

Table 4.1 – Coordinate resolution in azimuthal ($r\varphi$) and longitudinal (z) directions for each subsystem in the ITS [94].

Detector	$r\varphi$ precision (μm)	z precision (μm)
SPD	12	100
SDD	35	25
SSD	20	830

possible below the lower momentum limit of the TPC (which is at $\sim 150 \text{ MeV}/c$)².

Throughout the ITS, silicon based detector modules are used. Silicon is a semiconductor, and as such it has a valence band and a conduction band, which are separated by a band gap. When used in a detector, a pn junction is used where a reverse bias is applied, which depletes the active area of charge carriers [95, pp. 226-232]. When a charged particle (or photon) hits the detector, this will create electron-hole pairs along the trajectory³, as shown in Fig. 4.3, which generates a current pulse. This current will traverse the electric field and eventually be collected at the electrodes, where a current amplifier is connected. Since the ITS is only used for tracking, the relevant information is whether a particle has hit the detector. This is ensured by triggering if the pulse is above a certain threshold. The advantages of using a semiconductor are that this creates a fast signal, which makes it possible to determine the interaction time at high

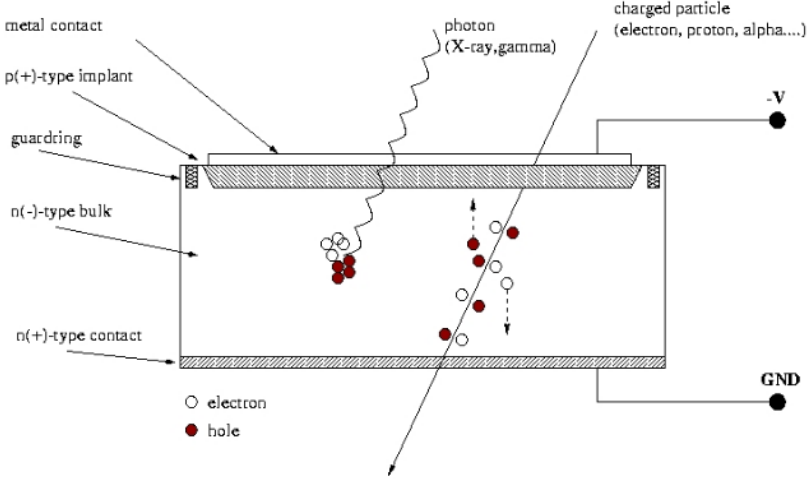


Figure 4.3 – Basic principle of a semiconductor detector. When a charged particle traverses the detector, it excites electrons from the valence band to the conduction band, which creates electron-hole pairs. These will drift in the applied electric field to the metal contacts, which generates a current pulse that can be detected. Figure taken from Ref. [96].

²If the momentum is too low, a charged particle will be trapped in the magnetic field and escape in the longitudinal direction, but may still be detected in the ITS. For heavier particles – in particular protons – there is also a large energy loss in the ITS, further reducing the efficiency at low momentum.

³For photons this will require an intermediate step of either Compton scattering or pair production.