Bunch-Crossing Identification for the ATLAS Level-1 Calorimeter Trigger

by

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Synopsis

As part of the design studies for the ATLAS level-1 calorimeter trigger, the process of Bunch-Crossing Identification (BCID) has been studied. Various digital BCID algorithms have been investigated using software simulation. The results of these investigations are presented here. They show that BCID can be performed with good efficiency for pulses corresponding to energy deposits down to a few GeV (~4 GeV).

A hardware demonstrator system has been constructed which performs BCID on 36 channels of trigger data. The BCID algorithms are implemented in Field-Programmable Gate-Arrays. This has allowed a number of BCID algorithms to be tested in hardware at a CERN test beam. The design of the BCID demonstrator module is presented here, and the off-line analysis of the data recorded at the test beam is described. The results show BCID being performed with a level of efficiency which is acceptable for the level-1 trigger system.

All of the data analysis described in this thesis is my own work, except where explicitly stated otherwise. The hardware BCID module which is described in chapter 6 was designed entirely by myself.