EXPERIMENT

Status Report

121st Open LHCC Session, 4th March 2015



Philipp Fleischmann (University of Michigan) On behalf of the ATLAS Collaboration



Run-1 Publications

- Publications since last LHCC meeting on Nov. 19th 2014
 - 24 papers (3 published already)
 - 7 notes for conferences
- Only a few examples can be shown here
- Two key SM Higgs measurements submitted since Nov'14
 - $-H \rightarrow WW^*$ arXiv:1412.2641 6.1 σ observed (5.8 exp.)
 - $-H \rightarrow \tau \tau$ arXiv:1501.04943 4.5 σ observed (3.4 exp.)

Beyond Standard Model Higgs

arXiv:1501.03276 $H \rightarrow quarkonium + \gamma$

Sensitive to magnitude and sign of Higgs coupling to (c, b) quarks

Sensitive to new physics e.g. in $Hc\overline{c}$ coupling

No significant excess above SM background Upper limits on branching fractions obtained





$A \rightarrow Zh$ arXiv:1502.04478

Higgs used as decay product

No deviation from SM background Setting upper limits on branching fractions



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Standard Model Wyy

Motivation

Test SM description of self-coupling between W and photon gauge bosons and sensitivity to new physics in anomalous quartic gauge couplings (aQGC)

Irreducible background to new physics searches and to future WH($\rightarrow\gamma\gamma$) measurements



Wγγ cross-section measurements in W electron and muon decay channels in fiducial phase space, inclusively ($N_{jets} \ge 0$) and exclusively ($N_{jets} = 0$) in associated jet multiplicity

Results

Cross-section compared with NLO prediction by MCFM => in agreement within 2σ uncertainties

aQGC limits performed for $m_{\gamma\gamma} > 300 \text{ GeV}$ => improving f_{τ_0}/Λ^4

	$\sigma^{\rm fid}$ [fb]	$\sigma^{\rm MCFM}$ [fb]			
Inclusive $(N_{\text{jet}} \ge 0)$					
$\ell u\gamma\gamma$	6.1 $^{+1.\hat{1}}_{-1.0}$ (stat.) ± 1.2 (syst.) ± 0.2 (lumi.)	2.90 ± 0.16			
Exclusive $(N_{\text{jet}} = 0)$					
$\ell u\gamma\gamma$	2.9 $^{+0.8}_{-0.7}$ (stat.) $^{+1.0}_{-0.9}$ (syst.) ± 0.1 (lumi.)	1.88 ± 0.20			



Top-antitop + Vector Boson Production



Testing coupling of bosons to top quarks Single lepton final state



Observation 5.3σ

 σ_{tty}^{fid} x BR = 63±8(stat)⁺¹⁷₋₁₃(syst)±1(lumi)

Theory: 48±10fb

ContributionTotalSignal 152 ± 31 Hadrons 93 ± 46 Prompt photons 106 ± 10 Total background 199 ± 47 Total 351 ± 59 Data candidates362

Completes the already presented:





Search for $e\mu$, $e\tau$, or $\mu\tau$ Resonances

Preliminary

Following on from a search for lepton flavour violating Z-boson decays $(B(Z \rightarrow e\mu) < 7.5 \times 10^{-7}, arXiv:1408.5774)$

Now search in the high mass region for:

- R-parity violating decays of the τ sneutrino
- Lepton flavour violating decays of a Z'



Excess searched for in mass ranges compatible with signal resolution Setting mass limits in the range of 1.7 - 2.0 TeV for sneutrinos and 2.2 - 2.5 TeV for Z'



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Search for EWKinos Decaying via Higgs

arXiv:1501.07110

- Heavier neutralino can decay via Z-boson or Higgs Z cases already exploited in earlier analyses, here consider Higgs case
- Include Higgs decays to $\gamma\gamma$, bb, WW, and $\tau\tau$ Starting to become sensitive, more statistics needed



Combination excludes chargino masses up to 250 GeV





Run-1 SUSY program completing

https://twiki.cern.ch/twiki/bin/view/AtlasPublic/SupersymmetryPublicResults

ATLAS SUSY Searches* - 95% CL Lower Limits

ATLAS Preliminary

Status: Feb 2015

Sla	103.1602013			rmise	C		$\gamma_{3} = 7, 0$ lev
	Model	e, μ, τ, γ	Jets	$E_{\rm T}^{\rm mas}$	$\int \mathcal{L} dt$ [fb	1 Mass limit	Reference
_	MSUGRA/CMSSM	0	2-6 jets	Yes	20.3	<i>α̃, ĝ</i> 1.7 TeV m(<i>α̃</i>)=m(<i>α̃</i>)	1405.7875
S	$\tilde{a}\tilde{a}, \tilde{a} \rightarrow a \tilde{\chi}_{1}^{0}$	0	2-6 jets	Yes	20.3	\hat{q} 850 GeV $m(\hat{x}_1^0)=0$ GeV, $m(1^{st} \text{ gen}, \tilde{a})=m(2^{sd} \text{ gen}, \tilde{a})$	1405.7875
	$\tilde{a}\tilde{a}\gamma, \tilde{a} \rightarrow a\tilde{\chi}_{1}^{0}$ (compressed)	1γ	0-1 jet	Yes	20.3	\tilde{q} 250 GeV m(2) m(c) $\tilde{k}_{1}^{0} = m(c)$	1411.1559
he	$\tilde{q}\tilde{q}$, $\tilde{q} \to a\tilde{a}\tilde{\chi}_{0}^{0}$	0	2-6 jets	Yes	20.3	β 1.33 TeV m(ξ ⁰)=0 GeV	1405.7875
arc	$\tilde{q}\tilde{q}$ $\tilde{q} \rightarrow aa\tilde{\chi}_{1}^{\pm} \rightarrow aaW^{\pm}\tilde{\chi}_{1}^{0}$	1 e.μ	3-6 jets	Yes	20	\tilde{k} 1.2 TeV $m(\tilde{k}_{1}^{0}) = 0.5(m(\tilde{k}_{1}^{0}) + m(\tilde{e}))$	1501.03555
Se.	$\tilde{q}\tilde{q} = \tilde{q} \rightarrow q a (ff/fv/vv) \tilde{\chi}_1^0$	$2 e, \mu$	0-3 jets	-	20	\tilde{g} 1.32 TeV $m(\tilde{\xi}_{i}^{0}) = 0$ GeV	1501.03555
e O	GMSB (Ĩ NLSP)	$1-2\tau + 0-1\ell$	0-2 jets	Yes	20.3	$\tilde{\mathbf{g}}$ 1.6 TeV $\tan\beta > 20$	1407.0603
siv	GGM (bino NLSP)	2γ	-	Yes	20.3	β 1.28 TeV m(𝔅 ⁰)>50 GeV	ATLAS-CONF-2014-001
sh	GGM (wino NLSP)	$1 e, \mu + \gamma$	-	Yes	4.8	ž 619 GeV m ⁽²⁾ / ₂ 50 GeV	ATLAS-CONF-2012-144
DĽ	GGM (higasino-bino NLSP)	Ŷ	1 <i>b</i>	Yes	4.8	2 900 GeV m(x ⁰)>220 GeV	1211.1167
	GGM (higgsing NLSP)	$2 e. \mu(Z)$	0-3 iets	Yes	5.8	2 690 GeV m(\LSP)>200 GeV	ATLAS-CONE-2012-152
	Gravitino I SP	0	mono-iet	Yes	20.3	β ^{1/2} scale 865 GeV m(<i>α̃</i>)≥1 8 × 10 ⁻⁴ eV m(<i>α̃</i>)≥m(<i>α̃</i>)=1 5 TeV	1502.01518
					20.0		
с, р	$\tilde{g} \rightarrow bb\chi_{1}^{-\infty}$	0	3 b	Yes	20.1	$\frac{g}{2}$ 1.25 lev $m(\chi_1) < 400 \text{ GeV}$	1407.0600
gene	$\tilde{g} \rightarrow t \tilde{t} \tilde{\chi}_{1}$	0	/-IU jets	Yes	20.3	8 1.1 TeV m(Y ²) <350 GeV	1308.1841
5 B	$\tilde{g} \rightarrow t \bar{t} \chi_1^{\vee}$	$0-1 \ e, \mu$	3 <i>b</i>	Yes	20.1	g 1.34 TeV m(X ^v ₁)<400 GeV	1407.0600
<u></u>	$\tilde{g} \rightarrow b t \chi_1^r$	0-1 <i>e</i> , μ	3 <i>b</i>	Yes	20.1	\tilde{g} 1.3 TeV $m(\tilde{\ell}_1^u) < 300 \text{ GeV}$	1407.0600
(n)	$\tilde{b}_1 \tilde{b}_1, \tilde{b}_1 \rightarrow b \tilde{\chi}_1^0$	0	2 <i>b</i>	Yes	20.1	\tilde{b}_1 100-620 GeV m (\tilde{v}_1^0) <90 GeV	1308.2631
- Xio	$\tilde{b}_1 \tilde{b}_1, \tilde{b}_1 \rightarrow t \tilde{\chi}_1^{\pm}$	2 <i>e</i> , μ (SS)	0-3 b	Yes	20.3	\tilde{b}_1 275-440 GeV $m(\tilde{\chi}_1^+)=2 m(\tilde{\chi}_1^0)$	1404.2500
lot	$\tilde{t}_1 \tilde{t}_1, \tilde{t}_1 \rightarrow b \tilde{\chi}_1^{\pm}$	1-2 <i>e</i> , μ	1-2 b	Yes	4.7	\tilde{I}_1 110-167 GeV 230-460 GeV $m(\tilde{\chi}_1^+) = 2m(\tilde{\chi}_1^0), m(\tilde{\chi}_1^0) = 55 \text{ GeV}$	1209.2102, 1407.0583
sd	$\tilde{t}_1 \tilde{t}_1, \tilde{t}_1 \rightarrow W b \tilde{\chi}_1^0$ or $t \tilde{\chi}_1^0$	$2 e, \mu$	0-2 jets	Yes	20.3	\tilde{i}_1 90-191 GeV 215-530 GeV m($\tilde{\chi}_1^0$)=1 GeV	1403.4853, 1412.4742
J. S	$\tilde{t}_1 \tilde{t}_1, \tilde{t}_1 \rightarrow t \tilde{\chi}_1^0$	0-1 e, µ	1-2 b	Yes	20	<i>i</i> 210-640 GeV m(<i>k</i> ⁰)=1 GeV	1407.0583,1406.1122
ct	$\tilde{t}_1 \tilde{t}_1, \tilde{t}_1 \rightarrow c \tilde{\chi}_1^0$	0 m	nono-jet/c-	tag Yes	20.3	λ 90-240 GeV m(λ)-(85 GeV	1407.0608
, de la	$\tilde{t}_1 \tilde{t}_1$ (natural GMSB)	$2 e. \mu(Z)$	1 h	Yes	20.3	T_{1} 150-580 GeV $m_{1}^{(2)}$ 150-500 GeV	1403 5222
d 3	$\tilde{t}_2 \tilde{t}_2, \tilde{t}_2 \rightarrow \tilde{t}_1 + Z$	$3 e, \mu (Z)$	1 b	Yes	20.3	1 290-600 GeV m(k ⁰)-200 GeV	1403.5222
	õ õ õ evõ	2	0	Vee	20.2		1402 5204
	$\ell_{L,R}\ell_{L,R}, \ell \rightarrow \ell \chi_1$ $\tilde{\nu}^+ \tilde{\nu}^- \tilde{\nu}^+ - \tilde{\ell} \cdot (\ell \tilde{\nu})$	2 e,µ	0	Yee	20.3		1403.5294
	$\chi_1\chi_1, \chi_1 \to \mathcal{U}(\mathcal{U})$ $\chi_1^+\chi_1^- \chi_1^+ = \chi_1(\chi_1)$	2 e, µ	0	Yee	20.3	x_1 $m(x_1) = 0$ GeV, $m(x_1) = 0$ GeVV, $m(x_1) = 0$ GeV, $m(x_1) = 0$ GeVV, $m(x_1) = 0$ GeVV, m	1403.5294
Sct >	$\chi_1\chi_1, \chi_1 \to \tau \nu(\tau \nu)$	27	-	res	20.3	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	1407.0350
E E	$\chi_1 \chi_2 \rightarrow \ell_L \nu \ell_L \ell(\tilde{\nu}\nu), \ell \tilde{\nu} \ell_L \ell(\tilde{\nu}\nu)$	$3e,\mu$	0	Yes	20.3	χ_1, χ_2 /00 GeV $m(\chi_1) = m(\chi_2), m(\chi_1) = 0.5(m(\chi_1) + m(\chi_1))$	1402.7029
Ŭ	$\chi_1^-\chi_2^- \rightarrow W \chi_1^- Z \chi_1^-$	2-3 e, µ	0-2 jets	Yes	20.3	χ_1, χ_2 420 GeV $m(\chi_1) = m(\chi_2), m(\chi_1) = 0$, sleptons decoupled	1403.5294, 1402.7029
	$\chi_1^+\chi_2^0 \rightarrow W\chi_1^0 h\chi_1^0, h \rightarrow bb/WW/\tau\tau/\tau$	$\gamma\gamma e, \mu, \gamma$	0-2 b	Yes	20.3	χ_1^*, χ_2^* 250 GeV $m(\chi_1^*)=m(\chi_2^*), m(\chi_1^*)=0$, sleptons decoupled	1501.07110
	$\chi_2^{\circ}\chi_3^{\circ}, \chi_{2,3}^{\circ} \to \ell_{\mathrm{R}}\ell$	4 <i>e</i> , µ	0	Yes	20.3	$\chi_{2,3}$ 620 GeV $m(\chi_2^\circ) = m(\chi_3^\circ), m(\chi_1^\circ) = 0.5(m(\chi_2^\circ) + m(\chi_1^\circ))$	1405.5086
-	Direct $\tilde{\chi}_1^+ \tilde{\chi}_1^-$ prod., long-lived $\tilde{\chi}_1^\pm$	Disapp. trk	1 jet	Yes	20.3	$\tilde{\chi}_{1}^{\pm}$ 270 GeV m($\tilde{\chi}_{1}^{0}$)=160 MeV, $\tau(\tilde{\chi}_{1}^{\pm})$ =0.2 ns	1310.3675
ec SS	Stable, stopped \tilde{g} R-hadron	0	1-5 jets	Yes	27.9	\tilde{s} 832 GeV $m(\tilde{\chi}_{1}^{0})$ =100 GeV, 10 μ s< $\tau(\tilde{g})$ <1000 s	1310.6584
i - i	Stable \tilde{g} R-hadron	trk	-	-	19.1	<i>š</i> 1.27 TeV	1411.6795
ng	GMSB, stable $\tilde{\tau}, \tilde{\chi}_1^0 \rightarrow \tilde{\tau}(\tilde{e}, \tilde{\mu}) + \tau(e, \tilde{\mu})$,μ) 1-2 μ	-	-	19.1	$\tilde{\chi}_{1}^{0}$ 537 GeV 10 <tan<math>\beta<50</tan<math>	1411.6795
pig	GMSB, $\tilde{\chi}_1^0 \rightarrow \gamma \tilde{G}$, long-lived $\tilde{\chi}_1^0$	2γ	-	Yes	20.3	$\tilde{\chi}_1^0$ 435 GeV $2 < \tau (\tilde{\chi}_1^0) < 3$ ns, SPS8 model	1409.5542
	$\tilde{q}\tilde{q}, \tilde{\chi}_{1}^{0} \rightarrow qq\mu$ (RPV)	1 μ , displ. vtx	-	-	20.3	\tilde{q} 1.0 TeV 1.5 < $c\tau$ <156 mm, BR(μ)=1, m(\tilde{v}_{1}^{0})=108 GeV	ATLAS-CONF-2013-092
_	LEV $pp \rightarrow \tilde{v}_r + X, \tilde{v}_r \rightarrow e + \mu$	2 e. µ	-	-	4.6	Σ 161 TeV d'=0.10, d ₁₃₂ =0.05	1212 1272
	$LFV pp \rightarrow \tilde{v}_{\tau} + X, \tilde{v}_{\tau} \rightarrow e(\mu) + \tau$	$1 e. \mu + \tau$	-	-	4.6	$\tilde{\mathbf{y}}_{\mathbf{z}}$ 11 TeV $\mathcal{J}_{\mathbf{z}_{\mathbf{z}}} = 0.05$	1212 1272
	Bilinear BPV CMSSM	$2 e. \mu$ (SS)	0-3 h	Yee	20.3		1404 2500
2	$\tilde{V}_{+}^{+}\tilde{V}_{-}^{-}\tilde{V}_{+}^{+} \rightarrow W \tilde{V}_{-}^{0} \tilde{V}_{-}^{0} \rightarrow a a \tilde{v}$	4 e. u	-	Vec	20.3	² [±] 750 GeV m(² / ₂) ≤ 0 cm ² − 0	1405 5086
E	$\tilde{v}^+ \tilde{v}^- \tilde{v}^+ \rightarrow W \tilde{v}^0 \tilde{v}^0 \rightarrow \tilde{v}^-$	$3e\mu + \tau$	-	Vac	20.0	γ_1 γ_2 γ_3 γ_4 γ_5	1405 5086
	$\chi_1\chi_1, \chi_1 \rightarrow W\chi_1, \chi_1 \rightarrow TTV_e, eTV_T$ $\tilde{g} \rightarrow aaa$	οτ,μ + i Λ	6-7 inte	-	20.0	λ₁ 450 GeV Π(κ1)>0.4Xml(k1), λ133≠0 δ 016 CoV BB(n)=BB(n)=B0(n)=004	ATLAS_CONE 2012 001
	$\tilde{s} \rightarrow \tilde{t}_1 t, \tilde{t}_1 \rightarrow bs$	2 e. µ (SS)	0-3 h	Vac	20.3	2 850 GeV	1404 250
Other	Scalar charm. $\tilde{c} \rightarrow c \tilde{\chi}_1^0$	0	2 c	Yes	20.3	č 490 GeV m(k̃ ⁰)<200 GeV	1501.01325
Other		-	-				J
	$\sqrt{s} = 7 \text{ TeV}$	$\sqrt{s} = 8$ TeV partial data	$\sqrt{s} = full$	8 TeV data	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.



Dark Matter Searches: MET+jet arXiv:1502.01518

Clean signature for BSM searches

p_{T.iet}>120GeV, data-driven background

No evidence for signal

Model dependant exclusion limits obtained

Hadronic W.Z

Leptonic W

Leptonic Z





Expected sensitivity of MET+jet @run-2 ATL-PHYS-PUB-2014-007 5 fb⁻¹ data can surpass 8 TeV result



PRD 91, 012008(2015) PRL 112, 041802 (2014) JHEP 09 (2014) 037 PRD 90, 012004 (2014) **MET+Heavy flavour** arXiv:1410.4031

$LS1 \rightarrow Run\text{-}2$

Milestone Runs

• M7 (Nov/Dec 2014)

- First time with shifters back in the control room
- Almost all sub-detectors in, some without HV
- Solenoid and Toroid B-field on for part

• M8 (Feb 2015)

- Testing of new DAQ and Trigger software
- All sub-detectors integrated
- Stable runs up to 20h
- Start of continuous shift operation
- Solenoid B-field on for part (Toroid off)
- M9 (Mar 2015)
 - Calibration and alignment cosmic data taking
 - Runs through to beam splashes







Preparation for Run-2



- It's a long time since run-1
 - Many new Shifters and Experts
- Regular shift training
 - Already done three times



DAQ

- Network overhaul
 - Redundancy implemented for all critical systems
- Data flow architecture
 - Redesigned to simplify resource management
- Tested in technical runs of central infrastructure
 - Followed by milestone runs with all sub-systems
- More Web based monitoring tools
 - Easier access for experts from remote



Trigger

Level 1 Trigger

- New central trigger processor installed and commissioned with all detector systems
 - Doubles number of trigger items and allows for new inputs from Topo processor and ALFA
- L1 Calo firmware and hardware upgraded
 - Relative isolation, correct for bunch train effects, provide more trigger items
- Max L1 rate 100 kHz
 - Was 75 kHz in run-1

High Level Trigger

- New data flow architecture
 - Data read as needed from detector, no Level 2
- Run-2 trigger menu very close to final
 - Validation of trigger items ongoing
- Run-2 average HLT rate ~1kHz
 - Was 200-400 Hz in run-1



Pixel / Insertable B-Layer / Diamond Beam Monitor

 Pixel Calibration updated Already performed end of 2014 Pixel & IBL operation More than 100 hours of data taking DBM currently running with 16 of 24 modules First DBM hits seen during M8

ATLAS Preliminary Cosmics 2014 IBL Planar 0.08 0.06 0.04 0.02	Image: Second state sta
0 10 20 30 40 50	Disk Layer 2 Layer 1 Layer 0
Cluster ToT [Bunch Crossing]	

Cosmic muon Solenoid On Total events (Millions) (Millions) **IDCosmic** 2.5 9.2

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Pixel / Insertable B-Layer / Diamond Beam Monitor

IBL calibration applied

- First time performed in the cavern
- IBL integration into DCS being completed
- IBL Safe For Beam (SFB)
 - Under commissioning





Semiconductor Tracker

Expansion of DAQ to cope with higher pileup

- Increased number of ROD/BOC from 90 to 128
- Pile-up limit well above run-2 expectation
- Running smoothly during M8
 - Validated Run-2 fibre mapping
 - First round of calibrations performed
- Off-detector optical transmitters TX
 - Many failures during run-1
 - Some crates equipped with new LTx





Transition Radiation Tracker

• High voltage ON in the entire detector

- Successfully tested operation at 100 kHz with up to 50% occupancy
- FastOR trigger in stable use during cosmic ray runs
- New active gas system
 - Leaks can lead to contamination into active gas volume
 - New system allows to remove accumulated nitrogen
 - Baseline for 2015: operating part of the detector with Argon mixture instead of Xenon
 - Impact on e/γ -identification small after algorithm updates

HV overshoot at beam dump in run-1

- Amplitude depends linearly on detector current
- Solution found: under preparation (for summer 2015)





Baseline scenario for 2015 operation

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Liquid Argon Calorimeter

- All planned hardware maintenance work finished
 - In January HV modules replaced on EMEC outer wheel and FCal
 - Quick re-ramping after trips and precision current reading
 - Nominal HV for M8
- Some improvements in LAr online software and DQ assessment
 - Since M7 data taking with 4-sample mode up to 100 kHz
 - Online flagging of noise bursts
 - successfully tested during M8 with HV-ramp-induced noise bursts
 - Automatic flagging of hot cells in trigger towers
- LAr Cryostat grounding
 - Reminder: grounding inadvertently changed during LS1
 - No impact on LAr noise and noise bursts seen so far



HV-ramp-induced noise burst

Hadronic Tile Calorimeter

- New Laser-II system under commissioning
 - Improve long term stability control of the system
- First Cs scans performed and HV settings updated
 - Preserve absolute EM scale as in run-1
- Minimum Bias Trigger Scintillators replaced
 - Finalising commissioning
- Tile-Muon-Trigger
 - Coincidence between Tile and TGC
 - Trigger rate reduction in $1 < |\eta| < 1.3$
 - Expected reduction with E(Tile)>500MeV: ~82%
 - First Tile-Muon Digitizer Boards available
 - To be tested soon









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ATLAS Status

Laser-II

Cathode Strip Chambers

- New ROD complex fully integrated
 - Old system had rate limitations not adequate for run-2
- Running up to 100 kHz achieved
 - Ongoing development to improve stability at higher occupancy
- Readout system housed in ATCA shelf
 - First ATCA based system in ATLAS DAQ
 - Monitored and controlled via DCS







Monitored Drift Tube Chambers

- Various small repairs performed
 - Exchange of some broken on chamber electronics
 - HV/LV problems
 - Gas leak repairs
- MROD Double Read-out



- Remove potential bandwidth bottleneck in endcap inner region
- Converted (by firmware update) 1 of 6 inputs into an additional output
- New chambers installed and integrated
 - Covering holes (0.9%) due to elevator shafts in in bottom sectors
 - First sMDT (small tube MDT) chambers
 - Tube diameter half of standard MDT tube

New chambers '



Resistive Plate Chambers

• Gas system upgrade

- Repair of cracked inlets (2 teams nearly full-time in 2014)
- New flowmeters and impedances (during 2015)
- RPC chambers in bottom sectors
 - Cover holes in BM layer due to feet (2.8%)
 - Cover holes due to elevator shafts (0.9%)
 - New type 1mm-gap RPC



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Thin Gap Chambers

- Nominal gas back since few weeks ago
 - Successfully replaced 27 chambers
 - Participated in M8 with HV on
 - Sending trigger signals
- Inner coincidence
 - Inner chambers added to coincidence with big wheel
 - Timing adjustments ongoing





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Detector Control System

- Major migration of all sub-systems
 - Last few sub-system upgrades finalising
- Several new sub-detector components integrated
 - IBL, DBM, new MDT/RPC chambers, ...
- LHC-handshakes tested during dry-runs
 - No major issues observed
 - Time(Stable Beam \rightarrow Ready for Physics) improved by factor ~2
- Detector experts working hard to get "all green"



Data Preparation

Exercising DataPreparation workflow since M7

- Automatic Tier0 reconstruction
- 48 hour calibration loop
- Detector conditions uploads
- Data Quality assessment and shifts
- Data replication to grid
- Collecting cosmic data for detector alignment
 - First ID alignments including IBL done
 - Muon barrel alignment started, full sample in M9



Tier0 jobs running over 2 weeks during M8

	Solenoid On (Millions)	Total (Millions)
IDCosmic	2.5	9.2
CosmicCalo	8.3	31.5
CosmicMuons	52.9	186.2

Events collected during M8

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Computing and Software

- Distributed Data Management
 - DQ2 \rightarrow Rucio: scalability for run-2 and beyond
- Distributed Workload Management
 - ProdSys \rightarrow ProdSys2
- New Data Management
 - All data assigned lifetime, delete when expired
- Software
 - New Analysis Workflow and Framework
 - Reconstruction: factor of ~4x faster at high μ

(in operation)

(in operation)

(automatic during 2015)

(in use)



Upgrade



Upgrade: Phase I

• Four main projects

- New muon small wheel, FastTracker, LAr trigger electronics and TDAQ
- TDRs approved by LHCC in 2013 & Research Board in March 2014
- Some parts are installed early for run-2 (e.g. L1Topo)
- Remainder approaching production for installation during run-2 (FTK) or in LS2
- LAr "Demonstrator" crate backplane and modules installed for run-2
- First comprehensive LHCC annual review in Nov 2014

ATLAS Forward Physics ("AFP")

- Roman pots at 210m, close to ALFA stations
- Project now approved by ATLAS as part of the upgrade programme
- Proceeding towards a TDR for next LHCC
- Discussed yesterday in LHCC Upgrade Session



First L1Topo production module



One (of four) AFP Roman Pot setup

Upgrade: Phase II

- New inner tracker (ITK)
 - Approved by ATLAS as an upgrade project (Feb 2015)
 - -~95 institutions
- Huge range of R&D ongoing for all phase-II projects
 - Overall summary being prepared for April RRB
- Three scenarios being prepared
 - For study and inclusion in "Scoping Document" for LHCC and UCG consideration this summer
 - Informed by outcome of "high-eta task force" which is close to completion

Options being considered by high-eta task force





Summary

- Ongoing finalisation of run-1 analyses
 - Searches ~done, measurements continue
- ATLAS has been fully closed since December
 - Still access for some final repairs ongoing
- Several new detector components successfully integrated
 - IBL, DBM, additional muon chambers, ...
- Many other small changes 'behind the scene' during LS1
 - Recommissioning ATLAS close to complete
 - New shifters and experts training fast

•ATLAS is looking forward to beams and low and high intensity collisions at 13 TeV!

Backup

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Hadronic Gluino Decays with R-Parity Violation

arXiv:1502.05686

In RPV SUSY gluino can decay to many-jet final states with no missing energy Challenging to separate signal from huge multi-jet background q

Two complementary techniques used:

-Scaling number of jets above p_{τ} cut from lower jet multiplicities -Using total jet mass of 4 large-R jets in event





p

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ATLAS Status

q

Heavy Ion: Inclusive Jet Production

arXiv:1412.4092

Centrality and rapidity dependence



Nuclear modification factor R_{pPb} : Quantifies absolute modification of jet rate relative to geometric expectation

Central-to-peripheral ratio R_{CP}: Sensitive to relative deviations in jet rate from geometric expectation between event centralities



CERN-PH-EP-2015-026 Higgs off-shell analysis searches for large Higgs couplings for the off-shell Higgs at large virtualities (mass) m_{vv}

- Use high mass channels $H^* \rightarrow ZZ \rightarrow 4I+2I2v$; added $H^* \rightarrow WW \rightarrow IvIv$ for this paper
- Because of unknown QCD effects, all analysis done inclusive in jets and depending on the unknown Kfactor for the gg → VV bkg.
- Combination with on-shell analysis @ 125GeV allows interpretation as measurement of total width $\Gamma_{\!_{\rm H}}$







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New Analysis Model



Central pieces:

- New, dual Athena/ROOT format for reconstruction output "xAOD"
 - Fully defined and commissioned
- New derivation framework for efficient data reduction
 - So far: 22 derivations for performance groups, 39 for physics analysis
 - Total size of derivations roughly half of original xAOD size
 - Production of derivations in "trains" reliable and fast in new prodsys
- New analysis tools for implementation of harmonised physics objects
 - Most analysis tools available, tested during DC14
 - Update for CP pre-recommendations using newest MC15 production expected for April