The Lorentz force acts on the β-particles, which move vertically in the direction of a magnetic field. As a result, the β-particles move in a circular path in the field, whose radius depends on the speed of the particles and the strength of the magnetic field.
Since the β-particles coming from a radiation source show a continuous energy spectrum, they are strongly deflected differently by a magnetic field of constant strength.

Equipment

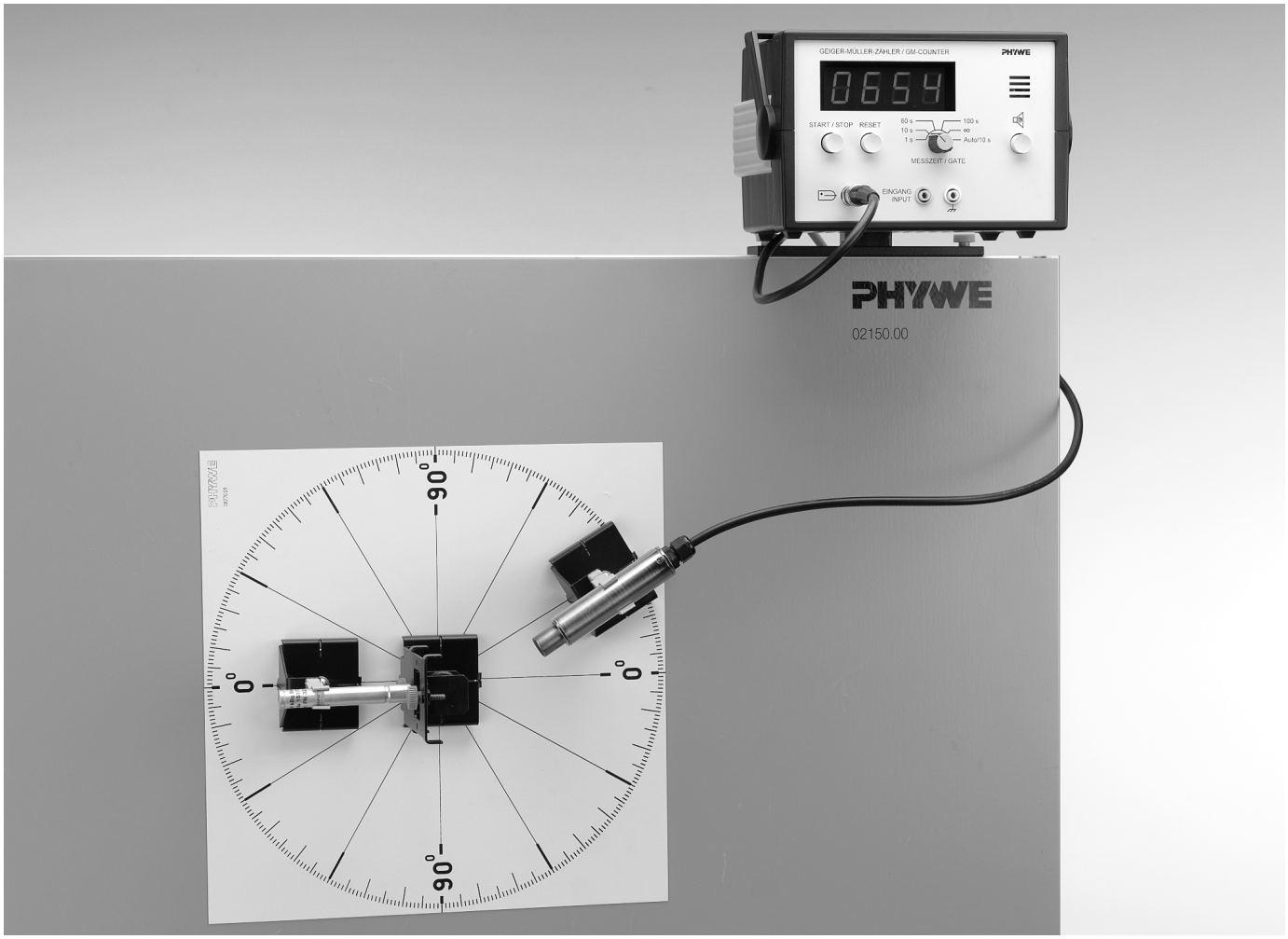
Support clamp for small case	02043.10	1
Clamp on holder	02164.00	1
Support rod, stainless steel	02030.00	1
Counter tube on fix. magnet	09201.00	1
Source holder on fixing magnet	09202.00	1
Plate holder on fix. magnet	09203.00	1
Deflection magnet for plate holder, 2 pcs	09203.02	1
Optical disc, magnet held	08270.09	1
Counter tube Type B	09005.00	1
Geiger-Müller-Counter	13606.99	1
Demo-Board for Physics with stand	02150.00	1
Radioactive sources, set	09047.50	1

Set-up and Procedure

Instruction: To avoid the disturbing of the positions of the radiation source and the plate holder during the execution of the experiment, it is recommended to conduct the experiment first with and then without the deflection magnet. Further, the position of the counter tube in the counter tube holder should be marked either with the help of an adhesive strip or a color marker and should not be disturbed during the experiment.

— Place the optical disc on the demo board.
— Place the deflection magnet with a pole distance of 1.5 cm on the inner surface of the plate holder and position it such on the optical disc, that the center of the magnetic poles is present over the center of the angular scale.
— Set the counter tube along with holder without the protective cap on the 0°-line of the optical disc such that the rear pointed end of the holder lies exactly on the outer circumference of the optical disc; the counter tube window should be at a distance of about 5 cm from the deflection magnet;
Align the longitudinal axis of the counter tube with the center point of the angular scale.

Fig. 1: Experimental setup



Deflection of β^--particles (electrons) in a magnetic field

— Place the source holder with the β^--radiation source Sr-90 on the demo board such that the exit opening for the radiation is positioned directly in front of the deflection magnet.
— Select the measurement time "Auto /10 s", determine the count rate three times and note the values in Table 1.
Note: If measurements are not repeated, the deviations in the measured values will be higher.
— Push the counter tube to the 10°-angle mark, such that the distance of the tube to the radiation source does not change.
— Determine the count rates three times for this and for all other deflection angles in steps of 10°-in the range of + 90° and -90° and enter the values in Table 1.
— Remove the plate holder with the deflection magnet from the demo board; the position of the radiation source should not change; repeat the complete series of measurements in the same way without the deflection magnet and note down all the values.
— After concluding the measurements replace the radiation source in the protective container and place the protective cap again on the counter tube.

Result
see Table 1

Evaluation
The mean values $\overline{Z}$ of the count rates are calculated for all the deflection angles φ and entered in the table.
The mean values of the count rates are graphically displayed as a function of the deflection angle in a Cartesian coordinate system or in a polar diagram.
(see Fig. 2 and Fig. 3)
A comparison of the intensity distribution shows, that the β-radiation comprise of charged particles, because it is deflected in a magnetic field. Upon the application of the three-finger rule, the direction of the magnetic field and the deflection show, that the β-particles from Sr-90 source carry a negative charge.

Instruction
An interchange of the magnetic poles causes a reversal of direction of the magnetic field and hence a change in the direction of the deflection of the β-particles.
Reducing the distance of the magnets increases the strength of the magnetic field and the β-particles get deflected more strongly.

Table 1

φ/Degree	with magnetic field				without magnetic field			
	Z_1 Imp/10 s	Z_2 Imp/10 s	Z_3 Imp/10 s	$\overline{Z}$ Imp/10 s	Z_1 Imp/10 s	Z_2 Imp/10 s	Z_3 Imp/10 s	$\overline{Z}$ Imp/10 s
0	475	481	475	477	563	488	526	526
10	506	476	514	499	468	495	532	498
20	594	609	580	594	497	489	519	502
30	686	681	687	685	440	395	447	427
40	680	667	708	685	257	277	266	267
50	736	714	699	716	109	103	115	109
60	420	422	405	416	44	38	61	48
70	199	195	186	193	44	32	37	38
80	99	97	126	107	35	38	31	35
90	70	67	66	68	22	29	20	24
-10	382	402	376	387	515	495	528	513
-20	203	224	187	205	490	477	480	482
-30	112	92	98	100	473	479	464	472
-40	58	56	56	57	262	253	261	259
-50	34	46	35	38	58	54	71	61
-60	26	30	26	27	36	42	53	44
-70	25	24	26	25	42	36	46	41
-80	28	21	24	24	30	30	26	29
-90	21	21	16	19	24	23	26	24

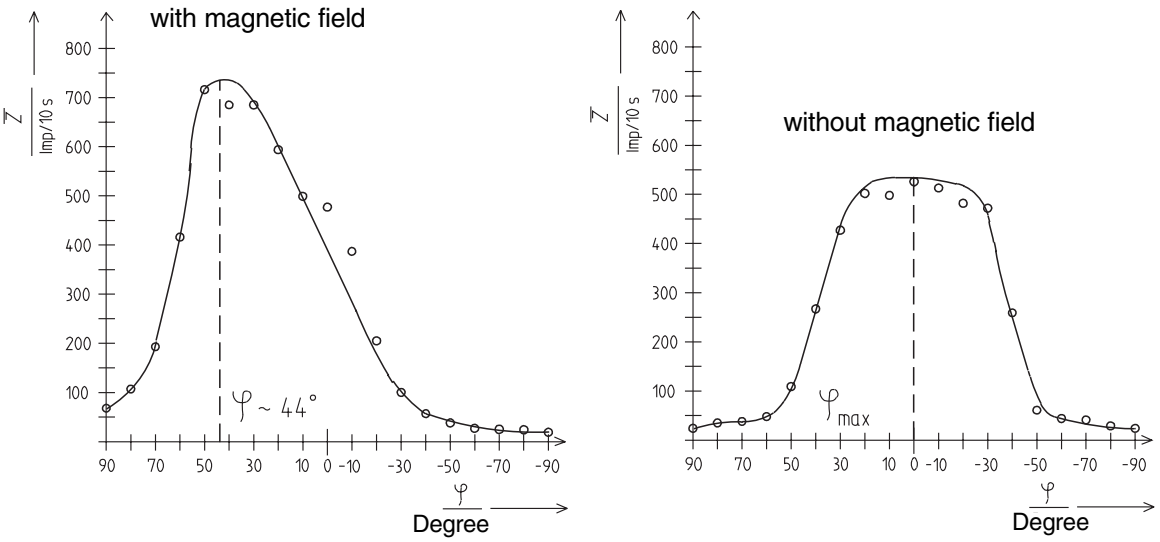
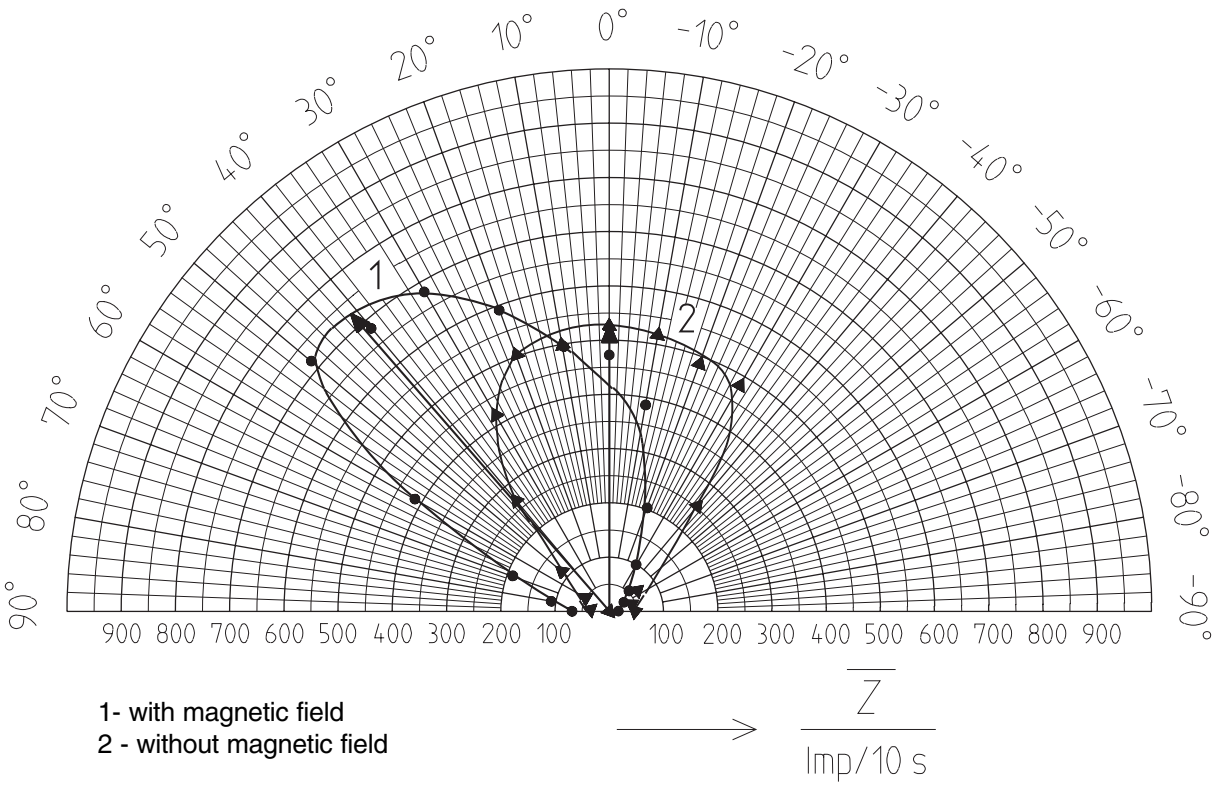

with magnetic field
without magnetic field
Z
Imp/10 s
800
700
600
500
400
300
200
100
φ ~ 44°
φ max
90 70 50 30 10 0 -10 -30 -50 -70 -90
φ
Degree

Fig. 2

Fig. 3


0°
10°
20°
30°
40°
50°
60°
70°
80°
90°
-10°
-20°
-30°
-40°
-50°
-60°
-70°
-80°
-90°
1
2
900 800 700 600 500 400 300 200 100
100 200 300 400 500 600 700 800 900
1- with magnetic field
2 - without magnetic field
Z
Imp/10 s

Room for notes