

Vertex Charge Determination

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- Top's full hadronic decay channel (namely, $t\bar{t} \rightarrow b\bar{b}q\bar{q}'q\bar{q}'$)
- 6-jet final state
- 46% of Top decays through this channel.
- Data sets
 - /hsm/ilc/grid/storm/prod/ilc/mc-dbd/ild/dst-merged/*yyuyyc.eL.pR*.slcio
 - /hsm/ilc/grid/storm/prod/ilc/mc-dbd/ild/dst-merged/*yycyyu.eL.pR*.slcio

Problems with Vertex Measurement

Missing prongs

Fail to reconstruct prongs due to missing track information.

Missing vertex

Missing prongs affects vertex identification which leads to failure in vertex reconstruction.

Inaccurate vertex charge measurement

Without solid vertex information, it will influence b or t identification.

Vertex Restoration Process

- Securing prong candidates - Upon vertex restoration, the algorithm collects all charged particles as prong candidates. Then it will iterates through all candidates and reconstruct them as PFO.
- Check if there's any duplicates in PFOs.
- Vertex reconstruction will be done with above informations.

Pre-selection conditions

- b-tag cut
 $\text{Top1btag} > 0.8 \ \&\& \ \text{Top2btag} > 0.8$
- Chi2 cut
 $\text{chiTopMass1} + \text{chiTopE1} + \text{chiPbstar1} < 30$
 $\text{chiTopMass2} + \text{chiTopE2} + \text{chiPbstar2} < 30$
- Kinematic cut
 $140 \text{ GeV} < \text{Top1mass} < 210 \text{ GeV}$
 $140 \text{ GeV} < \text{Top2mass} < 210 \text{ GeV}$

Precuts & Generated

	Before vertex recovery	After vertex recovery
Event number	506773 (100%)	506773 (100%)
After b-tag cut	371410 (73.3%)	372884 (73.6%)
After kinematic cut	242100 (47.8%)	243046 (48.0%)
After chi2 cut	146479 (28.9%)	146990 (29.0%)

	Generated
Event number	491557
AFB(top)	0.324676
AFB(bottom)	0.341256

Vertex charge cut

Strict cuts

- $\text{Top1bcharge} * \text{Top2bcharge} < 0 \ \&\&$
 $\text{Top1TotalKaonCharge} * \text{Top2TotalKaonCharge} < 0$

Loose cuts

- $\text{Top1bcharge} * \text{Top2bcharge} < 0$
- $\text{Top1TotalKaonCharge} * \text{Top2TotalKaonCharge} < 0$
- $\text{Top1bcharge} * \text{Top2TotalKaonCharge} < 0$
- $\text{Top2bcharge} * \text{Top1TotalKaonCharge} < 0$

Vertex charge cut (strict cuts)

	Before vertex recovery	After vertex recovery
Number after cut	5113 (1.01%)	5469 (1.08%)
AFB(top)	0.280853	0.296581
AFB(bottom)	0.29337	0.301518
	Generated	
Event number	491557	
AFB(top)	0.324676	
AFB(bottom)	0.341256	

Polar angle spectrum (Strict cuts)

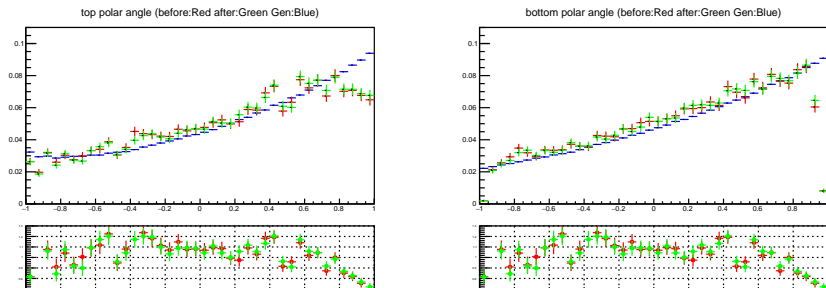


Figure: Top and bottom polar angle spectrum

Polar angle spectrum (Strict cuts)

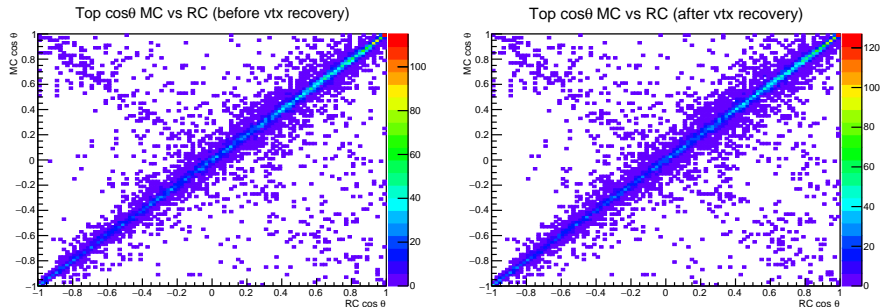


Figure: Top polar angle with MC and RC compared

Vertex charge cut (Loose cuts)

	Before vertex recovery	After vertex recovery
Number after cut	57866 (11.4%)	58365 (11.5%)
vtx1+vtx2	25527	25254
kaon1+kaon2	13481	14557
vtx1+kaon2	5784	5833
vtx2+kaon1	13074	12721
AFB(top)	0.266201	0.269991
AFB(bottom)	0.263730	0.267026
	Generated	
Event number	491557	
AFB(top)	0.324676	
AFB(bottom)	0.341256	

Polar angle spectrum (Loose cuts)

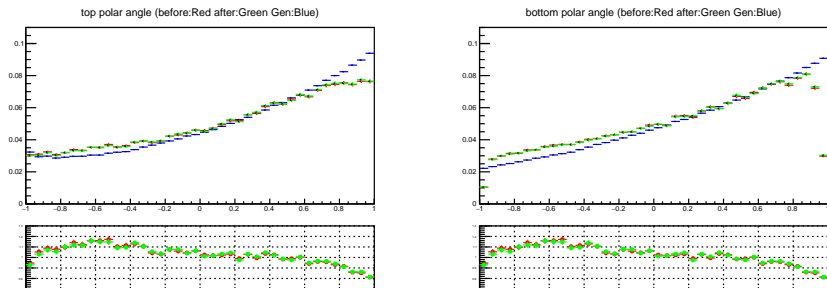


Figure: Top and bottom polar angle spectrum

Polar angle spectrum (Loose cuts)

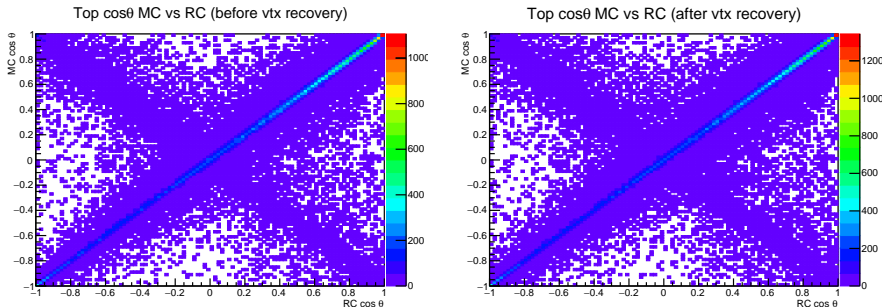


Figure: Top polar angle with MC and RC compared

Conclusion

- We have increased amount of events without decreasing detection efficiency.
- We could not see “effects” of vertex restoration in full-hadronic channel.
- Going back to the semi-leptonic decay channel and reproduce Dr.Svatolvs’s lab’s thesis.