Ref.: NP/mk

M E M O R A N D U M

To/A : E.E.C.

From/De : Omega Rapporteur

Subject/Objet : Ω Physics Programme

PH I/COM-71/9
14 January 1971

I. Introduction

The purpose of this Note is to discuss various operational aspects of the Ω physics programme. A large number of experiments are being proposed (see section 2) which, if accepted, should be done within a reasonable time scale (section 3). Provision must then be made that several experiments can run simultaneously on Ω, either testing or in production. This implies a largely standardized detector layout, and triggering devices which can mutually coexist (section 4), a powerful on-line computer system capable of serving different users simultaneously (section 5), and a close cooperation between the users and a strong technical support (section 6). Section 7 summarizes our Beam requirements. In section 8, we comment upon the Plumbicon readout proposal.

2. The Physics Programme

Table I shows a list of the 10 Ω proposals which have been submitted to EEC, 1 Ω letter of Intention, and two Proposals which have been discussed within the Ω Working Party and which are expected to be submitted within the next months. Assuming that a majority of these will be accepted, and that some new proposals might still come, we are faced with a programme of a dozen or more experiments to be carried out in a foreseeable future.

3. The Time Scale

The required data taking time per experiment is short : one PS period - 14 days of good beam - for almost all proposed experiments. In most cases, this means a million or more triggers, saturation of the off-line computer facilities, and substantial physics results.

With the foreseen scheme (PS/Coord./Memo/1021, 13 Nov. 1970) of alternating PS periods for the East Hall and periods with sharing between the South and West Halls, there will be $\sim$ 7 PS periods for the West Hall per year. Allowing for a few months for the start-up of Ω , from June 1972 on, and considering that many experiments will eventually come back on the floor to be redone under improved conditions (polarized target, RF separated beam, better trigger system...), a programme of a dozen experiments can be carried through before the hypothetical shutdown of the West area on the condition that at every PS period with beam for Omega - i.e. every 6 calendar weeks - a new experiment will be taking data.

The main problem is to provide the machine time and facilities for setting up and testing the individual experiments, in view of the relatively complex triggering devices proposed. Some of these will be mounted and tested elsewhere, but the actual running-in must be done on the spot, and may often take many calendar months. We are aiming at a scheme which allows three users to run, simultaneously and almost independently, one as main user, one preparing for production and one doing preliminary tests. An experiment will then stay on the floor during four months on average. The implications are discussed in the next sections.

4. The Layout

The efforts done by the different user groups towards standardization and compatibility have led to essentially two "Standard Layouts" 1 and 2 shown in Figs. 1, 2a and 2b.

The last column of Table I refers to these; the meaning of the Standard Layout labels is that when one experiment is taking data, then those other experiments which use the same standard layout can in principle do useful tests. Some of the stated compatibilities are still uncertain and need more detailed study before confirmation. Most experiments are satisfied with Layout 1 (all spark chambers perpendicular to the beam, hydrogen target inside the second module, several coexisting trigger devices : proton counter, neutron detector, fast forward particle detection, proportional chambers inside the magnet for counting multiplicities). Layout 2 is essential for the Ξ^* experiment (spark chambers with plates parallel to the beam on both sides of the target). Its version 2a allows that experiment to test most of the K^+ detectors, and several of the other experiments to test, or take data. In its version 2b, all K^+ detectors and a special chamber are installed, and the Ξ^* experiment, as well as one other experiment ($K^-p \rightarrow K^{*o}n$) can go in production.

5. The On-line Computer

Three experiments must be simultaneously connected to the EMR 6130 computer, backed up by the CII 10070, which takes care of the data acquisition for the main user, and also checks the performance of all three experiments (histograms, printouts, etc). We are in close contact with the DD group who is working on a project along these lines.

6. The People

On the floor, the different user groups will have to closely collaborate together. While they must be supported by a strong service team, whose constitution is being discussed with C.E.R.N. we intend to entrust the general service responsibilities to a team of physicists (the Omega Resident Group) to be formed by the Ω staff and by representatives of the groups which have approved (or proposed) experiments for Omega.

7. Beam Requirements

We summarize here our requests for the Slow Ejection to the West Area, as foreseen now :

1. A $\gtrsim$ 400 msec spill-out beam every alternate PS period, on a sharing basis with the South Hall. The amount of protons to be ejected towards the Omega target may vary between a few 10^{10} and 10^{12} protons/burst.

2. A ~40 msec spill-out, parasitic beam during the other PS periods is very strongly requested. It may be used only part of the time, but should be permanently available.

3. A very good emittance of the Slow Ejection is crucial for several Omega experiments which need secondary beams of a diameter not exceeding 1 cm at the image.

4. A simple test beam, to be derived from the Omega target station will be valuable for many experiments.

Three secondary beams are requested, and are quoted in the second last column of Table 1, for each experiment : HE, a High Energy unseparated beam, 1-15 GeV/c, 60 m long; ES Long, a Long Electrostatically Separated beam, 2-5 GeV/c, 60 m long, 20 m of separators; and ES Short, a Short Electrostatically Separated beam, 1-2 GeV/c, 36 m long, with a 10 m separator. These beams are described in "Possible Beams for Omega (1972-1975)", Int. Report NP 70-29, as Beams No 4,3,2, respectively. The HE and ES Long beams use the same target station; another target station has to be built for ES Short. Later on (not before 1973) an RF separated beam (Beam No. 6, ibid.) will possibly be installed, which will be valuable to many of the proposed experiments.

8. The Plumbicon Readout Proposal

A Plumbicon Readout System has been proposed (PH I/COM 71/4) by the Birmingham-RHEL-Westfield group, who would build the Plumbicon cameras and the associated electronics. The E.P.Paris-Orsay group would build the readout electronics, and the CERN Omega group would give general support to the project.

The proposal has been discussed within the Omega Working Party. A. Michelini and P. Sonderegger stressed that Omega should be provided with either a film camera or a Plumbicon readout, but not both. Reservations were made mainly with respect to the spatial accuracy of the Plumbicon readout, which should be improved. Several groups explicitly required this readout system, while none would oppose a decision in its favor. Such a decision should be taken very rapidly.

P. Sonderegger

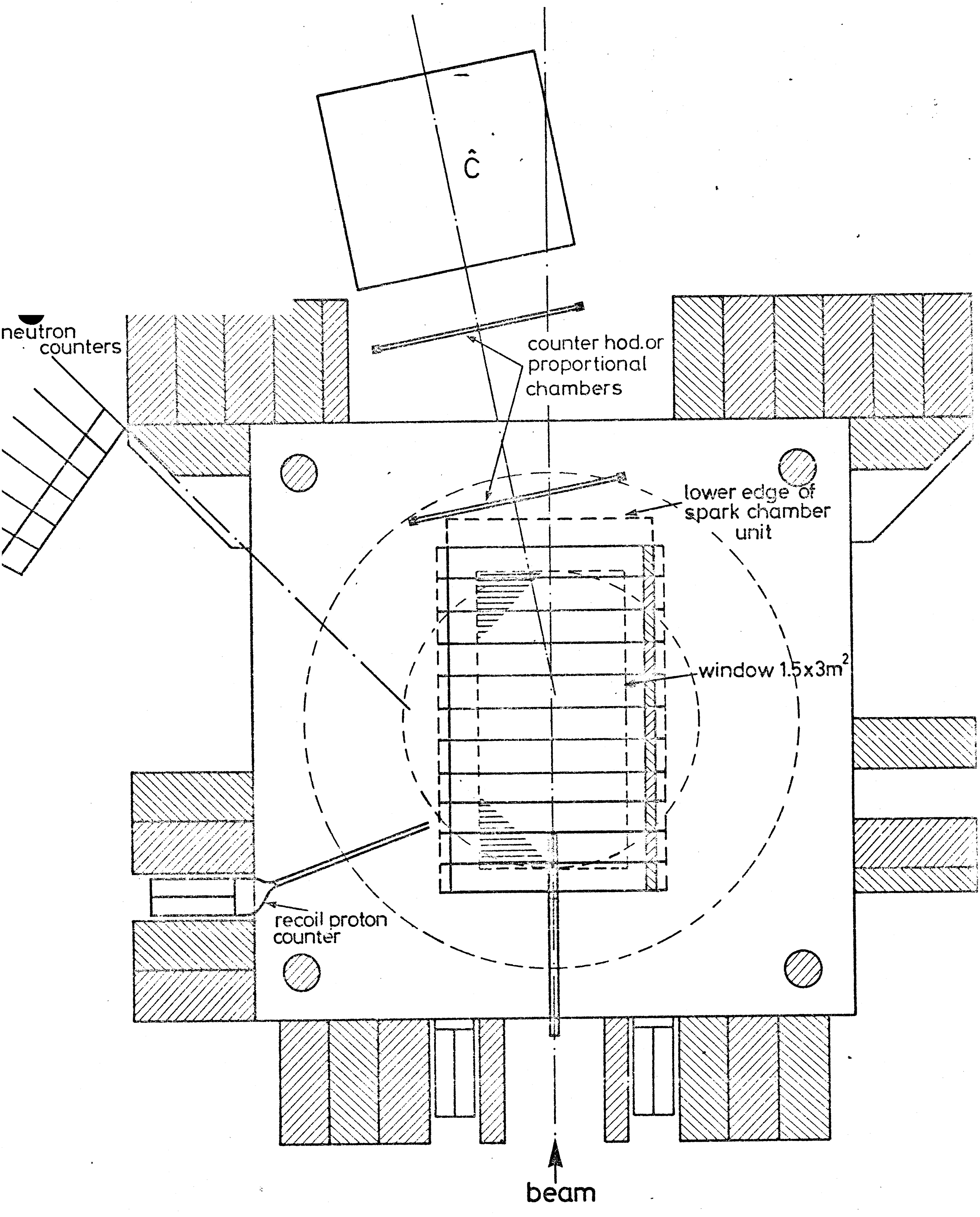
TABLE I

PH 1/COM	LAB.	PHYSICS	TRIGGER PARTICLE	TRIGGER DEVICE	BEAM	LAYOUT
70/59	Birmingham-RHEL-Westfield C.	S = 0 Neutral Mesons M = 1.5-1.9 GeV (Doubly charged Mesons)	Slow Neutron	Neutron Detector (Time of flight, angles)	HE π^-8 (π^+)	1, 2a
70/63	Bari-Bonn-CERN-Milan	S=0 Charged Mesons M= 1.5 - 2 GeV	Slow Proton	Proton Detector (T.o.F., Absorption)	HE π^-12	1
70/64	Bari-CERN-Glasgow	K^{*o}'s from $\pi^- p \to K^* \Lambda$ M= 1.0-2.0 GeV	Slow Λ	Proton Detector + 3 counters	HE π^-8	1
70/65	Saclay-CERN	Forbidden Peaks (2- and 3-body)	Fast positive part., narrow mom. band	2 Proport.chambers + Cerenkov C.	HE -8,15	1, 2a
71/2	Imperial College	Ξ^{*}'s M= 1.5 - 2.5 GeV	Slow K^+	K^+ Detector (T.o.F., Absorption, Pulse Height) (For testing : also	ES Long K^-5 HE	2b 2a)
71/3	CERN-ETH	K^{*o}'s from $K^- p \to K^o \pi^+ \pi^- n$ M= 1 - 2 GeV	First 2, than 4 charged part.	Multiplicity in 2 Prop. Chambers, + anticoincidence sideways	HE K^-10	1, 2a, 2b
71/6	CERN-ETH- Karslruhe-Saclay	Baryon exchange leading to fw. Λ's (incl.exotic mesons by non-exotic mechanism)	Fast decay proton (wide momentum band)	Anticoincidence C. + 2 Hodoscope + Cerenkov C.	HE $\pm$ 4-10	1, 2a
71/5	Glasgow-Saclay	Antibaryon production (S=0 and S=1 baryon-antibaryon states, including exotic)	Fast fw. Antiproton	2 Hodoscopes + Cerenkov C.	HE + 10	1, 2a

TABLE I Cont.

71/8	CERN-CdF- E.P.-ORSAY	Baryon exchange, mainly inelastic leading to p, Λ, Σ, Δ	Fast fw. Proton wide mom. band	2 Proport.Ch. + 2 Cerenkov C.	HE $\pm$ 7-15	(1) 2a
71/7	CERN-CdF- E.P.-ORSAY	Helicity Amplitudes in $\pi^+p \longrightarrow K^+\Sigma^+$ (Y^{*+}) $K^-p \rightarrow \pi^-\Sigma^+$ (Y^{*+})	Fast fw. $K^+(\pi^-)$, narrow mom.band	2 Proport. Ch. + Cerenkov C.	HE $\pm$ 8-15	1; 2a with Pol. Target
<u>Letter of Intent</u> :						
71/1	CERN	Polarization in $K^-p \longrightarrow \bar{K}^0n, \pi^0\Lambda, \pi^\pm\Sigma^\mp$ 1-3 GeV/c	2 Charged Part.	Counters (T.o.F.)	ES Short K^- 1-3	... Pol.Target
<u>Still in Preparation</u> :						
	Milan	Diffraction Dissociation on living (Si) target	3 or 5 charged Part.	Multiplicity in Prop. Chamber, & Anticoincidence	HE π^- ~18	1 with Si Target
	Pisa	Electromagnetic Decays of Mesons into Charged Particles + one Photon	Slow Neutron + Decay Config.	Neutron Detector, Multiplicity & γ Detector	ES Long K^-	1, 2a

(Geometry of fw. hodoscopes and Ĉ is variable. Possible additional proportional chambers in between the spark chamber modules are not shown)



STANDARD LAYOUT 2a (same remarks as FIG.1)

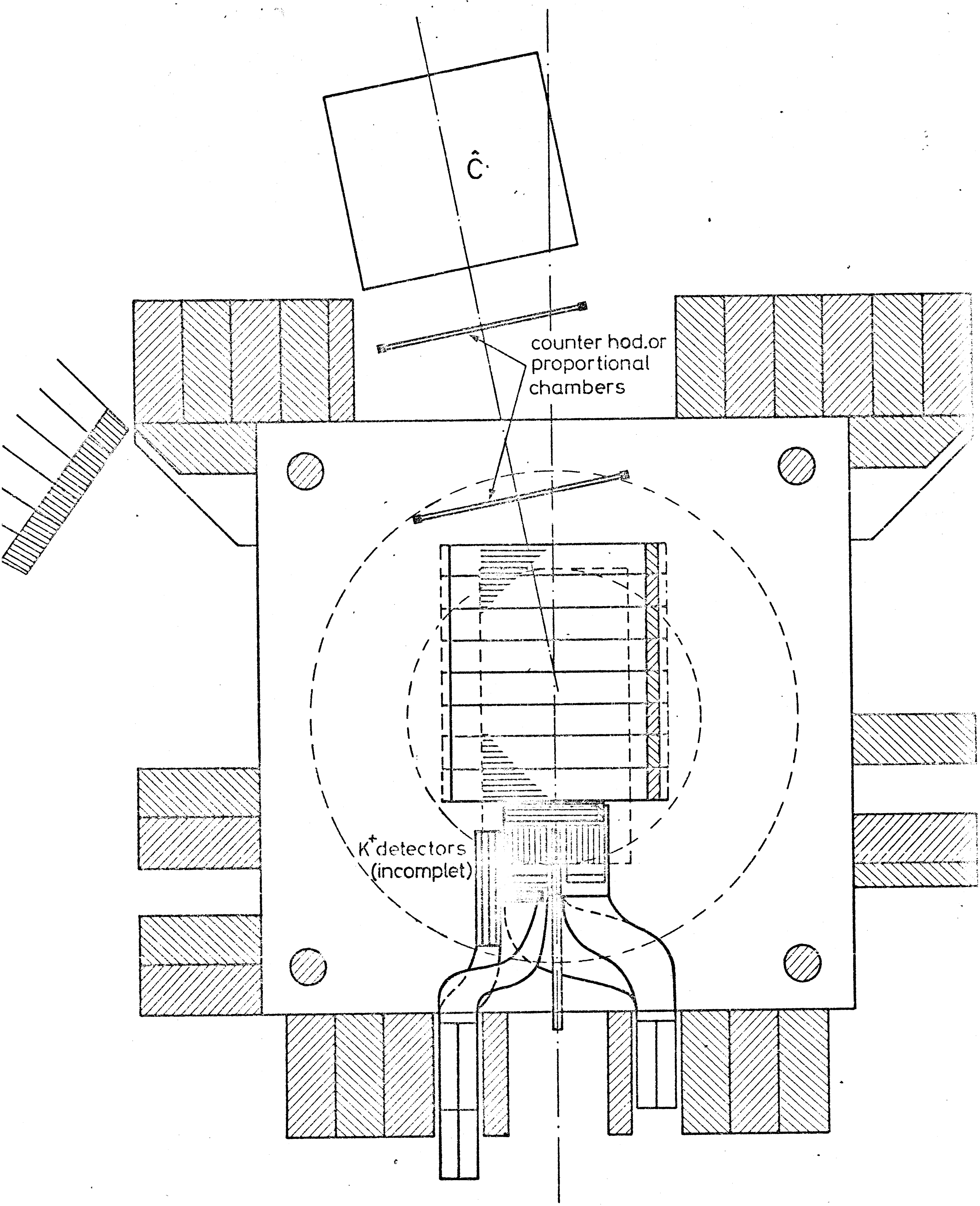


FIG. 2a

STANDARD LAYOUT 2b (same remarks as FIG.1)

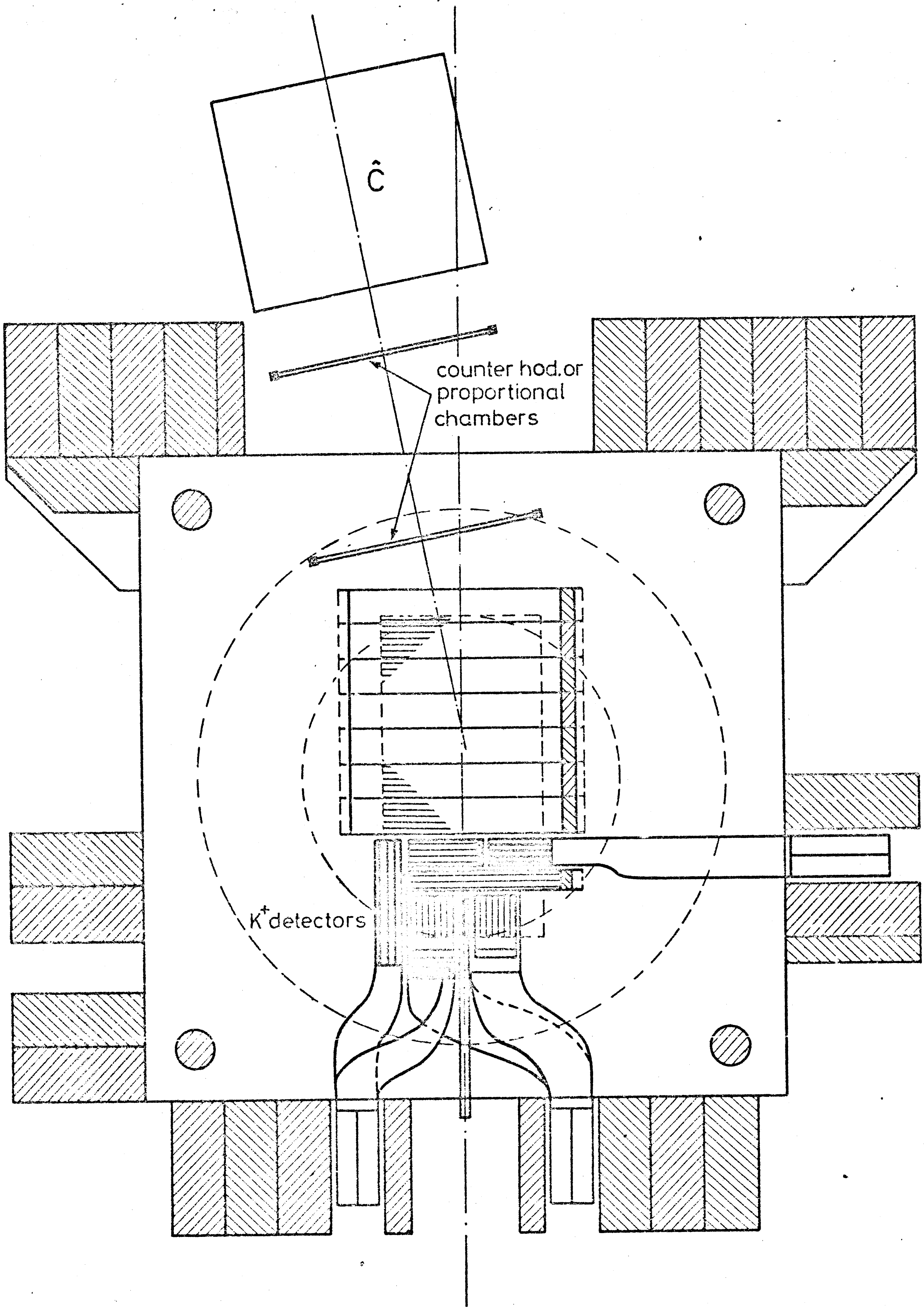


FIG. 2b