



# Trigger Bandwidth Division for 2015 run

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# Outline

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# Procedure

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- Optimise the efficiency after L0
- Obtain the maximum efficiency for each channel individually
- Minimise:

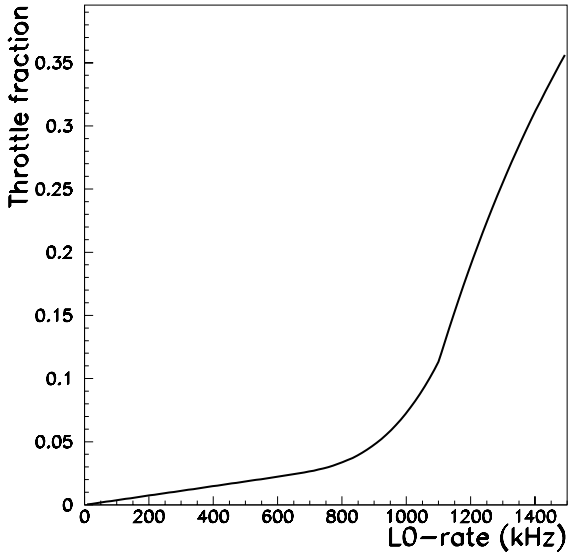
$$\chi^2 = \sum_{\text{channels}} \sum_{\text{lines}} \left(1 - \frac{\epsilon_{\text{channel\&line}}}{\epsilon_{\text{max}}}\right)^2, \quad (1)$$

- Throttle: max output rate + function to deal with the Beetle and RICH constraints  
Beetle bug: effectively the fifo buffer is not 16 deep as the administration bits are stored in it too  
RICH bug: cannot read two consecutive events



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# Maximum Efficiencies

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Running on 2015 MC samples (see twiki)

Event type	Channel	Nb of events	Max Eff (L0 only)	Throttle
13112001	Bs2MuMu	31239	0.92	0.03
13144001	Bs2JpsPhi	21207	0.87	0.035
11114001	B2KstMuMu	24149	0.86	0.036
11874004	B2Dmu antinu	22471	0.66	0.056
13774002	Bs2Dsmu antinu	24723	0.62	0.072
11124001	Bd2Kstaree	25245	0.56	0.092
11102003	B02Kpi	28169	0.38	0.097
12103035	Bplus2KKPi	24273	0.34	0.11
13264021	Bs2Dspi	21899	0.32	0.11
12165106	Bplus2DK	25101	0.29	0.11
21263002	D2KKpi	23568	0.18	0.11



# Optimised Efficiencies

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Event type	Channel	Nb of events	Eff (L0 only)	Throttle
13112001	Bs2MuMu	31239	0.79	0.11
13144001	Bs2JpsPhi	21207	0.69	0.11
11114001	B2KstMuMu	24149	0.67	0.11
11874004	B2Dsmu antinu	22471	0.44	0.11
13774002	Bs2Dsmu antinu	24723	0.38	0.11
11124001	Bd2Kstaree	25245	0.19	0.11
11102003	B02Kpi	28169	0.29	0.11
12103035	Bplus2KKPi	24273	0.25	0.11
13264021	Bs2Dspi	21899	0.24	0.11
12165106	Bplus2DK	25101	0.21	0.11
21263002	D2KKpi	23568	0.12	0.11

Minimum Bias eff: L0mu: 0.37 / L0had: 0.58 / L0ecal: 0.15



# L0 Thresholds

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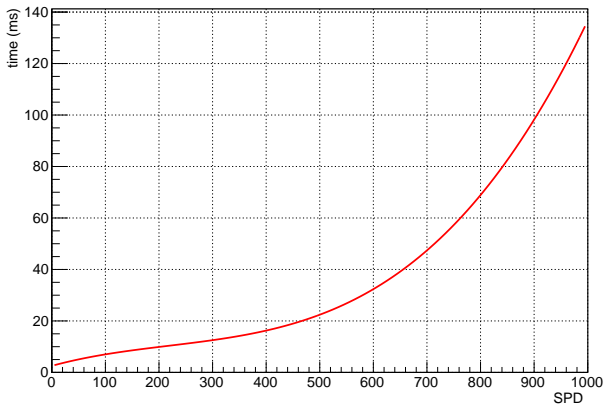
L0Channel	Threshold (ADC)
L0Electron	200
L0Photon	200
L0Hadron	210
L0Muon	60
L0DiMuon	950



# Optimisation using a CPU time limit

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Using a function to give the HLT time per event given a number of SPD hits







# L0 Thresholds

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Set the maximum time as 20% of the time obtained with the thresholds of page 7.

L0Channel	Threshold (ADC)
L0Electron	170
L0Photon	170
L0Hadron	210
L0Muon	60
L0DiMuon	940
SPD mu, had, ele	480
SPD dimu (fixed)	900



# Optimised Efficiencies

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Event type	Channel	Nb of events	Eff (L0 only)	Throttle
13112001	Bs2MuMu	31239	0.80	0.10
13144001	Bs2JpsPhi	21207	0.70	0.10
11114001	B2KstMuMu	24149	0.68	0.10
11874004	B2Dmuantinu	22471	0.44	0.10
13774002	Bs2Dsmuantinu	24723	0.38	0.10
11124001	Bd2Kstaree	25245	0.24	0.10
11102003	B02Kpi	28169	0.27	0.10
12103035	Bplus2KKPi	24273	0.24	0.10
13264021	Bs2Dspi	21899	0.23	0.10
12165106	Bplus2DK	25101	0.21	0.10
21263002	D2KKpi	23568	0.11	0.10

Minimum Bias eff: L0mu: 0.36 / L0had: 0.53 / L0ecal: 0.19



# Giving 4 times the weight to Kstee

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Event type	Channel	Nb of events	Eff (L0 only)	Throttle
13112001	Bs2MuMu	31239	0.73	0.08
13144001	Bs2JpsPhi	21207	0.58	0.08
11114001	B2KstMuMu	24149	0.57	0.08
11874004	B2Dsmu antinu	22471	0.29	0.08
13774002	Bs2Dsmu antinu	24723	0.23	0.08
11124001	Bd2Kstaree	25245	0.45	0.08
11102003	B02Kpi	28169	0.20	0.08
12103035	Bplus2KKPi	24273	0.17	0.08
13264021	Bs2Dspi	21899	0.16	0.08
12165106	Bplus2DK	25101	0.14	0.08
21263002	D2KKpi	23568	0.06	0.08

Minimum Bias eff: L0mu: 0.23 / L0had: 0.30 / L0ecal: 0.56



# L0 Thresholds

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L0Channel	Threshold (ADC)
L0Electron	117
L0Photon	117
L0Hadron	250
L0Muon	112
L0DiMuon	1440
SPD mu,had,ele	530
SPD dimu (fixed)	900



# Conclusions

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- old standard L0 optimisation working again to get benchmark values
- will evolve to the new system with a genetic algorithm running on the pit
- bw-div twiki:  
<https://twiki.cern.ch/twiki/bin/view/LHCb/BWDivision>