Status of the L0 Trigger Performance

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- L0 performance in the last MC production
- Re-tuning of the L0 E_T thresholds
- Re-tuning of the Pile-up Veto (from Marko Zupan)
- Outlook and future plans

L0 Performance in the Last Production

General observations:

▷ Current L0 E_T thresholds in Brunel v13r1 are slightly too high $\rightarrow$ the L0 "under-performs", since only about 4.5% of minimum bias events are accepted at L0, which corresponds to an output rate of 670 kHz (design at 1 MHz)

▷ The re-tuning of the thresholds allows to recover most of the rate

▷ The pile-up veto is to a large extent responsible for a reduction of the output rate:

- it now rejects 16% of minimum bias events compared to 11% as of Dec. 2001.
- it rejects $\approx$ 30-40% of events in main signal channels

BUT it still performs well in rejecting multiple-interaction events: the ratio (L0-accept for Pile-up vetoed events)/(L0 "single" accept rate) is rather constant and ≈ 2 (see tables further...)

▷ The re-tuning of the pile-up veto is necessary

RE-TUNING OF THE L0 E_T THRESHOLDS

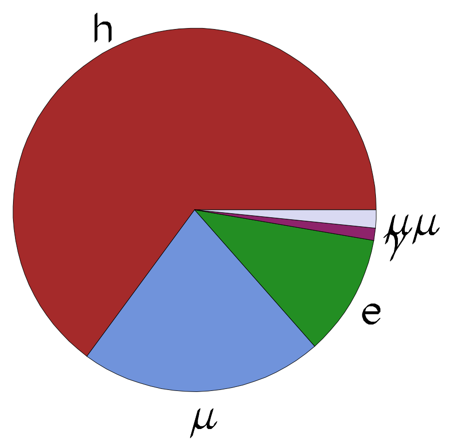
⇒ **Re-tuning to a L0 output rate of 1 MHz**

- NOTE: re-tuning based on minimum bias events **keeping the bandwidth division fixed** (BW division study to be done ...)

▶ Comparative studies with samples of minimum bias and $B_d \to \pi\pi$ events

√ Database v248r4, Brunel v13r1 (summer production)

√ Database v243r1 (Dec. 2001)



Bandwidth division h:μ:e:γ:$\mu\mu$ = 6:2:1:0.1:0.15

Comparison of L0 Rates

Rates for Minimum Bias Events

	DB v243r1 (12/2001)	DB v248r4 (summer 2002)	retuning 1 MHz
$\sum E_T$ veto$^{(1)}$	45.8	47.4	47.4
Pile-up veto$^{(1)}$	10.7	15.9	16.2
L0-accept for Pile-up vetoed events$^{(2)}$	25.8	17.7	30.1
% events accepted by pile-up veto and $\sum E_T$ cut	43.5	36.7	36.4
L0 total accept rate	6.07	4.5	6.5
L0 "single" accept rate$^{(3)}$	14	12.3	17.7

- The pile-up veto over-rejects with present algorithm
- BUT it still performs well in rejecting multiple-interaction events: the ratio (L0-accept for Pile-up vetoed events)/(L0 "single" accept rate) is rather constant and ≈ 2

$^{(1)}$ $\sum E_T$ / Pile-up veto : % events rejected by $\sum E_T$ cut / Pile-up veto

$^{(2)}$ % of the events "pile-up vetoed" that otherwise would pass L0

$^{(3)}$ % events classified as single interaction by pile-up veto, that pass L0

Comparison of L0 Rates (II)

NOTE: no offline selection applied !

Rates for $B_d \to \pi\pi$ Events			
	DB v243r1 (12/2001)	DB v248r4 (summer 2002)	retuning 1 MHz
$\sum E_T$ veto	1.0	1.1	1.1
L0-accept for $\sum E_T$ vetoed events	4.9	5.0	5.5
Pile-up veto	29.2	39.1	40.7
L0-accept for Pile-up vetoed events	57.5	47.9	64.8
% events accepted by pile-up veto and $\sum E_T$ cut	69.7 (76.2[*])	59.8	58.3
L0 total accept rate	33.5 (58.0[*])	27.0	33.0
L0 "single" accept rate	48.1 (76.1[*])	45.2	56.6

- $\approx$ 40% events rejected
- re-tuning recovers the rate

[*] same numbers for offline-selected events

Comparison of L0 E_T Thresholds

L0 $\mathrm{E_T}$ Thresholds (GeV)			
	DB v243r1 (12/2001)	DB v248r4 (summer 2002)	retuning 1 MHz
μ P_T cut	0.795	0.61	0.462
electron E_T cut	2.712	2.65	2.403
γ E_T cut	5.006	3.82	4.991
hadron E_T cut	4.469	3.95	3.182
$\sum P_T(\mu\mu)$ cut	5.024	1.83	4.013

TO BE USED in next Brunel version ...

Conclusions:

- ▷ Some thresholds changed significantly (e.g. μ cuts), but:
  - the origins are understood
  - changes will occur with the new BW division (under way ...)
- ▷ A best and efficiency-aimed re-tuning of the L0 trigger should be made in conjunction with the re-tuning of the E_T thresholds and the pile-up veto
- ▷ **The next Brunel will use these re-tuned L0 E_T thresholds**
- ▷ At present one can re-run the L0 Decision Unit in DaVinci ...

Re-tuning of the Pile-up Veto

(from Marko Zupan)

% min. bias events accepted by pile-up veto		
	Before	Now
"good" 1-vertex events	96	91
2-vertex events[*]	74	67
3-vertex events[*]	54	45
4-vertex events[*]	30	17

- performance roughly as before (in rejecting multiple-vertices events)

- Re-tuning of the algorithm in progress ...

(*) multiple-vertices events can still have vertices not seen by the detector
$\Rightarrow$ event still OK, even with multiple vertices.

Outlook and future plans

L0 algorithm being studied on different fronts:

- ▷ Pile-up veto re-tuning under way
- ▷ Bandwidth division study starting
- ▷ L0 E_T thresholds will then be re-tuned also including the π^0 triggers