Combined Results for Upper Limit

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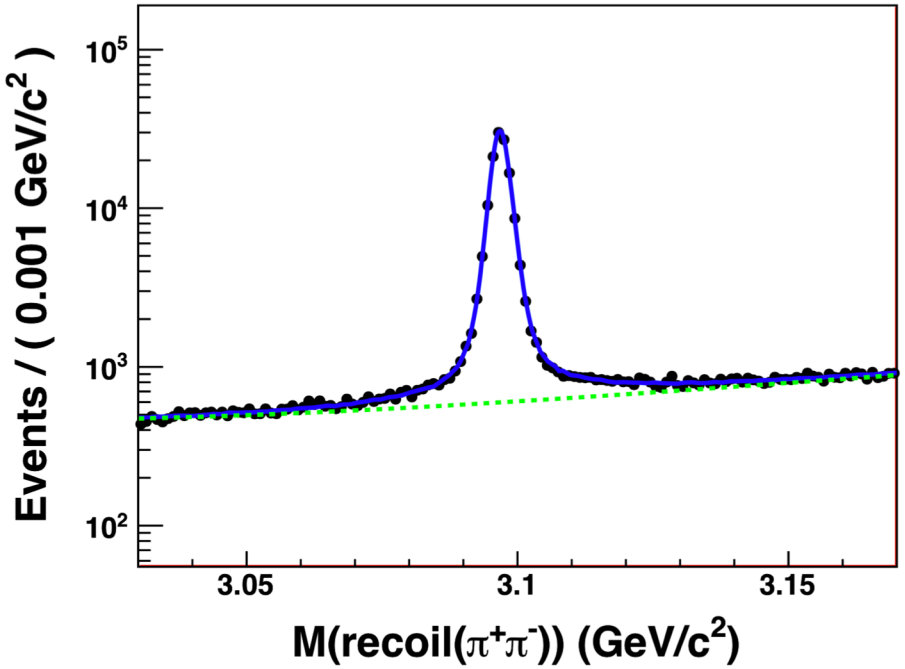
20180817

Get Upper Limit



Get N(J/psi->invisible) by fitting && main background contribution(together with uncertainty).
Get $\boldsymbol{\varepsilon}_{invi}$(from MC simulation) and $\boldsymbol{\varepsilon}_{trig}$(from data).

Get Upper Limit

Subtract main background

$\psi(3686) \to \pi^+\pi^- J/\psi, J/\psi \to \mu^+\mu^-$	714438±693
$\psi(3686) \to \pi^+\pi^- J/\psi,\ J/\psi \to \pi^+\pi^-$	744±25
$\psi(3686) \to \eta J/\psi,\ \eta \to \gamma\pi^+\pi^-,\ J/\psi \to \mu^+\mu^-$	35±6
scaled continuum data	7±5

713652±693

Get N(J/psi->$\boldsymbol{\mu^+\mu^-}$) by subtracting main background contribution(together with uncertainty).
Get $\boldsymbol{\varepsilon}_{\mu\mu}$(from MC simulation).

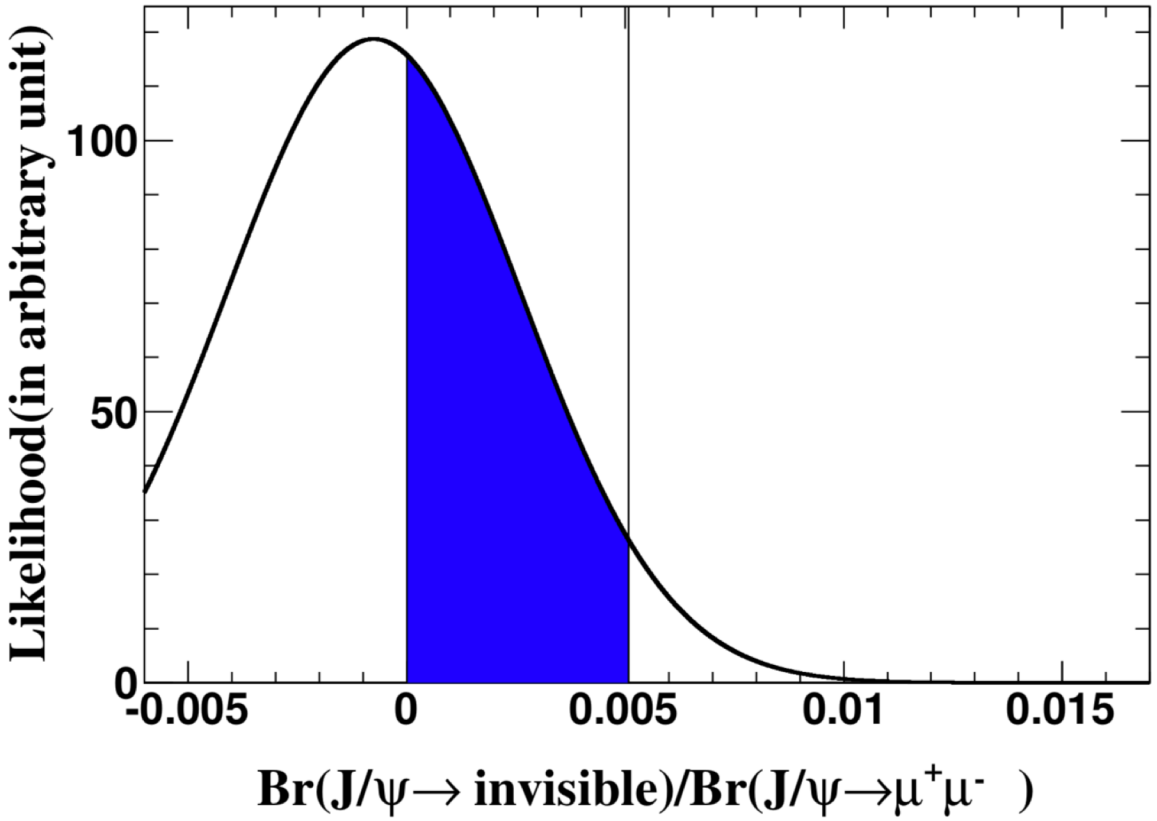
Get Upper Limit

$$\frac{\mathcal{B}(J/\psi \to \text{invisible})}{\mathcal{B}(J/\psi \to \mu^+\mu^-)} = \frac{N_{\text{invi}}/(\epsilon_{\text{invi}} \cdot \epsilon_{\text{trig}})}{N_{\mu\mu}/\epsilon_{\mu\mu}}$$

$$= (-7.55 \pm 4.58(\text{stat.}) \pm 33.7(\text{syst.})) \times 10^{-4}$$

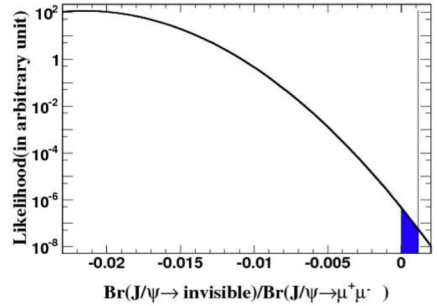
Calculate relative branching fraction of signal over normalization channel.

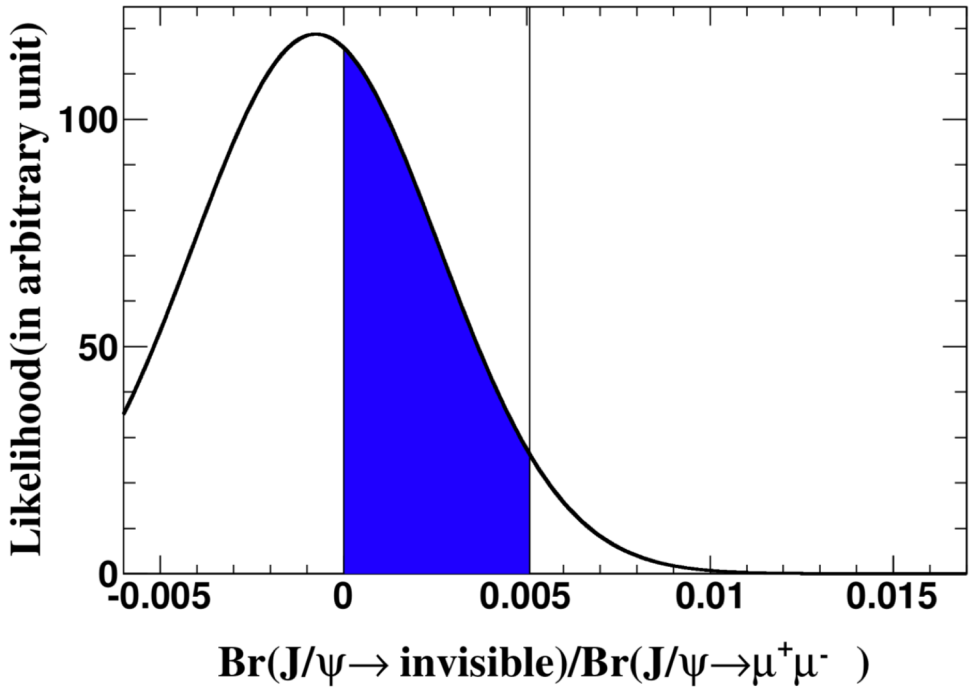
Get Upper Limit



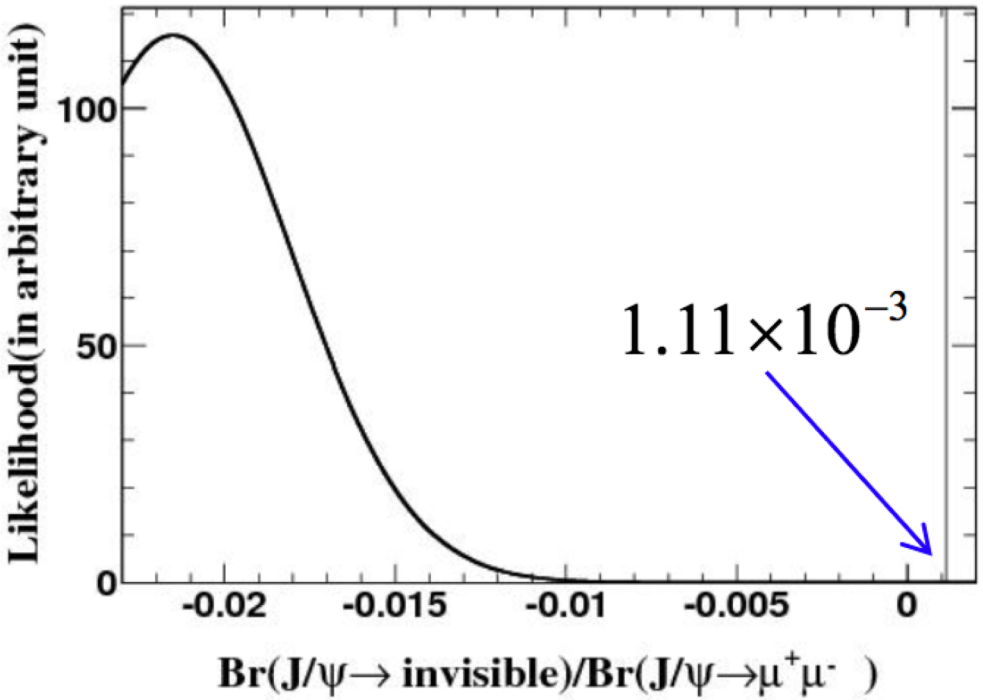
Normalize likelihood distribution after smearing by systematic error(statistical error is much smaller).
Get the upper limit at 90% confidence level.

2 data sets





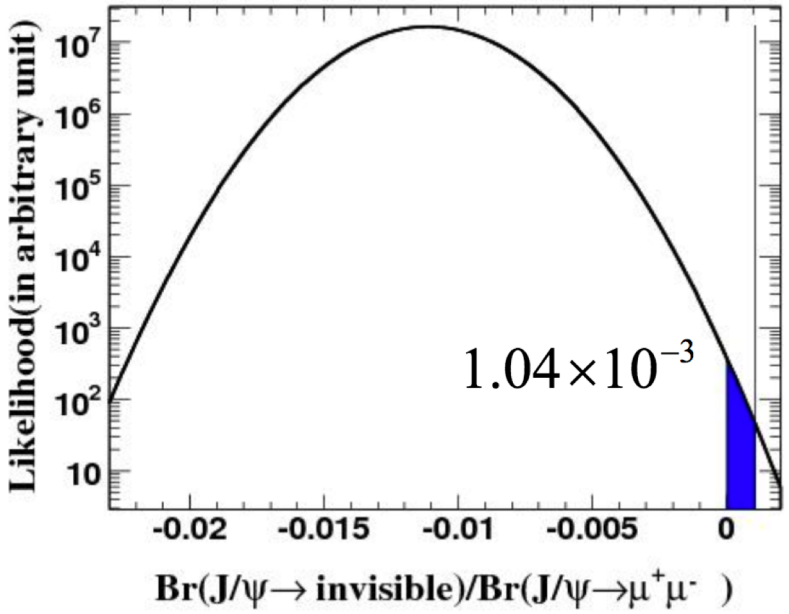
$$(-7.55 \pm 33.7) \times 10^{-4}$$



$$(-219.72 \pm 34.44) \times 10^{-4}$$

Assume summation of 2 Gaussian → Gaussian

$$\frac{B(J/\Psi \rightarrow invisible\ )}{B(J/\Psi \rightarrow \mu^{+}\mu^{-})} = (-111\ .33 \pm 24\ .09) \times 10^{-4}$$



Get a combined upper limit which is smaller than any of them.

Discuss with Zhu Kai

Take 2 data sets as one.

We can also use simultaneous fit by requiring number of events as a same parameter(taking place of sigma in usual simultaneous fit).

Thanks!