

# Status of ATLAS disappearing track analysis recasting

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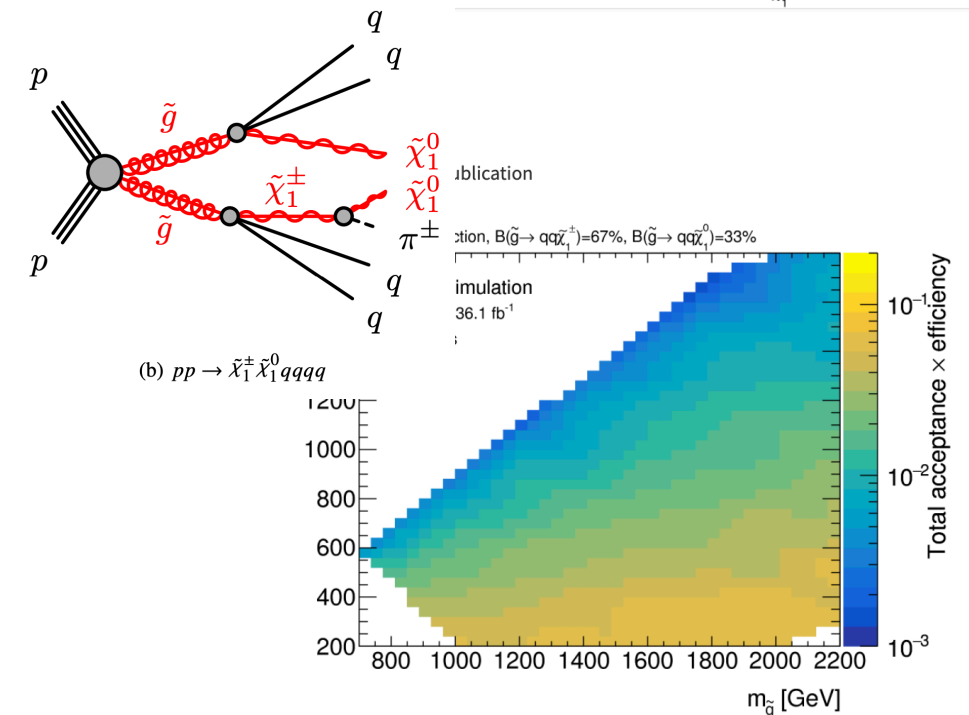
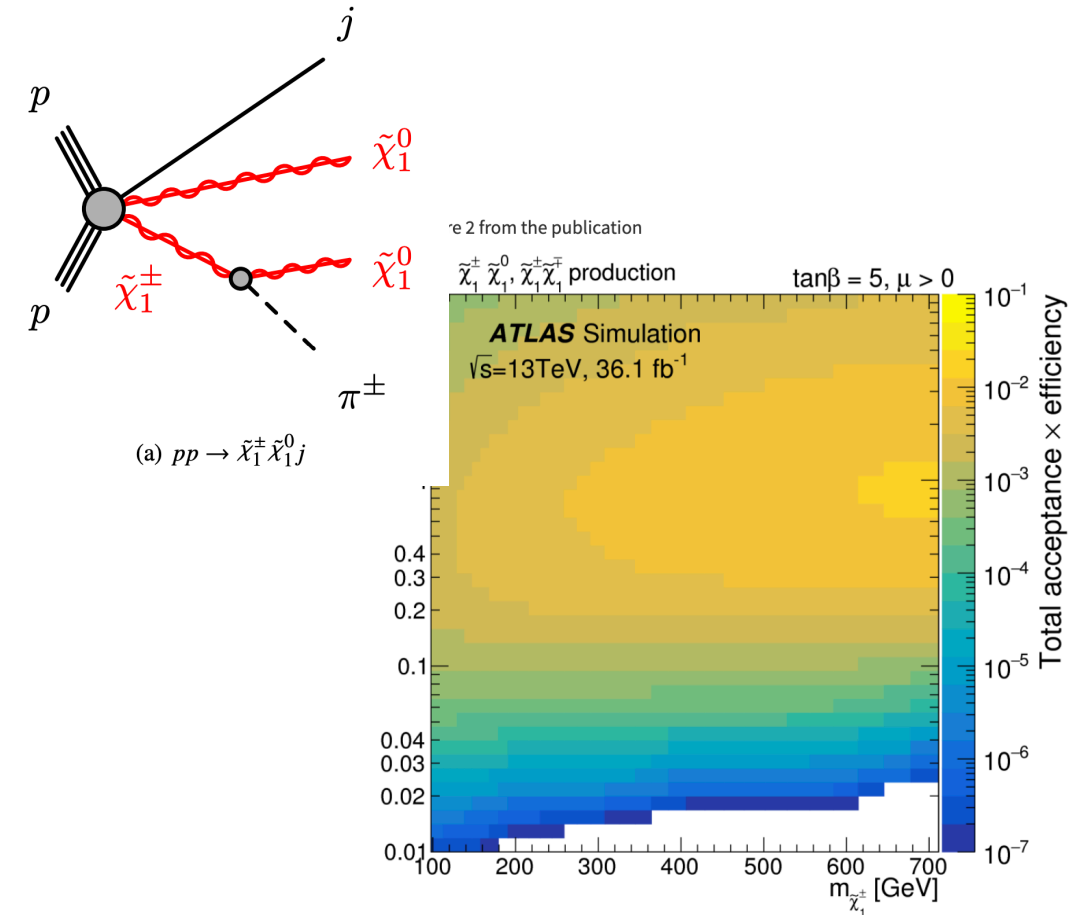
# Central problem and setup

- ATLAS disappearing track analysis gives two ways to recast the analysis
  - Translation of pseudo code (with reach level MET, jets in it)
  - Generator level analysis (with no reco objects)
  - In either cases, the tracklets are simply generator level charginos with appropriate pT, eta cuts and efficiencies are looked up via tables of eta, Lxy dependent efficiency

- For generator level analysis, the note advocates to compute the final efficiency as

$$\epsilon = E_A \times E_E \times (1 - (1 - T_A \times T_E \times T_p)^N)$$

- Aim is to reproduce ATLAS given acceptance times efficiency maps for strong and electroweak production mechanisms
- Question: Should we use factor  $T_p$  or not?
  - I need to use  $T_p$ , ATLAS advices not to use  $T_p$



- Produced samples for both strong and electroweak production using ATLAS given cards, MG5 version 2.7.2 and Pythia version 8.245
- Produced EW and strong sample up to two jets with specified matching merging parameters
- **NOTE:** didn't use the same PDF
- Used Delphes ATLAS card for analysing both generator level and reconstructed level objects
- Implemented analysis by converting pseudo-code with reco level MET and jets
- Also implemented analysis by ATLAS given generator level objects
- Can reasonably match the cutflow for pseudo code, can not recover results by generator level code

# What am I trying to reproduce?

- Cutflow by translating ATLAS pseudo code

Selection requirement	Electroweak channel		Strong channel	
	Observed	Expected signal	Observed	Expected signal
Trigger	434 559 704	1276 (0.20)	434 559 704	285 (0.98)
Jet cleaning	288 498 579	1181 (0.19)	288 498 579	282 (0.97)
Lepton veto	275 243 946	1178 (0.19)	275 243 946	278 (0.95)
$E_T^{\text{miss}}$ and jet requirements	2 697 917	579.1 (0.092)	537 861	202 (0.69)
Isolation and $p_T$ requirement	464 524	104.2 (0.017)	107 381	43.6 (0.15)
Geometrical $ \eta $ acceptance	339 602	83.6 (0.013)	77 675	36.4 (0.13)
Quality requirement	6134	29.6 (0.0047)	1337	13.9 (0.048)
Disappearance condition	154	24.1 (0.0038)	35	11.0 (0.038)

- ‘Cutflow’ for generator level analysis

Signal model		Event		Tracklet		
Mass [GeV]	Lifetime [ns]	Acceptance	Efficiency	Acceptance	Efficiency	$P$
Electroweak production						
$m_{\tilde{\chi}_1^\pm}=400$	0.2	0.09	1.03	0.07	0.47	0.57
$m_{\tilde{\chi}_1^\pm}=600$	0.2	0.12	1.05	0.05	0.48	0.57
$m_{\tilde{\chi}_1^\pm}=600$	1.0	0.11	1.03	0.20	0.47	0.57
Strong production						
$m_{\tilde{g}}=1600, m_{\tilde{\chi}_1^\pm}=500$	0.2	0.71	0.97	0.10	0.38	0.55
$m_{\tilde{g}}=1000, m_{\tilde{\chi}_1^\pm}=900$	0.2	0.18	0.93	0.03	0.36	0.55

# How am I trying to reproduce?

- Following cuts are applied either to reconstructed level or generator level objects
- Numbers in bracket signify strong production cuts
  - MET > 100 (70) GeV [Trigger]
  - Lead jet pT > 140 (100) GeV
  - MET > 140 (150) GeV
  - No electrons or muons
  - (Two more jets with pT > 50 GeV)
  - $\Delta\phi(\text{MET}, 4 \text{ jets}) > 1$  (0.4) ————> Defines event acceptance
  - Chargino pT > 20,  $0.1 < \eta < 1.9$
  - $122.5 \text{ mm} < L_{xy} < 295 \text{ mm}$
  - $\Delta R(\text{chargino}, 4 \text{ jets}) > 0.4$  ————> Defines Tracklet acceptance
    - jets have pT > 50 GeV
  - For reconstructed level code, tracklet efficiency applied, for generator level not

# EW Pseudo code results

- Sample for 400 GeV chargino with lifetime of 0.2ns
- Followed CheckMATE implementation where things were unclear (Thanks Nishita Desai and Jong-Soo Kim for help here)

Cut	Nevts (unweighted)	Efficiency	Relative efficiency
NGen	20000	1	1
Trigger (MET > 100 GeV)	6100	0.305	0.305
Lepton Veto	6098	0.304	0.99
JET MET	2322	0.116	0.38
EW SR	92	0.0046	0.039

- Official efficiency = 0.0038, not too bad, although not perfect

# EW Generator level code results

- All objects generator level

<b>Cut</b>	<b>Nevts (unweighted)</b>	<b>Efficiency</b>	<b>Relative efficiency</b>
NGen	20000	1	1
Trigger (MET > 100 GeV)	5422	0.271	0.271
Lepton Veto	5422	0.271	1
JET MET (evt acceptance)	1979	0.0989	0.38
Tracklet acceptance	285	0.014	0.14

- Official event acceptance 0.09, official tracklet acceptance 0.07

# Strong Pseudo code results

- Sample with gluino mass 1600 GeV, chargino mass of 400 GeV, lifetime 0.2ns
- Followed CheckMATE implementation where things were unclear (Thanks Nishita Desai and Jong-Soo Kim for help here)

<b>Cut</b>	<b>Nevts (unweighted)</b>	<b>Efficiency</b>	<b>Relative efficiency</b>
NGen	20000	1	1
Trigger (MET > 100 GeV)	16998	0.85	0.85
Lepton Veto	16991	0.85	0.99
JET MET	11744	0.58	0.69
Strong SR	619	0.03	0.05

- Official efficiency = 0.038, not too bad, although not perfect



# Strong Generator code results

- All objects generator level

<b>Cut</b>	<b>Nevts (unweighted)</b>	<b>Efficiency</b>	<b>Relative efficiency</b>
NGen	20000	1	1
Trigger (MET > 100 GeV)	16826	0.85	0.85
Lepton Veto	16826	0.85	1.0
JET MET	10103	0.50	0.60
Strong SR	1661	0.08	0.16

- Official event acceptance = 0.71, official tracklet acceptance = 0.1

# Inputs?

- For both strong and electroweak analysis, I seem to be able to reproduce analysis results using pseudo code
- Using generator level recasting procedure, I can not reproduce tracklet acceptance
- Any suggestions to debug this will be highly appreciated.