

I. Tracker

A. Pixels

1. Technology
 - a. Physical basis of charged particle detection by semiconductor
 - b. Silicon sensors with front end chips for readout
 - c. Optical readout
2. Physical structure
 - a. 46,080 pixels per sensor
 - b. Sensors generally 50x400 microns each
 - c. 16 sensors per module, 1744 modules total
 - d. 80 million channels, 1.4 m long, 0.5 m wide
3. Readout
 - a. On-detector lasers provide optical readout link
 - b. DAQ crates off-detector receive and interpret signals
 - c. Failures of lasers and motivation for alternatives
4. Relevance for b-tagging

B. SCT

1. Technology and structure
 - a. Silicon technology also
 - b. 4 double-sided layers, 6.36 x 6.40 cm
2. Role in track reconstruction

C. TRT

1. Technology, structure, readout
 - a. Ionization of gas when traversed by charged particle
 - b. 2-tier threshold system distinguishes between tracking hits and transition radiation
2. Particle identification role

D. Track reconstruction and SV reconstruction

1. Quality cuts
2. Track Reconstruction algorithms
 - a. Kalman fitter
 - b. Track seed finding: road window around a track seed
 - c. Leapfrog to further points along trajectory
 - d. Ambiguity solving: generally give hits to tracks with higher chi2
 - e. Points where problems can arise

- (1) Noise hits
- (2) Dropped hits
- (3) Scatters off detector material
- (4) Other stuff: bremsstrahlung, photon conversions
- 3. Secondary Vertex Reconstruction
 - a. Significance: used in b-jet identification
 - b. determination of signed impact parameter (is IP in front of or behind jet)
 - c.

II. Calorimeters

A. Introduction

- 1. Jets, MET, particle ID
- 2. Large range of energies detected

B. Electromagnetic

- 1. Purpose
 - a. Higgs and heavy VB measurements
 - b. Shield hadronic calorimeter from EM jets
- 2. Specifications
 - a. lead and liquid Argon accordion geometry
 - b. fine (order 0.01) granularity over 3 sampling layers
 - c. out to $\eta=3.2$
 - d. about 25 radiation lengths thick
- 3. Performance

C. Hadronic

- 1. Purpose
 - a. Measurement of hadronic jets from quarks and gluons
 - b. particular attention to b, tau, hadronic W
- 2. Specifications
 - a. Tile scintillator and iron in central region
 - b. Liquid argon in more forward region (radiation hard)
 - c. Endcap at high η
 - d. 11 interaction lengths thick at $\eta=0$ to reduce punch-through to muons
- 3. Performance
- 4. B-jet detection

III. Muon System