

Erratum: Search for exclusive Higgs and Z boson decays to $\phi\gamma$ and $\rho\gamma$ with the ATLAS detector



The ATLAS collaboration

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| | Observed yields (Mean expected background) | | | Expected signal yields | |
|--------------|--|------------------------|----------------------|---------------------------|---------------------------|
| | Mass range [GeV] | | | H | Z |
| | All | 81–101 | 120–130 | $[\mathcal{B} = 10^{-4}]$ | $[\mathcal{B} = 10^{-6}]$ |
| $\phi\gamma$ | 12051 | 3364 (3500 \pm 30) | 1076 (1038 \pm 9) | 15.1 \pm 1.5 | 98 \pm 8 |
| $\rho\gamma$ | 58702 | 12583 (12660 \pm 60) | 5473 (5450 \pm 30) | 14.3 \pm 1.4 | 47 \pm 4 |

Table 2. The number of observed events and the mean expected background, estimated from the maximum-likelihood fit and shown with the associated total uncertainty, for the $m_{M\gamma}$ ranges of interest. The expected Higgs and Z boson signal yields, along with the total systematic uncertainty, for $\phi\gamma$ and $\rho\gamma$, estimated using simulations, are also shown in parentheses.

| Branching Fraction Limit (95% CL) | Expected | Observed |
|---|-----------------------|----------|
| $\mathcal{B}(H \rightarrow \phi\gamma) [10^{-4}]$ | 4.2 $^{+1.8}_{-1.2}$ | 5.0 |
| $\mathcal{B}(Z \rightarrow \phi\gamma) [10^{-6}]$ | 1.1 $^{+0.5}_{-0.3}$ | 0.7 |
| $\mathcal{B}(H \rightarrow \rho\gamma) [10^{-4}]$ | 10.0 $^{+4.9}_{-2.8}$ | 10.4 |
| $\mathcal{B}(Z \rightarrow \rho\gamma) [10^{-6}]$ | 5.1 $^{+2.1}_{-1.4}$ | 4.0 |

Table 3. Expected and observed branching fraction upper limits at 95% CL for the $\phi\gamma$ and $\rho\gamma$ analyses. The $\pm 1\sigma$ intervals of the expected limits are also given.

One correction is noted for the paper. The calculation of an angle used to account for meson polarisation in the signal decays was not correct. Amending this leads to a modification of the p_T distributions of the decay products in the signal decays, which propagates to the signal yields and efficiencies, and the extracted 95% confidence-level (CL) upper limits on the branching fractions for each signal. The trigger efficiency for both the Higgs and Z boson decays to $\phi\gamma$ is approximately 83% with respect to the offline selection. The trigger efficiency for Higgs boson decays to $\rho\gamma$ is 78%, while for the corresponding Z boson decays is approximately 72%. The total signal efficiencies (kinematic acceptance, trigger and reconstruction efficiencies) is 17% for $H \rightarrow \phi\gamma$ and 10% for $Z \rightarrow \phi\gamma$ decays. The efficiencies for the $\rho\gamma$ final state are 8% and 2.4% respectively for the Higgs and Z boson decays. The effect of polarisation in the expected Higgs (Z) boson signal yields with respect to the hypothetical case where the mesons are not polarised is also modified. For decays to $\phi\gamma$ there is a relative 2.4% and 9% signal yield increase, respectively, for the Higgs and Z boson decays compared to the unpolarised case. For decays to $\rho\gamma$ the corresponding relative increase is 12% and 7%, respectively, for Higgs and Z boson signals compared to the unpolarised case. The expected signal yields are shown in table 2 and the 95% CL limits are shown in table 3. Upper limits at 95% CL on the production cross section times branching fraction are 26.1 fb for the $H \rightarrow \phi\gamma$ decay, and 54.8 fb for the $H \rightarrow \rho\gamma$ decay. The signal p_T distributions are shown in figure 1, and the signal normalisation in the results of the background-only fits for the $\phi\gamma$ and $\rho\gamma$ analyses are shown in figure 5.

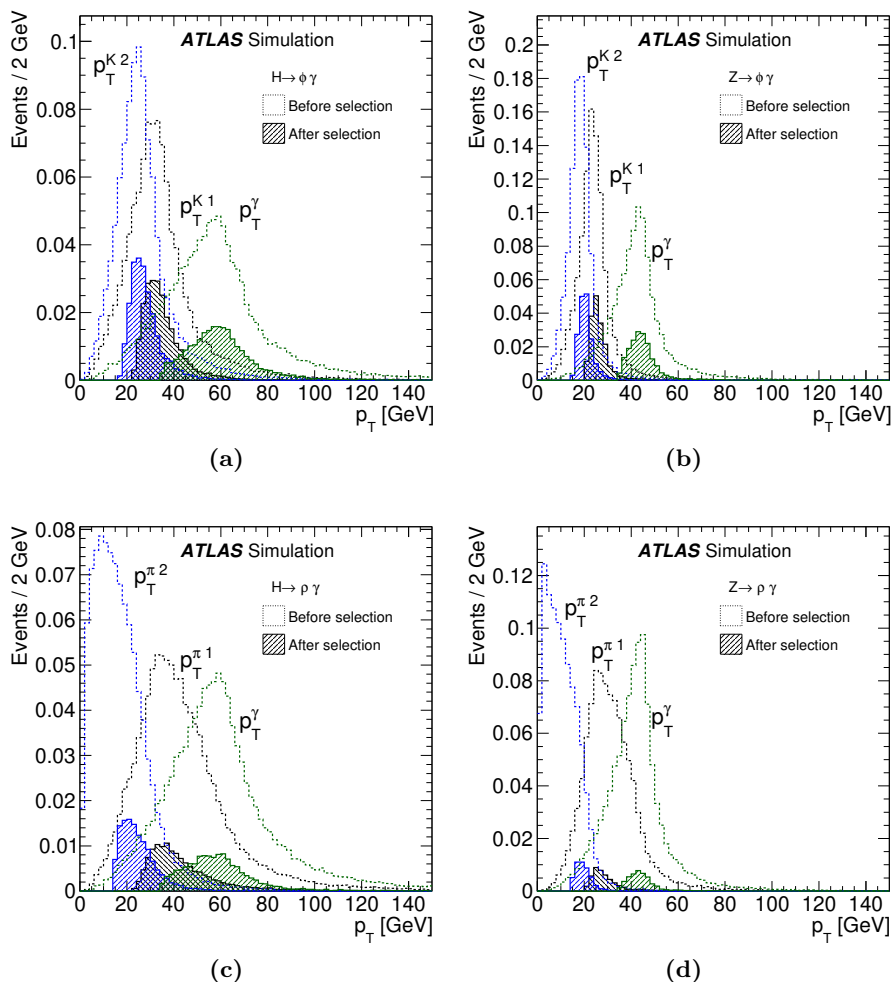


Figure 1. Generator-level transverse momentum (p_T) distributions of the photon and of the charged-hadrons, ordered in p_T , for (a) $H \rightarrow \phi\gamma$, (b) $Z \rightarrow \phi\gamma$, (c) $H \rightarrow \rho\gamma$ and (d) $Z \rightarrow \rho\gamma$ simulated signal events, respectively. The hatched histograms denote the full event selection while the dashed histograms show the events at generator level that fall within the analysis geometric acceptance (both charged-hadrons are required to have $|\eta| < 2.5$ while the photon is required to have $|\eta| < 2.37$, excluding the region $1.37 < |\eta| < 1.52$). The dashed histograms are normalised to unity, and the relative difference between the two sets of distributions corresponds to the effects of reconstruction, trigger, and event selection efficiencies. The leading charged-hadron candidate $h = K, \pi$ is denoted by p_T^{h1} and the sub-leading candidate by p_T^{h2} .

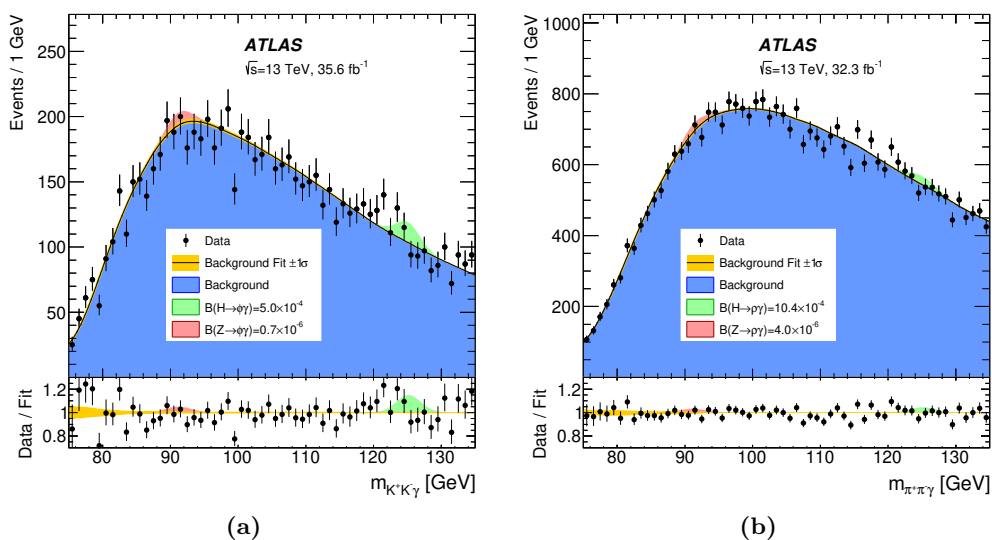


Figure 5. The (a) $m_{K^+K^-\gamma}$ and (b) $m_{\pi^+\pi^-\gamma}$ distributions of the selected $\phi\gamma$ and $\rho\gamma$ candidates, respectively, along with the results of the maximum-likelihood fits with a background-only model. The Higgs and Z boson contributions for the branching fraction values corresponding to the observed 95% CL upper limits are also shown. Below the figures the ratio of the data to the background-only fit is shown.

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