Mu3e Cosmic Trigger Meeting

Introduction

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Motivation

- Use cosmics for detector alignment → PhD project Uli Hartenstein

- Cosmic muons have high momentum!

  ➔ low multiple scattering and no other IA

  ➔ more or less straight lines → gives additional constraints
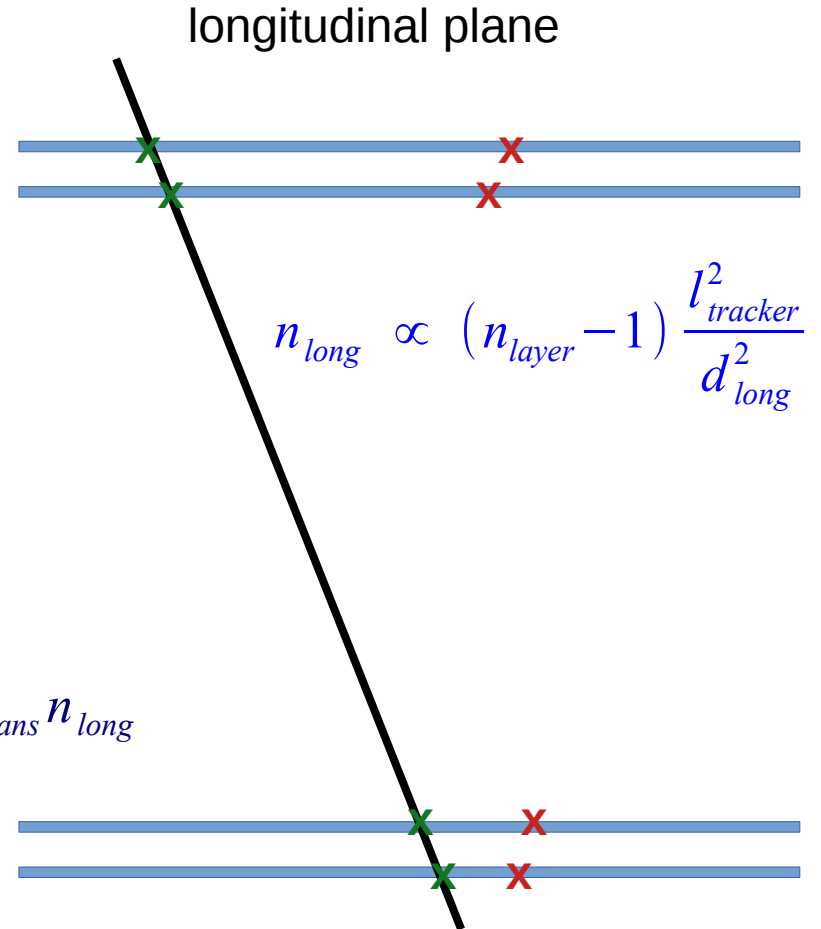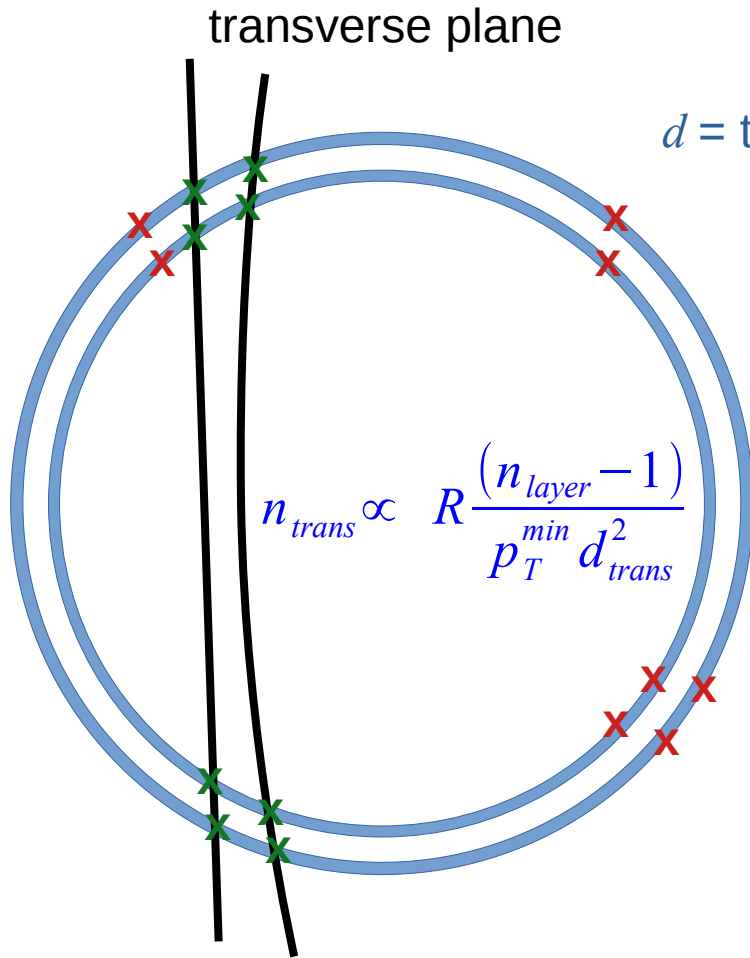
  ➔ clear signature in reconstruction and for triggering

Concepts & Ideas

- Scintillator-based trigger (extra detector)

  ➔ scintillators inside magnet probably not feasible (→ Nik's study)

  ➔ scintillators outside magnet possible but space is critical

- Pixel-based cosmic tracker (extra firmware and/or hardware)

  ➢ this meeting!

- Cosmic hits are readout all the time together with other hits from the 10^8 muon decays/s → cosmics are for free!

- Extra logic required to identify readout frames containing cosmics

Topologies

transverse plane

longitudinal plane

d = template size

$$n_{long} \propto (n_{layer} - 1) \frac{l_{tracker}^2}{d_{long}^2}$$

$$n_{trans} \propto R \frac{(n_{layer} - 1)}{p_T^{min} d_{trans}^2}$$

$$n_{comb} \approx n_{trans} n_{long}$$

Questions & Challenges

- Solve combinatorial problem with pattern recognition (no computation)

- How many patterns are needed?

  - superpixel or superstrips?

  - if strips: longitudinal plane, transverse plane?

- algorithm in FPGAs or GPUs → Martin

- dedicated trigger hardware?

  - e.g. Pattern Recognition Mezzanine (PRM, ATLAS)
    → Sebastian

- other ideas?