

J/ψ rate estimates

Nathaly Santiesteban
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Threshold energy $E_\gamma = 8.2 \text{ GeV}$ (protons)

$m_c \approx 1.5 \text{ GeV}$

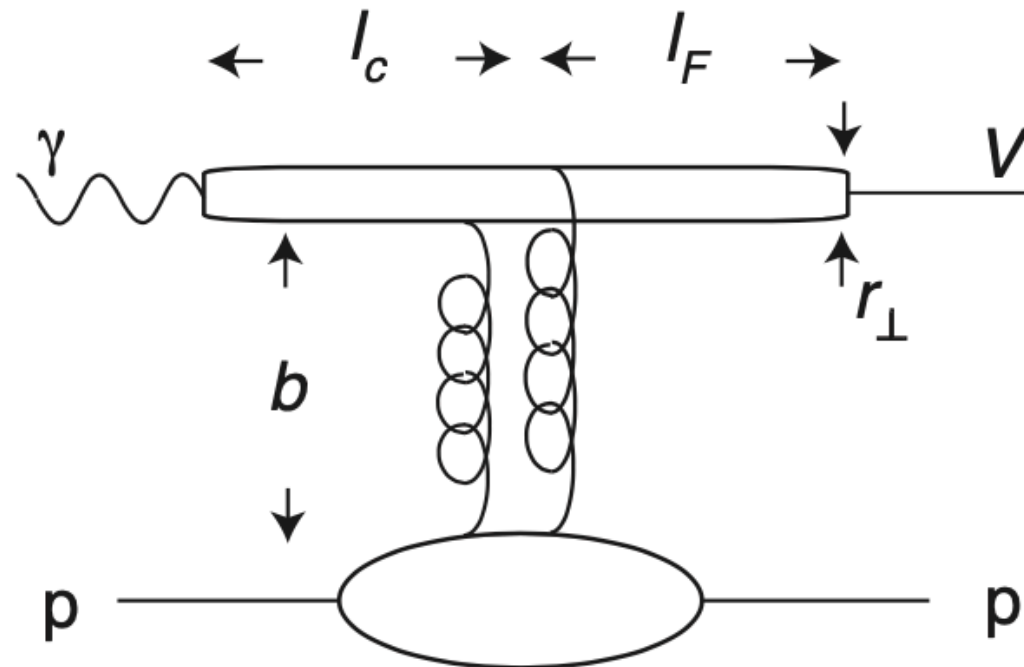
Photon travels: $l_c = 2E_\gamma/4m_c^2 = 0.36 \text{ fm}$

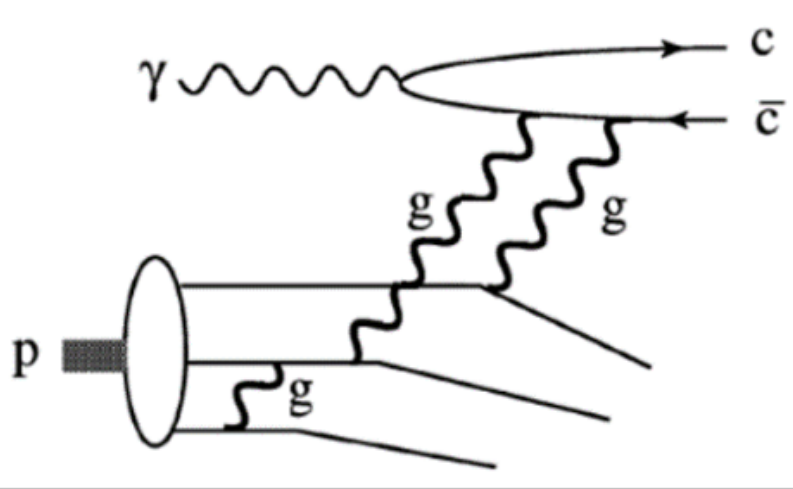
At threshold $t_{min} \sim 1.7 \text{ GeV}^2$

At $E_\gamma = 10 \text{ GeV}$ $t_{min} \sim 1. \text{ GeV}^2$

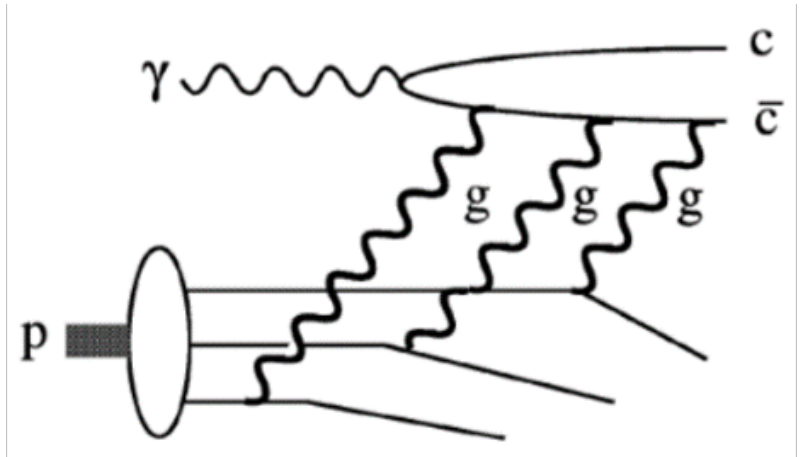
Transverse size: $r_\perp \sim 1/(\alpha_s m_c) = 0.3 \text{ fm}$

Impact distance: $b \sim 1/m_c \sim 0.13 \text{ fm}$





2-gluon J/ψ photoproduction

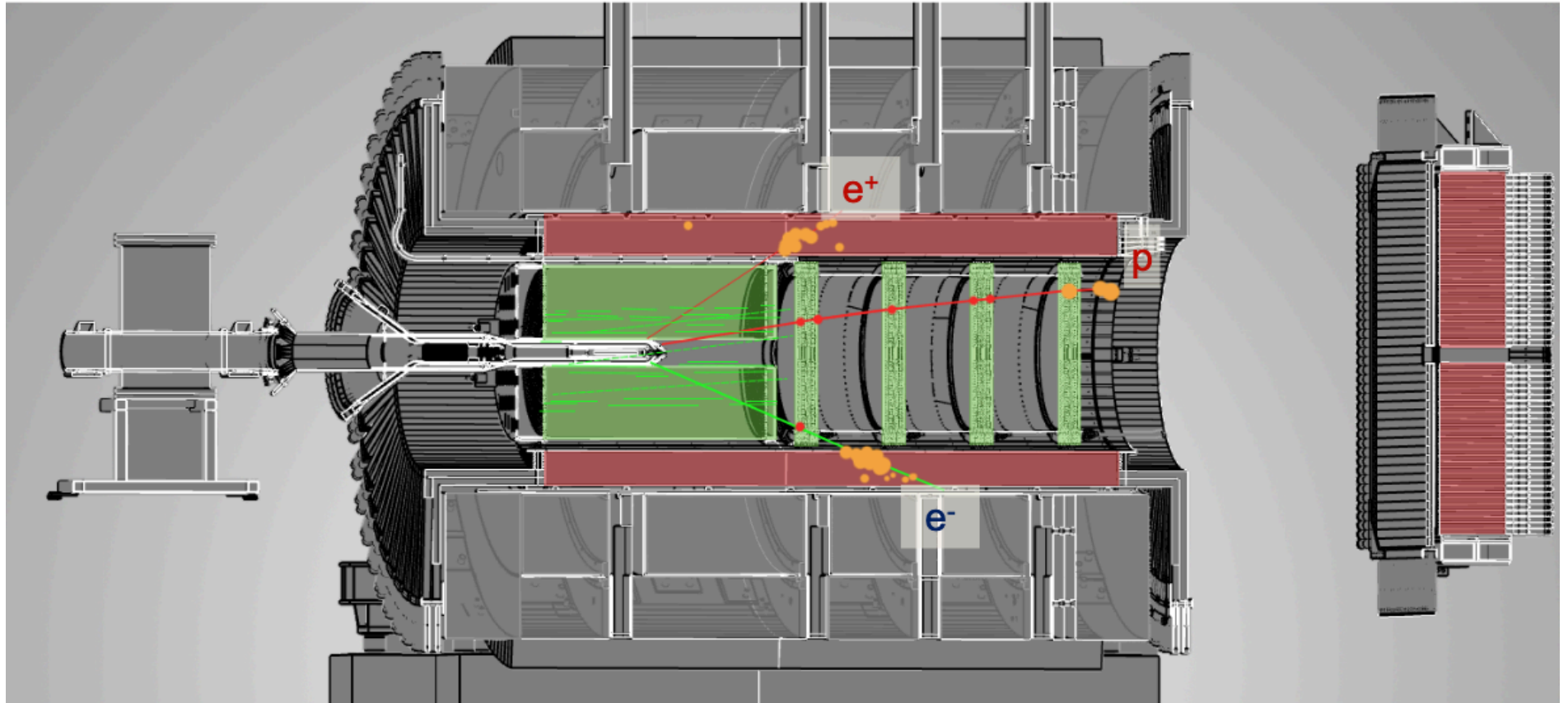


3-gluon J/ψ photoproduction

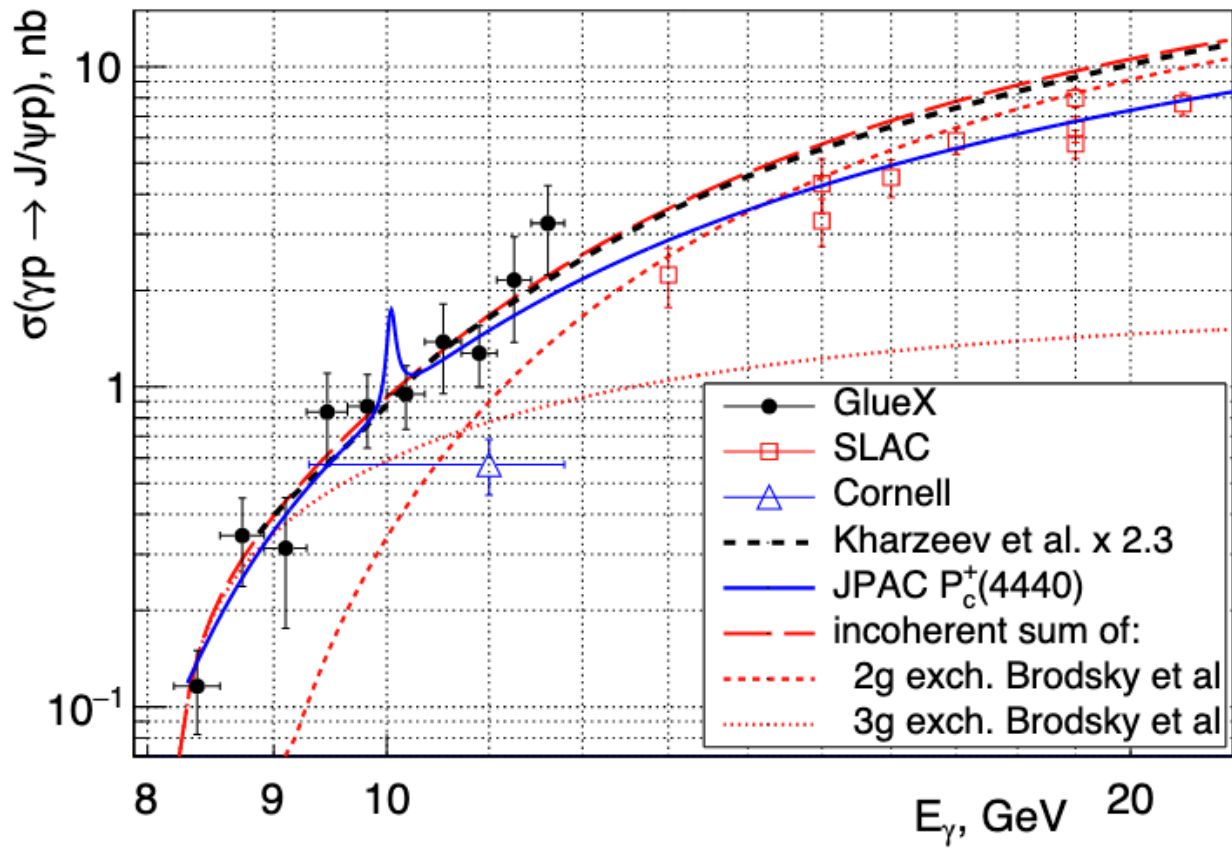
Brodsky et al., Phys. Lett. B 498, 23 (2001)]

J/ ψ event

Exclusive reaction $\gamma p \rightarrow J/\psi p \rightarrow e^+ e^- p$

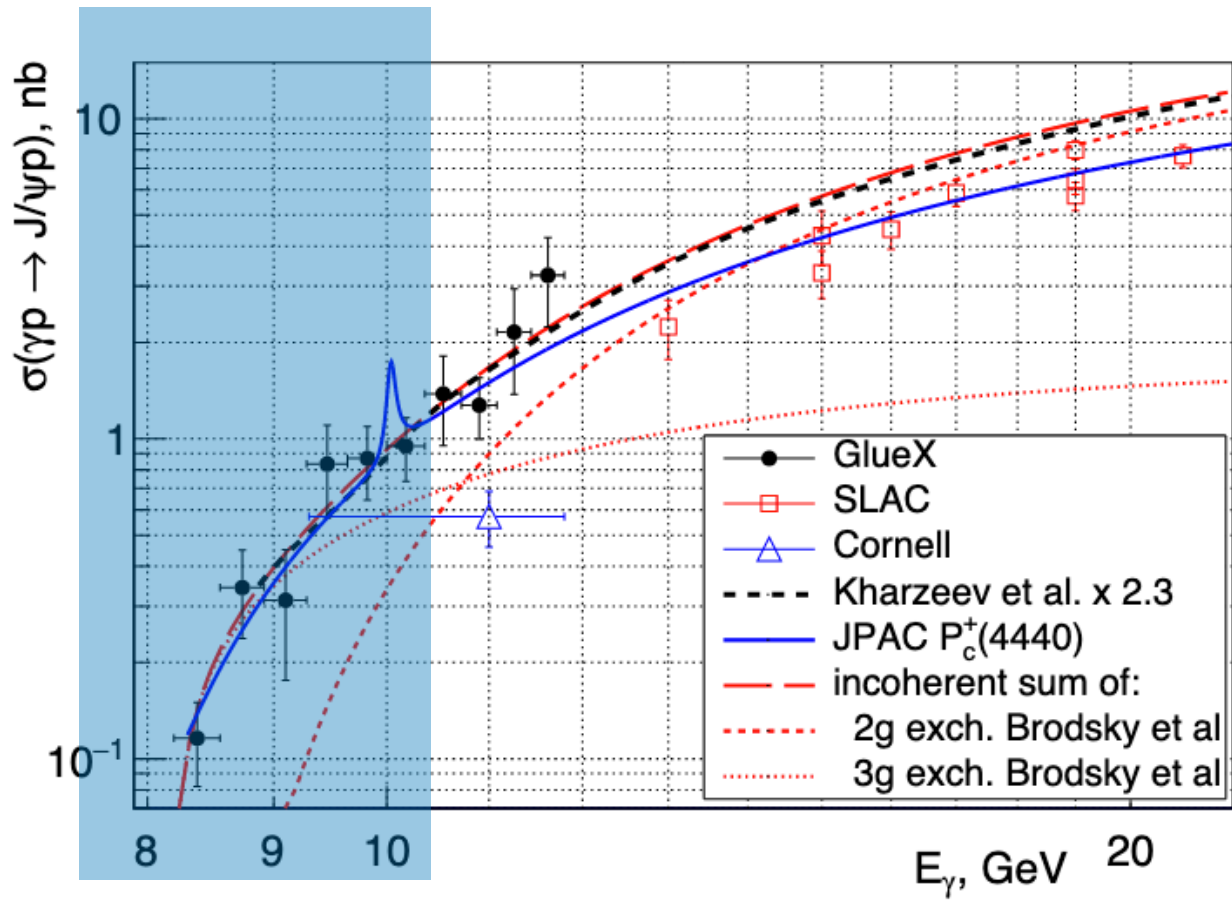


Taken from Gluex Collaboration



near-threshold J/ψ photoproduction at GlueX

Phys. Rev. Lett. 123, 7 (2019)



SRC-CT Experiment

near-threshold J/ψ photoproduction at GlueX

Phys. Rev. Lett. 123, 7 (2019)

Summary of J/ψ production with nuclear targets

date	reference	experiment	beam	energy	target	state
1975	Knapp [13]	FNAL	γ	50–200 GeV	Be	J/ψ
1975	Gittelman [12]	Cornell	γ	11 GeV	Be	J/ψ
1975	Camerini [1]	SLAC	γ	13–21 GeV	p, d	$J/\psi, \psi'$
1976	Nash [14]	FNAL	γ	31–80 GeV	d	J/ψ
1976	Andersen [15]	SLAC	γ	9.5–15 GeV	Be, Ta	J/ψ
1982	Binkley [16]	FNAL	γ	60–300 GeV	p, d	J/ψ
1984	Denby [17]	FNAL	γ	105 GeV	p	J/ψ
1986	Sokoloff [18]	FNAL E691	γ	120 GeV	p, Be, Fe, Pb	J/ψ
1987	Barate [19]	CERN NA14	γ	90 GeV	${}^6\text{Li}$	$J/\psi, \psi'$
1993	Frabetti [20]	FNAL E687	γ	100–375 GeV	Be	J/ψ
1997	Breitweg [21, 22]	HERA ZEUS	e	850–32400 GeV	p	J/ψ
2000	Aldoff [23, 24]	HERA H1	e	360–43300 GeV	p	$J/\psi, \psi'$

Talken form PR-07-106

$$N_{Total} = \frac{Z}{A} \cdot \mathcal{L} \cdot \sigma_{AV} \cdot Br \cdot \epsilon$$

$$\sigma_{\gamma A} = A \cdot \sigma_{\gamma N}.$$

Assuming

$$\sigma_{AV} = 0.5 \text{ nb}$$

$$Br = 0.06 (J/\psi \rightarrow e^- e^+)$$

$\epsilon = 0.25$ (taken from previous J/ψ at Gluex)

A	Z	Total Lumi (1/nb)	Total Counts
2	1	12400	93
4	2	13200	198
12	6	5300	238

Note: The luminosity was estimated for $E_\gamma > 7$ GeV

The total counts is overestimated for above the threshold