Curriculum Vitae

Personal Details

- Name: Dr. Aruna Kumar Nayak
- Affiliation: Institute of Physics, Bhubaneswar.
- Contact address:

office# F-21,
Institute of Physics,
Sachivalaya Marg,
Bhubaneswar - 751005
Email: nayak@iopb.res.in

Employment

- Associate Professor (G): Institute of Physics, Bhubaneswar (July 2021 - till date)
- Reader (F): Institute of Physics, Bhubaneswar (Oct 2015 - June 2021)
- Fellow: Deutsches Elektronen-Synchrotron - DESY, Hamburg, Germany (Feb 2014 - Oct 2015)
- Post-doc: Institute of Research into the Fundamental Laws of the Universe - IRFU, CEA, Saclay, France (Nov 2011 - Jan 2014)
- Post-doc: Laboratory for Instrumentation and Experimental Particle Physics - LIP, Lisbon, Portugal (Dec 2009 - Oct 2011)

Academic Record

- Graduate School & Ph.D.: Tata Institute of Fundamental Research, Mumbai (August 2003 - November 2009).
  Title: *Study of* Z *boson production in association with b-jets using CMS detector at LHC.*
- M.Sc.: Physics (Specialization: Particle Physics), Utkal University, Bhubaneswar, India (2003).
- B.Sc.: Physics (Honours with distinction), Chemistry, and Mathematics, Bhadrak College (Fakir Mohan University, Balasore), India (2001).

Area of Research

Experimental high energy physics (The CMS experiment at LHC, CERN, Switzerland).

Research Experience (in brief)

- Leading contributions to search of a low mass Charged Higgs boson in $\boldsymbol{t \to bH^+,\ H^+ \to c\bar{s}}$ decay channel using 13 TeV data.
- Major involvement in the measurement of CP properties of the Higgs boson in $H \to \tau\tau$ decay
- Major involvement in the measurement of Higgs boson to top quark coupling in the $\boldsymbol{\tau}$ lepton final state using 13 TeV data.
- Major involvement in the search for the SM Higgs boson and MSSM neutral Higgs boson decaying to a pair of $\boldsymbol{\tau}$ leptons using proton-proton collision data at centre-of-mass energy of 8 TeV.
- Led the CMS analysis effort for the search of a low mass MSSM Charged Higgs boson in $\boldsymbol{t \to bH^+,\ H^+ \to \tau\nu}$ decay channel with $\boldsymbol{t\bar{t}}$ decaying to $\boldsymbol{e\tau}$ and $\boldsymbol{\mu\tau}$ final states using 7 TeV data.
- Led the analysis for the measurement of $\boldsymbol{t\bar{t}}$ production cross section at LHC in $\boldsymbol{e\tau}$ and $\boldsymbol{\mu\tau}$ final states.
- Participated in the cross section measurement of $t\bar{t}$ production at LHC in the dilepton final state using the 2010 LHC data.
- Led the search of a low mass Charged Higgs boson in $\boldsymbol{t \to bH^+,\ H^+ \to c\bar{s}}$ decay channel using 8 TeV data.
- Leading contributions to the development and performance study of the hadronic decaying τ identification techniques.
- Led the tau identification performance measurement using 2016 data at 13 TeV.
- Participation in the R&D activities for the CMS silicon tracker detector.
- Measured the performance of CMS Level-1 calorimeter triggers during the LHC run at 7 TeV and 8 TeV.
- Leading contribution in the development of CMS High Level Trigger.
- Developed strategy to measure the production cross section of $\mathrm{Z}b\bar{b}, \mathrm{Z} \to \ell^+\ell^-$ process at LHC.
- Devised a data-driven technique for the evaluation of b-jet energy corrections.
- Measured the cosmic muon charge asymmetry as a function of the zenith angle using cosmic data collected by the CMS detector.

- Participation in the CMS data taking.

Leadership Roles within CMS Collaboration

- Convenor of the group on Strategy for Trigger Evolution And Monitoring (STEAM) (Sep 2020 - Aug 2022).
- Convenor of the jets and missing transverse energy trigger group (Sep 2016 - Aug 2019).
- Convenor of the offline τ identification group (Oct 2014 - Sep 2016).
- Convenor of the τ-trigger group (Jan 2012 - Dec 2013).
- Contact person between τ object group and alignment and calibration group (2015 - 2020).
- Contact person between τ object group and dataset definition group (2012 - 2013).
- Contact person between τ object group and top quark physics group (2011).

Leadership Roles of my students within CMS Collaboration

- Sanu Varghese, Convener of STEAM group under TSG for Sep 2022 - Aug 2024.
- Vinaya Krishna Nair, Convener of the τ-trigger group (Sep 2021 - Aug 2023).

Presentations at International Conferences, Workshops and Seminars

1. *BSM Higgs searches at ATLAS and CMS*, **Plenary Talk**, **SUSY 2021, 23 - 28 August 2021, CAS, China**.
2. *Searches for $t\bar{t}$H production at CMS*, **XXVI International Workshop on Deep-Inelastic Scattering and Related Subjects (DIS2018), April 16 - 20, 2018, Kobe, Japan.**
3. *Recent inclusive $t\bar{t}$ cross section measurements*, **9th CKM international Workshop, November 28 - December 03, 2016, TIFR, Mumbai**.
4. *Higgs to di-fermion results from CMS*, **Higgs Hunting, August 31 - September 02, 2016, LPNHE, Paris, France**, (All Plenary).
5. *Study of Higgs production in fermionic decay channels at the LHC*, **50th Rencontres de Moriond, QCD and High Energy Interactions, March 21 - 28, 2015, La Thuile, Italy**, (All Plenary).
6. *Searches for Beyond Standard Model Higgs boson at CMS*, **EPS-HEP Conference, July 17 - 24, 2013, Stockholm, Sweden**.

7. *Search for Higgs to $\tau\tau$ at ATLAS and CMS*, **LHC-France Meeting, April 01 - 02, 2013, Annecy, France**, (All Plenary).

8. *Searches for Beyond Standard Model Higgs boson at CMS*, **Higgs Hunting, July 18 - 20, 2012, Orsay, France**, (All Plenary).

9. *Reconstruction of physics objects in the CMS detector*, **Prospects for Charged Higgs Discovery at Colliders - Charged 2012, October 8 - 11, 2012, Uppsala, Sweden**, **Invited Talk**.

10. *Higgs to $\tau\tau$ search at CMS*, September 28, 2012, **Higgs boson workshop, IRFU, CEA, Saclay, France**.

11. *Search for H^+ and H^{++} Higgs boson with the CMS detector*, **EPS-HEP Conference, July 21 - 27, 2011, Grenoble, France**.

12. *Search for charged Higgs boson with CMS detector*, November 02, 2011, **Higgs boson workshop, IRFU, CEA, Saclay, France**.

13. *Search for charged Higgs boson with CMS detector*, October 07, 2011, **LIP-Seminar, LIP, Lisbon**.

14. *Measurement of the Z boson plus two b-jets cross section in CMS with 100 pb^{-1}*, **Physics at LHC, September 29 - October 04, 2008, Split, Croatia**.

15. *Study of Higgs boson search in CPV MSSM at CMS*, June 2007, **Les Houches workshop, Higgs Working Group meeting, France**.

Presentations at National Conferences, Workshops and Seminars in India

1. *An overview of top quark and Higgs boson measurements at the LHC*, **Plenary Talk**, **XXV DAE-BRNS High Energy Physics Symposium, 12 16 Dec 2022, IISER Mohali**.

2. *Indian contributions in the search for Higgs boson in beyond Standard Model Scenario*, **Plenary Talk**, **Celebrating a Decade of Higgs, 6-10 June 2022, TIFR, Mumbai**.

3. *Experimental searches for charged Higgses*, **Plenary Talk**, **HUNTING SUSY @ HL-LHC, ICTS Bengaluru, 22 26 Dec. 2021**.

4. *Recent results on Higgs boson measurements at CMS*, **Plenary Talk**, **Anomalies-2020, September 11 - 13, 2020, IIT Hyderabad**.

5. *Summary of Higgs boson measurements at LHC*, **Mini-review Talk**, SM-BSM group session, **WHEPP 2019, December 01 - 10, 2019, IIT-Guwahati**.

6. *Measurement of Higgs boson coupling to top quark at CMS*, **Plenary Talk**, **Anomalies-2019, July 18 - 20, 2019, IIT Hyderabad**.

7. *BSM Higgs boson searches at LHC*, Invited mini-review Talk, **DAE-BRNS symposium in HEP, December 10 - 14, 2018, IIT Madras**.

8. *Higgs boson production in association with a top quark pair at CMS*, **HEP seminar, Institute of Physics, Bhubaneswar, May 21, 2018**.

9. *Tau lepton identification at CMS*, **Invited talk at Jets@LHC workshop, January 21 - 28, 2017, ICTS, Bengaluru**.

10. *Search for new physics in high mass diphoton events at LHC*, **HEP seminar, Institute of Physics, Bhubaneswar, February 01, 2016**.

11. *Search for Higgs to $\tau\tau$ at CMS*, January 23, 2014, **DHEP Seminar, TIFR, Mumbai**.

12. *Search for Higgs boson in final states containing a tau lepton with CMS detector*, September 04, 2012, **DHEP Seminar, TIFR, Mumbai**.

13. *Search for charged Higgs boson with CMS detector*, August 09, 2011, **DHEP Seminar, TIFR, Mumbai**.

14. *Search for charged Higgs boson with CMS detector*, August 17, 2011, **Physics Seminar, NISER, Bhubaneswar**.

15. *Measurement of the Z boson plus two b-jets cross section in CMS*, April 2009, **DHEP Seminar, TIFR, Mumbai**.

16. *Measurement of $b\bar{b}$Z, Z $\to \ell^+\ell^-$ cross section at CMS*, March 2008, **Workshop on Physics at LHC, TIFR, India**.

17. *Possible discovery of Higgs boson in CP violating scenario of MSSM at CMS*, February 2008, **Higgs hunters meeting, Visva Bharati University, Santiniketan, India**.

18. *b-jet energy corrections using $b\bar{b}$Z, Z $\to \ell^+\ell^-$ in CMS*, December 2006, **DAE-BRNS symposium on High Energy Physics, IIT Kharagpur, India**.

Important Presentations at Collaboration Meetings

Apart from the ones listed below, I have made numerous presentations at the working group meetings within the CMS collaboration.

1. *Summary of TSG trigger review*, 15 Sep 2021, CMS Week Plenary on Run-3 preparation.

2. *STEAM Validation Review Summary*, 20 Dec 2020, TSG Meeting.

3. *Expected results of the CP H to tautau decay analysis (HIG-20-006)*, 5 March 2020, Higgs To Tau Tau Group Meeting.

4. *Trigger Reviews: JetMET*, 9 April 2019, TSG Meeting in CMS Week.

5. *JetMET triggers in 2018*, 27 Jun 2018, JetMET Meeting in CMS Week.

6. *TAU-16-003: Status of paper draft*, 11 Sep 2017, CMS Week Tau POG Meeting.
7. *Performance of tau identification with 2016 data (DPS)*, 9 March 2017, Approvals for Moriond EWK.
8. *Report from Tau POG*, 18 Nov 2016, Physics Plenary during CMS Week.
9. *DPS Note Approval for Tau ID performance at 13 TeV*, 27 Oct 2016, PPD General Meeting.
10. *Status report on offline Tau ID*, 21 Jun 2016, Tau POG Meeting during CMS Week.
11. *Validation of new tau ID MVA training*, 28 Sep 2015, Tau POG Meeting.
12. *MVA TauID proposal*, 24 Aug 2015, Tau Id Meeting.
13. *Offline Tau Identification Status & Plans*, 28 Jan 2015, Higgs to tau tau workshop.
14. *Tau ID status*, 19 Dec 2014, Tau POG meeting (MIAMI CMS week).
15. *Tau POG report*, 27 Sep 2013, Torino Trigger Workshop.
16. *H to tautau Analysis Improvements*, 7 March 2013, Higgs to Taus group meeting.
17. *Tau trigger: status, news, plans*, 11 Dec 2012, Tau POG meeting CMS Week.
18. *A new cut based VBF selections*, 5 July 2012, Higgs to Taus Meeting.
19. *Higgs PAG pre-approval: Search for the charged Higgs boson in top quark decays (HIG-11-019)*, 16 Dec 2011, Weekly Higgs Group Meetings.
20. *Pre-approval of TOP-11-006 (tau dilepton cross section)*, 24 Jun 2011, Special Top Quark Meeting.
21. *Review of charged Higgs analysis - leptonic*, 16 Jun 2011, Weekly Higgs Group Meetings.
22. *W to taunu*, 19 May 2011, Topology Workshop: Inclusive W - CMS Physics Week.
23. *Pre-Approval of Search for charged Higgs in ttbar events (HIG-11-002)*, 18 Feb 2011, Preapproval meeting for H^{++} & H^{+} Analyses.
24. *L1 Calo TPG Energy Scales*, 30 Sep 2010, CMS Trigger Technical Coordination + L1 DPG Meeting.
25. *L1 Trigger Synchronisation & Timing scan results*, 6 May 2010, L1 Trigger DPG meeting.
26. *Approval of Zbb analysis (EWK-08-001)*, 15 July 2008, Physics analysis approvals.
27. *Pre-approval of the bbZ analysis (EWK-08-001)*, 17 Jun 2008, General EWK Meeting.
28. *Analysis of light CPV H^{+} in MSSM-like model*, 16 Nov 2007, CMS Higgs WG Meeting.

29. *Pre-approval of b-jet Correction using bbZ, Z to ll (CMS Note 2007/014)*, 24 Oct 2006, Jet-MET PRS Meeting.

Outreach Activities

- Member of the institute organinising committee on National Science Day celebration, 2022.
- Science Day Talk to school students on the topic Understanding the fundamental Constituents of matter, Institute of Physics, Bhubaneswar, 28th Feb 2019.
- Talk on Higgs boson studies at LHC, to MSc students, Revanshaw University, Cuttack, 10th November 2018.
- Talk on Physics at the Large Hadron Collider, to MSc students, SOA University, Bhubaneswar, 15th September 2017.
- Talk on Physics at the Large Hadron Collider, to undergraduate college students, IANCAS program at IOP, 7th July 2017.
- Tau lepton as a probe for New Physics at LHC, Seminar on Contemporary Physics, Utkal University, 12th August 2017.
- Talk on Physics at LHC: Present Status and Future Prospects, 9th January 2017 , UGC sponsored national seminar on Recent Trends in Physics, Maharishi College, Bhubaneswar.
- Talk on Unraveling the mysteries in particle physics at the Large Hadron Collider, Seminar at Indira Gandhi Institute of Technology, Sarang, Odisha, 13 March 2016.

Lectures at Schools

- Four lectures on Basics of Machine Learning at the school on "Data and Machine Learning at the Large Hadron Collider (DML@LHC-2022)", 22 - 28 August, 2022, IIT Hyderabad.
- Four online lectures and tutorials on Monte Carlo methods and Markov-Chain Monte Carlo at IIT Indore, 12 December 2020 (Short-Term Course on Statistical Methods in Physical Science and Engineering).
- Two online lectures on basics of statistics in HEP, 11-12 June, 2020, during India-CMS online lecture series programme.
- A number of lectures and tutorials on basics of multivariate methods in HEP, in particular about Boosted Decision Trees & XGBoost, in activity classes at RECAPP, HRI, Allahabad (March 6-8, 2019) and at IIT Hyderabad (July 22-23, 2019).
- Four online lectures and tutorials on "Monte Carlo methods" and "Multivariate Analysis Methods" at MNIT Jaipur, July 12 - 19, 2021.

- Two online lectures on "Monte Carlo Methods" and "Hypothesis Tests, Confidence Intervals, and Limits" at NIT Jalandhar, Nov 23 - 24, 2021.
- Lectures on basics of multivariate methods and applications to HEP, IOP, Bhubaneswar, 10th and 18th April 2019.
- Tutorials on ROOT and data analysis, EHEP SERC School at NISER, Bhubaneswar, November 2017.
- Tutorial on relativistic kinematics, EHEP SERC School at NISER, Bhubaneswar, November 2017.

Organization of Conferences, Workshops, Meetings, and Schools

- One of the organisers of the two weeks school-cum-workshop on "Statistical Methods and Machine Learning in High Energy Physics (ML4HEP)", to be held on 28 Aug. - 08 Sept. 2023, ICTS, Bengaluru, India.
- One of the organisers of International Meeting on High Energy Physics - 2023 (IMHEP2023), 16 - 22 February, 2023, Institute of Physics, Bhubaneswar
- One of the convener of International Meeting on EFFECTIVE PATHWAYS TO NEW PHYSICS (IMEPNP), 712 Feb 2022, Institute of Physics, Bhubaneswar
- Co-convener of International Meeting on High Energy Physics - 2019 (IMHEP2019), 17 - 22 January, 2019, Institute of Physics, Bhubaneswar
- Co-chaired one SM-BSM working group session on topic "Discussion of experimental results" at WHEPP 2019, IIT Guwahati.
- Chaired one parallel session at DAE-BRNS High Energy Physics Symposium, 2020 and one parallel session at Anomalies-2020.
- Member of local organizing committee for XXIV DAE-BRNS High Energy Physics Symposium, 14 - 18 December, 2020, NISER, Bhubaneswar.
- Member of national organizing committee for XXIII DAE-BRNS High Energy Physics Symposium, 10 - 14 December, 2018, IIT Madras.
- Organized India-CMS Collaboration Meeting at Institute of Physics, Bhubaneswar, 26 - 28 November 2017
- Member of local organizing committee for XI SERC School on Experimental High-Energy Physics, 07 - 27 November, 2017, NISER, Bhubaneswar
- Organizing member of School on Probing the frontiers of particle physics with neutrinos and LHC, 17 - 21 October, 2016, Institute of Physics, Bhubaneswar

Fellowships

- Corresponding Associateship, March - June 2023, CERN, Geneva.
- Ramanujan Fellowship, DST, Govt. of India, 2015.
- DESY research fellowship from February 2014 to October 2015.
- CEA postdoctoral fellowship from November 2011 to December 2013 to work in IRFU, CEA, Saclay (France).
- LIP and FCT postdoctoral fellowships for the year 2010 and 2011, respectively, to work at LIP, Lisbon.
- Ph.D. research scholarship, for the year 2003 to 2009, Tata Institute of Fundamental Research (TIFR), Mumbai.
- Kanwal Rekhi career development scholarship, Year 2003 - 2004, TIFR, Mumbai.
- Best student award, Year 2003, Department of Physics, Utkal University, Bhubaneswar.
- Qualified CSIR-NET Junior Research Fellowship, Year 2003, Government of India.
- Qualified all India Graduate Aptitude Test for Engineering, Year 2003.
- Qualified all India Joint Entrance Screening Test, Year 2003.