

Stony Brook University The Graduate School

Doctoral Defense Announcement

Abstract

Topics in the measurement of electrons with the ATLAS detector at the LHC

By

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The CERN Large Hadron Collider (LHC) located near Geneva, Switzerland is a 27 km proton-proton accelerator and collider with a 14 TeV center-of-mass energy and a design luminosity of $10^{34} \text{ cm}^{-2}\text{s}^{-1}$. Upon completion, it will be the most powerful instrument ever built to investigate particles properties.

The ATLAS (A Toroidal LHC ApparatuS) experiment is one of five experiments at the LHC. ATLAS is a general-purpose detector designed for the discovery of new particles predicted by the Standard Model (i.e. Higgs boson), and of signatures of physics beyond the Standard Model (i.e. supersymmetry). These discoveries require a highly efficient detection and high-resolution measurement of leptons or photons in the final state. In ATLAS, the liquid Argon (LAr) calorimeters identify and measure electrons and photons with high resolution. This dissertation reports on a study of various topics relevant to the measurement of electrons and photons with the LAr calorimeters.

The first topic concerns the high voltage feedthroughs (HVFT) for the LAr calorimeters. The HVFTs carry high-voltage lines to the calorimeter cells in the liquid, while maintaining the electrical and cryogenic integrity of the system. Seven HVFTs, including one spare, were designed and built at Stony Brook and installed on the ATLAS calorimeters at CERN. It is shown that the inaccessible parts of the HVFTs are expected to operate without failures in excess of 20 years.

The second topic of this dissertation addresses the inactive material installed in the gap between the barrel and the two end-cap cryostats of the LAr calorimeters. A detailed knowledge and accounting of the up-stream material budget is required to properly calibrate the calorimeter energy measurement with electrons from well-known resonances. Simulations show that the amount of materials in the gap is consistent with the early estimates used in the Calorimeter Performance Technical Design Report and therefore does not impact the e/g energy resolution beyond what was predicted.

In the third and last topic of this dissertation we report on results of photon runs from the 2004 Combined Test Beam (CTB) and compare this data to photon simulations done with the ATLAS software.

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