Trigger behaviour on B_s->$K^{*}_{0}K^{*}_{0}$ and B_s->$\Phi\Phi$

Outlook:

- Reminder of the hadron alley
- Soft dihadron alley
- Results for Hlt1
- Results for Hlt2
- Conclusions

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B_s->$K^{*}_{0}K^{*}_{0}$ group meeting

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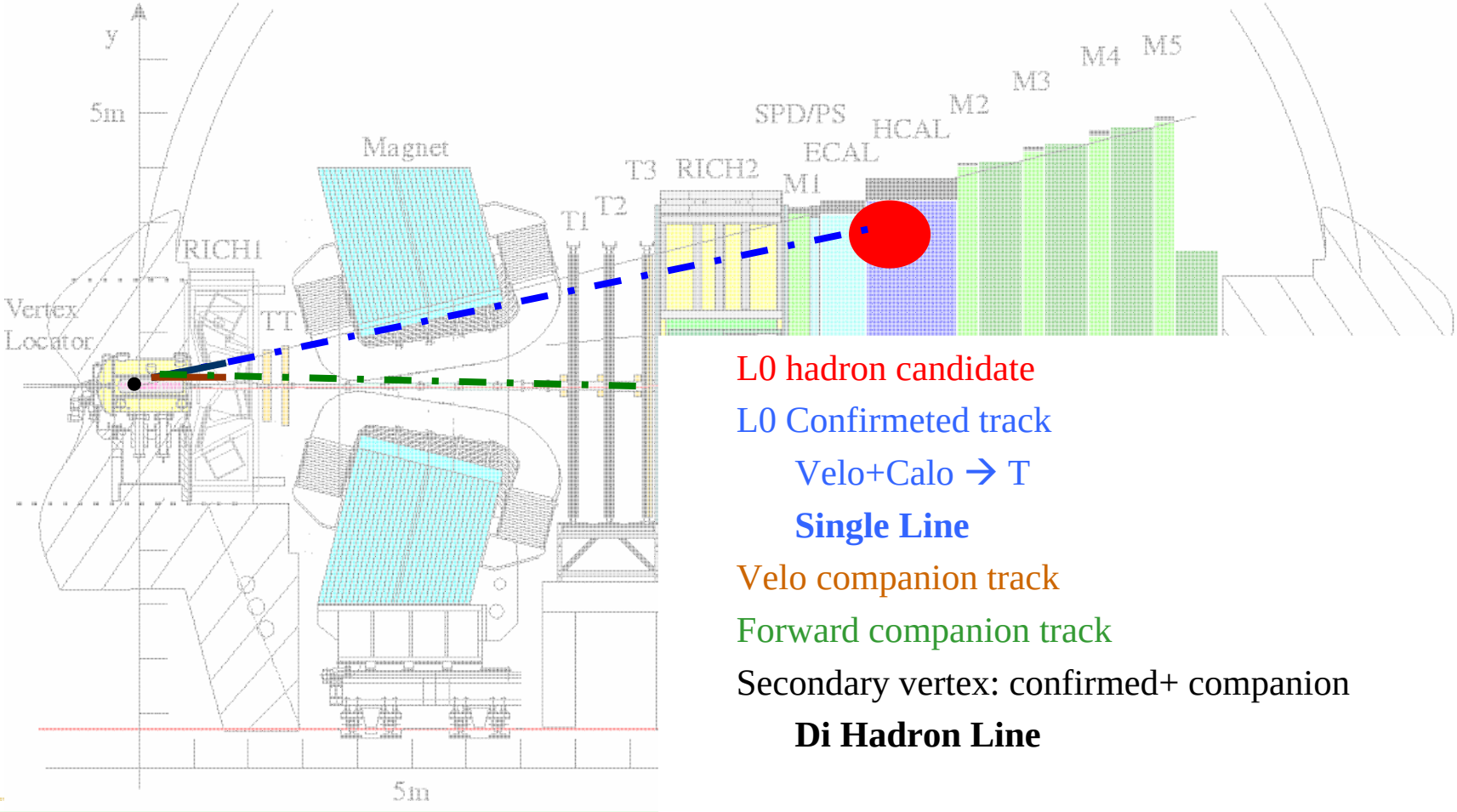
Hadron Alley: Single and Di Hadron Lines



L0 hadron candidate

L0 Confirmeted track

Velo+Calo → T

Single Line

Velo companion track

Forward companion track

Secondary vertex: confirmed+ companion

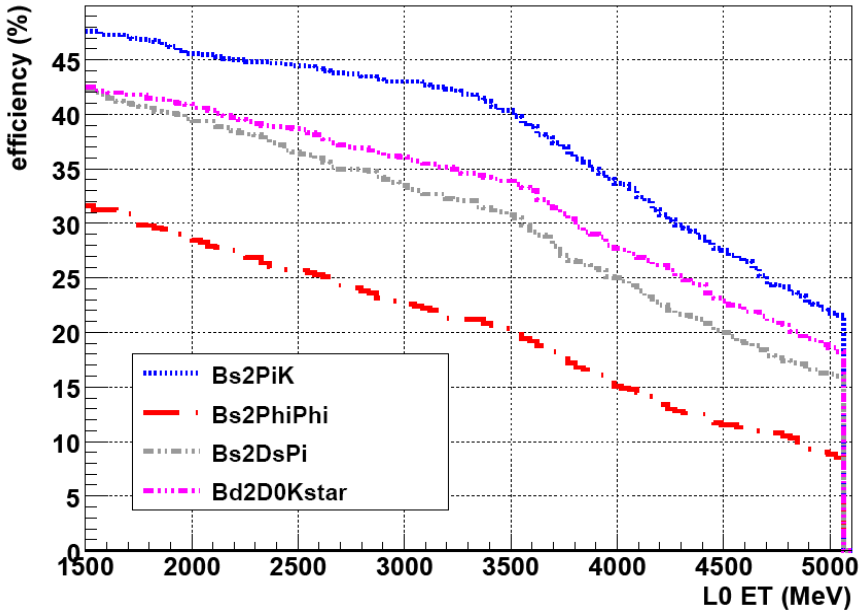
Di Hadron Line

Soft dihadron alley

Introduction of **FastFit** on trigger allows rate reduction => cuts could be relaxed!

Fastfit candidade tracks cut on chi2 and reapply cuts, better IP resolution kills lots of ghosts

- L0 TOS on signal is 20-40% of L0!
  - Bs→ΦΦ 34% L0, 19% L0 TOS
- There usually exists a L0 calo TOS below L0 ET threshold
- So, start with L0 calo seeds with a lower ET
  - i.e L0 yes & L0ET hadron seed > 2.5 GeV
- Lower PT cut on confirmation
  - i.e PT>1500 MeV



L0 TOS efficiency vs L0 ET seed

* Note: **TOS** = Trigger on signal, we've applied trigger on our offline selected candidate (daughters of K*0,Φ). Trigger strategy based in principle on following these.

Results for Hlt1

Starting point →

	GLOBAL EFFICIENCIES - L0	
	L0	L0Hadron
B_s->$K^*_0K^*_0$	42.2	33.2
B_s->$\phi\phi$	34.7	24.6

	GLOBAL EFFICIENCIES - HLT1			
	Hlt1+L0	Hlt1SingleHadron+L0	Hlt1DiHadron+L0	Hlt1SoftDiHadron+L0
B_s->$K^*_0K^*_0$	30.3	11.7	19.8	26.8
B_s->$\phi\phi$	22.1	5.0	12.4	18.9

	EFFICIENCIES - HLT1 with respect to L0			
	Hlt1	Hlt1SingleHadron	Hlt1DiHadron	Hlt1SoftDiHadron
B_s->$K^*_0K^*_0$	71.8	27.7	47.0	63.4
B_s->$\phi\phi$	63.8	14.4	35.7	54.5

- Hlt1 version from **DaVinci v22r3.**
- Results with respect to available DaVinci preselection on $K^*_0K^*_0$ and official preselection for $\Phi\Phi$. Denominator for efficiencies.
- As expected, most of triggers come from DiHadron alley.
- Perfect examples of necessity to implement Soft DiHadron alley!
- $K^*_0K^*_0$ behaving a bit better than $\Phi\Phi$ for Hlt1.

Results for Hlt2

	HLT 2 - EFFICIENCIES (%)			
	Hlt2+Hlt1+L0	Hlt2 with respect to Hlt1+L0	Hlt2+DiHadron+L0	Hlt2+SoftDiHadron+L0
$Bs->K^*_0K^*_0$	26.5	87.4	18.0	23.9
$Bs->\phi\phi$	21.2	95.7	12.1	18.3

>33%!

	TOPO - EFFICIENCIES		
	Topo with respect to Hlt1+L0	Topo with respect to Dihadron+L0	Topo with respect to Soft DiHadron+L0
$B_s->K^*_0K^*_0$	83.3	88.3	85.8
$B_s->\phi\phi$	84.2	92.3	87.8

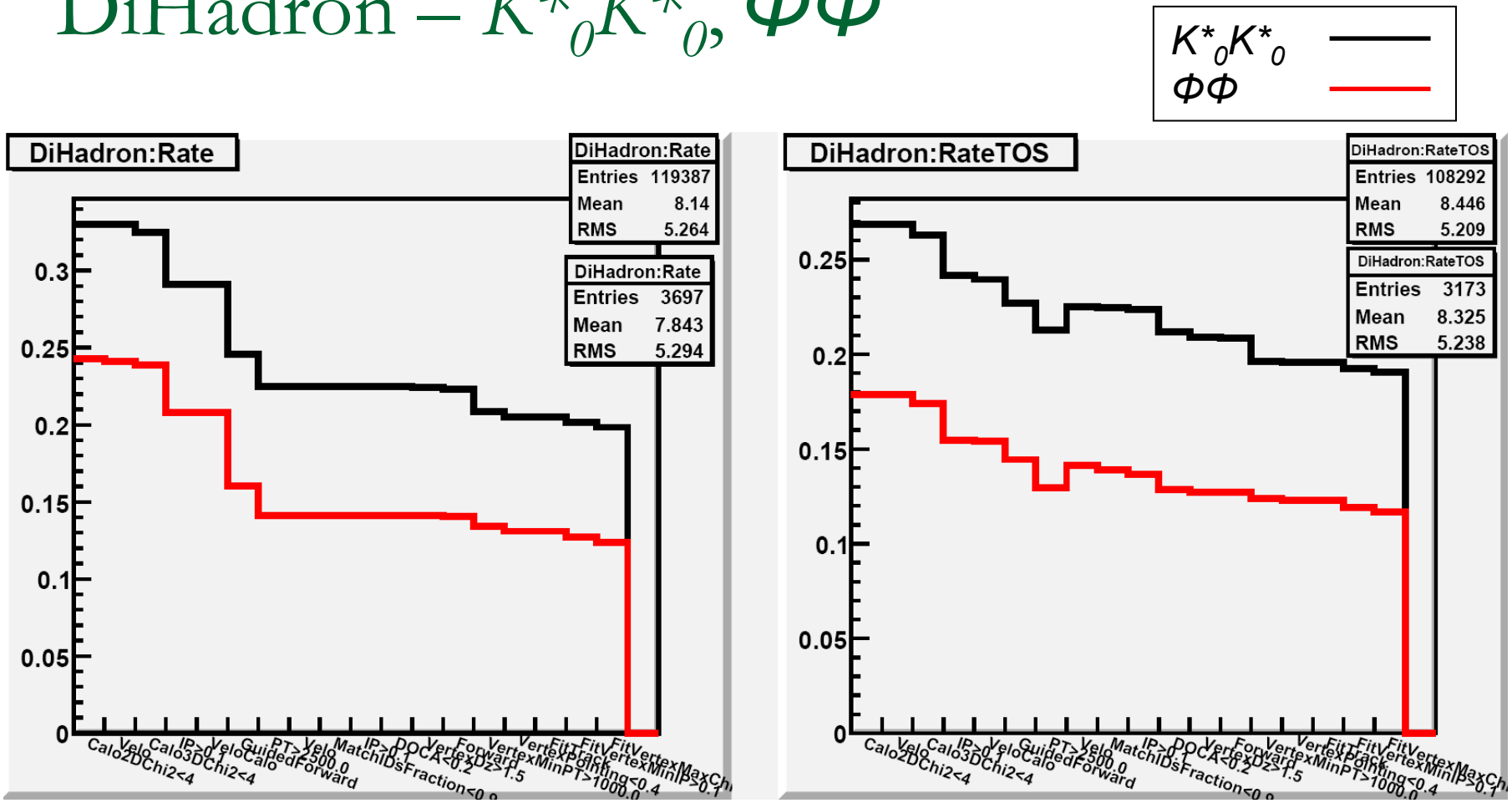
- Hlt2 version from DaVinci v22r3
- Hlt2 eficiencient. Mainly thanks to Hlt2 topological,
  - **Hlt2 topological**: look for 2,3,4 generic track combinations in a wide mass window. Can trigger on signal despite reflections or missed tracks. Very inclusive selection.
  - Hlt2 topological efficient both for $K^*_0K^*_0$ and $\Phi\Phi$, yet more for DiHadron candidates than for **Soft** DiHadron's. Needs adaptation!

Conclusions

- Soft DiHadron alley included to deal with channels with small Hlt1 efficiency. Makes use of rate reduction from use of fastfit. Rise on global trigger efficiency of >33% for $K^*_0K^*_0$ and $\Phi\Phi$.
- Hlt1+L0 26% efficient on $K^*_0K^*_0$ when Soft DiHadron alley applied. If not, efficiency goes to less than 20%.
- Hlt2 ~90% efficient with respect to Hlt1.
- Hlt2 topological selection responsible for triggering on most of cases. Expected to work even better when adapted to Soft DiHadron (as it does with DiHadron)
- Can quote global trigger (with SoftDiH) eficiency of
  - 27% for $K^*_0K^*_0$
  - 21% for $\Phi\Phi$

Backup

Results for Hlt1 (without L0)
DiHadron – $K^*_0K^*_0$, $\Phi\Phi$



Results for Hlt1 (without L0)
Soft DiHadron – $K^*_0K^*_0$, $\Phi\Phi$