The ATLAS Inner Detector Semiconductor Tracker (Si and GaAs Strips): Review of the 1995 Beam Tests at the CERN SPS H8 Beamline

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Introduction

This talk will consist of a brief review of the ATLAS Inner Detector (ID) Semiconductor Tracker (SCT) strip detector (both silicon and gallium arsenide) beam tests conducted at the ATLAS test beam facility at the CERN SPS H8 beamline. It will include a brief overview of the H8 facilities, the experimental layout of the SCT/Strip apparatus, the data acquisition system, some of the online software tools and the high precision silicon hodoscope and timing modules used. A very brief indication of some of the main varieties of detector systems tested and the measurements performed will be given. Throughout some emphasis will be placed on the contributions and interests of members of the Melbourne group.

The facility

In 1995 the H8 test beam was used by many individual groups to test modules of their particular design and construction. To support these individual tests, many common facilities have been provided by CERN - such as the beamline itself - and by members of the ATLAS collaboration.

The H8 beamline [1] is one of the most versatile fixed target beams at the CERN 450 GeV Super Proton Synchrotron (SPS). It can provide primary proton beams at the full SPS energy, secondary electron and pion beams up to 200 GeV and numerous tertiary beams, largely under user control through the manipulation of magnets and targets. For SCT testing, high energy pion beams are preferred, though other beams are selected as agreed between the SCT and other ATLAS detector groups when used in tandem.

As precision position sensitive devices, the SCT/Strip modules are mounted in-line on a specially engineered, 80 cm long support table providing micron stability and reproducibility. Apart from the varying modules under test, the apparatus includes several trigger scintillators providing precision timing pulses, and four silicon X-Y hodoscopes providing particle trajectory tracking to approximately 2-3 μm precision.

The data acquisition system (DAQ) [2] is sited in an adjoining control room housed in several VME and NIM crates connected by 20 m cables and optical fibres. It was

controlled by a VME RISC processor running a real-time UNIX to read out the various modules, assemble the event data structures, record the data to tape and coordinate monitoring and control. Among the general contributions of the Melbourne group were the development of an efficient and versatile online monitoring system [3,4] and an electronic logbook and tape log facility [5].

The 1995 tests

Beam tests were conducted at H8 during May, August and September of 1995; tests included measurements of the signal and noise amplitudes, the noise occupancy and tracking efficiency at different thresholds, and many others, all as functions of timing, position and angle.

Modules tested during 1995 included demonstrations and test of the three contending readout architectures, Digital (ADAM) [6,7], Analogue (APV5,FELIX) [7], and Binary [8], several different Silicon and GaAs detector designs, the two contending module architectures (Z and R-phi), and several optical readout transmission mechanisms. Important tests on Forward module designs were also performed including a full length variable pitch silicon detector module. Results were presented at several important collaboration meetings including the Inner Detector Working Group which resolved to recommend silicon instead of microstrip gas counters for the Forward region.

References

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