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Evidence for the Higgs Boson Decay to a Z Boson and a Photon at the LHC

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The first evidence for the Higgs boson decay to a Z boson and a photon is presented, with a statistical significance of 3.4 standard deviations. The result is derived from a combined analysis of the searches performed by the ATLAS and CMS Collaborations with proton-proton collision datasets collected at the CERN Large Hadron Collider (LHC) from 2015 to 2018. These correspond to integrated luminosities of around 140 fb^{-1} for each experiment, at a center-of-mass energy of 13 TeV. The measured signal yield is 2.2 ± 0.7 times the standard model prediction, and agrees with the theoretical expectation within 1.9 standard deviations.

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Since the discovery of the Higgs boson [1–3] by the ATLAS [4] and CMS [5] Collaborations in 2012, a detailed program of measurements [6–8] has confirmed its couplings and other properties to be mostly consistent with those predicted by the standard model (SM). However, there are several rare Higgs boson decay channels, including $H \to Z\gamma$ [9–11], that have not been observed. These channels provide probes for possible contributions arising from physics beyond the SM (BSM physics). During LHC Run 2 (2015–2018), large data samples of proton-proton collisions at $\sqrt{s} = 13$ TeV were collected by the two experiments, improving the sensitivity to such decays.

In the SM, the $H \to Z\gamma$ decay is expected to have a relatively small branching fraction of $(1.5 \pm 0.1) \times 10^{-3}$ for a Higgs boson mass (m_H) close to 125 GeV [12,13]. As the $H \to Z\gamma$ decay occurs via loop diagrams, with examples given in Fig. 1, it is sensitive to modifications in several BSM scenarios that would cause the branching fraction to be enhanced compared with the SM value. Examples include models where the Higgs boson is a composite state [14], a pseudo Nambu-Goldstone boson [15], or a neutral scalar originating from a different source [16,17]. Branching fractions deviating from the SM value are also expected for models with additional colorless charged scalars, leptons, or vector bosons that couple to the Higgs boson, because of their contributions via loop corrections [18–20].

This Letter reports the first evidence for $H \to Z\gamma$ decay obtained from a combination of ATLAS [21] and CMS [22] searches for this channel. The analyses are based on the Run 2 datasets collected by the ATLAS and CMS experiments, corresponding to integrated luminosities of 139 and 138 fb^{-1}, respectively, at a center-of-mass energy of 13 TeV. Previous $H \to Z\gamma$ searches by the ATLAS and CMS Collaborations used the datasets collected at $\sqrt{s} = 7$ and 8 TeV, and partial datasets collected at $\sqrt{s} = 13$ TeV [23–25].

The ATLAS detector [4] is a multipurpose particle detector with cylindrical geometry. It consists of an inner tracking detector surrounded by a thin superconducting solenoid providing a 2 T axial magnetic field, electromagnetic and hadronic sampling calorimeters, and a muon spectrometer with three toroidal superconducting magnets, providing nearly 4π coverage in solid angle. The CMS apparatus [5] is a nearly hermetic, multipurpose detector. Contained within a 3.8 T superconducting solenoid are an all-silicon inner tracker, a crystal electromagnetic calorimeter, and a brass-scintillator hadron calorimeter. Gas-ionization muon detectors are embedded in the flux-return yoke outside the solenoid.

The ATLAS and CMS $H \to Z\gamma$ analyses share many features. In both, the Z boson is reconstructed through its decays into electron or muon pairs ($Z \to \ell^+\ell^-$, $\ell = e$ or μ), requiring a dilepton mass above 50 GeV. The leptons provide a clean signature and ensure a high trigger

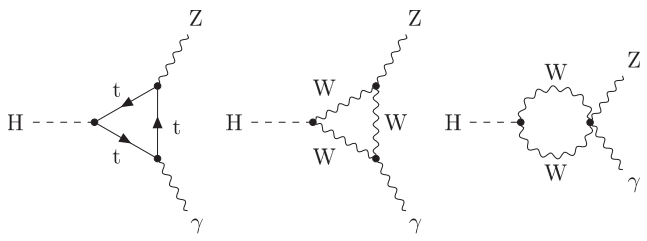

FIG. 1. Examples of Feynman diagrams for $H \to Z\gamma$ decay.

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efficiency and good invariant mass resolution for the final-state products of the Higgs boson decay. The photon candidate is reconstructed from energy clusters in the electromagnetic calorimeters. It must satisfy identification criteria and be isolated from other event activity. The dominant backgrounds arise from Drell-Yan production in association with a photon or a jet misidentified as a photon. In both analyses, the production of the SM Higgs boson signal is modeled with the POWHEG BOX v2 Monte Carlo event generator [26–31].

After the reconstruction and selection of $H \to Z\gamma$ candidate events, the signal is identified as a narrow resonant peak at m_H in the $Z\gamma$ invariant mass ($m_{Z\gamma}$) distribution, calculated as the invariant mass of the $\ell^+\ell^-\gamma$ system. The $m_{Z\gamma}$ resolution is improved by dedicated final-state radiation corrections to the momenta of muons with nearby photons, and via kinematic fits for the dilepton mass of the Z boson candidate using a Breit-Wigner line shape to model the Z boson resonance, convolved with a Gaussian response function for the leptons [32,33]. The resulting $m_{Z\gamma}$ resolution is 1.4–2 GeV, depending on the final state and event topology.

To enhance the sensitivity, both analyses assign events to categories with different signal-to-background ratios by exploiting the kinematic features of different Higgs boson production modes. The ATLAS analysis assigns each event to one of six categories, including a category targeting the vector-boson fusion (VBF) topology, which requires the presence of at least two jets and a selection on the output score of a dedicated boosted decision tree (BDT). The remaining five categories target other Higgs boson production modes, which are defined with different lepton flavors and kinematic properties of the momentum of the $Z\gamma$ system transverse to the beam direction [34].

The CMS analysis assigns each event to one of eight categories, including a category with additional leptons targeting the production of Higgs bosons associated with either a weak vector boson or a top quark pair, and three categories defined by the output score of a dedicated BDT targeting the VBF topology. The other four categories are defined by the output score of another BDT exploiting the differences between the kinematic properties of $H \to Z\gamma$ signal events and background events.

Simultaneous signal-plus-background fits across the analysis categories are performed to the $Z\gamma$ invariant mass distribution, with analytic signal and background functions. The signal models are from Crystal Ball [35] and Gaussian functions, and the background models are based on exponential functions, power law functions, Laurent series, and Bernstein polynomials. Experimental and theoretical uncertainties affecting the expected number of signal events, the shape of the $Z\gamma$ invariant mass distribution from the $H \to Z\gamma$ signal process, and the background models are considered as constrained nuisance parameters. The Higgs boson production cross sections and $H \to Z\gamma$ branching fraction used to normalize the signal are common to both experiments. In both analyses, the parameters of the analytic background functions are determined from the data. Both the ATLAS and CMS analyses measure the signal strength (μ) defined as the ratio of the Higgs boson production cross section times $H \to Z\gamma$ branching fraction to the SM prediction.

The statistical treatment of the data is based on the standard LHC data modeling and handling toolkits: RooFit [36], RooStats [37], and HistFactory [38]. The confidence intervals of the signal strength are determined via the profile-likelihood-ratio test statistic [39]. The likelihood function used to define the test statistic is the product of the likelihood functions of the ATLAS and CMS analyses, adapted to have common constraint terms for the nuisance parameters representing the correlated uncertainties. The main differences between the likelihood functions of the two analyses are the background models. In each category of the ATLAS analysis, the chosen background model is the one that minimizes the presence of "spurious" signal, i.e., the extracted signal yields in signal-plus-background fits to background-only templates of $m_{Z\gamma}$ [1]. The spurious-signal yield is introduced as an additional nuisance parameter in the likelihood function, which modifies the expected signal yield. In the CMS analysis, a discrete profiling method [40] is used to determine the background model directly in the fit to the data. For each category, this method introduces an additional discrete nuisance parameter that selects the best background model among a large set of alternative models. The discrete nuisance parameter is profiled in the final fit.

The experimental uncertainties from the ATLAS and CMS analyses are considered uncorrelated. While some components of the experimental systematic uncertainties could be correlated due to the similar simulation software and calibration techniques, these are expected to be much smaller than the uncorrelated components. Among the theoretical uncertainty sources, the one associated with missing higher orders in the perturbative calculations of the gluon-gluon fusion cross section (renormalization and factorization scale uncertainties) [41–43], and the ones in the $H \to Z\gamma$ branching fraction prediction [13] are correlated. In the CMS analysis, a small number of modifications are made to facilitate the combination. In particular, for consistency, the scale and branching fraction uncertainties are reevaluated. These changes have a minor impact on the CMS result. In the ATLAS analysis, the decomposition of the scale uncertainties in terms of independent sources is modified, which has a negligible impact on the observed signal strength. The uncertainties associated with missing higher orders in the calculations for the other Higgs boson production modes, with the choice of parton distribution functions (PDFs) [44,45], with the value of the strong-force coupling constant (α_s), and with the modeling of the underlying event and parton shower are not correlated because of their different implementations in the two

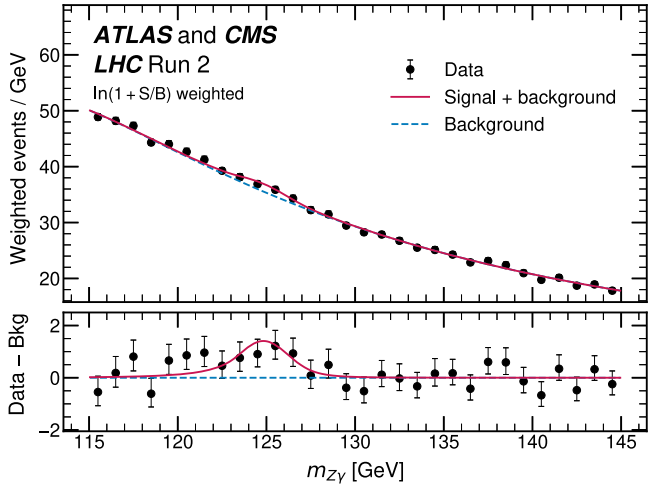

FIG. 2. The $Z\gamma$ invariant mass distribution. Events from all categories in the ATLAS and CMS analyses are shown. As different ranges in $m_{Z\gamma}$ are used in the two analyses, only the common subrange is visualized here. The data (points with error bars) in each category are weighted by $\ln(1 + S/B)$, where S and B are the observed signal and background yields in that category, in the 120–130 GeV interval. The S and B values are derived from the fit to data. The error bars are invisible because of their small values. The fitted signal-plus-background (background) probability density functions (pdfs) in each category are also weighted in the same way and summed, and represented by a red solid (blue dashed) line. The lower panel shows the background-subtracted results with the same data and pdfs.

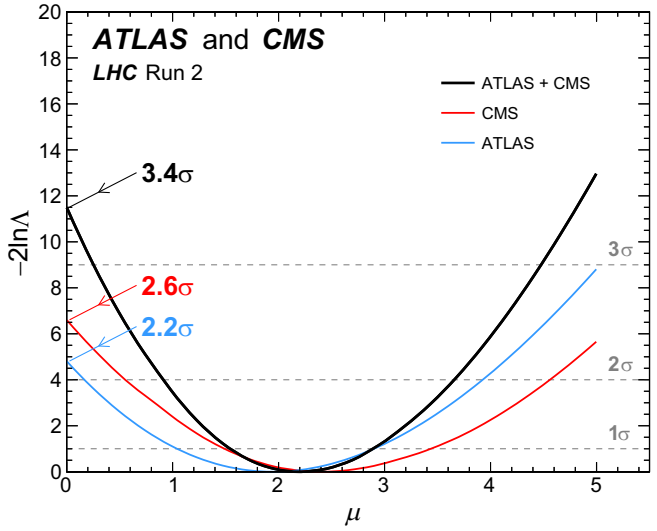

FIG. 3. The negative profile log-likelihood test statistic, where Λ represents the likelihood ratio as a function of the signal strength μ derived from the ATLAS data (blue line), the CMS data (red line), and the combined result (black line). The different Higgs boson masses assumed by ATLAS and CMS have a negligible impact on the results.

analyses. However, approximate correlation strategies were investigated for the integrated luminosity [46–50], scale, and PDF uncertainties; they are found to have a negligible impact and are not adopted in the following results. One difference between the ATLAS and CMS analyses is the assumed value of m_H taken to be 125.09 GeV [51] in the former and 125.38 GeV [52] in the latter. The results of the combination are determined for both m_H values, and the different mass assumptions have a negligible impact within the precision reported in this Letter.

The $Z\gamma$ invariant mass distribution observed in data is shown in Fig. 2. To demonstrate the sensitivity of this likelihood analysis, the events in each category are weighted by $\ln(1 + S/B)$, where S and B are the observed signal and background yields in that category in the range $120 < m_{Z\gamma} < 130$ GeV, as determined by the minimization of the test statistic. The negative log-likelihood ratio as a function of the signal strength is shown in Fig. 3. The observed (expected) signal strength at the 68% confidence level is $\mu = 2.0^{+1.0}_{-0.9}$ (1.0 ± 0.9) for the ATLAS analysis, $\mu = 2.4^{+1.0}_{-0.9}$ $(1.0^{+1.0}_{-0.9})$ for the CMS analysis, and $\mu = 2.2 \pm 0.6(\text{stat})^{+0.3}_{-0.2}(\text{syst}) = 2.2 \pm 0.7$ $[1.0 \pm 0.6(\text{stat}) \pm 0.2(\text{syst}) = 1.0 \pm 0.6]$ for their combination. Expressed in standard deviations σ, the observed (expected) local significance, with respect to the $\mu = 0$ hypothesis of no $H \to Z\gamma$ signal, is 2.2σ (1.2σ) for the ATLAS analysis, 2.6σ (1.1σ) for the CMS analysis, and 3.4σ (1.6σ) for their combination. The uncertainties in the $H \to Z\gamma$ branching fraction and the background modeling are the largest systematic uncertainties. Assuming SM Higgs boson production cross sections, the measured branching fraction for $H \to Z\gamma$ decay is $(3.4 \pm 1.1) \times 10^{-3}$. In contrast to the signal strength measurement, the uncertainty in the SM branching fraction prediction is not included in this fit. The uncertainties in the results are dominated by the statistical fluctuations of data.

The combined result is compatible with the measured signal strengths from individual categories with a p-value greater than 12%. The p-value for compatibility with the SM hypothesis ($\mu = 1$) is about 6%, and the observed local significance with respect to the SM is 1.9σ. The goodness of fit of the model to the data is evaluated with a likelihood-ratio test [53], and has a p-value greater than 90%. Tabulated results are provided in the HEPData record for this analysis [54].

In summary, a combined analysis of ATLAS and CMS searches for the Higgs boson decay to a Z boson and a photon, where the Z boson decays into an electron or muon pair, is presented. The results are based on the 13 TeV proton-proton collision data recorded by the ATLAS and CMS experiments at the CERN LHC, amounting to integrated luminosities of 139 and 138 fb^{-1}, respectively. Evidence for $H \to Z\gamma$ decay is established, with an observed significance of 3.4 standard deviations. The observed signal yield is 2.2 ± 0.7 times the SM prediction. The measured $H \to Z\gamma$ branching fraction is $(3.4 \pm 1.1) \times 10^{-3}$. The result agrees with the SM prediction within 1.9 standard deviations.

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[1] ATLAS Collaboration, Observation of a new particle in the search for the standard model Higgs boson with the ATLAS detector at the LHC, Phys. Lett. B **716**, 1 (2012).
[2] CMS Collaboration, Observation of a new boson at a mass of 125 GeV with the CMS experiment at the LHC, Phys. Lett. B **716**, 30 (2012).
[3] CMS Collaboration, Observation of a new boson with mass near 125 GeV in pp collisions at $\sqrt{s} = 7$ and 8 TeV, J. High Energy Phys. 06 (2013) 081.
[4] ATLAS Collaboration, The ATLAS experiment at the CERN Large Hadron Collider, J. Instrum. **3**, S08003 (2008).
[5] CMS Collaboration, The CMS experiment at the CERN LHC, J. Instrum. **3**, S08004 (2008).
[6] ATLAS and CMS Collaborations, Measurements of the Higgs boson production and decay rates and constraints on its couplings from a combined ATLAS and CMS analysis of the LHC pp collision data at $\sqrt{s} = 7$ and 8 TeV, J. High Energy Phys. 08 (2016) 045.
[7] ATLAS Collaboration, A detailed map of Higgs boson interactions by the ATLAS experiment ten years after the discovery, Nature (London) **607**, 52 (2022).
[8] CMS Collaboration, A portrait of the Higgs boson by the CMS experiment ten years after the discovery, Nature (London) **607**, 60 (2022).
[9] R. Cahn, M. Chanowitz, and N. Fleishon, Higgs particle production by $Z \to H\gamma$, Phys. Lett. **82B**, 113 (1979).
[10] L. Bergstrom and G. Hulth, Induced Higgs couplings to neutral bosons in e^+e^- collisions, Nucl. Phys. **B259**, 137 (1985).

[11] M. Spira, A. Djouadi, and P. Zerwas, QCD corrections to the $HZ\gamma$ coupling, Phys. Lett. B **276**, 350 (1992).

[12] A. Djouadi, J. Kalinowski, and M. Spira, HDECAY: A program for Higgs boson decays in the standard model and its supersymmetric extension, Comput. Phys. Commun. **108**, 56 (1998).

[13] D. de Florian *et al.*, Handbook of LHC Higgs cross sections: 4. Deciphering the nature of the Higgs sector, 10.23731/CYRM-2017-002 (2017).

[14] A. Azatov, R. Contino, A. Di Iura, and J. Galloway, New prospects for Higgs compositeness in $h \to Z\gamma$, Phys. Rev. D **88**, 075019 (2013).

[15] Q.-H. Cao, L.-X. Xu, B. Yan, and S.-h. Zhu, Signature of pseudo Nambu-Goldstone Higgs boson in its decay, Phys. Lett. B **789**, 233 (2019).

[16] I. Low, J. Lykken, and G. Shaughnessy, Singlet scalars as Higgs imposters at the Large Hadron Collider, Phys. Rev. D **84**, 035027 (2011).

[17] I. Low, J. Lykken, and G. Shaughnessy, Have we observed the Higgs (imposter)?, Phys. Rev. D **86**, 093012 (2012).

[18] M. Carena, I. Low, and C. E. Wagner, Implications of a modified Higgs to diphoton decay width, J. High Energy Phys. 08 (2012) 060.

[19] C.-W. Chiang and K. Yagyu, Higgs boson decays to $\gamma\gamma$ and $Z\gamma$ in models with Higgs extensions, Phys. Rev. D **87**, 033003 (2013).

[20] C.-S. Chen, C.-Q. Geng, D. Huang, and L.-H. Tsai, New scalar contributions to $h \to Z\gamma$, Phys. Rev. D **87**, 075019 (2013).

[21] ATLAS Collaboration, A search for the $Z\gamma$ decay mode of the Higgs boson in pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector, Phys. Lett. B **809**, 135754 (2020).

[22] CMS Collaboration, Search for Higgs boson decays to a Z boson and a photon in proton-proton collisions at $\sqrt{s} = 13$ TeV, J. High Energy Phys. 05 (2023) 233.

[23] ATLAS Collaboration, Search for Higgs boson decays to a photon and a Z boson in pp collisions at $\sqrt{s} = 7$ and 8 TeV with the ATLAS detector, Phys. Lett. B **732**, 8 (2014).

[24] CMS Collaboration, Search for a Higgs boson decaying into a Z and a photon in pp collisions at $\sqrt{s} = 7$ and 8 TeV, Phys. Lett. B **726**, 587 (2013).

[25] CMS Collaboration, Search for the decay of a Higgs boson in the $\ell\ell\gamma$ channel in proton-proton collisions at $\sqrt{s} = 13$ TeV, J. High Energy Phys. 11 (2018) 152.

[26] P. Nason and C. Oleari, NLO Higgs boson production via vector-boson fusion matched with shower in POWHEG, J. High Energy Phys. 02 (2010) 037.

[27] S. Alioli, P. Nason, C. Oleari, and E. Re, A general framework for implementing NLO calculations in shower Monte Carlo programs: The POWHEG BOX, J. High Energy Phys. 06 (2010) 043.

[28] P. Nason, A new method for combining NLO QCD with shower Monte Carlo algorithms, J. High Energy Phys. 11 (2004) 040.

[29] S. Frixione, P. Nason, and C. Oleari, Matching NLO QCD computations with parton shower simulations: The POWHAG method, J. High Energy Phys. 11 (2007) 070.

[30] H. B. Hartanto, B. Jäger, L. Reina, and D. Wackeroth, Higgs boson production in association with top quarks in the POWHEG BOX, Phys. Rev. D **91**, 094003 (2015).

[31] S. Alioli, P. Nason, C. Oleari, and E. Re, NLO Higgs boson production via gluon fusion matched with shower in POWHEG, J. High Energy Phys. 04 (2009) 002.

[32] ATLAS Collaboration, Measurements of Higgs boson production and couplings in the four-lepton channel in pp collisions at center-of-mass energies of 7 and 8 TeV with the ATLAS detector, Phys. Rev. D **91**, 012006 (2015).

[33] CMS Collaboration, Measurements of properties of the Higgs boson decaying into the four-lepton final state in pp collisions at $\sqrt{s} = 13$ TeV, J. High Energy Phys. 11 (2017) 047.

[34] M. Vesterinen and T. Wyatt, A novel technique for studying the Z boson transverse momentum distribution at hadron colliders, Nucl. Instrum. Methods Phys. Res., Sect. A **602**, 432 (2009).

[35] M. Oreglia, A study of the reactions $\psi' \to \gamma\gamma\psi$, 1980, https://www.slac.stanford.edu/cgi-wrap/getdoc/slac-r-236.pdf.

[36] W. Verkerke and D. Kirkby, The RooFit toolkit for data modeling, arXiv:physics/0306116.

[37] L. Moneta *et al.*, The RooStats project, Proc. Sci. ACAT2010 (**2010**) 057.

[38] K. Cranmer, G. Lewis, L. Moneta, A. Shibata, and W. Verkerke, HistFactory: A tool for creating statistical models for use with RooFit and RooStats, Report No. CERN-OPEN-2012-016, 2012, https://cds.cern.ch/record/1456844.

[39] G. Cowan, K. Cranmer, E. Gross, and O. Vitells, Asymptotic formulae for likelihood-based tests of new physics, Eur. Phys. J. C **71**, 1554 (2011); **73**, 2501(E) (2013).

[40] P. Dauncey, M. Kenzie, N. Wardle, and G. Davies, Handling uncertainties in background shapes: The discrete profiling method, J. Instrum. **10**, P04015 (2015).

[41] I. W. Stewart and F. J. Tackmann, Theory uncertainties for Higgs and other searches using jet bins, Phys. Rev. D **85**, 034011 (2012).

[42] S. Gangal and F. J. Tackmann, Next-to-leading-order uncertainties in Higgs + 2 jets from gluon fusion, Phys. Rev. D **87**, 093008 (2013).

[43] M. Grazzini and H. Sargsyan, Heavy-quark mass effects in Higgs boson production at the LHC, J. High Energy Phys. 09 (2013) 129.

[44] A. Martin, W. Stirling, R. Thorne, and G. Watt, Parton distributions for the LHC, Eur. Phys. J. C **63**, 189 (2009).

[45] J. Butterworth *et al.*, PDF4LHC recommendations for LHC Run II, J. Phys. G **43**, 023001 (2016).

[46] ATLAS Collaboration, Luminosity determination in pp collisions at $\sqrt{s} = 13$ TeV using the ATLAS detector at the LHC, Report No. ATLAS-CONF-2019-021, 2019, https://cds.cern.ch/record/2677054.

[47] G. Avoni *et al.*, The new LUCID-2 detector for luminosity measurement and monitoring in ATLAS, J. Instrum. **13**, P07017 (2018).

[48] CMS Collaboration, Precision luminosity measurement in proton-proton collisions at $\sqrt{s} = 13$ TeV in 2015 and 2016 at CMS, Eur. Phys. J. C **81**, 800 (2021).

[49] CMS Collaboration, CMS luminosity measurement for the 2017 data-taking period at $\sqrt{s} = 13$ TeV, Report No. CMS-PAS-LUM-17-004, 2018, https://cds.cern.ch/record/2621960.

[50] CMS Collaboration, CMS luminosity measurement for the 2018 data-taking period at $\sqrt{s} = 13$ TeV, Report No. CMS-PAS-LUM-18-002, 2019, https://cds.cern.ch/record/2676164.

[51] ATLAS and CMS Collaborations, Combined measurement of the Higgs boson mass in pp collisions at $\sqrt{s} = 7$ and 8 TeV with the ATLAS and CMS experiments, Phys. Rev. Lett. **114**, 191803 (2015).
[52] CMS Collaboration, A measurement of the Higgs boson mass in the diphoton decay channel, Phys. Lett. B **805**, 135425 (2020).
[53] S. Baker and R. D. Cousins, Clarification of the use of chi square and likelihood functions in fits to histograms, Nucl. Instrum. Methods **221**, 437 (1984).
[54] ATLAS and CMS Collaborations, HEPData record for this analysis, 2023, 10.17182/hepdata.142406.
[55] ATLAS Collaboration, ATLAS computing acknowledgements, Report No. ATL-SOFT-PUB-2023-001, 2023, https://cds.cern.ch/record/2869272.

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