A Preliminary Design for a Small Permanent Magnet Cyclotron

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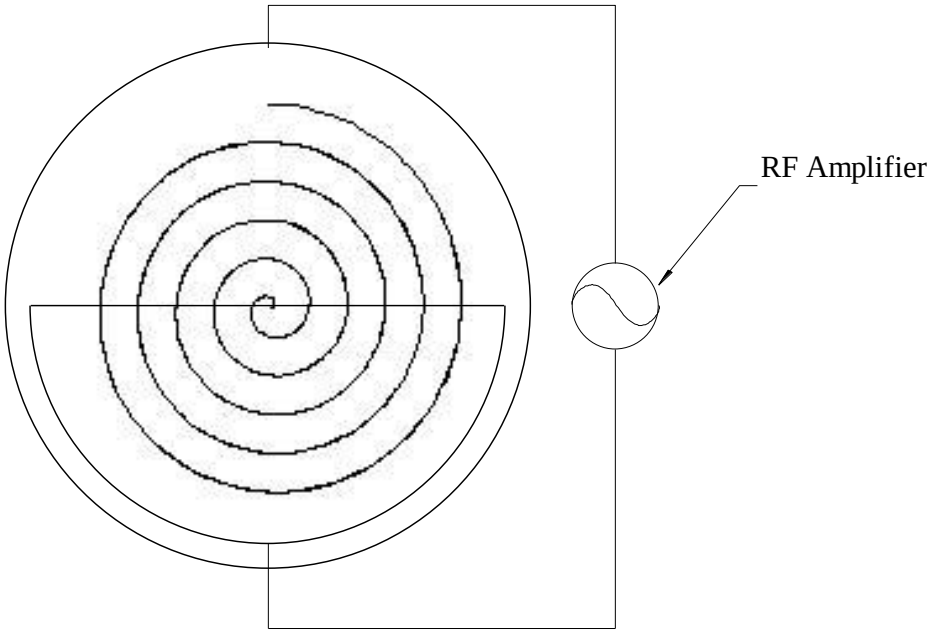
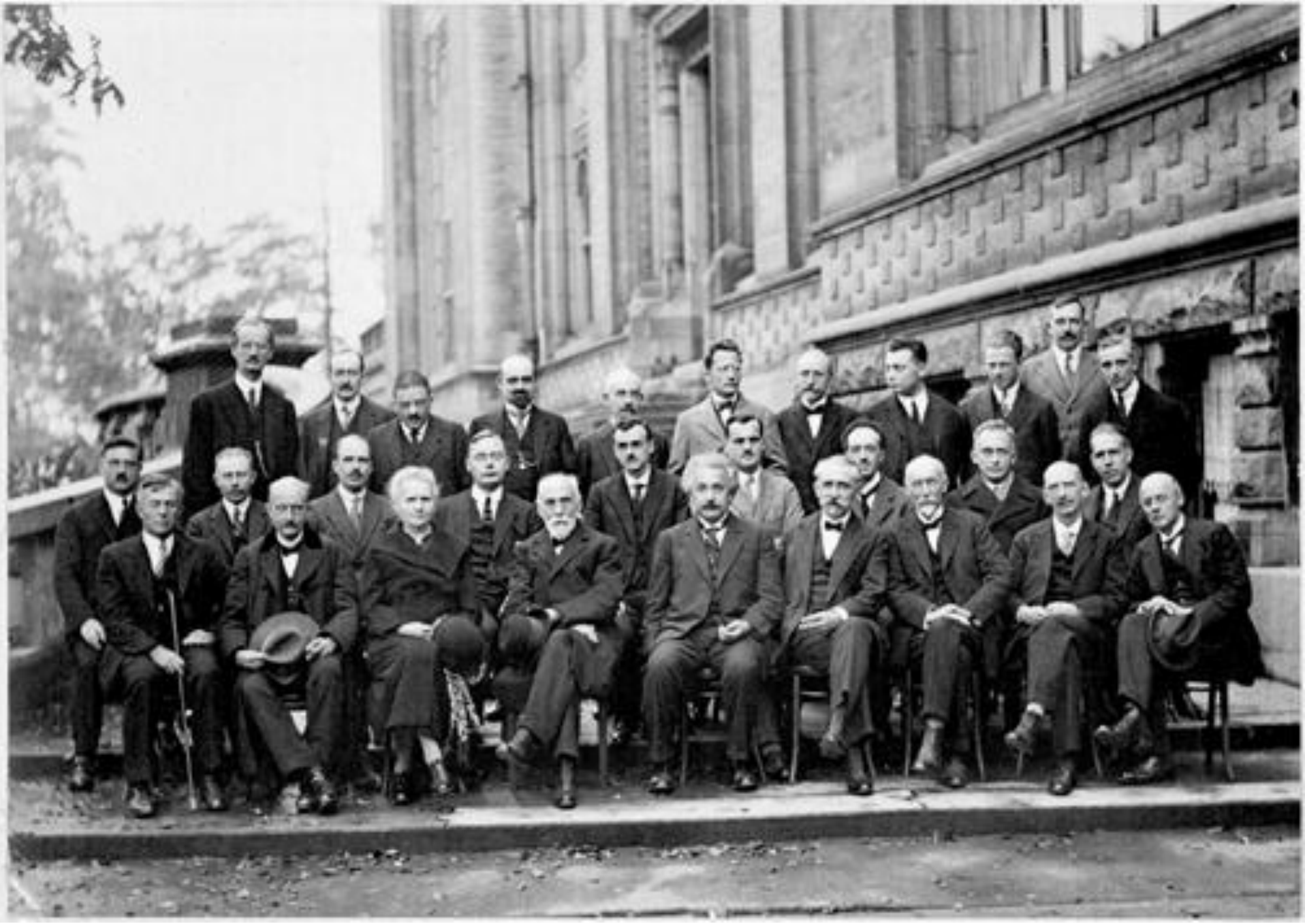
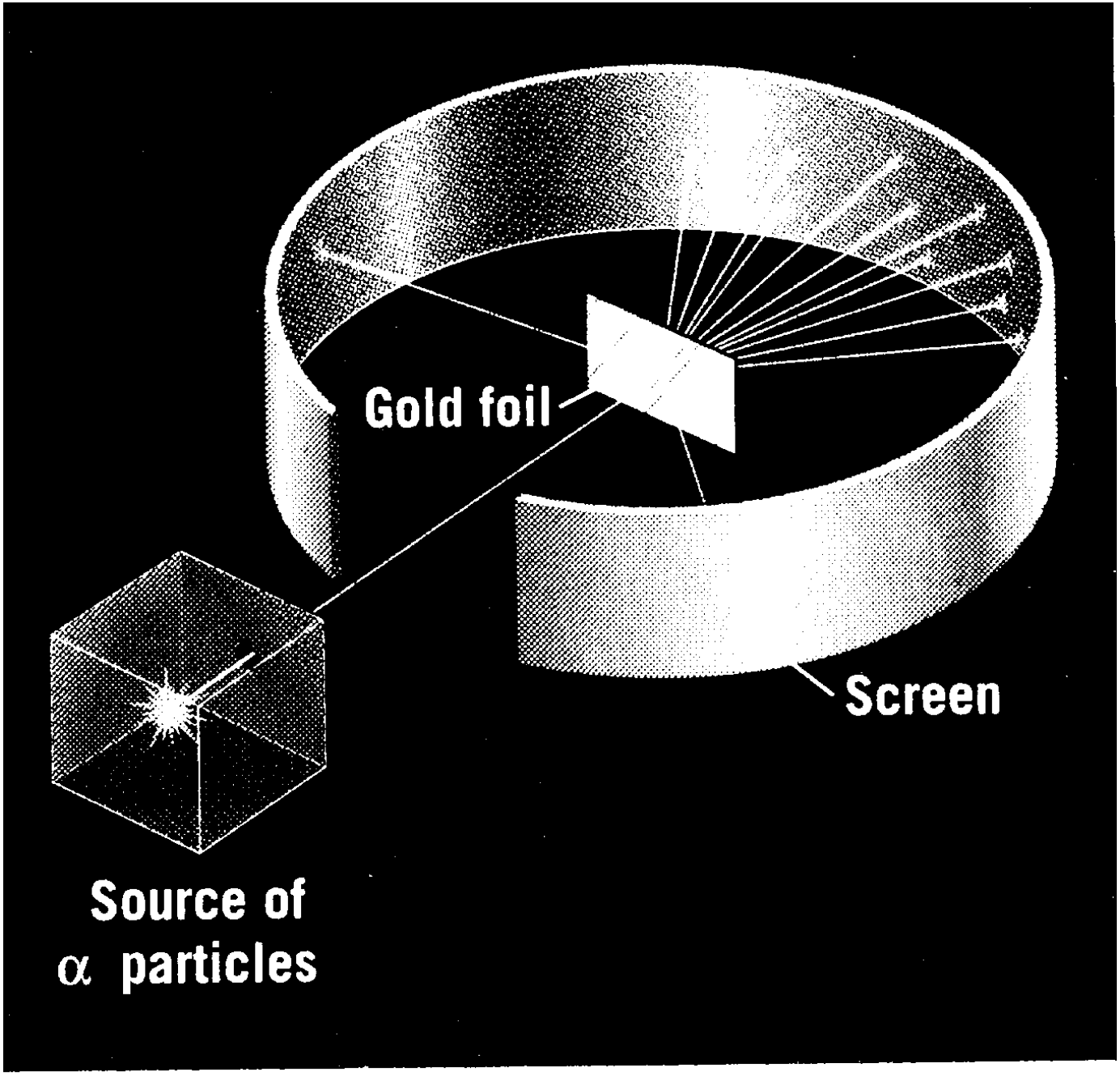
- What is a Cyclotron?
- Why build one?
- What have we done?

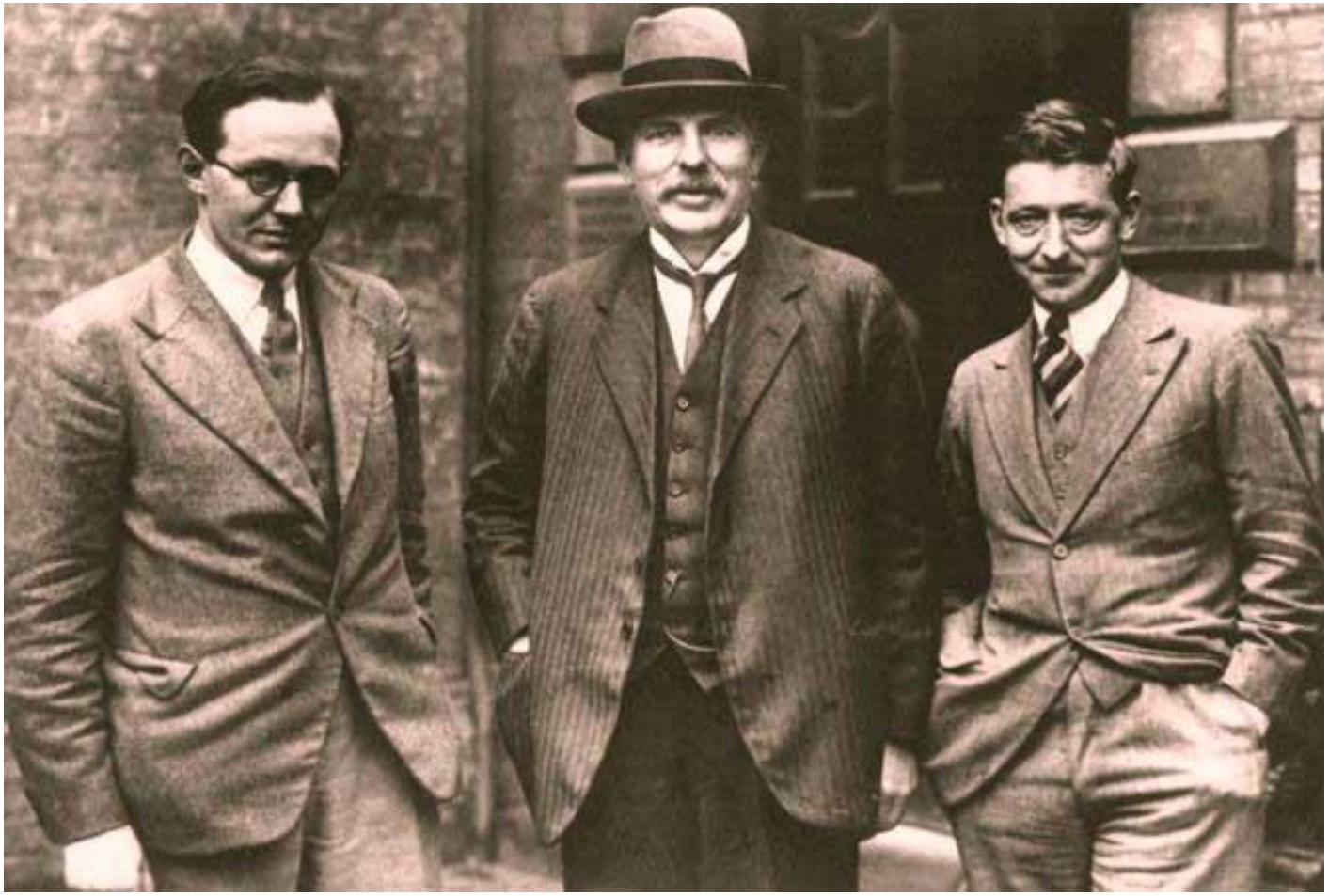
What is a Cyclotron?

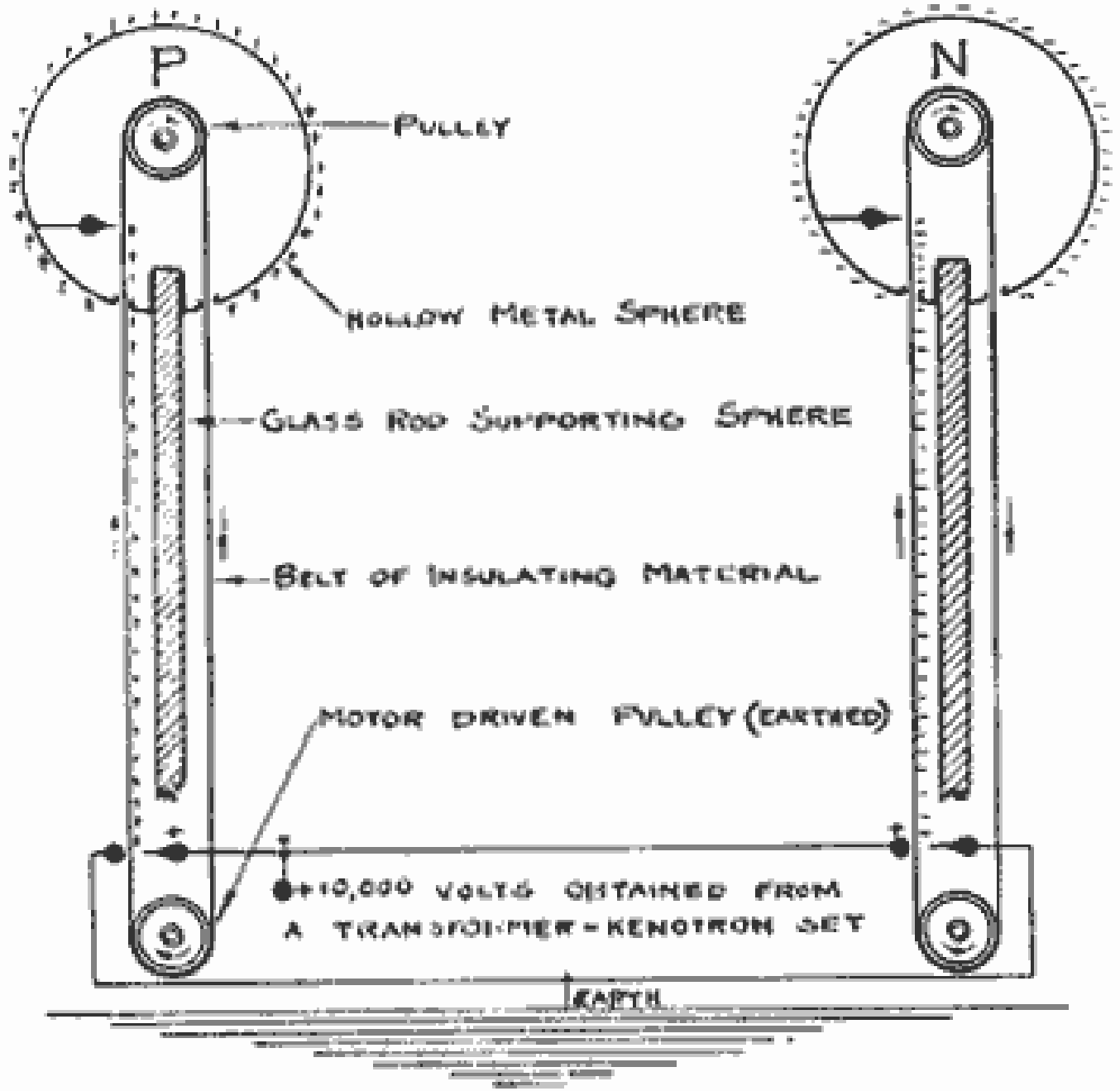
- Ionized gas
- Vacuum
- Oscillating Voltages
- Magnets

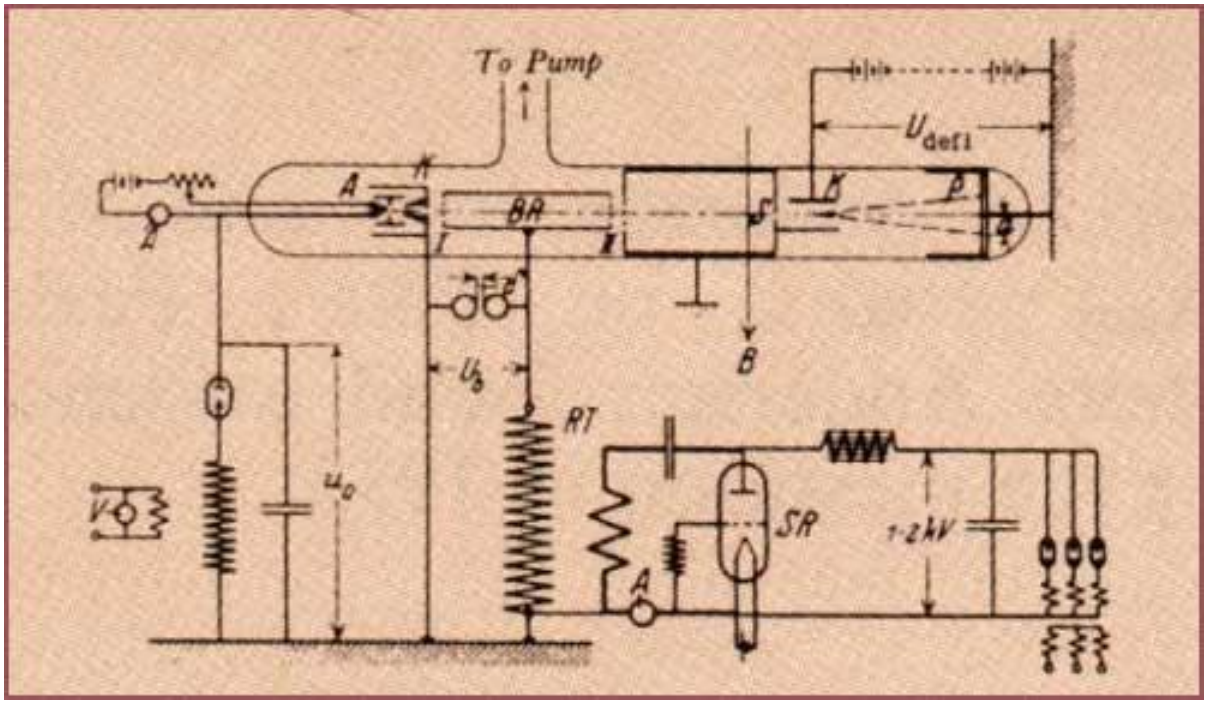





Gold foil
Screen
Source of
α particles




P
N
PULLEY
HOLLOW METAL SPHERE
GLASS ROD SUPPORTING SPHERE
BELT OF INSULATING MATERIAL
MOTOR DRIVEN PULLEY (EARTHED)
+10,000 VOLTS OBTAINED FROM
A TRANSFORMER - KENOTRON SET
EARTH

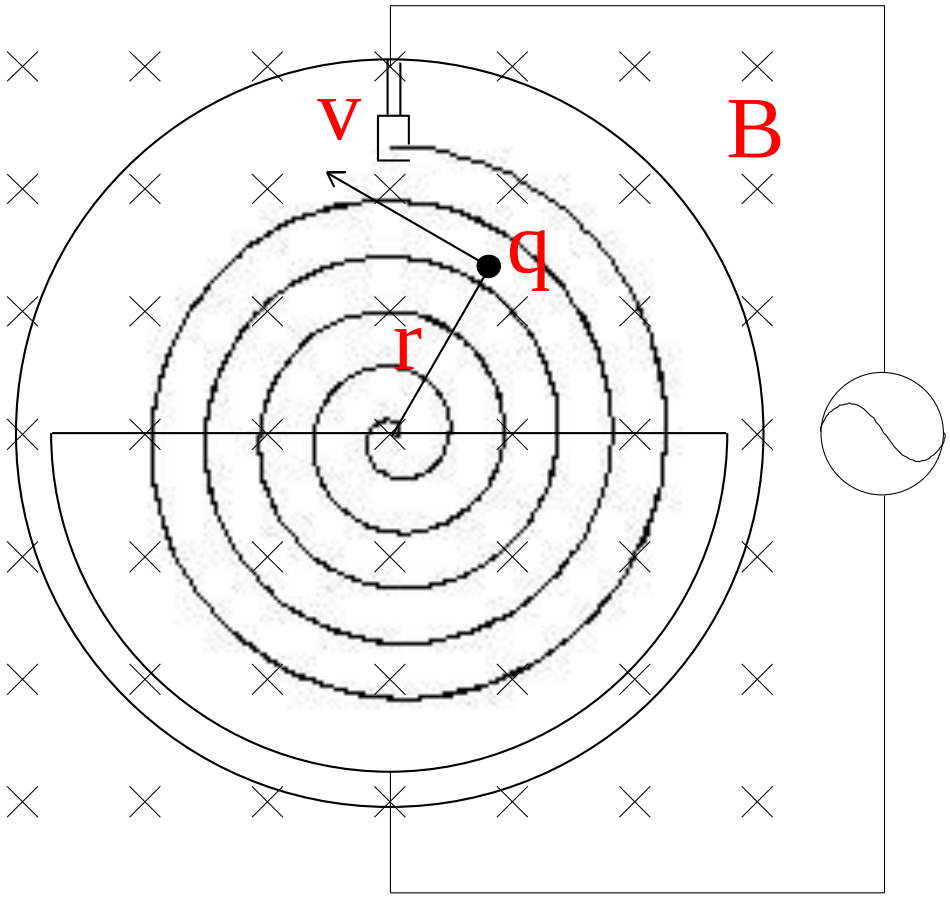

To Pump
A
K
BR
I
II
S
K
P
B
U_{defl}
U_b
RT
u_0
V
SR
A
1·2 kV

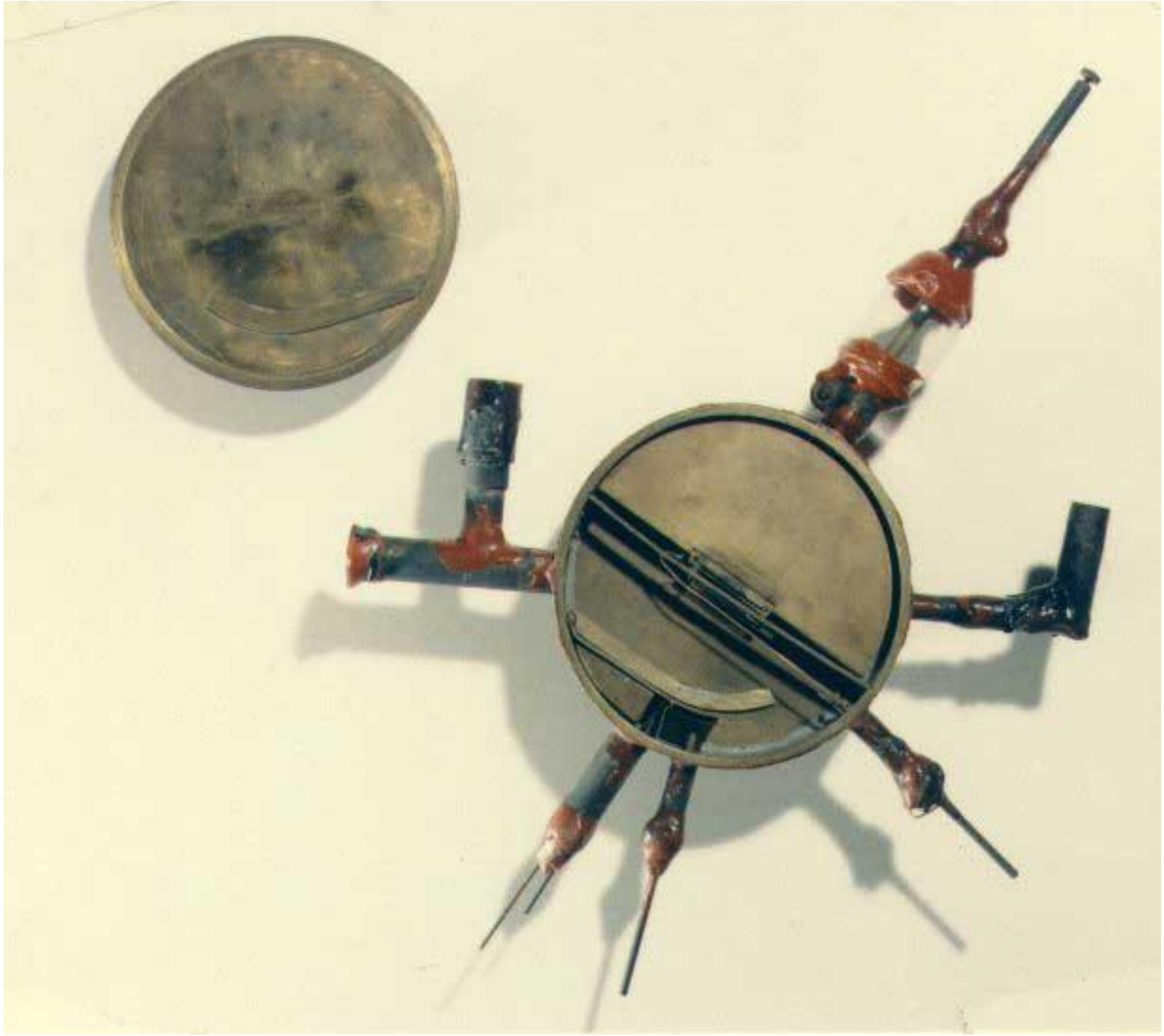
AIP

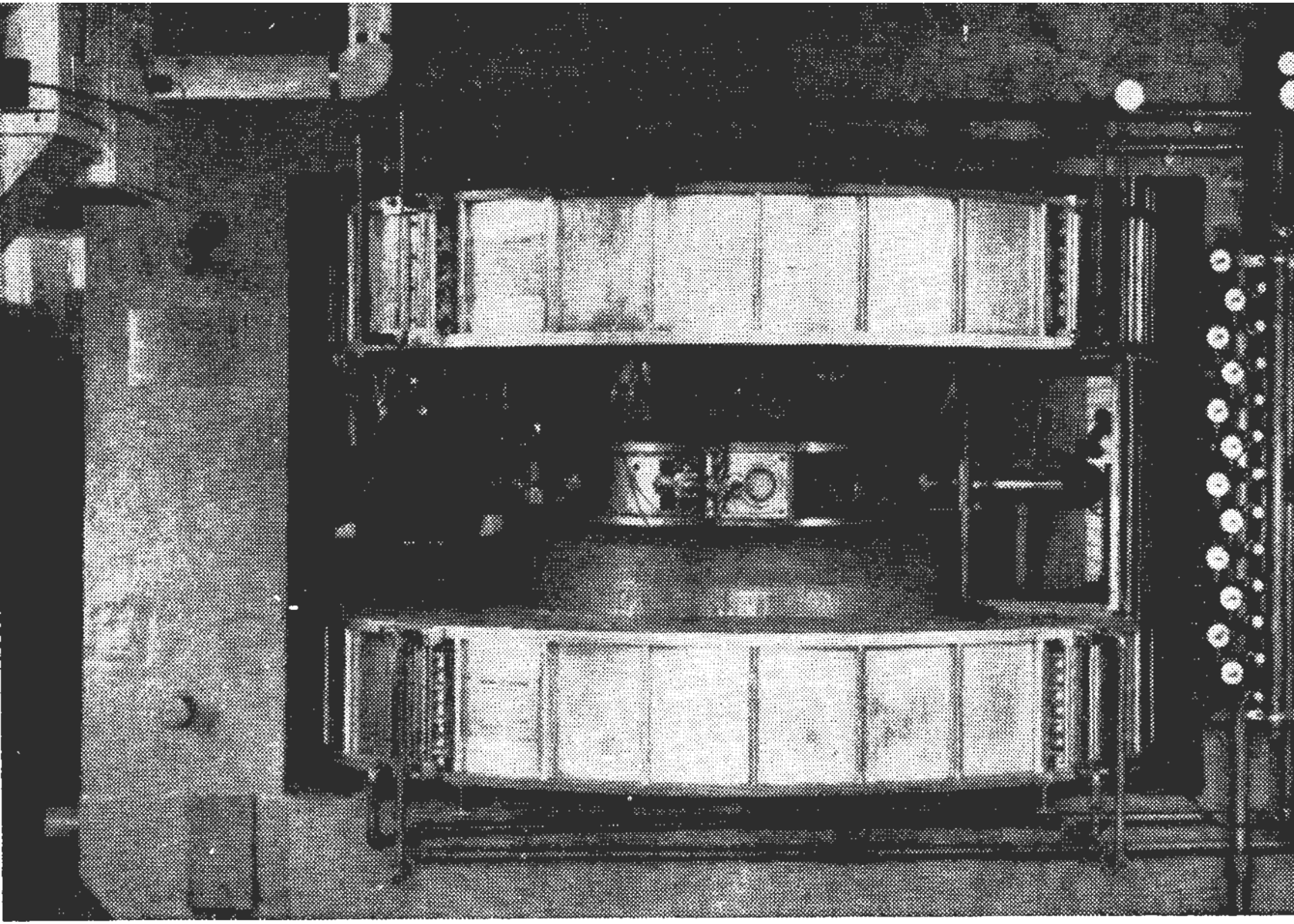
$$\frac{mv^2}{r} = qvB$$

$$f = \frac{v}{2r\pi} = \frac{qB}{2m\pi}$$

$$T = \frac{mv^2}{2} = \frac{q^2B^2R^2}{2m}$$







MIT

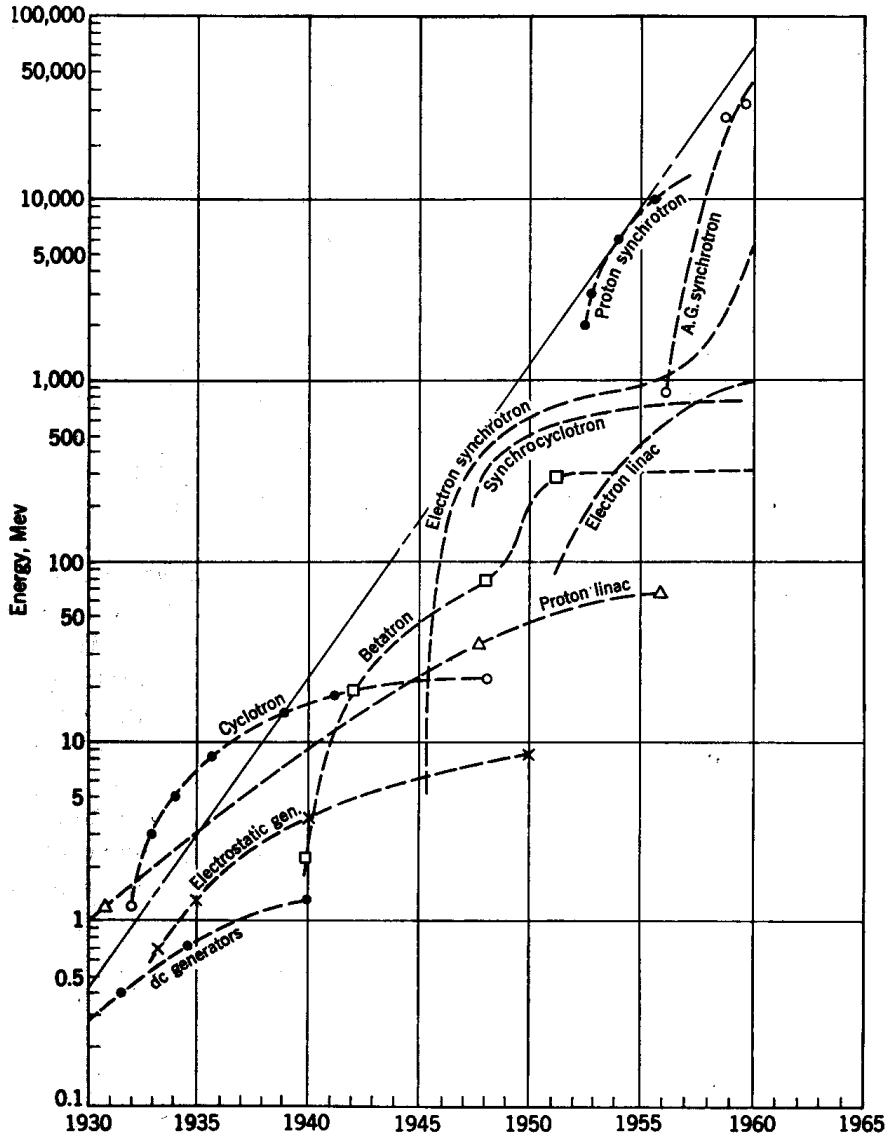
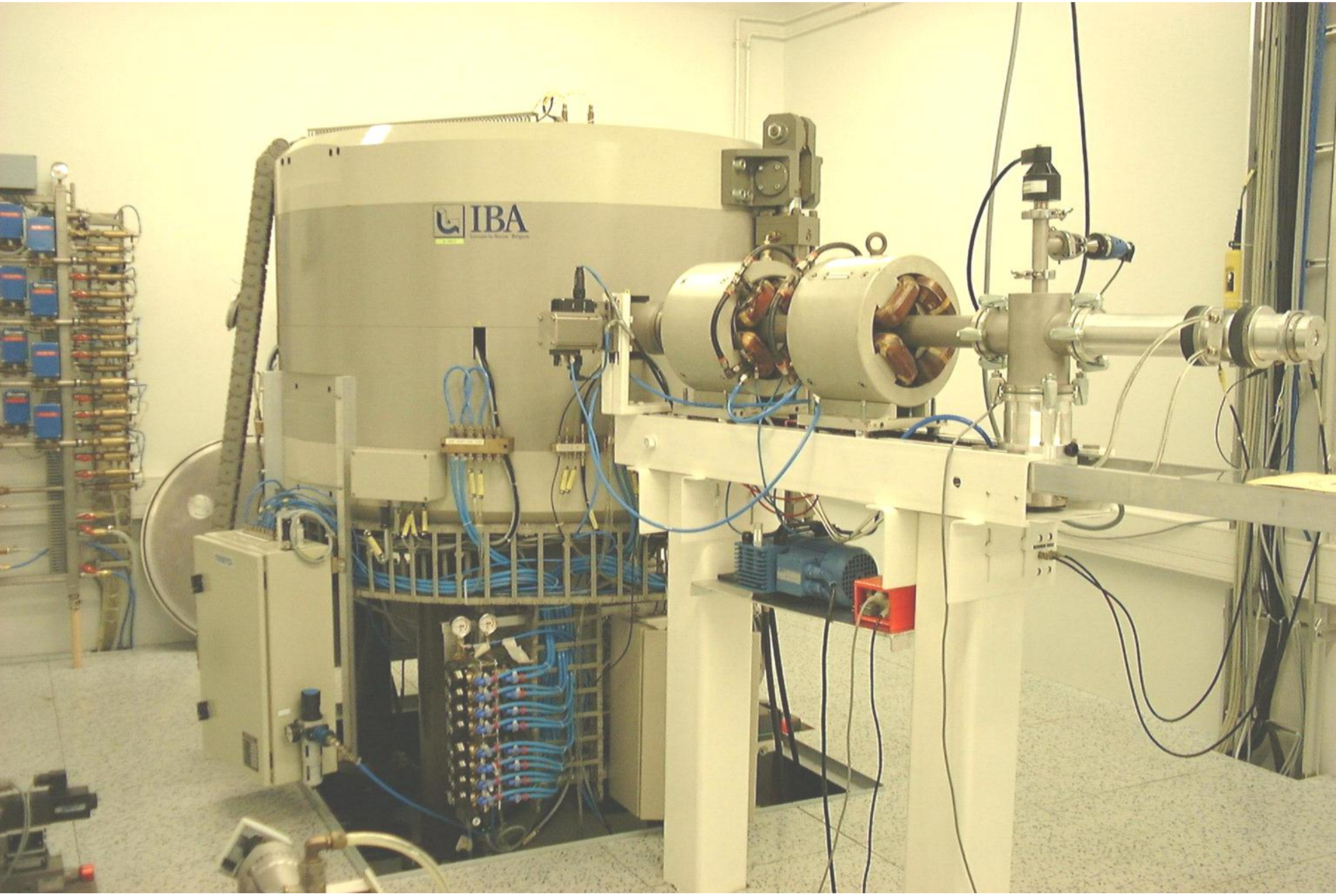
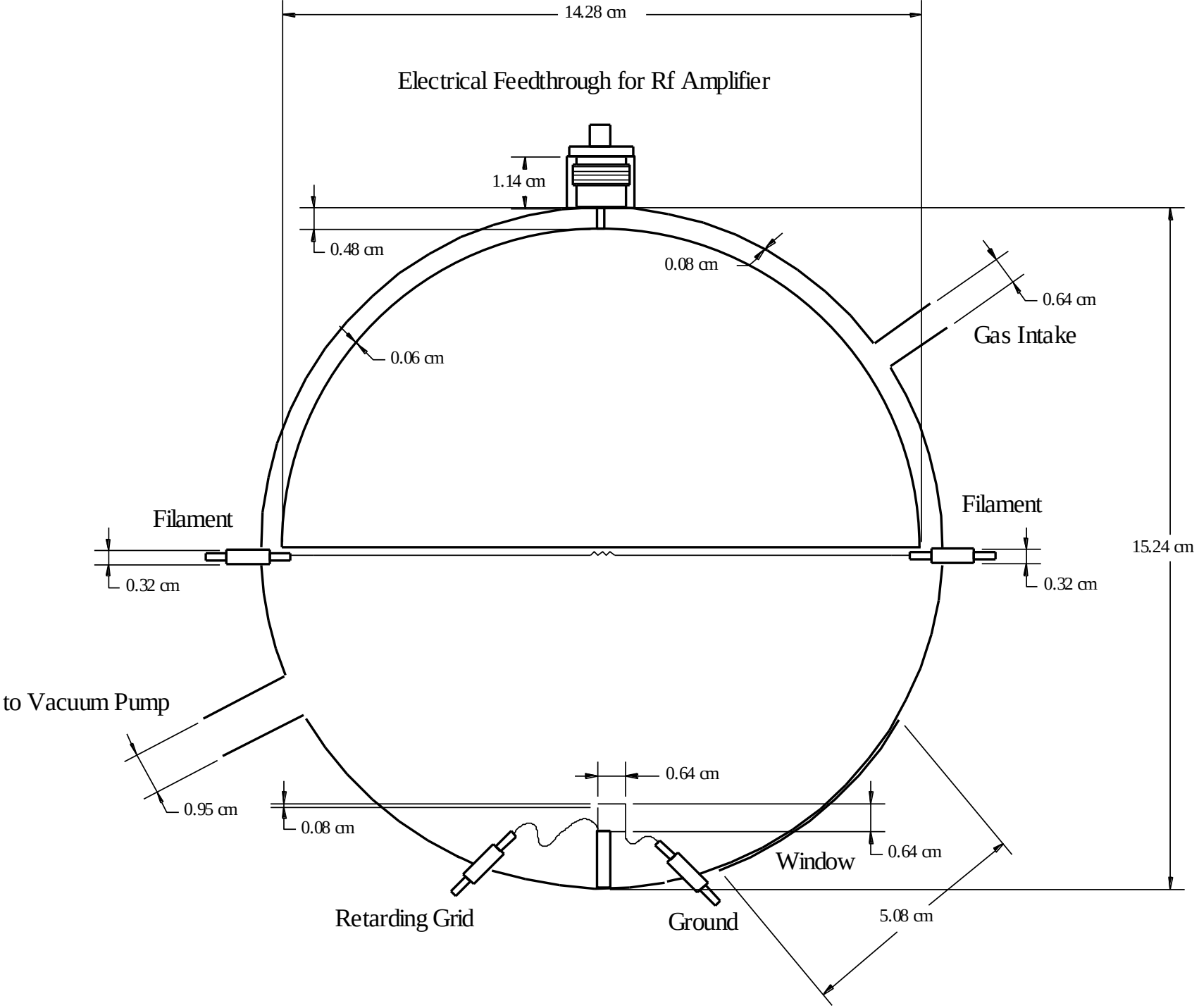
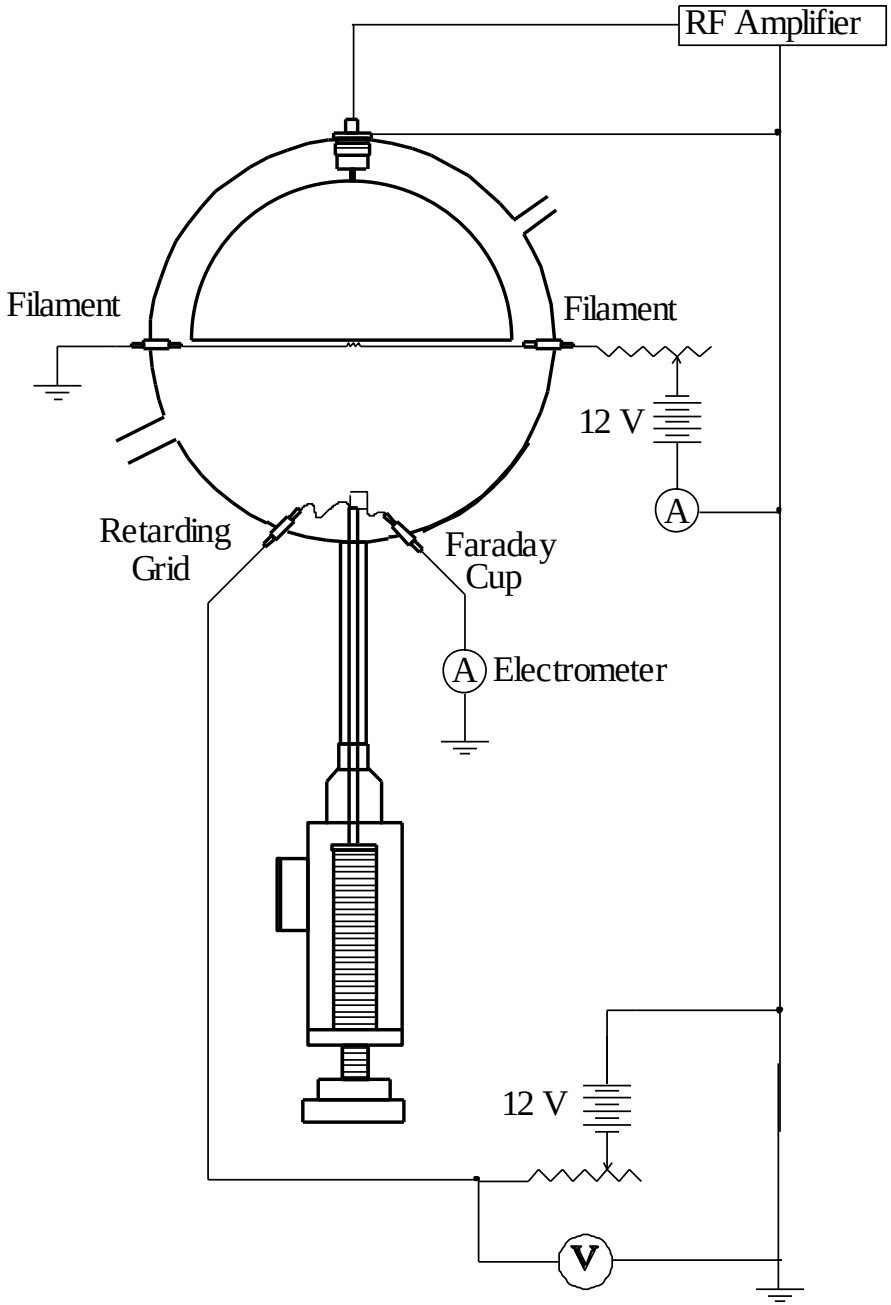


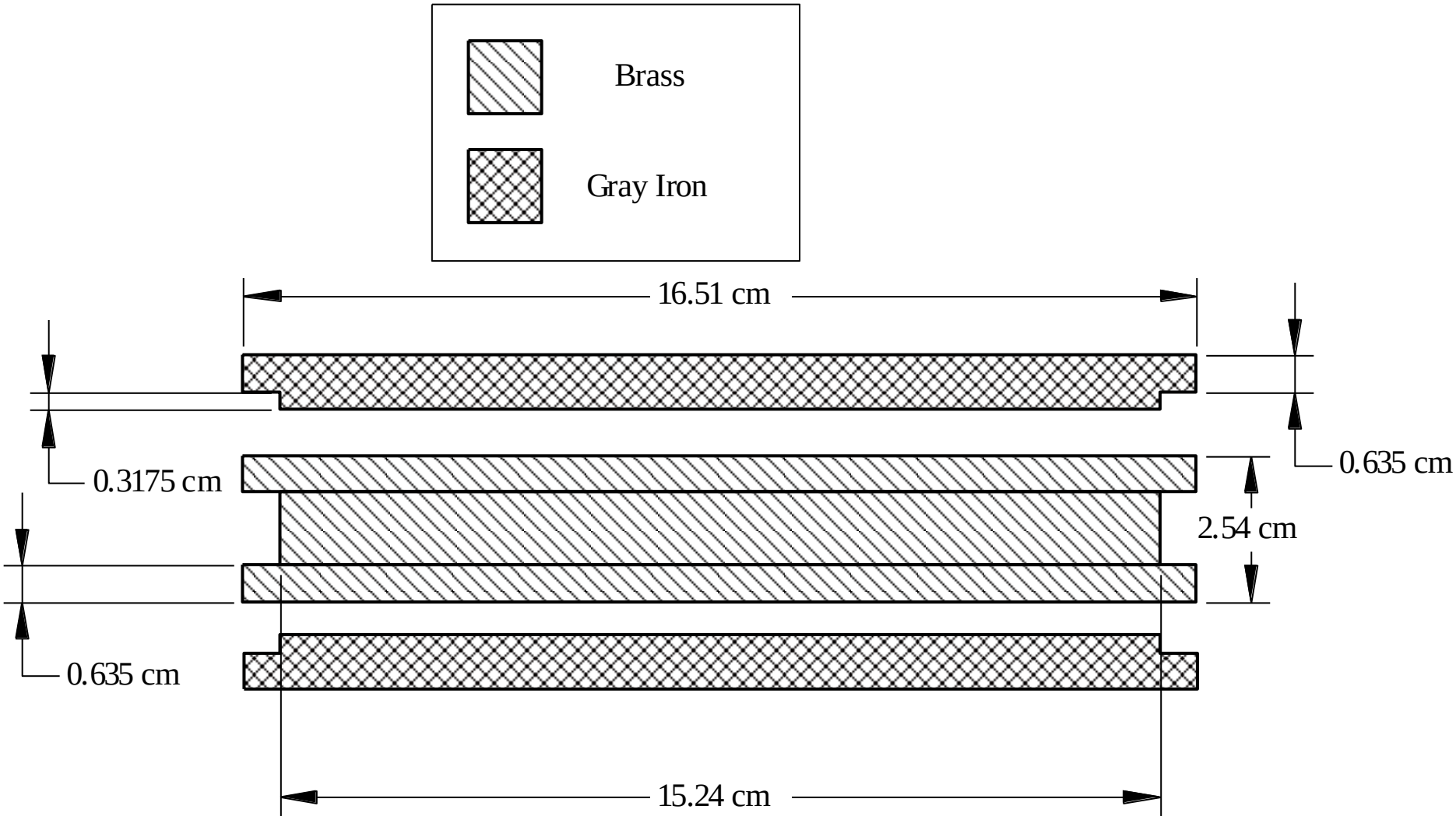
Fig. 1-1. Energies achieved by accelerators from 1930 to 1960. The linear envelope of the individual curves shows an average tenfold increase in energy every six years.

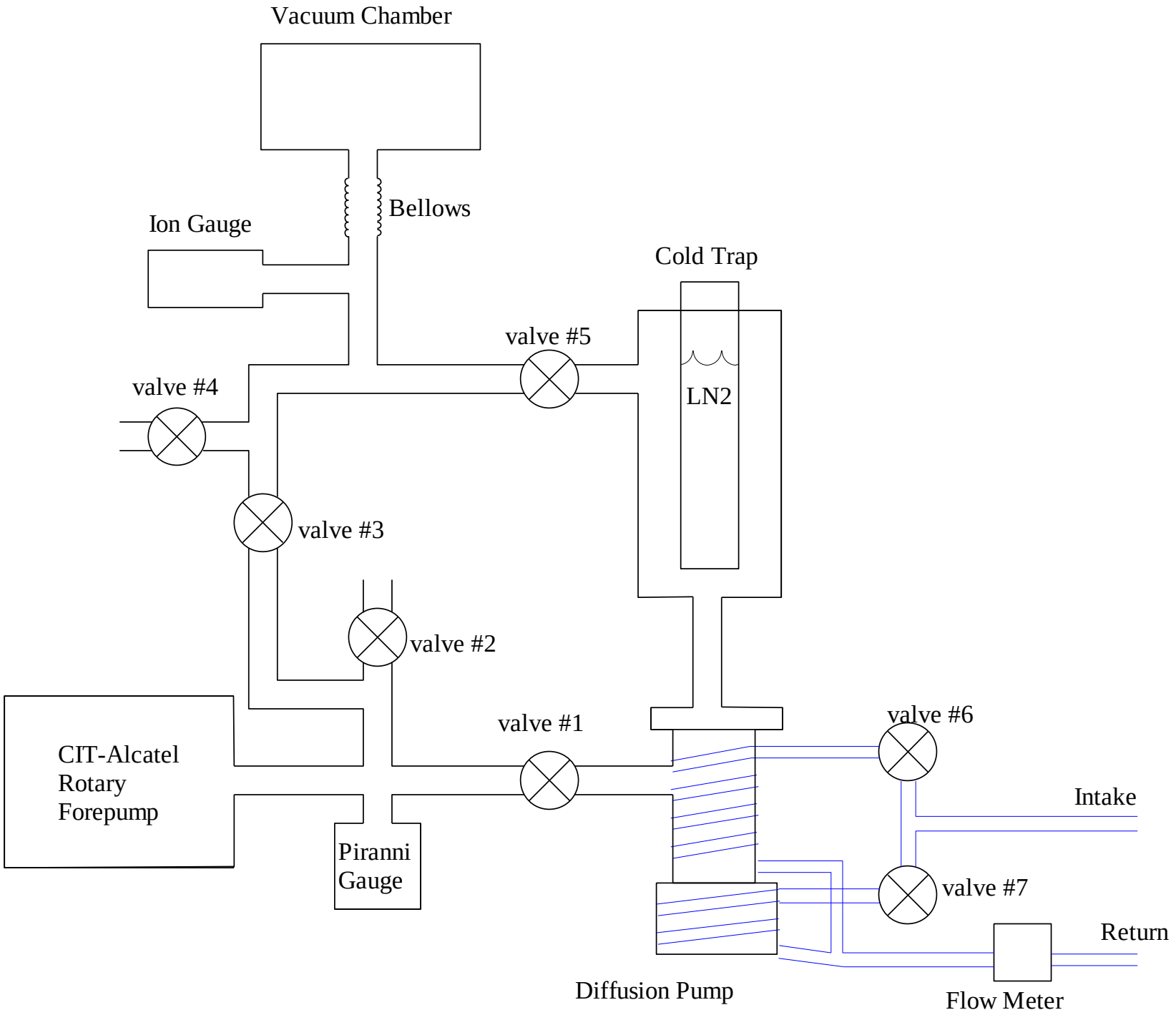

IBA

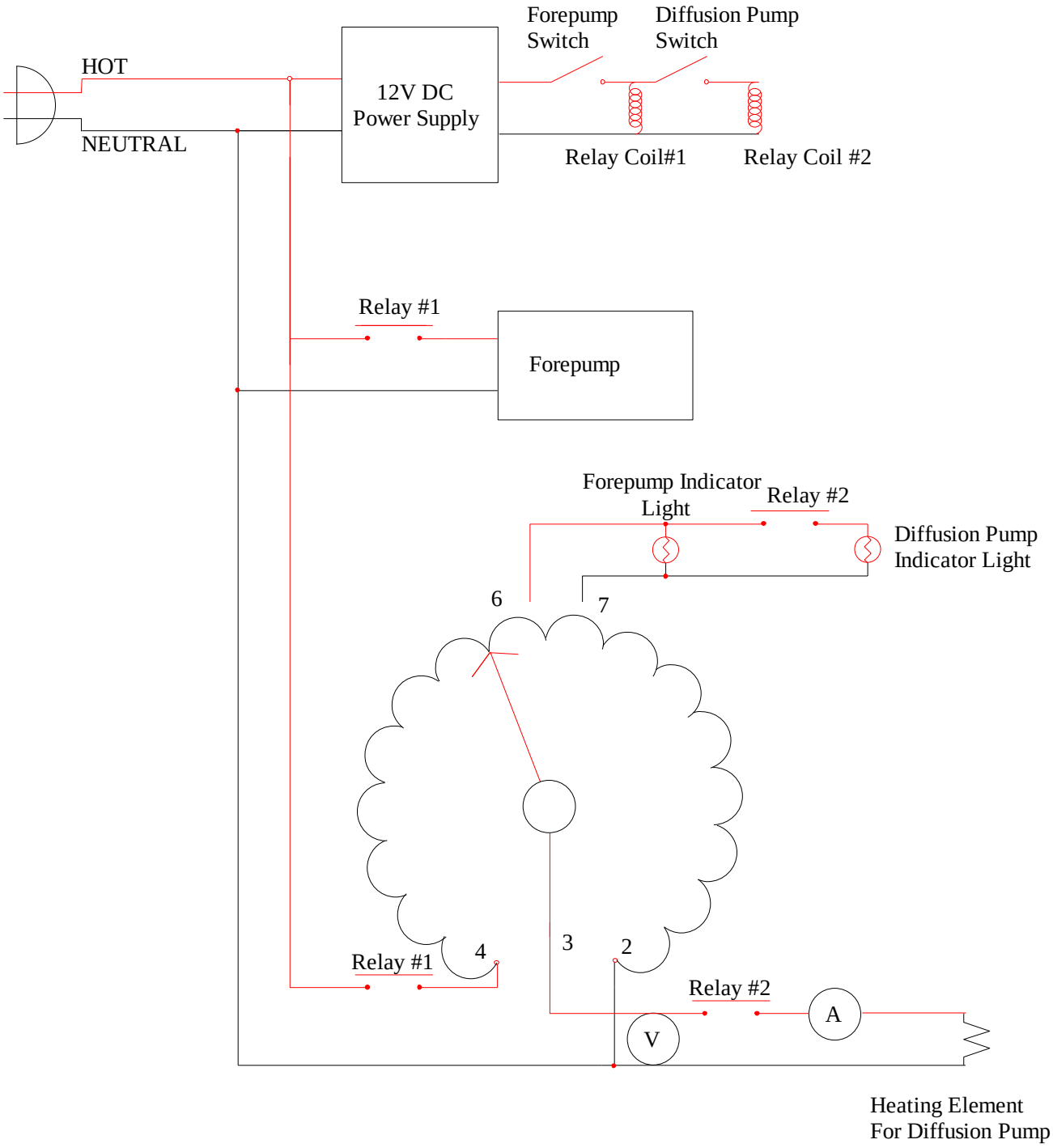
THIS SIDE UP

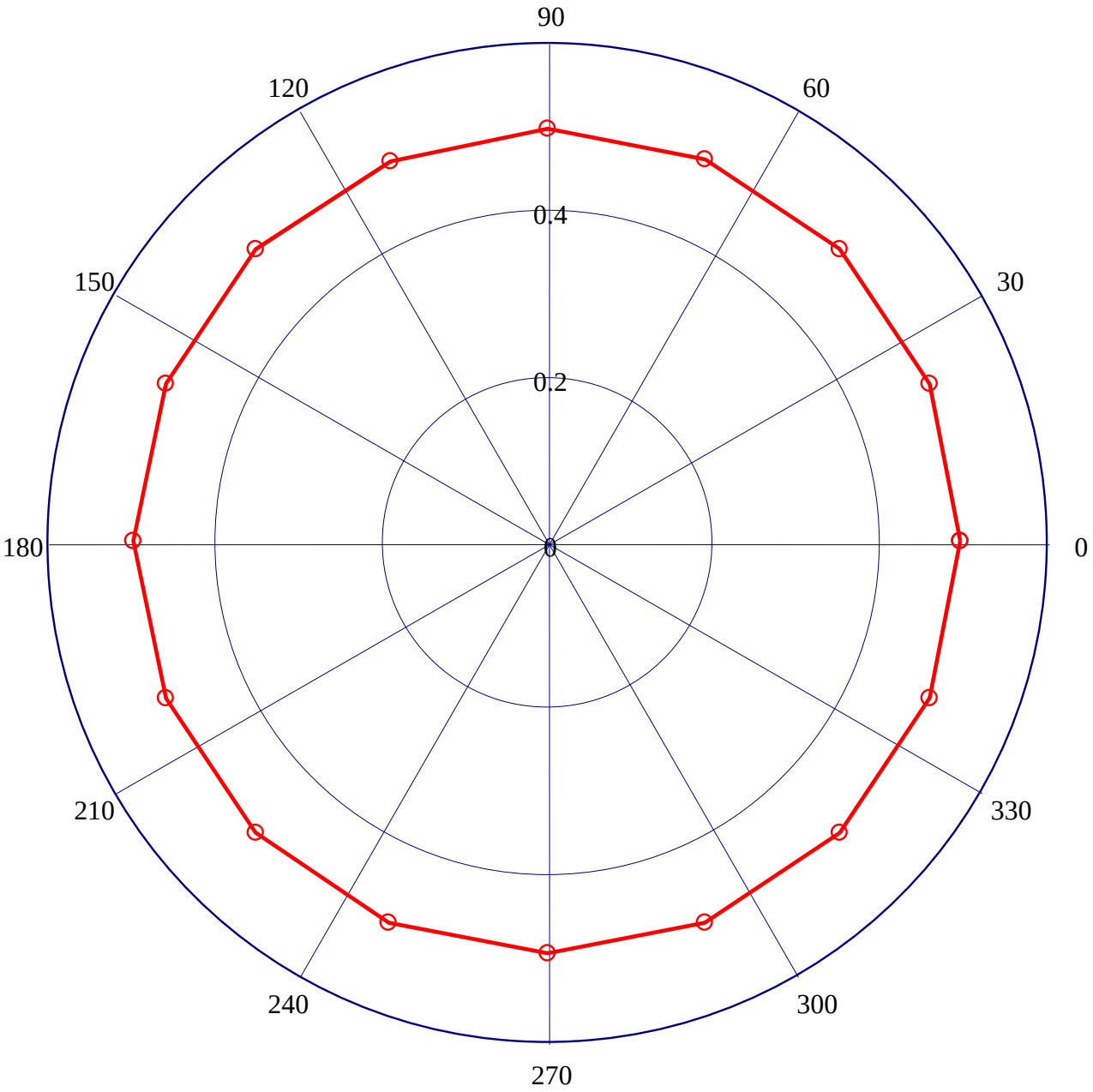

14.28 cm
Electrical Feedthrough for Rf Amplifier
1.14 cm
0.48 cm
0.08 cm
0.64 cm
Gas Intake
0.06 cm
Filament
Filament
15.24 cm
0.32 cm
0.32 cm
to Vacuum Pump
0.64 cm
0.95 cm
0.08 cm
0.64 cm
Window
Retarding Grid
Ground
5.08 cm

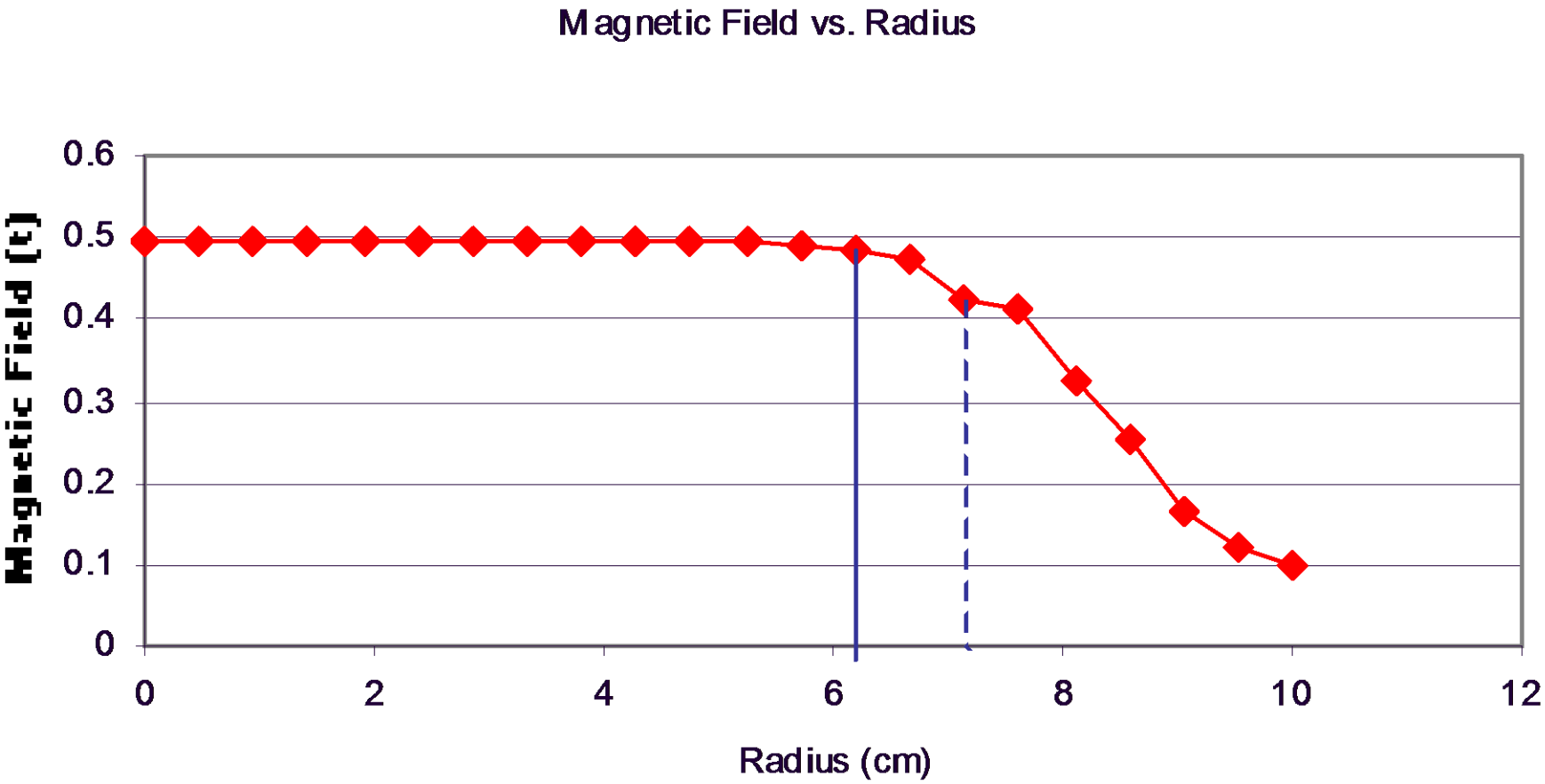

RF Amplifier
Filament
Filament
12 V
A
Retarding
Grid
Faraday
Cup
A
Electrometer
12 V
V


Brass
Gray Iron
16.51 cm
0.3175 cm
0.635 cm
2.54 cm
0.635 cm
15.24 cm


Vacuum Chamber
Bellows
Ion Gauge
Cold Trap
valve #5
valve #4
LN2
valve #3
valve #2
valve #1
valve #6
CIT-Alcatel
Rotary
Forepump
Intake
Piranni
Gauge
valve #7
Return
Diffusion Pump
Flow Meter


Forepump
Switch
Diffusion Pump
Switch
HOT
12V DC
Power Supply
NEUTRAL
Relay Coil#1
Relay Coil #2
Relay #1
Forepump
Forepump Indicator
Light
Relay #2
Diffusion Pump
Indicator Light
6
7
Relay #1
4
3
2
Relay #2
A
V
Heating Element
For Diffusion Pump


90
120
60
0.4
150
30
0.2
180
0
210
330
240
300
270


Magnetic Field vs. Radius
Magnetic Field (t)
0.6
0.5
0.4
0.3
0.2
0.1
0
0
2
4
6
8
10
12
Radius (cm)

- Where are we now?
- Where are we going?
- What are are long term Goals?