Faculty of Physics - University Duisburg - Essen - Campus Duisburg

Lab report: **B8 specific charge e/m**

Date: .....
Participants: group nr.: ..... Names: .....

.....

Supervisor..... Sign..... Date.....

---

1. Generating electron beam by thermal emission from cathode;
2. Focussing and accelleration of electrons by electric fields

energy conservation:

$$E_{kin} = \frac{1}{2} m v^2 = e U$$

m $9{,}110 \times 10^{-31}$ kg
e $1{,}602 \times 10^{-19}$ C
e/m $1{,}759 \times 10^{11}$ C/kg

U: overall potential

3. Circular movement of electrons by mag. field B (B $\perp$ v) with radius r

Helmholtz-coils: (radius 20cm, each 154 windings); current through coils I:

$$\frac{e}{m} = 4{,}178 \times 10^{10} \frac{U/U_0}{(r\,I/r_0 I_0)^2} \frac{C}{kg}, \qquad U_0 = 1V,\ r_0 = 1cm,\ I_0 = 1A$$

Results:

measurement of I at four different U and r for four times:

U (V)	r (cm)	I_1 (A)	I_2 (A)	I_3 (A)	I_4 (A)	$\bar{I}$ (A)	e/m (10^{11}C/kg)	$(e/m)^2$ $(10^{11}C/kg)^2$
150	2							
	3							
	4							
	5							

U (V)	r (cm)	I_1 (A)	I_2 (A)	I_3 (A)	I_4 (A)	$\bar{I}$ (A)	e/m (10^{11}C/kg)	$(e/m)^2$ (10^{11}C/kg)^2
200	2							
	3							
	4							
	5							

U (V)	r (cm)	I_1 (A)	I_2 (A)	I_3 (A)	I_4 (A)	$\bar{I}$ (A)	e/m (10^{11}C/kg)	$(e/m)^2$ (10^{11}C/kg)^2
250	2							
	3							
	4							
	5							

U (V)	r (cm)	I_1 (A)	I_2 (A)	I_3 (A)	I_4 (A)	$\bar{I}$ (A)	e/m (10^{11}C/kg)	$(e/m)^2$ (10^{11}C/kg)^2
300	2							
	3							
	4							
	5							

sums:

....

Error calculation and discussion:

Mean value: $\overline{e/m} = \frac{1}{n}\sum_i (e/m)_i$ n: amount of single values $(e/m)_i$

Standard deviation $s_{e/m} = \sqrt{\frac{\sum (e/m_i)^2 - \frac{1}{n}\left(\sum e/m_i\right)^2}{n-1}}$

result: ($e/m = \overline{e}/\overline{m} \pm s_{e/m}$):

$e/m = (\qquad \pm \qquad) \times 10^{11} C/kg$

comparison to literature:

$$\frac{\Delta e/m}{e/m} = \text{.....} \%$$

systematical problem of experiment: