

ATLAS TILE CALORIMETER UPGRADE WEEK HOSTED BY ITHEMBA LABS

The ATLAS Tile Calorimeter Upgrade week took place at iThemba LABS in Cape Town, 15 -17 March. The event gathered scientists working at the ATLAS experiment at the European Laboratory CERN from the US, various countries of Europe and South Africa. The event was organized by Professor Bruce Mellado, from Wits University, in conjunction with several colleagues from Europe and the US. The event was sponsored by the Department of Science and Technology and the National Research Foundation.

The Tile Calorimeter of the ATLAS detector covers the central region of detector and it is designed to measure the energy and position of particles that result from high-energy proton-proton collisions provided by the Large Hadron Collider (LHC). The Tile Calorimeter detects particles called hadrons, which are copiously produced in high-energy proton-proton collisions.

Following the discovery of the Higgs boson in 2012, the LHC is developing a long-term plan to increase the intensity of the collisions. This is necessary to provide much more data with which to explore the Higgs boson and its coupling to other particles, the search for other bosons and other new particles. In 2016 the LHC delivered collisions with an intensity significantly surpassing the initial design. The LHC envisions major upgrades in the future that will increase the data available by about 100 times.

The Tile Calorimeter will undergo a major replacement of its on- and off-detector electronics for the high luminosity programme of the LHC starting in 2026. All signals will be digitised and then transferred to the off-detector electronics, where the signals will be reconstructed, buffered, and sent to the first level of the trigger at a rate of 40 MHz, or 40 million times every second. This will provide a better precision of the calorimeter signals used by the trigger system, will provide more information and will allow the development of more complex trigger algorithms.

This represent a major challenge in digital electronics that South African scientists and industry are profiting from. The generation and real-time processing of digital signals conform the first stage of what is usually referred to as the Big Data problem. In the process of pursuing this type of complex problems South African students encounter the opportunity to acquire unique skills, which are brought to the country. Local industry also profits from these activities. Based on a design developed for the upgrade of the off-detector electronics of the Tile Calorimeter, South African industry was able to manufacture in 2016 the most complex electronics board in the country to date. The production of the board was possible thanks to a concerted effort in investing and innovating that now enables local industry to produce complex boards more efficiently and affordably.

The workshop was kicked off with an open session chaired by Professor Bruce Mellado. The first speaker was the Director of iThemba LABS, Dr Faïçal Azaiez, who welcomed the participants and gave an overview of his vision for the laboratory and its international projection. The Director emphasized the commitment to support the development of instrumentation for South Africa. Daniel Dock, Managing Director, TraX Interconnect (Pty) Ltd, gave a presentation on the history and capabilities of the South African electronics industry. Mr Dock gave an overview of the complexities behind the manufacturing of high-density electronics board, with emphasis on the techniques that had to be developed to manufacture the board for the ATLAS Tile Calorimeter. The open session was concluded with a colloquium by Dr. Oleg Solovyanov, the Project Leader of the ATLAS Tile Calorimeter. Dr. Solovyanov reviewed the most important features of the detector and plans for the upgrade.



The Director of iThemba LABS addresses the audience



Group photo of participants at the TileCal Upgrade Week Workshop