

Tracking and physics performance on $B \rightarrow hh$ with a simplified geometry

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Outline

- ▶ Fast Geometry

A fast test

- ▶ Using machinery from $B \rightarrow hh$ misalignment studies:
Run Brunel v32r2 and DaVinci v19r9 on 20k $B \rightarrow \pi\pi$ events
- ▶ Fast geometry uses largely simplified description of material in LHCb
- ▶ Test performance (without misalignments) compared to detailed geometry
- ▶ Use option file from Stefanie
...MaterialLocator =
SimplifiedMaterialLocator
- ▶ Timing:
2934 ms/evt (std), 1968 ms/evt (fast) on 2.8GHz Xeon

Effects on pattern recognitions

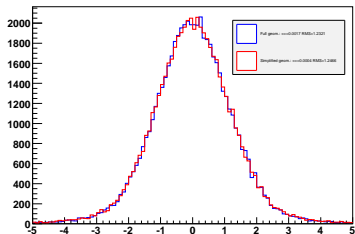
- ▶ Pattern recognition efficiencies quoted are for all long tracks
- ▶ Numbers in brackets are uncertainties on last digit

geometry	VeloR	VeloSpace	Forward	Match	N_{sel}
standard	0.9803(9)	0.9703(8)	0.859(2)	0.811(2)	4141
fast	0.9803(9)	0.9703(8)	0.859(2)	0.814(2)	4186

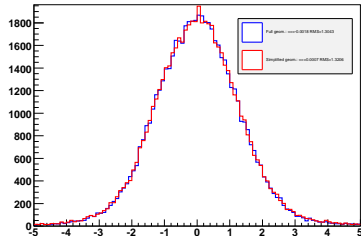
- ▶ Pattern recognition efficiencies (almost) not changed at all
- ▶ Slight increase in number of selected events

Tr/TrackCheckers PatForward long tracks

Track/CheckLongTrack/PatForward/firstMeas/x pull



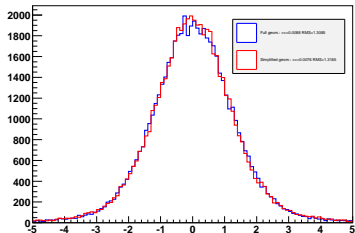
Track/CheckLongTrack/PatForward/firstMeas/y pull



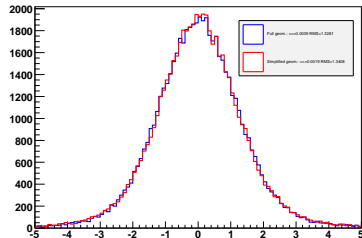
- ▶ x, y pull at first measurement

Tr/TrackCheckers PatForward long tracks

Track/CheckLongTrack/PatForward/firstMeas/tx pull

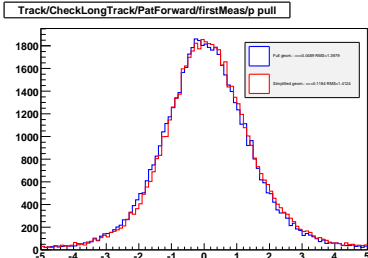
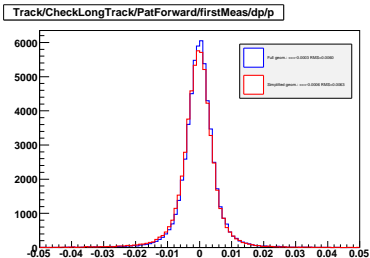


Track/CheckLongTrack/PatForward/firstMeas/ty pull



- tx , ty pull at first measurement

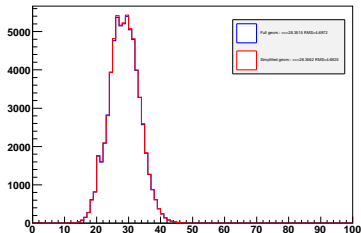
Tr/TrackCheckers PatForward long tracks



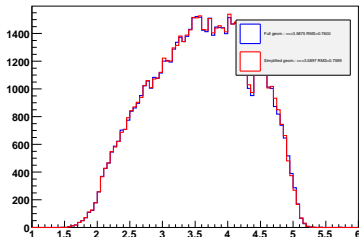
- ▶ Momentum resolution and pull at first measurement
- ▶ Slight increase in bias 0.05 (std) \rightarrow 0.12 (fast)
- ▶ RMS of resolution 0.0060 (std) \rightarrow 0.0063 (fast)

Tr/TrackCheckers PatForward long tracks

Track/EffLong/PatForward/real/meas



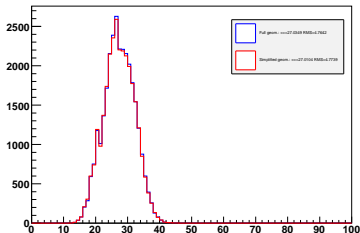
Track/EffLong/PatForward/real/eta



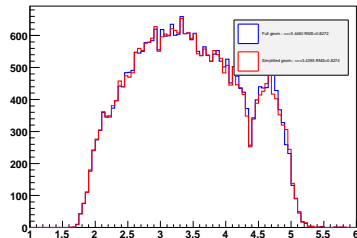
- ▶ Number of measurements per track (left)
- ▶ Reconstructed tracks vs eta (right)

Tr/TrackCheckers TrackMatching long tracks

Track/EffLong/TrackMatching/real/meas



Track/EffLong/TrackMatching/real/eta



- ▶ Number of measurements per track (left)
- ▶ Reconstructed tracks vs eta (right)

Resolutions in numbers

- ▶ Resolutions of standard reconstruction and 'fast geometry'
- ▶ All values quoted are single Gaussian fits to distribution for selected candidates
- ▶ Numbers in brackets are uncertainties on last digit

geometry	$\pi \sigma(p)/p$ (%)	B mass (MeV)	B $c\tau$ (fs)
standard	0.495(5)	22.5(3)	37.7(5)
fast	0.502(6)	22.9(4)	37.7(6)

- ▶ No significant degradation in resolution observed

Resolutions in numbers - II

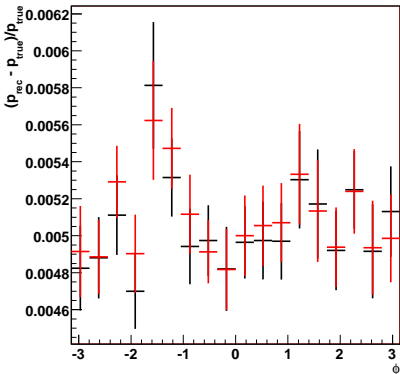
- ▶ Resolutions of standard reconstruction and 'fast geometry'
- ▶ All values quoted are single Gaussian fits to distribution for selected candidates
- ▶ Numbers in brackets are uncertainties on last digit

geometry	PV			B vertex		
	x (μm)	y (μm)	z (μm)	x (μm)	y (μm)	z (μm)
standard	9.2(1)	8.8(2)	41.4(7)	14.2(2)	14.0(2)	147(3)
fast	8.9(1)	8.8(1)	41.4(7)	14.3(2)	14.3(2)	145(3)

- ▶ No significant degradation in resolutions observed

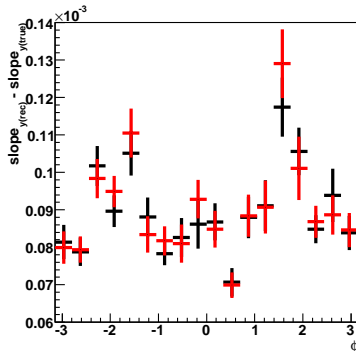
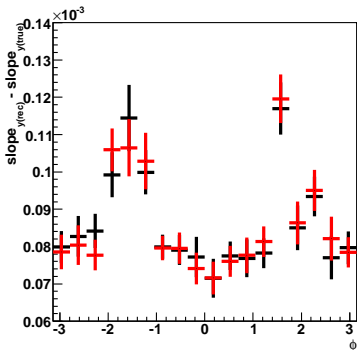
A closer look

- ▶ Due to simplifications, effects are expected as function of ϕ
- ▶ Check momentum resolution vs ϕ



- ▶ No significant deviation from standard geometry observed

A closer look - II



- ▶ Slope resolution vs ϕ
- ▶ No significant deviation from standard geometry observed

Conclusion

- ▶ Fast geometry has been tested with $B \rightarrow hh$ events
- ▶ No significant change in pattern recognition efficiency or resolution has been observed
- ▶ Small increase in bias and resolution of track momentum observed
- ▶ Slight changes in TrackMatching related numbers (e.g. vs eta)