For the purpose of background rejection, C5 was used in a similar way as the Veto Wall detector.

3.2.2 Luminosity monitor

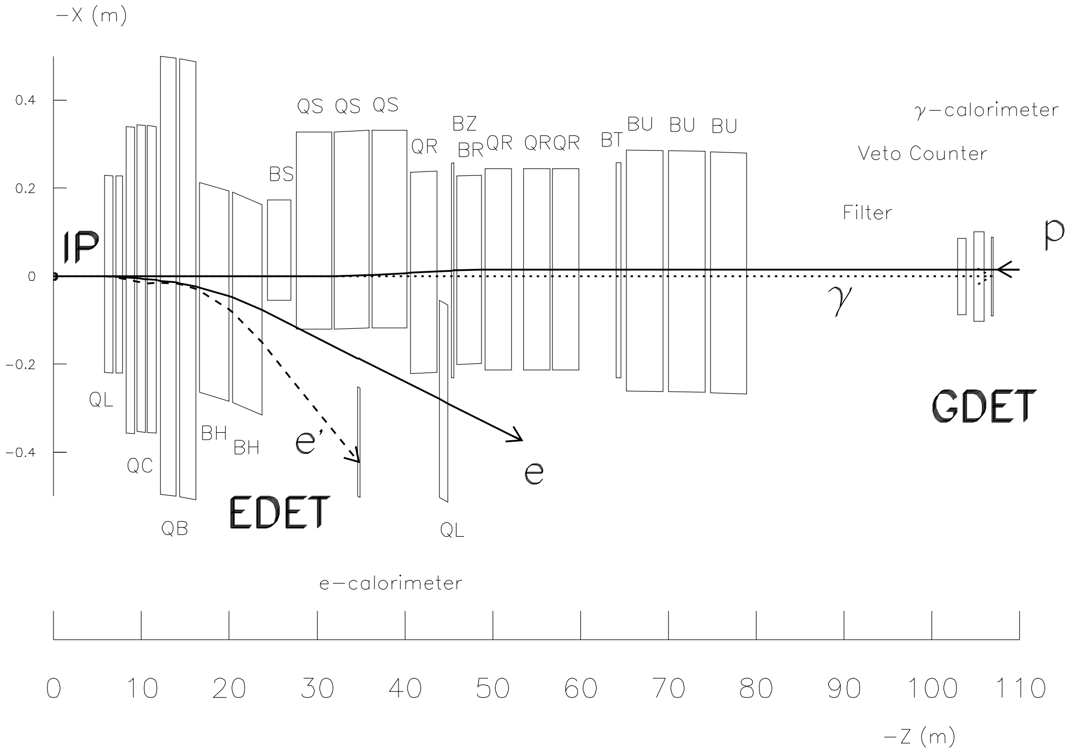

Figure 12: Top view of the ZEUS luminosity monitor.

At HERA, luminosity is best determined by monitoring event rate for the bremsstrahlung process $ep \to e'\gamma p'$, a process with precisely calculable cross section[27] and simple event topology. The high event rate of this process(the cross section of this process is by far the largest in all ep interactions) allows continuous monitoring of the luminosity. The experimental signature for this process is detection of an electron and a photon at negligibly small angles with respect to the electron beam, with energies adding up to electron beam energy, $E_e' + E_\gamma = E_e$.

Figure 12 shows the layout of the ZEUS luminosity monitor(LUMI).[28] LUMI consists of an electron detector(EDET) and a photon detector(GDET). Bremsstrahlung photons exit the beampipe through a window and enter the GDET. Similarly, bremsstrahlung electrons are deflected by the beam bending magnetic field, exit the beampipe through a window, and reach the EDET if E'_e is within appropriate energy range. Energies of bremsstrahlung photons and electrons are measured by a radiation hard lead-scintillator calorimeter in the GDET and EDET, with a resolution $\sigma_E/E_\gamma = 0.18/\sqrt{E_\gamma(GeV)}$.

The residual gas in the beampipe may also cause beam electron to bremsstrahlung. Additional event rate due to these background bremsstrahlung can be subtracted by measuring the event rate from e pilot bunches.[29]

3.2.3 Calorimeter

The calorimeter measures energy, position and arrival time of both neutral and charged particles without using magnetic field. Its energy resolution σ_E/E improves with increasing energy as $1/\sqrt{E(GeV)}$. It discriminates between electrons and hadrons. It is a fast device with response time $\sim 100ns$. It measures the time the particles reach the calorimeter with good resolution(less than $1ns$ at ZEUS). These features of calorimetry well match the needs of physics programs at HERA. Many QCD related topics at HERA rely on measurement of jets of neutral and charged particles, because a jet is kind of a "trace" left by a quark or a gluon. The measurement of proton structure functions, a major task at HERA, requires high precision measurements of energy and position for electrons and jets with energy up to a few hundred GeV. The high background rate at HERA requires rather sophisticated trigger algorithms based on features of global energy distributions which must be provided by the detector at every bunch crossing i.e. at every $96ns$, to avoid event pile-up.

The ZEUS calorimeter is a compensating sampling calorimeter of sandwich structure.[30] It consists of layers of dense absorber material(depleted uranium) interleaved with scintillator tiles. Showers of secondary particles produced in the