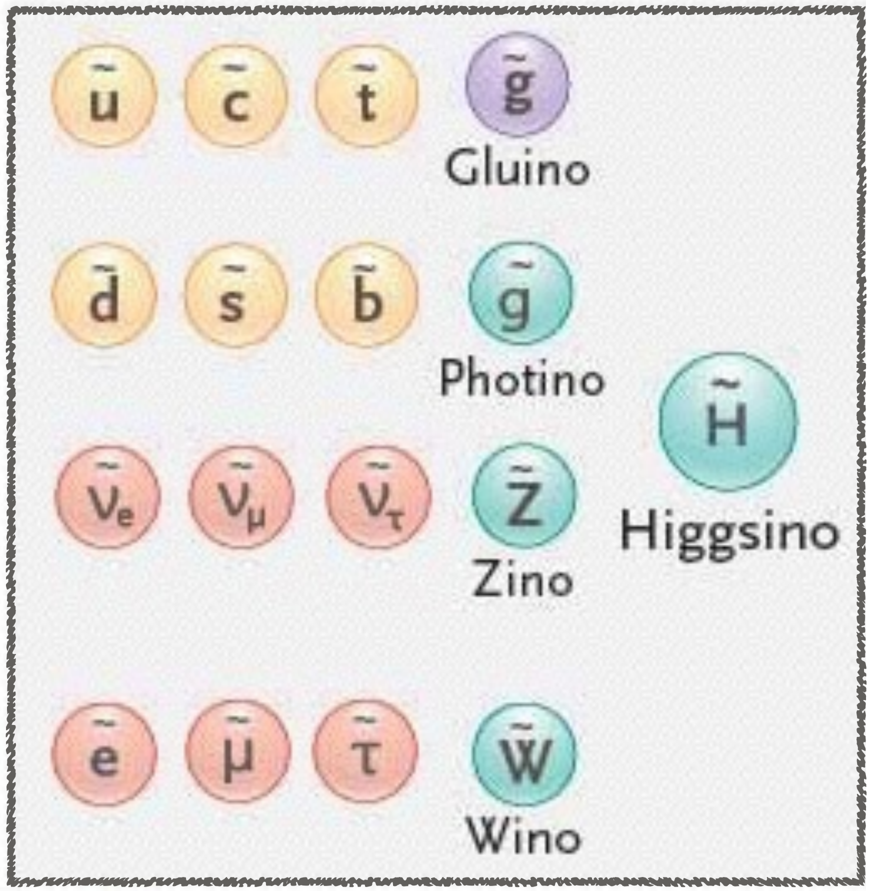
First Run-2 SUSY Results

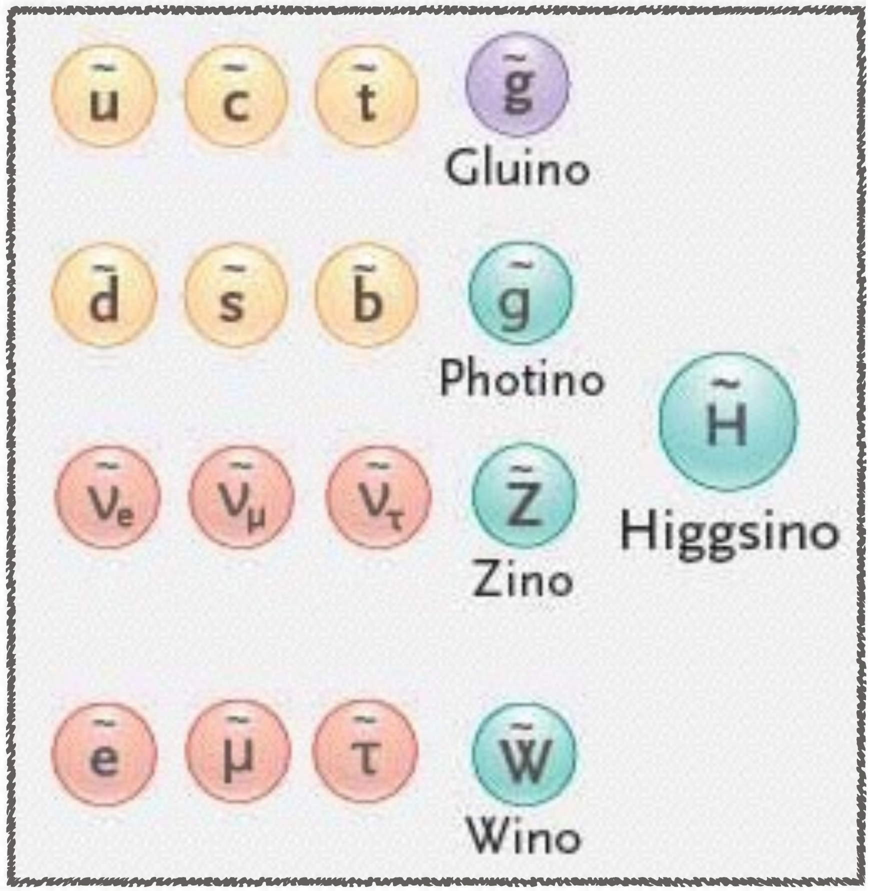
Ingrid Deigaard

Why look for SUSY?



Why look for SUSY?

Dark Matter Candidate



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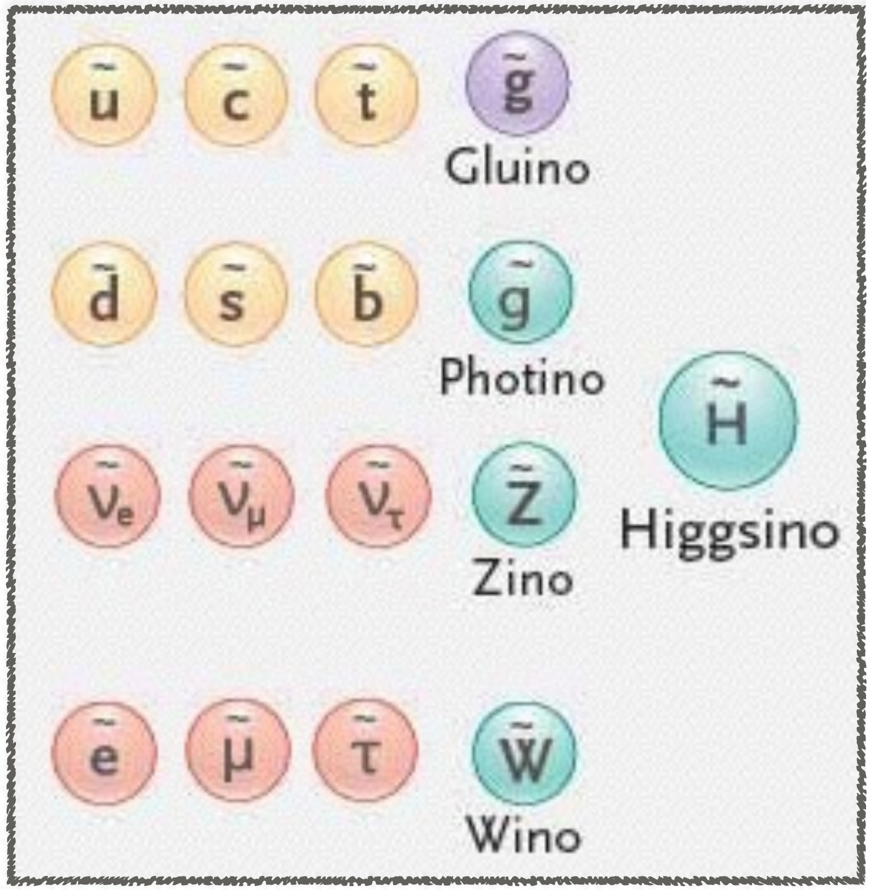

Fine-tuning of Higgs mass

Why look for SUSY?

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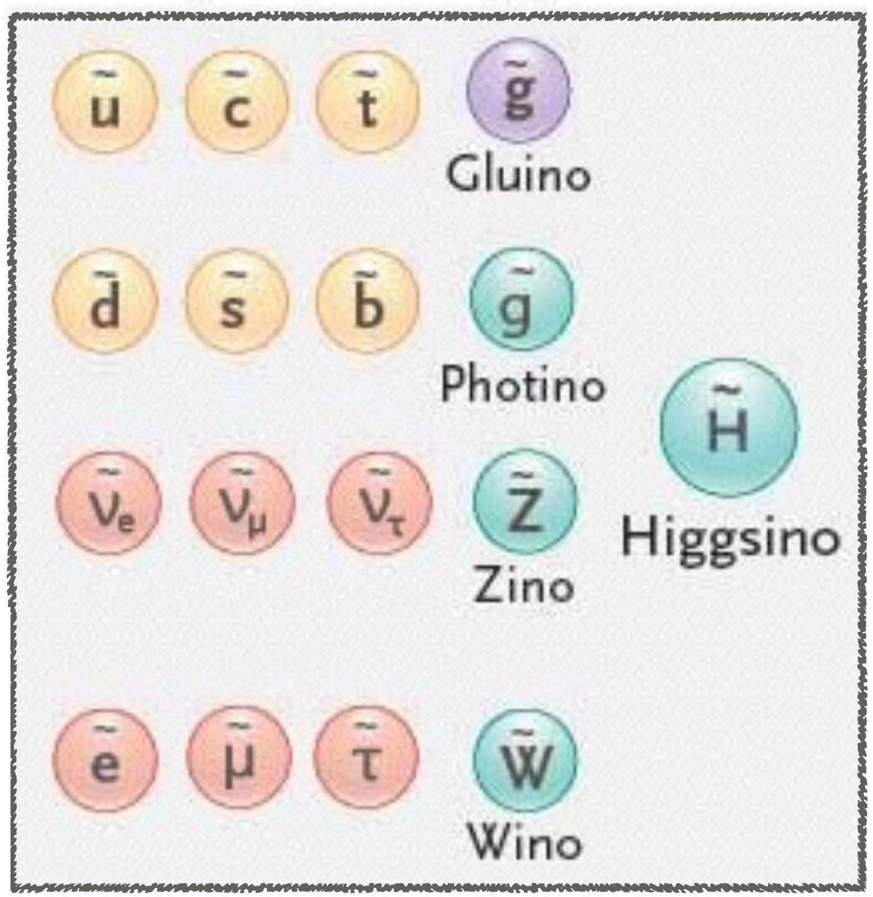
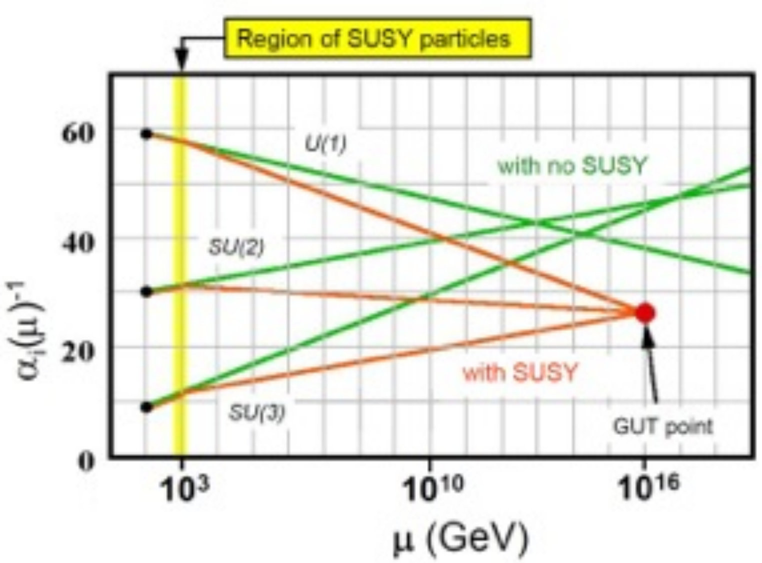


Fine-tuning of Higgs mass

Grand Unification



Why look for SUSY?

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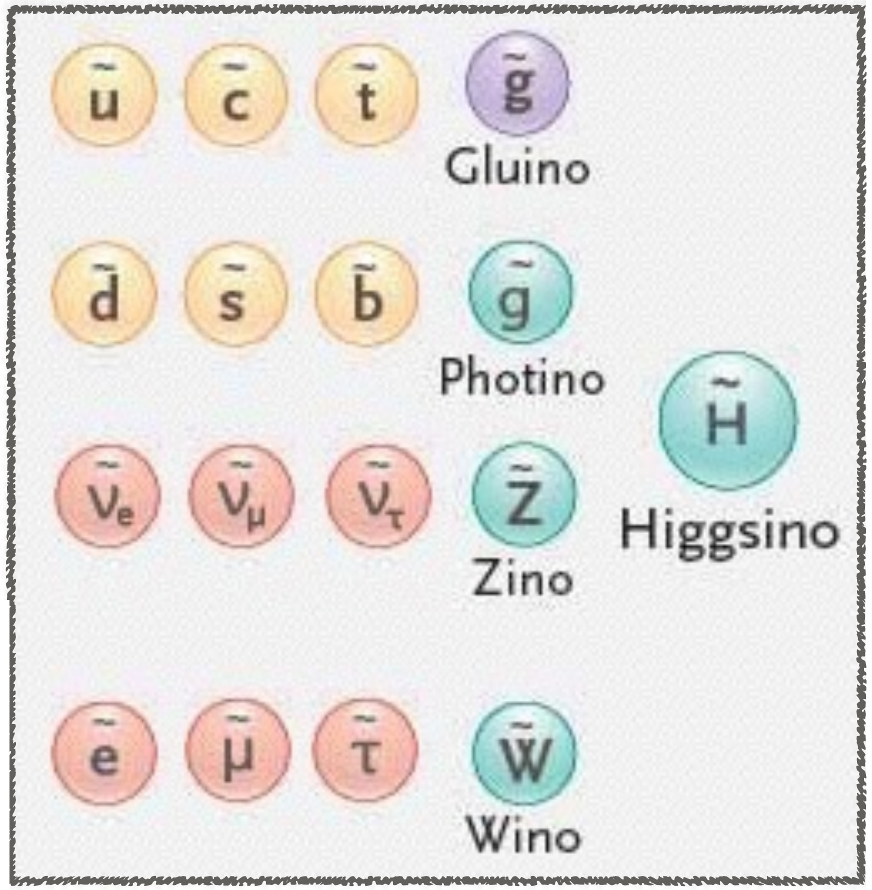
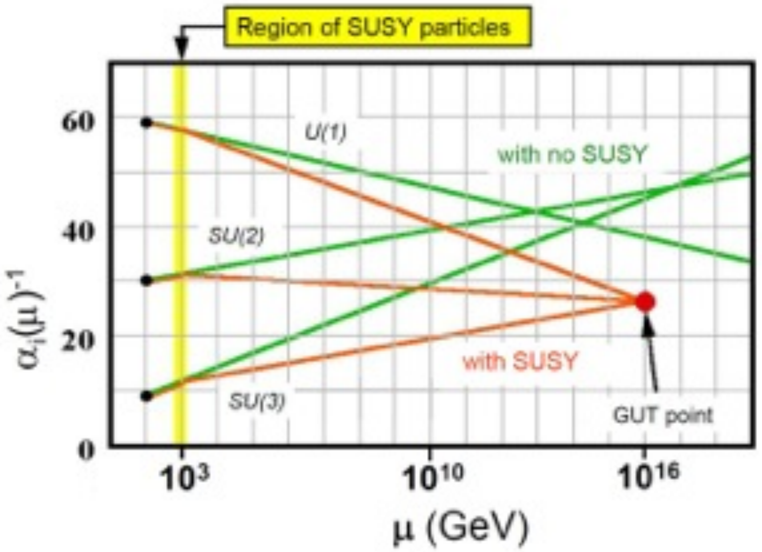


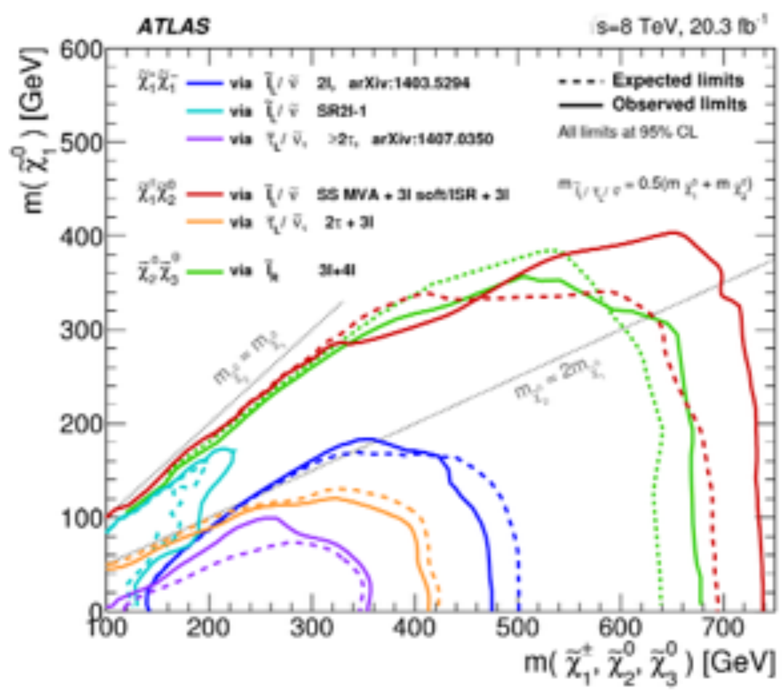
Fine-tuning of Higgs mass

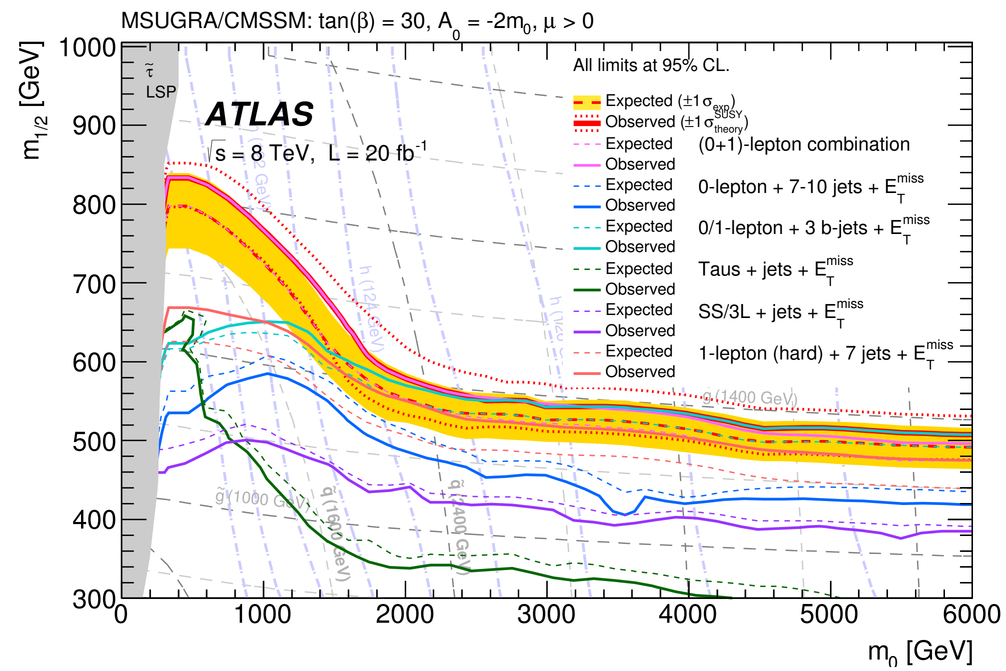
Grand Unification

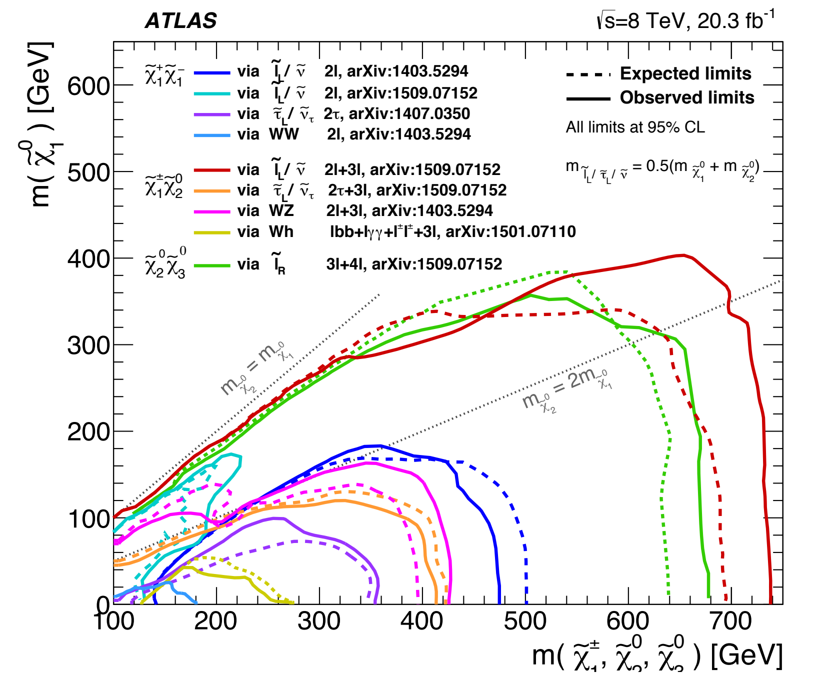


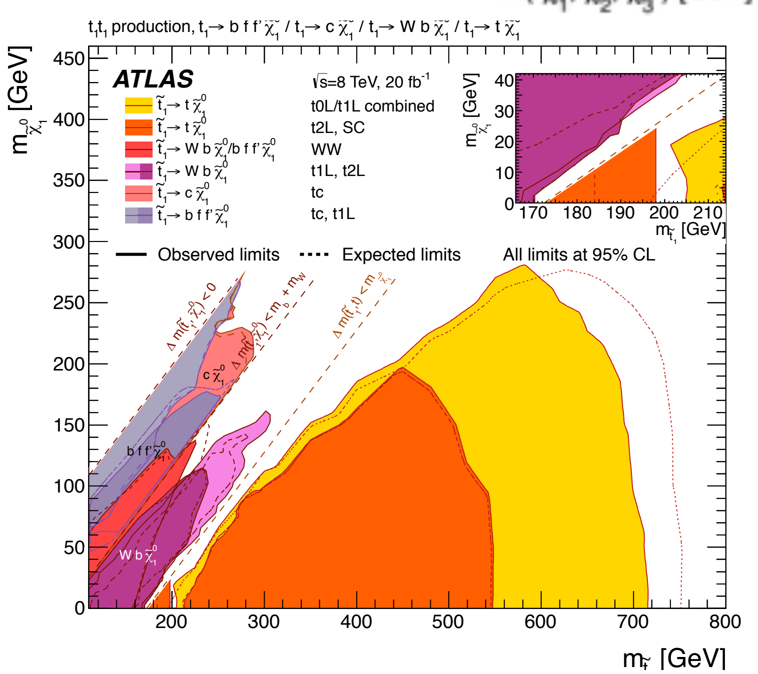
Only extension of Poincaré

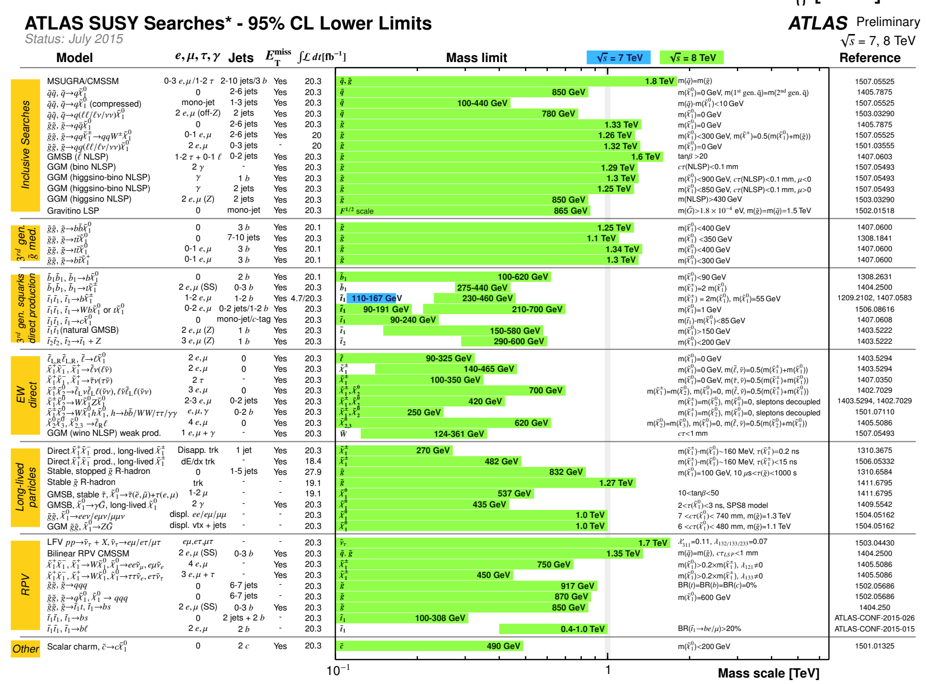
Where did we look in Run-1?

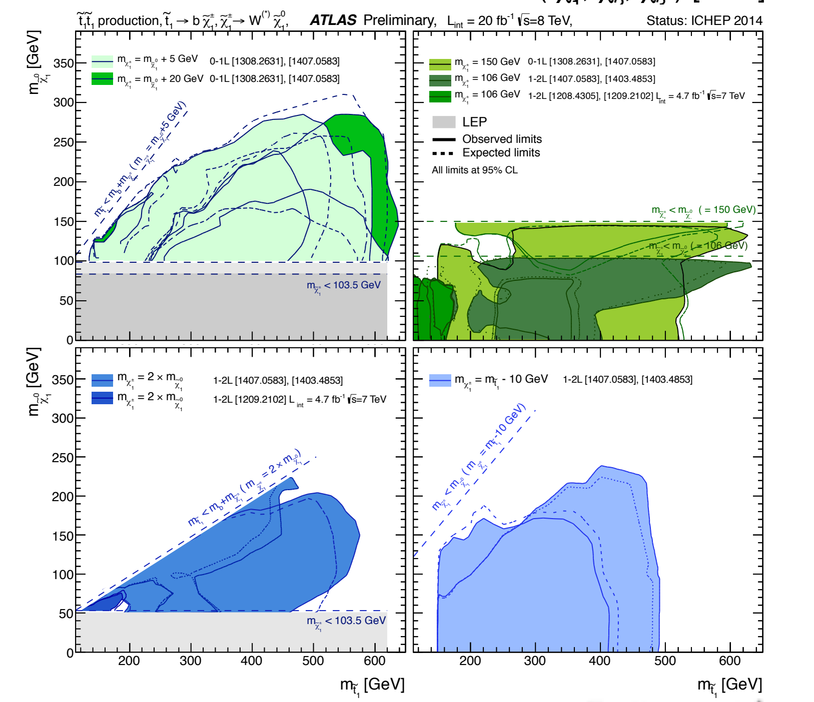

ATLAS
√s=8 TeV, 20.3 fb⁻¹
Expected limits
Observed limits
All limits at 95% CL
m(χ̃₁⁰) [GeV]
m(χ̃₁±, χ̃₂⁰, χ̃₃⁰) [GeV]

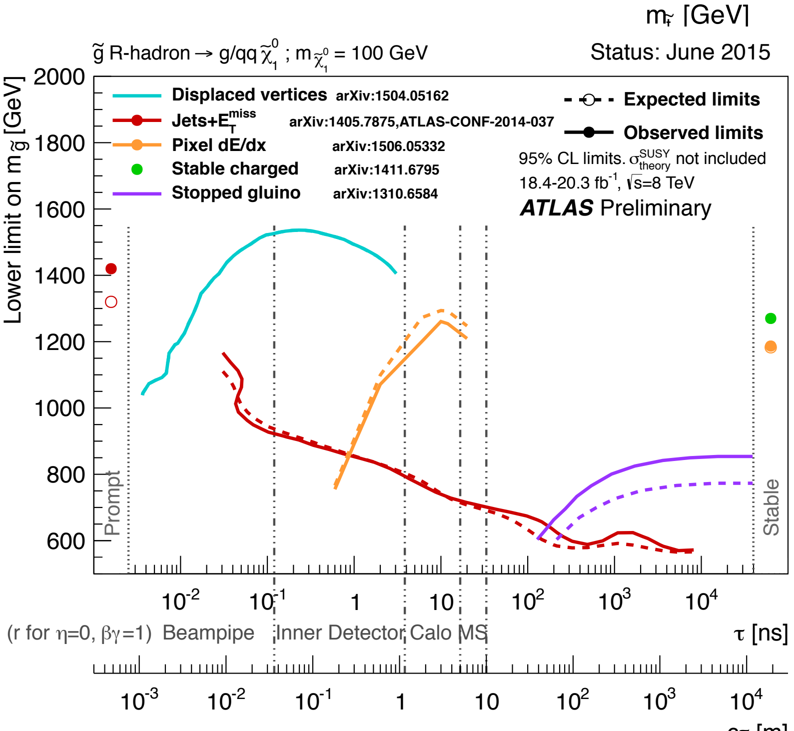

MSUGRA/CMSSM: tan(β) = 30, A₀ = -2m₀, μ > 0
ATLAS
√s = 8 TeV, L = 20 fb⁻¹
All limits at 95% CL.
(0+1)-lepton combination
0-lepton + 7-10 jets + E_T^miss
0/1-lepton + 3 b-jets + E_T^miss
Taus + jets + E_T^miss
SS/3L + jets + E_T^miss
1-lepton (hard) + 7 jets + E_T^miss
m₁/₂ [GeV]
m₀ [GeV]

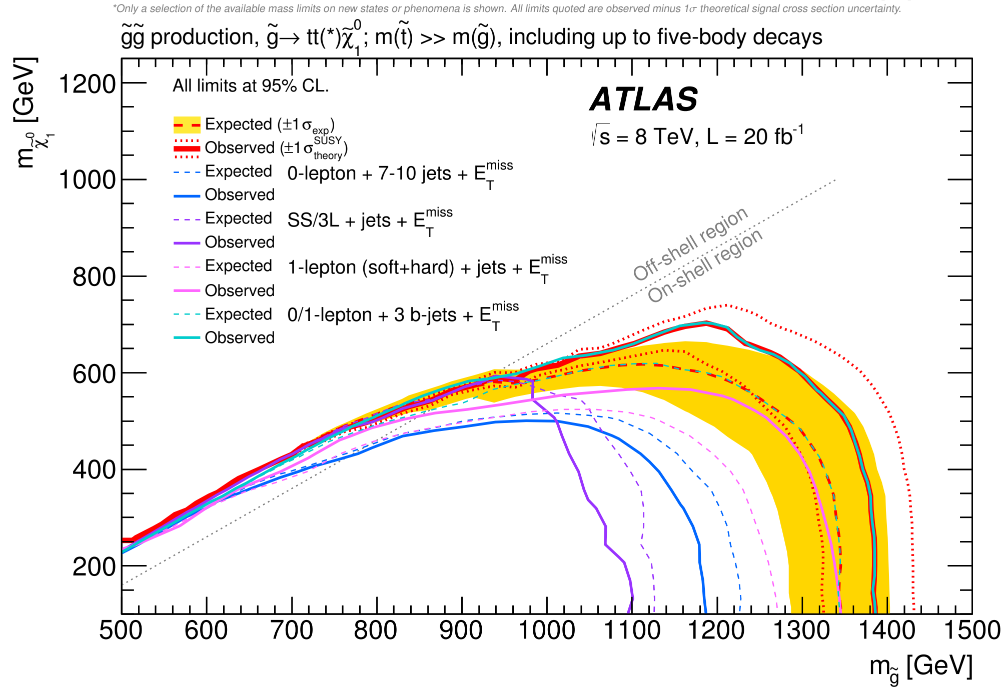

ATLAS
√s=8 TeV, 20.3 fb⁻¹
via WW 2l, arXiv:1403.5294
via WZ 2l+3l, arXiv:1403.5294
via Wh lbb+lγγ+l±l±+3l, arXiv:1501.07110
3l+4l, arXiv:1509.07152
Expected limits
Observed limits
All limits at 95% CL
m(χ̃₁⁰) [GeV]
m(χ̃₁±, χ̃₂⁰, χ̃₃⁰) [GeV]

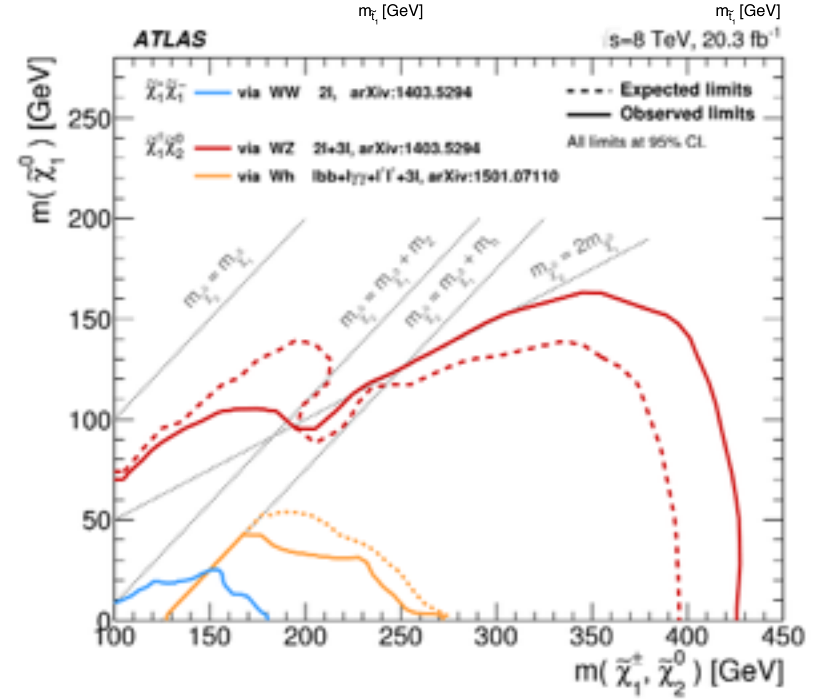

ATLAS
√s=8 TeV, 20 fb⁻¹
t0L/t1L combined
t2L, SC
WW
t1L, t2L
tc
tc, t1L
Observed limits
Expected limits
All limits at 95% CL
m_χ̃₁⁰ [GeV]
m_t̃₁ [GeV]


ATLAS SUSY Searches* - 95% CL Lower Limits
Status: July 2015
ATLAS Preliminary
√s = 7, 8 TeV
Model
Jets
Mass limit
Reference
Inclusive Searches
EW direct
Long-lived particles
RPV
Other
Mass scale [TeV]


ATLAS Preliminary
Status: ICHEP 2014
LEP
Observed limits
Expected limits
All limits at 95% CL
m_t̃ [GeV]


g̃ R-hadron → g/qq̄χ̃₁⁰ ; m_χ̃₁⁰ = 100 GeV
Status: June 2015
Displaced vertices arXiv:1504.05162
Jets+E_T^miss arXiv:1405.7875,ATLAS-CONF-2014-037
Pixel dE/dx arXiv:1506.05332
Stable charged arXiv:1411.6795
Stopped gluino arXiv:1310.6584
Expected limits
Observed limits
95% CL limits. σ_theory^SUSY not included
18.4-20.3 fb⁻¹, √s=8 TeV
ATLAS Preliminary
Lower limit on m_g̃ [GeV]
Prompt
Stable
Beampipe
Inner Detector
Calo
MS
τ [ns]
cτ [m]


g̃g̃ production, g̃→ tt(*)χ̃₁⁰; m(t̃) >> m(g̃), including up to five-body decays
All limits at 95% CL.
ATLAS
√s = 8 TeV, L = 20 fb⁻¹
0-lepton + 7-10 jets + E_T^miss
SS/3L + jets + E_T^miss
1-lepton (soft+hard) + jets + E_T^miss
0/1-lepton + 3 b-jets + E_T^miss
Off-shell region
On-shell region
m_χ̃₁⁰ [GeV]
m_g̃ [GeV]


ATLAS
√s=8 TeV, 20.3 fb⁻¹
via WW 2l, arXiv:1403.5294
via WZ 2l+3l, arXiv:1403.5294
via Wh lbb+lγγ+l±l±+3l, arXiv:1501.07110
Expected limits
Observed limits
All limits at 95% CL
m(χ̃₁⁰) [GeV]
m(χ̃₁±, χ̃₂⁰) [GeV]

ATLAS SUSY Searches* - 95% CL Lower Limits

Status: July 2015

ATLAS Preliminary

$\sqrt{s}$ = 7, 8 TeV

Legend: $\sqrt{s}$ = 7 TeV, $\sqrt{s}$ = 8 TeV

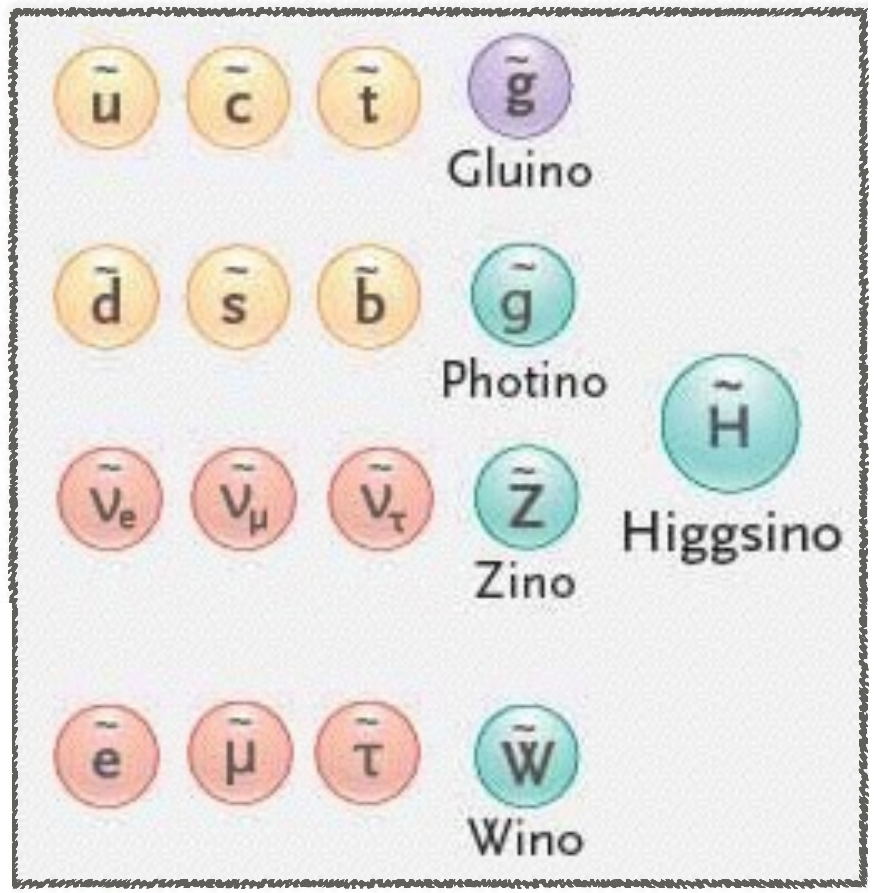
	Model	e,μ,τ,γ	Jets	E_T^{miss}	$\int\mathcal{L}\,dt[fb^{-1}]$	Mass limit		Reference
Inclusive Searches	MSUGRA/CMSSM	0-3 e,μ/1-2 τ	2-10 jets/3 b	Yes	20.3	$\tilde{q},\tilde{g}$ 1.8 TeV	$m(\tilde{q})=m(\tilde{g})$	1507.05525
	$\tilde{q}\tilde{q}$, $\tilde{q}\to q\tilde{\chi}_1^0$	0	2-6 jets	Yes	20.3	$\tilde{q}$ 850 GeV	$m(\tilde{\chi}_1^0)$=0 GeV, m(1st gen. $\tilde{q}$)=m(2nd gen. $\tilde{q}$)	1405.7875
	$\tilde{q}\tilde{q}$, $\tilde{q}\to q\tilde{\chi}_1^0$ (compressed)	mono-jet	1-3 jets	Yes	20.3	$\tilde{q}$ 100-440 GeV	$m(\tilde{q})-m(\tilde{\chi}_1^0)$<10 GeV	1507.05525
	$\tilde{q}\tilde{q}$, $\tilde{q}\to q(\ell\ell/\ell\nu/\nu\nu)\tilde{\chi}_1^0$	2 e,μ (off-Z)	2 jets	Yes	20.3	$\tilde{q}$ 780 GeV	$m(\tilde{\chi}_1^0)$=0 GeV	1503.03290
	$\tilde{g}\tilde{g}$, $\tilde{g}\to q\bar{q}\tilde{\chi}_1^0$	0	2-6 jets	Yes	20.3	$\tilde{g}$ 1.33 TeV	$m(\tilde{\chi}_1^0)$=0 GeV	1405.7875
	$\tilde{g}\tilde{g}$, $\tilde{g}\to qq\tilde{\chi}_1^\pm\to qqW^\pm\tilde{\chi}_1^0$	0-1 e,μ	2-6 jets	Yes	20	$\tilde{g}$ 1.26 TeV	$m(\tilde{\chi}_1^0)$<300 GeV, $m(\tilde{\chi}^\pm)=0.5(m(\tilde{\chi}_1^0)+m(\tilde{g}))$	1507.05525
	$\tilde{g}\tilde{g}$, $\tilde{g}\to qq(\ell\ell/\ell\nu/\nu\nu)\tilde{\chi}_1^0$	2 e,μ	0-3 jets	-	20	$\tilde{g}$ 1.32 TeV	$m(\tilde{\chi}_1^0)$=0 GeV	1501.03555
	GMSB ($\tilde{\ell}$ NLSP)	1-2 τ + 0-1 ℓ	0-2 jets	Yes	20.3	$\tilde{g}$ 1.6 TeV	$\tan\beta$>20	1407.0603
	GGM (bino NLSP)	2 γ	-	Yes	20.3	$\tilde{g}$ 1.29 TeV	$c\tau$(NLSP)<0.1 mm	1507.05493
	GGM (higgsino-bino NLSP)	γ	1 b	Yes	20.3	$\tilde{g}$ 1.3 TeV	$m(\tilde{\chi}_1^0)$<900 GeV, $c\tau$(NLSP)<0.1 mm, μ<0	1507.05493
	GGM (higgsino-bino NLSP)	γ	2 jets	Yes	20.3	$\tilde{g}$ 1.25 TeV	$m(\tilde{\chi}_1^0)$<850 GeV, $c\tau$(NLSP)<0.1 mm, μ>0	1507.05493
	GGM (higgsino NLSP)	2 e,μ (Z)	2 jets	Yes	20.3	$\tilde{g}$ 850 GeV	m(NLSP)>430 GeV	1503.03290
	Gravitino LSP	0	mono-jet	Yes	20.3	$F^{1/2}$ scale 865 GeV	$m(\tilde{G})>1.8\times10^{-4}$ eV, $m(\tilde{g})=m(\tilde{q})$=1.5 TeV	1502.01518
3rd gen. $\tilde{g}$ med.	$\tilde{g}\tilde{g}$, $\tilde{g}\to b\bar{b}\tilde{\chi}_1^0$	0	3 b	Yes	20.1	$\tilde{g}$ 1.25 TeV	$m(\tilde{\chi}_1^0)$<400 GeV	1407.0600
	$\tilde{g}\tilde{g}$, $\tilde{g}\to t\bar{t}\tilde{\chi}_1^0$	0	7-10 jets	Yes	20.3	$\tilde{g}$ 1.1 TeV	$m(\tilde{\chi}_1^0)$ <350 GeV	1308.1841
	$\tilde{g}\tilde{g}$, $\tilde{g}\to t\bar{t}\tilde{\chi}_1^0$	0-1 e,μ	3 b	Yes	20.1	$\tilde{g}$ 1.34 TeV	$m(\tilde{\chi}_1^0)$<400 GeV	1407.0600
	$\tilde{g}\tilde{g}$, $\tilde{g}\to b\bar{t}\tilde{\chi}_1^+$	0-1 e,μ	3 b	Yes	20.1	$\tilde{g}$ 1.3 TeV	$m(\tilde{\chi}_1^0)$<300 GeV	1407.0600
3rd gen. squarks direct production	$\tilde{b}_1\tilde{b}_1$, $\tilde{b}_1\to b\tilde{\chi}_1^0$	0	2 b	Yes	20.1	$\tilde{b}_1$ 100-620 GeV	$m(\tilde{\chi}_1^0)$<90 GeV	1308.2631
	$\tilde{b}_1\tilde{b}_1$, $\tilde{b}_1\to t\tilde{\chi}_1^\pm$	2 e,μ (SS)	0-3 b	Yes	20.3	$\tilde{b}_1$ 275-440 GeV	$m(\tilde{\chi}_1^\pm)=2\,m(\tilde{\chi}_1^0)$	1404.2500
	$\tilde{t}_1\tilde{t}_1$, $\tilde{t}_1\to b\tilde{\chi}_1^\pm$	1-2 e,μ	1-2 b	Yes	4.7/20.3	$\tilde{t}_1$ 110-167 GeV ($\sqrt{s}$ = 7 TeV), 230-460 GeV	$m(\tilde{\chi}_1^\pm) = 2m(\tilde{\chi}_1^0)$, $m(\tilde{\chi}_1^0)$=55 GeV	1209.2102, 1407.0583
	$\tilde{t}_1\tilde{t}_1$, $\tilde{t}_1\to Wb\tilde{\chi}_1^0$ or $t\tilde{\chi}_1^0$	0-2 e,μ	0-2 jets/1-2 b	Yes	20.3	$\tilde{t}_1$ 90-191 GeV, 210-700 GeV	$m(\tilde{\chi}_1^0)$=1 GeV	1506.08616
	$\tilde{t}_1\tilde{t}_1$, $\tilde{t}_1\to c\tilde{\chi}_1^0$	0	mono-jet/c-tag	Yes	20.3	$\tilde{t}_1$ 90-240 GeV	$m(\tilde{t}_1)-m(\tilde{\chi}_1^0)$<85 GeV	1407.0608
	$\tilde{t}_1\tilde{t}_1$ (natural GMSB)	2 e,μ (Z)	1 b	Yes	20.3	$\tilde{t}_1$ 150-580 GeV	$m(\tilde{\chi}_1^0)$>150 GeV	1403.5222
	$\tilde{t}_2\tilde{t}_2$, $\tilde{t}_2\to\tilde{t}_1+Z$	3 e,μ (Z)	1 b	Yes	20.3	$\tilde{t}_2$ 290-600 GeV	$m(\tilde{\chi}_1^0)$<200 GeV	1403.5222
EW direct	$\tilde{\ell}_{L,R}\tilde{\ell}_{L,R}$, $\tilde{\ell}\to\ell\tilde{\chi}_1^0$	2 e,μ	0	Yes	20.3	$\tilde{\ell}$ 90-325 GeV	$m(\tilde{\chi}_1^0)$=0 GeV	1403.5294
	$\tilde{\chi}_1^+\tilde{\chi}_1^-$, $\tilde{\chi}_1^+\to\tilde{\ell}\nu(\ell\tilde{\nu})$	2 e,μ	0	Yes	20.3	$\tilde{\chi}_1^\pm$ 140-465 GeV	$m(\tilde{\chi}_1^0)$=0 GeV, $m(\tilde{\ell},\tilde{\nu})=0.5(m(\tilde{\chi}_1^\pm)+m(\tilde{\chi}_1^0))$	1403.5294
	$\tilde{\chi}_1^+\tilde{\chi}_1^-$, $\tilde{\chi}_1^+\to\tilde{\tau}\nu(\tau\tilde{\nu})$	2 τ	-	Yes	20.3	$\tilde{\chi}_1^\pm$ 100-350 GeV	$m(\tilde{\chi}_1^0)$=0 GeV, $m(\tilde{\tau},\tilde{\nu})=0.5(m(\tilde{\chi}_1^\pm)+m(\tilde{\chi}_1^0))$	1407.0350
	$\tilde{\chi}_1^\pm\tilde{\chi}_2^0\to\tilde{\ell}_L\nu\tilde{\ell}_L\ell(\tilde{\nu}\nu)$, $\ell\tilde{\nu}\tilde{\ell}_L\ell(\tilde{\nu}\nu)$	3 e,μ	0	Yes	20.3	$\tilde{\chi}_1^\pm,\tilde{\chi}_2^0$ 700 GeV	$m(\tilde{\chi}_1^\pm)=m(\tilde{\chi}_2^0)$, $m(\tilde{\chi}_1^0)$=0, $m(\tilde{\ell},\tilde{\nu})=0.5(m(\tilde{\chi}_1^\pm)+m(\tilde{\chi}_1^0))$	1402.7029
	$\tilde{\chi}_1^\pm\tilde{\chi}_2^0\to W\tilde{\chi}_1^0 Z\tilde{\chi}_1^0$	2-3 e,μ	0-2 jets	Yes	20.3	$\tilde{\chi}_1^\pm,\tilde{\chi}_2^0$ 420 GeV	$m(\tilde{\chi}_1^\pm)=m(\tilde{\chi}_2^0)$, $m(\tilde{\chi}_1^0)$=0, sleptons decoupled	1403.5294, 1402.7029
	$\tilde{\chi}_1^\pm\tilde{\chi}_2^0\to W\tilde{\chi}_1^0 h\tilde{\chi}_1^0$, $h\to b\bar{b}/WW/\tau\tau/\gamma\gamma$	e,μ,γ	0-2 b	Yes	20.3	$\tilde{\chi}_1^\pm,\tilde{\chi}_2^0$ 250 GeV	$m(\tilde{\chi}_1^\pm)=m(\tilde{\chi}_2^0)$, $m(\tilde{\chi}_1^0)$=0, sleptons decoupled	1501.07110
	$\tilde{\chi}_2^0\tilde{\chi}_3^0$, $\tilde{\chi}_{2,3}^0\to\tilde{\ell}_R\ell$	4 e,μ	0	Yes	20.3	$\tilde{\chi}_{2,3}^0$ 620 GeV	$m(\tilde{\chi}_2^0)=m(\tilde{\chi}_3^0)$, $m(\tilde{\chi}_1^0)$=0, $m(\tilde{\ell},\tilde{\nu})=0.5(m(\tilde{\chi}_2^0)+m(\tilde{\chi}_1^0))$	1405.5086
	GGM (wino NLSP) weak prod.	1 e,μ + γ	-	Yes	20.3	$\tilde{W}$ 124-361 GeV	$c\tau$<1 mm	1507.05493
Long-lived particles	Direct $\tilde{\chi}_1^+\tilde{\chi}_1^-$ prod., long-lived $\tilde{\chi}_1^\pm$	Disapp. trk	1 jet	Yes	20.3	$\tilde{\chi}_1^\pm$ 270 GeV	$m(\tilde{\chi}_1^\pm)-m(\tilde{\chi}_1^0)$~160 MeV, $\tau(\tilde{\chi}_1^\pm)$=0.2 ns	1310.3675
	Direct $\tilde{\chi}_1^+\tilde{\chi}_1^-$ prod., long-lived $\tilde{\chi}_1^\pm$	dE/dx trk	-	Yes	18.4	$\tilde{\chi}_1^\pm$ 482 GeV	$m(\tilde{\chi}_1^\pm)-m(\tilde{\chi}_1^0)$~160 MeV, $\tau(\tilde{\chi}_1^\pm)$<15 ns	1506.05332
	Stable, stopped $\tilde{g}$ R-hadron	0	1-5 jets	Yes	27.9	$\tilde{g}$ 832 GeV	$m(\tilde{\chi}_1^0)$=100 GeV, 10 μs<$\tau(\tilde{g})$<1000 s	1310.6584
	Stable $\tilde{g}$ R-hadron	trk	-	-	19.1	$\tilde{g}$ 1.27 TeV		1411.6795
	GMSB, stable $\tilde{\tau}$, $\tilde{\chi}_1^0\to\tilde{\tau}(\tilde{e},\tilde{\mu})+\tau(e,\mu)$	1-2 μ	-	-	19.1	$\tilde{\chi}_1^0$ 537 GeV	10<$\tan\beta$<50	1411.6795
	GMSB, $\tilde{\chi}_1^0\to\gamma\tilde{G}$, long-lived $\tilde{\chi}_1^0$	2 γ	-	Yes	20.3	$\tilde{\chi}_1^0$ 435 GeV	2<$\tau(\tilde{\chi}_1^0)$<3 ns, SPS8 model	1409.5542
	$\tilde{g}\tilde{g}$, $\tilde{\chi}_1^0\to eev/e\mu v/\mu\mu v$	displ. $ee/e\mu/\mu\mu$	-	-	20.3	$\tilde{\chi}_1^0$ 1.0 TeV	7 <$c\tau(\tilde{\chi}_1^0)$< 740 mm, $m(\tilde{g})$=1.3 TeV	1504.05162
	GGM $\tilde{g}\tilde{g}$, $\tilde{\chi}_1^0\to Z\tilde{G}$	displ. vtx + jets	-	-	20.3	$\tilde{\chi}_1^0$ 1.0 TeV	6 <$c\tau(\tilde{\chi}_1^0)$< 480 mm, $m(\tilde{g})$=1.1 TeV	1504.05162
RPV	LFV $pp\to\tilde{\nu}_\tau+X$, $\tilde{\nu}_\tau\to e\mu/e\tau/\mu\tau$	$e\mu,e\tau,\mu\tau$	-	-	20.3	$\tilde{\nu}_\tau$ 1.7 TeV	λ'_{311}=0.11, $\lambda_{132/133/233}$=0.07	1503.04430
	Bilinear RPV CMSSM	2 e,μ (SS)	0-3 b	Yes	20.3	$\tilde{q},\tilde{g}$ 1.35 TeV	$m(\tilde{q})=m(\tilde{g})$, $c\tau_{LSP}$<1 mm	1404.2500
	$\tilde{\chi}_1^+\tilde{\chi}_1^-$, $\tilde{\chi}_1^+\to W\tilde{\chi}_1^0$, $\tilde{\chi}_1^0\to ee\tilde{\nu}_\mu, e\mu\tilde{\nu}_e$	4 e,μ	-	Yes	20.3	$\tilde{\chi}_1^\pm$ 750 GeV	$m(\tilde{\chi}_1^0)>0.2\times m(\tilde{\chi}_1^\pm)$, $\lambda_{121}\neq0$	1405.5086
	$\tilde{\chi}_1^+\tilde{\chi}_1^-$, $\tilde{\chi}_1^+\to W\tilde{\chi}_1^0$, $\tilde{\chi}_1^0\to\tau\tau\tilde{\nu}_e, e\tau\tilde{\nu}_\tau$	3 e,μ + τ	-	Yes	20.3	$\tilde{\chi}_1^\pm$ 450 GeV	$m(\tilde{\chi}_1^0)>0.2\times m(\tilde{\chi}_1^\pm)$, $\lambda_{133}\neq0$	1405.5086
	$\tilde{g}\tilde{g}$, $\tilde{g}\to qqq$	0	6-7 jets	-	20.3	$\tilde{g}$ 917 GeV	BR(t)=BR(b)=BR(c)=0%	1502.05686
	$\tilde{g}\tilde{g}$, $\tilde{g}\to q\tilde{\chi}_1^0$, $\tilde{\chi}_1^0\to qqq$	0	6-7 jets	-	20.3	$\tilde{g}$ 870 GeV	$m(\tilde{\chi}_1^0)$=600 GeV	1502.05686
	$\tilde{g}\tilde{g}$, $\tilde{g}\to\tilde{t}_1 t$, $\tilde{t}_1\to bs$	2 e,μ (SS)	0-3 b	Yes	20.3	$\tilde{g}$ 850 GeV		1404.250
	$\tilde{t}_1\tilde{t}_1$, $\tilde{t}_1\to bs$	0	2 jets + 2 b	-	20.3	$\tilde{t}_1$ 100-308 GeV		ATLAS-CONF-2015-026
	$\tilde{t}_1\tilde{t}_1$, $\tilde{t}_1\to b\ell$	2 e,μ	2 b	-	20.3	$\tilde{t}_1$ 0.4-1.0 TeV	BR($\tilde{t}_1\to be/\mu$)>20%	ATLAS-CONF-2015-015
Other	Scalar charm, $\tilde{c}\to c\tilde{\chi}_1^0$	0	2 c	Yes	20.3	$\tilde{c}$ 490 GeV	$m(\tilde{\chi}_1^0)$<200 GeV	1501.01325

10^{-1} — 1 — **Mass scale [TeV]**

*Only a selection of the available mass limits on new states or phenomena is shown. All limits quoted are observed minus 1σ theoretical signal cross section uncertainty.

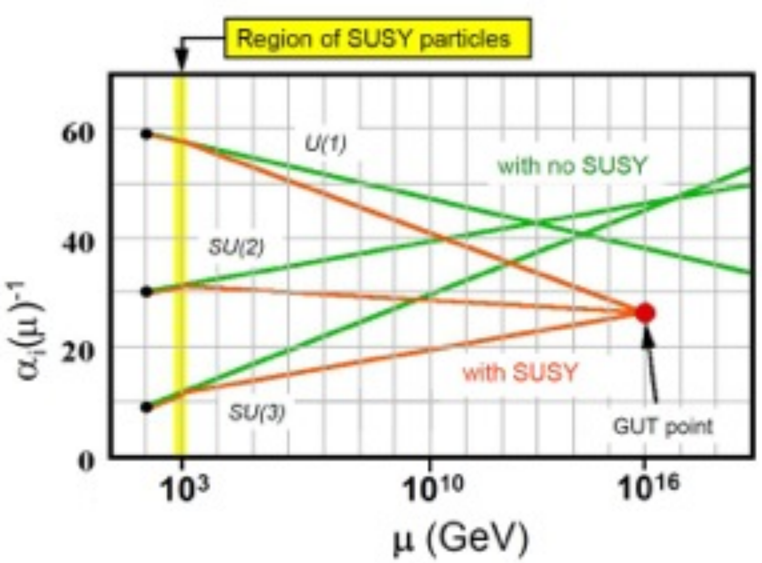
Why we keep looking for SUSY?

Dark Matter Candidate



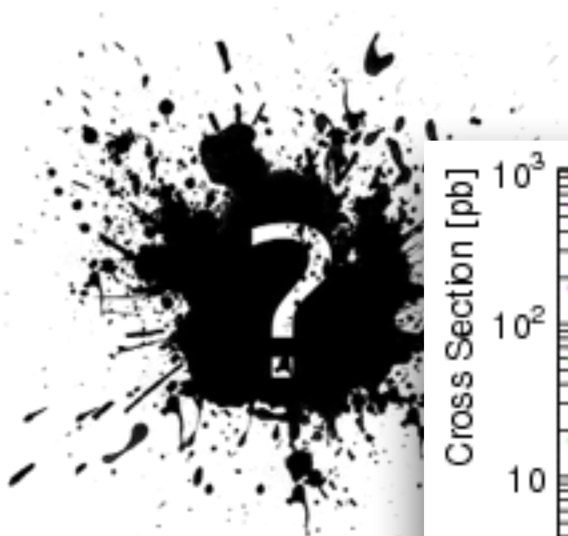
Fine-tuning of Higgs mass

Grand Unification



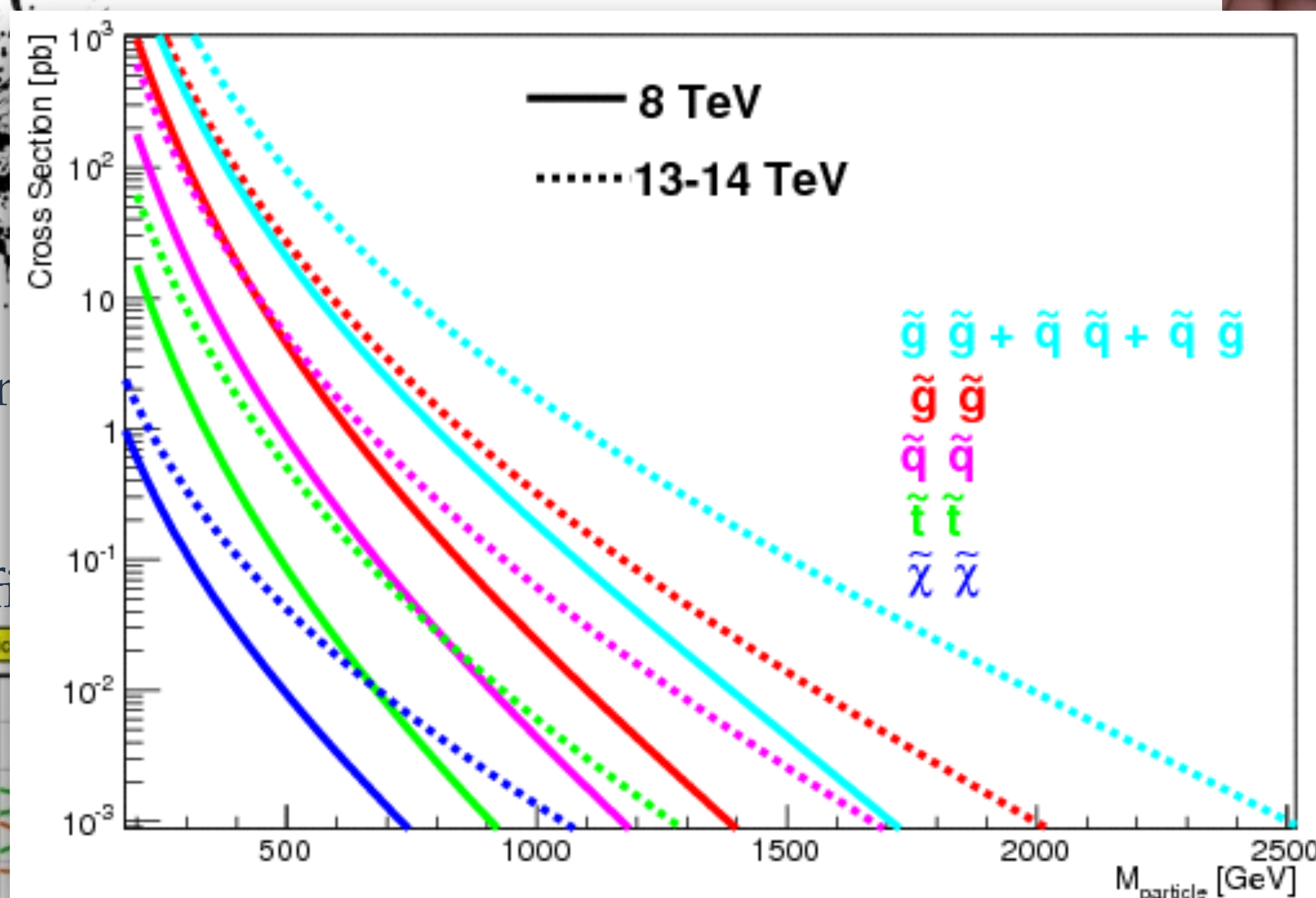
Only extension of Poincaré

Why we keep looking for SUSY?

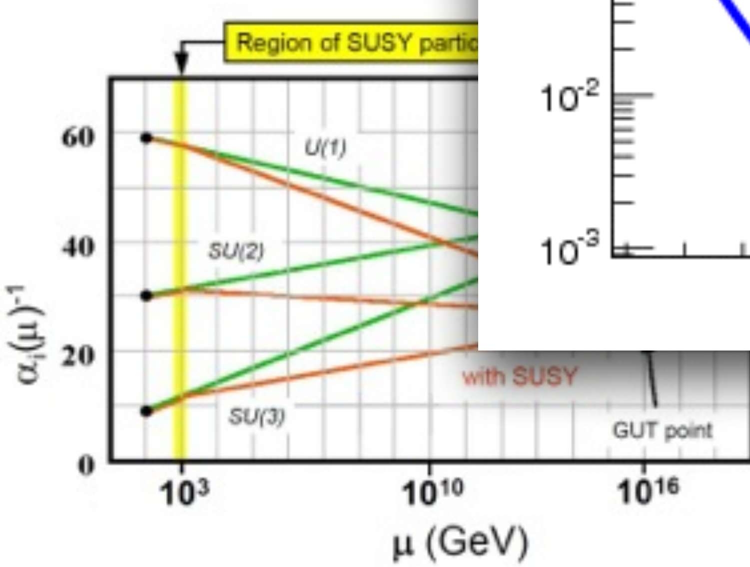


Dark Matter Car

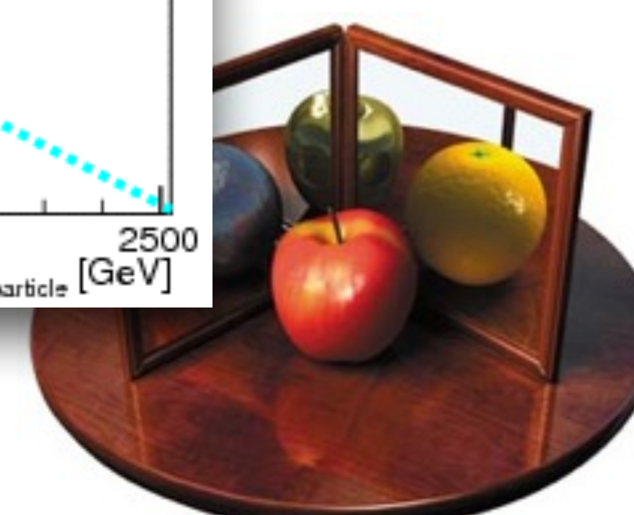
ing of Higgs mass



Grand Unifi



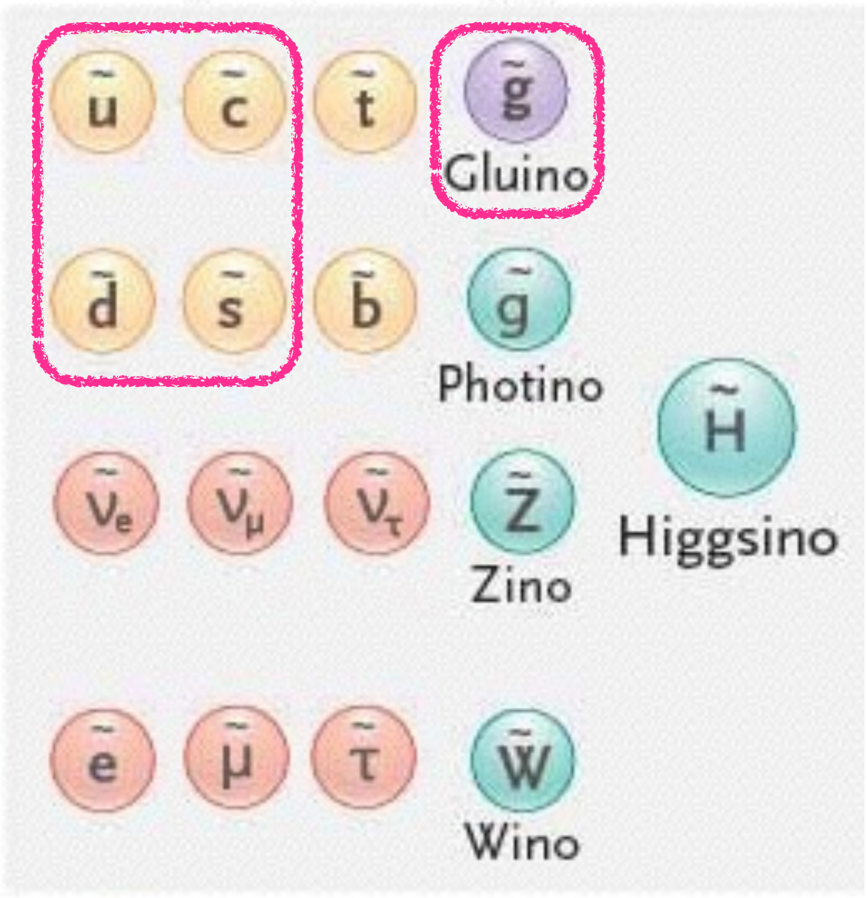
ension of Poincaré



SUSY hunters @ Nikhef

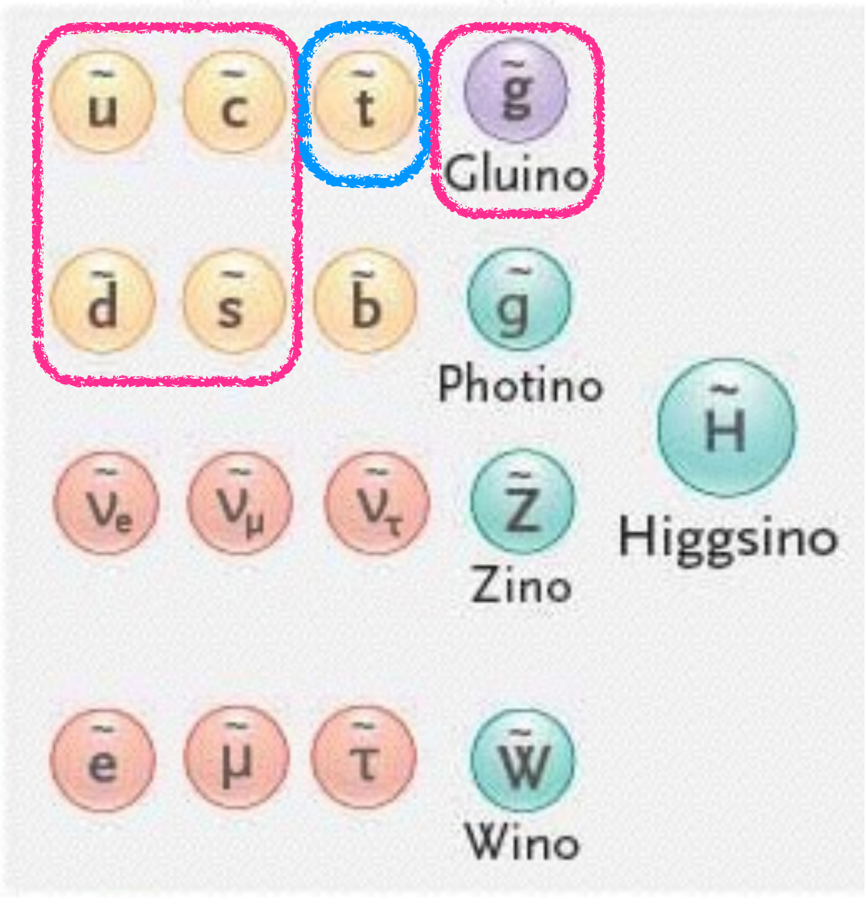
SUSY hunters @ Nikhef

Paul, Sascha, Antonia, Ingrid: 0-leptons, 2-6 jets, and E_T^{miss}



SUSY hunters @ Nikhef

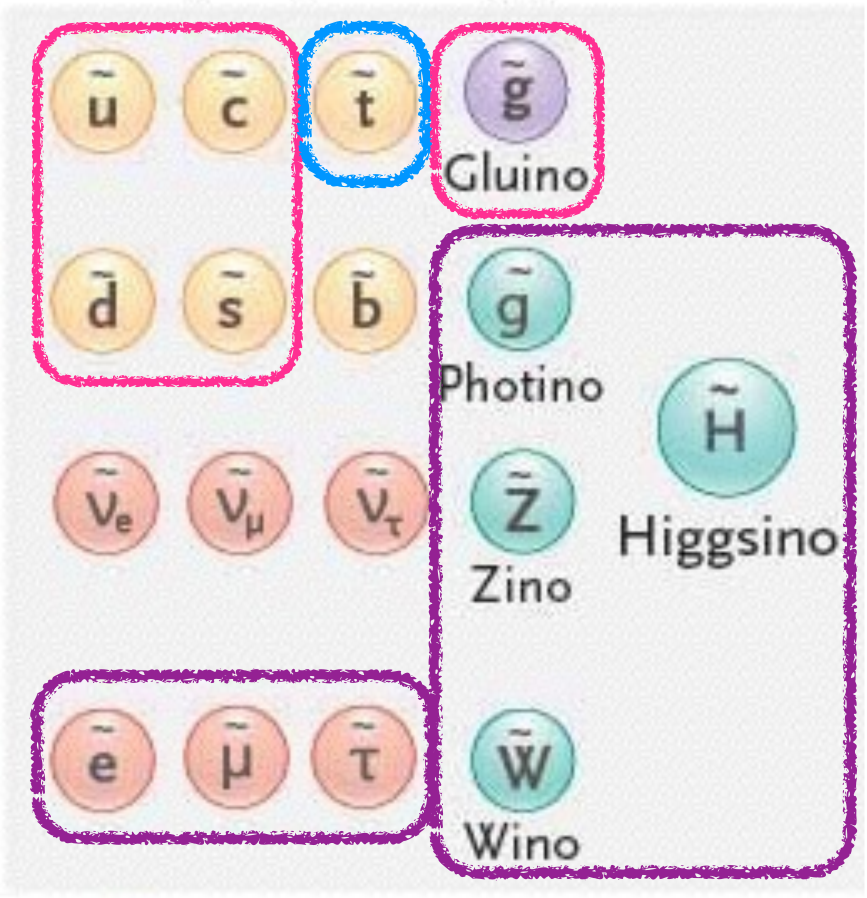
Paul, Sascha, Antonia, Ingrid: 0-leptons, 2-6 jets, and E_T^{miss}



Paul, Sarah, Pierfrancesco: Stop decays with taus.

SUSY hunters @ Nikhef

Paul, Sascha, Antonia, Ingrid: 0-leptons, 2-6 jets, and E_T^{miss}

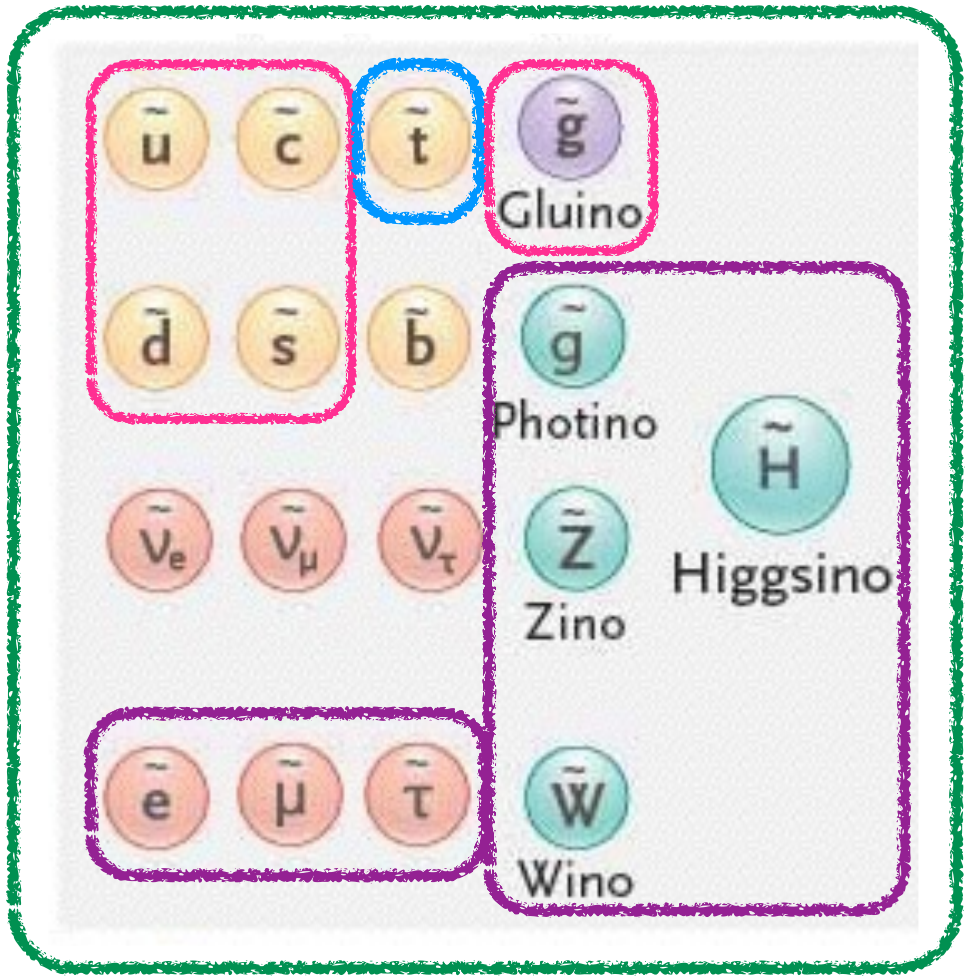


Paul, Sarah, Pierfrancesco: Stop decays with taus.

Sarah: Chargino, neutralino, and slepton production

SUSY hunters @ Nikhef

Paul, Sascha, Antonia, Ingrid: 0-leptons, 2-6 jets, and E_T^{miss}



Paul, Sarah, Pierfrancesco: Stop decays with taus.

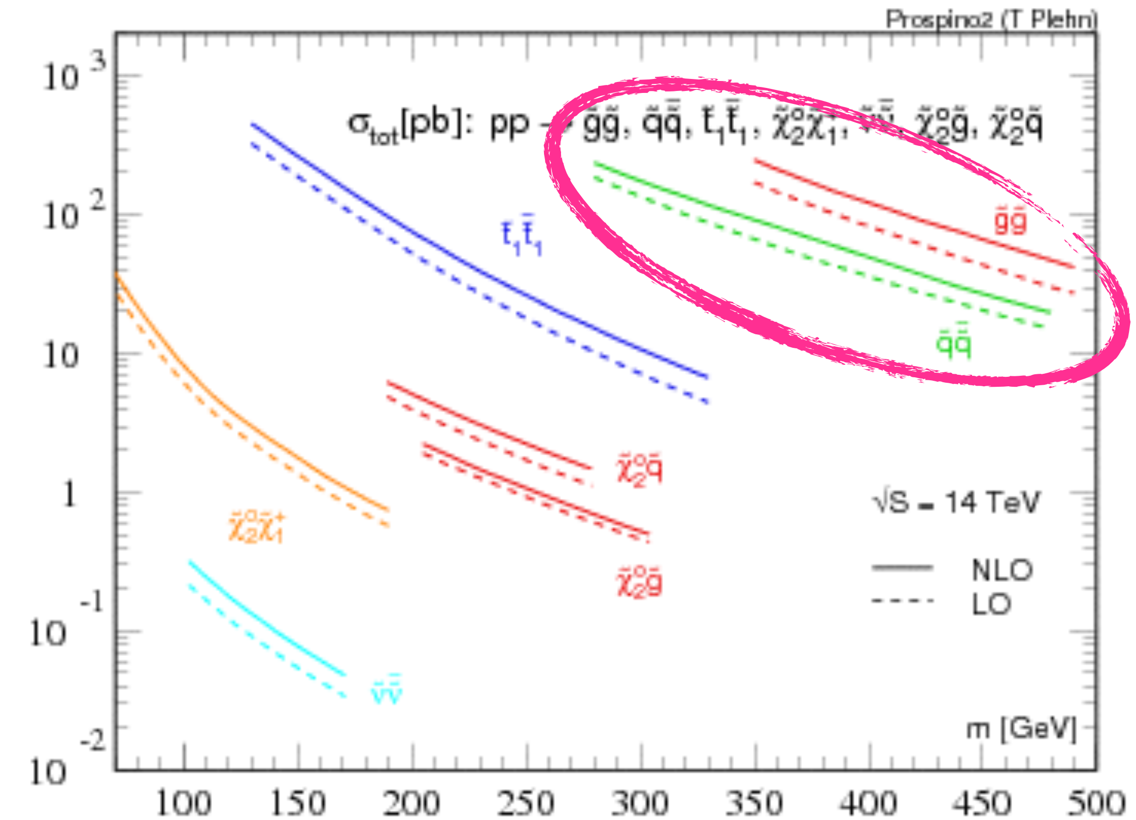
Sarah: Chargino, neutralino, and slepton production

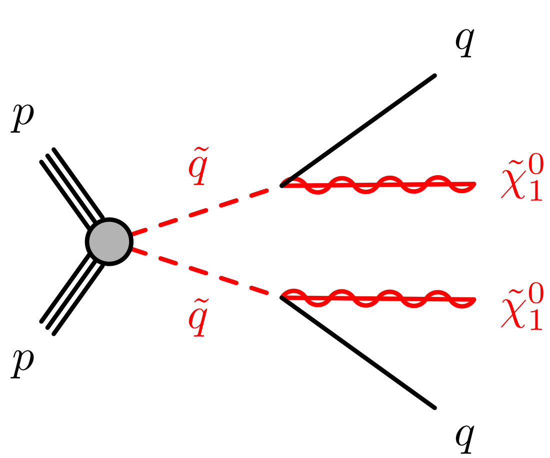
Sascha, Jeroen: Model independent general searches.

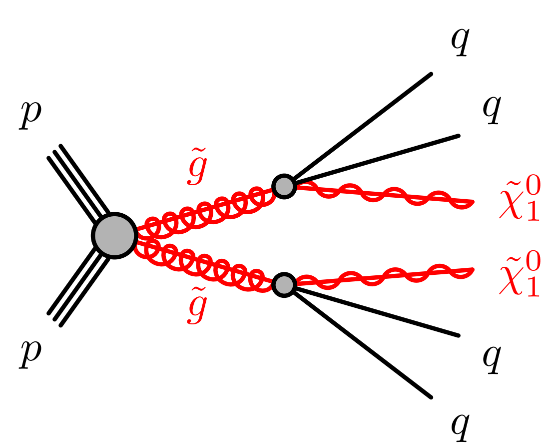
What am I looking for?

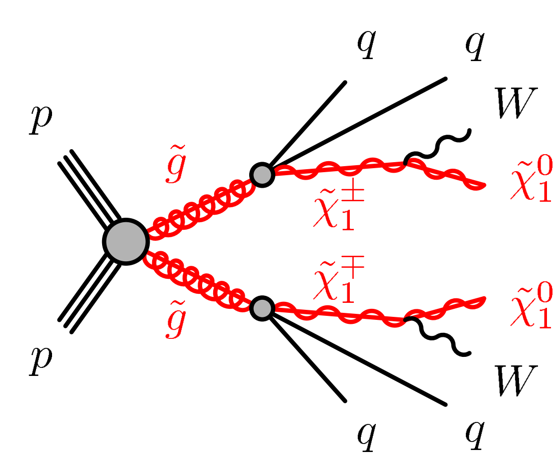
Squark and gluino, simplified models:

- No assumption on the SUSY breaking
- One type of sparticle is produced
- 100% BF with simple decay chain.

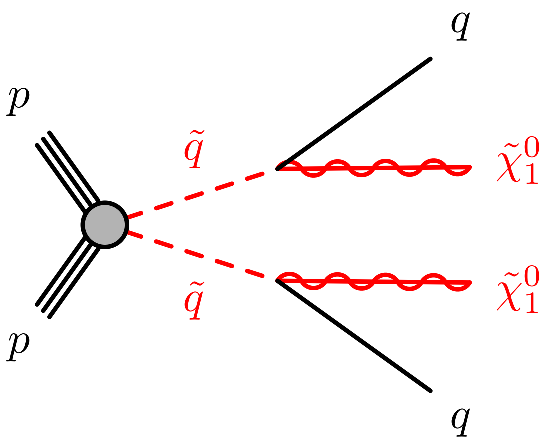


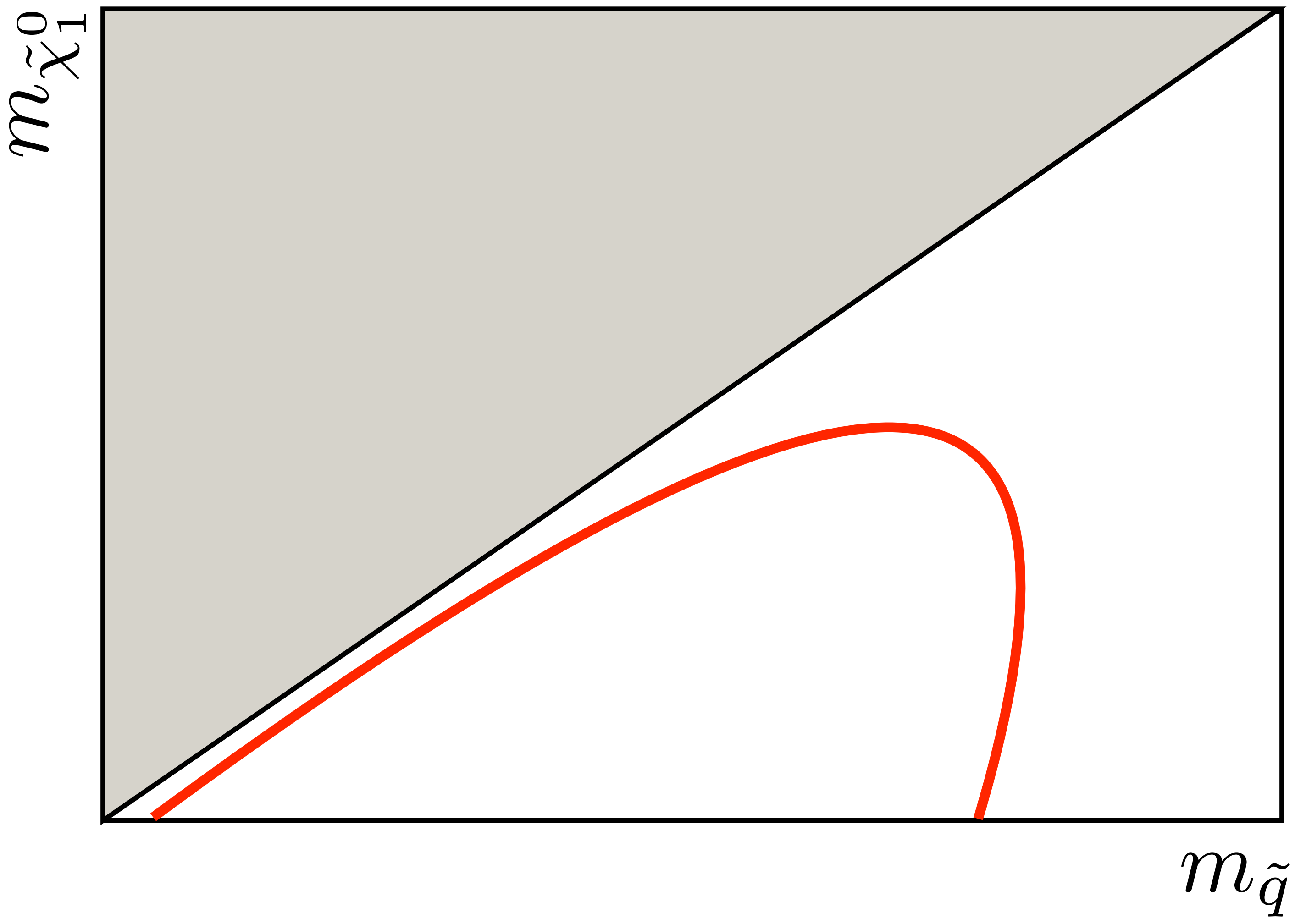




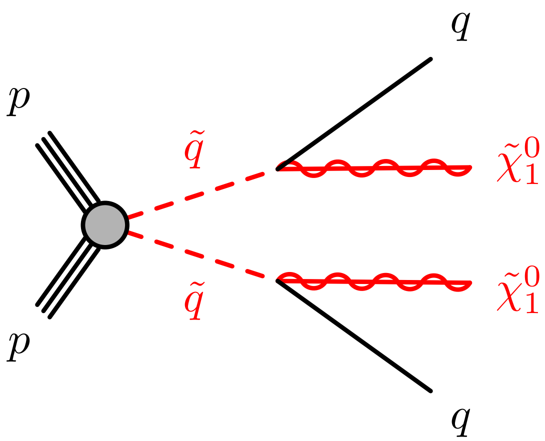


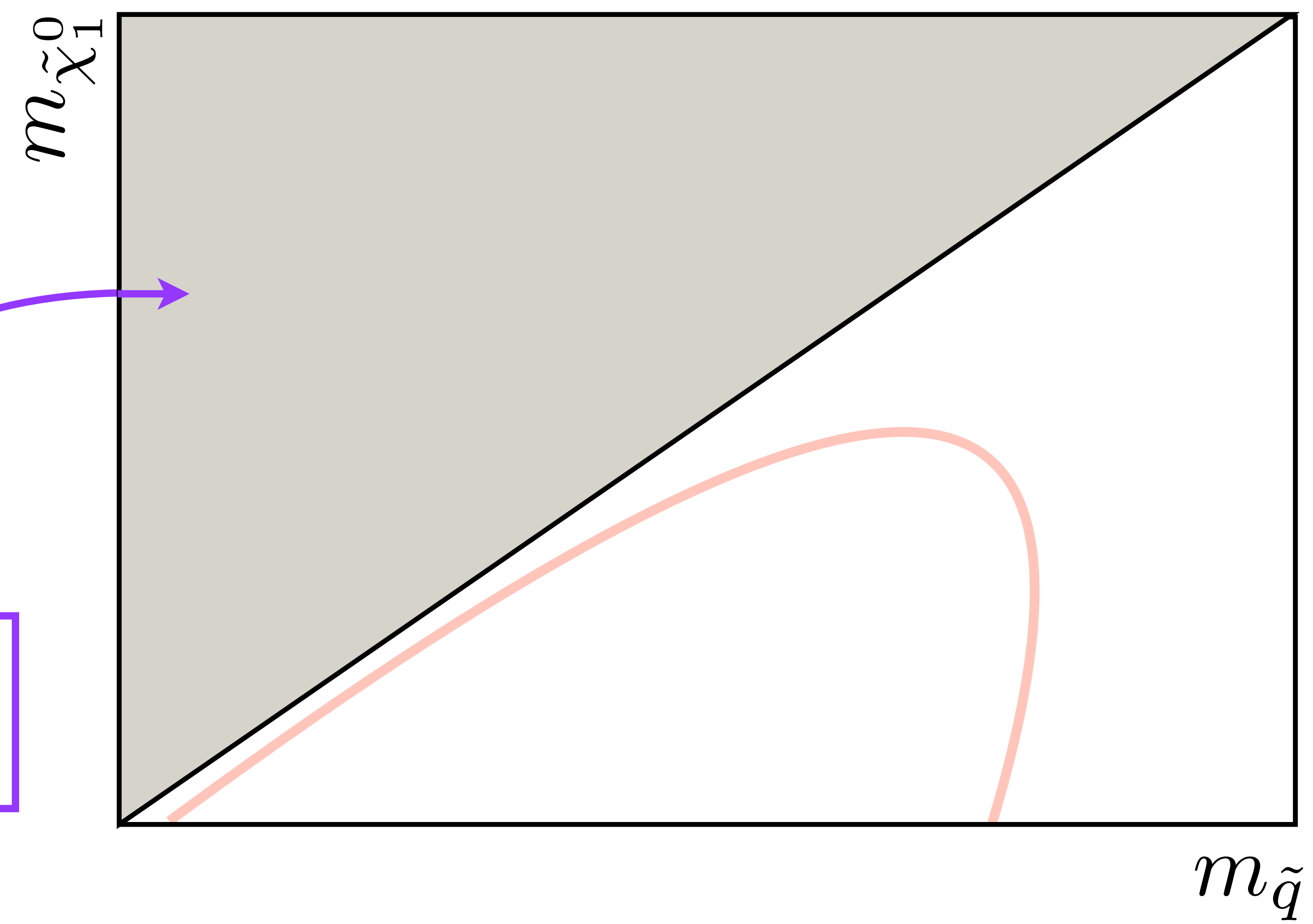
How does it look?





How does it look?





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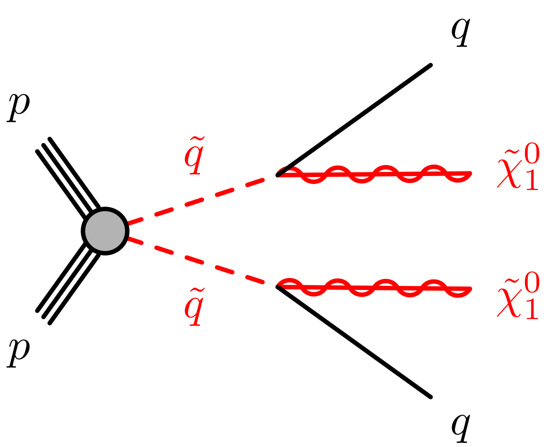
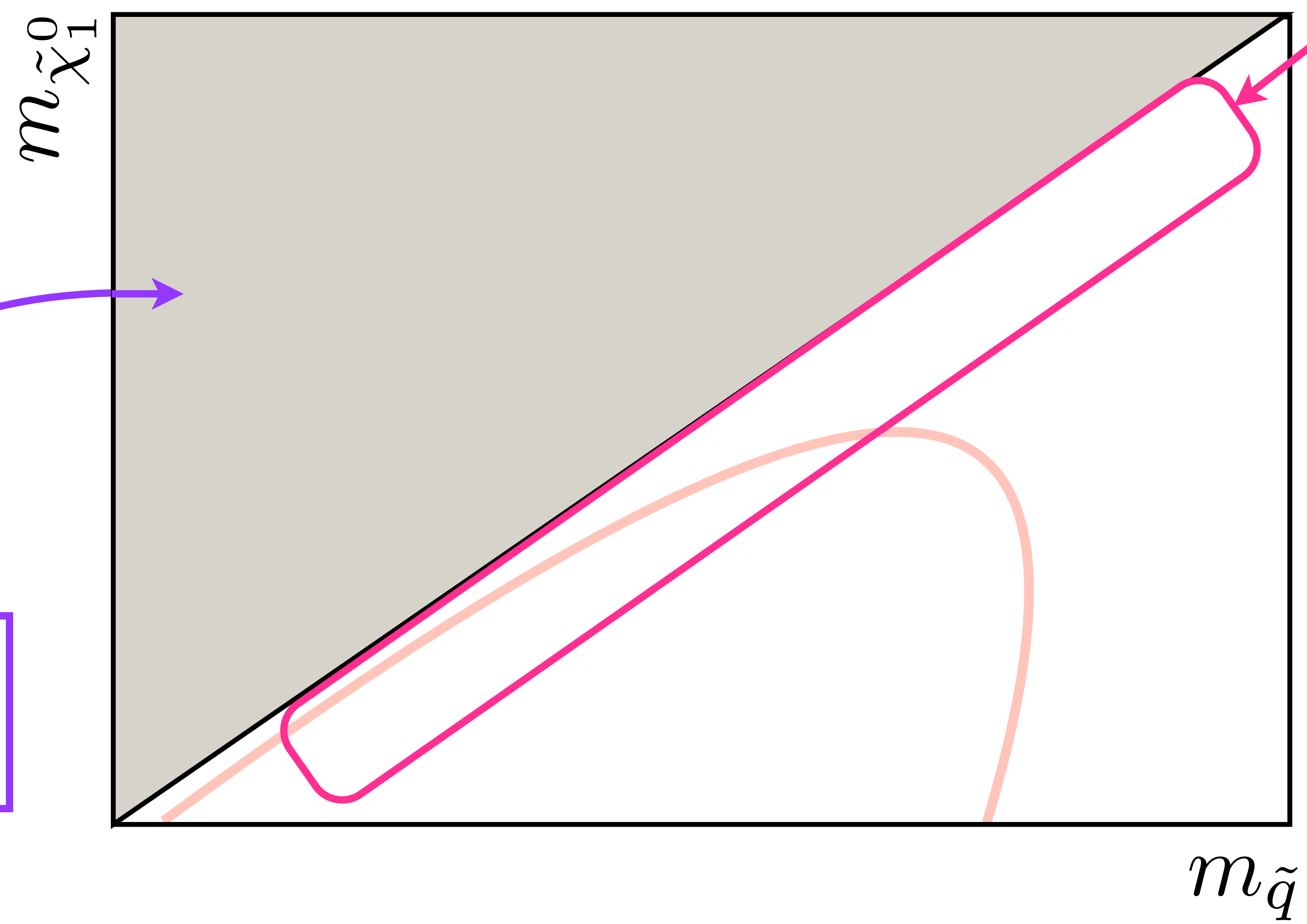
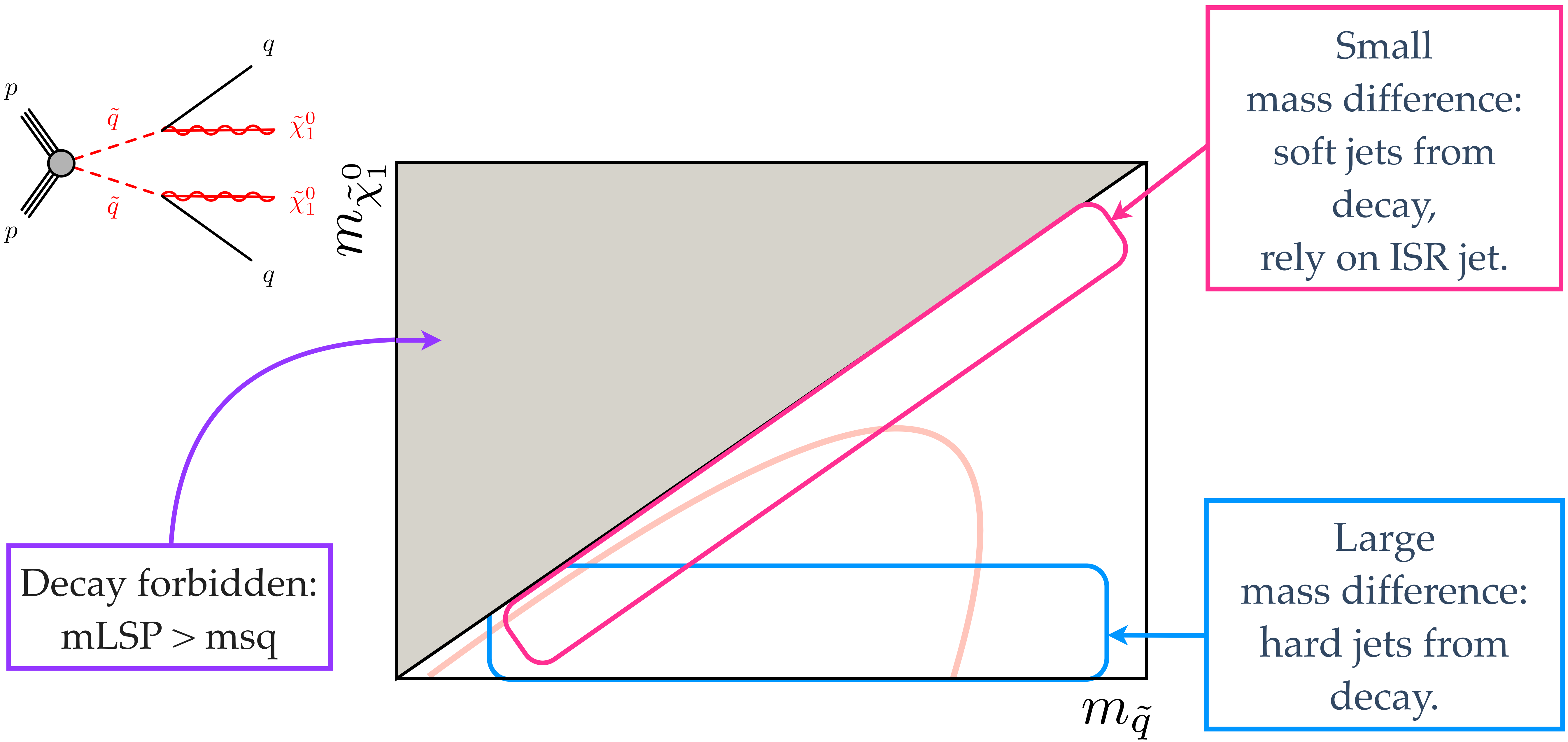




Small
mass difference:
soft jets from
decay,
rely on ISR jet.

Decay forbidden:
mLSP > msq

How does it look?



Analysis Strategy

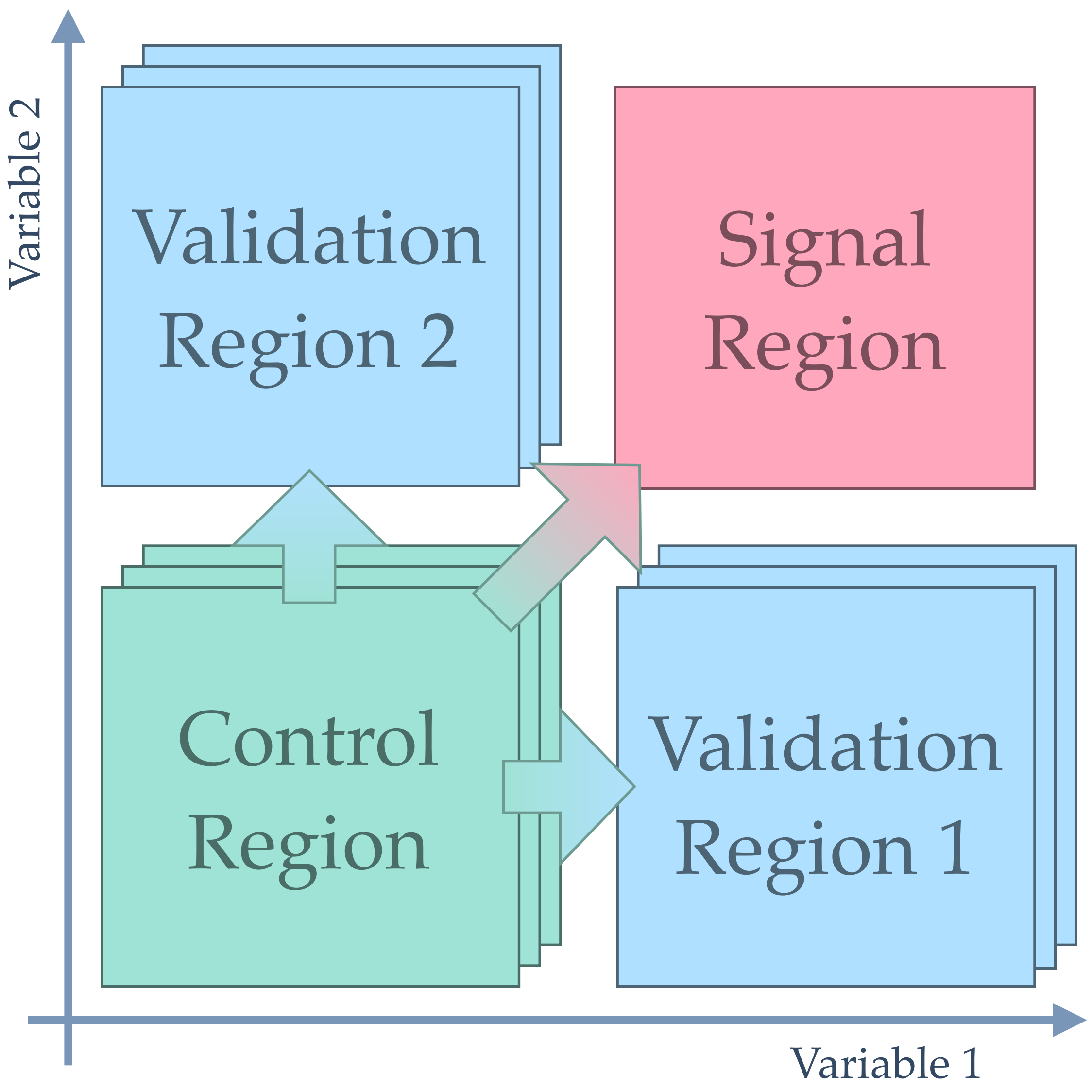
- Signal regions: **no** leptons, 2-6 jets, and ETmiss.
- Cut on the effective mass discriminates between signal and background:

$$m_{\text{eff}} = E_{\text{T}}^{\text{miss}} + \sum_{i}^{n_{\text{jets}}} |p_{\text{T}}^{i}(\text{jet})|$$

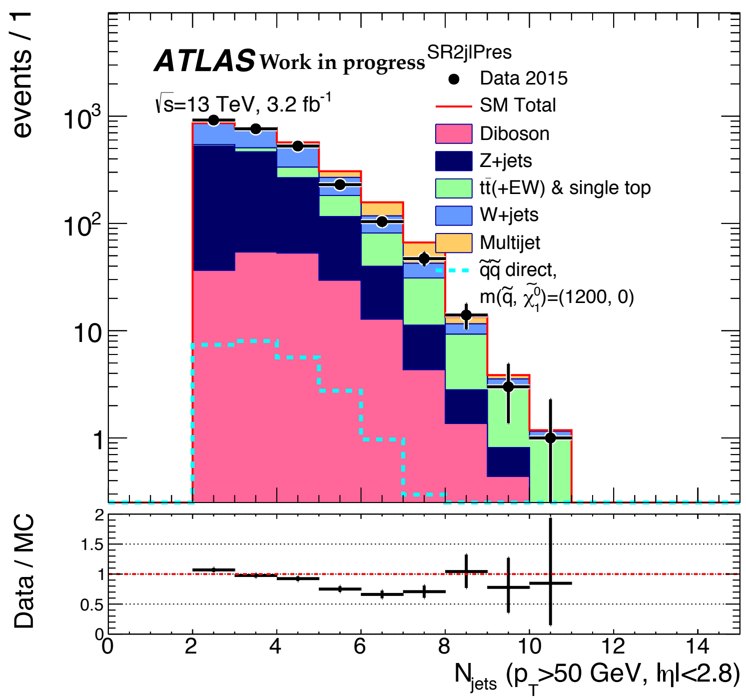
- Background estimates performed with transfer factors from Control Regions:

$$N_{\text{SR}}^{\text{bkg,est}} = N_{\text{CR}}^{\text{bkg,obs}} \cdot \frac{N_{\text{SR}}^{\text{bkg,MC}}}{N_{\text{CR}}^{\text{bkg,MC}}}$$

- Five major backgrounds considered:
    - Top, W+jets, Z+jets, diboson, multijet.



What do we look at?



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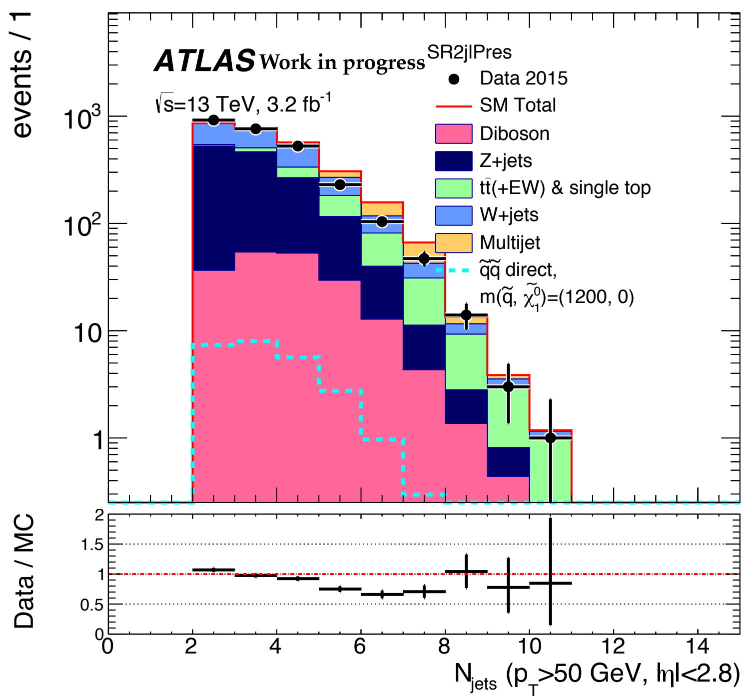

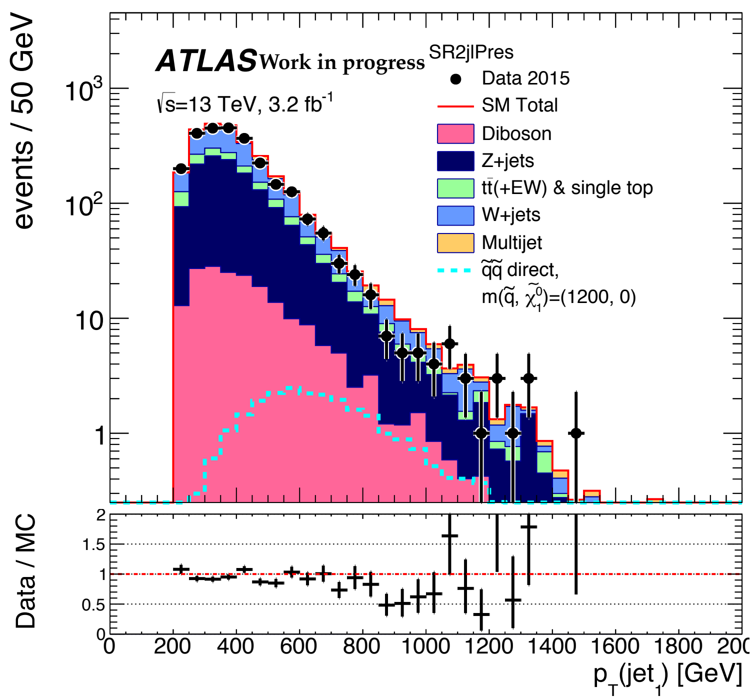

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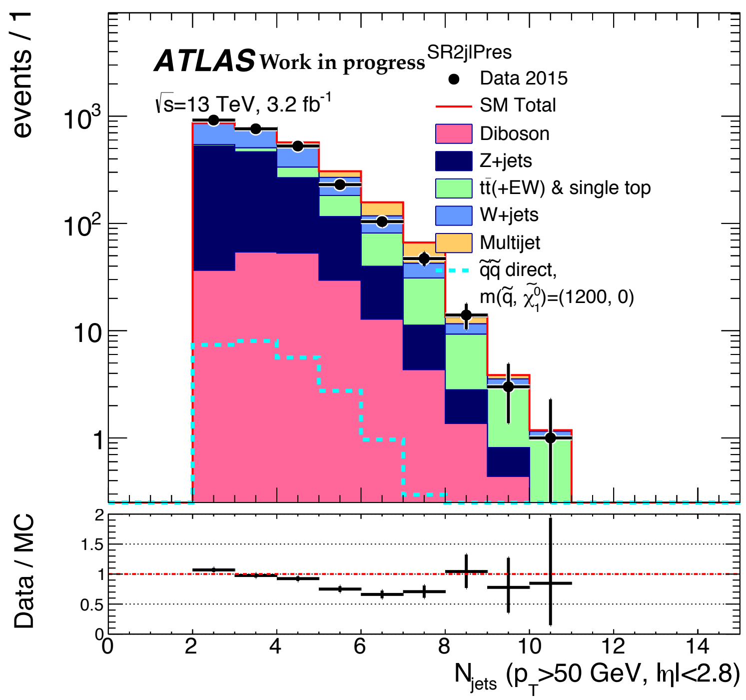

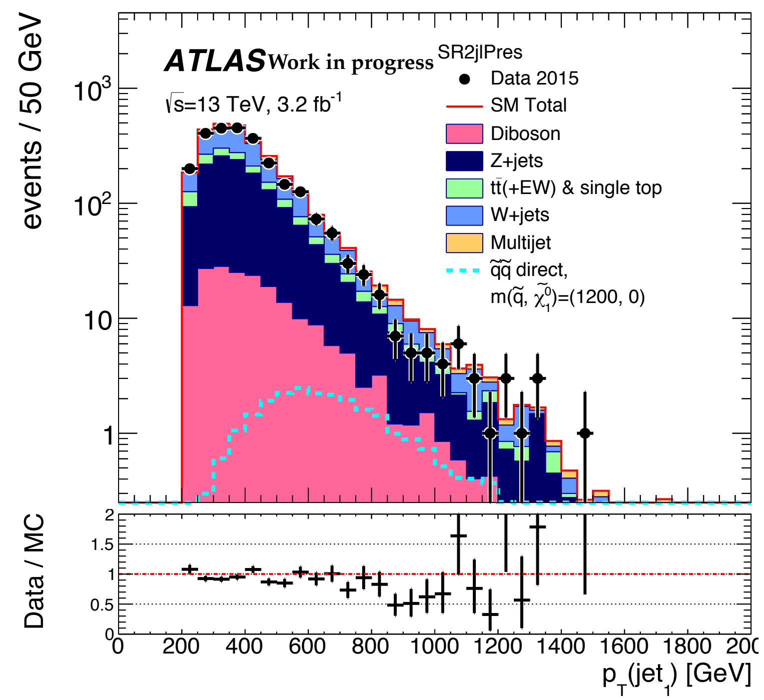

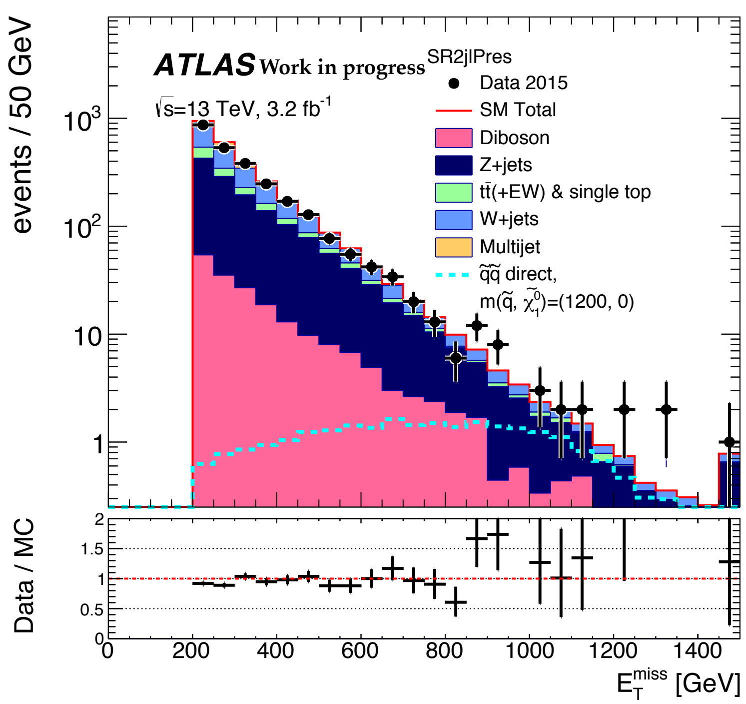

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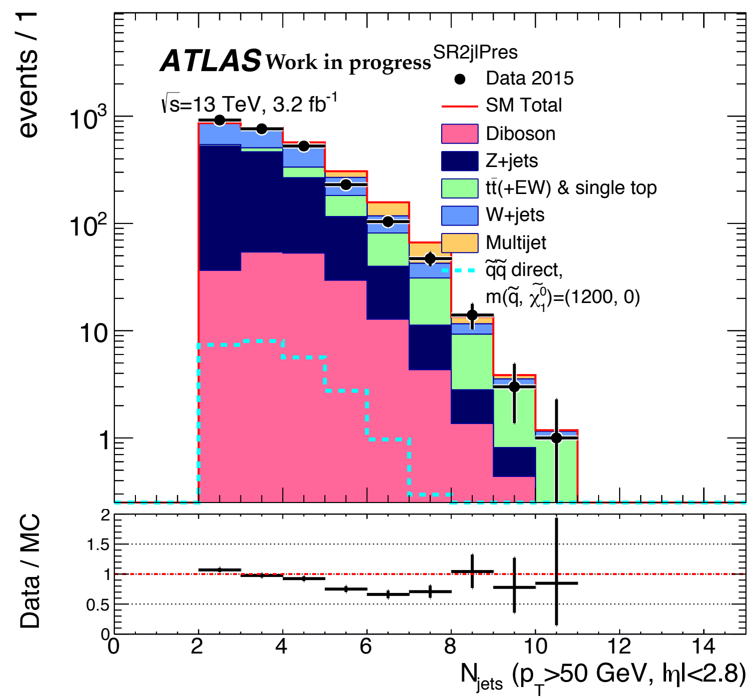
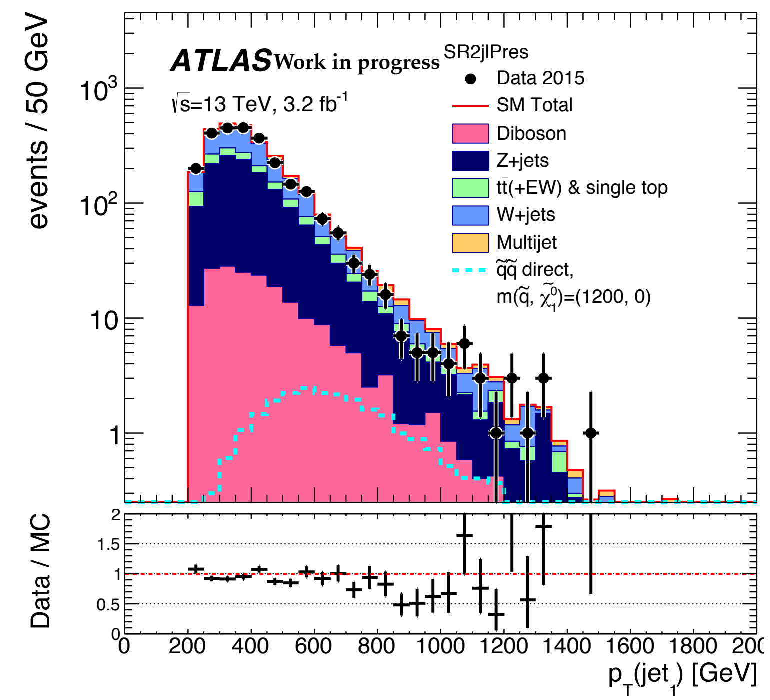
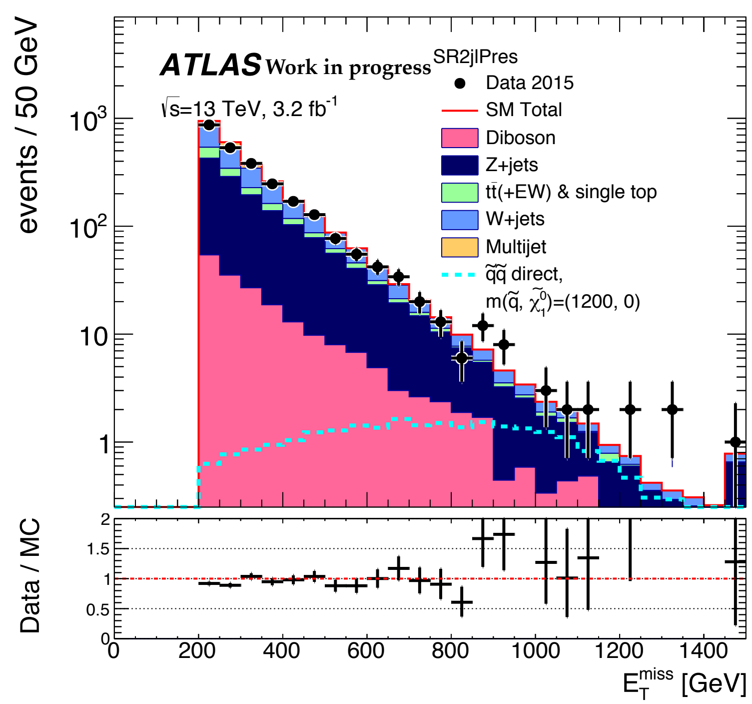
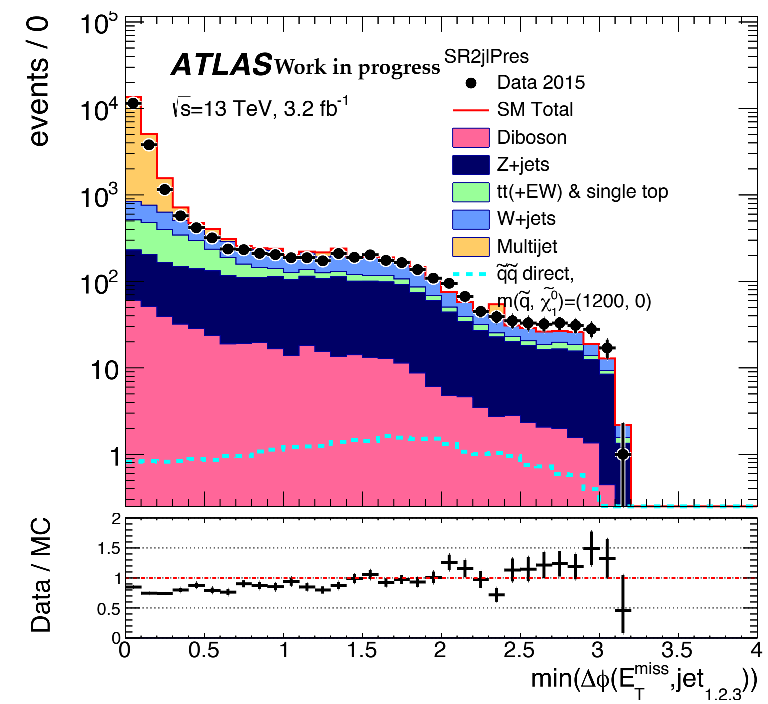


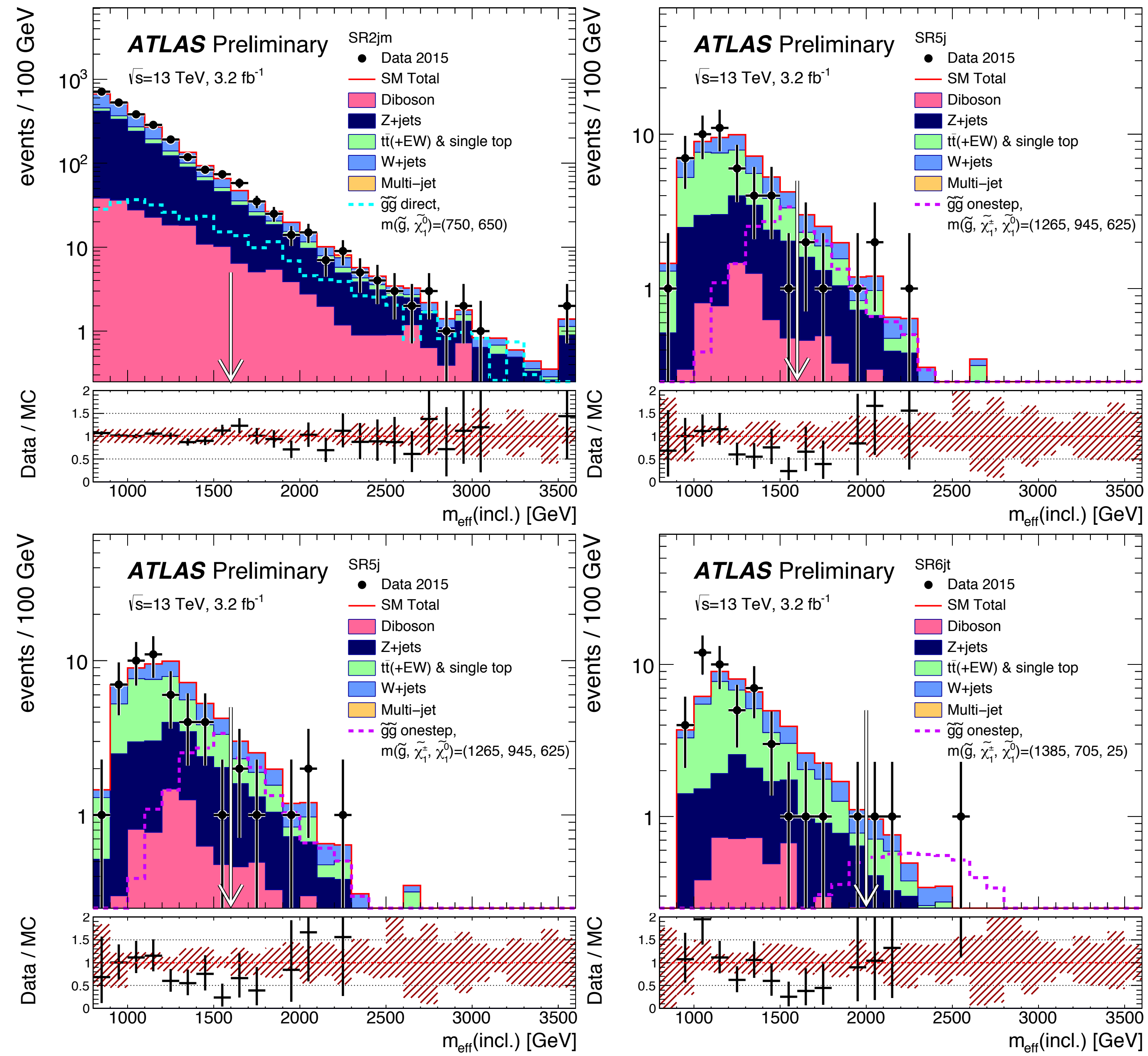






Run -2 results

Requirement	Signal Region						
	2jl	**2jm**	**2jt**	**4jt**	**5j**	**6jm**	**6jt**
$E_{\mathrm{T}}^{\mathrm{miss}}$ [GeV] >	200						
$p_{\mathrm{T}}(j_1)$ [GeV] >	200	300	200				
$p_{\mathrm{T}}(j_2)$ [GeV] >	200	50	200	100			
$p_{\mathrm{T}}(j_3)$ [GeV] >	–			100			
$p_{\mathrm{T}}(j_4)$ [GeV] >	–			100			
$p_{\mathrm{T}}(j_5)$ [GeV] >	–				100		
$p_{\mathrm{T}}(j_6)$ [GeV] >	–					100	
$\Delta\phi(\mathrm{jet}_{1,2,(3)}, \boldsymbol{E}_{\mathrm{T}}^{\mathrm{miss}})_{\mathrm{min}}$ >	0.8	0.4	0.8	0.4			
$\Delta\phi(\mathrm{jet}_{i>3}, \boldsymbol{E}_{\mathrm{T}}^{\mathrm{miss}})_{\mathrm{min}}$ >	–			0.2			
$E_{\mathrm{T}}^{\mathrm{miss}}/\sqrt{H_{\mathrm{T}}}$ [GeV$^{1/2}$] >	15		20	–			
Aplanarity >	–			0.04			
$E_{\mathrm{T}}^{\mathrm{miss}}/m_{\mathrm{eff}}(N_{\mathrm{j}})$ >	–			0.2	0.25		0.2
$m_{\mathrm{eff}}(\mathrm{incl.})$ [GeV] >	1200	1600	2000	2200	1600	1600	2000



Run -2 results

Requirement	Signal Region						
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$p_T(j_1)$ [GeV] >	200	300	200				
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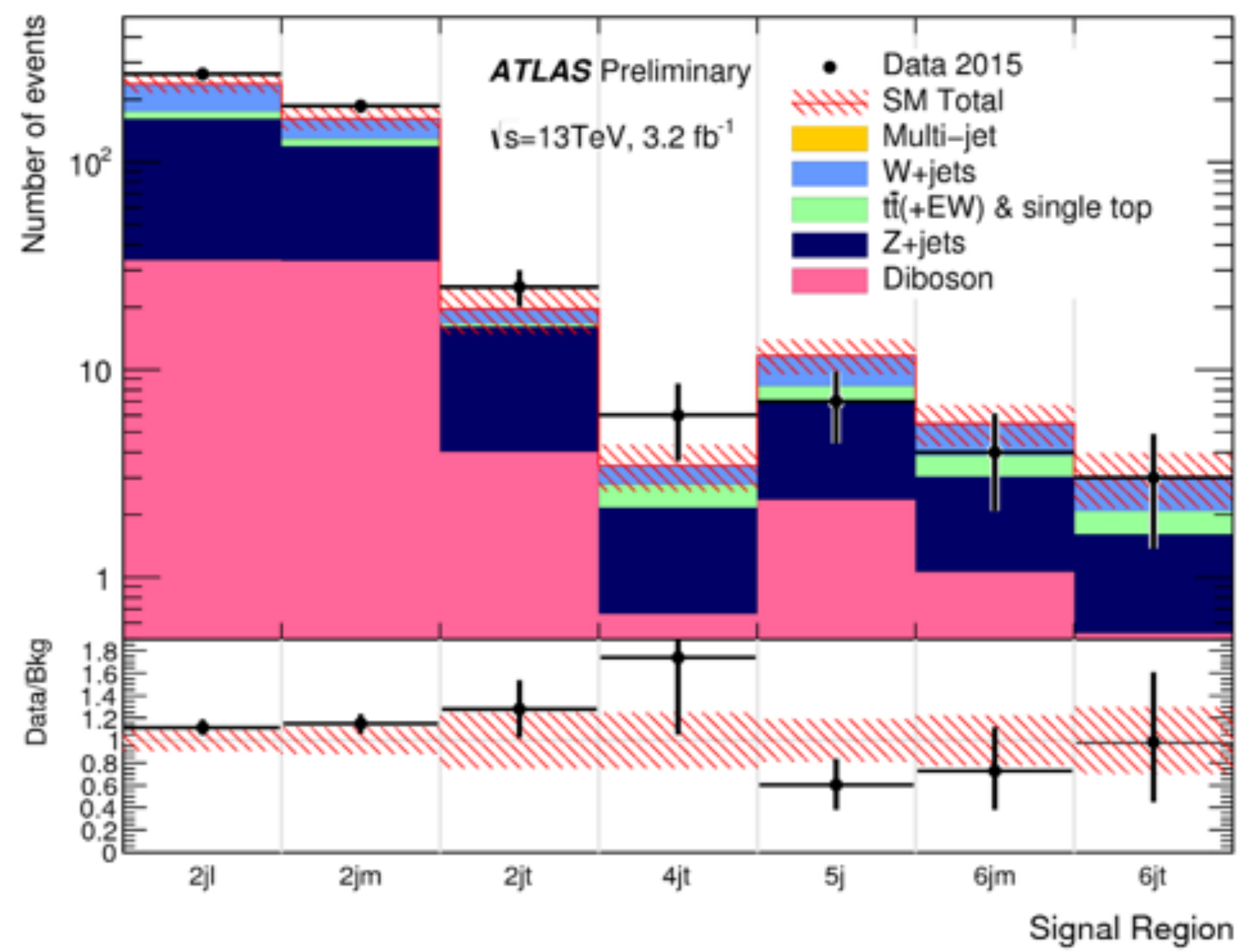
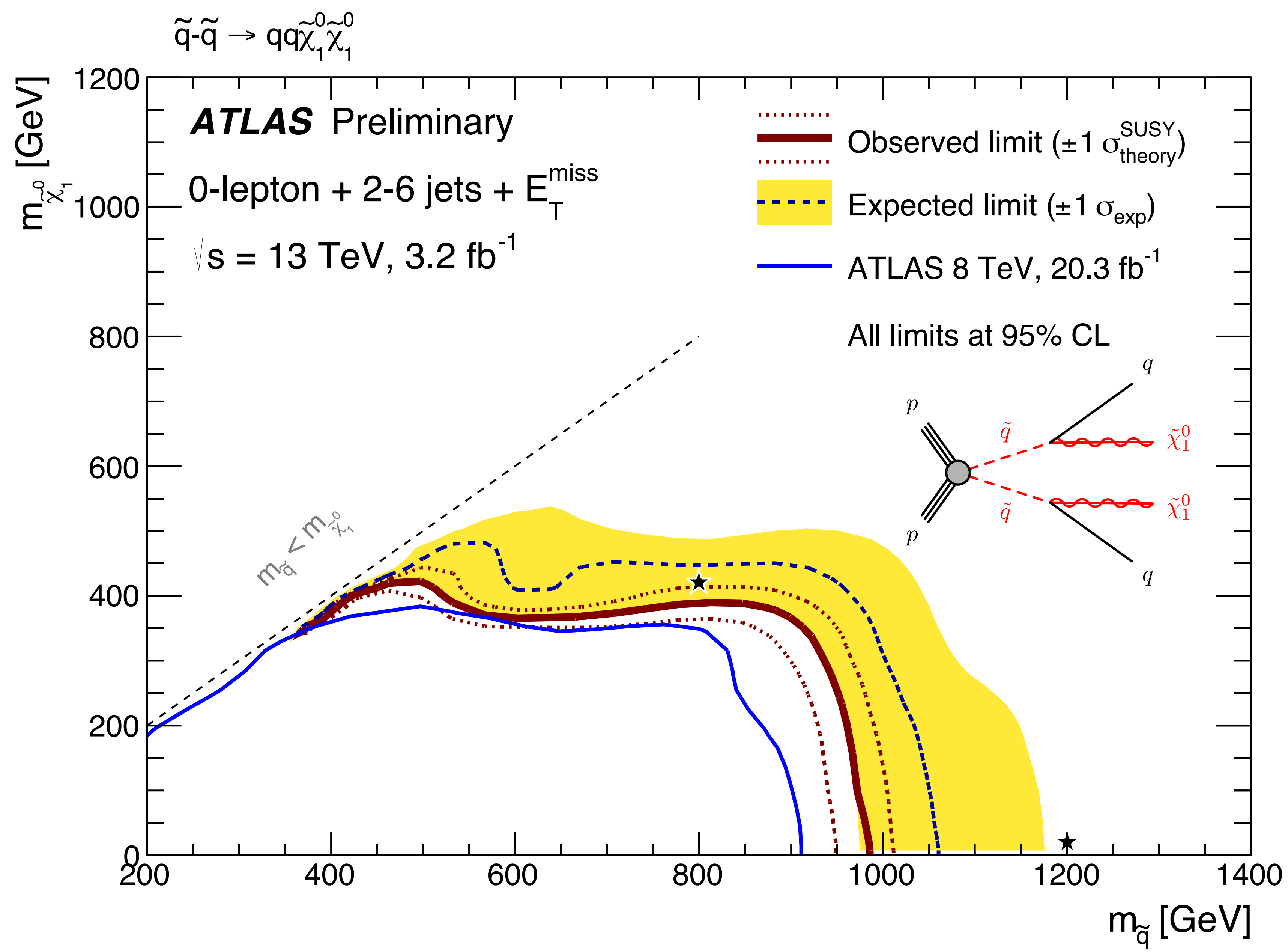
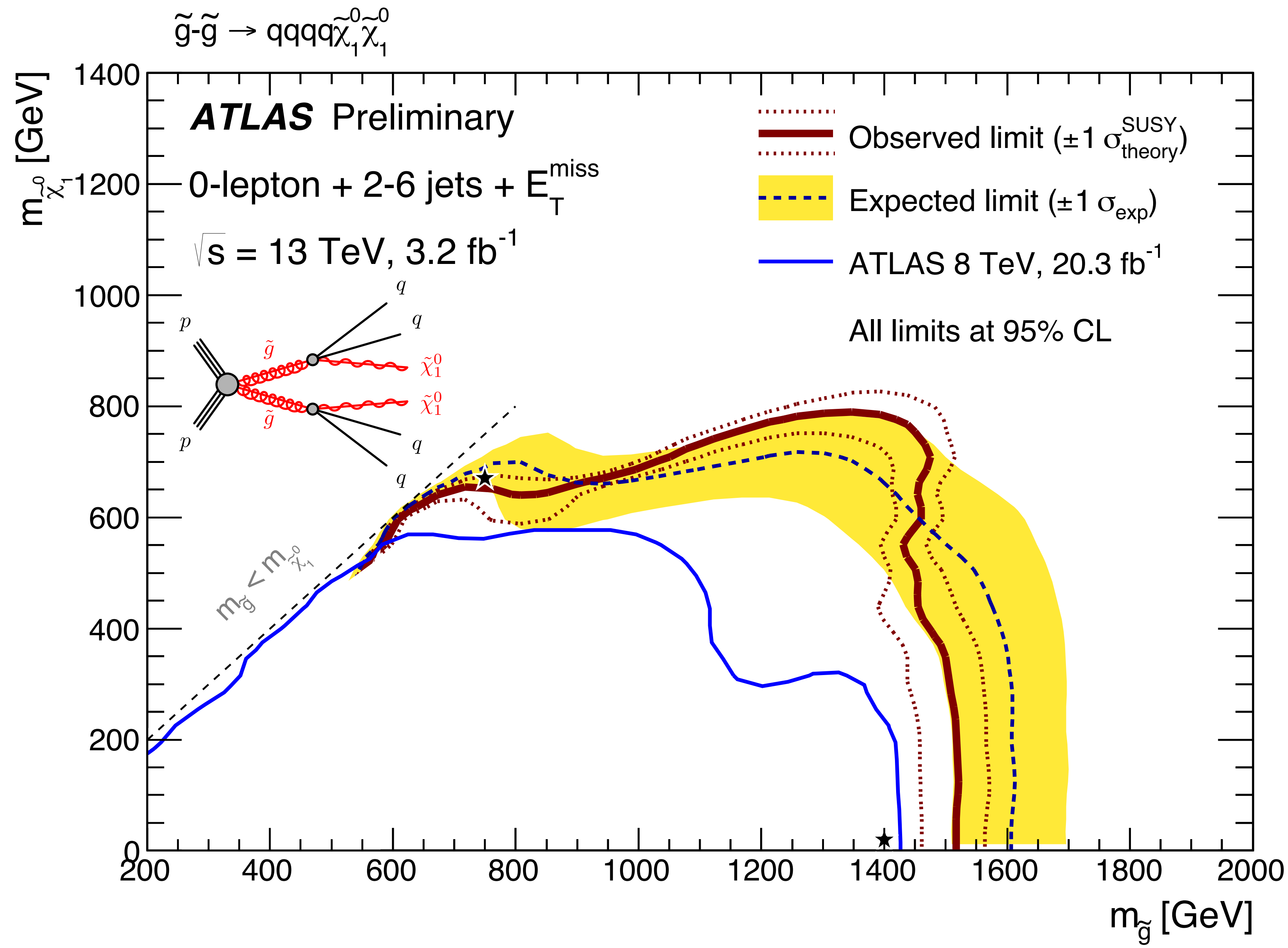
$p_T(j_3)$ [GeV] >	–			100			
$p_T(j_4)$ [GeV] >	–			100			
$p_T(j_5)$ [GeV] >	–				100		
$p_T(j_6)$ [GeV] >	–					100	
$\Delta\phi(\text{jet}_{1,2,(3)}, \boldsymbol{E}_T^{miss})_{min}$ >	0.8	0.4	0.8	0.4			
$\Delta\phi(\text{jet}_{i>3}, \boldsymbol{E}_T^{miss})_{min}$ >	–			0.2			
$E_T^{miss}/\sqrt{H_T}$ [GeV$^{1/2}$] >	15		20	–			
Aplanarity >	–			0.04			
$E_T^{miss}/m_{eff}(N_j)$ >	–			0.2	0.25		0.2
m_{eff}(incl.) [GeV] >	1200	1600	2000	2200	1600	1600	2000



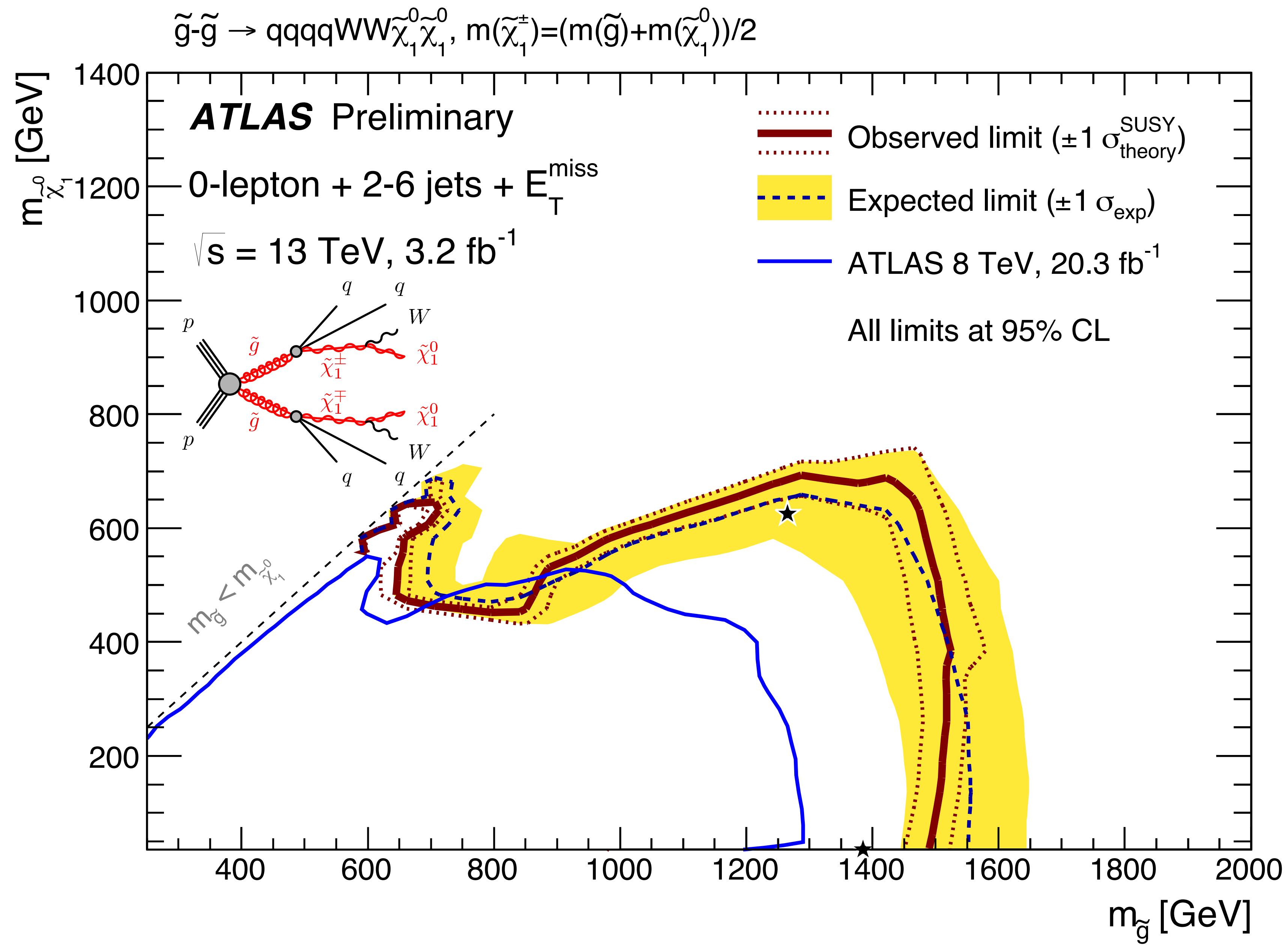
Limits on simplified models

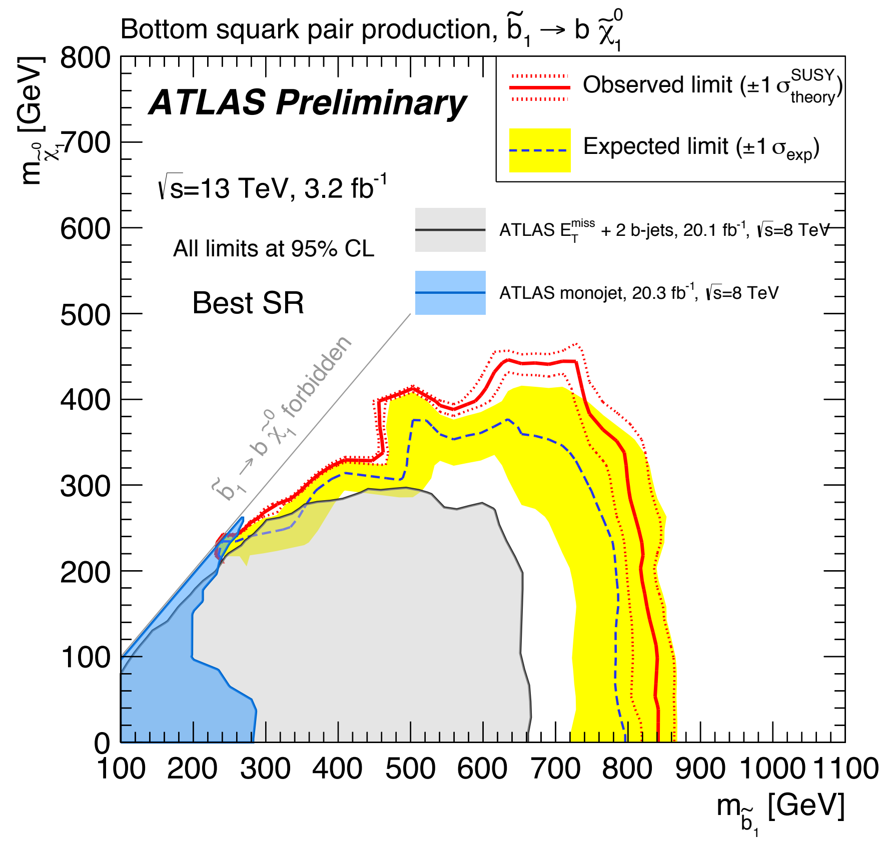


Limits on simplified models

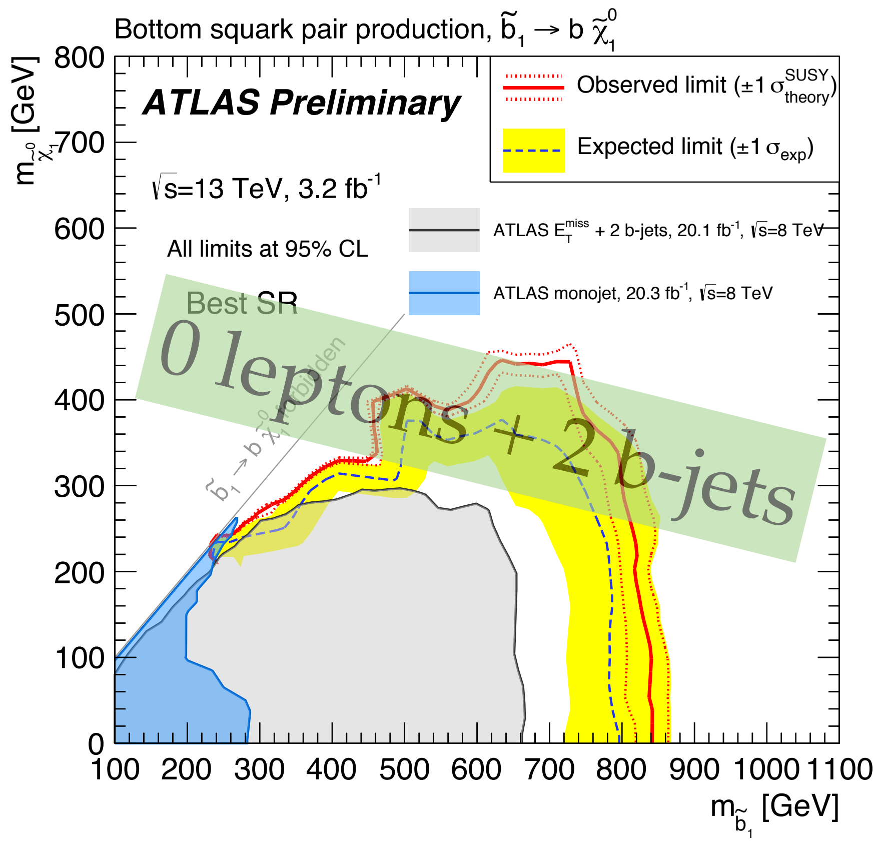


Limits on simplified models

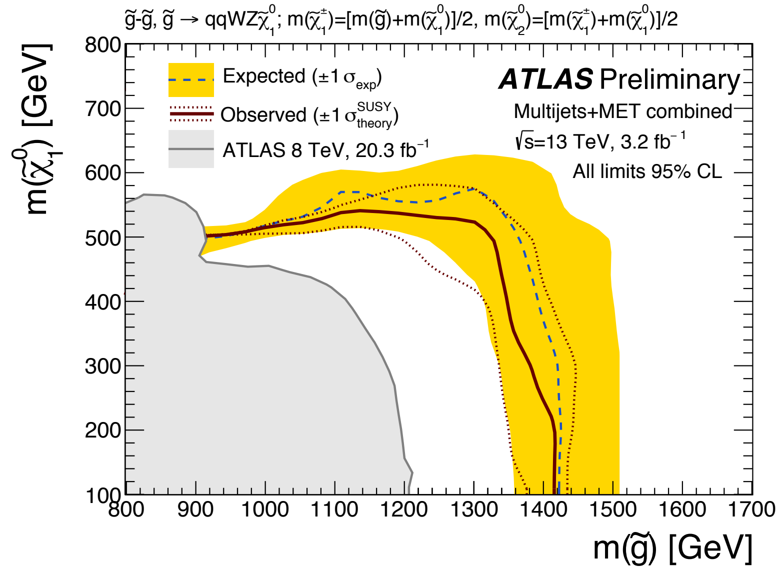




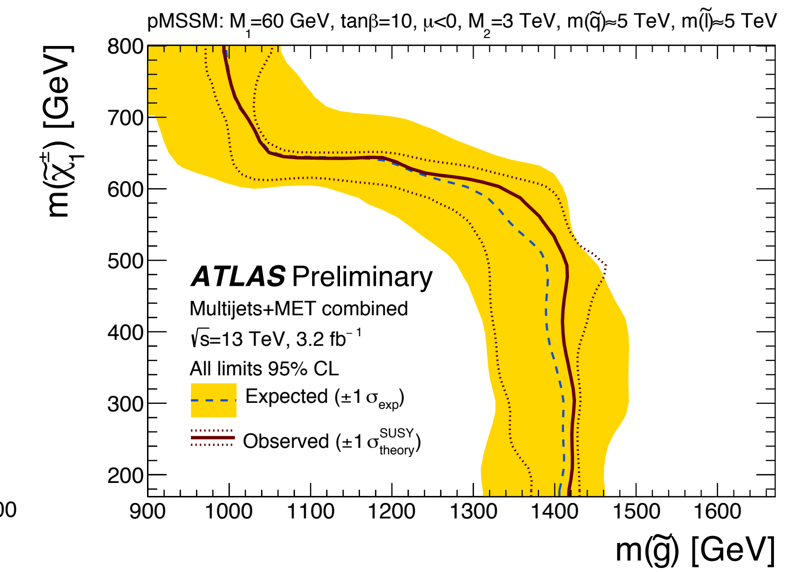
Bottom squark pair production, $\tilde{b}_1 \rightarrow b\, \tilde{\chi}_1^0$
ATLAS Preliminary
$\sqrt{s}$=13 TeV, 3.2 fb^{-1}
All limits at 95% CL
Best SR
Observed limit ($\pm 1\, \sigma^{SUSY}_{theory}$)
Expected limit ($\pm 1\, \sigma_{exp}$)
ATLAS E_T^{miss} + 2 b-jets, 20.1 fb^{-1}, $\sqrt{s}$=8 TeV
ATLAS monojet, 20.3 fb^{-1}, $\sqrt{s}$=8 TeV
$\tilde{b}_1 \rightarrow b\, \tilde{\chi}_1^0$ forbidden
$m_{\tilde{\chi}_1^0}$ [GeV]
$m_{\tilde{b}_1}$ [GeV]



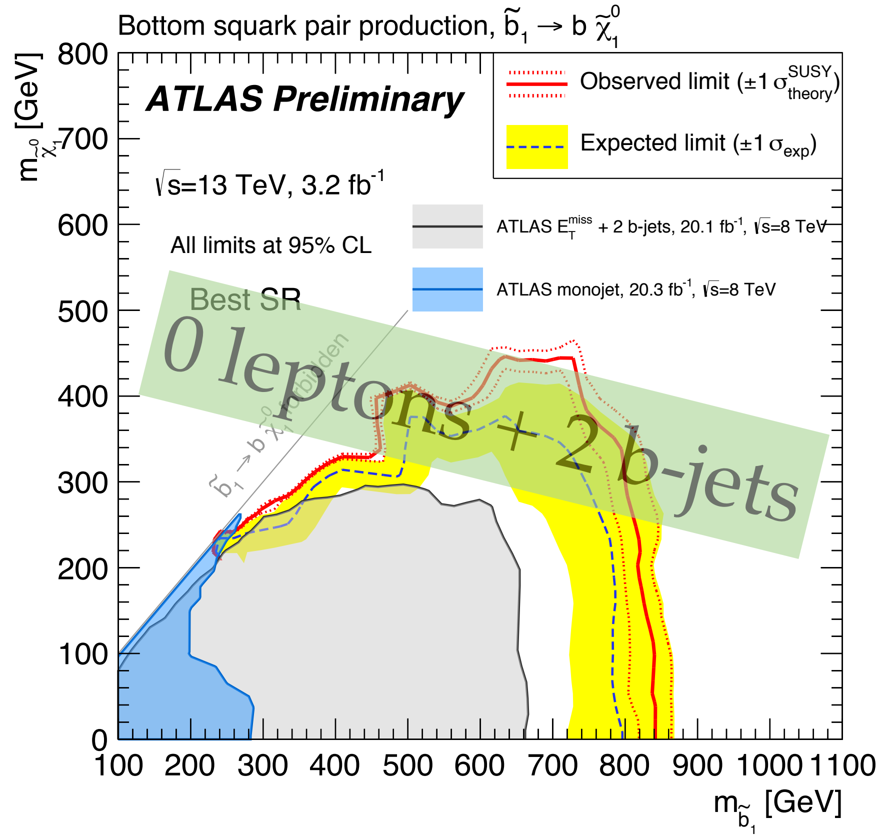
Bottom squark pair production, $\tilde{b}_1 \rightarrow b\,\tilde{\chi}_1^0$
ATLAS Preliminary
$\sqrt{s}$=13 TeV, 3.2 fb^{-1}
All limits at 95% CL
Observed limit ($\pm 1\,\sigma^{SUSY}_{theory}$)
Expected limit ($\pm 1\,\sigma_{exp}$)
ATLAS E_T^{miss} + 2 b-jets, 20.1 fb^{-1}, $\sqrt{s}$=8 TeV
ATLAS monojet, 20.3 fb^{-1}, $\sqrt{s}$=8 TeV
Best SR
0 leptons + 2 b-jets
$\tilde{b}_1 \rightarrow b\,\tilde{\chi}_1^0$ forbidden
$m_{\tilde{\chi}_1^0}$ [GeV]
$m_{\tilde{b}_1}$ [GeV]



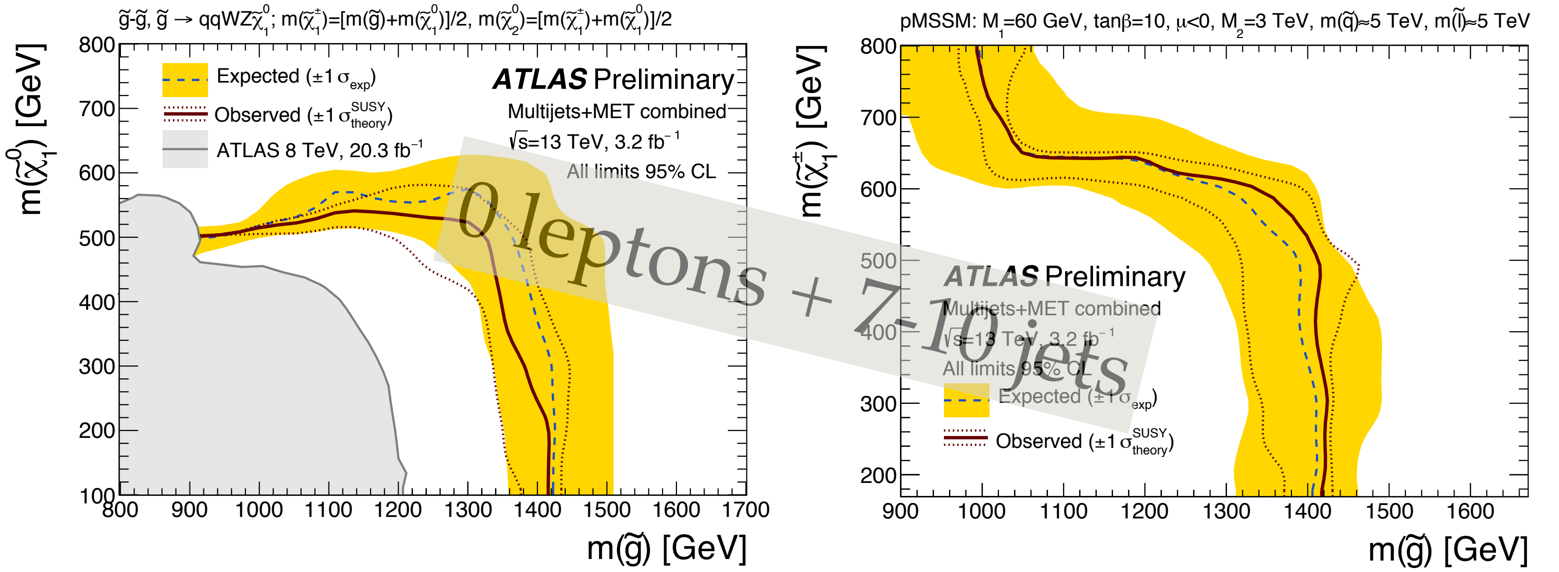
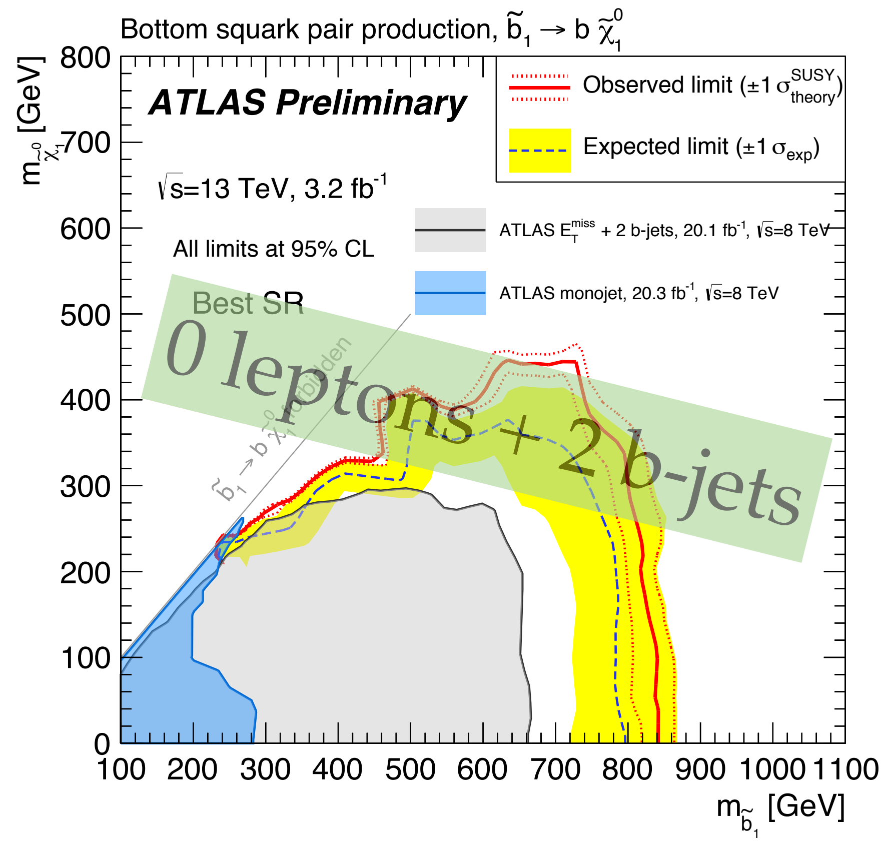
ATLAS Preliminary
Multijets+MET combined
√s=13 TeV, 3.2 fb⁻¹
All limits 95% CL
Expected (±1 σexp)
Observed (±1 σ SUSY theory)
ATLAS 8 TeV, 20.3 fb⁻¹
m(g̃) [GeV]
m(χ̃⁰₁) [GeV]

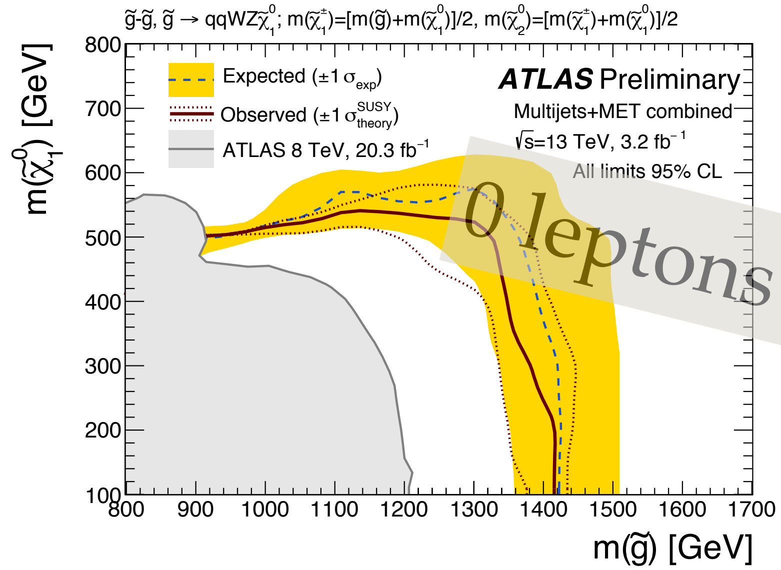
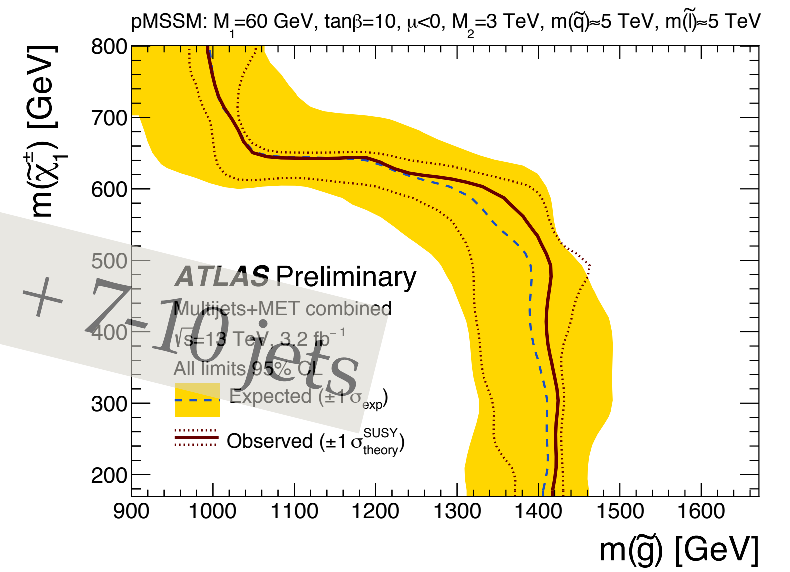
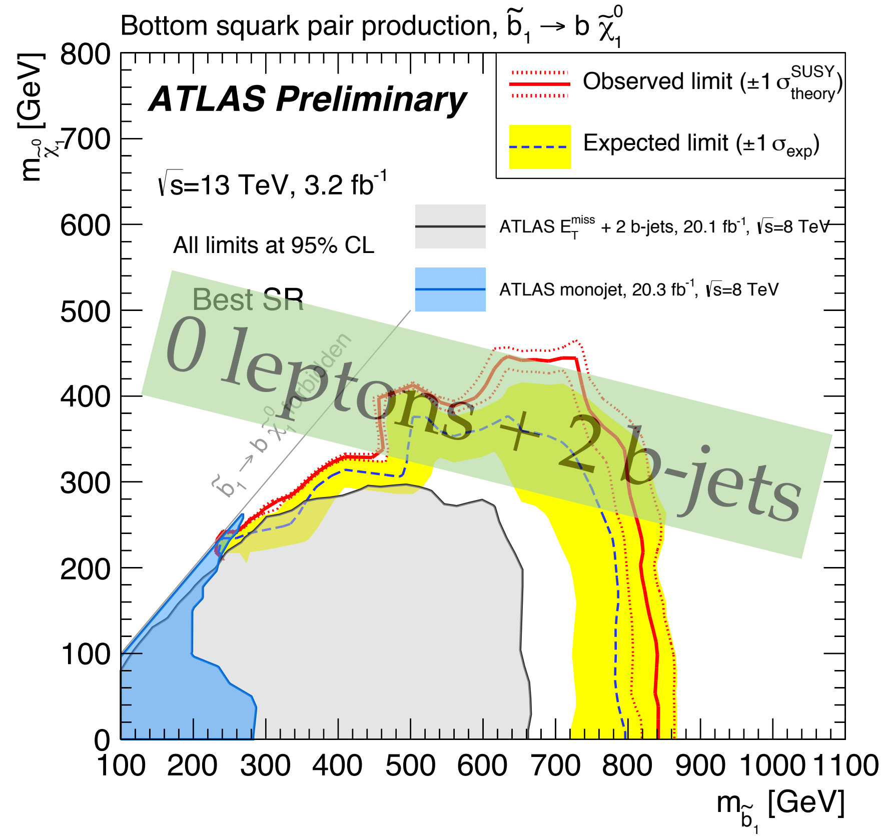
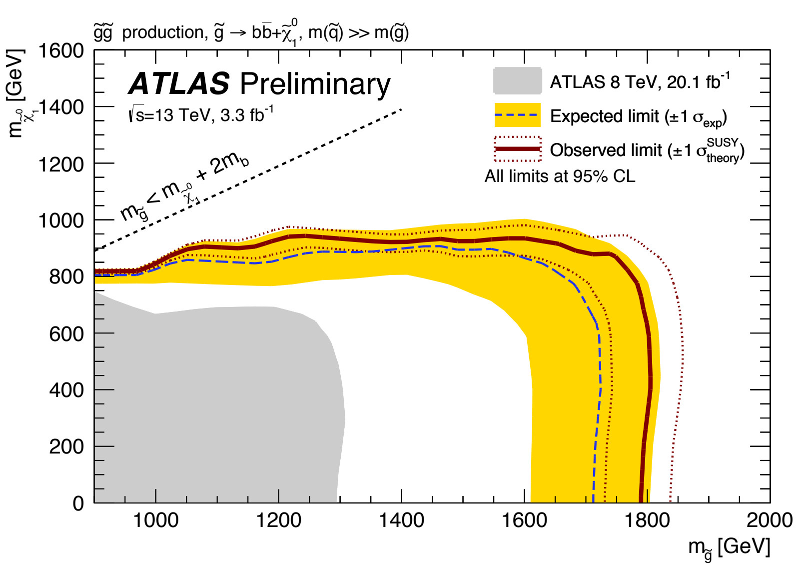
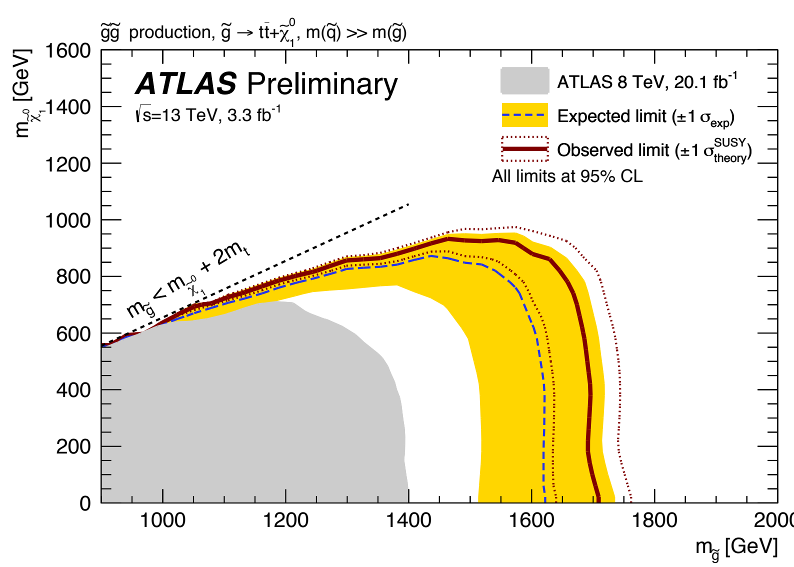


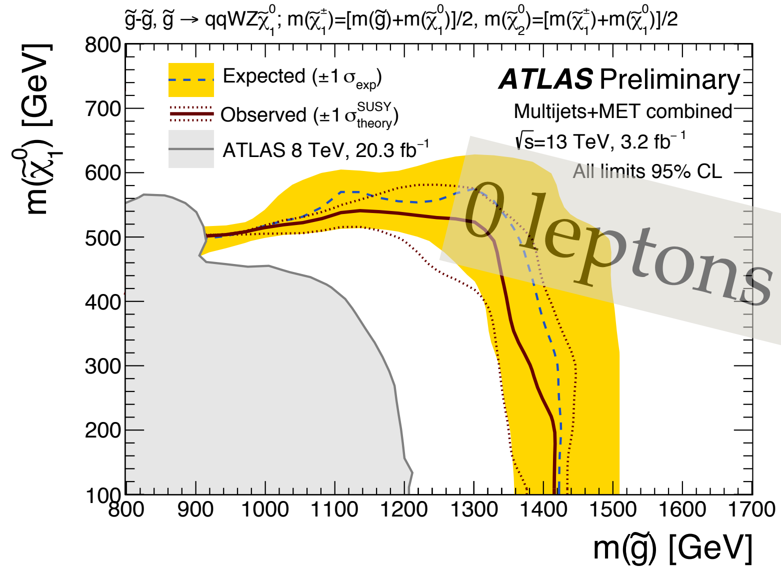
pMSSM: M1=60 GeV, tanβ=10, μ<0, M2=3 TeV, m(q̃)≈5 TeV, m(l̃)≈5 TeV
ATLAS Preliminary
Multijets+MET combined
√s=13 TeV, 3.2 fb⁻¹
All limits 95% CL
Expected (±1 σexp)
Observed (±1 σ SUSY theory)
m(g̃) [GeV]
m(χ̃±₁) [GeV]

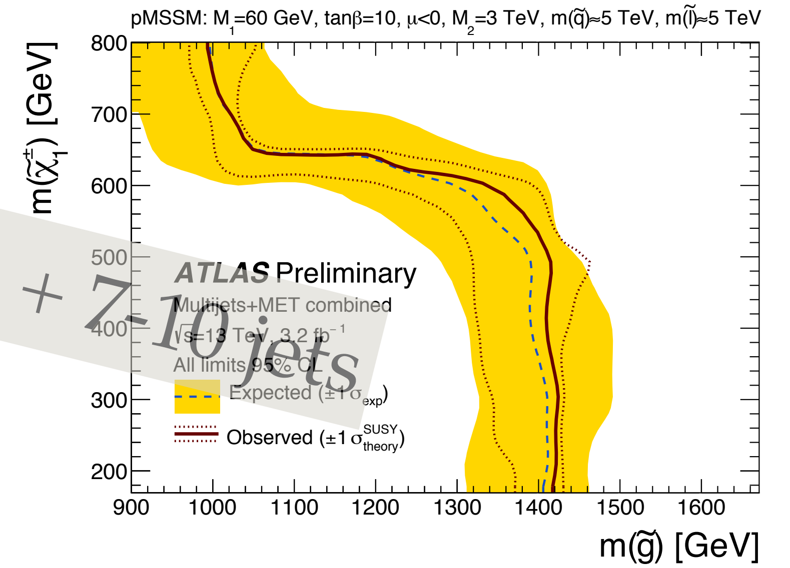


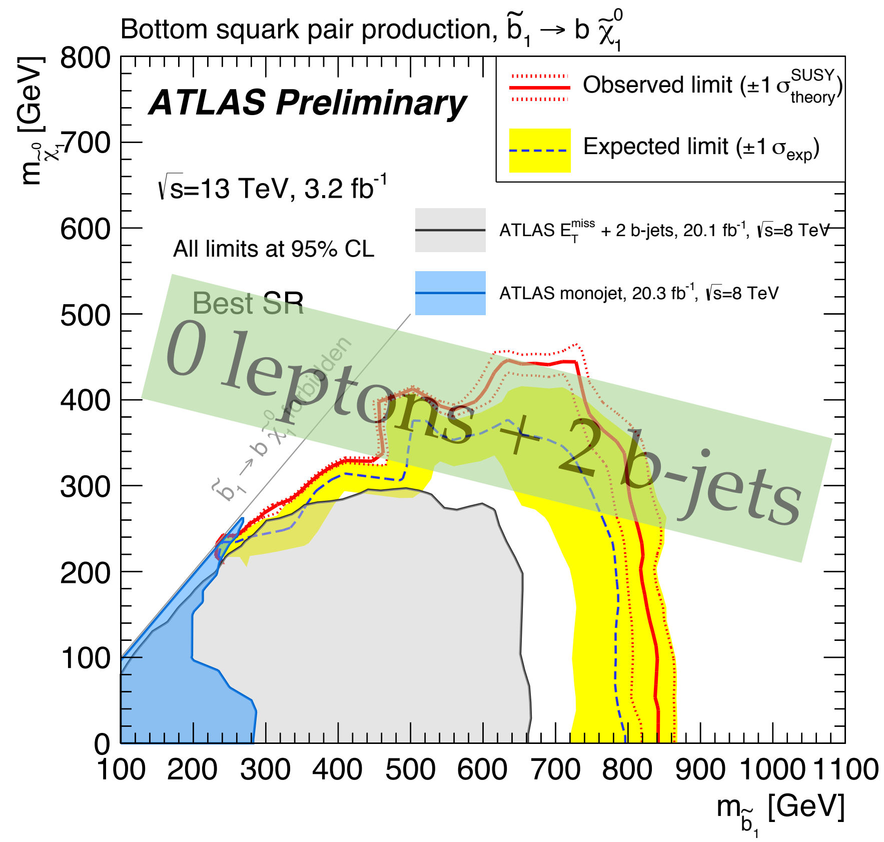
Bottom squark pair production, b̃₁ → b χ̃⁰₁
ATLAS Preliminary
√s=13 TeV, 3.2 fb⁻¹
All limits at 95% CL
Observed limit (±1 σ SUSY theory)
Expected limit (±1 σexp)
ATLAS E_T^miss + 2 b-jets, 20.1 fb⁻¹, √s=8 TeV
ATLAS monojet, 20.3 fb⁻¹, √s=8 TeV
Best SR
0 leptons + 2 b-jets
b̃₁ → b χ̃⁰₁ forbidden
m_b̃₁ [GeV]
m_χ̃⁰₁ [GeV]

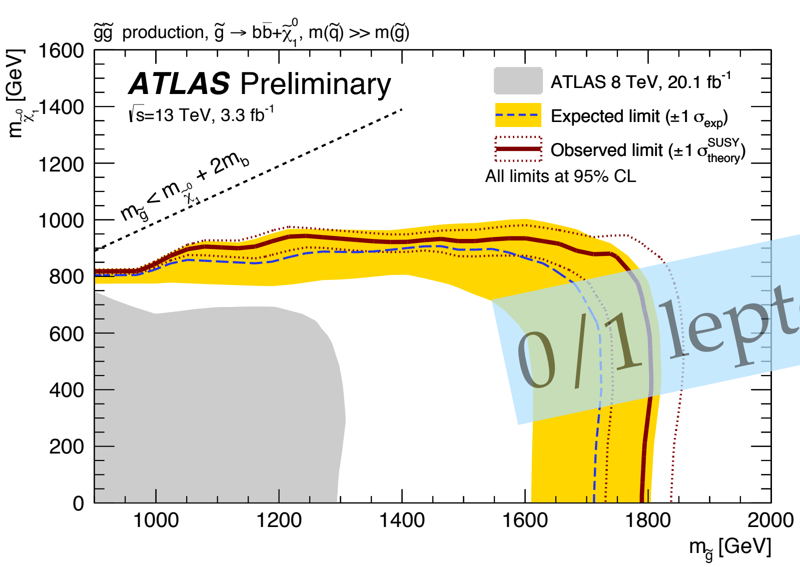

g̃-g̃, g̃ → qqWZχ̃₁⁰; m(χ̃₁±)=[m(g̃)+m(χ̃₁⁰)]/2, m(χ̃₂⁰)=[m(χ̃₁±)+m(χ̃₁⁰)]/2
Expected (±1 σexp)
Observed (±1 σtheorySUSY)
ATLAS 8 TeV, 20.3 fb⁻¹
ATLAS Preliminary
Multijets+MET combined
√s=13 TeV, 3.2 fb⁻¹
All limits 95% CL
m(χ̃₁⁰) [GeV]
m(g̃) [GeV]
pMSSM: M1=60 GeV, tanβ=10, μ<0, M2=3 TeV, m(q̃)≈5 TeV, m(l̃)≈5 TeV
m(χ̃₁±) [GeV]
0 leptons + 7-10 jets

Bottom squark pair production, b̃₁ → b χ̃₁⁰
ATLAS Preliminary
√s=13 TeV, 3.2 fb⁻¹
All limits at 95% CL
Observed limit (±1 σtheorySUSY)
Expected limit (±1 σexp)
ATLAS ETmiss + 2 b-jets, 20.1 fb⁻¹, √s=8 TeV
ATLAS monojet, 20.3 fb⁻¹, √s=8 TeV
Best SR
0 leptons + 2 b-jets
b̃₁ → b χ̃₁⁰ forbidden
mχ̃₁⁰ [GeV]
mb̃₁ [GeV]

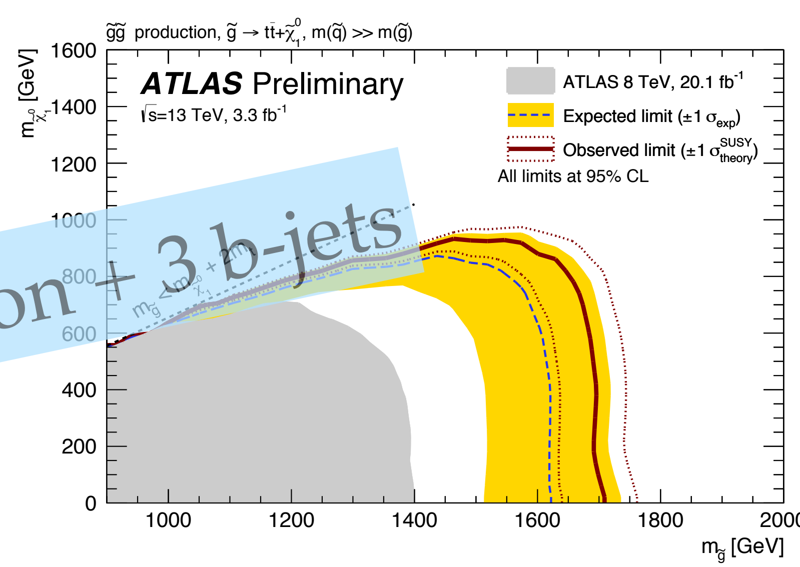

g̃-g̃, g̃ → qqWZχ̃₁⁰; m(χ̃₁±)=[m(g̃)+m(χ̃₁⁰)]/2, m(χ̃₂⁰)=[m(χ̃₁±)+m(χ̃₁⁰)]/2
Expected (±1 σexp)
Observed (±1 σtheorySUSY)
ATLAS 8 TeV, 20.3 fb-1
ATLAS Preliminary
Multijets+MET combined
√s=13 TeV, 3.2 fb-1
All limits 95% CL
0 leptons + 7-10 jets
m(χ̃₁⁰) [GeV]
m(g̃) [GeV]

pMSSM: M1=60 GeV, tanβ=10, μ<0, M2=3 TeV, m(q̃)≈5 TeV, m(l̃)≈5 TeV
ATLAS Preliminary
Multijets+MET combined
√s=13 TeV, 3.2 fb-1
All limits 95% CL
Expected (±1 σexp)
Observed (±1 σtheorySUSY)
m(χ̃₁±) [GeV]
m(g̃) [GeV]

Bottom squark pair production, b̃₁ → b χ̃₁⁰
ATLAS Preliminary
√s=13 TeV, 3.2 fb-1
All limits at 95% CL
Best SR
Observed limit (±1 σtheorySUSY)
Expected limit (±1 σexp)
ATLAS ETmiss + 2 b-jets, 20.1 fb-1, √s=8 TeV
ATLAS monojet, 20.3 fb-1, √s=8 TeV
b̃₁ → b χ̃₁⁰ forbidden
0 leptons + 2 b-jets
mχ̃₁⁰ [GeV]
mb̃₁ [GeV]

g̃g̃ production, g̃ → bb̄+χ̃₁⁰, m(q̃) >> m(g̃)
ATLAS Preliminary
√s=13 TeV, 3.3 fb-1
ATLAS 8 TeV, 20.1 fb-1
Expected limit (±1 σexp)
Observed limit (±1 σtheorySUSY)
All limits at 95% CL
mg̃ < mχ̃₁⁰ + 2mb
mχ̃₁⁰ [GeV]
mg̃ [GeV]

g̃g̃ production, g̃ → tt̄+χ̃₁⁰, m(q̃) >> m(g̃)
ATLAS Preliminary
√s=13 TeV, 3.3 fb-1
ATLAS 8 TeV, 20.1 fb-1
Expected limit (±1 σexp)
Observed limit (±1 σtheorySUSY)
All limits at 95% CL
mg̃ < mχ̃₁⁰ + 2mt
mχ̃₁⁰ [GeV]
mg̃ [GeV]

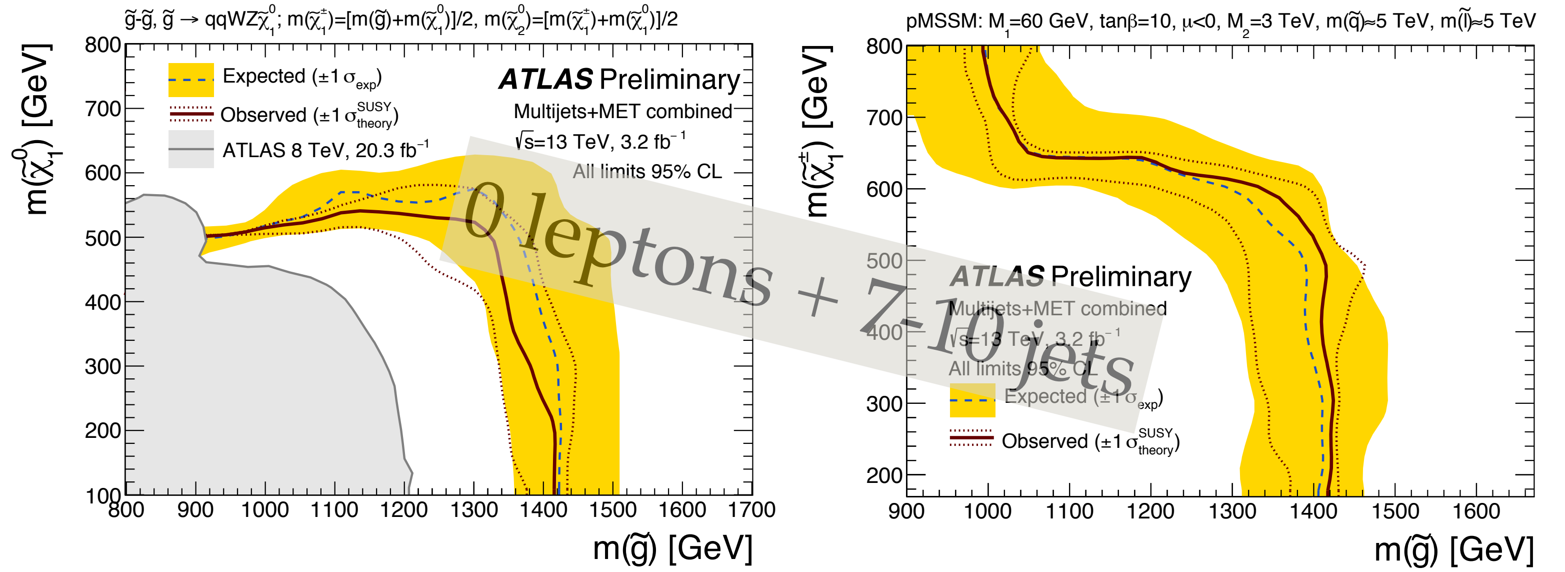

g̃-g̃, g̃ → qqWZχ̃₁⁰; m(χ̃₁±)=[m(g̃)+m(χ̃₁⁰)]/2, m(χ̃₂⁰)=[m(χ̃₁±)+m(χ̃₁⁰)]/2
ATLAS Preliminary
Multijets+MET combined
√s=13 TeV, 3.2 fb⁻¹
All limits 95% CL
Expected (±1 σexp)
Observed (±1 σtheory SUSY)
ATLAS 8 TeV, 20.3 fb⁻¹
m(χ̃₁⁰) [GeV]
m(g̃) [GeV]
0 leptons + 7-10 jets

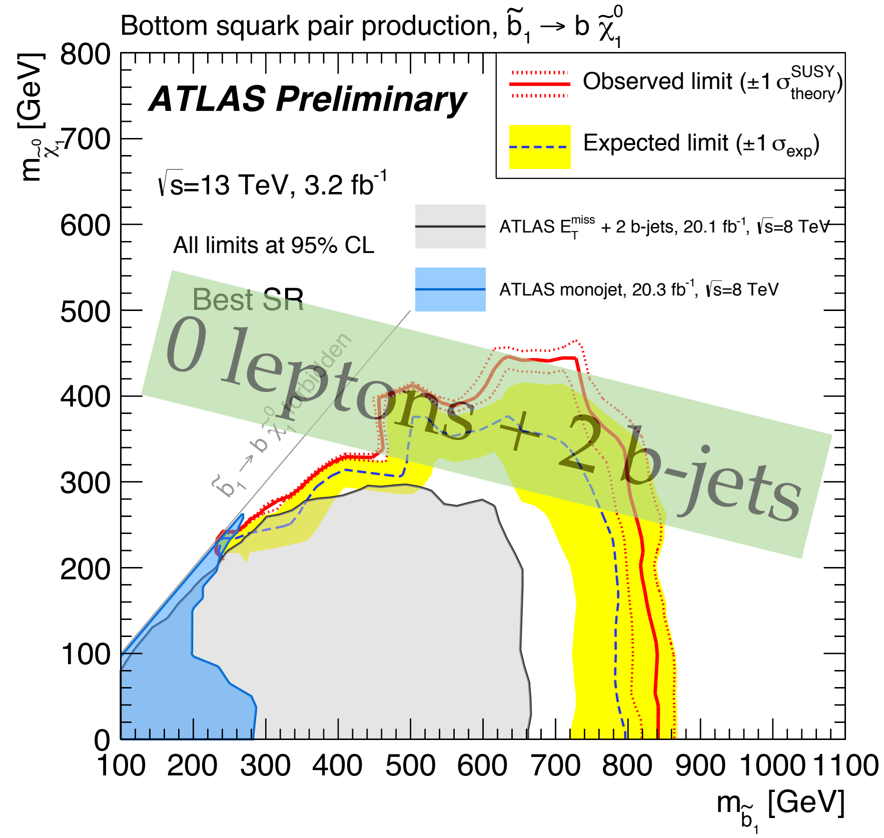

pMSSM: M1=60 GeV, tanβ=10, μ<0, M2=3 TeV, m(q̃)≈5 TeV, m(l̃)≈5 TeV
ATLAS Preliminary
Multijets+MET combined
√s=13 TeV, 3.2 fb⁻¹
All limits 95% CL
Expected (±1 σexp)
Observed (±1 σtheory SUSY)
m(χ̃₁±) [GeV]
m(g̃) [GeV]

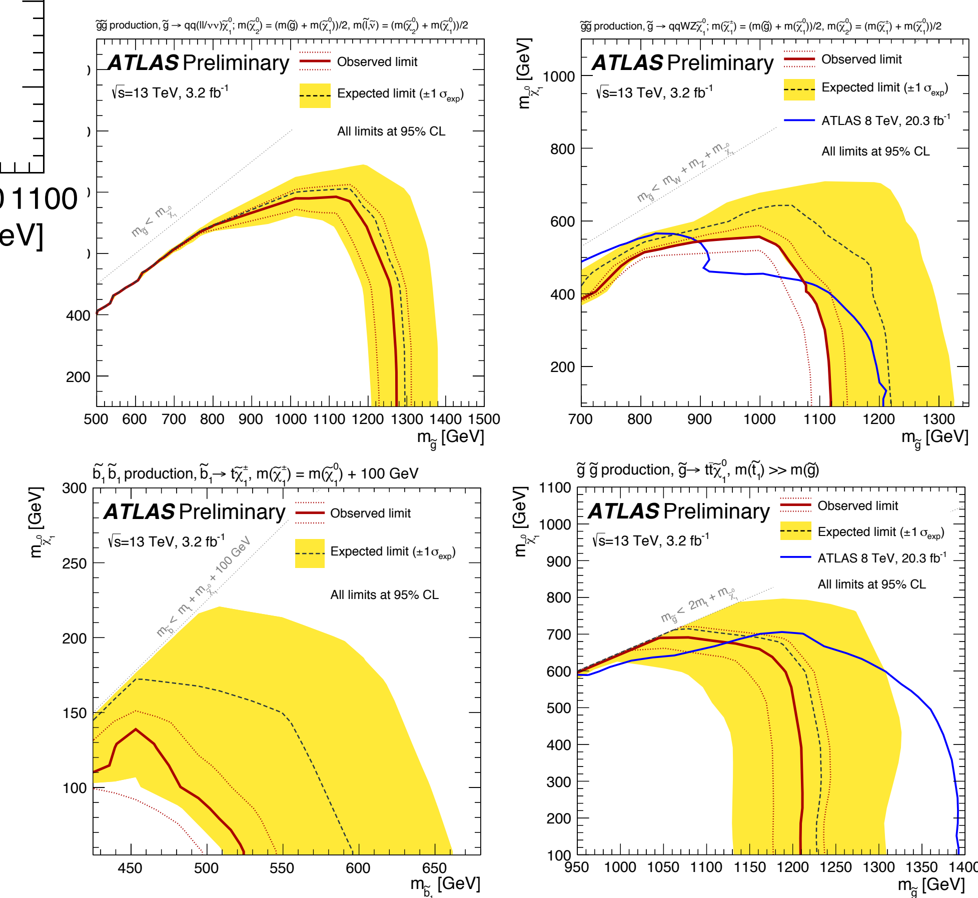

Bottom squark pair production, b̃₁ → b χ̃₁⁰
ATLAS Preliminary
√s=13 TeV, 3.2 fb⁻¹
All limits at 95% CL
Best SR
Observed limit (±1 σtheory SUSY)
Expected limit (±1 σexp)
ATLAS ETmiss + 2 b-jets, 20.1 fb⁻¹, √s=8 TeV
ATLAS monojet, 20.3 fb⁻¹, √s=8 TeV
b̃₁ → b χ̃₁⁰ forbidden
0 leptons + 2 b-jets
m_χ̃₁⁰ [GeV]
m_b̃₁ [GeV]

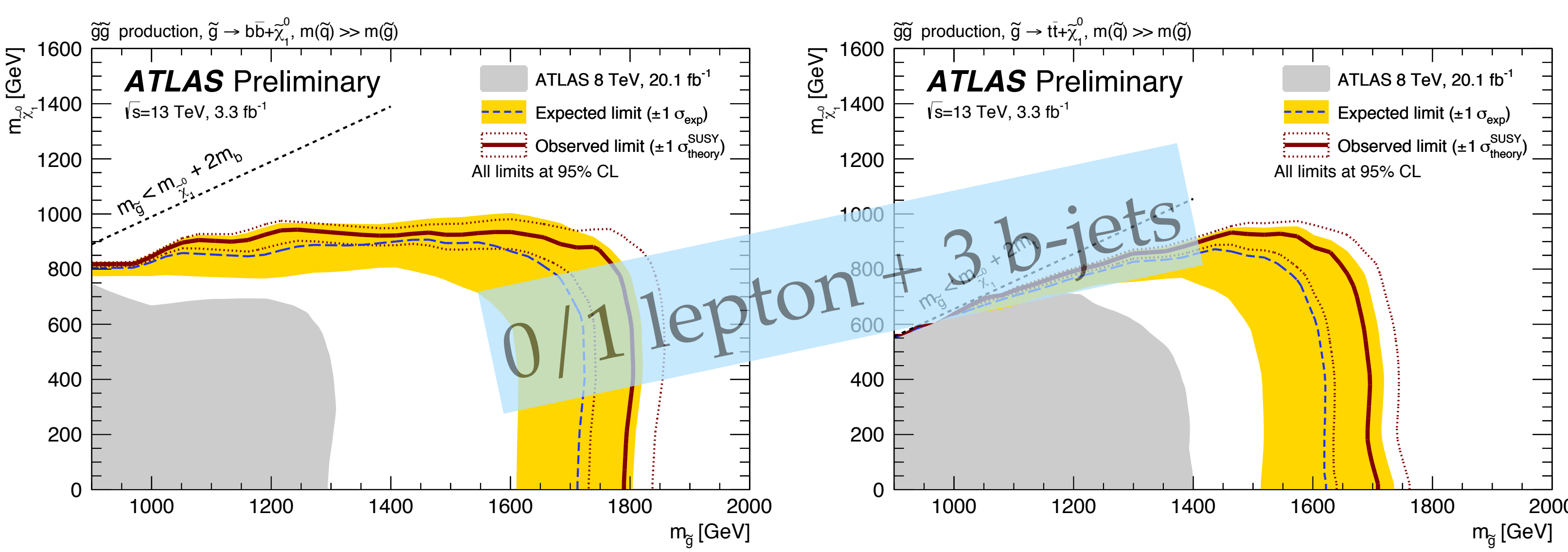

g̃g̃ production, g̃ → bb̄+χ̃₁⁰, m(q̃) >> m(g̃)
ATLAS Preliminary
√s=13 TeV, 3.3 fb⁻¹
ATLAS 8 TeV, 20.1 fb⁻¹
Expected limit (±1 σexp)
Observed limit (±1 σtheory SUSY)
All limits at 95% CL
m_g̃ < m_χ̃₁⁰ + 2m_b
m_χ̃₁⁰ [GeV]
m_g̃ [GeV]
0/1 lepton + 3 b-jets

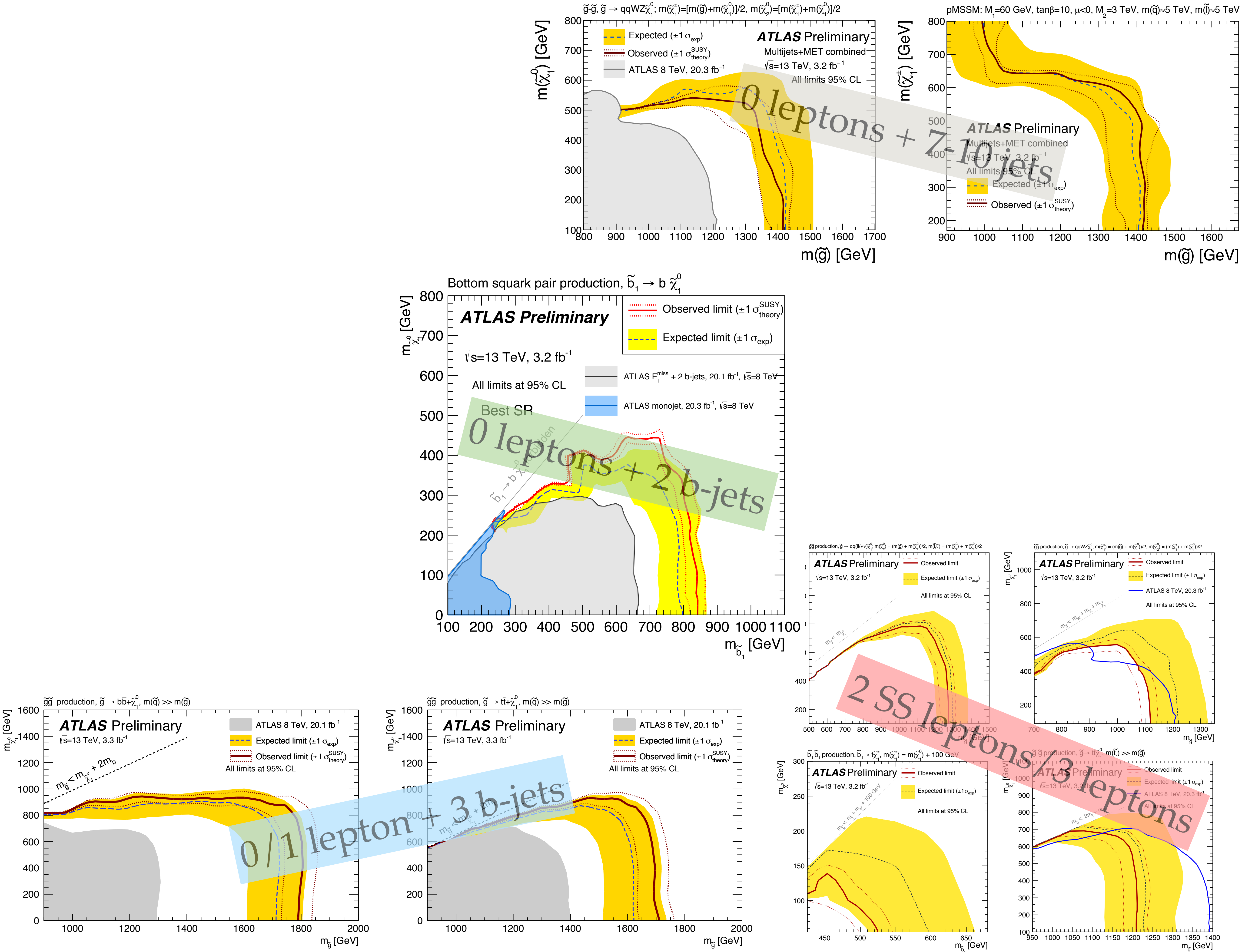

g̃g̃ production, g̃ → tt̄+χ̃₁⁰, m(q̃) >> m(g̃)
ATLAS Preliminary
√s=13 TeV, 3.3 fb⁻¹
ATLAS 8 TeV, 20.1 fb⁻¹
Expected limit (±1 σexp)
Observed limit (±1 σtheory SUSY)
All limits at 95% CL
m_χ̃₁⁰ [GeV]
m_g̃ [GeV]


g̃-g̃, g̃ → qqWZχ̃⁰₁; m(χ̃±₁)=[m(g̃)+m(χ̃⁰₁)]/2, m(χ̃⁰₂)=[m(χ̃±₁)+m(χ̃⁰₁)]/2
pMSSM: M₁=60 GeV, tanβ=10, μ<0, M₂=3 TeV, m(q̃)≈5 TeV, m(l̃)≈5 TeV
ATLAS Preliminary
Multijets+MET combined
√s=13 TeV, 3.2 fb⁻¹
All limits 95% CL
Expected (±1 σexp)
Observed (±1 σSUSY theory)
ATLAS 8 TeV, 20.3 fb⁻¹
0 leptons + 7-10 jets
m(g̃) [GeV]

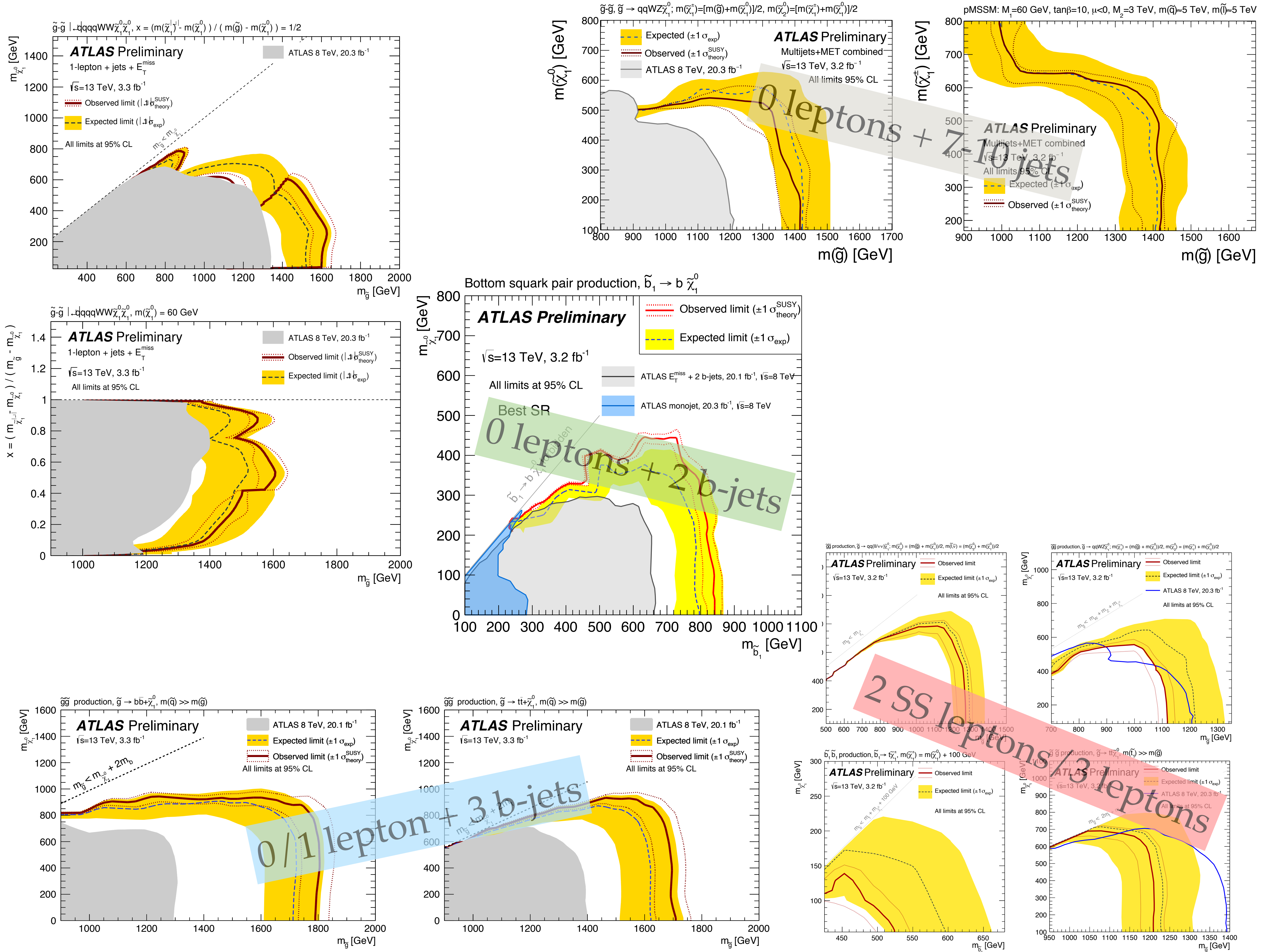

Bottom squark pair production, b̃₁ → b χ̃⁰₁
ATLAS Preliminary
√s=13 TeV, 3.2 fb⁻¹
All limits at 95% CL
Observed limit (±1 σSUSY theory)
Expected limit (±1 σexp)
ATLAS E_T^miss + 2 b-jets, 20.1 fb⁻¹, √s=8 TeV
ATLAS monojet, 20.3 fb⁻¹, √s=8 TeV
Best SR
0 leptons + 2 b-jets
b̃₁ → b χ̃⁰₁ forbidden
m_b̃₁ [GeV]

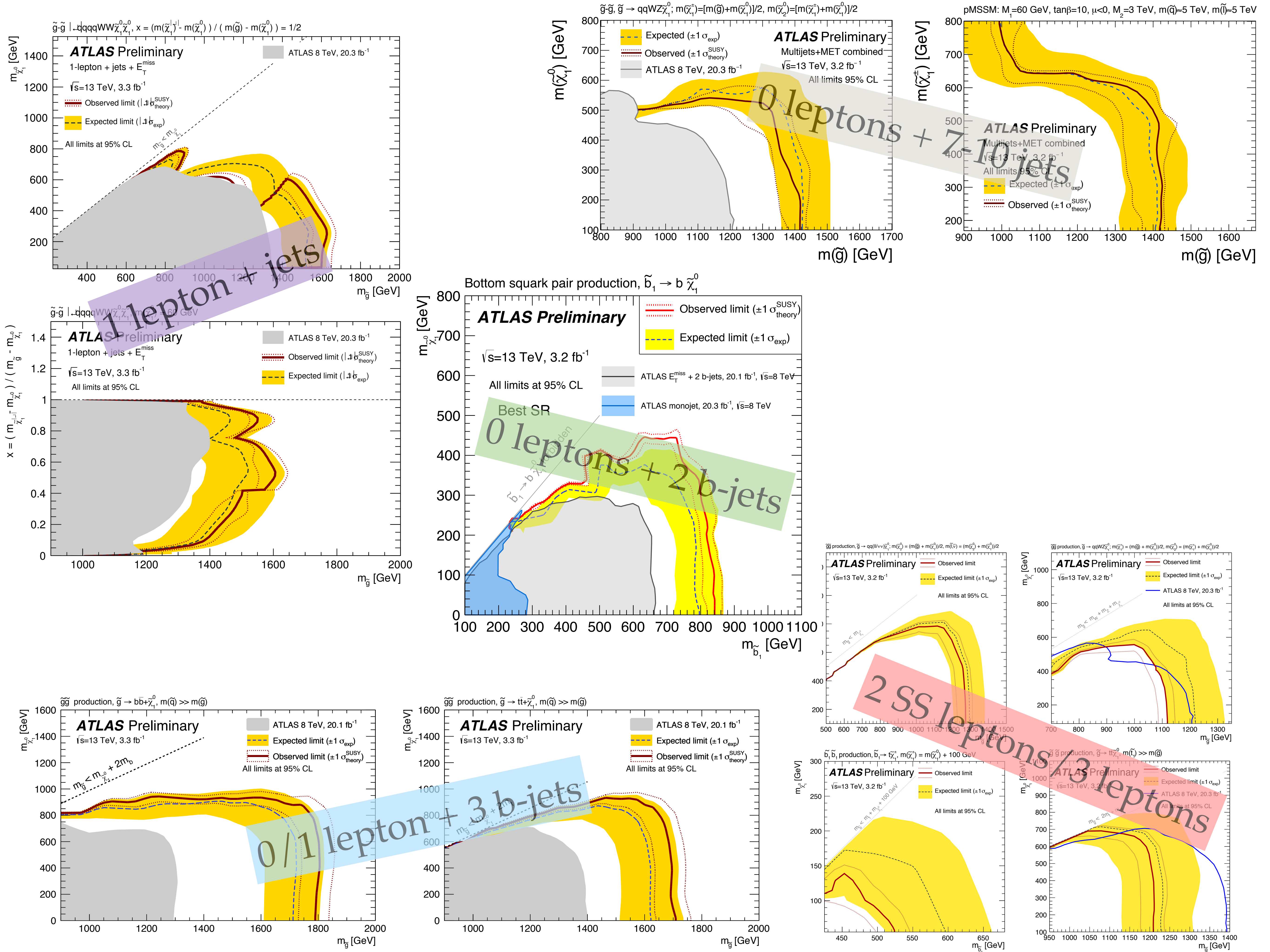

ATLAS Preliminary
√s=13 TeV, 3.2 fb⁻¹
Observed limit
Expected limit (±1 σexp)
ATLAS 8 TeV, 20.3 fb⁻¹
All limits at 95% CL
m_g̃ [GeV]
m_b̃₁ [GeV]

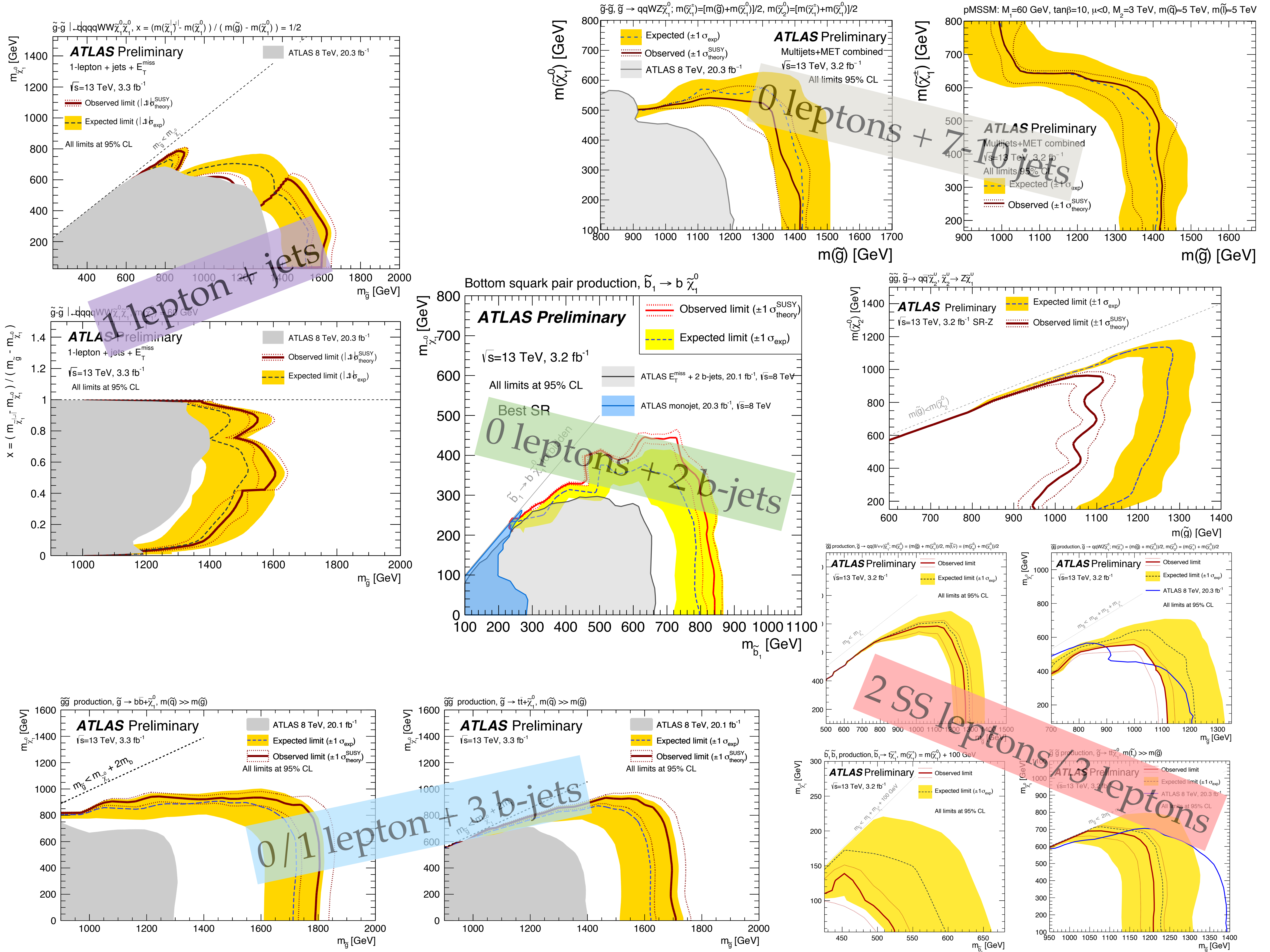

g̃g̃ production, g̃ → bb̄+χ̃⁰₁, m(q̃) >> m(g̃)
g̃g̃ production, g̃ → tt̄+χ̃⁰₁, m(q̃) >> m(g̃)
ATLAS Preliminary
√s=13 TeV, 3.3 fb⁻¹
ATLAS 8 TeV, 20.1 fb⁻¹
Expected limit (±1 σexp)
Observed limit (±1 σSUSY theory)
All limits at 95% CL
0/1 lepton + 3 b-jets
m_g̃ [GeV]



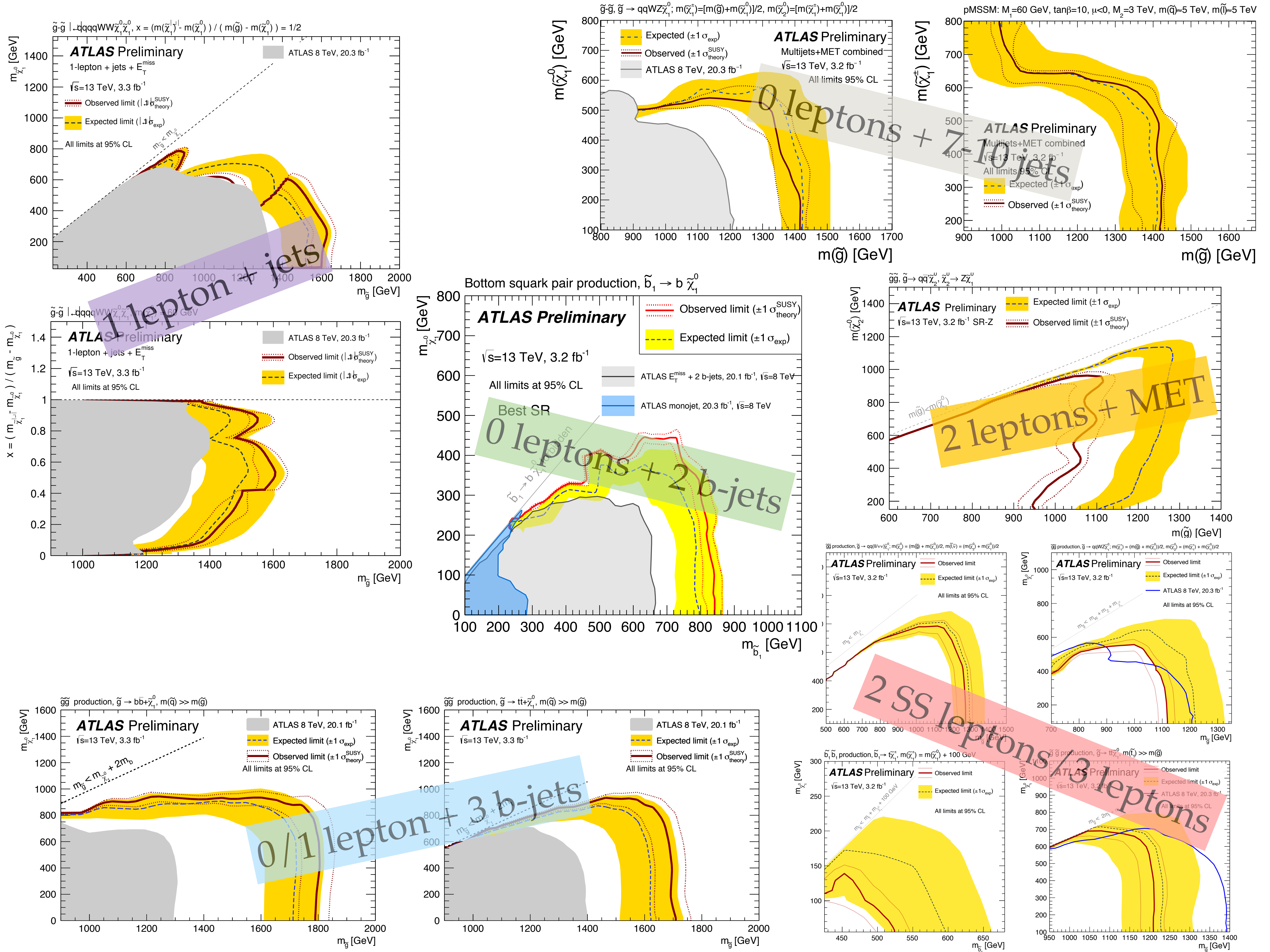
0 leptons + 7-10 jets
ATLAS Preliminary
Multijets+MET combined
√s=13 TeV, 3.2 fb⁻¹
All limits 95% CL
Expected (±1 σ_exp)
Observed (±1 σ_theory^SUSY)
ATLAS 8 TeV, 20.3 fb⁻¹
m(g̃) [GeV]
m(χ̃₁⁰) [GeV]
pMSSM: M₁=60 GeV, tanβ=10, μ<0, M₂=3 TeV, m(q̃)≈5 TeV, m(l̃)≈5 TeV
m(χ̃₁±) [GeV]
0 leptons + 2 b-jets
Bottom squark pair production, b̃₁ → b χ̃₁⁰
ATLAS Preliminary
√s=13 TeV, 3.2 fb⁻¹
All limits at 95% CL
Observed limit (±1 σ_theory^SUSY)
Expected limit (±1 σ_exp)
ATLAS E_T^miss + 2 b-jets, 20.1 fb⁻¹, √s=8 TeV
ATLAS monojet, 20.3 fb⁻¹, √s=8 TeV
Best SR
m_b̃₁ [GeV]
m_χ̃₁⁰ [GeV]
0/1 lepton + 3 b-jets
g̃g̃ production, g̃ → bb̄+χ̃₁⁰, m(q̃) >> m(g̃)
g̃g̃ production, g̃ → tt̄+χ̃₁⁰, m(q̃) >> m(g̃)
ATLAS Preliminary
√s=13 TeV, 3.3 fb⁻¹
ATLAS 8 TeV, 20.1 fb⁻¹
Expected limit (±1 σ_exp)
Observed limit (±1 σ_theory^SUSY)
All limits at 95% CL
m_g̃ [GeV]
m_χ̃₁⁰ [GeV]
2 SS leptons / 3 leptons
ATLAS Preliminary
√s=13 TeV, 3.2 fb⁻¹
Observed limit
Expected limit (±1 σ_exp)
ATLAS 8 TeV, 20.3 fb⁻¹
All limits at 95% CL
b̃₁b̃₁ production, b̃₁→ tχ̃₁±, m(χ̃₁±) = m(χ̃₁⁰) + 100 GeV
m_b̃₁ [GeV]
m_g̃ [GeV]


ATLAS Preliminary
1-lepton + jets + E_T^{miss}
$\sqrt{s}$=13 TeV, 3.3 fb^{-1}
Observed limit ($\pm1\sigma_{theory}^{SUSY}$)
Expected limit ($\pm1\sigma_{exp}$)
All limits at 95% CL
ATLAS 8 TeV, 20.3 fb^{-1}
$m_{\tilde{g}}$ [GeV]
$\tilde{g}$-$\tilde{g}$, $\tilde{g} \to qqWZ\tilde{\chi}_1^0$; $m(\tilde{\chi}_1^{\pm})=[m(\tilde{g})+m(\tilde{\chi}_1^0)]/2$, $m(\tilde{\chi}_2^0)=[m(\tilde{\chi}_1^{\pm})+m(\tilde{\chi}_1^0)]/2$
Multijets+MET combined
$\sqrt{s}$=13 TeV, 3.2 fb^{-1}
All limits 95% CL
0 leptons + 7-10 jets
pMSSM: M_1=60 GeV, tanβ=10, μ<0, M_2=3 TeV, $m(\tilde{q})$≈5 TeV, $m(\tilde{l})$≈5 TeV
m($\tilde{g}$) [GeV]
Bottom squark pair production, $\tilde{b}_1 \to b\,\tilde{\chi}_1^0$
ATLAS Preliminary
$\sqrt{s}$=13 TeV, 3.2 fb^{-1}
All limits at 95% CL
ATLAS E_T^{miss} + 2 b-jets, 20.1 fb^{-1}, $\sqrt{s}$=8 TeV
ATLAS monojet, 20.3 fb^{-1}, $\sqrt{s}$=8 TeV
Best SR
0 leptons + 2 b-jets
$m_{\tilde{b}_1}$ [GeV]
$\tilde{g}\tilde{g}$ production, $\tilde{g} \to b\bar{b}+\tilde{\chi}_1^0$, $m(\tilde{q}) >> m(\tilde{g})$
$\tilde{g}\tilde{g}$ production, $\tilde{g} \to t\bar{t}+\tilde{\chi}_1^0$, $m(\tilde{q}) >> m(\tilde{g})$
ATLAS 8 TeV, 20.1 fb^{-1}
0/1 lepton + 3 b-jets
2 SS leptons/3 leptons


1 lepton + jets
0 leptons + 7-10 jets
0 leptons + 2 b-jets
0 / 1 lepton + 3 b-jets
2 SS leptons / 3 leptons
ATLAS Preliminary
1-lepton + jets + E_T^miss
√s=13 TeV, 3.3 fb^-1
Multijets+MET combined
√s=13 TeV, 3.2 fb^-1
All limits 95% CL
All limits at 95% CL
Bottom squark pair production, b̃1 → b χ̃1^0
Best SR
ATLAS 8 TeV, 20.3 fb^-1
ATLAS 8 TeV, 20.1 fb^-1
ATLAS monojet, 20.3 fb^-1, √s=8 TeV
Observed limit
Expected limit
pMSSM: M1=60 GeV, tanβ=10, μ<0, M2=3 TeV, m(q̃)≈5 TeV, m(l̃)≈5 TeV
m(g̃) [GeV]
m_g̃ [GeV]
m_b̃1 [GeV]



1 lepton + jets
0 leptons + 7-10 jets
0 leptons + 2 b-jets
0 / 1 lepton + 3 b-jets
2 SS leptons / 3 leptons
ATLAS Preliminary
1-lepton + jets + E_T^{miss}
$\sqrt{s}$=13 TeV, 3.3 fb^{-1}
Multijets+MET combined
$\sqrt{s}$=13 TeV, 3.2 fb^{-1}
pMSSM: M_1=60 GeV, tanβ=10, μ<0, M_2=3 TeV, m($\tilde{q}$)≈5 TeV, m($\tilde{l}$)≈5 TeV
Bottom squark pair production, $\tilde{b}_1 \rightarrow b\,\tilde{\chi}_1^0$
All limits at 95% CL
Best SR
ATLAS E_T^{miss} + 2 b-jets, 20.1 fb^{-1}, $\sqrt{s}$=8 TeV
ATLAS monojet, 20.3 fb^{-1}, $\sqrt{s}$=8 TeV
$\tilde{g}\tilde{g}$ production, $\tilde{g} \rightarrow b\bar{b}+\tilde{\chi}_1^0$, m($\tilde{q}$) >> m($\tilde{g}$)
$\tilde{g}\tilde{g}$ production, $\tilde{g} \rightarrow t\bar{t}+\tilde{\chi}_1^0$, m($\tilde{q}$) >> m($\tilde{g}$)
ATLAS 8 TeV, 20.1 fb^{-1}
ATLAS 8 TeV, 20.3 fb^{-1}
Expected limit (±1 σ_{exp})
Observed limit (±1 σ_{theory}^{SUSY})
m($\tilde{g}$) [GeV]


1 lepton + jets
0 leptons + 7-10 jets
0 leptons + 2 b-jets
2 leptons + MET
2 SS leptons / 3 leptons
0 / 1 lepton + 3 b-jets
ATLAS Preliminary
1-lepton + jets + E_T^{miss}
$\sqrt{s}$=13 TeV, 3.3 fb^{-1}
All limits at 95% CL
ATLAS 8 TeV, 20.3 fb^{-1}
Multijets+MET combined
$\sqrt{s}$=13 TeV, 3.2 fb^{-1}
All limits 95% CL
pMSSM: M_1=60 GeV, tanβ=10, μ<0, M_2=3 TeV, m($\tilde{q}$)≈5 TeV, m($\tilde{l}$)≈5 TeV
Bottom squark pair production, $\tilde{b}_1 \to b \tilde{\chi}_1^0$
ATLAS Preliminary
$\sqrt{s}$=13 TeV, 3.2 fb^{-1}
All limits at 95% CL
Best SR
ATLAS E_T^{miss} + 2 b-jets, 20.1 fb^{-1}, $\sqrt{s}$=8 TeV
ATLAS monojet, 20.3 fb^{-1}, $\sqrt{s}$=8 TeV
$\sqrt{s}$=13 TeV, 3.2 fb^{-1} SR-Z
$\tilde{g}\tilde{g}$ production, $\tilde{g} \to b\bar{b}\tilde{\chi}_1^0$, m($\tilde{q}$) >> m($\tilde{g}$)
$\tilde{g}\tilde{g}$ production, $\tilde{g} \to t\bar{t}\tilde{\chi}_1^0$, m($\tilde{q}$) >> m($\tilde{g}$)
ATLAS 8 TeV, 20.1 fb^{-1}
Expected limit (±1 σ_{exp})
Observed limit (±1 σ_{theory}^{SUSY})
m($\tilde{g}$) [GeV]

Conclusion

- First Run-2 SUSY results are public.
- Already exceeding Run-1 sensitivity, but barely.
- No hints of SUSY yet; limited by amount of data.
- ATLAS is already publishing a wide range of searches with more to come.
- We are ready for the data to come in 2016.

So stay tuned in 2016…

Backup Slides

Object definitions

Objects defined from AnalysisBase 2.3.28, SUSYTools-00-06-24

Photon selection

Cut	Value/description
Acceptance	$p_{\mathrm{T}} > 25$ GeV, $\lvert\eta\rvert < 2.37$
Quality	Tight
Isolation	Cone20
Overlap	$\Delta R(\gamma, \mathrm{jet}) > 0.4$

Muon selection

Cut	Value/description
Baseline muon	
Acceptance	$p_{\mathrm{T}} > 10$ GeV, $\lvert\eta\rvert < 2.4$
Quality	Medium
Signal muon	
Acceptance	$p_{\mathrm{T}} > 10$ GeV
Isolation	GradientLoose
	$\lvert z_0^{PV}\rvert < 0.5$ mm
	$\lvert d_0^{PV}\rvert/\sigma(d_0^{PV}) < 3$
Overlap	$\Delta R(\mu, \mathrm{jet}) > 0.4$

Electron selection

Cut	Value/description
Baseline electron	
Algorithm	AuthorElectron
Acceptance	$p_{\mathrm{T}} > 10$ GeV, $\lvert\eta^{\mathrm{clust}}\rvert < 2.47$
Quality	LooseLH
Signal Electron	
Acceptance	$p_{\mathrm{T}} > 10$ GeV
Quality	TightLH
Isolation	GradientLoose
	$\lvert z_0^{PV}\rvert < 0.5$ mm
	$\lvert d_0^{PV}\rvert/\sigma(d_0^{PV}) < 5$
Overlap	$\Delta R(e, \mathrm{jet}) > 0.4$

Jet selection

Cut	Value/description
Baseline jet	
Algorithm	anti-k_t4Topo
Acceptance	$p_{\mathrm{T}} > 20$ GeV, $\lvert\eta\rvert < 2.8$
Quality	`LooseBad` (checked on jets with $p_{\mathrm{T}} > 20$ GeV)
b-jet	
b-tagging algorithm	MV2c20 at 77% efficiency point
Acceptance	$p_{\mathrm{T}} > 20$ GeV , $\lvert\eta\rvert < 2.5$

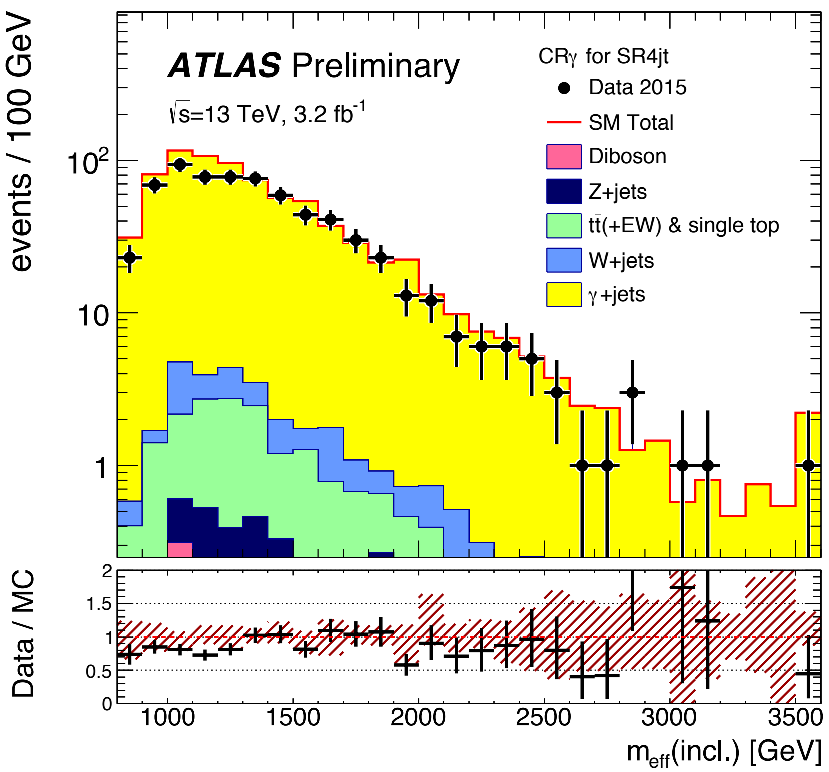
Control Regions

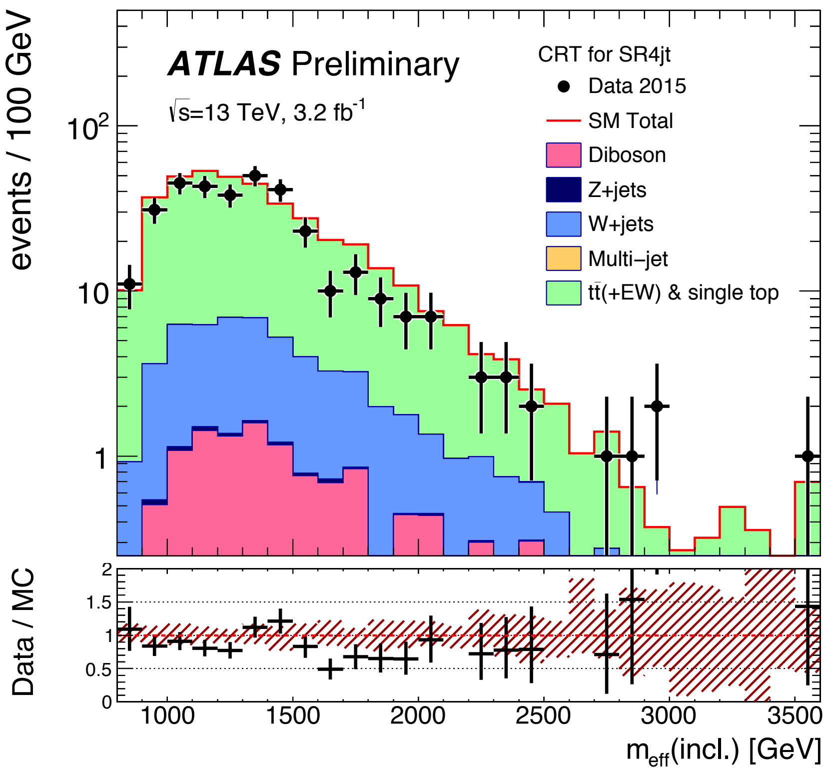
CR	Background	CR process	CR selection
CRY	*Z*	γ	Isolated photon
CRQ	Multijets	Multijets	Reversed $\Delta\phi$(jet,ETmiss) cuts Reversed METSig or ETmiss/meff cuts
CRW	*W*	*W*	1 electron or muon with pT > 25 GeV 30 GeV < mT(l,ETmiss) < 100 GeV,
CRT	*ttbar*	*ttbar*	1 electron or muon with pT > 25 GeV 30 GeV < mT(l,ETmiss) < 100 GeV,
VRZ	*Z*	Validate Z contribution	2 OS electrons or muons with pT > 25, 10 GeV 66 GeV < m(ll) < 116 GeV

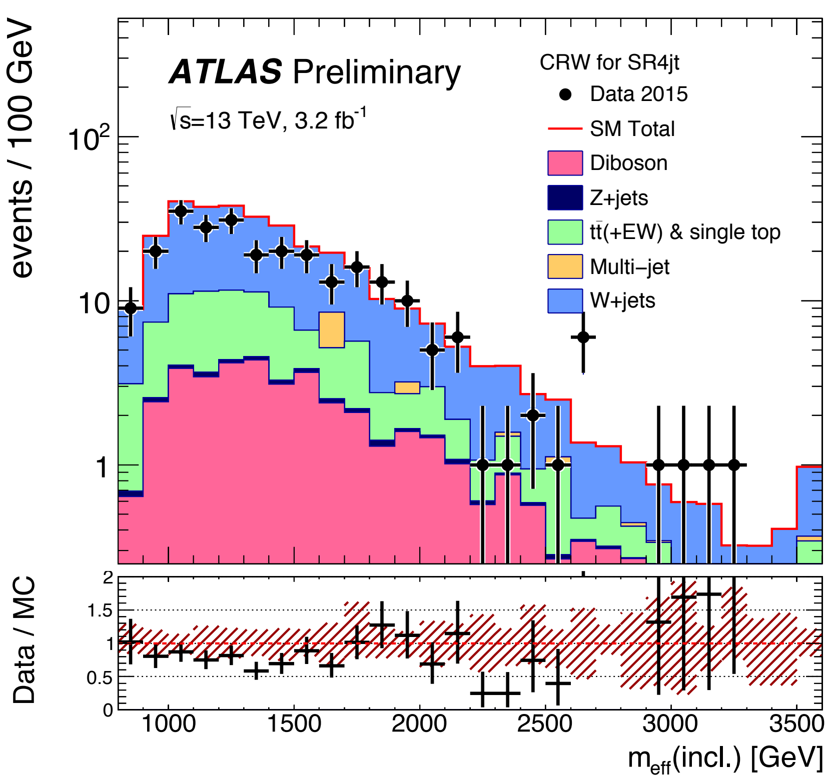
CR definition

Cut	Control Region				
	CRY	VRZ	CRQ	CRW	CRT
1	HLT_g120_loose	HLT_e24_lhmedium_iloose_L1EM20VH OR HLT_e60_lhmedium / HLT_mu20_iloose_L1MU15 OR HLT_mu50	As for SR cut 1	As for VRZ	As for VRZ
2-5	As for SR cuts 2-5				
6a	$\geq$ 1 signal photon No selected e/μ as for SR Cut 6	Exactly 2 OS selected signal electrons or muons: $p_{\mathrm{T}}(e)$ >25, 10 GeV or $p_{\mathrm{T}}(\mu)$ >25, 10 GeV	As for SR Cut 6	Exactly 1 selected signal electron or muon with $p_{\mathrm{T}}(e)$ >25 GeV or $p_{\mathrm{T}}(\mu)$ >25 GeV	Exactly 1 selected signal electron or muon with $p_{\mathrm{T}}(e)$ >25 GeV or $p_{\mathrm{T}}(\mu)$ >25 GeV
6b	–	–	–	No p_{T} >50 GeV sel. $\lvert\eta\rvert < 2.5$ jet with MV2c20 77% eff.	$\geq$ 1 p_{T} >50 GeV sel. $\lvert\eta\rvert < 2.5$ jet with MV2c20 77% eff.
6c	–	66 GeV < $m(\ell\ell)$ < 116 GeV	–	30 GeV < $m_T(\ell, E_{\mathrm{T}}^{\mathrm{miss}})$ < 100 GeV	30 GeV < $m_T(\ell, E_{\mathrm{T}}^{\mathrm{miss}})$ < 100 GeV
Use below:	$E_{\mathrm{T}}^{\mathrm{miss}\,\prime} = p_{\mathrm{T}}(\gamma) + E_{\mathrm{T}}^{\mathrm{miss}}$	$E_{\mathrm{T}}^{\mathrm{miss}\,\prime} = E_{\mathrm{T}}^{\mathrm{miss}} + p_{\mathrm{T}}(\ell\ell)$	–	Treat lepton as a jet	Treat lepton as a jet
$p_{\mathrm{T}}(j_{1,2,\ldots,6})$	As for SR cuts				
$\Delta\phi(j_i, E_{\mathrm{T}}^{\mathrm{miss}})$	As for SR cut	No cut	$\Delta\phi(j_i, E_{\mathrm{T}}^{\mathrm{miss}}) < 0.2$,i={1,2,(3)} : [or $\Delta\phi(j_i, E_{\mathrm{T}}^{\mathrm{miss}}) < 0.1$,$p_{\mathrm{T}} > 50$ GeV jets / (for 4j,5j,6j)]	No cut	No cut
Aplanarity	No cut				
$E_{\mathrm{T}}^{\mathrm{miss}}/m_{\mathrm{eff}}(Nj)$ or $E_{\mathrm{T}}^{\mathrm{miss}}/\sqrt{H_T}$	As for SR cut	No cut	$X - \Delta < E_{\mathrm{T}}^{\mathrm{miss}}/m_{\mathrm{eff}}(Nj) < X$ $X - \Delta < E_{\mathrm{T}}^{\mathrm{miss}}/\sqrt{H_T} < X\sqrt{\mathrm{GeV}}$ if $E_{\mathrm{T}}^{\mathrm{miss}}/m_{\mathrm{eff}}(Nj) > X$ or $E_{\mathrm{T}}^{\mathrm{miss}}/\sqrt{H_T} > X$ in SR	No cut	No cut
m_{eff}(incl.)	As for SR cut				

CR plots


ATLAS Preliminary
√s=13 TeV, 3.2 fb-1
CRγ for SR4jt
Data 2015
SM Total
Diboson
Z+jets
tt̄(+EW) & single top
W+jets
γ+jets
events / 100 GeV
Data / MC
m_eff(incl.) [GeV]


ATLAS Preliminary
√s=13 TeV, 3.2 fb-1
CRT for SR4jt
Data 2015
SM Total
Diboson
Z+jets
W+jets
Multi−jet
tt̄(+EW) & single top
events / 100 GeV
Data / MC
m_eff(incl.) [GeV]


ATLAS Preliminary
√s=13 TeV, 3.2 fb-1
CRW for SR4jt
Data 2015
SM Total
Diboson
Z+jets
tt̄(+EW) & single top
Multi−jet
W+jets
events / 100 GeV
Data / MC
m_eff(incl.) [GeV]