Новые результаты эксперимента АТЛАС

новые результаты ATLAS по электро-слабой физике в

докладе Александра Солодкова сегодня в 15:00



Леонид Гладилин НИИЯФ МГУ



Сессия СЯФ ОФН РАН, Протвино, 5-8.11.2013



Содержание :

- Заключение

- Введение
- бозон Хиггса: рождение, распады, масса, спин-чётность
- поиск заряженного бозона Хиггса
- поиски суперсимметрии
- поиск тяжёлых двух-лептонных резонансов

- поиск микроскопических чёрных дыр

рождение струй в Pb+Pb столкновениях

- измерение рождения кваркониев χ_{c1} , χ_{c2} , $\psi(2S)$

ATLAS @ LHC





Run 4 HL-LHC 3000 fb⁻¹

Реконструкция и моделирование объектов



Бозон Хиггса на LHC - картина ATLAS'а

Higgs Decay	Sub. Decay	Sub-Channels	∫ <i>L dt</i> [fb ⁻¹]
		$2011 \sqrt{s} = 7 \mathrm{TeV}$	
$H \rightarrow ZZ^*$	4ℓ	$\{4e, 2e2\mu, 2\mu 2e, 4\mu, 2 ext{-jet VBF}, \ell ext{-tag}\}$	4.6
$H \rightarrow \gamma \gamma$	-	10 categories $\{p_{\mathcal{T}_l}\otimes\eta_\gamma\otimes ext{conversion}\}\oplus\{ ext{2-jet VBF}\}$	4.8
$H \rightarrow WW^*$	$\ell \nu \ell \nu$	$\{ee,e\mu,\mu e,\mu\mu\}\otimes \{ extsf{0-jet, 1-jet, 2-jet VBF}\}$	4.6
$H \rightarrow \tau \tau$	기ep기ep 기ep7had 7had7had	$\begin{array}{l} \{e\mu\} \otimes \{\text{0-jet}\} \oplus \{\ell\ell\} \otimes \{\text{1-jet}, 2\text{-jet}, p_{\mathcal{T}_{\tau\tau}} > 100 \text{ GeV}, \textit{VH} \} \\ \{e,\mu\} \otimes \{\text{0-jet}, 1\text{-jet}, p_{\mathcal{T}_{\tau\tau}} > 100 \text{ GeV}, 2\text{-jet} \} \\ \{1\text{-jet}, 2\text{-jet} \} \end{array}$	4.6 4.6 4.6
$VH \rightarrow Vbb$	$\begin{array}{l} Z \to \nu \nu \\ W \to \ell \nu \\ Z \to \ell \ell \end{array}$	$\begin{array}{l} \textit{E}_{T}^{miss} \in \{120-160, 160-200, \geq 200 GeV\} \otimes \{\texttt{2-jet}, \texttt{3-jet}\} \\ \textit{p}_{T}^{W} \in \{<50, 50-100, 100-150, 150-200, \geq 200 GeV\} \\ \textit{p}_{T}^{Z} \in \{<50, 50-100, 100-150, 150-200, \geq 200 GeV\} \end{array}$	4.6 4.7 4.7
		$2012\sqrt{s} = 8 \mathrm{TeV}$	
$H \rightarrow ZZ^*$	4ℓ	$\{4e, 2e2\mu, 2\mu 2e, 4\mu, 2 ext{-jet VBF}, \ell ext{-tag}\}$	20.7
$H \rightarrow \gamma \gamma$	-	14 categories $\{p_{T_t} \otimes \eta_{\gamma} \otimes \text{conversion}\} \oplus \{2\text{-jet VBF}\} \oplus \{\ell\text{-tag}, E_T^{\text{miss}}\text{-tag}, 2\text{-jet VH}\}$	20.7
$H \rightarrow WW^*$	$\ell \nu \ell \nu$	$\{ee,e\mu,\mu e,\mu\mu\}\otimes \{$ 0-jet, 1-jet, 2-jet VBF $\}$	20.7
$H \rightarrow \tau \tau$	$\mathcal{T}_{ep}\mathcal{T}_{ep}$ \mathcal{T}_{had} \mathcal{T}_{had} \mathcal{T}_{had}	$ \begin{array}{l} \{\ell\ell\} \otimes \{\texttt{1-jet}, \texttt{2-jet}, p_{T_{\tau\tau}} > 100 GeV, \textit{VH} \} \\ \{e,\mu\} \otimes \{\texttt{0-jet}, \texttt{1-jet}, p_{T_{\tau\tau}} > 100 GeV, \texttt{2-jet} \} \\ \{\texttt{1-jet}, \texttt{2-jet} \} \end{array} $	13 13 13
VH ightarrow Vbb	$\begin{array}{l} Z \to \nu \nu \\ W \to \ell \nu \\ Z \to \ell \ell \end{array}$	$\begin{array}{l} {\it E}_{T}^{\sf miss} \in \{120-160, 160-200, \geq 200 {\rm GeV}\} \otimes \{{\it 2}\text{-jet}, {\it 3}\text{-jet}\} \\ {\it p}_{T}^{W} \in \{<50, 50-100, 100-150, 150-200, \geq 200 {\rm GeV}\} \\ {\it p}_{T}^{Z} \in \{<50, 50-100, 100-150, 150-200, \geq 200 {\rm GeV}\} \end{array}$	13 13 13



March2013



October 2013

Рождение бозона Хиггса на LHC

VH ttH

ggF

Dominant process is gluon-gluon fusion (ggF)

- Proceeds mainly through the top quark loop \rightarrow Indirect probe of Higgs-fermion coupling Vector Boson Fusion (VBF) VBF
- Direct probe of vector boson coupling
- Signature includes two forward high-pT jets with a large rapidity-gap

Associated production with W/Z (VZ)

- Direct probe of vector boson coupling
- Signature includes high-pT leptons

Associated production with a top quark pair (ttH)

Direct probe of Higgs-top quark coupling









ttH

0.13

0.09

Распады бозона Хиггса на LHC



Higgs boson can decay into a photon pair via W or t-quark loop.
Negative interference between W-boson loop and t-quark loop helps the indirect measurement of the coupling to fermions
Final states with leptons or photons are easier to measure
Discovery channels : H→γγ, ZZ(→4ℓ), WW(→ℓνℓν)
Decays to jets or τs are more difficult to separate from QCD background, but they are very important for the direct measurement of the coupling to fermions.6

Основные каналы наблюдения $H \to \gamma \gamma$ $H \to Z Z$ $H \to W W$



Дифференциальные сечения $H \rightarrow \gamma \gamma$ ATLAS-CONF-2013-072

- 8 observables : $p_T^{\gamma\gamma}$, $|\gamma^{\gamma\gamma}|$, $|\cos\theta^*|$, N_{jets} , Φ_{jj} , ...,
- The distributions are unfolded to particle level and compared with MC generators
- Sensitive to PDF, radiative correction, relative rate of Higgs production, spin,...



Probability of χ^2 test

	Njets	$p_{\mathrm{T}}^{\gamma\gamma}$	$ y^{\gamma\gamma} $	$ \cos \theta^* $	$p_{\mathrm{T}}^{j_1}$	$\Delta \phi_{jj}$	$p_{\mathrm{T}}^{\gamma\gamma jj}$	
POWHEG	0.54	0.55	0.38	0.69	0.79	0.42	0.50	No significant deviation from SM
MINLO	0.44	_	_	0.67	0.73	0.45	0.49	(POWHEG, MINLO, HRES1.0) is
HRes 1.0	_	0.39	0.44	_	_	_	_	observed. 8

Масса бозона Хиггса



Mass difference $\sim 2.4\sigma$ - not a problem yet to be clarified with Run2 data

"Сила" сигнала бозона Хиггса arXiv:1307.1427

 $\mu = \frac{\sigma \times \mathrm{BR}}{(\sigma \times \mathrm{BR})}_{\mathrm{SM}}$

 μ =1 (if SM Higgs), μ =0 (if no SM Higgs)

combined

 $\mu = 1.33 \pm 0.14 ({\rm stat}) \pm 0.15 ({\rm sys}) \label{eq:mh}$ (m_H=125.5GeV)

Result is consistent with the SM prediction with 15% precision.

H \rightarrow bb and H \rightarrow τ τ not in the combination

Statistical, systematic and theory (QCD scale, PDF) uncertainties are already comparable.



Наблюдение VBF рождения бозона Хиггса



3.3 σ evidence that a fraction of Higgs boson production occurs through VBF

-+- σ(stat) ATLAS Total uncertainty σ(sys) m_н = 125.5 GeV ± 1σ ± 2σ σ(theo) + 0.4 - 0.4 $H \rightarrow \gamma \gamma$ + 0.7 2σ 0.4 $\frac{\mu_{\rm VBF+VH}}{\mu_{\rm ggF+ttH}} = 1.1^{+0.9}_{-0.5}$ 0.2 0.2 1σ + 1.3 - 0.8 $H \rightarrow ZZ^* \rightarrow 4I$ + 2.0 - 0.4 $\frac{\mu_{VBF+VH}}{\mu_{ggF+ttH}} = 0.6^{+2.4}_{-0.9}$ + 0.3 0.2 1σ + 0.8 0.8 $H \rightarrow WW^* \rightarrow h/h$ + 2.0 0.7 $\frac{\mu_{VBF+VH}}{\mu_{ggF+ttH}} = 2.0^{+2.2}_{-1.0}$ 0.5 0.2 1σ + 0.4 Combined - 0.3 $H \rightarrow \gamma \gamma$, ZZ*, WW* + 0.6 2σ 0.4 $\frac{\mu_{_{VBF+VH}}}{\mu_{_{ggF+ttH}}} = 1.4^{+0.7}_{-0.5}$ + 0.20.1 3 5 0 2 4 $\sqrt{s} = 7 \text{ TeV} \int Ldt = 4.6-4.8 \text{ fb}^{-1}$ μ_{VBF+VH} / $\mu_{aaF+ttH}$ √s = 8 TeV ∫Ldt = 20.7 fb⁻¹

arXiv:1307.1427

Константы связи бозона Хиггса arXiv:1307.1427

coupling scale factors are considered





good agreement with SM expectations

Спин-чётность бозона Хиггса arXiv:1307.1432

0⁺ is expected; test it vs 0⁻, 1⁺, 1⁻, 2⁺



Spin-Parity 0⁺ confirmed



J ^P hypo	Exclusion CL	Source
0-	97.8%	$H \rightarrow ZZ^* \rightarrow 4I$
1-	99.7%	Combined ZZ*/WW*
1+	99.97%	Combined ZZ*/WW*
2+	99.9%	Combined $\gamma\gamma/ZZ^*/WW^*$

Поиск заряженного бозона Хиггса $H^+ \rightarrow \tau^+ v$

ATLAS-CONF-2013-090



Signature: 3-4 jets, at least one jet b-tagged, exactly one τ (narrow jet), E_{T}^{miss}



 $m_{\rm T} = \sqrt{2p_{\rm T}^{\tau} E_{\rm T}^{\rm miss} (1 - \cos \Delta \phi_{\tau,{\rm miss}})}$



Поиски Суперсимметрии в эксперименте ATLAS



SUSY can

- eliminate quadratic divergences in Higgs mass corrections
- unify forces at high scales
- explain nature of Dark Matter (if LSP stable or long-lived)

R-Parity $P_R = (-1)^{3(B-L)+2S}$

Search strategy designed to provide coverage for a broad class of SUSY models





For each search, a number of signal regions is optimized based on a variety of models

Поиски *q̃* и *g̃* в событиях без лептонов, с 2- 6 струями и большим *E*^{miss} ATLAS-CONF-2013-047



simplified phenomenological MSSM scenario with only strong production of gluinos and first- and second-generation squarks (of common mass), with direct decays to jets and lightest neutralinos







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Поиск $\tilde{\chi}_1^{\pm} c m(\tilde{\chi}_1^{\pm}) \approx m(\tilde{\chi}_1^{0})$ в событиях с большим E_T^{miss} и "исчезающим" треком arXiv:1310.3675



 $p_{\tau}^{track} > 75, 100, 150, 200 \text{ GeV}$

Ограничения на $m(\tilde{\chi}_1^{\pm}), \tau(\tilde{\chi}_1^{\pm}) u m(\tilde{\chi}_1^{\pm}) - m(\tilde{\chi}_1^{0}) в событиях с$ $большим <math>E_T^{miss}$ и "исчезающим" треком arXiv:1310.3675



For $\tau \sim 0.2$ ns, charginos excluded up to 270 GeV For $\tau \sim 1-10$ ns, chargino excluded up to 520 GeV

Поиск долгоживущих остановившихся R-адронов "decaying out of time with pp collisions" arXiv:1310.6584



$E_T^{miss} / E_T^{leading jet} > 0.5$, no muons segments





> 100, 300 GeV

R-Hadron Lifetime [seconds]

Ограничения на характеристики *ĝ, ť и ḃ́* из долгоживущих остановившихся R-адронов arXiv:1310.6584



Limits are somewhat model dependent

Conclusion is general – No SUSY signature (yet?)



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Ограничения на массы суперсимметричных партнёров

ATLAS SUSY Searches* - 95% CL Lower Limits

Status: SUSY 2013 Model

ATLAS Preliminary

ſL TeV

	Reference
$dt = (4.6 - 22.9) \text{ fb}^{-1}$	$\sqrt{s} = 7, 8 \text{ Terms}$

	Model	e, μ, τ, γ	Jets	$\mathbf{E}_{\mathrm{T}}^{\mathrm{miss}}$	∫£ dt[fb	p ⁻¹]	Mass limit	u u u u u u u u u u u u u u u u u u u	Reference
Inclusive Searches	$ \begin{array}{l} \text{MSUGRA/CMSSM} \\ \text{MSUGRA/CMSSM} \\ \text{MSUGRA/CMSSM} \\ \tilde{q}\tilde{q}, \tilde{q} \rightarrow q \tilde{\chi}_{1}^{0} \\ \tilde{g}\tilde{g}, \tilde{g} \rightarrow q \tilde{\chi}_{1}^{0} \\ \tilde{g}\tilde{g}, \tilde{g} \rightarrow q \tilde{\chi}_{1}^{0} \\ \tilde{g}\tilde{g}, \tilde{g} \rightarrow q q (\ell \ell / \ell \nu / \nu \nu) \tilde{\chi}_{1}^{0} \\ \text{GMSB} (\tilde{\ell} \text{ NLSP}) \\ \text{GGM (bino NLSP)} \\ \text{GGM (bino NLSP)} \\ \text{GGM (higgsino-bino NLSP)} \\ \text{GGM (higgsino NLSP)} \\ \text{GGM (higgsino NLSP)} \\ \text{Gravitino LSP} \\ \end{array} $	$\begin{array}{c} 0 \\ 1 \ e, \mu \\ 0 \\ 0 \\ 1 \ e, \mu \\ 2 \ e, \mu \\ 2 \ e, \mu \\ 1 \ e, \mu + \gamma \\ \gamma \\ 2 \ e, \mu + \gamma \\ \gamma \\ 2 \ e, \mu + \gamma \\ \gamma \\ 2 \ e, \mu (Z) \\ 0 \end{array}$	2-6 jets 3-6 jets 7-10 jets 2-6 jets 2-6 jets 3-6 jets 0-3 jets 0-2 jets 	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes	20.3 20.3 20.3 20.3 20.3 20.3 20.3 4.7 20.7 4.8 4.8 4.8 4.8 5.8 10.5	q. g g. g g </th <th>1.2 TeV 1.1 TeV 740 GeV 1.3 Te 1.3 Te 1.3 Te 1.18 TeV 1.12 TeV 1.2 TeV 1.3 Te 1.3 Te 1.3 Te 1.3 Te 1.3 Te 1.3 Te 1.3 Te 1.4 TeV 1.4 TeV 1.4 TeV 1.4 TeV 1.4 TeV 1.5 TeV 1.</th> <th>1.7 TeV $m(\tilde{q})=m(\tilde{g})$ any $m(\tilde{q})$ any $m(\tilde{q})$ $m(\tilde{\chi}_{1}^{0})=0$ GeV $m(\tilde{\chi}_{1}^{0})=0$ GeV $m(\tilde{\chi}_{1}^{0})=0$ GeV $m(\tilde{\chi}_{1}^{0})=0$ GeV $ta\eta\delta>18$ $m(\tilde{\chi}_{1}^{0})=50$ GeV $m(\tilde{\chi}_{1}^{0})>50$ GeV $m(\tilde{\chi}_{1}^{0})>50$ GeV $m(\tilde{\chi}_{1}^{0})>50$ GeV $m(\tilde{\chi}_{1}^{0})>220$ GeV $m(\tilde{\chi}_{1}^{0})=20$ GeV $m(\tilde{\chi}_{1}^{0})=210$ GeV $m(\tilde{\chi}_{1}^{0})=210$ GeV</th> <th>ATLAS-CONF-2013-047 ATLAS-CONF-2013-062 1308.1841 ATLAS-CONF-2013-047 ATLAS-CONF-2013-047 ATLAS-CONF-2013-062 ATLAS-CONF-2013-068 1208.4688 ATLAS-CONF-2013-026 1209.0753 ATLAS-CONF-2012-144 1211.1167 ATLAS-CONF-2012-152 ATLAS-CONF-2012-152</th>	1.2 TeV 1.1 TeV 740 GeV 1.3 Te 1.3 Te 1.3 Te 1.18 TeV 1.12 TeV 1.2 TeV 1.3 Te 1.3 Te 1.3 Te 1.3 Te 1.3 Te 1.3 Te 1.3 Te 1.4 TeV 1.4 TeV 1.4 TeV 1.4 TeV 1.4 TeV 1.5 TeV 1.	1.7 TeV $m(\tilde{q})=m(\tilde{g})$ any $m(\tilde{q})$ any $m(\tilde{q})$ $m(\tilde{\chi}_{1}^{0})=0$ GeV $m(\tilde{\chi}_{1}^{0})=0$ GeV $m(\tilde{\chi}_{1}^{0})=0$ GeV $m(\tilde{\chi}_{1}^{0})=0$ GeV $ta\eta\delta>18$ $m(\tilde{\chi}_{1}^{0})=50$ GeV $m(\tilde{\chi}_{1}^{0})>50$ GeV $m(\tilde{\chi}_{1}^{0})>50$ GeV $m(\tilde{\chi}_{1}^{0})>50$ GeV $m(\tilde{\chi}_{1}^{0})>220$ GeV $m(\tilde{\chi}_{1}^{0})=20$ GeV $m(\tilde{\chi}_{1}^{0})=210$ GeV $m(\tilde{\chi}_{1}^{0})=210$ GeV	ATLAS-CONF-2013-047 ATLAS-CONF-2013-062 1308.1841 ATLAS-CONF-2013-047 ATLAS-CONF-2013-047 ATLAS-CONF-2013-062 ATLAS-CONF-2013-068 1208.4688 ATLAS-CONF-2013-026 1209.0753 ATLAS-CONF-2012-144 1211.1167 ATLAS-CONF-2012-152 ATLAS-CONF-2012-152
3 rd gen. ĝ med.	$\begin{array}{l} \tilde{g} \rightarrow b \bar{b} \tilde{k}_{1}^{0} \\ \tilde{g} \rightarrow t \bar{t} \tilde{k}_{1}^{0} \\ \tilde{g} \rightarrow t \bar{t} \tilde{k}_{1}^{0} \\ \tilde{g} \rightarrow b \bar{t} \tilde{k}_{1}^{+} \end{array}$	0 0 0-1 e,μ 0-1 e,μ	3 <i>b</i> 7-10 jets 3 <i>b</i> 3 <i>b</i>	Yes Yes Yes Yes	20.1 20.3 20.1 20.1	200 200 200 200	1.2 TeV 1.1 TeV 1.34 T 1.34 T	$\begin{array}{c} m(\tilde{\chi}_{1}^{0}) < 600 \; \text{GeV} \\ m(\tilde{\chi}_{1}^{0}) < 350 \; \text{GeV} \\ \textbf{eV} \qquad m(\tilde{\chi}_{1}^{0}) < 400 \; \text{GeV} \\ \textbf{V} \qquad m(\tilde{\chi}_{1}^{0}) < 300 \; \text{GeV} \end{array}$	ATLAS-CONF-2013-061 1308.1841 ATLAS-CONF-2013-061 ATLAS-CONF-2013-061
3 rd gen. squarks direct production	$ \begin{array}{l} \tilde{b}_{1}\tilde{b}_{1}, \ \tilde{b}_{1} \! \rightarrow \! b \tilde{\chi}_{1}^{0} \\ \tilde{b}_{1}\tilde{b}_{1}, \ \tilde{b}_{1} \! \rightarrow \! t \tilde{\chi}_{1}^{0} \\ \tilde{t}_{1}\tilde{t}_{1}(\text{light}), \ \tilde{t}_{1} \! \rightarrow \! t \tilde{\chi}_{1}^{1} \\ \tilde{t}_{1}\tilde{t}_{1}(\text{light}), \ \tilde{t}_{1} \! \rightarrow \! t \tilde{\chi}_{1}^{0} \\ \tilde{t}_{1}\tilde{t}_{1}(\text{medium}), \ \tilde{t}_{1} \! \rightarrow \! t \tilde{\chi}_{1}^{0} \\ \tilde{t}_{1}\tilde{t}_{1}(\text{medium}), \ \tilde{t}_{1} \! \rightarrow \! t \tilde{\chi}_{1}^{0} \\ \tilde{t}_{1}\tilde{t}_{1}(\text{heavy}), \ \tilde{t}_{1} \! \rightarrow \! t \tilde{\chi}_{1}^{0} \\ \tilde{t}_{1}\tilde{t}_{1}, \ (\text{heavy}), \ \tilde{t}_{1} \! \rightarrow \! t \tilde{\chi}_{1}^{0} \\ \tilde{t}_{1}\tilde{t}_{1}, \ (\text{heavy}), \ \tilde{t}_{1} \! \rightarrow \! t \tilde{\chi}_{1}^{0} \\ \tilde{t}_{1}\tilde{t}_{1}, \ \tilde{t}_{1} \! \rightarrow \! t \tilde{\chi}_{1}^{0} \\ \tilde{t}_{1}\tilde{t}_{2}, \ \tilde{t}_{2} \! \rightarrow \! t \! \xi_{2} \\ \tilde{t}_{2}\tilde{t}_{2}, \ \tilde{t}_{2} \! \rightarrow \! \tilde{t}_{1} + Z \end{array} $	$\begin{array}{c} 0 \\ 2 \ e, \mu \ (\text{SS}) \\ 1\text{-}2 \ e, \mu \\ 2 \ e, \mu \\ 2 \ e, \mu \\ 0 \\ 1 \ e, \mu \\ 0 \\ 1 \ e, \mu \\ 0 \\ 3 \ e, \mu \ (Z) \end{array}$	2 b 0-3 b 1-2 b 0-2 jets 2 jets 2 b 1 b 2 b ono-jet/c-ta 1 b 1 b	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes	20.1 20.7 4.7 20.3 20.3 20.1 20.7 20.5 20.3 20.7 20.7	Ď1 Ď1 €1 €1 €1 €1 €1 €1 €1 €1 €1 €1 €1 €1 €1 €1 €1 €1 €1 €1 €2	100-620 GeV 275-430 GeV 110 <mark>-167 GeV</mark> 130-220 GeV 225-525 GeV 150-580 GeV 200-610 GeV 320-660 GeV 90-200 GeV 500 GeV 271-520 GeV	$\begin{split} & m(\tilde{\chi}_{1}^{0}) < 90 \text{GeV} \\ & m(\tilde{\chi}_{1}^{+}) = 2 m(\tilde{\chi}_{1}^{0}) \\ & m(\tilde{\chi}_{1}^{0}) = 55 \text{GeV} \\ & m(\tilde{\chi}_{1}^{0}) = 55 \text{GeV} \\ & m(\tilde{\chi}_{1}^{0}) = 0 \text{GeV} \\ & m(\tilde{\chi}_{1}^{0}) = 50 \text{GeV} \\ & m(\tilde{\chi}_{1}^{0}) = 150 \text{GeV} \\ & m(\tilde{\chi}_{1}^{0}) = 180 \text{GeV} \\ & m(\tilde{\chi}_{1}^{0}) = m(\tilde{\chi}_{1}^{0}) + 180 \text{GeV} \end{split}$	1308.2631 ATLAS-CONF-2013-007 1208.4305, 1209.2102 ATLAS-CONF-2013-048 ATLAS-CONF-2013-045 1308.2631 ATLAS-CONF-2013-024 ATLAS-CONF-2013-024 ATLAS-CONF-2013-025 ATLAS-CONF-2013-025
EW direct	$ \begin{split} \tilde{\ell}_{L,R} \tilde{\ell}_{L,R}, \tilde{\ell} \to \ell \tilde{\chi}_1^0 \\ \tilde{\chi}_1^+ \tilde{\chi}_1^-, \tilde{\chi}_1^+ \to \tilde{\ell} \nu(\ell \tilde{\nu}) \\ \tilde{\chi}_1^+ \tilde{\chi}_1^-, \tilde{\chi}_1^+ \to \tilde{\tau} \nu(\ell \tilde{\nu}) \\ \tilde{\chi}_1^+ \tilde{\chi}_2^0 \to \tilde{\ell}_L \nu \tilde{\ell}_L \ell(\tilde{\nu}), \ell \tilde{\nu} \tilde{\ell}_L \ell(\tilde{\nu}\nu) \\ \tilde{\chi}_1^+ \tilde{\chi}_2^0 \to W \tilde{\chi}_1^0 \ell \chi_1^0 \\ \tilde{\chi}_1^+ \tilde{\chi}_2^0 \to W \tilde{\chi}_1^0 h \tilde{\chi}_1^0 \end{split} $	2 e,μ 2 e,μ 2 τ 3 e,μ 3 e,μ 1 e,μ	0 0 - 0 2 b	Yes Yes Yes Yes Yes Yes	20.3 20.3 20.7 20.7 20.7 20.7 20.3	$ \vec{\ell} \\ \vec{\chi}_{1}^{\pm} \\ \vec{\chi}_{1}^{\pm} \\ \vec{\chi}_{1}^{\pm} \\ \vec{\chi}_{1}^{\pm} \\ \vec{\chi}_{2}^{0} \\ \vec{\chi}_{1}^{\pm} \\ \vec{\chi}_{2}^{0} \\ \vec{\chi}_{1}^{\pm} \\ \vec{\chi}_{2}^{0} $	85-315 GeV 125-450 GeV 180-330 GeV 600 GeV 315 GeV 285 GeV	$\begin{split} & m(\tilde{k}_{1}^{0}) \!\!=\! O GeV \\ & m(\tilde{k}_{1}^{0}) \!\!=\! O GeV, \ m(\tilde{\ell}, \tilde{\nu}) \!\!=\! O.5(m(\tilde{k}_{1}^{+}) \!+\! m(\tilde{k}_{1}^{0})) \\ & m(\tilde{k}_{1}^{0}) \!\!=\! O GeV, \ m(\tilde{\ell}, \tilde{\nu}) \!\!=\! O.5(m(\tilde{k}_{1}^{+}) \!+\! m(\tilde{k}_{1}^{0})) \\ & m(\tilde{k}_{1}^{0}) \!\!=\! m(\tilde{k}_{2}^{0}), \ m(\tilde{k}_{1}^{0}) \!\!=\! m(\tilde{k}_{2}^{0}), \ m(\tilde{k}_{1}^{0}) \!\!=\! m(\tilde{k}_{2}^{0}), \ m(\tilde{k}_{2}^{0}) \!\!=\! O.s(m(\tilde{k}_{1}^{+}) \!+\! m(\tilde{k}_{1}^{0})) \\ & m(\tilde{k}_{1}^{0}) \!\!=\! m(\tilde{k}_{2}^{0}), \ m(\tilde{k}_{2}^{0}) \!\!=\! O. \ s(eptons \ decoupled \\ & m(\tilde{k}_{1}^{0}) \!\!=\! m(\tilde{k}_{2}^{0}), \ m(\tilde{k}_{2}^{0}) \!\!=\! O. \ s(eptons \ decoupled) \end{split}$	ATLAS-CONF-2013-049 ATLAS-CONF-2013-049 ATLAS-CONF-2013-028 ATLAS-CONF-2013-028 ATLAS-CONF-2013-035 ATLAS-CONF-2013-035
Long-lived particles	$\begin{array}{l} \text{Direct} \tilde{\chi}_1^+ \tilde{\chi}_1^- \text{ prod., long-lived } \tilde{\chi}_1^\pm \\ \text{Stable, stopped } \tilde{g} \text{ R-hadron} \\ \text{GMSB, stable } \tilde{\tau}, \tilde{\chi}_1^0 \rightarrow \tilde{\tau}(\tilde{e}, \tilde{\mu})_{\uparrow} \tau(\tilde{e} \\ \text{GMSB, } \tilde{\chi}_1^0 \rightarrow \gamma \tilde{G}, \text{ long-lived } \tilde{\chi}_1^0 \\ \tilde{q} \tilde{q}, \tilde{\chi}_1^0 \rightarrow qq\mu \text{ (RPV)} \end{array}$	Disapp. trk 0 (e, μ) 1-2 μ 2 γ 1 μ , displ. vtx	1 jet 1-5 jets - - -	Yes Yes - Yes -	20.3 22.9 15.9 4.7 20.3	$ \begin{array}{c} \tilde{\chi}_1^{\pm} \\ \tilde{g} \\ \tilde{\chi}_1^{0} \\ \tilde{\chi}_1^{0} \\ \tilde{q} \end{array} $	270 GeV 832 GeV 832 GeV 475 GeV 1.0 TeV	$\begin{array}{l} m(\tilde{\chi}_1^*)\!=\!n(\tilde{\chi}_1^0)\!=\!160\;MeV,\; r(\tilde{\chi}_1^*)\!=\!\!0.2\;ns\\ m(\tilde{\chi}_1^0)\!=\!100\;GeV,\; 10\;\!\mus\!<\!r(\tilde{g})\!<\!1000\;s\\ 10\!<\!tan\beta\!<\!50\\ 0.4\!<\!r(\tilde{\chi}_1^0)\!<\!\!2\;ns\\ 1.5\;<\!cr\!<\!156\;mm,\;BR(\mu)\!=\!\!1,\;m(\tilde{\chi}_1^0)\!=\!\!108\;GeV \end{array}$	ATLAS-CONF-2013-069 ATLAS-CONF-2013-057 ATLAS-CONF-2013-058 1304.6310 ATLAS-CONF-2013-092
RPV	$ \begin{array}{l} LFV \ pp \rightarrow \widetilde{v}_{\tau} + X, \ \widetilde{v}_{\tau} \rightarrow e + \mu \\ LFV \ pp \rightarrow \widetilde{v}_{\tau} + X, \ \widetilde{v}_{\tau} \rightarrow e(\mu) + \tau \\ Bilinear \ RPV \ CMSSM \\ \widetilde{X}_1^+ \widetilde{X}_1^-, \ \widetilde{X}_1^+ \rightarrow \mathcal{W} \widetilde{X}_1^0, \ \widetilde{X}_1^0 \rightarrow e \widetilde{v}_{\mu}, \ e \mu \widetilde{v}, \\ \widetilde{X}_1^+ \widetilde{X}_1^-, \ \widetilde{X}_1^+ \rightarrow \mathcal{W} \widetilde{X}_1^0, \ \widetilde{X}_1^0 \rightarrow \tau \tau \widetilde{v}_e, \ e \tau \widetilde{v}, \\ \widetilde{g} \rightarrow q q q \\ \widetilde{g} \rightarrow \widetilde{t}_1 t, \ \widetilde{t}_1 \rightarrow b s \end{array} $	$ \begin{array}{c} 2 \ e, \mu \\ 1 \ e, \mu + \tau \\ 1 \ e, \mu \\ 4 \ e, \mu \\ 3 \ e, \mu + \tau \\ 0 \\ 2 \ e, \mu \left(SS \right) \end{array} $	- 7 jets - - 6-7 jets 0-3 <i>b</i>	- Yes Yes Yes - Yes	4.6 4.7 20.7 20.7 20.3 20.7	$ \vec{\tilde{v}}_{r} $ $ \vec{\tilde{v}}_{r} $ $ \vec{\tilde{q}}_{, \frac{4}{1}} $ $ \vec{\tilde{\chi}}_{1 \frac{4}{1}} $ $ \vec{\tilde{g}} $ $ \vec{\tilde{g}} $	1. 1.1 TeV 1.2 TeV 760 GeV 350 GeV 916 GeV 880 GeV	61 TeV $\lambda_{111}^{\prime}=0.10, \lambda_{132}=0.05$ $\lambda_{311}^{\prime}=0.10, \lambda_{1(2)33}=0.05$ $m(\tilde{q})=m(\tilde{g}), cr_{LSP}<1 mm$ $m(\tilde{\chi}_{1}^{0})>300 \text{ GeV}, \lambda_{121}>0$ $m(\tilde{\chi}_{1}^{0})>80 \text{ GeV}, \lambda_{133}>0$ BR(t)=BR(b)=BR(c)=0%	1212.1272 1212.1272 ATLAS-CONF-2012-140 ATLAS-CONF-2013-036 ATLAS-CONF-2013-036 ATLAS-CONF-2013-091 ATLAS-CONF-2013-007
Other	Scalar gluon pair, sgluon $\rightarrow q\bar{q}$ Scalar gluon pair, sgluon $\rightarrow t\bar{t}$ WIMP interaction (D5, Dirac χ)	$\begin{bmatrix} 0 \\ 2 \\ e, \mu \\ 0 \end{bmatrix}$	4 jets 1 <i>b</i> mono-jet	Yes Yes	4.6 14.3 10.5	sgluon sgluon M* scale	100-287 GeV 800 GeV 704 GeV	incl. limit from 1110.2693 $m(\chi){<}80~{\rm GeV}, limit~{\rm of}{<}687~{\rm GeV}~{\rm for}~{\rm D8}$	1210.4826 ATLAS-CONF-2013-051 ATLAS-CONF-2012-147
	$\sqrt{s} = 7 \text{ TeV}$	√s = 8 TeV artial data	√s = 8	d leV			10 ⁻¹ 1	Mass scale [TeV]	

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

Перспективы обнаружения SUSY в эксперименте ATLAS



Поиск тяжёлых двух-лептонных резонансов ATLAS-CONF-2013-017



limits on *m(Z')* (SSM and GU E6)

Events

σ B [pb]

limits on *m(G*)* (RS graviton)

Поиск микроскопических чёрных дыр в событиях с большой множественностью и двумя мюонами одного знака arXiv:1308.4075



 $N_{trk} > 30$ ($p_T^{track} > 10 \, GeV$)

"Signal" – rotating black hole for n=4, $M_{TH}=5$ TeV, $M_D=1.5$ TeV

 $p_{\tau}(\mu) > 100 \, GeV$



Ограничения на рождение микроскопических чёрных дыр и "струнных клубков" (BlackMax) arXiv:1308.4075



 $k = M_{TH}/M_D$, k >> 1 corresponds to physical models



Weakly-coupled string model $M_D = 5^{1/(n+1)} M_S$ $g_S^2 = 1/5^{(n+2)/(n+1)}$

Model	n	$M_{\rm TH}[{\rm TeV}] \ge$
Non-rotating black hole	2	5.3
Non-rotating black hole	4	5.6
Non-rotating black hole	6	5.7
Rotating black hole	2	5.1
Rotating black hole	4	5.4
Rotating black hole	6	5.5
String ball	6	5.3

Ограничения на массы "новых" частиц (не SUSY)

	ATLAS Exotics S	earches* - 95% CL Lower Limits (Status: May 2013)
Large ED (ADD) : monojet + E _{7,miss}	L=4.7 fb ⁻¹ , 7 TeV [1210.4491]	4.37 TeV M _D (δ=2	2)
Large ED (ADD) : monophoton + $E_{T,miss}$	L=4.6 fb ⁻¹ , 7 TeV [1209.4625]	1.93 TeV M _D (δ=2)	ΔΤΙ Δς
Large ED (ADD) : diphoton & dilepton, m _{yy / II}	L=4.7 fb ⁻¹ , 7 TeV [1211.1150]	4.18 TeV M _S (HLZ	δ=3, NLO) AILAS
O UED : diphoton + $E_{T,miss}$	L=4.8 fb ⁻¹ , 7 TeV [1209.0753]	1.40 TeV Compact. scale R ⁻¹	Freinfinary
S^{1}/Z_{2} ED : dilepton, m_{\parallel}	L=5.0 fb ⁻¹ , 7 TeV [1209.2535]	4.71 TeV M _{KK} ~ F	₹ ⁻¹
RS1 : dilepton, m	L=20 fb ⁻¹ , 8 TeV [ATLAS-CONF-2013-017]	2.47 TeV Graviton mass ($k/M_{\rm Pl} = 0.1$)
RS1 : WW resonance, m _{T.NN}	L=4.7 fb ⁻¹ , 7 TeV [1208.2880]	1.23 TeV Graviton mass (k/M _{PI} = 0.1	1)
Bulk RS : ZZ resonance, m	L=7.2 fb ⁻¹ , 8 TeV [ATLAS-CONF-2012-150]	850 Gev Graviton mass (k/M _{PI} = 1.0)	$Ldt = (1 - 20) \text{ fb}^{-1}$
RS $g_{\mu\nu} \rightarrow t\bar{t}$ (BR=0.925) : $t\bar{t} \rightarrow I+jets, m_{\mu\nu}$	L=4.7 fb ⁻¹ , 7 TeV [1305.2756]	2.07 TeV g	
ADD BH $(M_{TH} / M_D = 3)$: SS dimuon, $N_{ch, part}$	L=1.3 fb ⁻¹ , 7 TeV [1111.0080]	1.25 TeV M _D (δ=6)	s = 7, 8 lev
ADD BH $(M_{TH}/M_{D}=3)$: leptons + jets, Σp_{T}	L=1.0 fb ⁻¹ , 7 TeV [1204.4646]	1.5 TeV M _D (δ=6)	
Quantum black hole : dijet, F (m)	L=4.7 fb ⁻¹ , 7 TeV [1210.1718]	4.11 TeV M _D (δ=6))
qqqq contact interaction : $\chi(m_{\perp})$	L=4.8 fb ⁻¹ , 7 TeV [1210.1718]	7.6 TeV	Λ
5 qqll Cl : ee & μμ, m	L=5.0 fb ⁻¹ , 7 TeV [1211.1150]		13.9 TeV A (constructive int.)
uutt CI : SS dilepton + jets + E , min	L=14.3 fb ⁻¹ , 8 TeV [ATLAS-CONF-2013-051]	3.3 TeV ∆ (C=1)	,
Z' (SSM) : m _{es(uu}	L=20 fb ⁻¹ , 8 TeV [ATLAS-CONF-2013-017]	2.86 TeV Z' mass	
Z' (SSM) : m	L=4.7 fb ⁻¹ . 7 TeV [1210.6604]	1.4 TeV Z' mass	
Z' (leptophobic topcolor) : $t\bar{t} \rightarrow t$	L=14.3 fb ⁻¹ .8 TeV [ATLAS-CONE-2013-052]	1.8 TeV Z' mass	
$W'(SSM): m_{r}$	1 =4.7 fb ⁻¹ 7 TeV [1209.4446]	2.55 TeV W' mass	
W' $(\rightarrow tq, q = 1)$: m_{eq}	L=4.7 fb ⁻¹ , 7 TeV [1209.6593] 4	30 GeV W' mass	
$W'_{r} (\rightarrow tb, LR^{S}M) : m^{q}$	/ =14.3 fb ⁻¹ .8 TeV IATLAS-CONE-2013-0501	1.84 TeV W' mass	
Scalar I O nair (β =1) : kin vars in eeii evii	(=1.0 fb ⁻¹ 7 TeV [1112.4828]	660 Gev 1 st gen LQ mass	
Scalar LQ pair (β =1): kin, vars, in ceiji, evij	L=1.0 fb ⁻¹ 7 TeV [1203 3172]	685 Gev 2 nd gen 1 Q mass	
Scalar LO pair ($\beta = 1$): kin vars in πi πi	L=4.7 fb ⁻¹ 7 TeV [1203.0576]	534 GeV 3 rd gen LO mass	
A th constraints + We Wh	L=4.7 fb ⁻¹ 7 TeV [1340.5459]	ssecov t mass	
4 generation : $tt \rightarrow wbwb$ 4th generation : b'b' \rightarrow SS dilepton + iets + E	L=4.7 10 , 7 10 [1210.3400]	720 GoV b' mass	
T,miss	L=14.5 TD , 8 TEV [AT LAS-CONF-2013-051]	Tan Cave T mass (isospin doublet)	
Vector-like quark : $\Gamma \rightarrow \Pi T \rightarrow \Pi$	L=14.3 fb , 8 lev [AI LAS-CONF-2013-018]	1 12 Tay VI O maga (sharran 1/2 and	
Excited quarks : v-let resonance m	1-24.010 , 7 TeV [ATLAS-CONF-2012-137]	1.12 Tev VLQ mass (charge - 1/3, cou	$r_{\text{def}} = r_{\text{def}}$
Excited quarks : dijet resonance, m	L=2.110 , 7 lev [1112.3580]	2.40 TeV y Thass	
Excited b quarks : Wit resonance m	L=13.0 fb , 8 TeV [ATLAS-CONF-2012-148]	3.64 TeV q" mass	
Excited b quark . w-t resonance, m	L=4.7 fb , 7 TeV [1301.1583]	Bro GeV primass (len-handed coupling)	× .
Teshei hadrens (LSTO) i dilantea m	L=13.0 fb , 8 TeV [ATLAS-CONF-2012-146]	2.2 rev 1° mass ($\Lambda = m(1^\circ)$	
Techni-hadrons (LSTC) : dilepton, $m_{ee/\mu\mu}$	L=5.0 fb ⁻¹ , 7 TeV [1209.2535]	850 GeV $\rho_{\rm T}/\omega_{\rm T}$ mass $(m(\rho_{\rm T}/\omega_{\rm T}) - m(\pi_{\rm T}) = 1)$	
Techni-hadrons (LSTC) . WZ resonance (Wil), m	L=13.0 fb", 8 TeV [ATLAS-CONF-2013-015]	920 GeV $\rho_{\rm T}$ mass $(m(\rho_{\rm T}) = m(\pi_{\rm T}) + m_{\rm W}, m$	$n(a_{T}) = 1.1 m(\rho_{T})$
Major. neutr. (LRSM, no mixing) : 2-lep + jets	L=2.1 fb ⁻¹ , 7 TeV [1203.5420]	1.5 TeV N mass $(m(VV_R) = 2 \text{ IeV}$	()
Heavy lepton N [*] (type III seesaw) : Z-I resonance, m _{zi}	L=5.8 fb", 8 TeV [ATLAS-CONF-2013-019]	N [*] mass ($ V_{e} = 0.055$, $ V_{\mu} = 0.063$, $ V_{\mu} = 0$)	
H_{L} (DY prod., BR($H_{L} \rightarrow II$) : SS ee ($\mu\mu$), m_{I}	L=4.7 fb ⁻¹ , 7 TeV [1210.5070] 40	9 GeV H ^{2*} mass (limit at 398 GeV for μμ)	
Color octet scalar : dijet resonance, m	L=4.8 fb ⁻¹ , 7 TeV [1210.1718]	1.86 TeV Scalar resonance m	ass
Multi-charged particles (DY prod.) : highly ionizing tracks	L=4.4 fb ⁻¹ , 7 TeV [1301.5272]	490 GeV mass (q = 4e)	
Magnetic monopoles (DY prod.) : highly ionizing tracks	L=2.0 fb ⁻¹ , 7 TeV [1207.6411]	862 GeV mass	, , , , , , , , , , , , , , , , , , ,
	10 ⁻¹	1	10 10
		-	Mass
****			wass scale [lev]

Измерение рождения кваркониев $\chi_{c1}, \chi_{c2}, \psi(2S)$ ATLAS-CONF-2013-094, ATLAS-CONF-2013-095









To separate prompt and non-prompt (from B decays) production pseudo-proper lifetime is used

$$\tau = \frac{L_{xy} \cdot m_{J/\psi}}{|\vec{p_T}|} \qquad \qquad L_{xy} = \frac{\vec{L} \cdot \vec{p}}{|\vec{p_T}|}$$

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Сечения прямого рождения кваркониев χ_{c1} , χ_{c2} , $\psi(2S)$ ATLAS-CONF-2013-094, ATLAS-CONF-2013-095

Prompt $\psi(2S)$ data

 10^{2}

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→ |y|<0.75 (×10⁶) ---- 0.75< |y|<1.5 (×10³)

- 1.5< |y|<2.0

50 60

40 $\psi(2S)$ transverse momentum [GeV]

30

20



Сечения непрямого рождения $\chi_{c1}, \chi_{c2}, \psi(2S)$ ATLAS-CONF-2013-094, ATLAS-CONF-2013-095



Парциальная ширина распада $B^+ \to \chi_{c1} K^+$



Азимутальная зависимость инклюзивного рождения струй в Pb+Pb столкновениях





Azimuthal angle distribution parametrized by: $\frac{dN}{d\phi} \propto 1 + 2v_2 \cos 2(\phi - \Psi_2)$ $\Psi_2 \text{ is the elliptic event plane angle}$ $v_2 \text{ is the magnitude of the modulation}$

Significant $\Delta \phi$ variation in the jet yield is observed for all centrality intervals

Азимутальная зависимость инклюзивного рождения струй в Pb+Pb столкновениях



 $f_2 = 1 - \left. \frac{d^2 N_{\text{jet}}}{dp_{\text{T}}} \frac{d\Delta \phi}{d\phi} \right|_{\text{out}} / \left. \frac{d^2 N_{\text{jet}}}{dp_{\text{T}}} \frac{d\Delta \phi}{d\phi} \right|_{\text{in}}$

PRL 111(2013)152301 (arXiv:1306.6469)



a suppression by as much as 20% seen for out-of-plane jets comparing to in-plane jets

smaller suppression in the peripheral (small quenching) and the most central (small eccentricity) collisions for $60 < p_T < 110$ GeV

Заключение

Higgs boson established

 $m_{H} = 125.5 \pm 0.2^{+0.5}_{-0.6} \text{ GeV}$ $J^{P} = 0^{+}$

production and decay properties consistent with SM expectations

Searches for new physics (H[±], SUSY, extra dimensions, heavy resonances, ...) performed no new physics observed limits are set

Many new measurements in QCD and B-physics areas, in particular

measurements of prompt and non-prompt χ_{c1} , χ_{c2} , $\psi(2S)$ production measurement of $B^+ \rightarrow \chi_{c1} K^+$ decay branching

New measurement with Pb+Pb collisions, in particular azimuthal angle dependence of inclusive jet yields (varied up-to 20% between in-plane and out-of-plane directions)

Back-up

SM measurements



tt production



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single top production



m(t) measurements

A	TLAS Pre	eliminary	m _{top} summ	ary - Oct. 20)13, L _{int} =	₌ 35 pb ⁻¹ - 4	.7 fb ⁻¹	
2010, lepto CONF-2011-033,	n+jets* , L _{int} = 35 pb ⁻¹			-	169.3 =	± 4.0		± 4.9
2011, lepto Eur. Phys. J. C72	n+jets 2 (2012) 2046, L _{int} = 1	.04 fb ⁻¹		;	174.5 =	± 0.6 ± 0.	.4	± 2.3
2011, all jet CONF-2012-030,	ts* , L _{int} = 2.05 fb ⁻¹				174.9 =	± 2.1		± 3.8
2011, dilept CONF-2012-082,	ton* , L _{int} = 4.7 fb ⁻¹ ∞				175.2 =	± 1.6		$\pm \frac{3.1}{2.8}$
2011, lepto CONF-2013-046,	n+jets* ^{,©} , L _{int} = 4.7 fb ⁻¹				172.31	± 0.23 ± 0.2	?7±0.67	± 1.35
2011, dilept CONF-2013-077,	ton* ^{,©} , L _{int} = 4.7 fb ⁻¹			•	173.09:	± 0.64 (stat.) (JS	F) (bJSF)	± 1.50 (syst.)
АТLAS Соі 172.65 ± 0.	mb. Sept. 201 .31 _{stat.} ± 1.40	13 (CONF-2013-102 ISF⊕bJSF⊕syst.) -			stat. uncertain stat. ⊕ JSF ⊕ total uncertain *Preliminarv. [©]	ity bJSF unce ity Input comb	rtainty
					1			
155	160	165	170	175 1	80	185	190	195 m _{top} [GeV

ATLAS Preliminar	y m _{top} s	summary - Oct.	2013, L _{int} = 3	35 pb ⁻¹ - 4.7 t	fb ⁻¹	
2010, lepton+jets* CONF-2011-033, L _{int} = 35 pb ⁻¹			169.3 ±	4.0	± 4.9	
2011, lepton+jets Eur. Phys. J. C72 (2012) 2046, L _{int} = 1.04 fb ⁻¹			174.5 ±	0.6 ± 0.4	± 2.3	
2011, all jets* CONF-2012-030, L _{int} = 2.05 fb ⁻¹	-		- 1 74.9 ±	2.1	± 3.8	
2011, dilepton* CONF-2012-082, L _{int} = 4.7 fb ⁻¹	•		175.2 ±	1.6	$\pm \frac{3.1}{2.8}$	
2011, lepton+jets [*] [∞] CONF-2013-046, L _{int} = 4.7 fb ⁻¹			172.31±	0.23 ± 0.27 ±	0.67 ± 1.35	
2011, dilepton* [®] CONF-2013-077, L _{int} = 4.7 tb ⁻¹	-		$173.09\pm$	0.64 (stat.) (JSF)	(bJSF) ± 1.50 (syst.)	
$\begin{array}{l} 173.29 \pm 0.23_{stal.} \pm 0.92_{JSF \oplus bJSF \oplus sys} \\ \text{Tevatron Comb. May 2013 (arXiv:1305)} \\ 173.20 \pm 0.51_{stal.} \pm 0.71_{JSF \oplus syst} \end{array}$	2) st. .3929)	⊷⊕ ⊶1 H€H	sta	at. uncertainty at. ⊕ JSF ⊕ bJS al uncertainty	F uncertainty	
Siai. UCH OSySI.		1	Р 	reliminary, inp	ut comb.	
55 160 165	170	175	180	185	190 1 m _{top} [Ge	95 eV

Searches for vector-like B and T quarks



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MSUGRA/CMSSM limits



Limits for gluino and stop



Future Higgs measurements



