TOPOLOGICAL STRIPPING

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MOTIVATION

- Run the HLT2 topological trigger in the stripping when the running conditions do not require HLT2 yet
- Once the topological is deployed in HLT2, run it with tighter cuts in the stripping
- In this talk, just present the results of the DC06 Topo optimization for the Hadronic trigger scenario when run in the stripping
  - See P. Spradlin's presentation to the joint HLT-WG meeting 16th July 2009 for list of cuts

TOPOLOGICAL REMINDER

- Generic trigger for **decays into charged hadron final states** (+ muons/electrons)
- Look for 2,3 track combinations in a wide mass window (> 4 GeV)
  - The "signal" is a displaced vertex pointing back towards the PV
  - Can trigger on signal despite reflections or missed tracks

THINGS TO BEAR IN MIND

- As currently configured, the topological run in the stripping doesn't
  - select 4 body combinatorics
  - select prompt charm (mass > 4 GeV applied)
- Testing procedure (DaVinci v24r2)
  - Measure retention on MC09 minimum bias events (interpret it as a rate later)
  - Measure efficiency on L0xHLT1xOffline selected MC09 signal (thanks to P. Spradlin for the files)

RESULTS

Channel	Efficiency
Minimum bias	(0.014 ± 0.002)%
$B \rightarrow hh$	(82.9 ± 1.7)%
$B_s \rightarrow D_s K$	(77.6 ± 1.9)%
$B_d \rightarrow K^* \mu\mu$	(74.8 ± 1.9)%
$B^+ \rightarrow D^0 K^*$	(70.2 ± 2.0)%
$B^+ \rightarrow D^0 K$, $D^0 \rightarrow K_S^{LL,DD} \pi\pi$	(50.4 ± 1.1)%
$B_s \rightarrow \phi\phi$	(42.4 ± 2.2)%

SIGNAL EFFICIENCIES

- Efficiencies between 70-80% for some of the "key" channels, $\phi\phi$ and $K_s\pi\pi$ much poorer
  - This version of the topological trigger was optimized with respect to the DC06 L0xHLT1xOffline selected events
  - The L0 and HLT1 are much softer in MC09
- We could probably gain some efficiency from reoptimizing as is being done for HLT2
- The main advantage of the topological approach is that a common stripping makes understanding the data easier; especially important early on.

RUNNING SCENARIOS

- Stolen from Ulrik's talk on 18th August

LHC scenario	Low	Low	Low	Low	Mid	High	High	High
Bunches: LHCb/Total	1/ 2	19/ 43	19/ 43	68/ 156	68/ 156	468/ 468	468/ 468	468/ 468
$\nu(\sigma^{\mathrm{Tot}}$ =93.90 mb)	0.20	0.20	1.00	0.20	1.00	0.50	1.00	1.34
Rates (kHz)								
bb-xings	11.2	213.7	213.7	764.7	764.7	5263.0	5263.0	5263.0
eb,be-xings	11.2	269.9	269.9	989.6	989.6	0.0	0.0	0.0
ee-xings	40057.5	39596.4	39596.4	38325.7	38325.7	34817.0	34817.0	34817.0
xings MC-Mbias	2.0	38.7	135.1	138.6	483.4	2070.8	3326.9	3884.9
Maximum L (10^{31})	0.002	0.046	0.228	0.163	0.814	2.802	5.605	7.511
Visible xings (kHz)	1.2	22.1	89.9	79.2	321.9	1258.0	2215.3	2732.0
% single pp-vis	94.6	94.6	75.2	94.6	75.2	87.0	75.2	67.8
μ/vis (σ^{μ} =51.30 mb)	1.06	1.06	1.30	1.06	1.30	1.14	1.30	1.41
L0-rate (kHz)								
L0-μ (0.8 GeV)	0.028	0.539	2.688	1.930	9.619	33.168	66.205	88.583
L0-hadron (2.5 GeV)	0.149	2.828	13.912	10.120	49.789	173.145	342.668	455.579
L0-e (1.5 GeV)	0.063	1.197	5.943	4.283	21.269	73.514	146.382	195.508
L0-γ (1.5 GeV)	0.041	0.787	3.917	2.816	14.018	48.379	96.479	129.003

- Consider 3 visible crossing rates (5x5 TeV):
  1. 90 kHz
  2. 320 kHz
  3. 1.3 MHz

RUNNING SCENARIOS (2)

- In all three cases we assume the trigger as a whole (L0+HLT) is 100% efficient on events passing the stripping and offline selections
- For **90 kHz** of visible crossings retain 13 Hz with the topological stripping ➔ Fine!
- For **320 kHz** retain 45 Hz ➔ Still fine!
- For **1.3 MHz** retain 180 Hz ➔ Not so fine...
  - ➢ Could run a tighter topo configuration for data mining and robustness alongside the exclusive stripping selections.

CONCLUSIONS

- In the “hadronic” DC06 configuration, the topological stripping retains about 0.014% of the MC09 minimum bias
- 70-80% efficiencies on “key” channels (with some exceptions)
- Run alongdside the HLT2 topological as long as the visible interaction rate is < 1 MHz
  - Maybe even afterwards as a high bbar purity (50%) data mining stream
- Need to study the impact of the ongoing reoptimization of the HLT2 topological on the cuts used and adjust accordingly.