CERN/AC/25
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ORGANISATION EUROPÉENNE POUR LA RECHERCHE NUCLÉAIRE
CERN EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

ADVISORY COMMITTEE ON VISITING TEAMS

Sixth Meeting

13 May, 1960

DESCRIPTION OF A NEW EXPERIMENT REQUESTED BY A VISITING TEAM

Attached is a description of a new experiment to be performed with the synchro-cyclotron requested by :

Istituto di Scienze Fisiche dell'Università di Milano
Istituto Nazionale di Fisica Nucleare - Sezione di Milano
} Exp. 37

Visiting Team Experiments with the CERN Cyclotron

Exp.No.	Visiting Team (Date of first proposal)	Type of experiment	Total no. of shifts required	Remarks
34	A. Loria Padova 26.9.59	Scattering of polarized 382 MeV kinetic energy protons on protons	15	See copy of questionnaire CERN/AC/22/Add. Bubble Chamber experiment
35	P. Bassi Bologna 29.9.59	Complete survey of P.P interactions at 600 MeV	22	See copy of questionnaire CERN/AC/22/Add. Bubble Chamber experiment
36	J.K. Bøggild Copenhagen 8.1.60	π^- - absorption in various elements to begin with carbon and gold	5 x $\frac{1}{2}$?	Emulsion experiment
37	P. Caldirola Milano 14.1.1960	Spallation Reaction of 300 MeV protons in carbon	10	See copy of questionnaire CERN/AC/27 Cloud chamber experiment
38	J. Teillac Orsay 17.2.1960	Study of heavy fragment produced by protons on oxygen at 250, 400 and 600 MeV	3?	Continuation of series made at Orsay. Irradiations for nuclear chemistry

Note: For previous proposed experiments, see CERN/AC/21.

CERN/SC/5372 A
Exp. 37

EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

QUESTIONNAIRE CONCERNING PROPOSED EXPERIMENT WITH THE CERN CYCLOTRON

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Short title of experiment : Spallation Reaction of 300 MeV protons in carbon.

Nature and purpose of the experiment

The problem of 300 MeV proton interactions is usually studied using a nuclear Fermi gas model following the Goldberger scheme.

Other nuclear models are not convenient at these energies for many reasons.

Montecarlo calculations on heavy nuclei (Bernardini et al.; Morrison et al.; J. Combe; Metropolis et al.) have given a good agreement with the experimental data (see, for instance, Harvey: Progress in Nuclear Physics 7, 90 (1959)).

On light nuclei, practically the only existing experimental results are the following:

a) - J. Combe data on about 250 interactions in light nuclei of nuclear emulsion. The total number of events is rather small and the choice of the events may be affected by the particular scanning criteria used to distinguish interactions in light and heavy nuclei.

The chamber operates horizontally as shown in fig. 1; the graphite plates, 2 mm thick, 60x20 cm^2 are built as shown in fig. 2. Two aluminium plates are put near the bottom of the chamber.

Let us suppose to have a beam of 60 protons per pulse at 300 MeV; being the total interaction cross-section for protons in carbon .13 barns, we expect about 2 interactions per expansion. With a dead time of 3 minutes we have about 1,000 interactions per day (24 hours of machine time).

We have also $\sim$ 5% of pion production because of the non zero cross-section at this energy (8 millibarns at 340 MeV).

In many cases Coulomb scattering and ionization loss make it possible to distinguish between pions and protons in the chamber, (fig. 3); thus we consider that the contamination of pions among the secondary prongs is not too high.

So an exposure of 3-4 days can be sufficient to have good statistics.

1. Set-up of the chamber

The chamber can operate in horizontal position with carbon plates built in 5-6 months.

2. Experimental disposition

The rough experimental disposition is shown in fig. 4. Using an aluminium target 1 mm thick in the internal beam of 10^{10} particles of 600 MeV per pulse, we have about 100 protons of 300 MeV elastically scattered in a solid angle 10^{-4} sterad at 33°-34°.

Within the 800 MeV/C protons beams we can have pions with momentum less than 400 MeV/C: they are eliminated by using a bending magnet M.

The Milan group is equipped for development, analysis and stereoscopic reconstruction of the photograms.

The experiment could also be made with a propane bubble chamber, but track lengths make it difficult to distinguish between pions and protons. Nevertheless with a 3 lt propane bubble chamber, density .5 gr/cm^3, we can have about 3 interactions per photogram. We note that the presence of hydrogen makes the analysis longer.

Fig 1

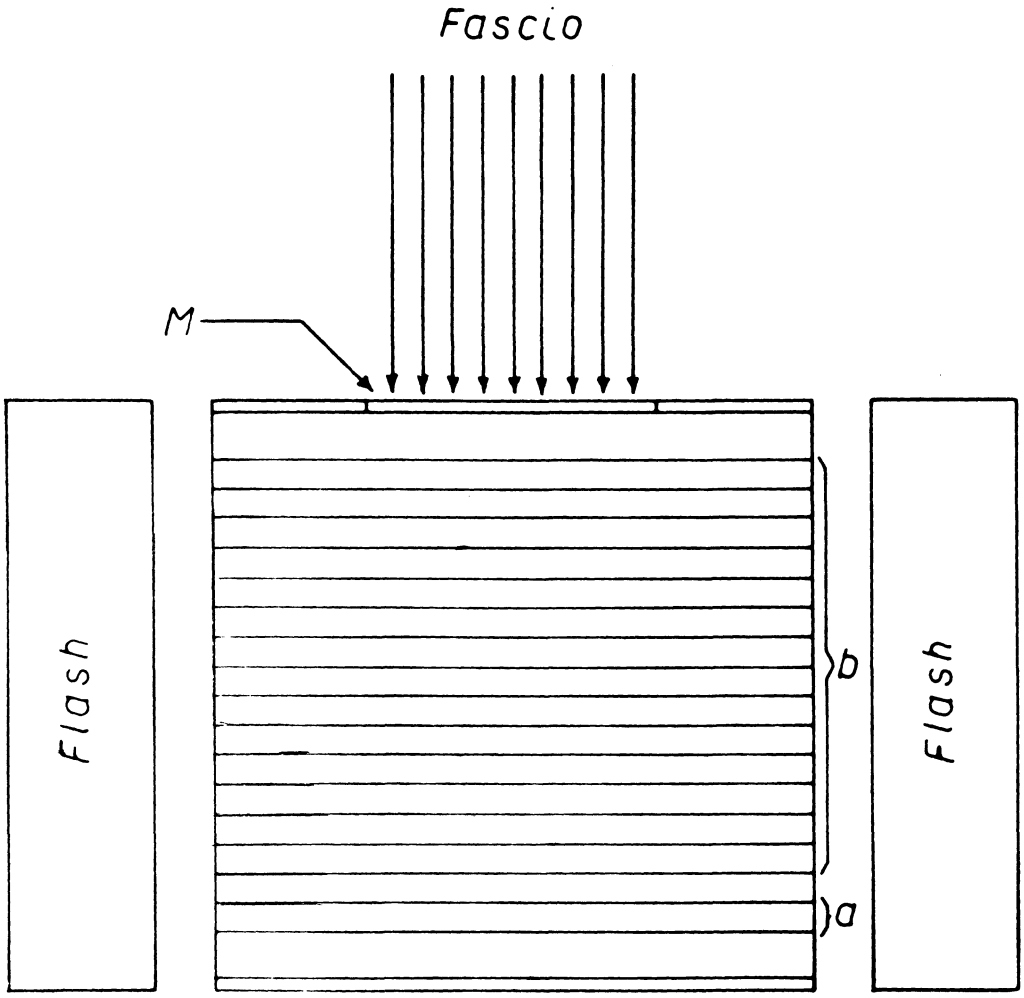
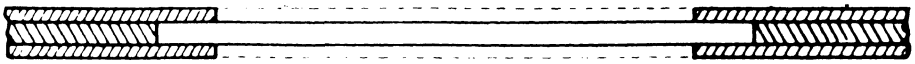


Fig 2



□ Carbonio ▨ Alluminio

SIS.R/1338

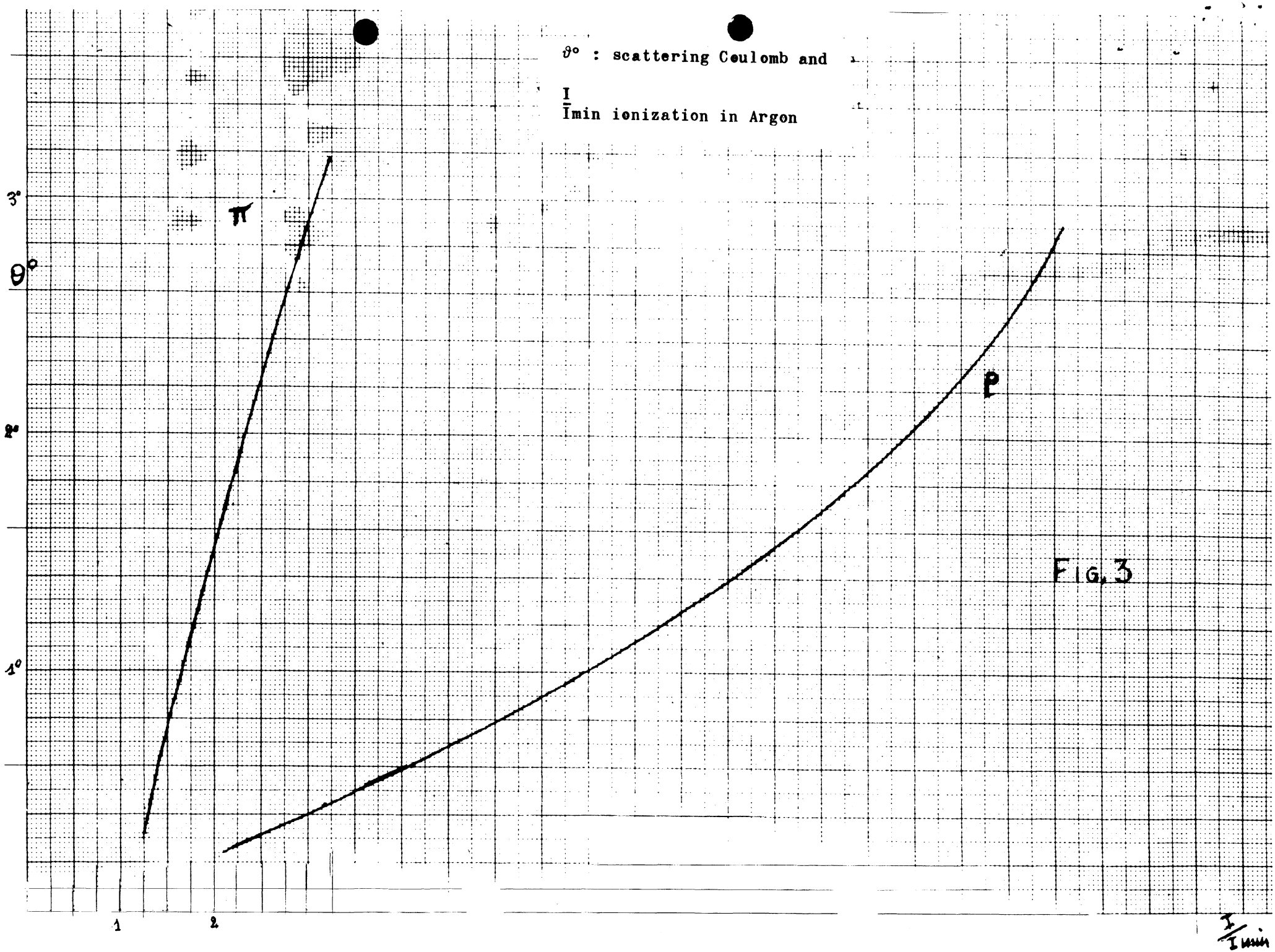


FIG. 3

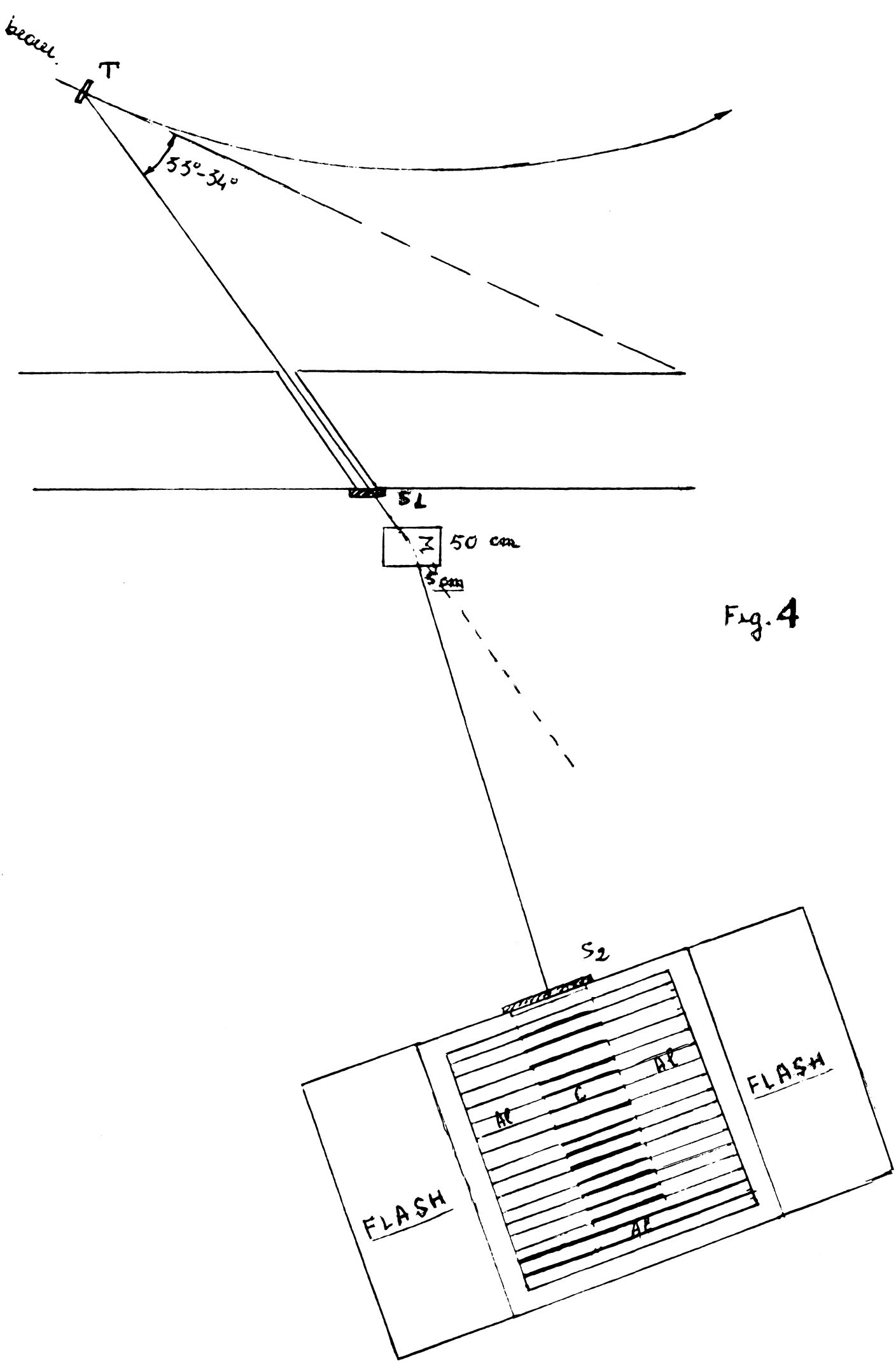


Fig. 4