

Searches for supersymmetric dark matter candidates and long-lived particles with the ATLAS experiment

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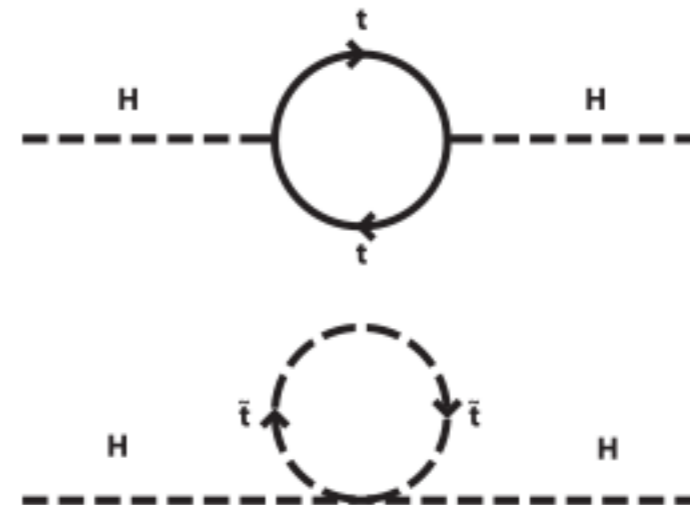
on Behalf of the ATLAS Collaboration

Supersymmetry as SM extension

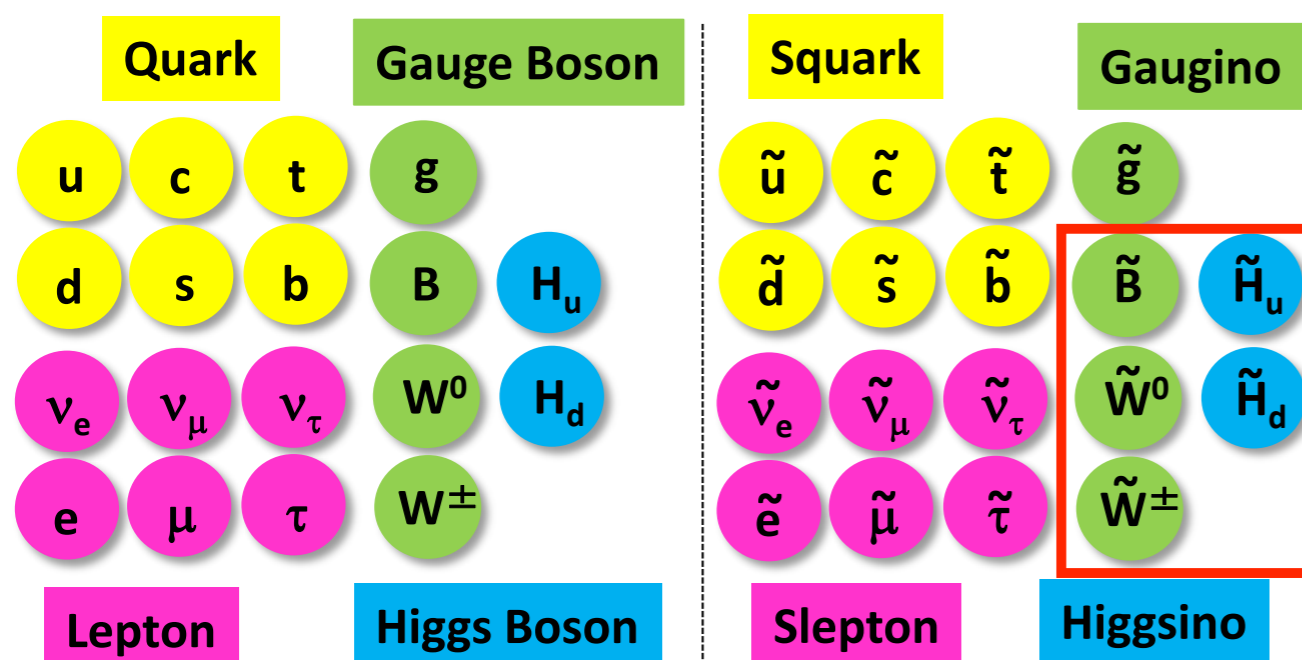
Possible SM extension based on a *broken Symmetry* between bosons and fermions: each SM particle has a supersymmetric partner differing by 1/2 spin

Could provide explanations to:

- Naturalness
- Gauge coupling unification
- Dark matter



Simplified models (reducing the number of free parameters) are studied at LHC

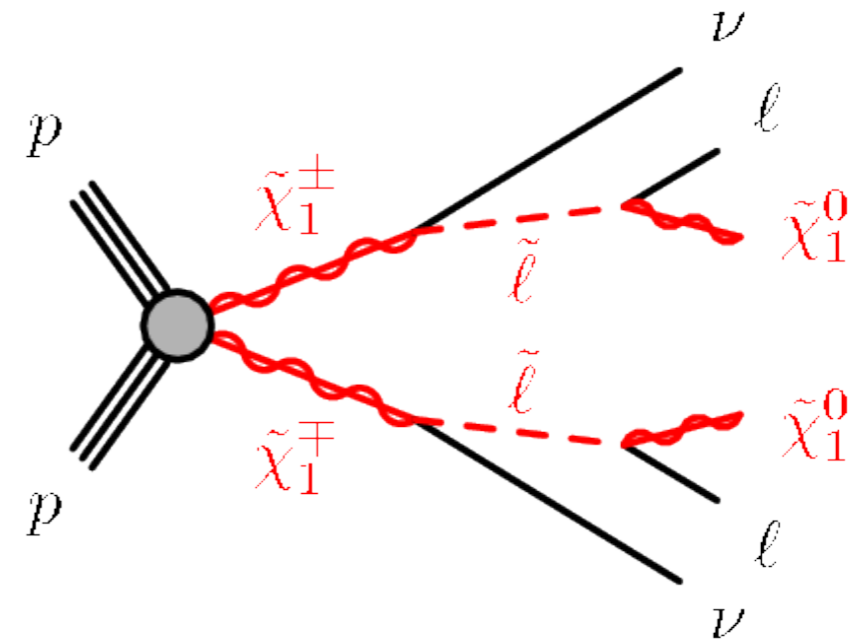


- 2 complex SM Higgs doublets are needed
- R-Parity conserved: sparticles cannot decay only into particles \rightarrow **LSP**
- Sparticle masses not fully defined by the theory
- Higgsinos and Gauginos define mass eigenstate $\tilde{\chi}_{1,2}^\pm$ and $\tilde{\chi}_{1,2,3,4}^0$

Looking for SUSY at ATLAS

Analyses are optimised for dedicated signal models based on assumptions:

- R-Parity conserved or violated
- Defined mass spectrum
- Restricting free parameters
- Specific final state



SM Background processes

MC normalized in background process enriched region

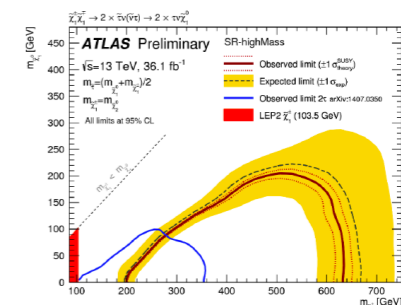
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Pure MC estimation of non dominant background processes

Search optimisation

Based on cut and count regions, shape fit..

if nothing found...



Looking for SUSY at ATLAS: latest results

Strong production (Inclusive searches):

- 0L 2-6Jets** ATLAS-CONF-2017-022
- 0L 7-11 Jets** ATLAS-CONF-2017-033
- multi b-jets** ATLAS-CONF-2017-021
- SS/3L + jets** arXiv:1706.03731

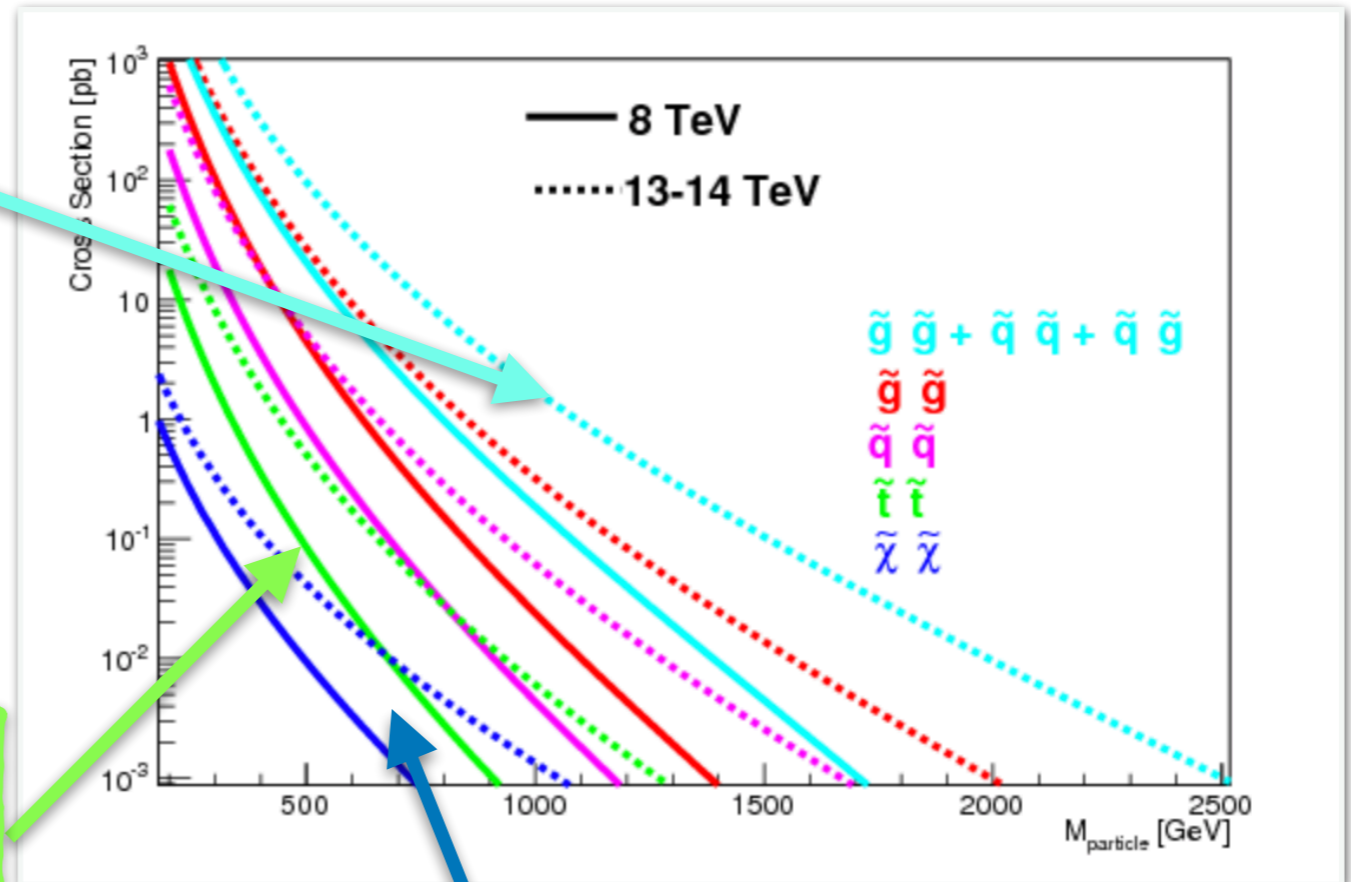
3rd Generation

- stop 0L** ATLAS-CONF-2017-020
- stop 1L** with DM+HF ATLAS-CONF-2017-037
- Stop 2L** ATLAS-CONF-2017-034
- 2b+MET** ATLAS-CONF-2017-038
- Stop in Z/h** arXiv:1706.03986

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Many R-Parity violating analyses

<https://twiki.cern.ch/twiki/bin/view/LHCPhysics/SUSYCrossSections>



EWK production

- EWK 2/3L** ATLAS-CONF-2017-039
- EWK di-tau** ATLAS-CONF-2017-035

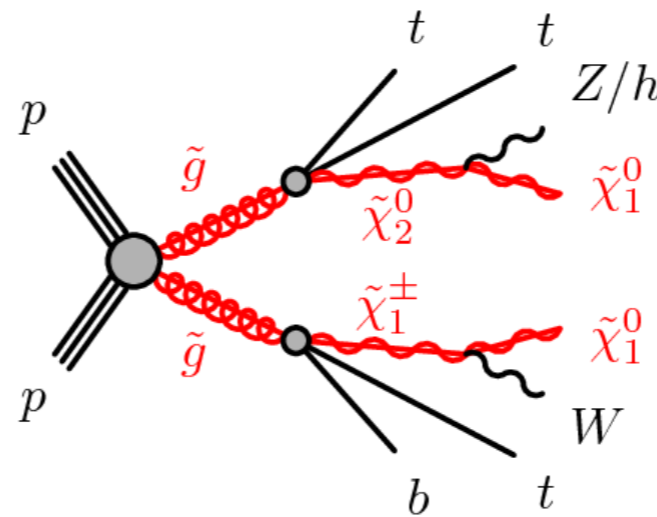
Inclusive search: multijets analysis

Target:

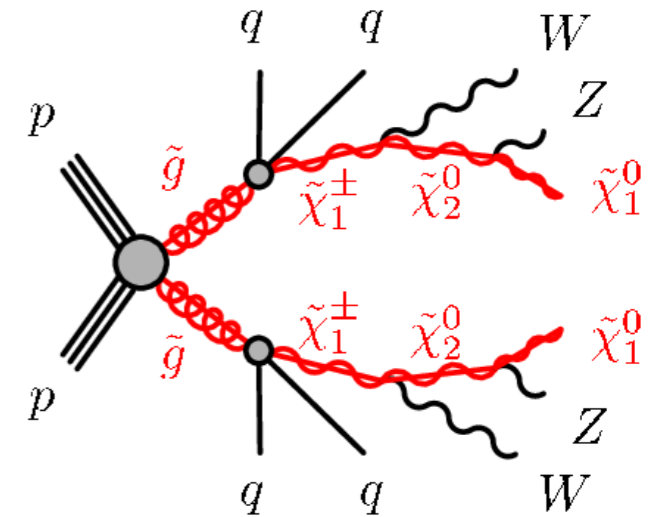
High multiplicity jet events originating from gluinos decay

Main discriminating variables:

- Missing transverse energy
- Jet and b-tagged jet multiplicity
- Scalar sum of jet momenta
- Mass of "fat" jets



2 step decay

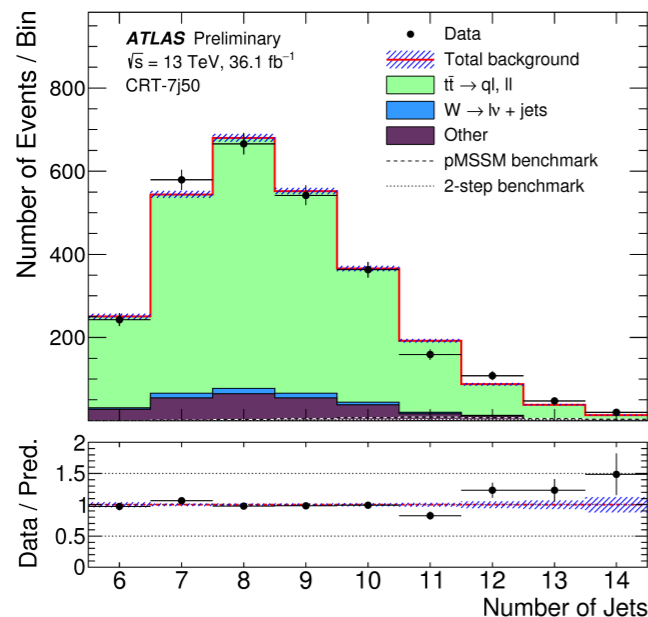


pMSSM

Background estimates

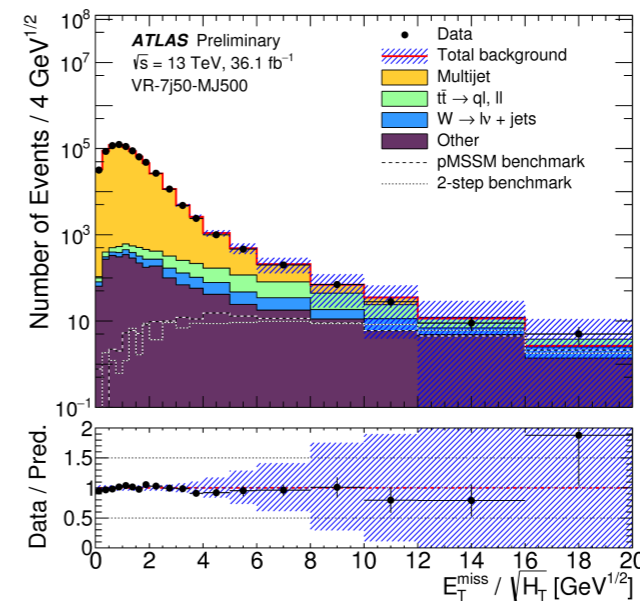
W+jets/ttbar enriched 1 lepton CR

1 lepton, same SR selection lower jet multiplicity



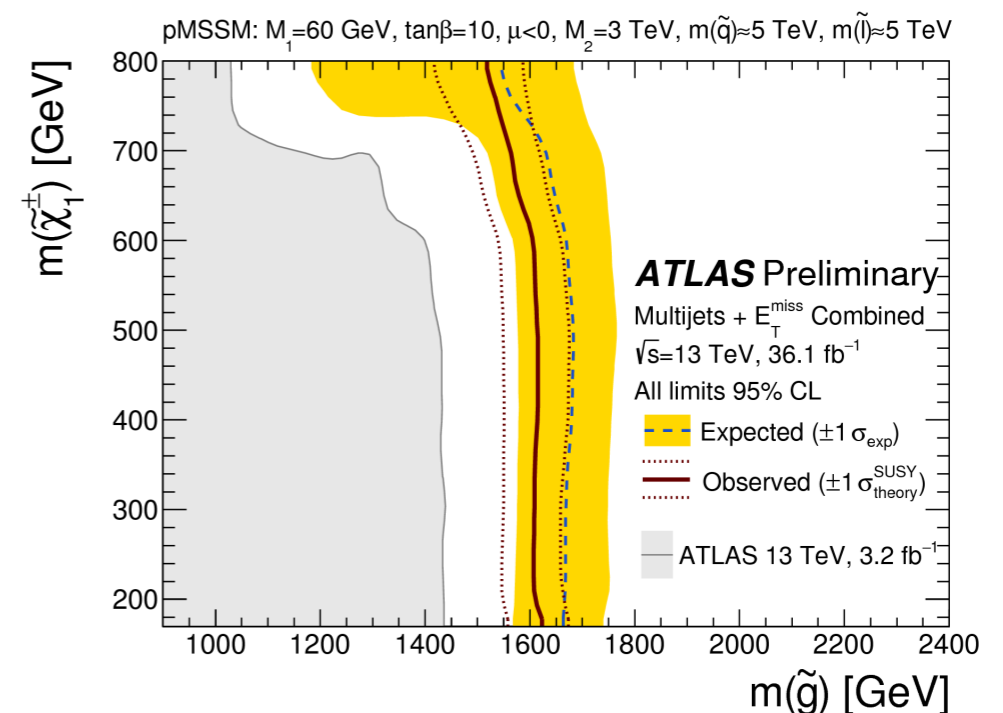
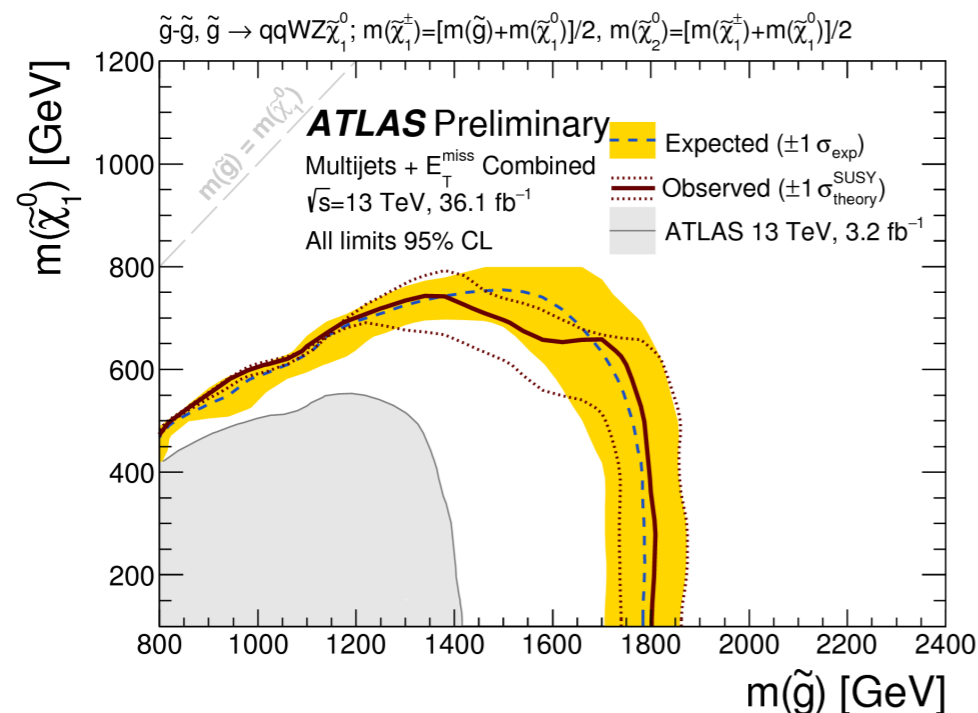
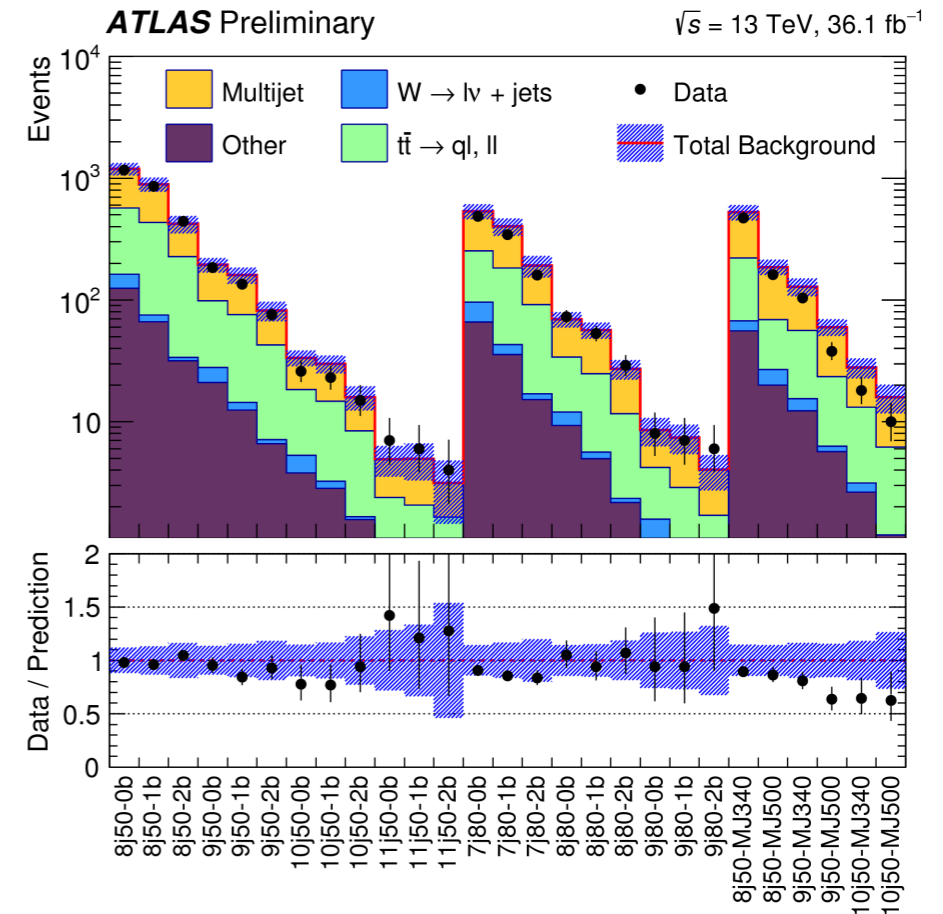
QCD Multijet background

Template based on MET/√HT at lower jet multiplicity



Inclusive search: multijets analysis

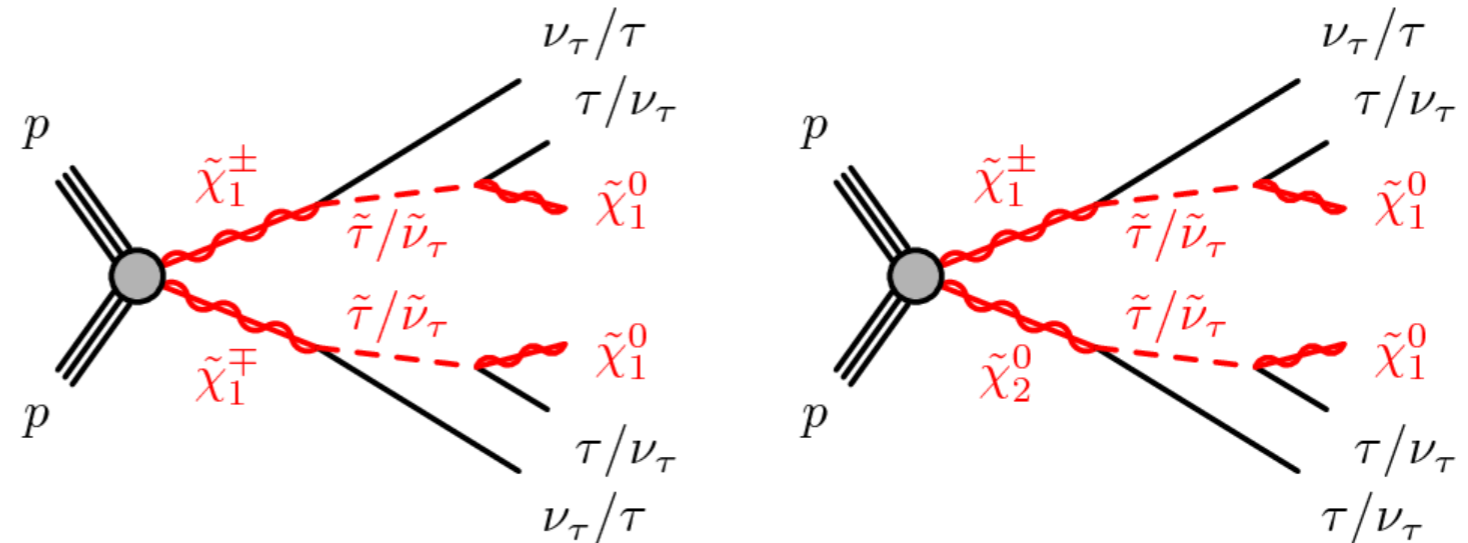
- 27 SRs based on jet/b-jet multiplicity and sum of reclustered jet masses
- No significant excess found
- Limits on gluino masses obtained:
 - In two steps decay gluino is excluded up to 1.8 TeV for light LSP
 - In pMSSM for chargino mass below 600 GeV gluino excluded up to 1.6 TeV



Electroweak production: 2 τ final state

Target:

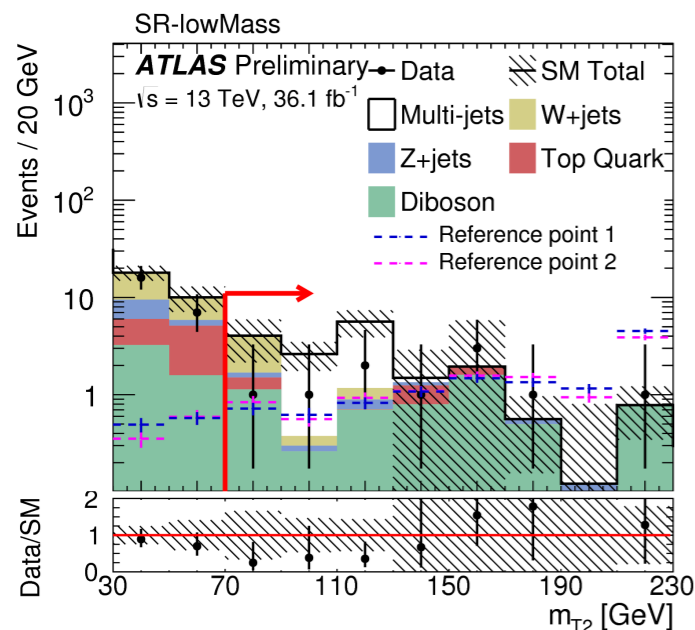
Neutralino/Chargino production having tau leptons in final state



Models with stau can lead to dark matter relic density compatible with observation

Main discriminating variables:

- Missing transverse energy
- Stranverse mass (m_{T2})



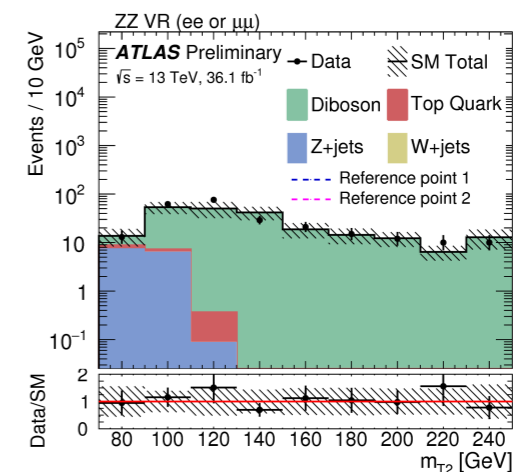
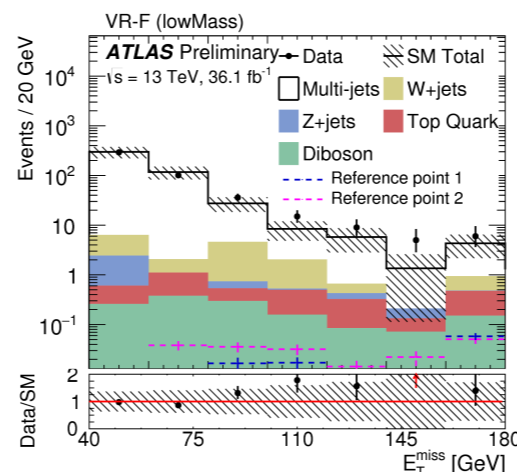
Background estimates

Multijets (mis. taus): Estimated from data

W+jets (mis. taus): Estimated from MC and data

Irreducible background (ttbar, single top, WW, ZZ): Estimated from MC

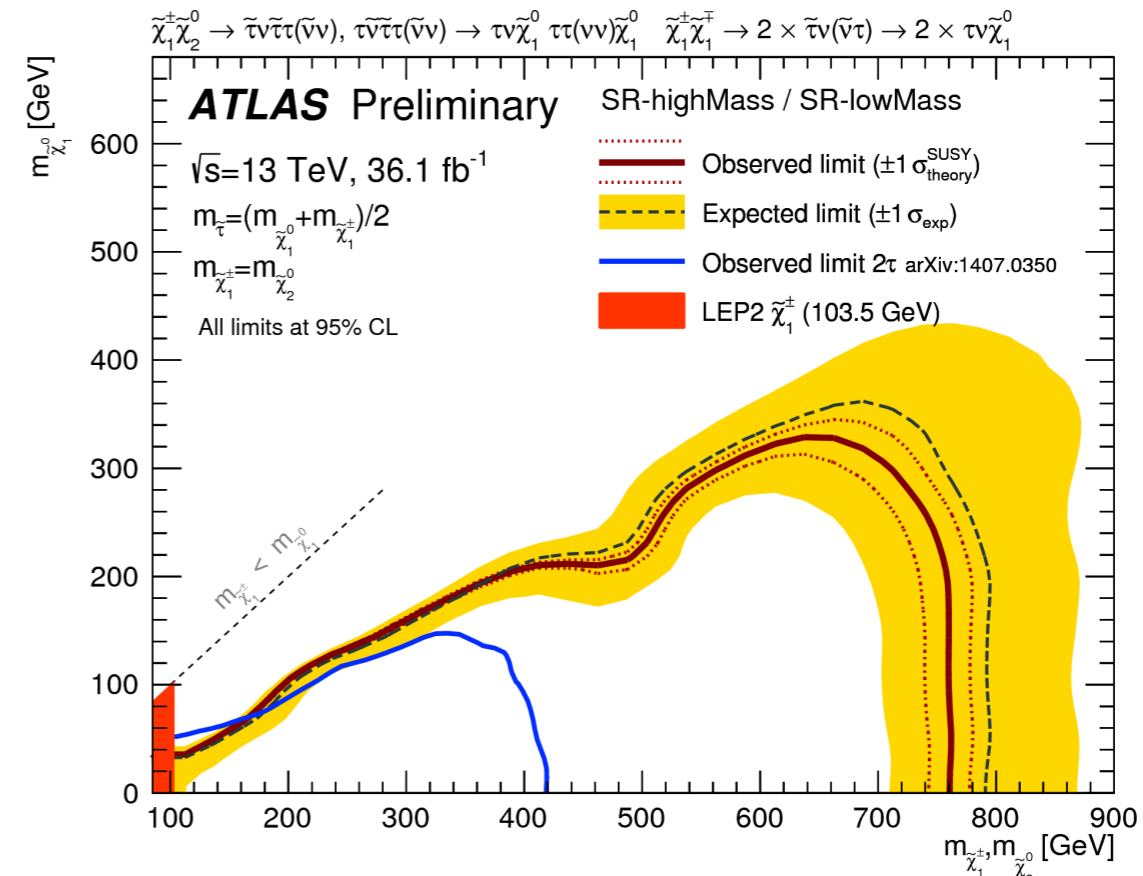
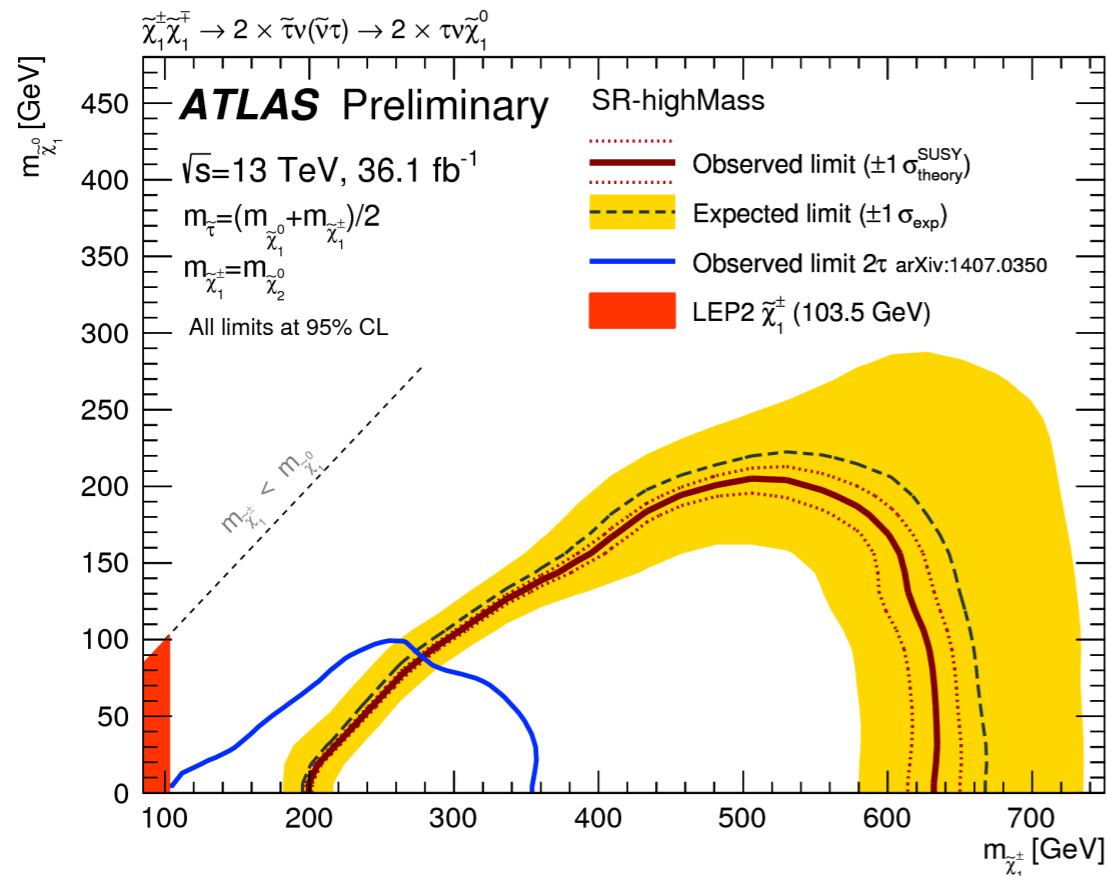
VRs are defined to validate each background estimation:



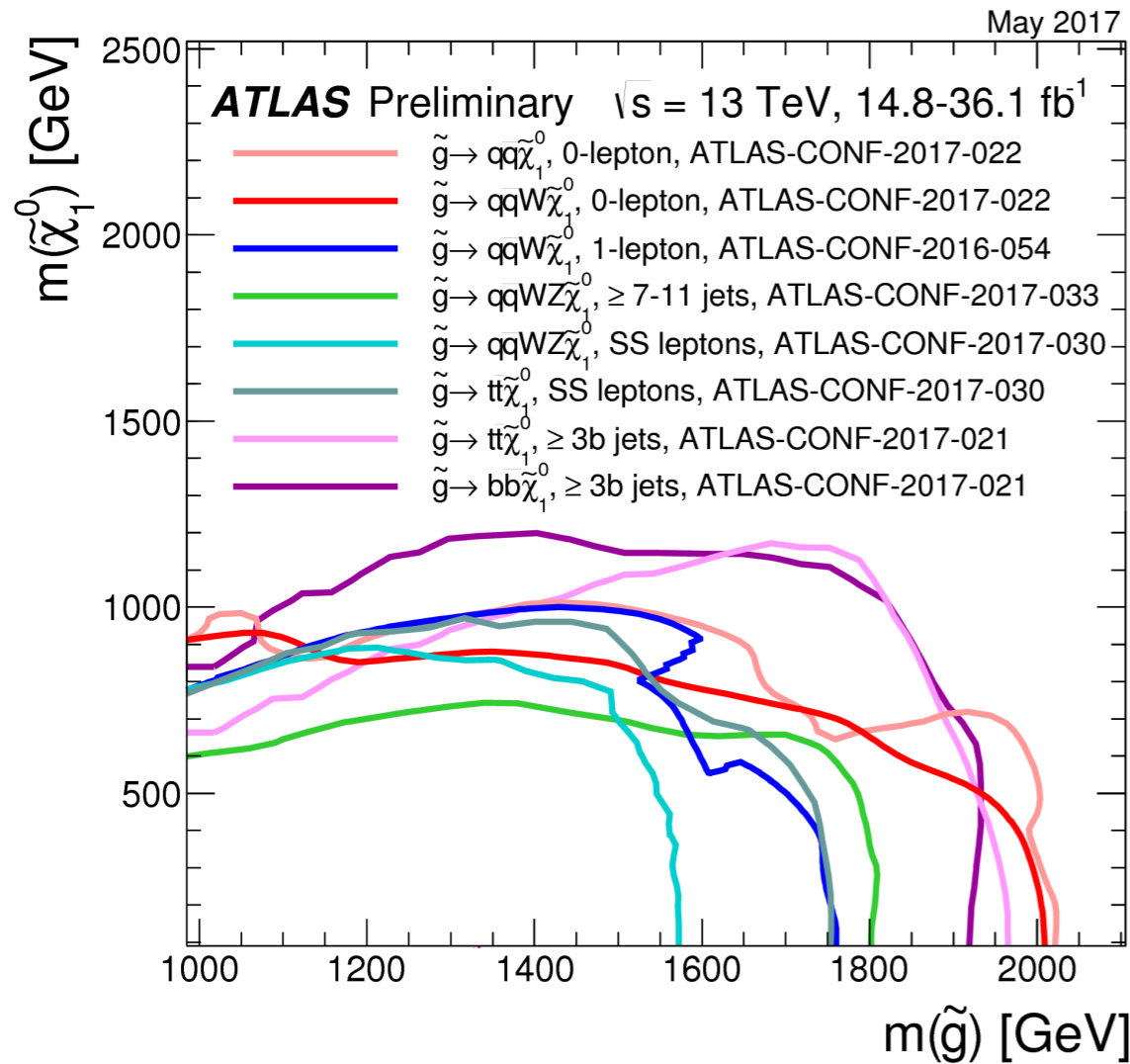
Electroweak production: 2 τ final state

- **2 Signal regions defined** targeting signal model with mass difference between chargino and neutralino smaller or larger than 200 GeV
- No significant excess found
- Chargino/next-to-lightest Neutralino masses up to 630 GeV and 760 are excluded for massless neutralino in the two scenarios

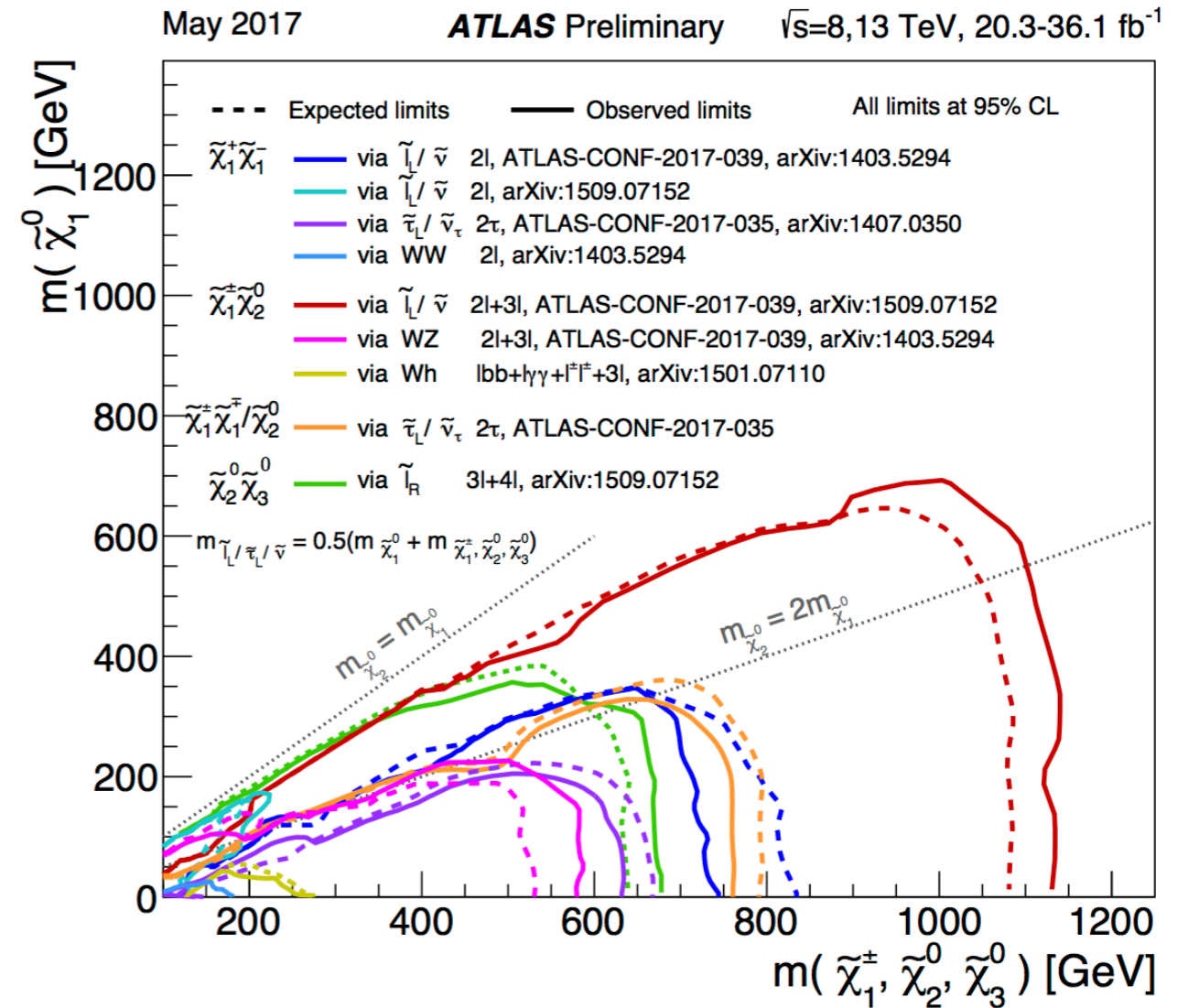
SM process	SR-lowMass	SR-highMass
diboson	5.9 ± 2.2	1.0 ± 0.8
W +jets	1.8 ± 1.1	0.7 ± 0.5
Top quark	1.2 ± 1.0	$0.03^{+0.26}_{-0.03}$
Z +jets	$0.6^{+0.7}_{-0.6}$	0.6 ± 0.5
multi-jet	4.3 ± 4.0	1.3 ± 1.1
SM total	14 ± 6	3.7 ± 1.4
Observed	10	5
Reference point 1	11.6 ± 2.6	11.8 ± 2.8
Reference point 2	10.0 ± 2.1	11.4 ± 2.6
p_0	0.5	0.3
Expected σ_{vis}^{95} [fb]	$0.31^{+0.12}_{-0.08}$	$0.17^{+0.08}_{-0.05}$
Observed σ_{vis}^{95} [fb]	0.26	0.20



Summary of strong and electroweak production



Strong



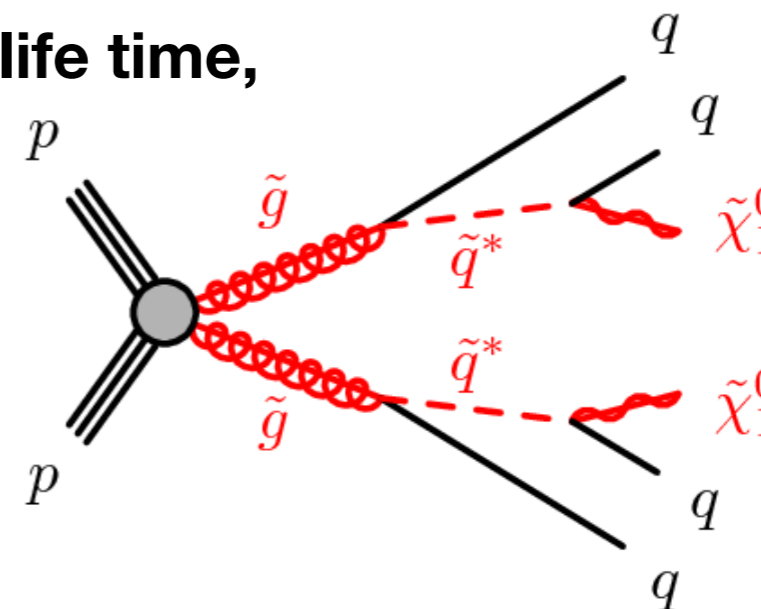
Electroweak

Search for long lived particles: displaced vertices

Several SUSY models foresee sparticles having long life time, leading to **displaced vertices**

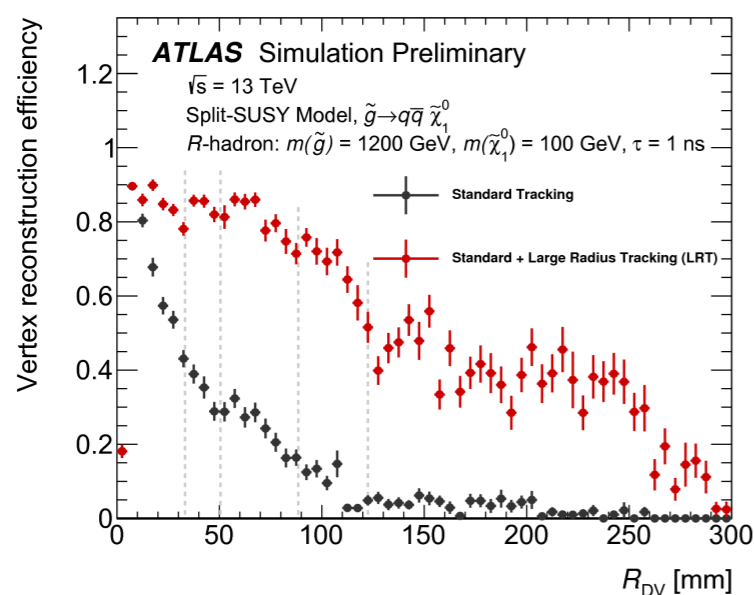
Target:

Glino production decaying into virtual heavy squark (suppressed decay)



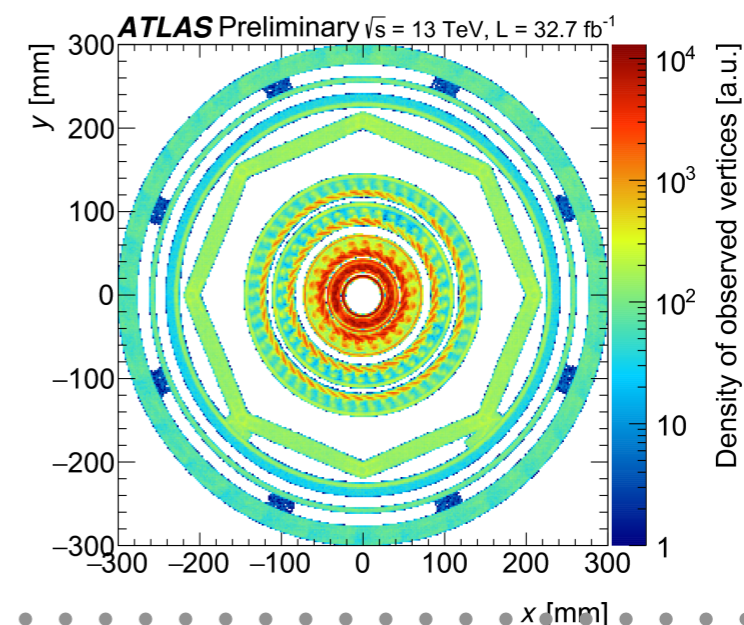
Analysis strategy:

- Reconstruction of displaced vertices, accepting tracks up to $|d_0| < 300$ mm and $|z_0| < 1500$ mm.
- Minimum invariant mass of selected vertices and missing transverse energy are also required.



Background:

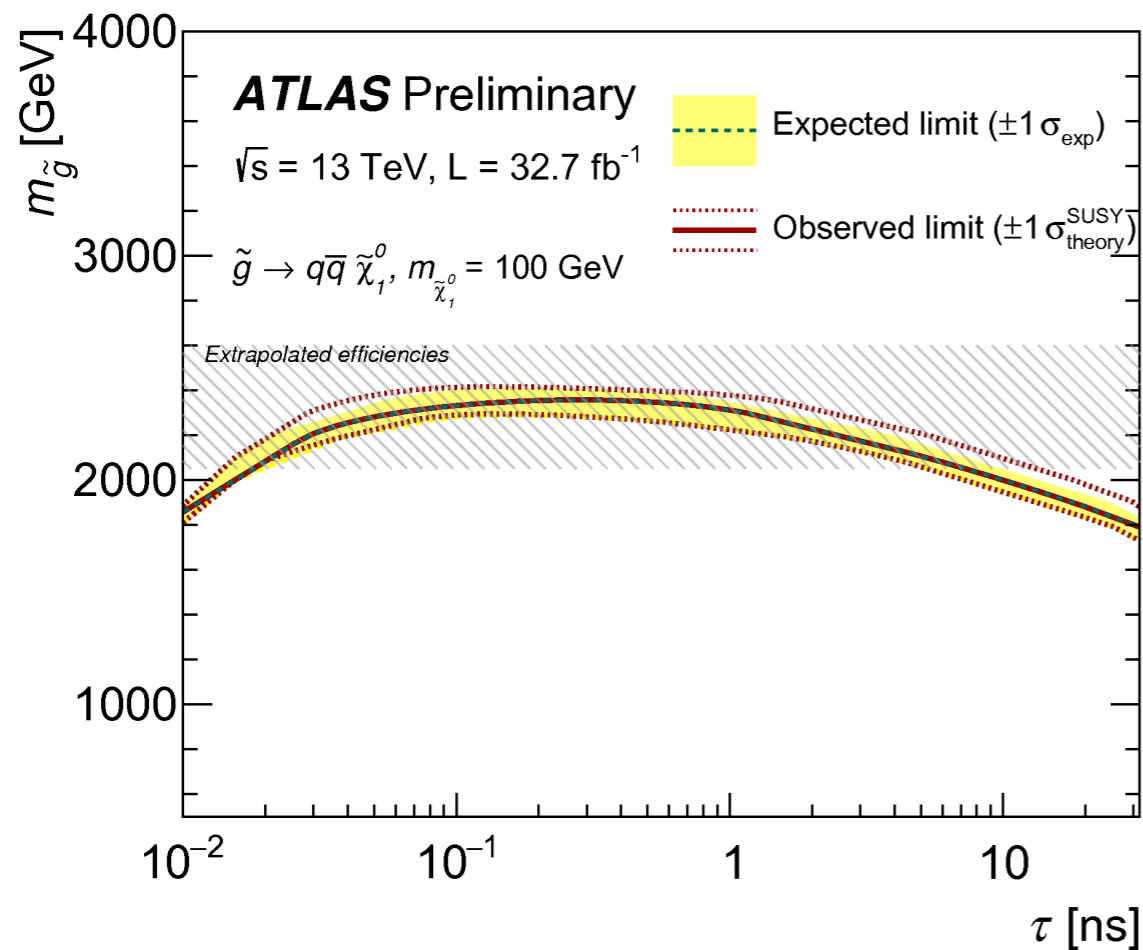
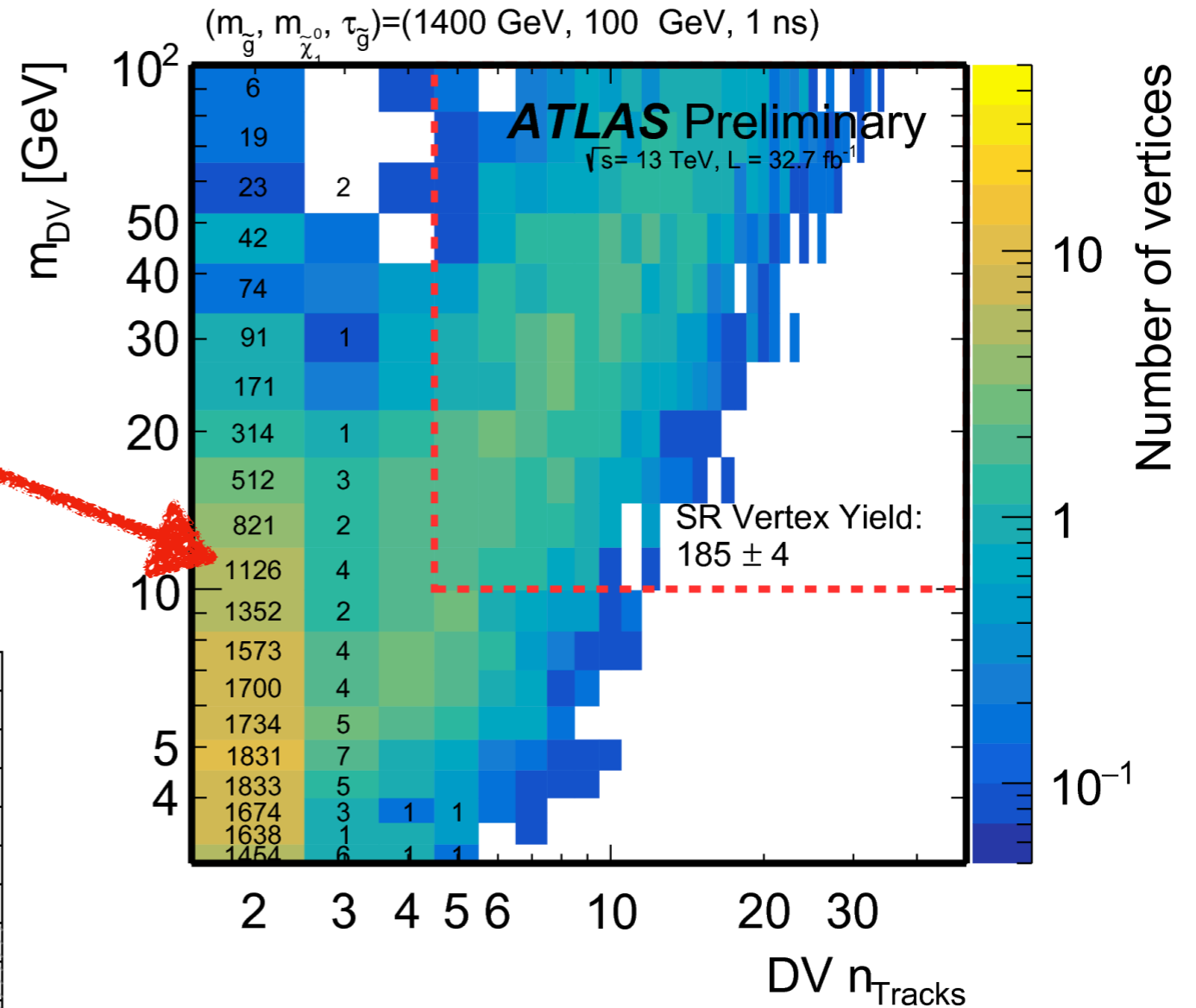
- Hadronic interactions in the material
- Merged vertices
- Accidental tracks crossing vertices



Search for long lived particles: displaced vertices

No events observed,
exclusion limits are derived

Numbers refer to events
observed from data, colors
refer to the benchmark signal

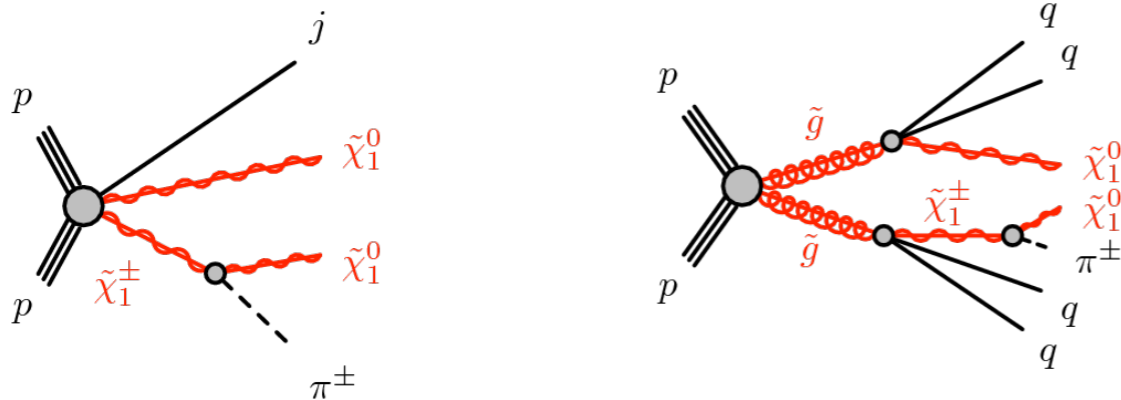


Glino masses up to 2300 GeV are excluded for LSP mass of 100 GeV and lifetime between 0.02 and 10 ns

Search for long lived particles: disappearing tracks

Target:

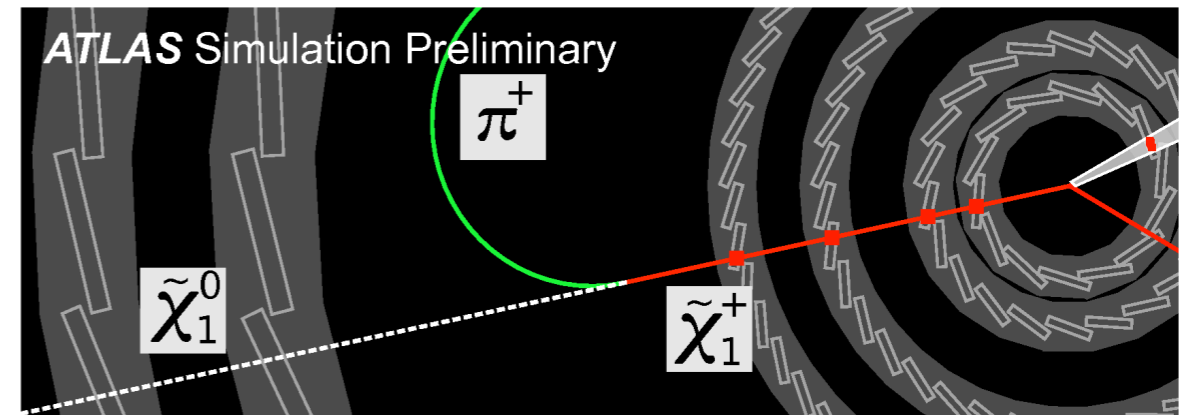
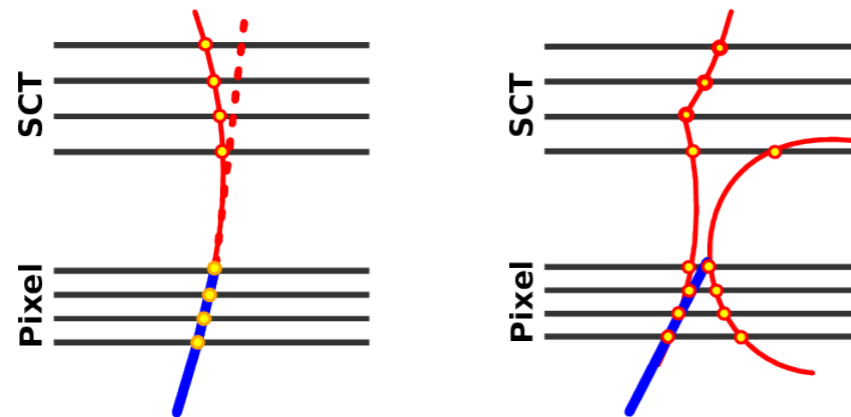
Long living chargino decaying into pion (not reconstructed) and neutralino



Background:

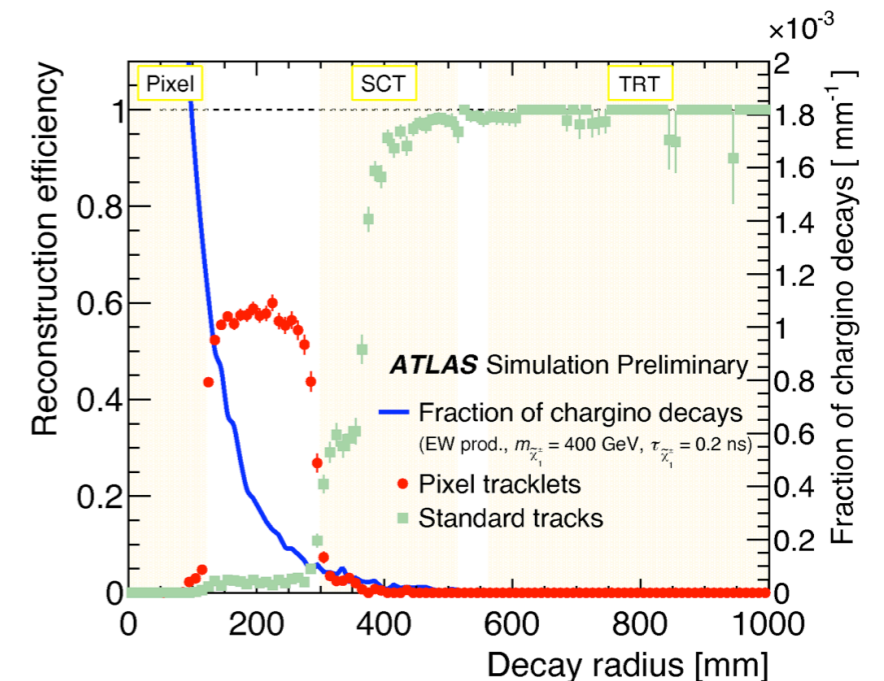
Interaction in the detector material

- Lepton emitting hard photon radiation
- Random combination of hits

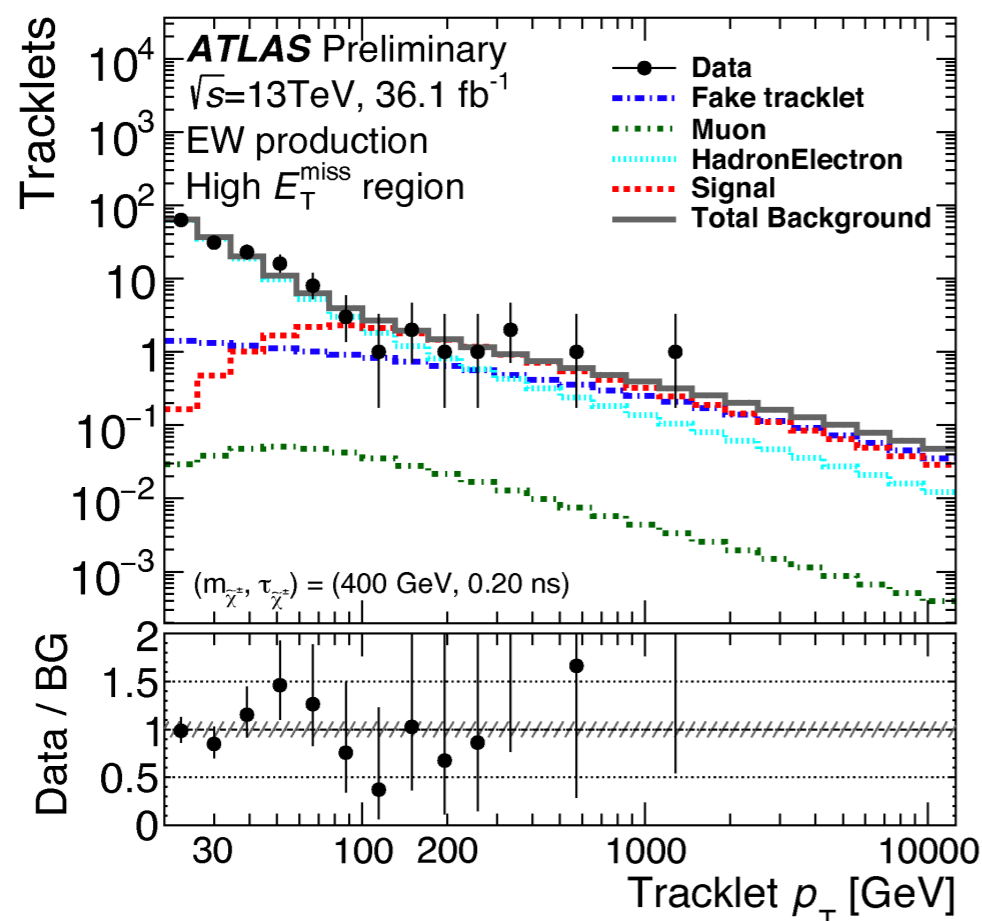


Analysis strategy:

Reconstruction of tracklets based on pixel hits only. To reject background, jet activity and missing transverse energy also required

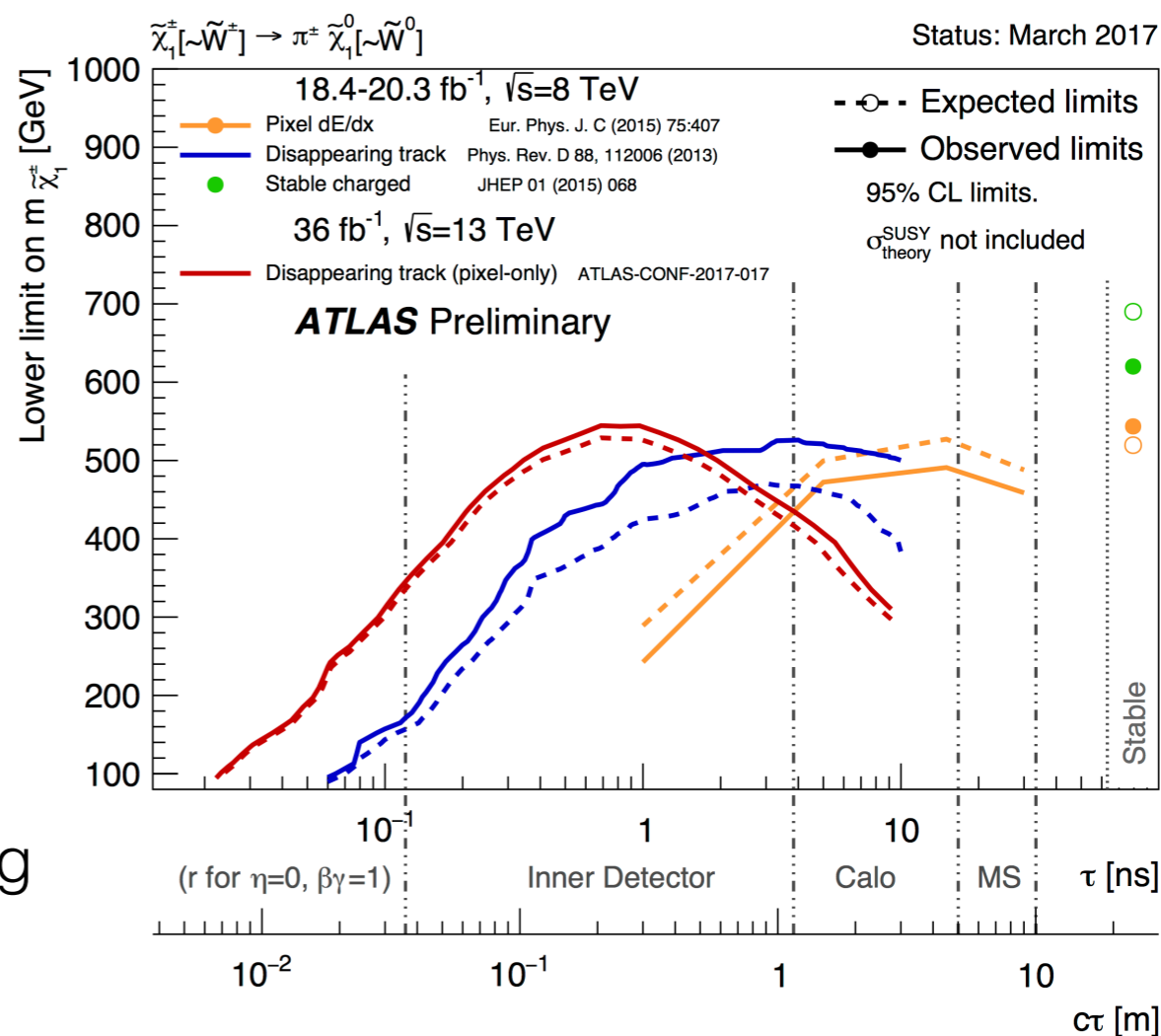


Search for long lived particles: disappearing tracks



Chargino masses up to 430 GeV are excluded for lifetime of 0.2 ns, corresponding to a mass splitting of 160 MeV

**No excess observed,
 exclusion limits are derived**



Summary and conclusions

- **Many SUSY searches foresee LSP dark matter candidates as final state**
- **Only few analyses have been discussed, much wider panorama (see next slide)**
- **No significant excess found so far, but:**
 - **Full Run 2 dataset will provide more insight in many unexplored SUSY scenarios**
 - **More complex tools and analysis strategies are being implemented**

Summary and conclusion

ATLAS SUSY Searches* - 95% CL Lower Limits
May 2017

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

Model	e, μ, τ, γ	Jets	E_T^{miss}	$\int \mathcal{L} dt [\text{fb}^{-1}]$	Mass limit	$\sqrt{s} = 7, 8$ TeV	$\sqrt{s} = 13$ TeV	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	$m(\tilde{g})=m(\tilde{g})$	1507.05525
	$\tilde{q}\tilde{q}, \tilde{q} \rightarrow q\tilde{\chi}_1^0$	0	2-6 jets	Yes	36.1	\tilde{q}	1.57 TeV	$m(\tilde{\chi}_1^0) < 200$ GeV, $m(1^{\text{st}} \text{ gen. } \tilde{q})=m(2^{\text{nd}} \text{ gen. } \tilde{q})$	ATLAS-CONF-2017-022
	$\tilde{q}\tilde{q}, \tilde{q} \rightarrow q\tilde{\chi}_1^0$ (compressed)	mono-jet	1-3 jets	Yes	3.2	\tilde{q}	608 GeV	$m(\tilde{g})-m(\tilde{\chi}_1^0) < 5$ GeV	1604.07773
	$\tilde{g}\tilde{g}, \tilde{g} \rightarrow q\tilde{q}\tilde{\chi}_1^0$	0	2-6 jets	Yes	36.1	\tilde{g}	2.02 TeV	$m(\tilde{\chi}_1^0) < 200$ GeV	ATLAS-CONF-2017-022
	$\tilde{g}\tilde{g}, \tilde{g} \rightarrow q\tilde{q}\tilde{\chi}_1^0 \rightarrow q\tilde{q}W^\pm\tilde{\chi}_1^0$	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
	$\tilde{g}\tilde{g}, \tilde{g} \rightarrow q\tilde{q}(\ell\ell/\nu\nu)\tilde{\chi}_1^0$	3 e, μ	4 jets	-	36.1	\tilde{g}	1.825 TeV	$m(\tilde{\chi}_1^0) < 400$ GeV	ATLAS-CONF-2017-030
	$\tilde{g}\tilde{g}, \tilde{g} \rightarrow q\tilde{q}WZ\tilde{\chi}_1^0$	0	7-11 jets	Yes	36.1	\tilde{g}	1.8 TeV	$m(\tilde{\chi}_1^0) < 400$ GeV	ATLAS-CONF-2017-033
	GMSB ($\tilde{\ell}$ NLSP)	1-2 τ + 0-1 ℓ	0-2 jets	Yes	3.2	\tilde{g}	2.0 TeV	$c\tau(\text{NLSP}) < 0.1$ mm	1607.05979
	GGM (bino NLSP)	2 γ	-	Yes	3.2	\tilde{g}	1.65 TeV	$c\tau(\text{NLSP}) < 0.1$ mm, $\mu < 0$	1606.09150
	GGM (higgsino-bino NLSP)	γ	1 b	Yes	20.3	\tilde{g}	1.37 TeV	$m(\tilde{\chi}_1^0) < 950$ GeV, $c\tau(\text{NLSP}) < 0.1$ mm, $\mu < 0$	1507.05493
	GGM (higgsino-bino NLSP)	γ	2 jets	Yes	13.3	\tilde{g}	1.8 TeV	$m(\tilde{\chi}_1^0) > 680$ GeV, $c\tau(\text{NLSP}) < 0.1$ mm, $\mu > 0$	ATLAS-CONF-2016-066
	GGM (higgsino NLSP)	2 e, μ (Z)	2 jets	Yes	20.3	\tilde{g}	900 GeV	$m(\text{NLSP}) > 430$ GeV	1503.03290
Gravitino LSP	0	mono-jet	Yes	20.3	$P^{1/2}$ scale	865 GeV	$m(\tilde{G}) > 1.8 \times 10^{-4}$ eV, $m(\tilde{g})=m(\tilde{g})=1.5$ TeV	1502.01518	
3rd gen. \tilde{g} med.	$\tilde{g}\tilde{g}, \tilde{g} \rightarrow b\tilde{b}\tilde{\chi}_1^0$	0	3 b	Yes	36.1	\tilde{g}	1.92 TeV	$m(\tilde{\chi}_1^0) < 600$ GeV	ATLAS-CONF-2017-021
	$\tilde{g}\tilde{g}, \tilde{g} \rightarrow t\tilde{t}\tilde{\chi}_1^0$	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
	$\tilde{g}\tilde{g}, \tilde{g} \rightarrow b\tilde{t}\tilde{\chi}_1^0$	0-1 e, μ	3 b	Yes	20.1	\tilde{g}	1.37 TeV	$m(\tilde{\chi}_1^0) < 300$ GeV	1407.0600
3rd gen. squarks direct production	$\tilde{b}_1\tilde{b}_1, \tilde{b}_1 \rightarrow b\tilde{\chi}_1^0$	0	2 b	Yes	36.1	\tilde{b}_1	950 GeV	$m(\tilde{\chi}_1^0) < 420$ GeV	ATLAS-CONF-2017-038
	$\tilde{b}_1\tilde{b}_1, \tilde{b}_1 \rightarrow t\tilde{\chi}_1^\pm$	2 e, μ (SS)	1 b	Yes	36.1	\tilde{b}_1	275-700 GeV	$m(\tilde{\chi}_1^0) < 200$ GeV, $m(\tilde{\chi}_1^\pm) = m(\tilde{\chi}_1^0) + 100$ GeV	ATLAS-CONF-2017-030
	$\tilde{t}_1\tilde{t}_1, \tilde{t}_1 \rightarrow b\tilde{\chi}_1^\pm$	0-2 e, μ	1-2 b	Yes	4.7/13.3	\tilde{t}_1	117-170 GeV	$m(\tilde{\chi}_1^\pm) = 2m(\tilde{\chi}_1^0), m(\tilde{\chi}_1^0) = 55$ GeV	1209.2102, ATLAS-CONF-2016-077
	$\tilde{t}_1\tilde{t}_1, \tilde{t}_1 \rightarrow Wb\tilde{\chi}_1^0$ or $\tilde{t}\tilde{t}^0$	0-2 e, μ	0-2 jets/1-2 b	Yes	20.3/36.1	\tilde{t}_1	90-198 GeV	$m(\tilde{\chi}_1^0) = 1$ GeV	1506.08616, ATLAS-CONF-2017-020
	$\tilde{t}_1\tilde{t}_1, \tilde{t}_1 \rightarrow c\tilde{\chi}_1^0$	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
	$\tilde{t}_2\tilde{t}_2, \tilde{t}_2 \rightarrow \tilde{t}_1 + Z$	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
	$\tilde{t}_2\tilde{t}_2, \tilde{t}_2 \rightarrow \tilde{t}_1 + h$	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	$\tilde{\ell}_{L,R}\tilde{\ell}_{L,R}, \tilde{\ell} \rightarrow \ell\tilde{\chi}_1^0$	2 e, μ	0	Yes	36.1	$\tilde{\ell}$	90-440 GeV	$m(\tilde{\chi}_1^0) = 0$	ATLAS-CONF-2017-039
	$\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm, \tilde{\chi}_1^\pm \rightarrow \ell\nu(\ell\nu)$	2 e, μ	0	Yes	36.1	$\tilde{\chi}_1^\pm$	710 GeV	$m(\tilde{\chi}_1^0) = 0, m(\tilde{\ell}, \tilde{\nu}) = 0.5(m(\tilde{\chi}_1^\pm) + m(\tilde{\chi}_1^0))$	ATLAS-CONF-2017-039
	$\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm/\tilde{\chi}_2^0, \tilde{\chi}_1^\pm \rightarrow \tau\nu(\tau\nu), \tilde{\chi}_2^0 \rightarrow \tau\tau(\nu\bar{\nu})$	2 τ	-	Yes	36.1	$\tilde{\chi}_1^\pm$	760 GeV	$m(\tilde{\chi}_1^0) = 0, m(\tilde{\ell}, \tilde{\nu}) = 0.5(m(\tilde{\chi}_1^\pm) + m(\tilde{\chi}_1^0))$	ATLAS-CONF-2017-035
	$\tilde{\chi}_1^\pm\tilde{\chi}_2^0 \rightarrow \tilde{\ell}_L\nu, \tilde{\ell}(\tilde{\nu}\nu), \tilde{\ell}\tilde{\nu}\tilde{\ell}_L(\tilde{\nu}\nu)$	3 e, μ	0	Yes	36.1	$\tilde{\chi}_1^\pm, \tilde{\chi}_2^0$	1.16 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-2017-039
	$\tilde{\chi}_1^\pm\tilde{\chi}_2^0 \rightarrow W\tilde{\chi}_1^0 Z\tilde{\chi}_1^0$	2-3 e, μ	0-2 jets	Yes	36.1	$\tilde{\chi}_1^\pm, \tilde{\chi}_2^0$	580 GeV	$m(\tilde{\chi}_1^\pm) = m(\tilde{\chi}_2^0), m(\tilde{\chi}_1^0) = 0, \tilde{\ell}$ decoupled	ATLAS-CONF-2017-039
	$\tilde{\chi}_1^\pm\tilde{\chi}_2^0 \rightarrow W\tilde{\chi}_1^0 h\tilde{\chi}_1^0, h \rightarrow b\tilde{b}/WW/\tau\tau/\gamma\gamma$	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
	$\tilde{\chi}_2^0\tilde{\chi}_3^0, \tilde{\chi}_2^0 \rightarrow \tilde{\ell}_R\tilde{\ell}$	4 e, μ	0	Yes	20.3	$\tilde{\chi}_2^0, \tilde{\chi}_3^0$	635 GeV	$m(\tilde{\chi}_1^0) = m(\tilde{\chi}_2^0), m(\tilde{\chi}_1^\pm) = 0, m(\tilde{\ell}, \tilde{\nu}) = 0.5(m(\tilde{\chi}_2^0) + m(\tilde{\chi}_1^0))$	1405.5086
	GGM (wino NLSP) weak prod., $\tilde{\chi}_1^0 \rightarrow \gamma\tilde{G}$	1 $e, \mu + \gamma$	-	Yes	20.3	\tilde{W}	115-370 GeV	$c\tau < 1$ mm	1507.05493
GGM (bino NLSP) weak prod., $\tilde{\chi}_1^0 \rightarrow \gamma\tilde{G}$	2 γ	-	Yes	20.3	\tilde{W}	590 GeV	$c\tau < 1$ mm	1507.05493	
Long-lived particles	Direct $\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$ prod., long-lived $\tilde{\chi}_1^\pm$	Disapp. trk	1 jet	Yes	36.1	$\tilde{\chi}_1^\pm$	430 GeV	$m(\tilde{\chi}_1^\pm) - m(\tilde{\chi}_1^0) \sim 160$ MeV, $\tau(\tilde{\chi}_1^\pm) = 0.2$ ns	ATLAS-CONF-2017-017
	Direct $\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$ prod., long-lived $\tilde{\chi}_1^\pm$	dE/dx trk	-	Yes	18.4	$\tilde{\chi}_1^\pm$	495 GeV	$m(\tilde{\chi}_1^\pm) - m(\tilde{\chi}_1^0) \sim 160$ 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}	850 GeV	$m(\tilde{\chi}_1^0) = 100$ GeV, $10 \mu\text{s} < \tau(\tilde{g}) < 1000$ 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	-	1604.04520
	GMSB, stable $\tilde{\tau}, \tilde{\chi}_1^0 \rightarrow \tilde{\tau}(\tilde{\ell}, \tilde{\mu}) + \tau(e, \mu)$	1-2 μ	-	-	19.1	$\tilde{\chi}_1^0$	537 GeV	$m(\tilde{\chi}_1^0) = 100$ GeV, $\tau > 10$ ns	1411.6795
	GMSB, $\tilde{\lambda}_1^0 \rightarrow \gamma\tilde{G}$, long-lived $\tilde{\lambda}_1^0$	2 γ	-	Yes	20.3	$\tilde{\lambda}_1^0$	440 GeV	$10 < \tan\beta < 50$	1409.5542
	$\tilde{g}\tilde{g}, \tilde{\lambda}_1^0 \rightarrow ee\nu/\mu\nu/\mu\nu$	displ. $ee/\mu\mu/\mu\mu$	-	-	20.3	$\tilde{\lambda}_1^0$	1.0 TeV	$1 < \tau(\tilde{\lambda}_1^0) < 3$ ns, SPS8 model	1504.05162
	GGM $\tilde{g}\tilde{g}, \tilde{\lambda}_1^0 \rightarrow Z\tilde{G}$	displ. vtx + jets	-	-	20.3	$\tilde{\lambda}_1^0$	1.0 TeV	$7 < c\tau(\tilde{\lambda}_1^0) < 740$ mm, $m(\tilde{g}) = 1.3$ TeV	1504.05162
RPV	LFV $pp \rightarrow \tilde{\nu}_\tau + X, \tilde{\nu}_\tau \rightarrow e\mu/\epsilon\tau/\mu\tau$	$e\mu, \epsilon\tau, \mu\tau$	-	-	3.2	$\tilde{\nu}_\tau$	1.9 TeV	$\lambda'_{311} = 0.11, \lambda_{132/133/233} = 0.07$	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
	$\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm, \tilde{\chi}_1^\pm \rightarrow W\tilde{\chi}_1^0, \tilde{\chi}_1^0 \rightarrow ee\nu, \mu\nu, \mu\mu\nu$	4 e, μ	-	Yes	13.3	$\tilde{\chi}_1^\pm$	1.14 TeV	$m(\tilde{\chi}_1^\pm) > 400$ GeV, $\lambda_{12k} \neq 0$ ($k = 1, 2$)	ATLAS-CONF-2016-075
	$\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm, \tilde{\chi}_1^\pm \rightarrow W\tilde{\chi}_1^0, \tilde{\chi}_1^0 \rightarrow \tau\tau\nu_e, \epsilon\tau\nu_\tau$	3 $e, \mu + \tau$	-	Yes	20.3	$\tilde{\chi}_1^\pm$	450 GeV	$m(\tilde{\chi}_1^\pm) > 0.2 \times m(\tilde{\chi}_1^\pm), \lambda_{133} \neq 0$	1405.5086
	$\tilde{g}\tilde{g}, \tilde{g} \rightarrow qq\tilde{q}$	0	4-5 large- R jets	-	14.8	\tilde{g}	1.08 TeV	$BR(b) = BR(c) = BR(s) = 0\%$	ATLAS-CONF-2016-057
	$\tilde{g}\tilde{g}, \tilde{g} \rightarrow qq\tilde{q}, \tilde{\chi}_1^0 \rightarrow qq\tilde{q}$	0	4-5 large- R jets	-	14.8	\tilde{g}	1.55 TeV	$m(\tilde{\chi}_1^0) = 800$ GeV	ATLAS-CONF-2016-057
	$\tilde{g}\tilde{g}, \tilde{g} \rightarrow t\tilde{t}\tilde{\chi}_1^0, \tilde{\chi}_1^0 \rightarrow qq\tilde{q}$	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
	$\tilde{g}\tilde{g}, \tilde{g} \rightarrow \tilde{t}_1 t, \tilde{t}_1 \rightarrow bs$	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
	$\tilde{t}_1\tilde{t}_1, \tilde{t}_1 \rightarrow bs$	0	2 jets + 2 b	-	15.4	\tilde{t}_1	410 GeV	-	ATLAS-CONF-2016-022, ATLAS-CONF-2016-084
	$\tilde{t}_1\tilde{t}_1, \tilde{t}_1 \rightarrow b\tilde{\ell}$	2 e, μ	2 b	-	36.1	\tilde{t}_1	0.4-1.45 TeV	$BR(\tilde{t}_1 \rightarrow b\ell/\mu) > 20\%$	ATLAS-CONF-2017-036
Other	Scalar charm, $\tilde{c} \rightarrow c\tilde{\chi}_1^0$	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.

10⁻¹ 1 Mass scale [TeV]