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ADDENDUM TO THE PROPOSAL FOR THE MEASUREMENT OF THE ELASTIC SCATTERING CROSS-SECTION AT THE ISR

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We would like to put forward some additional comments to our recent proposal for a measurement of the elastic scattering cross-section at the ISR[1].

In the original design of the small-angle spectrometer, we have assumed to reverse the return yokes of an F-unit and a D-unit, in order to extract scattered particles from the long straight sections following the Interaction Regions. Although this one still remains the best design from the experimentalist's point of view, it has seemed worth while to explore the possibility of alternatives with far less modifications to the magnetic structure of the storage rings. We felt that this point was important enough to justify the present addendum, since we would like to perform this experiment as early as possible.

In order to extract the scattered particles without reversing the position of the return yokes, we have increased the magnetic field in the magnets B_3 and B_4 of Figs. 8 and 9 of Reference 1 from 1.5 T to 2.2 T, and slightly rearranged the layout of the beam transport elements (Figs. 1, 2, and 3). The increased bending power of the above-mentioned magnets is now sufficient to "miss" the return yokes of the ISR magnets. Furthermore, in order to fit within the available space inside the ISR tunnel (Fig. 1) we have added another 2-metre standard bending magnet B_6 at the end of the spectrometer (Figs. 2 and 3). The general parameters of the spectrometer are only slighty different from the one of the original proposal[1], and they are listed in Table 1. Furthermore, we have considered two possible alternatives:

i) no modification to the ISR magnetic structure is possible;

ii) modifications are limited to the aperture of some of the correcting elements, i.e. a quadrupole, a sextupole, and a vertical deflecting magnet in the long straight section of the inner arcs downstream of the interaction region.

Table 1

Parameters of small-angle spectrometer

	Original proposal (Ref. 1)	New arrangement
Total length (from interaction point to focus)	56.9	60.1 m
Acceptance		
a) horizontal	3.0	3.0 mrad
b) vertical	±1.0	±1.0 mrad
Solid angle	6×10^{-6}	6×10^{-6} sr
Angular magnification		
a) horizontal plane	1.25	1.05
b) vertical plane	1.60	1.25
Bending magnets		
a) inside vacuum chamber (septum magnets)	2(B1,B2)	2(B1,B2)
b) outside vacuum chamber (septum magnets)	2(B3,B4)	2(B3,B4)
c) analysing magnets	1(B5)	2(B5,B6)
Quadrupoles	2 × 1.5 m (Q1,Q2)	2 × 1.5 m (Q1,Q2)

For alternative (i) the longest scattering angle is limited to about 4.0 mrad by the available radial aperture of the ISR. Although not completely satisfactory, this alternative is considered an acceptable one, the main drawback being that the overlap between the angular ranges of the small-angle and the large-angle detector is considerably reduced, and consequently the relative normalization could become more delicate.

In order to extend up to about 6.0 mrad, (the largest scattering angle, as discussed in Ref. 1), it is necessary to increase the radial acceptance of the ISR locally by enlarging of about 4.0 cm the vacuum chamber and some of the correcting elements.

More precisely, in the case of the interaction region 6, the modifications are the following:

1) Enlarge the vacuum chamber of the second F magnet by 4 cm (cf. Fig. 7 of Ref. 1).

2) Enlarge the vaccuum chamber of the quadrupole by about 1 cm just in front of the above-mentioned F magnet.

3) Enlarge the vacuum chamber and the correcting sextupole S in the long straight section of the inner arc (by ∿ 4 cm) (cf. Figs. 2 and 3).

4) Enlarge the gap of correcting magnet H by the same amount (cf. Figs. 2 and 3).

It appears to us that none of these modifications is of a fundamental nature. However, should it turn out to be <u>very</u> difficult or even impossible to introduce them, we are prepared to start the experiment along alternative (i), namely with <u>no</u> modification of the ISR structure.

REFERENCE

1) P. Darriulat, C. Rubbia, P. Strolin, K. Tittel, G. Diambrini, I. Giannini, P. Ottonello, A. Santroni, G. Sette, V. Bisi, A. Germak, C. Grosso, M.I. Ferrero, CERN-Genova-Torino Collaboration, Measurement of the elastic scattering cross-section at the ISR, CERN/ISRC/69-19 (16.3.1969).

Figure captions

Fig. 1 : Schematic arrangement of the upstream part of the small-angle spectrometer. B1 and B2 are ejection-type septum magnets (ISR design). B3 and B4 are separated from the ultra-vacuum region by a thin window (cf. Fig. 7 of Ref. 1).

Fig. 2 : Plan view of the left branch of the very small-angle spectrometer. In the present version no yoke has to be reversed (cf. Fig. 8 of Ref. 1).

Fig. 3 : Plan view of the right branch of the very small angle spectrometer. In the present version no yoke has to be reversed (cf. Fig. 9 of Ref. 1).

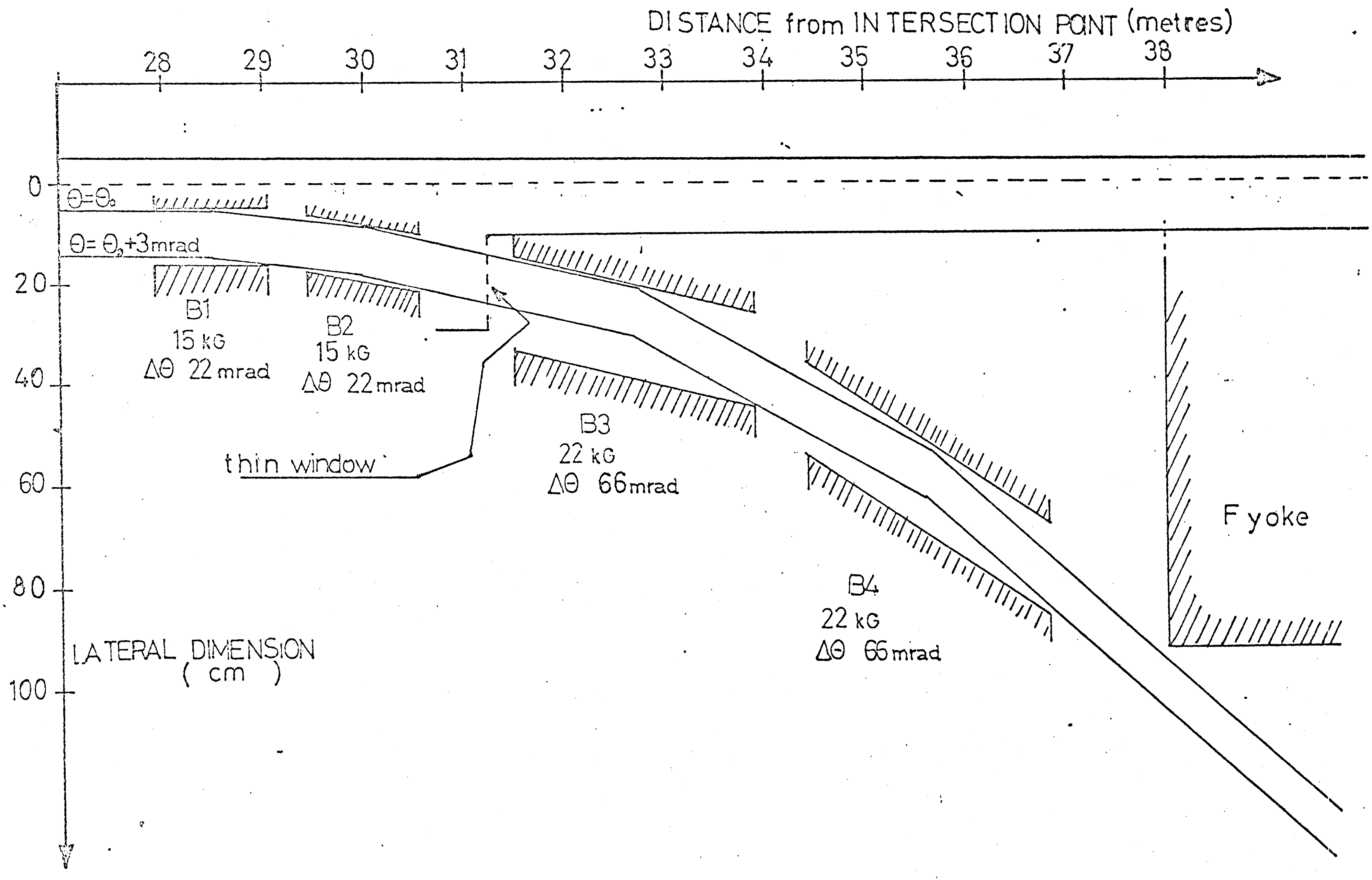
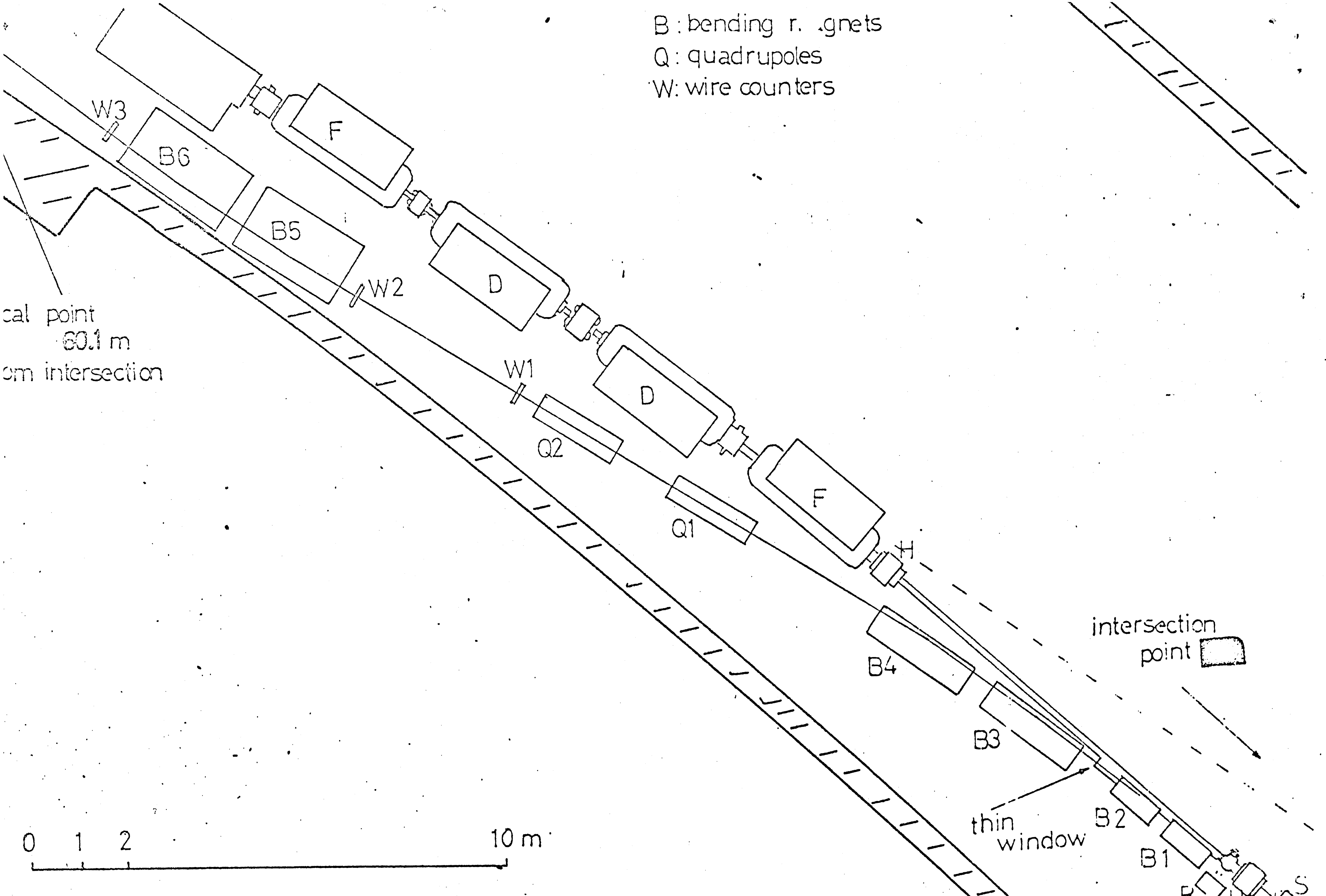

DISTANCE from INTERSECTION POINT (metres)
28
29
30
31
32
33
34
35
36
37
38
0
20
40
60
80
100
$\Theta = \Theta_0$
$\Theta = \Theta_0 + 3$ mrad
B1
15 kG
ΔΘ 22 mrad
B2
15 kG
ΔΘ 22 mrad
thin window
B3
22 kG
ΔΘ 66 mrad
B4
22 kG
ΔΘ 66 mrad
F yoke
LATERAL DIMENSION
(cm)

Fig. 1



B : bending r. .gnets
Q : quadrupoles
W: wire counters
F
D
D
F
H
W3
B6
B5
W2
W1
Q2
Q1
B4
B3
B2
B1
thin window
intersection point
R
H
S
cal point
60.1 m
om intersection
0
1
2
10 m

Fig. 2

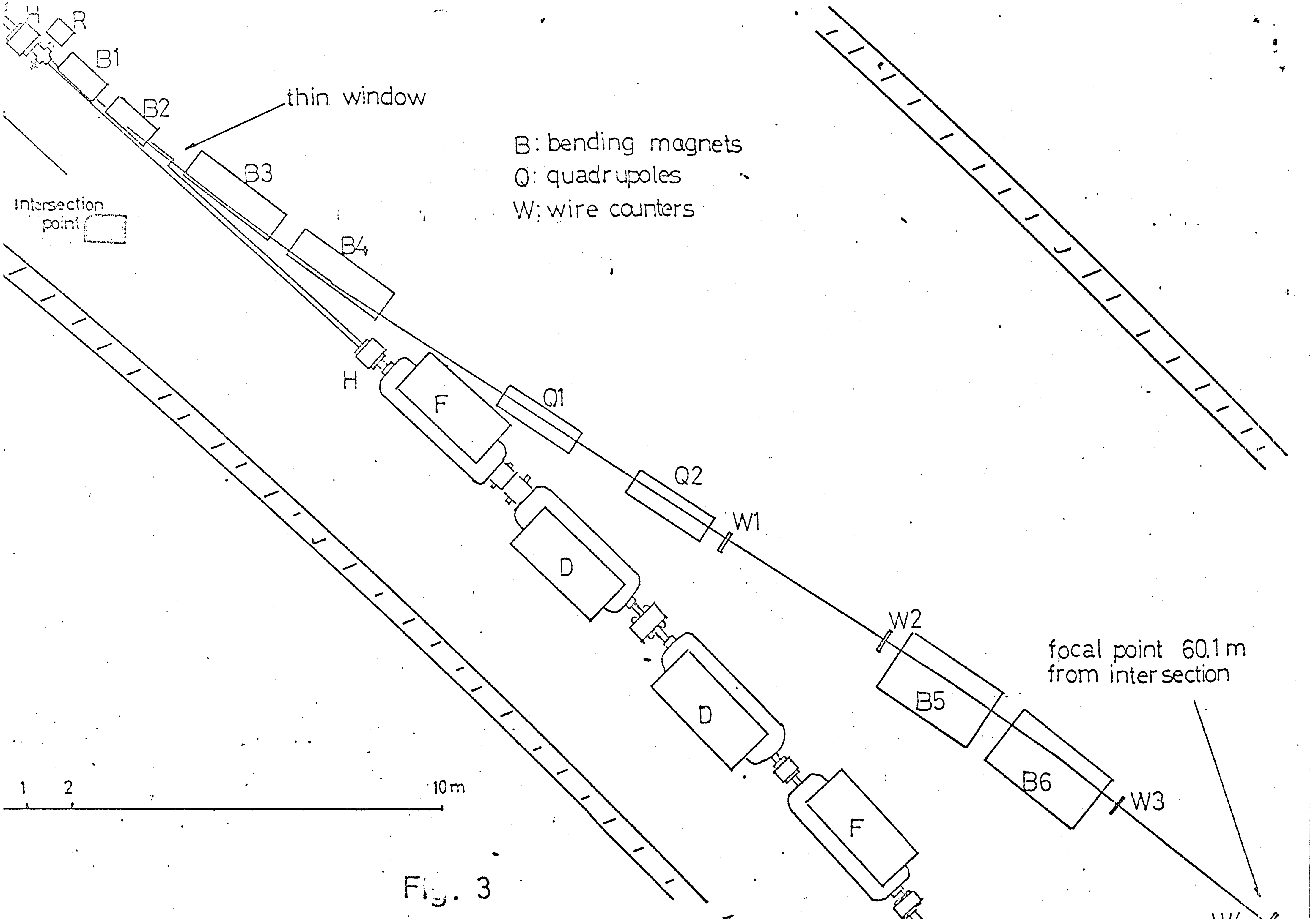

H
R
B1
B2
thin window
B3
B4
B: bending magnets
Q: quadrupoles
W: wire counters
Intersection point
H
F
Q1
Q2
W1
D
D
F
W2
B5
B6
W3
focal point 60.1 m
from intersection
1
2
10 m

Fig. 3