

ON THE  $3\gamma$  EFFECTIVE MASS SPECTRUM AT  
 $201.3 \leq M(3\gamma) \leq 703.8 \text{ MeV}/c^2$

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RESUMEN

Se ha investigado la existencia de una posible partícula que se desintegrará en  $\pi^0\gamma$  ( $\rightarrow 3\gamma$  en la región de masa  $201.3 \leq m(3\gamma) \leq 703.8 \text{ MeV}/c^2$  utilizando la cámara de burbujas de líquido pesado BP3 de l'Ecole Polytechnique de Paris, donde los fotones resultantes son detectados y medidos. No se aprecia ninguna señal significativa.

INTRODUCTION

We were looking for reaction  $\pi^-p \rightarrow Xn \rightarrow \pi^0\gamma \rightarrow \gamma\gamma\gamma$  produced in the Ecole Polytechnique heavy liquid bubble chamber BP3 ( $1 \times 0,5 \times 0,5 \text{ m}^3$ ) exposed to a beam of  $950 \text{ MeV}/c$  negative pions at the Saturne synchrotron in Saclay. 200.000 photographs in a mixture 50%  $\text{CF}_3\text{Br}-\text{C}_3\text{H}_8$  ( $X_0=20 \text{ cm}$ ) and 100.000 photographs in a pure freon  $\text{CF}_3\text{Br}$  ( $X_0=11 \text{ cm}$ ) were taken. Several searches have been previously done with those photographs (1-4). Present work is carried out using a sample of 44 100  $\pi^-$  interactions in the mixture. All  $\gamma$ -rays are directly detected by electron pair production in the chamber, and their momenta are measured using Behr-Mittner method (5). The detection probability for one  $\gamma$ -ray was 54%. We have applied the detection and measurability cut-offs reported in several previous papers. The main interest of this search consists in the fact that the heavy liquid bubble chamber offers a better efficiency for  $\gamma$  detection than other techniques.

SEARCH FOR  $X \rightarrow \pi^0\gamma \rightarrow \gamma\gamma\gamma$  CANDIDATES

As candidates for such a decay we have scanned for "0 prongs- $3\gamma$ " events. In this scanning, events containing  $\gamma$ -rays with ambiguous origin have been rejected. We have found 511 events and their mass effective squared distribution is shown in fig. 1 a. A logarithmic scale has been used.

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## BACKGROUND

The three important sources of background are coming from the following reactions:

1)  $\pi^-p \rightarrow \pi^0\pi^0n \rightarrow 4\gamma n$  in which 1  $\gamma$ -ray among the four has escaped detection. In order to estimate the contribution of this reaction we have scanned for "0 prongs-4 $\gamma$ " events in a sample of 38 100  $\pi^-$  interactions. Each combination of 3  $\gamma$ -rays among the four is weighted taking into account its probability to be observed as a "0 prong-3  $\gamma$ " event.

2)  $\pi^-p \rightarrow \eta^0n \rightarrow 3\pi^0n \rightarrow 6\gamma n$  and  $\pi^-p \rightarrow \pi^0\pi^0\pi^0n \rightarrow 6\gamma n$ , where three  $\gamma$ -rays among the six have escaped detection. Contaminations coming from those reactions were evaluated using a Monte-Carlo method. We have generated events taking into account the measurement errors, and the same weighting procedure has been applied to them.

All the background distributions obtained in this way were normalized to the same number of  $\pi^-$  interactions than in the case of "0 prongs-3  $\gamma$ " events. Total background mass histogram is shown in fig. 1 b.

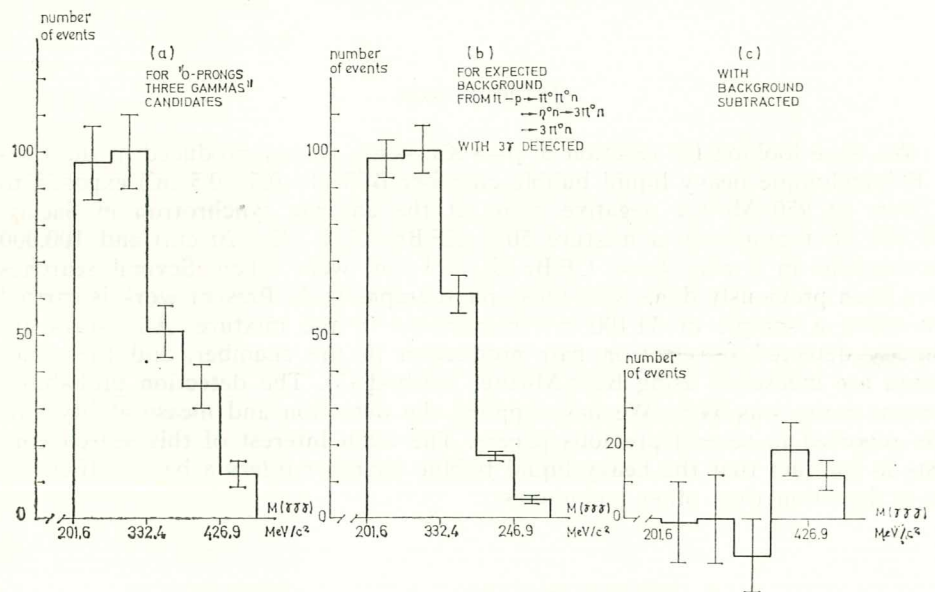


FIG. 1.— $\gamma\gamma$  mass distribution (no fit  $n^0$ ).

## RESULTS

The effect of the background subtraction is shown in fig. 1 c. No significant bump can be seen in this region and the number of remaining events is compatible with zero at less than two standard deviations. This result is in agreement with the preliminary results of a similar work (6) presented at the XV Conference on High Energy Physics.

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