EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

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REVISED PROPOSAL FOR A SEARCH FOR MULTIGAMMA EVENTS AT THE ISR

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I. INTRODUCTION

Since the time of submission of our original proposal entitled "Search for High Energy Multigamma Event; Possible Consequence of Magnetic Monopole Pairs or of High Z Leptons" in April 1971, (CERN/ISRC/70-19) we have carried out an exploratory experiment by sharing the detection equipment of the CCR group with the approval of the ISRC. Some preliminary results have been obtained from the analysis of a fraction of our data thus far showing some extremely interesting characteristics of the multigamma events. In view of these results, we are submitting to the ISRC a revised proposal for a detailed search of multigamma events using a high energy-resolution leadglass multiwire chamber hodoscope system. The details of this revised proposal is given in the attached addendum (CERN/ISRC/73-7/Add.1).

II. Summary of Preliminary Results

Some of the earlier analyzed results using a rather crude computer program at the beginning stage of the analysis are shown in the attached addendum. Very recently we have completed a much refined version of our computer program which enables us to separate γ-rays from charged particles determined in our detection system and thus to extract the desired information on the distinct multiplicity distributions of the γ-rays and charged particles respectively; the energy distribution of the γ-rays; the average multiplicity as a function of the center-of-mass energy, etc.

Fig. 1 shows the integral γ-ray multiplicity distribution for four colliding beam energies ranging from 11.7 GeV to 26.6 GeV in each beam. These results were obtained with a trigger mode of ≥ 4 HV counters at a trigger threshold of 160 MeV. This latter threshold is more than twice the average energy deposited by a charged particle in a HV counter (amount to $\sim$70 MeV), thus it would most likely ensure that these triggered events are due to multigamma rays. It should be emphasized, however, that once an event was obtained by such a trigger, the respective energies and positions of all the counters fired as well as the information on all the charged tracks given by the wire spark chambers were completely recorded. The number of γ-rays in each triggered event was obtained by subtracting out all those HV counters fired which have any charged tracks traversing through them.

Fig. 2 shows the average multiplicity of both the γ-rays and the charged particles as a function of the center-of-mass energy. It is to be noted that the space resolution of the γ-ray detector is rather poor (the size of each HV counter is 15 cm x 35 cm).

Fig. 3 shows the integral γ multiplicity distribution for various trigger modes from $\geqslant 1$ to $\geqslant 4$ at a center-of-mass energy of 53.2 GeV. For comparison, an expected γ multiplicity distribution calculated from an uncorrelated π^o production theory within the same angular region is also presented. It is strikingly evident that the detected high multiplicity γ-rays are several orders of magnitude higher than those predicted by the uncorrelated π^o production theory.

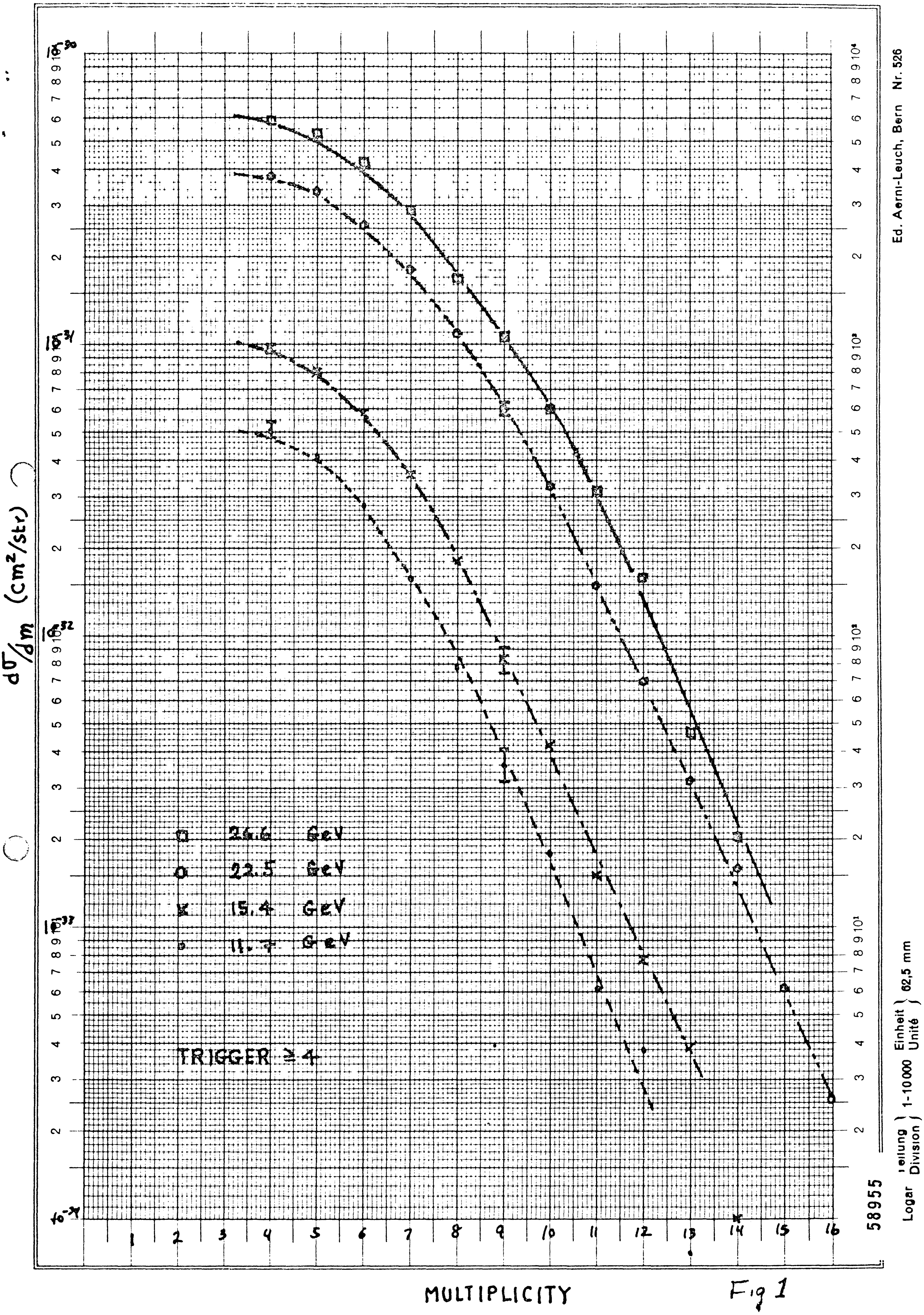
Fig. 4 shows the energy distribution of the γ-rays measured in the HV counters (3 radiation lengths thick) also at 53.2 GeV center-of-mass energy. A very prominent peak shows up at $\sim$350 MeV, basing on the original energy calibration of the CCR group while detailed corrections basing on a new energy calibration is being worked out. However, the corrected energy values of the γ's from the new calibration would push this peak energy to an even higher value than the present 350 MeV. This peak remains prominently even when the trigger mode was changed from $\geqslant 4$ to $\geqslant 3$, $\geqslant 2$, and $\geqslant 1$ respectively, and the energy value of the peak also remains unchanged. Furthermore, such phenomenon remains true also when we separate the inside HV counters from those HV counters on the outside of the interaction region, indicating, at least, that the peak is not attributable to kinematic effects of the colliding beams. Data from widely separated runs i.e. runs separated by an appreciable period of time, also give rise to the same peak.

III. Proposed Experimental Steps and Time Schedule.

As described in the addendum, the whole detector system consists of six individual units which would cover ∿70% of the total solid angle around the interaction region. Our plan is that we will start with four units only which cover the upper hemisphere and may add the rest two units at a later time if the results obtained so dictate.

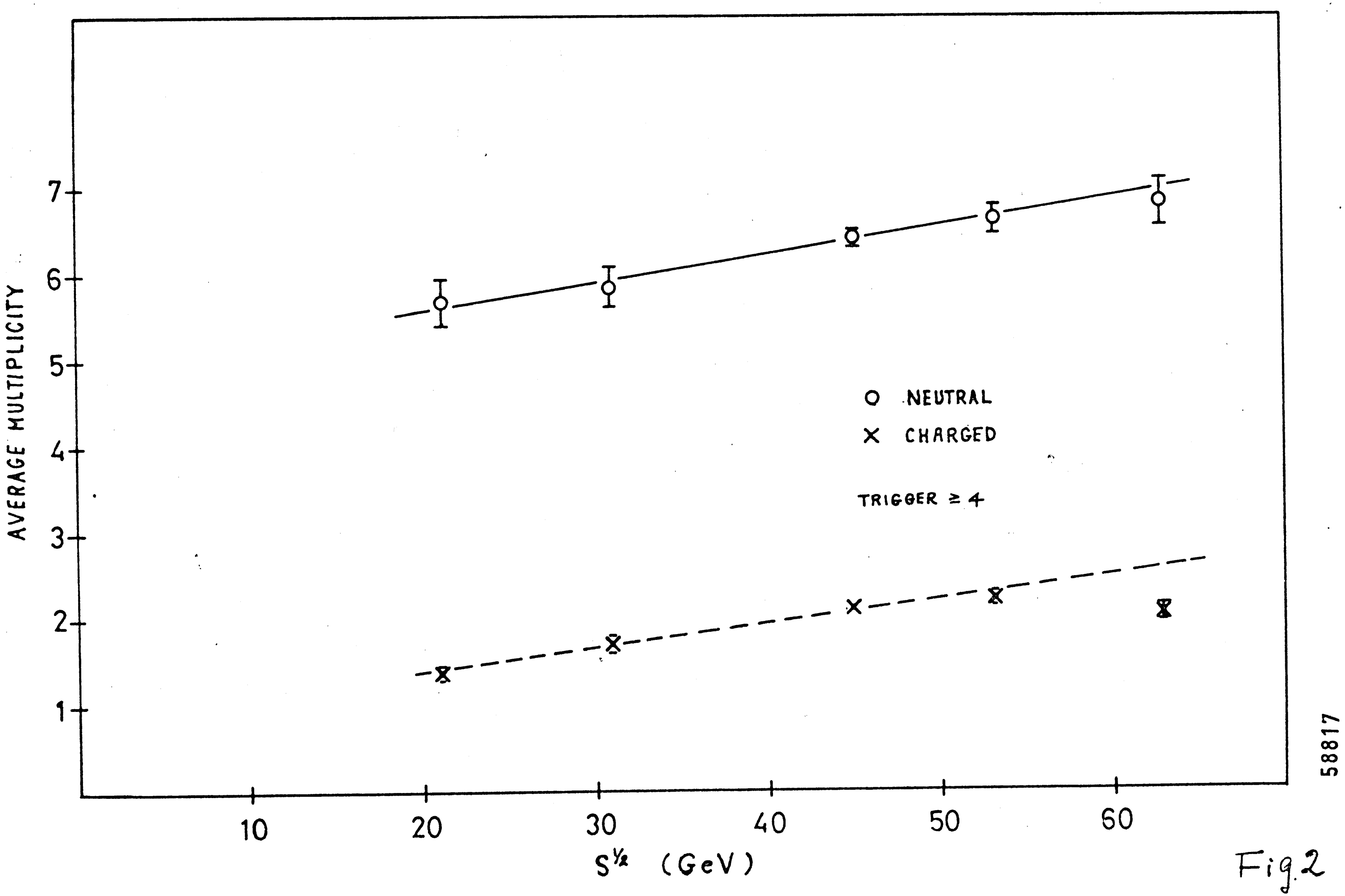
All the major apparatus and personnel involved in the proposed experiment will be provided by Brookhaven and Rome University.

The time required for constructing and bench testing of the proposed detection system is estimated to be about one year. The estimated testing time under actual beam conditions is about 4-6 weeks and the estimated data taking time is approximately six months. Therefore we would like to require that the setting-up of the proposed experiment be started around June 1, 1974. We wish also to mention that any interaction section which would permit us to cover the upper hemisphere of the interaction region with our detection system will be satisfactory to us.



dσ/dm (cm²/str)
10⁻³⁰
10⁻³¹
10⁻³²
10⁻³³
10⁻³⁴
□ 26.6 GeV
○ 22.5 GeV
✕ 15.4 GeV
• 11.7 GeV
TRIGGER ≥ 4
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
MULTIPLICITY
Ed. Aerni-Leuch, Bern Nr. 526
58955
Logar Teilung Division 1-10000 Einheit Unité 62,5 mm

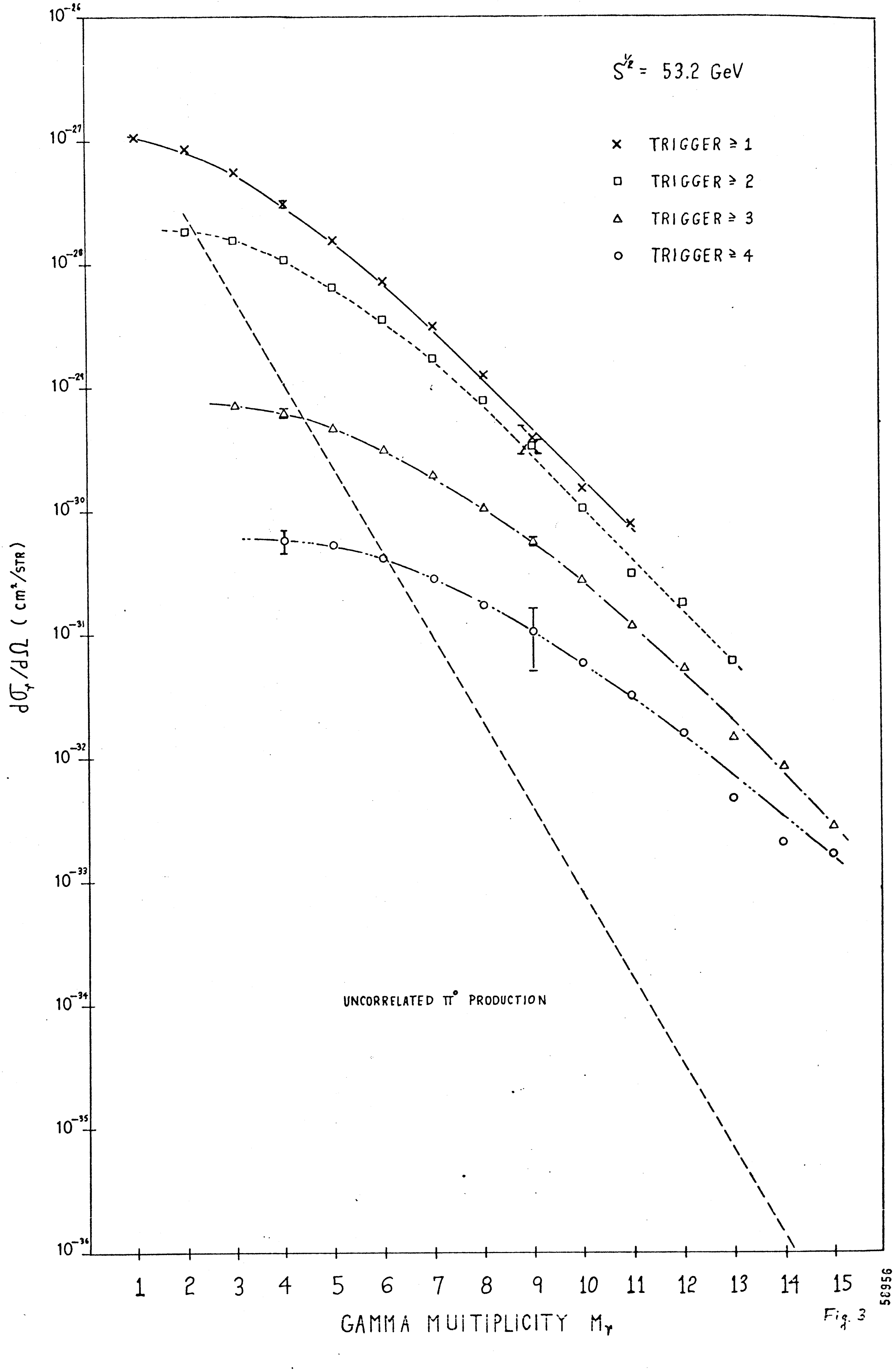
Fig 1



AVERAGE MULTIPLICITY
7
6
5
4
3
2
1
10
20
30
40
50
60
S½ (GeV)
O NEUTRAL
X CHARGED
TRIGGER ≥ 4
58817

Fig.2

58817



$S^{1/2}$ = 53.2 GeV
TRIGGER ≥ 1
TRIGGER ≥ 2
TRIGGER ≥ 3
TRIGGER ≥ 4
UNCORRELATED π° PRODUCTION
$d\sigma_\gamma/d\Omega$ (cm²/STR)
10^{-26}
10^{-27}
10^{-28}
10^{-29}
10^{-30}
10^{-31}
10^{-32}
10^{-33}
10^{-34}
10^{-35}
10^{-36}
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
GAMMA MUITIPLICITY M_γ
58956

Fig. 3

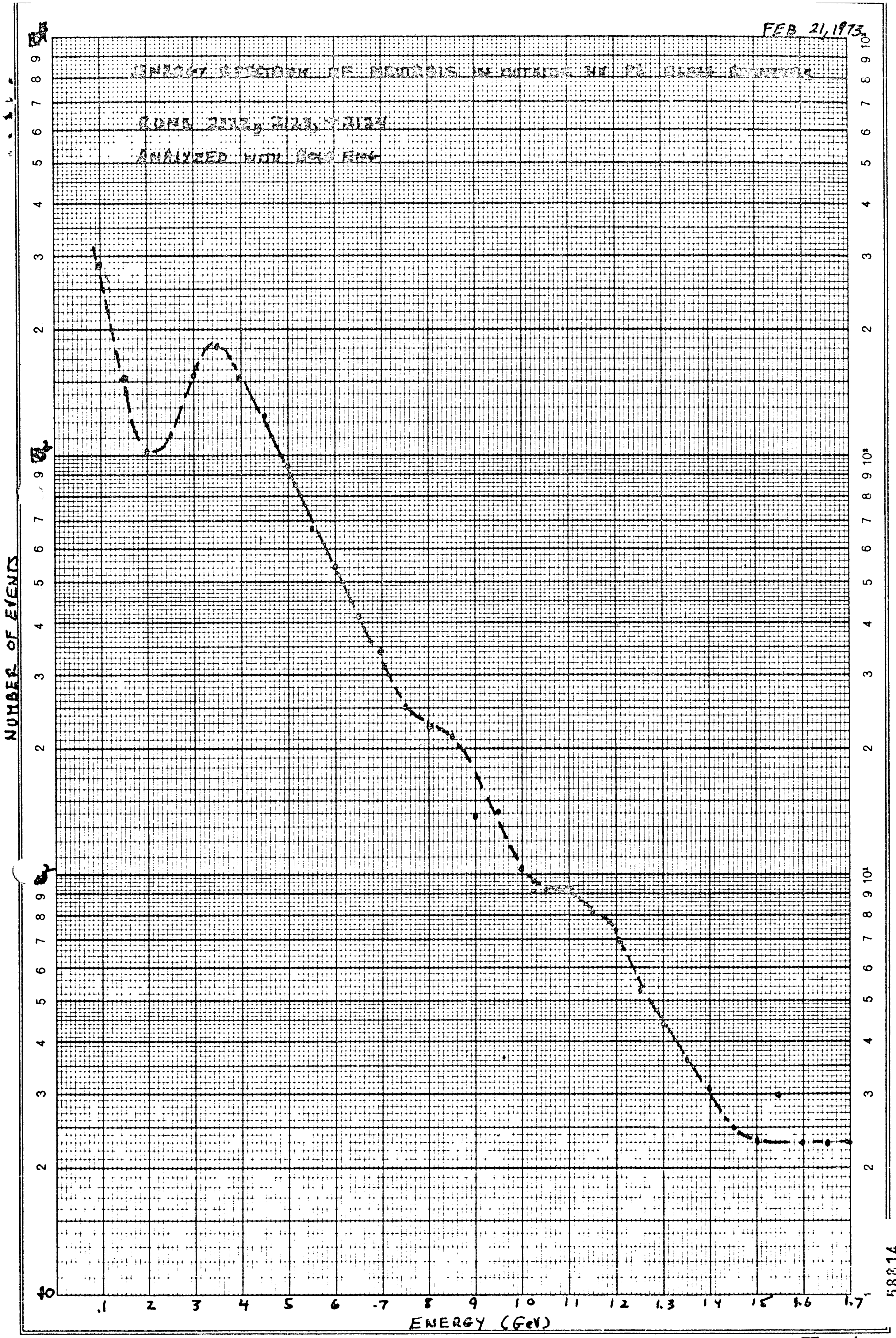

FEB 21, 1973
ANALYZED
NUMBER OF EVENTS
ENERGY (GeV)
.1
.2
.3
.4
.5
.6
.7
.8
.9
1.0
1.1
1.2
1.3
1.4
1.5
1.6
1.7
Ed. Aerni-Leuch, Bern. Nr 534
58814

Fig A