CURRICULUM VITAE

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EDUCATION

PhD (2021)	*Thesis:* 'Multiplicity of muon in $2\,\mathrm{m} \times 2\,\mathrm{m}$ detector and charge ratio of cosmic muon at Madurai' Homi Bhabha National Institute, Anushaktinagar, Mumbai, India.
MSc (2014)	Department of Physics, Indian Institute of Technology Madras, Chennai, Tamil Nadu, India.
BSc (2012)	Department of Physics, Ramakrishna Mission Vidyamandira (Affiliated to Calcutta University), Howrah, West Bengal, India.
HSC (2009)	Majilpur J. M. Training School (Affiliated to West Bengal Council of Higher Secondary Education), South 24 Parganas, West Bengal, India.
SSC (2007)	Majilpur J. M. Training School (Affiliated to West Bengal Board of Secondary Education), South 24 Parganas, West Bengal, India.
Primary (2001)	Chandpur Free Pay School (Affiliated to West Bengal Board of Primary Education), South 24 Parganas, West Bengal, India.

RESEARCH EXPERIENCE

Postdoctoral Researcher University of Pisa, Largo Bruno Pontecorvo, Pisa, Italy 56127 (Oct 2021 – Oct 2024)

- I am now involved in the Belle II Collaboration, more specifically, in upgrade group and the Silicon Vertex Detector (SVD).

- An all-pixel vertex detector (VTX) is under proposal as a replacement of the present one. With smaller pixel size, it is capable of higher hit-occupancy in sensors and better vertex resolution. I am studying the physics performance using simulation in a few benchmark decay channels, $B^0 \to D^{*-}\mu^+\nu_\mu$, $D^{*-} \to \overline{D}^0\pi^-_{\text{soft}}$, $\overline{D}^0 \to K^+[\pi^-\pi^+]\pi^-$. Along with the unknown flight length of B^0 and combinatorials due to negligible D^* flight length, low momentum of π_{soft} makes the reconstruction of these channels rely heavily on the vertex detector. Along with excellent vertexing capabilities, VTX performs very well in terms of efficiency. This performance study is important for the Belle II Upgrade Program and will be published in the next Conceptual Design Report (CDR).

  The upgrade work is a continuous progress. The detector geometry is periodically in testing with updated material budgets and using improved background predictions.

- I developed on a new algorithm to minimise the effect of background in the track reconstruction of the current SVD in Belle II. It exploits the time of SVD clusters event-by-event, grouping the clusters depending on the contribution by different collisions. Only the best group of clusters is chosen for the reconstruction. Using this method, the rate of fake-tracks is reduced significantly while keeping the efficiency unchanged.

  This module is now part of the official release of the Belle II software and under test in data. This method will play an important role at the target luminosity helping to set the limit of SVD hit-occupancy to ~6 %, which is higher than the one expected from the background extrapolation ~4.7 %, increasing the safety margin. Additionally, it is now used as helper to the SVD cluster-time calibration which was previously significantly effected by the background hits biasing the calibration.

- I improved the quality of the cluster time calibration on data by implementing a a new calibration that removes the cluster-size dependant bias on cluster-time.

- Alongside, I contributed to the Belle II software in order to improve its quality. I managed to find and resolve the issue of high execution time consumed by the SVD cluster-time calibration process. The issue was quite technical. The merging of histograms from large number of ROOT files consumes time and SVD requires more than thousand histograms during calibration. I managed to reduce the number of histograms by using multi-dimensional histograms which in turns reduces the execution time dramatically from days to minutes.

RESEARCH EXPERIENCE

Research Scholar

Tata Institute of Fundamental Research, Mumbai, India (Aug 2014 – Aug 2021)

- I was involved in India-based Neutrino Observatory (INO). My works were solely contributed towards the proposed Iron Calorimeter (ICAL) detector. This future underground facility is going to be dedicated for the study of the oscillation parameters from atmospheric neutrinos along with the mass ordering. Resistive Plate Chambers (RPCs) with glass electrodes are chosen as the sensitive detector in INO-ICAL to sense the signature of the muons produced in the charged-current interaction of neutrinos. Many prototype detector stacks were thus planned to study the performance of the RPCs and the electronics along with the data acquisition systems. I clocked a significant presence in commissioning two prototypes, gaining experience and contributing in some key aspects.
- Involved in the mechanical facets of commissioning the detectors.
- Formulated and implemented a easy-to-use system to estimate the leak tightness of RPC gaps with high precision, which is in use at collaborating institutes and industries.
- Developed an algorithm to fetch events with multiple tracks in the detector. Also isolated the events occurring due to the random coincidences in order to test the CORSIKA simulation.
- As the part of the mini-ICAL team, I was stationed at the complex of *Saint-Gobain Glass India Pvt.Ltd.* for 2 months supervising the production, especially stream-lining the quality-control of first batch of RPCs to be used in the prototype of ICAL.
- Worked in developing a method to reconstruct muon momentum from the data obtained in the magnetised mini-ICAL detector consisting of 10 layers of RPCs for the measurement of the charge ratio of low energy muon at the earth surface.
- Grasp in GEANT4, CERN-ROOT, CORSIKA.

STATEMENT OF RESEARCH INTERESTS

Currently I am at the University of Pisa since October 2021 and should end in October 2024. This position will be a great opportunity for me to plan and continue my research ahead. My main research interest rests in the high-energy physics, especially in the design, development and commissioning of the detector components along with the analysis of acquired data.

Modern particle detector setups are complex. These setups consist of various kinds of particle detectors. The GEANT4 simulation toolkit is proven to be effective in these cases, simulating the properties and response of the various components. This simulation provides a crucial role in understanding the feasibility and the physics potential of the experiment. Once these detector setups are commissioned, it is hard to access the individual components. Hence much interest is given towards the characterisation of each detector before integrating in the setup. This process is generally repetitive and thus should require least presence of human and minimal time. As the detectors grow larger, the number of data-channels also increases accordingly. So processing the events in order to extract the useful information by avoiding noises becomes more challenging. Along with this, an algorithm to reconstruct track parameters is required to optimise specific to the detector setup.

My past involvement with the *India-based Neutrino Observatory (INO)* project let me work with a few prototype setups; especially a 12-layer RPC stack and a magnetised mini-ICAL, both are of tracker type. Both the setups gave me plenty of opportunity to gain knowledge on the aforesaid topics. Apart from that I learned about the difficulties and hold-ups while commissioning a detector setup and also gained experience of the solutions. I had developed the leak test system from scratch and it is now used by the whole INO collaboration. Similarly during the commissioning of mini-ICAL, I had solved many challenging problems; one of them even saved us from dismantling the whole magnet. In summary, I gained experience in both software and hardware during this time.

My current involvement in the Belle II experiment gave me additional opportunity to boost my knowledge in the accelerator based experiments. Here I got to learn about the schemes and frameworks of the software tools used along with the physics goals of the experiment. An all-pixel vertex detector is under proposal as a replacement of the present one in the Belle II detector. With smaller pixel size, it is capable of higher occupancy and vertex resolution. I am highly involved in this group and contributing in assessing the physics performance of the new setup using simulation in a few benchmark decay channels. I am also working in the existing Silicon Vertex Detector of Belle II to reduce the effect of background in track finding. I devised a technique of groping the position clusters based on time to suppress the clusters contributed by background collision. This reduces the rate of fake-tracks significantly.

I carried forward my experience and skills from INO to Belle II, enriching it significantly and want to spend more time in both SVD and the vertex detector (VTX) upgrade.

■ Large uncertainity in the prediction of background at the peak luminosity is going to effect the tracking performance and the the latest estimate reduced the tracking effiency to 91 %. The effort to recover the efficiency is fundamental for the physics program. I want to explore more in the tracking of the SVD believing in improving the track finding efficiency keeping the rate of fake tracks low. Now the method of grouping is not used at its full potential and there are large room for improvement; one of which is to use MVA to better filter groups selected for tracking.

■ I will be involved greatly in the in the upgrade of the vertex detector, not only in the benchmarking and software developements, also in the hardware activities. I can contribute to various aspects of the design and testing of the sensors for next few years targeting the Belle II Long Shutdown 2 in 2027.

The Belle II team in Pisa is excellent in both work and motivation. It will be great to continue work here.

LIST OF PUBLICATIONS

a. Publications:

1. I Adachi et al. *First Measurement of $R(X_{\tau/\ell})$ as an Inclusive Test of the $b \to c\tau\nu$ Anomaly*, Physical Review Letters 132 (2024) 211804
2. I Adachi et al. *Search for $e^+e^- \to \eta_b(1S)\omega$ and $e^+e^- \to \chi_{b0}(1P)\omega$ at $\sqrt{s} = 10.745$ GeV with Belle II*, Physical Review D 109 (2024) 072013
3. I Adachi et al. *Precise measurement of the D_s^+ lifetime at Belle II*, Physical Review Letters 131 (2023) 171803
4. I Adachi et al. *Tests of light-lepton universality in angular asymmetries of $B^0 \to D^{*-}\ell^+\nu$ decays*, Physical Review Letters 131 (2023) 181801
5. I Adachi et al. *Measurement of branching-fraction ratios and CP asymmetries in $B^\pm \to D_{CP\pm}K^\pm$ decays at Belle and Belle II*, Journal of High Energy Physics 2024 (2024) 212
6. I Adachi et al. *Measurement of CP asymmetries and branching-fraction ratios for $B^\pm \to DK^\pm$ and $D\pi^\pm$ with $D \to K_S^0K^\pm\pi^\mp$ using Belle and Belle II data*, Journal of High Energy Physics 2023 (2023) 146
7. I Adachi et al. *Search for a long-lived spin-0 mediator in $b \to s$ transitions at the Belle II experiment*, Physical Review D 108 (2023) L111104
8. I Adachi et al. *Measurement of the τ lepton mass with the Belle II experiment*, Physical Review D 108 (2023) 032006
9. I Adachi et al. *Measurement of CP violation in $B^0 \to K_S^0\pi^0$ decays at Belle II*, Physical Review Letters 131 (2023) 111803
10. I Adachi et al. *Measurement of CP asymmetries in $B^0 \to \phi K_S^0$ decays with Belle II*, Physical Review D 108 (2023) 072012
11. I Adachi et al. *Novel method for the identification of the production flavor of neutral charmed mesons*, Physical Review D 107 (2023) 112010
12. I Adachi et al. *Search for a $\tau^+\tau^-$ resonance in $e^+e^- \to \mu^+\mu^-\tau^+\tau^-$ events with the Belle II experiment*, Physical Review Letters 131 (2023) 121802
13. G. Batignani et al., *Simulation of an all-layer monolithic pixel vertex detector for the Belle II upgrade in 16th Pisa Meeting on Advanced Detectors*, NIMA 1045 (January 2023) 167616
14. Suryanarayan Mondal et al. *Study of Particle Multiplicity of Cosmic Ray Events using $2\,m \times 2\,m$ Resistive Plate Chamber Stack at IICHEP-Madurai*, Experimental Astronomy 51 (2021) 17–32
15. Suryanarayan Mondal et al. *Leak test of Resistive Plate Chamber gap by monitoring absolute pressure*, Journal of Instrumentation 14 (April 2019) P04009
16. S. Mondal et al., *Leak Rate Estimation of a Resistive Plate Chamber Gap by Monitoring Absolute Pressure in 13th Workshop on Resistive Plate Chambers and Related Detectors (RPC2016)*, Journal of Instrumentation 11 (Nov 2016) C11009
17. G. Majumder et al., *Development of a Resistive Plate Chamber with heat strengthened glass in 13th Workshop on Resistive Plate Chambers and Related Detectors (RPC2016)*, Journal of Instrumentation 11 (2016) C09019

b. Proceedings

1. Suryanarayan Mondal et al., *Cosmic Muon Momentum Spectra at Madurai in XXIV DAE High Energy Physics Symposium*, Springer Proceedings in Physics 277 (October 2022) 743–747

2. Suryanarayan Mondal et al., *Study of Particle Multiplicity by 2 m × 2 m Resistive Plate Chamber Stack at IICHEP-Madurai in XXIII DAE High Energy Physics Symposium*, Springer Proceedings in Physics 261 (May 2021) 1155–1158
3. G. Majumder and S. Mondal, *Design, construction and performance of magnetised mini-ICAL detector module in The 39th International Conference on High Energy Physics (ICHEP2018)*, Proceedings of Science 340 (2019) 360
4. Suryanarayan Mondal et al., *Estimation of Leak of a Resistive Plate Chamber by Monitoring Absolute Pressure in XXII DAE High Energy Physics Symposium*, Springer Proceedings in Physics 203 (May 2018) 851-853
5. G. Majumder et al., *Development of a Resistive Plate Chamber with Heat Strengthened Glass in XXII DAE High Energy Physics Symposium*, Springer Proceedings in Physics 203 (2018) 575-578
6. S. Pethuraj et al., *Measurement of Angular Distribution and Integrated Flux of Cosmic Ray Muons Using 2 m×2 m RPC Stack at IICHEP Madurai in XXII DAE High Energy Physics Symposium*, Springer Proceedings in Physics 203 (2018) 845-846

Conferences/Workshops

1. Attended *16th Topical Seminar on Innovative Particle and Radiation Detectors (IPRD23) held at Siena, Italy during 25–29 September 2023.*
   Talk: The Silicon Vertex Detector of the Belle II Experiment.

2. Attended *XXIV DAE-BRNS High Energy Physics Symposium* held at NISER, Bhubaneswar, India during 14-18 December, 2020.
   Poster: Correlation of muons arrival times from two different cosmic showers.
   Talk: Cosmic muon momentum spectra at Madurai.

3. Attended *XXIII DAE-BRNS High Energy Physics Symposium* held at IIT Madras, Chennai, India during 10-14 December, 2018.
   Poster: Muon Multiplicity in 2 m $\times$ 2 m RPC and comparison with CORSIKA simulation.

4. Attended *National Symposium on Particles, Detectors & Instrumentation (NSPDI 2017)* held at Tata Institute of Fundamental Research, Mumbai, India during 4-7 October, 2017.
   Poster: Estimation of Leak of a Resistive Plate Chamber by Monitoring Absolute Pressure.

5. Attended *13th Workshop on Resistive Plate Chambers and Related Detectors (RPC2016)* held at Ghent University, Ghent, Belgium during 22–26 February, 2016.
   Poster: Leak Rate Estimation of a Resistive Plate Chamber Gap by Monitoring Absolute Pressure.

6. Attended *XXII DAE-BRNS High Energy Physics Symposium* held at University of Delhi, Delhi, India during 12-16 December, 2016.
   Poster: Estimation of Leak of a Resistive Plate Chamber by Monitoring Absolute Pressure.

7. Attended the course of *Japan-Asia Youth Exchange program in Science (SAKURA Exchange Program in Science)* administered by Japan Science and Technology Agency and held at Osaka university, Osaka, Japan during 29–04 December, 2015.

Personal Details

Mother:	Minakshi Jana (Mondal)
Father:	Lakshmi Narayan Mondal
Date of Birth:	12 March 1990
Place of Birth:	Jaynagar Majilpur, West Bengal, India
Hobby:	Trekking