Status of Measurement of J/ψ→Λ/Λ̄+X

Reports at

Spring Workshop (Mar. 16th)
P&S meeting (Apr. 27th)
Update at P&S meeting (May 4th)

Measurement of $J/\psi \rightarrow \Lambda/\bar{\Lambda}+X$

B. Zheng[1], M.G. Zhao[2], Y.D. Wang[3], M.Q. Jing[1], F. Maas[3]

1 University of South China
2 Nankai University
3 Helmholtz-Institut Mainz

Measurement of $J/\psi \rightarrow \Lambda/\bar{\Lambda}+X$

B. Zheng[1], M.G. Zhao[2], Y.D. Wang[3], M.Q. Jing[1], F. Maas[3]

1 University of South China
2 Nankai University
3 Helmholtz-Institut Mainz

Physics and Software meeting, 2018.4.27

Measurement of $J/\psi \rightarrow \Lambda/\bar{\Lambda}+X$

B. Zheng[1], M.G. Zhao[2], Y.D. Wang[3], M.Q. Jing[1], F. Maas[3]

1 University of South China
2 Nankai University
3 Helmholtz-Institut Mainz

Physics and Software meeting, 2018.5.4

1

Fit to the observed cross section

$$\chi^2 = \sum_{i=1}^{15} \frac{[\sigma^{\mathrm{obs}}_{e^+e^- \to \Lambda+X}(E^i_{\mathrm{cm}}) - \sigma^{\mathrm{exp}}_{e^+e^- \to \Lambda+X}(E^i_{\mathrm{cm}})]^2}{\Delta^2_{\sigma^{\mathrm{obs}}_{e^+e^- \to \Lambda+X}(E^i_{\mathrm{cm}})} + [\Delta W_i \frac{d\sigma^{\mathrm{exp}}_{e^+e^- \to \Lambda+X}(E^i_{\mathrm{cm}})}{dW}]^2}$$

Statistic uncertainty,
Statistic of Lum
Uncertainty from MC modeling

Statistic uncertainty of Wi

$$e^+e^- \to \Lambda + X$$

$$e^+e^- \to \overline{\Lambda} + X$$
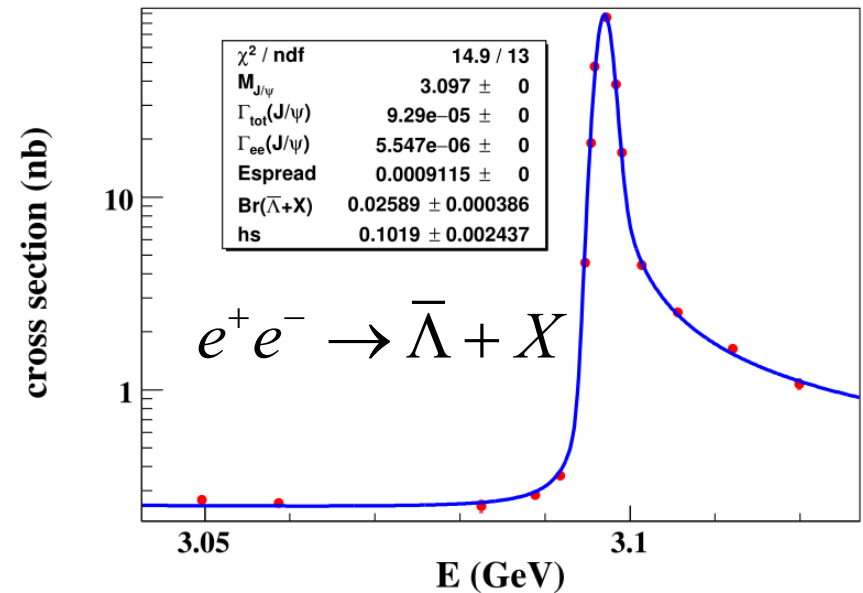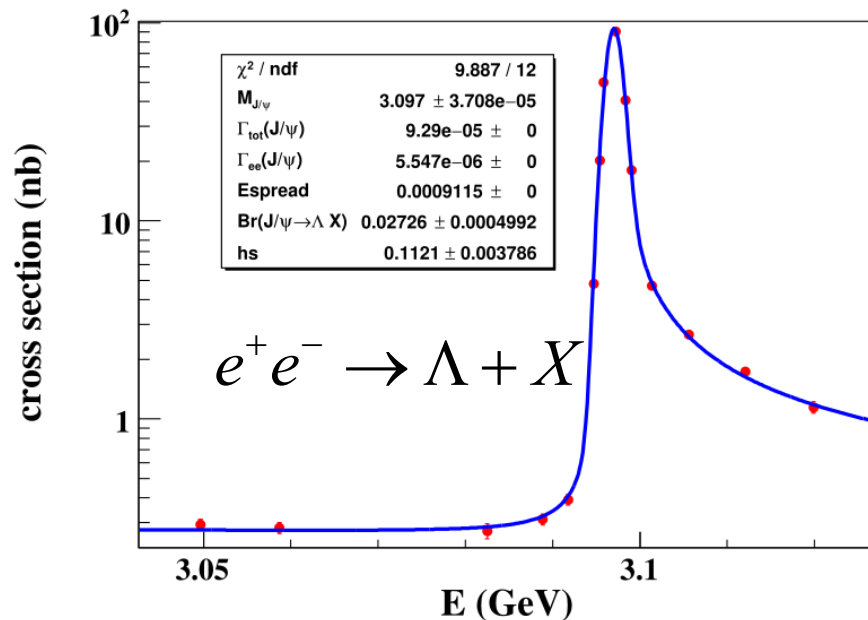
Results reported

We measured the J/ψ inclusive decays for the first time
BF(J/$\psi \rightarrow \Lambda$+X)= (2.73 $\pm$0.05 $\pm$0.15) %,
BF(J/$\psi \rightarrow \overline{\Lambda}$+X)= (2.59 $\pm$0.04 $\pm$0.11) %.

The sum of branching fractions of J/ψ exclusive decays
containing $\Lambda/\overline{\Lambda}$ is less than1.7%, which give us
information on searching for new decays.

The results also show baryon-anti-baryon production
symmetry in J/ψ decays.

Minutes for the P&S meeting on May 4, 2018

Attendees: **Xiaorui Lv, Andrzej Kupsc, Shuangshi Fang, Steve Olsen, Kai Zhu**

Speakers: **Bo Zheng**

Bo Zheng: Measurement of Jpsi→Lambda(anti-Lambda)+X

-) It would be great to present the asymmetry parameter measurement of Jpsi→Lambda+X and Jpsi→Lambdabar+X after takining into the operlapping events. eg., Jpsi→Lambda Labmdabar.

-) Since the detection efficiency changes significantly around Jpsi peak, suggest to check the results by excluding the events of Jpsi→Lambda Lambdabar. Then the sum of the B(Jpsi→Lambda+X) [Lambda Lambdabar excluded] and B(Jpsi→Lambda Lambdar) could be used as a cross check of the present result.

-) Suggest to present the B(Jpsi→Lambda +X + c.c.) instead of two of them separately.

4

It would be great to present the asymmetry parameter measurement of Jpsi->Lambda+X and Jpsi->Lambdabar+X after takining into the overlapping events. eg., Jpsi->Lambda Labmdabar.

The asymmetry represents the difference between the production of Lambda and Lambdabar in Jpsi decay, so the overlapping should not be removed, otherwise, the asymmetry will be enlarged improperly.

Therefore, when calculating the asymmetry parameter, we should consider the total yields of Lambda and Lambdabar, and it is calculated as following:

$$A = \frac{(2.73 \pm 0.05 \pm 0.14)\,\% - (2.59 \pm 0.04 \pm 0.11)\,\%}{(2.73 \pm 0.05 \pm 0.14)\,\% + (2.59 \pm 0.04 \pm 0.11)\,\%}$$

$$= 0.028 \pm 0.012 \pm 0.034$$

Dealing of the systematic uncertainty is shown in the following two slides.

Summary of systematic uncertainty of observed cross section

sources	Trking (%)	PID (%)	Λ Recon (%)	Br (%)	Fitting (%)	Lum (%)	MC Modeling (%)	Total (%)
$\Lambda + X$	2	2	1.0	0.8	2.4	$1.1 + \Delta_{stat}$	1.5-5.1	4.1
$\overline{\Lambda} + X$	2	2	0.8	0.8	1.0	$1.1 + \Delta_{stat}$	0.9-2.4	3.4

cancelled

Systematic uncertainty for measured Brs

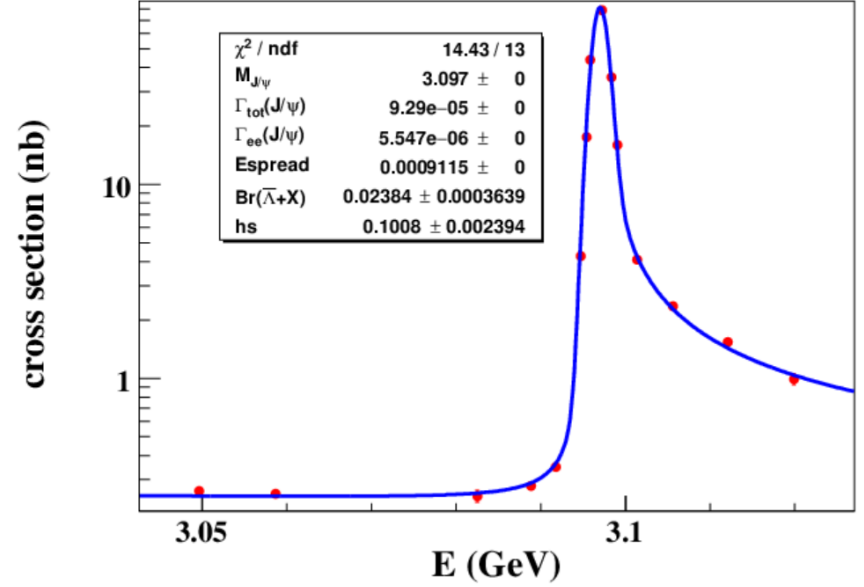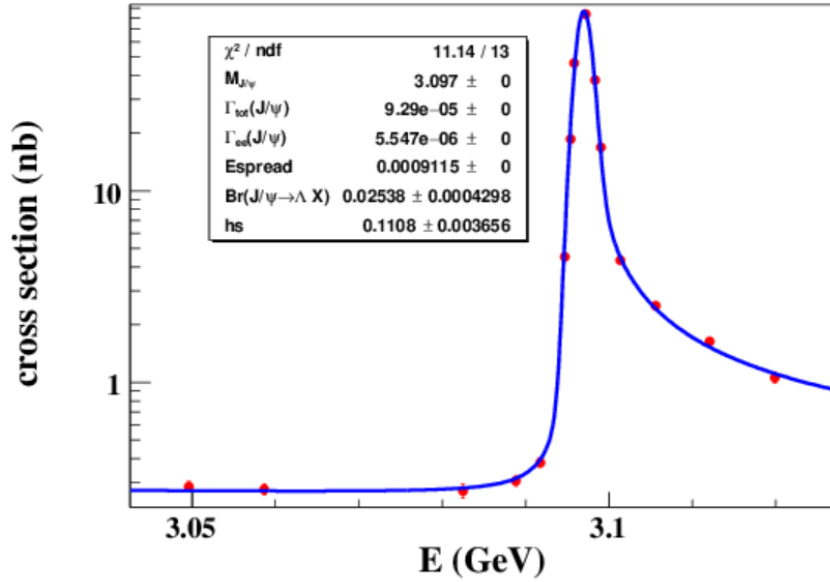| sources	Γ_{ee} (%)	Γ_{tot} (%)	$M_{J/\psi}$ (%)	Interference	E_{spread}	E_{CMS} calibration	Observed Cross Section	Total (%)
$\Lambda + X$	0.6	0.2	0.2	2.9	0.1	0.0	4.1(3.9)	5.1(5.0)
$\overline{\Lambda} + X$	0.6	0.1	0.3	2.7	0.2	0.8	3.4(3.2)	4.5(4.4)

uncorrelated

Since the detection efficiency changes significantly around Jpsi peak, suggest to check the results by excluding the events of Jpsi->Lambda Lambdabar. Then the sum of the B(Jpsi->Lambda+X) [Lambda Lambdabar excluded] and B(Jpsi->Lambda Lambdar) could be used as a cross check of the present result.
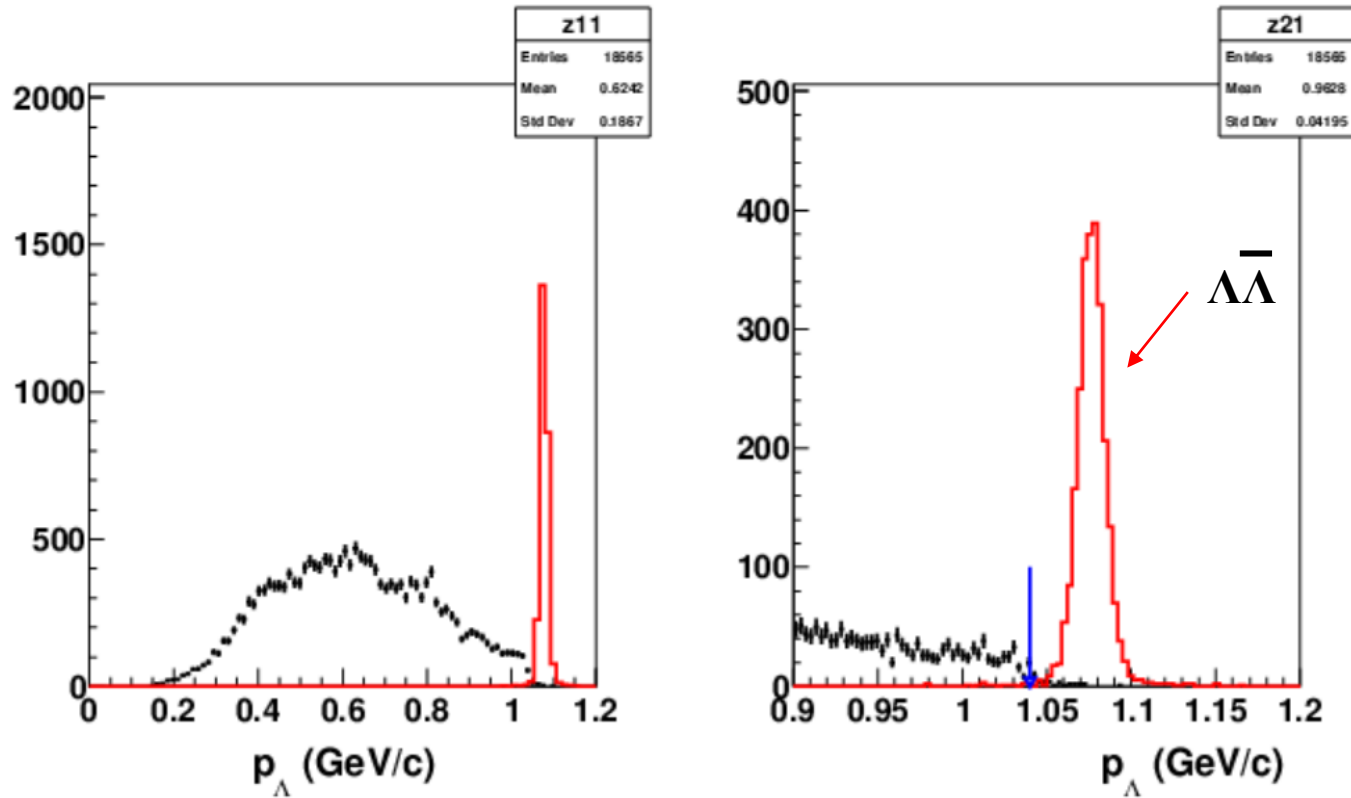
P<1.04GeV/c to remove $\Lambda\bar{\Lambda}$ events, P<1.02GeV/c for the first two energy points.

The ratio of remaining $\Lambda\bar{\Lambda}$ events is less than 0.5% and the efficiency for other $\Lambda+X$ events is larger than 99.5%

Cross sections with J/ψ → ΛΛ̄ removed

Left plot fit box:

χ² / ndf	11.14 / 13
$M_{J/\psi}$	3.097 ± 0
$\Gamma_{tot}(J/\psi)$	9.29e−05 ± 0
$\Gamma_{ee}(J/\psi)$	5.547e−06 ± 0
Espread	0.0009115 ± 0
Br(J/ψ→Λ X)	0.02538 ± 0.0004298
hs	0.1108 ± 0.003656

Right plot fit box:

χ² / ndf	14.43 / 13
$M_{J/\psi}$	3.097 ± 0
$\Gamma_{tot}(J/\psi)$	9.29e−05 ± 0
$\Gamma_{ee}(J/\psi)$	5.547e−06 ± 0
Espread	0.0009115 ± 0
Br(Λ̄+X)	0.02384 ± 0.0003639
hs	0.1008 ± 0.002394

	Br(10⁻³) With ΛΛ̄	Br(10⁻³) Without ΛΛ̄	Difference (10⁻³)	Br(J/ψ→ΛΛ̄) (10⁻³)
Λ+X	27.3±0.5±1.5	25.4±0.4	1.9±0.5±1.5	1.89±0.08
Λ̄+X	25.9±0.4±1.1	23.8±0.4	2.1±0.4±1.1	

Suggest to present the B(Jpsi->Lambda +X + c.c.) instead of two of them separately.

The B(Lambda+X+c.c.) represents different theoretical content with B(Lambda+X) and B(Lambdabar+X).
In our measurement, we can measure the production of Lambda and Lambdabar in Jpsi decay, and determine the asymmetry of their production.
While, in the measurement with charge conjugation, we can only get the total production of Lambda+Lambdabar hyperon without further information.
Thus, we think it is better to separate them.

Thank you !