A Preliminary Design For A Small Cyclotron

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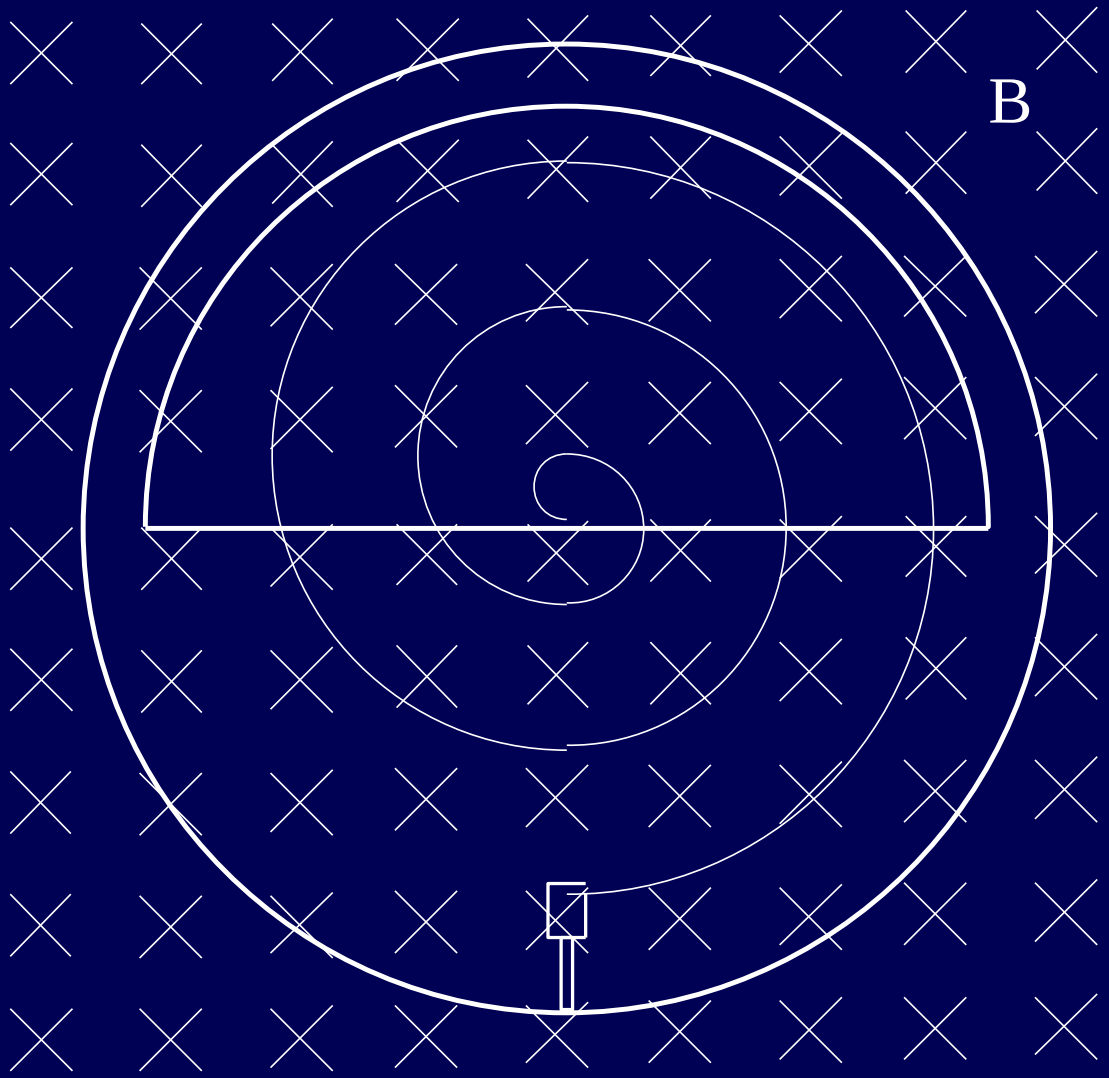
Why Build A Cyclotron?

- Educational purposes
- Radiation source
- Ideal for small laboratories

What Is A Cyclotron?



Theory

Lorentz Force $\vec{F} = q\left(\vec{E} + \vec{v} \times \vec{B}\right)$

Circular Motion $F = \frac{mv^2}{r}$

$$\therefore v = \frac{qBr}{m}$$

Theory

The Period of Revolution

$$T = \frac{2\pi r}{v}$$

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

Theory

Kinetic Energy: $T = \frac{1}{2}mv^2$

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

Energy Calculations

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

Protons

T_p =37 keV

$T_{p,enhanced}$ = 88 keV

Deuterons

T_d = 19 keV

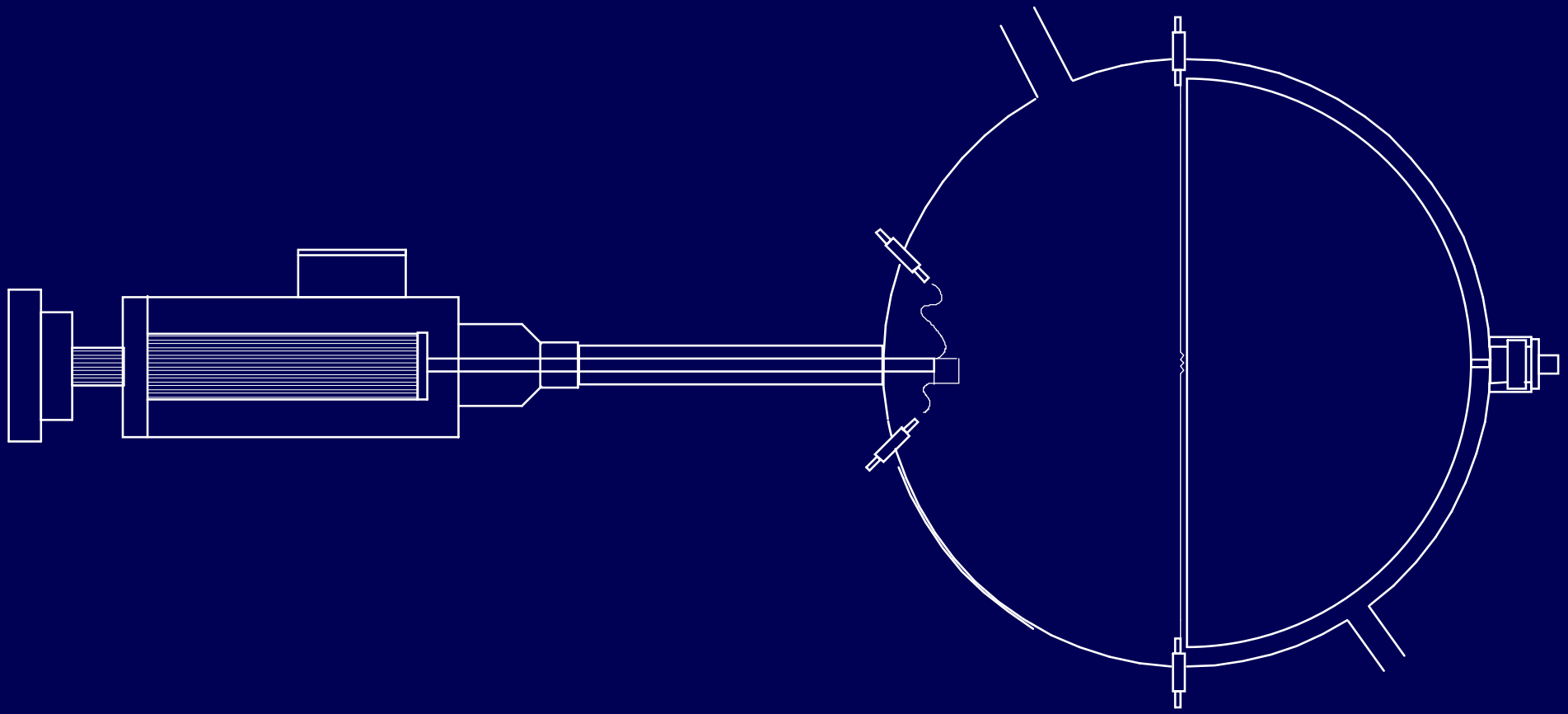
$T_{d,enhanced}$ = 44 keV

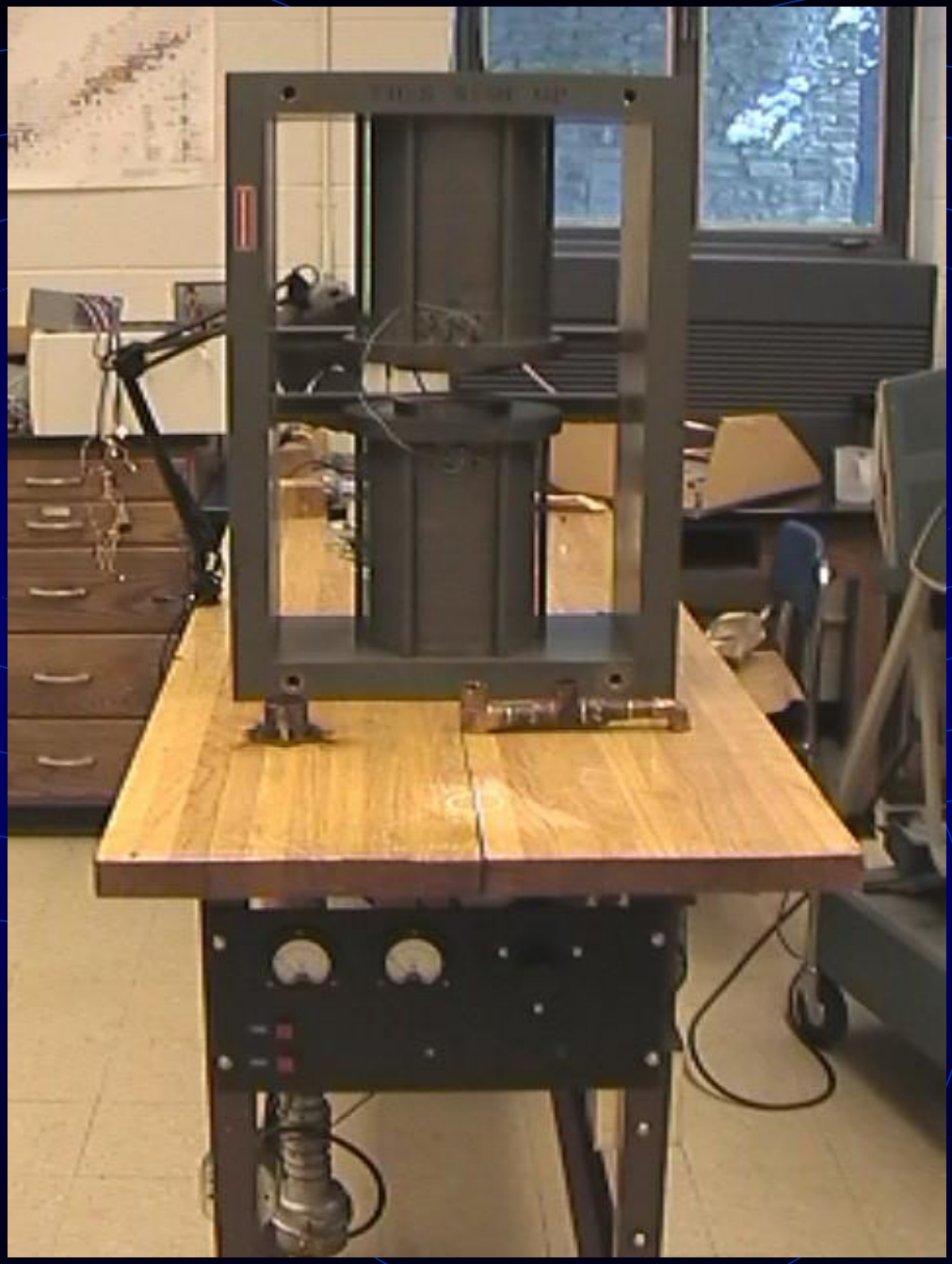
r = 6.2 cm

B = 0.49 T

$B_{enhanced}$ = 0.75T

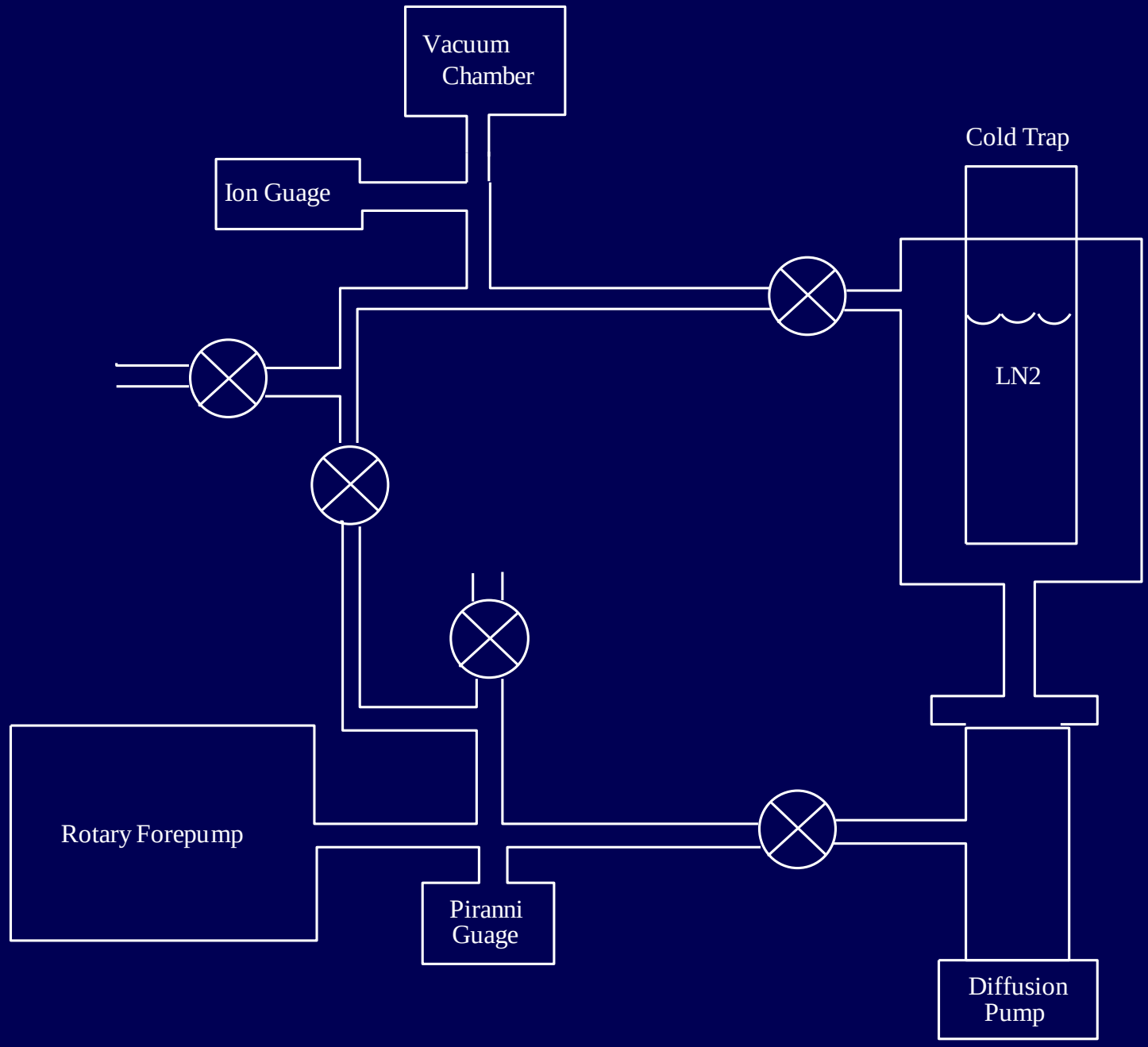
Chamber Design



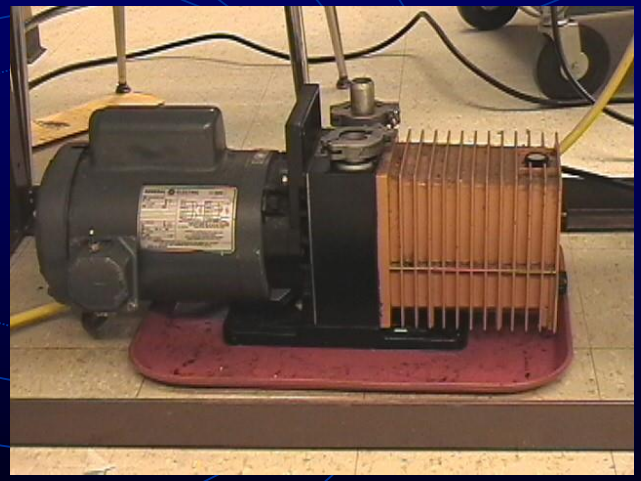


Vacuum Pump

- Rotary Fore Pump
- Liquid Nitrogen Cold Trap
- Water-Cooled Diffusion Pump


Vacuum Chamber
Ion Guage
Cold Trap
LN2
Rotary Forepump
Piranni Guage
Diffusion Pump

Vacuum Pump



Conclusions

- Complete vacuum
- Begin chamber assembly
- Commence testing of system