

Problem with Signal production

# History

- Starting point: discrepancies observed for :
  - tt where  $t > h_q$  between Lorenzo & Kevin (factor of  $\sim 2$ )
  - tt where  $t > Z_q$  between Lorenzo & Isis (small factor)
- Differences between Brussels and Strasbourg:



*Param\_card:*

*parameters with more up-to-date values for Brussels*

*Process\_card:*

*-Strasbourg forgot b-quark like extrajets [negligible effects]*

*-Brussels added hadronical decay of SM top*

*Run\_card:*

*strictly identical*



**Could explain Lorenzo-Isis differences, but not Lorenzo-Kevin ones**

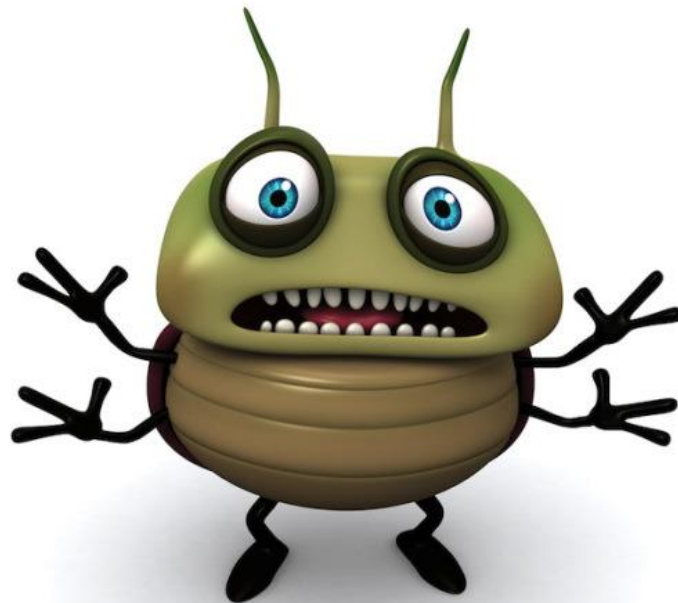
# History

- During the investigation, one first bug/feature in MG is found
    - « Automated ptj\_mjj cut » is applied once xqcut is different to zero (even if merging is switched off: ickkw=0). Confirmed with MG5 2.3.0
- No problem for us



# History

- Difference of cross-section between Lorenzo and Kevin samples can be explained by the « automated `ptj_mjj` cut »
- Switching this parameter has different effects on hadronic and leptonic decay of  $W$  which fake the ratio leptonic/hadronic.
- Lorenzo's summary: both samples are wrong because this cut is used.



# Proof

$p p \rightarrow t \bar{t}$  with  $t \rightarrow h u$  and  $t \rightarrow w b$  with inclusive decay of  $w$

Run	Collider	Banner	Cross section (pb)	Events	Data
run_01	p p 6500 x 6500 GeV	tag_1	<u><a href="#">0.4655 ± 0.00045</a></u>	100000	parton
			<u><a href="#">0.2172 ± 0.00076</a></u>	46660	pythia
run_02	p p 6500 x 6500 GeV	tag_2	<u><a href="#">0.9746 ± 0.00086</a></u>	100000	parton
			<u><a href="#">0.4657 ± 0.0016</a></u>	47780	pythia

Must be x 1/3



$p p \rightarrow t \bar{t}$  with  $t \rightarrow h u$  and  $t \rightarrow w b$  with leptonic decay of  $w$

Run	Collider	Banner	Cross section (pb)	Events	Data
run_01	p p 6500 x 6500 GeV	tag_2	<u><a href="#">0.7973 ± 0.00085</a></u>	100000	parton
			<u><a href="#">0.3707 ± 0.0013</a></u>	46502	pythia
run_02	p p 6500 x 6500 GeV	tag_3	<u><a href="#">2.923 ± 0.003</a></u>	100000	parton
			<u><a href="#">1.39 ± 0.0048</a></u>	47565	pythia

Due to the factor of 2 between Lorenzo and Kevin, we expect also changes in distributions. To be confirmed.

# Questions

- Is the cut « automated ptj\_mjj cut » working properly? Do we need to contact the authors?
- Cross-sections are wrong, but spectra?
  - For signal?
  - For background?

# Action plans

- Cross-check: producing sample without this cut and see if the most representative spectra are changed (<10%).
  - For signal. For safety, all signal ttbar should be reproduced.
  - For some important background sources. Our proposal:
    - ttbar [ongoing]
    - Z
    - W