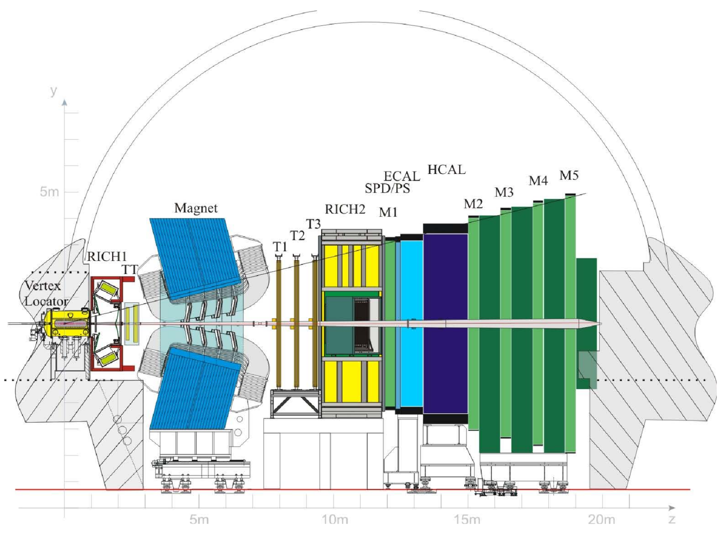
David Dossett on behalf of the LHCb VELO Group

Frontier Detectors for Frontier Physics - 12th Pisa Meeting on Advanced Detectors

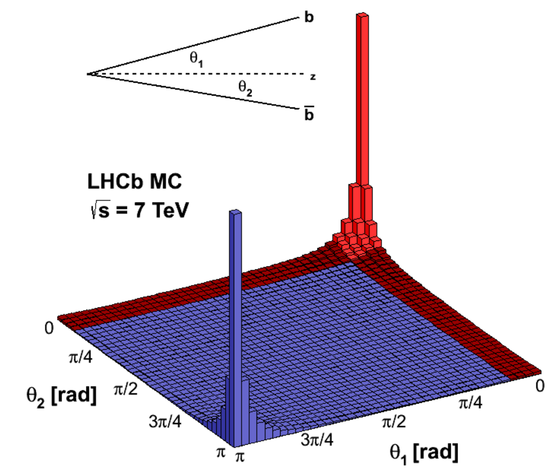
Performance of the LHCb VELO

THE UNIVERSITY OF WARWICK

LHCb Detector

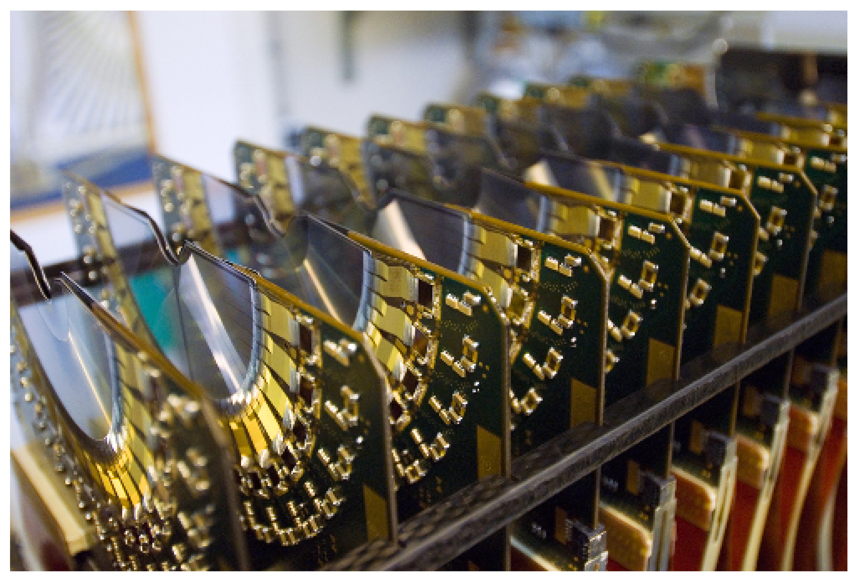


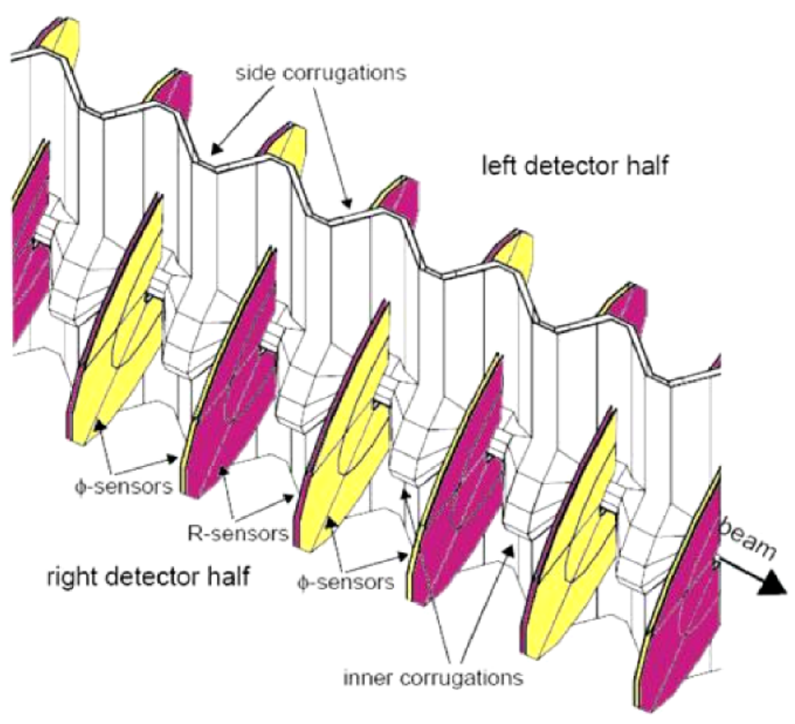
The LHCb is a single arm spectrometer at the LHC. The primary aim of LHCb is to study the CP violating decays of b-hadrons. Excellent vertex reconstruction is required to resolve the separation of the primary vertex and the displaced secondary decay vertex.

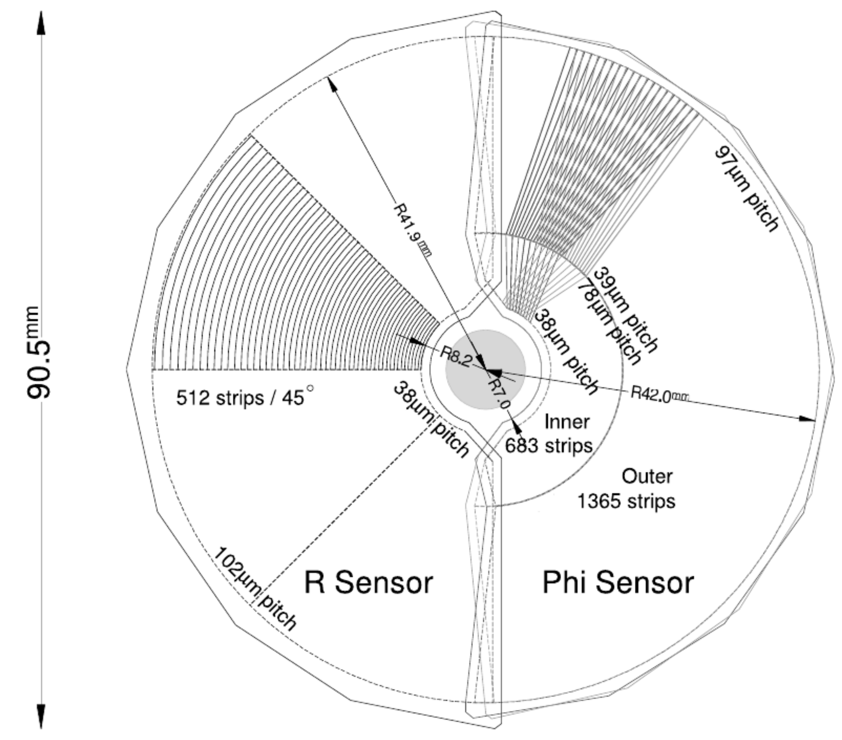


LHCb VErtex LOcator (VELO)

- The VELO is a silicon micro-strip detector which surrounds the proton-proton interaction point at the LHCb detector.
- The VELO has 88 sensor planes, 86 n-in-n and 2 n-in-p. Half of the sensors provide information about the radial coordinate (R Sensor) and half which measure the φ coordinate (Phi Sensor). These two types of sensors are paired into VELO modules to provide both coordinates.
- During running conditions, the closest active silicon strips are only 8.2mm from the colliding beams. However, during the beam set-up the LHC requires a larger aperture than this. Therefore the VELO is constructed of two retractable halves which stay at a distance of 3cm from the beams during setup. Once the beams are stable the VELO then closes symmetrically around them.

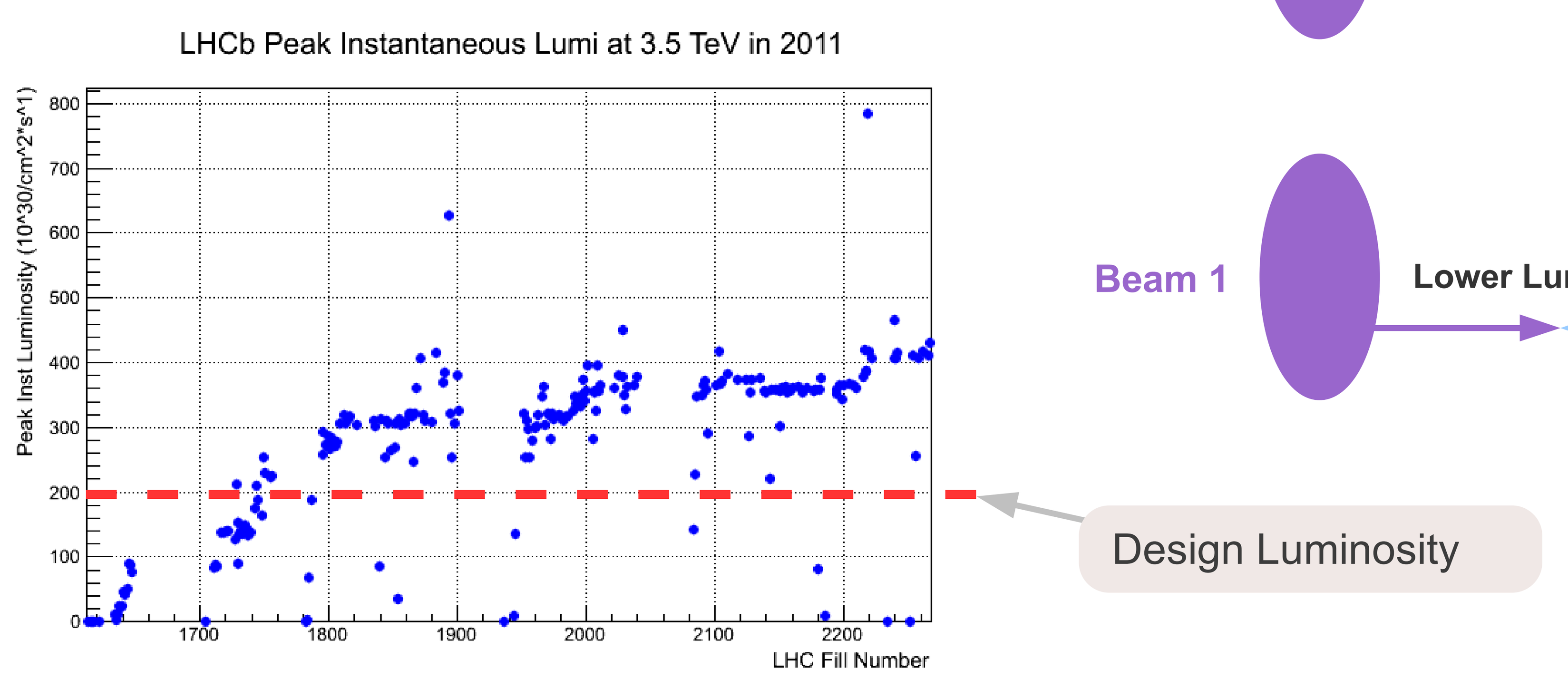


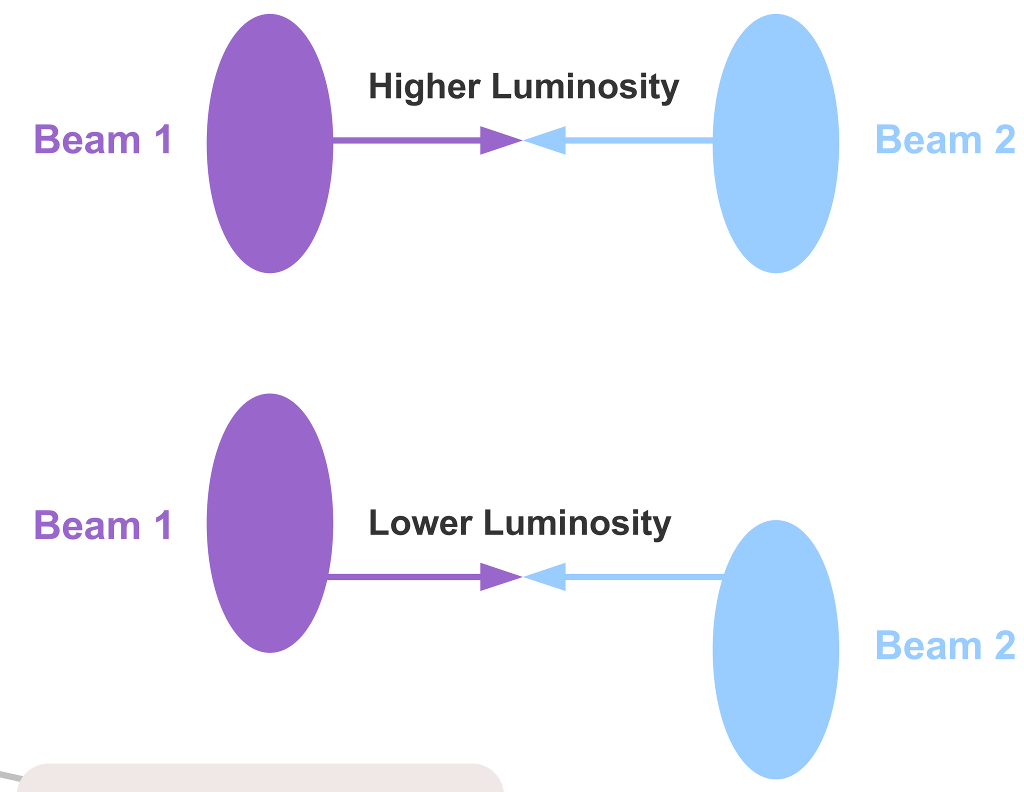




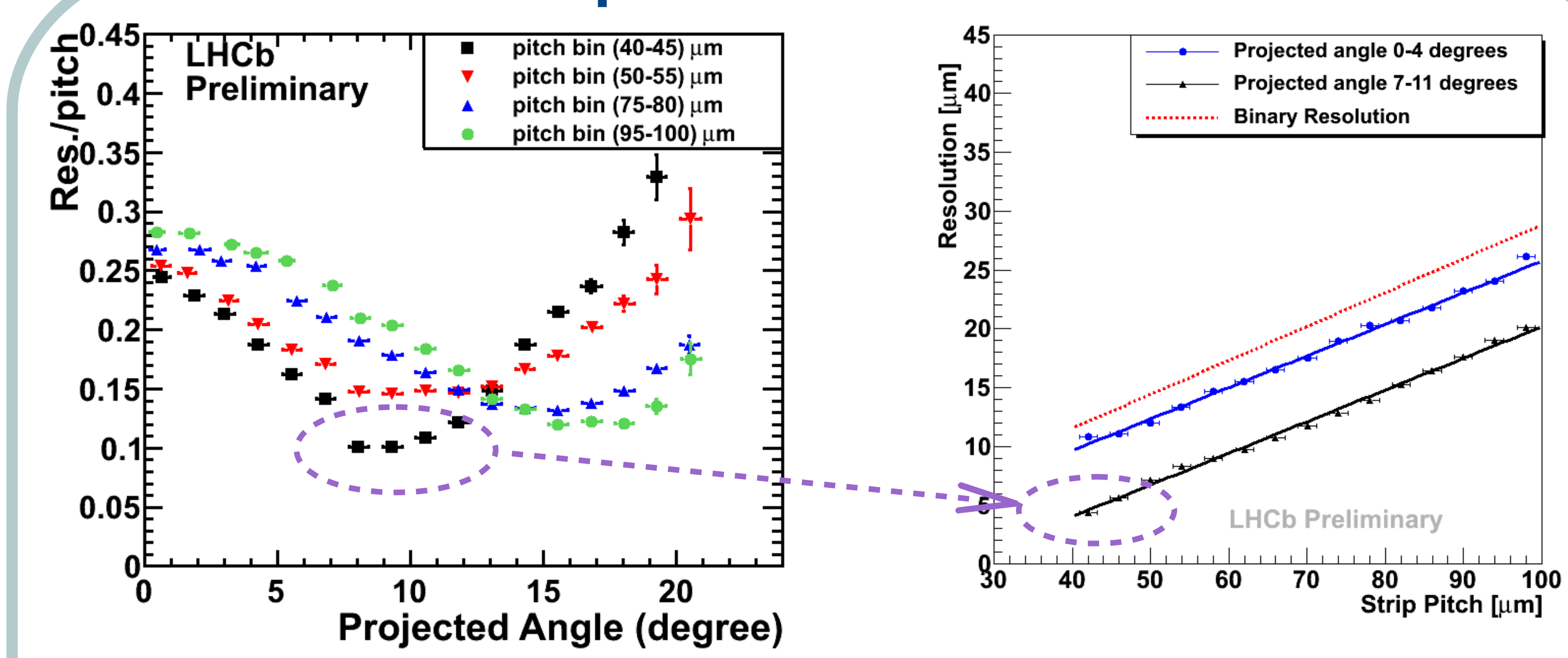
2011 Running Conditions

- Running at 3.5 TeV beam energy (increased to 4TeV for 2012).
- LHCb was designed to operate at a luminosity of $2x10^{-32}$ $cm^{-2}s^{-1}$. Values up to $4x10^{-32}$ $cm^{-2}s^{-1}$ are regularly achieved.
- Luminosity levelling has been implemented to maintain a constant luminosity during a fill. Achieved by continuously steering the beams.



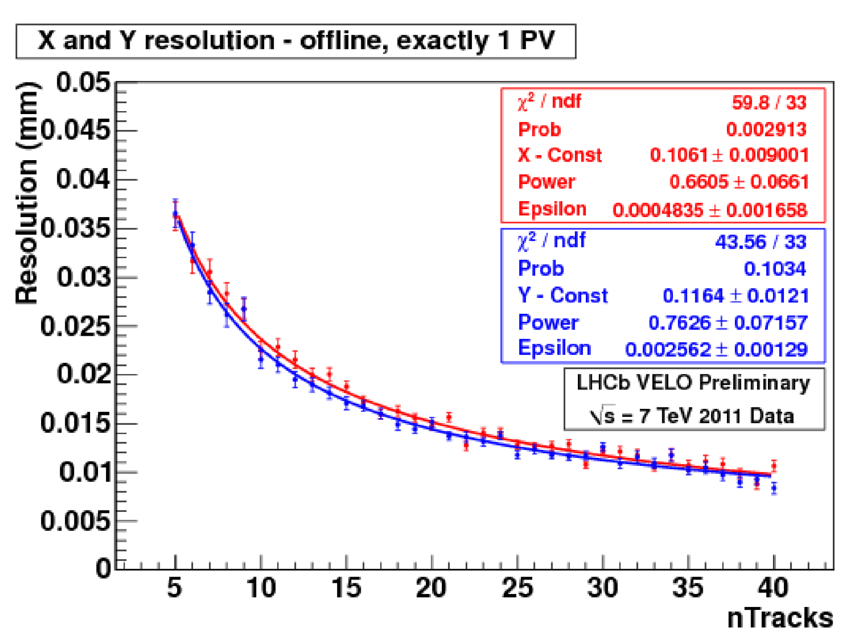


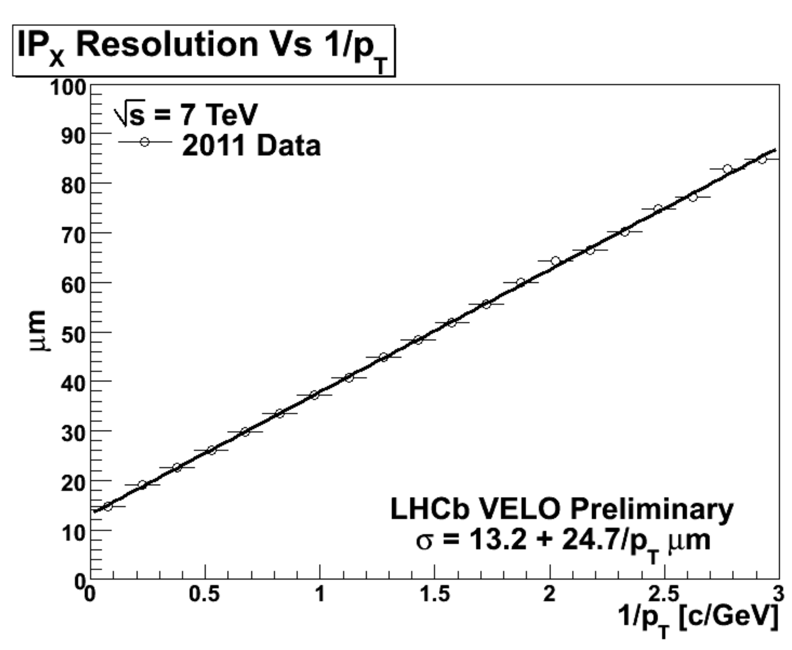
Spatial Resolution



Resolution is ~4 μm for the most optimally angled tracks in the smallest pitch region.

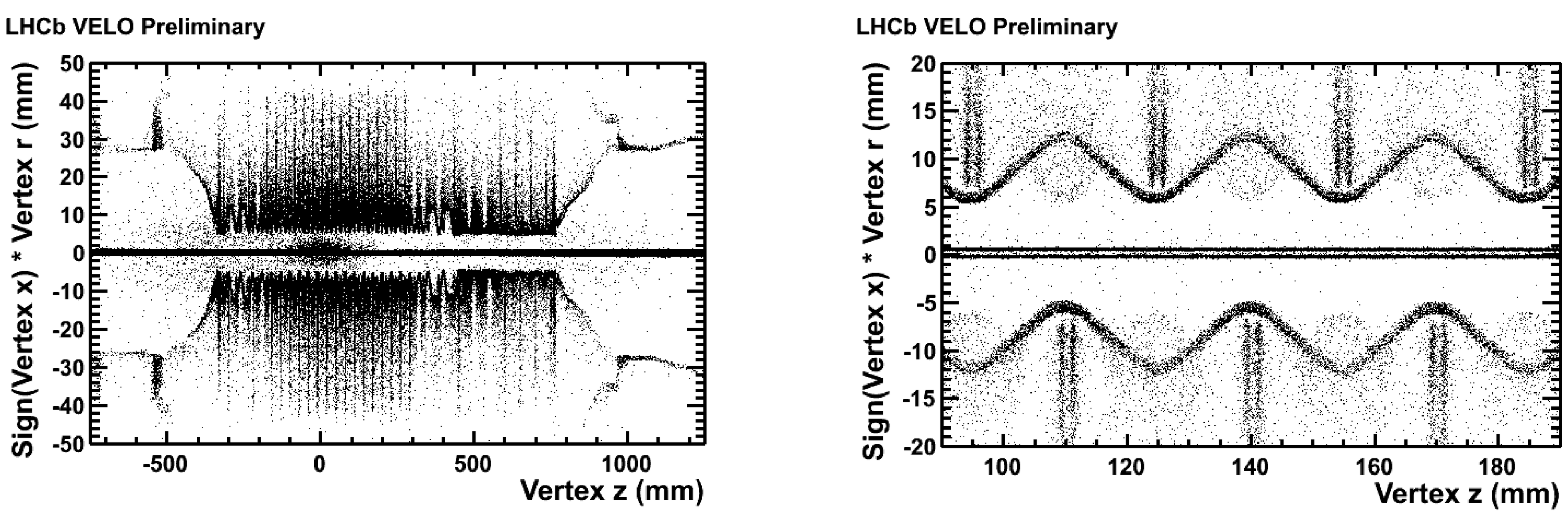
Primary Vertex and IP Resolution





A typical PV with 35 tracks yields: σ_x = 12 μm, σ_y = 12 μm, σ_z = 65 μm

Material Interaction Vertices



Self image of the VELO sensors + RF Box using hadronic vertices from Beam-gas events.

Signal vs. Noise