15.4° 630
E.W. 1°15.4°
N.S. 1°15.4°
E.W. 1°15.4°

11:33 Instrument check.

24. 21.09 CRITICAL

Removed top layer - 42 T cubic. Exp. 37 C.

11:50 L 1°34.4" CRITICAL

N.S. 1°14.58 8
E.W. 1°14.58
N.S. 1°14.58
E.W. 1°14.58

Removed complete W side face (40 T cubic)

1:05 N.S. 1°14.58
E.W. 1°14.58
N.S. 1°14.58 548
E.W. 1°14.58

Repeated 37 D, but with the table under the pilereamed with Eh.

67 L 0.55" 548
Experiment 37 F.

Removed complete face from South (39 Tubs).
New array:

\[
\begin{align*}
N & : S & : 13 \\
E & : W & : 14 \\
Height & : 14
\end{align*}
\]

13 35 Instrument Check.

33 \( \sim 0.29'' \) CRITICAL.

Experiment 37 G

Removed 8-p layers from stationary cells (17 Tubs).

\[
\begin{align*}
N & : S & : 13 \\
E & : W & : 14 \\
Height & : 13 \frac{6}{13}
\end{align*}
\]

98 \( \sim 0.16'' \) CRITICAL.

Exp. 37 H.

Put layers of 1'' white cubes on top only.
Same no. 7 T cubes at 37 G.

83 \( \sim 0.35'' \)

Exp. 37 I

Covered South face with 1'' white cubes.

66 \( \sim 0.56'' \) CRITICAL

Exp. 37 J

Covered all 7 5 faces with 1'' white cubes.

10 \( \sim 1.26'' \) CRITICAL.
Conclusions:

1. The CIH for an unvamped assembly, moderated at a cube ratio 11/7 = 4/1, is:
   \[ \begin{align*}
   &470 \text{ T cubes for } 1/16 \text{ in.} \\
   &464 \text{ T cubes for } 0 \text{ sep.}
   \end{align*} \]

   Ratio of unvamped to tamped:
   \[ \frac{464}{258} = 1.80 \]

2. The wooden table has negligible tamping effect.
**Experiment 38**

**Date:** 11/14/46

**Purpose:** To determine the effect of Porex shielding on CH.

**Conditions:** Tempered, moderated

Core ratio of H1: 11

Assay: 30%

People Present:
- Callahan
- Veze
- Williams

Initial Array:

<table>
<thead>
<tr>
<th>High</th>
<th>NS</th>
<th>EW</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>14</td>
<td>13</td>
</tr>
</tbody>
</table>

**Experiment 39A**

**1302 Instrument Check**

93. D.20" CRITICAL

Repeat:

92.5 Infinite doubling period

93. 3 doubling time

94.5 33 sec doubling time
Experiment 38 B.

Removed 6/17 of South face. (39 Tcubes).

New array.

\[
\begin{align*}
N - S & = 13 \frac{6}{7} \\
E - W & = 13 \\
\text{deg} & = 13.
\end{align*}
\]


106 0.04" 34 sec doubling time. CRITICAL

105 47 sec doubling time

103½ Infinite doubling time

Conclusion: The CM for a lampard assembly, moderated as a cube with \( \frac{H}{r} = \frac{1}{4} \), well boron shielding is 1134 Tcubes for 1/34. Tcubes for red. 17.2 Kg/L
Experiment #39   11/15/46

Purpose: To determine CM for an unstacked assembly

Assay: 30% X

Conditions: Unstacked, H/T cube ratio: 1/2

Personnel:
- Callahan
- Hull
- Viani
- Williams

Successive layers are made by stacking one at a time.

Labeled Array:
\[
\begin{align*}
N-S &= 16 \\
E-W &= 16 \\
H & \leq 16 \\
\end{align*}
\]

Layers 1, 4, 7, 10, 13, 16

\[ \square : H \text{ cube.} \]

Layers 2, 5, 8, 11, 14
Experiment 39A.

9:55 Instrument check.

NOT CRITICAL

Exp. 39B.

Add complete Top Layer (101 acts.)

N-S: 16
E-W: 16
Height: 12.17

44.6 Kg

10:24 Instrument check.

103 0.08" CRITICAL

Exp. 39C.

Deposit near assembly with brom pancreas

92 = 0.21 35% of surface area covered CRITICAL

Exp. 39D.

Covered 73% of surface area covered with brom pancreas.

87 = 0.35" CRITICAL

Exp. 39E.

Removal brom, but covered 76% of surface area with cadmium CRITICAL
Eqp. 39k

Removed cadmium, added 1 complete 40% dummy and 1 face 8" wide on stationary table only. added 283

665 days = 0.53" CRITICAL

Period measurements on the assembly:

<table>
<thead>
<tr>
<th>Scale</th>
<th>Debye Ion</th>
<th>Expanded</th>
<th>Bhr Time</th>
<th>Δθ</th>
<th>Δθ</th>
</tr>
</thead>
<tbody>
<tr>
<td>64</td>
<td>50</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>66</td>
<td>25 150</td>
<td>0</td>
<td>-</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>67</td>
<td>47</td>
<td>68</td>
<td>0.13</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>67</td>
<td>36</td>
<td>57</td>
<td>0.14</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>68</td>
<td>18</td>
<td>24</td>
<td>0.24</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

Conclusion:

1. For an untempered assembly, moderated at a cube ratio of H/T = 1/2, the CH is 
   \[ \int 280 \text{ tenus for } 4.6\text{" of rep.} \]
   \[ 2910 \text{ tenus of } 0\text{" rep. (43.2 kg x)} \]

2. Tempering Ratio: \[ \frac{CH \text{ untempered}}{CH \text{ tempered}} = 2.45 \]

3. "Boron" shielding of the untempered assembly decreased the CH.
   (5.5% decrease with CH for 73% shielding of surface area).

4. Cadmium shielding of the untempered assembly did not change the CH.
To measure cm of a moderated \[ (14:16) \] unmoderated assembly of 30% material.

**Personnel:**
- Paul
- Callahan
- Williams

**Critical Assembly:** 16\(\times\)1W cubed set in panel array

\[ 14\times 14 \times 1 \text{ containing } 1372 \text{ G. Cubes, } 21168 \text{ f.} \]
\[ 1372 \text{ W. Cubes} \]
\[ \frac{2742}{2548} \]

Critical at 66 scale division = 0.55”

**Exp 40A**

Removed 18 G. Cubes from south face assembly, now \[ 14 \times 14 \times 13 = 2858 \]
\[ 1274 \text{ G.} - 19.6 \text{ W.} \]
\[ \frac{2548}{2548} \]

Critical at 90 scale division = 0.25”

**Exp 40C**

Removes top of north assembly - 49 G. Cubes, now \[ 14 \times 13 \times 13 \text{ G. Cubes} \]
\[ 1225 \text{ f.} \]

Not quite critical at 108 div. (Removal of 74G. Cubes above did not affect criticality)

**Exp 40 D**

Add 14 G. Cubes to top of north assembly, these added were south face.
Now \[ 14 \times 13 \times 12 \text{ f.} = 2478 \text{ G. Cubes} \]
\[ 1239 \text{ W.} \]

Critical at 109 division = 1/80” = 0.01”
Experiment 40E

Since these vs critical distance curves is not linear a point is

be taken at 17.05"

Added two flats 3" x 3" x 3"

Offset by trim to match side and then face, then added

another face 1" square

Assembly 14 x 14 x 15 = 2940 containing

1470 G 22.6 Tr x

1470 W cubes

2940

Critical at 5/8" = 0.75"

Experiment 40F

To determine further the accuracy of the ellipsoid assembly theory

14 x 14 x 17 = 3332

14 x 14 x 19 = 3738

Critical at 1/2" = 11/80 = 1.43"

Experiment 40G 14 x 14 x 19

Added 1 foot lead N + 5, now 14 x 14 x 19 = 3738 + 1862 W

1862 G = 28.6 Kf

Critical at 6/92" or (tension) 50 (closed at 3/9/16)

Critical distance = 21/32 = 2.41" (also critical at 6/92 turns

before engaging dial indicator; dial at 72.62 inch per turn

distance = 48 x .62 + 6.2 = 2.92/32"

Experiment 40H

Added space lead - N + 5, now 14 x 14 x 21 (i.e. 2.13 x 14 x 11 + 14 x 14 x 14)

= 4116 + 2058 G + 2058 W

Critical at 4.0" (i.e. max. turn - 23/32") = 31.7 Kf x

Experiment 40I

Same as 40H, except slab placed between two good assemblies:

Critical at 3.63" (i.e. 7/12 - 3/16) = 2058 G cubes.

L9 31.7 Kf x

Experiment 40J

Added feet lead, now 7 - 14 x 14 x 11 assembly center is then 7 2.13/32"

L+ still between assemblies.

Critical at 8/16 - 3/16 = 4.78 = 4.88"
**Experimental 40K**

Same as 40 J, but with Cd sheet removed - 21.97 green cubes. Critical at (9.346 - 3.1416) = 5.25" x 5.25" = 27.7 square inches.

**Experiment 40 L**

Added seam to south assembly - now assembled everywhere.

12 x 12 x 12 + 12 x 12 x 11 + 8 of 22.5° cubes.

Cd sheet placed between assembly - 34.7 kV.

Critical at (11.146 - 3.1416) = 7.1396" = 7.81".

**Experiment 40 M**

Same as 40 L except without Cd - 22.5° cubes.

Critical at (12.146 - 3.1416) = 8.416" = 8.25" - 34.7 kV.

**Experiment 40 N**

To examine interaction of cubical arrays.

Remarks: The above arrays into two cubes each 13 x 13 x 13 and 38.64 green cubes, respectively, total 21.97 green cubes - 33.8 kV.

Critical at (9.346 - 3.1416) = 5.5".

**Experiment 40 O**

Same as 40 N except Cd placed between assembly - 21.97 green cubes.

Critical at (8.146 - 3.1416) = 5.0".

**Experiment 40 P**

Removed one layer from each face of each cubical assembly.

Making two 12 x 12 x 12 cubes, each containing 864 green cubes - total 1728 green cubes = 26.8 kV.

Cd sheet between front assemblies -

Critical at 12.146 (22.5° curvature) = 12.146 = 14.9 kV x 12.146° = 0.29.

**Experiment 40 Q**

Same as 40 P except with Cd removed.

Critical at 46.146 = (14.126 - 5.126) = 9.4° x 46.146° = 0.5°.
Experiment 40-2
Reduced each assembly to 11x11x12 containing 720 x 732
froon cubes respectively, total 1452 green cubes—
22.3 kg.

Not critical at 108 — needed several more division units.

Conclusions: 1. The critical mass of a cubical moderated
(11.12), untested array of 3026 moderated to
1239 Tcubes = 140 kg at 1/4" Al separation
1232 Tcubes = 18.9 kg at 1 1/2" Al separation.

Ratio of this reduction untested 498 = 2.48

2. Examination of the interaction of two such critical
assemblies as they were brought together until criticality was
reached, showed that the "safe distance" of separation increased
more rapidly than the "mass" increased. Then the mass in
each assembly varied from 5570 cm to 9070 cm. The relation
is approximately "safe mass" x log (safe separation).

3. Interception of Cd between the two subcritical
assemblies decreased the separation, at criticality, by only
about 7% at separation 0.3".

4. As the areas of the two assemblies is
adjacent, the "safe distance" decreased.
Check List

1. Two experienced present.
   One named chief ops.

2. Instruments
   #1 Counter
   #2 Ion Chamber
   #3 Counter
   #4 Ion Chamber

3. Emergency Disassembly
   Push failure
   Air failure
   #2 Ion Chamber
   #4 Ion Chamber

4. Scale reading at Oguna:
   Threaded rod:

5. Table top watch
   Safety bar been
   Cutoff which stand up
   Magnetic clutch released

6. Personal check
   Number in building
   Night light - not lit
   Film edges and Mount

7. Source on table

8. Instrument at interval

9. Breeze behind stack
   Mirror at center

10. Engage magnetic clutch
    Measure separation

11. Assemble personal
    Chain wfs.

12. Check Sensitivity Scale
    of equipment
<table>
<thead>
<tr>
<th></th>
<th>Date</th>
<th></th>
<th></th>
<th></th>
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<tr>
<td>2</td>
<td>9/26</td>
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<td>472</td>
<td>472</td>
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<td></td>
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</tr>
<tr>
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<td>9/27</td>
<td></td>
<td>952</td>
<td>988</td>
<td>952</td>
<td>926</td>
<td>926</td>
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<td>210</td>
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<td></td>
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<tr>
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<td>210</td>
<td>210</td>
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<td>19/24</td>
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</tr>
</tbody>
</table>

\[
\text{3248} \div 3248 = 1
\]

\[
\frac{220 - 220}{3248} = \frac{0}{3248} = 0
\]
<table>
<thead>
<tr>
<th>Table</th>
<th>1/10</th>
<th>1/8</th>
<th>1/6</th>
<th>1/4</th>
<th>1/3</th>
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</tr>
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<tbody>
<tr>
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<td>6</td>
<td>640</td>
<td>630</td>
<td>515</td>
<td>516</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total:** 3248

**95%**
30\% cubes. contain \( \frac{15.3 \text{ g}}{\text{cub.}} \).  

\[ H/T = 32.0 \text{ for 1\,quart (30\%)} \]

Cadmium Sheet, \(.017"\) thick  
\[ \text{density} = 8.67 \text{ g/ce} \times 0.017 \times 2.54 = 0.38 \text{ g/cm}^2 \]

Boron Powder  
\[ \text{density} = 0.29 \text{ g/ce} \times \frac{5}{8}" \times 2.54 = 0.16 \text{ g/cm}^2 \]

Boron Carbide Powder,  
\[ \text{density} = 0.77 \text{ g/ce} \text{ 3/4" thick} \]  
\[ = 0.77 \times \frac{3}{4}" \times 2.54 = \]
48 \times 20 - 3

96

480 - 3
427

477

123

640
513

513
127

127