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Performance of the High Symmetry Spectrometer PRISMA to be installed at SNS

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The spectrometer PRISMA proposed in previous reports (Internal Reports ISM 1985/3 and 1985/4) is an High Symmetry Spectrometer designed to get high performance in measuring inelastic neutron scattering in single crystals. Therefore this instrument should be the analogue of the triple-axis spectrometers used in steady sources. A sketch of this spectrometer is shown in fig. 1, while in Table I the geometrical specification is given. The main point of present design is the relatively small angular distance between various analysers, still having a rather short sample to analyser distance. This last condition allows an almost free rotation of the analyser bank around the sample, thus leaving quite large degree of freedom in choosing the scattering triangles. Special care has been used in designing all moving parts to obtain the required performance as far as the angular reproducibility is concerned. In figs. 2a and 2b the sketch of the design of the main arm is given. Because of the small space available between analysers, special Soller collimators will be employed. In fact we have to use 0.2° collimators 25 cm long and the distance between two adjacent collimators is less than 2 cm. Moreover because of the necessity of having a large number of different

collimations to allow an easy change of resolution, relatively low cost collimators should be employed. In fact more than 100 collimators should be available. Therefore various collimators with different design are now being tested. Special care should be also devoted to the analyser crystals. These will be good quality squashed Ge cylinders with the (110) axis vertical. In this zone all the reflections up to (333) are available, thus giving very high flexibility in choosing the analyser d spacing. However these crystals must be as similar as possible to reduce calibration problems. The alignement of the sample will be obtained using five auxiliary counters in the range 100° to 120°, with different vertical collimations. All the counters will be ^{3}He detectors with filling pressure of 20 bars, thus providing a rather high efficiency also at relatively high energy. To have a rough estimate of the spectrometer performance in fig. 3 the expected intensity for an excitation having 20 meV energy is shown, choosing a spectrometer resolution of 3 meV FWHM and an average performance for the various components.

Geometrical characteristics of PRISMA

			Tolerance
L_o	Moderator to sample distance	9000 mm	1 mm
L_1	Sample to analyser distance	573 mm	0.2 mm
L_2	Analyser to counter distance	170 mm	0.1 mm
d	Diameter of sample, analyser and counter	12.5 mm	---
h	Height of sample, analyser and counter	60 mm	---
$\Delta\phi$	Range of sample scatt. angle	$\pm 135^\circ$	0.02°
$\Delta 2\theta$	Range of counter angles	$\pm 60^\circ$	0.005° x
$\delta\phi$	Separation of counters	2°	0.02°
η_c	Number of counters	16	---
α_1	Sample-analyser collimators	0.2° to 1.1°	
α_2	Analyser-counter collimators	0.4° to 3°	

x The counter arm is positioned by a stepping motor having a step of 0.036° and a reproducibility better than 0.005°.

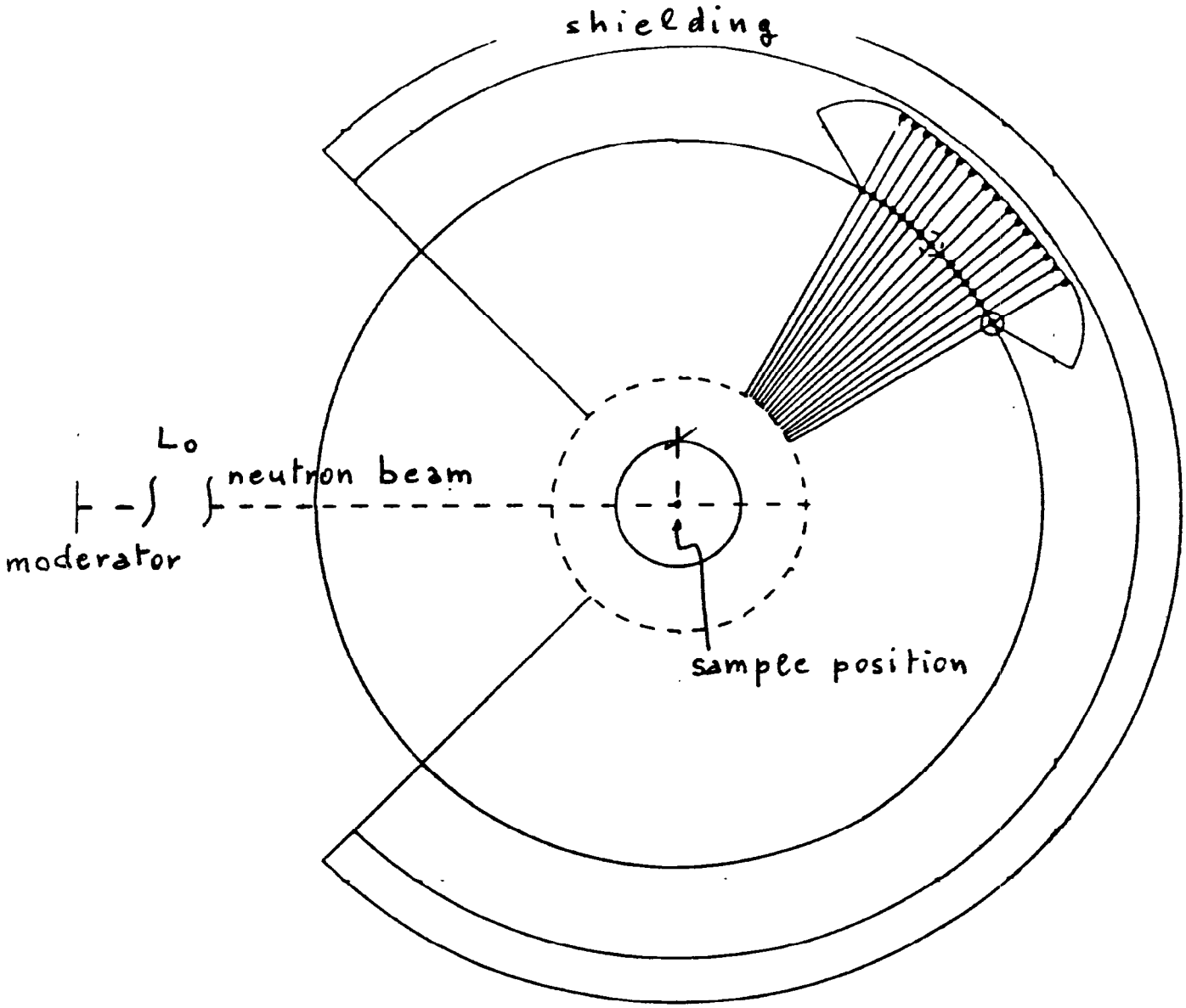

fig. 1

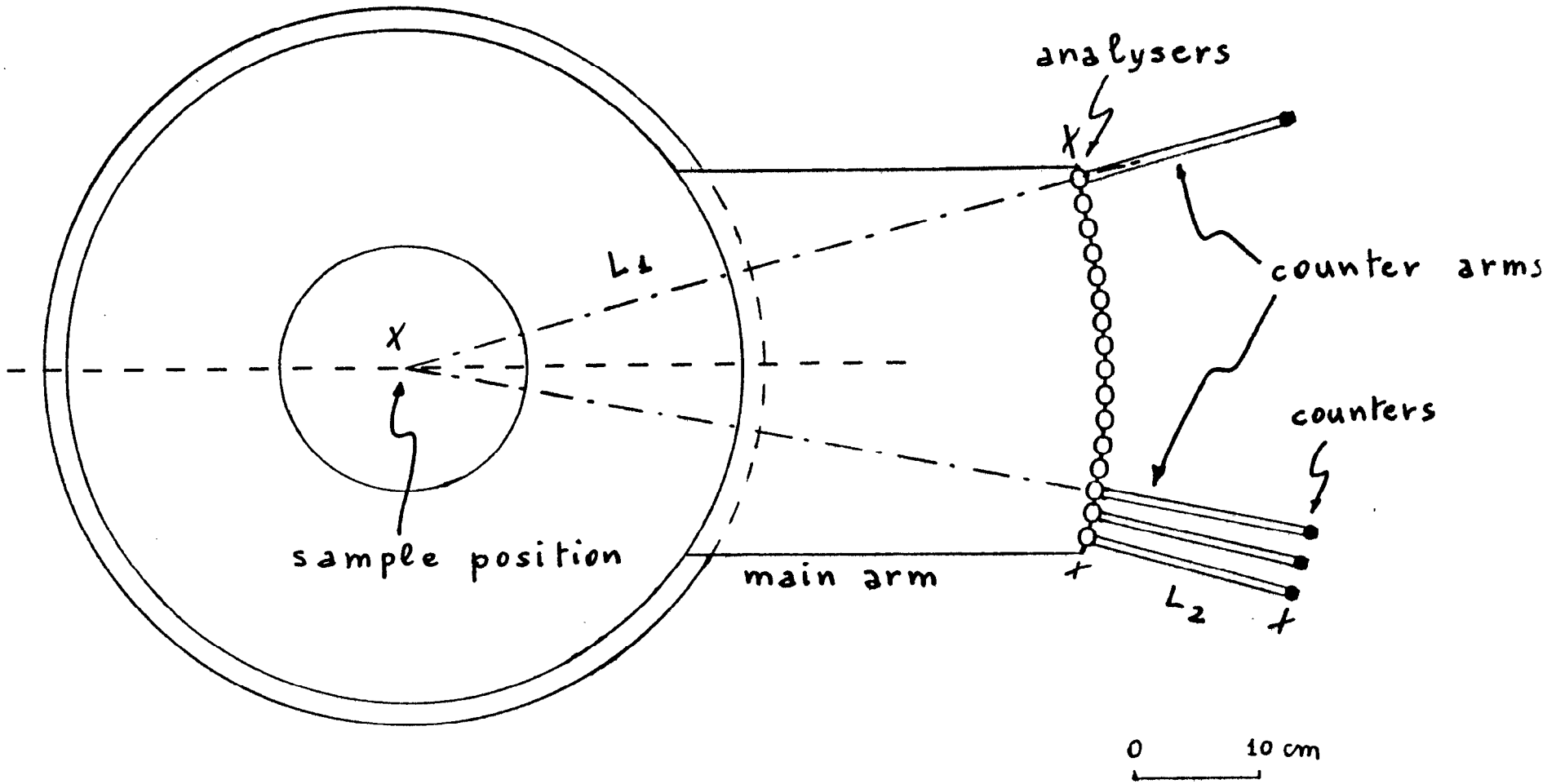
analysers
X
counter arms
L1
X
counters
sample position
main arm
L2
0
10 cm

fig. 2a

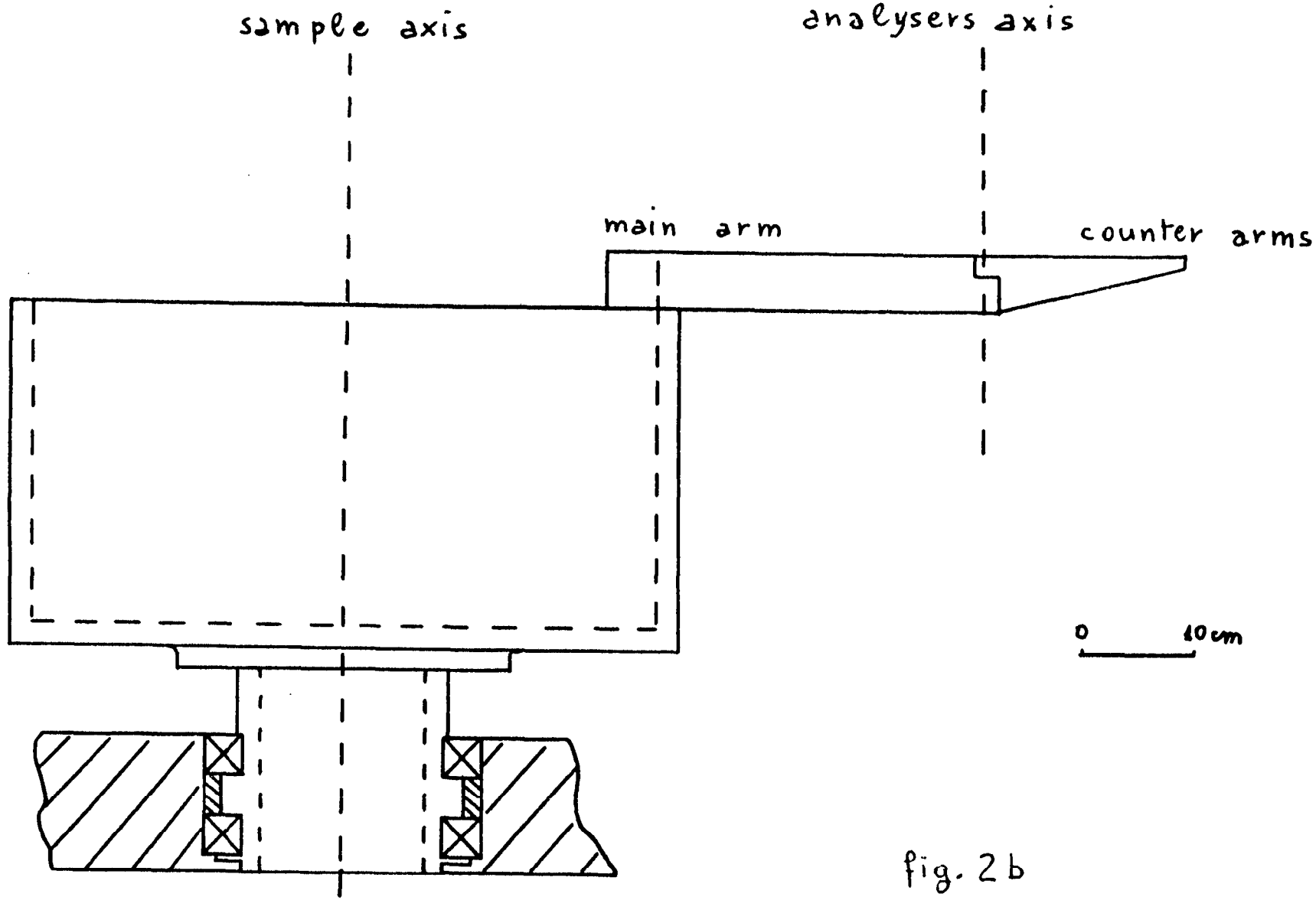

fig. 2b

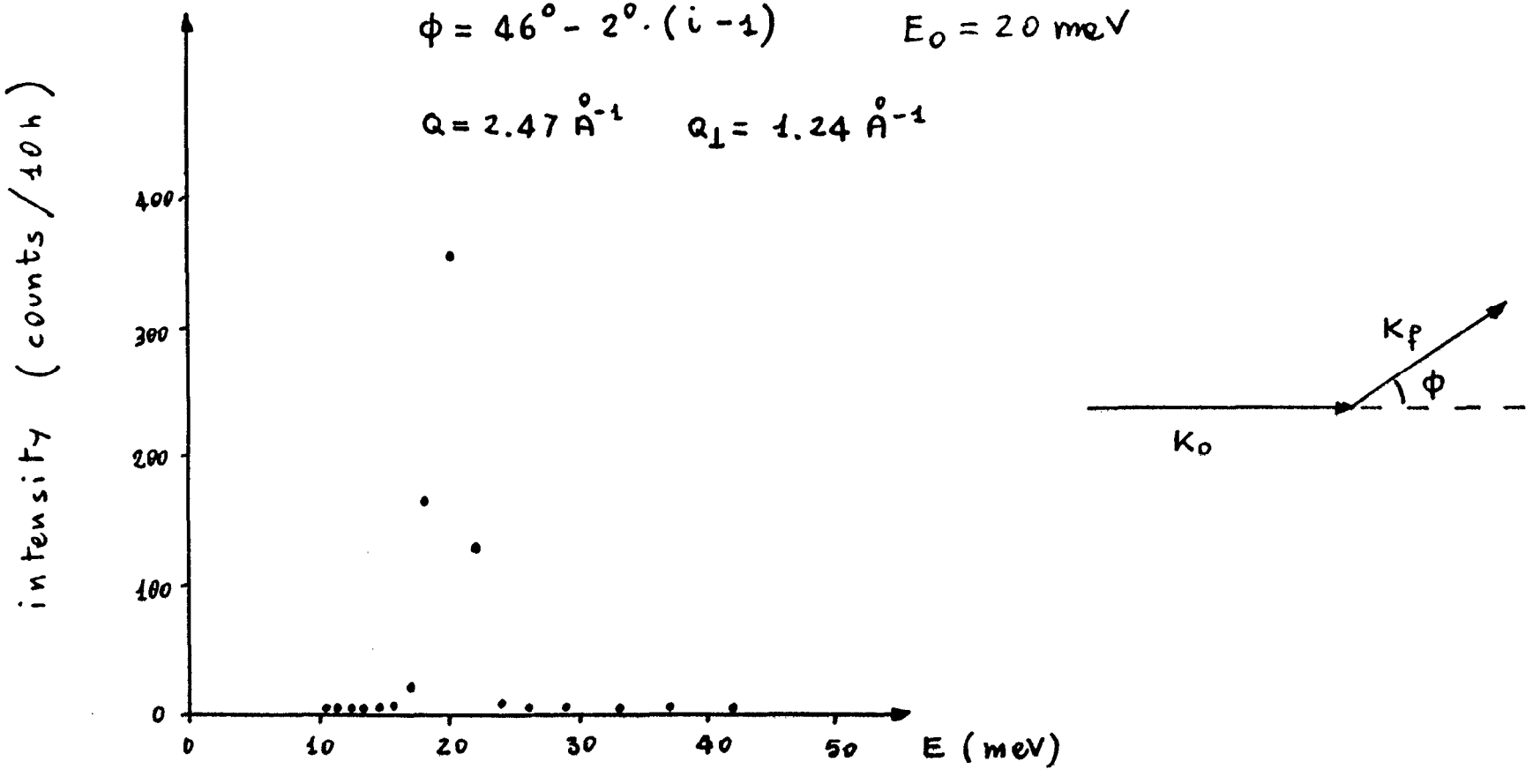
$\phi = 46^\circ - 2^\circ \cdot (i-1)$
$E_0 = 20$ meV
$Q = 2.47$ Å^{-1}
$Q_\perp = 1.24$ Å^{-1}
intensity (counts / 10 h)
400
300
200
100
0
0
10
20
30
40
50
E (meV)
K_f
ϕ
K_0

fig. 3