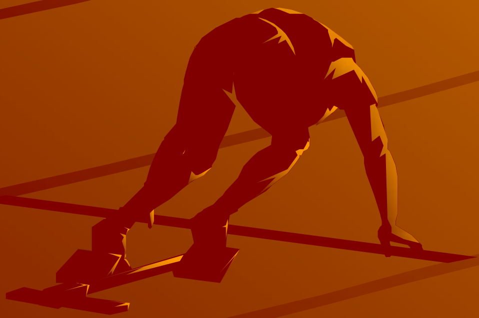
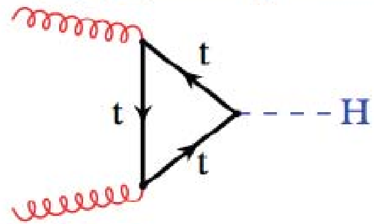
1. HIGGS



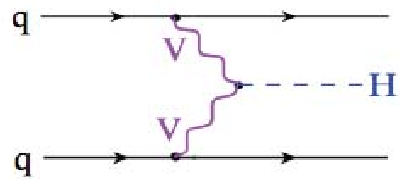
Round Table PNPI Dec 27, 2011

SM Higgs production at LHC

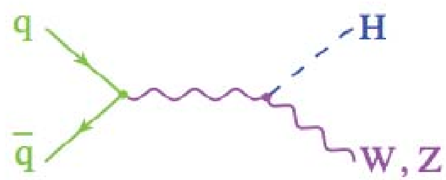
- Gluon fusion



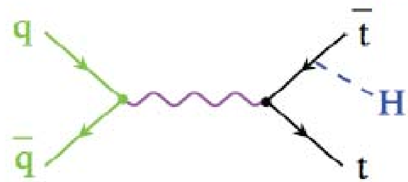
- VBF

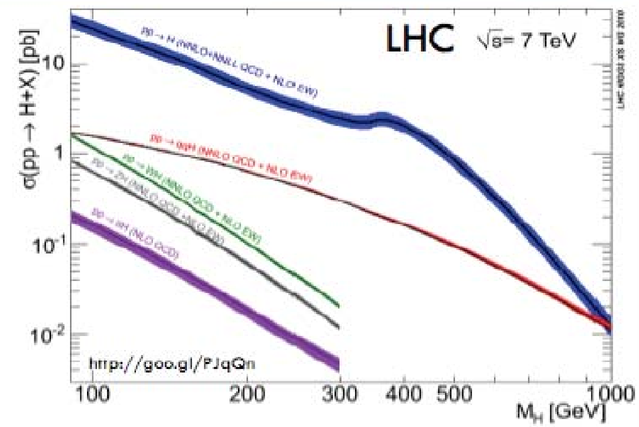


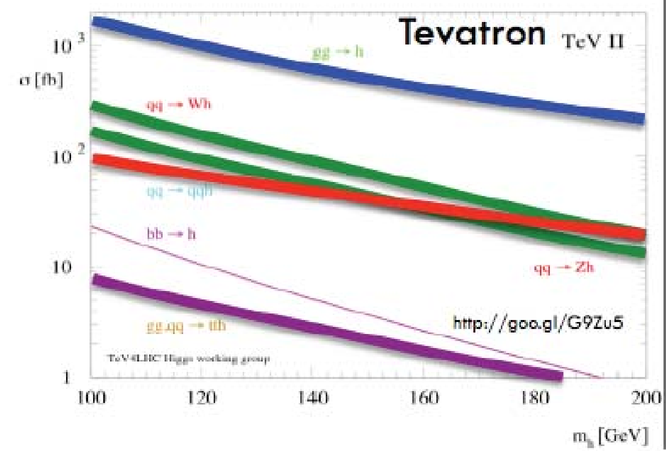
- VH



- ttH



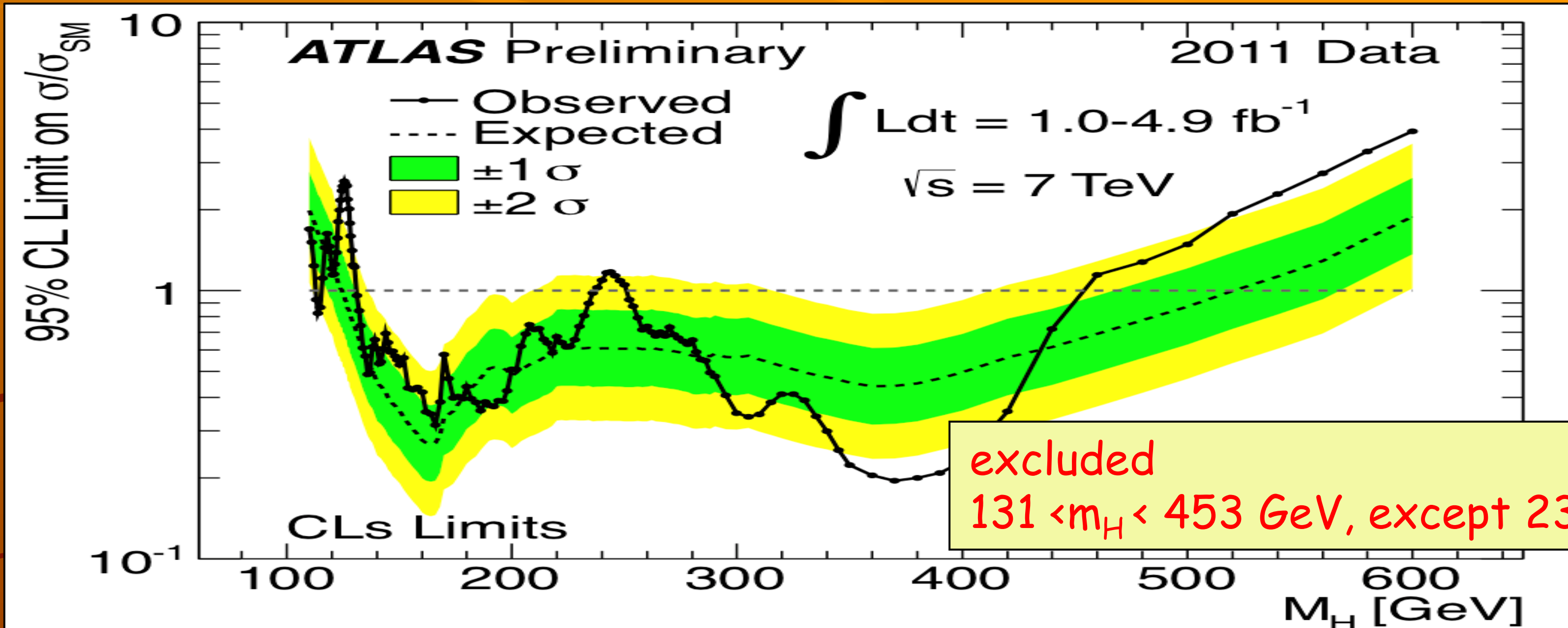




Gluon fusion (gg→ H) is the dominant production mechanism at LHC.
Irreducible backgrounds in H → WW, ZZ, γγ are from qq annihilation. Signal to Noise better than at Tevatron except in VH. **VBF and VH also very useful at LHC**

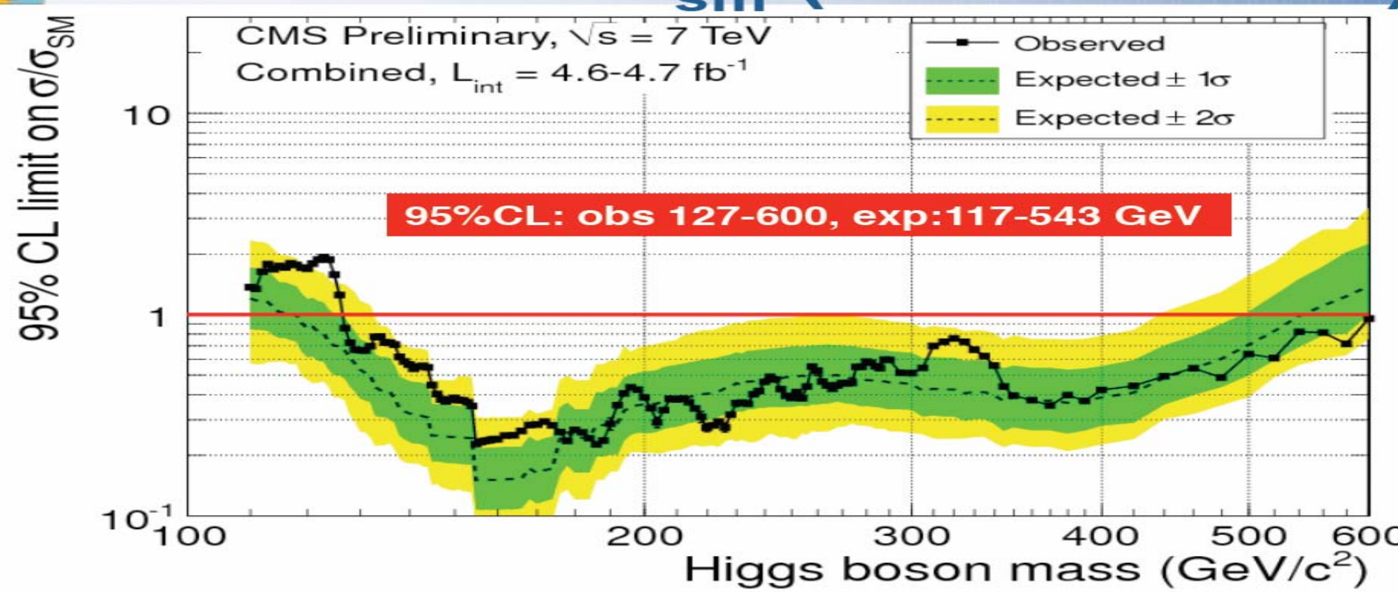
Micro-summary of present Higgs searches in ATLAS

Channel	m_H range (GeV)	Int. lumi fb^{-1}	Main backgrounds	Number of signal events after cuts	S/B after cuts	Expected σ/σ_{SM} sensitivity
$H \rightarrow \gamma\gamma$	110-150	4.9	$\gamma\gamma$, γj, jj	~70	~0.02	1.6-2
$H \rightarrow \tau\tau \rightarrow ll+\nu$	110-140	1.1	$Z \rightarrow \tau\tau$, top	~0.8	~0.02	30-60
$H \rightarrow \tau\tau \rightarrow l\tau_{had}$	100-150	1.1	$Z \rightarrow \tau\tau$	~10	~5 10^{-3}	10-25
$W/ZH \rightarrow bbl(l)$	110-130	1.1	W/Z+jets, top	~6	~5 10^{-3}	15-25
$H \rightarrow WW^{(*)} \rightarrow l\nu l\nu$	110-300	2.1	WW, top, Z+jet	~20 (130 GeV)	~0.3	0.3-8
$H \rightarrow ZZ^{(*)} \rightarrow 4l$	110-600	4.8	ZZ*, top, Zbb	~2.5 (130 GeV)	~1.5	0.7-10
$H \rightarrow ZZ \rightarrow ll\,\nu\nu$	200-600	2.1	ZZ, top, Z+jets	~20 (400 GeV)	~0.3	0.8-4
$H \rightarrow ZZ \rightarrow ll\,qq$	200-600	2.1	Z+jets, top	2-20 (400 GeV)	0.05-0.5	2-6
$H \rightarrow WW \rightarrow l\nu qq$	240-600	1.1	W+jets,top,jets	~45 (400 GeV)	10^{-3}	5-10



excluded
131 < m_H < 453 GeV, except 237-251 GeV

Limits on σ/σ_{sm} (CLs method)



Summaries

ATLAS@CMS

Исключено существование Хиггс-бозона с массой 127 – 600 ГэВ

ATLAS

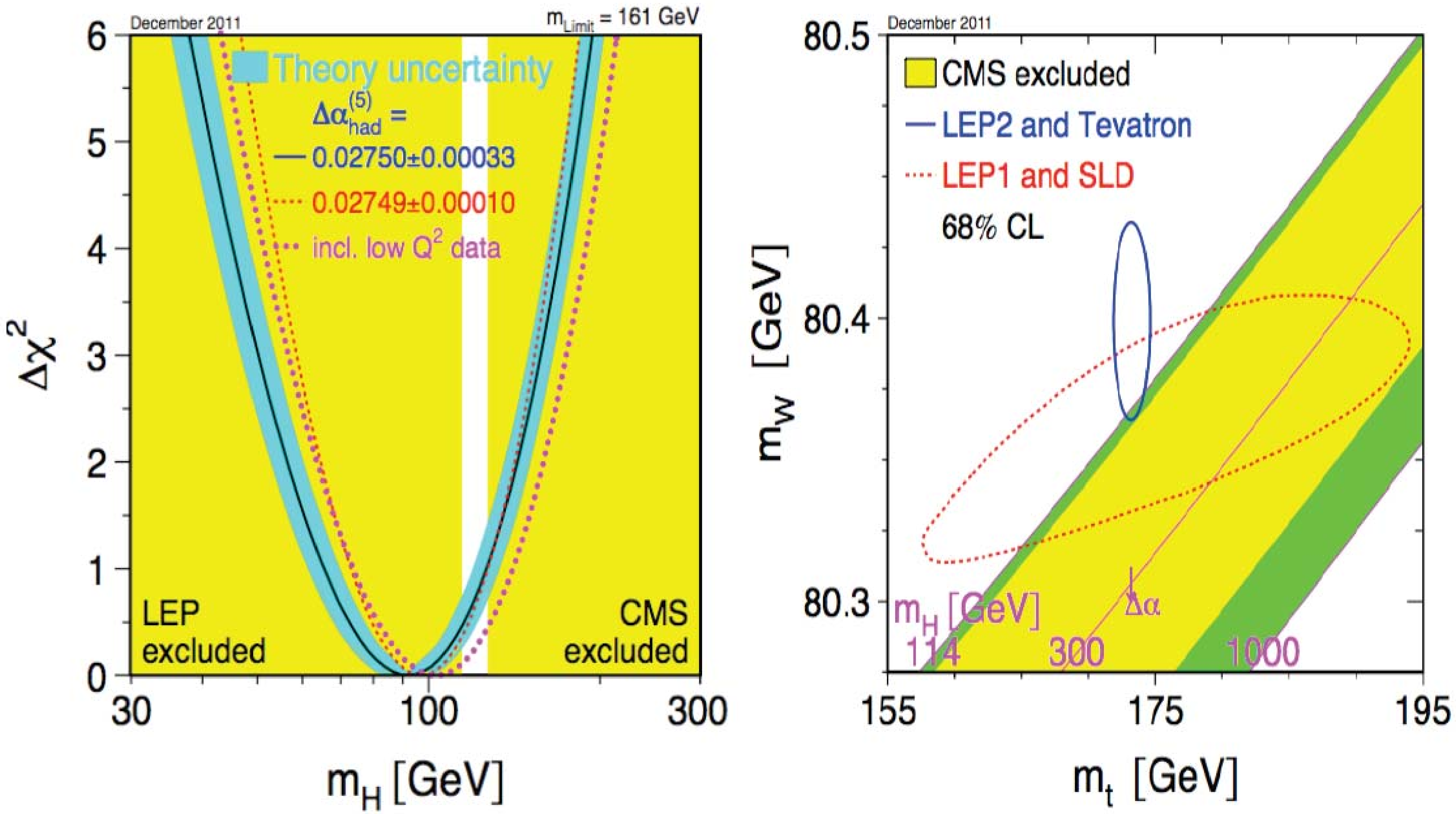
We observe an excess of events around **mH~ 126 GeV:**
Local significance 3.6 σ
Global significance ~2.3σ

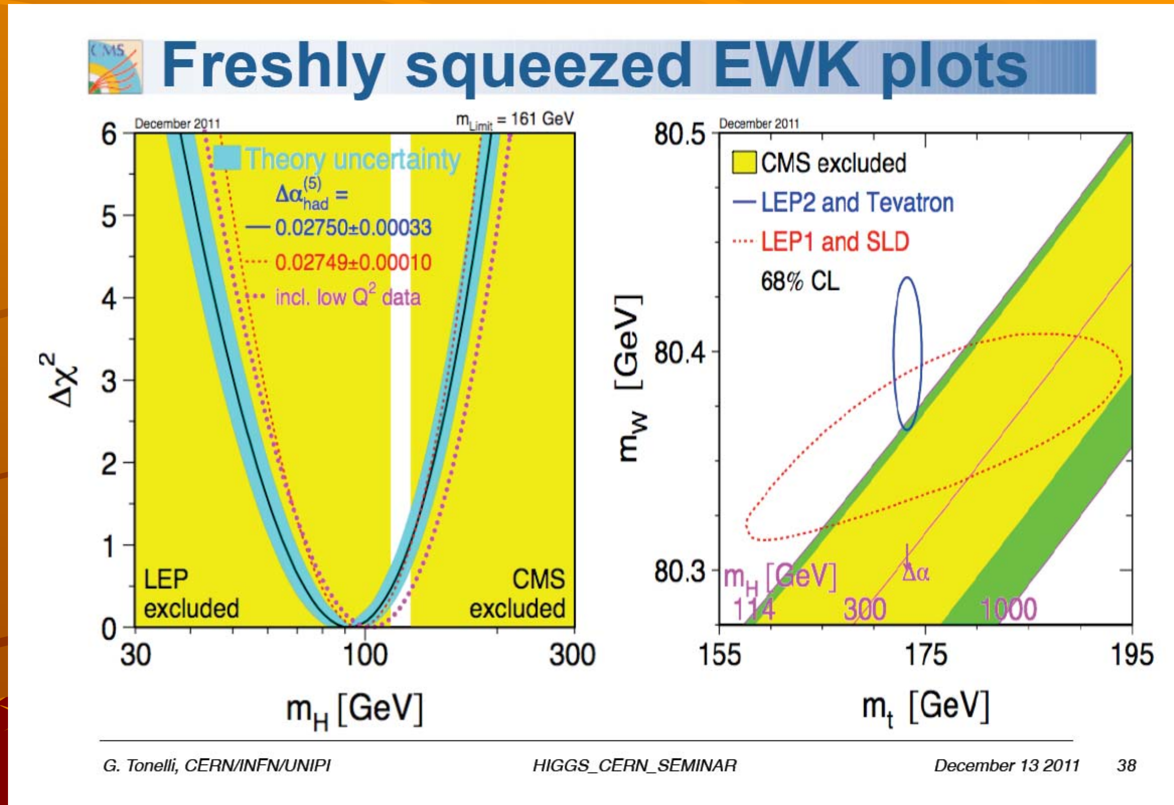
CMS

We are not able to exclude the presence of the SM Higgs below 127 GeV
since **we observe a modest excess** of the events **between 115 and 127 GeV**
The excess is most compatible with a SM Higgs **in the vicinity of 124 GeV** and below
But the statistical significance is not large enough to say anything conclusive.
Local significance 2.6σ
Global significance 1.9σ

Higgs is excluded in 127-543 GeV mass region

Freshly squeezed EWK plots

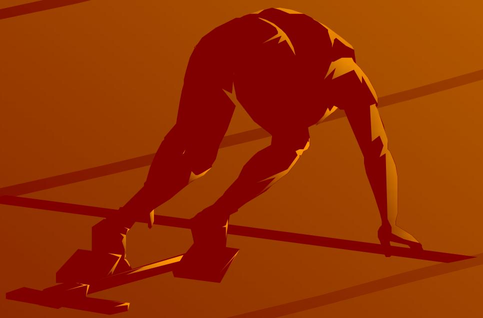


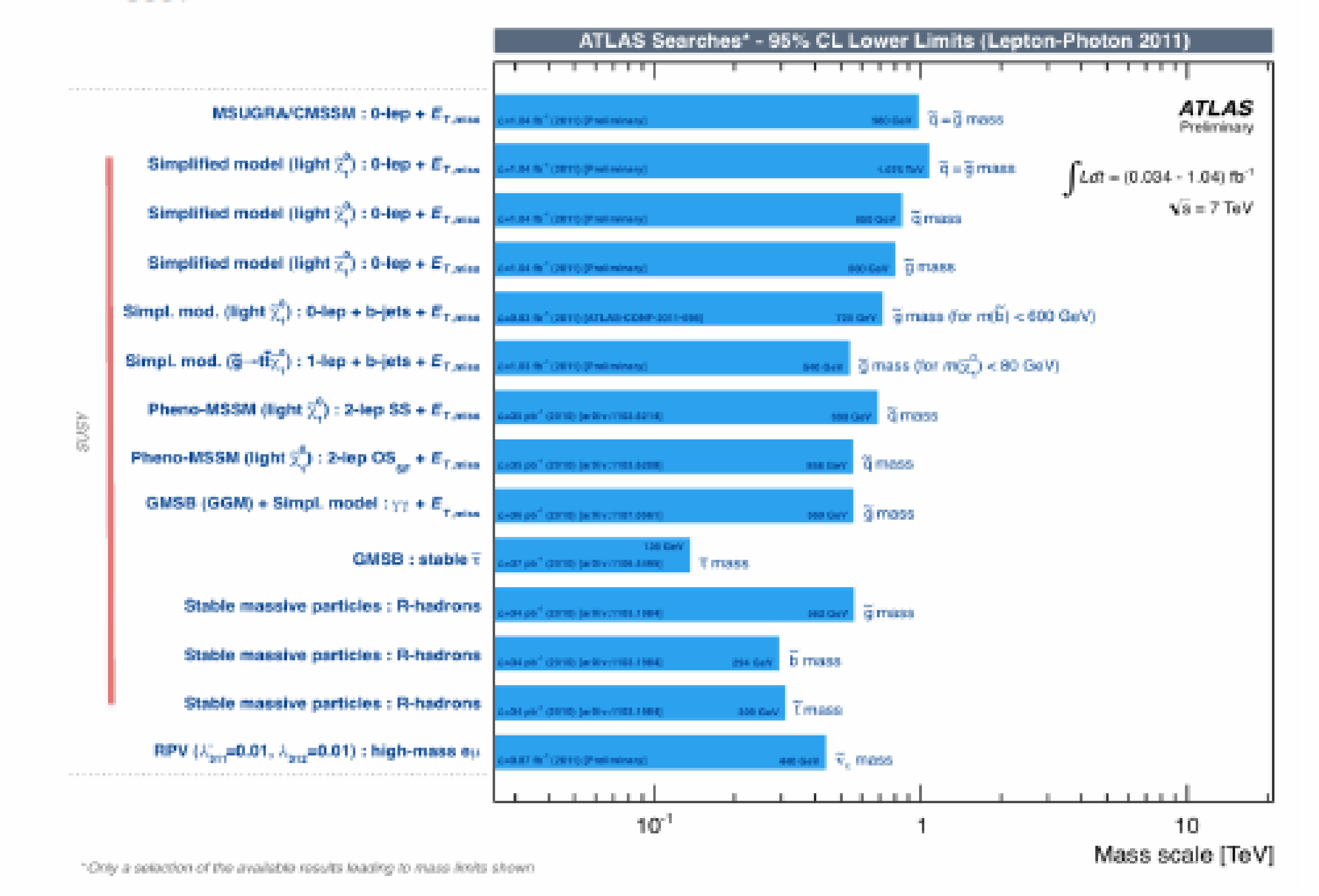


Сценарий 1 Обнаружен Хиггс с массой около 125 ГэВ

Сценарий 2 Хиггс исключен во всем диапазоне вплоть до 600 ГэВ

2. Суперсимметрия





Msusy > 500 GeV

Andreas Buras

	AC	RVV2	AKM	δLL	FBMSSM	$SSU(5)_{\rm RN}$
$D^0-\bar{D}^0$	★★★	★	★	★	★	★
ϵ_K	★	★★★	★★★	★	★	★★★
$S_{\psi\phi}$	★★★	★★★	★★★	★	★	★★★
$S_{\phi K_S}$	★★★	★★	★	★★★	★★★	★★
$A_{\rm CP}(B\to X_s\gamma)$	★	★	★	★★★	★★★	★
$A_{7,8}(K^*\mu^+\mu^-)$	★	★	★	★★★	★★★	★
$B_s\to\mu^+\mu^-$	★★★	★★★	★★★	★★★	★★★	★★★
$K^+\to\pi^+\nu\bar{\nu}$	★	★	★	★	★	★
$K_L\to\pi^0\nu\bar{\nu}$	★	★	★	★	★	★
$\mu\to e\gamma$	★★★	★★★	★★★	★★★	★★★	★★★
$\tau\to\mu\gamma$	★★★	★★★	★	★★★	★★★	★★★
$\mu+N\to e+N$	★★★	★★★	★★★	★★★	★★★	★★★
d_n	★★★	★★★	★★★	★★	★★★	★★★
d_e	★★★	★★★	★★	★	★★★	★★★
$(g-2)_\mu$	★★★	★★★	★★	★★★	★★★	★★★

	LHT	RSc	4G	2HDM	RHMFV
$D^0-\bar{D}^0$ (CPV)	★★★	★★★	★★	★★	
ϵ_K	★★	★★★	★★	★★	★★
$S_{\psi\phi}$	★★★	★★★	★★★	★★★	★★★
$S_{\phi K_S}$	★	★	★★		
$A_{\rm CP}(B\to X_s\gamma)$	★		★		
$A_{7,8}(K^*\mu^+\mu^-)$	★★	★	★★		
$B_s\to\mu^+\mu^-$	★	★	★★★	★★★	★★
$K^+\to\pi^+\nu\bar{\nu}$	★★★	★★★	★★★		★★
$K_L\to\pi^0\nu\bar{\nu}$	★★★	★★★	★★★		★★
$\mu\to e\gamma$	★★★	★★★	★★★		
$\tau\to\mu\gamma$	★★★	★★★	★★★		
$\mu+N\to e+N$	★★★	★★★	★★★		
d_n	★	★★★	★	★★★	
d_e	★	★★★	★	★★★	
$(g-2)_\mu$	★	★★	★		

Table 2. "DNA" of flavour physics effects for the most interesting observables in a selection of SUSY models. ★★★ signals large NP effects, ★★ moderate to small NP effects and ★ implies that the given model does not predict visible NP effects in that observable. From [77] and [180].

$$\Delta a_\mu^{SUSY} \approx +13 \cdot 10^{-10}\, \mathrm{sgn}(\mu) \left(\frac{100\ \mathrm{GeV}}{m_{SUSY}} \right)^2 \tan\beta$$

G-2 experiment

$\Delta a_\mu^{expt} = 30 \times 10^{-10}$

If $m_{susy} > 500$ GeV $\tan\beta > 75$

Bs -> μμ experiment

Вклад Суперсимметричных процессов ~ $(\tan\beta)^6$

Т.О. SUSY не может быть мотивацией эксперимента G-2

И как быть с мотивацией других эксперимертов μ -> eγ и др.?

3. CP асимметрия в распаде D -мезонов

$$ACP(f) = [\Gamma(D0 \to f) - \Gamma(\text{anti}D0 \to f)] / [\Gamma(D0 \to f) + \Gamma(\text{anti}D0 \to f)]$$

$f = K^{+}K^{-}$ $\quad$ $f = \pi^{+}\pi^{-}$

Year	Experiment	CP Asymmetry in the decay mode D0 to π+π-	[Γ(D0)-Γ(D0bar)]/[Γ(D0)+Γ(D0bar)]
2010	CDF	M.J. Morello (CDF Collab.), Preprint (CHARM 2010).	+0.0022 ± 0.0024 ± 0.0011
2008	BELLE	M. Staric et al. (BELLE Collab.), Phys. Lett. B 670, 190 2008).	+0.0043 ± 0.0052 ± 0.0012
2008	BABAR	B. Aubert et al. (BABAR Collab.), Phys. Rev. Lett. 100, 061803 (2008).	-0.0024 ± 0.0052 ± 0.0022
2002	CLEO	S.E. Csorna et al. (CLEO Collab.), Phys. Rev. D 65, 092001 (2002).	+0.019 ± 0.032 ± 0.008
2000	FOCUS	J.M. Link et al. (FOCUS Collab.), Phys. Lett. B 491, 232 (2000).	+0.048 ± 0.039 ± 0.025
1998	E791	E.M. Aitala et al. (E791 Collab.), Phys. Lett. B 421, 405 (1998).	-0.049 ± 0.078 ± 0.030
.	.	COMBOS average	+0.0020 ± 0.0022

Year	Experiment	CP Asymmetry in the decay mode D0 to K+K-	[Γ(D0)-Γ(D0bar)]/[Γ(D0)+Γ(D0bar)]
2011	CDF	A. Di Canto (CDF Collab.), Preprint (BEAUTY 2011).	-0.0024 ± 0.0022 ± 0.0010
2008	BELLE	M. Staric et al. (BELLE Collab.), Phys. Lett. B 670, 190 (2008).	-0.0043 ± 0.0030 ± 0.0011
2008	BABAR	B. Aubert et al. (BABAR Collab.), Phys. Rev. Lett. 100, 061803 (2008).	+0.0000 ± 0.0034 ± 0.0013
2002	CLEO	S.E. Csorna et al. (CLEO Collab.), Phys. Rev. D 65, 092001 (2002).	+0.000 ± 0.022 ± 0.008
2000	FOCUS	J.M. Link et al. (FOCUS Collab.), Phys. Lett. B 491, 232 (2000).	-0.001 ± 0.022 ± 0.015
1998	E791	E.M. Aitala et al. (E791 Collab.), Phys. Lett. B 421, 405 (1998).	-0.010 ± 0.049 ± 0.012
1995	CLEO	J.E. Bartelt et al. (CLEO Collab.), Phys. Rev. D 52, 4860 (1995).	+0.080 ± 0.061
1994	E687	P.L. Frabetti et al. (E687 Collab.), Phys. Rev. D 50, 2953 (1994).	+0.024 ± 0.084
.	.	COMBOS average	-0.0023 ± 0.0017

$\Delta ACP \equiv ACP\,(K^-K^+) - ACP\,(\pi^-\pi^+)$

LHCb

$\Delta ACP = [-0.82 \pm 0.21(\text{stat.}) \pm 0.11(\text{sys.})]\%$