

Discussion: Complications in Generating $t\bar{t}+b$ -jets

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tt+b-jets in Run 1

- tt+b-jets production:
 - Largest irreducible background in ttH, $H \rightarrow bb$ searches
 - Comes mostly from tt+gluon, gluon \rightarrow bb
- Categorize tt+b-jets events according to number of jets from prompt b's (prompt = not from top decay)
 - tt+bb: two distinct jets in the detector from prompt b's
 - tt+b: one distinct jet in the detector from a single prompt b
 - tt+B: single extra jet containing two merged prompt b's
- Modeling in Run 1:
 - CMS: Madgraph tt+0/1/2 jets ME@LO (tt+bb at LO)
 - ATLAS: PowHeg+Pythia6 tt NLO+PS (tt w/ bb from PS)
 - Re-weight tt+bb events to match kinematics of Sherpa+OL 4F NLO tt+bb
- tt+b-jets modeling choices provided leading systematic uncertainty in Run 1 ttH, $H \rightarrow bb$ analyses

tt+b-jets in Run 2

- For Run 2 – NLO to the rescue!
 - Several ME+PS tools now available for tt+b-jets at NLO:
 - Sherpa + OpenLoops
 - MadGraph5_aMC@NLO + Pythia
 - PowHel + Pythia
 - NLO calculations have smaller scale and PDF uncertainty than previous approaches, hence overall positive impact on ttH, H→bb
- Complication:
 - Large-scale inclusive NLO tt+jets samples at CMS+ATLAS being produced with 5FS
 - NLO tt+b-jets samples only available in 4FS
- How best to address this issue?

Various Thoughts

- First question:
 - Are the various NLO ME+PS approaches to $t\bar{t}+b$ -jets in 4FS consistent?
 - This is being addressed now in a joint study organized by the $t\bar{t}H/tHq$ subgroup of the HXSWG
 - exercise here is to compare the different generators under defined conditions to at least see if they are consistent -- and if they are not, to understand why
 - see talk in Thursday's session of in HXSWG General Meeting

- Mixed 5Fs for inclusive $t\bar{t}$ +jets / 4FS for $t\bar{t}+b$ -jets approach:
 - How do we stitch these different samples together?
 - Can we get a reasonable picture of $t\bar{t}$ +jets production when using mixed approaches?

Various Thoughts

- $t\bar{t}+b$ -jets in 5FS:
 - Some new diagrams need to be included when considering b 's in the initial state....these could be important
 - Can look for “volunteer” NLO $t\bar{t}+b$ -jet events that naturally arise from inclusive NLO $t\bar{t}$ +jets events made in 5FS
 - Computationally inefficient...it takes a LONG time to get reasonable statistics
 - Ideal would be an efficient filter to pick out $t\bar{t}+b$ -jet events early in the production chain from the inclusive NLO $t\bar{t}$ +jets sample made in the 5FS

Backup

