

J/ψ Photoproduction at Threshold

- JPAC Model -

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Data:

- Latest version from Lubomir
- Arbitrary normalization

References:

- A. N. Hiller Blin et al. (JPAC collaboration)
Phys. Rev. D 94, 034002 (2016)
Studying the $P_c(4450)$ resonance in J/ψ photoproduction off protons
- http://cgl.soic.indiana.edu/jpac/PentaQ_JPsi.php

$$\frac{d\sigma}{dt} \propto \frac{1}{E_\gamma^2} A^2 e^{2b(t-t_0)} \left(\frac{s-s_{\text{thr}}}{s_0} \right)^{2\alpha(t)} \quad (1)$$

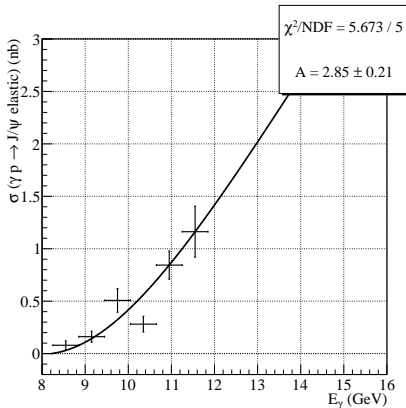
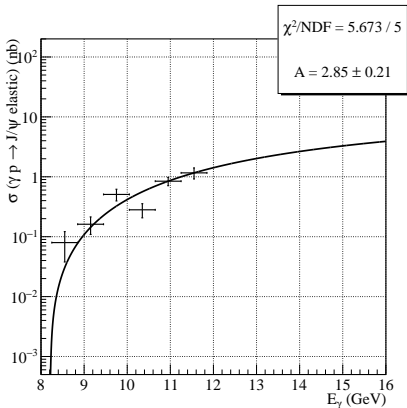
with

$$\begin{aligned} \alpha(t) = \alpha_0 + \alpha' t & : \text{ Pomeron} \\ A & : \text{ Normalization} \\ b & : \text{ } t - \text{ Slope} \end{aligned}$$

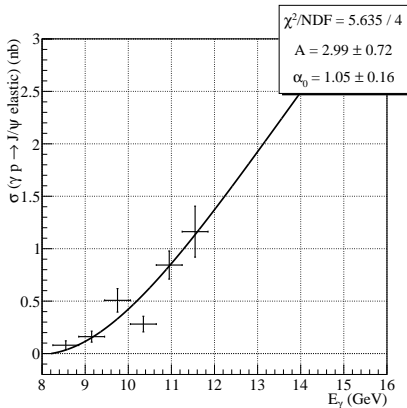
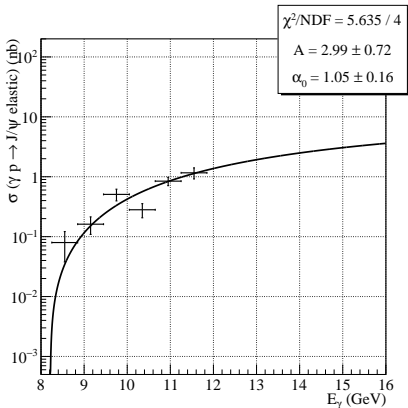
Total cross section:

$$\sigma = \int_{t_{\text{max}}}^{t_{\text{min}}} \frac{d\sigma}{dt} dt \quad (2)$$

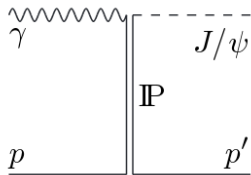
Integral can be evaluated analytically



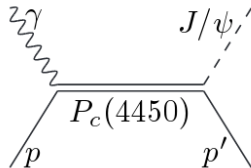
- Only normalization A fitted
- All other parameters fixed



- Normalization A and Pomeron intercept α_0 fitted
- All other parameters fixed, very weak dependence on b , α'



(a) Pomeron exchange



(b) Resonant contribution

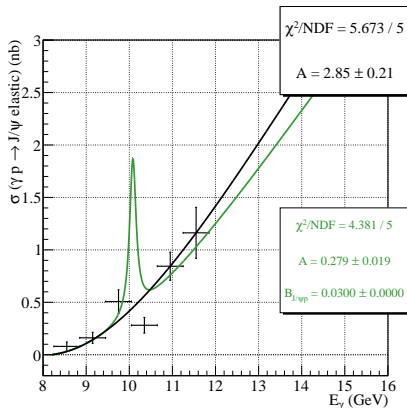
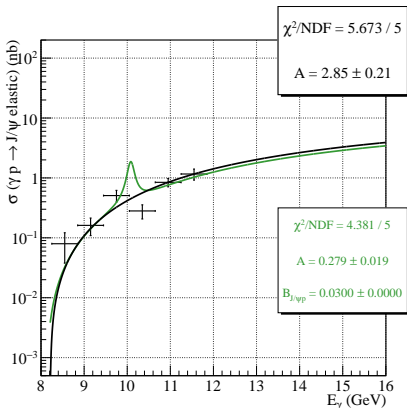
Integral with resonance can no longer be calculated analytically



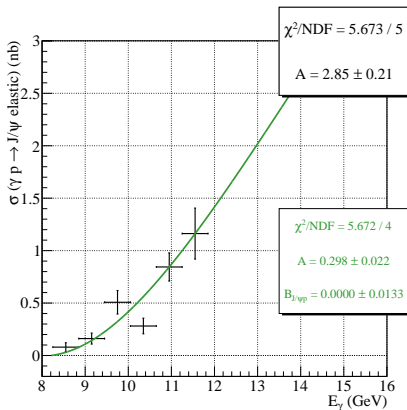
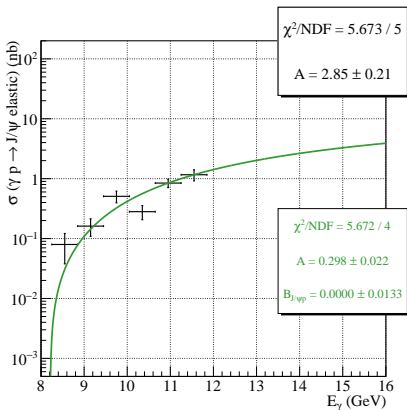
Use original fortran code to fit (in ROOT)

Full Model

full: green, non-resonant: black

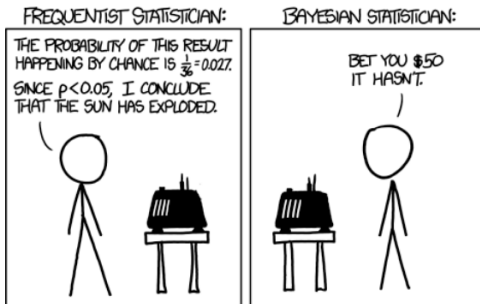


- Only normalization A fitted, branching ratio fixed to 3%
- $M_{P_c} = 4.45 \text{ GeV}/c^2$, $\Gamma_{P_c} = 0.039 \text{ GeV}/c^2$ fixed, spin 3/2



- Normalization A and branching fraction fitted
- Convergence at the same point as non-resonant model (apart from factor 4π for A)

- Test all different resonance models (spin, mass, width, photo-coupling ratio)
- Look at cross section as function of t
- Estimate upper limits with Confidence Level (CLs) method [frequentist]
- Use Bayes' Theorem to obtain full probability distribution [bayesian]



Suggestions are welcome!