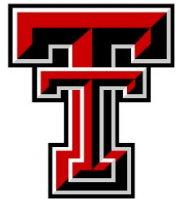
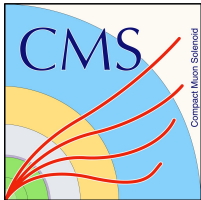


Materials for reinterpretation of SUS-21-002

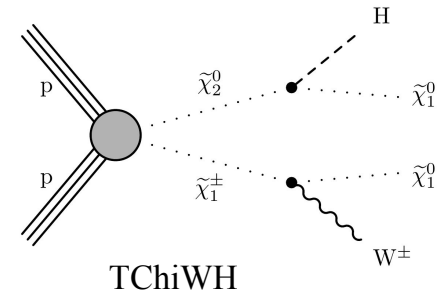
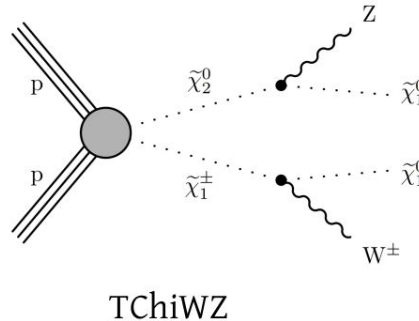
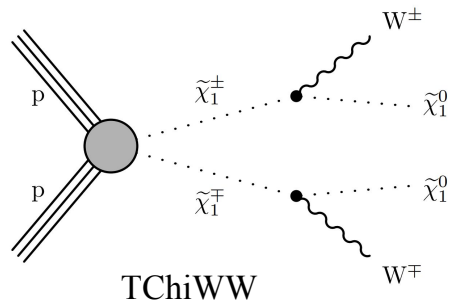
Reinterpretation Auxiliary Material Presentation
(RAMP)
12th May 2023

Vinay Hegde
On behalf of SUS-21-002



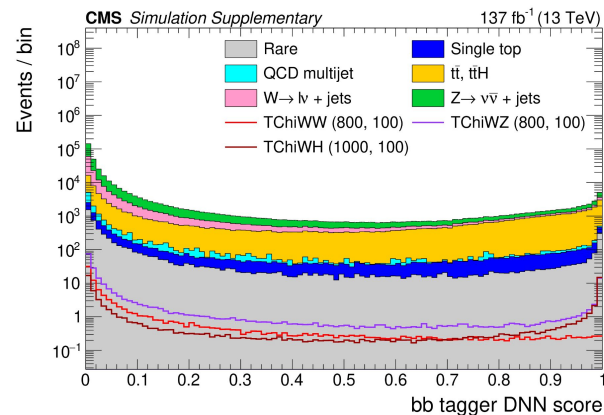
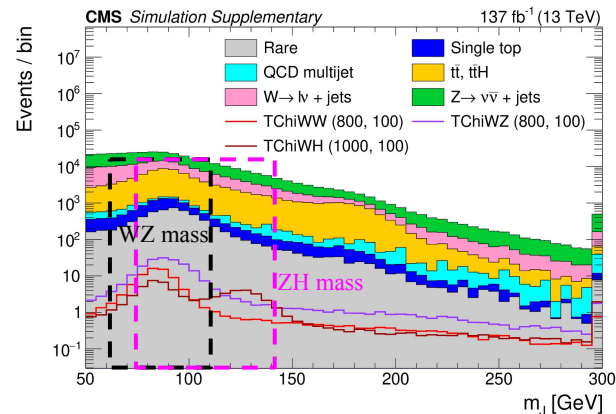
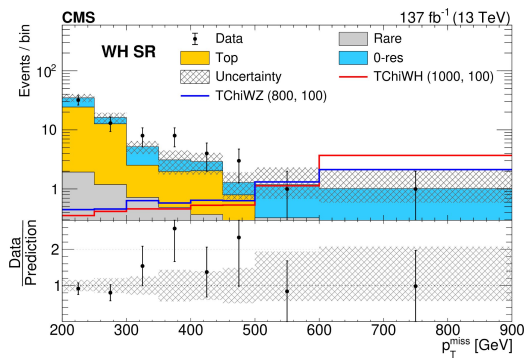
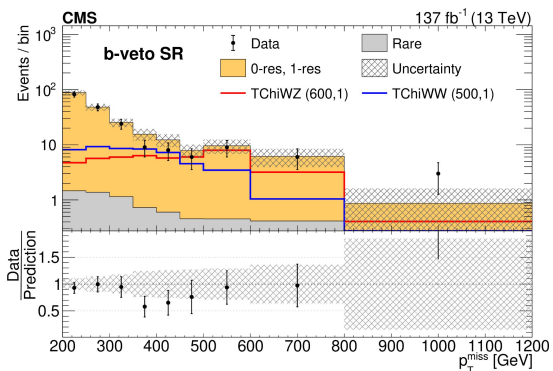
Introduction

- SUS-21-002 is a SUSY search with MET and large radius jets (AK8) originating from hadronic decay of W, Z and H bosons.
- MET comes from $\tilde{\chi}_1^0$ s.
- Hadronic decays of bosons are tagged using soft-drop mass of AK8 jets and deep learning based taggers: WvsQCD, WMDvsQCD (W/Z tagging) and bbVsQCD (Z/H \rightarrow bb tagger).



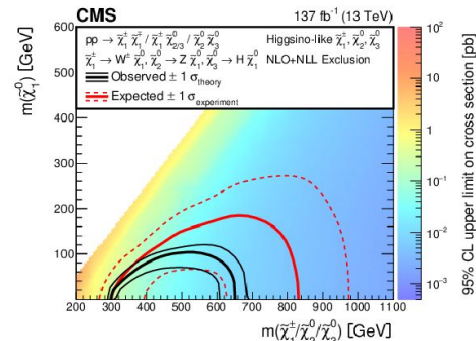
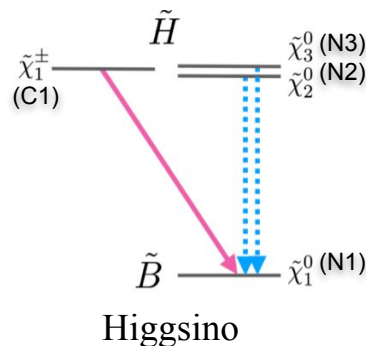
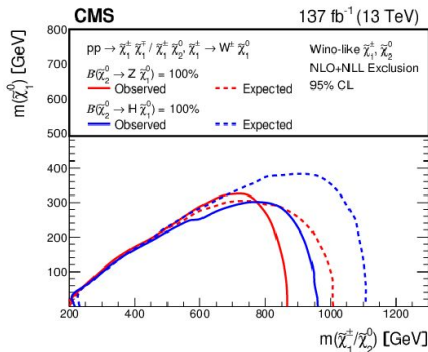
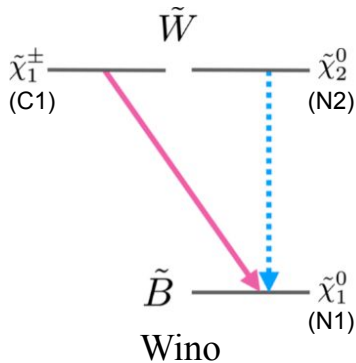
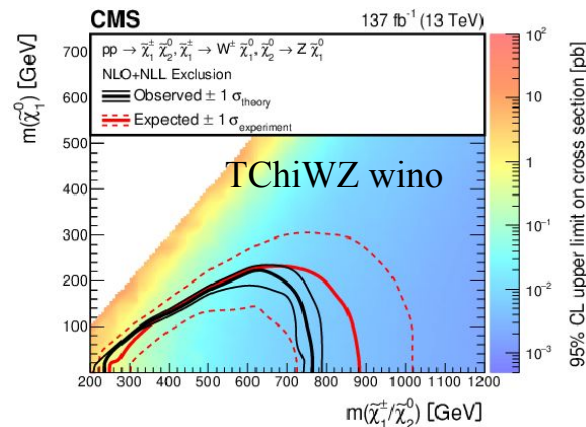
Search regions

- Number of b-tagged jets, mass of AK8 jets, the discriminator values define the search regions (SRs) and control regions (CRs).
- SRs and CRs are further divided into bins of MET with MET > 200 GeV.
- Total 35 SR bins - b-veto, WH, W and H SRs.



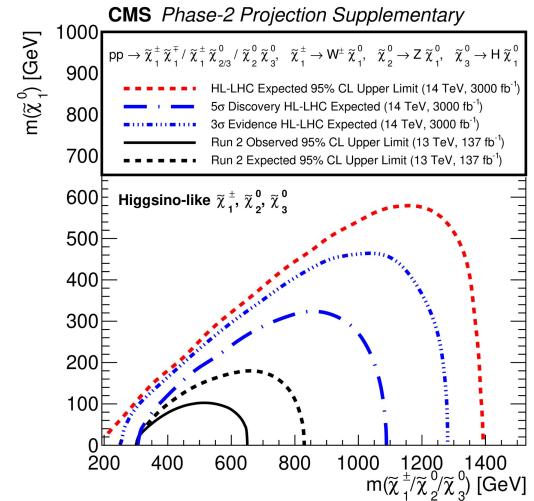
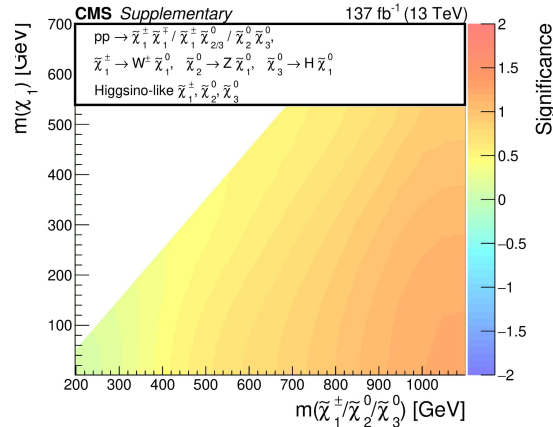
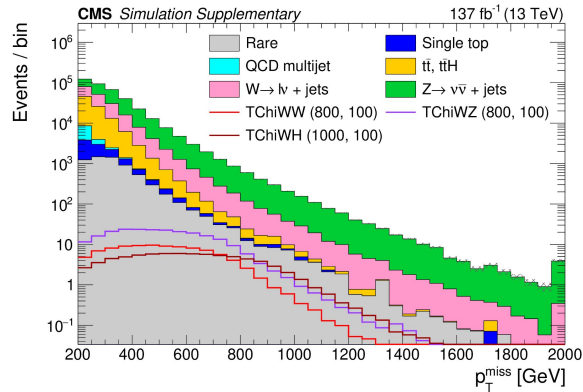
Simplified model (SMS) interpretations

- We interpret using TChiWW, TChiWZ and TChiWH models using wino C1/N2 production cross sections.
- More realistic model interpretations include:
 - Wino like C1C1+C1N2 production with separate limits for $N2 \rightarrow N1 + Z$ or H decays.
 - Higgsino scenario: C1C1, C1N2, C1N3, N2N3 are considered with $N2 \rightarrow Z+N1$ and $N3 \rightarrow H+N1$.



Additional plots

- For better understanding of the signal kinematics, background estimation and results, we provide additional plots.
- We also performed projection studies for HL-LHC (3000 fb⁻¹) as a part of snomass white paper results.

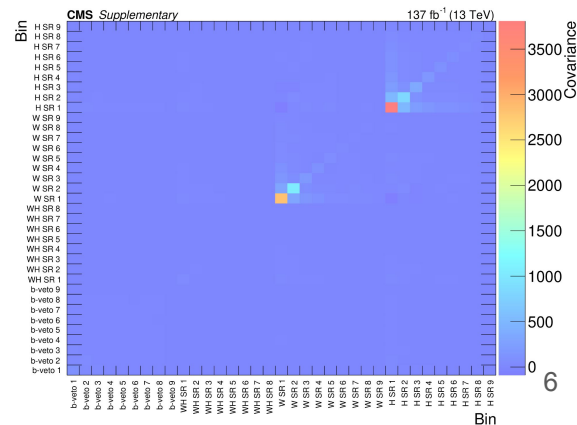


Electronically available or tabulated info

- Definition of objects, cuts used, background predictions with total uncertainty, data in SR, and signal yields for selected signal samples.
- Cutflow tables for selected signal samples.
- Covariance and correlation matrices corresponding to SR bins.

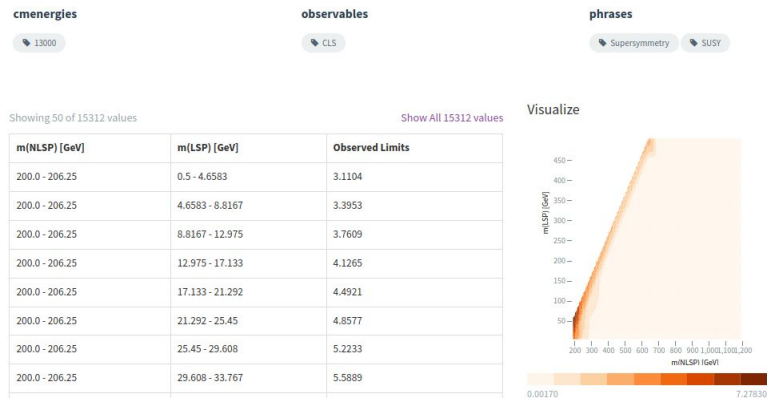
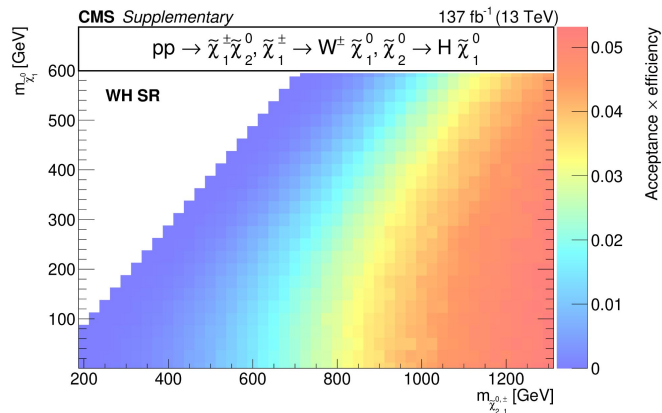
p_T^{miss} (GeV)	0- and 1-res bkg.	Rare	Total bkg.	Obs.	Signal
200 – 250	86.7 ± 9.2	1.5 ± 0.3	88.1 ± 9.2	82	4.4 ± 0.2
250 – 300	46.8 ± 6.7	1.4 ± 0.3	48.2 ± 6.7	48	5.3 ± 0.3
300 – 350	24.2 ± 4.3	1.1 ± 0.3	25.4 ± 4.4	24	5.6 ± 0.3
350 – 400	14.8 ± 3.7	0.7 ± 0.2	15.5 ± 3.7	9	6.0 ± 0.3
400 – 450	11.7 ± 3.1	0.6 ± 0.2	12.3 ± 3.1	8	5.5 ± 0.3
450 – 500	7.4 ± 2.1	0.4 ± 0.1	7.9 ± 2.1	6	5.7 ± 0.3
500 – 600	9.1 ± 2.7	0.4 ± 0.1	9.6 ± 2.8	9	7.6 ± 0.3
600 – 800	5.7 ± 2.2	0.4 ± 0.1	6.2 ± 2.2	6	3.0 ± 0.2
≥ 800	0.8 ± 0.7	0.1 ± 0.1	0.9 ± 0.7	3	0.4 ± 0.1

Cut	TChiWW (500,1)	TChiWZ (600,1)	TChiWZ (800,100)	TChiWH (1000,100)
All events	3017.8 ± 6.9	2764.1 ± 6.7	655.8 ± 1.7	186.3 ± 0.5
Electron veto	2416.2 ± 6.2	2368.8 ± 6.2	559.8 ± 1.5	157.8 ± 0.4
Muon veto	1857.6 ± 5.4	1981.9 ± 5.7	467.5 ± 1.4	129.5 ± 0.4
Isolated track veto	1708.0 ± 5.2	1881.0 ± 5.5	449.1 ± 1.4	124.3 ± 0.4
$p_T^{\text{miss}} > 200$ GeV	1191.6 ± 4.3	1431.0 ± 4.8	379.7 ± 1.3	112.4 ± 0.4
$H_T > 300$ GeV	1083.2 ± 4.2	1307.3 ± 4.6	361.6 ± 1.2	111.1 ± 0.4
$2 \leq m_j \leq 6$	1037.2 ± 4.1	1217.8 ± 4.4	332.4 ± 1.2	106.1 ± 0.4
Photon veto	1028.3 ± 4.0	1210.1 ± 4.4	329.8 ± 1.2	105.0 ± 0.4
≥ 1 AK8 jet with $m_j > 50$ GeV	774.5 ± 3.5	956.0 ± 3.9	279.9 ± 1.1	92.8 ± 0.3
$\Delta\phi, \Delta\Phi$	665.4 ± 3.3	824.7 ± 3.7	241.0 ± 1.0	79.0 ± 0.3
Filters and trigger	649.4 ± 3.2	807.6 ± 3.6	236.7 ± 1.0	77.7 ± 0.3
≥ 2 AK8 jets	253.1 ± 2.0	360.6 ± 2.4	133.3 ± 0.7	53.1 ± 0.3
b-veto SR	49.8 ± 0.9	46.6 ± 0.9	19.3 ± 0.3	1.38 ± 0.04
WH SR	1.5 ± 0.2	16.8 ± 0.5	6.8 ± 0.2	7.6 ± 0.1
WSR	14.5 ± 0.5	23.7 ± 0.6	8.6 ± 0.2	6.1 ± 0.1
H SR	2.6 ± 0.2	29.0 ± 0.7	10.9 ± 0.2	11.3 ± 0.1



Info included in HEPdata/ROOT files

- [HEPdata](#) entry has these tables:
 - Final results with background predictions and data with uncertainties.
 - Final interpretation or the limits plots with the UL on cross section.
- Most of this info is provided in ROOT files and they are attached to the public webpage.
- Acceptance x efficiency inclusive in SR bins is available (plot and ROOT) in the webpage.



Info to be added to HEPdata and webpage

- We plan to add acceptance X efficiency for TChiWW, TChiWZ, TChiWH and TChiHZ models for each SR bin and each mass scenarios studied (~ 800 mass points \times 35 SR bins $\sim 280k$ numbers per model) to the HEPdata, and ROOT files to webpage.
 - Sensitivity to TChiHZ is low and we had not provided any additional materials for this model. But it was included in higgsino interpretation.
- This info was requested by Wolfgang Waltenberger et.al of SModelS team.
 - We shared the ROOT files with them internally and they could obtain results close to ours.
- We expect these to be added soon (a few days - week timescale).

Summary and outlook

- For SUS-21-002 we have provided (or will provide) most of the information needed for reinterpretation.
- Are there any other missing information still? We are happy to provide the necessary information.