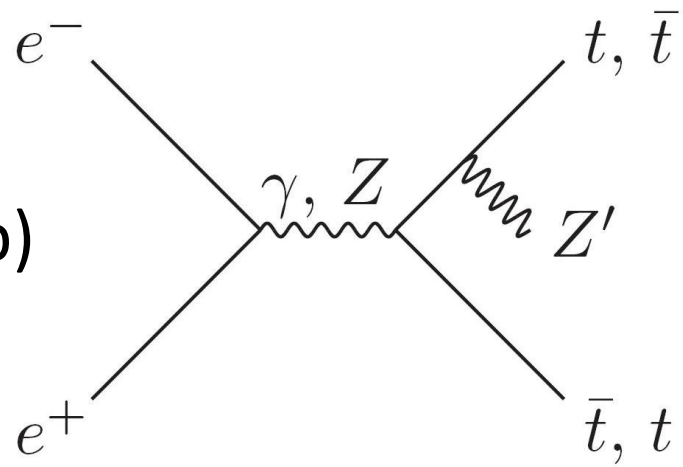
A step forward in Z’ events analysis

Comparison between signal and background in ttbarZp->invisible events

Introduction

- MZp = 400 GeV
- Signal : $e^+e^- \rightarrow$ t,tbar,Zp $\rightarrow$ t,tbar,inv. (~0.1fb)

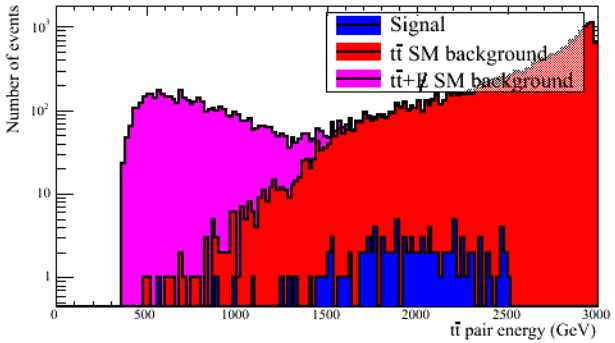
  (br(Zp $\rightarrow$ inv) ~ 10%)
- Background :
  - $e^+e^- \rightarrow$ t,tbar + missing E (~5fb)
  - $e^+e^- \rightarrow$ t,tbar (~20 fb)

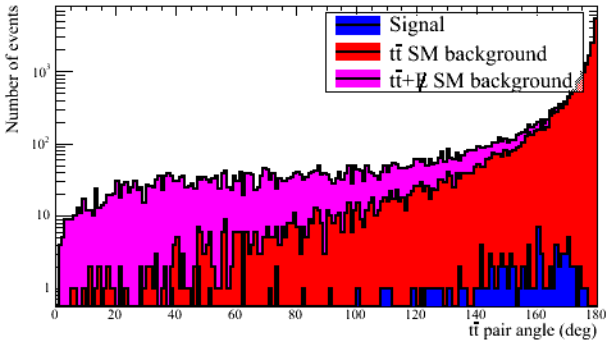


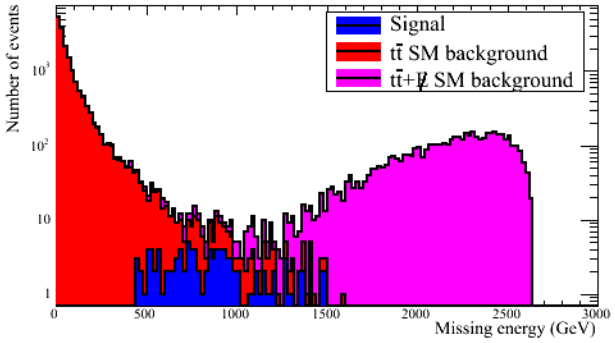
Variables plotted for this exercise

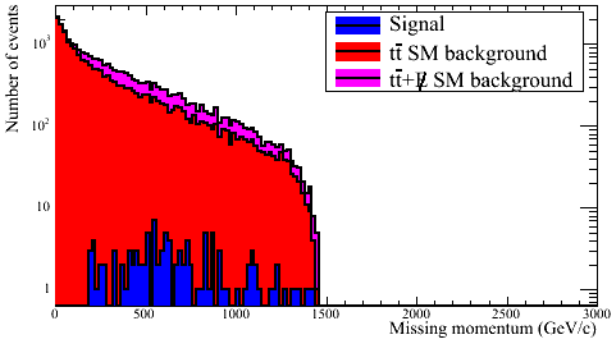
- Top pair total energy
- Angle between tops
- Missing energy
- Missing momentum
- Missing mass

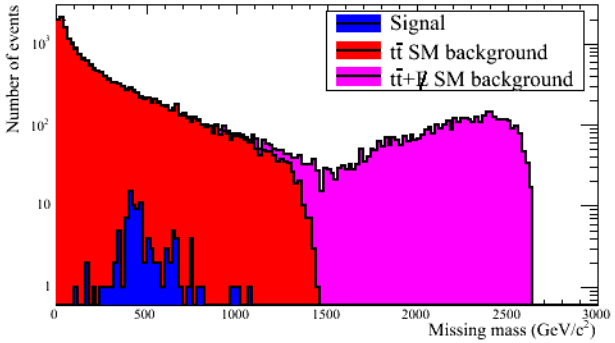
Raw plots





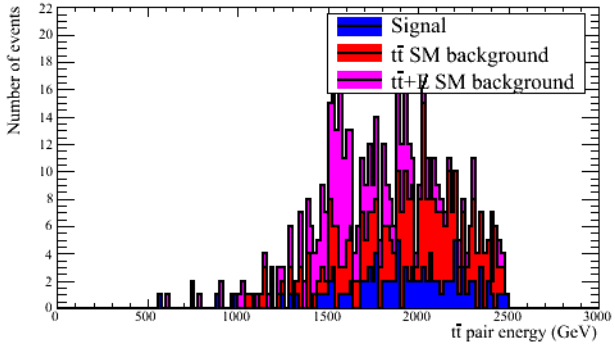


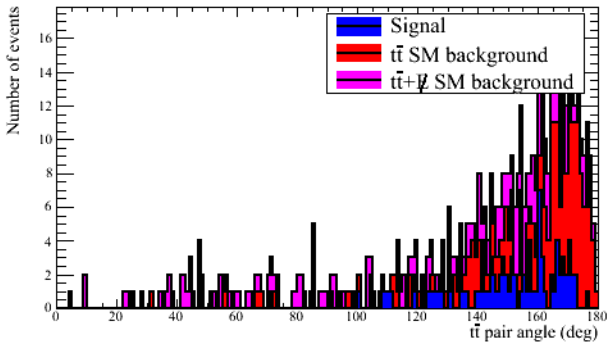


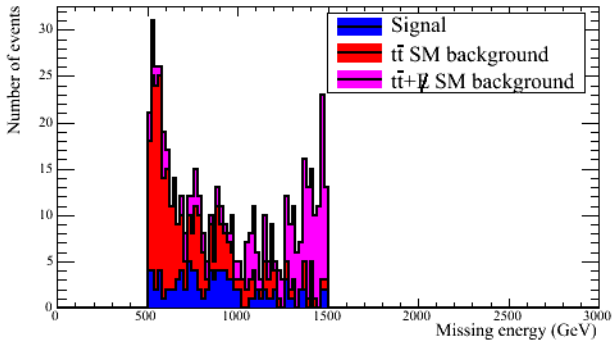


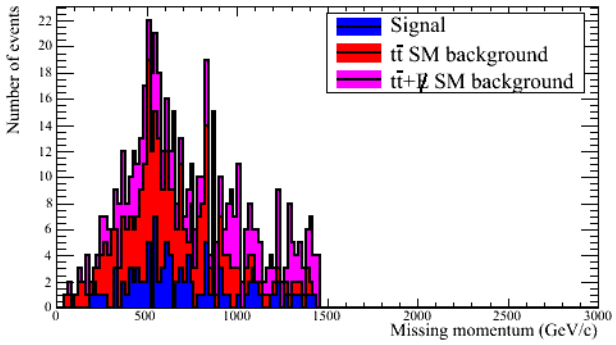
- Missing mass peaks at MZp
- S/B ~ 4.10^{-3}
- Srong cuts can be envisioned in the other variables

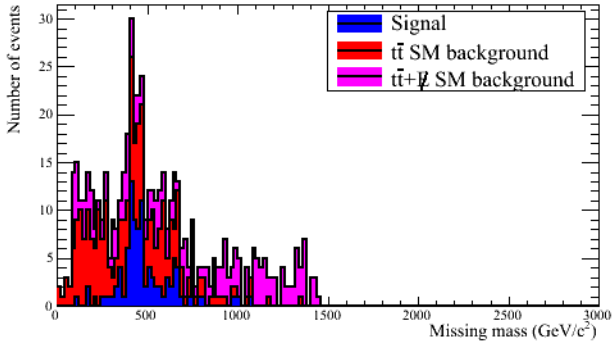
First cut

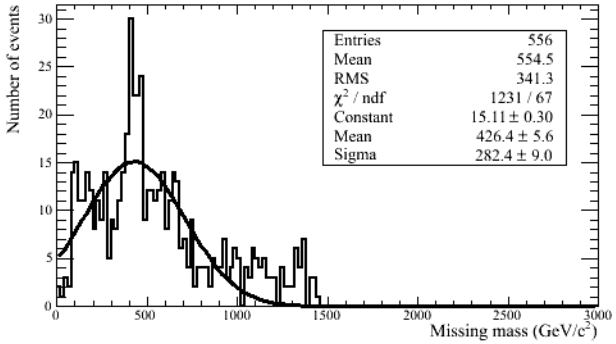












Cut on missing energy only:

- missingE>500 GeV & missingE<1500 GeV

Result:

- S/B = 22 %
- ε = 94 %

Stronger cuts

Missing E min	Missing E max	S/B	ε
0	3000	4.10^{-3}	100%
500	1500	22%	94%
600	1400	29%	76%
700	1300	33%	59%

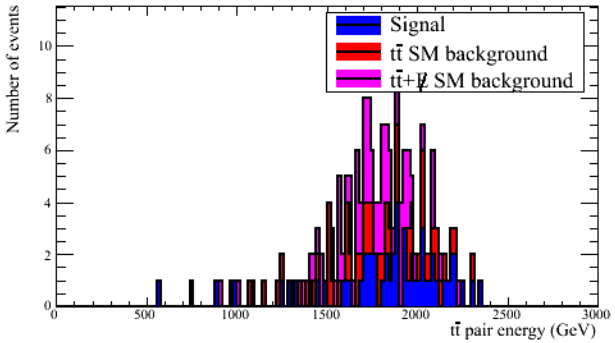
Cut on missing energy only:

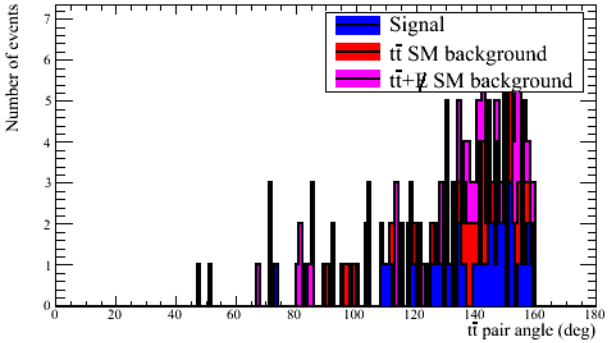
ε starts falling and S/B doesn't increase much…

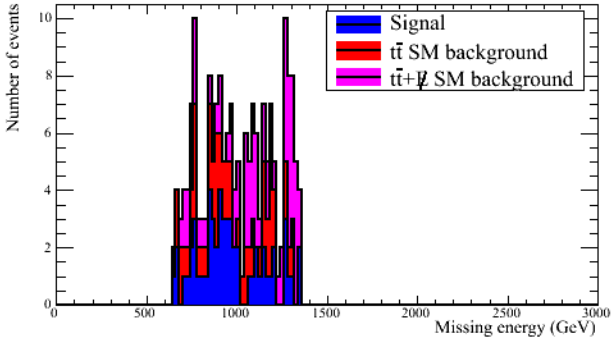
Mixed cut

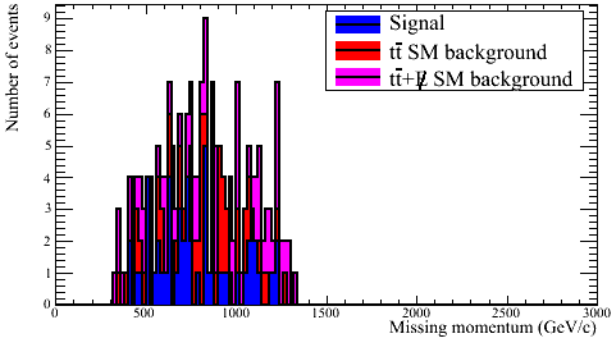
Missing E min (GeV)	Missing E max (GeV)	Pair angle max (deg)	S/B	ε
0 (no cut)	3000 (no cut)	(No cut)	4.10^{-3}	100%
500	1500	(No cut)	22%	94%
600	1400	(No cut)	29%	76%
700	1300	(No cut)	33%	59%
600	1400	165°	35%	64%
650	1350	160°	43%	53%

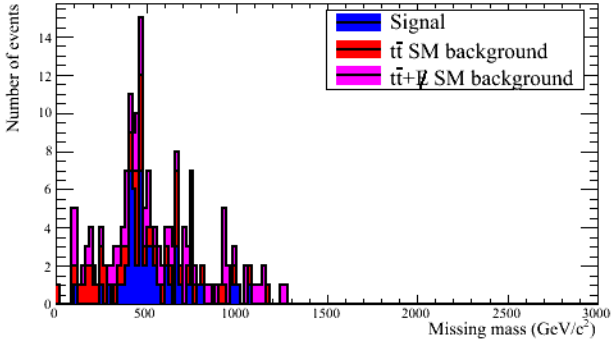
Mixed cut

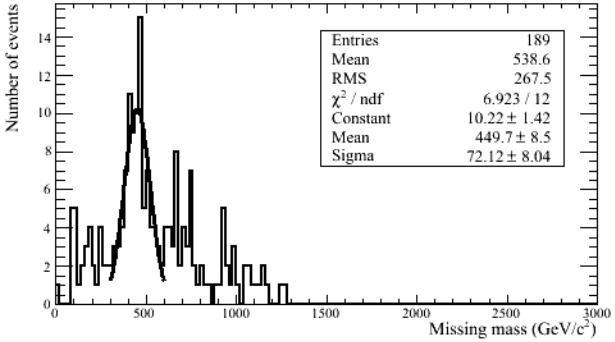












Cut on missing energy and ttbar angle:

- missingE>650 GeV & missingE<1350 GeV & ttbarA<165°

Result:

- S/B = 43 %
- ε = 53 %

The MZp peak is quite visible

conclusion

- Better way to increase S/B and preserve ε ?
- Plot some other variables:
  - Top quark energy difference ?
  - Single tops energy ?
  - Event spericity ?
  - 2 dimension topology ?
  - … ?