

# 1 Physics opportunities with exclusive $J/\psi$ at ECCE

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## 3 Abstract

4 Among the heavy quarkonia production processes at EIC, the exclusive photopro-  
5 duction with large cross section and simple final state is expected to play a key role. In  
6 the reaction, an incident virtual photon fluctuates into quark-antiquark pair, which then  
7 scatters off the target elastically, emerging as a real quarkonium. The scattering process  
8 occurs via the exchange of a color neutral object, Pomeron, which can be viewed as two  
9 gluons with self interaction (gluon ladder) in the language of QCD. Due to the gluonic  
10 nature of Pomeron, the exclusive heavy quarkonia photoproduction at EIC can be related  
11 to the gluon distribution of proton and nucleus using perturbative QCD. Furthermore,  
12 the distribution of momentum transfer from the target in the process is sensitive to the  
13 interaction sites, which provides a powerful tool to probe the spatial distribution of gluon  
14 in nucleus. Recently, there has been a lot of interests among the nucleon structure com-  
15 munity in determining the anomaly contribution  $M_a$  as a key to understand the origin  
16 of the proton mass. The trace anomaly is sensitive to the gluon condensate and exclu-  
17 sive production of quarkonia such as  $J/\psi$  and  $\Upsilon$  is an excellent laboratory to extract the  
18 anomaly contribution  $M_a$ , in which the sensitivity can be maximized for the production  
19 near threshold.

20 In this poster, we will cover the  $J/\psi$  detection at ECCE using data simulated with the  
21 fine-tuned Pythia6 together with Fun4All. And we present the capability of exclusive  
22 process of  $J/\psi$  photoproduction detection to probe the gluon nPDF and spatial distri-  
23 bution, the near threshold production mechanism and trace anomaly of proton mass  
24 decomposition with the ECCE detector setup.