## **Bibliography**

- [1] ATLAS Collaboration, Identification and energy calibration of hadronically decaying tau leptons with the ATLAS experiment in pp collisions at  $\sqrt{s}$ =8 TeV, arXiv:1412.7086 [hep-ex]. PERF-2013-06. Submitted to EPJC. 1, 3.3.3, 4, 4.3, 4.4, 4.5, 4.7, 4.1, 4.8, 4.9, 4.10, 4.11, 4.2, 4.12, 4.13, 4.14, 5.6, 8.1, 8.5, 8.2.1, B.1, B.2
- [2] ATLAS Collaboration, Evidence for the Higgs-boson Yukawa coupling to tau leptons with the ATLAS detector, JHEP 117 (2015), arXiv:1501.04943 [hep-ex]. HIGG-2013-32. 1, 5, 5.1.2, 5.6, 6.4, 6.4.1, 6.24, 6.25, 6.6, 6.26, 7, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, 8.2, 8.2.3.2, 8.2.4.1
- [3] F. Englert and R. Brout, Broken symmetry and the mass of gauge vector mesons, Phys. Rev. Lett. 13 (1964) 321–323. 2.1
- [4] P. Higgs, Broken symmetries, massless particles and gauge fields, Physics Letters 12 (1964) 132–133. 2.1
- [5] P. W. Higgs, Broken symmetries and the masses of gauge bosons, Phys. Rev. Lett. 13 (1964) 508–509. 2.1
- [6] G. S. Guralnik, C. R. Hagen, and T. W. B. Kibble, *Global conservation laws and massless particles*, Phys. Rev. Lett. **13** (1964) 585–587. 2.1
- [7] S. Glashow, Partial symmetries of weak interactions, Nucl. Phys. 22 (1961) 579–588. 2.1
- [8] S. Weinberg, A Model of Leptons, Phys. Rev. Lett. 19 (1967) 1264–1266. 2.1
- [9] A. Salam, Weak and electromagnetic interactions, Svartholm: Elementary Particle Theory, Proceedings Of The Nobel Symposium Held 1968 At Lerum, Sweden, Stockholm (1968) 367–377. 2.1
- [10] Gargamelle Collaboration, Search for elastic muon-neutrino electron scattering, Physics Letters B 46 (1973) 121–124. 2.1
- [11] Gargamelle Collaboration, Observation of neutrino-like interactions without muon or electron in the gargamelle neutrino experiment, Physics Letters B 46 (1973) 138–140. 2.1
- [12] Gargamelle Collaboration, Observation of neutrino-like interactions without muon or electron in the Gargamelle neutrino experiment, Nuclear Physics B 73 (1974) 1–22. 2.1

- [13] C. L. Smith and J. Wheater, Electroweak radiative corrections and the value of  $\sin^2 \theta_W$ , Physics Letters B 105 (1981) 486–488. 2.1
- [14] A. Sirlin, Radiative corrections in the SU(2)<sub>L</sub> × U(1) theory: A simple renormalization framework, Phys. Rev. D 22 (1980) 971. 2.1
- [15] UA1 Collaboration, Experimental observation of isolated large transverse energy electrons with associated missing energy at  $\sqrt{s} = 540$  GeV, Physics Letters B 122 (1983) 103–116. 2.1
- [16] UA1 Collaboration, Experimental observation of lepton pairs of invariant mass around 95  $GeV/c^2$  at the CERN SPS collider, Physics Letters B **126** (1983) 398–410. 2.1
- [17] UA2 Collaboration, Observation of single isolated electrons of high transverse momentum in events with missing transverse energy at the CERN pp collider, Physics Letters B 122 (1983) 476–485. 2.1
- [18] UA2 Collaboration, Evidence for  $Z^0 \to e^+e^-$  at the CERN pp collider, Physics Letters B 129 (1983) 130–140. 2.1
- [19] R. Reece and H. Williams, A search for new physics in high-mass ditau events in the ATLAS detector. PhD thesis, University of Pennsylvania, 2013. 2.1
- [20] J. Ellis, M. K. Gaillard, and D. V. Nanopoulos, A phenomenological profile of the Higgs boson, Nuclear Physics B 106 (1976) 292–340. 2.2
- [21] R. Cahn and S. Dawson, Production of very massive Higgs bosons, Physics Letters B 138 (1984) 464. 2.2
- [22] 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 (1998) 56–74, arXiv:9704448 [hep-ph]. 2.2
- [23] LHC Higgs Cross Section Working Group, Handbook of LHC Higgs Cross Sections: 3. Higgs Properties, arXiv:1307.1347 [hep-ph]. LHCHXSWG. 2.3
- [24] CERN Press Office, First results from LEP2, Press Release, 1996. 2.2
- [25] Fermilab Press Room, Collider Run II Begins at Fermilab, Press Release, 2001. 2.2
- [26] ALEPH, DELPHI, L3, OPAL Collaboration, Search for the Standard Model Higgs Boson at LEP, Phys. Lett. B **5**65 (2003) 61–75, arXiv:0306033 [hep-ex]. 2.2, 5.1
- [27] CDF, D0 Collaboration, *Higgs Boson Studies at the Tevatron*, arXiv:1303.6346 [hep-ex]. Submitted to Phys. Rev. D. 2.2, 5.1
- [28] H. Flaecher, M. Goebel, J. Haller, A. Hoecker, K. Moenig, and J. Stelzer, Revisiting the Global Electroweak Fit of the Standard Model and Beyond with Gfitter, Eur. Phys. J. C60 (2009) 543–583, arXiv:0811.0009 [hep-ph]. gfitter/publications. 2.4
- [29] 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 (2012) 1–29, arXiv:1207.7214 [hep-ex]. HIGG-2012-27. 2.2, 3.2
- [30] CMS Collaboration, Observation of a new boson at a mass of 125 GeV with the CMS experiment at the LHC, Phys. Lett. B 716 (2012) 30, arXiv:1207.7235 [hep-ex]. 2.2

- [31] All Nobel Prizes in Physics, nobelprize.org/nobel\_prizes/physics/laureates, 2015. 2.2
- [32] D. Clowe, M. Bradac, A. H. Gonzalez, M. Markevitch, S. W. Randall, C. Jones, and D. Zaritsky, A direct empirical proof of the existence of dark matter, Astrophys. J. 648 (2006) L109–L113, arXiv:arXiv:astro-ph/0608407 [astro-ph]. 2.3
- [33] Planck Collaboration, *Planck 2013 results. XVI. Cosmological parameters*, Astronomy and Astrophysics **5**71 (2014) A16, arXiv:1303.5076 [astro-ph]. 2.3
- [34] N. Arkani-Hamed, S. Dimopoulos, and G. Dvali, *The Hierarchy Problem and New Dimensions at a Millimeter*, Phys. Lett. B **429** (1998) 263–272, arXiv:9803315 [hep-ph]. 2.3
- [35] S. P. Martin, A Supersymmetry Primer, arXiv:9709356 [hep-ph]. 2.3
- [36] L. Evans and P. Bryant, LHC Machine, Journal of Instrumentation 3 (2008) S08001. jinst.sissa.it/LHC/. 3.1
- [37] ATLAS Collaboration, The ATLAS Experiment at the CERN Large Hadron Collider, Journal of Instrumentation 3 (2008) S08003. jinst.sissa.it/LHC/. 3.1, 3.2.1, 3.2.1, 3.11, 3.15, 3.3
- [38] CMS Collaboration, The CMS experiment at the CERN LHC, Journal of Instrumentation 3 (2008) S08004. jinst.sissa.it/LHC/. 3.1
- [39] ALICE Collaboration, The ALICE experiment at the CERN LHC, Journal of Instrumentation 3 (2008) S08002. jinst.sissa.it/LHC/. 3.1
- [40] LHCb Collaboration, The LHCb Detector at the LHC, Journal of Instrumentation 3 (2008) S08005. jinst.sissa.it/LHC/. 3.1
- [41] ATLAS Collaboration, ATLAS Photos, Detector Site, Surface, 2015. 3.1
- [42] CERN, The Accelerator Complex, home.web.cern.ch/about/accelerators, 2015. 3.1.1
- [43] C. Lefevre, LHC: The Guide, Brochure, 2009. 3.2, 3.1
- [44] CERN, CERN releases analysis of LHC incident, CERN Press Release, 2008. 3.1.2
- [45] CERN, The first LHC protons run ends with new milestone, CERN Press Release, 2012. 3.1.2
- [46] ATLAS Collaboration, Luminosity public results, Luminosity Public Results, 2012. 3.3, 3.4
- [47] W. Stirling, Tevatron and LHC parton luminosity comparison plots, http://www.hep.ph.ic.ac.uk/wstirlin/plots/plots.html, 2013. 3.5
- [48] ATLAS Collaboration, ATLAS Photos, Full Detector, CGI, 2015. 3.6
- [49] ATLAS Collaboration, Alignment of the ATLAS Inner Detector and its Performance in 2012, ATLAS-CONF-2014-047, 2014. 3.8, 3.2.1.2, 3.2
- [50] ATLAS Collaboration, Particle Identification Performance of the ATLAS Transition Radiation Tracker, ATLAS-CONF-2011-128, 2011. 3.2.1.1
- [51] ATLAS Collaboration, Performance of the ATLAS Inner Detector Track and Vertex Reconstruction in the High Pile-Up LHC Environment, ATLAS-CONF-2012-042, 2012. 3.2.1.2, 3.2.1.2

- [52] ATLAS Collaboration, Search for anomaly-mediated supersymmetry based on a disappearing-track signature with the ATLAS detector in pp collisions at sqrts = 7 TeV, Eur. Phys. J. C72 (2011) 1993, arXiv:1202.4847 [hep-ex]. SUSY-2011-14. 3.9
- [53] ATLAS Collaboration, Performance of primary vertex reconstruction in proton-proton collisions at  $\sqrt{s} = 7$  TeV in the ATLAS experiment, ATLAS-CONF-2010-069, 2010. 3.2.1.2
- [54] ATLAS Collaboration, Stand-Alone Event Displays, EventDisplayStandAlone, 2014. 3.10, 3.14, 3.17, 4.6
- [55] S. Menke, The Electromagnetic Shower Simulator, https://www.mppmu.mpg.de/menke/elss/home.shtml, 2015. 3.12
- [56] ATLAS Collaboration, Calorimeter Clustering Algorithms: Description and Performance, ATL-LARG-PUB-2008-002, 2008. 3.2.2.2
- [57] ATLAS Collaboration, Determination of the Jet Energy Scale, ATL-SLIDE-2007-027, 2007.
  3.13
- [58] ATLAS Collaboration, Commissioning of the ATLAS Muon Spectrometer with Cosmic Rays, Eur. Phys. J. C70 (2010) 875–916, arXiv:1006.4384 [hep-ex]. cds.cern.ch/record/1275998. 3.2.3
- [59] ATLAS Collaboration, Performance of the ATLAS muon trigger in pp collisions at  $\sqrt{s} = 8$  TeV, arXiv:1408.3179 [hep-ex]. TRIG-2012-03. Submitted to Eur. Phys. J. 3.14, 3.3, 3.22
- [60] ATLAS Collaboration, Measurement of the muon reconstruction performance of the ATLAS detector using 2011 and 2012 LHC proton-proton collision data, Eur.Phys.J. C74 (2014) 3130, arXiv:1407.3935 [hep-ex]. PERF-2014-05. 3.3.1, 3.16
- [61] ATLAS Collaboration, Electron efficiency measurements with the ATLAS detector using the 2012 LHC proton-proton collision data, ATLAS-CONF-2014-032, 2014. 3.3.2, 3.18, 5.3.1
- [62] ATLAS Collaboration, Measurements of the photon identification efficiency with the ATLAS detector using 4.9 fb<sup>-1</sup> of pp collision data collected in 2011, ATLAS-CONF-2012-123, 2012. 3.3.2
- [63] ATLAS Collaboration, Jet energy measurement and its systematic uncertainty in proton-proton collisions at  $\sqrt{s} = 7$  TeV, Eur. Phys. J. C75 (2014) 17, arXiv:1406.0076 [hep-ex]. PERF-2012-01. 3.3.3
- [64] M. Cacciari, G. P. Salam, and G. Soyez, The anti- $k_t$  jet clustering algorithm, JHEP **0**804 (2008) 063, arXiv:0802.1189 [hep-ph]. 3.3.3, 8.2.1
- [65] ATLAS Collaboration, Pile-up subtraction and suppression for jets in ATLAS, ATLAS-CONF-2013-083, 2013. 3.3.3
- [66] ATLAS Collaboration, Tagging and suppression of pileup jets with the ATLAS detector, ATLAS-CONF-2014-018, 2014. 3.3.3, 8.2.1, 8.2.2.2
- [67] ATLAS Collaboration, Calibration of the performance of b-tagging for c and light-flavour jets in the 2012 ATLAS data, ATLAS-CONF-2014-046, 2014. 3.3.3, 8.2.1
- [68] ATLAS Collaboration, Performance of the ATLAS Secondary Vertex b-tagging Algorithm in 900 GeV Collision Data, ATLAS-CONF-2010-004, 2010. 3.19

- [69] ATLAS Collaboration, Measurement of the b-tag Efficiency in a Sample of Jets Containing Muons with 5 fb<sup>-1</sup> of Data from the ATLAS Detector, ATLAS-CONF-2012-043, 2012. 3.19
- [70] ATLAS Collaboration, Performance of Missing Transverse Momentum Reconstruction in Proton-Proton Collisions at  $\sqrt{s} = 7$  TeV with ATLAS, Eur. Phys. J. C72 (2011) 1844, arXiv:1108.5602 [hep-ex]. PERF-2011-07. 3.3.4
- [71] ATLAS Collaboration, Pile-up Suppression in Missing Transverse Momentum Reconstruction in the ATLAS Experiment in Proton-Proton Collisions at √s = 8 TeV, ATLAS-CONF-2014-019, 2014. 3.3.4, 3.20
- [72] ATLAS Collaboration, TriggerOperationPublicResults, TriggerOperationPublicResults, 2015.
- [73] ATLAS Collaboration, Level-1 Trigger Technical Design Report, http://atlas.web.cern.ch/Atlas/GROUPS/DAQTRIG/TDR/tdr.html, 1998. 3.21
- [74] ATLAS Collaboration, Public Egamma Trigger Plots for Collision Data, EgammaTriggerPublicResults, 2015. 3.22
- [75] ATLAS Collaboration, Publications of the ATLAS Collaboration, ATLASPublications, 2015.
  3.5
- [76] ATLAS Collaboration, Summary plots from the ATLAS Standard Model physics group, CombinedSummaryPlots/SM, 2015. 3.23
- [77] ATLAS Collaboration, Performance of the Reconstruction and Identification of Hadronic tau Decays in ATLAS with 2011 Data, ATLAS-CONF-2012-142, 2012. 4, 4.3, 4.2
- [78] ATLAS Collaboration, Identification of Hadronic Decays of Tau Leptons in 2012 Data with the ATLAS Detector, ATLAS-CONF-2013-064, 2013. 4, 4.2, 4.14
- [79] ATLAS Collaboration, Determination of the tau energy scale and the associated systematic uncertainty in proton-proton collisions at  $\sqrt(s) = 8$  TeV with the ATLAS detector at the LHC in 2012, ATLAS-CONF-2013-044, 2013. 4
- [80] M. L. Perl et al., Evidence for anomalous lepton production in e<sup>+</sup>e<sup>-</sup> annihilation, Phys. Rev. Lett. 35 (1975) 1489–1492. 4.1
- [81] M. L. Perl et al., Properties of anomalous eμ events produced in e<sup>+</sup>e<sup>-</sup> annihilation, Physics Letters B **63** (1976) 466–470. 4.1
- [82] M. L. Perl et al., Properties of the proposed tau charged lepton, Physics Letters B 70 (1977) 487. 4.1
- [83] Belle Collaboration, Measurement of the  $\tau$ -lepton lifetime at Belle, Phys. Rev. Lett. 112 (2014) 031801, arXiv:1310.8503 [hep-ex]. 4.1
- [84] BaBar Collaboration, Measurements of the  $\tau$  Mass and Mass Difference of the  $\tau^+$  and  $\tau^-$  at BaBar, Phys. Rev. D 80 (2009) 092005, arXiv:0909.3562 [hep-ex]. 4.1
- [85] K. Kodama et al., Observation of tau neutrino interactions, Physics Letters B **504** (2001) 218 224, 4.1
- [86] ALEPH Collaboration, A precise determination of the number of families with light neutrinos and of the Z boson partial widths, Physics Letters B 235 (1990) 399–411. 4.1

- [87] J. Beringer et al. (Particle Data Group), The Review of Particle Physics, Phys.Rev.D 86 (2012) 010001. 4.1
- [88] ATLAS Collaboration, Local Hadronic Calibration, ATL-LARG-PUB-2009-001-2, 2008. 4.3.1
- [89] ATLAS Collaboration, Search for the Standard Model Higgs boson in  $H \to \tau\tau$  decays in proton-proton collisions with the ATLAS detector, ATLAS-CONF-2012-160, 2012. 5, 6.1.1, 6.2.1
- [90] ATLAS Collaboration, Evidence for Higgs Boson Decays to the ττ Final State with the ATLAS Detector, ATLAS-CONF-2013-108, 2013. 5
- [91] The LHC Higgs Cross Section Working Group, Handbook of LHC Higgs Cross Sections: 3. Higgs Properties, arXiv:1307.1347 [hep-ex]. 5.1
- [92] ATLAS Collaboration, Measurement of Higgs boson production in the diphoton decay channel in pp collisions at center-of-mass energies of 7 and 8 TeV with the ATLAS detector, Phys. Rev. D 90 (2014) 112015, arXiv:1408.7084 [hep-ex]. HIGG-2013-08. 5.1, 5.17, 5.8
- [93] 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 (2014) 012006, arXiv:1408.5191 [hep-ex]. HIGG-2013-21. 5.1, 5.17, 5.8
- [94] ATLAS Collaboration, Observation and measurement of Higgs boson decays to WW\* with the ATLAS detector, arXiv:1412.2641 [hep-ex]. HIGG-2013-13. Submitted to Physical Review D. 5.1, 5.6, 5.17, 5.8, 7, 7.1
- [95] ATLAS Collaboration, Search for the bb decay of the Standard Model Higgs boson in associated (W/Z)H production with the ATLAS detector, JHEP 01 (2014) 069, arXiv:1409.6212 [hep-ex]. HIGG-2013-23. 5.1.1.2
- [96] D. Rainwater, D. Zeppenfeld, and K. Hagiwara, Searching for  $H \to \tau\tau$  in weak boson fusion at the LHC, Phys. Rev. D 59 (1998) 014037, arXiv:9808468 [hep-ph]. 5.4.2
- [97] ATLAS Collaboration, A search for high-mass resonances decaying to  $\tau^+\tau^-$  in pp collisions at  $\sqrt{s} = 7$  TeV with the ATLAS detector, Phys. Lett. B **7**19 (2012) 242–260, arXiv:1210.6604 [hep-ex]. EXOT-2012-03. 5.6
- [98] A. Elagin, P. Murat, A. Pranko, and A. Safonov, A New Mass Reconstruction Technique for Resonances Decaying to di-tau, Nucl. Instrum. Methods A 654 (2011) 481–489, arXiv:1012.4686 [hep-ex]. 5.5.1
- [99] ATLAS Collaboration, Search for neutral MSSM Higgs bosons decaying to  $\tau\tau$  pairs in proton-proton collisions at  $\sqrt{s}=7$  TeV with the ATLAS detector, ATLAS-CONF-2011-132, 2011. 5.7
- [100] CMS Collaboration, Evidence for the 125 GeV Higgs boson decaying to a pair of tau leptons, JHEP 05 (2014) 104, arXiv:1401.5041 [hep-ex]. 5.5.1
- [101] L. Breiman, J. Friedman, C. Stone, and R. Olshen, Classification and Regression Trees. Chapman & Hall, 1984. 5.6
- [102] B. P. Roe, H.-J. Yang, J. Zhu, Y. Liu, I. Stancu, and G. McGregor, Boosted Decision Trees as an Alternative to Artificial Neural Networks for Particle Identification, Nucl. Instrum. Meth. A 543 (2005) 577–584, arXiv:0408124 [hep-ex]. 5.6

- [103] ATLAS Collaboration, Measurement of the Higgs boson couplings in the  $\tau\tau$  final state with the ATLAS detector (supporting note), ATL-COM-PHYS-2014-170, 2014. ATLAS Internal. 6
- [104] ATLAS Collaboration, Measurement of the  $Z/\gamma^*$  boson transverse momentum distribution in pp collisions at  $\sqrt{s}=7$  TeV with the ATLAS detector, JHEP **0**9 (2014) 145, arXiv:1406.3660 [hep-ex]. STDM-2012-23. 6.1
- [105] ATLAS Collaboration, Measurement of the production cross section of jets in association with a Z boson in pp collisions at  $\sqrt(s) = 7$  TeV with the ATLAS detector, JHEP **07** (2013) 032, arXiv:1304.7098 [hep-ex]. STDM-2012-04. 6.2
- [106] Heavy Flavor Averaging Group, Averages of b-hadron, c-hadron, and  $\tau$ -lepton properties as of summer 2014, arXiv:1412.7515 [hep-ex]. 6.1.2
- [107] ATLAS Collaboration, Search for Standard Model Higgs Boson decaying to di-tau pair with a lepton and hadronic tau in the final state with the ATLAS Detector in 8 TeV Proton-Proton Collisions, ATL-COM-PHYS-2012-1201, 2012. ATLAS Internal. 6.3
- [108] ATLAS Collaboration, Light-quark and gluon jet discrimination in pp collisions at  $\sqrt{s}=7$  TeV with the ATLAS detector, Eur. Phys. J. C74 (2014) 3023, arXiv:1405.6583 [hep-ex]. PERF-2013-02. 6.2.1, 6.6
- [109] ATLAS Collaboration, Measurements of the W production cross sections in association with jets with the ATLAS detector, arXiv:1409.8639 [hep-ex]. STDM-2012-24. 6.7
- [110] ATLAS Collaboration, Search for the Standard Model Higgs boson in the H to  $\tau\tau$  decay mode in  $\sqrt(s) = 7$  TeV pp collisions with ATLAS, JHEP 070 (2012), arXiv:1206.5971 [hep-ex]. HIGG-2012-07. 6.2.1
- [111] ATLAS Collaboration, Studies of the VBF  $H \rightarrow \tau_{\ell}\tau_{had}$  analysis at High Luminosity LHC conditions, ATL-PHYS-PUB-2014-018, 2014. 8, 8.2, 8.11, 8.12, 8.13, 8.14, 8.15, 8.16
- [112] ATLAS Internal, Trigger Menu Strategy for Run 2, ATL-COM-DAQ-2014-054, 2014. 8.1
- [113] ATLAS Collaboration, Upgrade of the ATLAS Level-1 trigger with an FPGA based Topological Processor, ATL-DAQ-PROC-2013-039, 2013. 8.1.2.2
- [114] ATLAS Internal, Physics Uses and Hardware Constraints of the L1 Topological Trigger, ATL-COM-DAQ-2014-005, 2014. 8.1.2.2
- [115] ATLAS Collaboration, Tau Trigger Rate Plots for 2011, ATL-COM-DAQ-2012-001, 2011. 8.4
- [116] G. Cowan, Discovery sensitivity for a counting experiment with background uncertainty, http://www.pp.rhul.ac.uk/cowan/stat/medsig, 2012. 8.1.2.3
- [117] ATLAS Collaboration, Projections for measurements of Higgs boson cross sections, branching ratios and coupling parameters with the ATLAS detector at a HL-LHC, ATL-PHYS-PUB-2013-014, 2013. 8.2.2
- [118] ATLAS Collaboration, Performance assumptions for an upgraded ATLAS detector at a High-Luminosity LHC, ATL-PHYS-PUB-2013-004, 2013. 8.2.2.1, 8.2.2.2