Discussion of the Next Charmonium Data-Taking Proposal

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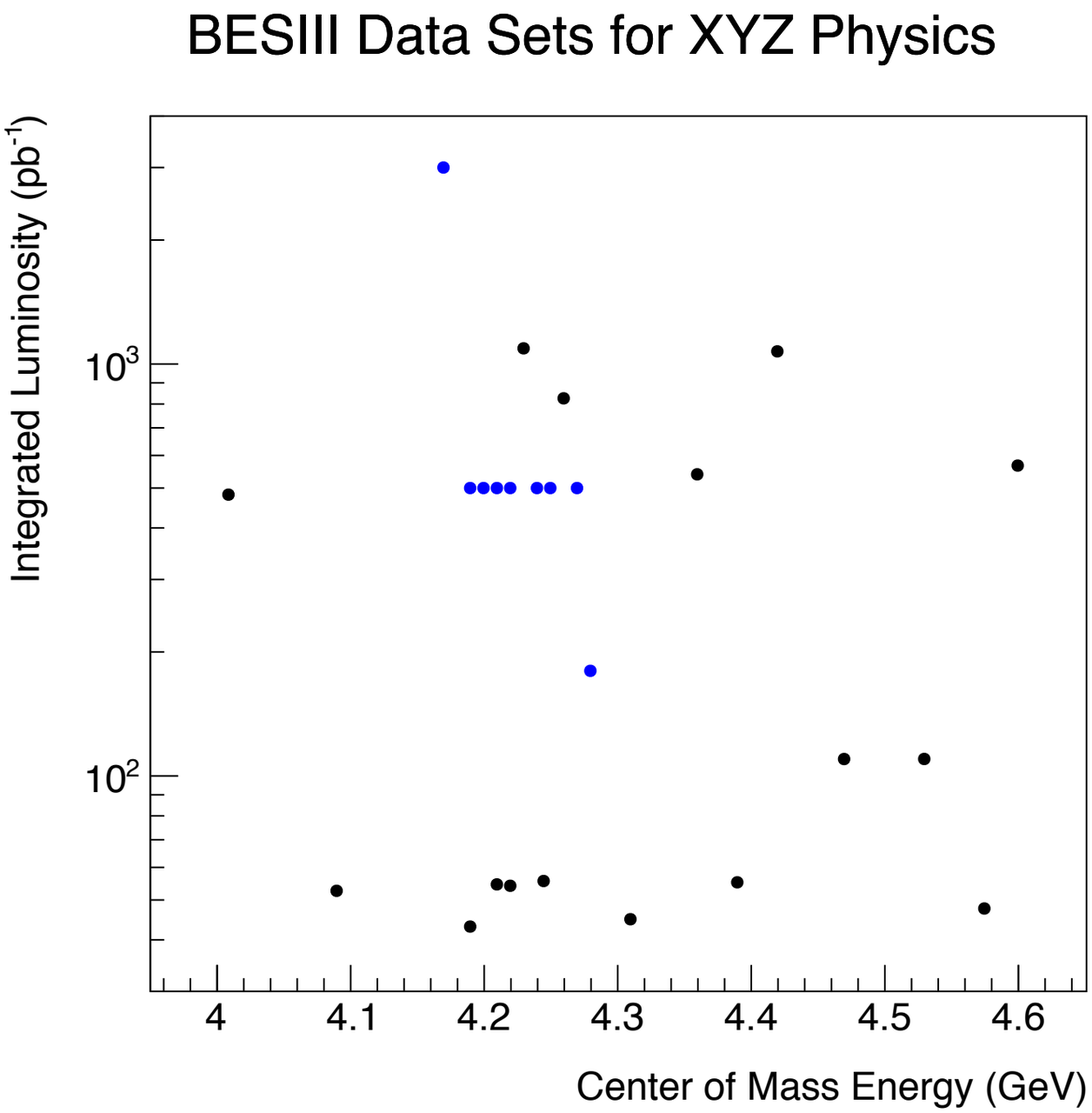
ZHU Kai
Charmonium Group Meeting
June 12, 2018

Current Data Sets / Previous Proposal



2017:

* proposed 10 data sets, each with 500 pb^{-1}, between 4.19 and 4.30 GeV

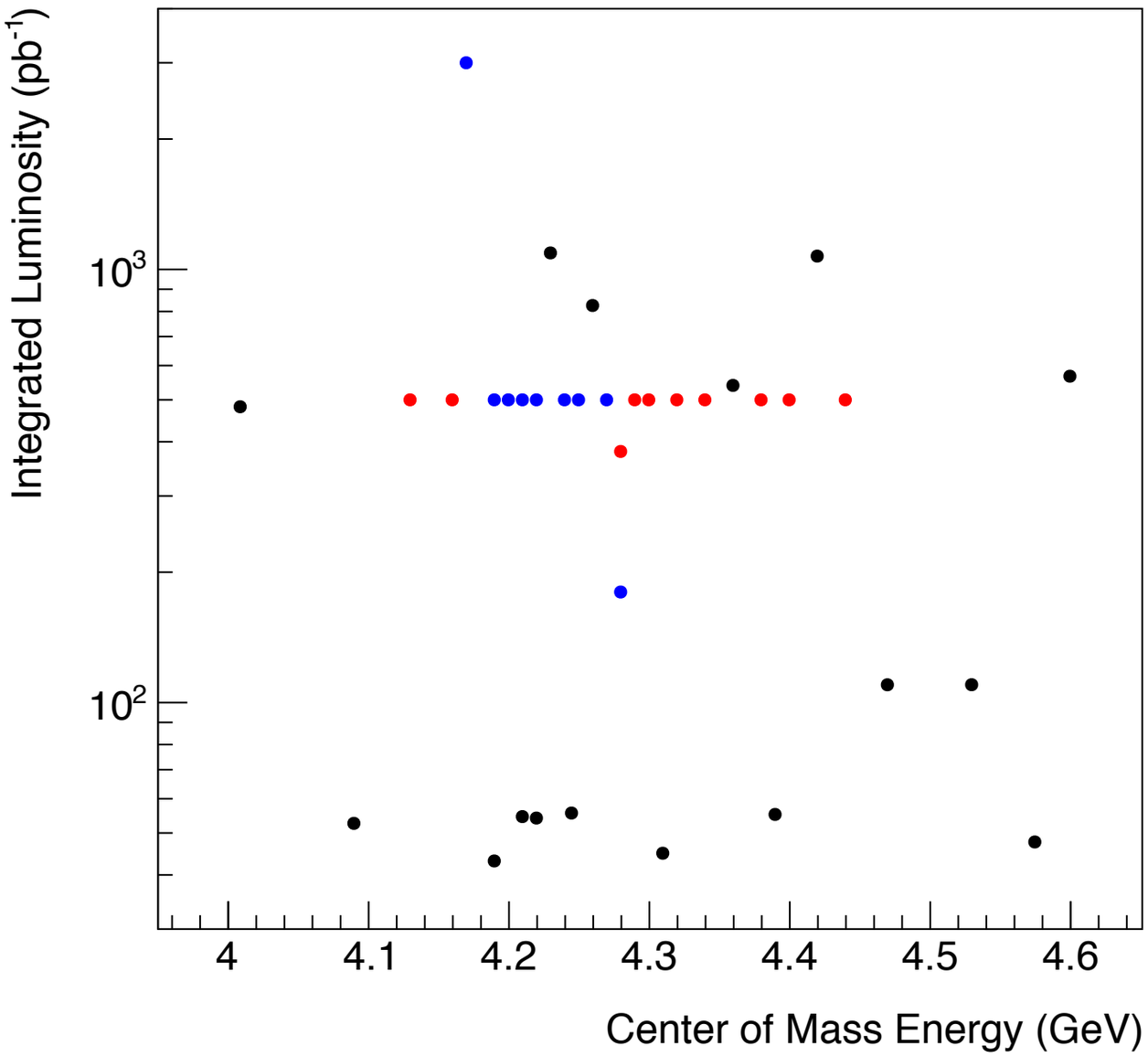
* finished 7.4 points

* did not finish 4.28 (only 180 pb^{-1}), 4.29 or 4.30 GeV

* focus was on the "Y(4260)" region

older data sets; newer data sets (2016/2017); proposed data sets

Current Data Sets / Next Proposal



2019:

* propose 8 data sets,
  each with 500 pb^{-1} (except 4.28 GeV),
  between 4.28 and 4.44 GeV

* focus on the higher energy region

* use 20 MeV spacing since structures seem wider

* also fill in some holes at lower energy with 500 pb^{-1} at 4.13 and 4.16 GeV

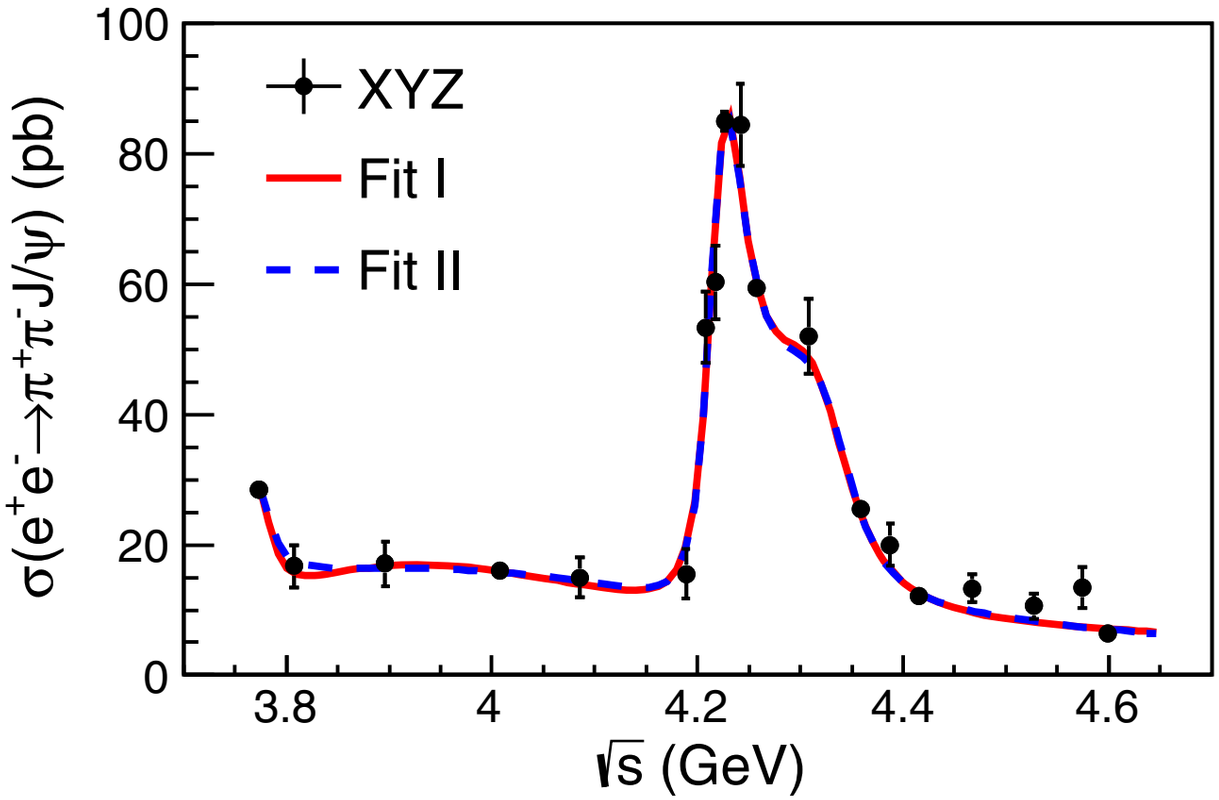
⇒ **this is an important complement to the existing data sets!**

older data sets; newer data sets (2016/2017); proposed data sets

Selection of Results (for reference)

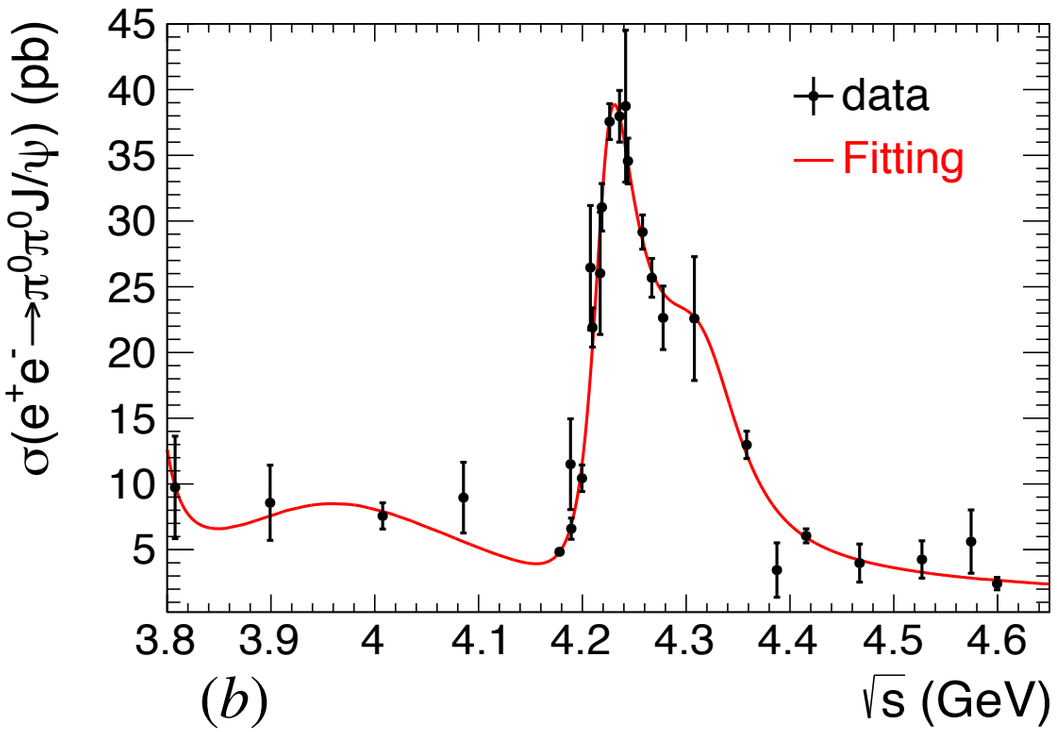
$e^+e^- \to \pi^+\pi^- J/\psi$

[PRL 118, 092001 (2017)]

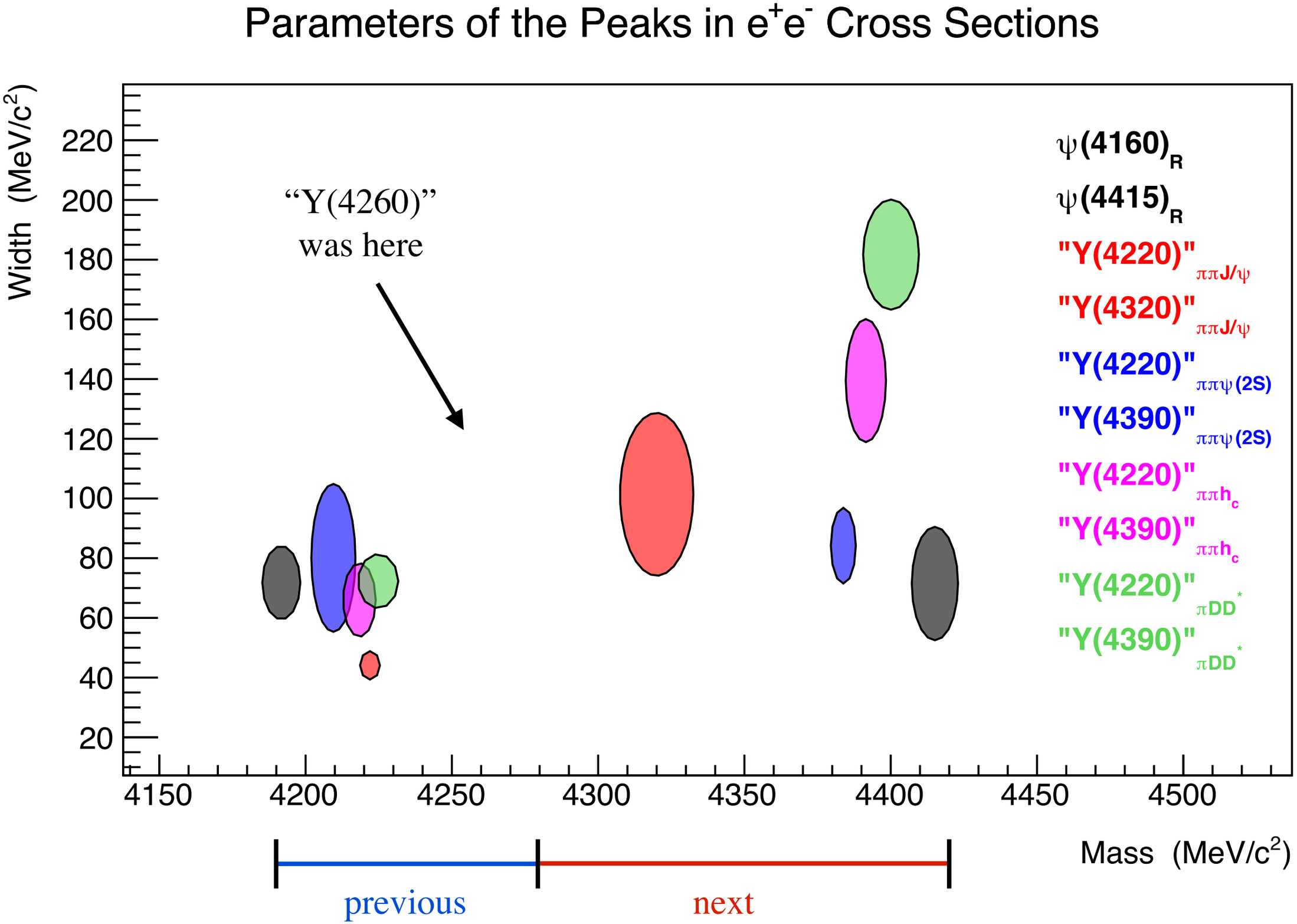


preliminary $\pi^0\pi^0 J/\psi$

(Peilian Li)



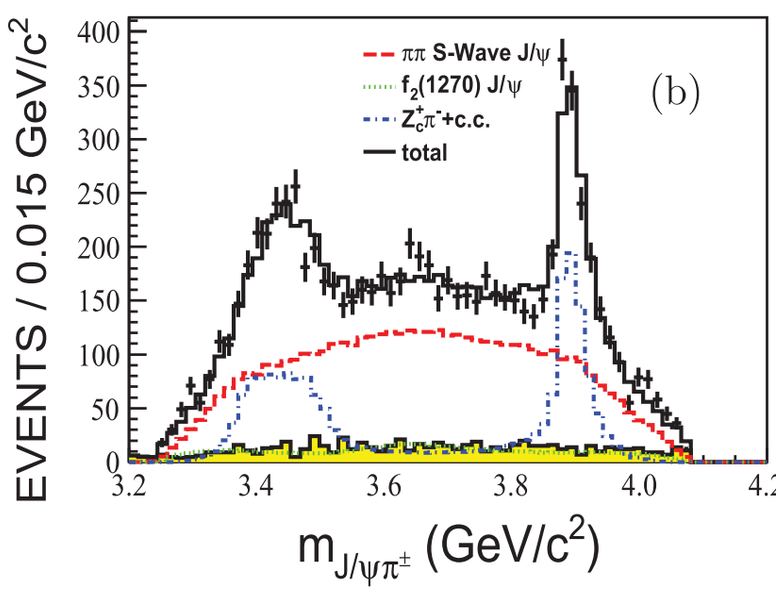
Selection of Results (for reference)



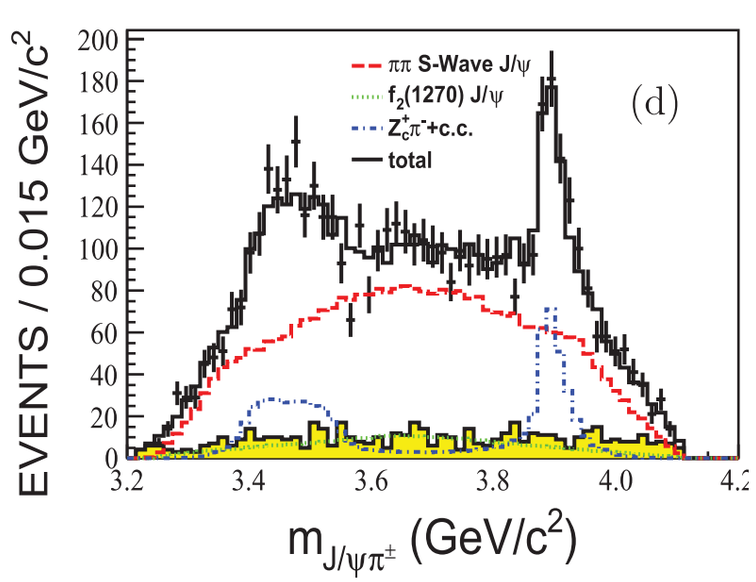
Selection of Results (for reference)

$$e^+e^- \to \pi^\pm(\pi^\mp J/\psi)$$

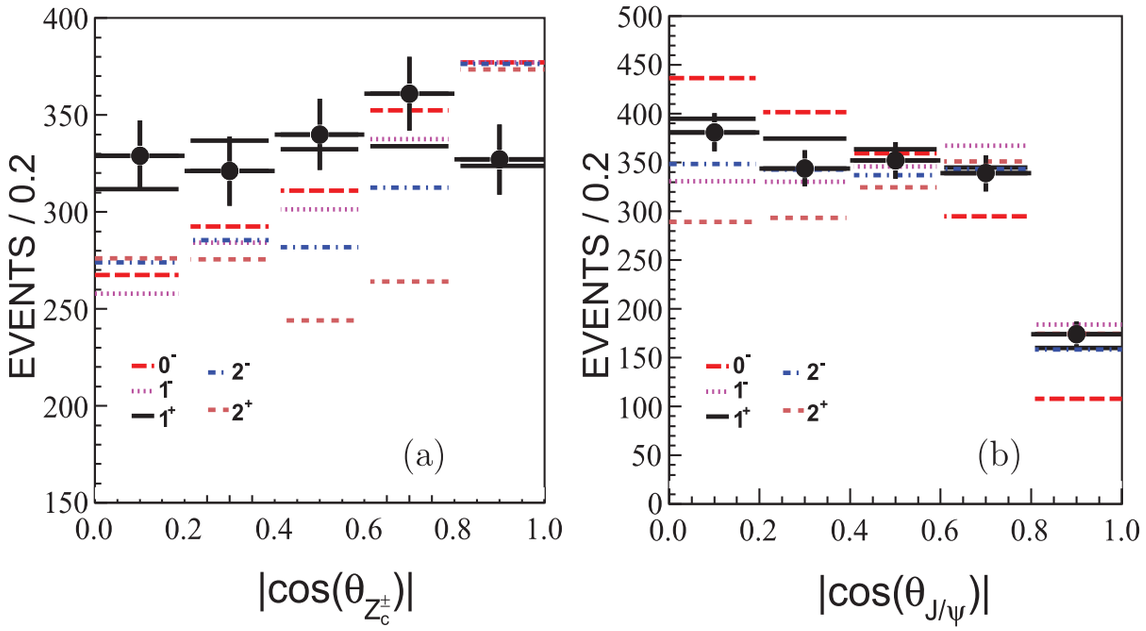
[PRL 119, 072001 (2017) (Aug. 16)]



(using 1092 pb^{-1} at 4.23 GeV)



(using 827 pb^{-1} at 4.26 GeV)

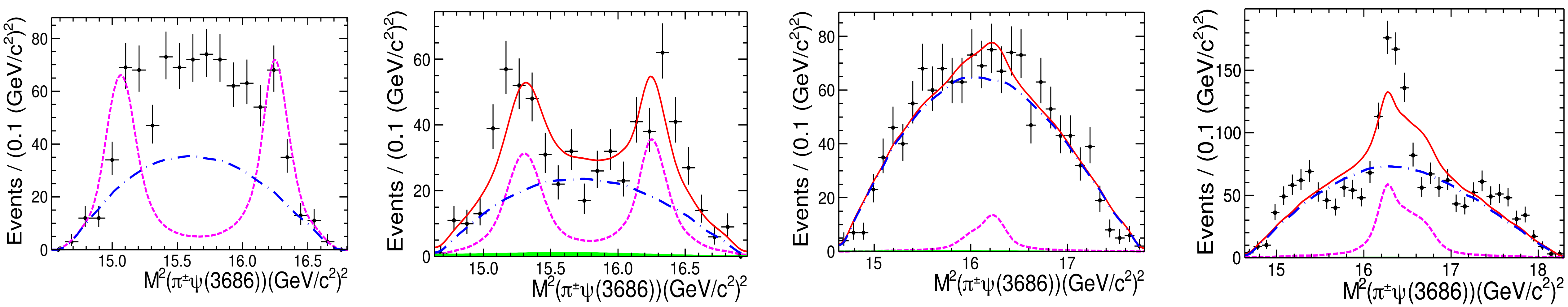


$$M = (3881.2 \pm 4.2 \pm 52.7)\ \mathrm{MeV}/c^2;$$
$$\Gamma = (51.8 \pm 4.6 \pm 36.0)\ \mathrm{MeV}/c^2;$$
$$J^P = 1^+$$

Selection of Results (for reference)

$$e^+e^- \to \pi^+\pi^-\psi(2S)$$

[PRD 96, 032004 (2017)]



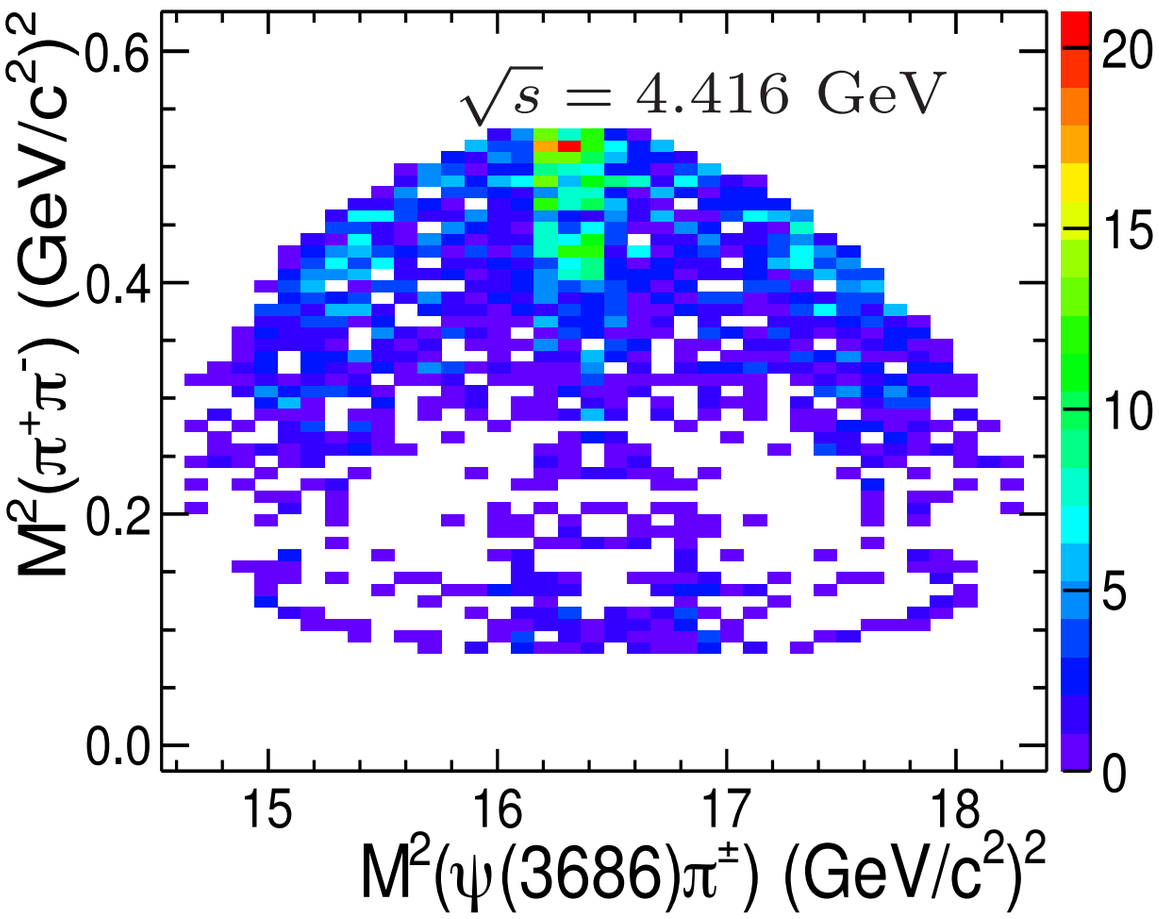
(1092 pb⁻¹ at 4.23 GeV;   826 pb⁻¹ at 4.26 GeV;   540 pb⁻¹ at 4.36 GeV;   1074 pb⁻¹ at 4.42 GeV)

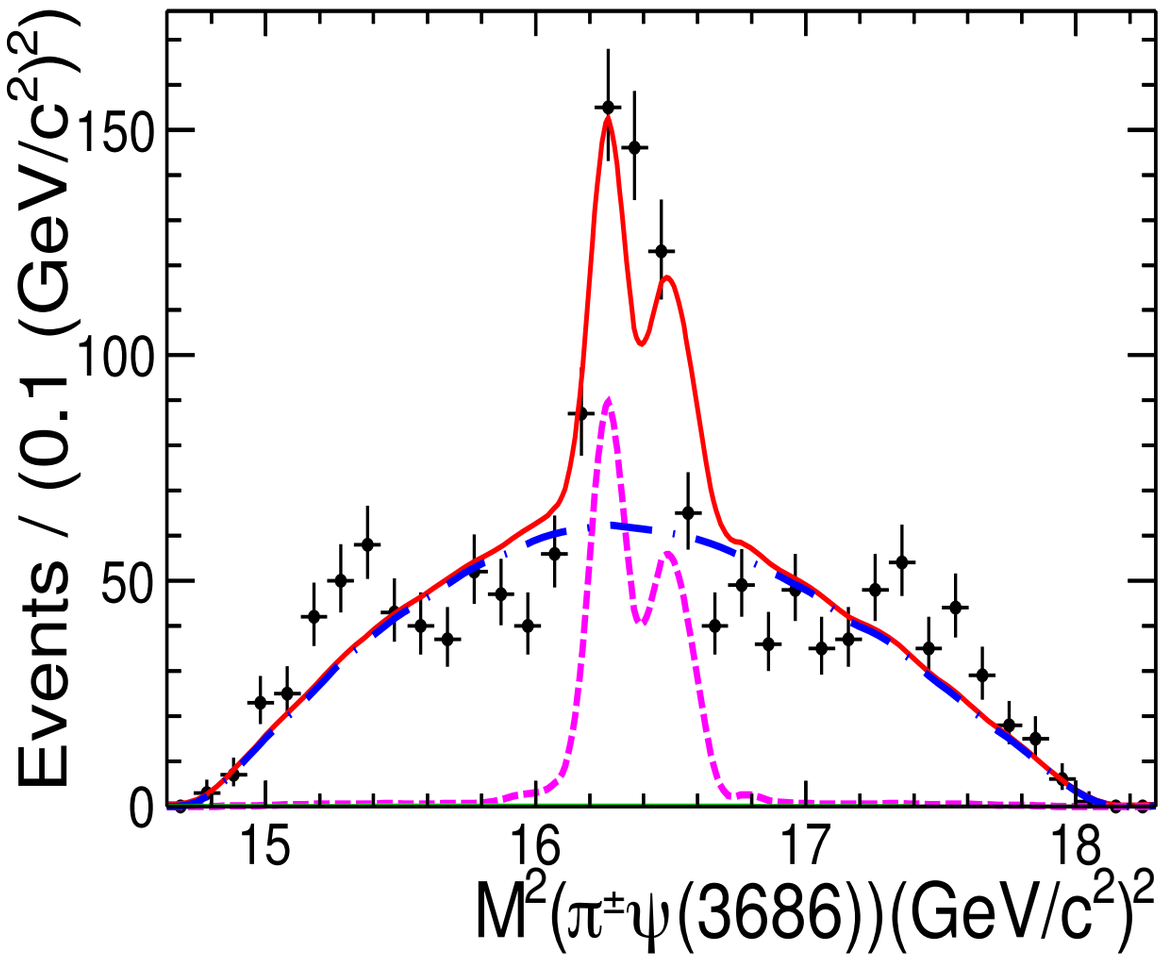
$$M = (4032.1 \pm 2.4)\ \mathrm{MeV}/c^2;$$
$$\Gamma = (26.1 \pm 5.3)\ \mathrm{MeV}/c^2$$

Selection of Results (for reference)

$$e^+e^- \to \pi^+\pi^-\psi(2S)$$

[PRD 96, 032004 (2017)]





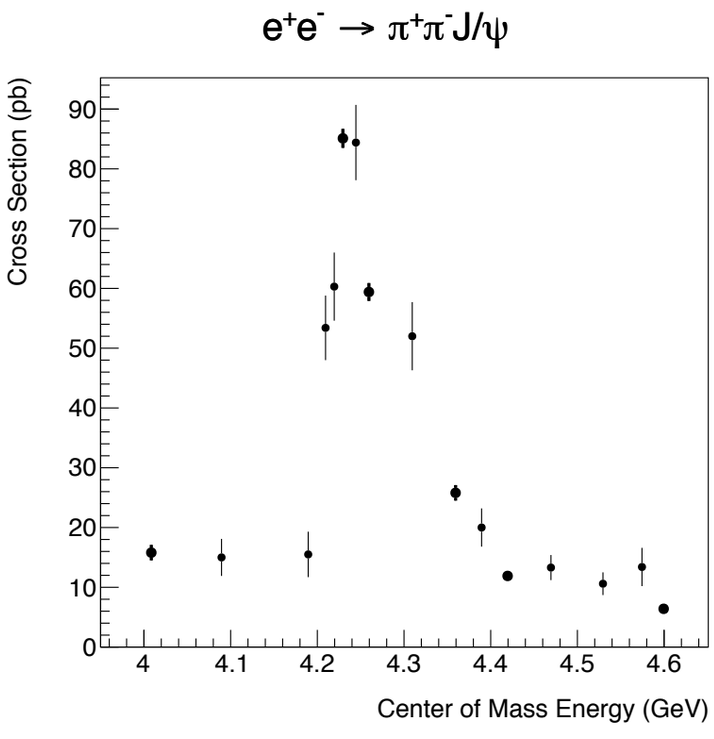
(also unsuccessful attempts to fit ππJ/ψ at 4420)

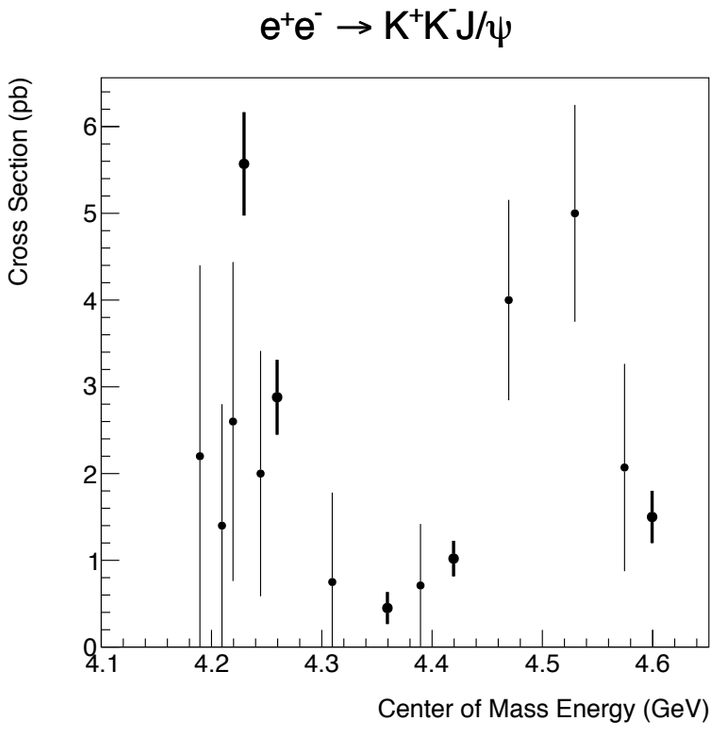
For $M^2(\pi^+\pi^-) > 0.3$ GeV$^2/c^4$:

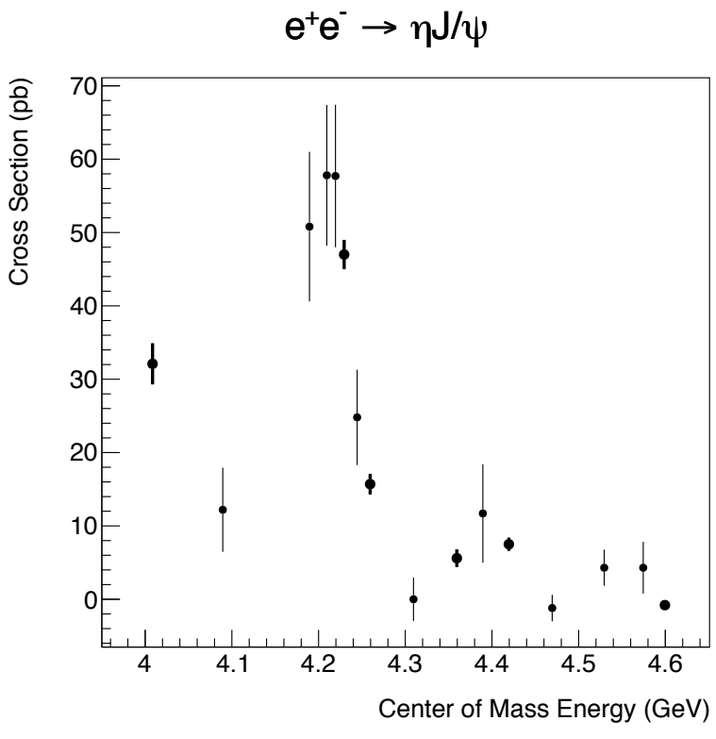
$M = (4030.3 \pm 0.1)$ MeV$/c^2$;

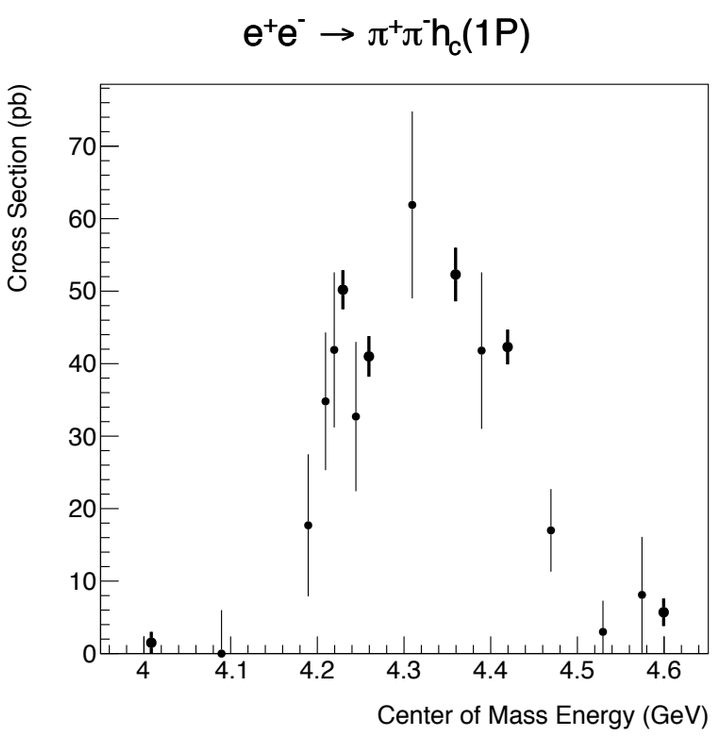
$\Gamma = (5.1 \pm 0.2)$ MeV$/c^2$

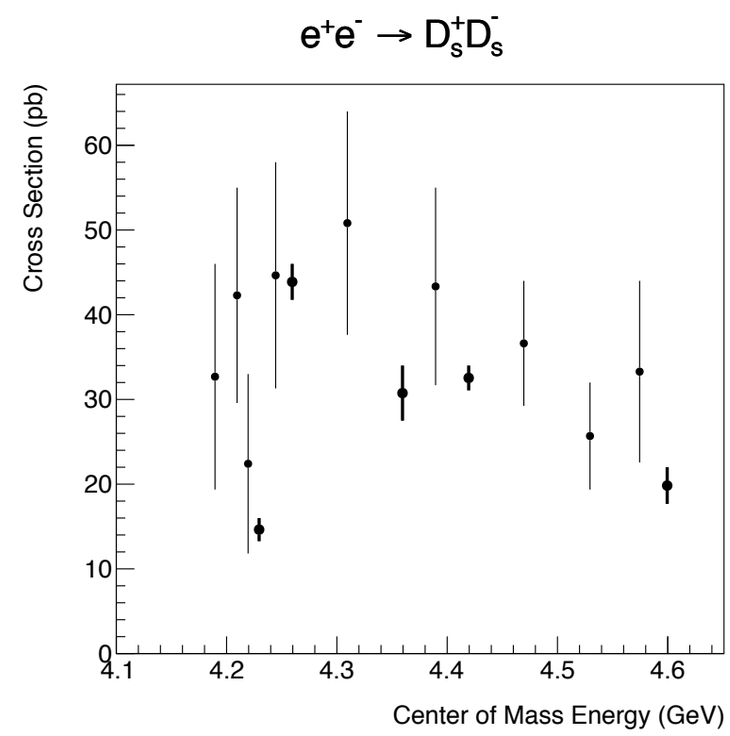
Selection of Projected Cross Sections

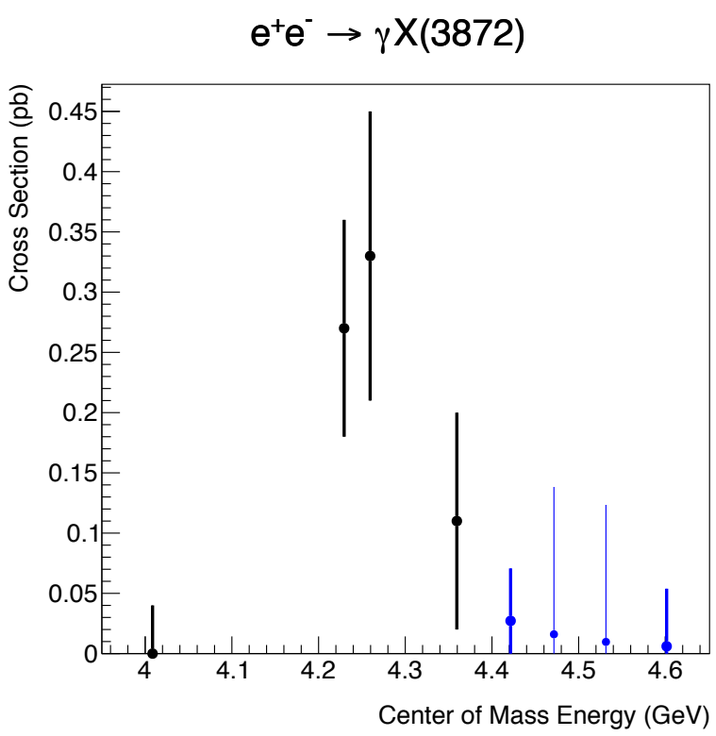






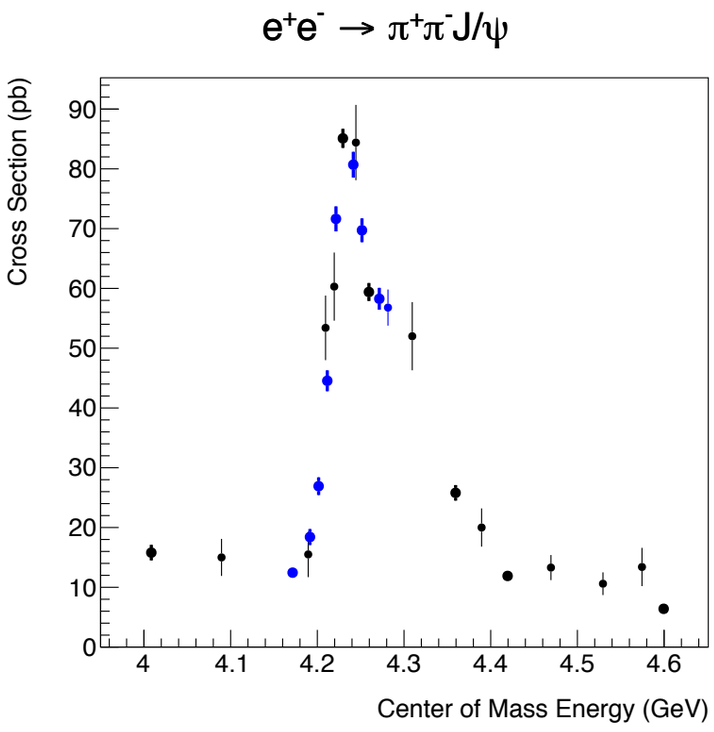


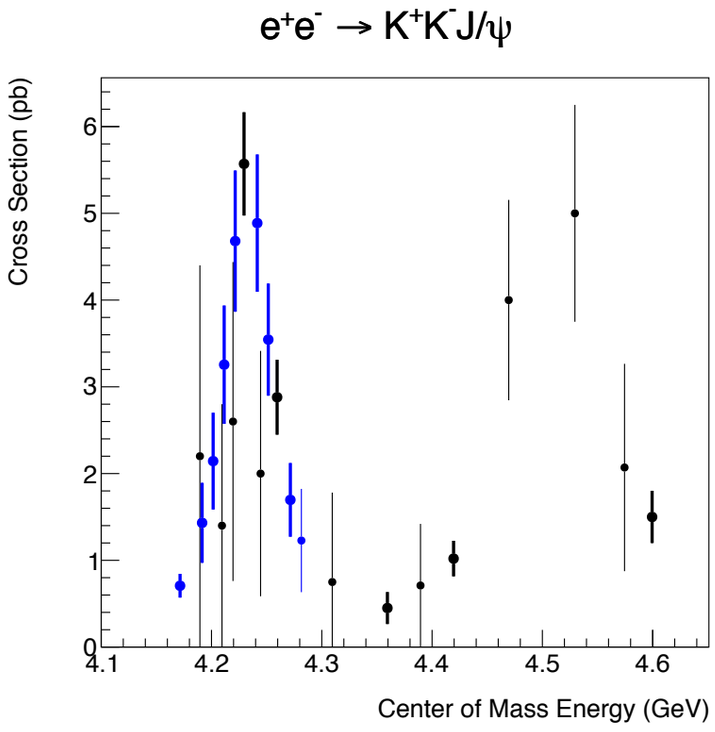


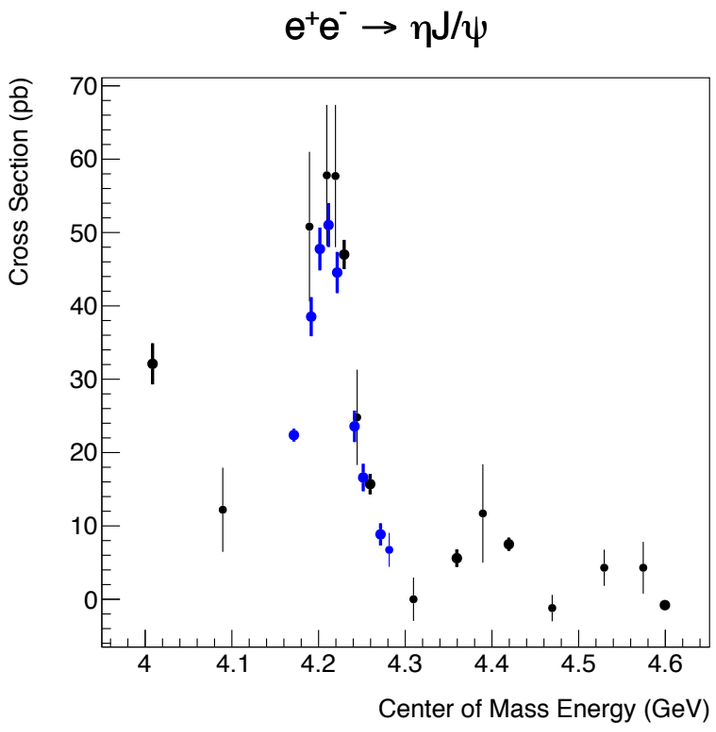


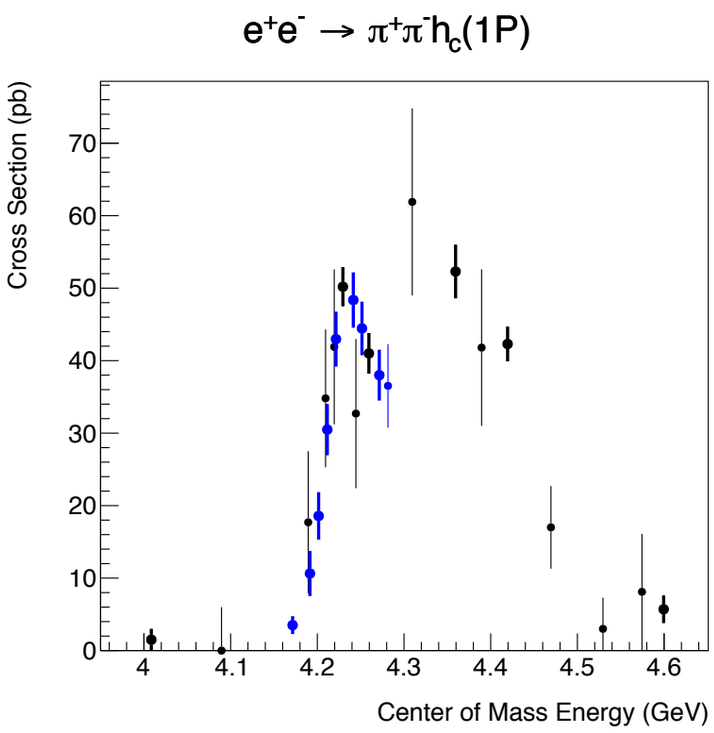
older data sets; newer data sets (2016/2017); proposed data sets

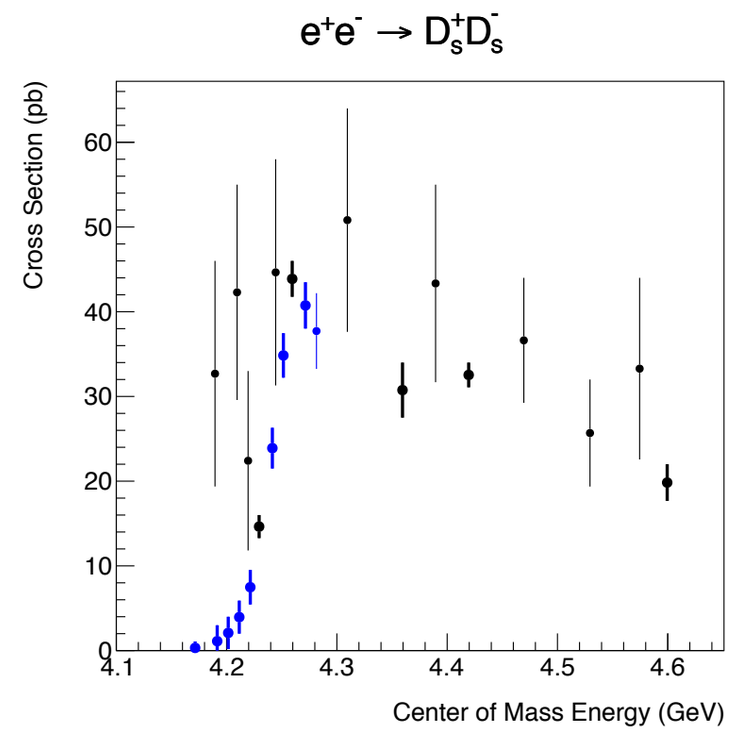
Selection of Projected Cross Sections

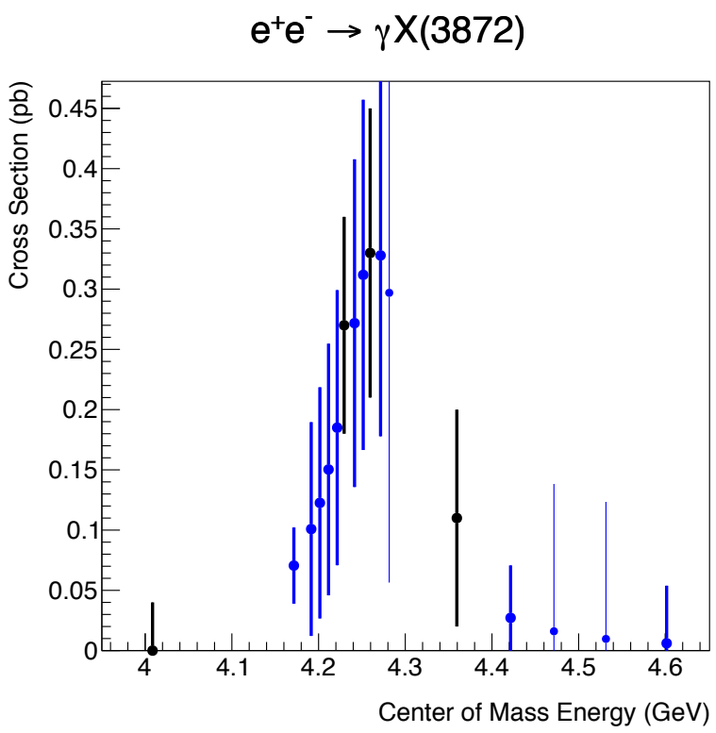






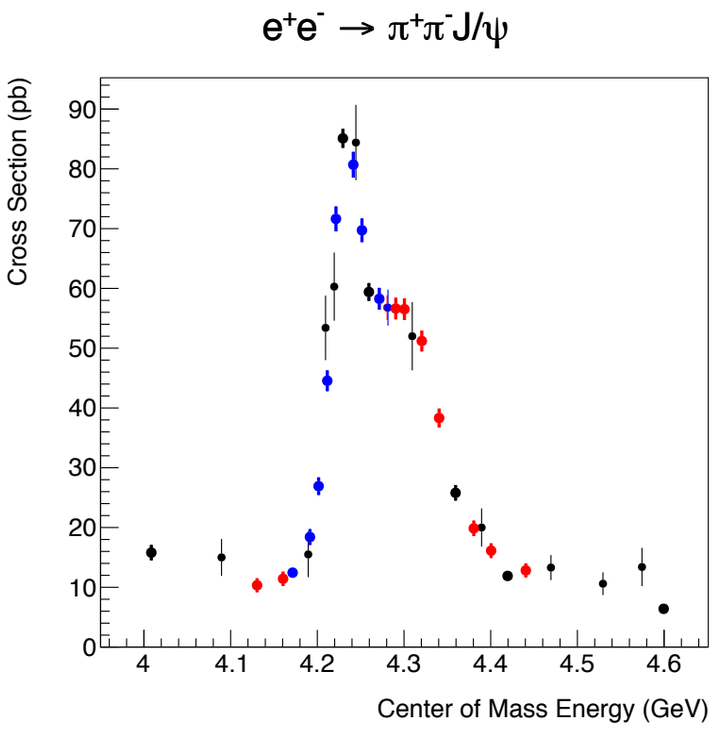


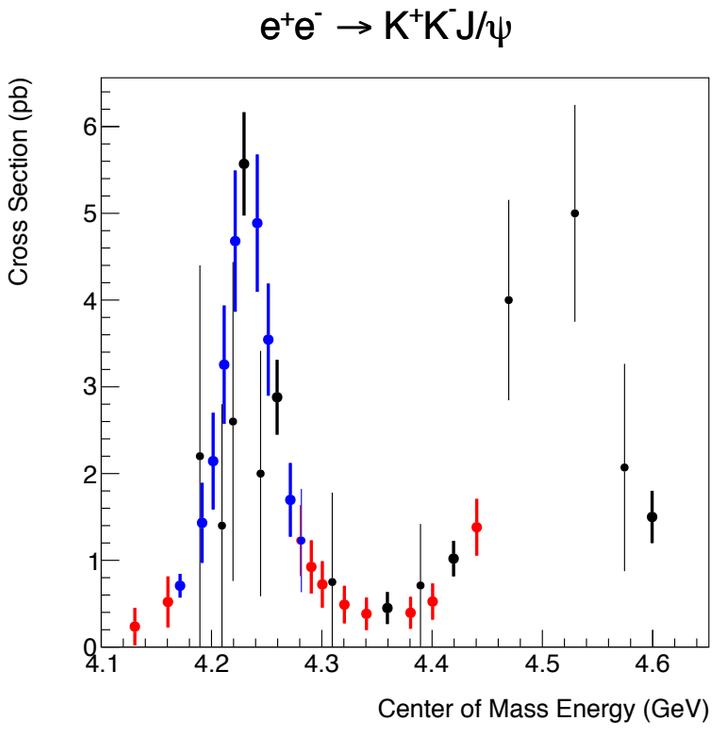


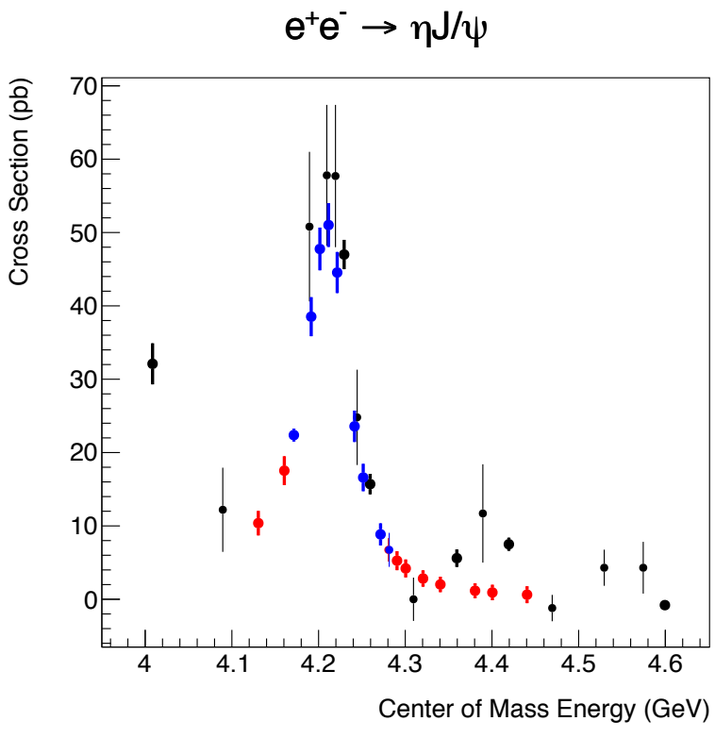


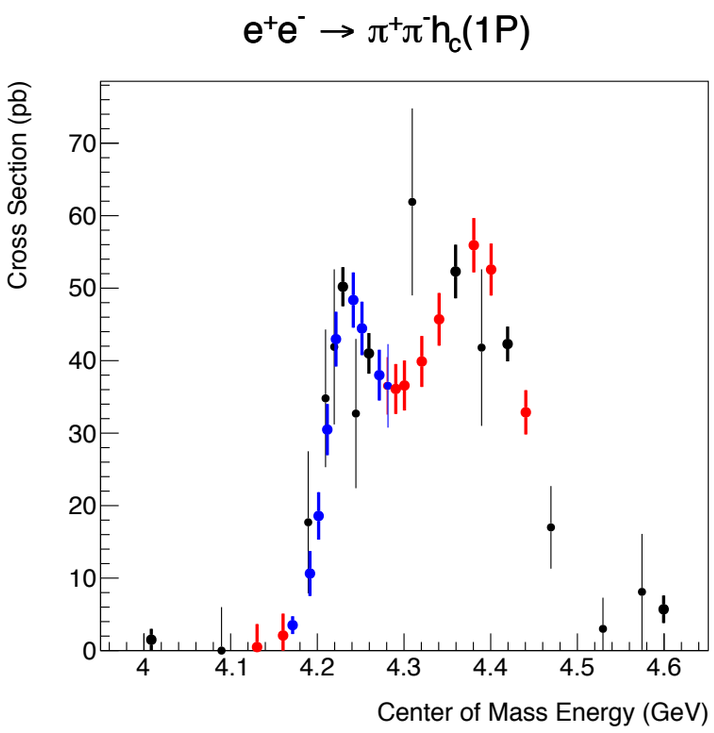
older data sets; newer data sets (2016/2017); proposed data sets

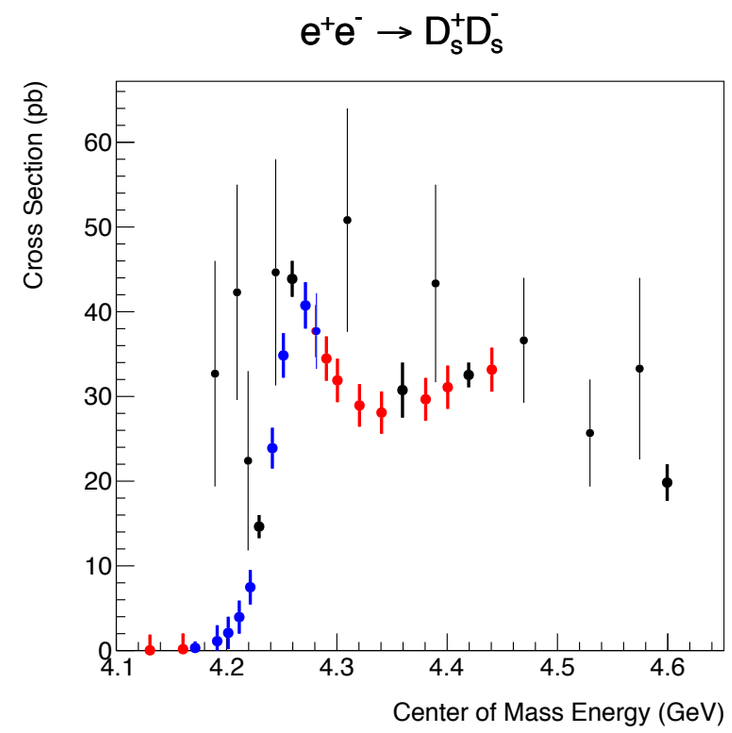
Selection of Projected Cross Sections

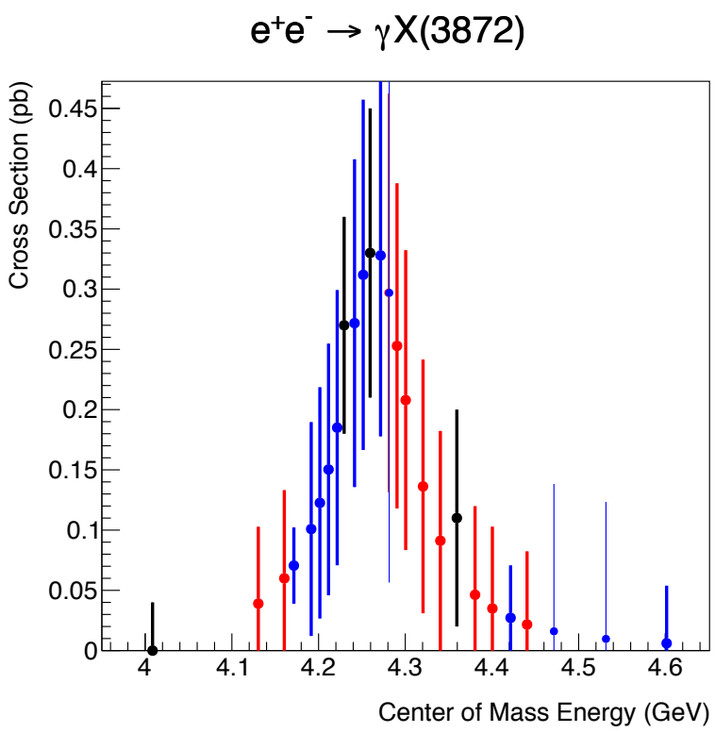






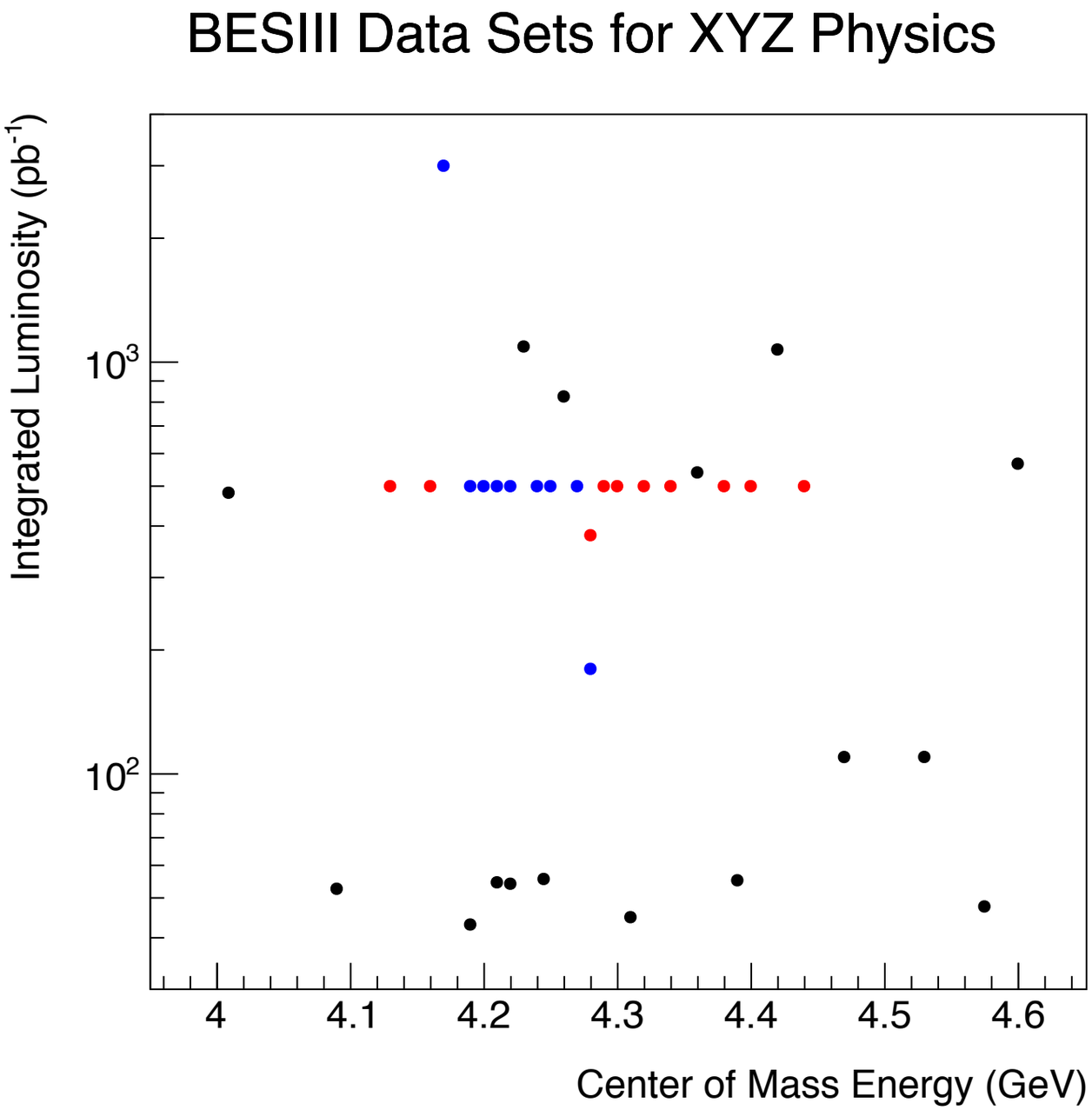






older data sets; newer data sets (2016/2017); proposed data sets

Other Considerations



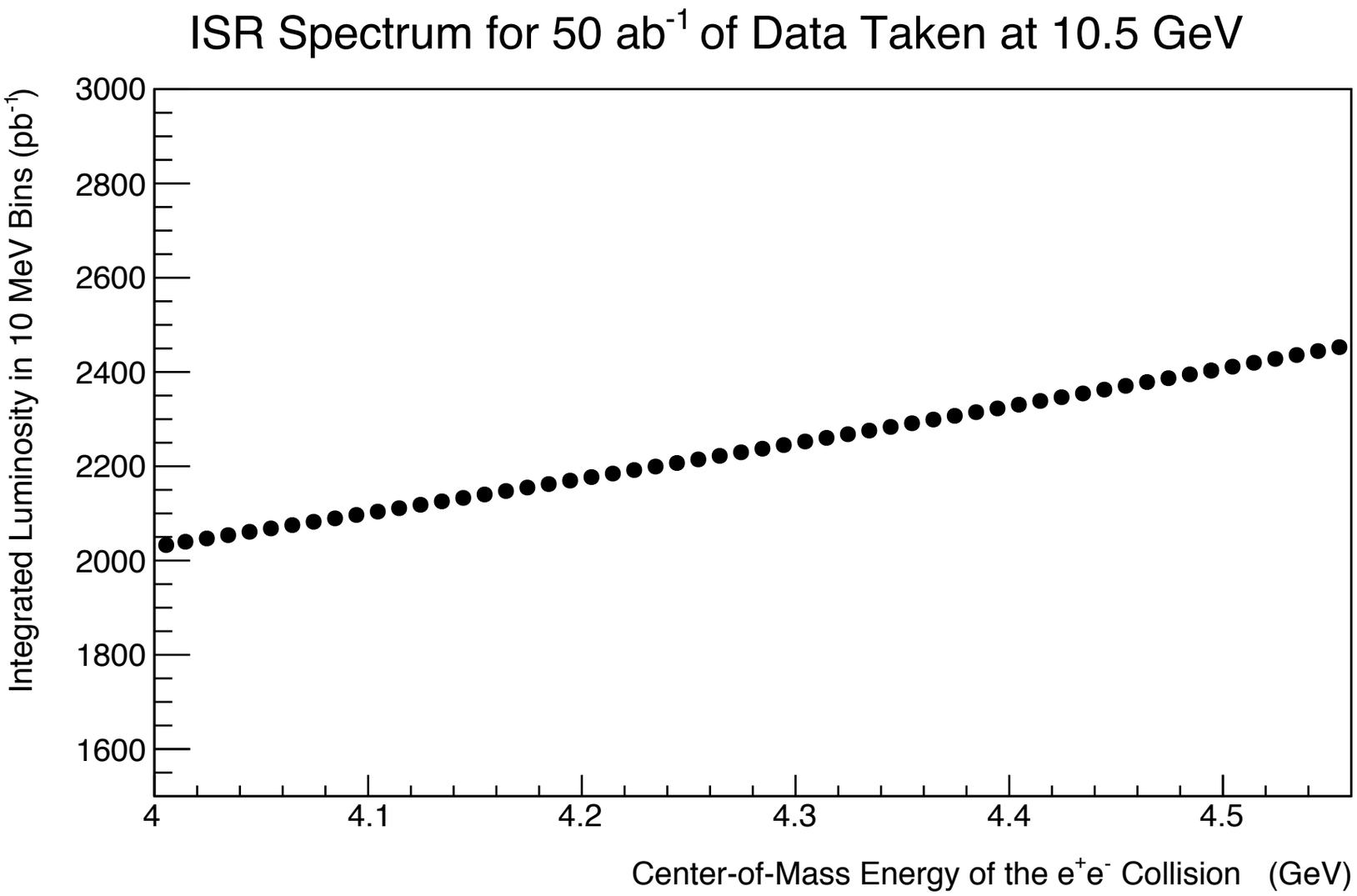
* carefully consider thresholds and adjust points accordingly

* consider the future of Belle II *(next slide)*.

* unique BESIII contributions:
  - — detailed amplitude analysis
  - — no integration over bins
  - — E_{CM} resolution
  - — complicated final states
  - — can build a global picture

older data sets; newer data sets (2016/2017); proposed data sets

Prospects from Belle II



<u>very large ISR data sets</u>

but:

- worse efficiency for most final states
- much much worse efficiency for many final states
- difficult amplitude analyses

<u>also very large B samples</u>

probably will lead to important XYZ discoveries

$\Rightarrow$ interest in XYZ physics will remain high