1. Introduction

This paper describes the pixel detector system for the ATLAS experiment at the Large Hadron Collider(LHC). The ATLAS detector is a general purpose detector for the study of primarily proton-proton collisions at the LHC.[1] The pixel detector system is a critical component of the inner tracking detector (ID) of ATLAS.[2] The ATLAS Inner Detector provides highly efficient charge-particle track reconstruction over the pseudo-rapidity range $|\eta| \leq 2.5$.[3] The pixel detector, with approximately 80 million channels, is essential to provide pattern recognition capability to meet the track reconstruction requirements of ATLAS at the full luminosity of the LHC of 10^{34} $cm^{-2}sec^{-1}$. The pixel detector system is the innermost element of the Inner Detector. It is therefore the most important contributor to the precision needed for efficient identification and reconstruction of secondary vertices from the decay of, for example, particles containing the b-quark (b-tagging). In addition, it provides the essential resolution required to reconstruct primary vertices in the proton-proton interaction region within ATLAS even in the presence of the many multiple interactions present at the LHC design luminosity of 10^{34} $cm^{-2}sec^{-1}$.

In the sections below, we first present an overview of the pixel detector and its relationship to the Inner Detector. This is followed by a description of the performance requirements for the pixel detector and a brief summary of the tracking and b-tagging performance. We then describe in detail the principal components of the pixel detector system – electronics, sensors, modules, mechanical systems and services. Finally, we summarize critical test beam studies of pixel components and the operation of about 10% of the pixel system using cosmic ray tracks.

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[1] ATLAS Collaboration, ATLAS Detector and Physics Performance, Technical Design Report, Volume I, CERN/LHCC/99-14 and Volume II, CERN/LHCC/99-15.

[2] ATLAS Collaboration, ATLAS Inner Detector, Technical Design Report, CERN/LHCC

[3] ATLAS Pixel Collaboration, ATLAS Pixel Detector, Technical Design Report, CERN/LHCC/98-13.