IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Study On The $A^-_2 \rightarrow H\ \Pi^-$ Decay Mode $1\pi^- 6\gamma$

Yogendra Kumar

[1] Assistant Professor.

[1] Dept. of Physics.

Gaya College of Engineering Gaya.

Shri Krishna Nagar, Khizarsarai, Bihar – 823003,India

Abstract: The performance of decay system has been checked by observing the different decay modes of well known meson viz. η- mesons and ω mesons resulting in avoiding the pile-up-effects. In this paper we present here the result of data analysis of $a^-_2 \rightarrow \eta\,\pi^-$ decay mode $1\pi^- 6\gamma$ for a^-_2 meson at about 1320 MeV mass and 100 MeV width obtained in background subtracted yield curve.The yield curve shows that there is a small enhancement for the a^-_2 meson at about 1320 MeV mass and 100 MeV width. It means (a) the a_2^- meson has been produced in the $\pi^- p \rightarrow a_2^- p$ near its production threshold with a sufficient production cross-section to be detected. (b) The a_2^- meson is expected to decay into $\eta\ \pi^-$ with $\eta \rightarrow \pi^0\ \pi^0\ \pi^0$ along with all $\pi^0 \rightarrow \gamma\gamma$ events.

However, the data suffer from the statistical limitations and high backgrounds.

In order to improve the data analysis it is advised to study $1\pi^- \leq 5\gamma$ and

$1\pi^- \leq 6\gamma$.

This is because some gammas of $1\pi^- \leq 6\gamma$ may be lost in the decay system.

Index Terms **- Meson Branching Ratio, Yield curve, Gamma, Proton, Pion.**

I. Introduction

Particle detection by Scintillation counters suffers from many problems such as pile-up-effects. Pile-up-effects are the outcome of distortion in photo cathode surface (PCS) of photo multiplier tube (PMT) of scintillation counter. Pile-up-effects associated with PMT are undesirable as these could affect the detection of the particles passing through the scintillator of the counter. Its output pulses are distorted and pulses of undesired shapes and amplitudes are produced. Hence clear distinction between two pulses becomes difficult. The pile-up-effects can be avoided by studying different decay modes of a_2^- meson particles. An investigation on the a_2^- meson constitutes a topic of great interest. The mass and the width of a_2^- meson have been estimated to be 1320 MeV and 100 MeV respectively. Its main decay modes are:

(i) $a_2^- \rightarrow \rho^0 \pi^-$

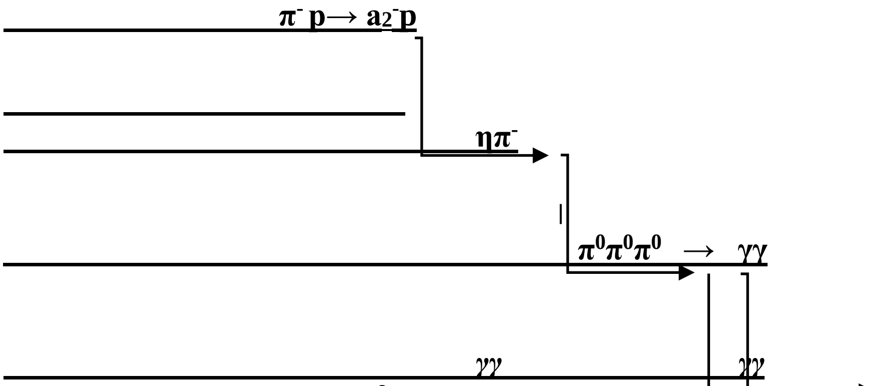
$\quad\quad\quad\quad\quad\;\;$ └→ **$\pi^+ \pi^-$ with a branching ratio (BR) of (70.1± 2.2)% and**

(ii) $a_2^- \rightarrow \eta\pi^-$ **with a B.R. of (14.5±1.2) %.**

Here we report some results on $a_2^- \rightarrow \eta\pi^-$ data analysis using yield curve method.

DISCUSSION:-

The decay mode is obtained as follows:-



We expect 2.8 events per 10^8 pions in the $a_2^- \rightarrow \eta\pi^-$ decay mode assuming 20 % detection efficiency of the decay system.

For $1\pi^- 6\gamma$ decay signature for this decay mode the branching ratio (B.R.)(33.24±0.29)% for $\eta \rightarrow \pi^0\pi^0\pi^0$ is also taken into account(Groom-2000).

Thus we expect 0.90 a_2^- events per 10^8 pions in its $1\pi^- 6\gamma$ decay mode

There is no significant enhancement for $1\pi^- 6\gamma$ decay mode of a_2^- meson in the yield curve.

This result is in good agreement with the expectation of $0.90/10^8$ pions in the yield curve. Statistically one can expect such a low signal in the yield curve. This is because the event will smear out through the channel of the yield curve.

The signal may be marred due to the fluctuation in the backgrounds.

Keeping all these points in mind, we have made an attempt to estimate the backgrounds non(a_2^- events) in this decay mode by dropping all the points of the yield curve ranging from 2140 to 2280 MeV/c P_π. It is found that the background level can be explained with the high confidence level (CF) of more than 99%.

For obtaining a_2^- (1320) signal the background levels are subtracted from the total events(for $1\pi^- \leq 6\gamma$) at each point of the yield curve. Fig. 1 shows the yield curve for $1\pi^- \leq 6\gamma$ obtained by subtracting tracting background from the total events table.1

CONCLUSION:- It is obivious from this curve(Fig. 1) that:

(i) there is small enhancement for the a_2^- meson at about 1320 MeV mass and 100 MeV width.

(ii) It means (a) the a_2^- meson has been produced in the $\pi^- p \rightarrow a_2^- p$ near its production threshold with a sufficient production cross-section to be detected. (b) the a_2^- meson is expected to decay into $\eta\pi^-$ with $\eta \rightarrow \pi^0 \pi^0 \pi^0$ along with all $\pi^0 \rightarrow \gamma\gamma$ events.

(iii) However, the data suffer from the statistical limitations and high background.

In order to improve the data analysis it is advised to study $1\pi^- \leq 5\gamma$ and $1\pi^- \leq 6\gamma$. This is because some gammas of $1\pi^- \leq 6\gamma$ may be lost in the decay system.

$\pi^- p \rightarrow a_2^- p$.

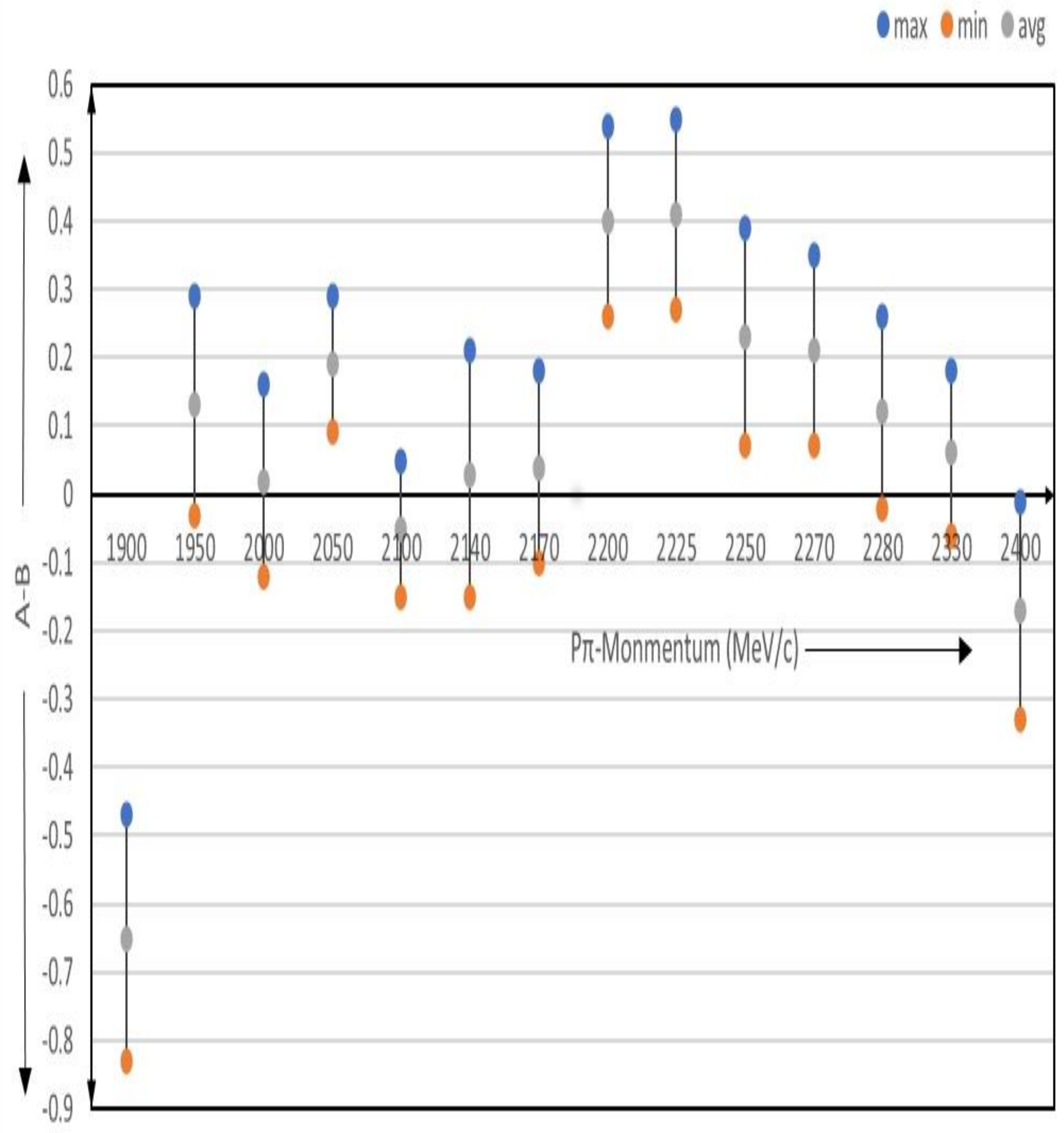


Fig1- Shows the yield curve for $1\pi6\Gamma$ events. obtained by subtracting the background level. The enhancement is or a2(1320) meson. Table-1

Table:- Enlists the points of the yield curve for $1\pi^{-} \leq 6\gamma$ events obtained by subtracting the backgrounds from the total events, Fig.1.

P_π Momentum MeV/c	Yield curve (A)	Background (B)	A-B
1900	5.68±0.18	6.33	-0.65±00.18
1950	6.42±0.16	6.29	0.13±0.16
2000	6.22±0.14	6.24	-0.02±0.14
2050	6.38±0.10	6.19	0.19±0.10
2100	6.10±0.10	6.15	-0.05±0.10
2140	6.14±0.18	6.11	0.03±0.18
2170	6.12±0.14	6.08	0.04±0.14
2200	6.46±0.14	6.06	0.40±0.14
2225	6.44±0.14	6.03	0.41±.0.14
2250	6.24±0.16	6.01	0.23±0.16
2270	6.20±0.14	5.99	0.21±0.14
2280	6.10±0.14	5.98	0.12±0.14
2330	6.00±0.12	5.94	0.06±0.12
2400	5.70±0.16	5.87	-0.17±0.16

ACKNOLEDGEMENT:-

Author expresses his gratitudes to the authority of Imperial College London for providing the data. Author also expresses his deep sense of gratitudes to Late Prof. P. N. Upadhyay for his guidance and co-operation given during research work.

REFERENCES:-

1. Caso, C., et al... Eur. Phys. J. C 1-4, 26 (1998).
2. D.E. Groom et al. Eur-Phys. J.C. 15(1-4) (2000) 28
3. Foccassi et.al. (1966). Phys. Letts. B.
4. P.N. Upadhyay and N. Yadav, Acta Clencia Indica, 27 (3)
5. Yogendra Kumar, Ph.D. Thesis 2002, Magadh University, Bodh Gaya
6. A. Yamazaki,K.Watnabe, A. Uritani,T.Iguchi, N.Kawaguchi, T. Yanagida,Y. Fujimoto. K. Fukuda, S. Kishimoto, and K. Asai : Appl. Phys. Exp. 6 (2013) 062601.
7 .K. Watanabe, Y. Kondo, A. Yamazaki, A.Urutani, T. Iguchi, N. Kawaguchi, K. Fukuda, S. Ishidu, T.Yanagida, Y. Fujimoto, and A. Yoshikawa: Radiat. Meas. 71 (2014) 158.