

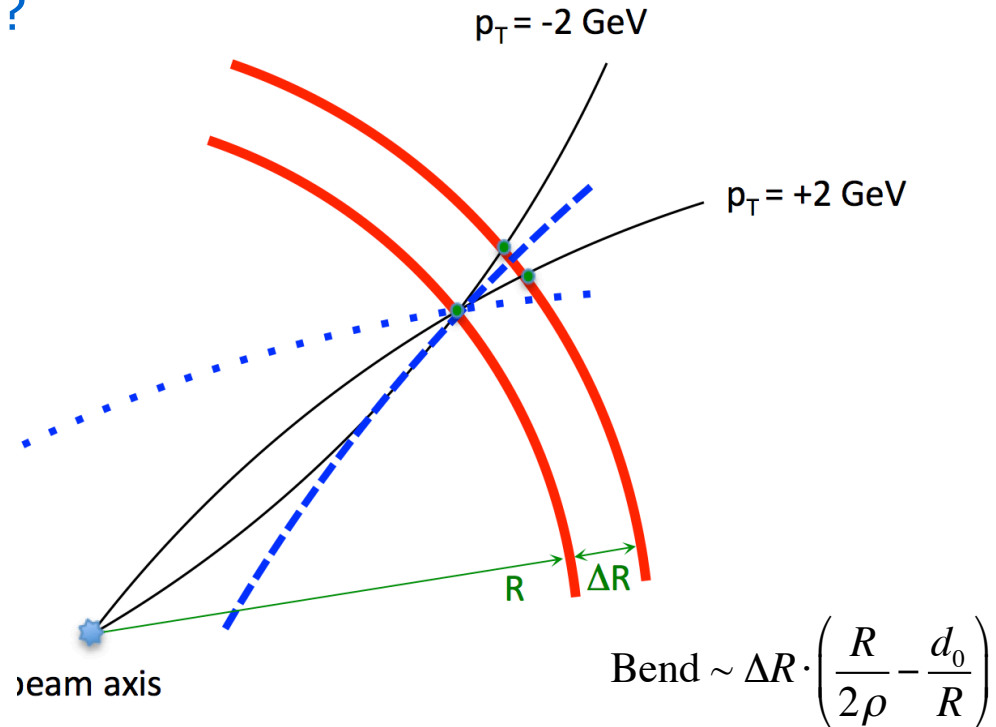
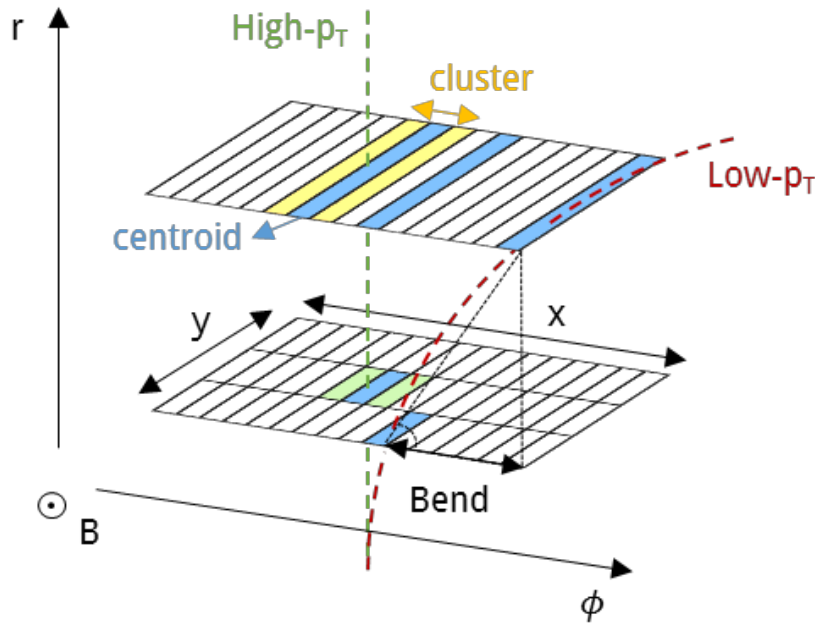
Explore trigger potential of CMS Tracker Pt- Modules

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Reminder

● CMS outer tracker ($R \sim 20$ to 110 cm) will consist of pT-modules, capable of identifying hits consistent with prompt tracks with $p_T > 2-3$ GeV (aka **stubs**) and reading them out @40 MHz

- Demonstrated that an FPGA-based system can reconstruct prompt tracks with high efficiency
- Can we do more with the stubs?



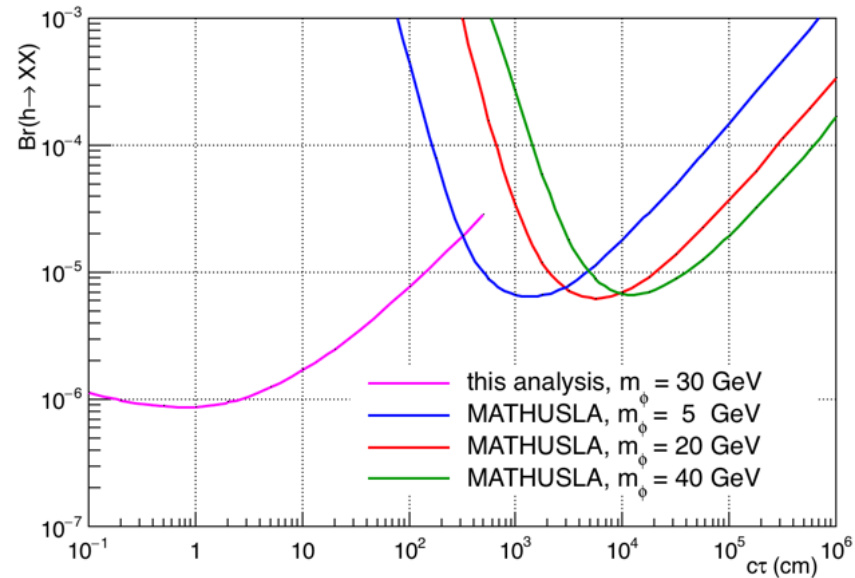
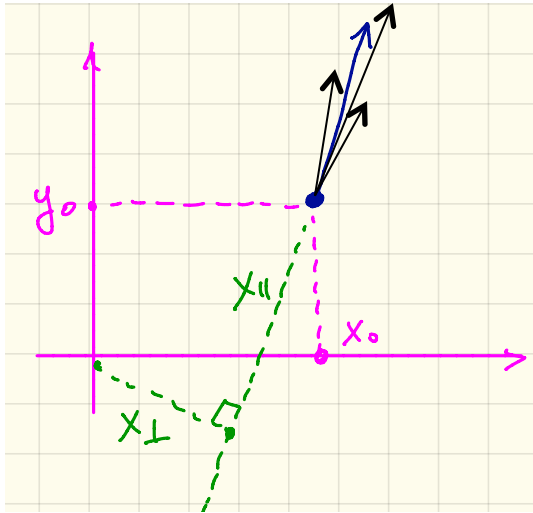
Observation: some of displaced tracks may give stubs

ρ – track radius
 d_0 – impact parameter

Displaced jet trigger

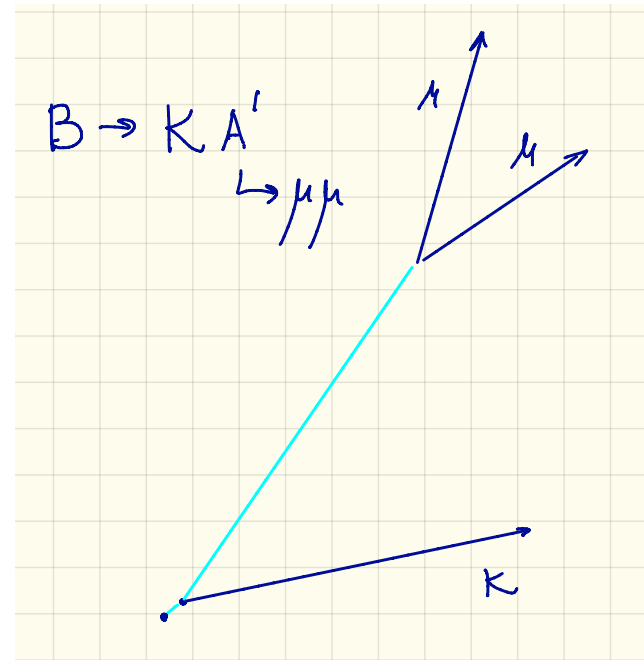
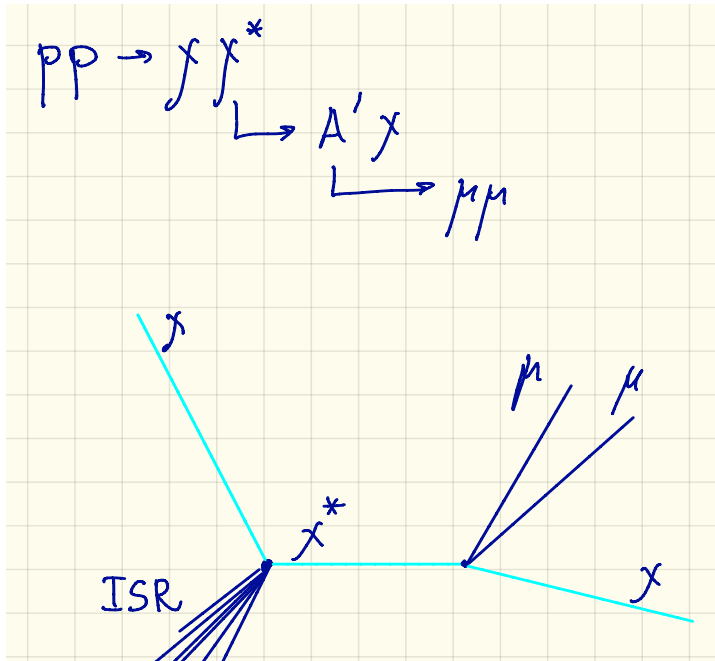
arXiv:1705.04321v1 [hep-ph]

- In context of $h(125) \rightarrow \phi\phi$ with long-lived ϕ



- Used toy MC for efficiency calculation, assumed that fake tracks do not form jets (a \sim good assumption)
 - Track IP $< 4-5$ cm, decay vertex $R < 20-25$ cm

low mass dimuon (pion?) resonances



- Current strategy: MET trigger, reconstruct displaced pair offline (HLT?)
- How many more events can we write out if we also trigger on the displaced pair?
 - Efficiency hit from pair reconstruction
 - Cross-section increase from smaller ISR jet requirement
- MIP timing? muon chambers?
- Note: the pair does not point back to PV

- Current strategy for HL-LHC
 - Dimuon trigger? CMS would likely do much worse than LHCb
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low mass dimuon (pion?) resonances

What are the benefits of including MIP timing in L1?

- \$\$\$\$, too much data
- may be only in regions of interest?

What are the benefits of making extra links with muon system?

- \$\$, but need a solid motivation

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Plan of attack (1)

- ~straightforward: signal efficiencies
 - Simon already done a lot of preparatory work for signal generation and processing
 - Can re-use some of the displaced track software

Plan of attack (2)

- Harder: need to be able to estimate trigger rates
 - Assume all displaced tracks are fake
 - Flat in ϕ , $1/p_T$, t , z_0 and d_0 ; try 10 to 40 fakes / event
- Tracker only
 - Not all pairs will combine into vertices, not all will point back to PV
- With muons
 - Assume occupancy of hits in inner muon layer: reduce fake rates
- With MIP timing:
 - Assume occupancy of hits: reduce fake rates
 - Two MIP hits reconstruct a spatial region for the vertex! This region should be consistent with the one from the tracks
 - assume timing resolution at L1
 - tracker hit precision is \sim known, translates into track parameter resolutions for given hit map
 - Some vertexing math is needed...

