Reply

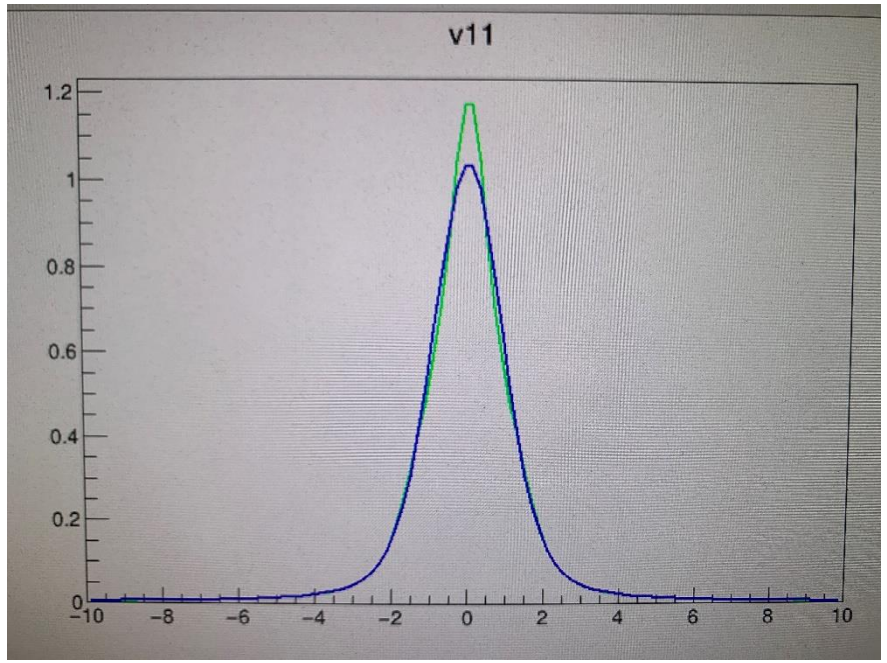
- Q1: On page 3, you introduced two variables (line 108-109) to suppress background events from jpsi->gam pi0 eta. a. How good is its performance? That's to ask how big are the probability of rejecting a true signal event, and the probability of accepting a background event as a signal. b. What kind of generator will you use to answer 1-a? How will your results change if changing to other generators? The choice of generators should be considered in systematic study if it has a considerable impact on signal efficiency.
- A1: After this criteria, the efficiencies of the background, data and signal are reduced by 98.02%, 84.32% and 4.12%, respectively.

- Q2: How did you treat "wrong combination" in 1d fit (Fig. 8) and amplitude analysis?
- A2: In order to describe the wrong combination due to the π^0 candidate, an angle $A_{\pi^0}(p_1, p_2)^\circ$ is applied to perform the MC truth matching, where p_1 stands for the momentum of the reconstructed $\pi^0$and p_2 stands for the π^0 momentum obtained from the MC truth. The requirement $A_{\pi^0}(p_1, p_2)^\circ < 3^\circ$ is employed for right combination, while the requirement $A_{\pi^0}(p_1, p_2)^\circ > 3^\circ$ is for wrong combination. Then, in order to estimate the contribution of the wrong combination in the data, we use the following formula to calculate:

$$N = N_{J/\psi} \cdot B(J/\psi \to \gamma\eta') \cdot \mathrm{B}(\eta' \to \gamma\gamma\pi^0) \cdot B(\pi^0 \to \gamma\gamma) \cdot \varepsilon,$$

where $N_{J/\psi}$ is the number of J/ψ, $B(J/\psi \to \gamma\eta')$, $\mathrm{B}(\eta' \to \gamma\gamma\pi^0)$ and $B(\pi^0 \to \gamma\gamma)$ are the branching fraction of the decay $J/\psi \to \gamma\eta',\ \eta' \to \gamma\gamma\pi^0$ and $\pi^0 \to \gamma\gamma$, ε is the detection efficiency of the wrong combination. For $\mathrm{B}(\eta' \to \gamma\gamma\pi^0)$, we use the PDG value at first, and after we obtained it, we use our result instead with some iterations.

- Q3: Page 11, line 223-227. I don't think this is a good method. It is easy to compare the look of a voigtian using this method with the look of a voigtian presented by RooFit. With the same paremeters, the former is more concentrated. (The impact of this method cannot be estimated by varying the resolution and seeing how results change, unless it can be proved that this method is (almost) equivalent with convolving with a narrower gaussian.)



- Q4: Page 17, this is a very nice check. I suggest providing a table similar to Table 6 for I/O check.
- A4: Ok. I will provide it in the latest memo.

- Q5: Page 20, line 327, what kind of MC was used?
- A5: We use the control sample of $J/\psi \to \gamma\eta' \to \gamma\gamma\omega \to \gamma\gamma\gamma\pi^0$ to estimate the systematic uncertainty here. The MC is generated with the generator based on VMD model including the contribution of ω only. The amplitude formula is the same as the formula (3) in the memo with $\alpha_1 = \alpha_2 = 0$.

- Q6: 6. Page 23, names of systematic terms. a. "Signal model"(8.1.5) and "Signal shape"(8.1.6) mean the same thing. (notice that in line 366 you mentioned "signal shape") b. "Class I and II backgrounds" -> "Background estimation".
- A6: I will reorganize them in the latest memo.

- Q7: Page 24, I noticed that "Barrier factor" affected BRs a lot, do you have any ideas? Could you please explain why "varying R from 0.75 fm to 0.35 fm" for estimation?
- A7: The barrier factor can effect the shape of the non-resonant process[1], and I have checked the impact on the yield when R has different values, as listed in the table in next page. I noticed that R changes 0.1fm in Ref[3] to estimate the uncertainty of the barrier factor.

I take the same value as the previous work at BESIII[2], when vary R from 0.75fm to 0.35fm, the effect on the yield is very large.

[1]F. von Hippel and C. Quigg, Phys. Rev. D 5, 624 (1972).
[2] M. Ablikim *et al.* (BESIII Collaboration) Phys. Rev. D **96**, 012005 (2017).
[3] M. Ablikim *et al.* (BESIII Collaboration) Phys. Rev. D **96**, 112012 (2017).

	ω	ρ	NR
nominal	14200 ± 213	1170 ± 102	156 ± 40
Barrier factor 0.35fm	14700 ± 444 3.5%	1190 ± 87 1.7%	98 ± 33 37.1%
Barrier factor 0.45fm	14600 ± 549 2.8%	1187 ± 81 1.5%	107 ± 32 31.4%
Barrier factor 0.55fm	14500 ± 220 2.1%	1184 ± 103 1.2%	120 ± 38 23.1%
Barrier factor 0.65fm	14300 ± 209 0.7%	1180 ± 109 0.9%	136 ± 38 12.8%

- Q8: Page 25, line 426. I think the I/O check mentioned in section 7 beautifully demonstrated that defect(s) existed in previous study (ignoring R-NR interference, using 1-d model, or maybe both are defects), but it did not "prove that our event selection criteria are reasonable". Please change your expression here. And I think we should chose a cautious one for the upcoming paper.
- A8: