Relativity: Fact or Fiction?

Relativistic Dynamics

MIT Department of Physics
11/9/21

Vedang Lad

Partner: Bryan Sperry

Home > Engineering > Materials Engineering > Anisotropic

Preprint | PDF Available

Proof that the Ether exists and that the speed of light is anisotropic

April 2019

Project: Classical Unification of Relativity and Quantum Mechanics

Authors:

Declan Traill

Preprints and early-stage research may not have been peer reviewed yet.

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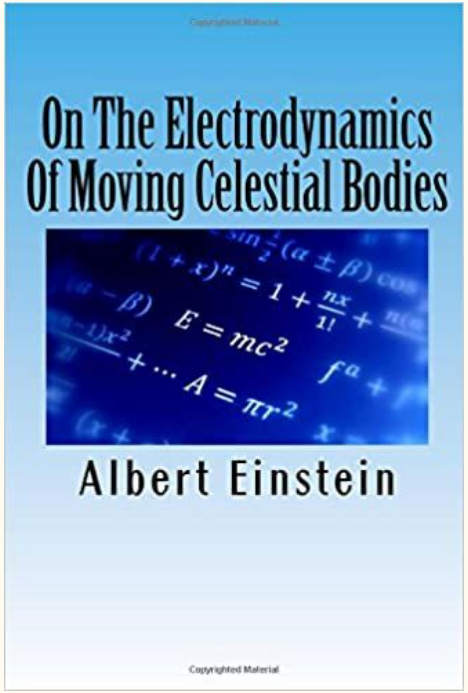
The Aether Field Exists, and We have Proof

ETHER 🌀 The ETHER exists, a simple experiment you can do

https://www.researchgate.net/publication/332556237_Proof_that_the_Ether_exists_and_that_the_speed_of_light_is_anisotropic
https://www.youtube.com/watch?v=eDSrIsvNLsM
https://www.youtube.com/watch?v=g_loyzL9Wi4

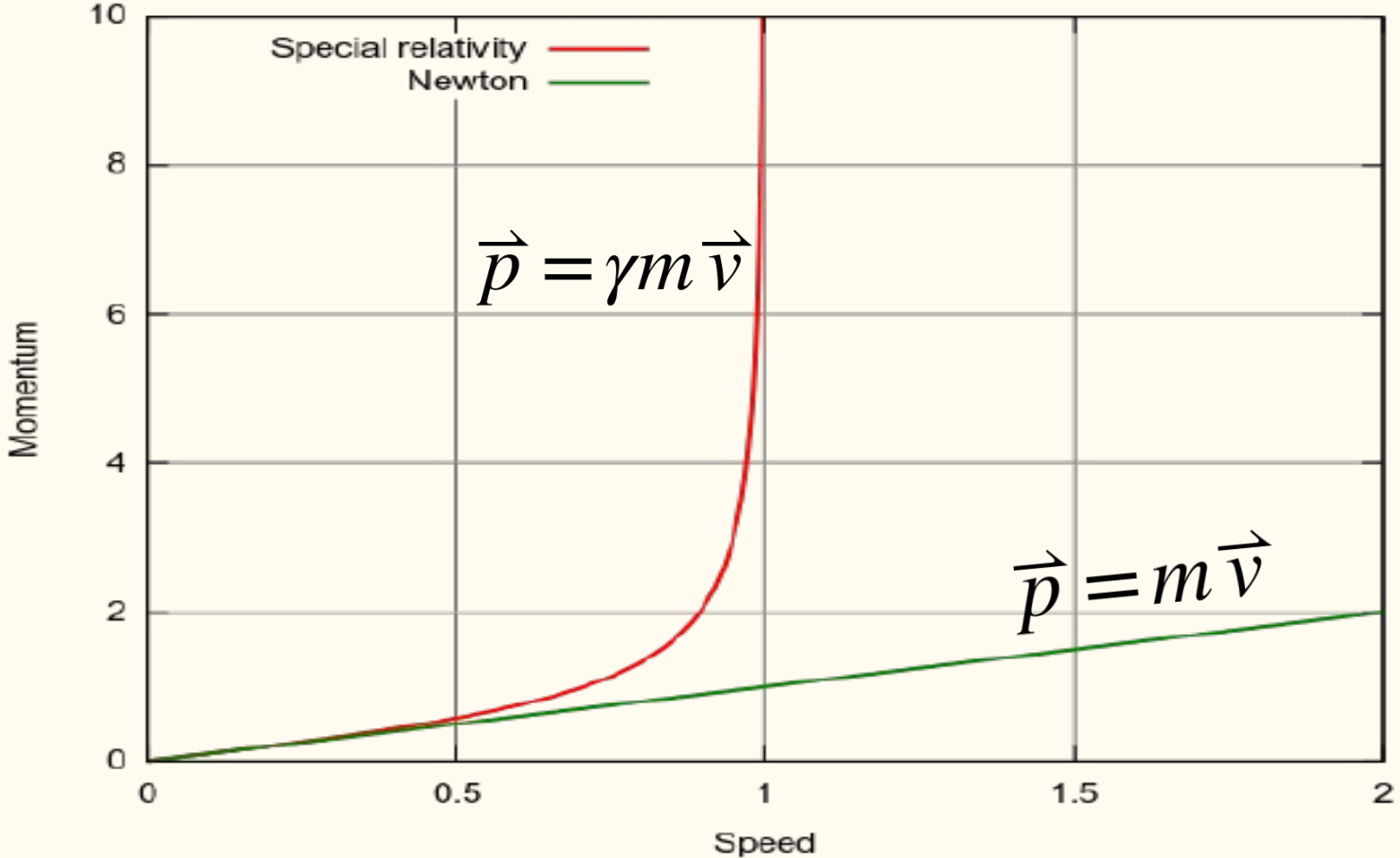
Where did it all begin?

- 1900-1910
  - Energy, momentum, velocity
- Contradictions Newtonian and Maxwell
- Where is the “aether”?
- “the electrodynamics of moving bodies”



https://images-na.ssl-images-amazon.com/images/I/51VkYS2iMyL._SX331_BO1,204,203,200_.jpg

Classical and Relativistic Corrections



$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$$

Goal

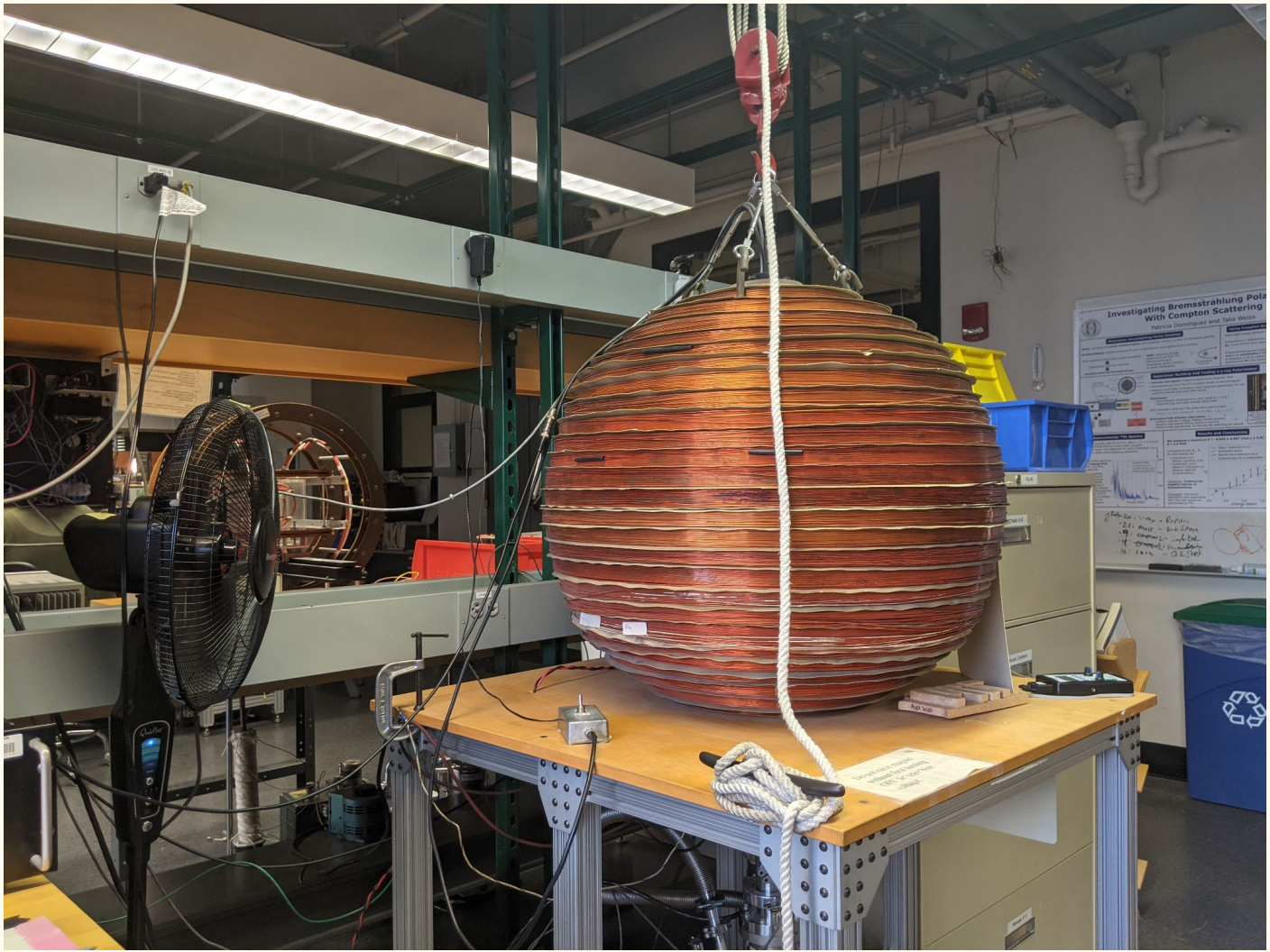
Make measurements of the velocity, momentum, energy of something moving **fast!**

- Compare relativistic and non-relativistic models

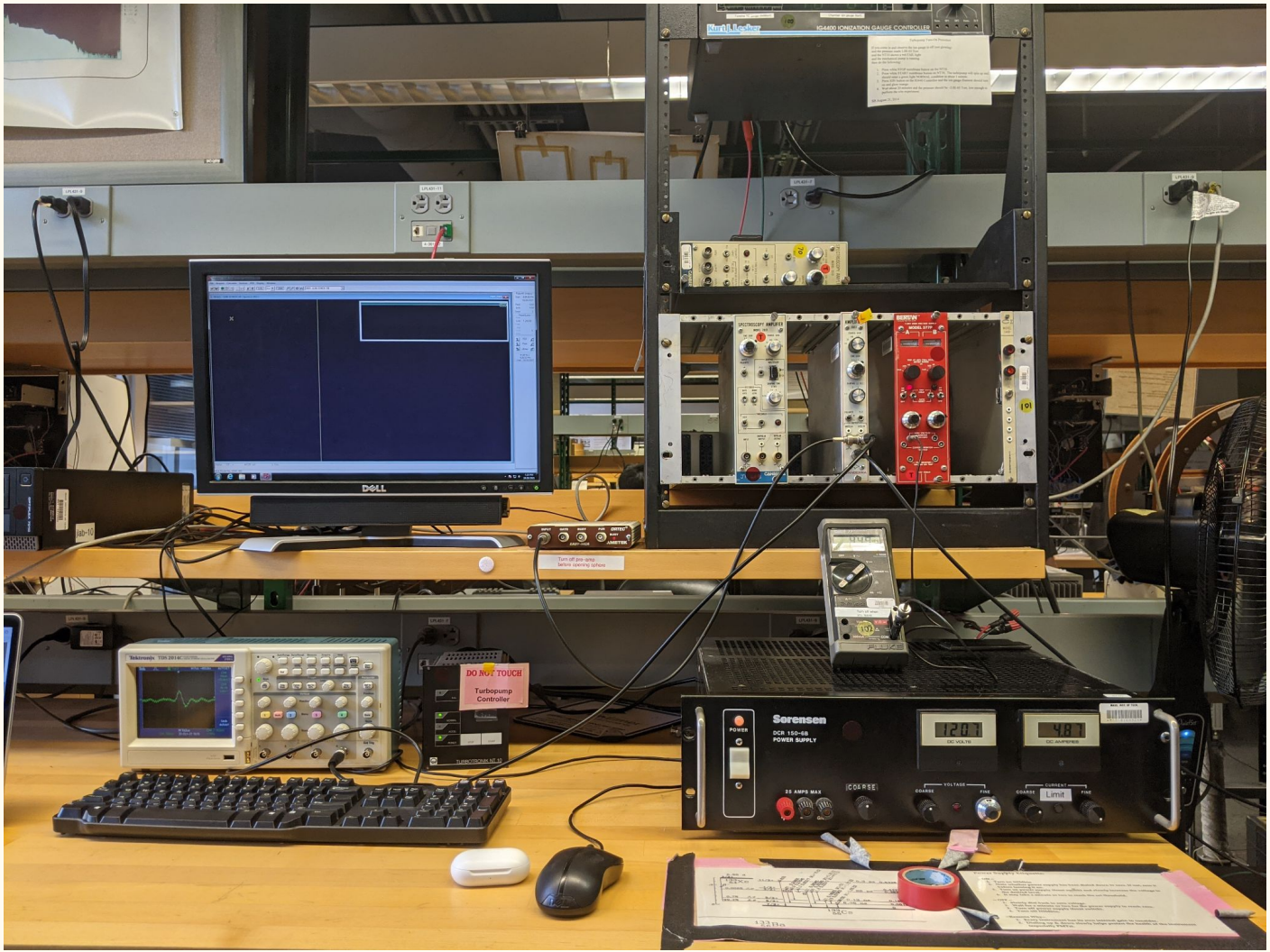
What moves **fast**? Runner? Light? Electrons!

https://www.nist.gov/si-redefinition/kelvin-boltzmann-constant
https://phys.org/news/2013-07-accurate-boltzmann-constant.html

Set Up


Investigating Bremsstrahlung Pola
With Compton Scattering

Set Up


DO NOT TOUCH
Turbopump Controller
Sorensen
DCR 150-6B
POWER SUPPLY
DELL

My Goal

Determine “central voltage”

My Goal

Determine “central voltage”

Extract charge-mass relationship

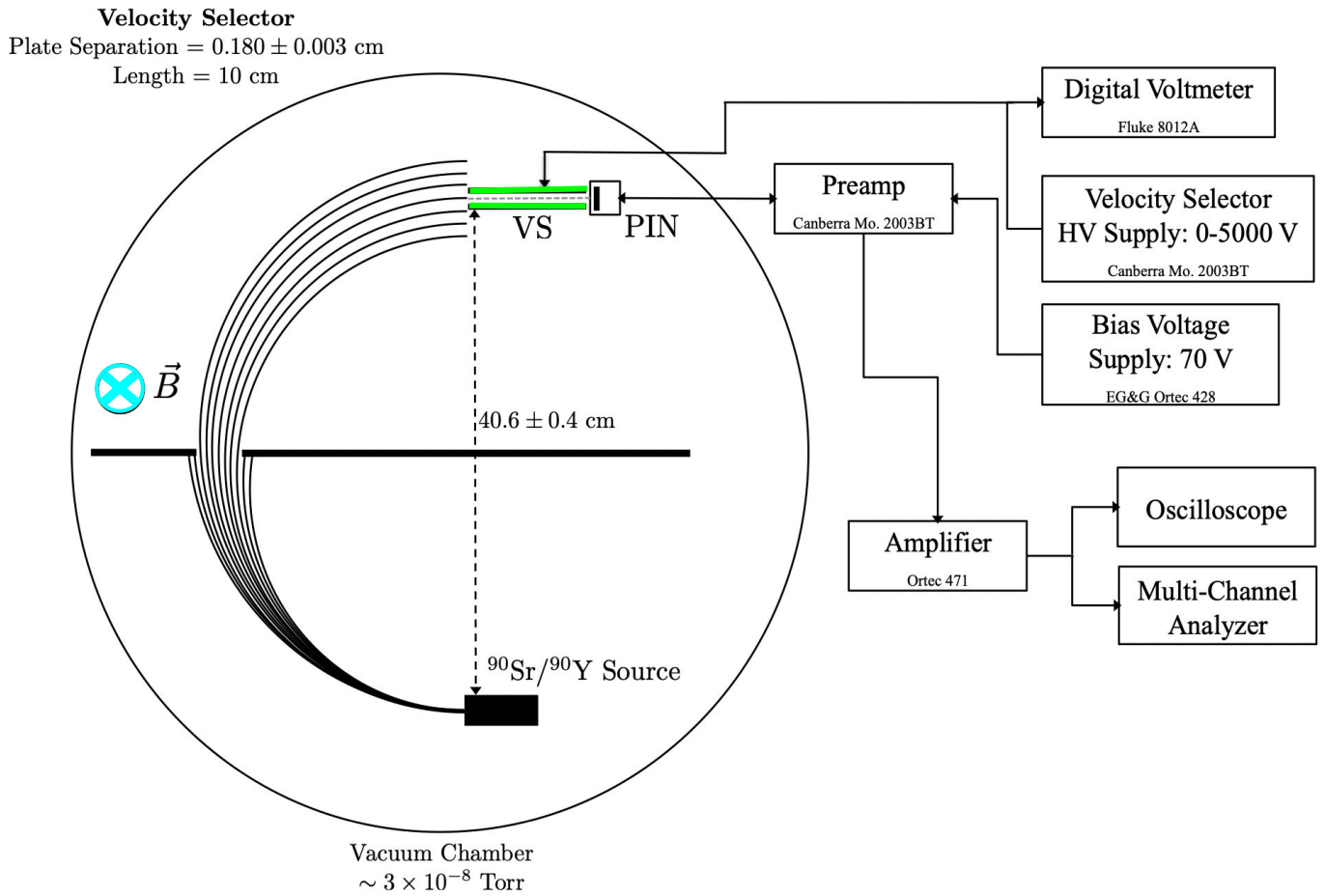
My Goal

Determine “central voltage”

Extract charge-mass relationship

Does relativity make sense?

Set Up


Velocity Selector
Plate Separation = 0.180 ± 0.003 cm
Length = 10 cm
VS
PIN
$\vec{B}$
40.6 ± 0.4 cm
^{90}Sr/^{90}Y Source
Vacuum Chamber
~ 3 × 10^{-8} Torr
Digital Voltmeter
Fluke 8012A
Preamp
Canberra Mo. 2003BT
Velocity Selector
HV Supply: 0-5000 V
Canberra Mo. 2003BT
Bias Voltage
Supply: 70 V
EG&G Ortec 428
Amplifier
Ortec 471
Oscilloscope
Multi-Channel
Analyzer

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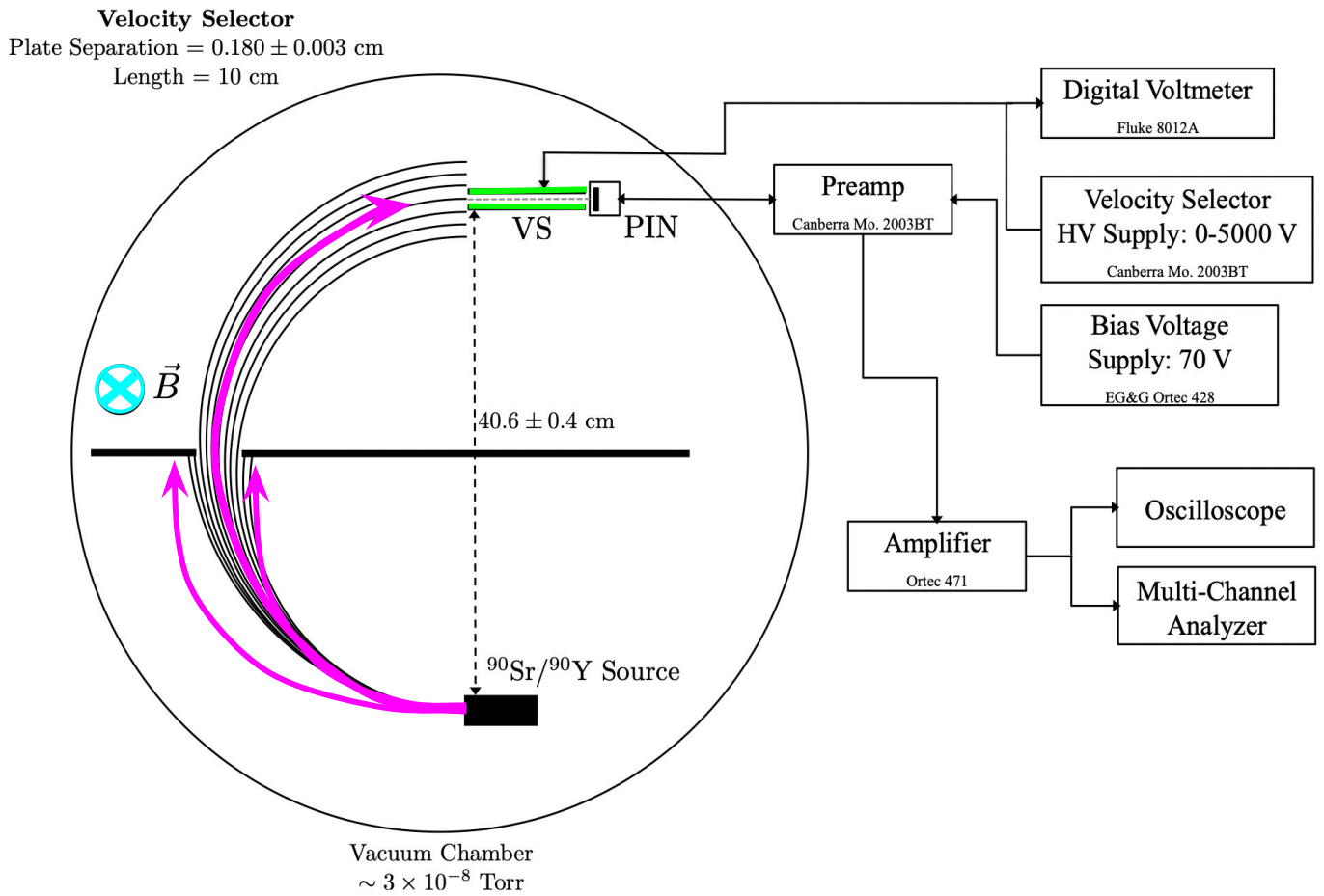
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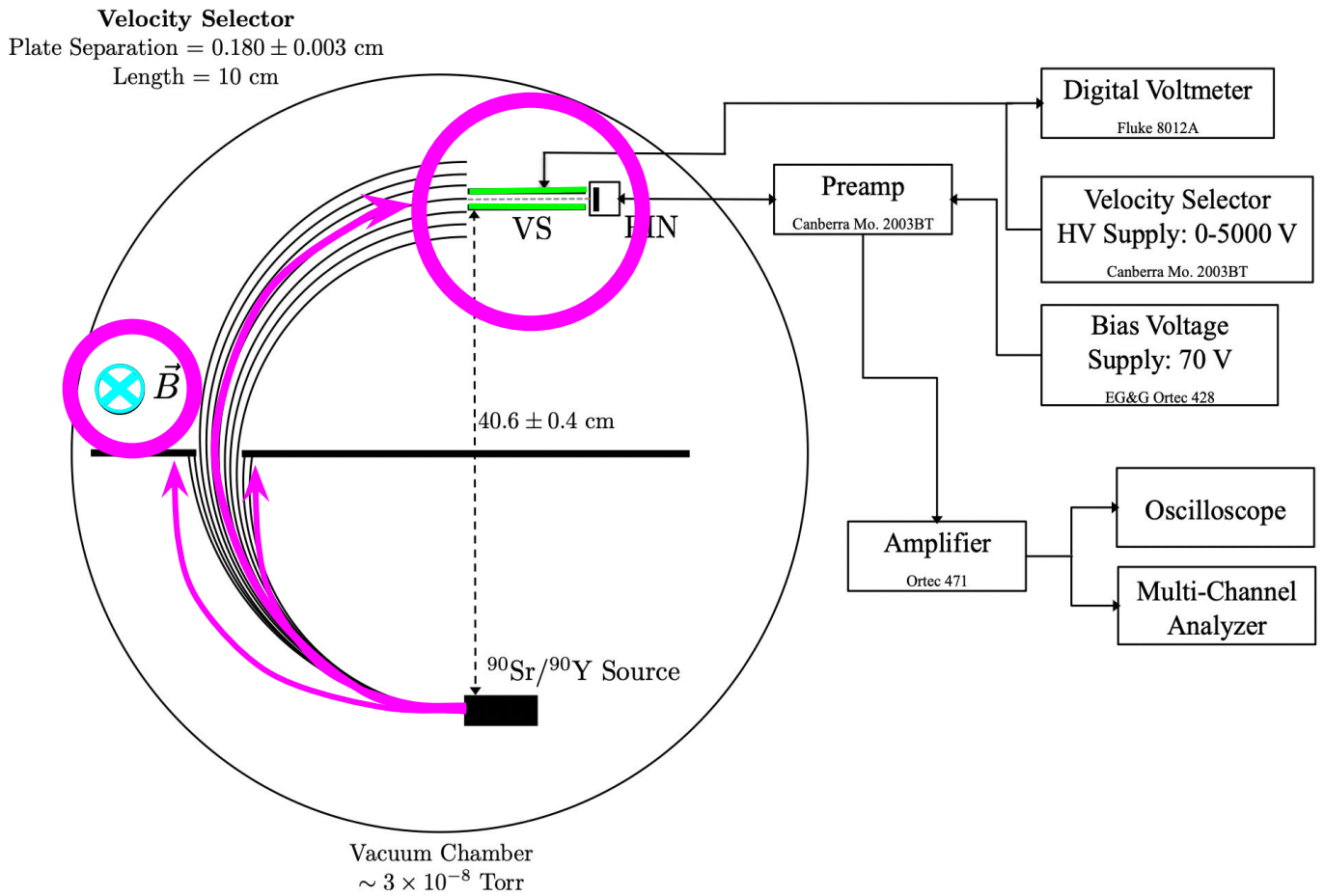
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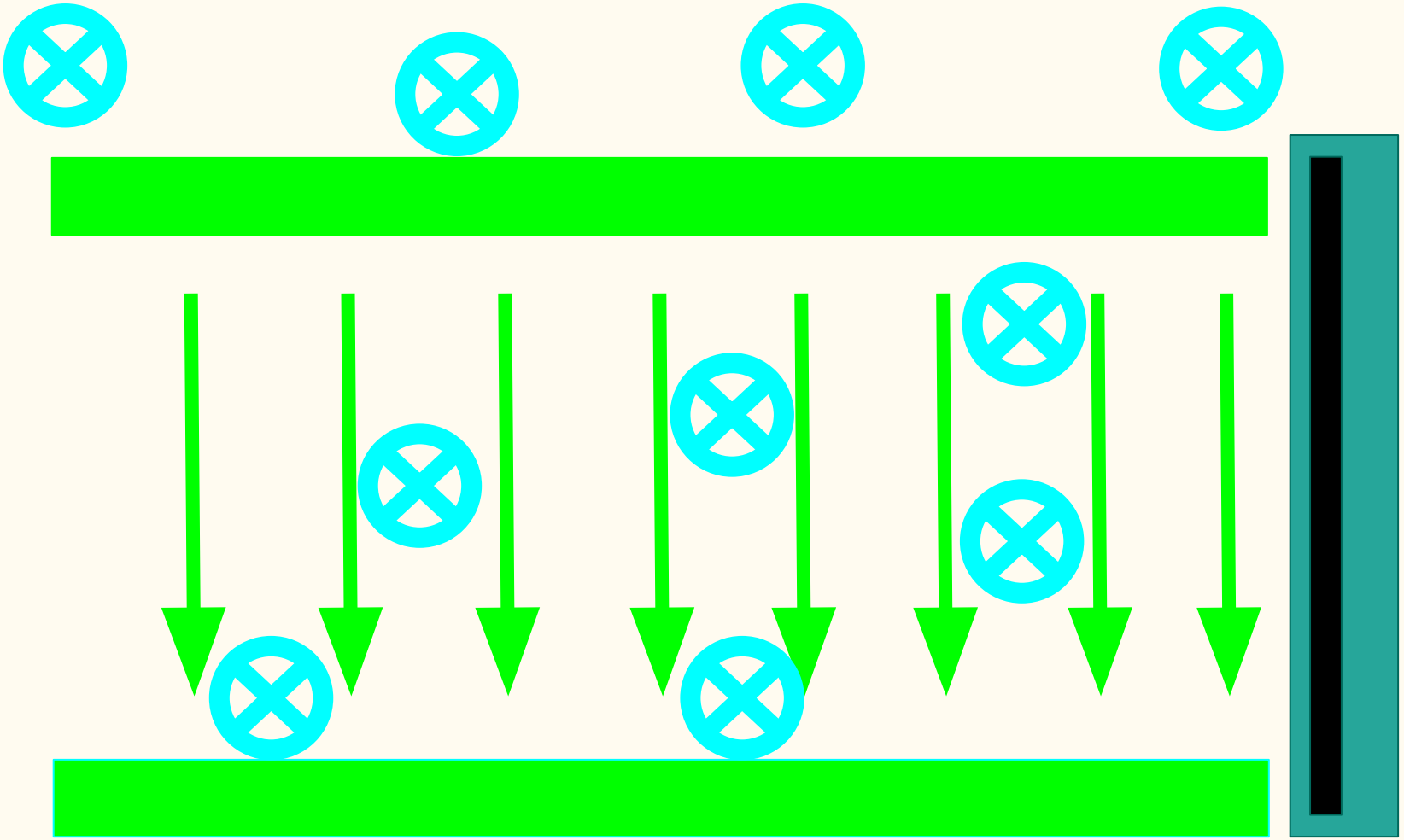
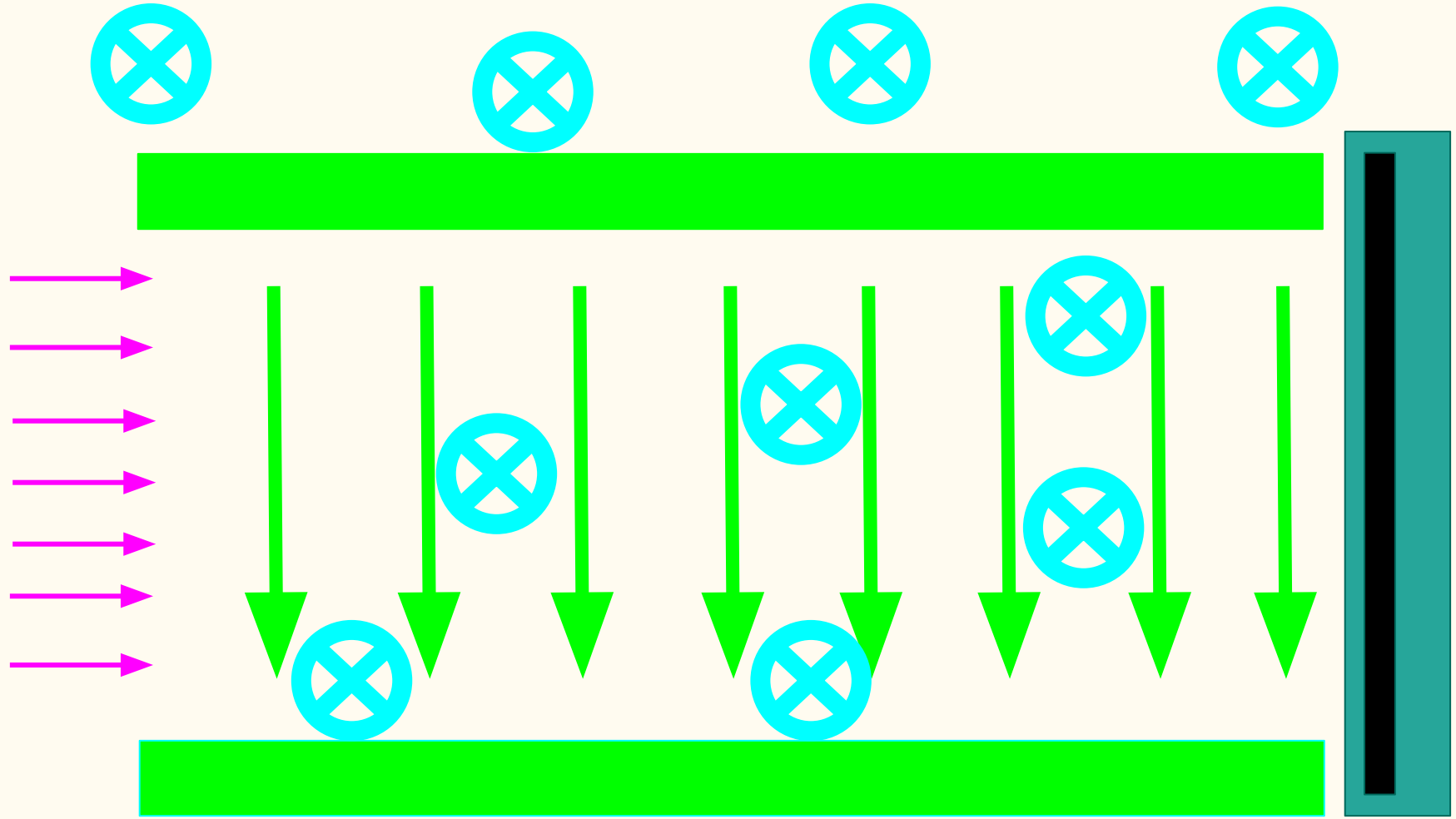
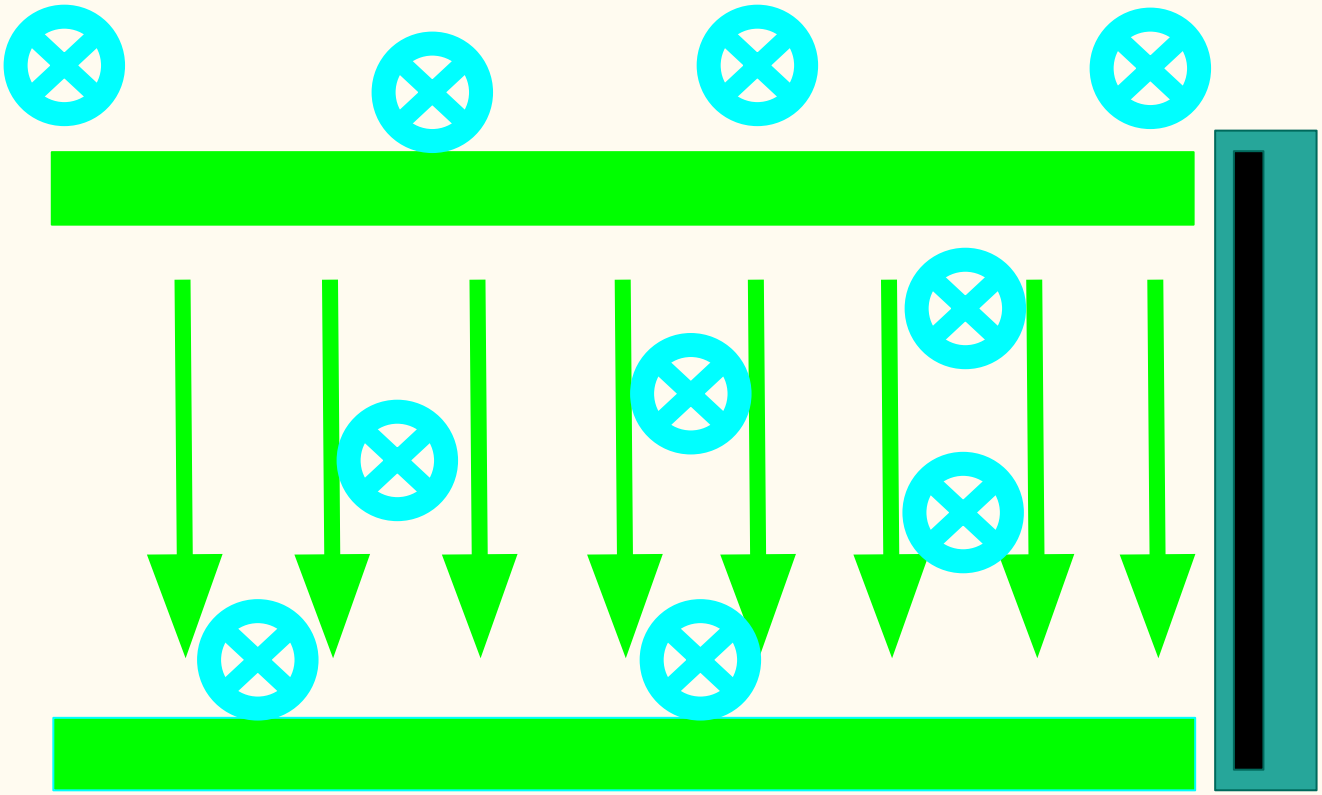
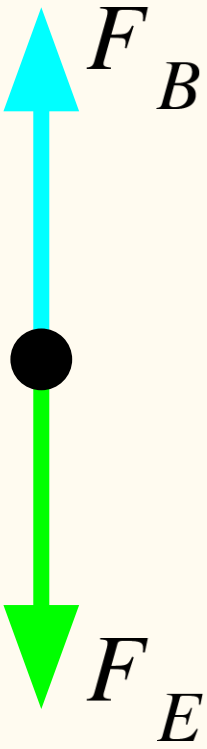
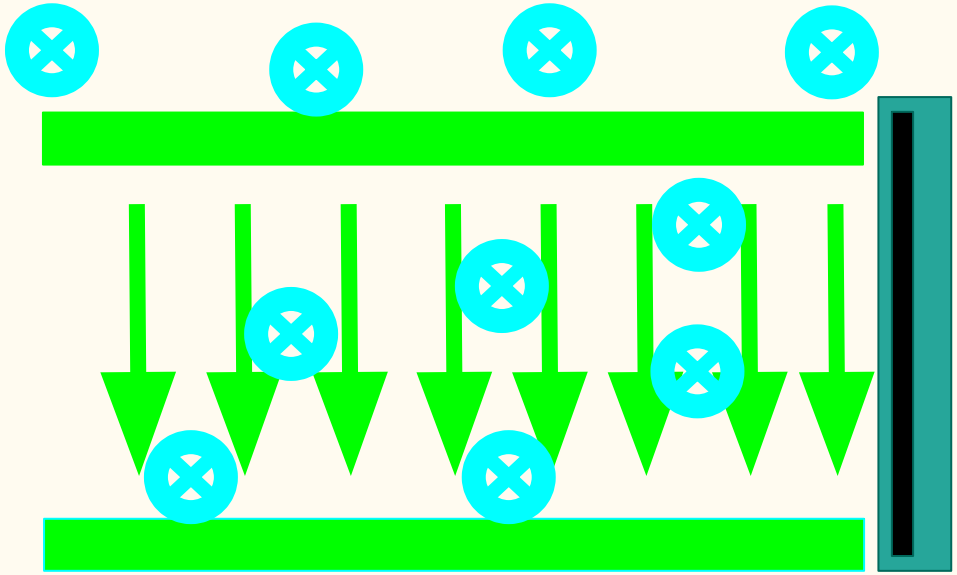
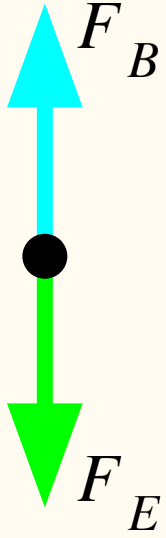







F_B
F_E





$$\vec{F}_E - \vec{F}_B = 0$$

$$e\vec{E} - \frac{e\vec{v}\vec{B}}{c} = 0$$

$$\vec{v} = \frac{\vec{E}c}{\vec{B}}$$

What voltage between the velocity selector plates make the electric and magnetic force cancel?

Determining the central voltage for different magnetic fields

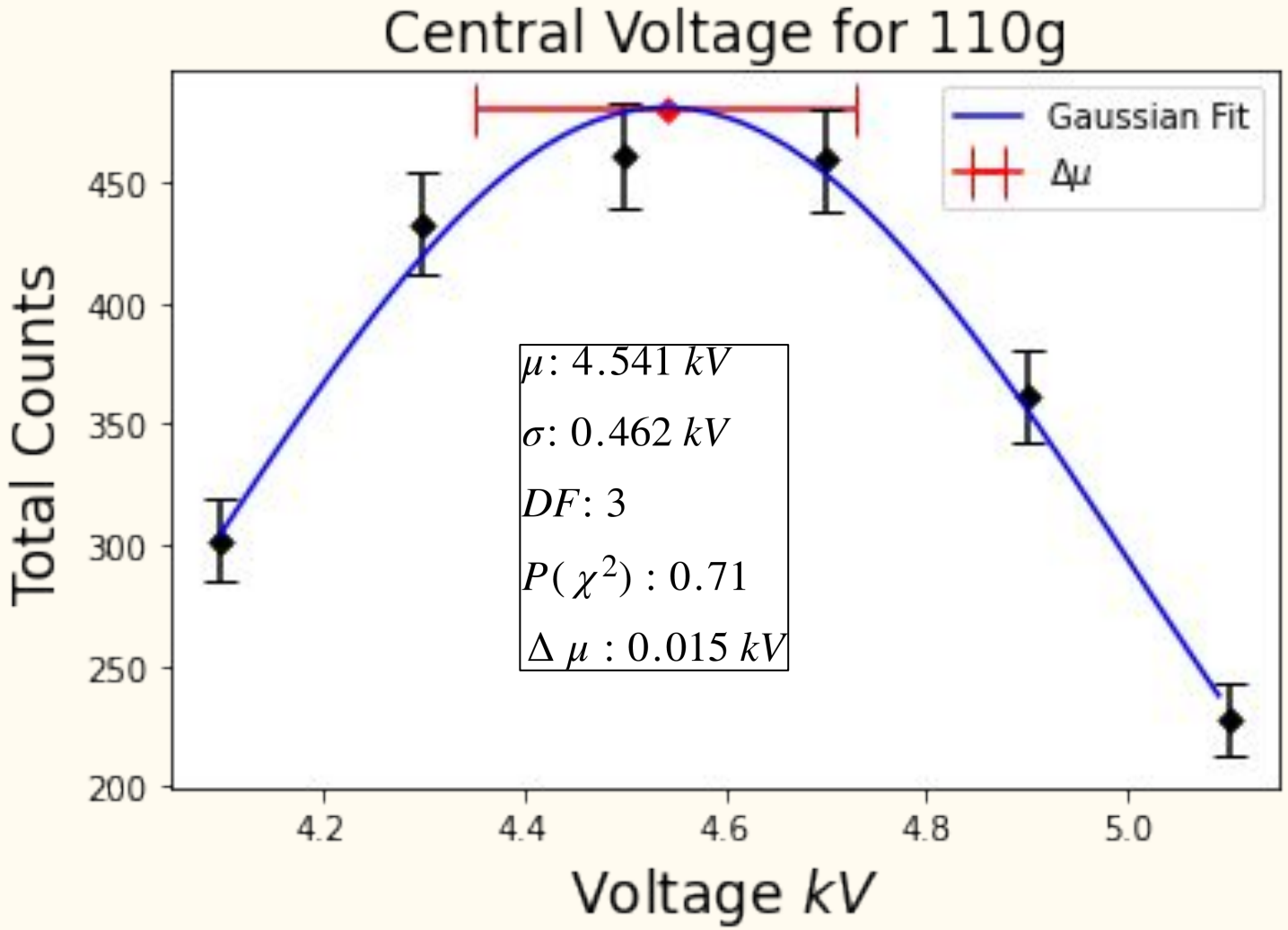
80 G 90 G 95 G 100 G 105 G 110 G

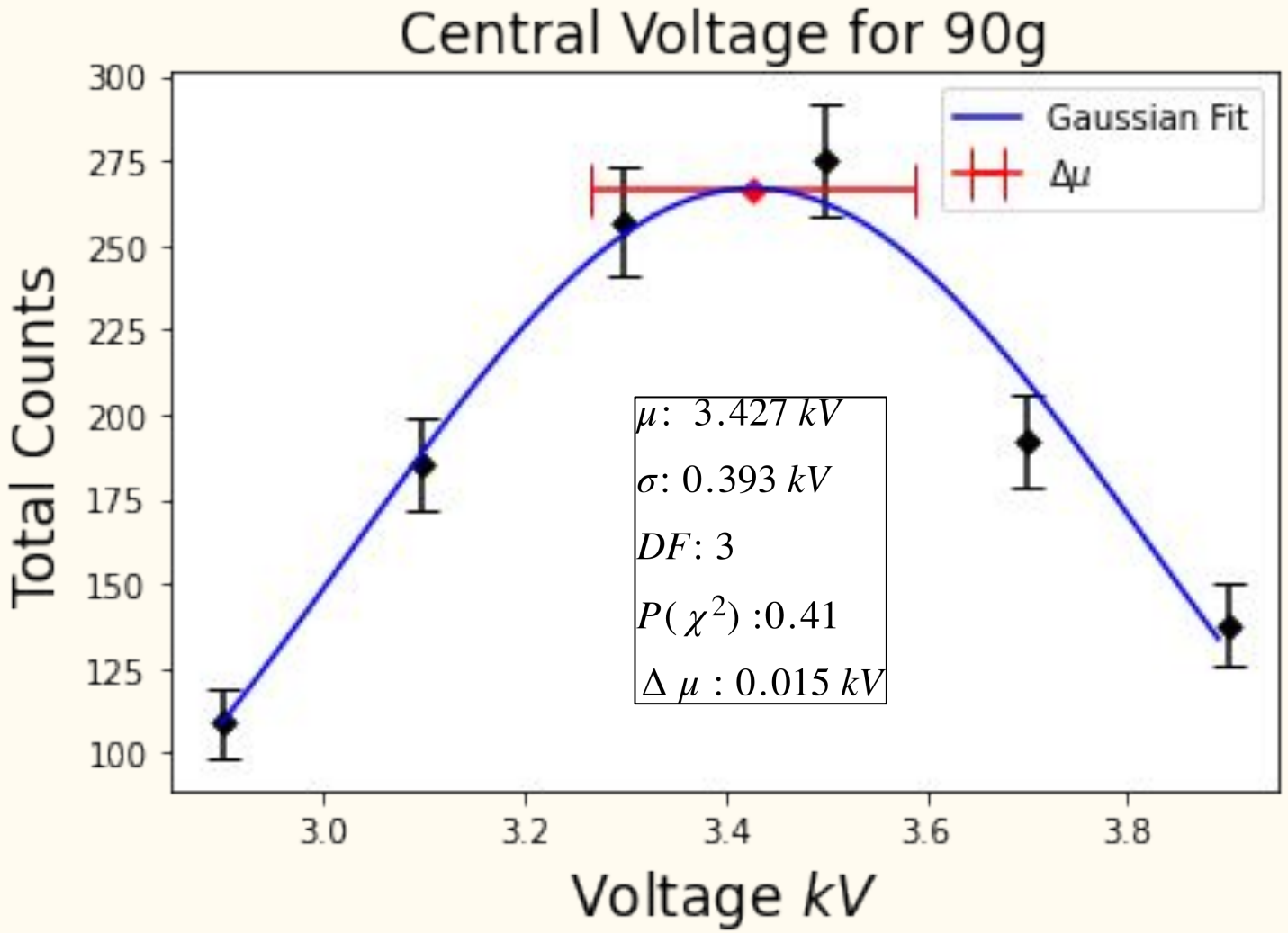
First pass: Large increments to get predicted central voltage

Second pass: Finer increments around predicted central voltage

Perform a fit

Extract mean value


Central Voltage for 110g
Gaussian Fit
Δμ
μ: 4.541 kV
σ: 0.462 kV
DF: 3
P(χ²) : 0.71
Δ μ : 0.015 kV
Total Counts
Voltage kV
200
250
300
350
400
450
4.2
4.4
4.6
4.8
5.0


Central Voltage for 90g
Total Counts
Voltage kV
Gaussian Fit
Δμ
μ: 3.427 kV
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DF: 3
P(χ²) :0.41
Δμ : 0.015 kV
300
275
250
225
200
175
150
125
100
3.0
3.2
3.4
3.6
3.8

Three Types of β : 2 Theoretical, 1 Experimental

$$\beta_{Classical} = \frac{eB\rho}{mc^2}$$

$$\beta_{Relativistic} = \frac{eB\rho}{mc^2\sqrt{1+\left(\frac{eB\rho}{mc^2}\right)^2}}$$

$$\beta_{Experimental} = \frac{E}{B} = \frac{V_{Central}}{Bd}$$

e Charge of electron

ρ Path Radius

m Mass of electron

c Speed of light

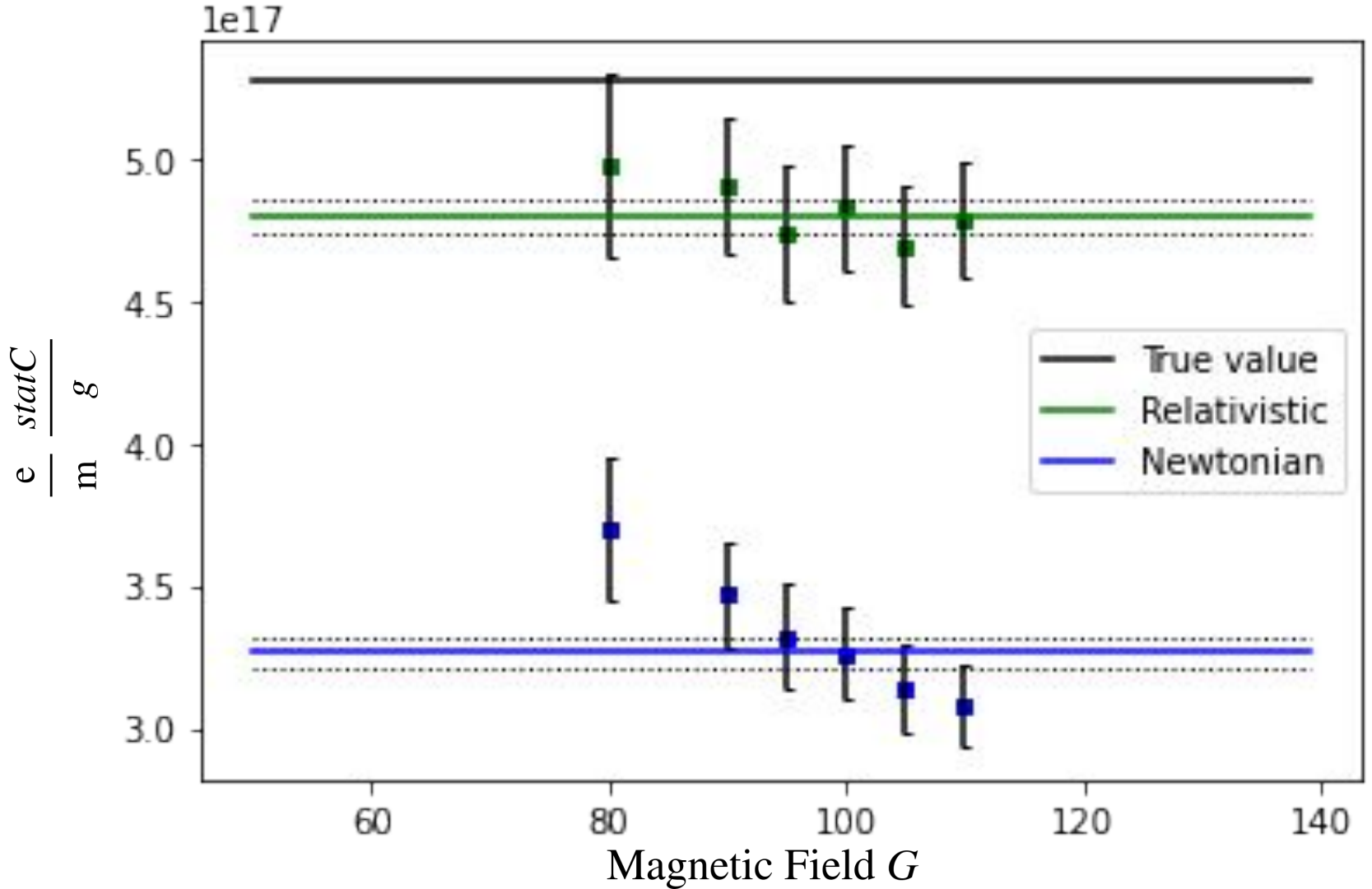
d Distance between the plates

After a little massaging...

Charge Mass Ratio Described By Two Theories

$$\left(\frac{e}{m}\right)_{Classical} = \frac{V_{Central}\, c^2}{B^2 d\rho}$$

$$\left(\frac{e}{m}\right)_{Relativistic} = \frac{V_{Central}\, c^2 \sqrt{1 + \left(\frac{V_{Central}}{Bd}\right)^2}}{B^2 d\rho}$$

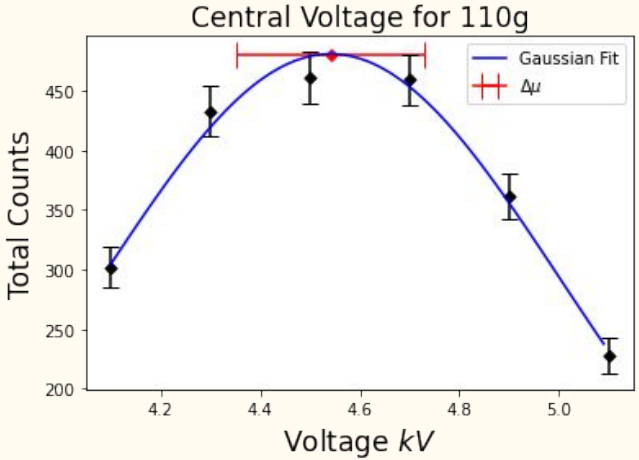

1e17
5.0
4.5
4.0
3.5
3.0
60
80
100
120
140
True value
Relativistic
Newtonian
Magnetic Field G
$\frac{e}{m}\frac{statC}{g}$

Uncertainty of Line

Monte Carlo simulation to determine uncertainty on line of best fit

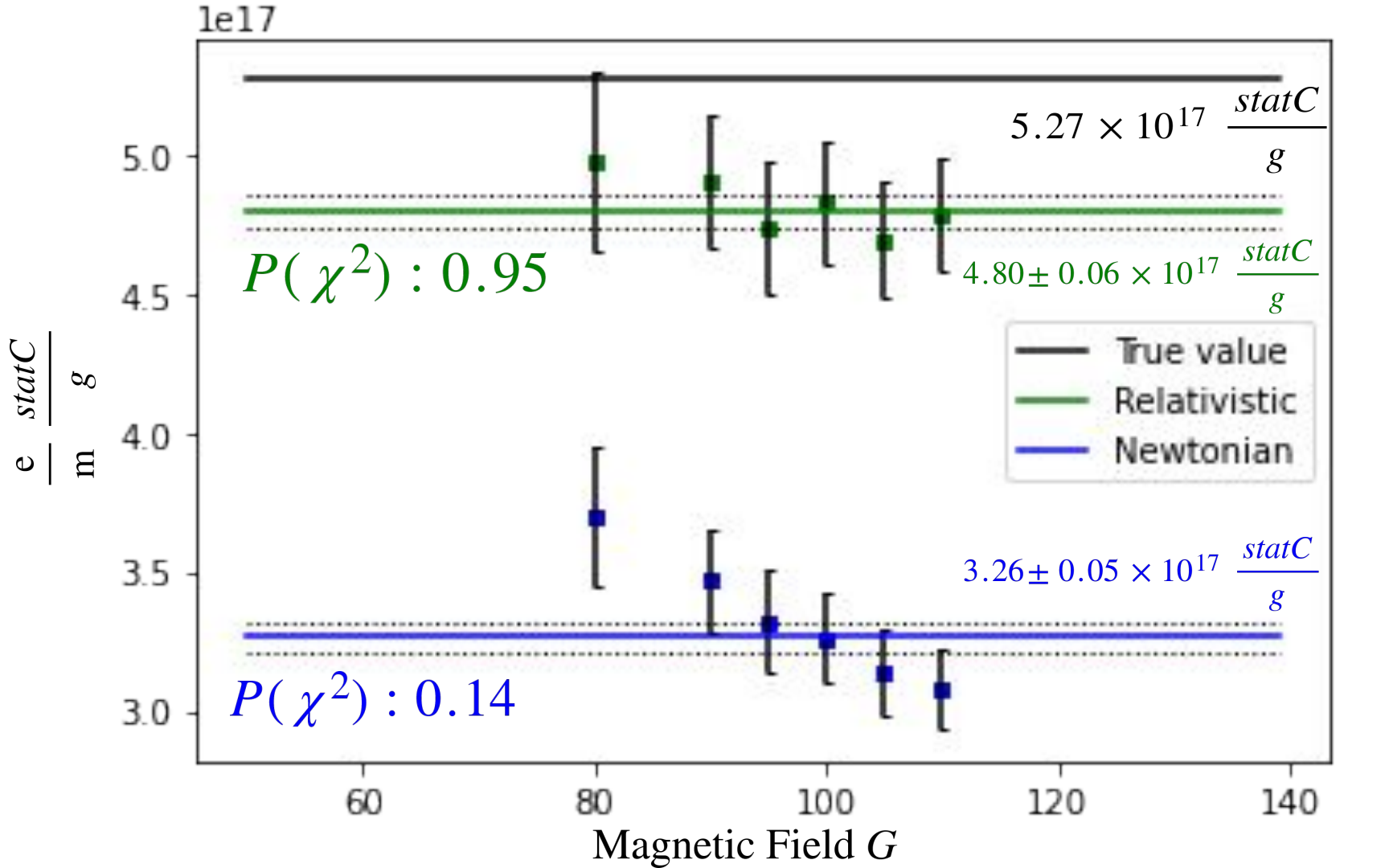
Why Monte Carlo?

- Each count is a random variable
- From the counts we determine central voltage



Monte Carlo introduces randomness

- Points are randomly shifted up or down within σ
- Perform a fit (constant)
- The standard deviation between simulations is the uncertainty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Magnetic Field G
$\frac{e}{m}\frac{statC}{g}$
$5.27 \times 10^{17}\ \frac{statC}{g}$
$P(\chi^2) : 0.95$
$4.80 \pm 0.06 \times 10^{17}\ \frac{statC}{g}$
True value
Relativistic
Newtonian
$3.26 \pm 0.05 \times 10^{17}\ \frac{statC}{g}$
$P(\chi^2) : 0.14$

Systematic Uncertainties

The given quantities may have larger uncertainties:

$$\sigma_\rho = 0.4 \text{ cm}$$

$$\sigma_d = 0.003 \text{ cm}$$

$$\left(\frac{e}{m}\right)_{Classical} = \frac{V_{Central}\, c^2}{B^2 d\rho}$$

$$\left(\frac{e}{m}\right)_{Relativistic} = \frac{V_{Central}\, c^2 \sqrt{1 + \left(\frac{V_{Central}}{Bd}\right)^2}}{B^2 d\rho}$$

The magnetic field is not truly uniform

$$\sigma_G = 1.14\, G$$

Systematic Uncertainties

The given quantities may have larger uncertainties:

$$\sigma_{\rho} = 0.4 \text{ cm} \qquad \approx 2\% \qquad \sigma_{other} \quad \approx 1\%$$

$$\sigma_{d} = 0.003 \text{ cm} \qquad \approx 2\%$$

The magnetic field is not truly uniform

$$\sigma_{G} = 1.14\, G \qquad \approx 5\%$$

Conclusion

The charge to mass ratio suggests that a relativistic model is a better description of the moving electron

$$\frac{e_{exp}}{m_{exp}} = 4.80 \pm 0.06(stat.) \pm 0.48(sys) \times 10^{17} \frac{statC}{gram}$$

$$\frac{e_{true}}{m_{true}} = 5.27 \times 10^{17} \frac{statC}{gram}$$

The barium calibration will connect voltage and energy and allow extraction of the value the charge and mass of the electron and therefore the momentum and energy.

Relativity: Fact or Fiction?

Relativistic Dynamics

MIT Department of Physics
11/9/21

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Partner: Bryan Sperry

Relativity: Probably a Fact

Relativistic Dynamics

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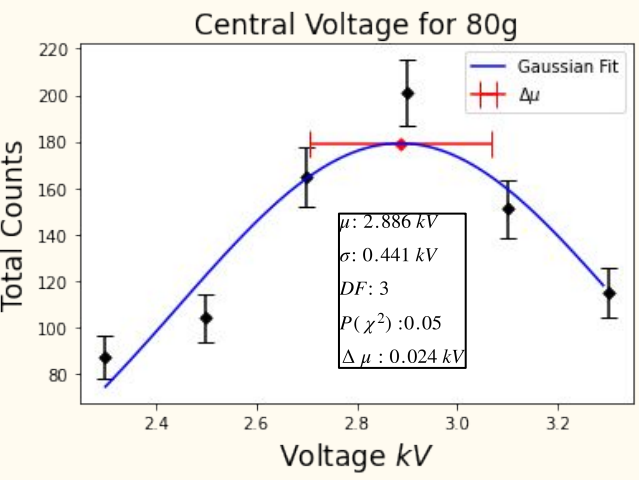
Resources

[1] J. L. Staff, Relativistic Dynamics lab guide (2018), jLab E-Library, URL http://web.mit.edu/8.13/www/JLExperiments/JLExp09.pdf

[2] P. Bevington and D. Robinson, Data Reduction and Error Analysis for the Physical Sciences (McGraw-Hill, 2003).

Thank You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Gaussian Fit
Δμ
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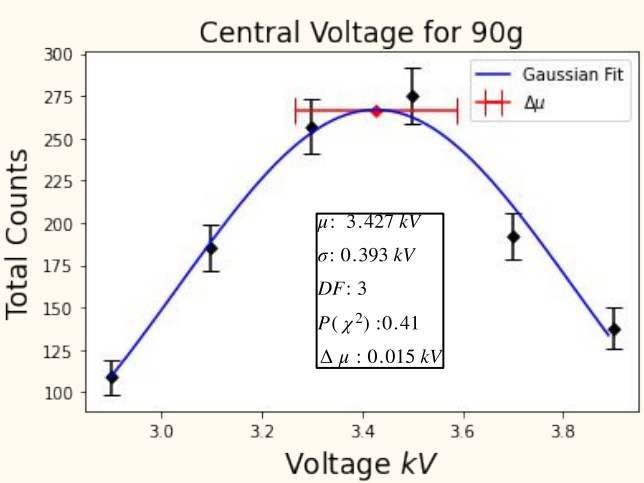
σ: 0.441 kV
DF: 3
P(χ²) :0.05
Δ μ : 0.024 kV
Total Counts
Voltage kV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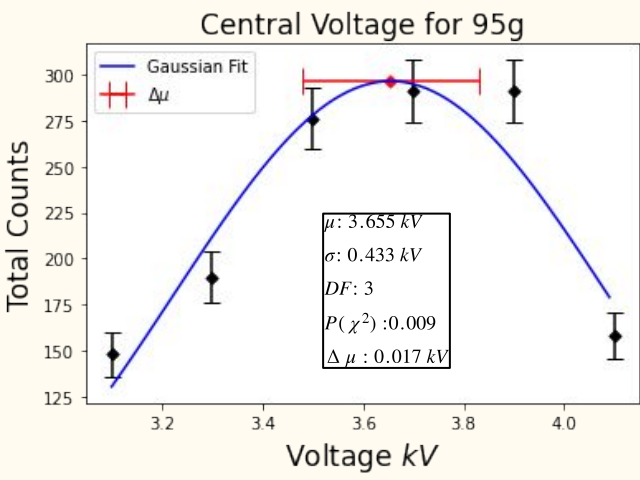
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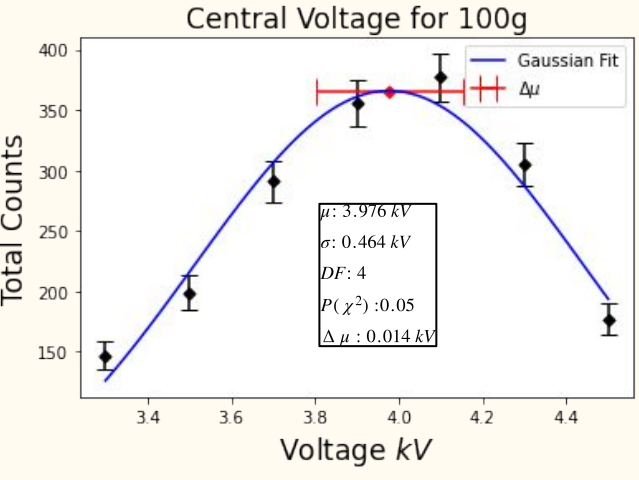
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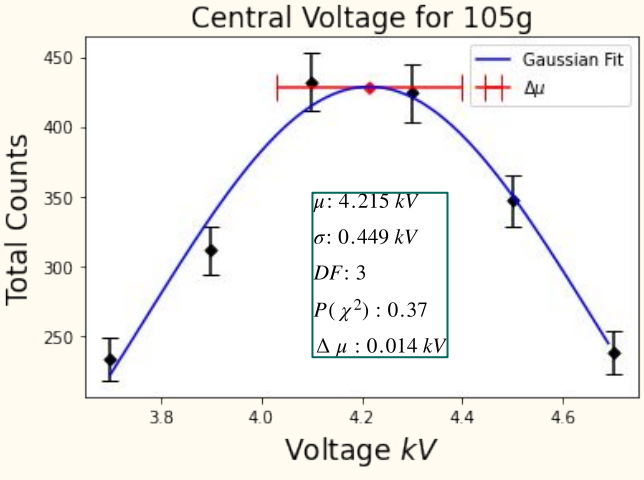
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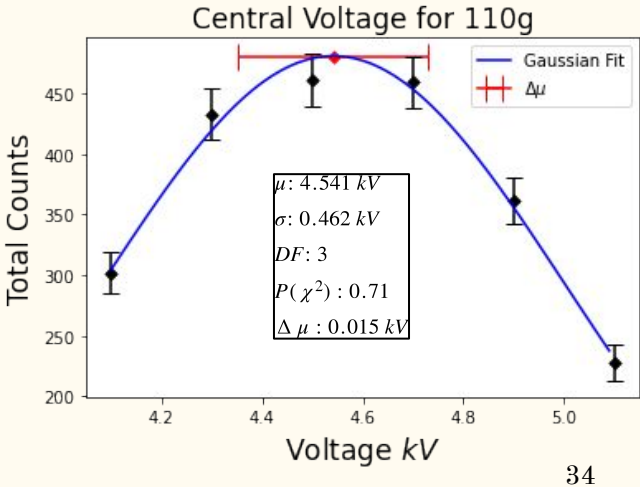
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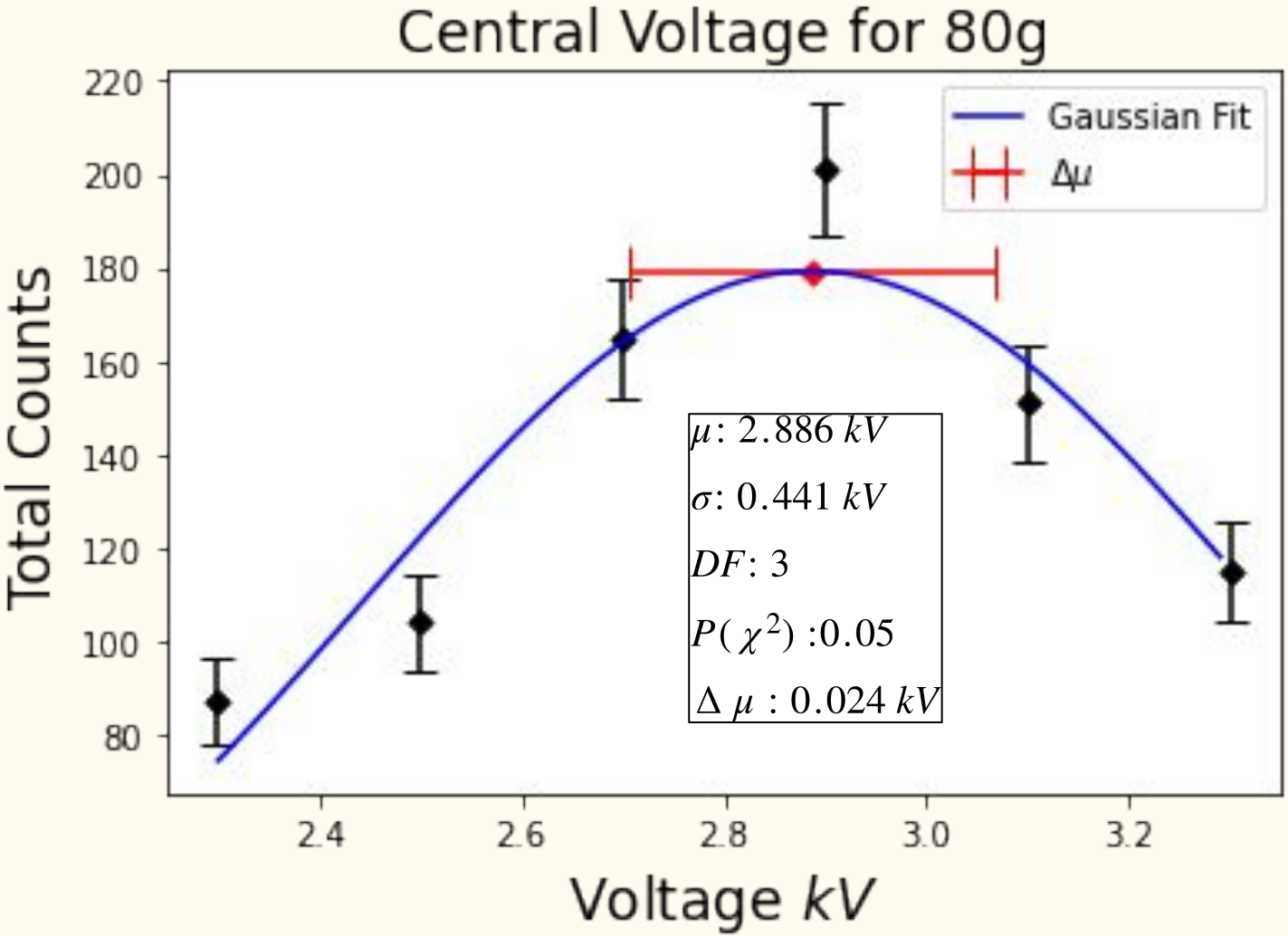
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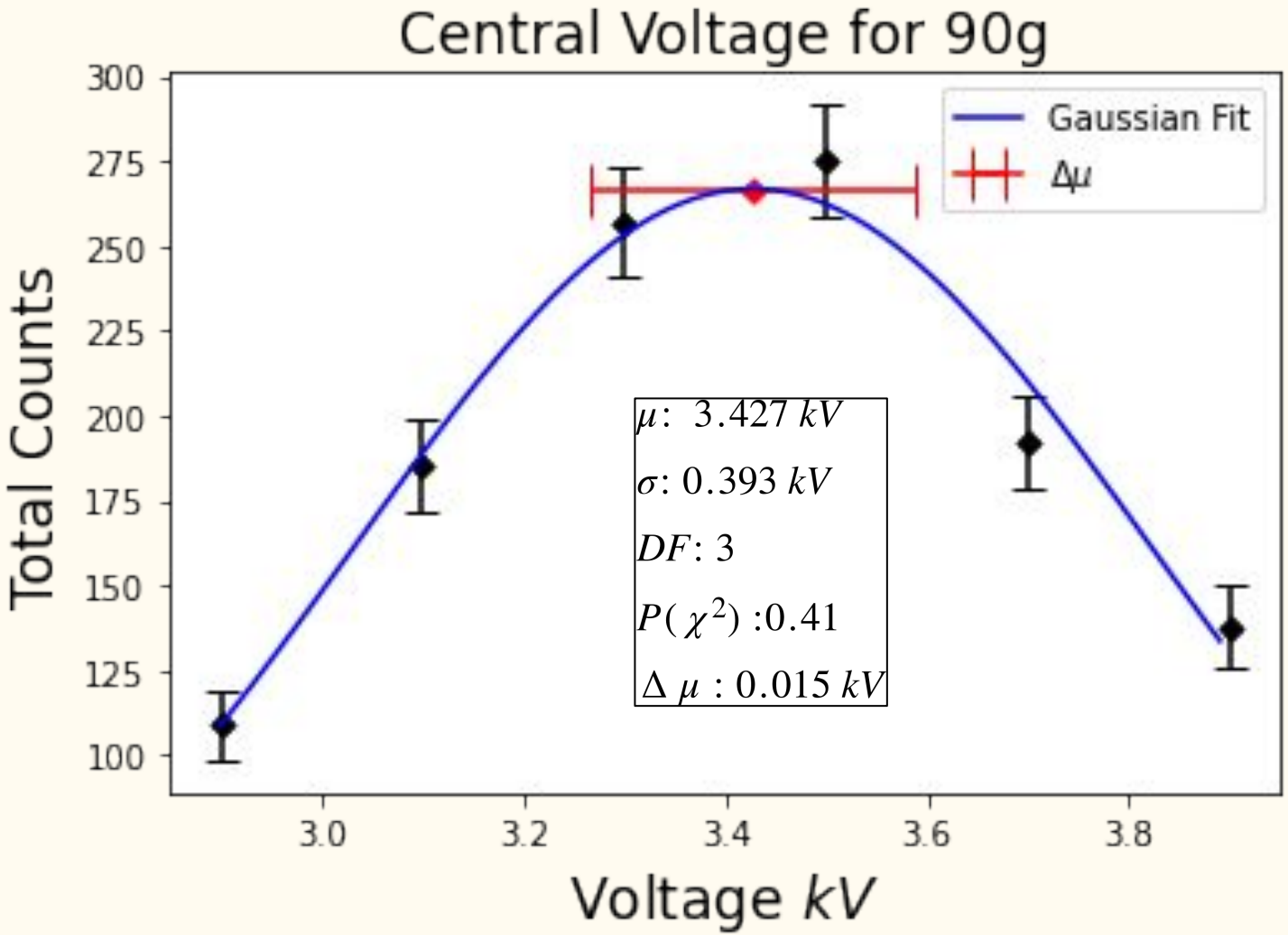
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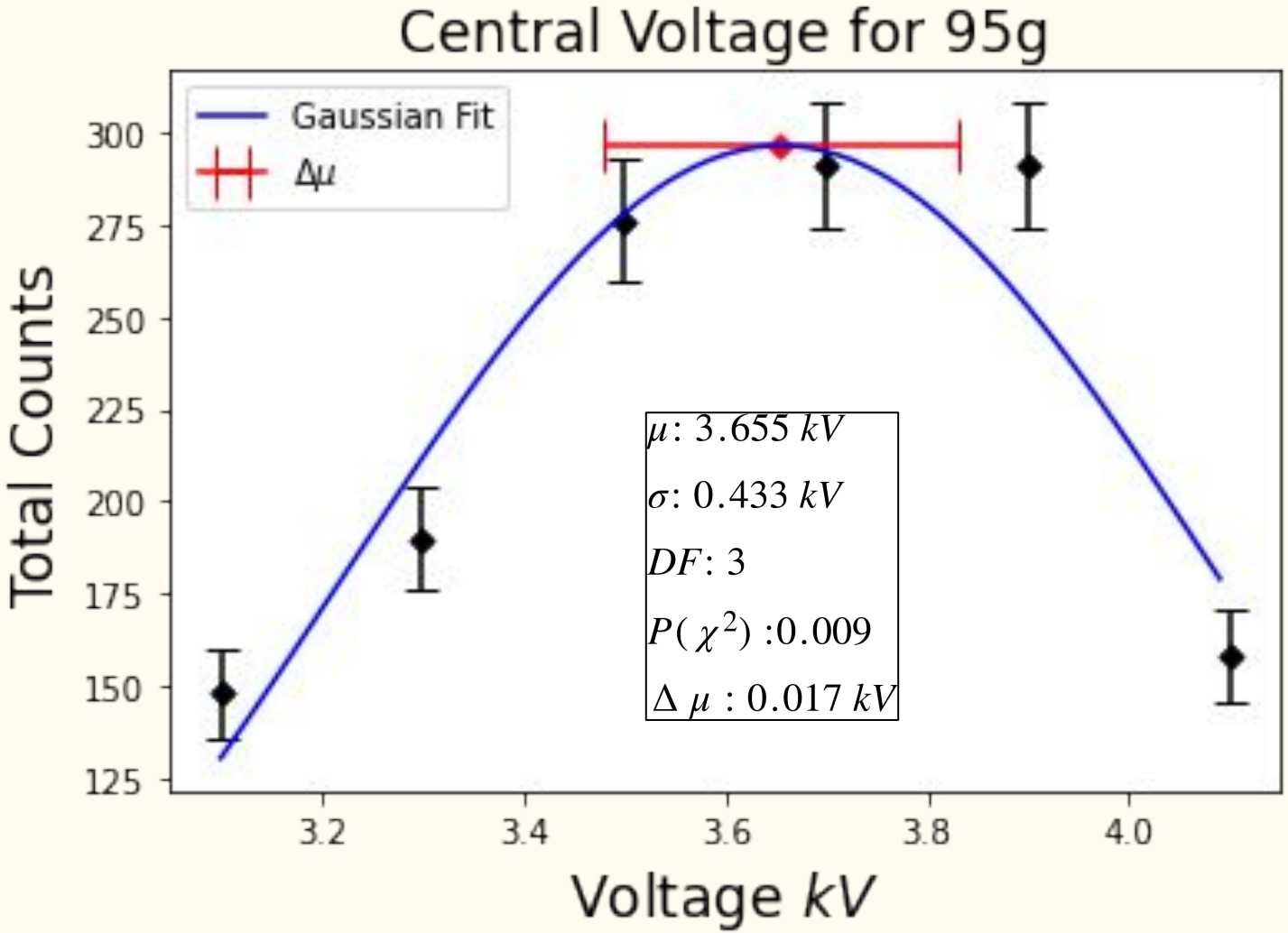
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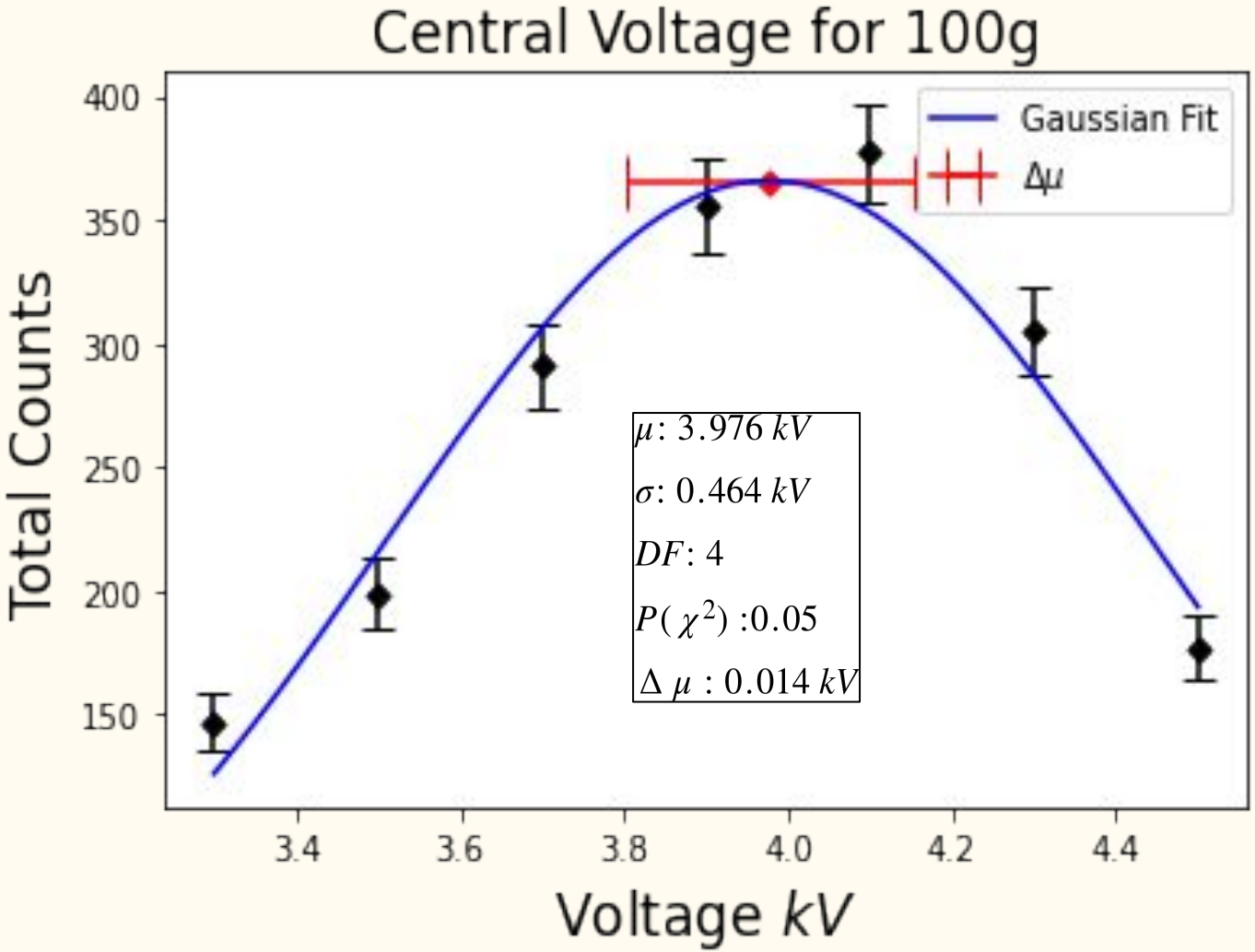
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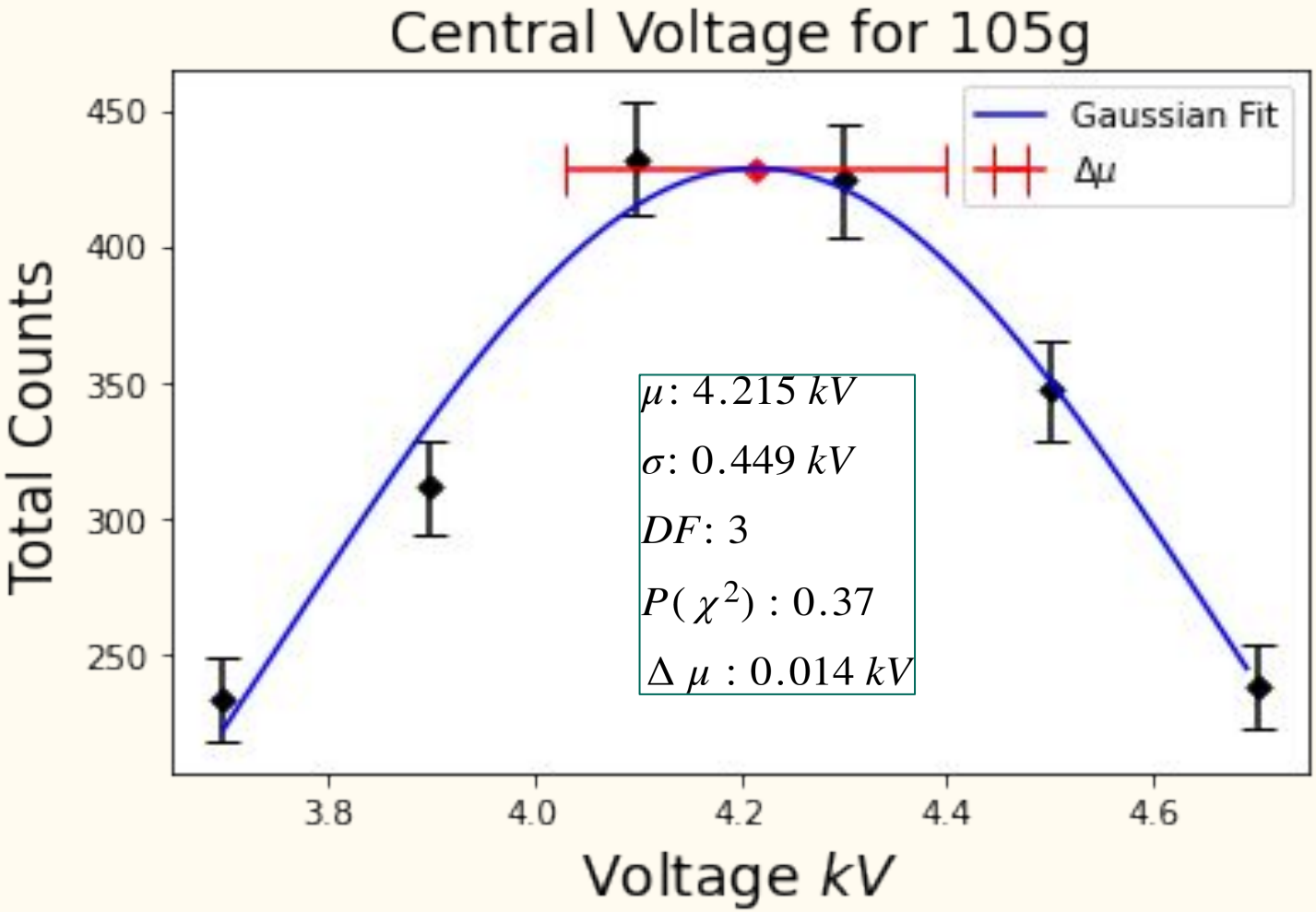
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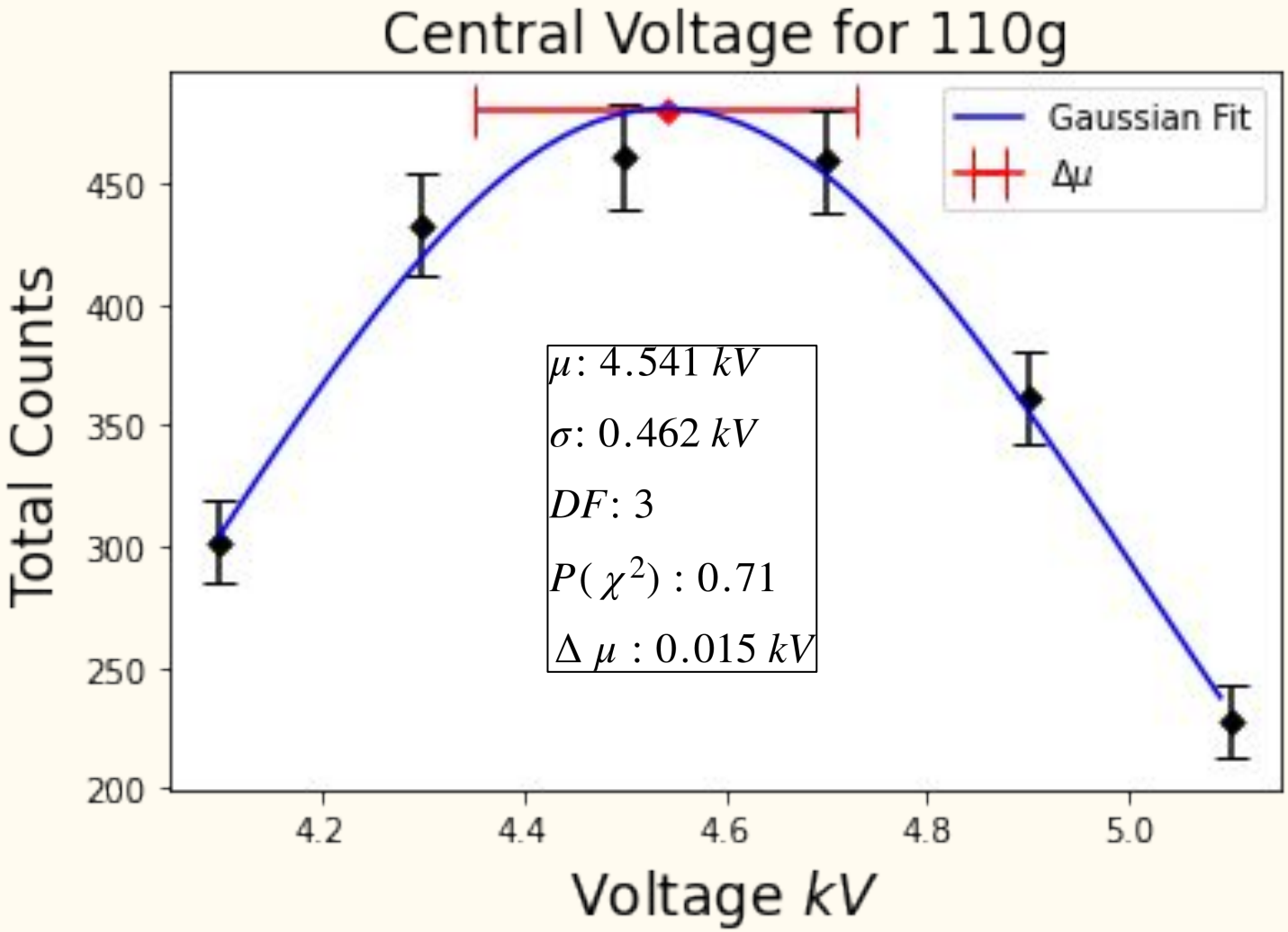
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