Summary of the Reinterpretations WG activities

Goal for this WG:

- Bring phenomenologists and experimentalists in the same room to discuss known issues
- Identify projects to work on. Google document to see more
- Projects should have some deliverable over a short time
- We start work now, touch base after ~1 month to see where we are

Thank you to all who participated actively in the discussions

Projects

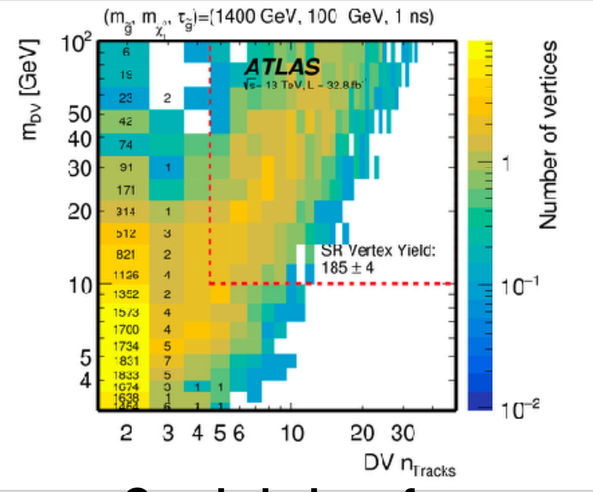
Problems with reinterpretation	Validating new analyses	Improving simulation	Models probing signature gaps
2	**2**	**1 + 1**	**3**

Around ~15 people signed up for active work, some on multiple issues

Useful discussion

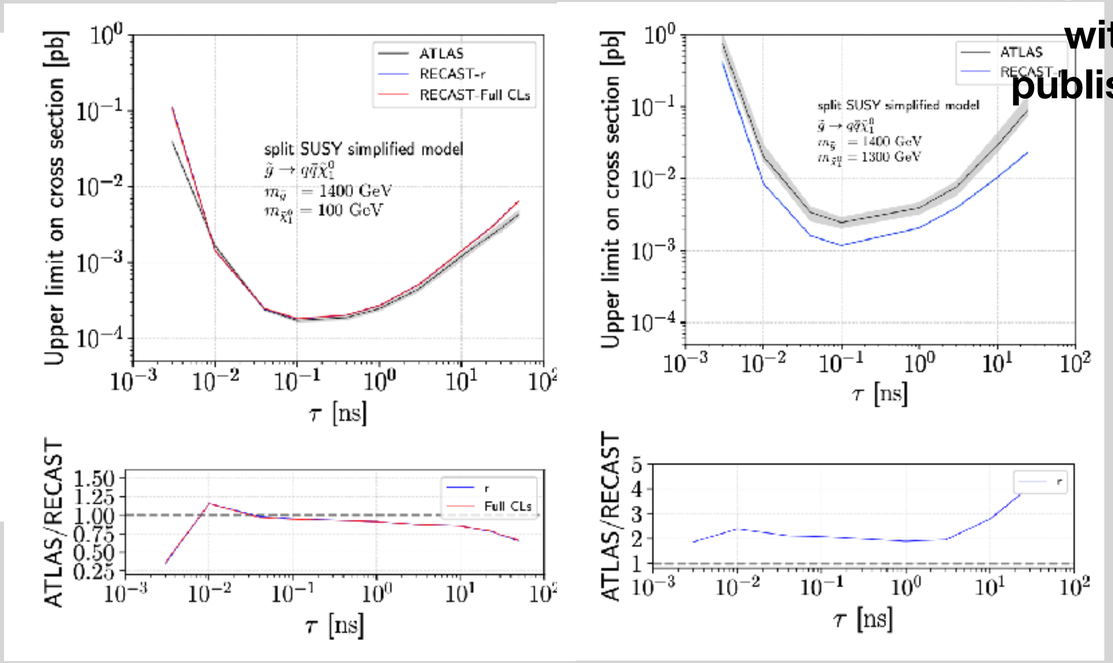
Comparison of reinterpretation with ATLAS published exclusions

https://arxiv.org/abs/1710.04901



Good choice of variables, in-principle model independent

Note the mismatch with published

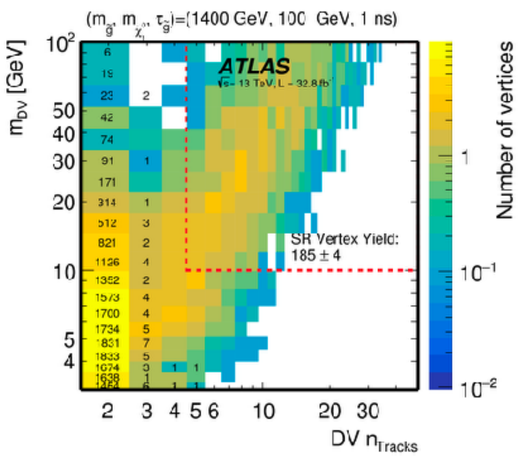


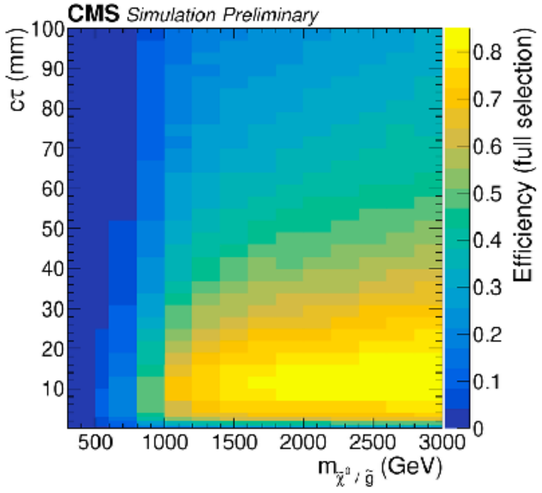
- Experimentalists confirmed the also see same thing with efficiencies
- Analysis with full data to come
- Recommendation for extra signal regions with smaller n_trk and/or reduced mDV which will hopefully be done for full Run2 data.
- If you need models as benchmarks for low n_trk/mDV, please do ask!

Project: Vertexing using Delphes

Michele Selvaggi pointed to how a simple vertex can be made using Delphes

class Track	
PID	HEP ID number
Charge	track charge
P	track momentum
PT	track transverse momentum
Eta	track pseudorapidity
Phi	track azimuthal angle
CtgTheta	track cotangent of theta
EtaOuter	track pseudorapidity at the tracker edge
PhiOuter	track azimuthal angle at the tracker edge
T	track vertex position (t component)
X	track vertex position (x component)
Y	track vertex position (y component)
Z	track vertex position (z component)





Tracks in Delphes give MC truth production vertex that can be used

Need to determine these for a realistic vertexing module:
1. Track efficiency (truth vs reco) AND/OR
2. Efficiency that a true vertex actually reconstructed at experiment

Plan: Make a toy vertex finder using truth tracks,
Step 1: try to reproduce ATLAS DV + MET (which is based on gen-level truth)
Step 2: See if it can apply to the new CMS DV (EXO-19-013)

A. Lessa, J. Heisig, G. Cottin, N. Desai, S. Kulkarni following this up. M. Goodsell reports parallel efforts with MA5 native fastsim

Active problem solving: ATLAS Disappearing Track

Two ways of reinterpretation: (1) Pseudocode given to reproduce cut flow for single benchmark

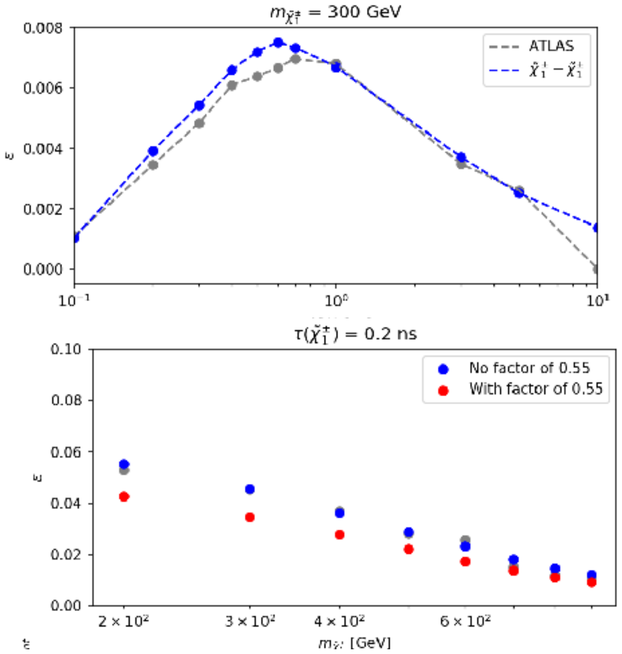
	CM $\tilde{\chi}_1^{\pm}\tilde{\chi}_1^{\pm}$	CM $\tilde{\chi}_1^{+}\tilde{\chi}_1^{0}$	CM $\tilde{\chi}_1^{-}\tilde{\chi}_1^{0}$	CM all channels	ATLAS
Trigger	445.1	624.0	274,4	1343.5	1276
Lepton Veto	423.4	608.5	267.3	1308.2	1181
MET and jet requirements	164.2	229.6	101.0	494.8	579
EW SR	5.2	4.4	1.6	11.2	13.5

	CM	ATLAS
Trigger	289	285
Lepton Veto	277	278
MET and jet requirements	216	202
strong SR	11	11

(2) Method in ATLAS paper (1712.02118)

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

[5] If E_A is the event acceptance, E_E is the event efficiency, T_A is the tracklet acceptance, T_E is the tracklet efficiency, and T_p is the tracklet p_T efficiency, then for an event with N charginos, the probability of having at least one reconstructed, selected tracklet with $p_T > 100$ GeV in an event can be calculated as: $E_E \times E_A \times (1 - (1 - T_A \times T_E \times T_P)^N)$.



Incompatible results in EW and Strong reported using this method

Active problem solving: ATLAS Disappearing Track

Proactive participation by experimentalists

I tried comparing the numbers in the aux Fig2/3 and The number of signal in Table 1 in the paper,
A: Signal model
B: Cross section
C: acc x eff_from_HEPData (aux Fig 2 and 3)
D: Computed from B and C for 36.5 ifb (B*C*36500)
E: Fullsim cutflow pT>20GeV (Table 1)

A	B	C	D	E
EWK400GeV(0.2ns)	0.175	0.00388	24.8	24.1
Str1600-500GeV(0.2ns)	0.00809	0.03859	11.4	11

Then, now I compute the acceptance*efficiency using the Table2 and the footnote formula,
EWK: 0.09 * 1.03 * ((1 - TMath::Power((1 - 0.07*0.47),2)) * 1./3 + (1 - (1 - 0.07*0.47))* 2./3) = 0.0040
Strong: 0.71 * 0.97 * ((1 - TMath::Power((1 - 0.1*0.38),2)) * 1./2 + (1 - (1 - 0.1*0.38))* 1./2) = 0.039
, which gives similar values to 'C' of the above table. Here I assumed single and doble-chargino event ratio as 2:1, and 1:1 for the EWK and strong productions, respectively. Correct numbers may give better estimates. Note that I omit the Tp~~omit Tp~~ factor to estimate for pT>20GeV.

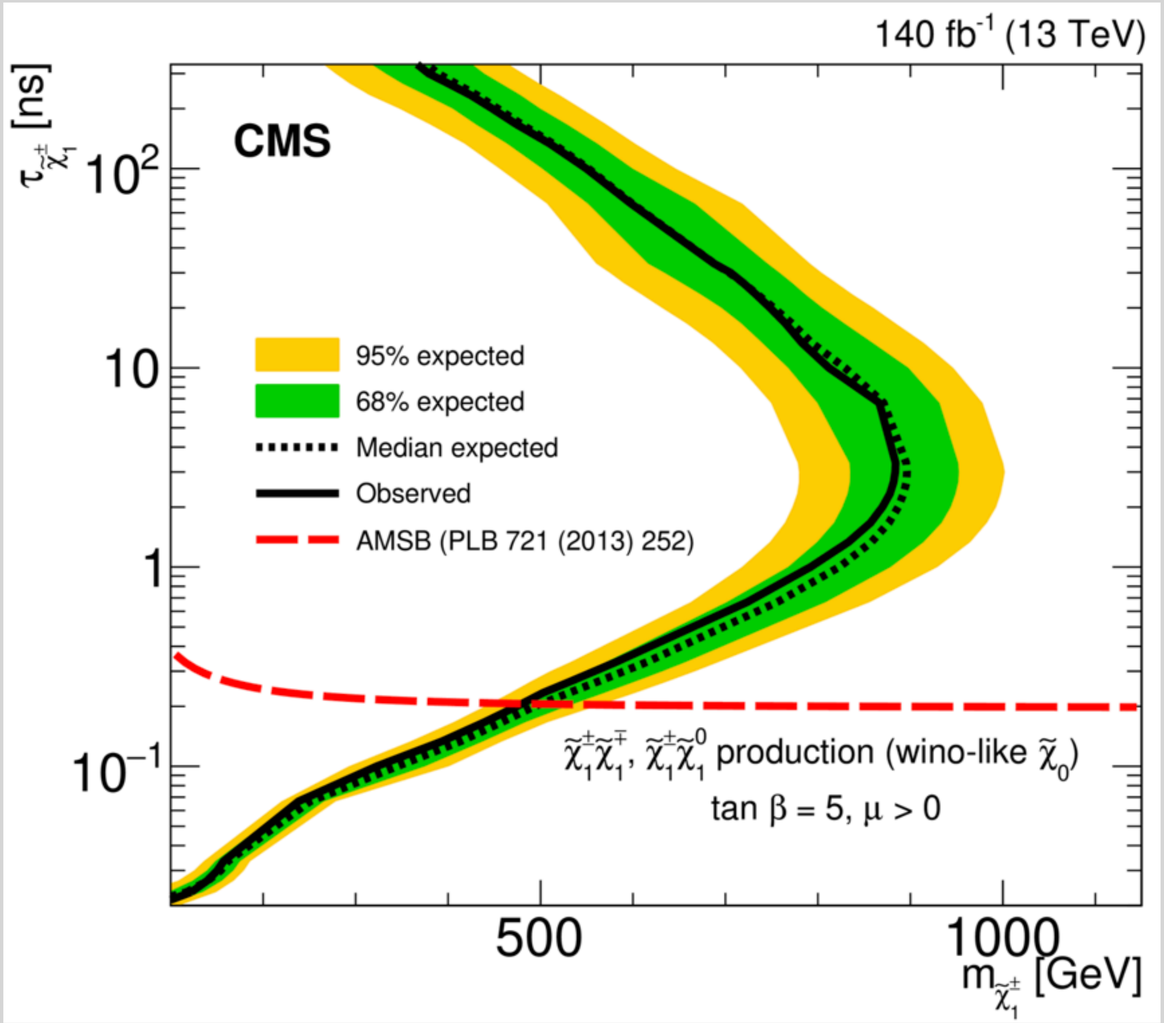
Thank You!

10 people following and contributing to discussion!

Also very happy to see this:

- James Smith: [redacted] (I am working on the reinterpretation material for the full run-2 paper)

Useful discussion



CMS disappearing track is out with full Run 2 data

arxiv.org/abs/2004.05153

- Has much information, but not enough* for reinterpretation, only a coarse interpolation matrix based on mass/ lifetime
- Worrying indications that there is NO PLAN of giving more information
- Would be a shame because this is a Run2 legacy analysis
- *CMS individuals to be contacted identified.*

** cut flow table shows significant acceptance reduction due to track fiducial and quality requirements that are un-simulable*

What next?

- Take a look at the Google doc; sign up to interesting projects
- A mailing list of theorists working on reinterpretation can be reached at llp-recasting@googlegroups.com
- Mattermost channel for this WG is here: https://mattermost.web.cern.ch/llpcommunity/channels/reinterpretations Use it to stay in touch after this workshop and follow up with the progress.
- For your standalone codes, please consider contributing here: https://github.com/llprecasting
- For people who have signed up for projects, I will send emails next Monday putting people in touch (feel free to do this yourself too).