

Bose Institute scientists receive Breakthrough Prize in Fundamental Physics as part of ALICE collaboration at CERN

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The Experimental High Energy Physics (HEP) group of Bose Institute (BI), currently consisting of Faculty members- Prof. Supriya Das, Dr. Sidharth Kumar Prasad and Dr. Saikat Biswas, Post Doctoral Fellow- Dr. Sanchari Thakur and Senior Research Fellow- Mr. Mintu Haldar, has been awarded the Breakthrough Prize 2025 in Fundamental Physics as a part of ALICE at CERN.

The \$3 million Breakthrough Prize in Fundamental Physics for 2025 is awarded to thousands of researchers from more than 70 countries representing four experimental collaborations at CERN's Large Hadron Collider (LHC) – ATLAS, CMS, ALICE and LHCb.



Fig 1: 2025 Breakthrough Prize Ceremony

Bose Institute, Kolkata is the only Autonomous Institute under Department of Science and Technology, Government of India, working in A Large Ion Collider Experiment (ALICE) at CERN along with many other collaborators in India. ALICE studies the Quark-Gluon Plasma (QGP), a state of extremely hot and dense matter that existed in the first microseconds after the Big Bang.

The institute joined ALICE Collaboration under the leadership of Prof. Sibaji Raha, former Director of Bose Institute as Principal Investigator.

Prof. Kaustuv Sanyal, Director, Bose Institute conveyed his warm congratulations to the team members of Experimental High Energy Physics group and said, “This is a great achievement not only for the Bose Institute team but also for the entire community of Indian high energy physicists working in mega science projects such as ALICE at CERN. Such awards will encourage young minds to join this kind of complex and large experimental programs for exploration of new physics.”

The HEP Group of Bose Institute has made significant contributions in several areas of the ALICE experimental program such as detector hardware development, simulation, physics analysis, data-taking and operations of the experiment.



Fig 2: Bose Institute Faculties at CERN

An indigenously built proportional counter based highly granular Photon Multiplicity Detector (PMD) was deployed in the ALICE experiment for detection of inclusive photons at forward rapidity. The PMD was commissioned in ALICE in the year 2008 and participated in the data taking program till 2018. Bose Institute played a leading role in the operations of PMD at CERN since 2014 till its decommissioning. Post data collection, the efforts of data clean up, calibration and quality assurance of the entire PMD data set to optimize it for physics analysis was also led by the faculty from Bose Institute in collaboration with students from various Indian institutes/universities participating in ALICE.

A new type of Time Projection Chamber (TPC) is being used after the upgrade of the ALICE so as to cater to the high luminosity environment expected at the LHC facility. This device relies on the intrinsic ion back flow (IBF) suppression of Micro-Pattern Gas Detectors (MPGD) based technology in particular the Gas Electron Multiplier (GEM).

The new read-out chambers in TPC consist of stacks of 4 GEM foils combining different hole pitches. In addition to the low ion back flow, other advantages of GEM technology are good energy resolution and long-term stability in operation. Researchers from Bose Institute were involved in ALICE-TPC upgradation project.

Faculties and trainees from Bose Institute have made significant contributions to the Physics program of the ALICE by leading about six publications in addition to contributing to several other ALICE papers. Bose Institute members have contributed to several areas of Physics studies.

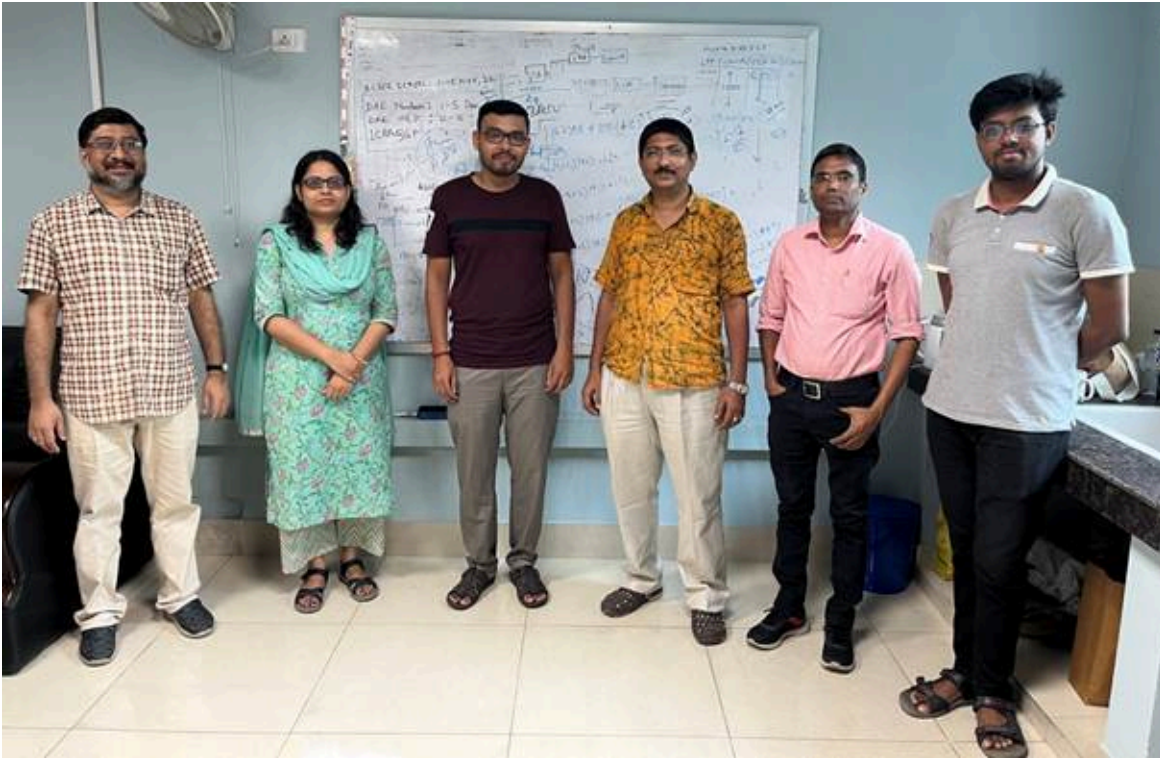


Fig 3: Faculty members and students of Bose Institute working in ALICE experiments

Congratulating all the collaborators, the ALICE Spokesperson Prof. Marco Van Leeuwen wrote “I would like to congratulate the entire collaboration and the LHC community for this well-deserved recognition of the scientific advancements achieved through our collective efforts. All authors of publications based on Run 2 data up to 15 July 2024 will be listed as laureates.”

Prof. Sanjay Kumar Ghosh, Dr. Rathijit Biswas, Dr. Abhi Modak, Dr. Debjani Banerjee, Dr. Prottoy Das and Dr. Md. Asif Bhatt were also part of this group.

The Break Through prize money is allocated to ATLAS (\$1 million); CMS (\$1 million), ALICE (\$500,000) and LHCb (\$500,000), in recognition of **13,508** co-authors of publications based on LHC Run-2 data released between 2015 and July 15, 2024. [ATLAS – 5,345 researchers; CMS – 4,550; ALICE – 1,869; LHCb – 1,744].

The prize money will be used to fund a Breakthrough prize studentship to allow selected PhD students to spend up to two years at CERN while working on their PhD research.

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