# SModelS

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# SUSY search interpretation

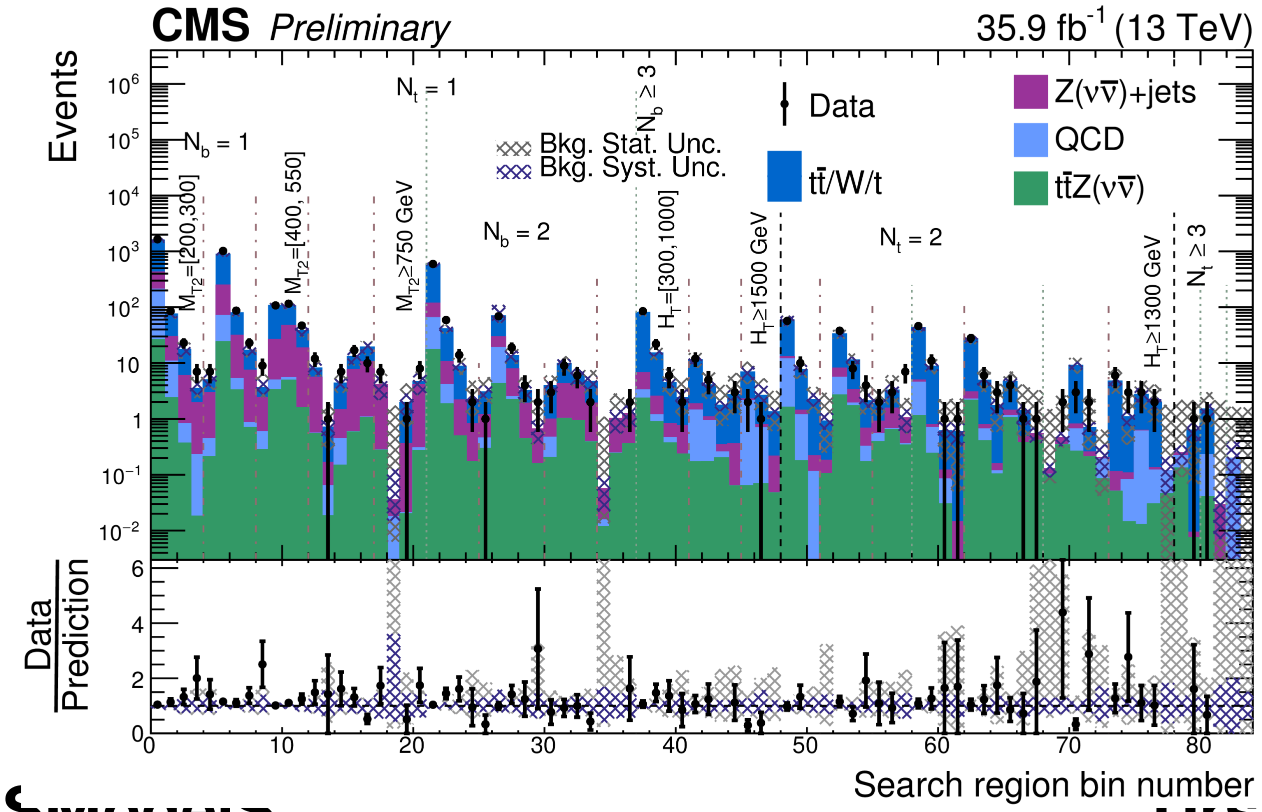
Most relevant parameters for SUSY search analysis:

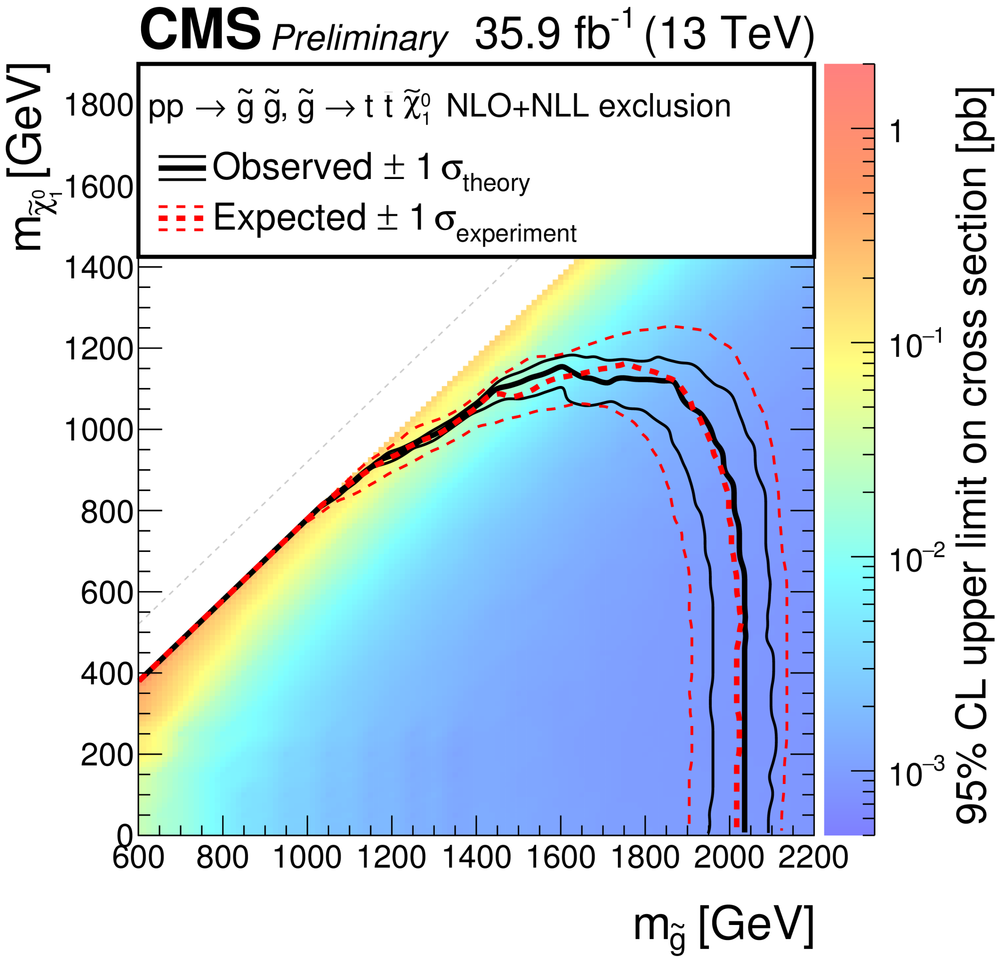
- Production cross section
- Decay branching ratios
- Mass parameters

➡ Simplified Model Spectra (SMS)

Select one “simplified model” that is defined by the initially produced particles and fixed decay branching ratios, scan dependence on the free parameters, i.e. particle masses, put upper limit on signal cross section

**Example:** Hadronic search with top tagging, CMS-SUS-16-050





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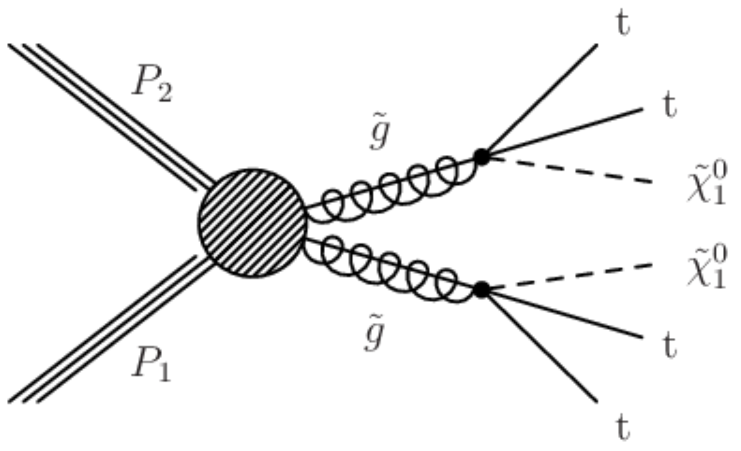

Gluino pair production, 100% decaying into 4 top + MET final state

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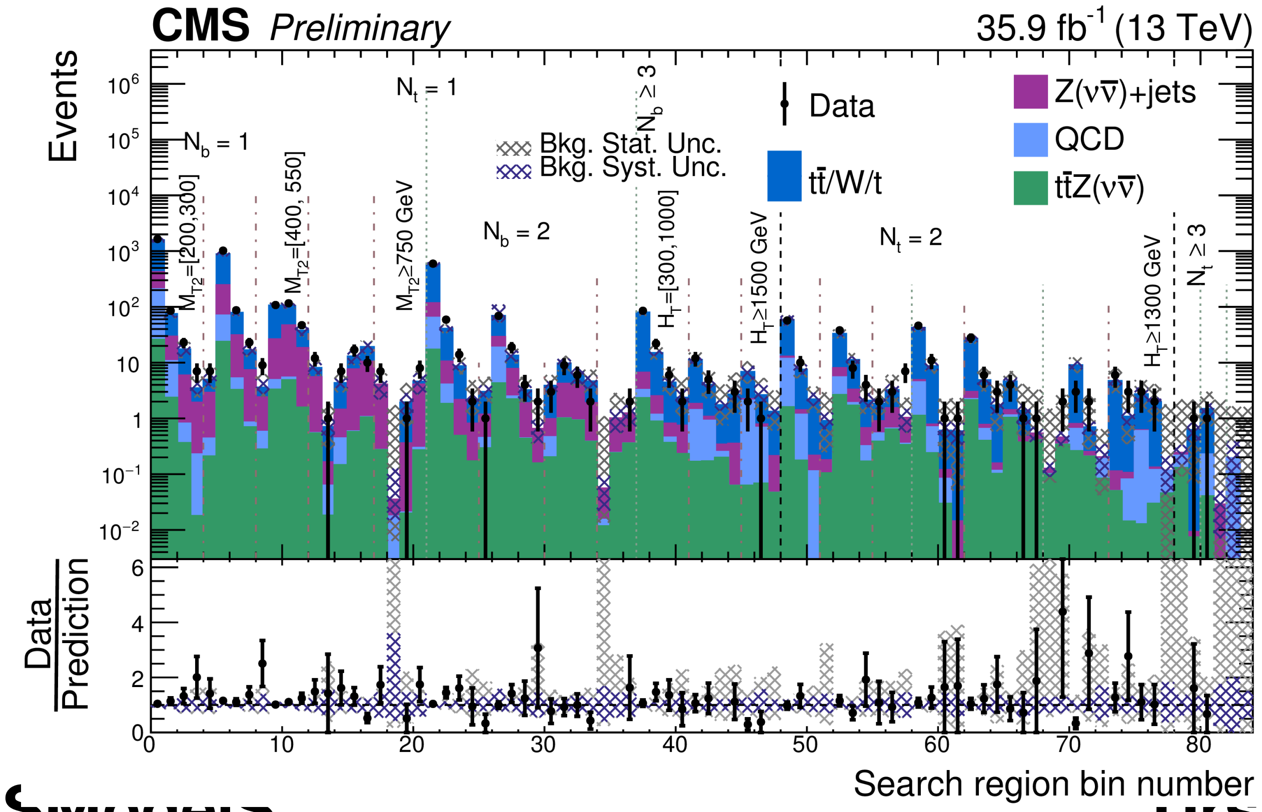
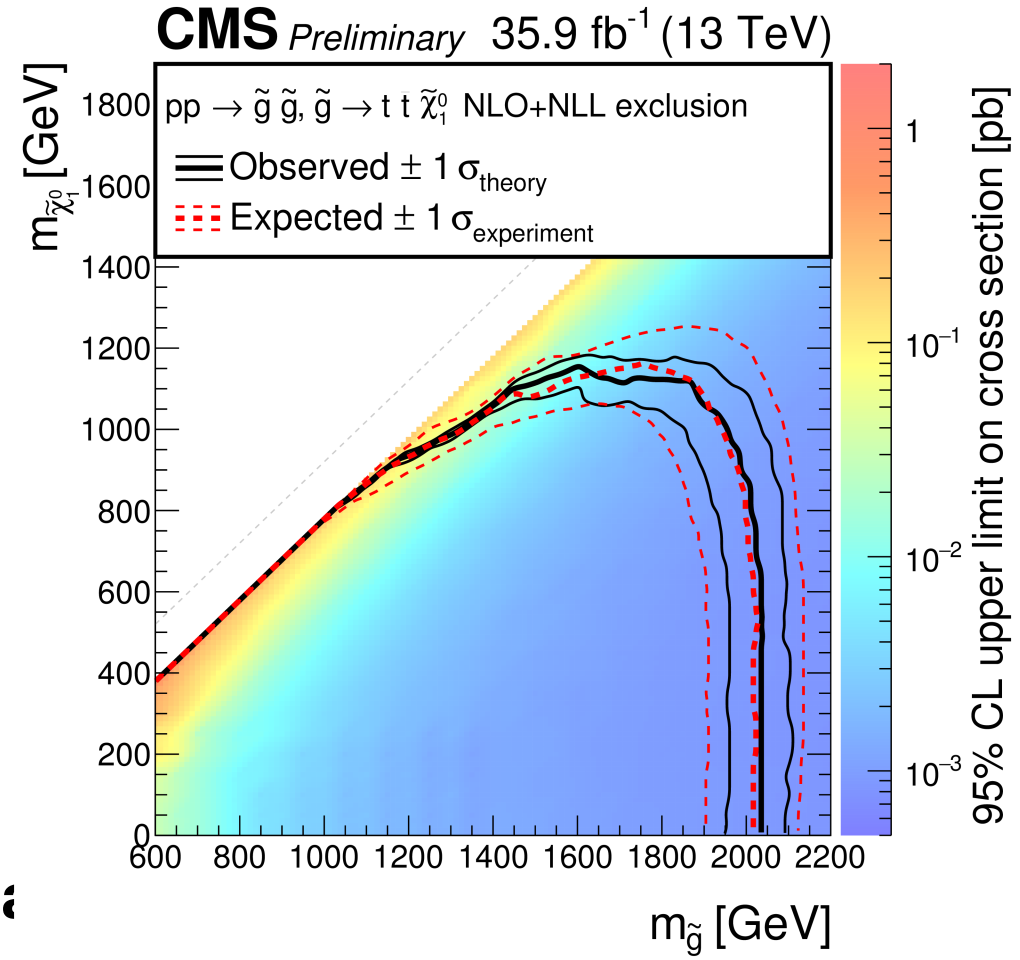
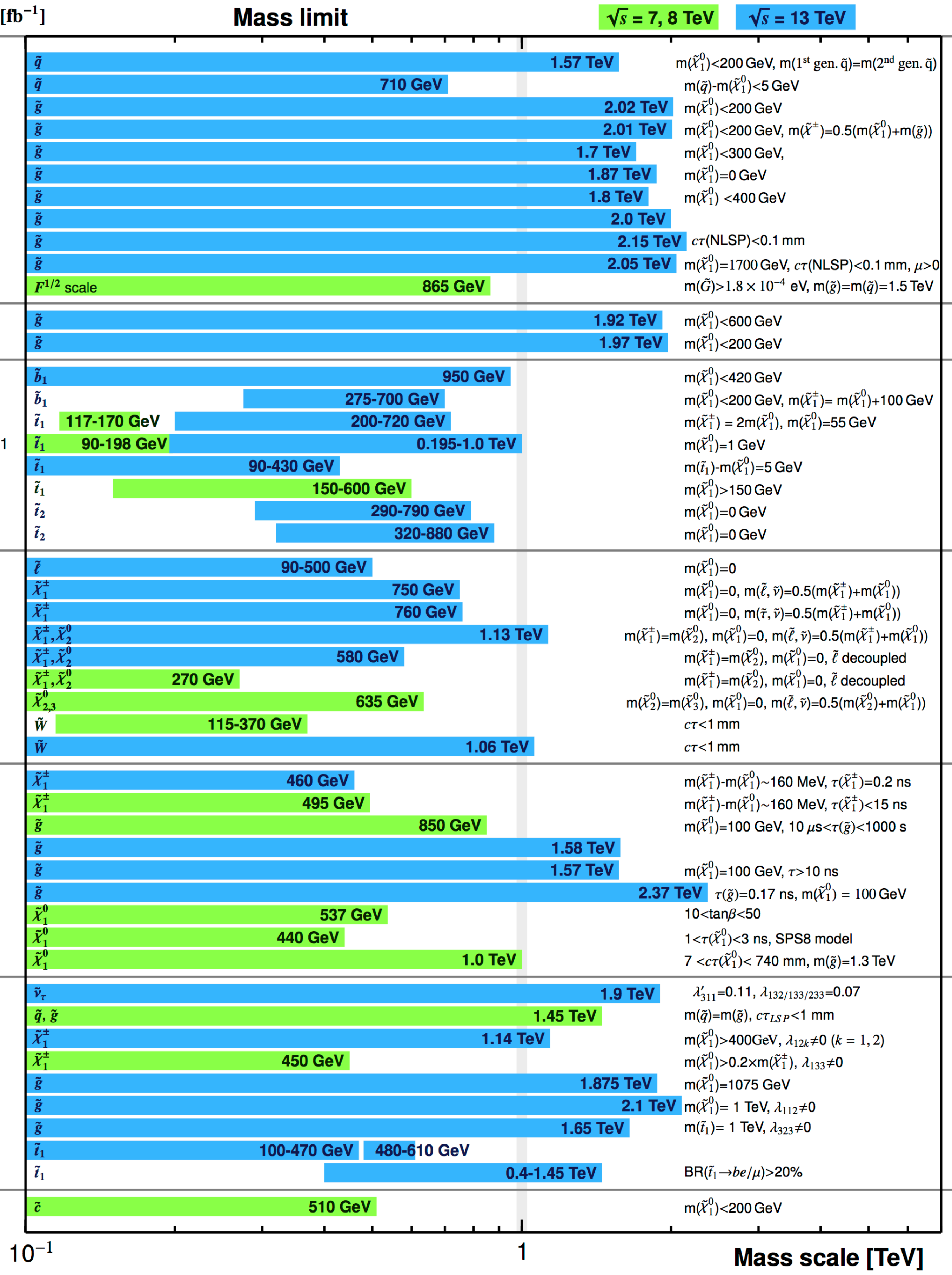




# ATLAS SUSY Searches* - 95% CL Lower Limits

December 2017

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



| | Model | $e, \mu, \tau, \gamma$ | Jets | $E_T^{miss}$ | $\int \mathcal{L}\, dt[\mathrm{fb}^{-1}]$ | Mass limit | | Reference |
|---|---|---|---|---|---|---|---|---|
| Inclusive Searches | $\tilde{q}\tilde{q}$, $\tilde{q}\to q\tilde{\chi}^0_1$ | 0 | 2-6 jets | Yes | 36.1 | $\tilde{q}$ 🟦 1.57 TeV | m($\tilde{\chi}^0_1$)<200 GeV, m(1st gen. q̃)=m(2nd gen. q̃) | 1712.02332 |
| | $\tilde{q}\tilde{q}$, $\tilde{q}\to q\tilde{\chi}^0_1$ (compressed) | mono-jet | 1-3 jets | Yes | 36.1 | $\tilde{q}$ 🟦 710 GeV | m($\tilde{q}$)-m($\tilde{\chi}^0_1$)<5 GeV | 1711.03301 |
| | $\tilde{g}\tilde{g}$, $\tilde{g}\to q\bar{q}\tilde{\chi}^0_1$ | 0 | 2-6 jets | Yes | 36.1 | $\tilde{g}$ 🟦 2.02 TeV | m($\tilde{\chi}^0_1$)<200 GeV | 1712.02332 |
| | $\tilde{g}\tilde{g}$, $\tilde{g}\to qq\tilde{\chi}^\pm_1\to qqW^\pm\tilde{\chi}^0_1$ | 0 | 2-6 jets | Yes | 36.1 | $\tilde{g}$ 🟦 2.01 TeV | m($\tilde{\chi}^0_1$)<200 GeV, m($\tilde{\chi}^\pm$)=0.5(m($\tilde{\chi}^0_1$)+m($\tilde{g}$)) | 1712.02332 |
| | $\tilde{g}\tilde{g}$, $\tilde{g}\to q\bar{q}(\ell\ell)\tilde{\chi}^0_1$ | $ee, \mu\mu$ | 2 jets | Yes | 14.7 | $\tilde{g}$ 🟦 1.7 TeV | m($\tilde{\chi}^0_1$)<300 GeV, | 1611.05791 |
| | $\tilde{g}\tilde{g}$, $\tilde{g}\to qq(\ell\ell/\nu\nu)\tilde{\chi}^0_1$ | 3 $e, \mu$ | 4 jets | - | 36.1 | $\tilde{g}$ 🟦 1.87 TeV | m($\tilde{\chi}^0_1$)=0 GeV | 1706.03731 |
| | $\tilde{g}\tilde{g}$, $\tilde{g}\to qqWZ\tilde{\chi}^0_1$ | 0 | 7-11 jets | Yes | 36.1 | $\tilde{g}$ 🟦 1.8 TeV | m($\tilde{\chi}^0_1$) <400 GeV | 1708.02794 |
| | GMSB ($\tilde{\ell}$ NLSP) | 1-2 $\tau$ + 0-1 $\ell$ | 0-2 jets | Yes | 3.2 | $\tilde{g}$ 🟦 2.0 TeV | | 1607.05979 |
| | GGM (bino NLSP) | 2 $\gamma$ | - | Yes | 36.1 | $\tilde{g}$ 🟦 2.15 TeV | $c\tau$(NLSP)<0.1 mm | ATLAS-CONF-2017-080 |
| | GGM (higgsino-bino NLSP) | $\gamma$ | 2 jets | Yes | 36.1 | $\tilde{g}$ 🟦 2.05 TeV | m($\tilde{\chi}^0_1$)=1700 GeV, $c\tau$(NLSP)<0.1 mm, $\mu$>0 | ATLAS-CONF-2017-080 |
| | 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 |
| $3^{rd}$ gen. $\tilde{g}$ med. | $\tilde{g}\tilde{g}$, $\tilde{g}\to b\bar{b}\tilde{\chi}^0_1$ | 0 | 3 $b$ | Yes | 36.1 | $\tilde{g}$ 🟦 1.92 TeV | m($\tilde{\chi}^0_1$)<600 GeV | 1711.01901 |
| | $\tilde{g}\tilde{g}$, $\tilde{g}\to t\bar{t}\tilde{\chi}^0_1$ | 0-1 $e, \mu$ | 3 $b$ | Yes | 36.1 | $\tilde{g}$ 🟦 1.97 TeV | m($\tilde{\chi}^0_1$)<200 GeV | 1711.01901 |
| $3^{rd}$ gen. squarks direct production | $\tilde{b}_1\tilde{b}_1$, $\tilde{b}_1\to b\tilde{\chi}^0_1$ | 0 | 2 $b$ | Yes | 36.1 | $\tilde{b}_1$ 🟦 950 GeV | m($\tilde{\chi}^0_1$)<420 GeV | 1708.09266 |
| | $\tilde{b}_1\tilde{b}_1$, $\tilde{b}_1\to t\tilde{\chi}^\pm_1$ | 2 $e, \mu$ (SS) | 1 $b$ | Yes | 36.1 | $\tilde{b}_1$ 🟦 275-700 GeV | m($\tilde{\chi}^0_1$)<200 GeV, m($\tilde{\chi}^\pm_1$)= m($\tilde{\chi}^0_1$)+100 GeV | 1706.03731 |
| | $\tilde{t}_1\tilde{t}_1$, $\tilde{t}_1\to b\tilde{\chi}^\pm_1$ | 0-2 $e, \mu$ | 1-2 $b$ | Yes | 4.7/13.3 | $\tilde{t}_1$ 🟩 117-170 GeV 🟦 200-720 GeV | m($\tilde{\chi}^\pm_1$) = 2m($\tilde{\chi}^0_1$), m($\tilde{\chi}^0_1$)=55 GeV | 1209.2102, ATLAS-CONF-2016-077 |
| | $\tilde{t}_1\tilde{t}_1$, $\tilde{t}_1\to Wb\tilde{\chi}^0_1$ or $t\tilde{\chi}^0_1$ | 0-2 $e, \mu$ | 0-2 jets/1-2 $b$ | Yes | 20.3/36.1 | $\tilde{t}_1$ 🟩 90-198 GeV 🟦 0.195-1.0 TeV | m($\tilde{\chi}^0_1$)=1 GeV | 1506.08616, 1709.04183, 1711.11520 |
| | $\tilde{t}_1\tilde{t}_1$, $\tilde{t}_1\to c\tilde{\chi}^0_1$ | 0 | mono-jet | Yes | 36.1 | $\tilde{t}_1$ 🟦 90-430 GeV | m($\tilde{t}_1$)-m($\tilde{\chi}^0_1$)=5 GeV | 1711.03301 |
| | $\tilde{t}_1\tilde{t}_1$ (natural GMSB) | 2 $e, \mu$ (Z) | 1 $b$ | Yes | 20.3 | $\tilde{t}_1$ 🟩 150-600 GeV | m($\tilde{\chi}^0_1$)>150 GeV | 1403.5222 |
| | $\tilde{t}_2\tilde{t}_2$, $\tilde{t}_2\to\tilde{t}_1+Z$ | 3 $e, \mu$ (Z) | 1 $b$ | Yes | 36.1 | $\tilde{t}_2$ 🟦 290-790 GeV | m($\tilde{\chi}^0_1$)=0 GeV | 1706.03986 |
| | $\tilde{t}_2\tilde{t}_2$, $\tilde{t}_2\to\tilde{t}_1+h$ | 1-2 $e, \mu$ | 4 $b$ | Yes | 36.1 | $\tilde{t}_2$ 🟦 320-880 GeV | m($\tilde{\chi}^0_1$)=0 GeV | 1706.03986 |
| EW direct | $\tilde{\ell}_{L,R}\tilde{\ell}_{L,R}$, $\tilde{\ell}\to\ell\tilde{\chi}^0_1$ | 2 $e, \mu$ | 0 | Yes | 36.1 | $\tilde{\ell}$ 🟦 90-500 GeV | m($\tilde{\chi}^0_1$)=0 | ATLAS-CONF-2017-039 |
| | $\tilde{\chi}^+_1\tilde{\chi}^-_1$, $\tilde{\chi}^+_1\to\tilde{\ell}\nu(\ell\tilde{\nu})$ | 2 $e, \mu$ | 0 | Yes | 36.1 | $\tilde{\chi}^\pm_1$ 🟦 750 GeV | m($\tilde{\chi}^0_1$)=0, m($\tilde{\ell}, \tilde{\nu}$)=0.5(m($\tilde{\chi}^\pm_1$)+m($\tilde{\chi}^0_1$)) | ATLAS-CONF-2017-039 |
| | $\tilde{\chi}^\pm_1\tilde{\chi}^\mp_1/\tilde{\chi}^0_2$, $\tilde{\chi}^+_1\to\tilde{\tau}\nu(\tau\tilde{\nu})$, $\tilde{\chi}^0_2\to\tilde{\tau}\tau(\nu\tilde{\nu})$ | 2 $\tau$ | - | Yes | 36.1 | $\tilde{\chi}^\pm_1$ 🟦 760 GeV | m($\tilde{\chi}^0_1$)=0, m($\tilde{\tau}, \tilde{\nu}$)=0.5(m($\tilde{\chi}^\pm_1$)+m($\tilde{\chi}^0_1$)) | 1708.07875 |
| | $\tilde{\chi}^\pm_1\tilde{\chi}^0_2\to\tilde{\ell}_L\nu\tilde{\ell}_L\ell(\tilde{\nu}\nu)$, $\ell\tilde{\nu}\tilde{\ell}_L\ell(\tilde{\nu}\nu)$ | 3 $e, \mu$ | 0 | Yes | 36.1 | $\tilde{\chi}^\pm_1, \tilde{\chi}^0_2$ 🟦 1.13 TeV | m($\tilde{\chi}^\pm_1$)=m($\tilde{\chi}^0_2$), m($\tilde{\chi}^0_1$)=0, m($\tilde{\ell}, \tilde{\nu}$)=0.5(m($\tilde{\chi}^\pm_1$)+m($\tilde{\chi}^0_1$)) | ATLAS-CONF-2017-039 |
| | $\tilde{\chi}^\pm_1\tilde{\chi}^0_2\to W\tilde{\chi}^0_1Z\tilde{\chi}^0_1$ | 2-3 $e, \mu$ | 0-2 jets | Yes | 36.1 | $\tilde{\chi}^\pm_1, \tilde{\chi}^0_2$ 🟦 580 GeV | m($\tilde{\chi}^\pm_1$)=m($\tilde{\chi}^0_2$), m($\tilde{\chi}^0_1$)=0, $\tilde{\ell}$ decoupled | ATLAS-CONF-2017-039 |
| | $\tilde{\chi}^\pm_1\tilde{\chi}^0_2\to W\tilde{\chi}^0_1h\tilde{\chi}^0_1$, $h\to b\bar{b}/WW/\tau\tau/\gamma\gamma$ | $e, \mu, \gamma$ | 0-2 $b$ | Yes | 20.3 | $\tilde{\chi}^\pm_1, \tilde{\chi}^0_2$ 🟩 270 GeV | m($\tilde{\chi}^\pm_1$)=m($\tilde{\chi}^0_2$), m($\tilde{\chi}^0_1$)=0, $\tilde{\ell}$ decoupled | 1501.07110 |
| | $\tilde{\chi}^0_2\tilde{\chi}^0_3$, $\tilde{\chi}^0_{2,3}\to\tilde{\ell}_R\ell$ | 4 $e, \mu$ | 0 | Yes | 20.3 | $\tilde{\chi}^0_{2,3}$ 🟩 635 GeV | m($\tilde{\chi}^0_2$)=m($\tilde{\chi}^0_3$), m($\tilde{\chi}^0_1$)=0, m($\tilde{\ell}, \tilde{\nu}$)=0.5(m($\tilde{\chi}^0_2$)+m($\tilde{\chi}^0_1$)) | 1405.5086 |
| | GGM (wino NLSP) weak prod., $\tilde{\chi}^0_1\to\gamma\tilde{G}$ | 1 $e, \mu$ + $\gamma$ | - | Yes | 20.3 | $\tilde{W}$ 🟩 115-370 GeV | $c\tau$<1 mm | 1507.05493 |
| | GGM (bino NLSP) weak prod., $\tilde{\chi}^0_1\to\gamma\tilde{G}$ | 2 $\gamma$ | - | Yes | 36.1 | $\tilde{W}$ 🟦 1.06 TeV | $c\tau$<1 mm | ATLAS-CONF-2017-080 |
| Long-lived particles | Direct $\tilde{\chi}^+_1\tilde{\chi}^-_1$ prod., long-lived $\tilde{\chi}^\pm_1$ | Disapp. trk | 1 jet | Yes | 36.1 | $\tilde{\chi}^\pm_1$ 🟦 460 GeV | m($\tilde{\chi}^\pm_1$)-m($\tilde{\chi}^0_1$)~160 MeV, $\tau$($\tilde{\chi}^\pm_1$)=0.2 ns | 1712.02118 |
| | Direct $\tilde{\chi}^+_1\tilde{\chi}^-_1$ prod., long-lived $\tilde{\chi}^\pm_1$ | dE/dx trk | - | Yes | 18.4 | $\tilde{\chi}^\pm_1$ 🟩 495 GeV | m($\tilde{\chi}^\pm_1$)-m($\tilde{\chi}^0_1$)~160 MeV, $\tau$($\tilde{\chi}^\pm_1$)<15 ns | 1506.05332 |
| | Stable, stopped $\tilde{g}$ R-hadron | 0 | 1-5 jets | Yes | 27.9 | $\tilde{g}$ 🟩 850 GeV | m($\tilde{\chi}^0_1$)=100 GeV, 10 $\mu$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 | m($\tilde{\chi}^0_1$)=100 GeV, $\tau$>10 ns | 1604.04520 |
| | Metastable $\tilde{g}$ R-hadron, $\tilde{g}\to qq\tilde{\chi}^0_1$ | displ. vtx | - | Yes | 32.8 | $\tilde{g}$ 🟦 2.37 TeV | $\tau$($\tilde{g}$)=0.17 ns, m($\tilde{\chi}^0_1$) = 100 GeV | 1710.04901 |
| | GMSB, stable $\tilde{\tau}$, $\tilde{\chi}^0_1\to\tilde{\tau}(\tilde{e},\tilde{\mu})+\tau(e,\mu)$ | 1-2 $\mu$ | - | - | 19.1 | $\tilde{\chi}^0_1$ 🟩 537 GeV | 10<tan$\beta$<50 | 1411.6795 |
| | GMSB, $\tilde{\chi}^0_1\to\gamma\tilde{G}$, long-lived $\tilde{\chi}^0_1$ | 2 $\gamma$ | - | Yes | 20.3 | $\tilde{\chi}^0_1$ 🟩 440 GeV | 1<$\tau$($\tilde{\chi}^0_1$)<3 ns, SPS8 model | 1409.5542 |
| | $\tilde{g}\tilde{g}$, $\tilde{\chi}^0_1\to ee\nu/e\mu\nu/\mu\mu\nu$ | displ. $ee/e\mu/\mu\mu$ | - | - | 20.3 | $\tilde{\chi}^0_1$ 🟩 1.0 TeV | 7 <$c\tau$($\tilde{\chi}^0_1$)< 740 mm, m($\tilde{g}$)=1.3 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 | $\lambda'_{311}$=0.11, $\lambda_{132/133/233}$=0.07 | 1607.08079 |
| | Bilinear RPV CMSSM | 2 $e, \mu$ (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 |
| | $\tilde{\chi}^+_1\tilde{\chi}^-_1$, $\tilde{\chi}^+_1\to W\tilde{\chi}^0_1$, $\tilde{\chi}^0_1\to ee\nu, e\mu\nu, \mu\mu\nu$ | 4 $e, \mu$ | - | Yes | 13.3 | $\tilde{\chi}^\pm_1$ 🟦 1.14 TeV | m($\tilde{\chi}^0_1$)>400GeV, $\lambda_{12k}\neq0$ ($k = 1, 2$) | ATLAS-CONF-2016-075 |
| | $\tilde{\chi}^+_1\tilde{\chi}^-_1$, $\tilde{\chi}^+_1\to W\tilde{\chi}^0_1$, $\tilde{\chi}^0_1\to\tau\tau\nu_e, e\tau\nu_\tau$ | 3 $e, \mu$ + $\tau$ | - | Yes | 20.3 | $\tilde{\chi}^\pm_1$ 🟩 450 GeV | m($\tilde{\chi}^0_1$)>0.2×m($\tilde{\chi}^\pm_1$), $\lambda_{133}\neq0$ | 1405.5086 |
| | $\tilde{g}\tilde{g}$, $\tilde{g}\to qq\tilde{\chi}^0_1$, $\tilde{\chi}^0_1\to qqq$ | 0 | 4-5 large-$R$ jets | - | 36.1 | $\tilde{g}$ 🟦 1.875 TeV | m($\tilde{\chi}^0_1$)=1075 GeV | SUSY-2016-22 |
| | $\tilde{g}\tilde{g}$, $\tilde{g}\to t\bar{t}\tilde{\chi}^0_1$, $\tilde{\chi}^0_1\to qqq$ | 1 $e, \mu$ | 8-10 jets/0-4 $b$ | - | 36.1 | $\tilde{g}$ 🟦 2.1 TeV | m($\tilde{\chi}^0_1$)= 1 TeV, $\lambda_{112}\neq0$ | 1704.08493 |
| | $\tilde{g}\tilde{g}$, $\tilde{g}\to\tilde{t}_1t$, $\tilde{t}_1\to bs$ | 1 $e, \mu$ | 8-10 jets/0-4 $b$ | - | 36.1 | $\tilde{g}$ 🟦 1.65 TeV | m($\tilde{t}_1$)= 1 TeV, $\lambda_{323}\neq0$ | 1704.08493 |
| | $\tilde{t}_1\tilde{t}_1$, $\tilde{t}_1\to bs$ | 0 | 2 jets + 2 $b$ | - | 36.7 | $\tilde{t}_1$ 🟦 100-470 GeV 🟦 480-610 GeV | | 1710.07171 |
| | $\tilde{t}_1\tilde{t}_1$, $\tilde{t}_1\to b\ell$ | 2 $e, \mu$ | 2 $b$ | - | 36.1 | $\tilde{t}_1$ 🟦 0.4-1.45 TeV | BR($\tilde{t}_1\to be/\mu$)>20% | 1710.05544 |
| Other | Scalar charm, $\tilde{c}\to c\tilde{\chi}^0_1$ | 0 | 2 $c$ | Yes | 20.3 | $\tilde{c}$ 🟩 510 GeV | m($\tilde{\chi}^0_1$)<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.

# Reinterpretation of search results

Reproduction of analysis cuts

- Use event generator + detector simulation to evaluate signal prediction for each parameter point
- Precise, but very time consuming
- Tools: CheckMATE, MadAnalysis5, Rivet, ColliderBIT, …

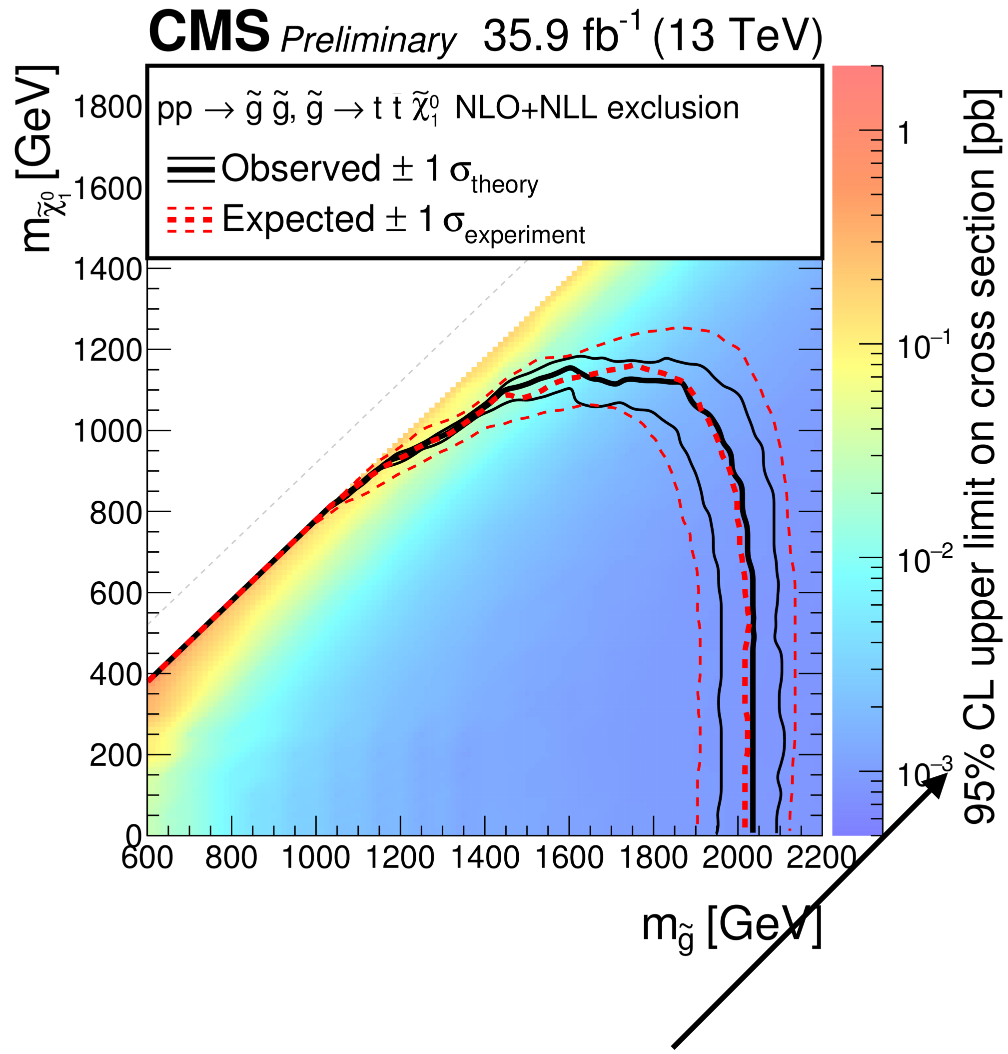
Apply simplified model mass exclusion

- Mass limits only valid within the simplified model
- Wrong when considering generic model, e.g. arbitrary gluino decays

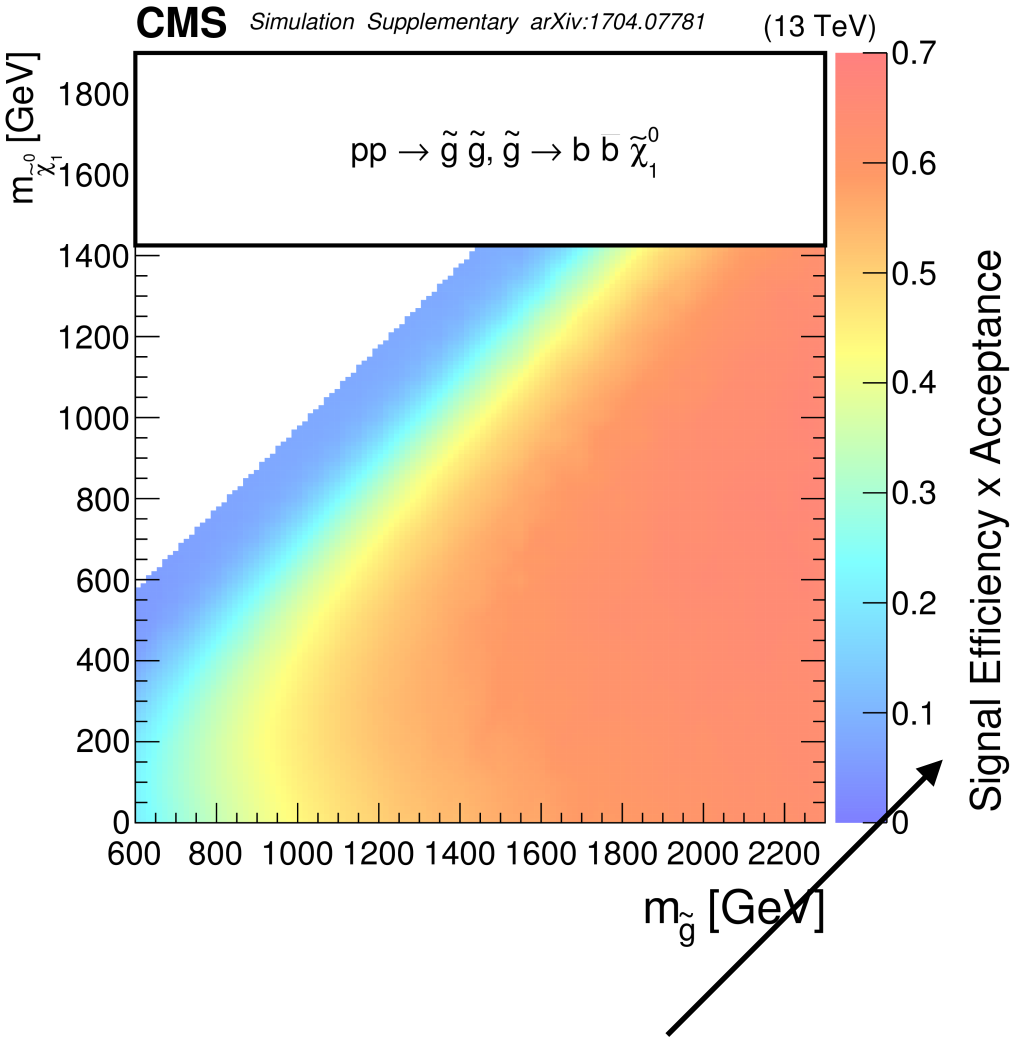
Decompose full model into simplified model components

- Each component can be compared against experimental upper limits
- Conservative, but fast
- Tools: **SModelS**, FastLim, XQCat

# Constraints from upper limit (UL) and efficiency maps (EM)



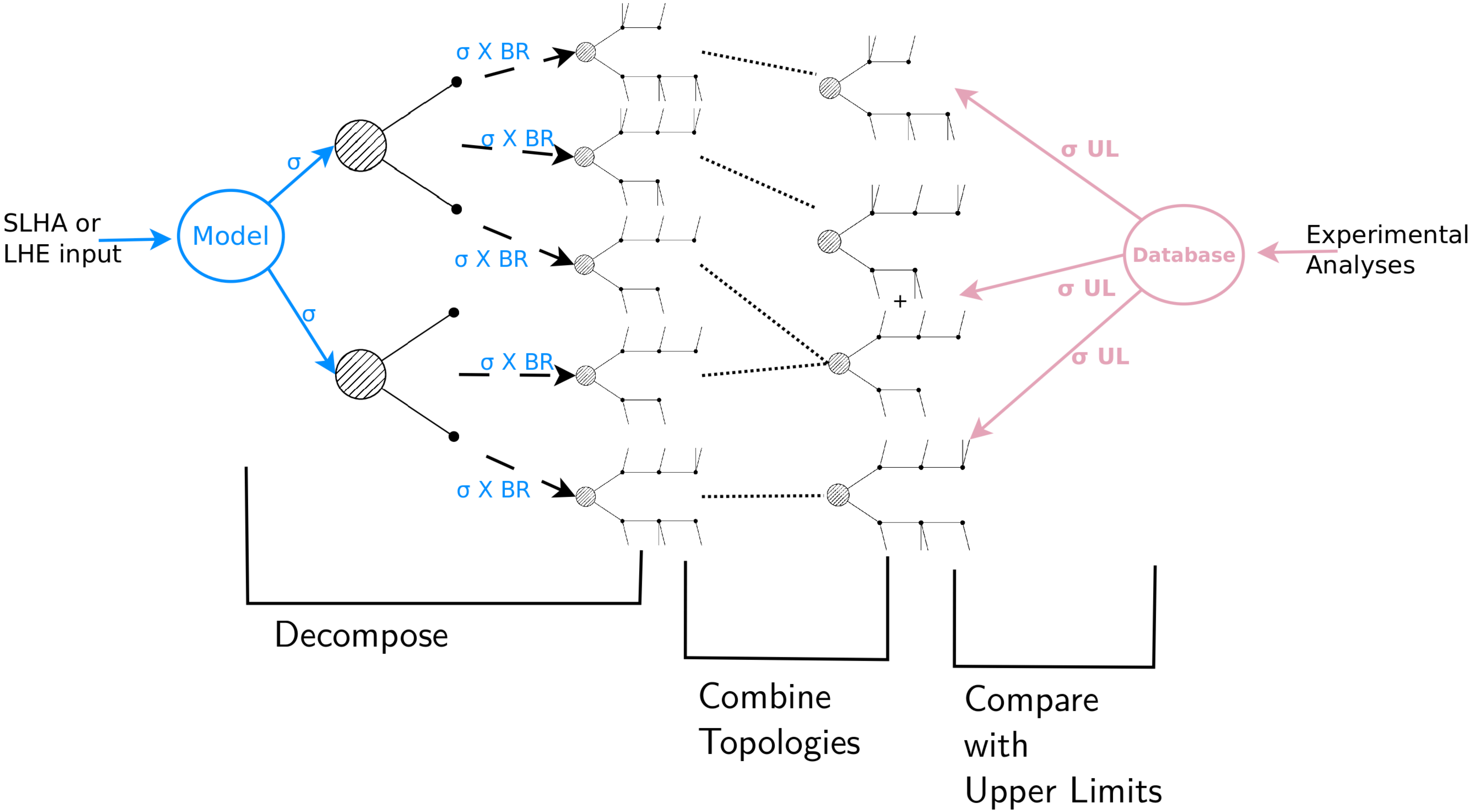
Directly constrains the gluino production cross section for this topology, all detector effects already “folded in”



Use efficiency*acceptance to calculate “visible signal cross section”, compare this to upper limit on total visible signal cross section

# SModelS

**Kraml, Kulkarni, UL, et. al**
**arXiv:1312.4175**
**arXiv:1412.1745**
**arXiv:1701.06586**



# SModelS

Kraml, Kulkarni, UL, et. al
arXiv:1312.4175
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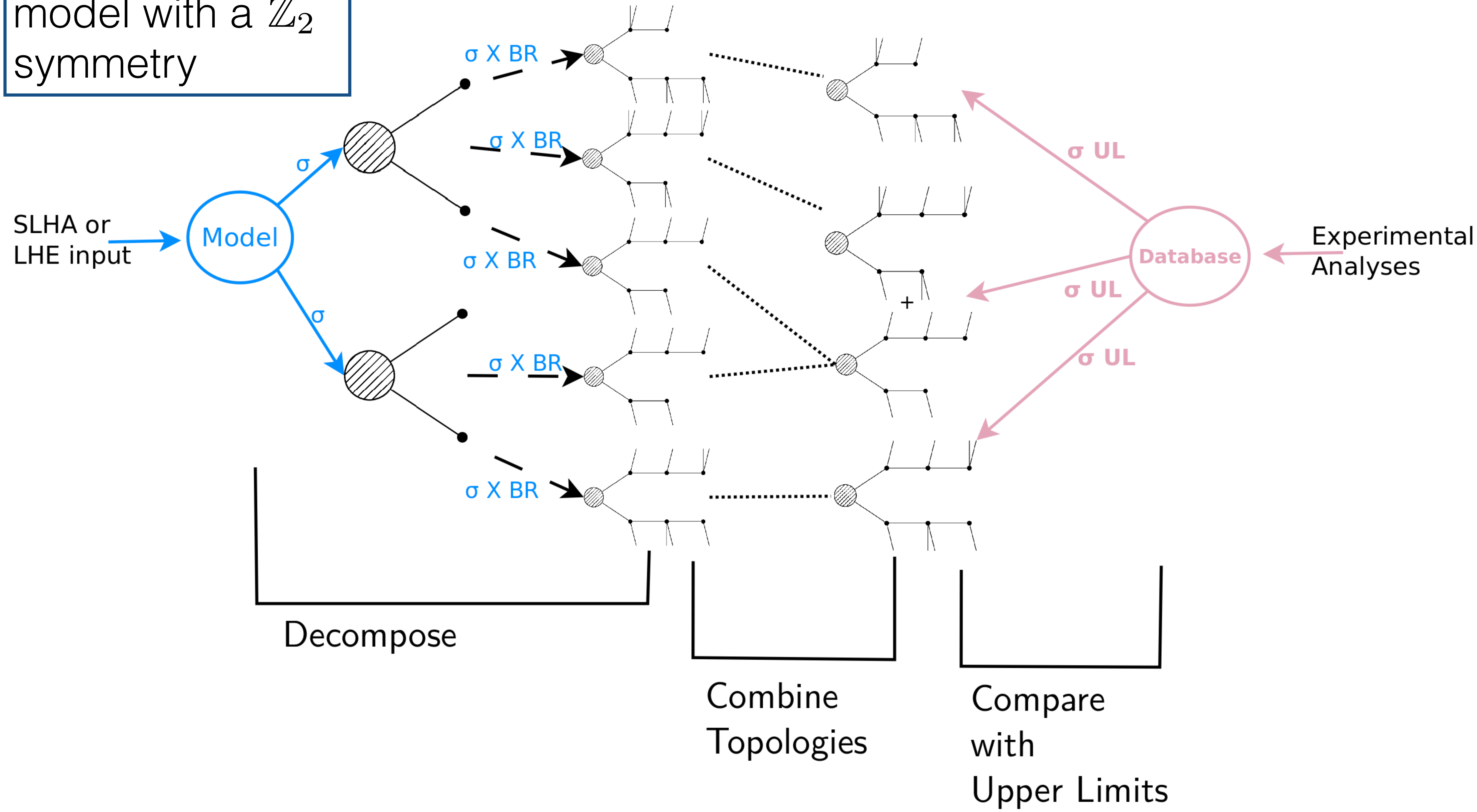
works for every model with a $\mathbb{Z}_2$ symmetry



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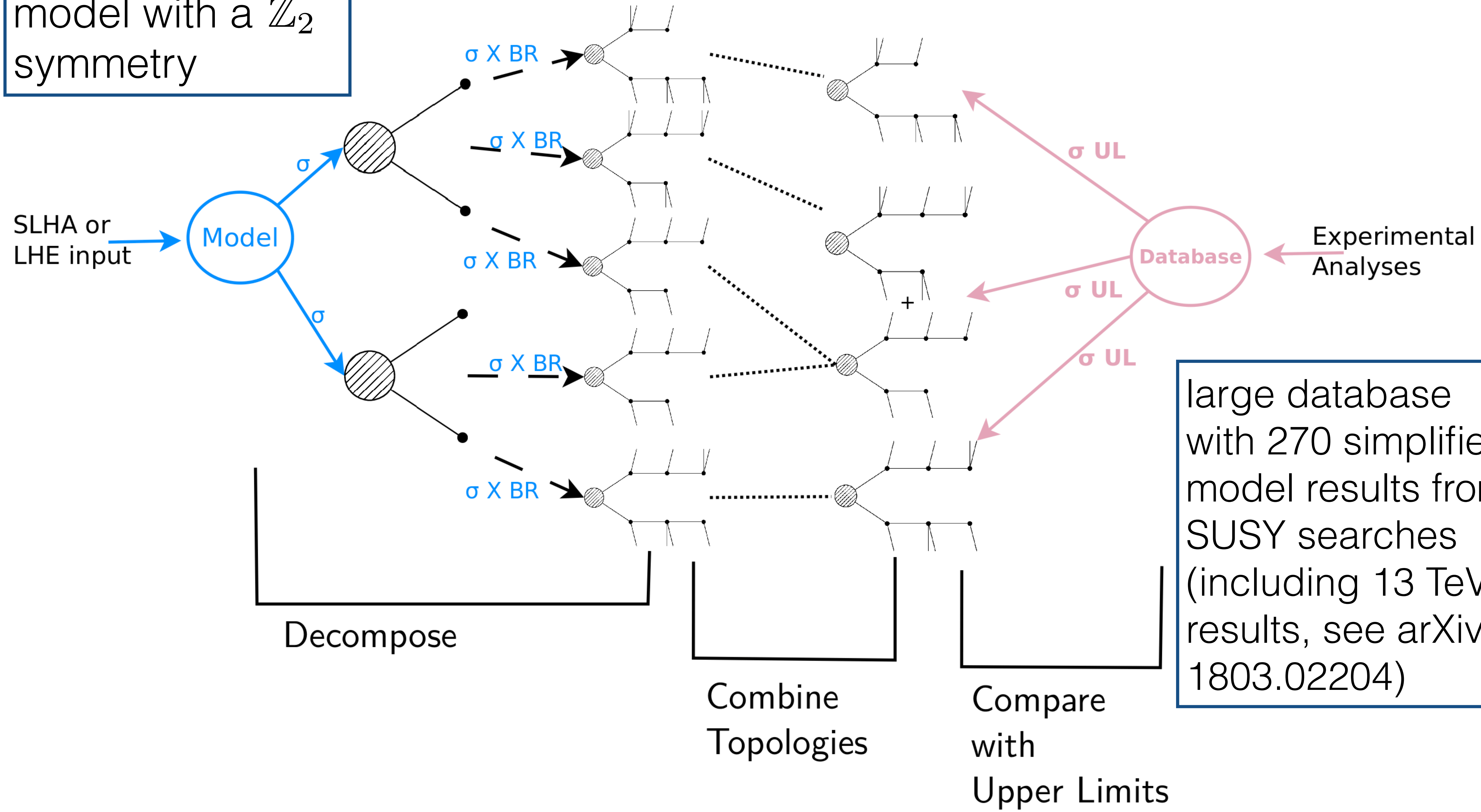

large database with 270 simplified model results from SUSY searches (including 13 TeV results, see arXiv: 1803.02204)

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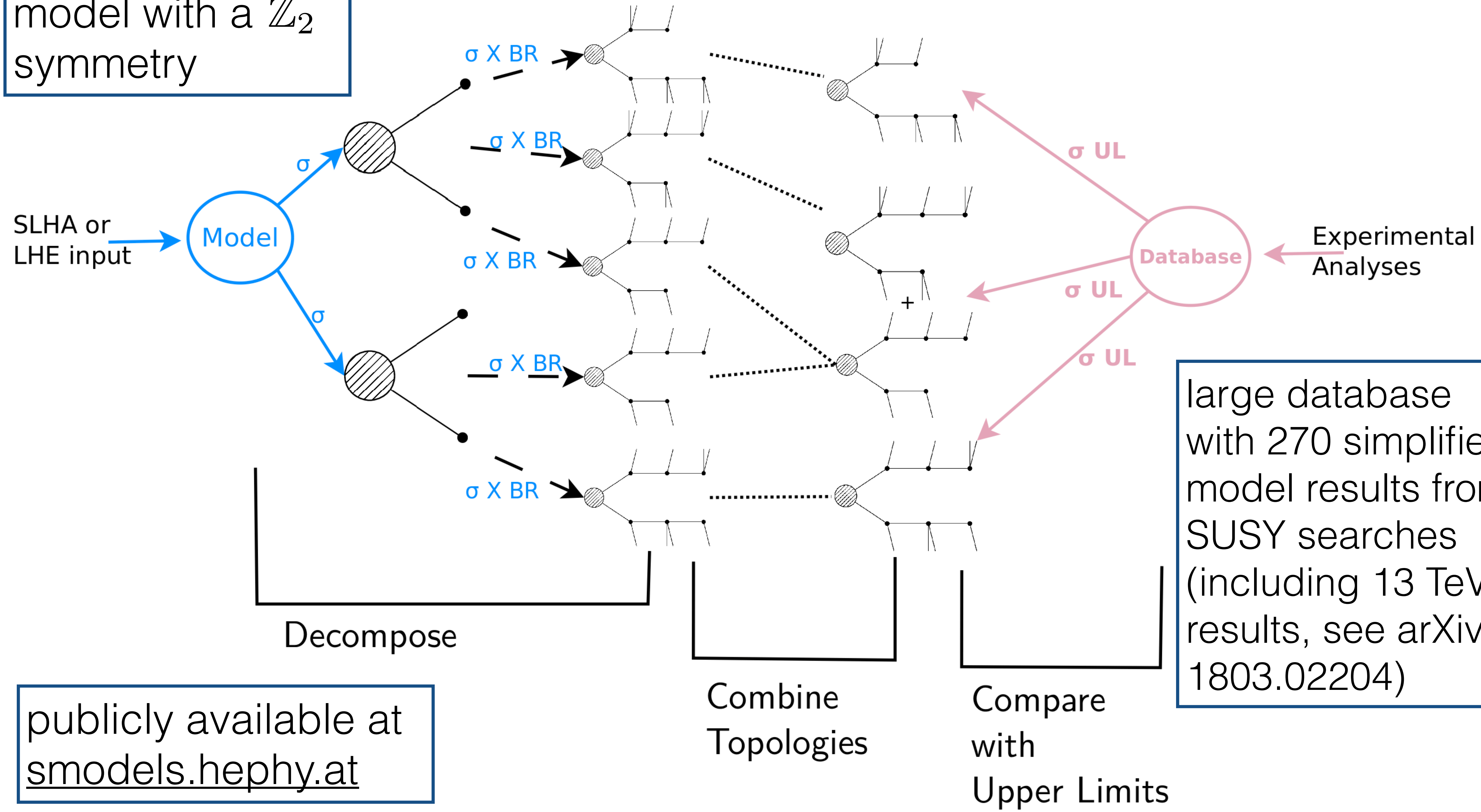


large database with 270 simplified model results from SUSY searches (including 13 TeV results, see arXiv: 1803.02204)

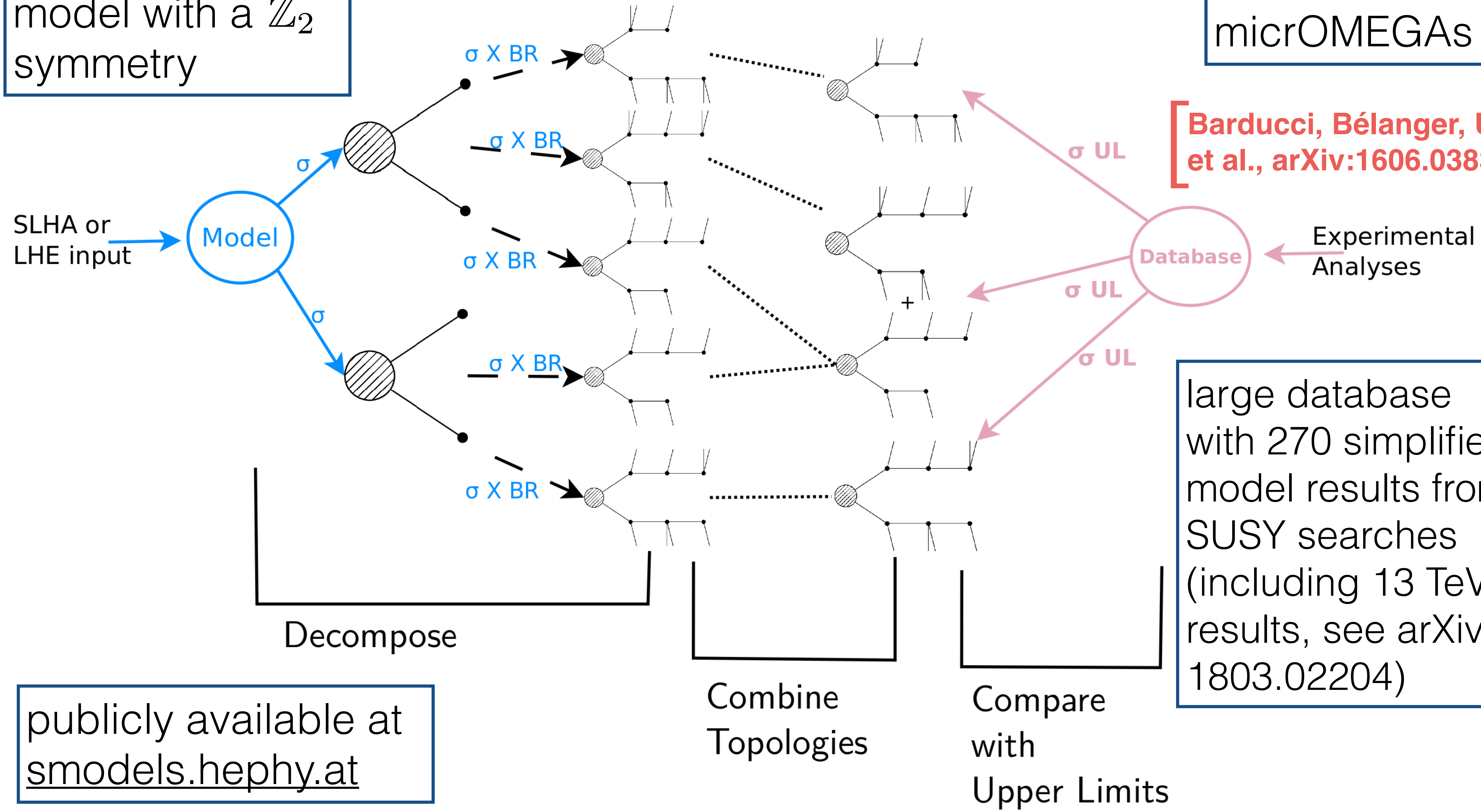
publicly available at smodels.hephy.at

# SModelS

**[Kraml, Kulkarni, UL, et. al**
**arXiv:1312.4175**
**arXiv:1412.1745**
**arXiv:1701.06586]**

works for every model with a $\mathbb{Z}_2$ symmetry

Interface with micrOMEGAs



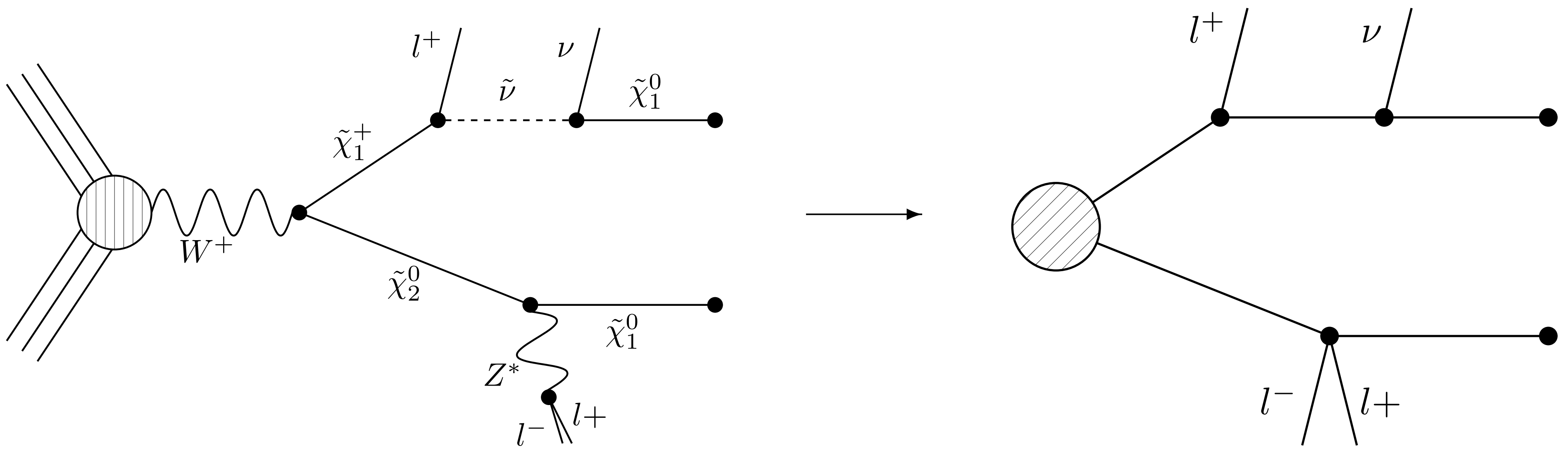
**[Barducci, Bélanger, UL et al., arXiv:1606.03834]**

large database with 270 simplified model results from SUSY searches (including 13 TeV results, see arXiv: 1803.02204)

publicly available at smodels.hephy.at

# Advantages and Assumptions

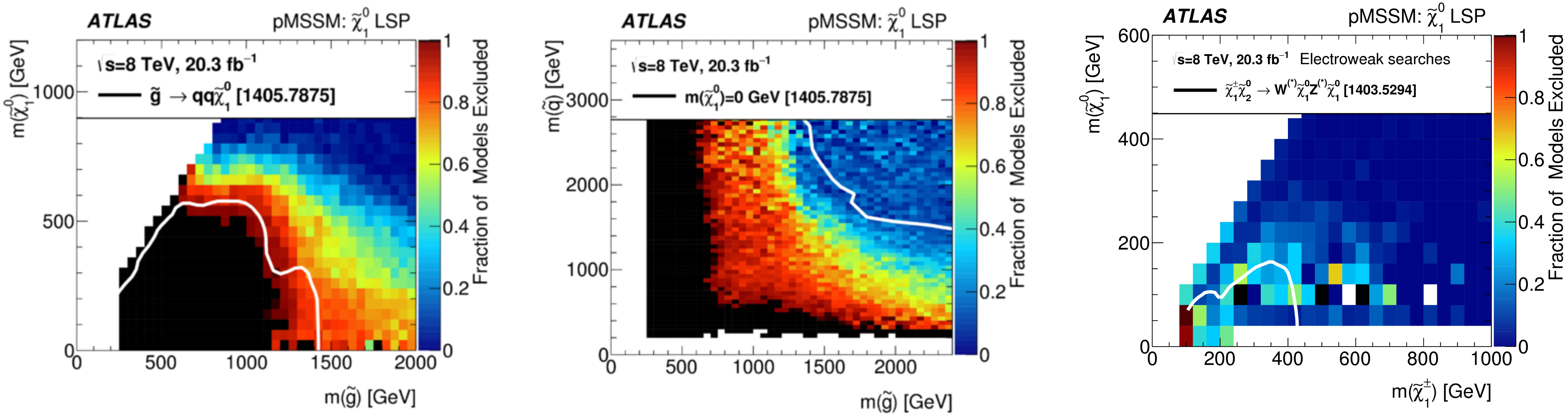
- Fast test against large database of results
- Identification of most relevant search channels, analysis strategies
- Information about topologies not covered in the results database, so-called "missing topologies", and their classification into long cascade decays and asymmetric branch topologies
- Model independent under the **SMS assumption:**
  - details of production process not important
  - only on-shell particles relevant to the description (replace off-shell particles by effective vertex)
  - mass is the only relevant quantum number



# Coverage of the pMSSM by simplified model results

comparison with the ATLAS pMSSM study [arXiv:1508.06608]

- ATLAS interpreted 22 SUSY analyses (8 TeV) in the phenomenological MSSM (pMSSM)
- Random scan in 19 free parameters, in reach of LHC8
- Sampling such that after selection similar number of points with Bino-, Wino- and Higgsino-like LSP remain
- SLHA files + exclusion information available on HepData !



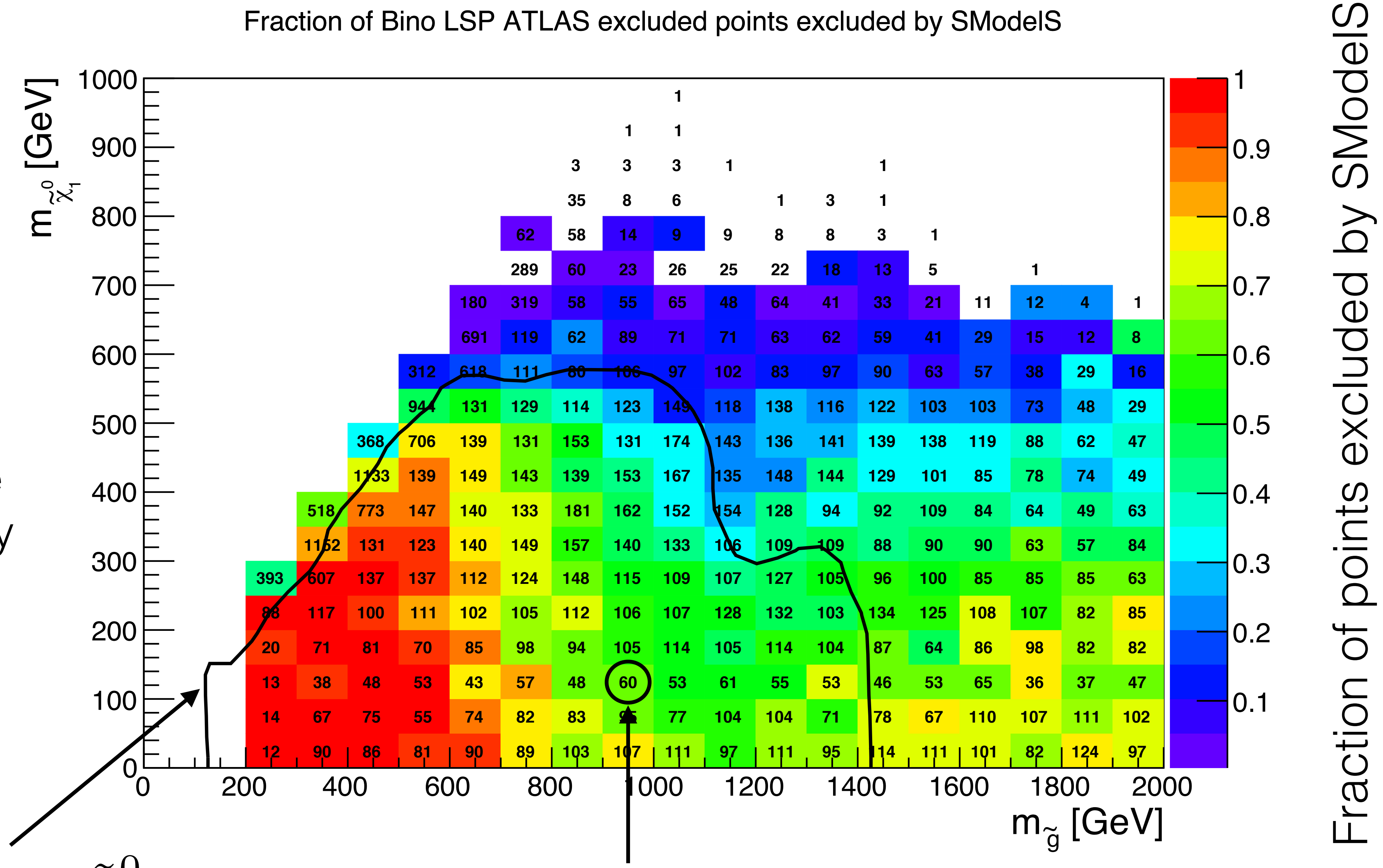
**To what extend can the ATLAS exclusion be reproduced using only 8 TeV simplified model results?**

# Coverage comparison for pMSSM scenarios

[ Ambrogi, Kraml, Kulkarni, UL, et.al, arXiv:1707.09036 ]

(Bino-like LSP scenarios)

- Light gluino well covered except for compressed region
- Coverage drops for intermediate gluino masses
- Main reasons: cascade decays preferred, many topologies not covered by existing simplified model interpretations



$$\tilde{g} \to q q \tilde{\chi}_1^0$$

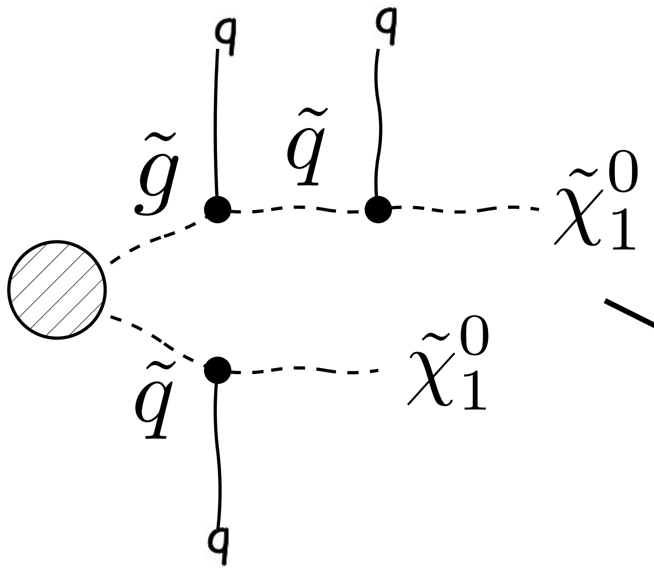
exclusion from ATLAS arXiv:1405.7875

Number of points tested (i.e. points excluded by ATLAS)

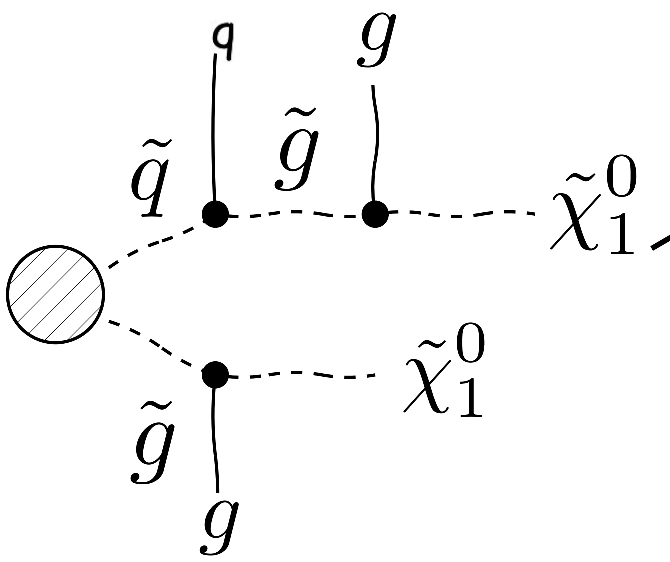
# Gluino-squark missing topology

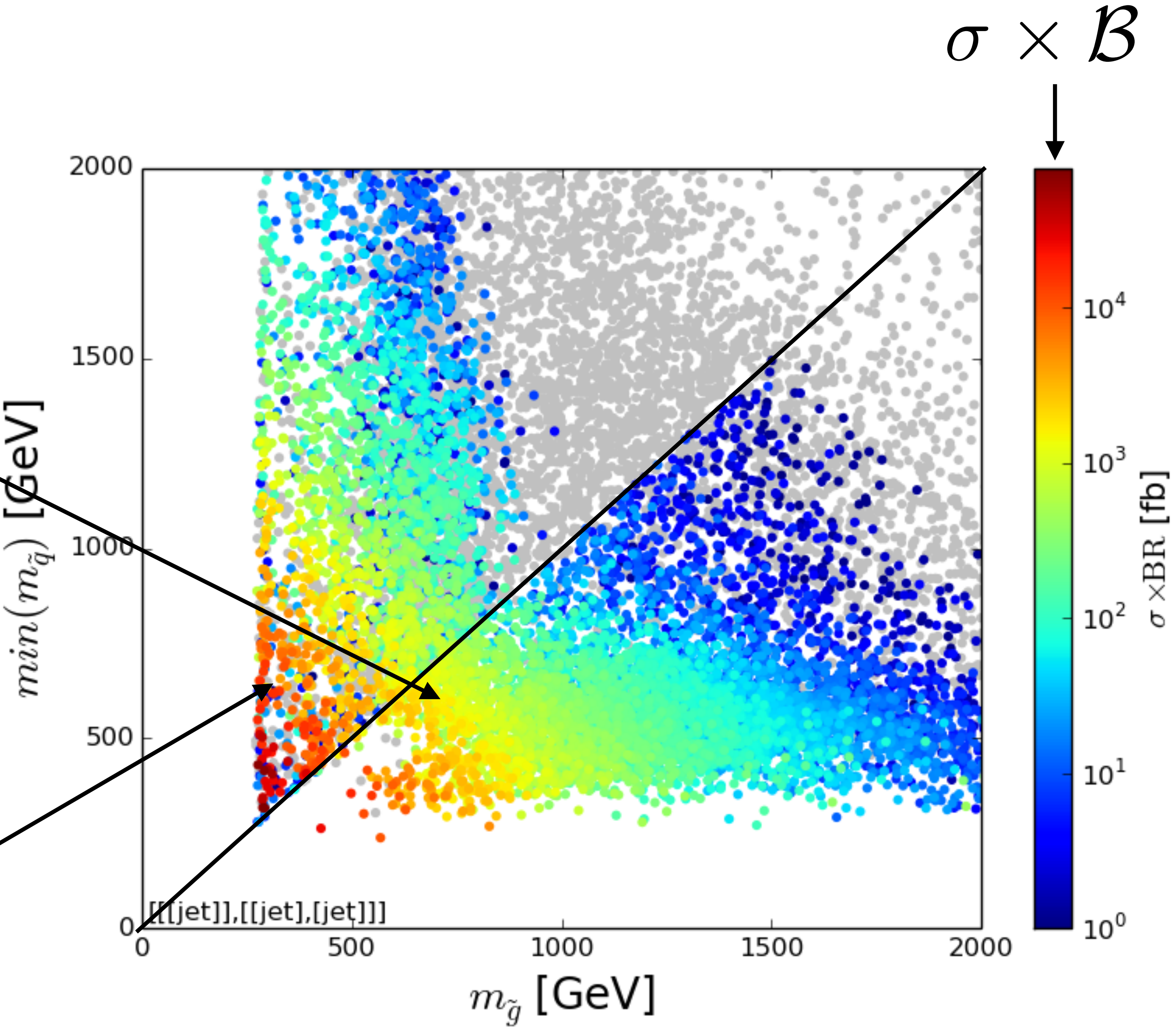
(Bino-like LSP scenarios)

Gluino-Squark production where (one of) the squarks are lighter than the gluino



Gluino-Squark production where the gluino is lighter than all squarks



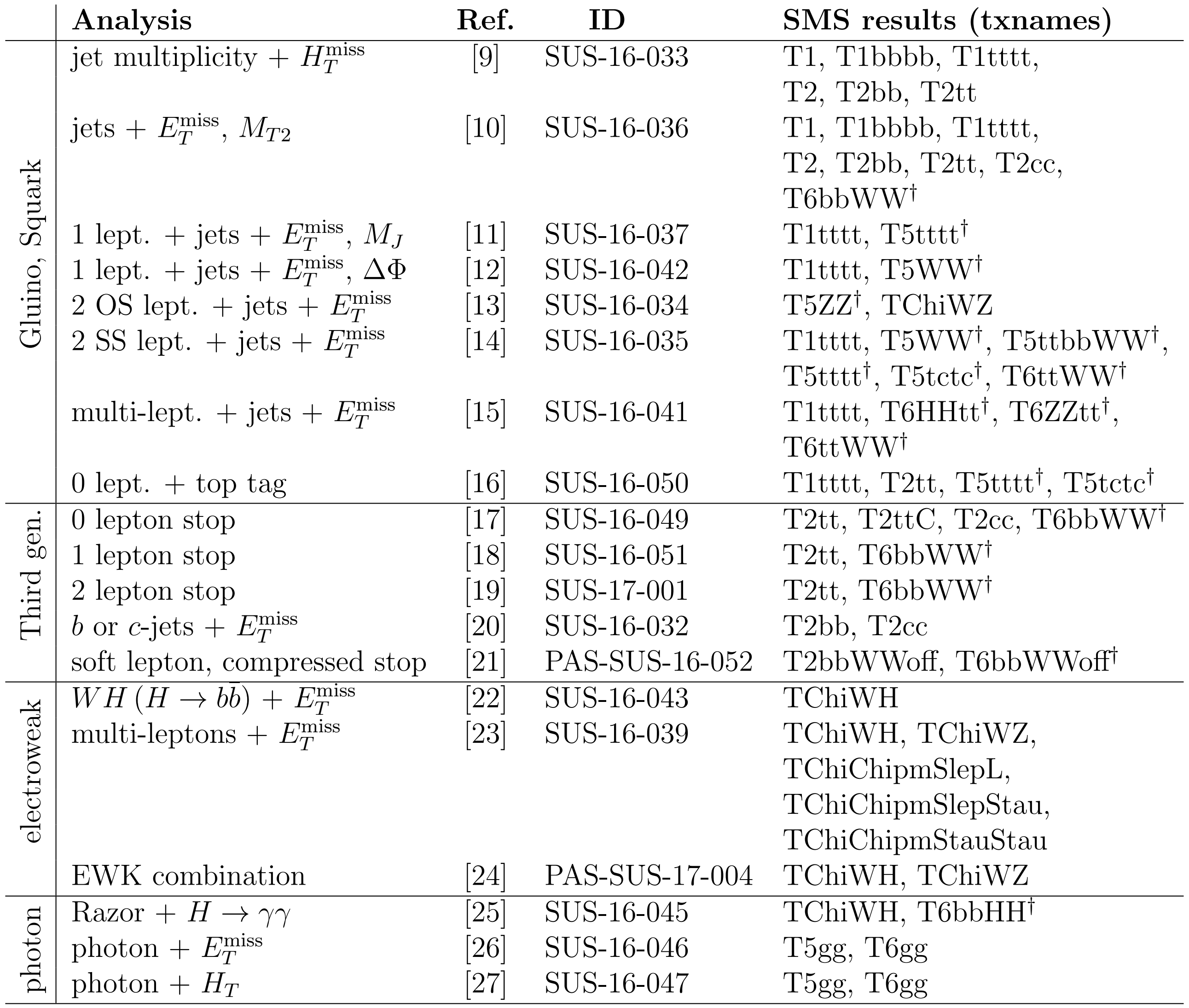


**Should be included in SModelS to improve coverage**

# Recent database update — including 13 TeV results

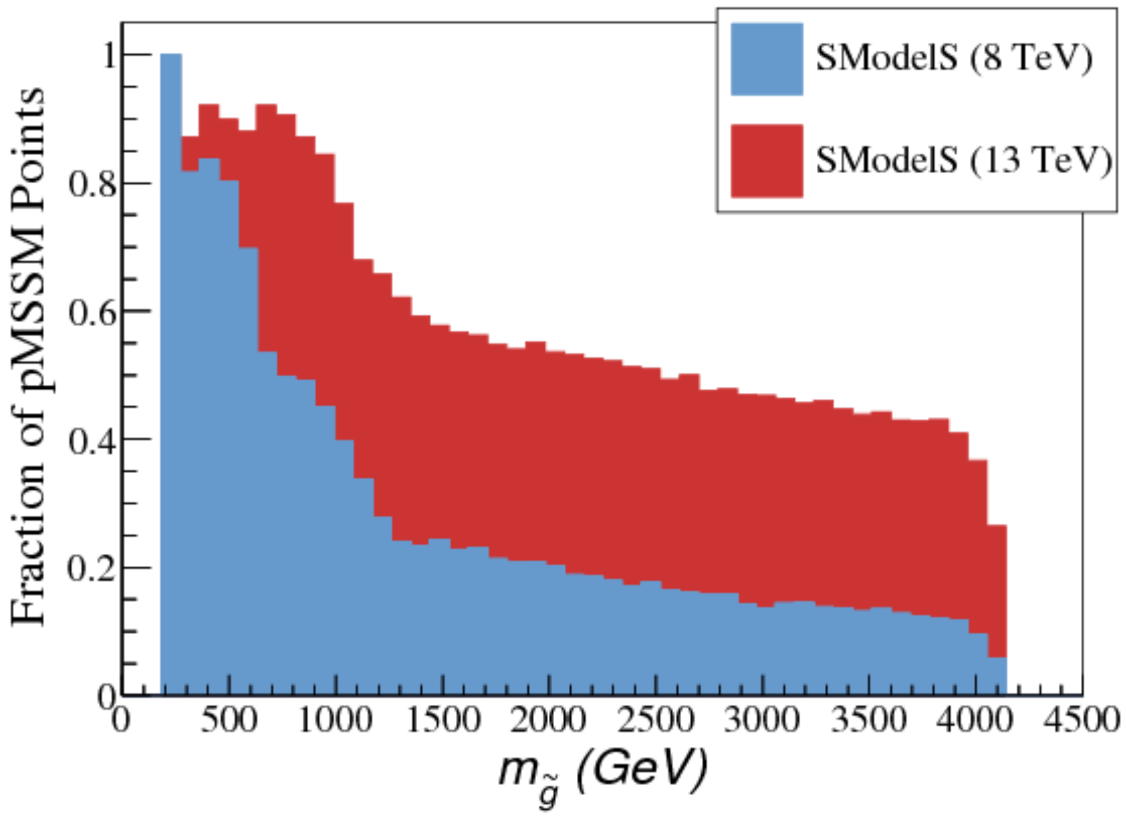
see [arXiv:1803.02204]

**Extends database by 19 Run 2 analyses from CMS**



| | Analysis | Ref. | ID | SMS results (txnames) |
|---|---|---|---|---|
| Gluino, Squark | jet multiplicity + $H_T^{\text{miss}}$ | [9] | SUS-16-033 | T1, T1bbbb, T1tttt,<br>T2, T2bb, T2tt |
| | jets + $E_T^{\text{miss}}$, $M_{T2}$ | [10] | SUS-16-036 | T1, T1bbbb, T1tttt,<br>T2, T2bb, T2tt, T2cc,<br>T6bbWW† |
| | 1 lept. + jets + $E_T^{\text{miss}}$, $M_J$ | [11] | SUS-16-037 | T1tttt, T5tttt† |
| | 1 lept. + jets + $E_T^{\text{miss}}$, $\Delta\Phi$ | [12] | SUS-16-042 | T1tttt, T5WW† |
| | 2 OS lept. + jets + $E_T^{\text{miss}}$ | [13] | SUS-16-034 | T5ZZ†, TChiWZ |
| | 2 SS lept. + jets + $E_T^{\text{miss}}$ | [14] | SUS-16-035 | T1tttt, T5WW†, T5ttbbWW†,<br>T5tttt†, T5tctc†, T6ttWW† |
| | multi-lept. + jets + $E_T^{\text{miss}}$ | [15] | SUS-16-041 | T1tttt, T6HHtt†, T6ZZtt†,<br>T6ttWW† |
| | 0 lept. + top tag | [16] | SUS-16-050 | T1tttt, T2tt, T5tttt†, T5tctc† |
| Third gen. | 0 lepton stop | [17] | SUS-16-049 | T2tt, T2ttC, T2cc, T6bbWW† |
| | 1 lepton stop | [18] | SUS-16-051 | T2tt, T6bbWW† |
| | 2 lepton stop | [19] | SUS-17-001 | T2tt, T6bbWW† |
| | $b$ or $c$-jets + $E_T^{\text{miss}}$ | [20] | SUS-16-032 | T2bb, T2cc |
| | soft lepton, compressed stop | [21] | PAS-SUS-16-052 | T2bbWWoff, T6bbWWoff† |
| electroweak | $WH\,(H \to bb)$ + $E_T^{\text{miss}}$ | [22] | SUS-16-043 | TChiWH |
| | multi-leptons + $E_T^{\text{miss}}$ | [23] | SUS-16-039 | TChiWH, TChiWZ,<br>TChiChipmSlepL,<br>TChiChipmSlepStau,<br>TChiChipmStauStau |
| | EWK combination | [24] | PAS-SUS-17-004 | TChiWH, TChiWZ |
| photon | Razor + $H \to \gamma\gamma$ | [25] | SUS-16-045 | TChiWH, T6bbHH† |
| | photon + $E_T^{\text{miss}}$ | [26] | SUS-16-046 | T5gg, T6gg |
| | photon + $H_T$ | [27] | SUS-16-047 | T5gg, T6gg |

Big impact on excluding pMSSM scenarios considered by ATLAS



# Summary & Outlook

- Simplified models are standard method of interpretation for ATLAS and CMS SUSY searches
- Results can be reinterpreted using SModelS to get fast test of model points against large number of experimental results
- Additional information provided to allow more detailed studies
- Large number of 13 TeV results already included in the database
- New version coming up, allowing the combination of signal regions when covariance matrix is provided (using simplified likelihood framework, see CMS Note 2017/001)

**pip install -user smodels**

**http://smodels.hephy.at**