SUSY

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澤田 龍, 東大ICEPP

新学術領域研究会 新テラスケール2017

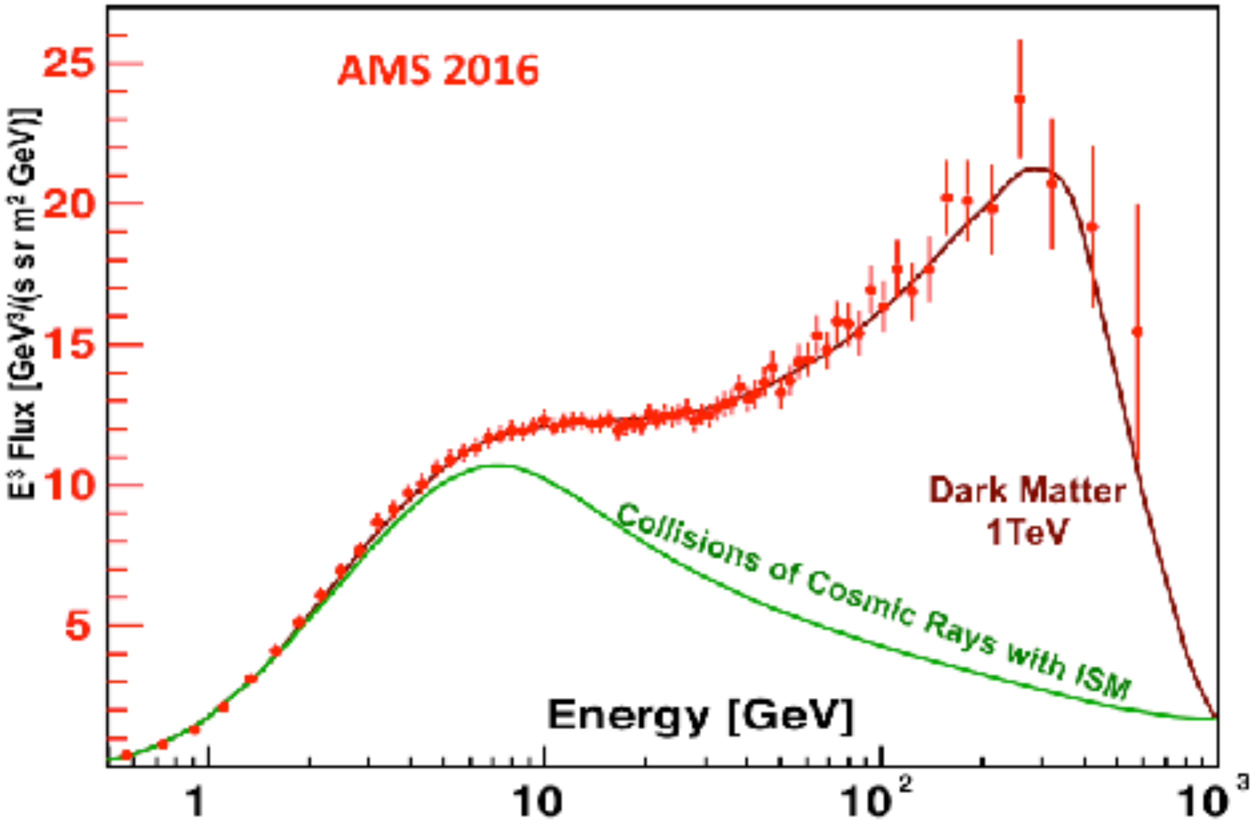
内容

- イントロダクション
- **Moriond**まとめ
- イベント超過についてのおさらい
- まとめ

標準理論と新物理の可能性

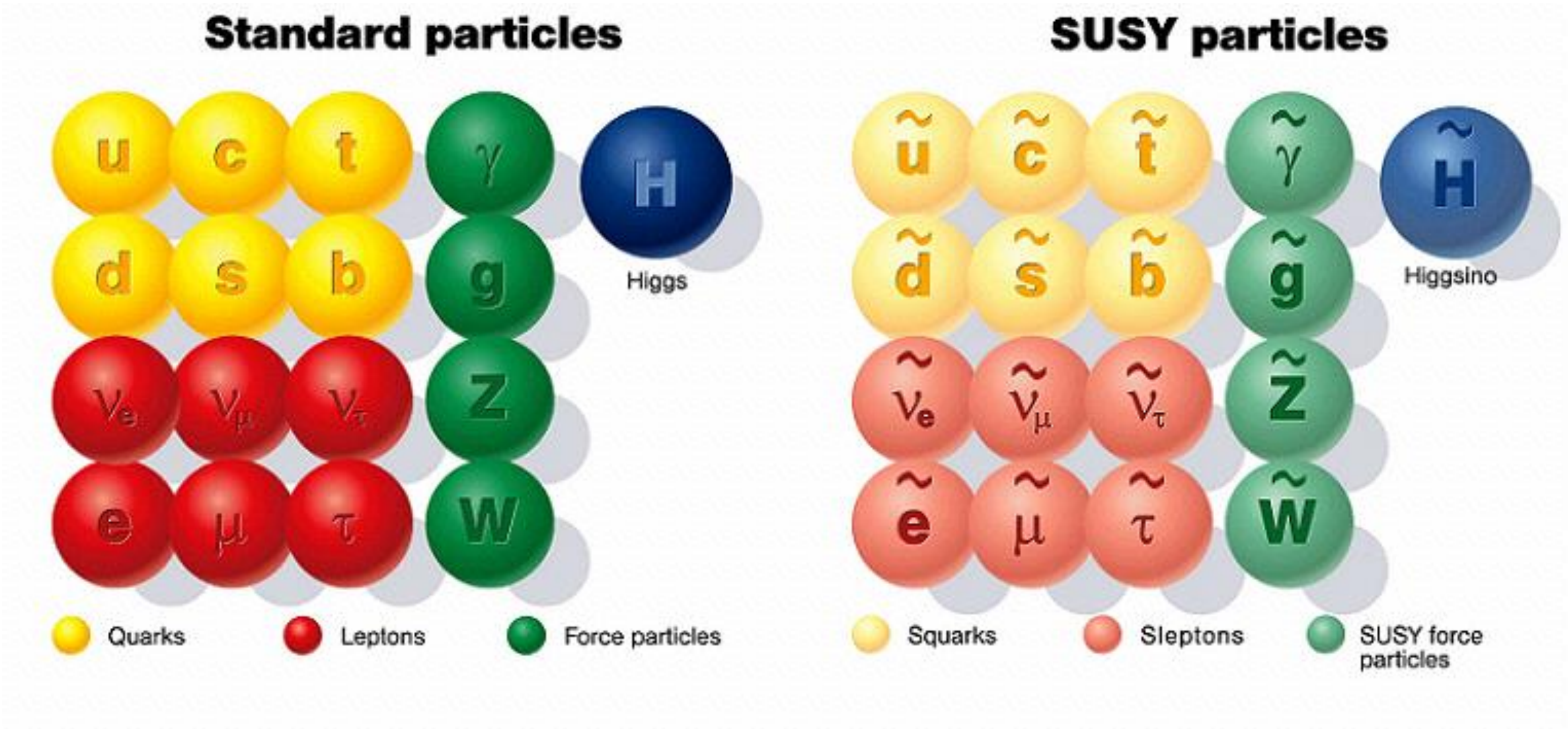
- **標準理論は高い精度で検証が行われており、今のところ有意なズレは見つかっていない。**
  - 標準理論には暗黒物質を説明する粒子は存在しない。
  - 階層性問題
  - 3-4 σ程度のズレはあり、新物理による可能性もある。

- **AMS-02の結果は~1TeV程度のダークマターを示唆**



超対称性

- **Fermionとbosonの間の対称性**
  - スピンが1/2ずれたSM粒子のパートナーを導入
- **階層性問題はFermionとbosonのループ補正のより解決される**
- **安定な中性SUSY粒子がダークマターの候補**
- **Gauge couplingが10^{16}GeVで統一される**
  - SMではそうならない

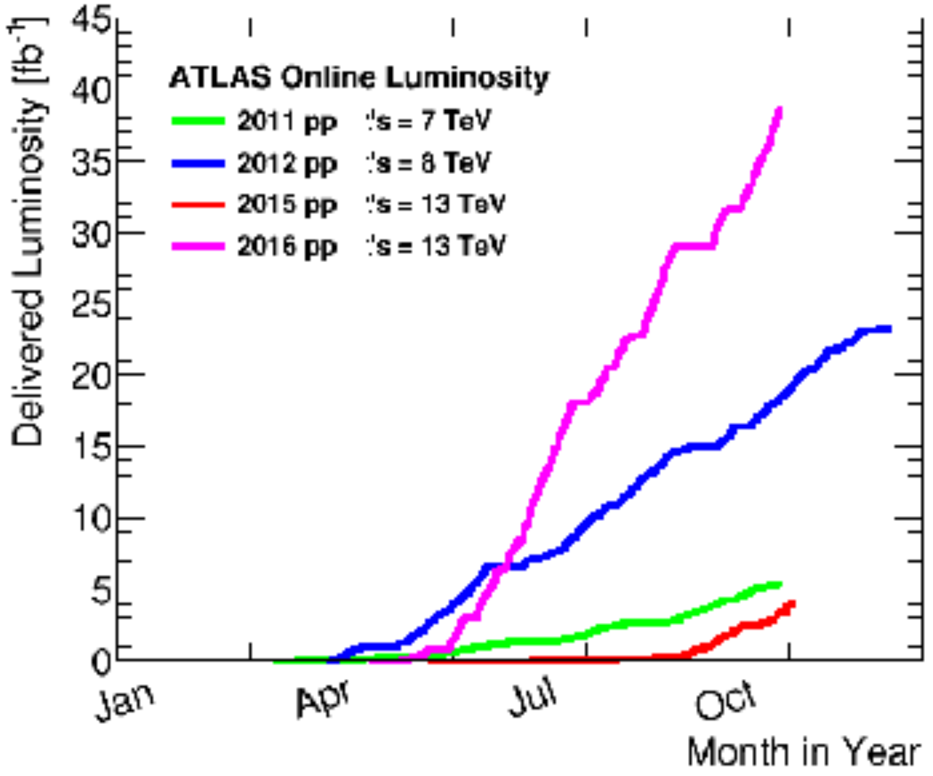


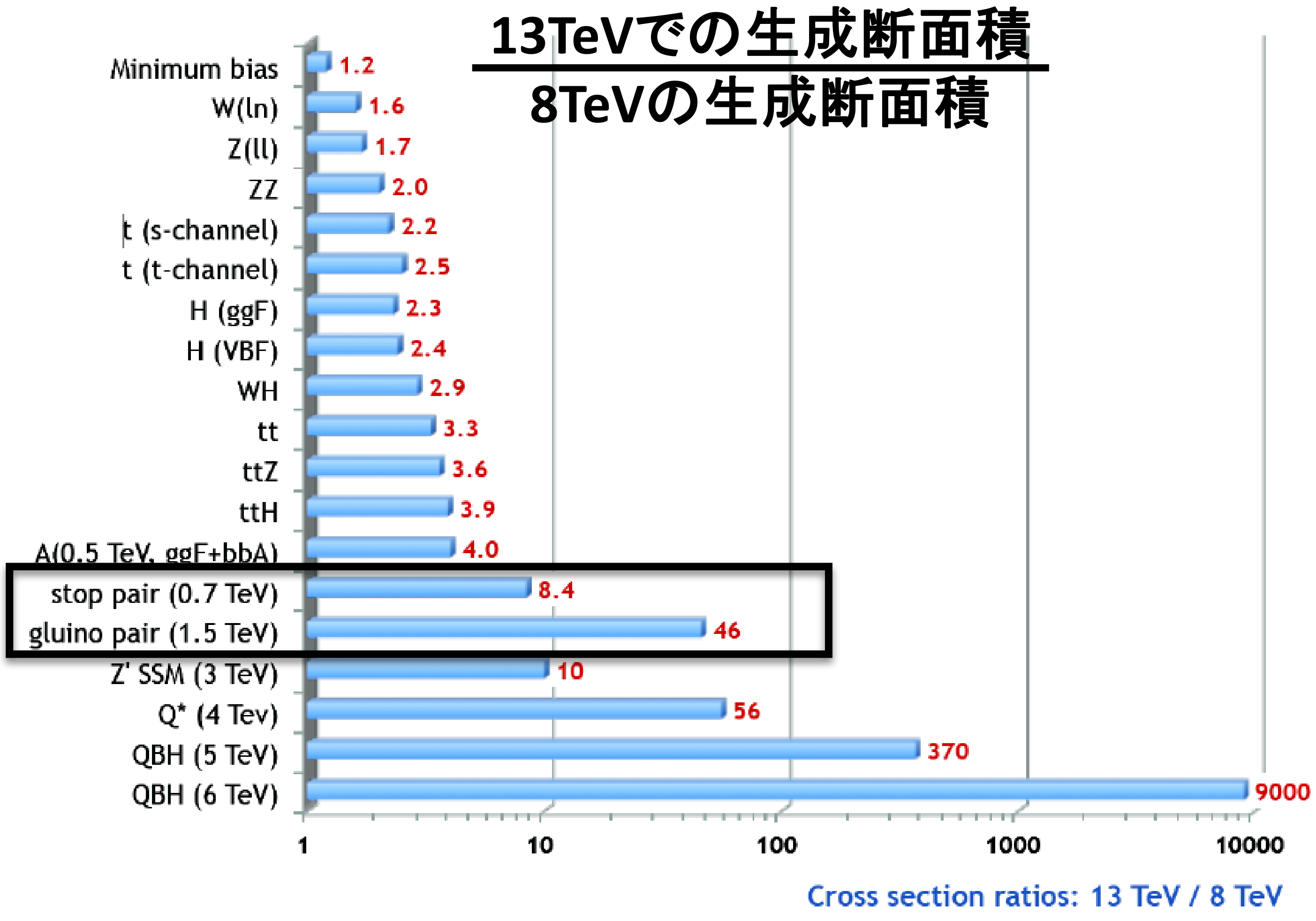
SUSY search

- **直接探索**
  - Energy frontierで生成されるSUSY粒子崩壊物の特徴的なパターンを探す。
- **間接探索**
  - Intensity frontierでの探索
    - 低エネルギー現象を精密測定し、SMからのズレを探す。
    - 稀崩壊の探索

SUSY search @ LHC

- **13 TeVでのデータ取得が2015年よりスタート**
- **2016年では、安定したビームが供給され予定以上のデータを取得**
  - 2015 : 3 fb^{-1}
  - 2015 + 2016 : 36 fb^{-1}




13TeVでの生成断面積 / 8TeVの生成断面積

- **13 TeVの2015+2016の結果が出てくるMoriondと夏のconferenceでの発表が注目される。**

SUSY signature

- **Squark/Gluino**
  - 0-lepton + jets
  - 1-lepton + jets
  - 2-lepton + jets
  - photon + jets
  - tau + jets
- **stop**
- **Electroweakino**

- **Long-lived**
  - Disappearing track
  - Displaced vertex
- **RPV**

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- **なぜSUSYがまだ見えていないか**
  - **Squark/Gluinoが重い？**
    - 感度を上げていく (統計、新たな変数、BGの推定方)
  - **質量固有状態が縮退？**
    - 終状態に多くのtrackを要求しない解析 (e.g. ISR + E_T^{miss} + …)
  - **RPVのためにE_T^{miss}が小さい *?***
    - E_T^{miss}を要求しない探索

  - **まだ探索されていない終状態**

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SUSY signature @ LHC

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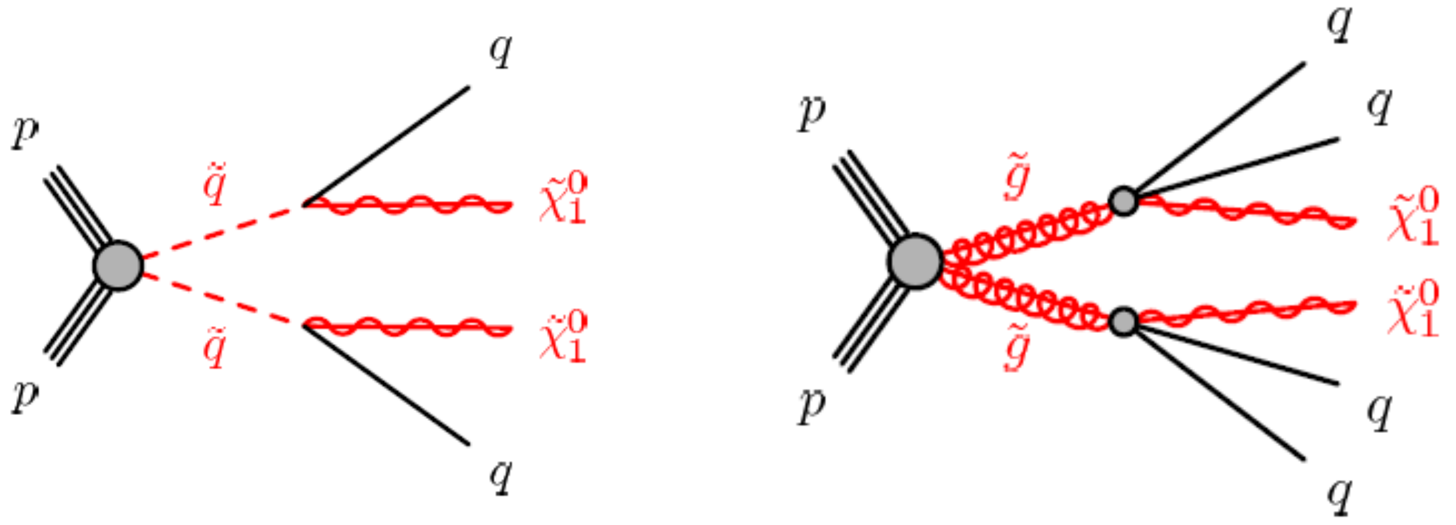
- R-Parityが保存する場合は、SUSY粒子はペアで生成し、複数のSM粒子と最終的には安定なLSP (invisible)になる。
- 大きなE_T^{miss}、複数のjet、レプトンのトポロジーが基本的なsignatureとなる。



- LHCでは、squark/gluinoのcross sectionが大きく、LHC解析ではメインのターゲット
- 終状態のトポロジーによる複数の解析を行う。

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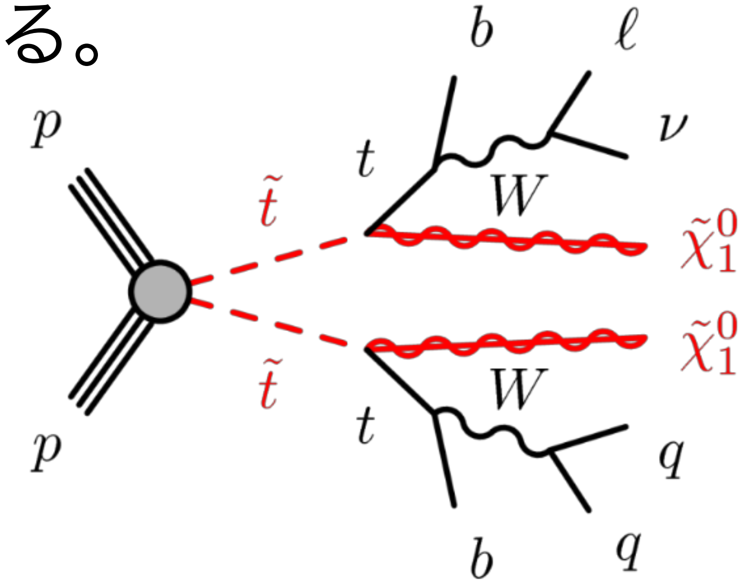
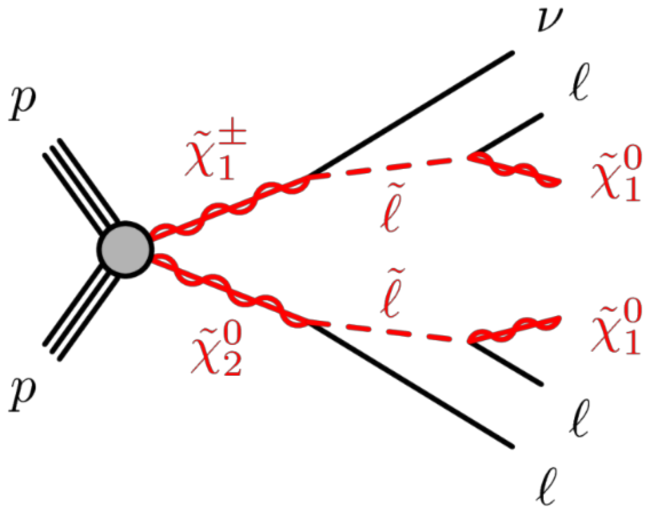
- Naturalnessを信じるとstopは軽い(<1TeV)と考えられる。



- Electroweak production
  - LSPがダークマターならば<O(1 TeV)にあると期待される。
  - Gluino質量によらず探索可能



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- **SUSY粒子が超寿命となるシナリオ**
  - 最も軽いチャージーノとニュートラリーノが縮退している場合(両者が同粒子の場合 e.g. Wino LSP)
  - スカラー質量が非常に大きい場合 (Split SUSY)
  - Gravitino LSP, stau NLSP

- **信号**
  - 主崩壊点から離れた位置(O(mm) - O(10cm))から多数のトラックが現れる。
    - Displaced vertex
  - 荷電SUSY粒子が飛跡を検出器に残して途中でLSPに崩壊
    - Disappearing track

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- **Long-lived**
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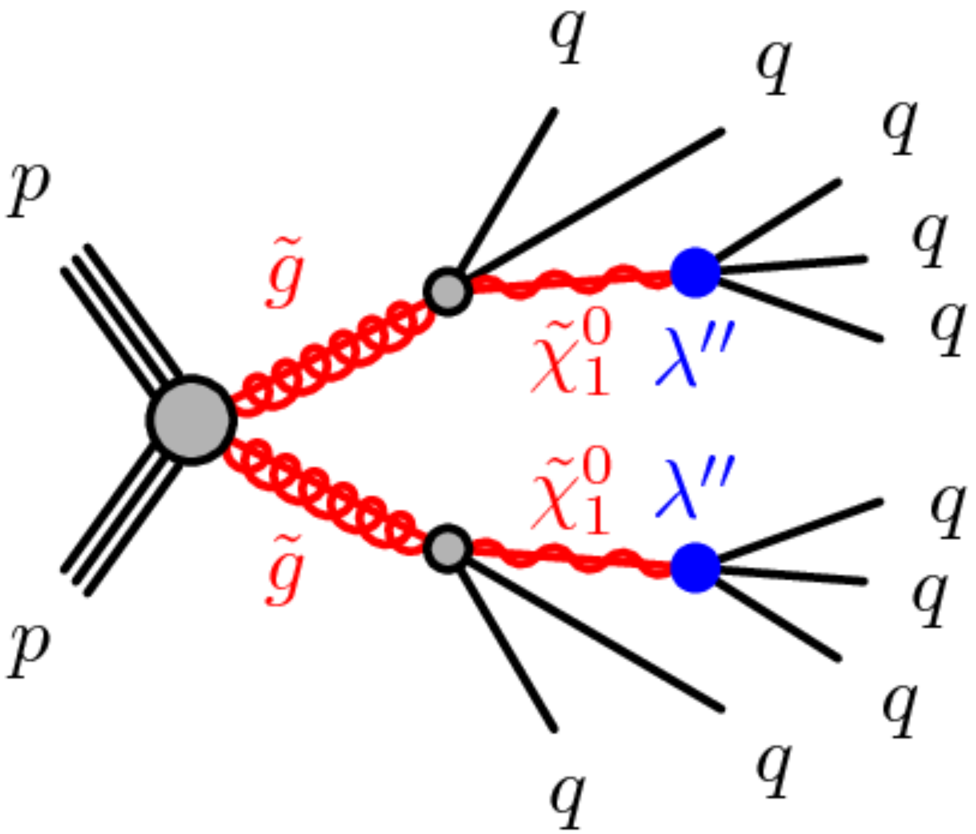
- **RPV**

- R-Parityが保存しない場合は、E_T^{miss}は伴わないが、非常に多くのjetが生成される特徴的な信号になる。



ATLAS Moriondの発表

ATLAS-CONF-2017-017	Search for long-lived charginos based on a disappearing-track signature in pp collisions at sqrt(s)=13TeV with the ATLAS detector
ATLAS-CONF-2017-022	Search for squarks and gluinos in final states with jets and missing transverse momentum using 36 fb−1 of sqrt(s)=13 TeV pp collision data with the ATLAS detector
ATLAS-CONF-2017-021	Search for production of supersymmetric particles in final states with missing transverse momentum and multiple b-jets at sqrt(s)=13 TeV proton-proton collisions with the ATLAS detector
ATLAS-CONF-2017-020	Search for a Scalar Partner of the Top Quark in the Jets+ETmiss Final State at sqrt(s)=13 TeV with the ATLAS detector
ATLAS-CONF-2017-019	Search for direct top squark pair production in events with a Higgs or Z boson, and missing transverse momentum in sqrt(s)=13 TeV pp collisions with the ATLAS detector
ATLAS-CONF-2017-013	Search for new phenomena in a lepton plus high jet multiplicity final state with the ATLAS experiment using sqrt(s)=13 TeV proton-proton collision data
ATLAS-CONF-2017-025	A search for pair-produced resonances in four-jet final states at sqrt(s)=13 TeV with the ATLAS detector
ATLAS-CONF-2017-026	Search for long-lived, massive particles in events with displaced vertices and missing transverse momentum in 13 TeV pp collisions with the ATLAS detector

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ATLAS-CONF-2017-022	Search for squarks and glui s with jets and missing transverse momentum using 36 fb−1 of sqrt(s)=13 data with the ATLAS detector	0 lepton
ATLAS-CONF-2017-021	Search for production of supersymmetric particles in final states with missing transverse momentum and multiple n-proton collisions with the ATLAS detector	0/1 lepton + b-jets
ATLAS-CONF-2017-020	Search for a Scalar Partner ETmiss Final State at sqrt(s)=13 Te	stop all hadronic
ATLAS-CONF-2017-019	Search for direct top squar ith a Higgs or Z boson, and missing transverse momentum in sc h the ATLAS detector	stop → Higgs, Z
ATLAS-CONF-2017-013	Search for new phenomena in a lepton plus high jet multiplicity final state with the ATLAS experiment usin proton collision data	RPV 1 lepton
ATLAS-CONF-2017-025	A search for pair-produced resonances in four-jet final states at sqrt(s)=13 TeV with the ATLAS detector	stop RPV
ATLAS-CONF-2017-026	Search for long-lived, massive particles in events with displaced vertices and missing transverse momentum in 13 LAS detector	Displaced vertex

CMS Moriondの発表

Moriond Electro-weak

Jets

- MHT **SUS-16-33**
- MT2 **SUS-16-36**
- Stop Production **SUS-16-49**
- Search for $\tilde{b}, \tilde{t}$ with $b\bar{b}$ or $c\bar{c}$ **SUS-16-32**
- Higgsino Search with $H \to b\bar{b}$ **SUS-16-44**

1-lep

- Summed Jet Mass **SUS-16-37**

2-lep

- Stop Search **SUS-17-001**
- Same-sign Leptons **SUS-16-35**
- Soft opposite-sign Leptons **SUS-16-48**

multi-lep

- Multilepton Search for EWKinos **SUS-16-39**

Photons

- SUSY Search with Photon and Missing E_T **SUS-16-46**
- SUSY Search with Photon and EM H_T **SUS-16-47**
- Razor Variables and $H \to \gamma\gamma$ **SUS-16-045**

Moriond QCD

1-lep

- SUSY Search with $\Delta\phi$ **SUS-16-42**
- Stop Search with 1-lepton **SUS-16-51**

2-lep

- Opposite-sign Edge Z **SUS-16-34**

multi-lep

- Multi-leptons with b-jets SUS-16-041

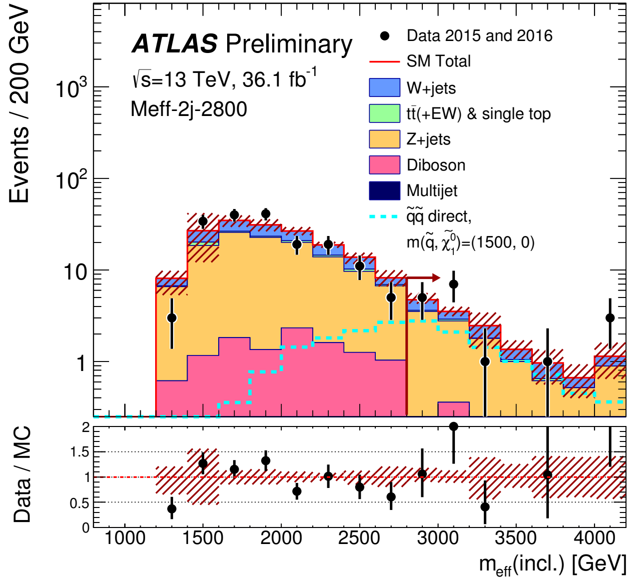
0-lepton + 2-6 jets + E_T^{miss}

- **解析に用いる変数**
  - 従来のM_{eff} : 24個のSR
  - Recursive Jigsaw Reconstruction (RJR)

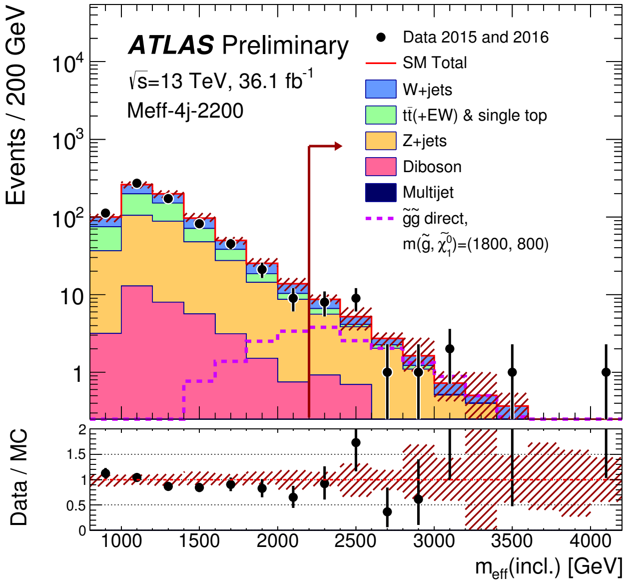
ATLAS

ATLAS-CONF-2017-022

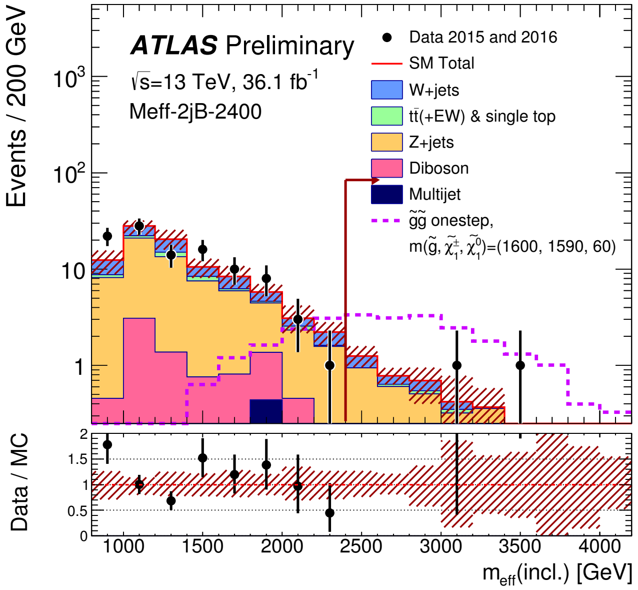
$\tilde{q}\tilde{q},\ \tilde{q} \rightarrow q\tilde{\chi}_1^0$

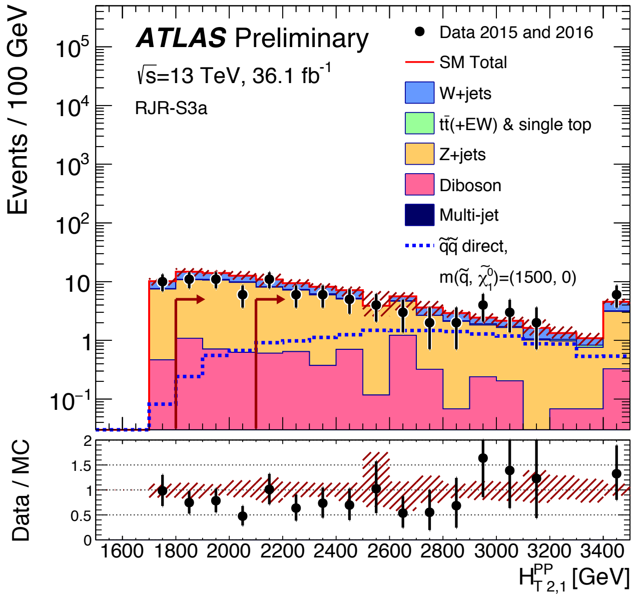


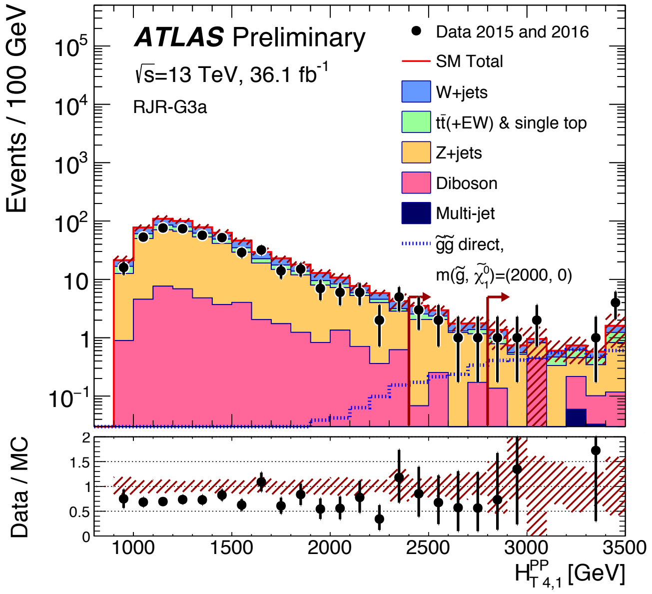
$\tilde{g}\tilde{g},\ \tilde{g} \rightarrow q\bar{q}\tilde{\chi}_1^0$



$\tilde{g}\tilde{g},\ \tilde{g} \rightarrow q\bar{q}W\tilde{\chi}_1^0$ and $\tilde{q}\tilde{q},\ \tilde{q} \rightarrow qW\tilde{\chi}_1^0$



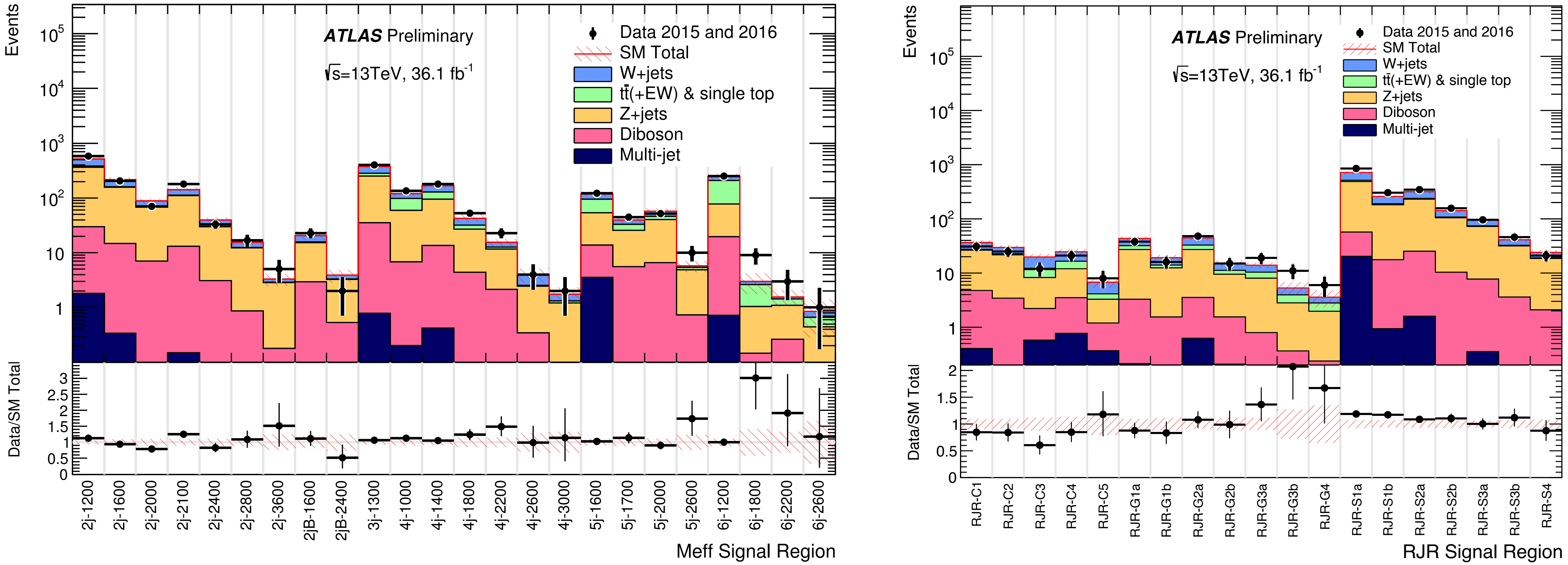




0-lepton + 2-6 jets + E_T^{miss}

ATLAS-CONF-2017-022

全信号領域のイベント数。



優位な超過はない。

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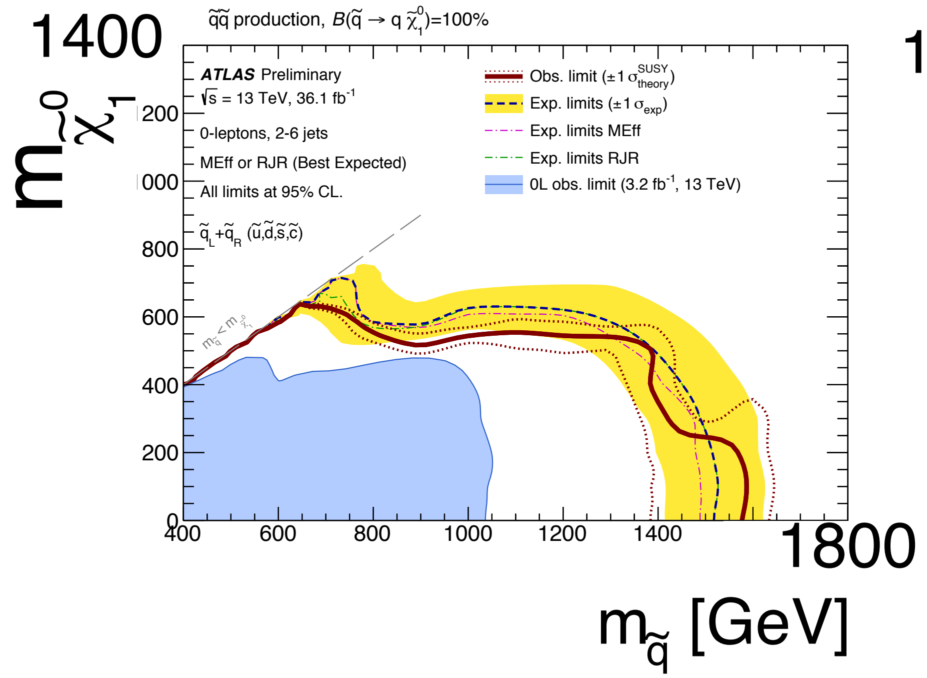
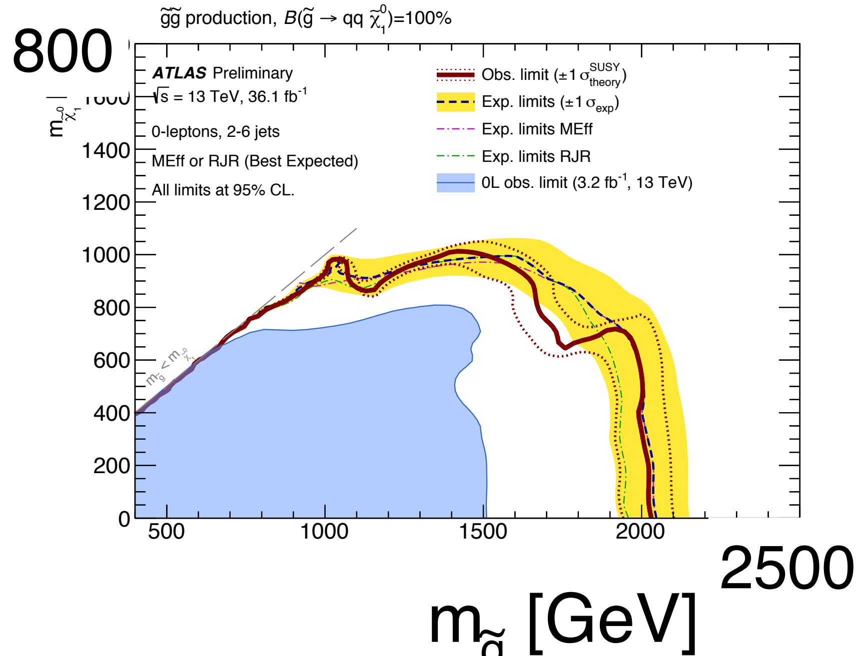
0-lepton + 2-6 jets + E_T^{miss}

ATLAS-CONF-2017-022

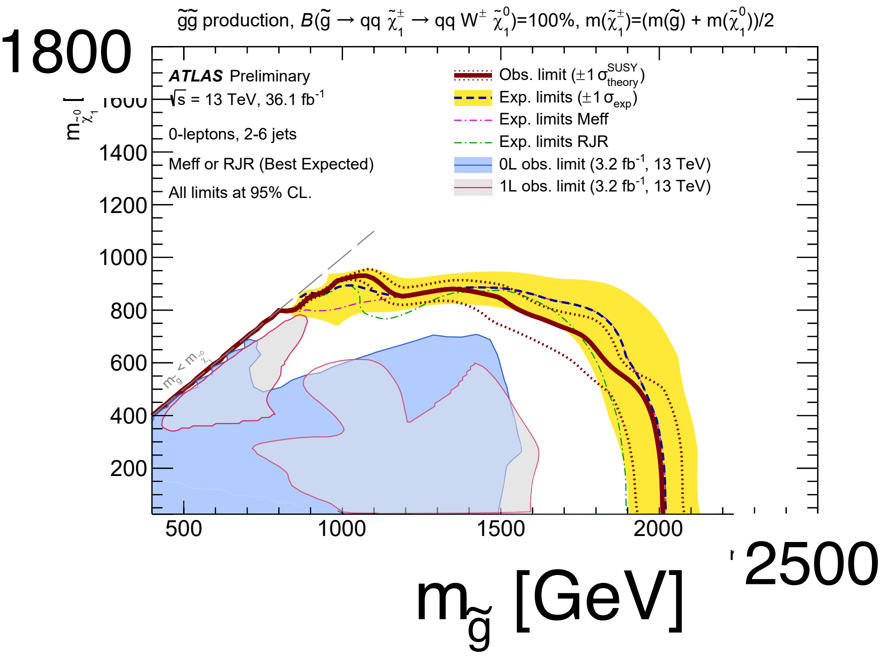
$\tilde{q}\tilde{q}$ production, $B(\tilde{q} \rightarrow q\,\tilde{\chi}_1^0)$=100%

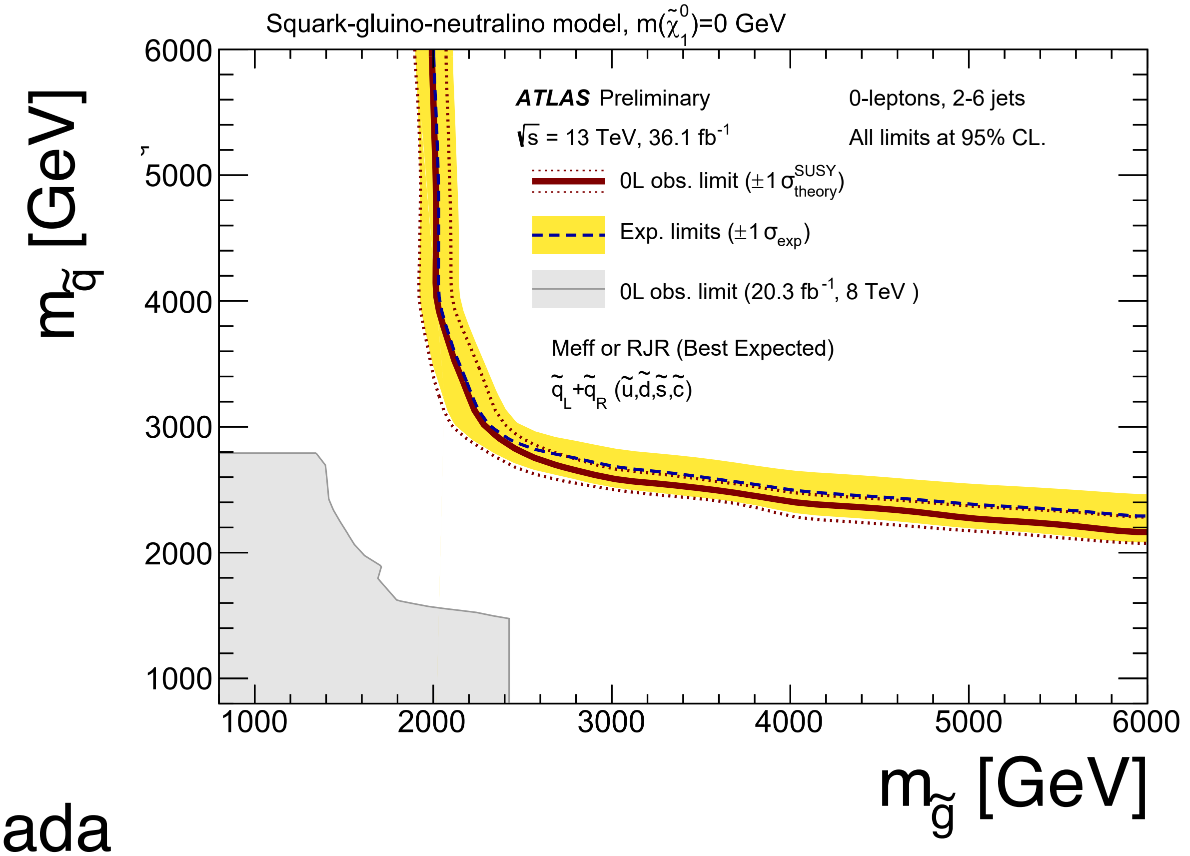


$\tilde{g}\tilde{g}$ production, $B(\tilde{g} \rightarrow qq\,\tilde{\chi}_1^0)$=100%



$\tilde{g}\tilde{g}$ production, $B(\tilde{g} \rightarrow qq\,\tilde{\chi}_1^{\pm} \rightarrow qq\,W^{\pm}\,\tilde{\chi}_1^0)$=100%,





squark 1.6 TeV, gluino 2 TeV
までで棄却

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0/1 lepton + B-jets > 3 + E_T^{miss}

ATLAS-CONF-2017-021

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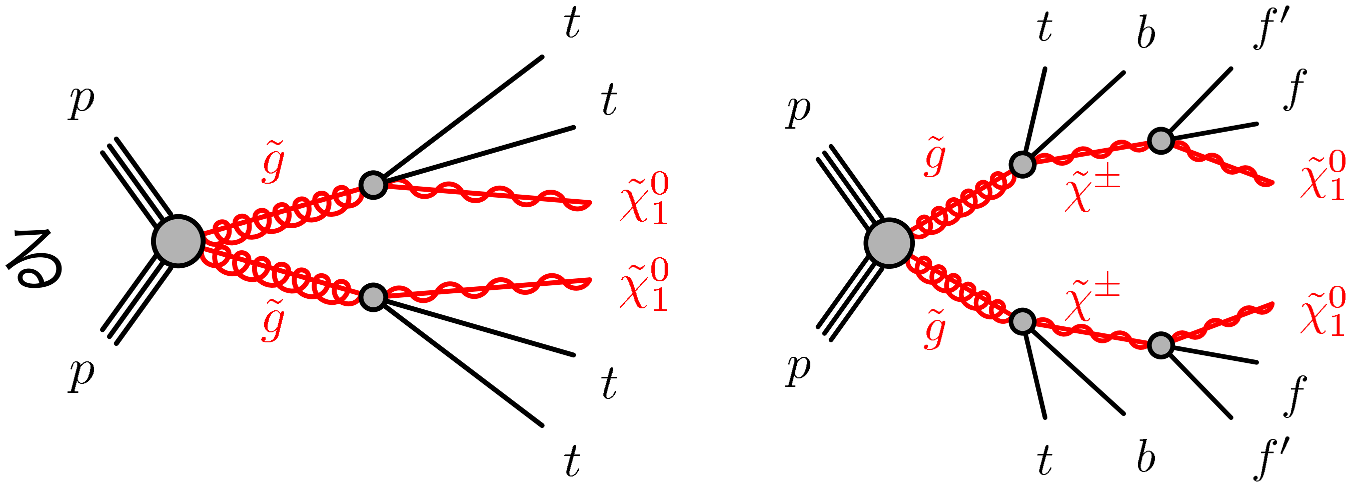
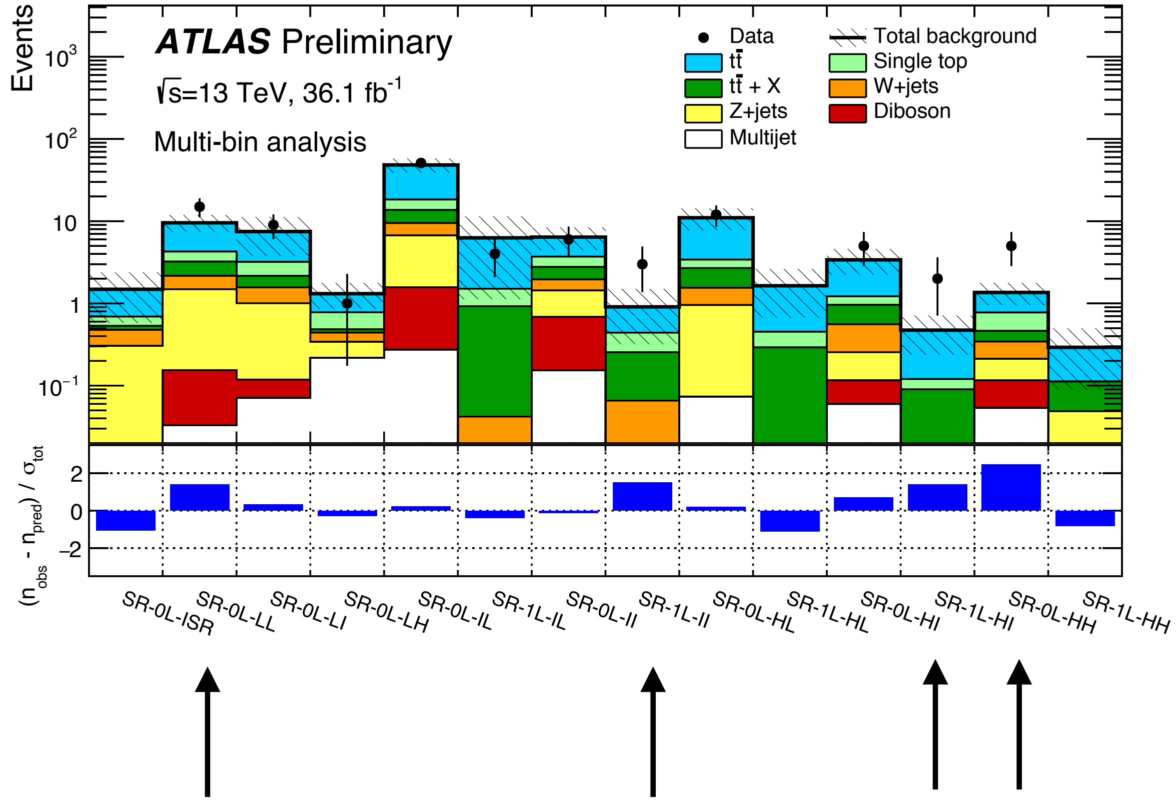
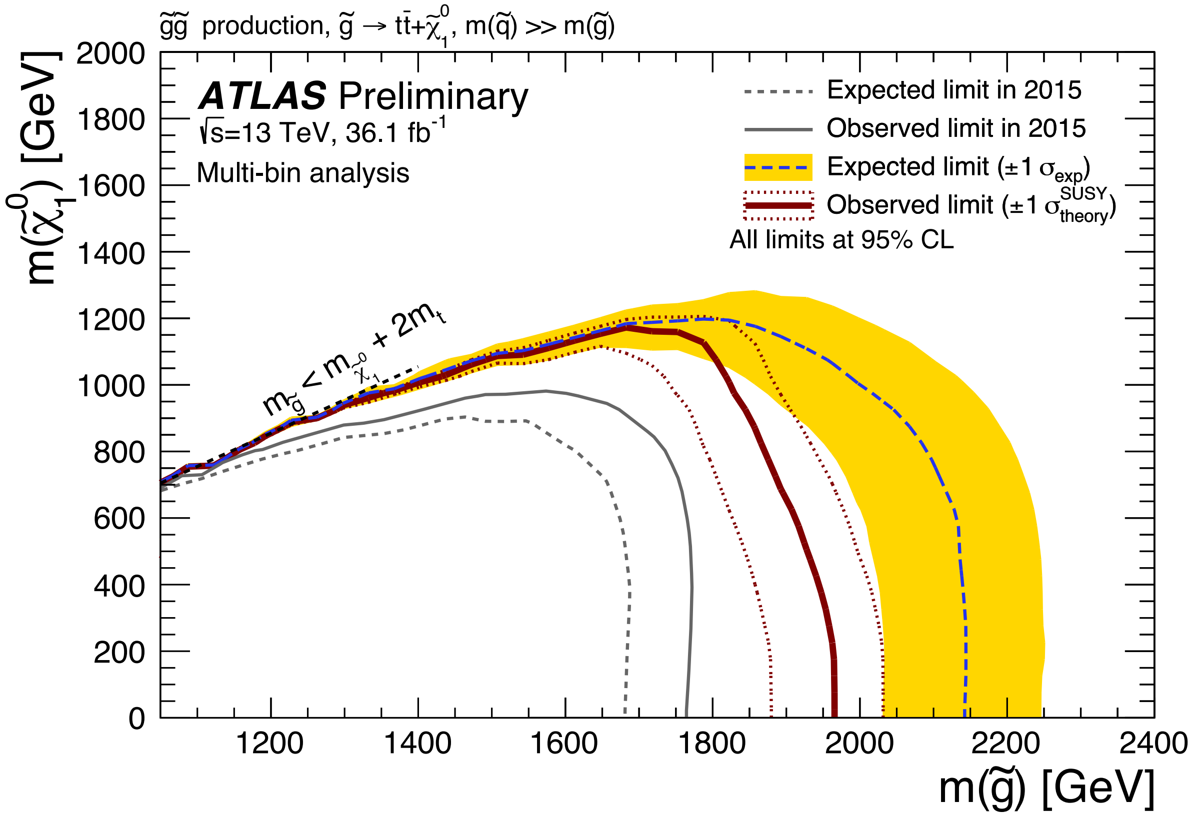
グルイーノ→ top or bottom を探索

排他的な信号領域を設定

→ コンバインして質量の下限を見積もる







イベント超過のため低めのリミット

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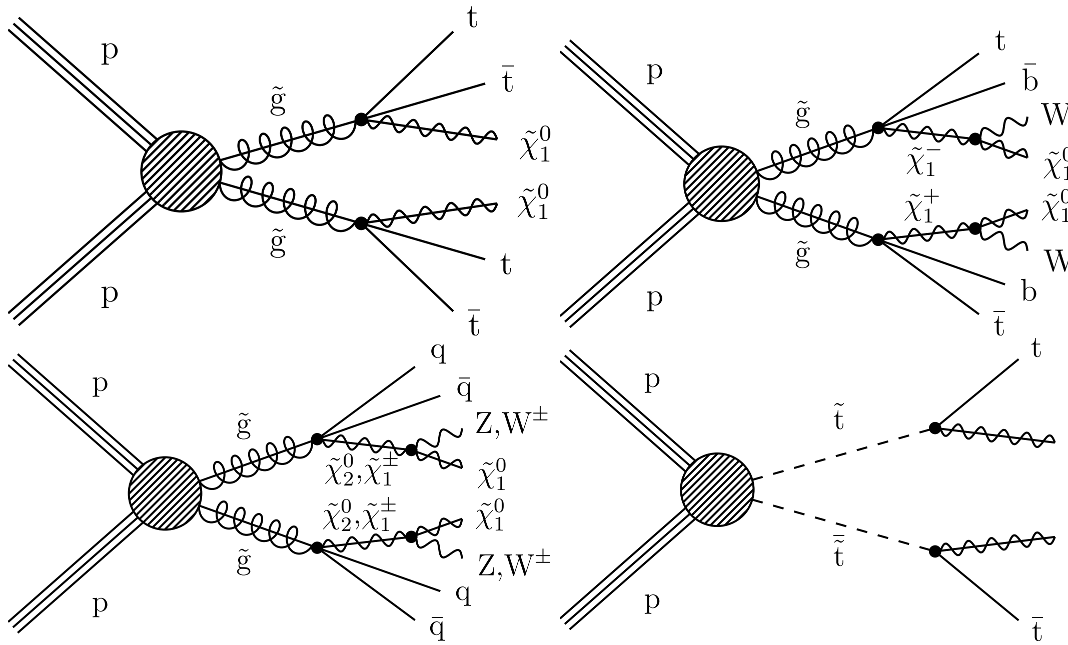
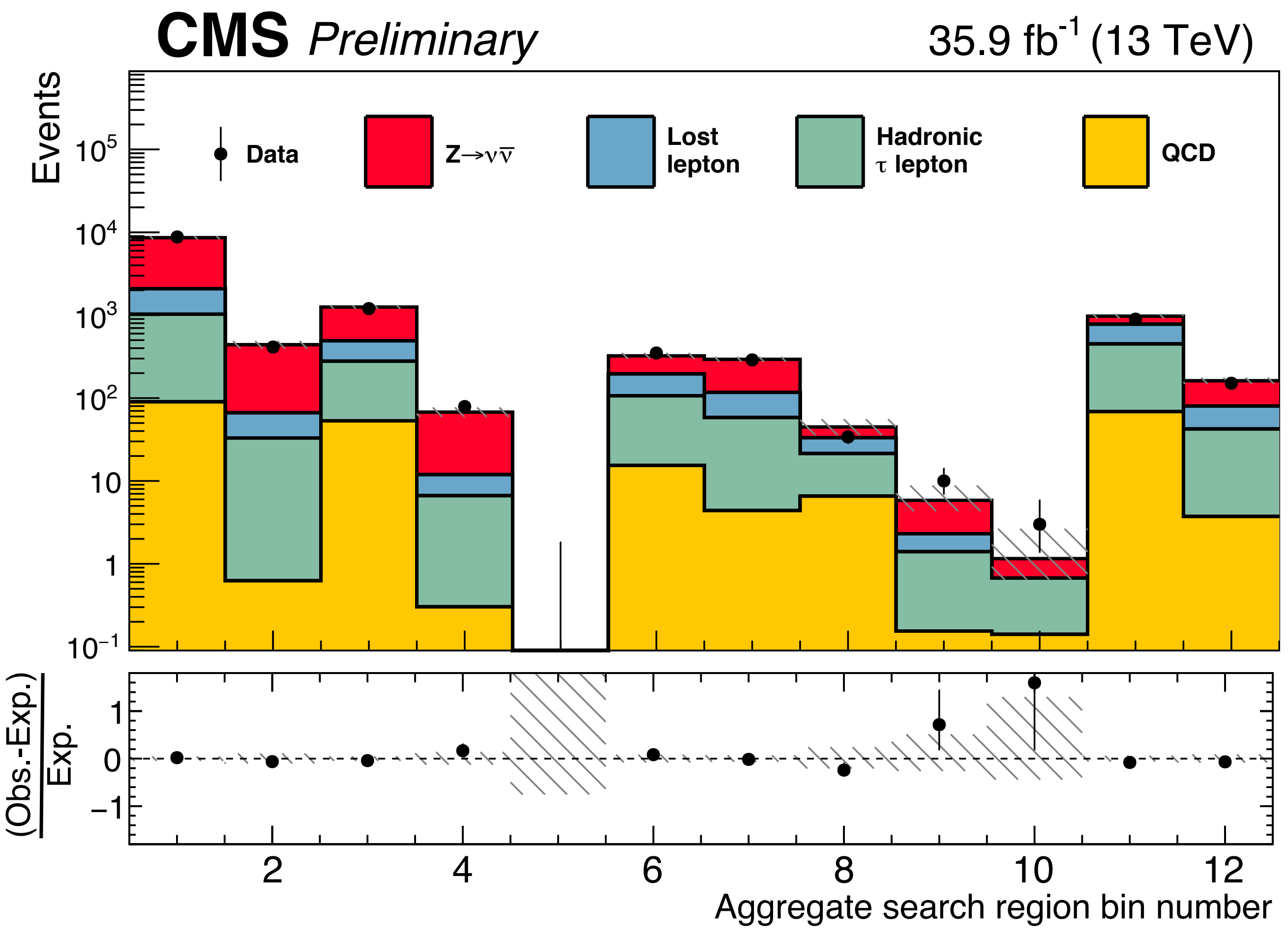
Strong production all hadronic

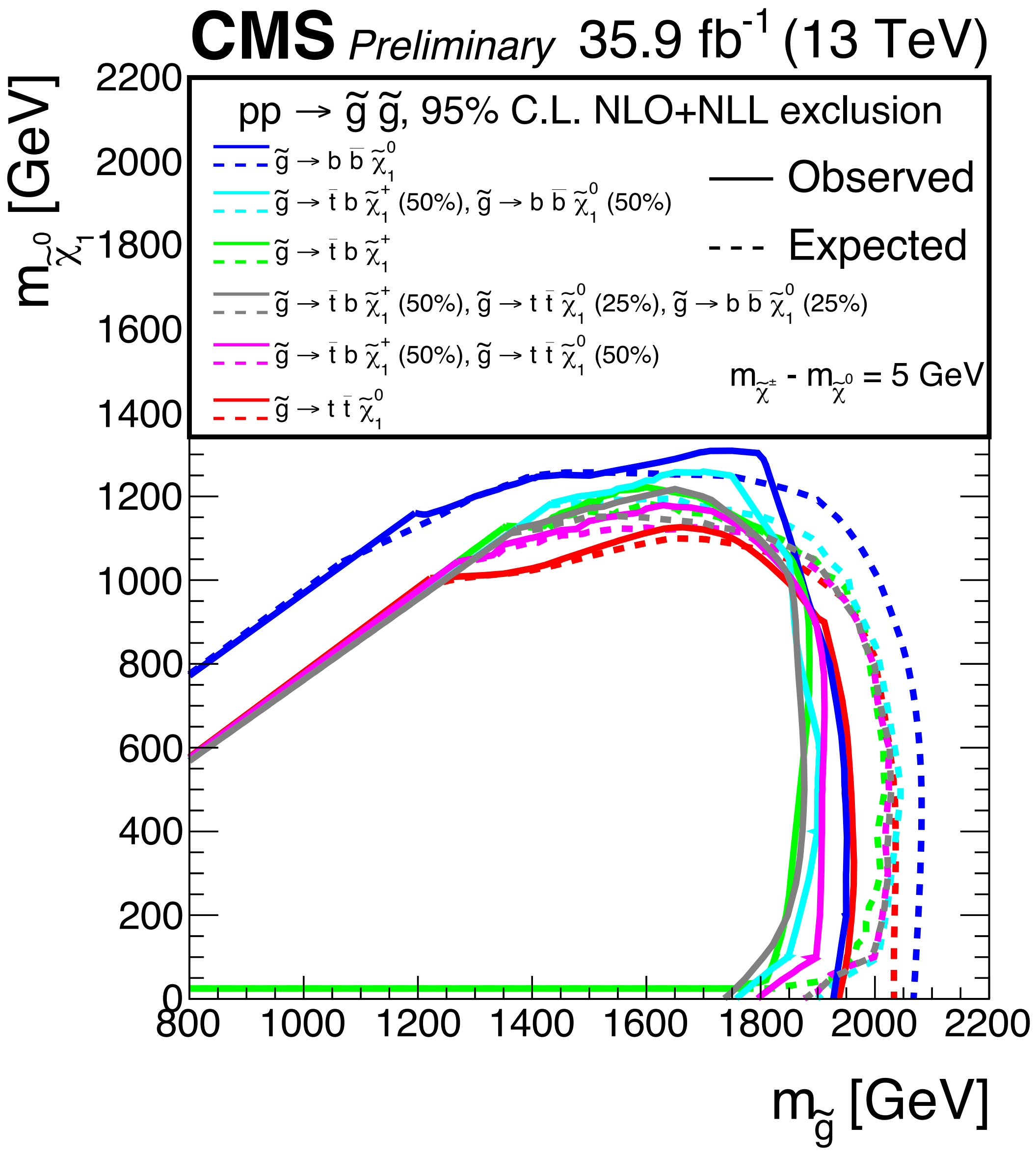
SUS-16-033



174個の排他的なSR

(#jets,#bjets, H_T, H_T^{miss})





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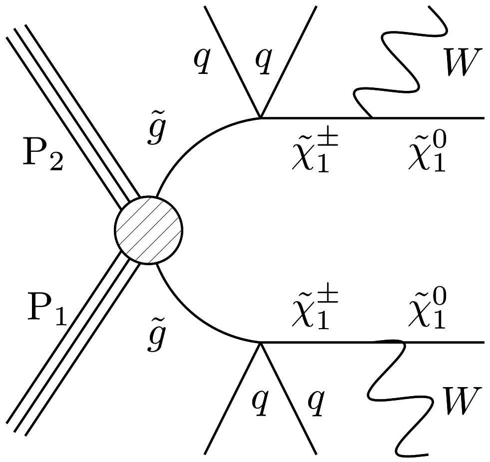
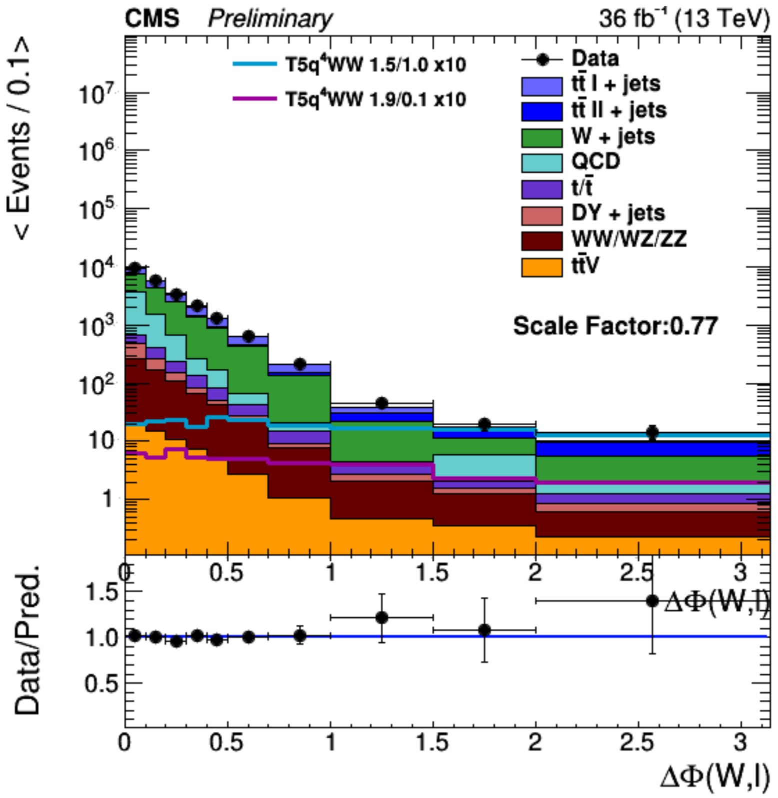
1 lepton and Δϕ

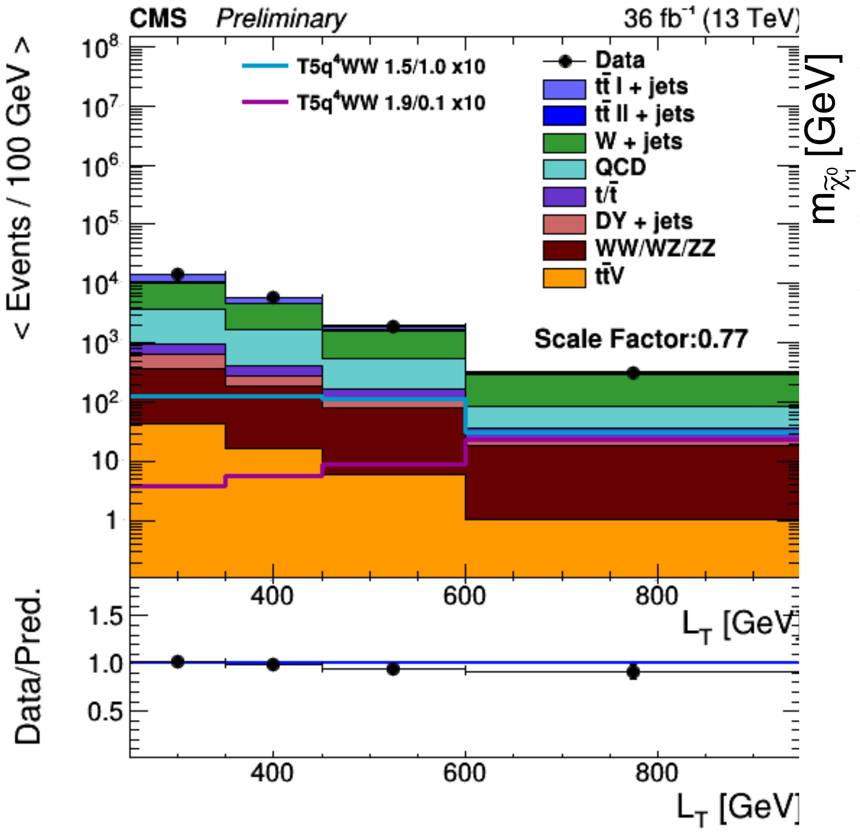
SUS-16-042

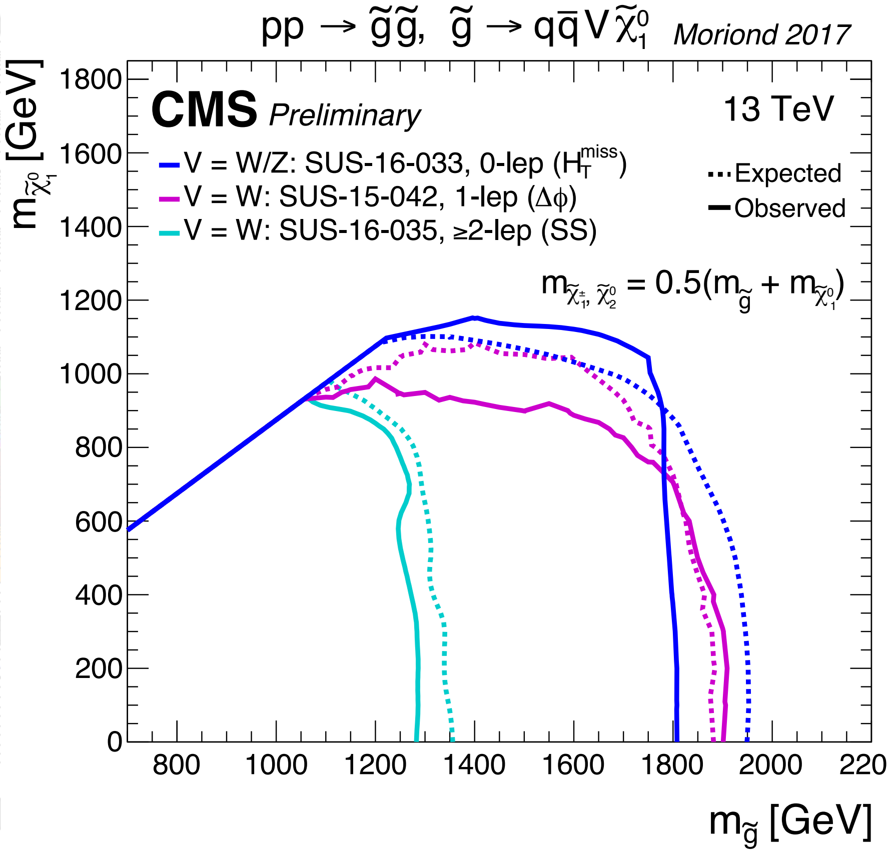
SUS-16-042



- SUSY粒子の崩壊からの高pTのWを使う
  - SUSYの場合はLSPとニュートリノがE_T^{miss}となるので、Δϕ(W, l)はフラットになる
- W崩壊からのレプトンとE_T^{miss}でSRを設定







$$L_T = p_T^\ell + E_T^{Miss}$$

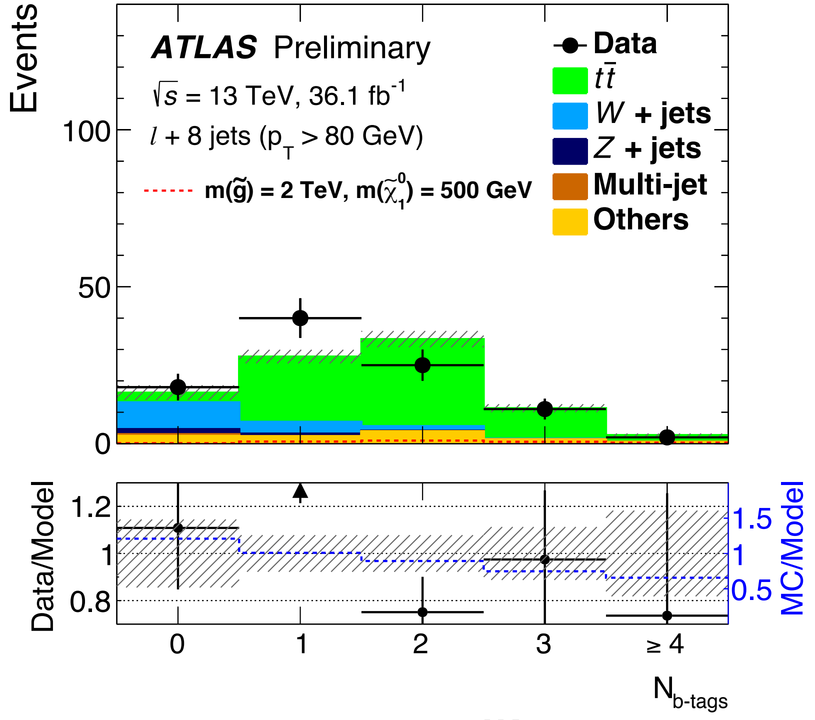
RPV 1L 8-12 jets

多数のジェット(8-12本)とレプトンを要求。

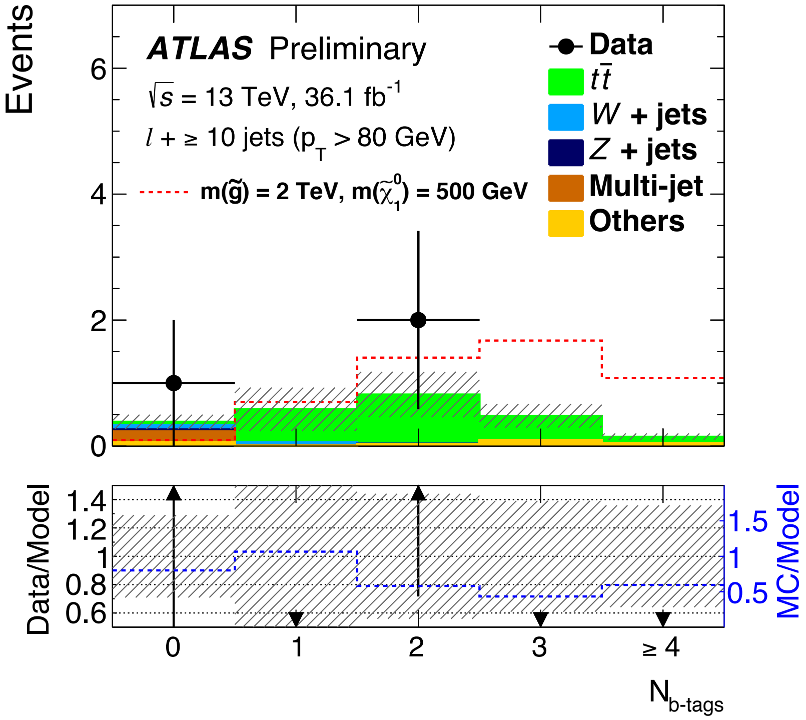
ATLAS-CONF-2017-013

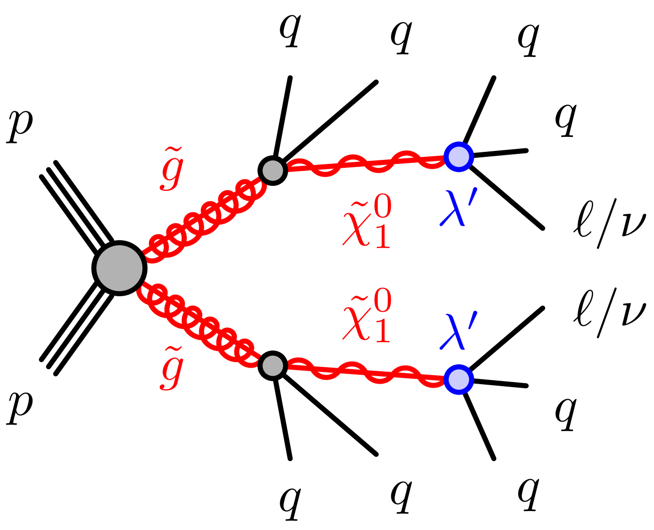
E_T^{miss}の要求はなし

#jets = 8

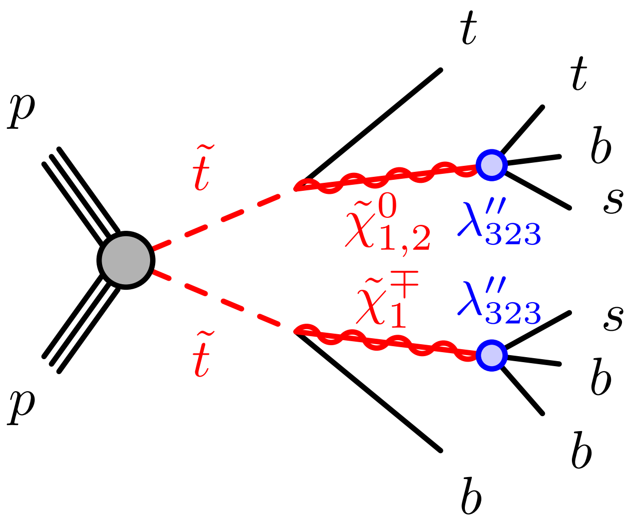


#jets ≥ 10

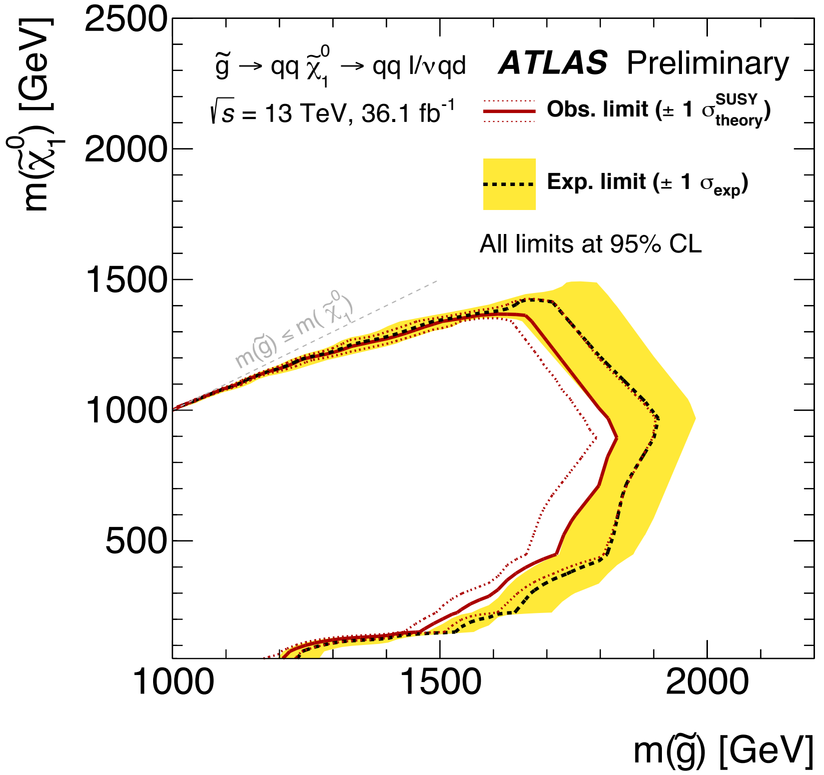


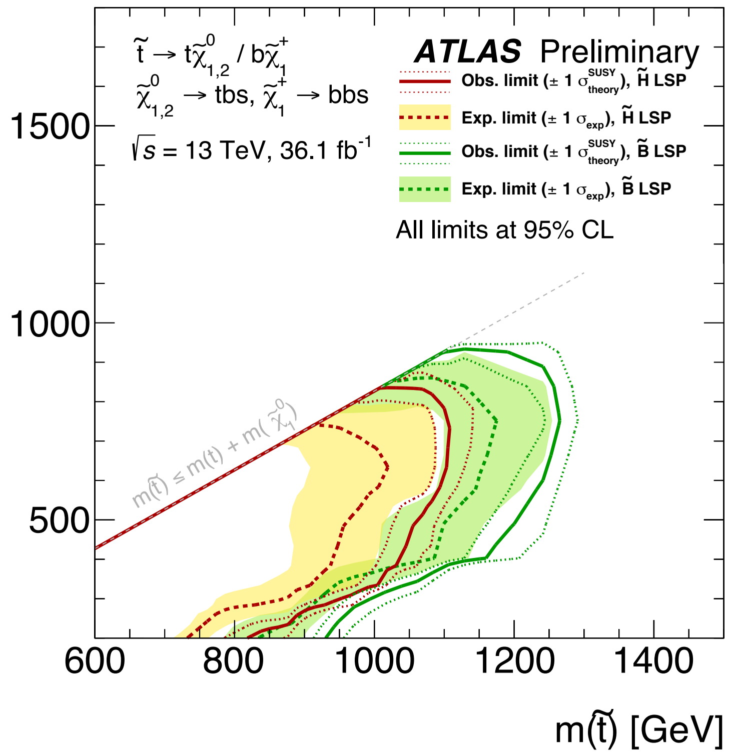


8 jets



8-10 jets, 6 b-jets

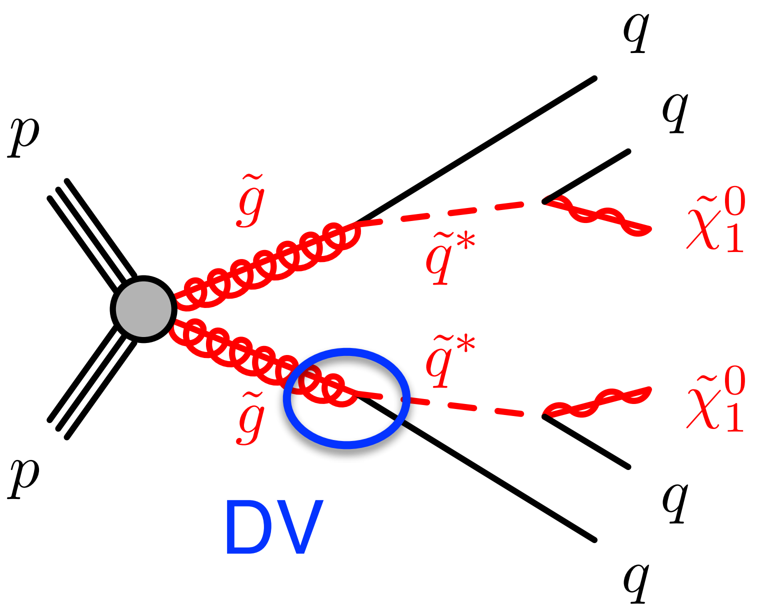


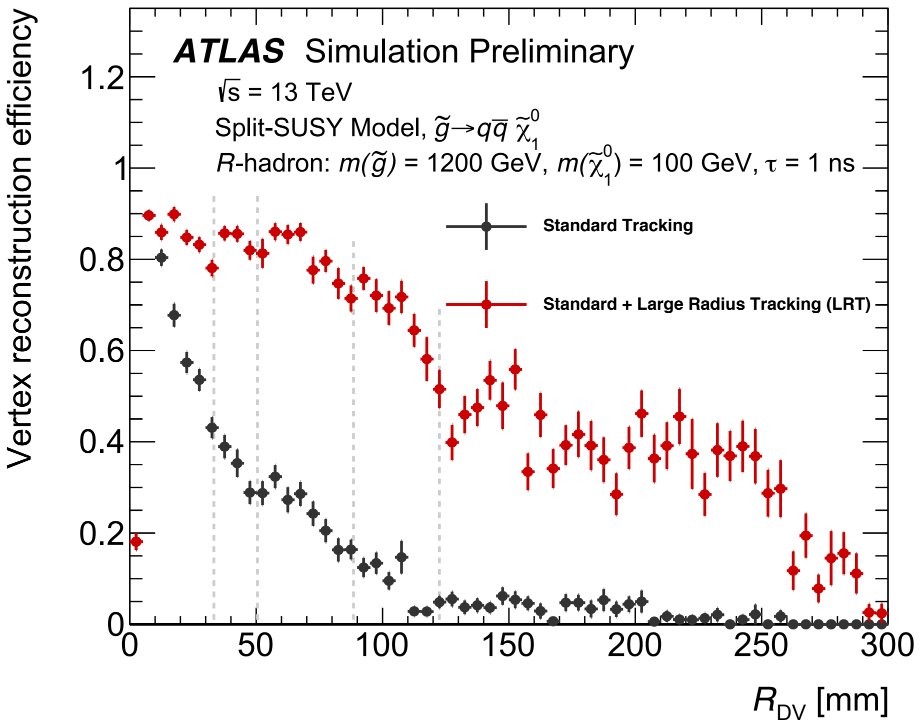


Displaced vertex

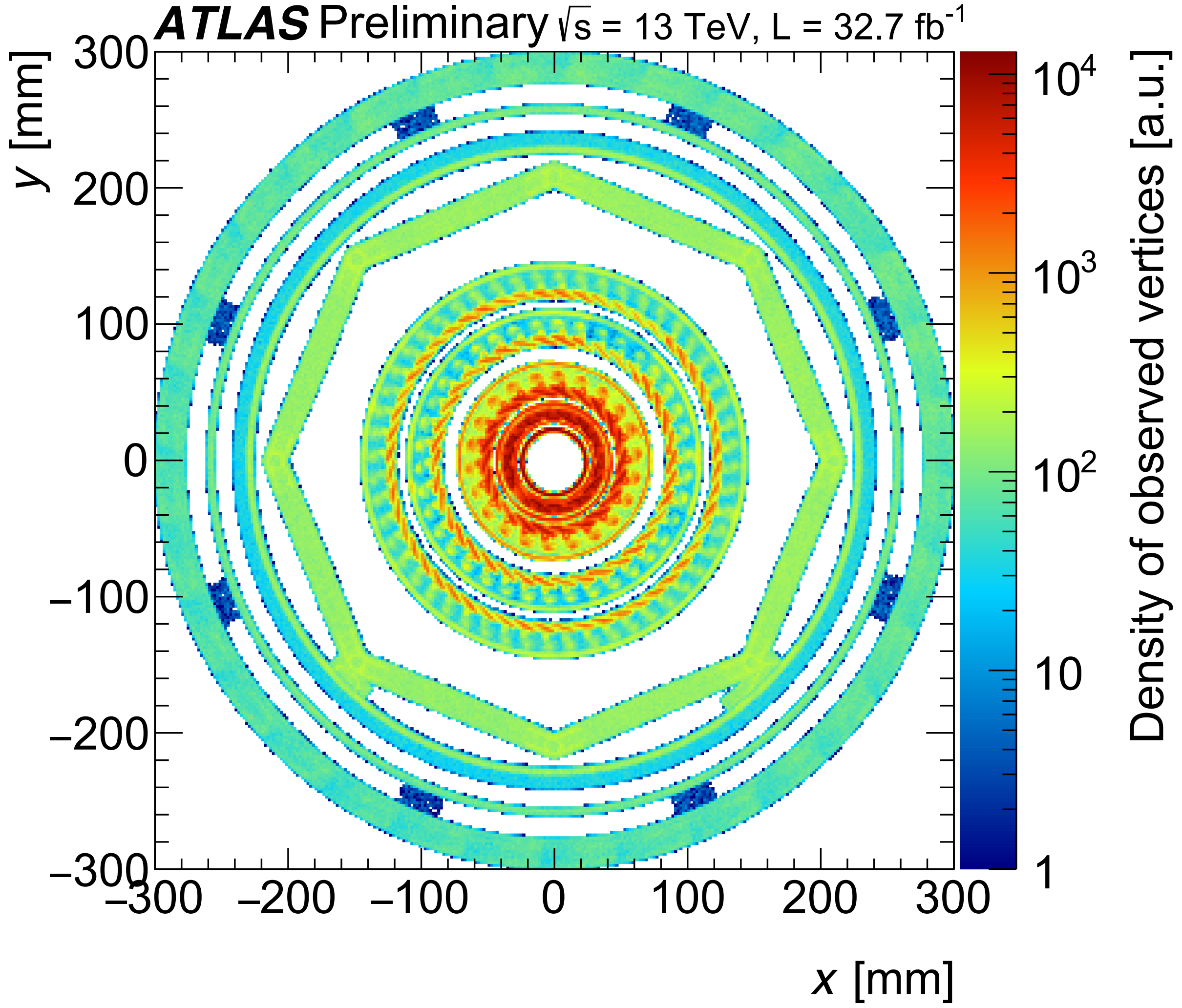
ATLAS-CONF-2017-026

- 超寿命新粒子の崩壊を探索
- 内部飛跡検出器内のバーテックスからの複数のジェット
- 専用のトラッキング (Large Radius Tracking)で効率を向上





物質量の多い位置をvetoし、BGを低減



Displaced vertex

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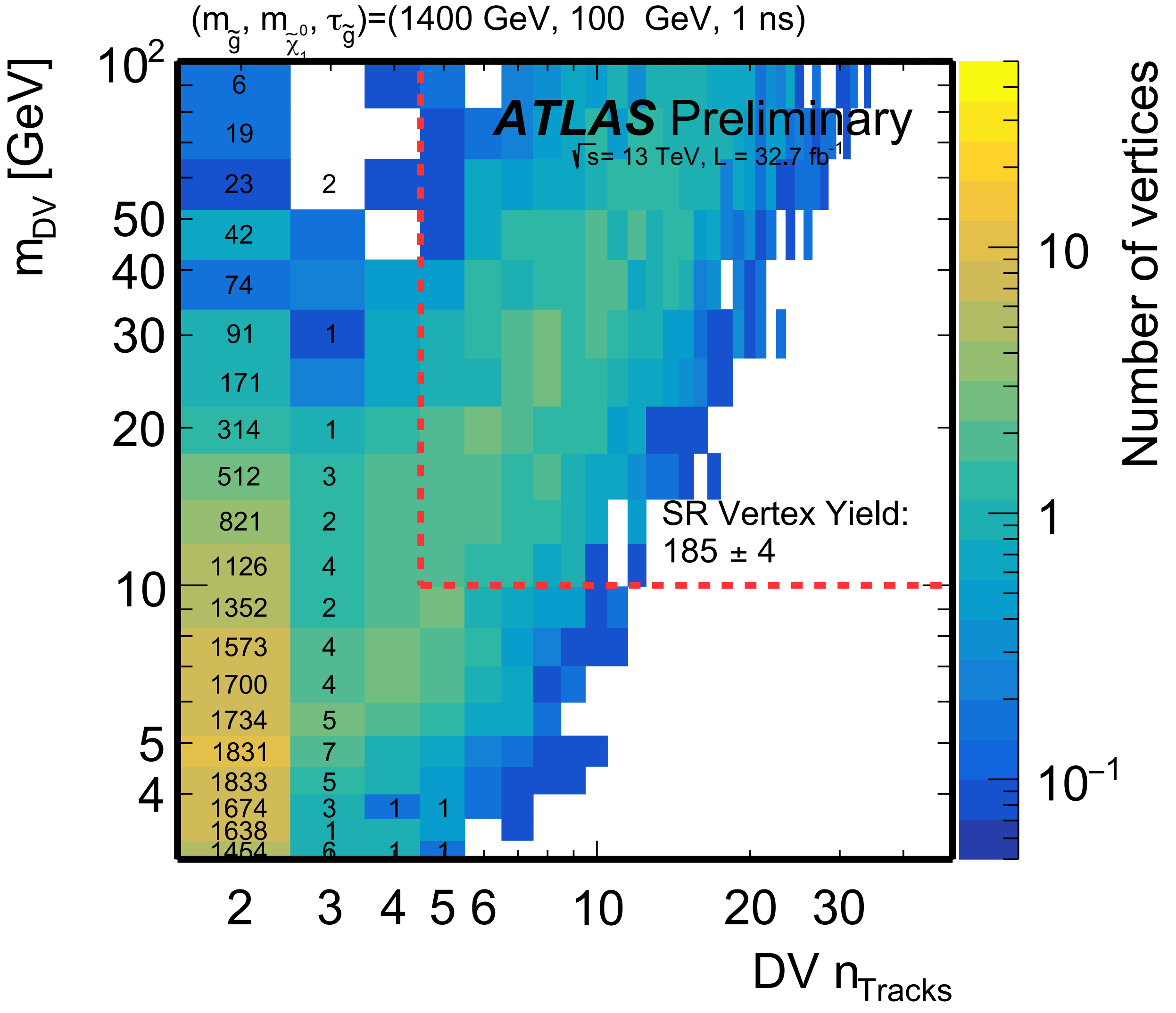
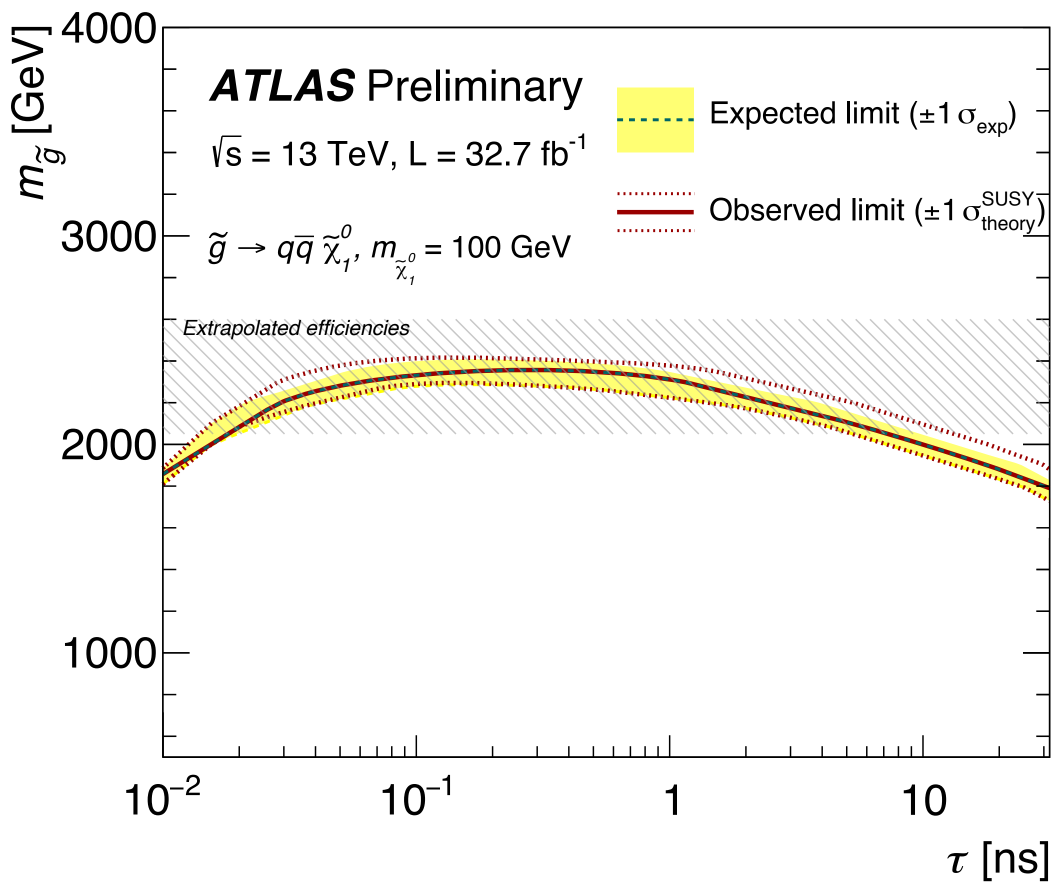
ATLAS-CONF-2017-026

- バックグランド
  - ハドロン相互作用
  - 複数のバーテックスがマージされた場合
  - 物理BGはない
- バックグランド予想 0.2 ± 0.2
- **観測 : 0 event**

色: signalの予想

数字 : 観測数





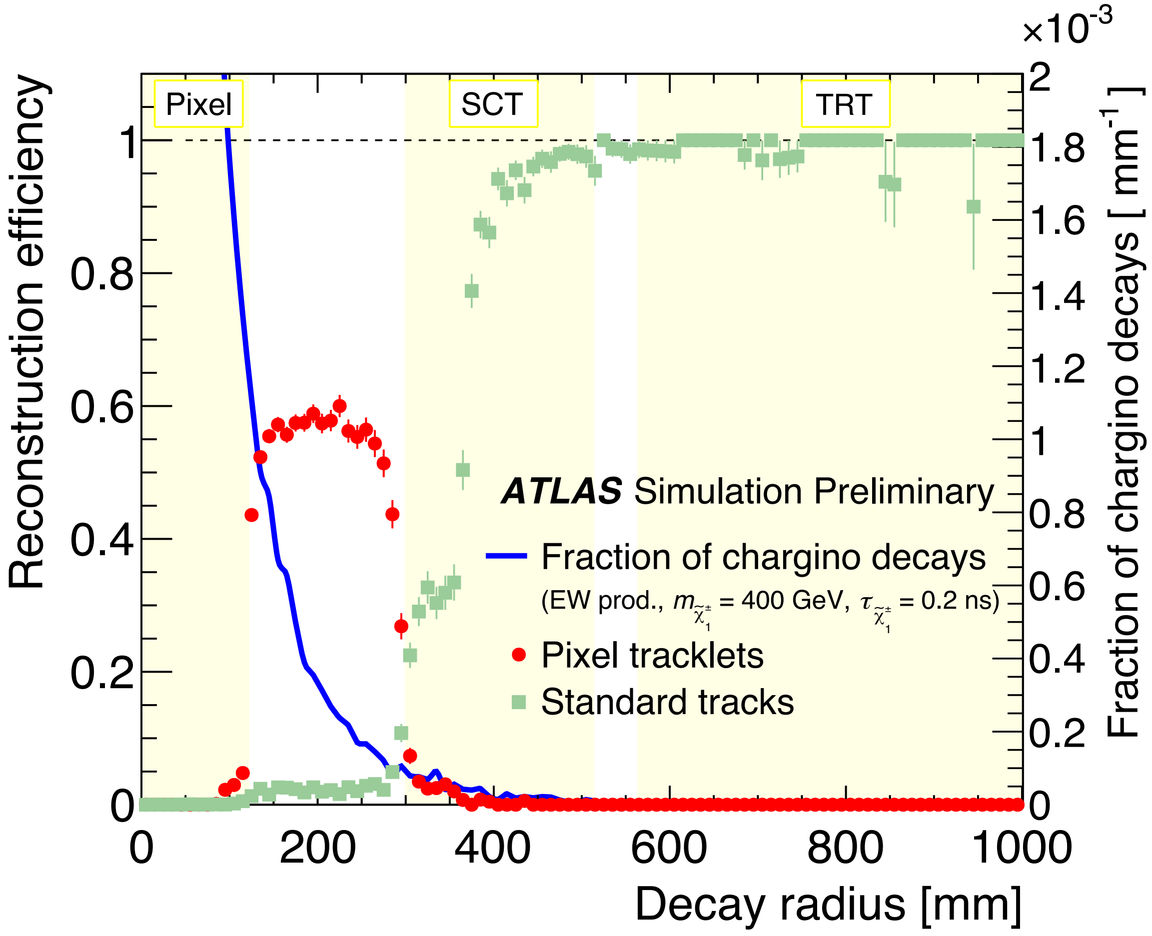
R.Sawada

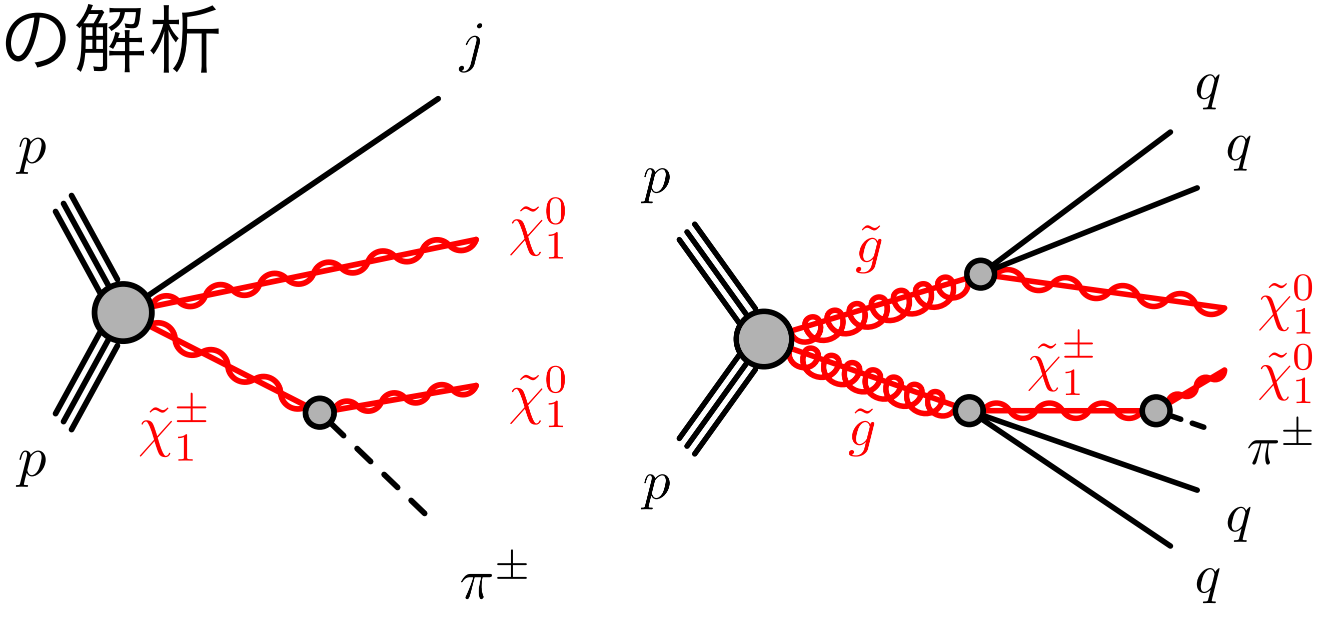
Disappearing track

ATLAS

ATLAS-CONF-2017-017

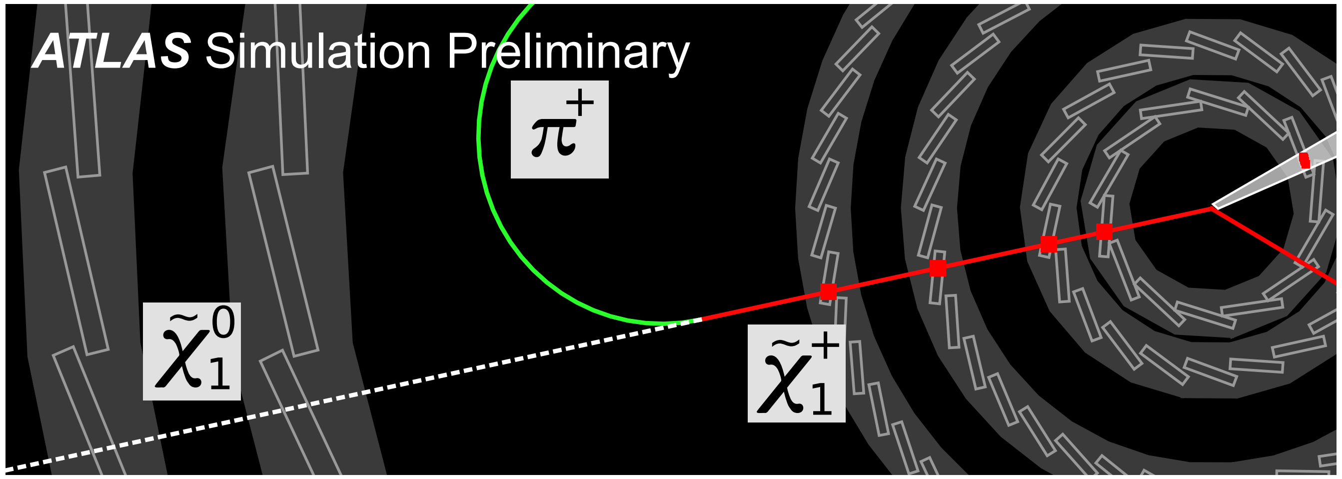
- O(10cm)で崩壊するSUSY粒子の飛跡を検出
- 通常よりも短い飛跡に適した再構成を行う
  - Run2から入った最内層のピクセル検出器で感度向上
- Electroweakとstrongプロダクションの解析





(a) $pp \to \tilde{\chi}_1^\pm \tilde{\chi}_1^0 j$

(b) $pp \to \tilde{\chi}_1^\pm \tilde{\chi}_1^0 jjjj$

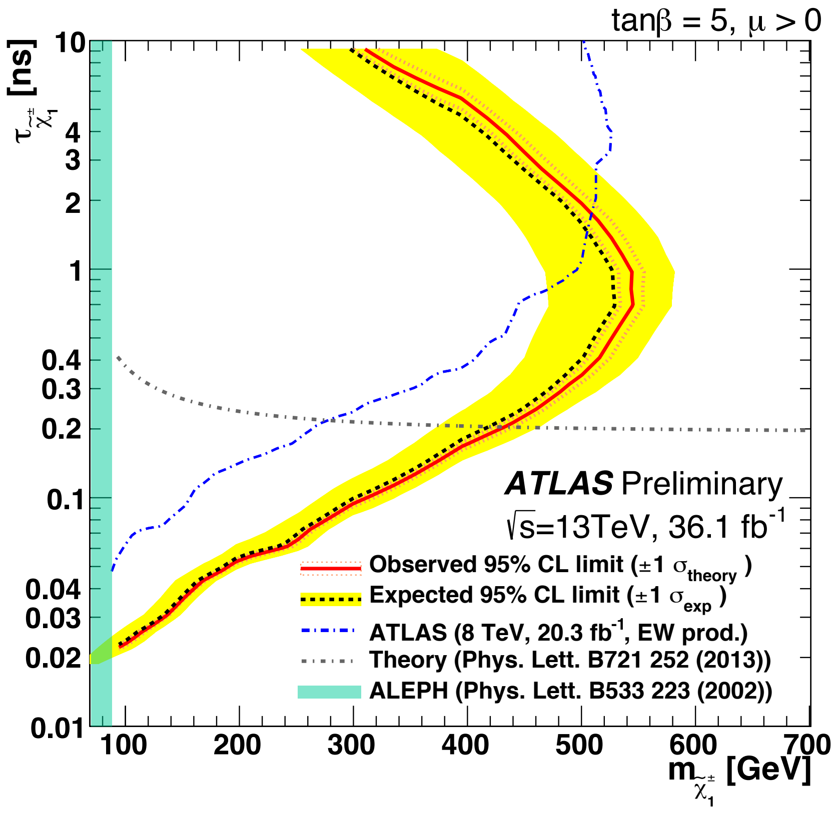


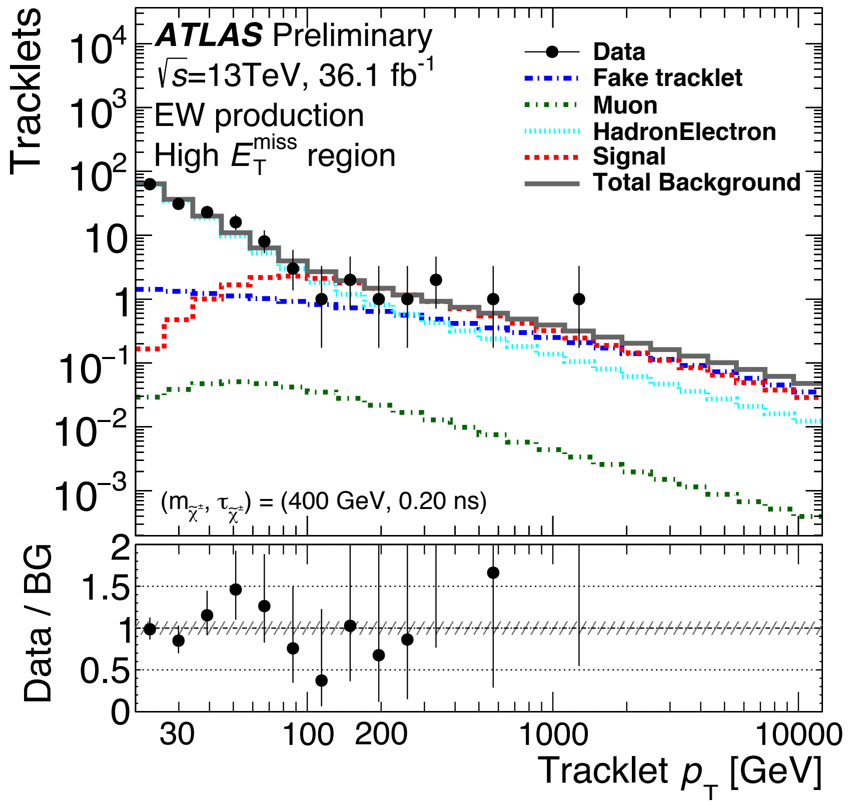
R.Sawada

Disappearing track

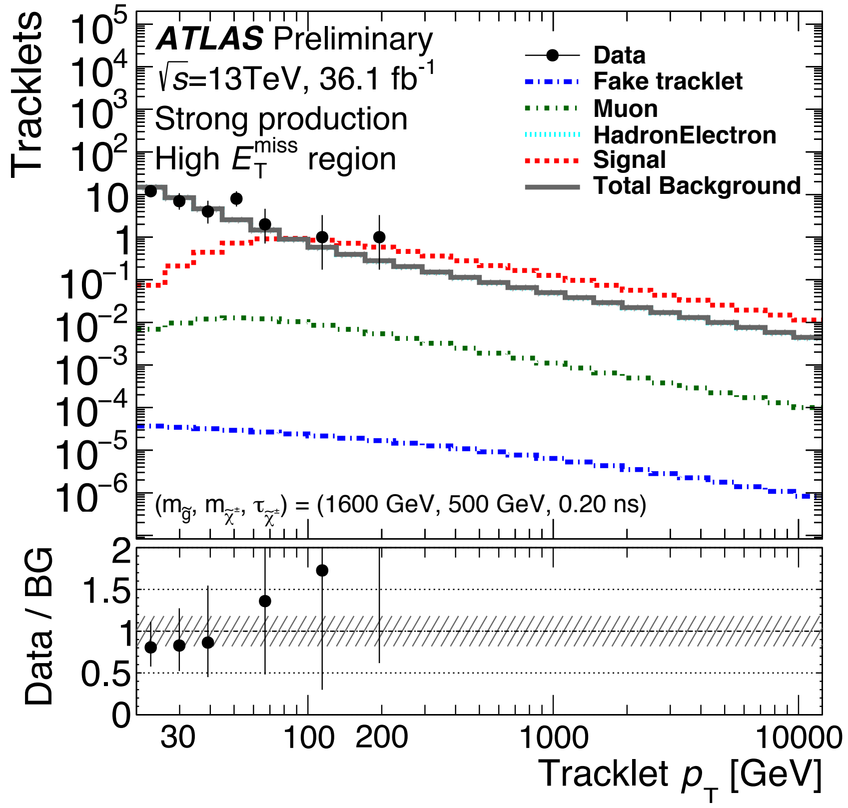
ATLAS-CONF-2017-017

- イベントの超過は無し
- Wino LSPに対応する~0.2nsecの寿命に対しての制限を向上
- 新たにグルイーノ質量に対しても制限をつけた

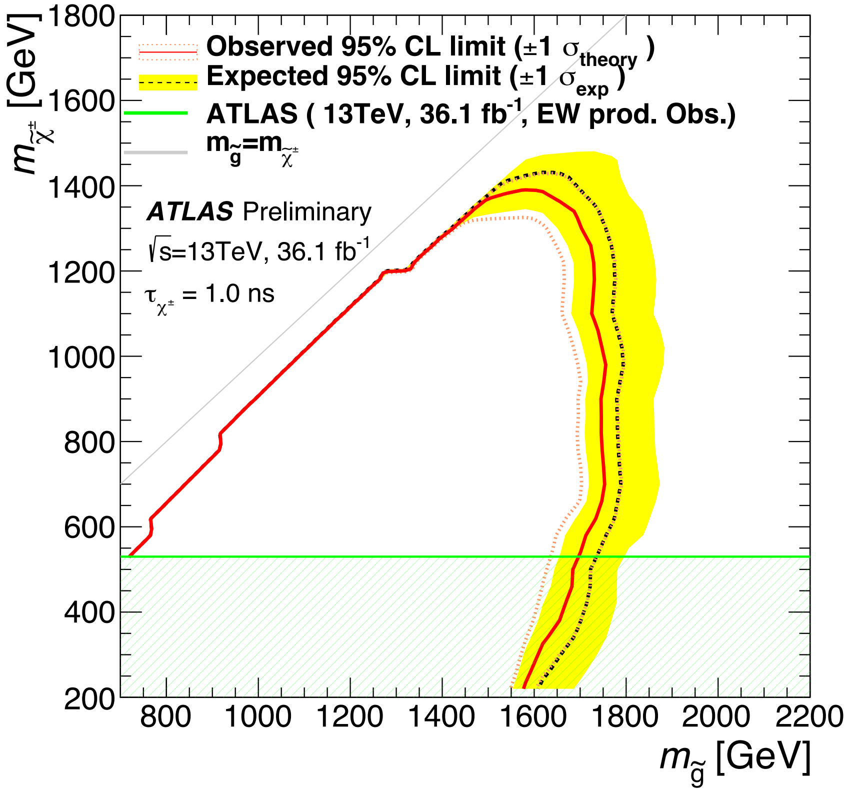




(c) Electroweak channel high-E_T^{miss} region

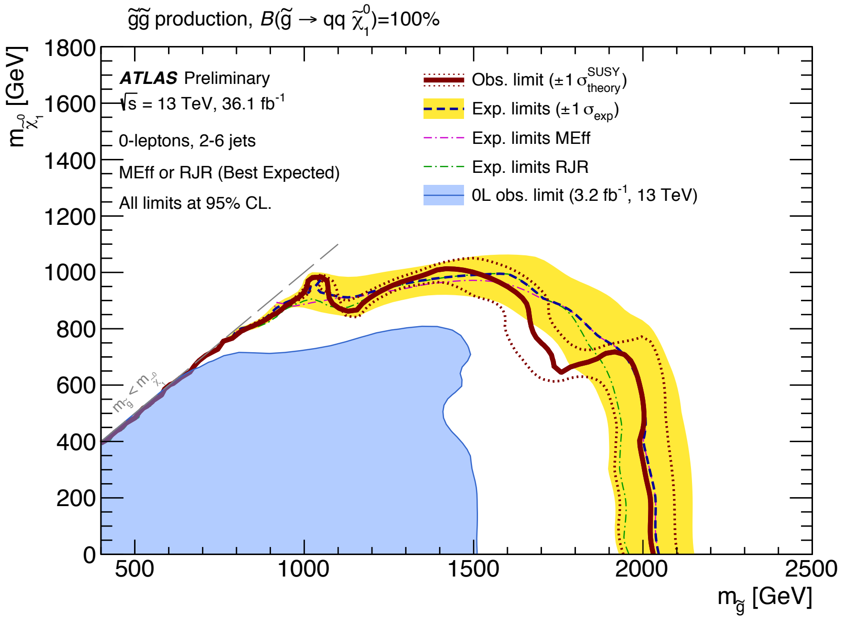


(d) Strong channel high-E_T^{miss} region

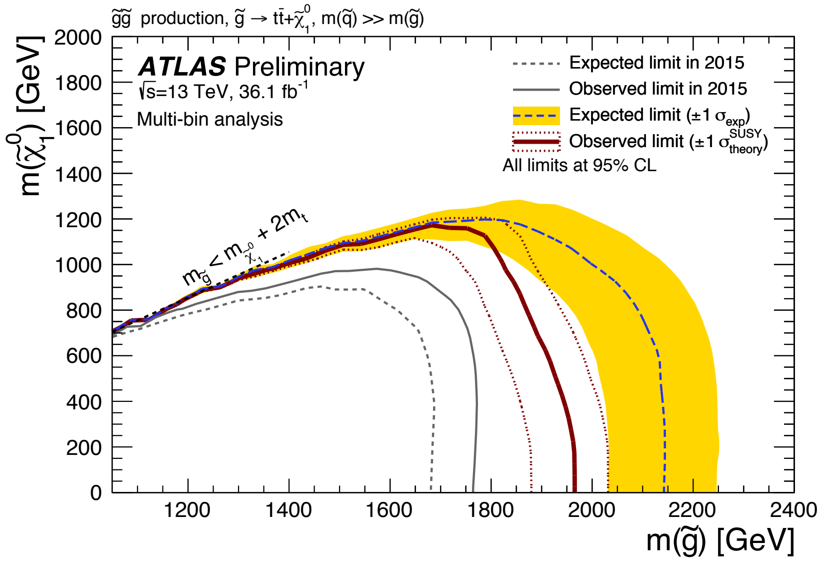


gluino pair production まとめ

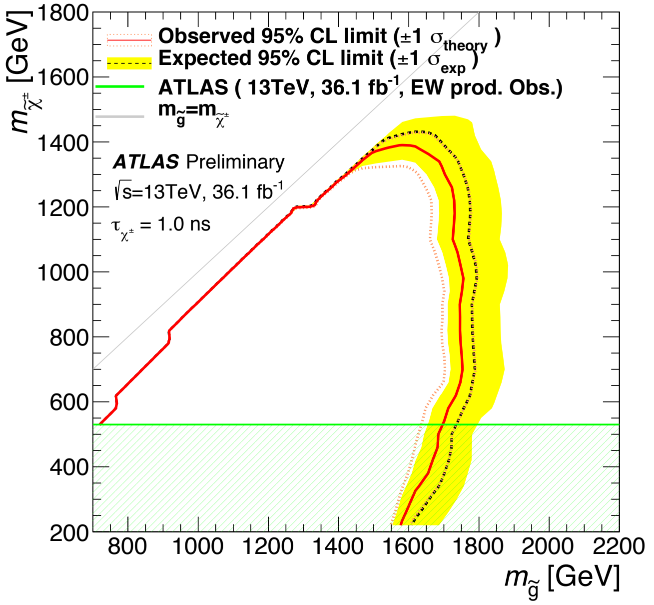
Inclusive 0 lepton



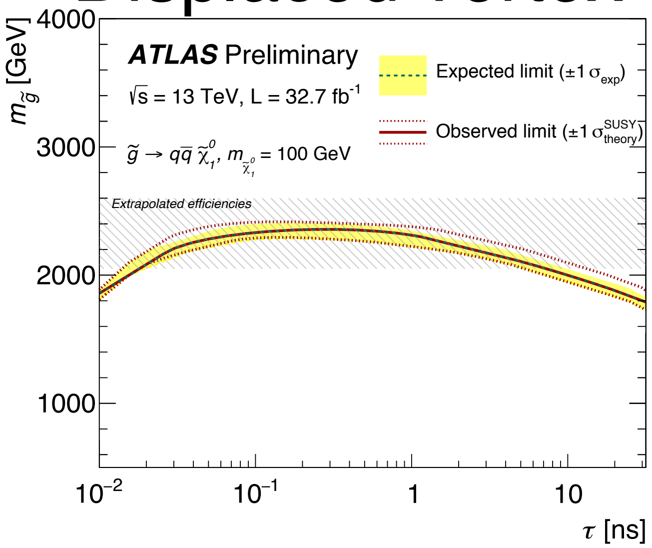
0/1 lepton + b jets



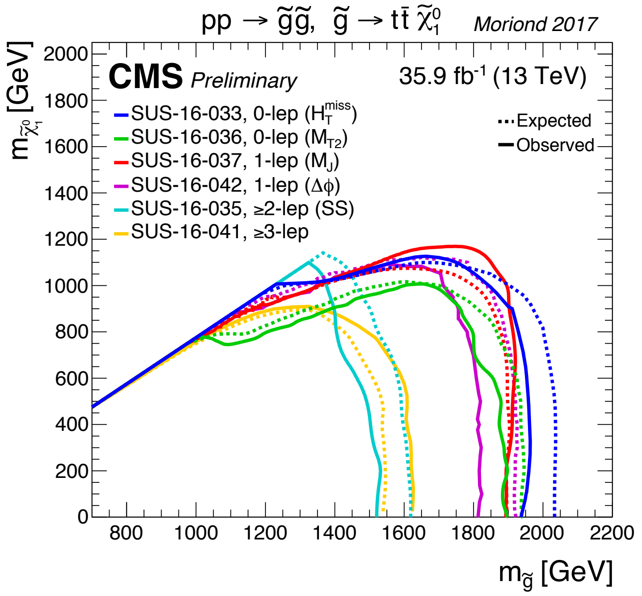
Disappearing track



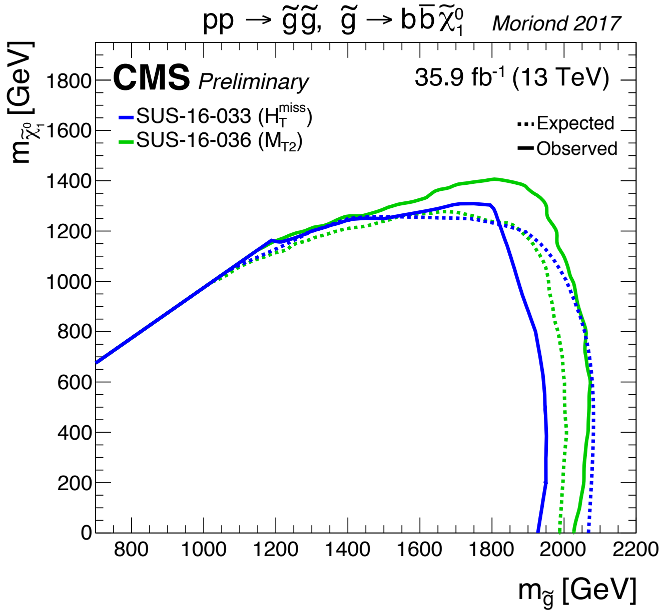
Displaced vertex



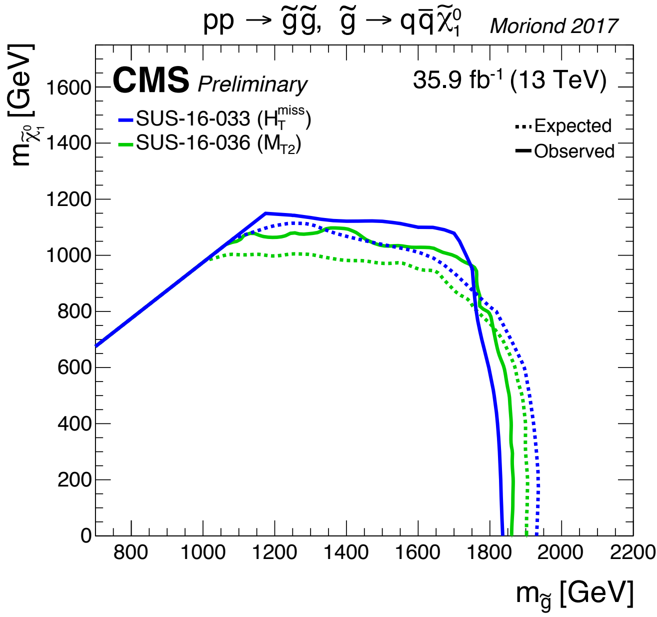
Gluino → 4 t



Gluino → 4 b



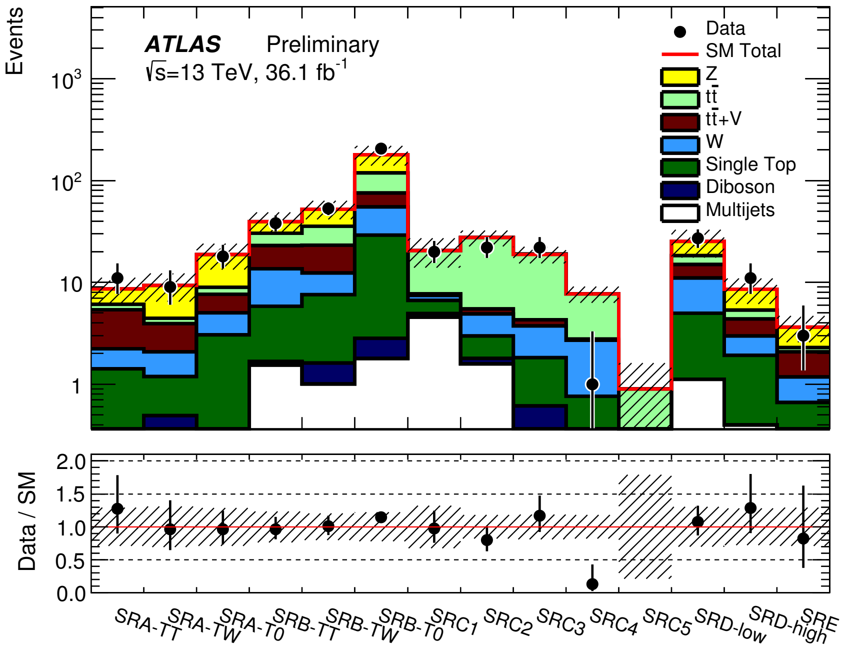
Gluino → light q

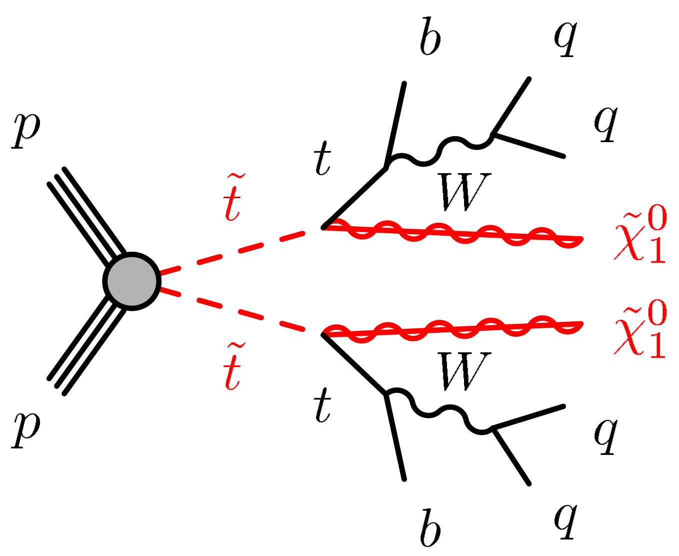


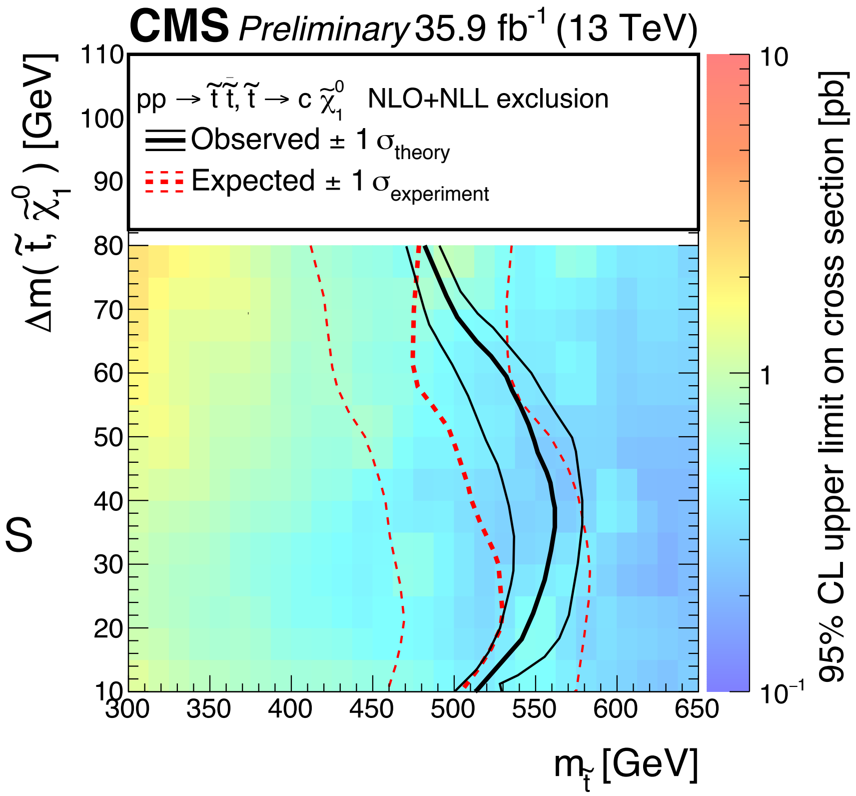
ATLAS stop all hadronic CMS

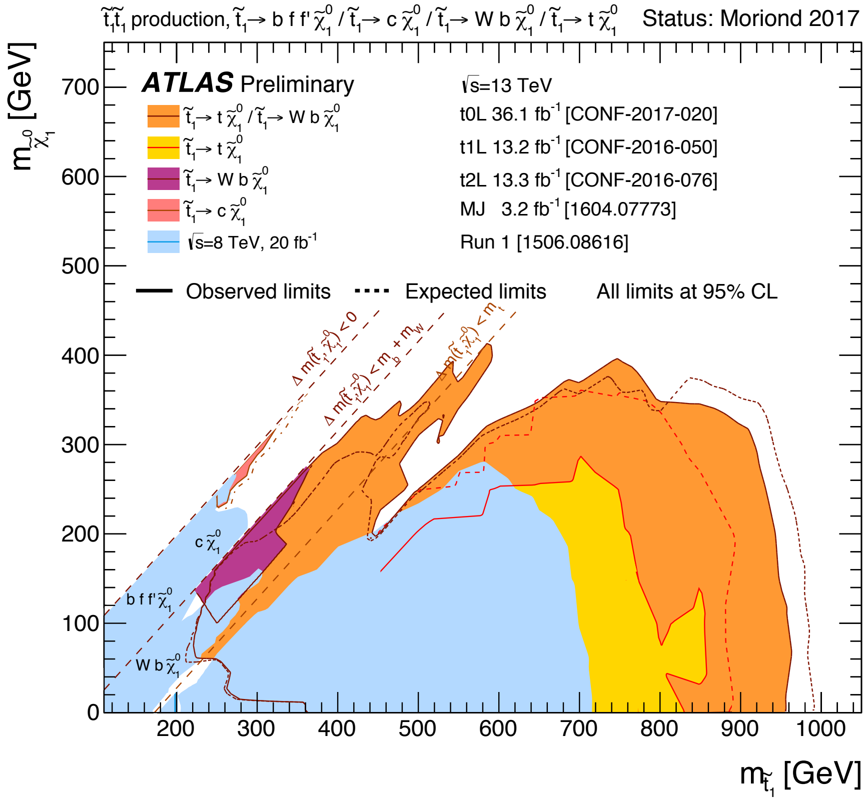
ATLAS-CONF-2017-020

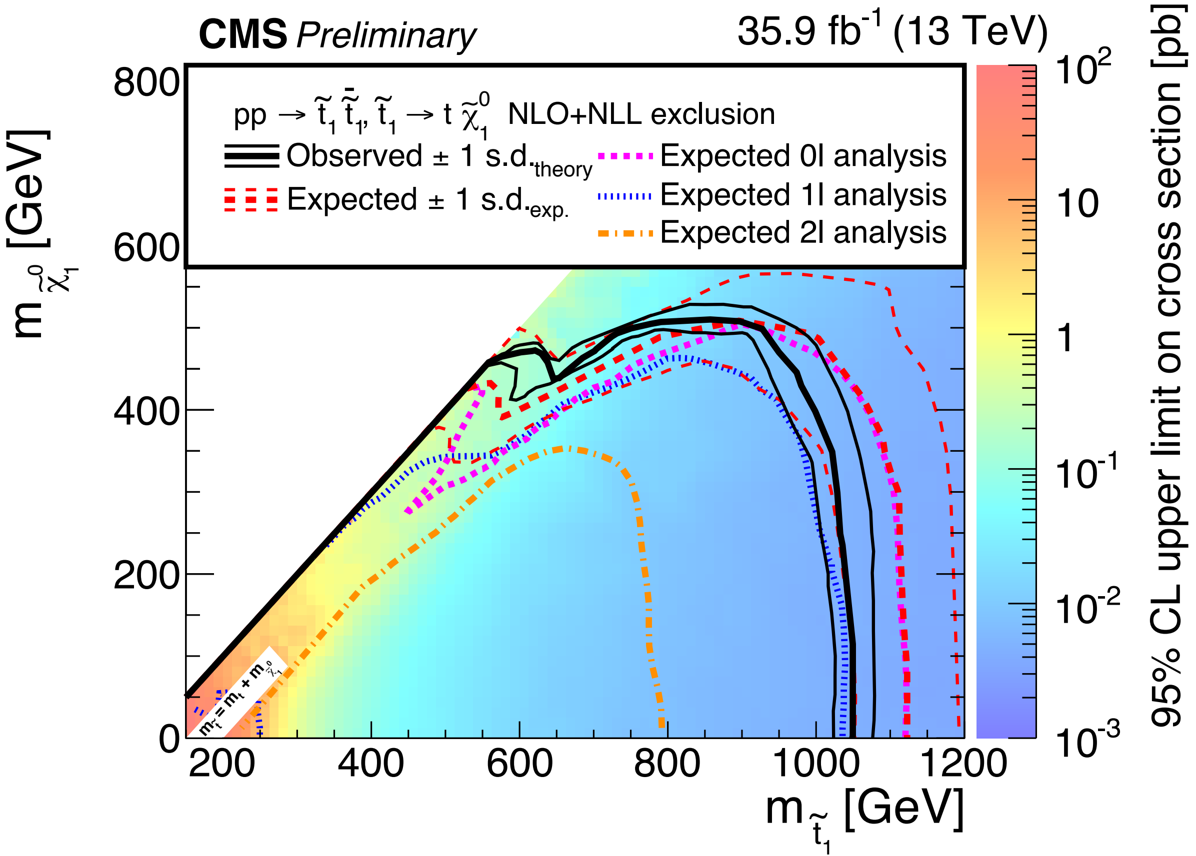
SUS-16-049









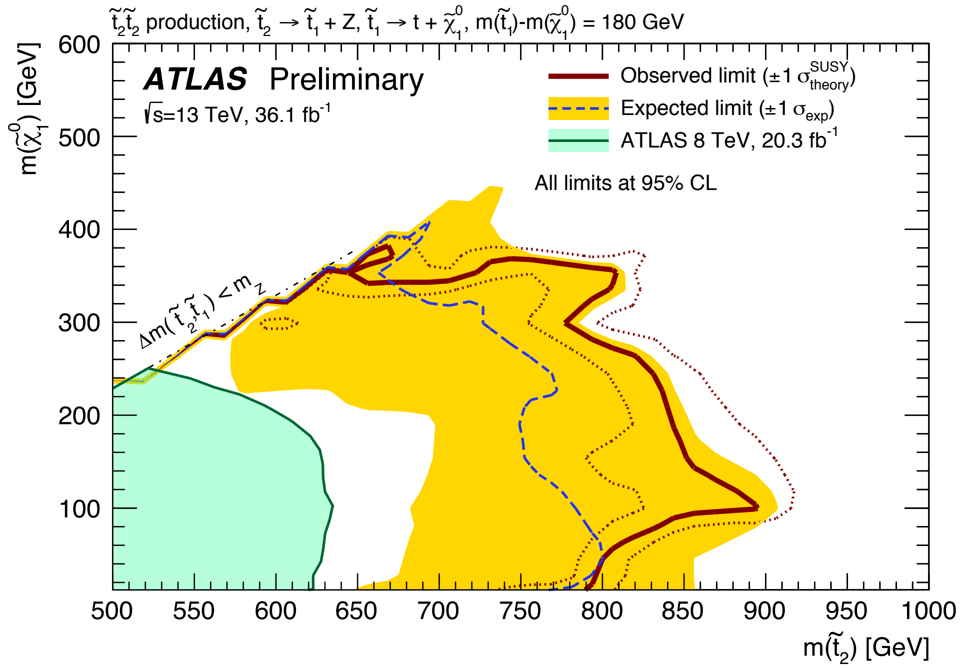


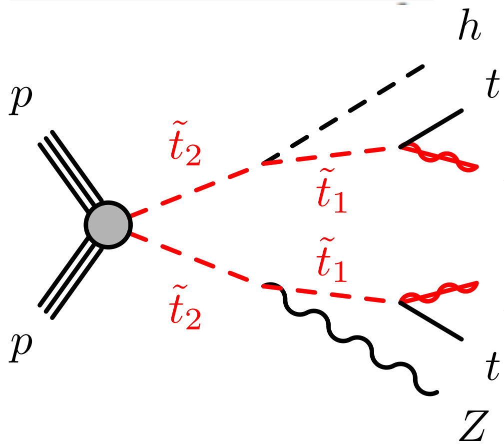
Stop → Z, Higgs

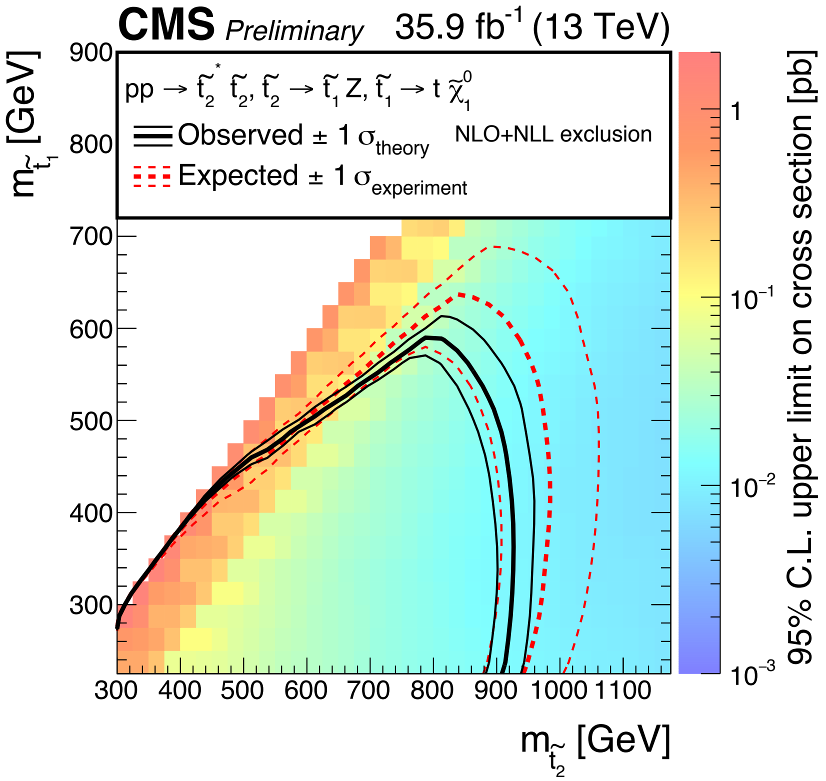
ATLAS-CONF-2017-019

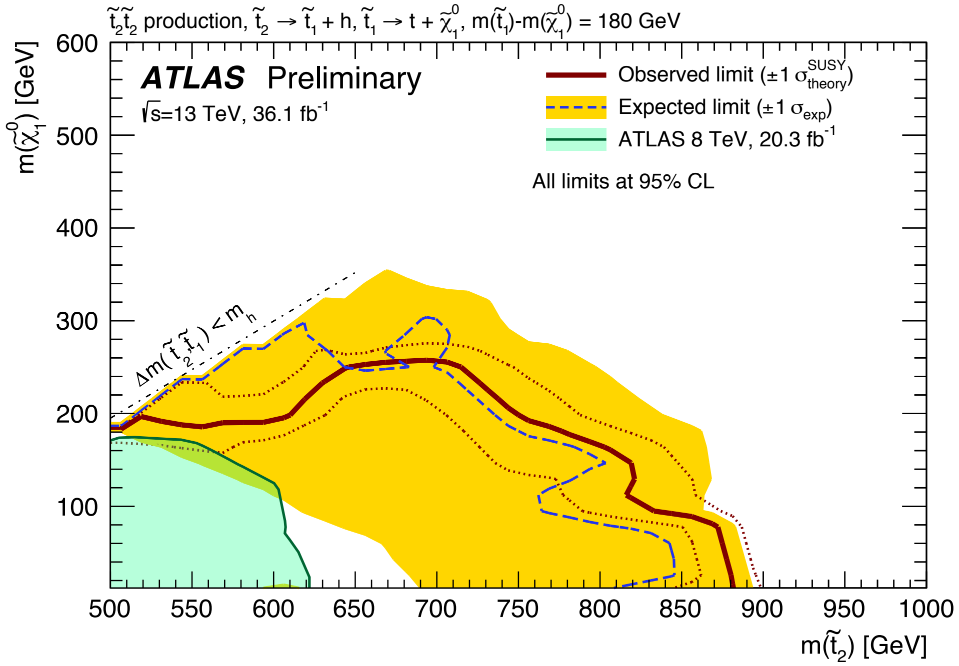
SUS-16-041

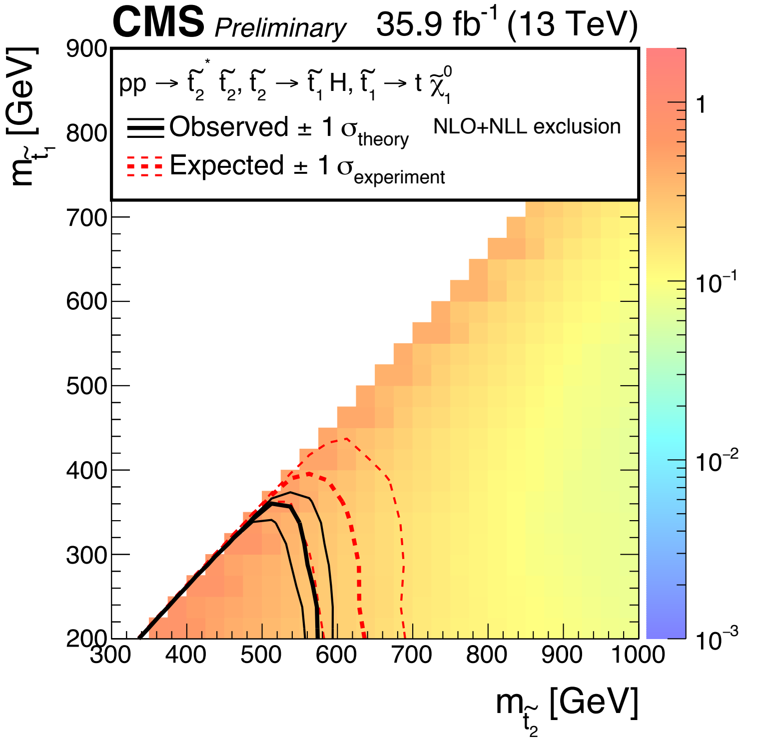
$$\tilde{t}_2 \to Z/h + \tilde{t}_1$$
$$\tilde{t}_1 \to t + \tilde{\chi}_1^0$$









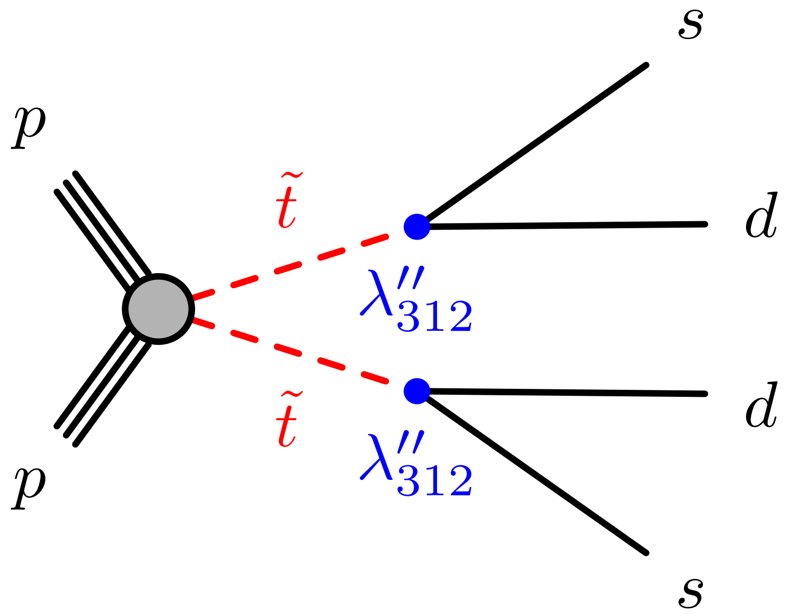


R.Sawada

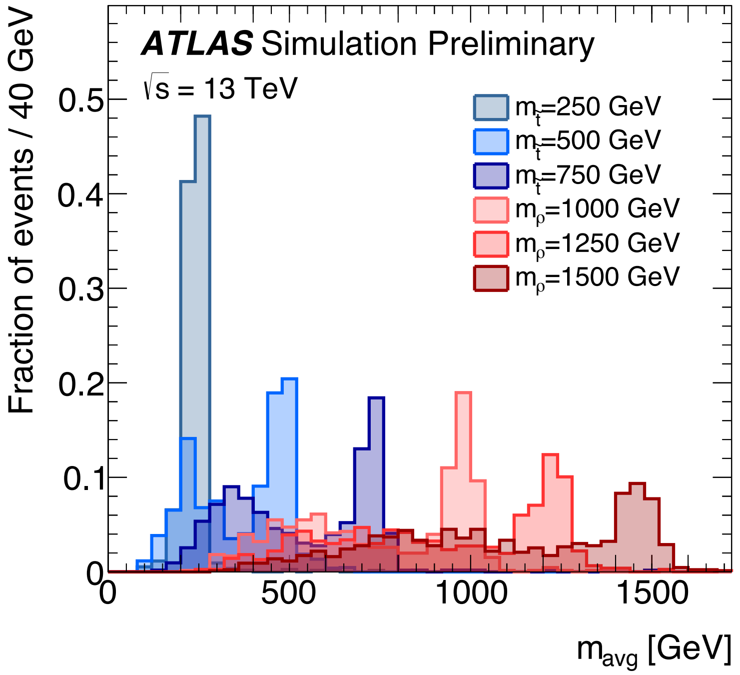
stop RPV

ATLAS-CONF-2017-025

stopがそれぞれ2クォークへ崩壊

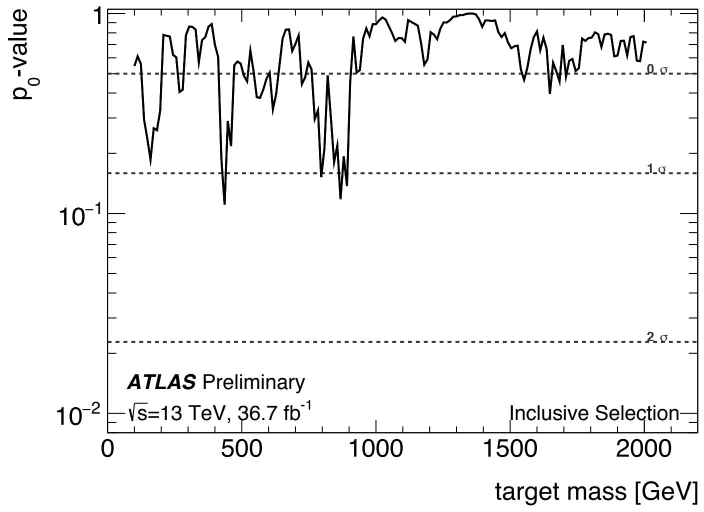


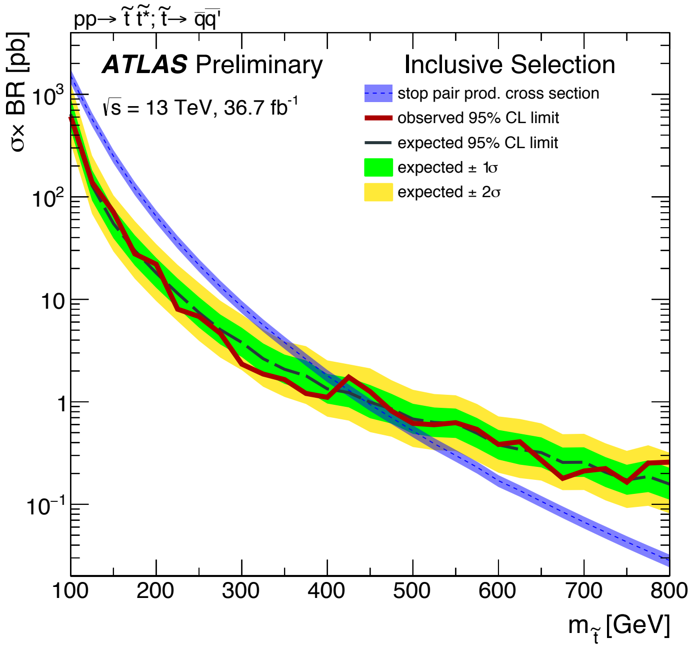
Jetのペアから質量をそれぞれ再構成し平均をとる



R.Sawada

Light quarkへ崩壊

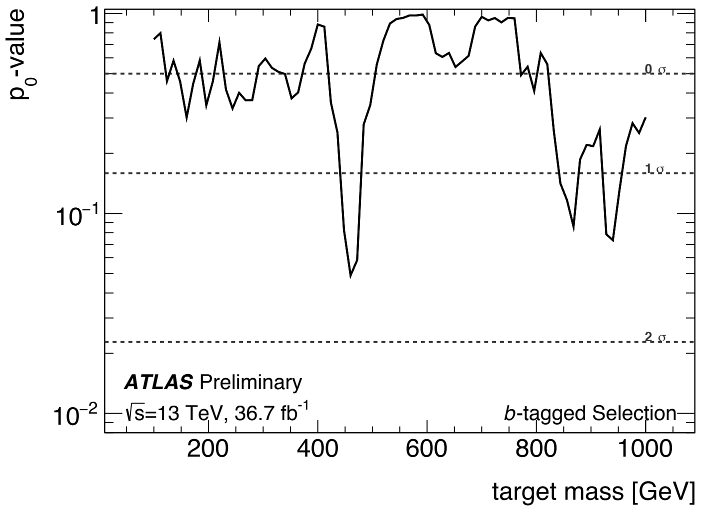


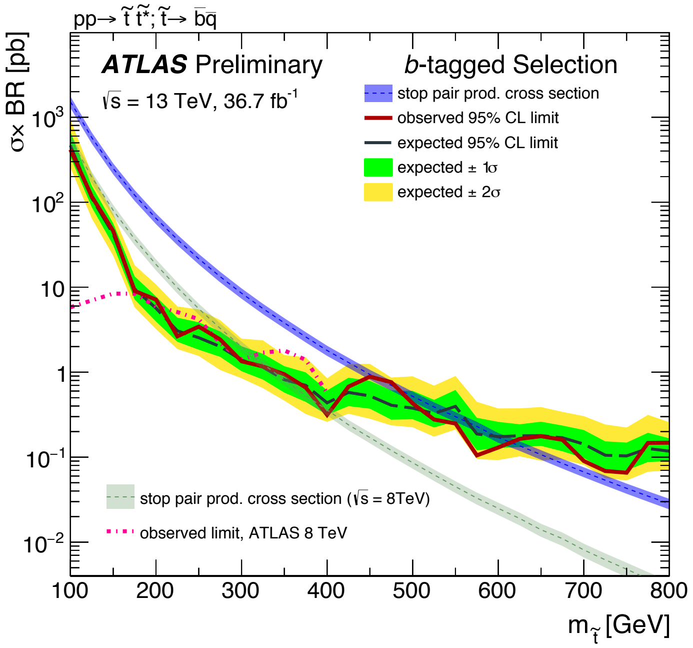


[100, 410] GeV

棄却領域

b quarkを含む崩壊



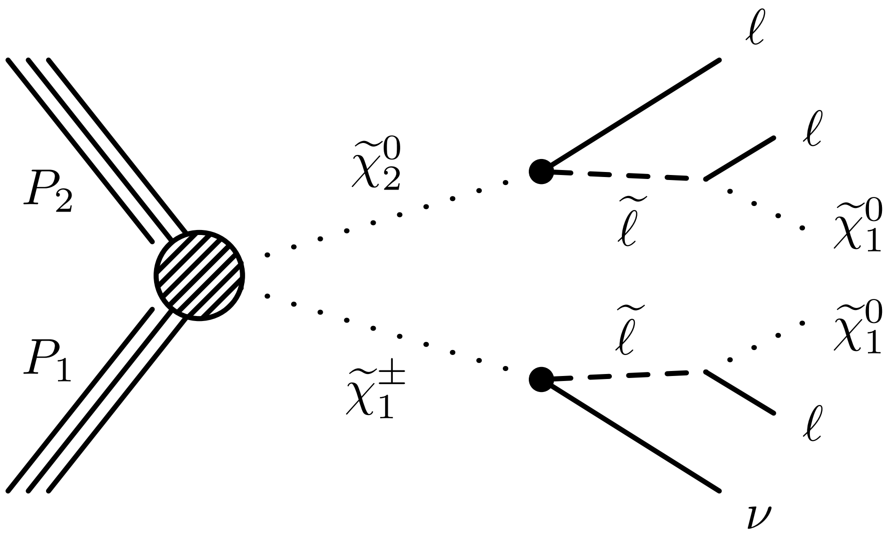


[100, 470] GeV

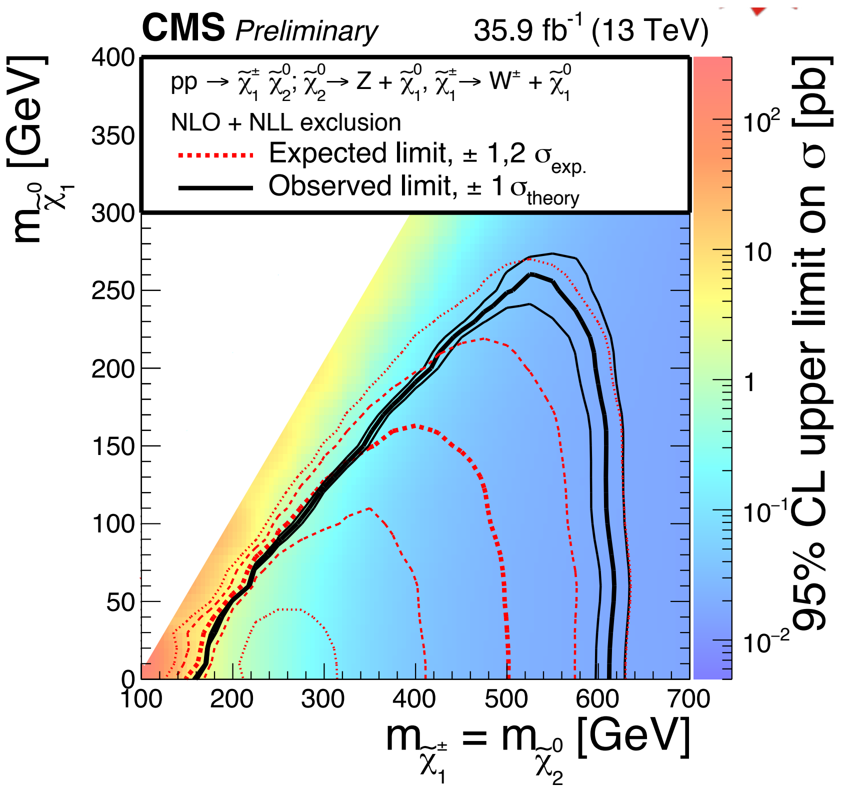
[480, 610] GeV

Electroweak prod

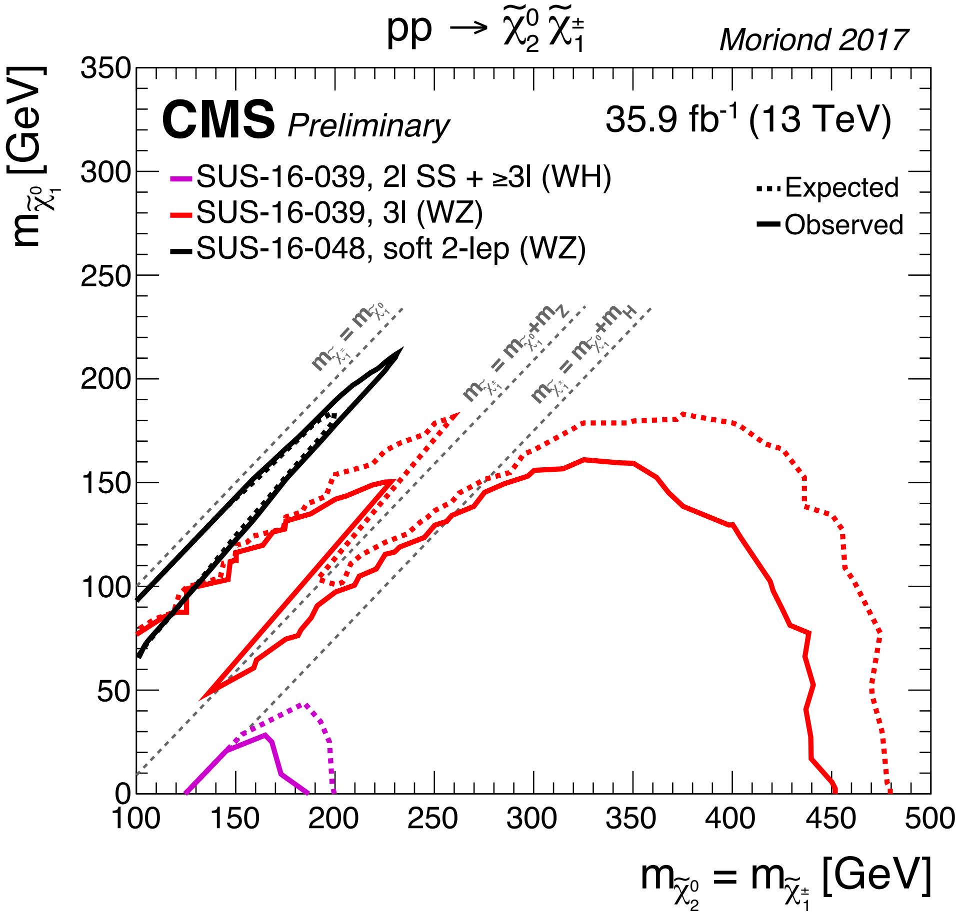
SUS-16-039

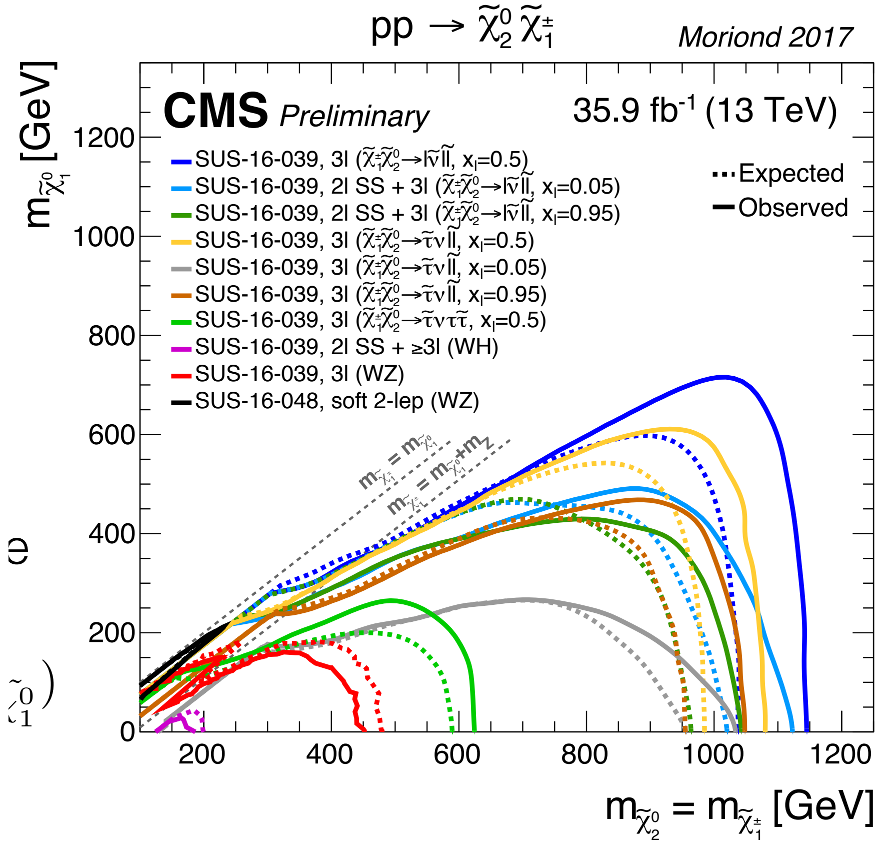


On-shell Z



W,Zへの直接崩壊



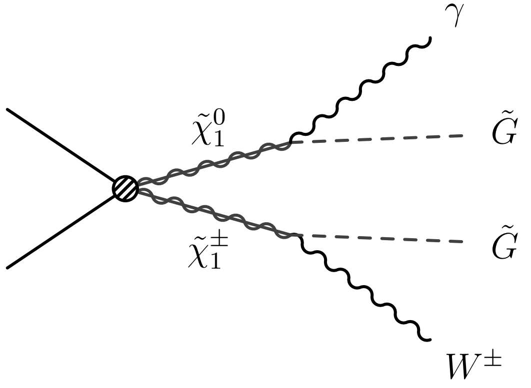


$$m_{\tilde\ell} = \quad m_{\tilde\chi^0_1} + x_\ell(m_{\chi^0_2} - m_{\tilde\chi^0_1})$$

Searches with photon

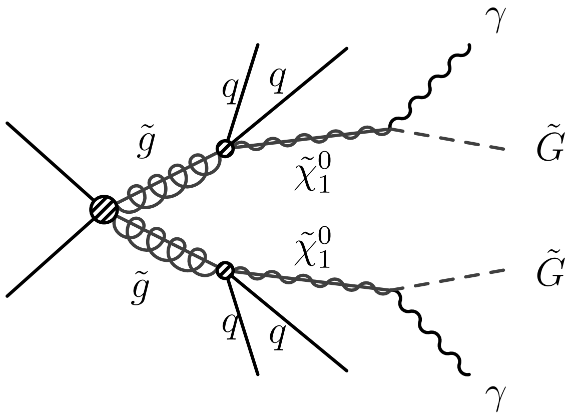
<u>SUS-16-046</u>
<u>SUS-16-047</u>

GMSB EW

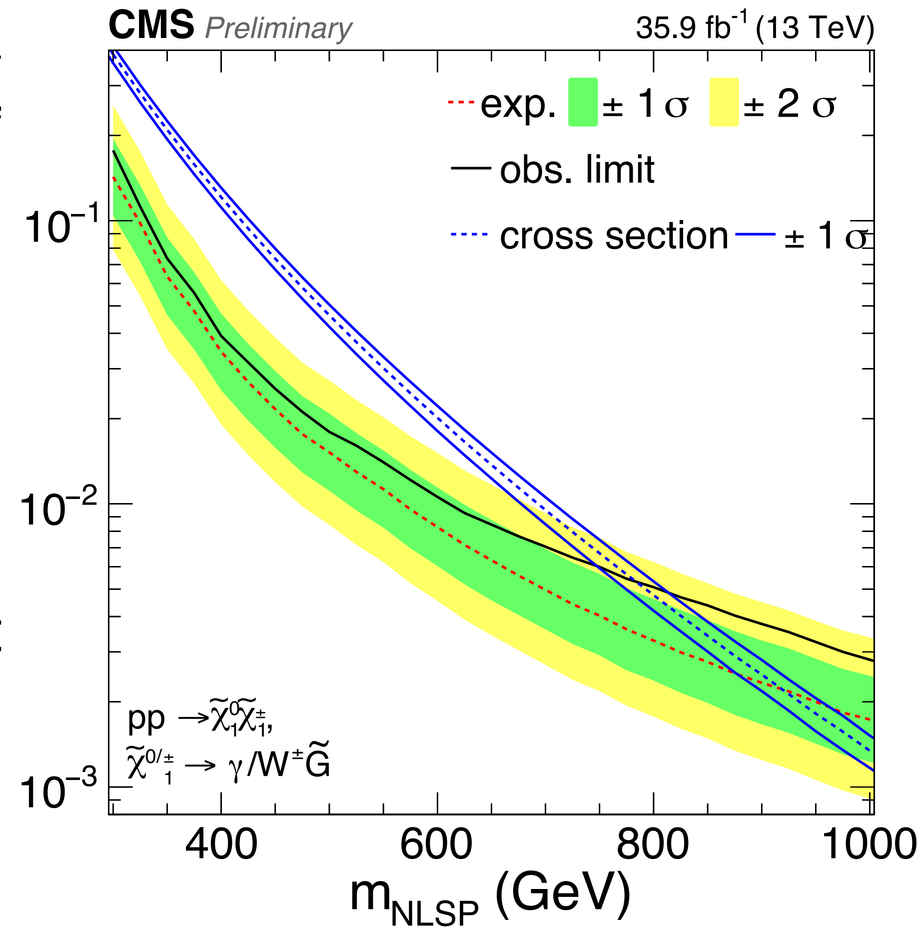


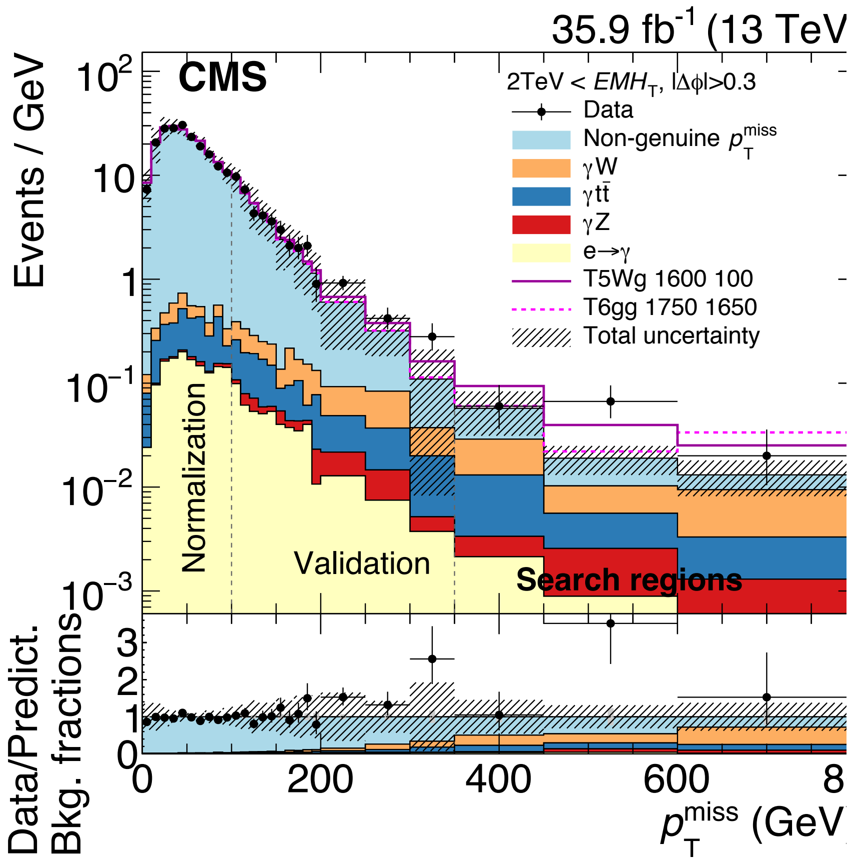
No explicit jet selection

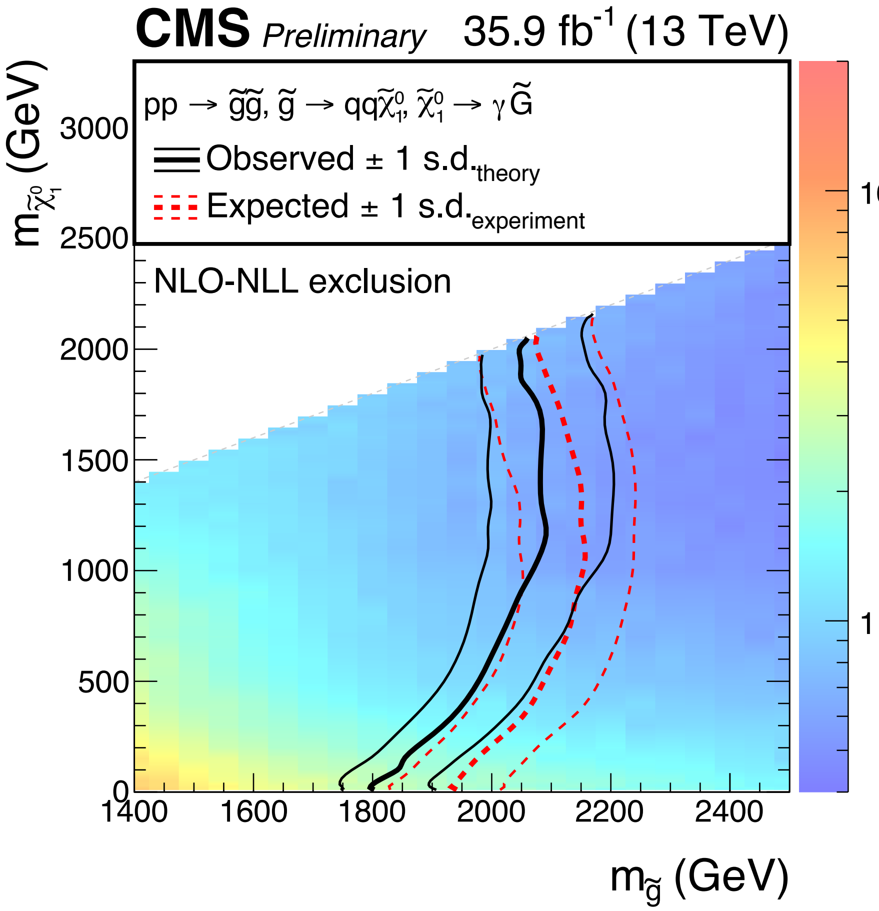
GMSB Strong



Use Jet activity





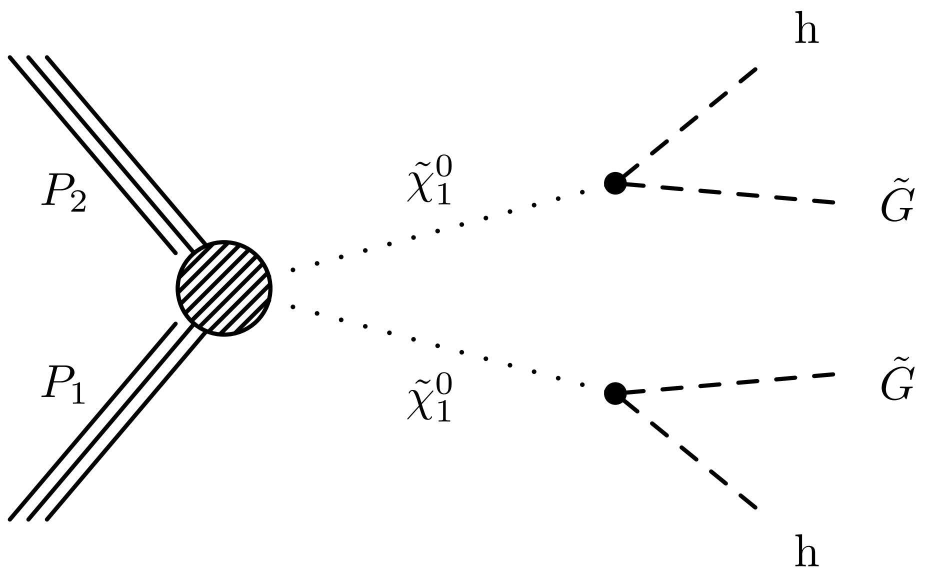


$$EMH_T = E_T^{miss} + p_T^\gamma$$

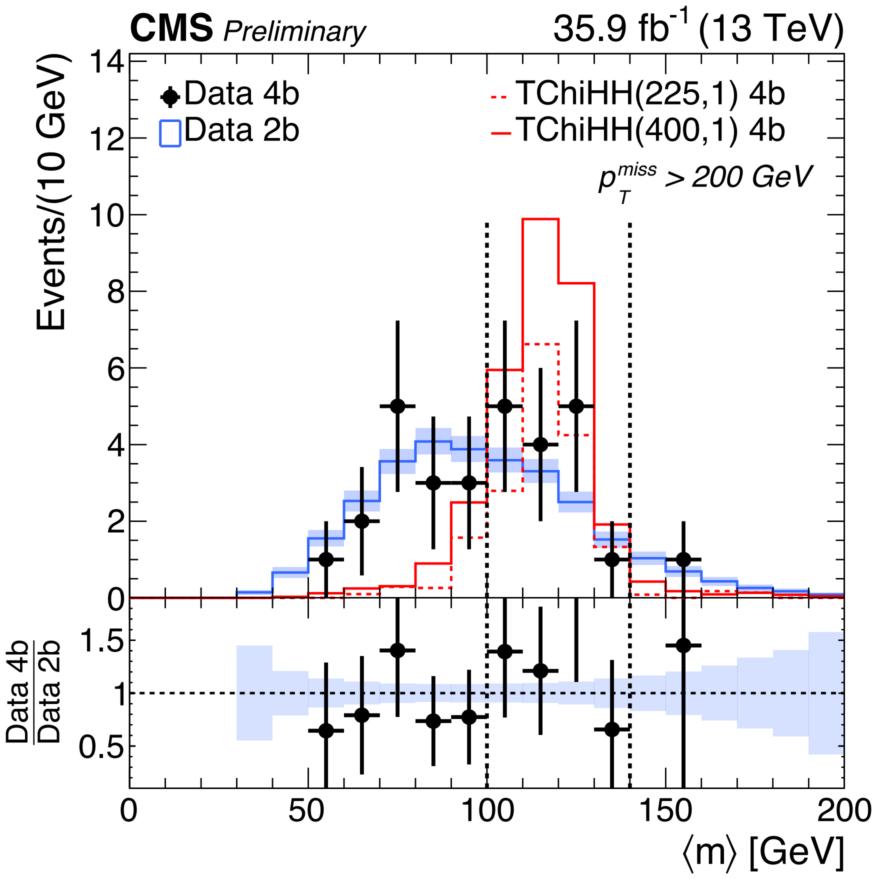
R.Sawada

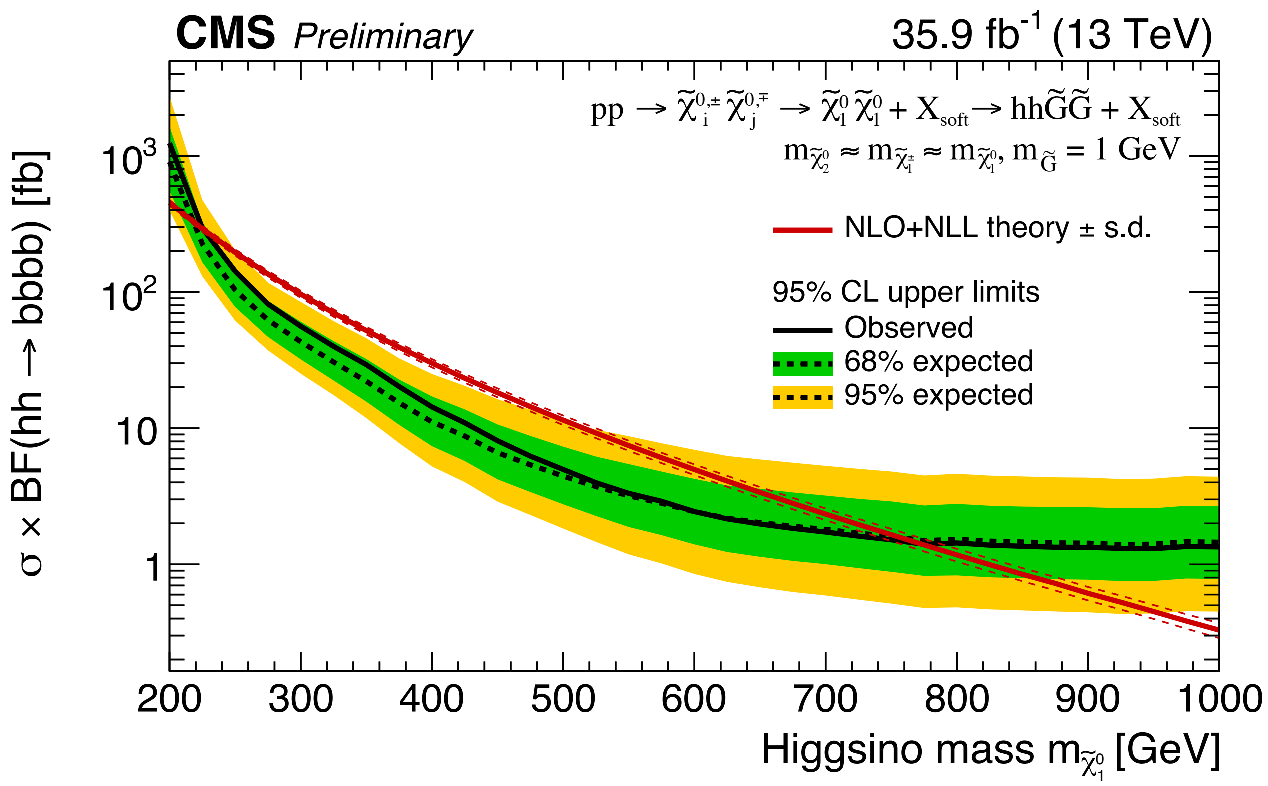
Higgsino production→h+$\tilde{G}$

SUS-16-044



- **GMSB**
- **h→bbからの4b終状態 (分岐比33%)**
- **[225,770] GeVを棄却**



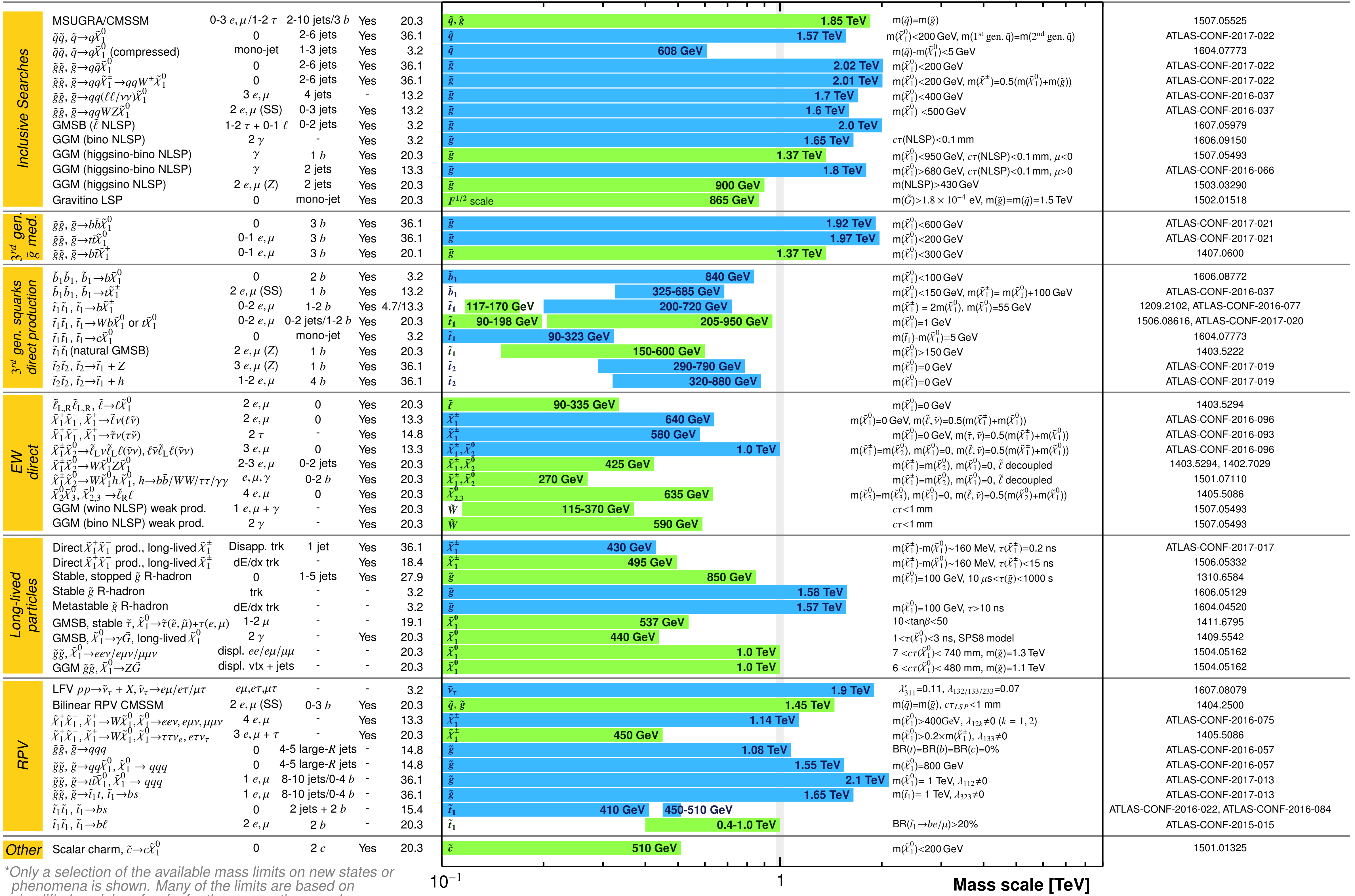


ATLAS SUSY Searches* - 95% CL Lower Limits

Status: March 2017

ATLAS Preliminary

$\sqrt{s}$ = 7, 8, 13 TeV



🟩 $\sqrt{s}$ = 7, 8 TeV 🟦 $\sqrt{s}$ = 13 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	$\tilde{q}, \tilde{g}$	🟩 1.85 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	36.1	$\tilde{q}$	🟦 1.57 TeV	m($\tilde{\chi}_1^0$)<200 GeV, m(1st gen. $\tilde{q}$)=m(2nd gen. $\tilde{q}$)	ATLAS-CONF-2017-022
	$\tilde{q}\tilde{q}, \tilde{q}\to q\tilde{\chi}_1^0$ (compressed)	mono-jet	1-3 jets	Yes	3.2	$\tilde{q}$	🟦 608 GeV	m($\tilde{q}$)-m($\tilde{\chi}_1^0$)<5 GeV	1604.07773
	$\tilde{g}\tilde{g}, \tilde{g}\to q\bar{q}\tilde{\chi}_1^0$	0	2-6 jets	Yes	36.1	$\tilde{g}$	🟦 2.02 TeV	m($\tilde{\chi}_1^0$)<200 GeV	ATLAS-CONF-2017-022
	$\tilde{g}\tilde{g}, \tilde{g}\to qq\tilde{\chi}_1^{\pm}\to qqW^{\pm}\tilde{\chi}_1^0$	0	2-6 jets	Yes	36.1	$\tilde{g}$	🟦 2.01 TeV	m($\tilde{\chi}_1^0$)<200 GeV, m($\tilde{\chi}^{\pm}$)=0.5(m($\tilde{\chi}_1^0$)+m($\tilde{g}$))	ATLAS-CONF-2017-022
	$\tilde{g}\tilde{g}, \tilde{g}\to qq(\ell\ell/\nu\nu)\tilde{\chi}_1^0$	3 e, μ	4 jets	-	13.2	$\tilde{g}$	🟦 1.7 TeV	m($\tilde{\chi}_1^0$)<400 GeV	ATLAS-CONF-2016-037
	$\tilde{g}\tilde{g}, \tilde{g}\to qqWZ\tilde{\chi}_1^0$	2 e, μ (SS)	0-3 jets	Yes	13.2	$\tilde{g}$	🟦 1.6 TeV	m($\tilde{\chi}_1^0$) <500 GeV	ATLAS-CONF-2016-037
	GMSB ($\tilde{\ell}$ NLSP)	1-2 τ + 0-1 ℓ	0-2 jets	Yes	3.2	$\tilde{g}$	🟦 2.0 TeV		1607.05979
	GGM (bino NLSP)	2 γ	-	Yes	3.2	$\tilde{g}$	🟦 1.65 TeV	$c\tau$(NLSP)<0.1 mm	1606.09150
	GGM (higgsino-bino NLSP)	γ	1 b	Yes	20.3	$\tilde{g}$	🟩 1.37 TeV	m($\tilde{\chi}_1^0$)<950 GeV, $c\tau$(NLSP)<0.1 mm, μ<0	1507.05493
	GGM (higgsino-bino NLSP)	γ	2 jets	Yes	13.3	$\tilde{g}$	🟦 1.8 TeV	m($\tilde{\chi}_1^0$)>680 GeV, $c\tau$(NLSP)<0.1 mm, μ>0	ATLAS-CONF-2016-066
	GGM (higgsino NLSP)	2 e, μ (Z)	2 jets	Yes	20.3	$\tilde{g}$	🟩 900 GeV	m(NLSP)>430 GeV	1503.03290
	Gravitino LSP	0	mono-jet	Yes	20.3	$F^{1/2}$ scale	🟩 865 GeV	m($\tilde{G}$)>1.8×10^{-4} eV, m($\tilde{g}$)=m($\tilde{q}$)=1.5 TeV	1502.01518
3^{rd} gen. $\tilde{g}$ med.	$\tilde{g}\tilde{g}, \tilde{g}\to b\bar{b}\tilde{\chi}_1^0$	0	3 b	Yes	36.1	$\tilde{g}$	🟦 1.92 TeV	m($\tilde{\chi}_1^0$)<600 GeV	ATLAS-CONF-2017-021
	$\tilde{g}\tilde{g}, \tilde{g}\to t\bar{t}\tilde{\chi}_1^0$	0-1 e, μ	3 b	Yes	36.1	$\tilde{g}$	🟦 1.97 TeV	m($\tilde{\chi}_1^0$)<200 GeV	ATLAS-CONF-2017-021
	$\tilde{g}\tilde{g}, \tilde{g}\to b\bar{t}\tilde{\chi}_1^+$	0-1 e, μ	3 b	Yes	20.1	$\tilde{g}$	🟩 1.37 TeV	m($\tilde{\chi}_1^0$)<300 GeV	1407.0600
3^{rd} gen. squarks direct production	$\tilde{b}_1\tilde{b}_1, \tilde{b}_1\to b\tilde{\chi}_1^0$	0	2 b	Yes	3.2	$\tilde{b}_1$	🟦 840 GeV	m($\tilde{\chi}_1^0$)<100 GeV	1606.08772
	$\tilde{b}_1\tilde{b}_1, \tilde{b}_1\to t\tilde{\chi}_1^{\pm}$	2 e, μ (SS)	1 b	Yes	13.2	$\tilde{b}_1$	🟦 325-685 GeV	m($\tilde{\chi}_1^0$)<150 GeV, m($\tilde{\chi}_1^{\pm}$)= m($\tilde{\chi}_1^0$)+100 GeV	ATLAS-CONF-2016-037
	$\tilde{t}_1\tilde{t}_1, \tilde{t}_1\to b\tilde{\chi}_1^{\pm}$	0-2 e, μ	1-2 b	Yes	4.7/13.3	$\tilde{t}_1$	🟩 117-170 GeV 🟦 200-720 GeV	m($\tilde{\chi}_1^{\pm}$) = 2m($\tilde{\chi}_1^0$), m($\tilde{\chi}_1^0$)=55 GeV	1209.2102, ATLAS-CONF-2016-077
	$\tilde{t}_1\tilde{t}_1, \tilde{t}_1\to Wb\tilde{\chi}_1^0$ or $t\tilde{\chi}_1^0$	0-2 e, μ	0-2 jets/1-2 b	Yes	20.3	$\tilde{t}_1$	🟩 90-198 GeV 🟩 205-950 GeV	m($\tilde{\chi}_1^0$)=1 GeV	1506.08616, ATLAS-CONF-2017-020
	$\tilde{t}_1\tilde{t}_1, \tilde{t}_1\to c\tilde{\chi}_1^0$	0	mono-jet	Yes	3.2	$\tilde{t}_1$	🟦 90-323 GeV	m($\tilde{t}_1$)-m($\tilde{\chi}_1^0$)=5 GeV	1604.07773
	$\tilde{t}_1\tilde{t}_1$(natural GMSB)	2 e, μ (Z)	1 b	Yes	20.3	$\tilde{t}_1$	🟩 150-600 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	36.1	$\tilde{t}_2$	🟦 290-790 GeV	m($\tilde{\chi}_1^0$)=0 GeV	ATLAS-CONF-2017-019
	$\tilde{t}_2\tilde{t}_2, \tilde{t}_2\to\tilde{t}_1 + h$	1-2 e, μ	4 b	Yes	36.1	$\tilde{t}_2$	🟦 320-880 GeV	m($\tilde{\chi}_1^0$)=0 GeV	ATLAS-CONF-2017-019
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	$\tilde{\ell}$	🟩 90-335 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	13.3	$\tilde{\chi}_1^{\pm}$	🟦 640 GeV	m($\tilde{\chi}_1^0$)=0 GeV, m($\tilde{\ell}, \tilde{\nu}$)=0.5(m($\tilde{\chi}_1^{\pm}$)+m($\tilde{\chi}_1^0$))	ATLAS-CONF-2016-096
	$\tilde{\chi}_1^+\tilde{\chi}_1^-, \tilde{\chi}_1^+\to\tilde{\tau}\nu(\tau\tilde{\nu})$	2 τ	-	Yes	14.8	$\tilde{\chi}_1^{\pm}$	🟦 580 GeV	m($\tilde{\chi}_1^0$)=0 GeV, m($\tilde{\tau}, \tilde{\nu}$)=0.5(m($\tilde{\chi}_1^{\pm}$)+m($\tilde{\chi}_1^0$))	ATLAS-CONF-2016-093
	$\tilde{\chi}_1^{\pm}\tilde{\chi}_2^0\to\tilde{\ell}_L\nu\tilde{\ell}_L\ell(\tilde{\nu}\nu), \ell\tilde{\nu}\tilde{\ell}_L\ell(\tilde{\nu}\nu)$	3 e, μ	0	Yes	13.3	$\tilde{\chi}_1^{\pm}, \tilde{\chi}_2^0$	🟦 1.0 TeV	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($\tilde{\chi}_1^0$))	ATLAS-CONF-2016-096
	$\tilde{\chi}_1^{\pm}\tilde{\chi}_2^0\to W\tilde{\chi}_1^0 Z\tilde{\chi}_1^0$	2-3 e, μ	0-2 jets	Yes	20.3	$\tilde{\chi}_1^{\pm}, \tilde{\chi}_2^0$	🟩 425 GeV	m($\tilde{\chi}_1^{\pm}$)=m($\tilde{\chi}_2^0$), m($\tilde{\chi}_1^0$)=0, $\tilde{\ell}$ 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	$\tilde{\chi}_1^{\pm}, \tilde{\chi}_2^0$	🟩 270 GeV	m($\tilde{\chi}_1^{\pm}$)=m($\tilde{\chi}_2^0$), m($\tilde{\chi}_1^0$)=0, $\tilde{\ell}$ 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	$\tilde{\chi}_{2,3}^0$	🟩 635 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 $e, \mu + \gamma$	-	Yes	20.3	$\tilde{W}$	🟩 115-370 GeV	$c\tau$<1 mm	1507.05493
	GGM (bino NLSP) weak prod.	2 γ	-	Yes	20.3	$\tilde{W}$	🟩 590 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	36.1	$\tilde{\chi}_1^{\pm}$	🟦 430 GeV	m($\tilde{\chi}_1^{\pm}$)-m($\tilde{\chi}_1^0$)~160 MeV, τ($\tilde{\chi}_1^{\pm}$)=0.2 ns	ATLAS-CONF-2017-017
	Direct $\tilde{\chi}_1^+\tilde{\chi}_1^-$ prod., long-lived $\tilde{\chi}_1^{\pm}$	dE/dx trk	-	Yes	18.4	$\tilde{\chi}_1^{\pm}$	🟩 495 GeV	m($\tilde{\chi}_1^{\pm}$)-m($\tilde{\chi}_1^0$)~160 MeV, τ($\tilde{\chi}_1^{\pm}$)<15 ns	1506.05332
	Stable, stopped $\tilde{g}$ R-hadron	0	1-5 jets	Yes	27.9	$\tilde{g}$	🟩 850 GeV	m($\tilde{\chi}_1^0$)=100 GeV, 10 μs<τ($\tilde{g}$)<1000 s	1310.6584
	Stable $\tilde{g}$ R-hadron	trk	-	-	3.2	$\tilde{g}$	🟦 1.58 TeV		1606.05129
	Metastable $\tilde{g}$ R-hadron	dE/dx trk	-	-	3.2	$\tilde{g}$	🟦 1.57 TeV	m($\tilde{\chi}_1^0$)=100 GeV, τ>10 ns	1604.04520
	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<tanβ<50	1411.6795
	GMSB, $\tilde{\chi}_1^0\to\gamma\tilde{G}$, long-lived $\tilde{\chi}_1^0$	2 γ	-	Yes	20.3	$\tilde{\chi}_1^0$	🟩 440 GeV	1<τ($\tilde{\chi}_1^0$)<3 ns, SPS8 model	1409.5542
	$\tilde{g}\tilde{g}, \tilde{\chi}_1^0\to ee\nu/e\mu\nu/\mu\mu\nu$	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 $pp\to\tilde{\nu}_\tau + X, \tilde{\nu}_\tau\to e\mu/e\tau/\mu\tau$	$e\mu$,$e\tau$,$\mu\tau$	-	-	3.2	$\tilde{\nu}_\tau$	🟦 1.9 TeV	λ'_{311}=0.11, $\lambda_{132/133/233}$=0.07	1607.08079
	Bilinear RPV CMSSM	2 e, μ (SS)	0-3 b	Yes	20.3	$\tilde{q}, \tilde{g}$	🟩 1.45 TeV	m($\tilde{q}$)=m($\tilde{g}$), $c\tau_{LSP}$<1 mm	1404.2500
	$\tilde{\chi}_1^+\tilde{\chi}_1^-, \tilde{\chi}_1^+\to W\tilde{\chi}_1^0, \tilde{\chi}_1^0\to ee\nu, e\mu\nu, \mu\mu\nu$	4 e, μ	-	Yes	13.3	$\tilde{\chi}_1^{\pm}$	🟦 1.14 TeV	m($\tilde{\chi}_1^0$)>400GeV, $\lambda_{12k}\neq$0 ($k = 1, 2$)	ATLAS-CONF-2016-075
	$\tilde{\chi}_1^+\tilde{\chi}_1^-, \tilde{\chi}_1^+\to W\tilde{\chi}_1^0, \tilde{\chi}_1^0\to\tau\tau\nu_e, e\tau\nu_\tau$	3 $e, \mu + \tau$	-	Yes	20.3	$\tilde{\chi}_1^{\pm}$	🟩 450 GeV	m($\tilde{\chi}_1^0$)>0.2×m($\tilde{\chi}_1^{\pm}$), $\lambda_{133}\neq$0	1405.5086
	$\tilde{g}\tilde{g}, \tilde{g}\to qqq$	0	4-5 large-R jets	-	14.8	$\tilde{g}$	🟦 1.08 TeV	BR(t)=BR(b)=BR(c)=0%	ATLAS-CONF-2016-057
	$\tilde{g}\tilde{g}, \tilde{g}\to qq\tilde{\chi}_1^0, \tilde{\chi}_1^0\to qqq$	0	4-5 large-R jets	-	14.8	$\tilde{g}$	🟦 1.55 TeV	m($\tilde{\chi}_1^0$)=800 GeV	ATLAS-CONF-2016-057
	$\tilde{g}\tilde{g}, \tilde{g}\to t\bar{t}\tilde{\chi}_1^0, \tilde{\chi}_1^0\to qqq$	1 e, μ	8-10 jets/0-4 b	-	36.1	$\tilde{g}$	🟦 2.1 TeV	m($\tilde{\chi}_1^0$)= 1 TeV, $\lambda_{112}\neq$0	ATLAS-CONF-2017-013
	$\tilde{g}\tilde{g}, \tilde{g}\to\tilde{t}_1 t, \tilde{t}_1\to bs$	1 e, μ	8-10 jets/0-4 b	-	36.1	$\tilde{g}$	🟦 1.65 TeV	m($\tilde{t}_1$)= 1 TeV, $\lambda_{323}\neq$0	ATLAS-CONF-2017-013
	$\tilde{t}_1\tilde{t}_1, \tilde{t}_1\to bs$	0	2 jets + 2 b	-	15.4	$\tilde{t}_1$	🟦 410 GeV 🟦 450-510 GeV		ATLAS-CONF-2016-022, ATLAS-CONF-2016-084
	$\tilde{t}_1\tilde{t}_1, \tilde{t}_1\to b\ell$	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	$\tilde{c}$	🟩 510 GeV	m($\tilde{\chi}_1^0$)<200 GeV	1501.01325

*Only a selection of the available mass limits on new states or phenomena is shown. Many of the limits are based on simplified models, c.f. refs. for the assumptions made.

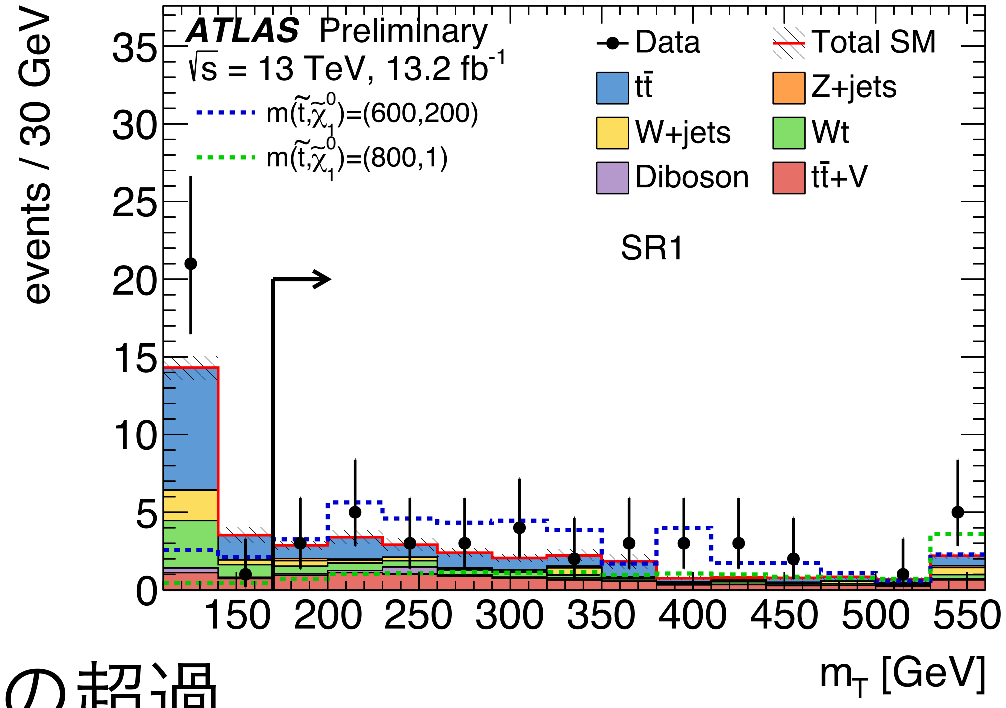
R.Sawada

Moriond前に見えていた超過 (I)

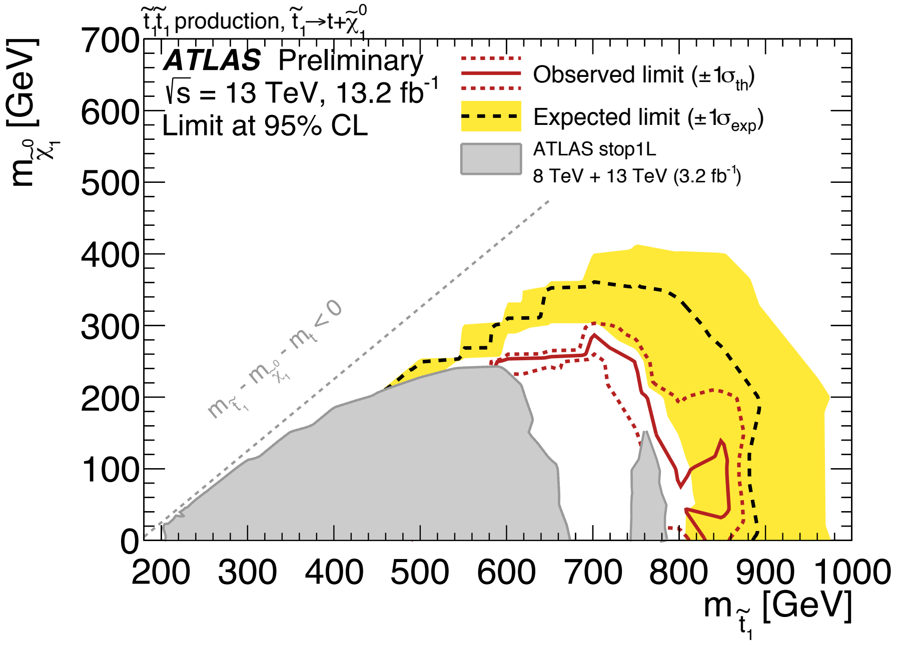
stop 1-lepton

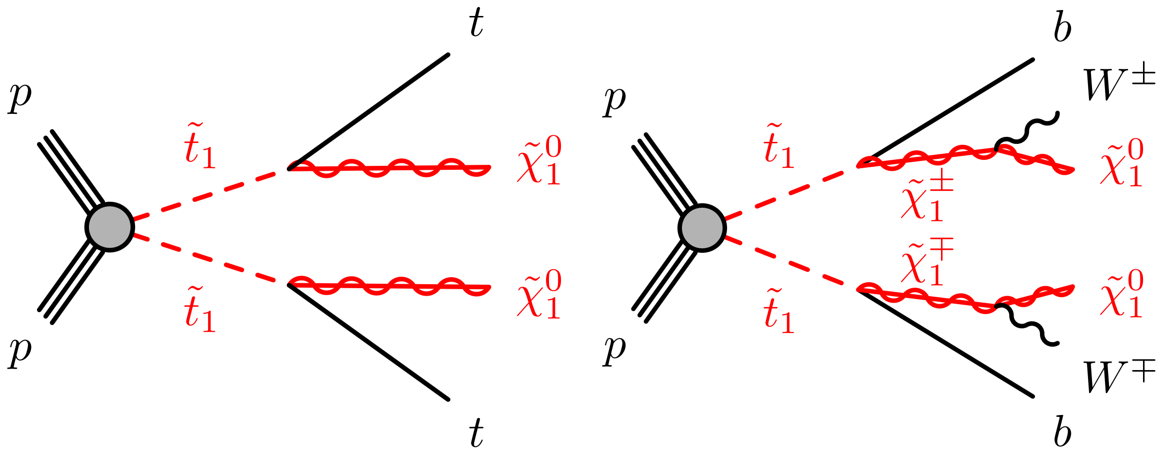
ATLAS

ICHEP2016



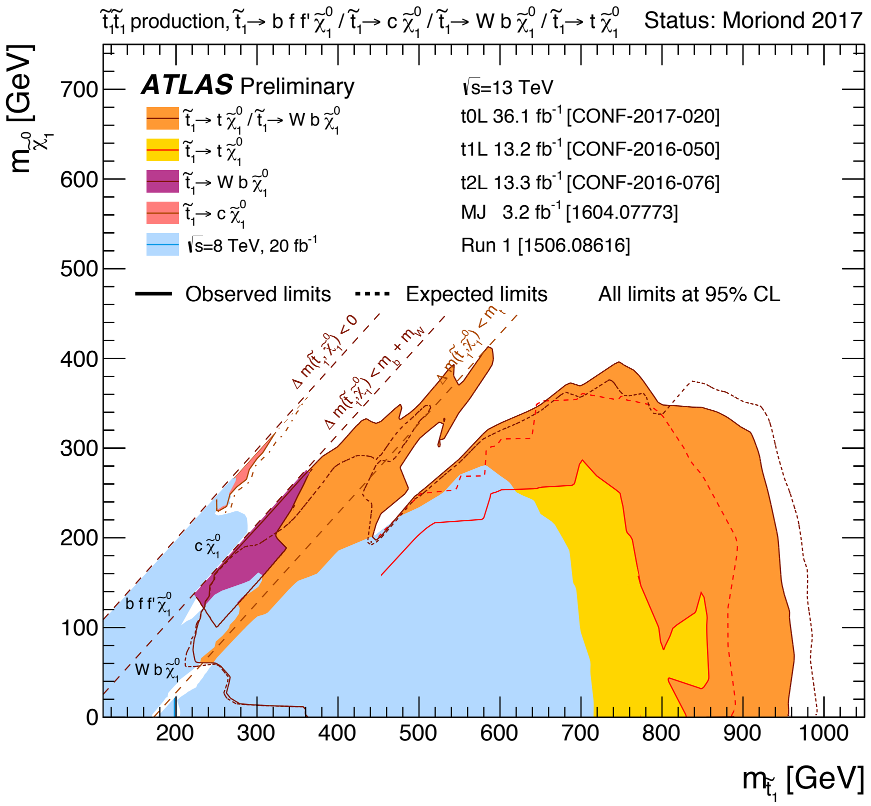
2.2σの超過





今回はアップデート無し

Moriond stop 0Lepでは棄却



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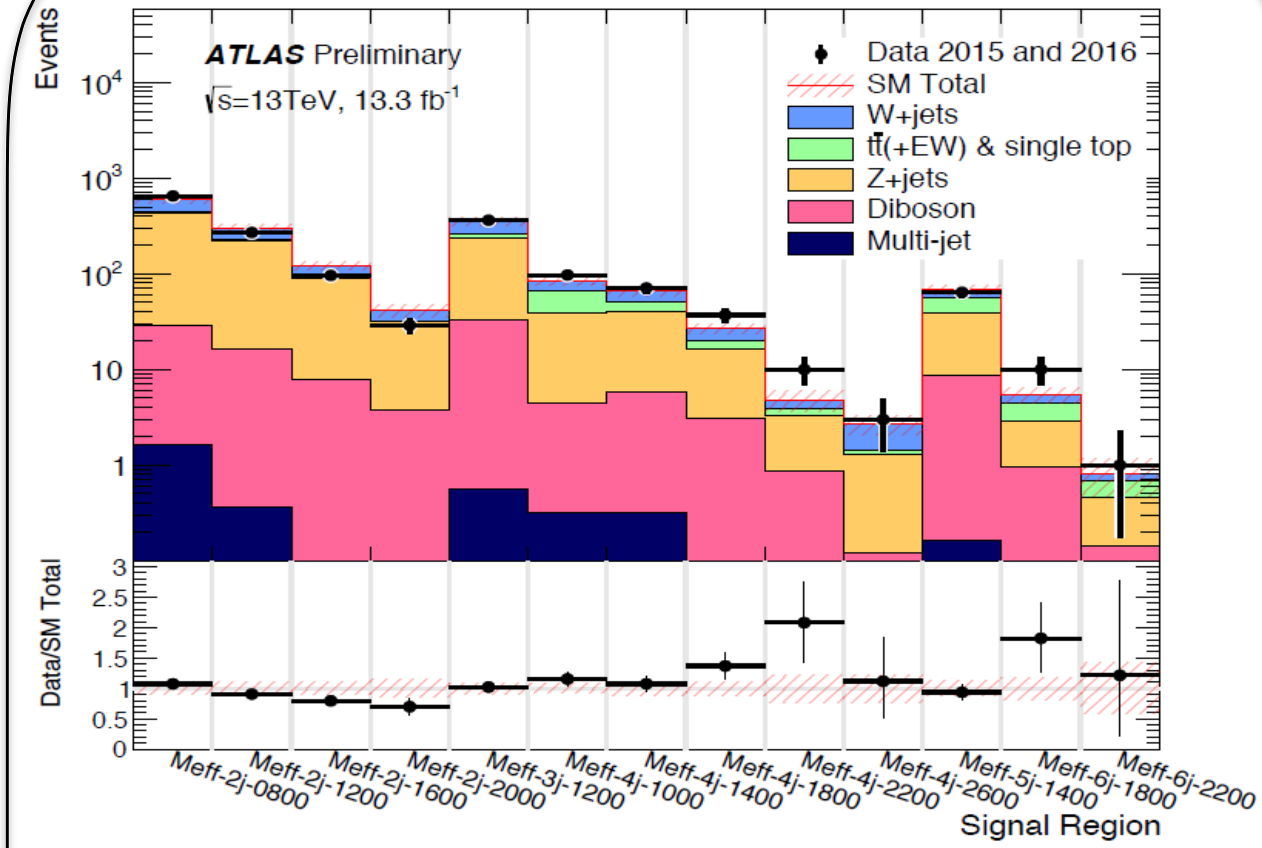
Moriond前に見えていた超過 (II)

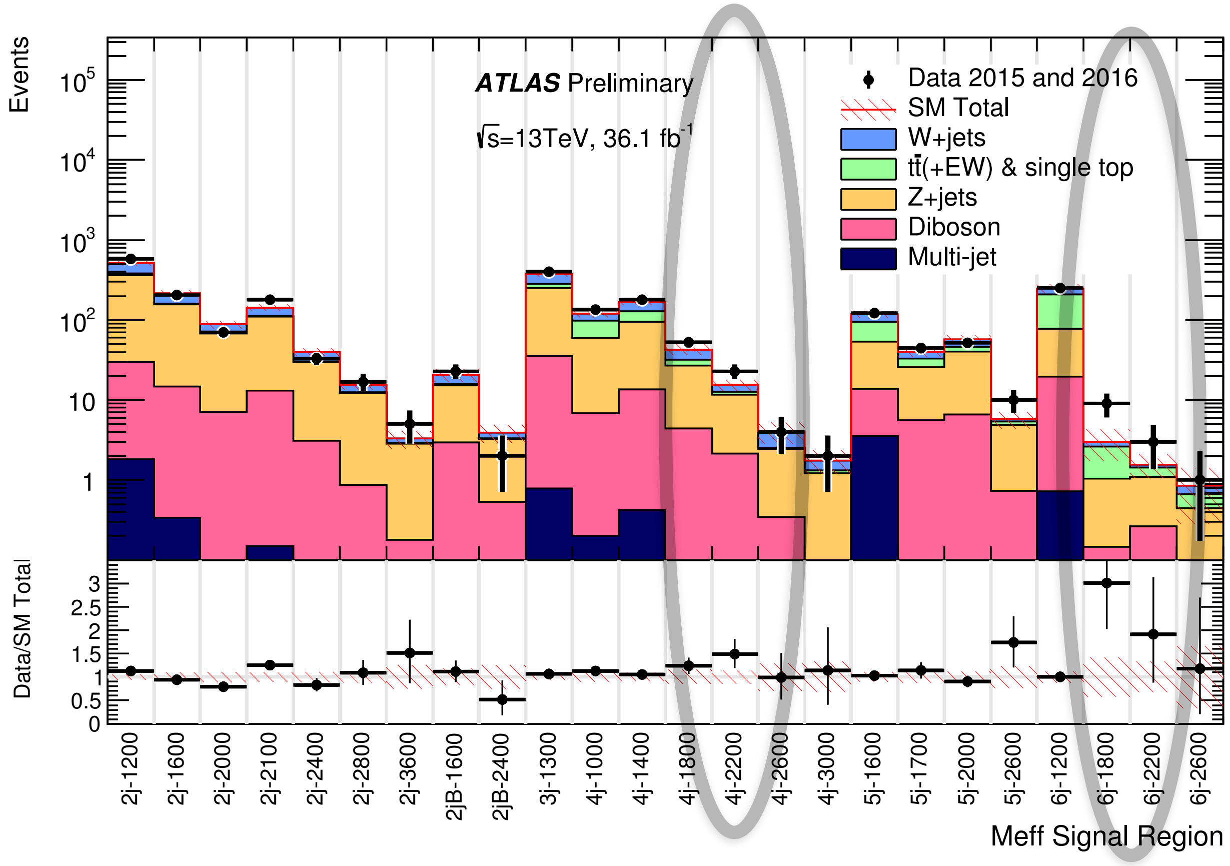
0-lepton

ATLAS

ICHEP2016



若干(1.5σ)の超過は大きな変化なし



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Moriond前に見えていた超過 (III)

2 lepton Z

ATLASは今回アップデートなし

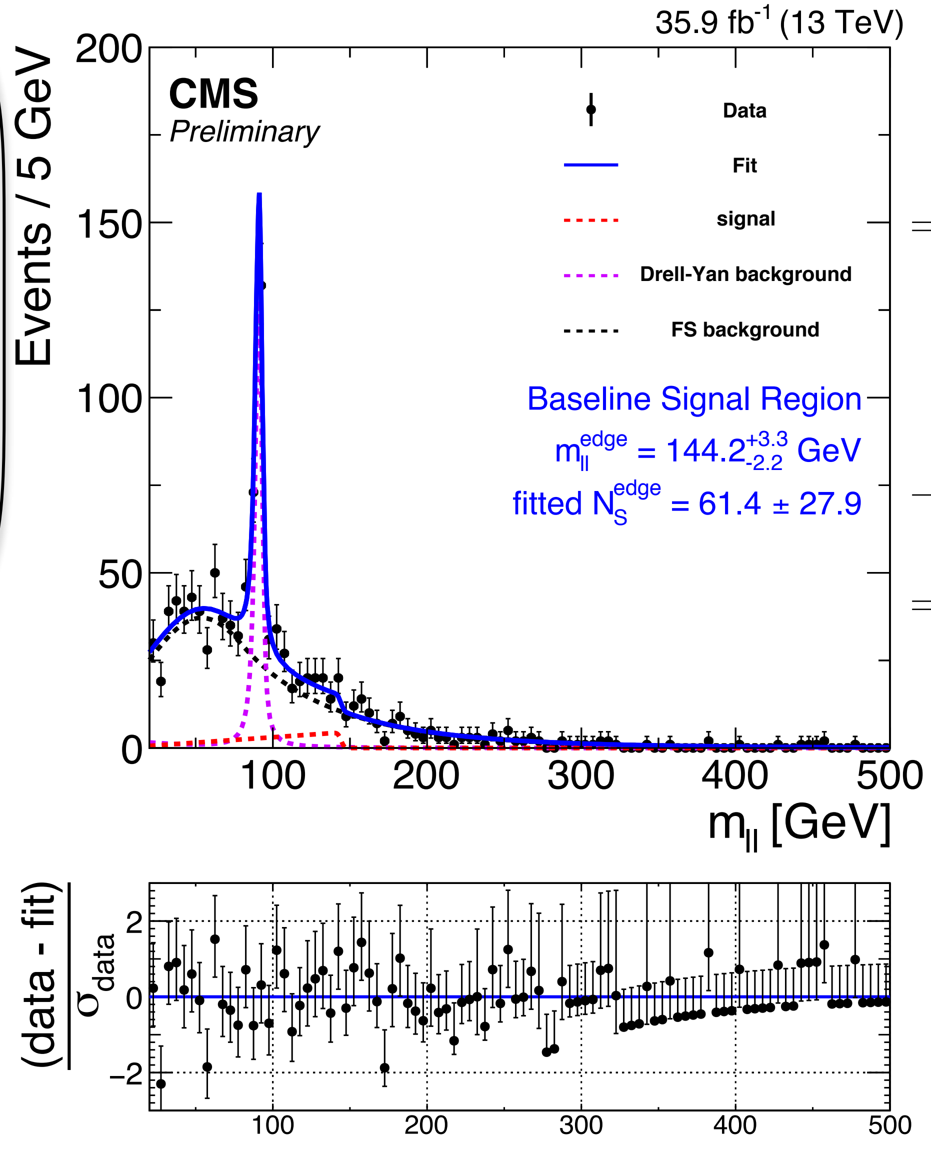
CMSはMoriondでアップデート

CMS

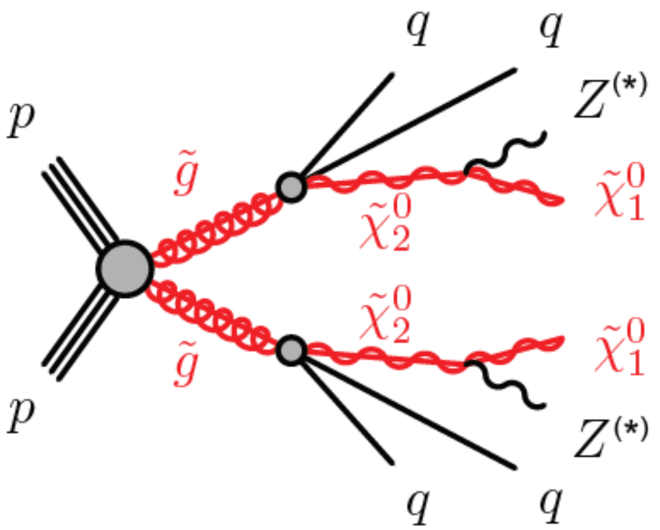
SUS-16-034

	ATLAS (EJPC75(2015)318,ATLAS-CONF-2015-082)	**CMS** (JHEP04(2015)124,CMS-PAS-SUS-16-021)
On-shell Z	2.2 σ (13 TeV, 3.2 fb^{-1}) 3.0 σ (8 TeV, 20 fb^{-1})	No excess (13 TeV, 12.9 fb^{-1}) No excess (8 TeV, 19.4 fb^{-1})
m_{ll} “edge”	-- No excess (8 TeV, 20 fb^{-1})	2.0 σ (13 TeV, 12.9 fb^{-1})
		2.4 σ (8 TeV, 19.4 fb^{-1})

- On-shell Z:
  - 81 GeV<mll<101 GeV, E_T^{miss}>200 GeV, H_T>600 GeV
  - Single bin counting
- m_{ll} edge:
  - m_{ll}>12 GeV, 2 jets, E_T^{miss}>200 GeV, H_T>0,400,700 GeV
  - multi-bin counting



Drell–Yan	191 ± 19
OF yield	768 ± 24
$R_{SF/OF}$	1.07 ± 0.03
Signal events	61.4 ± 27.9
$m_{\ell\ell}^{edge}$	$144.2^{+3.3}_{-2.2}$ GeV
Local significance	2.3 σ
Global significance	1.5 σ



local significance 2.3 σ
(global 1.5 σ)

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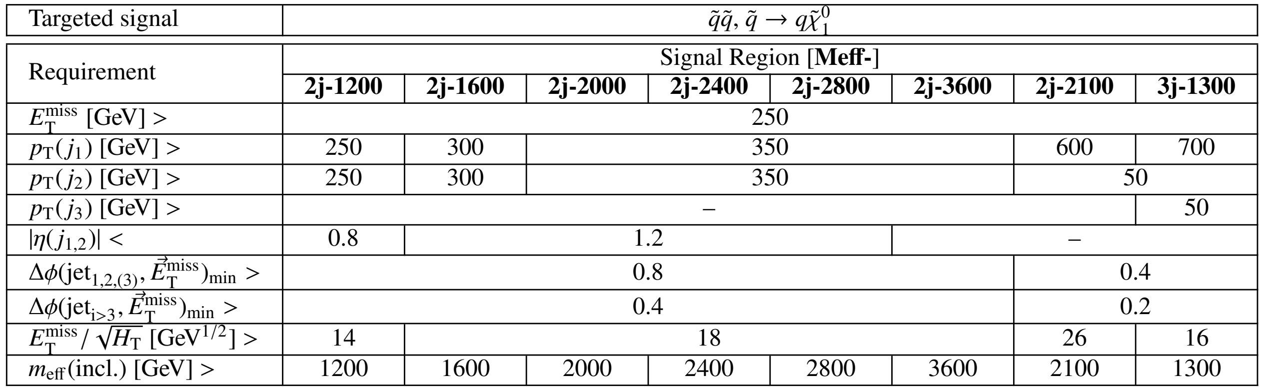
まとめ

- **ATLAS, CMSそれぞれ多くのチャンネルで結果を更新**
- **SUSYの兆候はなし**
- **制限**
  - グルイーノ ~2TeV
  - stop ~1 TeV
- **Electroweak production, long-lived, Higgsino等のチャンネルや、解析・オブジェクト再構成・IDの改良にも期待**

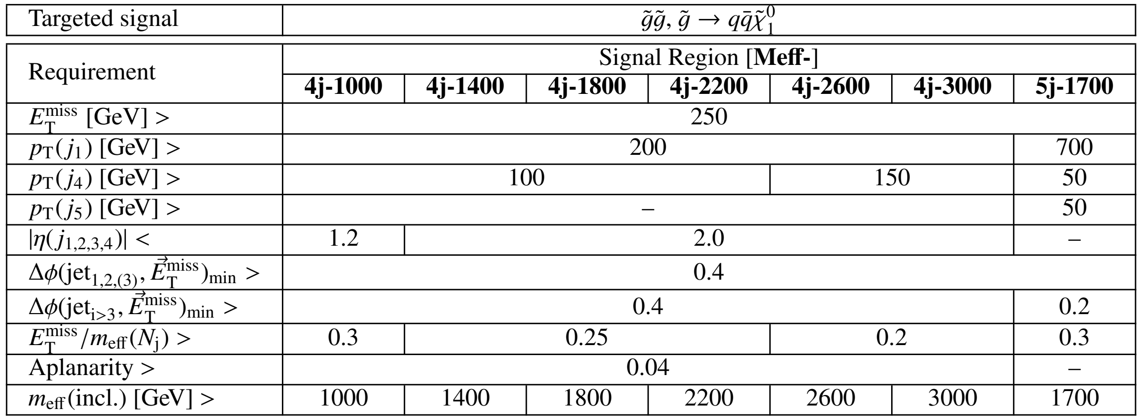
Backup

0 lepton SR

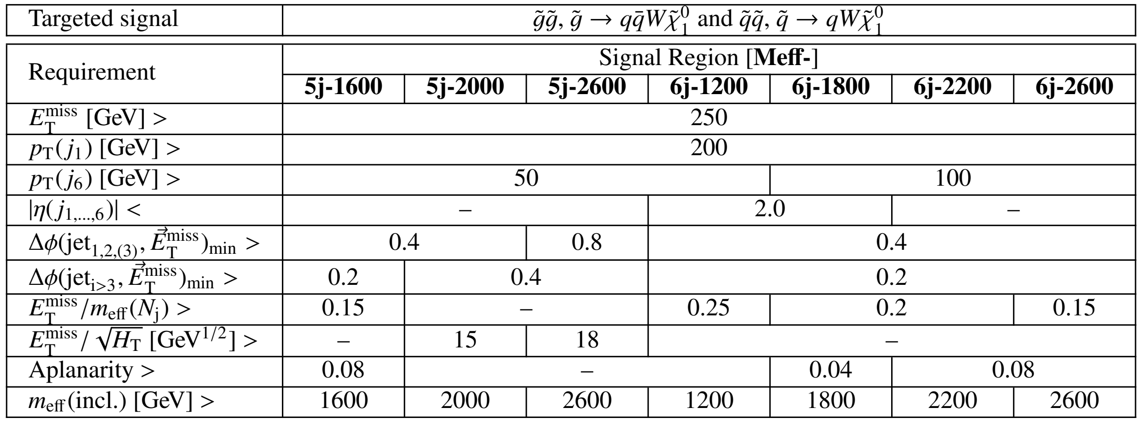
ATLAS



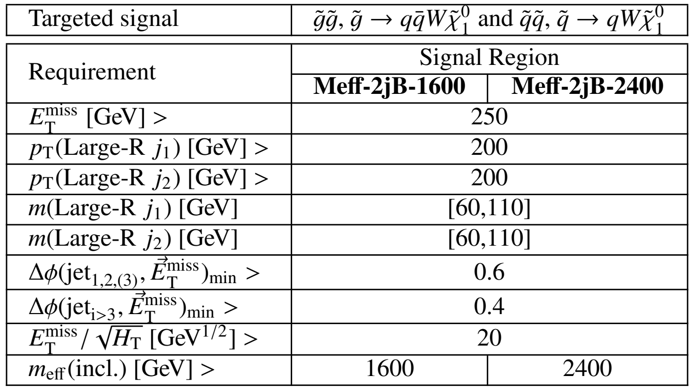
Targeted signal	$\tilde{q}\tilde{q}, \tilde{q} \to q\tilde{\chi}_1^0$							
Requirement	Signal Region [**Meff-**]							
	2j-1200	**2j-1600**	**2j-2000**	**2j-2400**	**2j-2800**	**2j-3600**	**2j-2100**	**3j-1300**
$E_{\mathrm{T}}^{\mathrm{miss}}$ [GeV] >	250							
$p_{\mathrm{T}}(j_1)$ [GeV] >	250	300	350				600	700
$p_{\mathrm{T}}(j_2)$ [GeV] >	250	300	350				50	
$p_{\mathrm{T}}(j_3)$ [GeV] >	–							50
$\lvert\eta(j_{1,2})\rvert$ <	0.8	1.2				–		
$\Delta\phi(\mathrm{jet}_{1,2,(3)}, \vec{E}_{\mathrm{T}}^{\mathrm{miss}})_{\mathrm{min}}$ >	0.8						0.4	
$\Delta\phi(\mathrm{jet}_{\mathrm{i}>3}, \vec{E}_{\mathrm{T}}^{\mathrm{miss}})_{\mathrm{min}}$ >	0.4						0.2	
$E_{\mathrm{T}}^{\mathrm{miss}}/\sqrt{H_{\mathrm{T}}}$ [GeV$^{1/2}$] >	14	18					26	16
m_{eff}(incl.) [GeV] >	1200	1600	2000	2400	2800	3600	2100	1300



Targeted signal	$\tilde{g}\tilde{g}, \tilde{g} \to q\bar{q}\tilde{\chi}_1^0$						
Requirement	Signal Region [**Meff-**]						
	4j-1000	**4j-1400**	**4j-1800**	**4j-2200**	**4j-2600**	**4j-3000**	**5j-1700**
$E_{\mathrm{T}}^{\mathrm{miss}}$ [GeV] >	250						
$p_{\mathrm{T}}(j_1)$ [GeV] >	200						700
$p_{\mathrm{T}}(j_4)$ [GeV] >	100				150		50
$p_{\mathrm{T}}(j_5)$ [GeV] >	–						50
$\lvert\eta(j_{1,2,3,4})\rvert$ <	1.2	2.0					–
$\Delta\phi(\mathrm{jet}_{1,2,(3)}, \vec{E}_{\mathrm{T}}^{\mathrm{miss}})_{\mathrm{min}}$ >	0.4						
$\Delta\phi(\mathrm{jet}_{\mathrm{i}>3}, \vec{E}_{\mathrm{T}}^{\mathrm{miss}})_{\mathrm{min}}$ >	0.4						0.2
$E_{\mathrm{T}}^{\mathrm{miss}}/m_{\mathrm{eff}}(N_{\mathrm{j}})$ >	0.3	0.25			0.2		0.3
Aplanarity >	0.04						–
m_{eff}(incl.) [GeV] >	1000	1400	1800	2200	2600	3000	1700



Targeted signal	$\tilde{g}\tilde{g}, \tilde{g} \to q\bar{q}W\tilde{\chi}_1^0$ and $\tilde{q}\tilde{q}, \tilde{q} \to qW\tilde{\chi}_1^0$						
Requirement	Signal Region [**Meff-**]						
	5j-1600	**5j-2000**	**5j-2600**	**6j-1200**	**6j-1800**	**6j-2200**	**6j-2600**
$E_{\mathrm{T}}^{\mathrm{miss}}$ [GeV] >	250						
$p_{\mathrm{T}}(j_1)$ [GeV] >	200						
$p_{\mathrm{T}}(j_6)$ [GeV] >	50				100		
$\lvert\eta(j_{1,\dots,6})\rvert$ <	–			2.0		–	
$\Delta\phi(\mathrm{jet}_{1,2,(3)}, \vec{E}_{\mathrm{T}}^{\mathrm{miss}})_{\mathrm{min}}$ >	0.4		0.8	0.4			
$\Delta\phi(\mathrm{jet}_{\mathrm{i}>3}, \vec{E}_{\mathrm{T}}^{\mathrm{miss}})_{\mathrm{min}}$ >	0.2	0.4		0.2			
$E_{\mathrm{T}}^{\mathrm{miss}}/m_{\mathrm{eff}}(N_{\mathrm{j}})$ >	0.15	–		0.25	0.2		0.15
$E_{\mathrm{T}}^{\mathrm{miss}}/\sqrt{H_{\mathrm{T}}}$ [GeV$^{1/2}$] >	–	15	18	–			
Aplanarity >	0.08	–			0.04	0.08	
m_{eff}(incl.) [GeV] >	1600	2000	2600	1200	1800	2200	2600



Targeted signal	$\tilde{g}\tilde{g}, \tilde{g} \to q\bar{q}W\tilde{\chi}_1^0$ and $\tilde{q}\tilde{q}, \tilde{q} \to qW\tilde{\chi}_1^0$	
Requirement	Signal Region	
	Meff-2jB-1600	**Meff-2jB-2400**
$E_{\mathrm{T}}^{\mathrm{miss}}$ [GeV] >	250	
p_{T}(Large-R j_1) [GeV] >	200	
p_{T}(Large-R j_2) [GeV] >	200	
m(Large-R j_1) [GeV]	[60,110]	
m(Large-R j_2) [GeV]	[60,110]	
$\Delta\phi(\mathrm{jet}_{1,2,(3)}, \vec{E}_{\mathrm{T}}^{\mathrm{miss}})_{\mathrm{min}}$ >	0.6	
$\Delta\phi(\mathrm{jet}_{\mathrm{i}>3}, \vec{E}_{\mathrm{T}}^{\mathrm{miss}})_{\mathrm{min}}$ >	0.4	
$E_{\mathrm{T}}^{\mathrm{miss}}/\sqrt{H_{\mathrm{T}}}$ [GeV$^{1/2}$] >	20	
m_{eff}(incl.) [GeV] >	1600	2400

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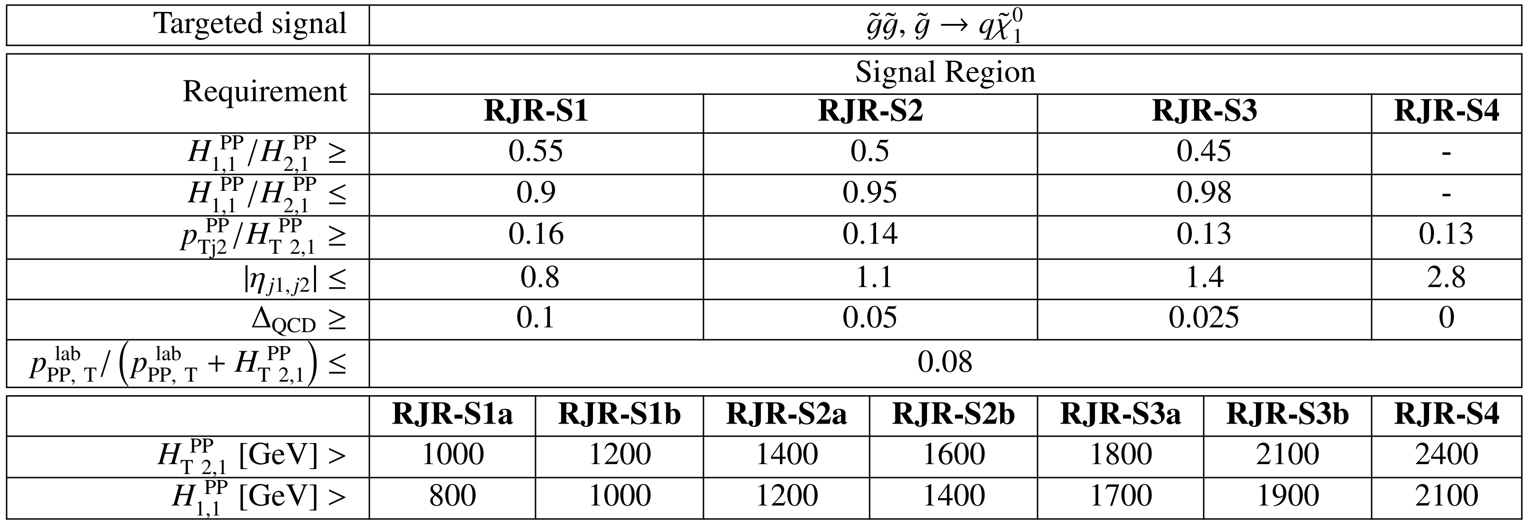
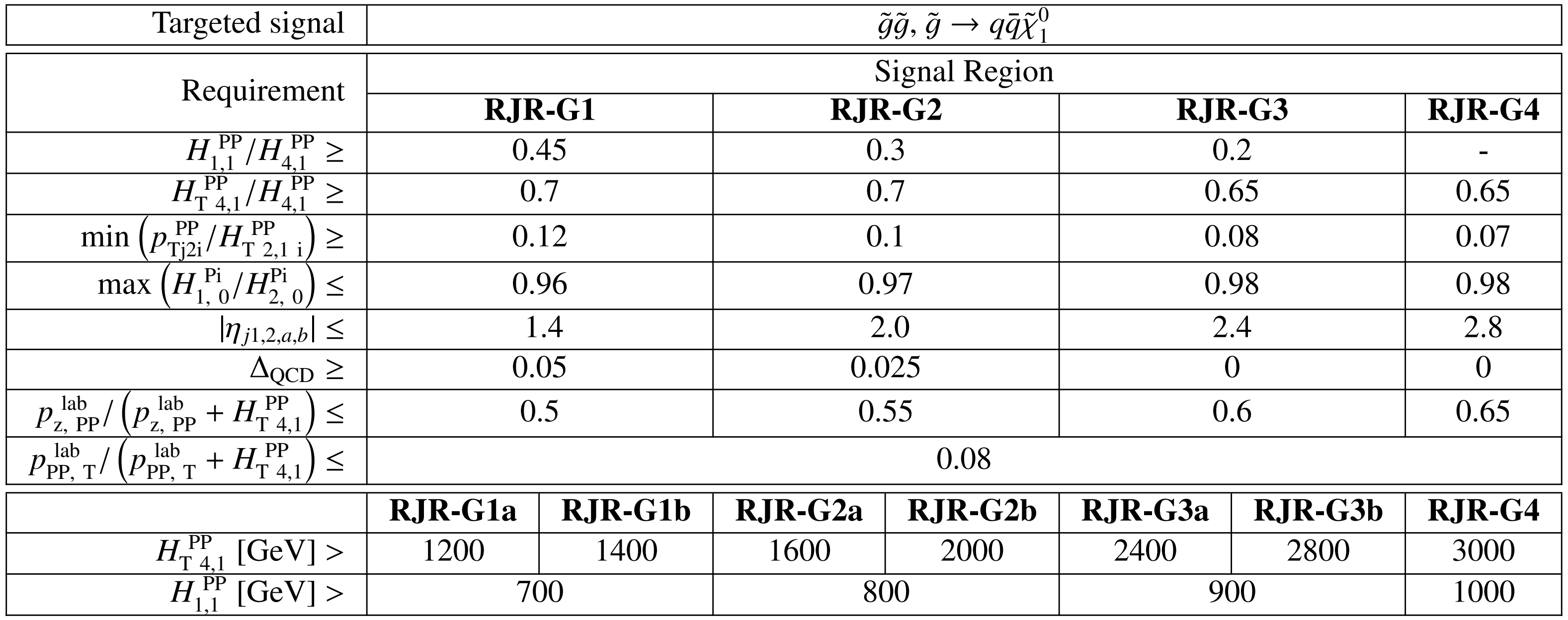
0 lepton SR

ATLAS



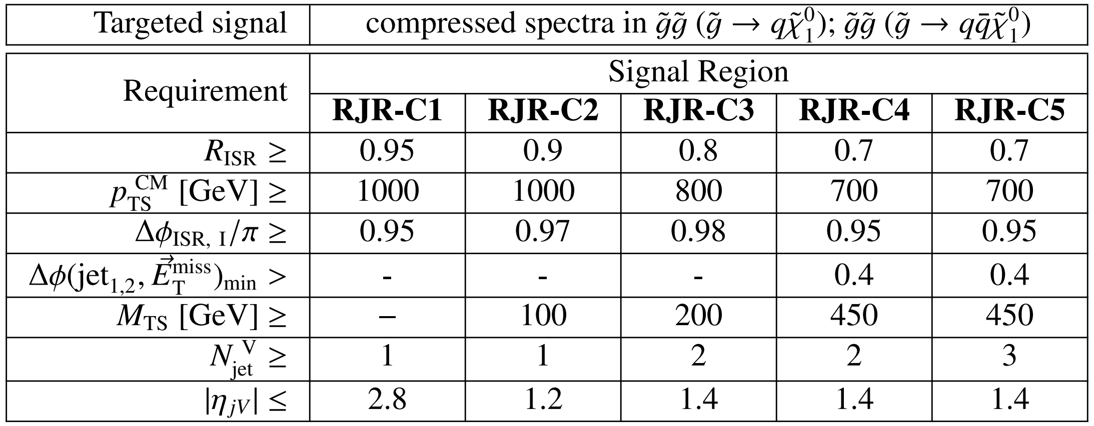
Targeted signal	$\tilde{g}\tilde{g}, \tilde{g} \rightarrow q\tilde{\chi}^0_1$			
Requirement	Signal Region			
	RJR-S1	**RJR-S2**	**RJR-S3**	**RJR-S4**
$H^{\rm PP}_{1,1}/H^{\rm PP}_{2,1} \geq$	0.55	0.5	0.45	-
$H^{\rm PP}_{1,1}/H^{\rm PP}_{2,1} \leq$	0.9	0.95	0.98	-
$p^{\rm PP}_{\rm Tj2}/H^{\rm PP}_{\rm T\ 2,1} \geq$	0.16	0.14	0.13	0.13
$\lvert\eta_{j1,j2}\rvert \leq$	0.8	1.1	1.4	2.8
$\Delta_{\rm QCD} \geq$	0.1	0.05	0.025	0
$p^{\rm lab}_{\rm PP,\ T}/\left(p^{\rm lab}_{\rm PP,\ T} + H^{\rm PP}_{\rm T\ 2,1}\right) \leq$	0.08			

	RJR-S1a	**RJR-S1b**	**RJR-S2a**	**RJR-S2b**	**RJR-S3a**	**RJR-S3b**	**RJR-S4**
$H^{\rm PP}_{\rm T\ 2,1}$ [GeV] >	1000	1200	1400	1600	1800	2100	2400
$H^{\rm PP}_{1,1}$ [GeV] >	800	1000	1200	1400	1700	1900	2100



Targeted signal	$\tilde{g}\tilde{g}, \tilde{g} \rightarrow q\bar{q}\tilde{\chi}^0_1$			
Requirement	Signal Region			
	RJR-G1	**RJR-G2**	**RJR-G3**	**RJR-G4**
$H^{\rm PP}_{1,1}/H^{\rm PP}_{4,1} \geq$	0.45	0.3	0.2	-
$H^{\rm PP}_{\rm T\ 4,1}/H^{\rm PP}_{4,1} \geq$	0.7	0.7	0.65	0.65
$\min\left(p^{\rm PP}_{\rm Tj2i}/H^{\rm PP}_{\rm T\ 2,1\ i}\right) \geq$	0.12	0.1	0.08	0.07
$\max\left(H^{\rm Pi}_{1,\ 0}/H^{\rm Pi}_{2,\ 0}\right) \leq$	0.96	0.97	0.98	0.98
$\lvert\eta_{j1,2,a,b}\rvert \leq$	1.4	2.0	2.4	2.8
$\Delta_{\rm QCD} \geq$	0.05	0.025	0	0
$p^{\rm lab}_{\rm z,\ PP}/\left(p^{\rm lab}_{\rm z,\ PP} + H^{\rm PP}_{\rm T\ 4,1}\right) \leq$	0.5	0.55	0.6	0.65
$p^{\rm lab}_{\rm PP,\ T}/\left(p^{\rm lab}_{\rm PP,\ T} + H^{\rm PP}_{\rm T\ 4,1}\right) \leq$	0.08			

	RJR-G1a	**RJR-G1b**	**RJR-G2a**	**RJR-G2b**	**RJR-G3a**	**RJR-G3b**	**RJR-G4**
$H^{\rm PP}_{\rm T\ 4,1}$ [GeV] >	1200	1400	1600	2000	2400	2800	3000
$H^{\rm PP}_{1,1}$ [GeV] >	700		800		900		1000



Targeted signal	compressed spectra in $\tilde{g}\tilde{g}$ ($\tilde{g} \rightarrow q\tilde{\chi}^0_1$); $\tilde{g}\tilde{g}$ ($\tilde{g} \rightarrow q\bar{q}\tilde{\chi}^0_1$)				
Requirement	Signal Region				
	RJR-C1	**RJR-C2**	**RJR-C3**	**RJR-C4**	**RJR-C5**
$R_{\rm ISR} \geq$	0.95	0.9	0.8	0.7	0.7
$p^{\rm CM}_{\rm TS}$ [GeV] $\geq$	1000	1000	800	700	700
$\Delta\phi_{\rm ISR,\ I}/\pi \geq$	0.95	0.97	0.98	0.95	0.95
$\Delta\phi({\rm jet}_{1,2}, \vec{E}^{\rm miss}_{\rm T})_{\rm min} >$	-	-	-	0.4	0.4
$M_{\rm TS}$ [GeV] $\geq$	–	100	200	450	450
$N^{\rm V}_{\rm jet} \geq$	1	1	2	2	3
$\lvert\eta_{jV}\rvert \leq$	2.8	1.2	1.4	1.4	1.4

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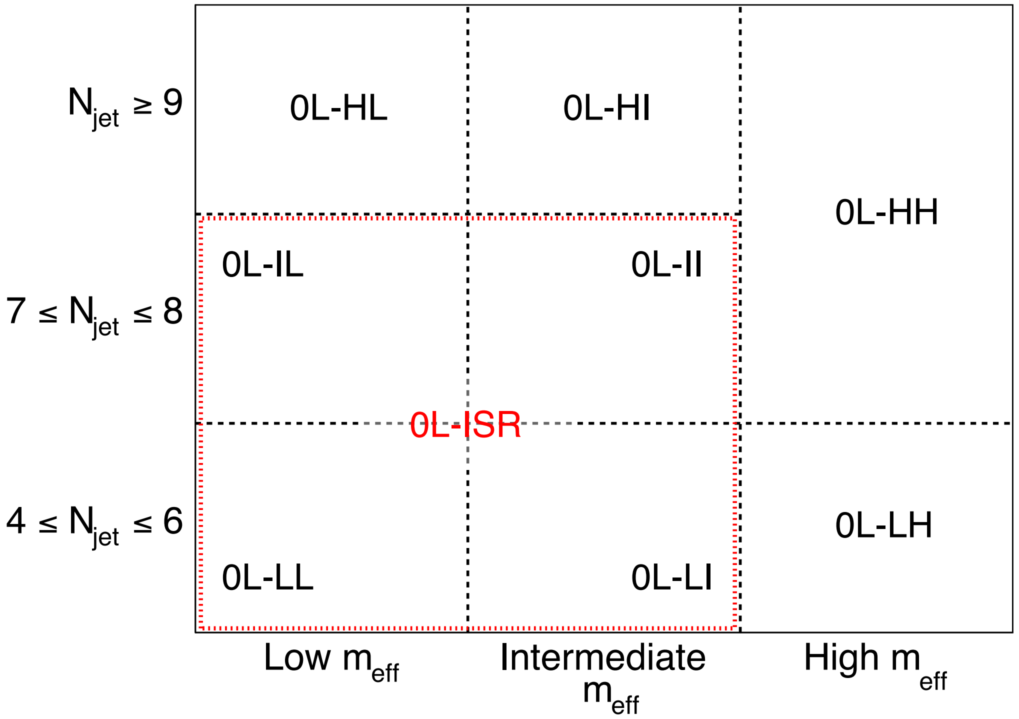
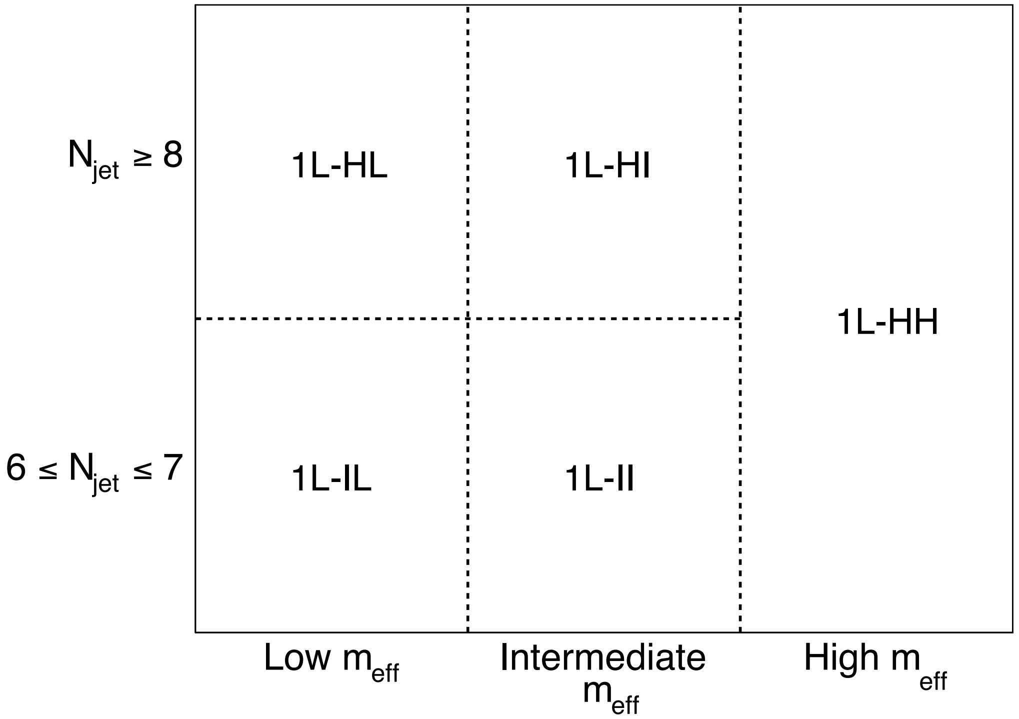
0/1 lepton + B-jets > 3 + E_T^{miss} SR





Strong production all hadronic

CMS

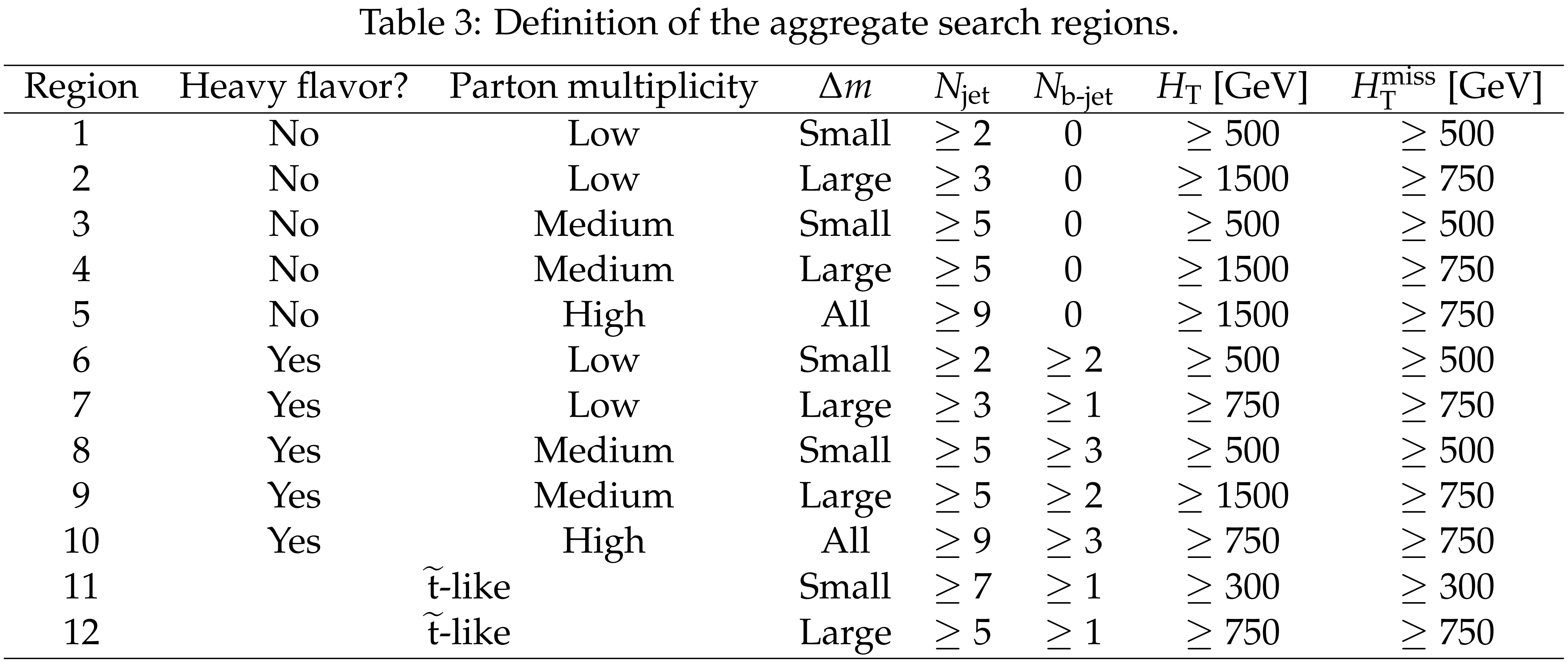
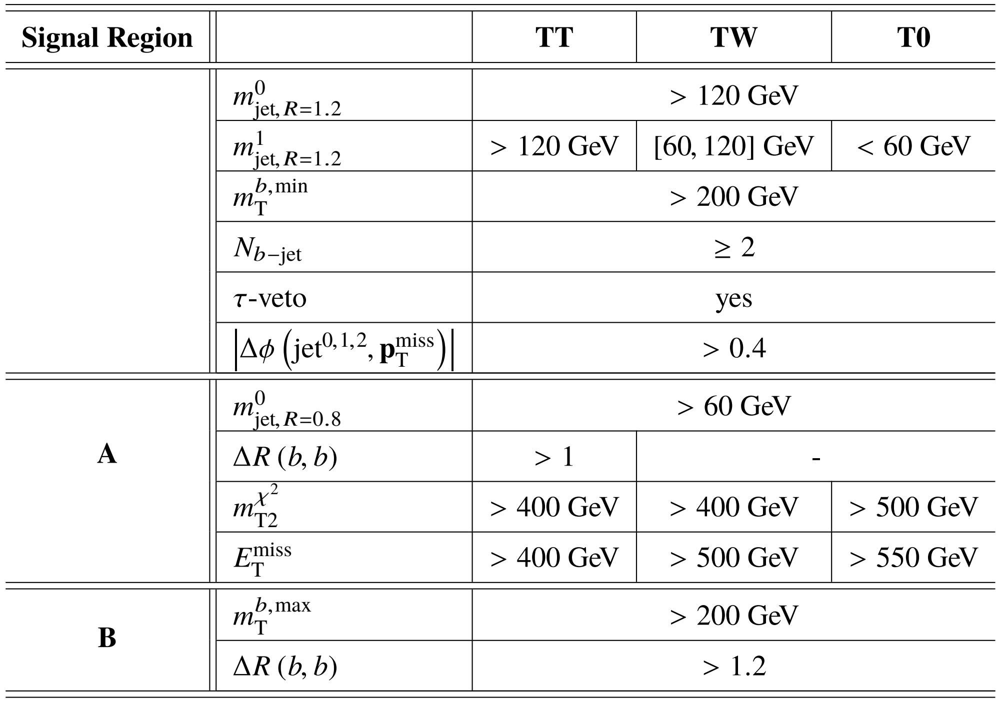


Table 3: Definition of the aggregate search regions.

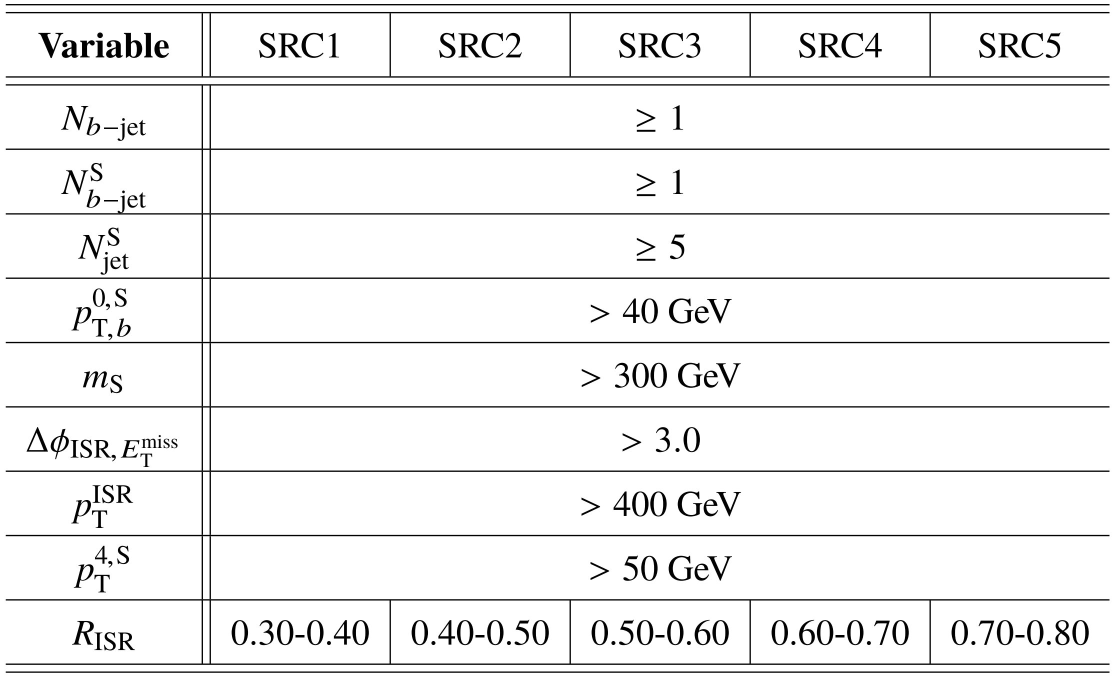
Region	Heavy flavor?	Parton multiplicity	Δm	N_{jet}	$N_{\text{b-jet}}$	H_{T} [GeV]	$H_{\text{T}}^{\text{miss}}$ [GeV]
1	No	Low	Small	≥ 2	0	≥ 500	≥ 500
2	No	Low	Large	≥ 3	0	≥ 1500	≥ 750
3	No	Medium	Small	≥ 5	0	≥ 500	≥ 500
4	No	Medium	Large	≥ 5	0	≥ 1500	≥ 750
5	No	High	All	≥ 9	0	≥ 1500	≥ 750
6	Yes	Low	Small	≥ 2	≥ 2	≥ 500	≥ 500
7	Yes	Low	Large	≥ 3	≥ 1	≥ 750	≥ 750
8	Yes	Medium	Small	≥ 5	≥ 3	≥ 500	≥ 500
9	Yes	Medium	Large	≥ 5	≥ 2	≥ 1500	≥ 750
10	Yes	High	All	≥ 9	≥ 3	≥ 750	≥ 750
11	$\tilde{t}$-like		Small	≥ 7	≥ 1	≥ 300	≥ 300
12	$\tilde{t}$-like		Large	≥ 5	≥ 1	≥ 750	≥ 750

ATLAS

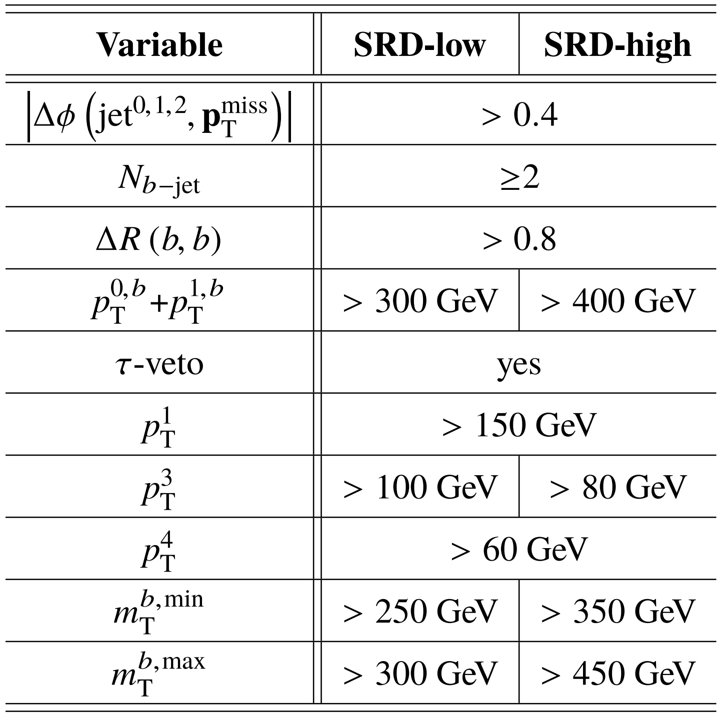
stop all hadronic



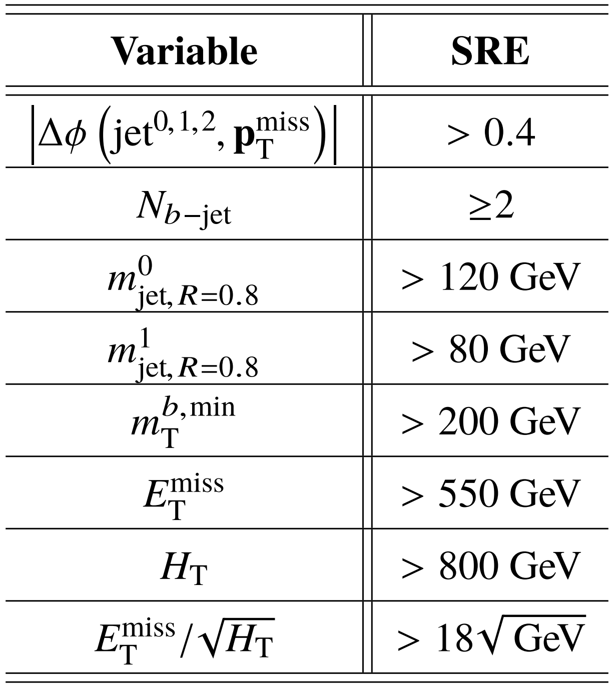
Signal Region		TT	TW	T0
	$m^{0}_{\text{jet},R=1.2}$	> 120 GeV		
	$m^{1}_{\text{jet},R=1.2}$	> 120 GeV	[60, 120] GeV	< 60 GeV
	$m_{\text{T}}^{b,\text{min}}$	> 200 GeV		
	$N_{b-\text{jet}}$	≥ 2		
	τ-veto	yes		
	$\left\|\Delta\phi\left(\text{jet}^{0,1,2}, \mathbf{p}_{\text{T}}^{\text{miss}}\right)\right\|$	> 0.4		
A	$m^{0}_{\text{jet},R=0.8}$	> 60 GeV		
	$\Delta R\,(b,b)$	> 1	-	
	$m_{\text{T2}}^{\chi^2}$	> 400 GeV	> 400 GeV	> 500 GeV
	$E_{\text{T}}^{\text{miss}}$	> 400 GeV	> 500 GeV	> 550 GeV
B	$m_{\text{T}}^{b,\text{max}}$	> 200 GeV		
	$\Delta R\,(b,b)$	> 1.2		



Variable	SRC1	SRC2	SRC3	SRC4	SRC5
$N_{b-\text{jet}}$	≥ 1				
$N^{\text{S}}_{b-\text{jet}}$	≥ 1				
$N^{\text{S}}_{\text{jet}}$	≥ 5				
$p^{0,\text{S}}_{\text{T},b}$	> 40 GeV				
m_{S}	> 300 GeV				
$\Delta\phi_{\text{ISR},E_{\text{T}}^{\text{miss}}}$	> 3.0				
$p_{\text{T}}^{\text{ISR}}$	> 400 GeV				
$p_{\text{T}}^{4,\text{S}}$	> 50 GeV				
R_{ISR}	0.30-0.40	0.40-0.50	0.50-0.60	0.60-0.70	0.70-0.80



Variable	**SRD-low**	**SRD-high**
$\left\|\Delta\phi\left(\text{jet}^{0,1,2}, \mathbf{p}_{\text{T}}^{\text{miss}}\right)\right\|$	> 0.4	
$N_{b-\text{jet}}$	≥ 2	
$\Delta R\,(b,b)$	> 0.8	
$p_{\text{T}}^{0,b}+p_{\text{T}}^{1,b}$	> 300 GeV	> 400 GeV
τ-veto	yes	
p_{T}^{1}	> 150 GeV	
p_{T}^{3}	> 100 GeV	> 80 GeV
p_{T}^{4}	> 60 GeV	
$m_{\text{T}}^{b,\text{min}}$	> 250 GeV	> 350 GeV
$m_{\text{T}}^{b,\text{max}}$	> 300 GeV	> 450 GeV



Variable	**SRE**
$\left\|\Delta\phi\left(\text{jet}^{0,1,2}, \mathbf{p}_{\text{T}}^{\text{miss}}\right)\right\|$	> 0.4
$N_{b-\text{jet}}$	≥ 2
$m^{0}_{\text{jet},R=0.8}$	> 120 GeV
$m^{1}_{\text{jet},R=0.8}$	> 80 GeV
$m_{\text{T}}^{b,\text{min}}$	> 200 GeV
$E_{\text{T}}^{\text{miss}}$	> 550 GeV
H_{T}	> 800 GeV
$E_{\text{T}}^{\text{miss}}/\sqrt{H_{\text{T}}}$	$> 18\sqrt{\text{GeV}}$

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Stop → Z, Higgs

CMS

N_{jets}	$N_{\text{b jets}}$	H_{T} (GeV)	$50(70)\,\text{GeV} \leq E_{\text{T}}^{\text{miss}} < 150\,\text{GeV}$	$150\,\text{GeV} \leq E_{\text{T}}^{\text{miss}} < 300\,\text{GeV}$	$E_{\text{T}}^{\text{miss}} \geq 300\,\text{GeV}$
≥ 2	0	$60 - 400$	SR1 †	SR2 †	SR16 †
		$400 - 600$	SR3 †	SR4 †	
	1	$60 - 400$	SR5	SR6	
		$400 - 600$	SR7	SR8	
	2	$60 - 400$	SR9	SR10	
		$400 - 600$	SR11	SR12	
	≥ 3	$60 - 600$	SR13		
	inclusive	≥ 600	SR14 †	SR15 †	

$M_{\text{T}}^{\text{min}} \geq 120\,\text{GeV}$	on-Z	$N_{\text{b jets}} \leq 2$		$N_{\text{b jets}} \geq 3$	
		$H_{\text{T}} \geq 200\,\text{GeV}$	$E_{\text{T}}^{\text{miss}} \geq 250\,\text{GeV}$	$H_{\text{T}} \geq 60\,\text{GeV}$	$E_{\text{T}}^{\text{miss}} \geq 50\,\text{GeV}$
	No	SSR1		SSR2	
	Yes	SSR3		SSR4	

ATLAS Stop → Z, Higgs

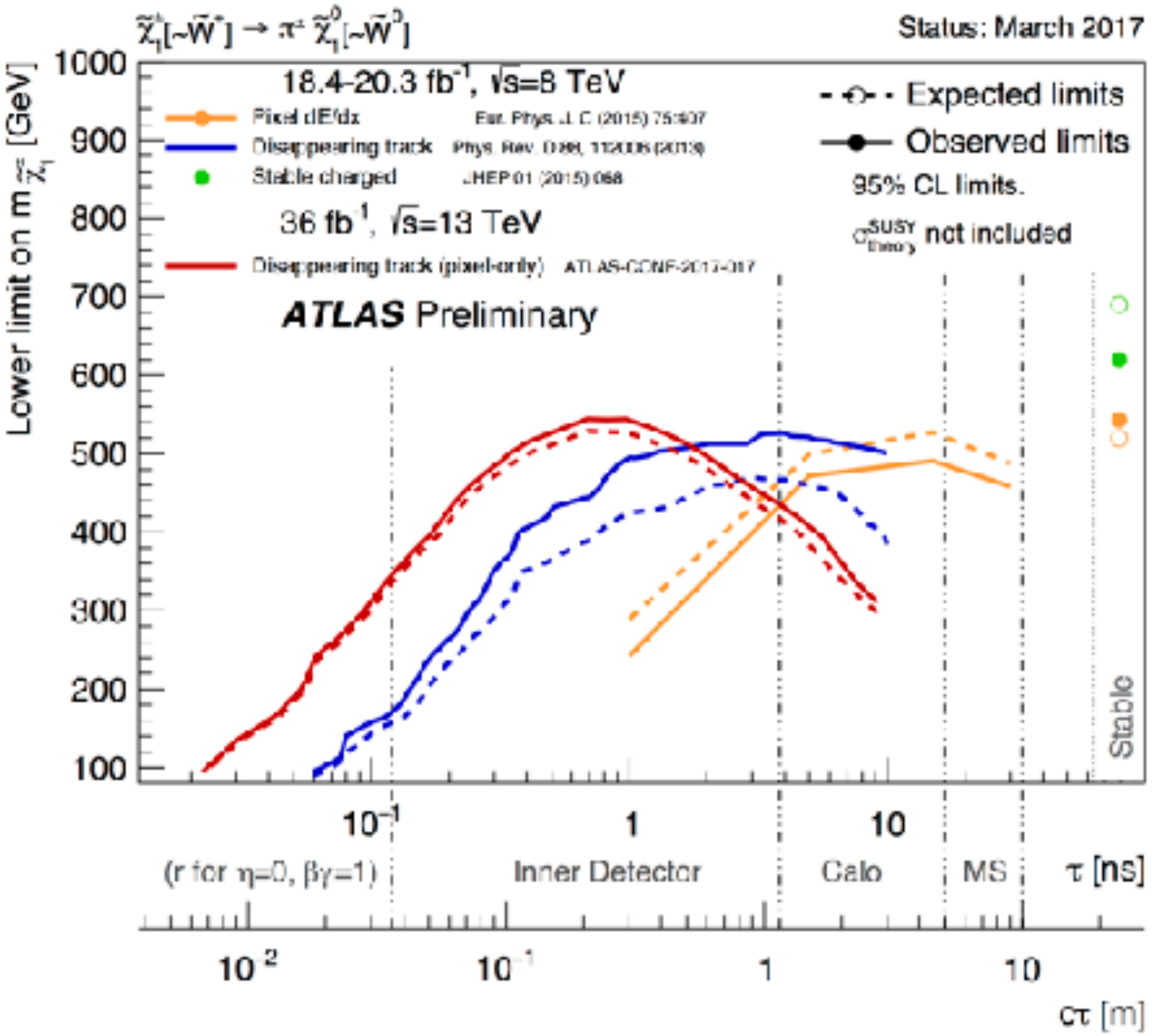
Requirement / Region	$\mathrm{SR}^{3\ell 1b}_{\mathrm{A}}$	$\mathrm{SR}^{3\ell 1b}_{\mathrm{B}}$	$\mathrm{SR}^{3\ell 1b}_{\mathrm{C}}$
Number of leptons	≥ 3	≥ 3	≥ 3
$n_{b-\text{tagged jets}}$	≥ 1	≥ 1	≥ 1
$\lvert m_{\ell\ell} - m_Z \rvert$ [GeV]	< 15	< 15	< 15
Leading lepton p_{T} [GeV]	> 40	> 40	> 40
Leading jet p_{T} [GeV]	> 250	> 80	> 60
Leading b-tagged jet p_{T} [GeV]	> 40	> 40	> 30
n_{jets} ($p_{\mathrm{T}} > 30$ GeV)	≥ 6	≥ 6	≥ 5
$E_{\mathrm{T}}^{\text{miss}}$ [GeV]	> 100	> 180	> 140
$p_{\mathrm{T}}^{\ell\ell}$ [GeV]	> 150	–	< 80

Requirement / Region	$\mathrm{SR}^{1\ell 4b}_{\mathrm{A}}$	$\mathrm{SR}^{1\ell 4b}_{\mathrm{B}}$	$\mathrm{SR}^{1\ell 4b}_{\mathrm{C}}$
Number of leptons	1–2	1–2	1–2
$n_{b-\text{tagged jets}}$	≥ 4	≥ 4	≥ 4
m_{T} [GeV]	–	>150	>125
H_{T} [GeV]	> 1000	–	–
$E_{\mathrm{T}}^{\text{miss}}$ [GeV]	> 120	> 150	> 150
Leading b-tagged jet p_{T} [GeV]	–	–	<140
m_{bb}[GeV]	95–155	–	–
p_{T}^{bb}[GeV]	> 300	–	–
n_{jets} ($p_{\mathrm{T}} >60$ GeV)	≥ 6	≥ 5	–
n_{jets} ($p_{\mathrm{T}} >30$ GeV)	–	–	≥ 7

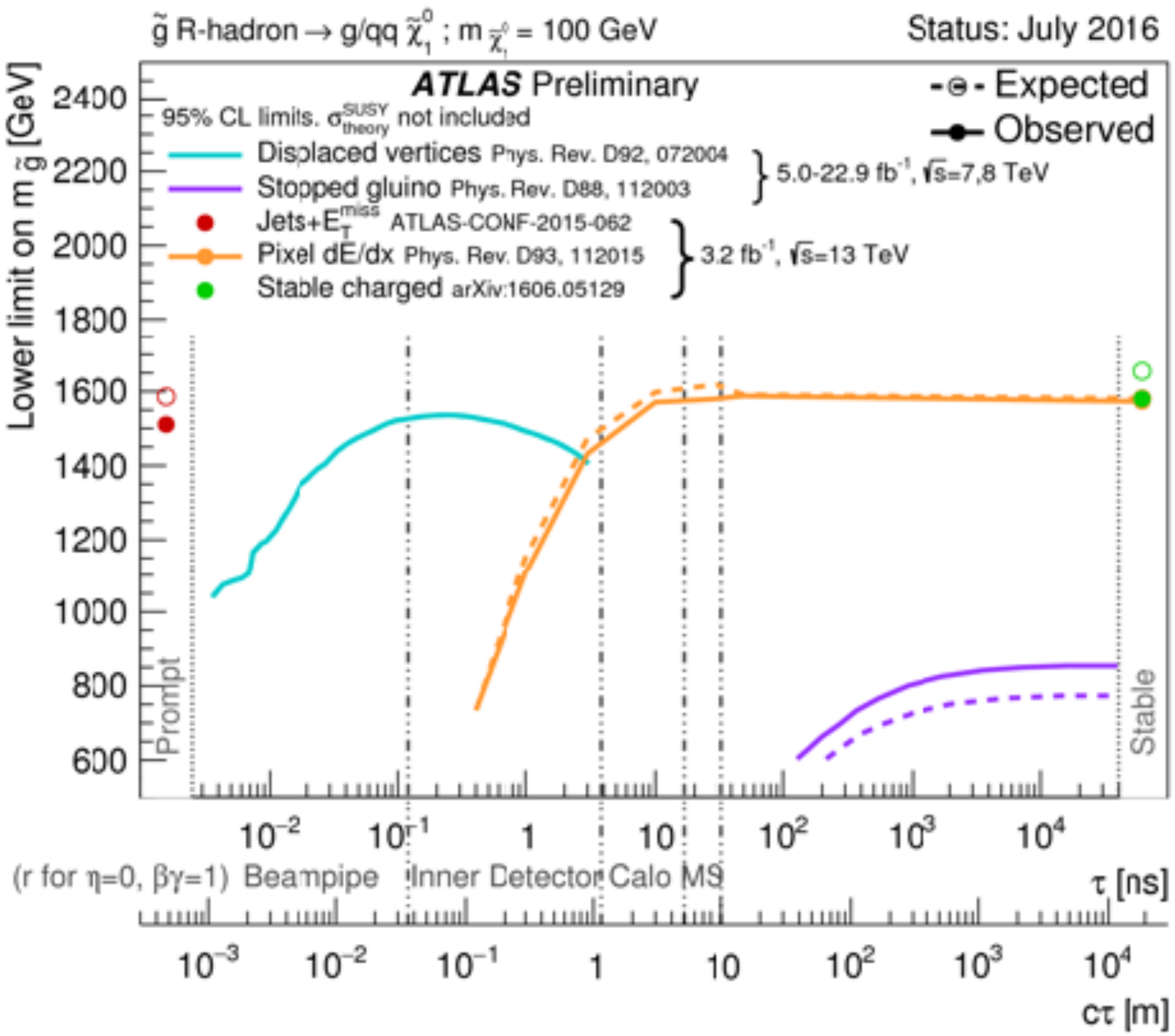
Long-livedまとめ

ATLAS

チャージーノ質量への制限



グルイーノ質量への制限



最新のDVの結果はまだ入っていない

R.Sawada