Group Report

Measure of the branching fraction of decay $J/\psi \to \Omega\pi^+\pi^+\pi^-\pi^-$

Ma Hsuning

physics of NKU

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Introduction

The process we are researching is the decay below

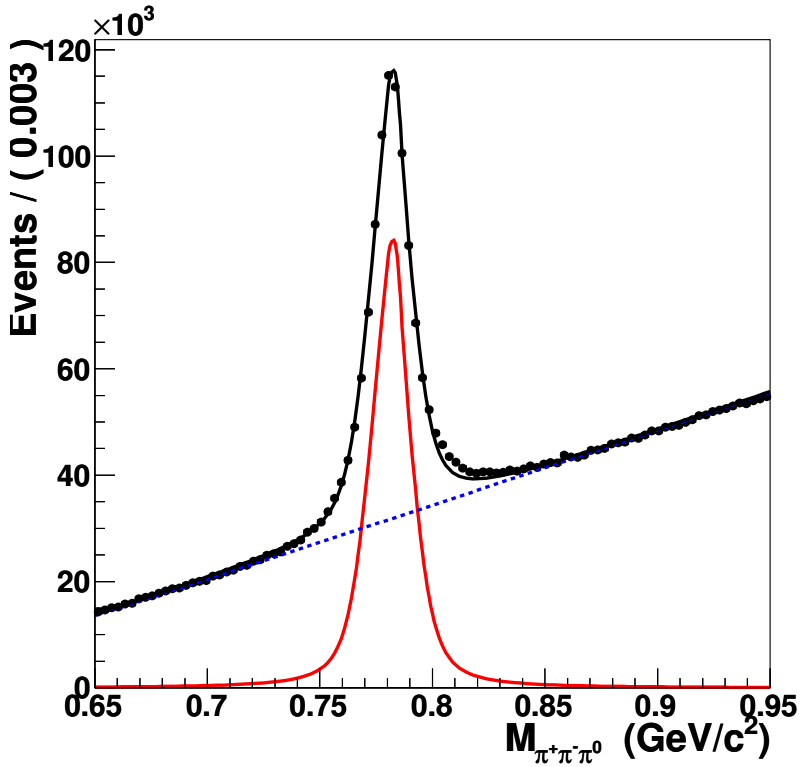
$$J/\psi \to \Omega\, \pi^+\pi^+\pi^-\pi^-$$
$$\Omega \to \pi^0\pi^-\pi^+$$
$$\pi^0 \to 2\gamma$$

The Measure of branching fraction is accomplished via the formula below

$$N^{tot}_{data} \times Br(J/\psi \to \Omega\ 4\pi) \times Br(\Omega \to 3\pi) \times Br(\pi^0 \to 2\gamma) \times \epsilon = N^{obs}_{data} \quad (*)$$

Measure of N_{data}^{obs}

After running the data samples, we got a root file, using it and a fitting script we did some fitting work.
Its principle is fitting the data with Chebychev polynomial and Gaussian distribution, as shown below.



Data of N^{obs}_{data}, N^{tot}_{data}, $Br(\Omega \to 3\pi)$ and $Br(\pi^0 \to 2\gamma)$

From the fitting of data, we learn that

$$N^{obs}_{data} = 7.01 \times 10^5.$$

And we learned from other's work that

$$N^{tot}_{data} = 2.25 \times 10^8.$$

As for $Br(\Omega \to 3\pi)$ and $Br(\pi^0 \to 2\gamma)$, we can look them up in the PARTICLE PHYSICS BOOKLET.

$$Br(\Omega \to 3\pi) = 89.2\%$$
$$Br(\pi^0 \to 2\gamma) = 98.823\%$$

Measure of the efficiency ϵ

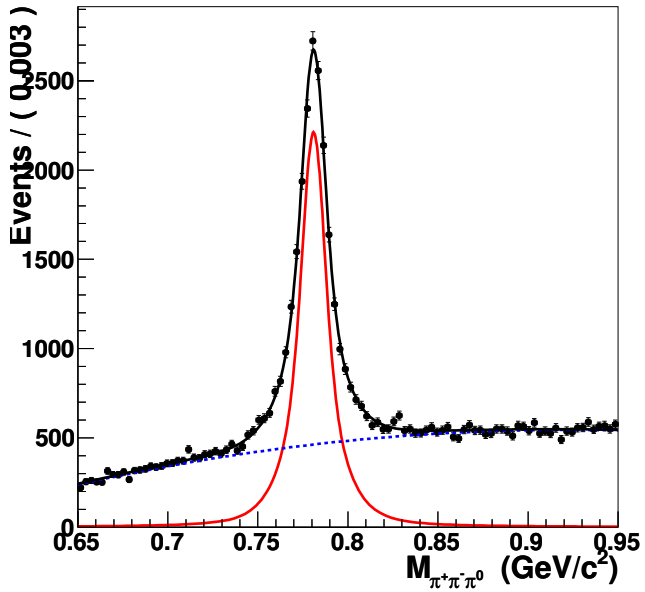
And the efficiency is calculated as $\epsilon = \frac{N_{sig}^{obs}}{N_{sig}^{tot}}$,
which will be calculated via signal MC which was introduced before.

$$N_{sig}^{obs} = 1.8285 \times 10^4,$$

which is obtained from the fitting of signal MC, and

$$N_{sig}^{tot} = 10^5$$

as we set it to be.
So we can get the efficiency as



$$\epsilon = 18.285\%$$

Calculation of $Br(J/\psi \to \Omega\ 4\pi)$

With the formula $(*)$, we can calculate $Br(J/\psi \to \Omega\ 4\pi)$ as

$$Br(J/\psi \to \Omega\ 4\pi) = \frac{N_{data}^{obs}}{N_{data}^{tot} \times Br(\Omega \to 3\pi) \times Br(\pi^0 \to 2\gamma) \times \epsilon}$$

$$= \frac{7.014 \times 10^5}{2.25 \times 10^8 \times 89.2\% \times 98.823\% \times 18.285\%}$$

$$= 1.934\%,$$

which almost equals to Ji Qingping's early work.

Summary

- As you can see, I didn't not deal with errors analysis. Actually, every variable was measured or looked up with errors.
- What was to be done is topology, which I didn't know very well.
- What is to be done this term is mainly taking my course.