Outline

- A lot of new, exciting results since the last LHCC in June
- Status of data-taking and reconstruction
- Focus on the latest Physics results:
  - Heavy Ions
  - B-physics
  - Standard Model
  - Top
  - Exotics
  - SUSY
  - Higgs
- For more: http://atlasresults.web.cern.ch/atlasresults/
Data-Taking in 2012

- 15 fb$^{-1}$ delivered luminosity
- 14 fb$^{-1}$ recorded by ATLAS
- Data-quality efficiency ~ 94%
  → Stable over entire period April-Sep
- Total efficiency (delivered → physics) ~ 88%

ATLAS p-p run: April-June 2012

<table>
<thead>
<tr>
<th>Inner Tracker</th>
<th>Calorimeters</th>
<th>Muon Spectrometer</th>
<th>Magnets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pixel</td>
<td>SCT</td>
<td>TRT</td>
<td>LAr</td>
</tr>
<tr>
<td>100</td>
<td>99.6</td>
<td>100</td>
<td>96.2</td>
</tr>
<tr>
<td>MDT</td>
<td>RPC</td>
<td>CSC</td>
<td>TGC</td>
</tr>
<tr>
<td>100</td>
<td>99.6</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>99.4</td>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All good for physics: 93.6%

Luminosity weighted relative detector uptime and good quality data delivery during 2012 stable beams in pp collisions at $\sqrt{s}=8$ TeV between April 4$^{th}$ and June 18$^{th}$ (in %) – corresponding to 6.3 fb$^{-1}$ of recorded data. The inefficiencies in the LAr calorimeter will partially be recovered in the future.
Trigger in 2012

Low-threshold dimuon triggers disabled at highest L due to Level 1 constraint of ~75kHz

Jet/ETMiss baseline triggers expected to hold till end of the year

Single lepton threshold correspond to offline cuts pT >25 GeV (unchanged during 2012)

(Main) streams sizes up to 3rd technical stop:

<table>
<thead>
<tr>
<th>Stream</th>
<th>Egamma</th>
<th>Muons</th>
<th>JetTauEtmiss</th>
<th>Total prompt</th>
<th>Hadron delayed</th>
<th>Bphysics delayed</th>
<th>Total Delayed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Events (10^9)</td>
<td>0.47</td>
<td>0.48</td>
<td>0.54</td>
<td>1.62</td>
<td>0.22</td>
<td>0.23</td>
<td>0.47</td>
</tr>
<tr>
<td>Average Rate [Hz]</td>
<td>110</td>
<td>110</td>
<td>120</td>
<td>370</td>
<td>50</td>
<td>50</td>
<td>110</td>
</tr>
</tbody>
</table>
Tier0 Reconstruction

- Tier0 reconstruction coping well with luminosity / pile-up
- Tier0 capacity 6k slots. Increased to 7.5k for reprocessing of initial data during TS1 and during the ICHEP ‘rush’.

Tier0 reconstruction coping well with luminosity / pile-up
Tier0 capacity 6k slots. Increased to 7.5k for reprocessing of initial data during TS1 and during the ICHEP ‘rush’.
Grid Computing

- Efficiently using all the resources provided by the Grid sites
- 1500 distinct ATLAS users
- Massive 8 TeV MC production

Running jobs
183 Days from Week 09 of 2012 to Week 35 of 2012

Pile-up

- Marginally more pile-up over the summer
- Efforts continue to understand and reduce the effect of pile-up
Pile-up and electron/photon ID
Calorimeter Isolation

- Now using 3D topological clusters when measuring isolation
- Sensitivity to out-of-time pile-up significantly reduced!
Heavy Ions: p-Pb at $\sqrt{s_{NN}} = 5$ TeV

- First look at p-Pb data taken on September 12
- About 3M events recorded with Minimum Bias trigger
- MBTS still functioning despite radiation damage
Heavy Ions: Pb-Pb at $\sqrt{s_{NN}} = 2.76$ TeV

Jet Fragmentation

- Fragmentation functions unfolded for detector effects
- Ratio of fragmentation functions of different centrality:

\[ z = \frac{p_T^{\text{charge}}}{p_T^{\text{jet}}} \cos \left( \sqrt{\Delta \eta^2 + \Delta \varphi^2} \right) \]

Central: over Peripheral:

ATLAS Preliminary

Pb+Pb $\sqrt{s_{NN}}=2.76$ TeV

$L_{\text{int}}=0.14$ nb$^{-1}$

ATLAS-CONF-2012-115

H. Bachacou, CEA-Saclay/CERN

LHCC, 26/10/2012
Heavy Ions: Pb-Pb at $\sqrt{s_{NN}} = 2.76$ TeV
Photon-Jet Correlation

- Significant deviation from p-p in very central events

more central events see more quenching
Heavy Ions: Pb-Pb at $\sqrt{s_{NN}} = 2.76$ TeV

Z-Jet Correlation

- Observation of 1995 $Z$ events
- Indication of the same jet-quenching effect as in photon-jet (although with large uncertainties)

Unfolded distr of $p_T(jet)/p_T(Z)$:

ATLAS Preliminary
Pb+Pb \(\sqrt{s_{NN}}=2.76\) TeV \(L_{int}=0.15\) nb\(^{-1}\)

- Anti-$k_T$, Jet R=0.3, $p_T^{jet}>25$, $p_T^{Z}>60$ GeV, $p_T^{jet}/p_T^{Z}>25/60$
  - PYTHIA: Mean=0.82±0.01
  - Pb+Pb: Mean=0.75±0.06±0.06
  - 20-80% Centrality

Peripheral events

Central events
Untagged analysis: decay time distribution and angular correlation between muons and kaons provide information on CP=±1 amplitudes and their interference.

Large sample: 23k reconstructed $B_s$ in 2011 data
CP violating phase is confirmed to be small: 
\[ \phi_s = 0.22 \pm 0.41 \pm 0.10 \text{ rad.} \]

- Average \( B_S \) lifetime and width difference \( \Delta \Gamma_S \) are measured with high accuracy

arXiv:1208.0572
Standard Model: WZ Cross-Section and Triple Gauge Coupling

- Isolate 317 candidate events $WZ \rightarrow l\ell l\ell$ ($l = e$ or $\mu$)
- Inclusive cross-section:
  \[ \sigma_{WZ}^{\text{tot}} = 19.0^{+1.4}_{-1.3}\text{(stat.)} \pm 0.9\text{(syst.)} \pm 0.4\text{(lumi.)}\text{ pb} \]
- SM expectation: $17.6^{+1.1}_{-1.0}\text{ pb}$
- Set limits on anomalous TGC

Data 2011 ($\sqrt{s} = 7\text{ TeV}$)

\[ \int L \, dt = 4.6\text{ fb}^{-1} \]

\[ \frac{\sigma_{\text{data}}}{\sigma_{\text{MC}}} \]

\[ p_T^Z \text{ [GeV]} \]

\[ \frac{\Delta \sigma_{WZ}}{\sigma_{WZ}} \]

\[ \Delta g^Z_1 \]

\[ \lambda_Z \]

\[ \Delta \kappa_Z \]

\[ \text{arXiv:1208.1390} \]

H. Bachacou, CEA-Saclay/CERN

LHCC, 26/10/2012
Standard Model: ZZ Cross-Section at 8 TeV

- ZZ → 4 leptons, using 5.8 fb\(^{-1}\) of 8 TeV data:
- Total c-s = \(9.3^{+1.1}_{-1.0}\) (stat.) +0.4\(^{-0.3}\) (syst.) ± 0.3(lumi.) pb
- Consistent with SM prediction: 7.4 ± 0.4 pb
Standard Model: Dijet Cross-Section, 2.76 TeV / 7 TeV

- Measurement of the double differential (p_T, rapidity) inclusive jet cross section using the 2.76 TeV data
- Ratio of cross-sections at 2.76 TeV and 7 TeV
  \[ \rightarrow \text{Impact on pdf's} \]
Top Physics
b-Tagging Calibration with t-tbar Events

3 techniques:
→ Tag-counting: fit $\varepsilon_b$ to the number of events with 0, 1, and 2 b-tags
→ Kinematic fit
→ Kinematic selection

$\varepsilon_b = \frac{1}{f_b} \left( f_{tag} - \varepsilon_c \cdot f_c - \varepsilon_l \cdot f_l - \varepsilon_{fake} \cdot f_{fake} \right)$

All consistent with muon-based techniques

Significant reduction of systematic uncertainty on $\varepsilon_b$ at high jet $p_T$
Top Physics
t-tbar Differential Cross-Section

- Differential t\bar{t} cross-sections relative to the inclusive cross-section measured in the lepton+jets channel.
- Data unfolded for detector effects and corrected acceptance
- Consider mass, p_{T} and y of the t-tbar system

[Graphs and plots showing data and theoretical predictions for t\bar{t} cross-sections]
Lepton+Jets channel, multivariate technique used to reject W+jets background

Jet definition at reco-level:
- $p_T > 25$ GeV and $|\mu| < 2.5$ (anti-kt, R=0.4)
- Compare 4-jet and $\geq$5-jet yields

Define extra-jet at particle level as any jet not matched to partons (q,g,γ) from top

\[
\sigma_{ttj} = 102 \pm 2{\text{(stat.)}}^{+23}_{-26}{\text{(syst.)}} \text{ pb}
\]

\[
\frac{\sigma_{ttj}}{\sigma_{tt}} = 0.54 \pm 0.01{\text{(stat.)}}^{+0.05}_{-0.08}{\text{(syst.)}}
\]

Dominant systematics t-tbar modelling and JES) cancel in the ratio
Single-Top t-channel Cross Section at 8 TeV

- Using events with 2/3 jets, exactly 1 b-tag.
- Multivariate analysis with maximum likelihood fit on full neural network output

\[ \sigma_t = 95 \pm 2 \, \text{(stat.)} \pm 18 \, \text{(syst.)} \, \text{pb} \]

\[ |V_{tb}| \gg |V_{ts}|, |V_{td}| \rightarrow |V_{tb}| = 1.04^{+0.10}_{-0.11} \]

\[ |V_{tb}| \leq 1 \rightarrow |V_{tb}| > 0.80 @ 95\% \text{CL} \]

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LHCC, 26/10/2012
Top Properties

Top Mass:

- First ATLAS measurement in the dilepton channel
  - $e\mu$ channel with 2-btags
  - Calibration curve of $<m_{T2}>$ vs input top quark mass

\[
m_{\text{top}} = 175.2 \pm 1.6\,(\text{stat.})^{+3.1}_{-2.8}\,(\text{syst.}) \text{ GeV}
\]

ATLAS-CONF-2012-082

Top polarization:

- Lepton+jets channel
- Template fit to $\cos(\theta_1)$
- $\theta_1$ = lepton polar angle in top rest frame
- $f$ = fraction of positively polarised top quarks

\[
f = 0.470 \pm 0.009\,(\text{stat})^{+0.023}_{-0.032}\,(\text{syst})
\]

Compatible with $f_{\text{SM}} = 0.5$
Exotics
t-tbar Heavy Resonance

- Lepton+jets channel
- Taking full advantage of boosted techniques
- Combining resolved and boosted reconstructions

\[ m(g_{KK}) > 1.9 \text{ TeV} \text{ 95\%CL} \]
Reconstruction of Boosted Objects

- Reconstruct boosted objects (top or W/Z/H) with a “fat” jet (R ~1)

\[ \frac{m(jet)}{m(track\ jet)} \]

ATLAS Preliminary
C/A LCW jets with R=1.2
No jet grooming applied
\[ 600 \leq p_T^{jet} < 800 \text{ GeV}, |\eta| < 0.8 \]
Data 2011, \( L_{int} = 4.7 \text{ fb}^{-1} \)
Dijets (Pythia)
Dijets (POWHEG+Pythia)

\[ \frac{m(track\ jet)}{m(track\ jet)} \]

ATLAS Preliminary
C/A LCW jets with R=1.2
Filtered (\( \mu = 0.67 \))
\[ 600 \leq p_T^{track} < 800 \text{ GeV}, |\eta| < 0.8 \]
Data 2011, \( L_{int} = 4.7 \text{ fb}^{-1} \)
Dijets (Pythia)
Dijets (POWHEG+Pythia)

ATLAS-CONF-2012-066
H. Bachacou, CEA-Saclay/CERN
LHCC, 26/10/2012
Exotics
Search for Heavy Quarks

- Up-type heavy quark: $t't' \rightarrow WbWb$
- Lepton + jets channel
- Reconstructing boosted hadronic $W$ decays
  $m(t') > 656$ GeV at 95% CL (exp. 638 GeV)

- Also new result on down-type quark:
  $b'b' \rightarrow WtWt$, same-sign dilepton channel
  $m(b') > 670$ GeV at 95% CL (expected: 640 GeV)

- Vector-Like Quark interpretation: setting limits on branching ratios to $Wb$, $tH$, $tZ$

ATLAS-CONF-2012-130
**Exotics**

**Dilepton and Dijet Resonances at 8 TeV**

- 7 TeV → 8 TeV brings significant gain in sensitivity, even with ~ same luminosity. Expected limits improved by:
  - +300 GeV for $Z' \rightarrow$ dilepton
  - +700 GeV for $q^* \rightarrow$ dijet

$m(q^*) > 3.66$ TeV at 95% CL

$m(SSM Z') > 2.49$ TeV at 95% CL
Exotics: A Summary

- Effort on 7 TeV data coming to a conclusion:
  - 33 papers on 2011 data. Finishing with the most complex final states.

- ATLAS programme well advanced

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LHCC, 26/10/2012
Supersymmetry

- “Standard” SUSY (mSUGRA) limits are beyond 1 TeV
- Now focusing on more general models
- Minimal requirements for a Weak Scale SUSY: i.e. how to avoid fine-tuning?

1\textsuperscript{st} and 2\textsuperscript{nd} gen. squarks can be very heavy

Higgs sector and gauginos must be light

\[ \tilde{q}_{1,2}, \tilde{b}_R, \tilde{t} \]

\[ \tilde{g} \]

\[ (\pm) \tilde{m} \]

\[ (\pm) \tilde{B} \]
SUSY: 1\textsuperscript{st} and 2\textsuperscript{nd} generation squarks / gluinos

- “Standard” SUSY search: 0-lepton + jets + Missing ET
- Gluino production decaying only to top and neutralino. Final state: gluino gluino → 4-top + 2 LSP's
- Sensitive to 1\textsuperscript{st}-2\textsuperscript{nd} squarks, gluinos masses beyond 1 TeV
SUSY Exclusive Searches: Direct Stop Production

- Looking for stop pair production
- 5 different dedicated analyses with 0, 1, 2 leptons, w/ or w/o b-jets
- Sensitive up to 500 GeV

- If \( m(\text{stop}) > m(\text{top}) + m(\text{LSP}) \), signature is \( t\bar{t} + \text{MET} \)

\[ \tilde{t}\tilde{t}, \text{production: } \tilde{t}\to b+\tilde{\chi}_1^\pm, \tilde{t}\to W^\pm+\tilde{\chi}_1^0, \tilde{t}\to+\tilde{\chi}_1^0, \tilde{t}\to t+\tilde{\chi}_1^0 \]

\[ \text{Missing ET in the lepton+jets channel} \]

\[ \text{stop} \to t + \text{LSP} \]

\[ \text{stop} \to b + \text{chargino} \]
SUSY Exclusive Searches: Direct Sbottom Production

- Looking for sbottom pair production:
  - Sbottom → t + chargino
  - Signature: multilepton
    
  \[ b_1 \bar{b}_1 \text{ production, } b_1 \rightarrow t\tilde{\chi}_1^\pm, m(\tilde{\chi}_1^\pm) = 2m(\tilde{\chi}_1^0) \]
  \[ L^{int} = 4.7 \text{ fb}^{-1}, \sqrt{s} = 7 \text{ TeV} \]

\[ 3 \text{ l + jets + MET} \]

- Sbottom → b + LSP
  - Signature: 2b's + MET
    
  \[ b_1 \bar{b}_1 \text{ production, } b_1 \rightarrow b\tilde{\chi}_1^0 \]
    
  \[ 2 \text{ bjets + MET} \]

Sensitive to \( m(\text{sbottom}) \sim 400-500 \text{ GeV} \)
SUSY Exclusive Searches: Direct Gaugino Production

- Looking for gaugino pair production:

\[ \tilde{\chi}_1^+ \tilde{\chi}_1^- \rightarrow 2 \times \tilde{\nu} (\tilde{\nu} l) \rightarrow 2 \times l \nu \tilde{\chi}_1^0 \]

\[ \tilde{\chi}_1^± \tilde{\chi}_2^0 \rightarrow l_L \nu l_L (\tilde{\nu} \nu), l \nu l_L (\tilde{\nu} \nu) \]

Intermediate slepton (50% l, 50% \( \nu \)), \( \chi_1^\pm \) wino-like, \( \chi_1^0 \) bino-like

Sensitive to \( m (\text{gauginos}) \sim 200\text{-}300 \text{ GeV} \)

H. Bachacou, CEA-Saclay/CERN

LHCC, 26/10/2012
Supersymmetry: Summary

1. Inclusive searches

- MSUGRA/CMSMSSM: 0 lep + fs + E_{T}\text{miss}
- MSUGRA/CMSMSSM: 1 lep + fs + E_{T}\text{miss}
- AMSB: 2 lep + 0 fs + E_{T}\text{miss}
- AMSB: 3 lep + 0 fs + E_{T}\text{miss}
- AMSB (direct \tilde{χ}_{1}\text{ pairs prod.}: long-lived \tilde{Z}
- AMSB: long-lived \tilde{Z}
- Stable \tilde{g} R-hadrons: Full detector
- Stable T \tilde{R}-hadrons: Full detector
- Metastable \tilde{g} R-hadrons: Pixel det. only
- GMSB: stable

2. Natural SUSY

- Rparity violation: high-mass quark
- Rparity violation: high-mass gluino

3. Long-Lived Particles

4. RPV

2011 (4.7 fb^{-1}): 12 papers, 3 CONF notes

2012 (5.8 fb^{-1}): 4 CONF notes

ATLAS seriously bites into Weak Scale SUSY

ATLAS SUSY Searches* - 95% CL Lower Limits (Status: SUSY 2012)

- M_{\tilde{g}} > 1.24 TeV
- M_{\tilde{g}} > 1.18 TeV
- M_{\tilde{g}} > 1.23 TeV
- M_{\tilde{g}} > 1.22 TeV
- M_{\tilde{g}} > 1.19 TeV
- M_{\tilde{g}} > 1.18 TeV
- M_{\tilde{g}} > 1.24 TeV
- M_{\tilde{g}} > 1.22 TeV
- M_{\tilde{g}} > 1.23 TeV
- M_{\tilde{g}} > 1.19 TeV
- M_{\tilde{g}} > 1.18 TeV
- M_{\tilde{g}} > 1.24 TeV

8 TeV

7 TeV
Higgs: $H \rightarrow WW \rightarrow e\nu\mu\nu$ with 8 TeV data

- Since July 4th, publication of observation paper including 8 TeV $WW \rightarrow e\nu\mu\nu$ channel
- 2.8 sigma excess in this channel alone (7+8 TeV data)

*Phys. Lett. B 716 (2012) 1-29*
Higgs Combination: Update since 4\textsuperscript{th} July CERN Council

4\textsuperscript{th} July \rightarrow \textit{Phys. Lett. B} 716 (2012) 1-29

Expected : 4.6 $\sigma$ \rightarrow 4.9 $\sigma$

Observed local : 5.0 $\sigma$ \rightarrow 5.9 $\sigma$

Observed global* : 4.1 $\sigma$ \rightarrow 5.1 $\sigma$  

\* full range
Using the Higgs LHC cross-section working group formalism: hep-ph: 1209.0040

Projected sensitivity for 300 and 3000 fb⁻¹ studied in the context of ESPP: ATL-PHYS-PUB-2012-001

Higgs Couplings

**ATLAS** 2011 - 2012

\[ m_H = 126.0 \text{ GeV} \]

- **W,Z H → bb**
  - \( s = 7 \text{ TeV} \), \( |\Delta t| = 4.7 \text{ fb}^{-1} \)
  - \( s = 8 \text{ TeV} \), \( |\Delta t| = 5.8 \text{ fb}^{-1} \)

- **H → \tau\tau**
  - \( s = 7 \text{ TeV} \), \( |\Delta t| = 4.6-4.7 \text{ fb}^{-1} \)

- **H → WW^\ast → l\nu l\nu**
  - \( s = 7 \text{ TeV} \), \( |\Delta t| = 4.7 \text{ fb}^{-1} \)
  - \( s = 8 \text{ TeV} \), \( |\Delta t| = 5.8 \text{ fb}^{-1} \)

- **H → γγ**
  - \( s = 7 \text{ TeV} \), \( |\Delta t| = 4.8 \text{ fb}^{-1} \)
  - \( s = 8 \text{ TeV} \), \( |\Delta t| = 5.9 \text{ fb}^{-1} \)

- **H → ZZ^\ast → 4l**
  - \( s = 7 \text{ TeV} \), \( |\Delta t| = 4.6-4.8 \text{ fb}^{-1} \)
  - \( s = 8 \text{ TeV} \), \( |\Delta t| = 5.8-5.9 \text{ fb}^{-1} \)

**Combined**

\( \mu = 1.4 \pm 0.3 \)

2D fit of coupling to Fermions (\( k_F \)) and Vector bosons (\( k_V \))

In SM: \( k_F = k_V = 1 \)

Probe non-SM contributions to \( gg \rightarrow H \) and \( H \rightarrow γγ \) loops

In SM: \( k_g = k_γ = 1 \)
Higgs Couplings

- **Test of custodial symmetry:**
  \[ \lambda_{WZ} = k_W/k_Z \ (=1 \text{ in SM}) \]

\[ \lambda_{WZ} = 1.07^{+0.35}_{-0.27} \]

- **Probe potential non-SM contribution to gg → H and H → γγ loops, assuming a possible invisible Higgs branching ratio**

\[ B_{inv., und.} < 0.68 \]
Conclusion

- Many thanks to the LHC team for the superb performance of the LHC!
- ATLAS detector continues to operate well
  - High data-taking efficiency and data-quality
  - Successful high-luminosity operation (trigger, pile-up under control)
- A wealth of data being analyzed in all directions
  - Heavy ions
  - Precision measurements using all center-of-mass energy datasets
  - BSM searches on 7 TeV data completed, on 8 TeV well underway
- Quickly entering the era of Higgs measurements
  - More data (~ 25 fb$^{-1}$ at 8 TeV) would be extremely useful!
- Very good progress also on upgrade activities and physics studies for HL-LHC (input submitted to the European Strategy Symposium in Cracow)
Backup
Fast Reprocessing

- Planning a reprocessing of the 2012 data with improved conditions (Inner detector and muon spectrometer alignments etc...).
- This reprocessing will happen at the Tier-1's and will be used for results shown at Moriond 2013.
- Data taken so far to be reprocessed is ~1.5B events.
ttbar-based b-tagging calibration

ATLAS-CONF-2012-097

b-tag eff measured in \( t\bar{t} \) events with three complementary methods:

- **Kinematic selection (lepton+jets and dilepton):**
  
  Tight kinematic selection to get high signal purity.
  
  One b-tagged jet at preselection stage (lepton+jets).

  \[
  \epsilon_b = \frac{1}{f_b} \left( f_{\text{tag}} - \epsilon_c \cdot f_c - \epsilon_l \cdot f_l - \epsilon_{\text{fake}} \cdot f_{\text{fake}} \right)
  \]

- **Tag counting (lepton+jets and dilepton):**
  
  \( \epsilon_b \) from fit to the number of b-tagged jets per event.
  
  Flavor fractions largely from simulated events.

- **Kinematic fit (lepton+jets):**
  
  \( \chi^2 \)-fit to map jets to top- and \( W \)-decays.
  
  Use b-jet on hadronic side to measure \( \epsilon_b \).

  Data-driven background subtraction.

- **Results consistent with \( \mu \)-based methods.**

- **Significantly reduces uncertainties on data-to-MC SFs at high jet pT.**
ATLAS SUSY Search strategy

Inclusive searches

Mass Spectrum

L. Hall (LBL Workshop, 21-Oct11)

Production cross-section

Decay

Phenomenology
1. Strong production (low, high $\Delta M/M_{\text{SUSY}}$
2. Natural spectrum
3. Low $\Delta m$, tiny RPV, weak coupling to $\tilde{g}$
4. ‘Sizeable’ RPV
5. MSSM Extensions?

Signature
Inclusive jets+MET
Dedicated searches with bjets, multileptons, jet/Z veto
Long Lived or meta-stable sparticles
Multileptons (inc. tau), No Z, jet resonances, LFV
Scalar Gluon

→ Phenomenology oriented searches
Inclusive searches

- Status and outlooks on SUSY energy frontier search
  - Exclude up to 1.4 TeV @ $\sqrt{s}=7$ TeV ($m_\tilde{g}=m_\tilde{q}$) and $m_\tilde{g}>800$ GeV
  - At the energy frontier $\sqrt{s}=8$ TeV can gain ~ 2.5-5 in parton luminosity wrt 7 TeV
    ➔ Expect a sensitivity increase of few hundreds GeV

- Worth to look at $\sqrt{s}=8$ TeV with $L(7$ TeV) $\sim L(8$ TeV)!
Long-Lived Particles
Direct sleptons

Direct Slepton production (first LHC limit)

Disappearing track (sensitivity beyond LEP2)

Direct long-lived Slepton production
Search for the SM-Higgs boson in the Channel $\bar{t}t (H \rightarrow b\bar{b})$

- Dominant background (tt+jets)
- Uncertainty on tt+HF prediction 50%

Result:
- $O(10) \times$ SM expected cross section

ATLAS-CONF-2012-135
Physics at High Luminosity

- Expected precision on Higgs BR and partial width with 300 and 3000 fb$^{-1}$

\[ \Delta \frac{\sigma \cdot \text{BR}}{\sigma \cdot \text{BR}} \]

\[ \Delta \frac{\Gamma_x}{\Gamma_y} \]

\[ \frac{\Gamma_Z}{\Gamma_g} \]

\[ \frac{\Gamma_t}{\Gamma_g} \]

\[ \frac{\Gamma_\tau}{\Gamma_\mu} \]

\[ \frac{\Gamma_\mu}{\Gamma_Z} \]

\[ \frac{\Gamma_\tau}{\Gamma_Z} \]

\[ \frac{\Gamma_\gamma}{\Gamma_Z} \]

\[ \frac{\Gamma_g \cdot \Gamma_Z}{\Gamma_H} \]

ATL-PHYS-PUB-2012-001
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