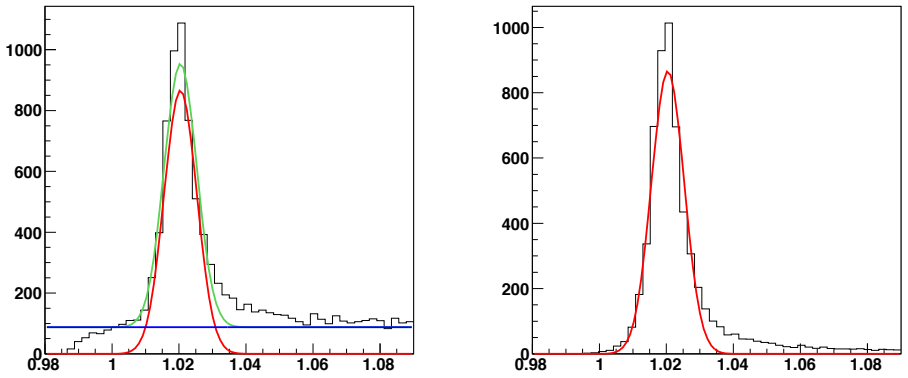

(a) (b)

Figure 1: $MM(p)$ for $E_\gamma = 3.3$ to 3.81 GeV and $0.7 \leq |t| \leq 0.9$. (a) is a fit with Gaussian + flat background. (b) shows a comparision between this signal Gaussian and the Q-value weighted (CMU signal) distribution.

Fourth Round Comments for CMU ϕ analysis

General comments:
The remaining issues that need to be addressed or resolved before we can give our blessing are the following:

1. Even though the explanations of some of the strange background shapes in the yield extraction plots are illustrative, and they becomes less weird in smaller phase space, it does point to the fact that the background shape does impact the yield extraction. We recommend the authors to try what the authors of the eta paper have to evaluate the systematic errors by using more traditional background shape. Judging from the current fitting results, it is hard to believe the systematic uncertainty from the background shape could be as small as the current note purports to be, especially in some of the low statistics bins, such as the the top two rows on Fig. 3.27.

Reiterating what was said in R3, yes, there could be some systematics, but this systematic error will come along with a statistical error as well and separating the two is non-trivial. The low statistics bins will also have large statistical uncertainties. In addition, unlike the eta, we have the charged and neutral modes at our disposal here, with very different background systematics. The difference between the two modes will serve as a "natural" measure of the any remnant systematic uncertainties (over the $\sim$ 13% combined flux, acceptance, target factors etc., which are common). Adding any further background uncertainties is going to be an overkill, in my opinion.

2. We understand it is difficult to compare with g6a at this point. And the committee does not believe there is major mistake in the current analysis that would cause such large discrepancy between g11 and g6a. However, we need to know quantitatively, had the authors used what g6a did, such as using the flat background, what will be the difference in terms of phi yields and the cross section results? The author could choose bins comparable with what g6a had (such as R3 response Fig.4a)

Fig. 1a (this reply) takes the top-most bin from R3 response Fig.4a (for $g11a$ and does a fit using a Gaussian + flat background. Doing an integral between $M_\phi = 1.0$ and 1.08 GeV gives a yield of

$\sim$ 4810. Fig. 1b shows the comparison between this Gaussian fit and my Q-value weighted signal (yield = 5830). In particular the difference in the long tail is to be noted.

Even comparing these crude numbers, 4810 and 5830, gives an 18% difference, compounded with the information that is missing on g6a's flux norms, accepatance calcs., etc., does a $30-40\%$ difference look too incredulous?

3. The committee encourages stronger communication with the ODU group. The fact that we have two independent analyses offers a rare opportunity to better understand some of the new methods CMU has developed, and the collaboration would benefit from our conclusion.

4. We would like to see the comparison between the two groups whenever results are updated. We caution the authors to include only independent-extracted uncertainties, and exclude common uncertainties such as normalization factors.

As noted in R3, all CMU plots show statistical uncertainties only. The systematic uncertanties for acceptance, flux norm, etc, are provided separately.