L0 Bandwidth Division Update

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- Physics channels under study and set-up
- Pile-up veto and L0 efficiencies
- Di-muon trigger and L0 efficiencies
- Offline selection and L0 efficiencies
- Status of the L0 bandwidth division

Physics Channels and Set-up

Physics channels studied:

$B_s \to J/\Psi(\mu\mu)\ \phi\ (KK)$ $\qquad$ $B_s \to J/\Psi(ee)\ \phi\ (KK)$

$B_d \to \pi\ \pi$ $\qquad$ $B_d \to K\ K$

$B_s \to D_s(KK\pi)\ K$ $\qquad$ $B_s \to D_s(KK\pi)\ \pi$

$B_d \to K^*\ \gamma$

- ✓ only for true single interaction events for signal channels
- ✓ all minimum bias events

Procedure for the L0 bandwidth division:

- ➢ keep always a fixed L0 output rate of 1 MHz on minimum bias events

  For each physics channel …
  - vary the parameter space of the different L0 thresholds (1 per sub-trigger + veto)
  - find point(s) of highest L0 efficiency (wrt offline selected events)
- ➢ determine point where the sum of the relative losses per channel is minimum overall

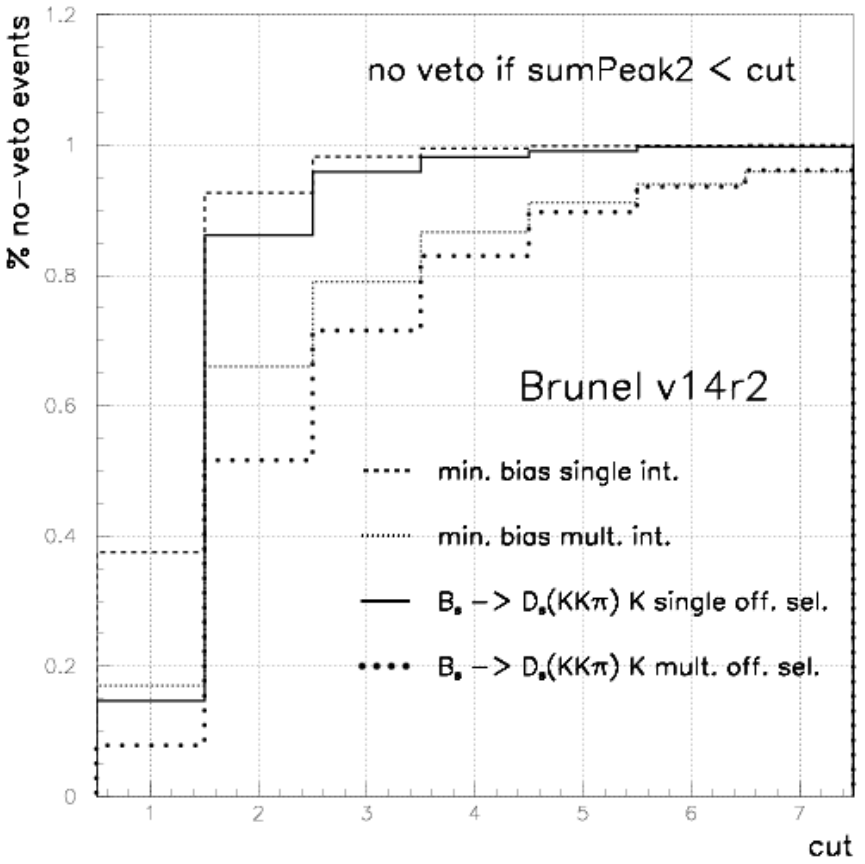
Pile-up Veto Scenarios

Pile-up veto helps selecting:

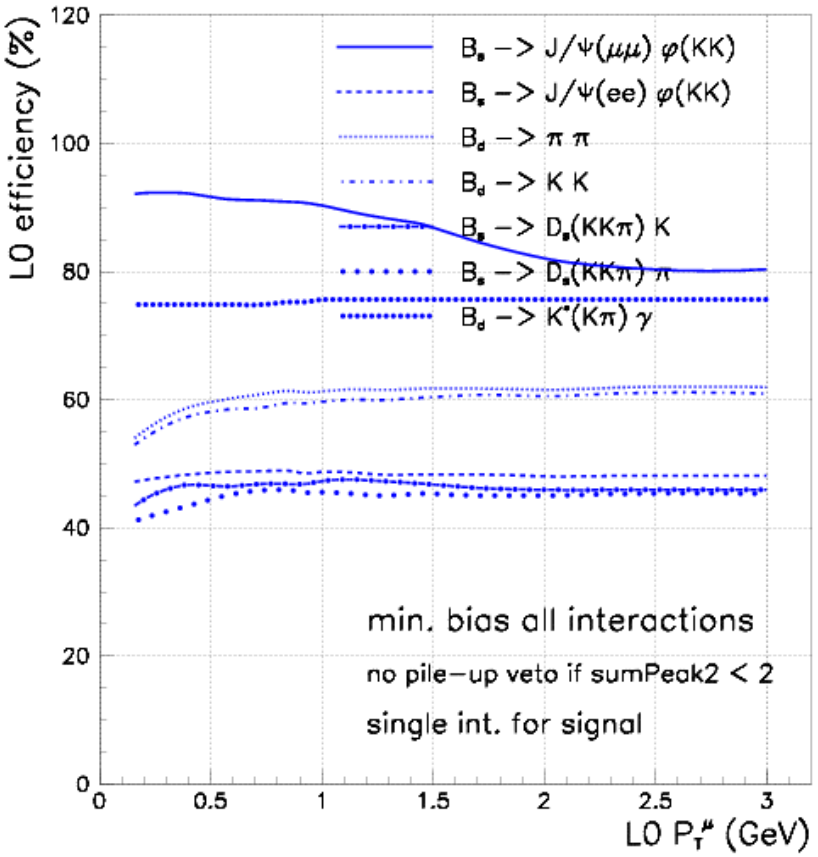
- preferentially single interaction events
- less complicated events

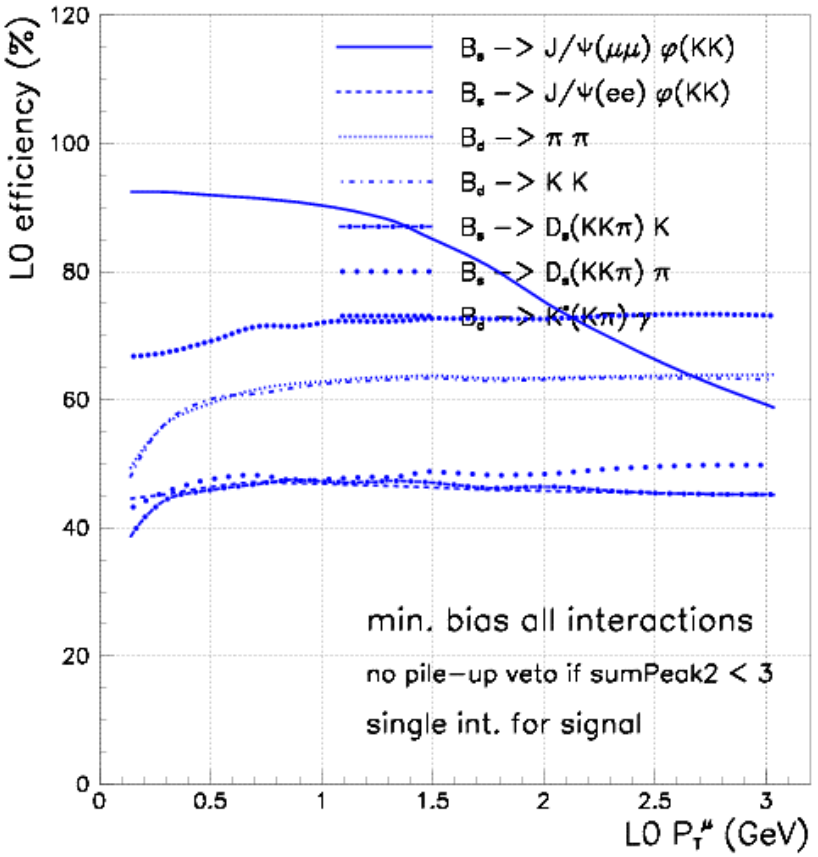
It was concluded (reminder):

- pile-up veto helps increasing the L0 efficiencies on (most) signal events (it allows to decrease the thresholds)
- cut at sumPeak2 of 2 is preferred by some hadronic channels
- cut at sumPeak2 of 3 is preferred by $J/\Psi\,\phi$ channels



L0 Efficiencies with no Pile-up Veto if sumPeak2 < 2,3





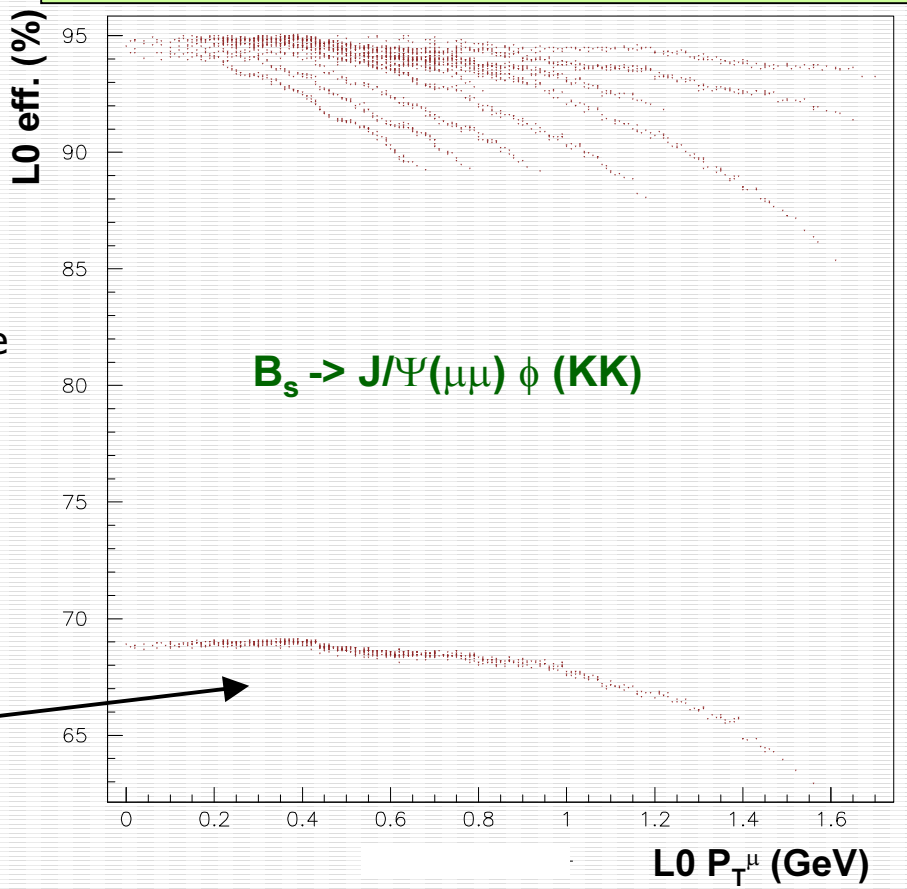
Di-muon Trigger and L0 Efficiencies

It was concluded (reminder):

- di-muon trigger has clear impact on the B_s -> J/$\Psi(\mu\mu)$ ϕ (KK) channel
- by decreasing the di-muon threshold one can use a harder pile-up veto (cut on sumPeak2 at 2), and recuperate some loss in efficiency (a softer cut at 3 is preferred for this channel but not by some hadronic channels)

No di-muon trigger!

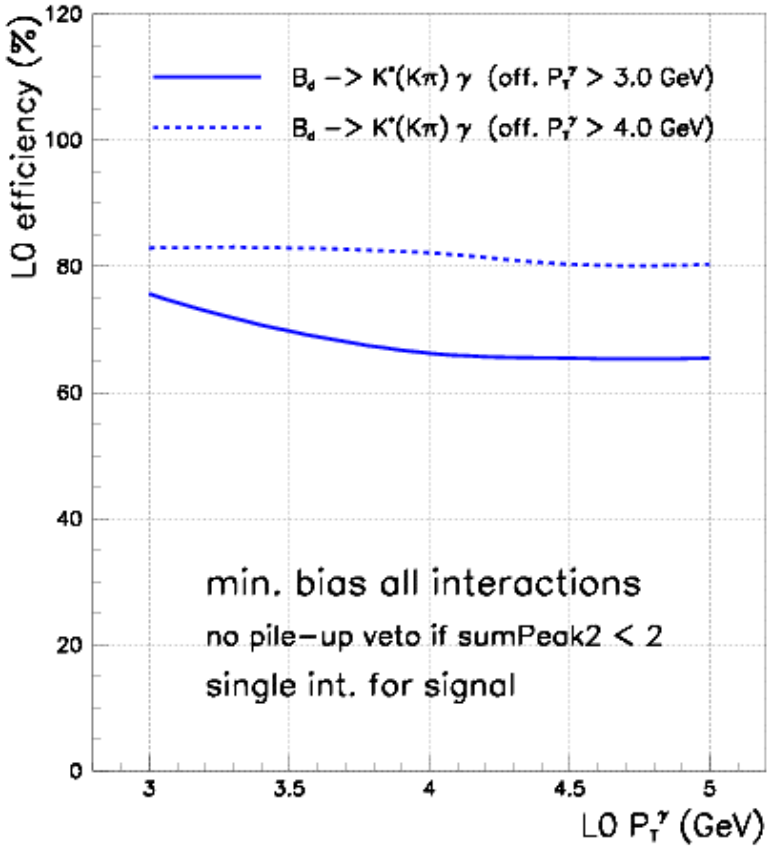
Each point is a different bandwidth division

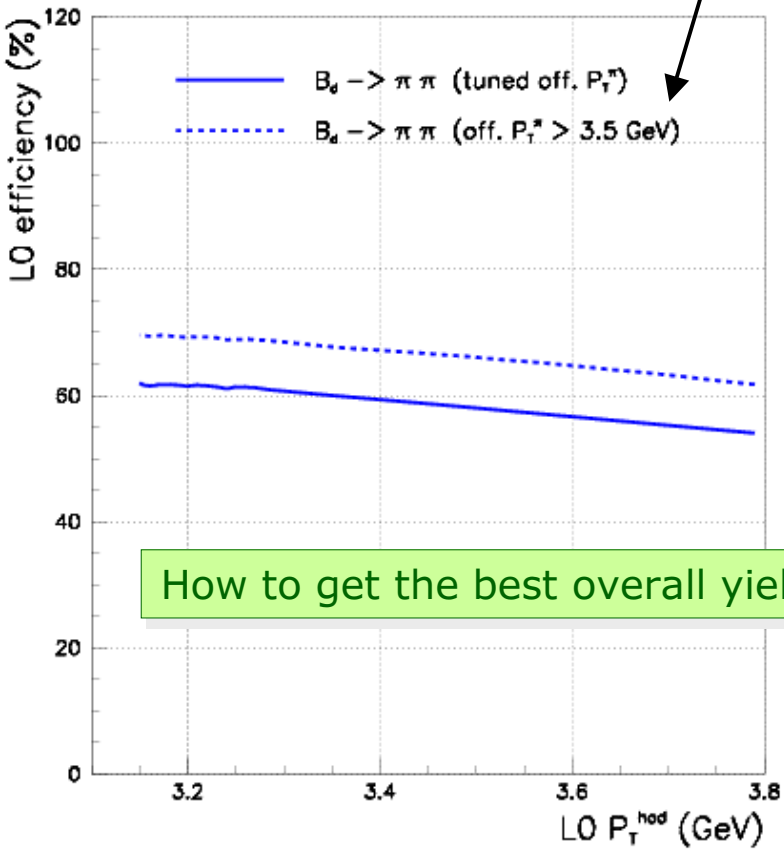


Offline Selection and L0 Efficiencies

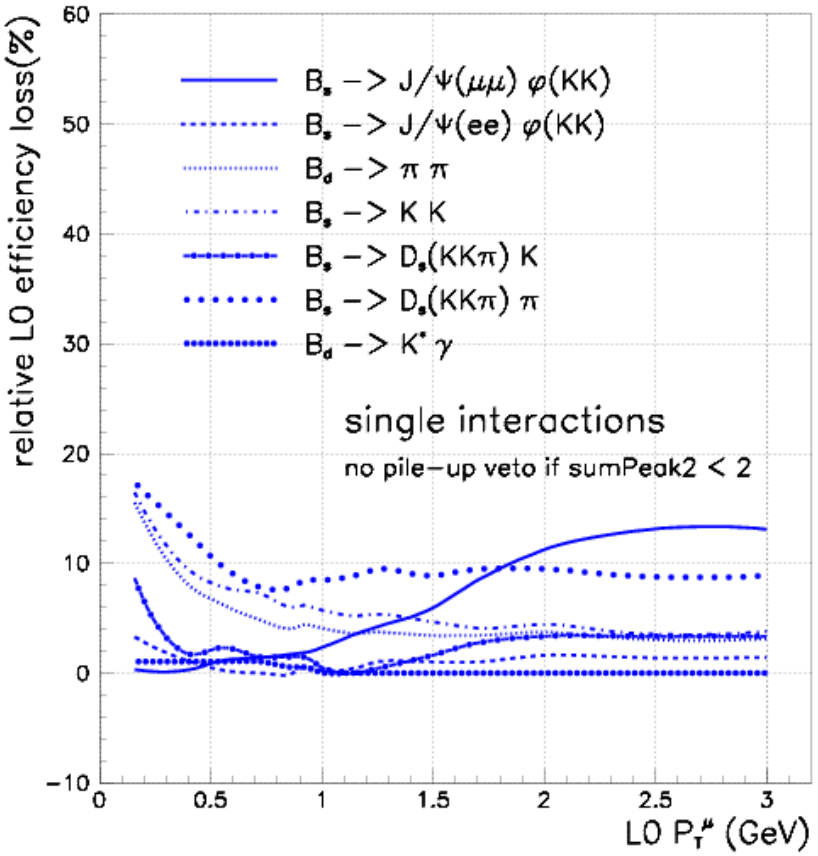
between offline selection and L0 efficiency…

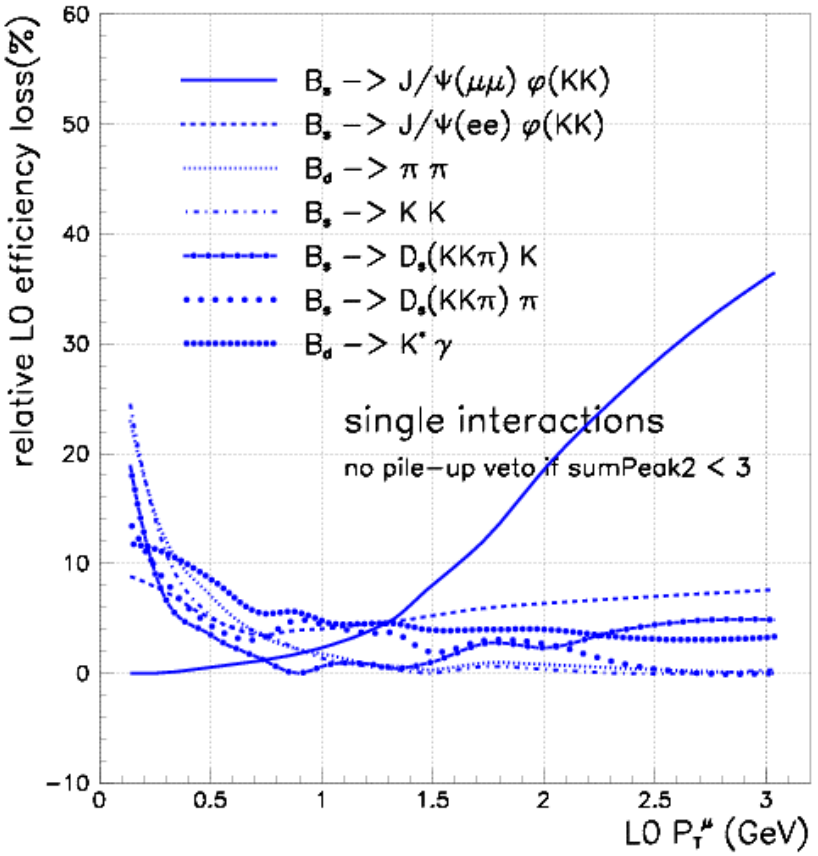
as @ time of TP





Bandwidth Division – Status (I)





Bandwidth Division – Status (II)

Situation at present:

- Tuning was done on (true) single int. events …
- cut on the 2nd pile-up veto peak chosen at 2

L0 trigger	E_T^{had}	E_T^{μ}	E_T^{e}	E_T^{γ}	$E_T^{\mu\mu}$	π^0_{global}	π^0_{local}
Thresholds (GeV)	3.23	0.92	2.85	3.0	2.5	4.1	4.6

L0 eff. (%)	$\pi\,\pi$	KK	$J/\Psi(\mu\mu)\,\phi$	$J/\Psi(ee)\,\phi$	$D_s\,K$	$D_s\,\pi$	$K^*\,\gamma$
true singles	65	60	91	49	47	46	76
all int.	55	51	89	42	41	-	66

… how will the situation change when looking at single events *visible* in the detector?

➡ pile-up veto will tend to be "softer"?

➡ and if one wants to select multiple interactions as well?

Outlook and Future Plans

- L0 bandwidth division and tuning studies progress along with improvements on the B-physics selections
- **L0 efficiencies are now at the level of the TP (for most channels)**
- **BwD tuning done up-to-now on (true) single interaction events … tuning on all signal events is under way …**
- **Also starting to look at visible singles rather than true singles (in vue of the results on the annual yields to be presented to the LHCC)**

➔ Open questions to investigate:

1) pile-up veto ⇔ visible singles / multiple interactions
2) 75ns versus 25ns running ⇔ L0 robustness / losses in efficiency
3) "the question": what is the best L0 scenario to maximize the total B-yield?