TPC Inner Radius

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Things to Take into Account

Experimental Aspects

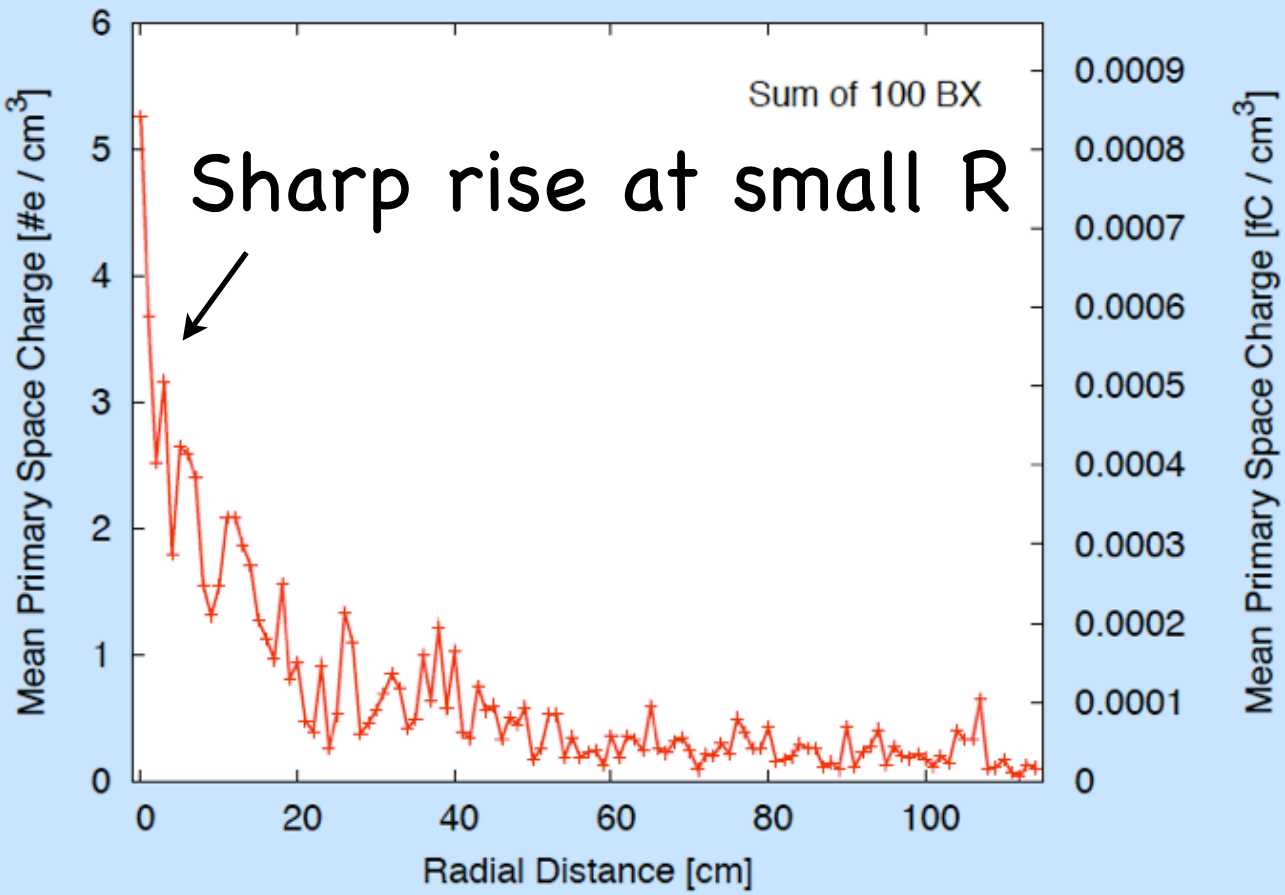
- Beam-related BG
  - TPC field cage acts as a Faraday cage. Better not let any +ve ion source to get in to take advantage of it.
- PFA: track-cluster matching in the forward region
  - linking of loopers (dE/dx at the inner wall)
- Pt cutoff and pattern recognition in the forward region
  - Not an issue if VTX-IT self-tracking works.

$$P_{t:\mathrm{cutoff}}\,[\mathrm{GeV}] = 0.3\,B\,[\mathrm{T}]\,(R_{\mathrm{in}}\,[\mathrm{m}]/2)$$

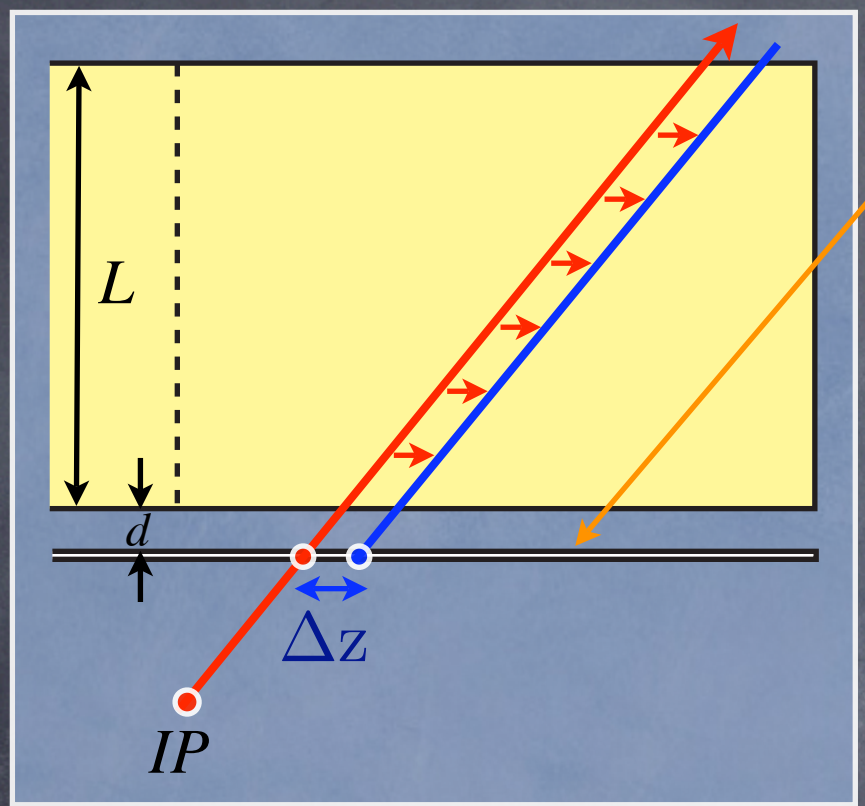
- Time stamping / TPC-IT linking
  - distance from the outermost IT layer

Beam Related BG

Primary Space Charge



Time Stamping



External Z Detector (T0 Device)

Wrong T0 makes a Z-shift!

$$\Delta z = v_{\rm drift} \times \Delta T_0$$

Naively we expect

$$\sigma_{\Delta T_0} \simeq \frac{2\sigma_z}{v_{\rm drift}\sqrt{n}} \left[1 + 3\left(\frac{d}{L}\right) + 3\left(\frac{d}{L}\right)^2\right]^{-\frac{1}{2}}$$

$$\simeq \frac{2\sigma_z}{v_{\rm drift}\sqrt{n}} \quad \text{if} \quad \left(\frac{d}{L}\right) \ll 1$$

ignoring multiple scattering

Assuming that Z resolution of the external detector is negligible

$$\begin{aligned} \sigma_z &= 1\,\text{mm} \\ v_{\rm drift} &= 5\,\text{cm}/\mu\text{s} \\ n &= 200 \end{aligned}$$

$$\sigma_{\Delta T_0} \simeq 3\,\text{ns}$$

Things to Take into Account

Engineering Aspects

- MPGD panel
  - If the inner radius is too small, individual pads will be apparently fan-shape in the innermost MPGD panels.
    - Effect on surface-mounting?
    - (Gating) GEM stretching?
    - Maybe OK since all the pad rows will have different radii more or less.
- Support tube
  - Should we be able to slide our TPC over the support tube so that we can easily pull out the TPC for maintenance purpose?