Reprinted from:

2.B

Nuclear Physics **A233** (1974) 495—520; © *North-Holland Publishing Co., Amsterdam*

THE $^{12}C(\alpha, \gamma)^{16}O$ REACTION AND STELLAR HELIUM BURNING †

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Received 15 July 1974

Abstract: The cross section for the reaction $^{12}C(\alpha, \gamma)^{16}O$ has been measured for a range of c.m. energies extending from 1.41 MeV to 2.94 MeV, by using ^{12}C targets of high isotopic purity.

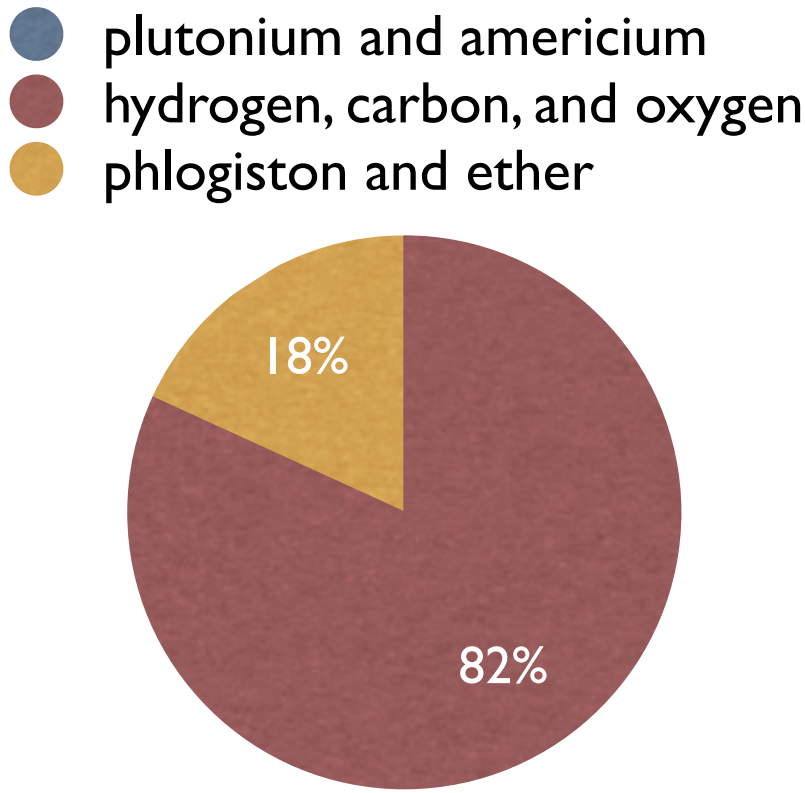
The First Days of $^{12}C(\alpha,\gamma)^{16}O$ at Caltech

Peggy Dyer Robertson
Department of Genome Sciences
University of Washington
Dec. 15, 2006

NORTH HOLLAND
AMSTERDAM

a survey of biologists

My body is mostly made up of



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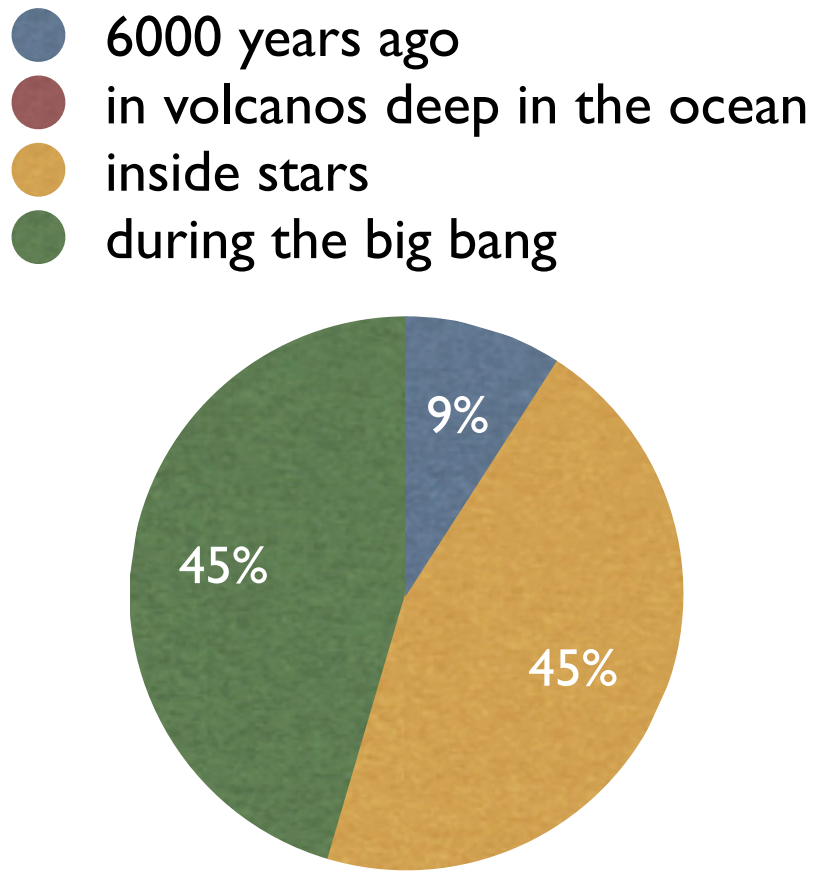
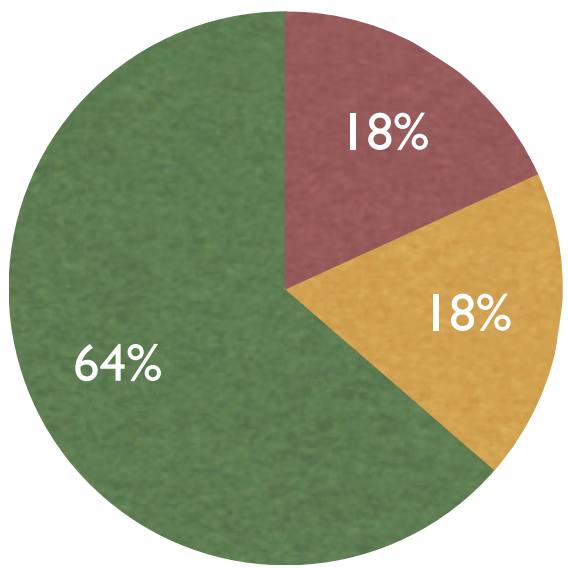
Most of the carbon and oxygen nuclei in my body were made



a survey of biologists

How important is it to know where the carbon and oxygen came from?

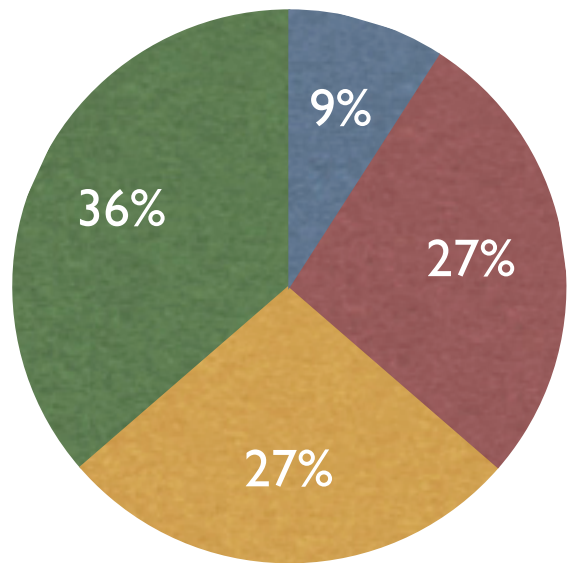
- I regularly donate to astrophysical research charities.
- I lay awake at night wondering about this.
- The government should support such research only when all diseases have been cured.
- Whatever.



a survey of biologists

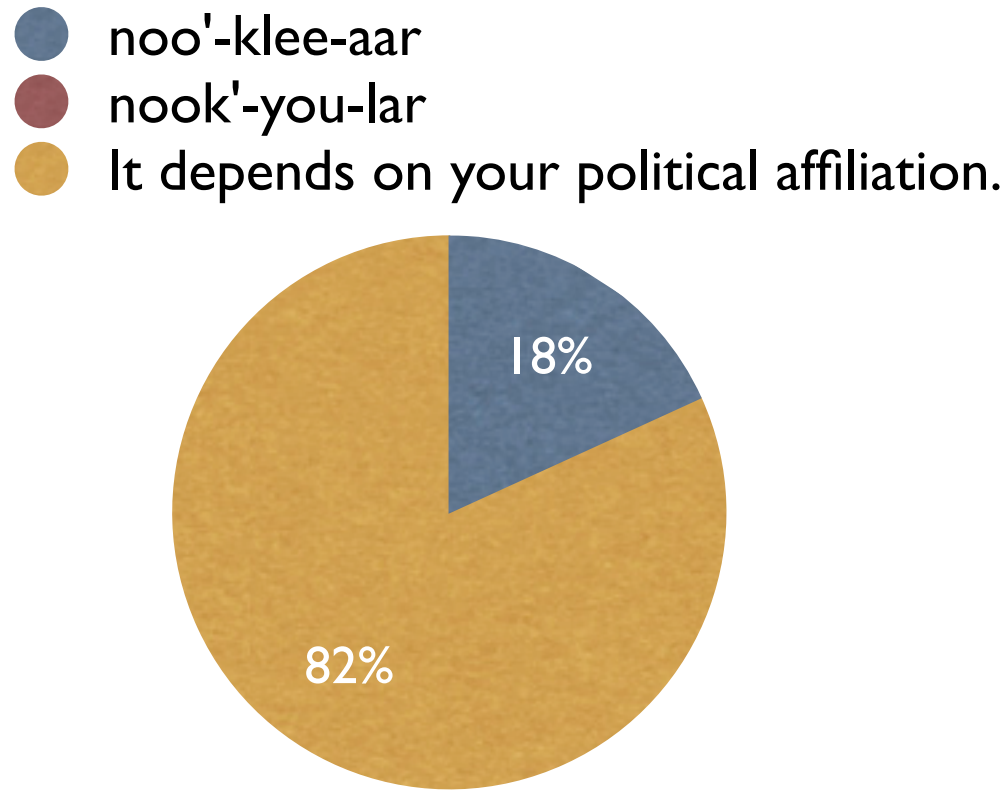
How hard is it to measure rates of stellar nuclear reactions in the lab?

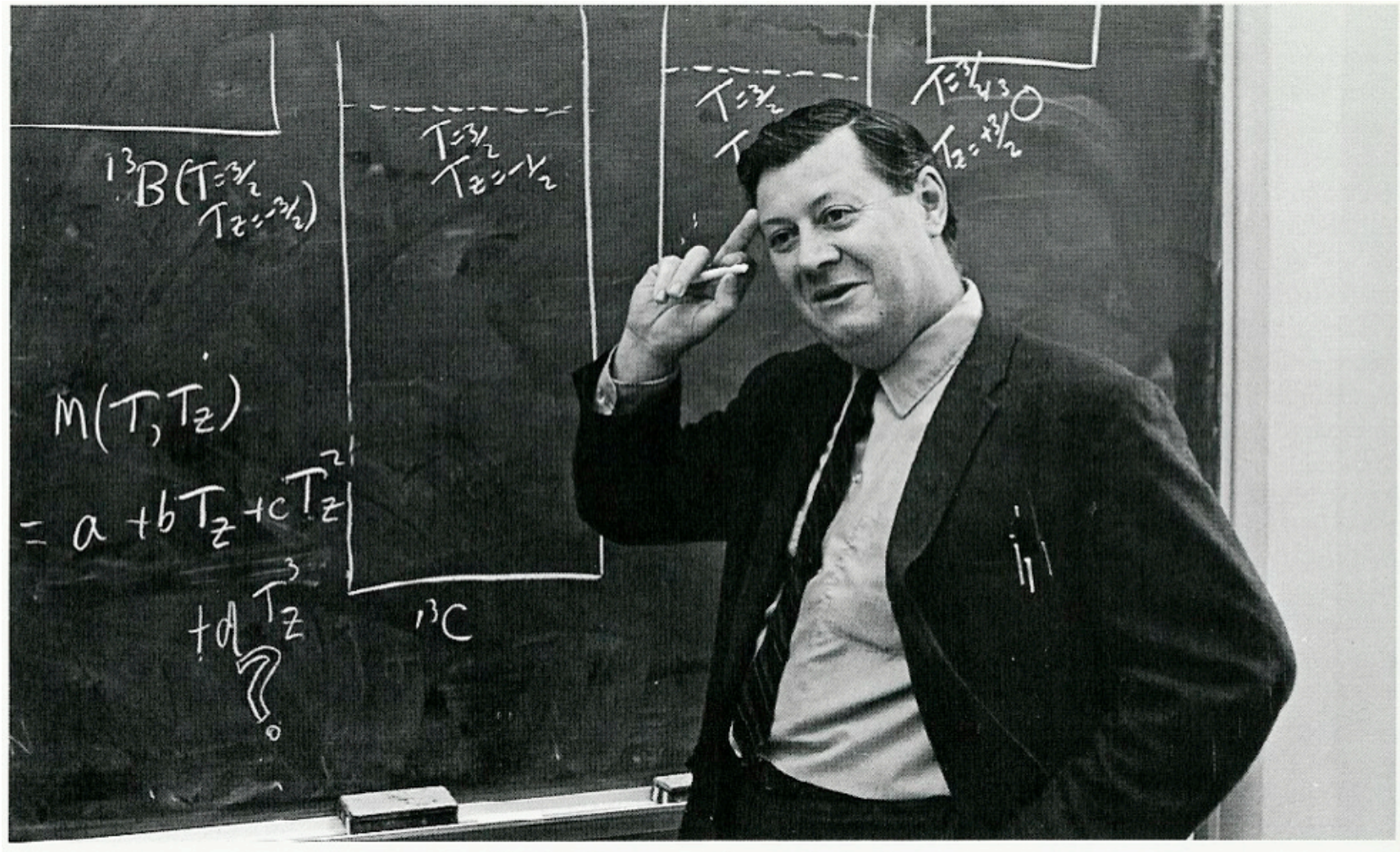
- You have to have a very hot lab.
- You have to have a particle accelerator.
- You have to wear goggles and protective clothing.
- What is a stellar nuclear reaction?



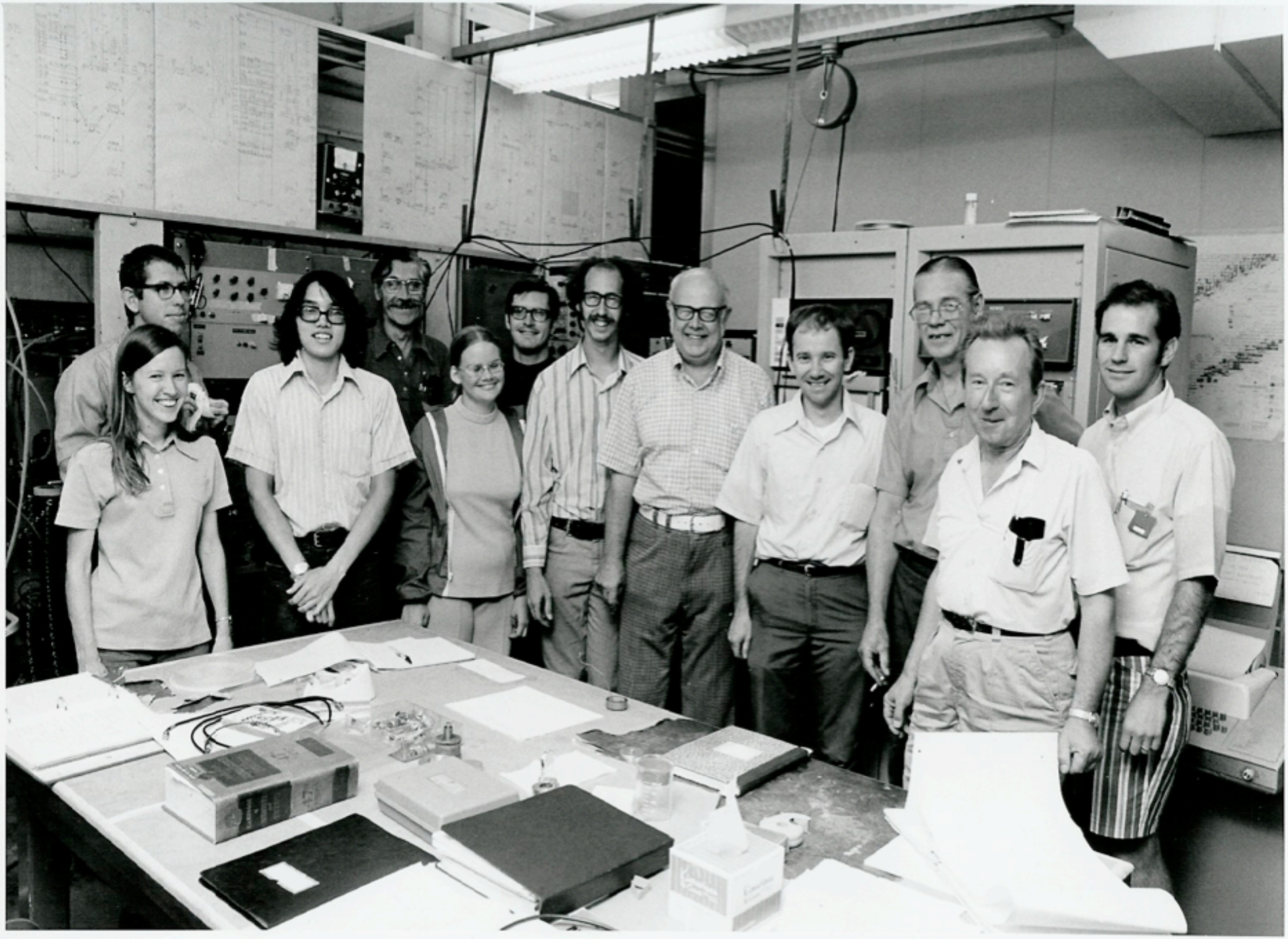
a survey of biologists

The word nuclear is pronounced

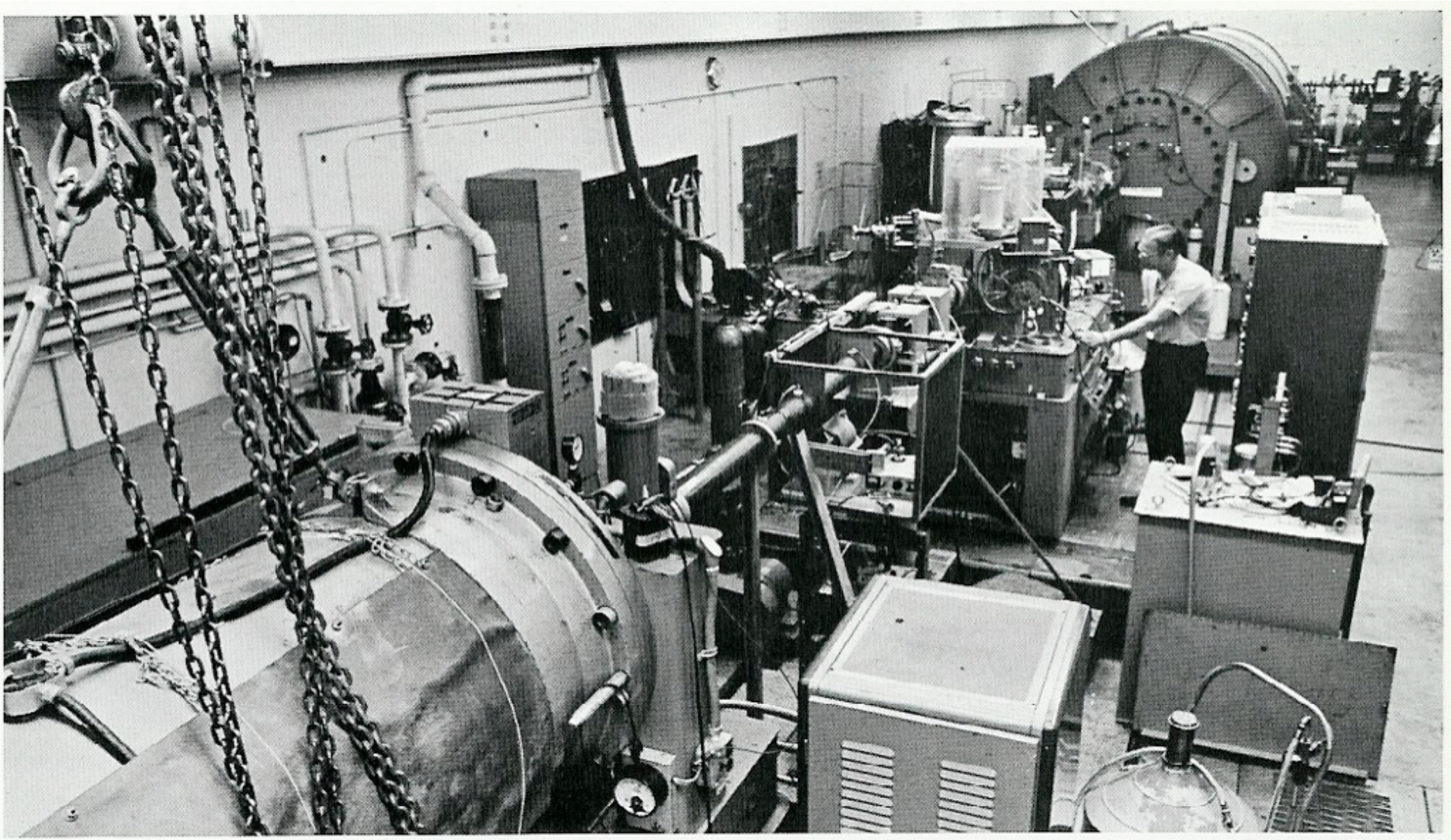




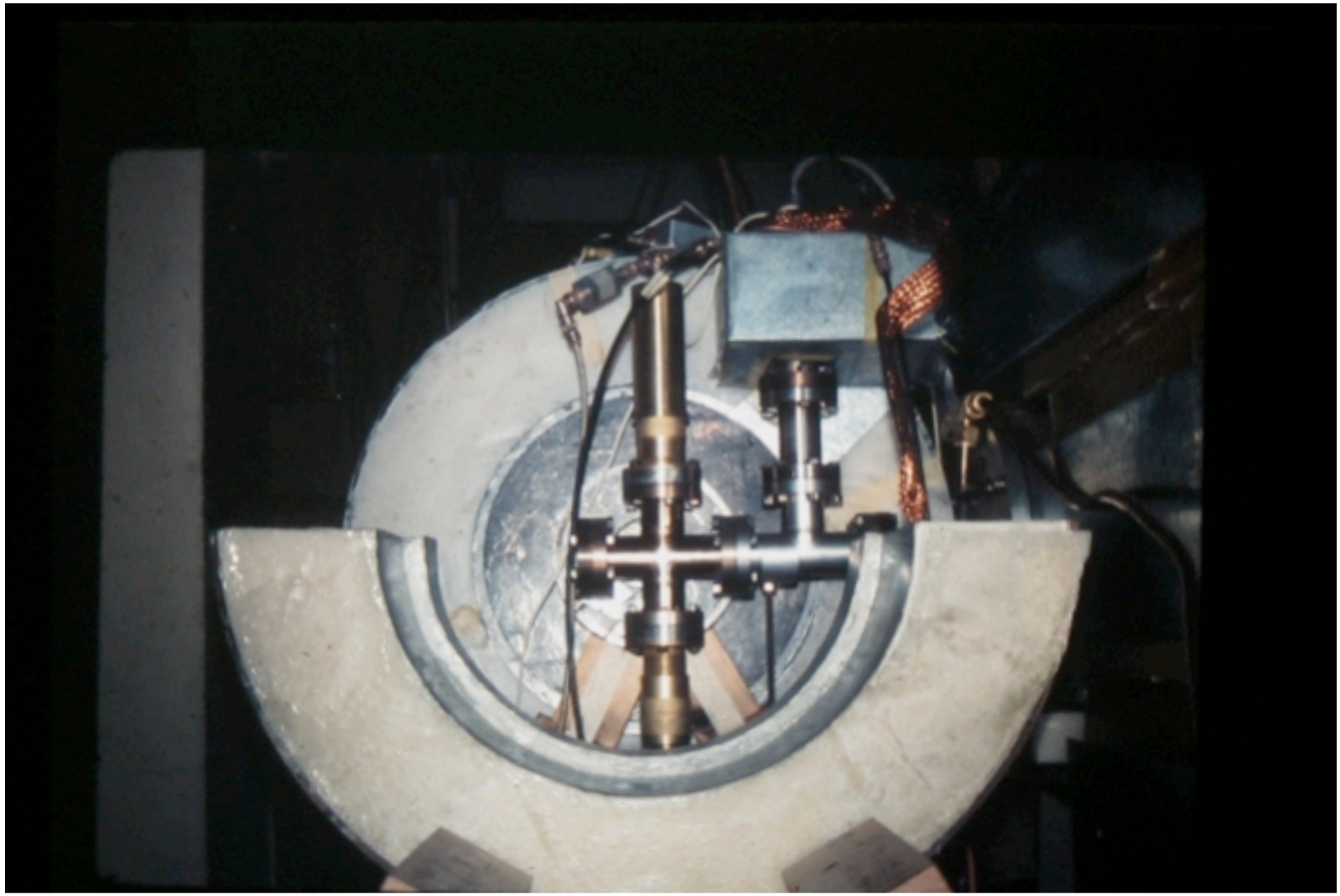
Engineering and Science, Caltech, 1969



Kellogg tandem lab, 1974



Kellogg tandem lab, 1969



$^{12}C(\alpha,\gamma)^{16}O$ beam-line apparatus

$^{12}C(\alpha,\gamma)$ $E_\alpha = 3.3$ MeV (on resonance)

start 11:30 PM
stop ~ 6 AM

9421 * 0.6 nC
run time 6 hrs. 30 min.

beam ≤ 270 nA
steady

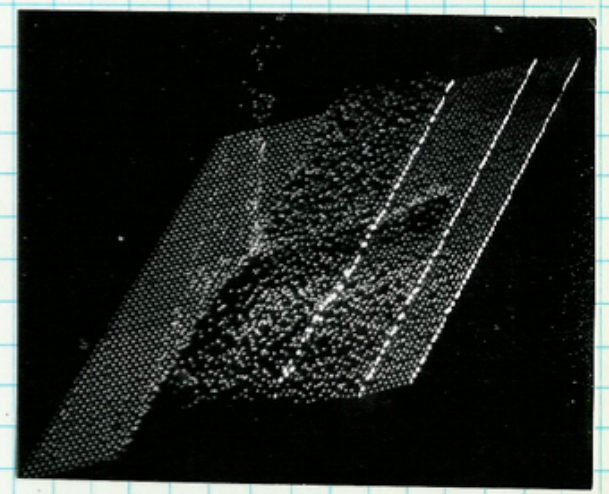
comc. 2,152
gates 506,738

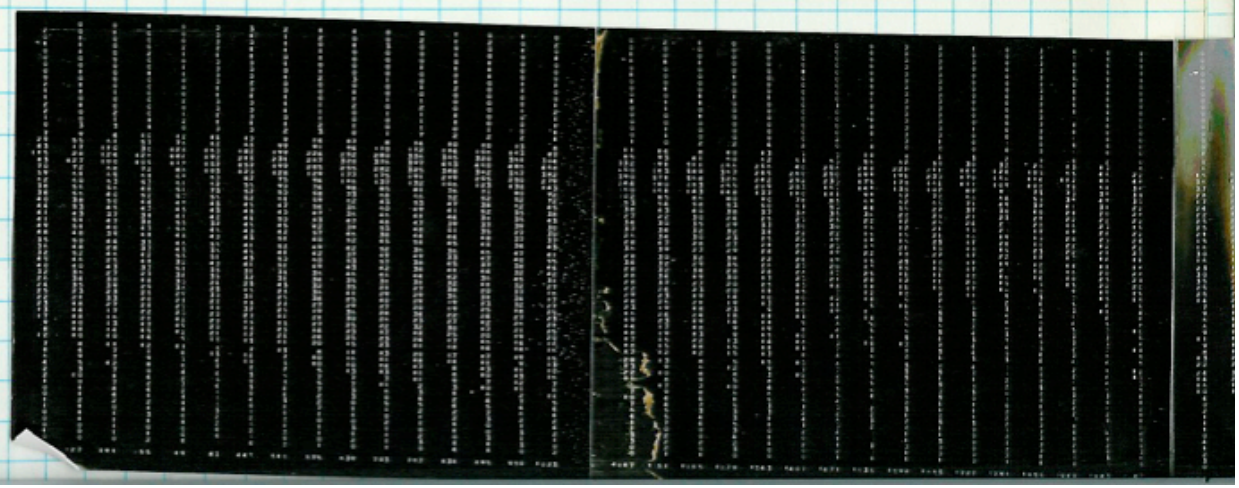
upper 264,627
lower 246,986

osc 82,610 * 10^6
target no reading; gate disconnected

checked for beam on quartz before beginning run — OK

RUN STOPPED BY EARTHQUAKE; WAS UNABLE TO TAKE PICTURES OF BEAM SPOT, TARGET STOP PULSES





3-level R-matrix:

$S(0.3\ \text{MeV}) = 0.14\ ^{+0.14}_{-0.12}\ \text{MeV . b}$

hybrid R-matrix optical model:

$S(0.3\ \text{MeV}) = 0.08\ ^{+0.05}_{-0.04}\ \text{MeV . b}$