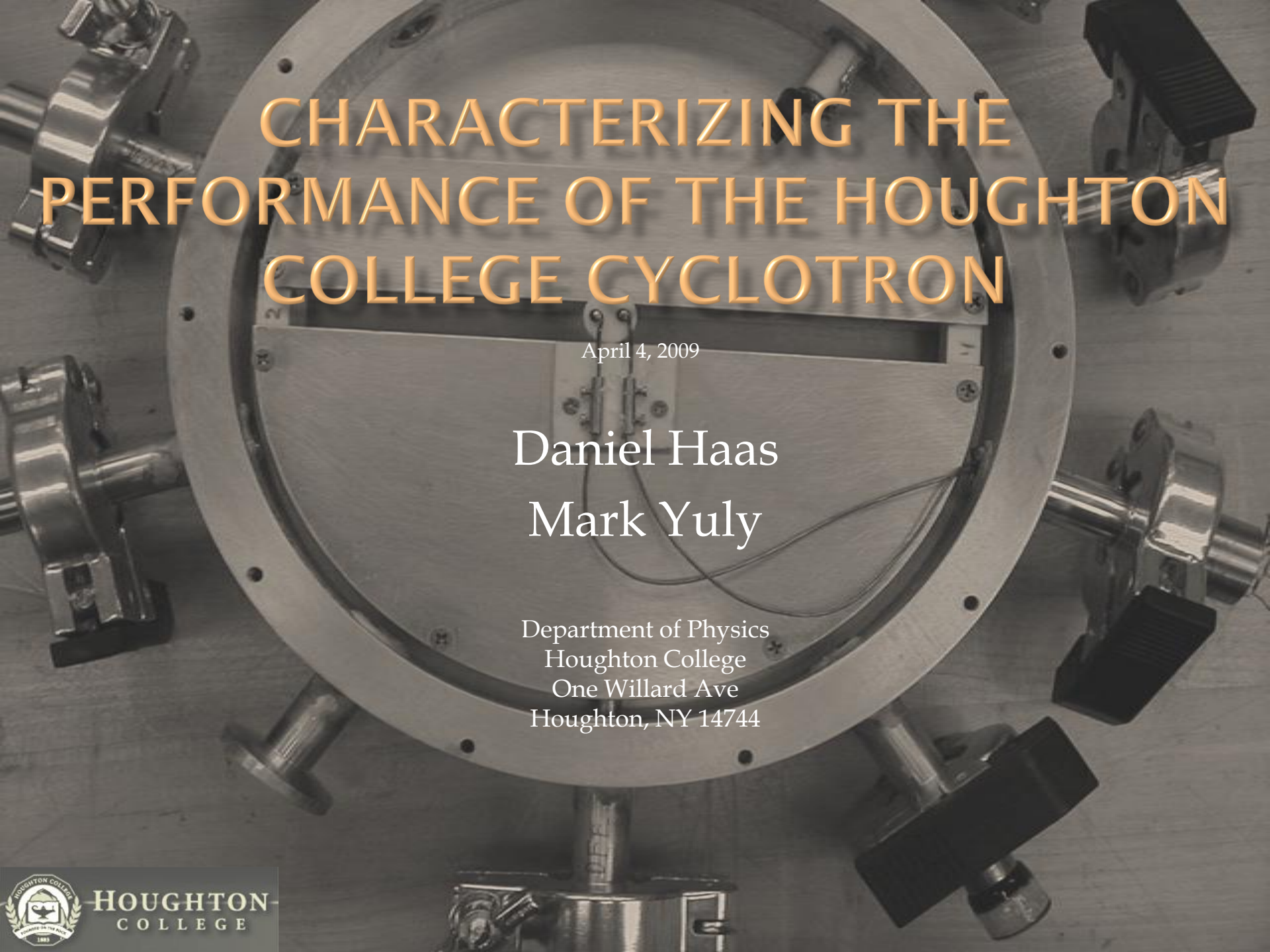


CHARACTERIZING THE PERFORMANCE OF THE HOUGHTON COLLEGE CYCLOTRON

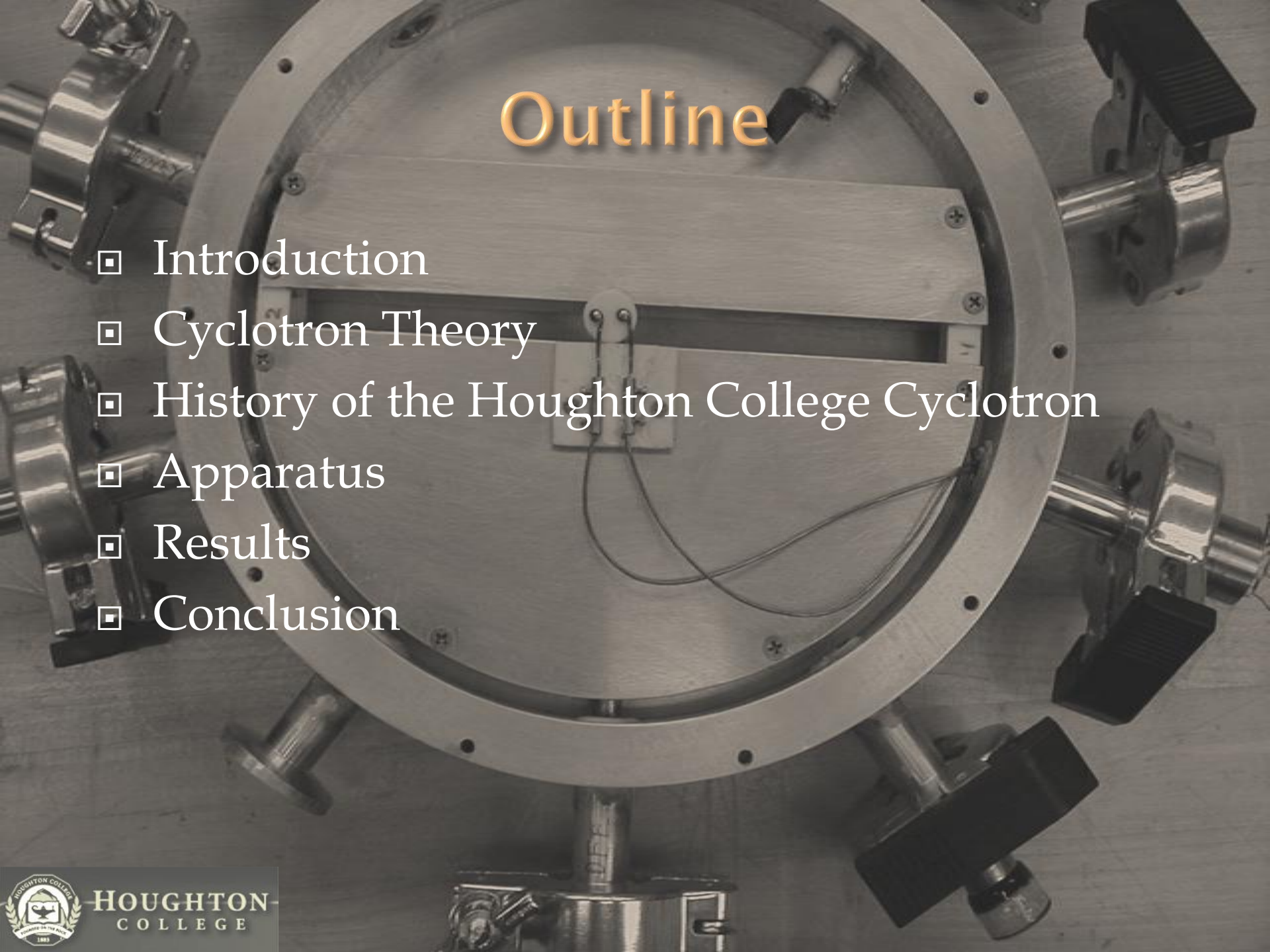
April 4, 2009

Daniel Haas

Mark Yuly

Department of Physics
Houghton College
One Willard Ave
Houghton, NY 14744

HOUGHTON COLLEGE

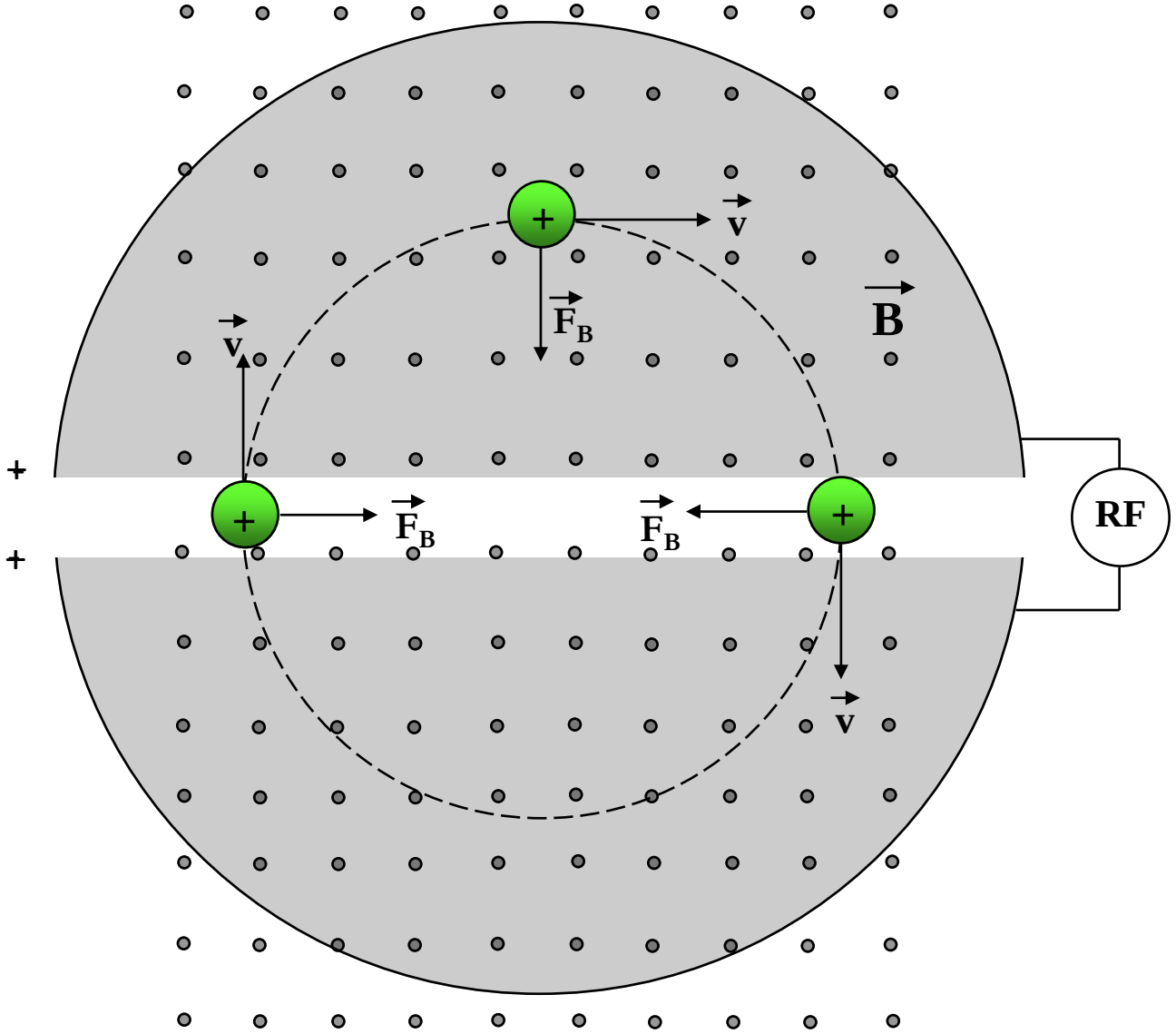


Outline

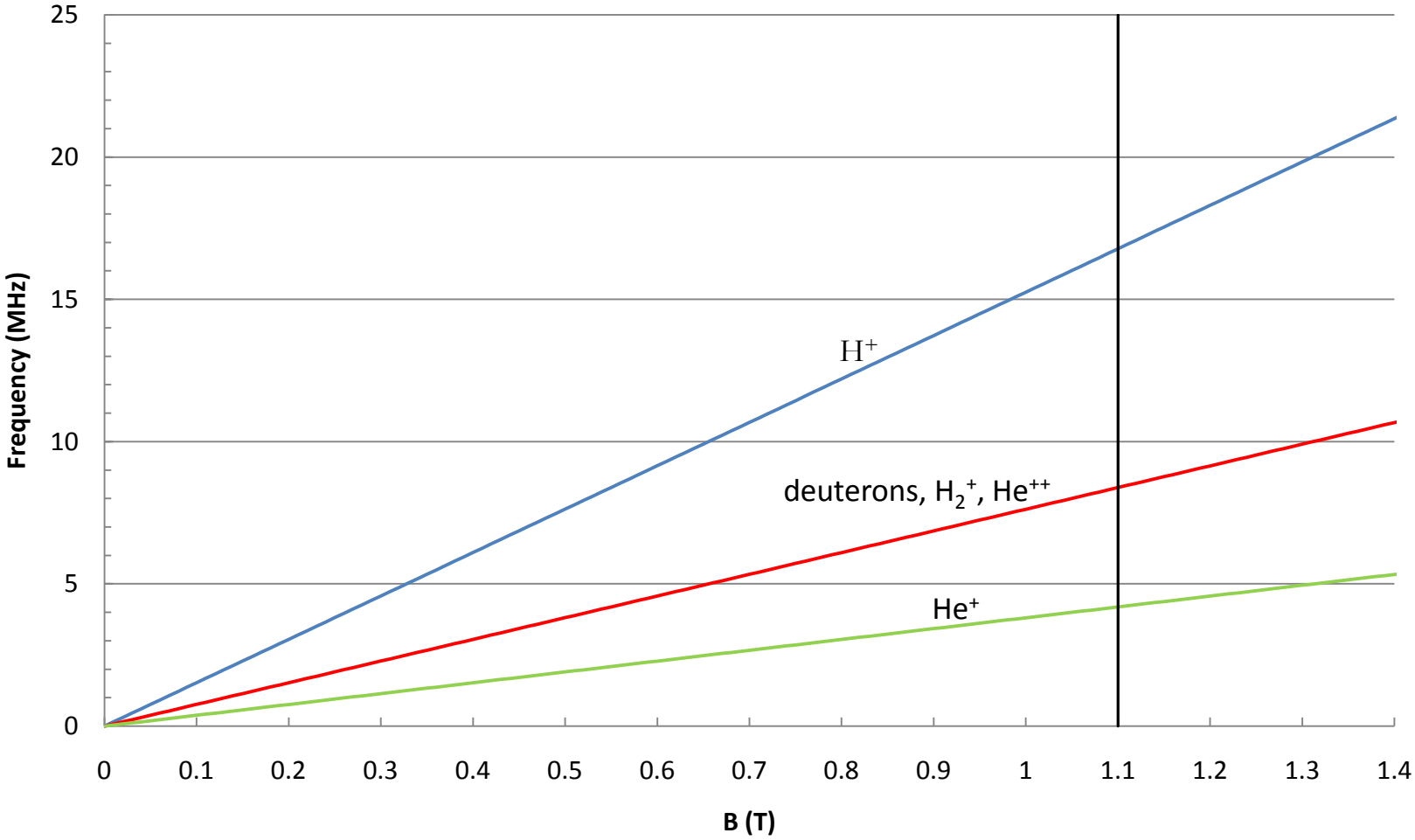
- Introduction
- Cyclotron Theory
- History of the Houghton College Cyclotron
- Apparatus
- Results
- Conclusion

HOUGHTON COLLEGE

Operating Principles

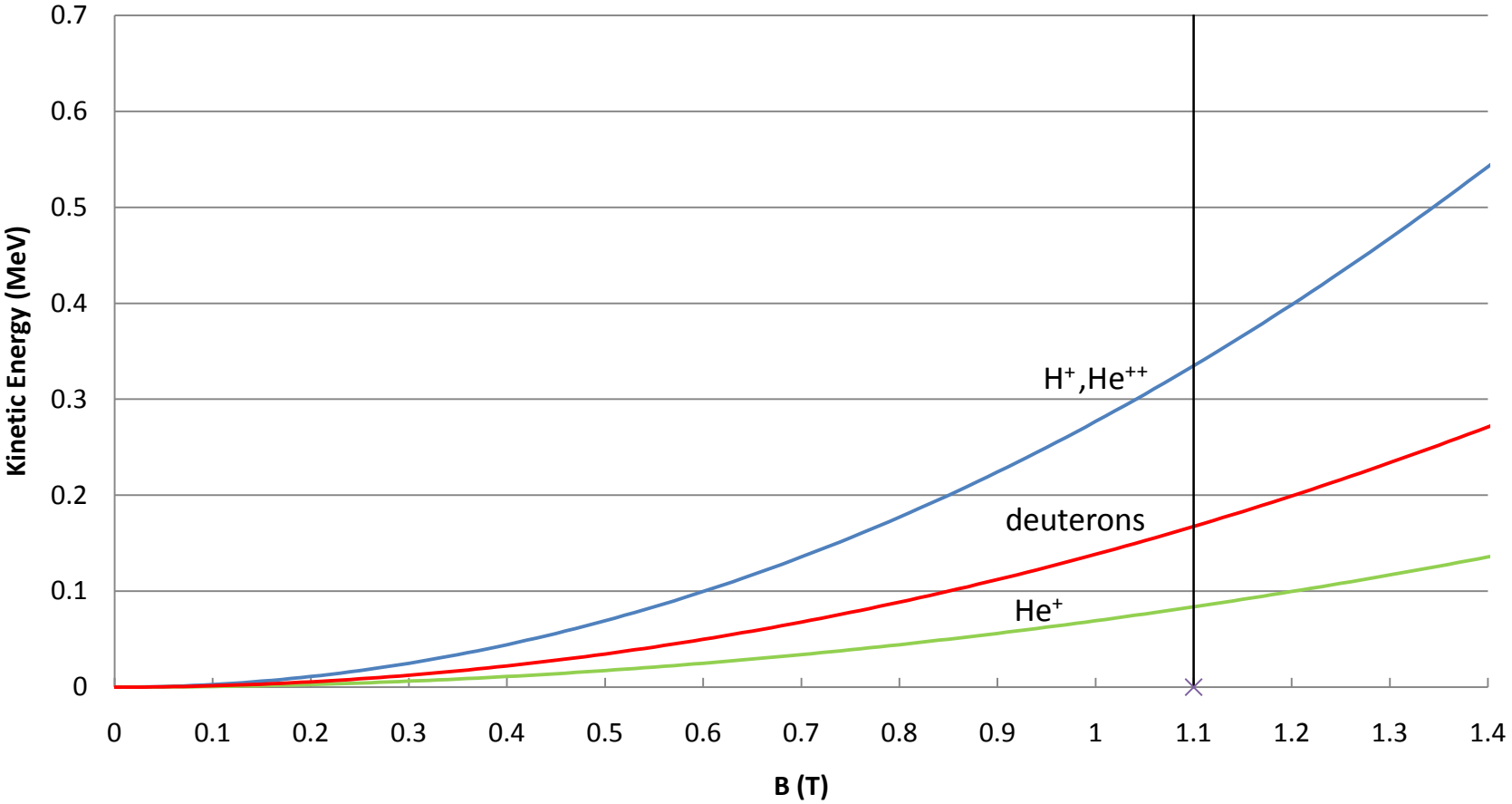


Cyclotron Frequency

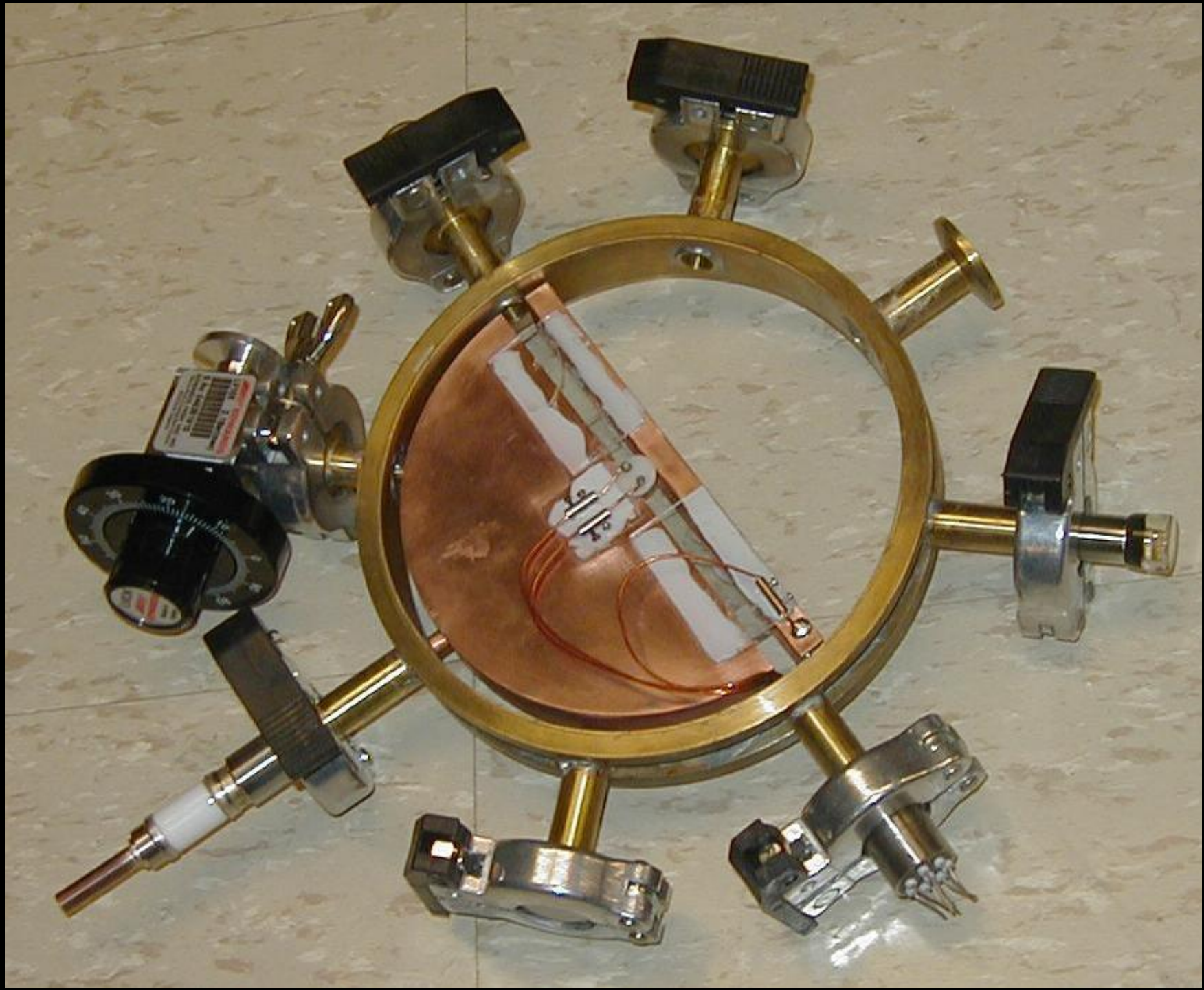


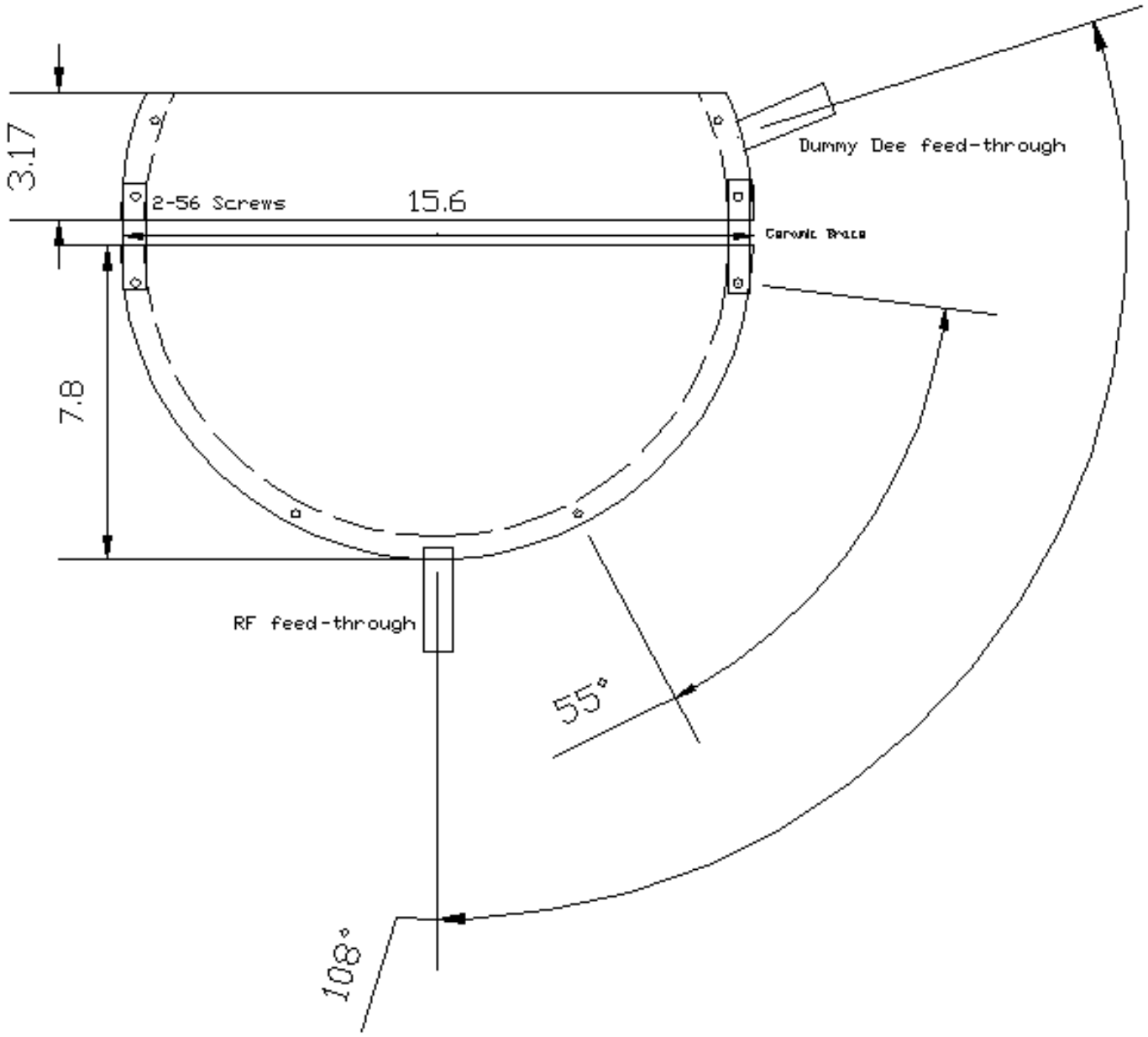
$$f = \frac{1}{2\pi}\left(\frac{q}{m}\right)B$$

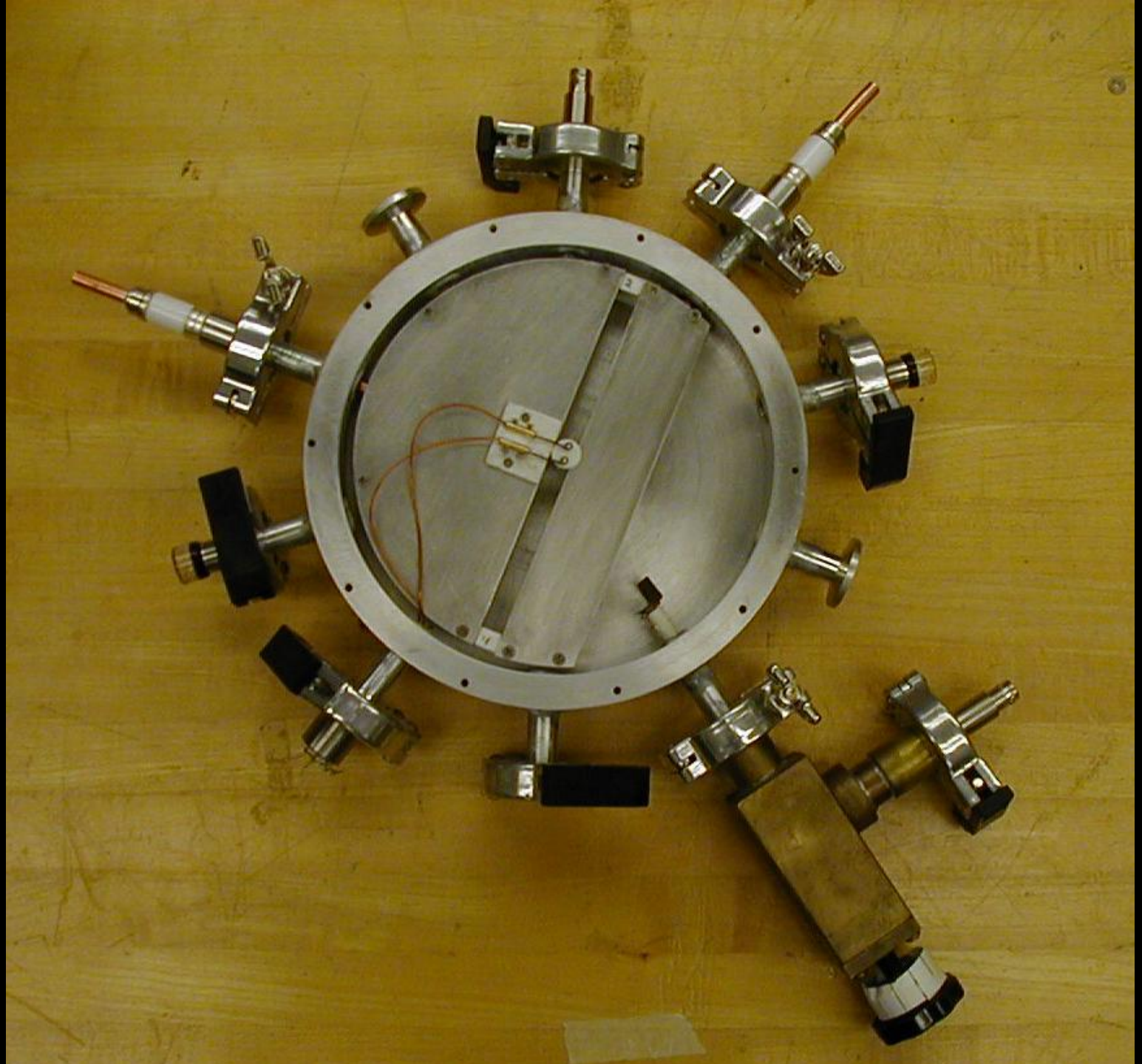
Cyclotron Energy

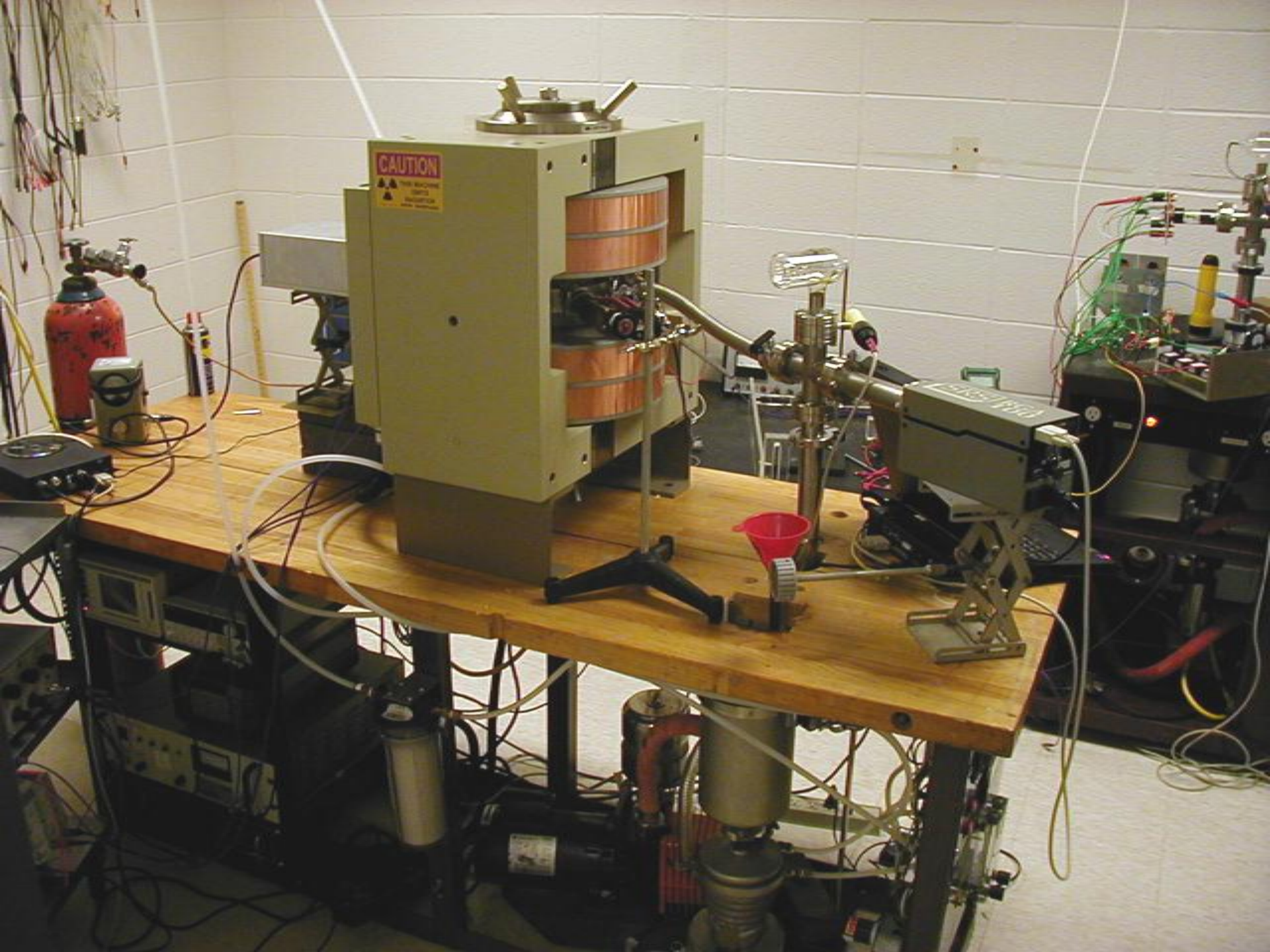


$$T = \frac{q^2 B^2 r^2}{2m}$$

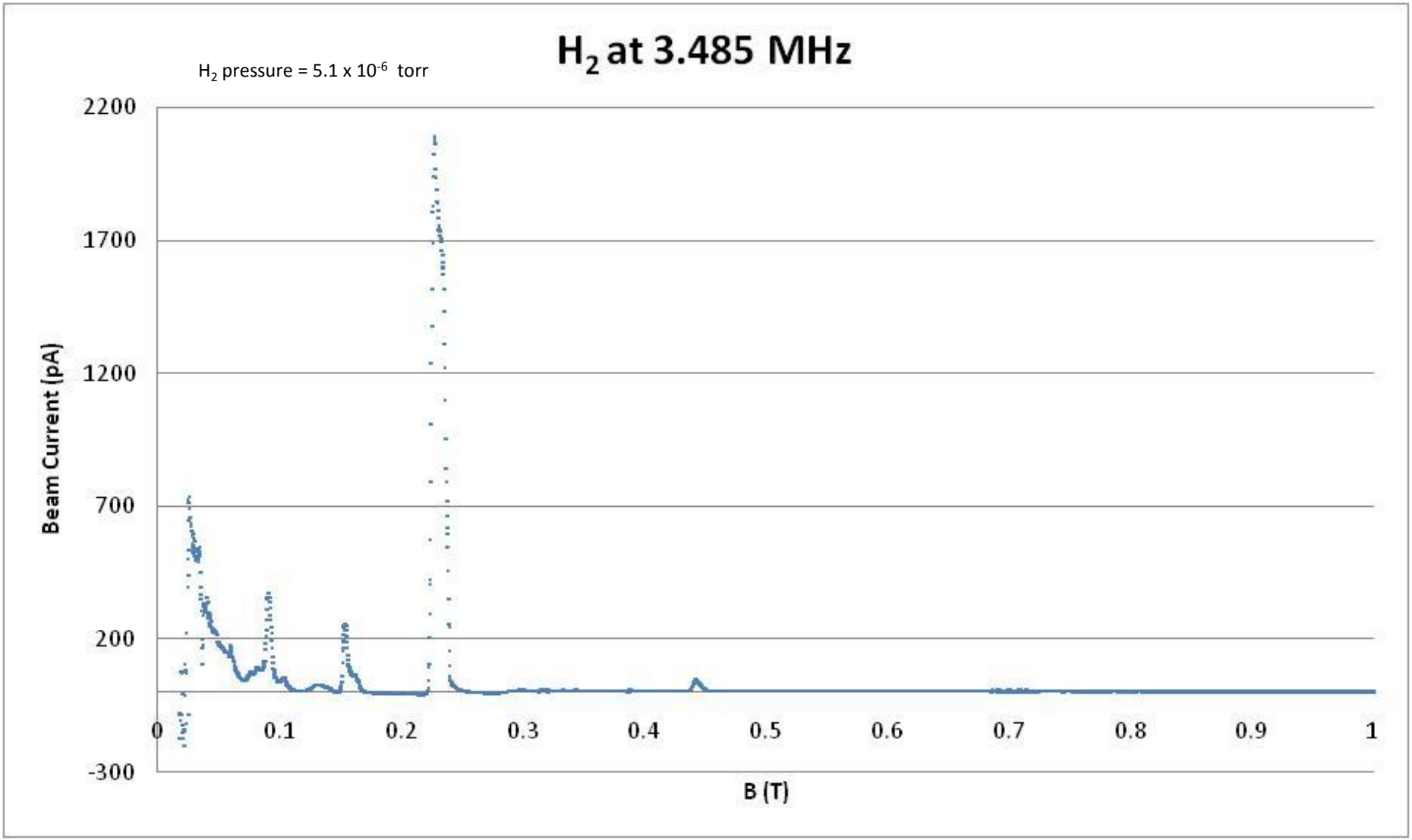



3.17
2-56 Screws
15.6
Ceramic Brace
Dummy Dee feed-through
7.8
RF feed-through
55°
108°

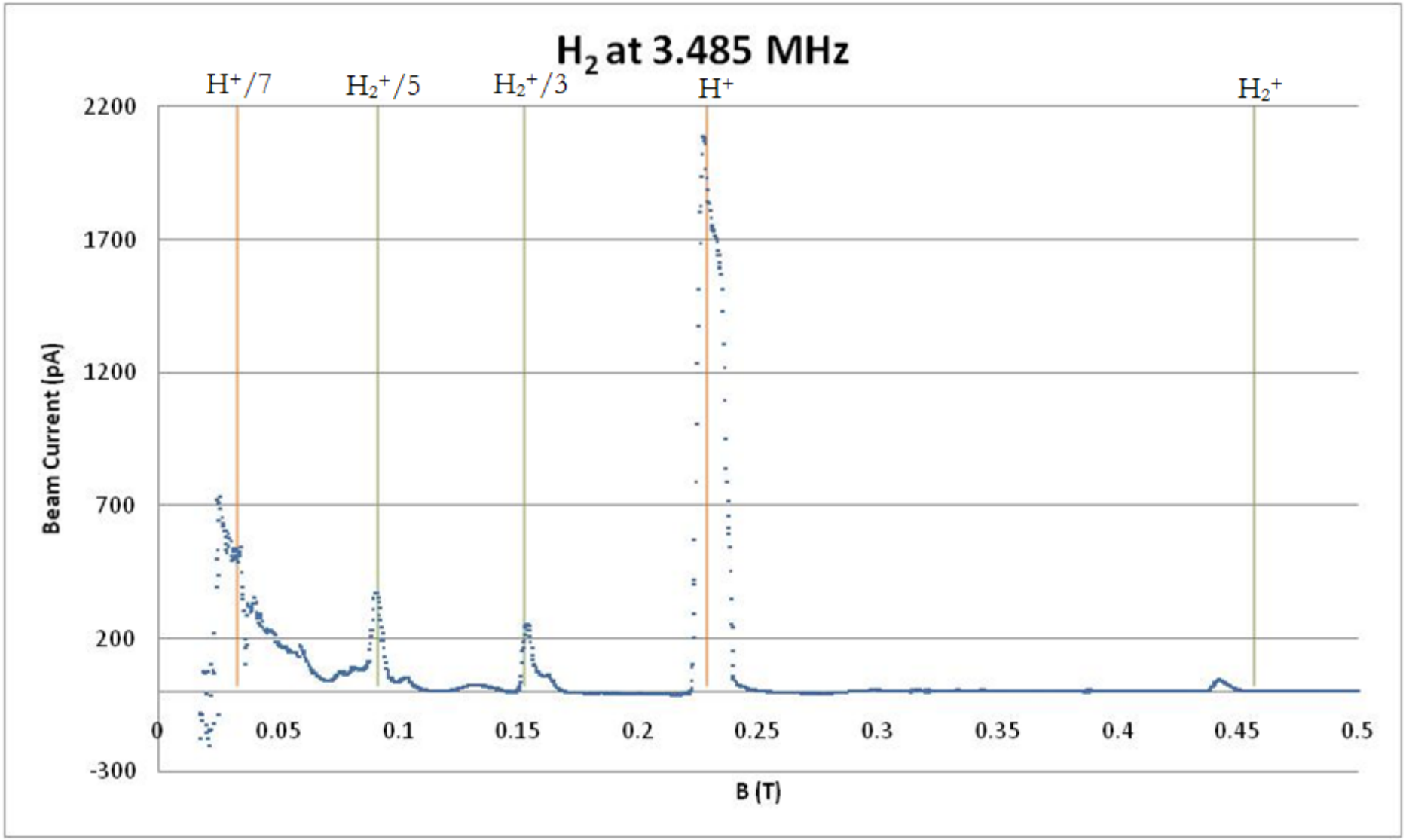



CAUTION

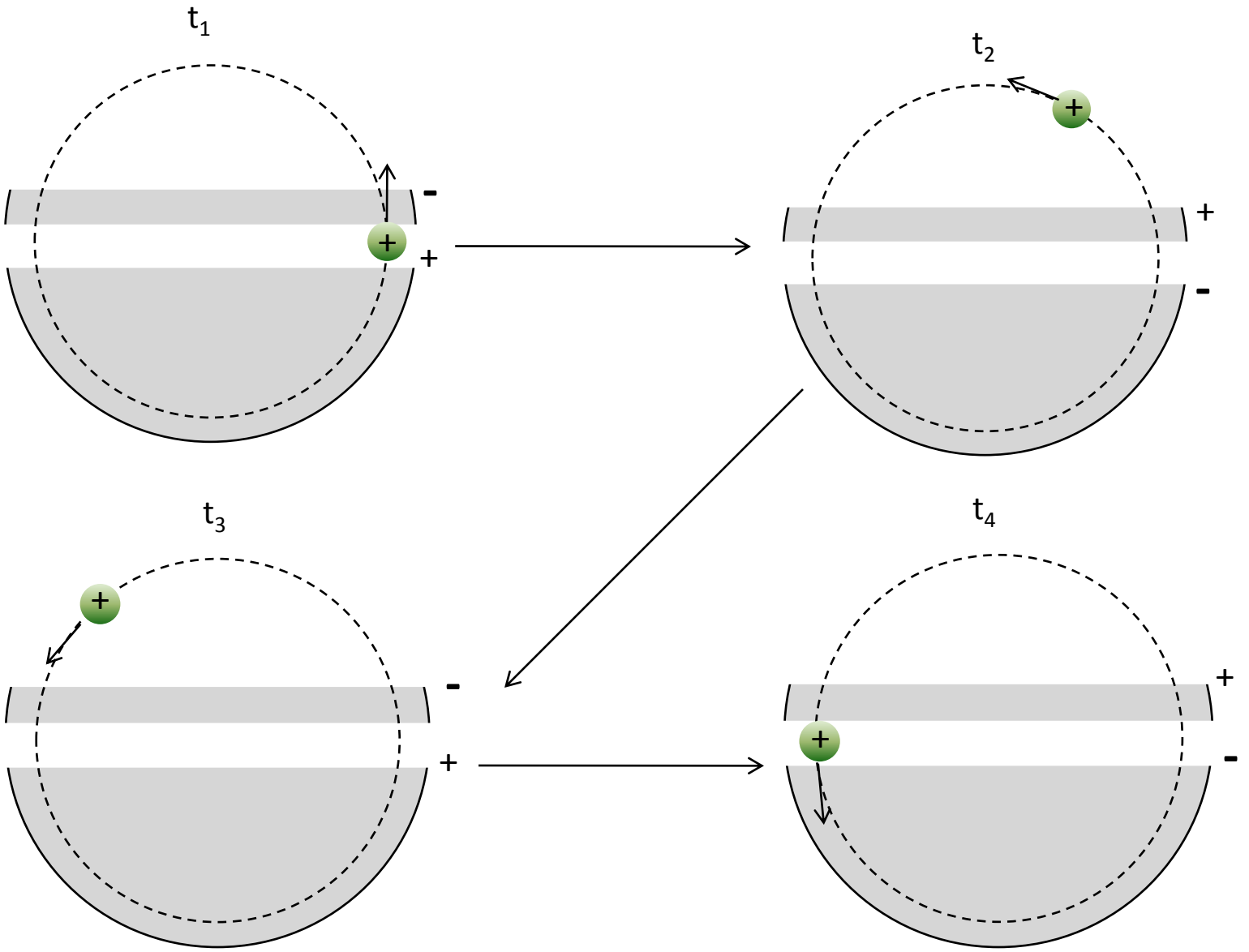
Results


H_2 at 3.485 MHz
H_2 pressure = 5.1 x 10^{-6} torr
Beam Current (pA)
2200
1700
1200
700
200
-300
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
B (T)

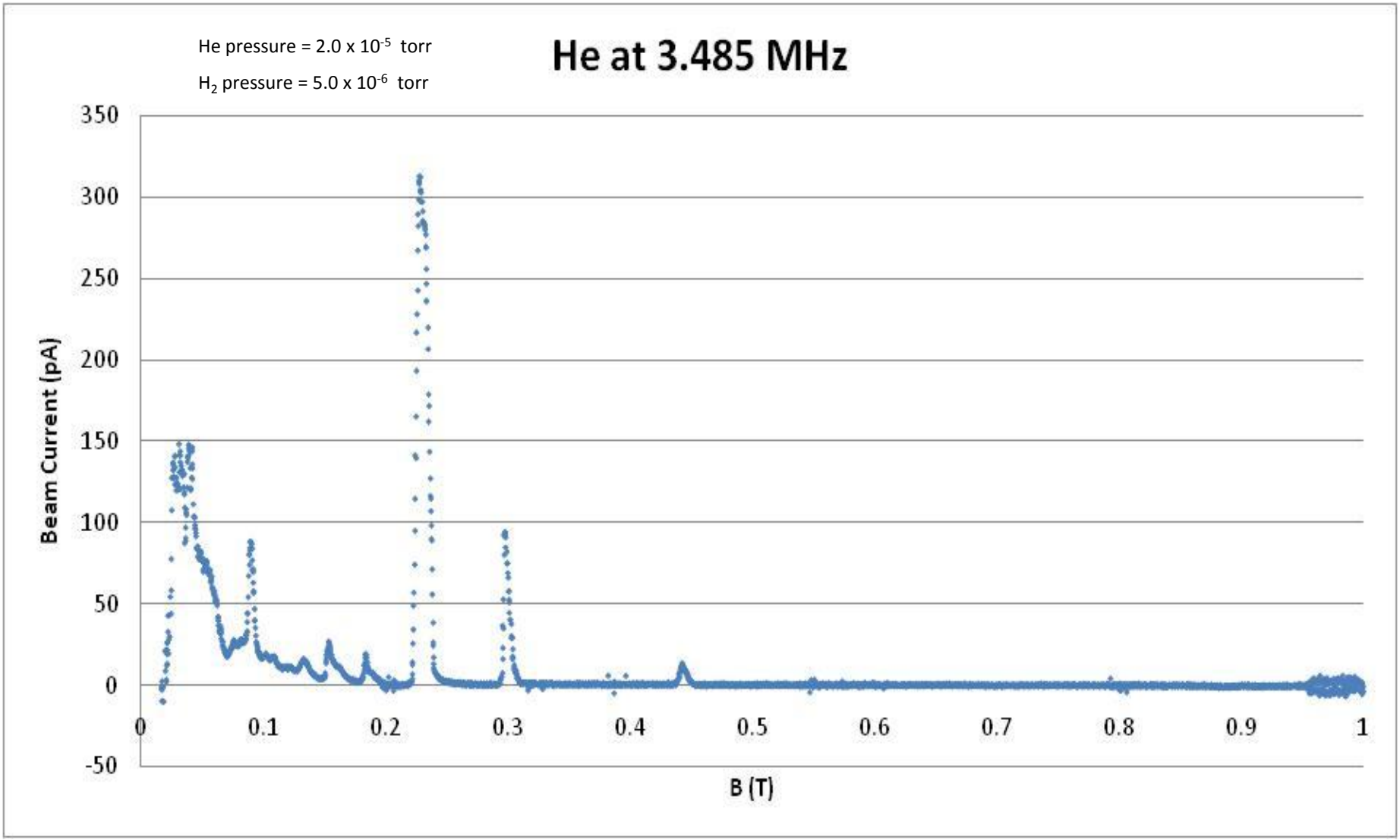
Results


H2 at 3.485 MHz
H+/7
H2+/5
H2+/3
H+
H2+
2200
1700
1200
700
200
-300
Beam Current (pA)
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
B (T)

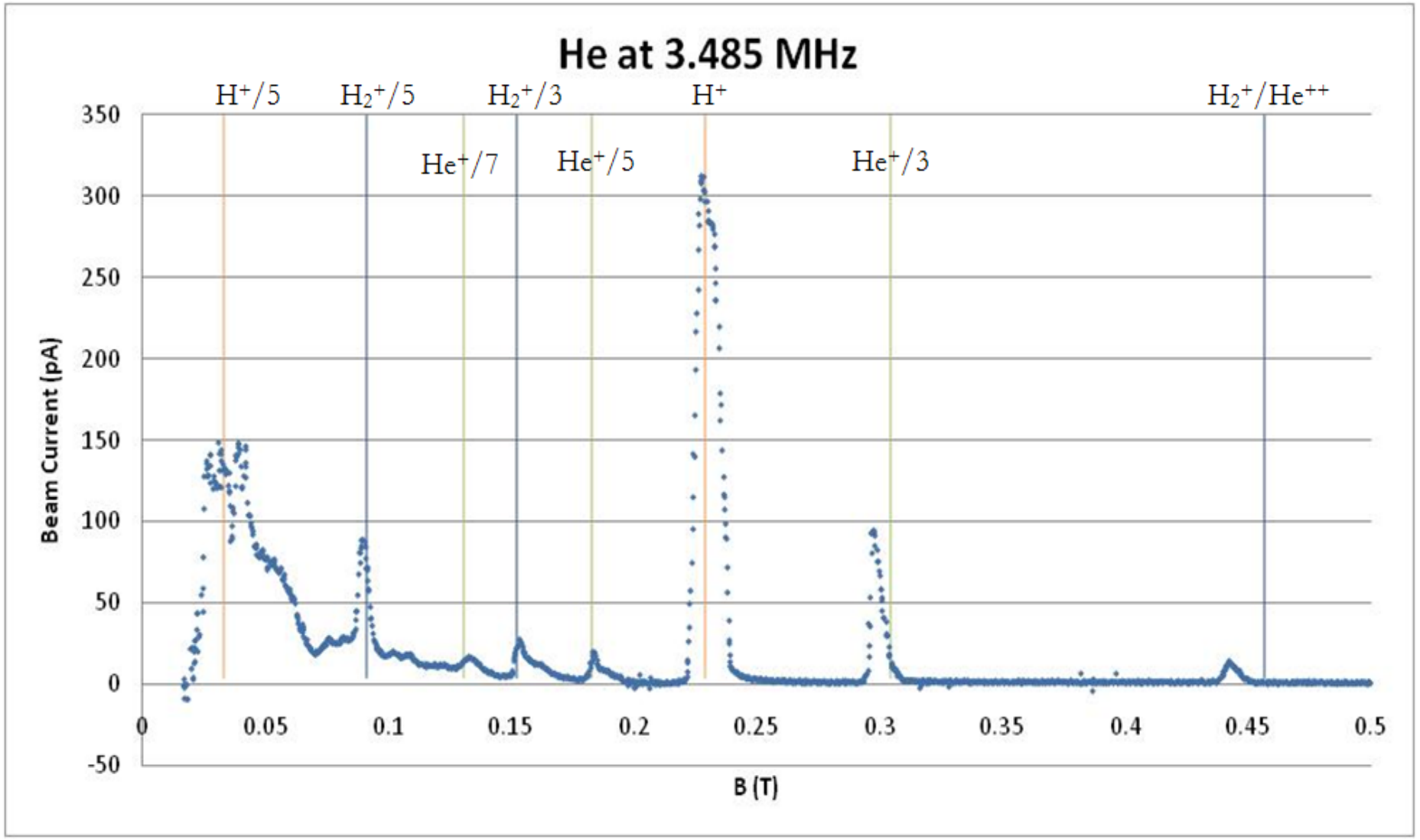
Harmonic Peaks

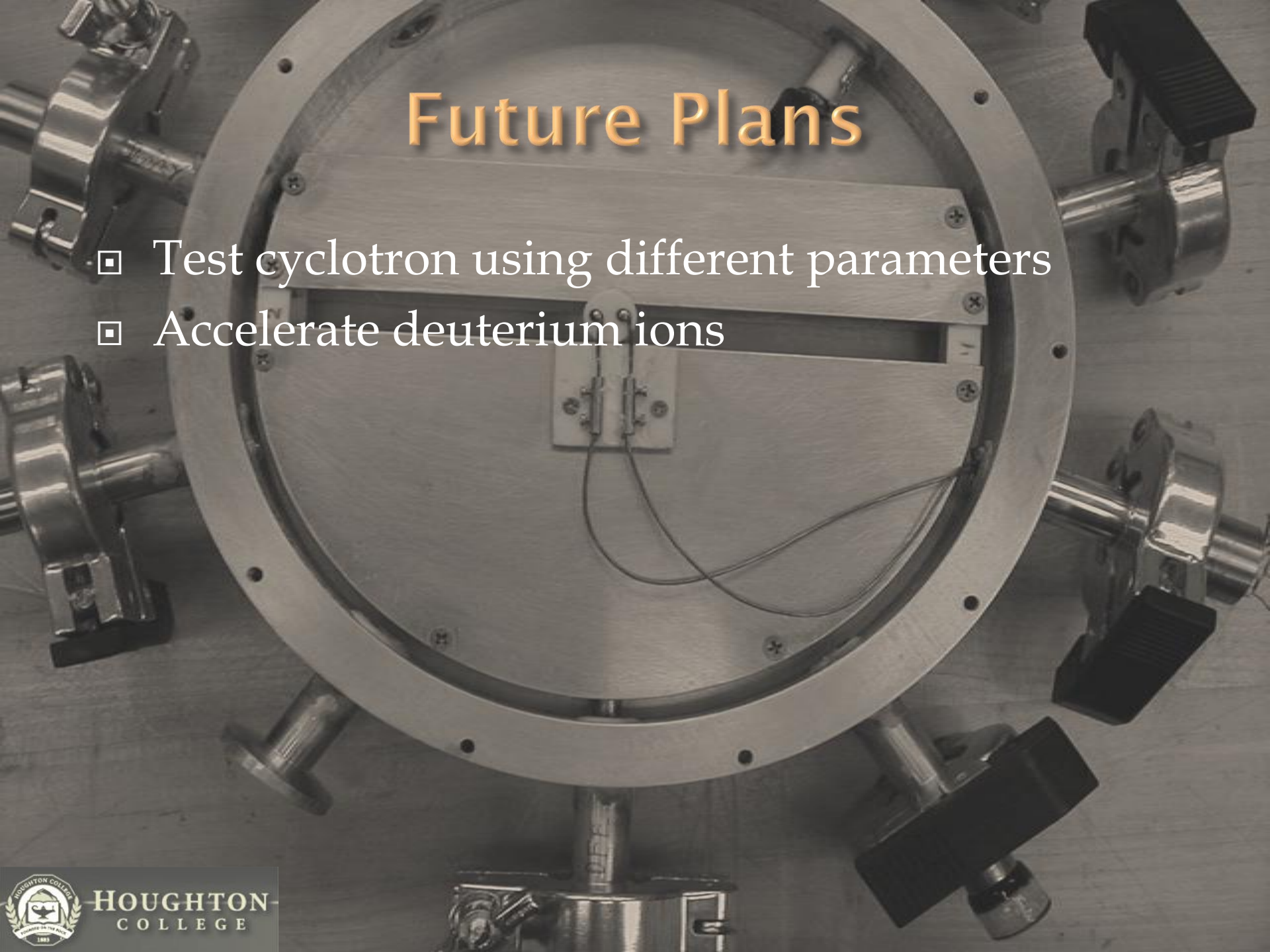


Results


He pressure = 2.0 x 10-5 torr
H2 pressure = 5.0 x 10-6 torr
He at 3.485 MHz
Beam Current (pA)
350
300
250
200
150
100
50
0
-50
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
B (T)

Results


He at 3.485 MHz
H+/5
H2+/5
H2+/3
H+
H2+/He++
He+/7
He+/5
He+/3
Beam Current (pA)
350
300
250
200
150
100
50
0
-50
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
B (T)



Future Plans

- Test cyclotron using different parameters
- Accelerate deuterium ions

HOUGHTON COLLEGE