

Quirks: a Rough Trigger Study (to make a trigger choice)

Jim Pivarski

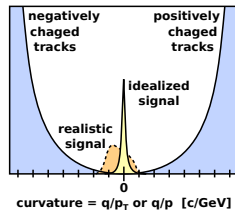
22 September, 2011

Reminder

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- ▶ Quirk-pair signature: isolated HSCP with zero curvature
- ▶ Analysis can use dE/dx and $\kappa = q/p_T$ to control backgrounds well (perhaps only modest cuts are needed to eliminate backgrounds)
- ▶ Trigger may be an issue, for the same reason as all HSCP analyses



This study

- ▶ I have received a generator-level ntuple from Jared Evans and Markus Luty
(100 and 250 GeV/c² charged, uncolored quirks at 7 TeV, Λ is relevant only for reconstruction, $SU(N)$ where $N = 2$, but cross-section is simply proportional to N)
- ▶ I have a muon trigger vs. β curve from Chris Farrell
- ▶ Checked current trigger thresholds and prescales on ConfDB
- ▶ **Goal:** choose an appropriate trigger/set of triggers

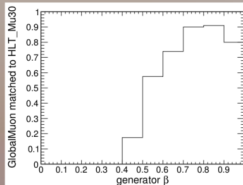
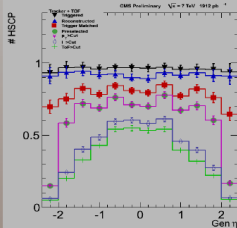
Muon trigger vs. β curve

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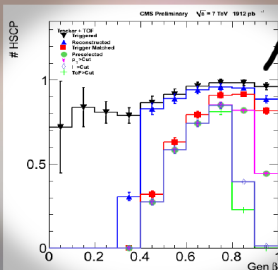
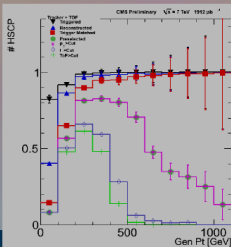
Note that **GlobalMuon-plus-trigger match (red)** is nearly flat in η and flat at high p_T
Only significant dependence is on β

Chris Farrell (Sep 1)

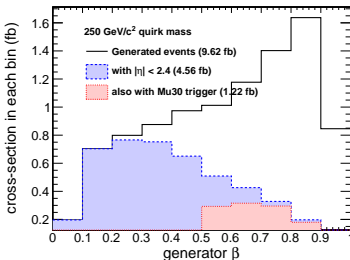
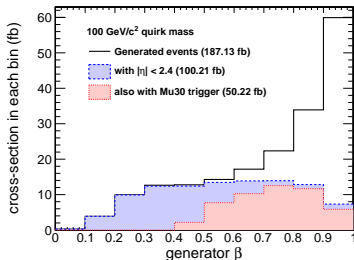
Tracker + Muon



I copied the results for
GlobalMuon-plus-trigger
match (by hand)



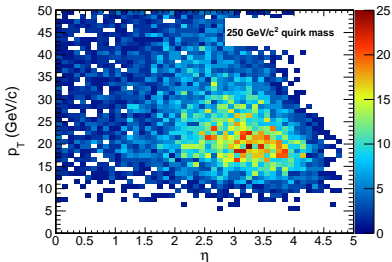
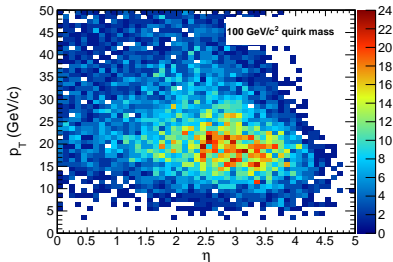
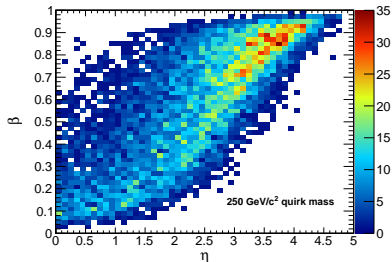
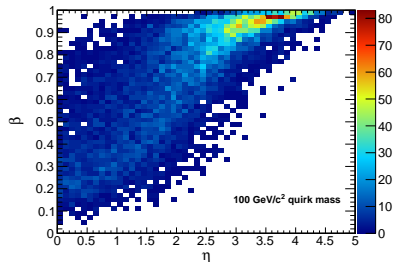
- ▶ Raw distributions (no cuts) peak at high β , but most of these events are beyond the muon system and tracker in η
- ▶ Requiring $|\eta| < 2.4$ shifts the distribution to low β , particularly for 250 GeV/c² quirks (right)
- ▶ Muon trigger β dependence applied by multiplying each bin with the plot from the previous page (assuming flat η dependence)
- ▶ It looks like we're losing a lot of $\beta < 0.5$ events to the muon trigger (though we still have 1 fb left for the 250 GeV/c² quirks)



Why the strong correlations among cuts? Jim Pivarski 5/8



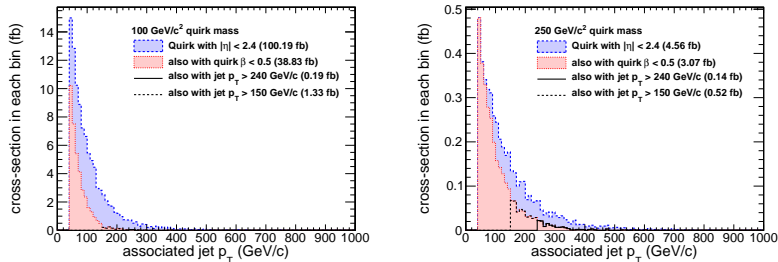
Kinematics: β has an S-shaped dependence on η because p_T is nearly flat versus η (with little dependence on quirk-pair mass)



Could a jet trigger get the rest?

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Here are distributions of the ISR jet p_T associated with the quirk-pair:



If the first unprescaled jet trigger is $p_T > 240$ GeV/c, or even $p_T > 150$ GeV/c, a jet trigger doesn't gain back much (red is $\beta < 0.5$)

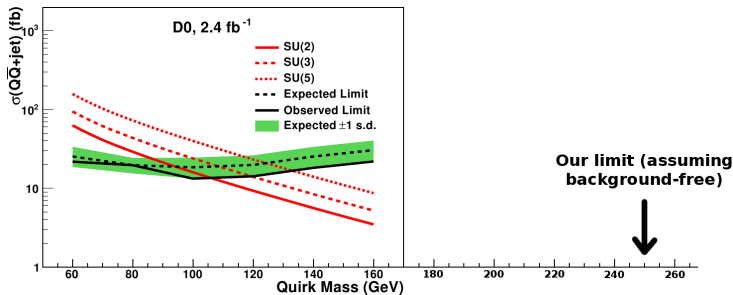
What about missing energy triggers?

The jet and the quirk-pair are back-to-back in these events (in ϕ):
no invisible particles to give us real missing energy.

Could the quirk-pair itself be fake missing energy?

Even if a no-tracking MET (e.g. CaloMET) considers the whole quirk-pair as missing energy, it only has $p_T \sim 20$ GeV/c (prev page), not enough

	100 GeV/ c^2 quirks	250 GeV/ c^2
Theoretical cross-section ($SU(2)$)	187 fb	9.6 fb
... with $ \eta < 2.4$	100 fb (53%)	4.6 fb (48%)
... matching Mu30 trigger	50 fb (26%)	1.2 fb (13%)
... and $\beta < 0.8$ (estimate of analysis cuts)	33 fb (18%)	1.0 fb (10%)
... and $ \eta < 2.0$ (unnecessary preselection?)	23 fb (12%)	0.60 fb (6%)
Expected in 3 fb^{-1} (without preselection)	99	3.0





- ▶ Using the muon trigger only would be a pretty good analysis
- ▶ No other options are evident: jets (used by DØ) are significantly below our current thresholds (at least, one cannot buy back the muon trigger losses with jets)

Other conclusions

- ▶ This model prefers high η : endcaps should be a particular focus
- ▶ “Preselection” on Chris Farrell’s slides has high, flat efficiency for $|\eta| < 2.0$, but very low efficiency outside of this range
- ▶ Perhaps I should release the preselection cuts (since the curvature constraint provides other good handles): does this imply re-skimming?

Next

- ▶ Get quirks into CMSSW (Jie Chen has pointed me in the right direction)