jets in the rear direction, the leading proton spectrometer(LPS) for tagging of protons in diffractive scatterings, and the transitional radiation detector(TRD) for electron identification. These auxiliary components were not fully instrumented for the 1993 runs.

Apart from the above mentioned components for reconstruction of physics events, there are also materials and devices which shield the detector from unwanted flux of background and take part in the first level trigger decision in rejecting background events. The Veto Wall detector and C5 detector will be described briefly in the next subsection.† Then the CAL, CTD and VXD, which are crucial for the analysis in this thesis, will be described in some detail.

### 3.2.1 Veto Wall and C5

At ZEUS, background to physics events come mostly from halo particles and particles produced in proton beam gas interactions upstream of the main detector. The VetoWall and C5 are positioned upstream of the main detector to discern these background events.

The Veto Wall detector[18,25] locates at $z = -7.5m$. It consists of an iron wall of thickness $87cm$ and area $8m \times 9m$ with two layers of scintillation hodoscopes installed on both sides. It recognizes whether particles have penetrated the iron wall and also checks whether the hits are in coincidence with arrival of the beam proton bunches. Information provided by the Veto Wall detector can be used by the first level trigger to reject proton beam background.

The C5 monitor is an assembly of scintillation counters partially surrounding the beampipe for the purpose of beam quality monitoring. It measures rates and arrival times of the halo particles accompanying electron and proton beams. The beam arrival time measurement, accurate to $1ns$, provided by this rather small device made a large contribution in the first two years of data taking and analysis.[26]

† Beam collimators and beam scrapers protect the ZEUS detector from most of the beam induced background.[18] Description of the ZEUS detector here is limited to the instrumented parts.

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

### 3.2.2 Luminosity monitor

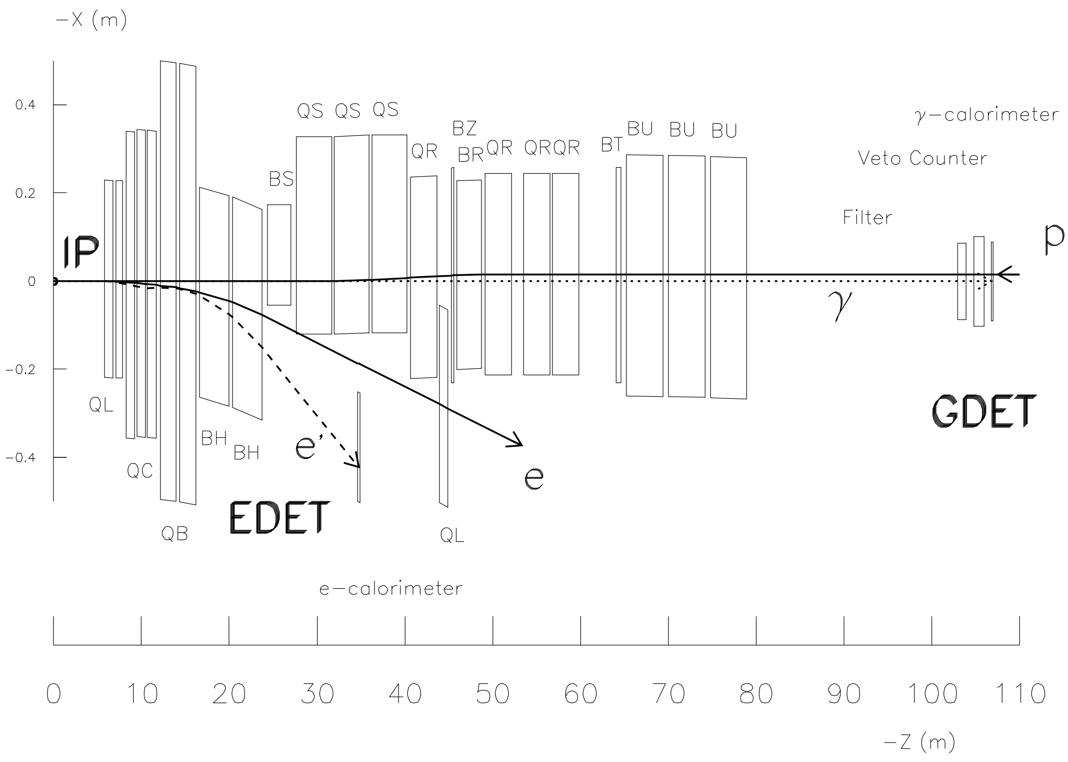


**Figure 12:** Top view of the ZEUS luminosity monitor.

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, $E_e' + E_\gamma = E_e$.