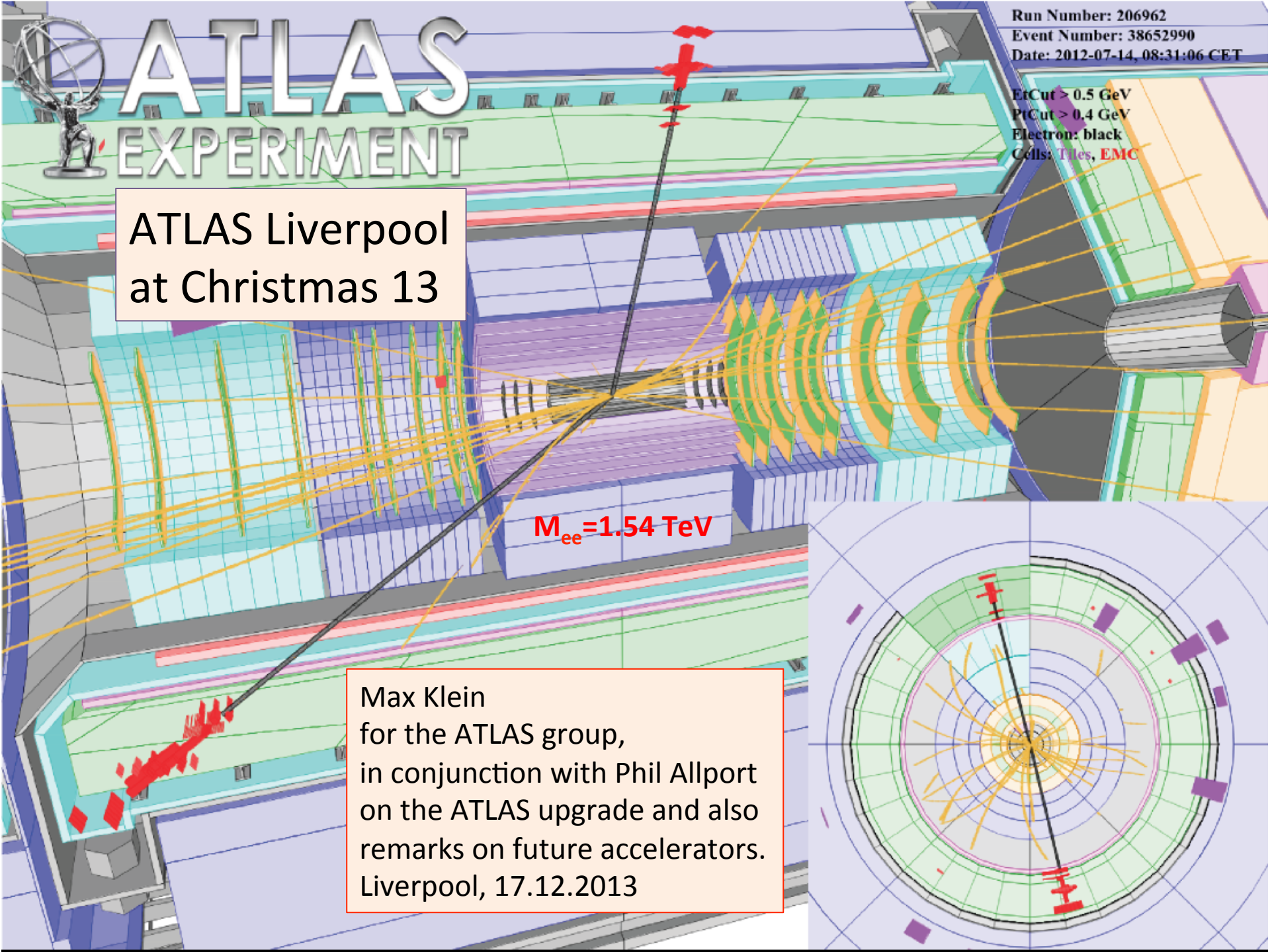
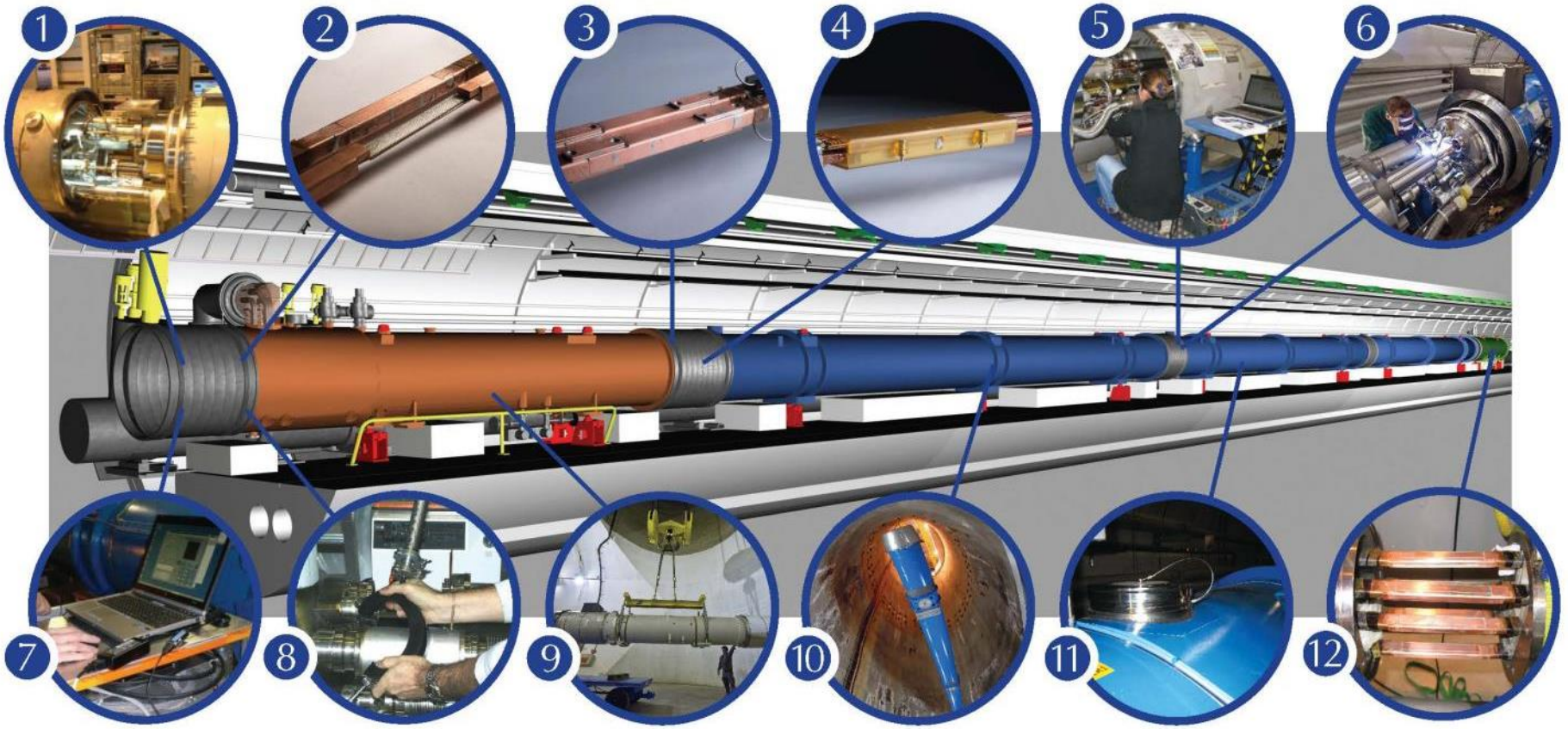

ATLAS
EXPERIMENT
Run Number: 206962
Event Number: 38652990
Date: 2012-07-14, 08:31:06 CET
EtCut > 0.5 GeV
PtCut > 0.4 GeV
Electron: black
Cells: Tiles, EMC
ATLAS Liverpool
at Christmas 13
M_{ee}=1.54 TeV
Max Klein
for the ATLAS group,
in conjunction with Phil Allport
on the ATLAS upgrade and also
remarks on future accelerators.
Liverpool, 17.12.2013

The main 2013-14 LHC consolidations



1695 Openings and final reclosures of the interconnections

Complete reconstruction of 1500 of these splices

Consolidation of the 10170 13kA splices, installing 27 000 shunts

~6000 done

Installation of 5000 consolidated electrical insulation systems

300 000 electrical resistance measurements

10170 orbital welding of stainless steel lines

18 000 electrical Quality Assurance tests

10170 leak tightness tests

4 quadrupole magnets to be replaced

4 quadrupoles, done

15 dipole magnets to be replaced

15 dipoles, done

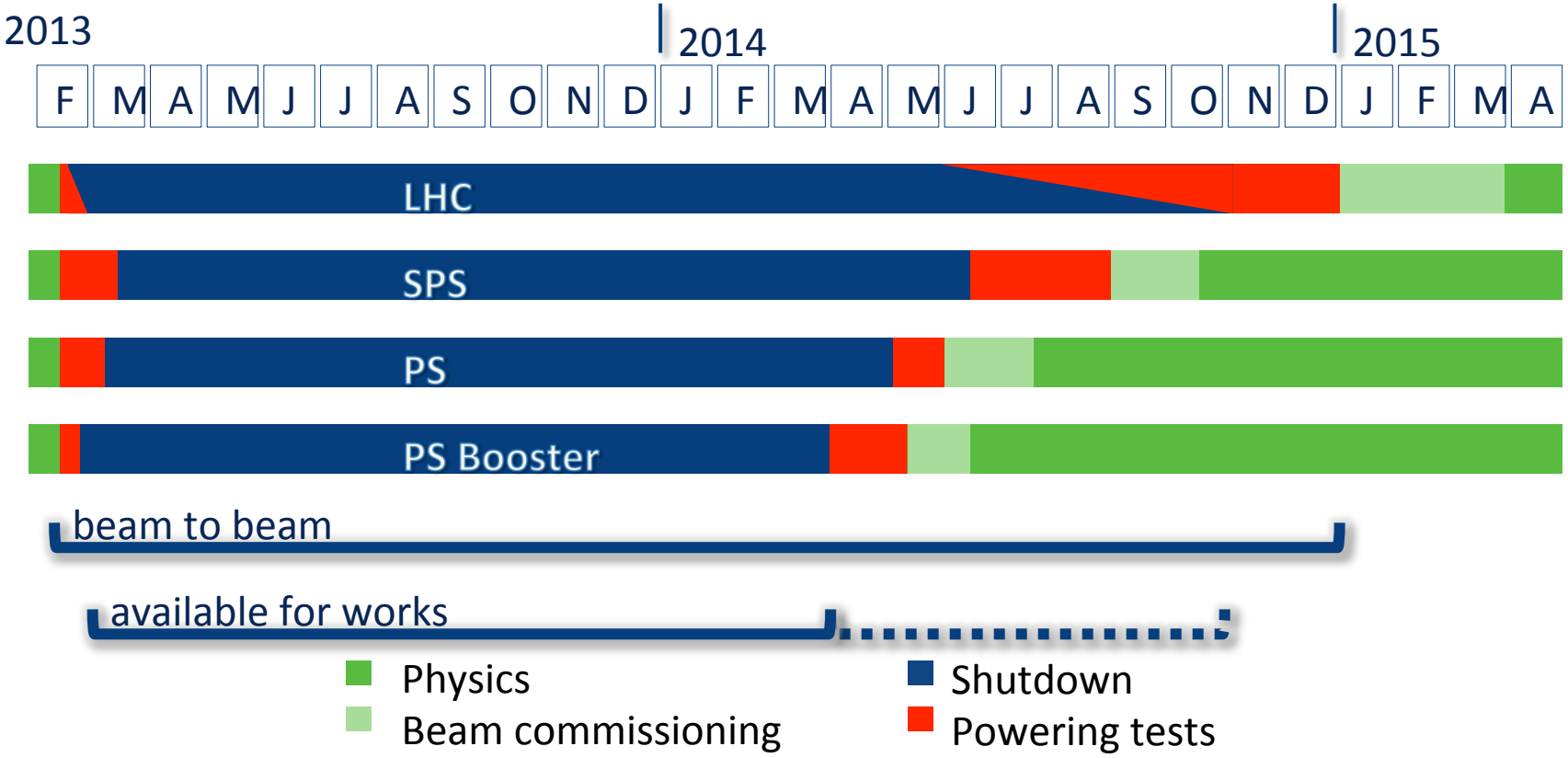
Installation of 612 pressure relief devices to bring the total to 1344

612 pressure reliefs done

Consolidation of the 13 kA circuits in the 16 main electrical feedboxes

LHC

13 TeV run begins in April 2015



	Number of bunches	Intensity per bunch	Transverse emittance	Peak luminosity	Pile up	Int. yearly luminosity
25 ns BCMS	**2508**	**1.15×10^{11}**	**1.9 µm**	**1.6×10^{34} cm^{-2}s^{-1}**	**~43**	**~42 fb^{-1}**

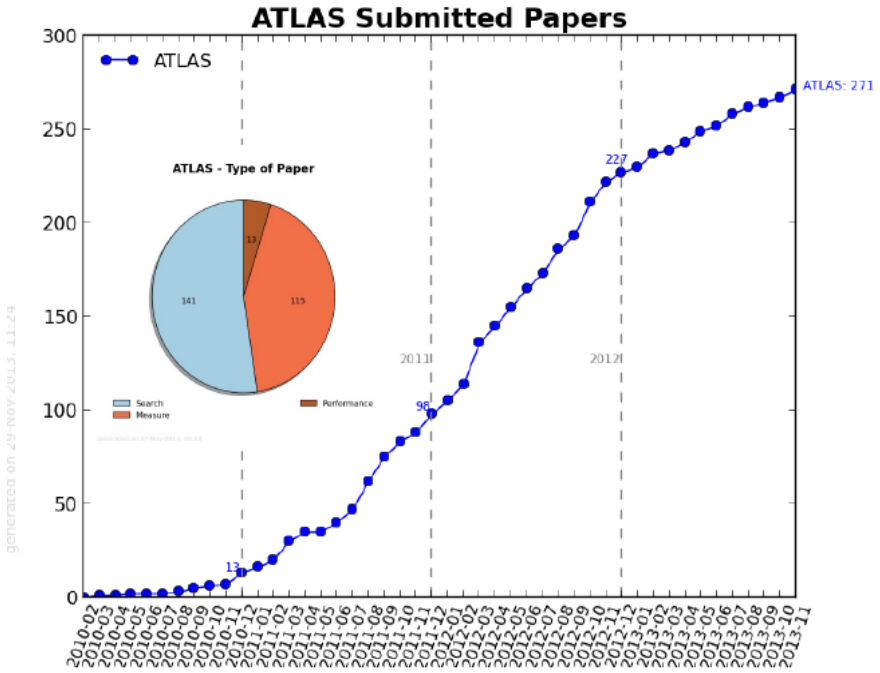
F. Bordry at LHCC 4.12.2013

Planning up to "LS3" and beyond to 2035

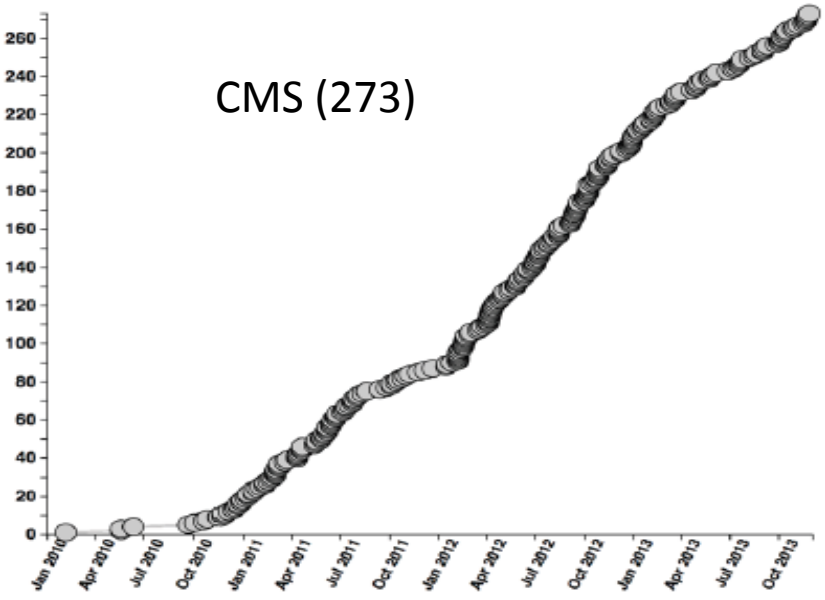
The LHC is now planned to operate until 2035 to deliver $3ab^{-1}$

2025-2035: indicative only

ATLAS and CMS Publications



CMS (273)



ATLAS 271

Status 4/12/2013

Luca Fiorini for ATLAS, LHCC 4.12.2013

Overview on Liverpool Activities

Students in 2013:
4 PhDs (Sylwia, Aaron, Joe, Peter)
5 actively engaged (cf talks on 16.12.)
Sara Mamoud decided to leave HEP

LTAs at CERN
Andy, Carl, Max, Monica, Paul, Phil, Uta
one funded with group budget, others centrally via ATLAS UK and/or CERN, because of various leading roles, complemented by regular visits by Jan, also by Helen, Sergey and Joost – backbone of our visibility and roles on ATLAS.

Editorial Boards and alike
21 edboards with 7 of us
20 **SUSY** Monica - convenor
12 W/Z Jan – convenor

Support note: 100-800 pages
Edboard main feedback towards ATLAS
→ We are involved in ~50 extra analyses

700 talks and 140 posters per year
at 130 conferences – Uta speakers
Committee (1.05:0.95 = female:male)

Upgrade: Helen, Sergey + ground →Phil

Reactions we are analysing
W+b, W+c, MPI, large Rjets, **hiM DY**, lowM DY, W/Z, W', Z', W'→WZ, monopoles, hi e*, **non-pointing photons**, FCNC t→ qH, H→Zγ, H→μμ, ZH→ ll/νν+bb, A→ZH→llbb
H→ZZ→llqq,llbb, H→ZZ→llνν**, ZH→ll+invisible**, $Z\pi_{TC}$→llbb, **stop→$\chi^{\pm}$ b→χ^0 W b**, stop → tχ^0…

→ central in SUSY, Higgs and precision SM – which all are related to (as QCD bgd to SUSY)
Work proceeds in analysis teams, subgroups, working groups, the Collaboration, "pubCom"
…huge challenge to communication ability besides analysis and physics competence!

Search for a Higgs boson in the $H \to ZZ$ and $ZH \to ll + invisible$ channels with the ATLAS detector

Thesis submitted in accordance with the requirements of the University of Liverpool for the degree of Doctor in Philosophy by

Joseph Price

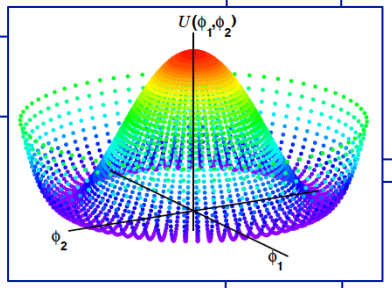
April 2013

A search for new physics in the $\gamma\gamma$ channel with the ATLAS experiment at $\sqrt{s} = 7\,\text{TeV}$

Thesis submitted in accordance with the requirements of the University of Liverpool for the degree of Doctor in Philosophy by Peter Malcolm Waller

July 2013

UNIVERSITY OF LIVERPOOL



Z+b

Aaron Bundock

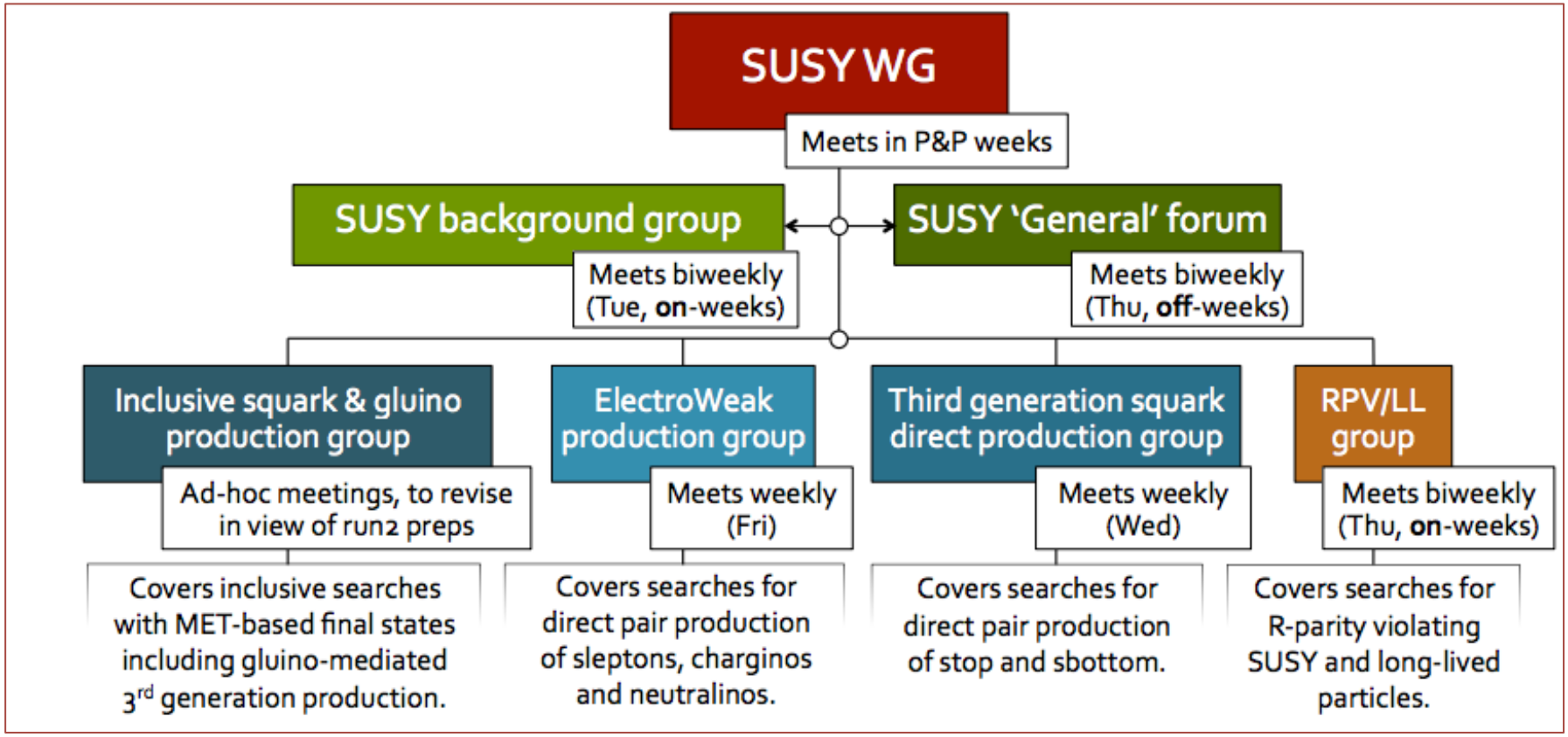
Z

Sylwia Migas

The ATLAS SUSY WG

- About 300 members, 35 analyses teams (and increasing)
- Split in **4 physics-oriented sub-groups** (strong production, third generation squarks, EWK production and RPV-Long Lived particles production)

+ 1 'transversal' sub-group following background matters (SUSY bkg forum)



Co-chaired by Monica D'Onofrio (12-14), now with Jamie Boyd, then with Andreas Hoecker

2013 SUSY achievements

- 7 TeV program ended in 2012
  - One paper published in 2013 on 7 TeV data: Non pointing photons (specilized techniques which need time)
- 8 TeV program
  - 20 CONF notes released on 20 fb^{-1} 8 TeV
  - 4 published papers
- Expect 6 more publications by the end of January, and another 15-20 by Summer 2014
  - Include 'legacy' papers aiming to provide additional reinterpretations and extended analyses – as the last word on SUSY from ATLAS in Run I
  - New ideas keep coming in
- But also: Getting prepared for Run II
  - Developing robust background estimate methods
  - Improve systematic uncertainties
  - Better understand of MC simulation

ATLAS SUSY Searches* - 95% CL Lower Limits

Status: SUSY 2013

ATLAS Preliminary

$\int \mathcal{L}\, dt$ = (4.6 - 22.9) fb^{-1} $\sqrt{s}$ = 7, 8 TeV

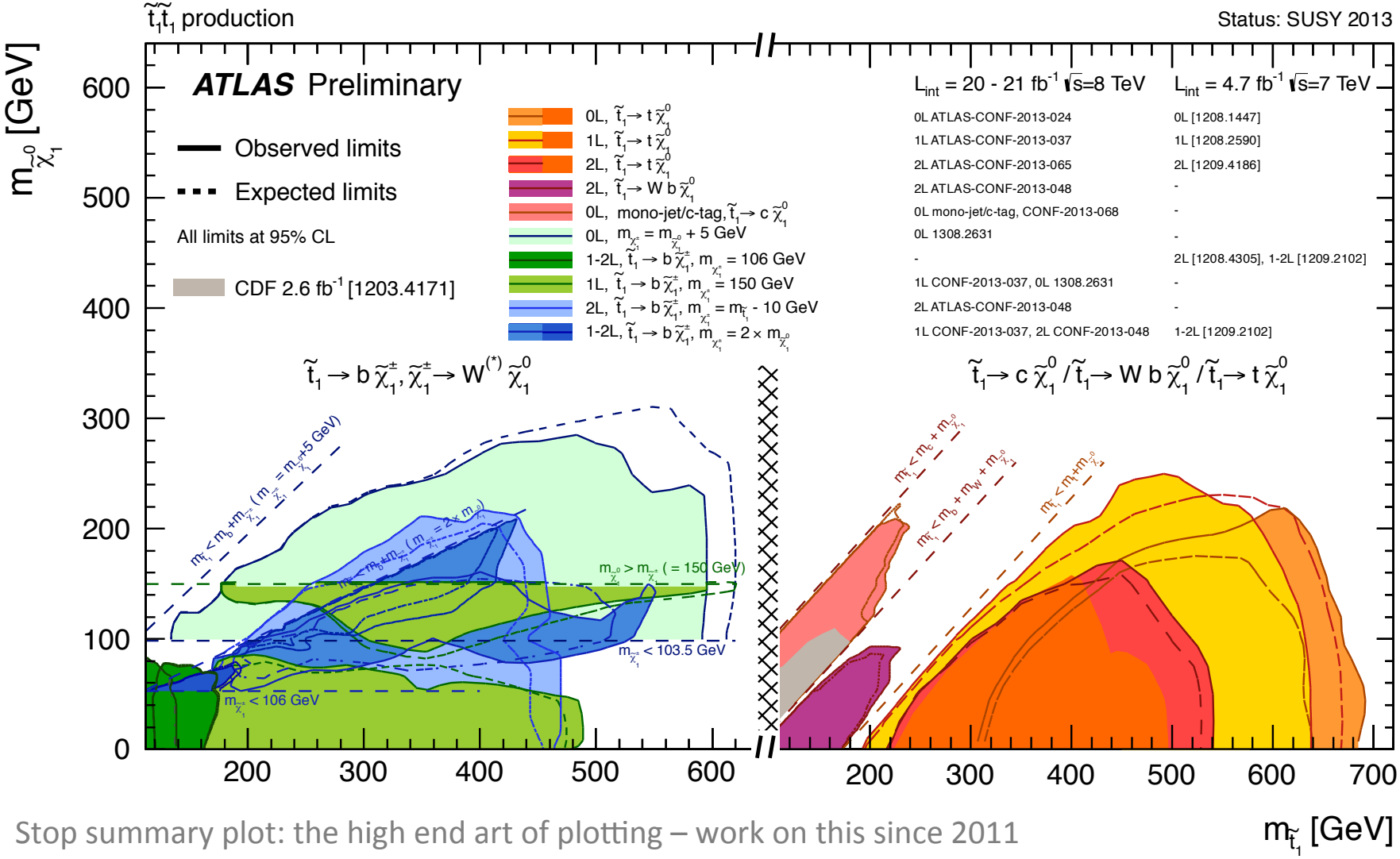
	Model	e, μ, τ, γ	Jets	E_T^{miss}	∫L dt[fb^{-1}]	Mass limit		Reference
Inclusive Searches	MSUGRA/CMSSM	0	2-6 jets	Yes	20.3	$\tilde{q}, \tilde{g}$ 1.7 TeV	m($\tilde{q}$)=m($\tilde{g}$)	ATLAS-CONF-2013-047
	MSUGRA/CMSSM	1 e,μ	3-6 jets	Yes	20.3	$\tilde{g}$ 1.2 TeV	any m($\tilde{q}$)	ATLAS-CONF-2013-062
	MSUGRA/CMSSM	0	7-10 jets	Yes	20.3	$\tilde{g}$ 1.1 TeV	any m($\tilde{q}$)	1308.1841
	$\tilde{q}\tilde{q}$, $\tilde{q}\to q\tilde{\chi}_1^0$	0	2-6 jets	Yes	20.3	$\tilde{q}$ 740 GeV	m($\tilde{\chi}_1^0$)=0 GeV	ATLAS-CONF-2013-047
	$\tilde{g}\tilde{g}$, $\tilde{g}\to q\bar{q}\tilde{\chi}_1^0$	0	2-6 jets	Yes	20.3	$\tilde{g}$ 1.3 TeV	m($\tilde{\chi}_1^0$)=0 GeV	ATLAS-CONF-2013-047
	$\tilde{g}\tilde{g}$, $\tilde{g}\to qqW^{\pm}\tilde{\chi}_1^0$	1 e,μ	3-6 jets	Yes	20.3	$\tilde{g}$ 1.18 TeV	m($\tilde{\chi}_1^0$)<200 GeV, m($\tilde{\chi}^{\pm}$)=0.5(m($\tilde{\chi}_1^0$)+m($\tilde{g}$))	ATLAS-CONF-2013-062
	$\tilde{g}\tilde{g}$, $\tilde{g}\to qq(\ell\ell/\ell\nu/\nu\nu)\tilde{\chi}_1^0$	2 e,μ	0-3 jets	-	20.3	$\tilde{g}$ 1.12 TeV	m($\tilde{\chi}_1^0$)=0 GeV	ATLAS-CONF-2013-089
	GMSB ($\tilde{\ell}$ NLSP)	2 e,μ	2-4 jets	Yes	4.7	$\tilde{g}$ 1.24 TeV	tanβ<15	1208.4688
	GMSB ($\tilde{\tau}$ NLSP)	1-2 τ	0-2 jets	Yes	20.7	$\tilde{g}$ 1.4 TeV	tanβ >18	ATLAS-CONF-2013-026
	GGM (bino NLSP)	2 γ	-	Yes	4.8	$\tilde{g}$ 1.07 TeV	m($\tilde{\chi}_1^0$)>50 GeV	1209.0753
	GGM (wino NLSP)	1 $e,\mu+\gamma$	-	Yes	4.8	$\tilde{g}$ 619 GeV	m($\tilde{\chi}_1^0$)>50 GeV	ATLAS-CONF-2012-144
	GGM (higgsino-bino NLSP)	γ	1 b	Yes	4.8	$\tilde{g}$ 900 GeV	m($\tilde{\chi}_1^0$)>220 GeV	1211.1167
	GGM (higgsino NLSP)	2 e,μ (Z)	0-3 jets	Yes	5.8	$\tilde{g}$ 690 GeV	m($\tilde{H}$)>200 GeV	ATLAS-CONF-2012-152
	Gravitino LSP	0	mono-jet	Yes	10.5	$F^{1/2}$ scale 645 GeV	m($\tilde{g}$)>10^{-4} eV	ATLAS-CONF-2012-147
3rd gen. $\tilde{g}$ med.	$\tilde{g}\to b\bar{b}\tilde{\chi}_1^0$	0	3 b	Yes	20.1	$\tilde{g}$ 1.2 TeV	m($\tilde{\chi}_1^0$)<600 GeV	ATLAS-CONF-2013-061
	$\tilde{g}\to t\bar{t}\tilde{\chi}_1^0$	0	7-10 jets	Yes	20.3	$\tilde{g}$ 1.1 TeV	m($\tilde{\chi}_1^0$) <350 GeV	1308.1841
	$\tilde{g}\to t\bar{t}\tilde{\chi}_1^0$	0-1 e,μ	3 b	Yes	20.1	$\tilde{g}$ 1.34 TeV	m($\tilde{\chi}_1^0$)<400 GeV	ATLAS-CONF-2013-061
	$\tilde{g}\to b\bar{t}\tilde{\chi}_1^+$	0-1 e,μ	3 b	Yes	20.1	$\tilde{g}$ 1.3 TeV	m($\tilde{\chi}_1^0$)<300 GeV	ATLAS-CONF-2013-061
3rd gen. squarks direct production	$\tilde{b}_1\tilde{b}_1$, $\tilde{b}_1\to b\tilde{\chi}_1^0$	0	2 b	Yes	20.1	$\tilde{b}_1$ 100-620 GeV	m($\tilde{\chi}_1^0$)<90 GeV	1308.2631
	$\tilde{b}_1\tilde{b}_1$, $\tilde{b}_1\to t\tilde{\chi}_1^{\pm}$	2 e,μ (SS)	0-3 b	Yes	20.7	$\tilde{b}_1$ 275-430 GeV	m($\tilde{\chi}_1^{\pm}$)=2 m($\tilde{\chi}_1^0$)	ATLAS-CONF-2013-007
	$\tilde{t}_1\tilde{t}_1$(light), $\tilde{t}_1\to b\tilde{\chi}_1^{\pm}$	1-2 e,μ	1-2 b	Yes	4.7	$\tilde{t}_1$ 110-167 GeV	m($\tilde{\chi}_1^0$)=55 GeV	1208.4305, 1209.2102
	$\tilde{t}_1\tilde{t}_1$(light), $\tilde{t}_1\to Wb\tilde{\chi}_1^0$	2 e,μ	0-2 jets	Yes	20.3	$\tilde{t}_1$ 130-220 GeV	m($\tilde{\chi}_1^0$) =m($\tilde{t}_1$)-m(W)-50 GeV, m($\tilde{t}_1$)<<m($\tilde{\chi}_1^{\pm}$)	ATLAS-CONF-2013-048
	$\tilde{t}_1\tilde{t}_1$(medium), $\tilde{t}_1\to t\tilde{\chi}_1^0$	2 e,μ	2 jets	Yes	20.3	$\tilde{t}_1$ 225-525 GeV	m($\tilde{\chi}_1^0$)=0 GeV	ATLAS-CONF-2013-065
	$\tilde{t}_1\tilde{t}_1$(medium), $\tilde{t}_1\to b\tilde{\chi}_1^{\pm}$	0	2 b	Yes	20.1	$\tilde{t}_1$ 150-580 GeV	m($\tilde{\chi}_1^0$)<200 GeV, m($\tilde{\chi}_1^{\pm}$)-m($\tilde{\chi}_1^0$)=5 GeV	1308.2631
	$\tilde{t}_1\tilde{t}_1$(heavy), $\tilde{t}_1\to t\tilde{\chi}_1^0$	1 e,μ	1 b	Yes	20.7	$\tilde{t}_1$ 200-610 GeV	m($\tilde{\chi}_1^0$)=0 GeV	ATLAS-CONF-2013-037
	$\tilde{t}_1\tilde{t}_1$(heavy), $\tilde{t}_1\to t\tilde{\chi}_1^0$	0	2 b	Yes	20.5	$\tilde{t}_1$ 320-660 GeV	m($\tilde{\chi}_1^0$)=0 GeV	ATLAS-CONF-2013-024
	$\tilde{t}_1\tilde{t}_1$, $\tilde{t}_1\to c\tilde{\chi}_1^0$	0	mono-jet/c-tag	Yes	20.3	$\tilde{t}_1$ 90-200 GeV	m($\tilde{t}_1$)-m($\tilde{\chi}_1^0$)<85 GeV	ATLAS-CONF-2013-068
	$\tilde{t}_1\tilde{t}_1$(natural GMSB)	2 e,μ (Z)	1 b	Yes	20.7	$\tilde{t}_1$ 500 GeV	m($\tilde{\chi}_1^0$)>150 GeV	ATLAS-CONF-2013-025
	$\tilde{t}_2\tilde{t}_2$, $\tilde{t}_2\to\tilde{t}_1+Z$	3 e,μ (Z)	1 b	Yes	20.7	$\tilde{t}_2$ 271-520 GeV	m($\tilde{t}_1$)=m($\tilde{\chi}_1^0$)+180 GeV	ATLAS-CONF-2013-025
EW direct	$\tilde{\ell}_{L,R}\tilde{\ell}_{L,R}$, $\tilde{\ell}\to\ell\tilde{\chi}_1^0$	2 e,μ	0	Yes	20.3	$\tilde{\ell}$ 85-315 GeV	m($\tilde{\chi}_1^0$)=0 GeV	ATLAS-CONF-2013-049
	$\tilde{\chi}_1^+\tilde{\chi}_1^-$, $\tilde{\chi}_1^+\to\tilde{\ell}\nu(\ell\tilde{\nu})$	2 e,μ	0	Yes	20.3	$\tilde{\chi}_1^{\pm}$ 125-450 GeV	m($\tilde{\chi}_1^0$)=0 GeV, m($\tilde{\ell}$, $\tilde{\nu}$)=0.5(m($\tilde{\chi}_1^{\pm}$)+m($\tilde{\chi}_1^0$))	ATLAS-CONF-2013-049
	$\tilde{\chi}_1^+\tilde{\chi}_1^-$, $\tilde{\chi}_1^+\to\tilde{\tau}\nu(\tau\tilde{\nu})$	2 τ	-	Yes	20.7	$\tilde{\chi}_1^{\pm}$ 180-330 GeV	m($\tilde{\chi}_1^0$)=0 GeV, m($\tilde{\tau}$, $\tilde{\nu}$)=0.5(m($\tilde{\chi}_1^{\pm}$)+m($\tilde{\chi}_1^0$))	ATLAS-CONF-2013-028
	$\tilde{\chi}_1^{\pm}\tilde{\chi}_2^0\to\tilde{\ell}_L\nu\tilde{\ell}_L\ell(\tilde{\nu}\nu)$, $\ell\tilde{\nu}\tilde{\ell}_L\ell(\tilde{\nu}\nu)$	3 e,μ	0	Yes	20.7	$\tilde{\chi}_1^{\pm},\tilde{\chi}_2^0$ 600 GeV	m($\tilde{\chi}_1^{\pm}$)=m($\tilde{\chi}_2^0$), m($\tilde{\chi}_1^0$)=0, m($\tilde{\ell}$, $\tilde{\nu}$)=0.5(m($\tilde{\chi}_1^{\pm}$)+m($\tilde{\chi}_1^0$))	ATLAS-CONF-2013-035
	$\tilde{\chi}_1^{\pm}\tilde{\chi}_2^0\to W\tilde{\chi}_1^0 Z\tilde{\chi}_1^0$	3 e,μ	0	Yes	20.7	$\tilde{\chi}_1^{\pm},\tilde{\chi}_2^0$ 315 GeV	m($\tilde{\chi}_1^{\pm}$)=m($\tilde{\chi}_2^0$), m($\tilde{\chi}_1^0$)=0, sleptons decoupled	ATLAS-CONF-2013-035
	$\tilde{\chi}_1^{\pm}\tilde{\chi}_2^0\to W\tilde{\chi}_1^0 h\tilde{\chi}_1^0$	1 e,μ	2 b	Yes	20.3	$\tilde{\chi}_1^{\pm},\tilde{\chi}_2^0$ 285 GeV	m($\tilde{\chi}_1^{\pm}$)=m($\tilde{\chi}_2^0$), m($\tilde{\chi}_1^0$)=0, sleptons decoupled	ATLAS-CONF-2013-093
Long-lived particles	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($\tilde{\chi}_1^{\pm}$)-m($\tilde{\chi}_1^0$)=160 MeV, τ($\tilde{\chi}_1^{\pm}$)=0.2 ns	ATLAS-CONF-2013-069
	Stable, stopped $\tilde{g}$ R-hadron	0	1-5 jets	Yes	22.9	$\tilde{g}$ 832 GeV	m($\tilde{\chi}_1^0$)=100 GeV, 10 μs<τ($\tilde{g}$)<1000 s	ATLAS-CONF-2013-057
	GMSB, stable $\tilde{\tau}$, $\tilde{\chi}_1^0\to\tilde{\tau}(\tilde{e},\tilde{\mu})+\tau(e,\mu)$	1-2 μ	-	-	15.9	$\tilde{\chi}_1^0$ 475 GeV	10<tanβ<50	ATLAS-CONF-2013-058
	GMSB, $\tilde{\chi}_1^0\to\gamma\tilde{G}$, long-lived $\tilde{\chi}_1^0$	2 γ	-	Yes	4.7	$\tilde{\chi}_1^0$ 230 GeV	0.4<τ($\tilde{\chi}_1^0$)<2 ns	1304.6310
	$\tilde{q}\tilde{q}$, $\tilde{\chi}_1^0\to qq\mu$ (RPV)	1 μ, displ. vtx	-	-	20.3	$\tilde{q}$ 1.0 TeV	1.5 <cτ<156 mm, BR(μ)=1, m($\tilde{\chi}_1^0$)=108 GeV	ATLAS-CONF-2013-092
RPV	LFV $pp\to\tilde{\nu}_\tau+X$, $\tilde{\nu}_\tau\to e+\mu$	2 e,μ	-	-	4.6	$\tilde{\nu}_\tau$ 1.61 TeV	λ'_{311}=0.10, λ_{132}=0.05	1212.1272
	LFV $pp\to\tilde{\nu}_\tau+X$, $\tilde{\nu}_\tau\to e(\mu)+\tau$	1 $e,\mu+\tau$	-	-	4.6	$\tilde{\nu}_\tau$ 1.1 TeV	λ'_{311}=0.10, $\lambda_{1(2)33}$=0.05	1212.1272
	Bilinear RPV CMSSM	1 e,μ	7 jets	Yes	4.7	$\tilde{q}, \tilde{g}$ 1.2 TeV	m($\tilde{q}$)=m($\tilde{g}$), $c\tau_{LSP}$<1 mm	ATLAS-CONF-2012-140
	$\tilde{\chi}_1^+\tilde{\chi}_1^-$, $\tilde{\chi}_1^+\to W\tilde{\chi}_1^0$, $\tilde{\chi}_1^0\to ee\tilde{\nu}_\mu, e\mu\tilde{\nu}_e$	4 e,μ	-	Yes	20.7	$\tilde{\chi}_1^{\pm}$ 760 GeV	m($\tilde{\chi}_1^0$)>300 GeV, λ_{121}>0	ATLAS-CONF-2013-036
	$\tilde{\chi}_1^+\tilde{\chi}_1^-$, $\tilde{\chi}_1^+\to W\tilde{\chi}_1^0$, $\tilde{\chi}_1^0\to\tau\tau\tilde{\nu}_e, e\tau\tilde{\nu}_\tau$	3 $e,\mu+\tau$	-	Yes	20.7	$\tilde{\chi}_1^{\pm}$ 350 GeV	m($\tilde{\chi}_1^0$)>80 GeV, λ_{133}>0	ATLAS-CONF-2013-036
	$\tilde{g}\to qqq$	0	6-7 jets	-	20.3	$\tilde{g}$ 916 GeV	BR(t)=BR(b)=BR(c)=0%	ATLAS-CONF-2013-091
	$\tilde{g}\to\tilde{t}_1 t$, $\tilde{t}_1\to bs$	2 e,μ (SS)	0-3 b	Yes	20.7	$\tilde{g}$ 880 GeV		ATLAS-CONF-2013-007
Other	Scalar gluon pair, sgluon→$q\bar{q}$	0	4 jets	-	4.6	sgluon 100-287 GeV	incl. limit from 1110.2693	1210.4826
	Scalar gluon pair, sgluon→$t\bar{t}$	2 e,μ (SS)	1 b	Yes	14.3	sgluon 800 GeV		ATLAS-CONF-2013-051
	WIMP interaction (D5, Dirac χ)	0	mono-jet	Yes	10.5	M* scale 704 GeV	m(χ)<80 GeV, limit of<687 GeV for D8	ATLAS-CONF-2012-147

$\sqrt{s}$ = 7 TeV full data | $\sqrt{s}$ = 8 TeV partial data | $\sqrt{s}$ = 8 TeV full data

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 1σ theoretical signal cross section uncertainty.*



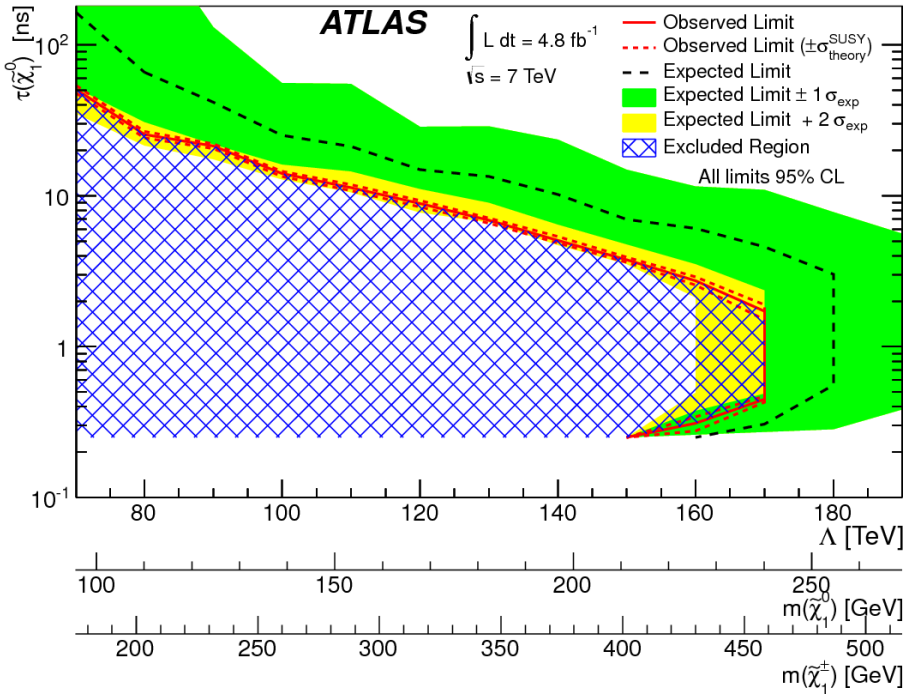
Stop summary plot: the high end art of plotting – work on this since 2011

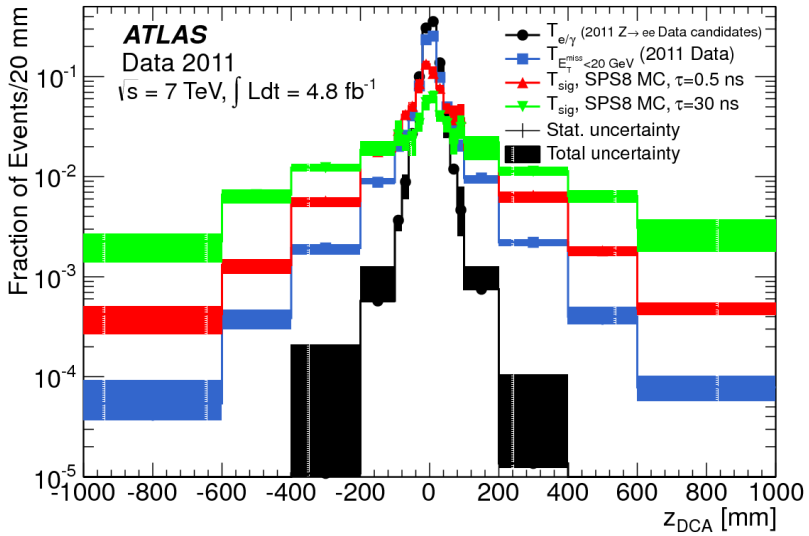
ATLAS SUSY WEB warning: **Note that these plots overlay contours belonging to different stop decay channels, different sparticle mass hierarchies, and simplified decay scenarios. care must be taken when interpreting them.**

Monica,John now working on mixed decays of stops to access free regions, both in **b** and **c**

“non-pointing photons”

Search for long-lived neutralinos decaying in γ+gravitino in Gauge Mediated SUSY models





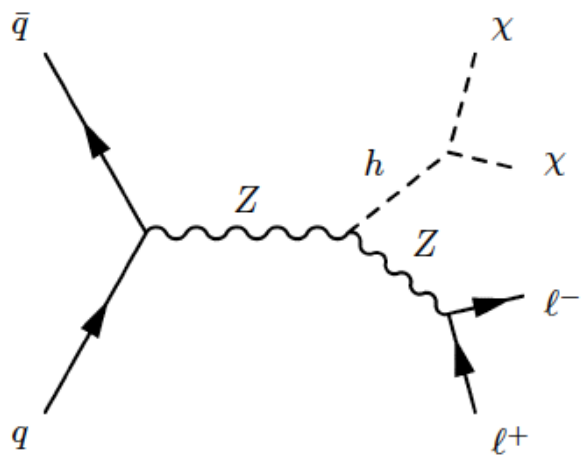
PRD 88, 012001 (2013)

Alan, Helen, Sergey:
Work on this since several years.

Non pointing photon analysis on 2012 data in progress , using timing info as well (see Alan Lehan’s talk yesterday)

Search for the invisible Higgs

- First paper on direct search for invisible Higgs
- SM BR($H \to \nu\nu\nu\nu$) $= 1.18 \times 10^{-3}$ too small for observation
- Extensions to the SM allow the Higgs to decay to stable or long lived particles
- Results on 125 GeV Higgs candidate still allow sizeable fraction of the Higgs to decay to invisible particles, even if production is at SM rate
- A further Higgs like particle decaying exclusively to invisible particles still not ruled out for $m_H > 115$ GeV

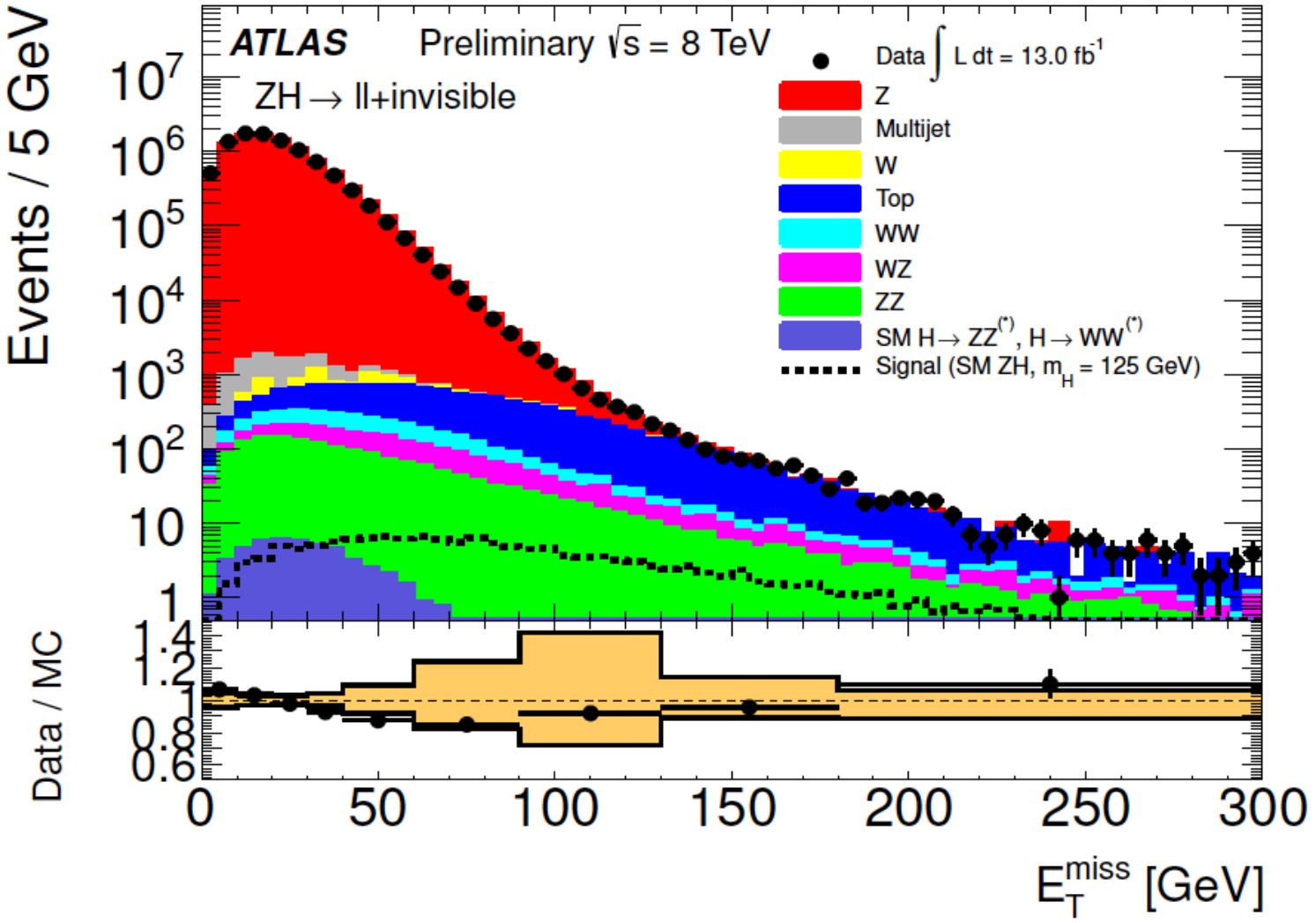


Joe in group meeting, 20.9.13

Thesis of Joe, in collaboration with Joost

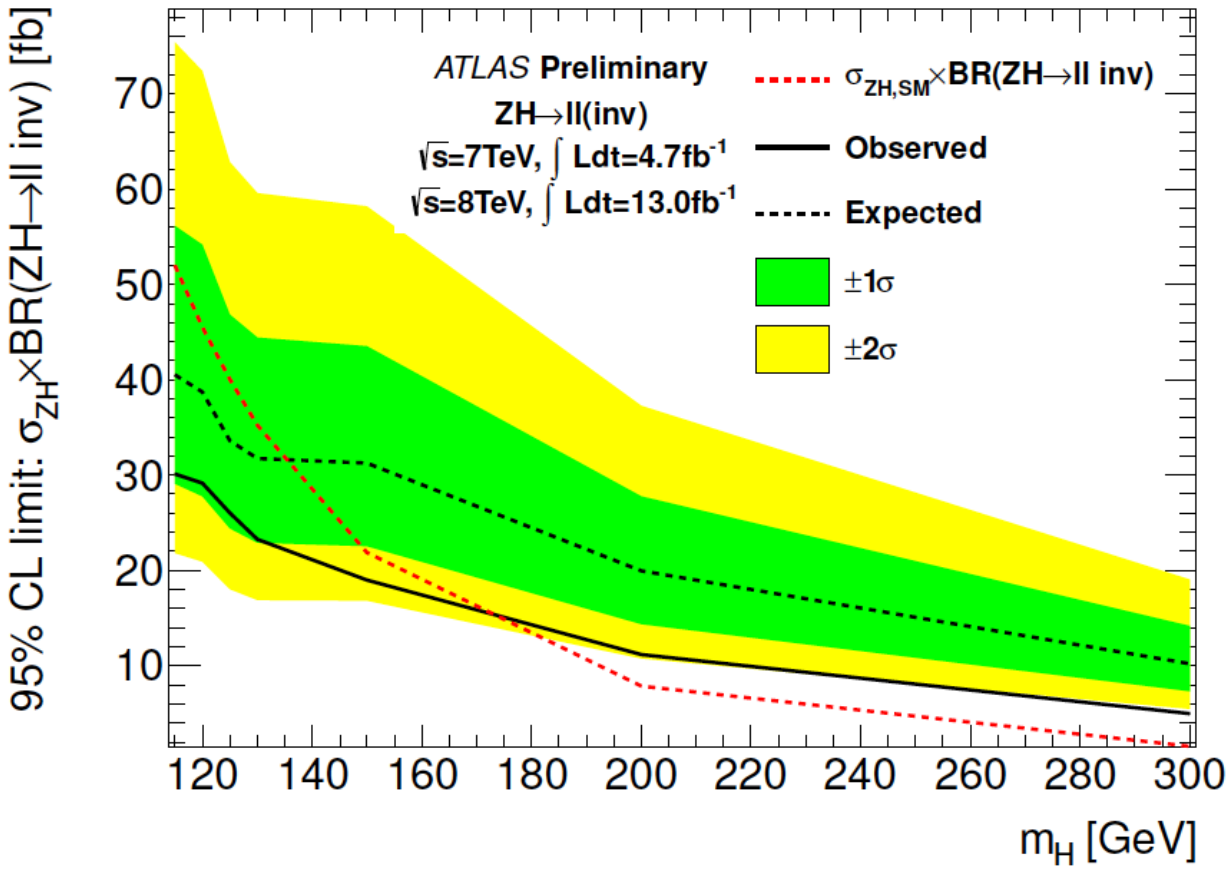
Thanks to Joost .. Carl.. Andy… and the CERN cricket club and whoever put a snooker table in B565 ..

Search for the invisible Higgs



No searches without W,Z,top, QCD physics and simulation …

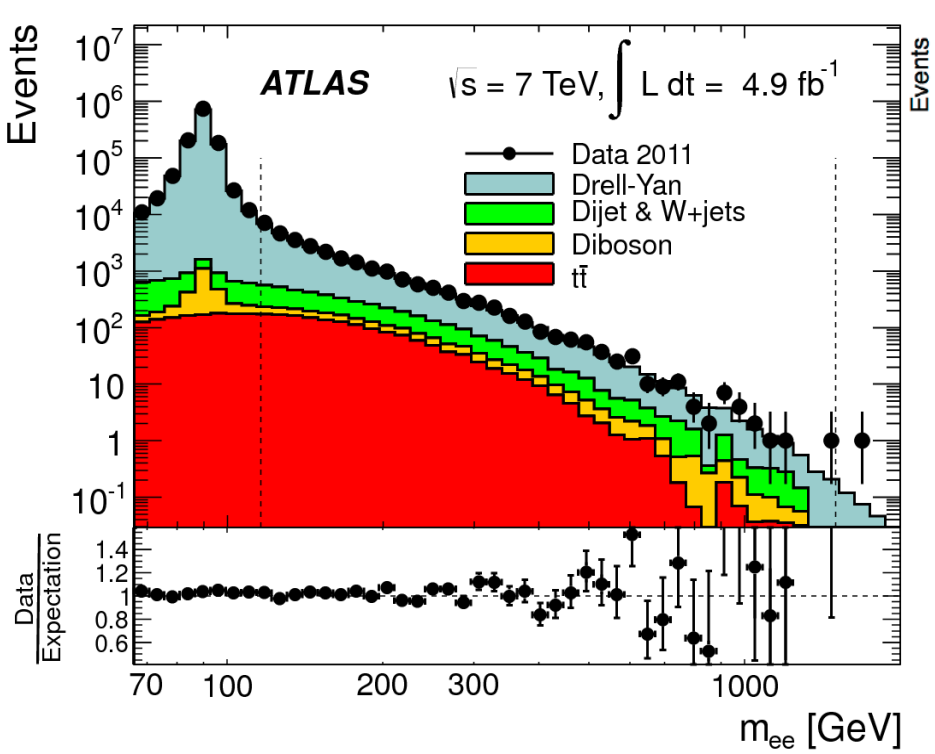
Search for the invisible Higgs

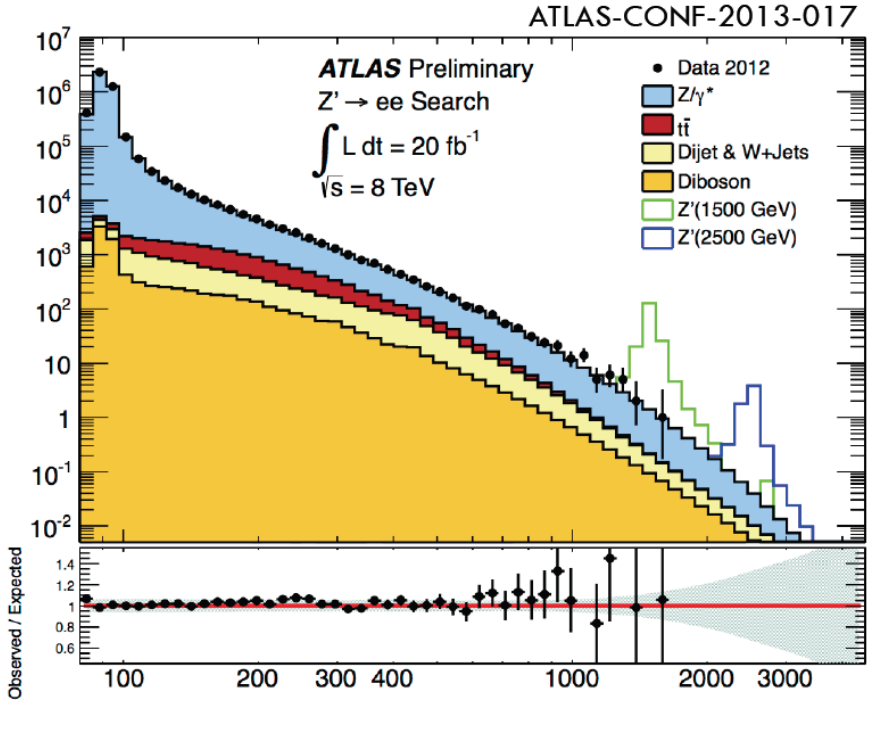


Limits on the ZH production cross section multiplied by invisible br fraction of H vs M_H.
Can be also interpreted as search for dark matter which couples to H ("Higgs portal").

High-Mass Drell-Yan Measurement ($Z/\gamma^* \rightarrow e^+e^-$)

- 2011 data set, 4.9 fb^{-1} at $\sqrt{s}$ = 7 TeV (only electron data)
- Yan-Jie ATLAS talk (CONF note) Epiphany Conference in Cracow Jan '13
- Paper published in early Summer 2013: Phys. Lett. B725 (2013); arXiv 1305.4192 [hep-ex

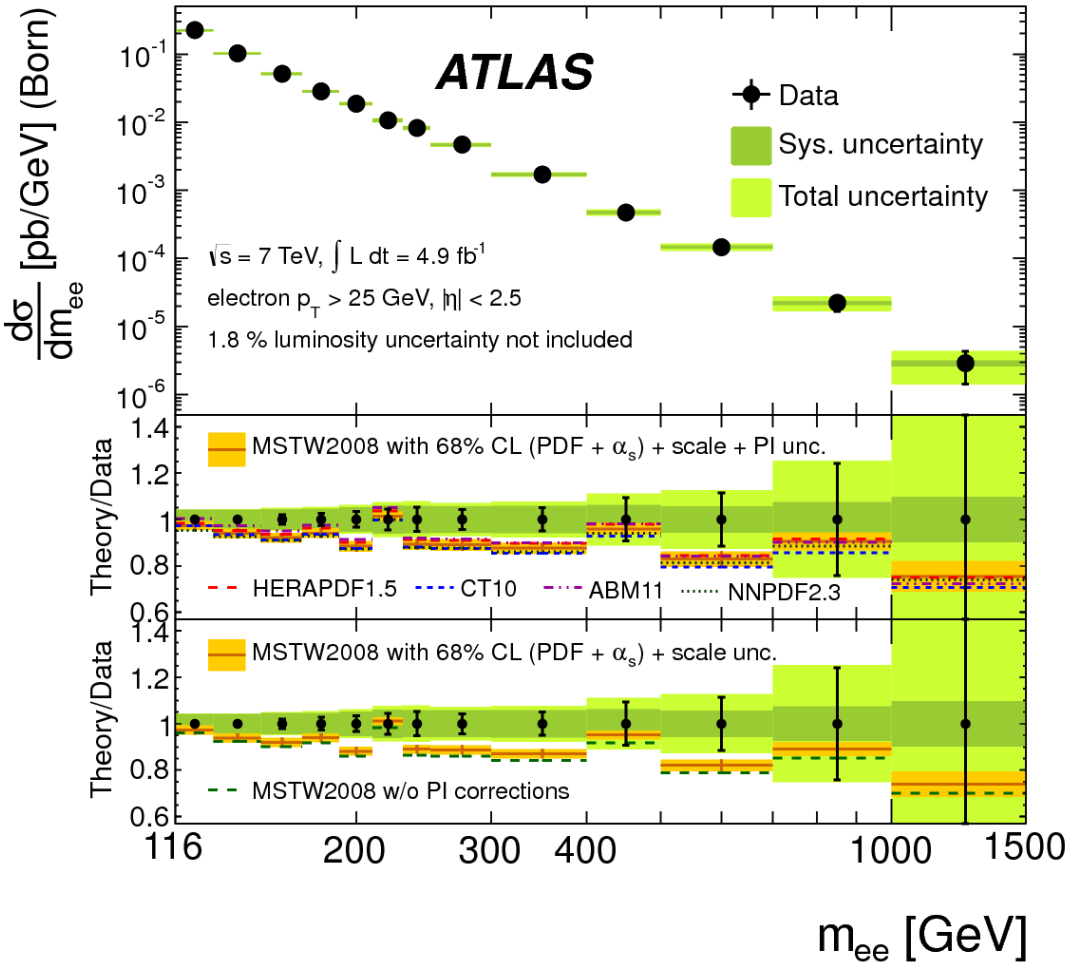




current limit on Z' is 2.88 TeV with SM couplings – remember KK towers of excitations in ED theory??

High-Mass Drell-Yan Measurement ($Z/\gamma^* \rightarrow e^+e^-$)

HO QCD, HO EW, photon-induced, and real W and Z radiation from final state leptons
→ first publication with thorough theory treatment, plus all NNLO QCD predictions



PDF comparison – hard to constrain PDFs at high mass

γ induced part improves χ^2

2012 data analysis in progress. High precision takes now also time for the ATLAS experiment [e/γ work after next slide - Jan]

Note: W,Z measurements turned into searches – introducing SM methodology into searches (Uta)

H.O. Theory, MCs and Computing

CERN-RFBR-Scientific-Cooperation 12-02-91526-CERN_a with
Dmitry Bardin, Serge Bondarenko, Lidia Kalinovskaya (JINR Dubna)

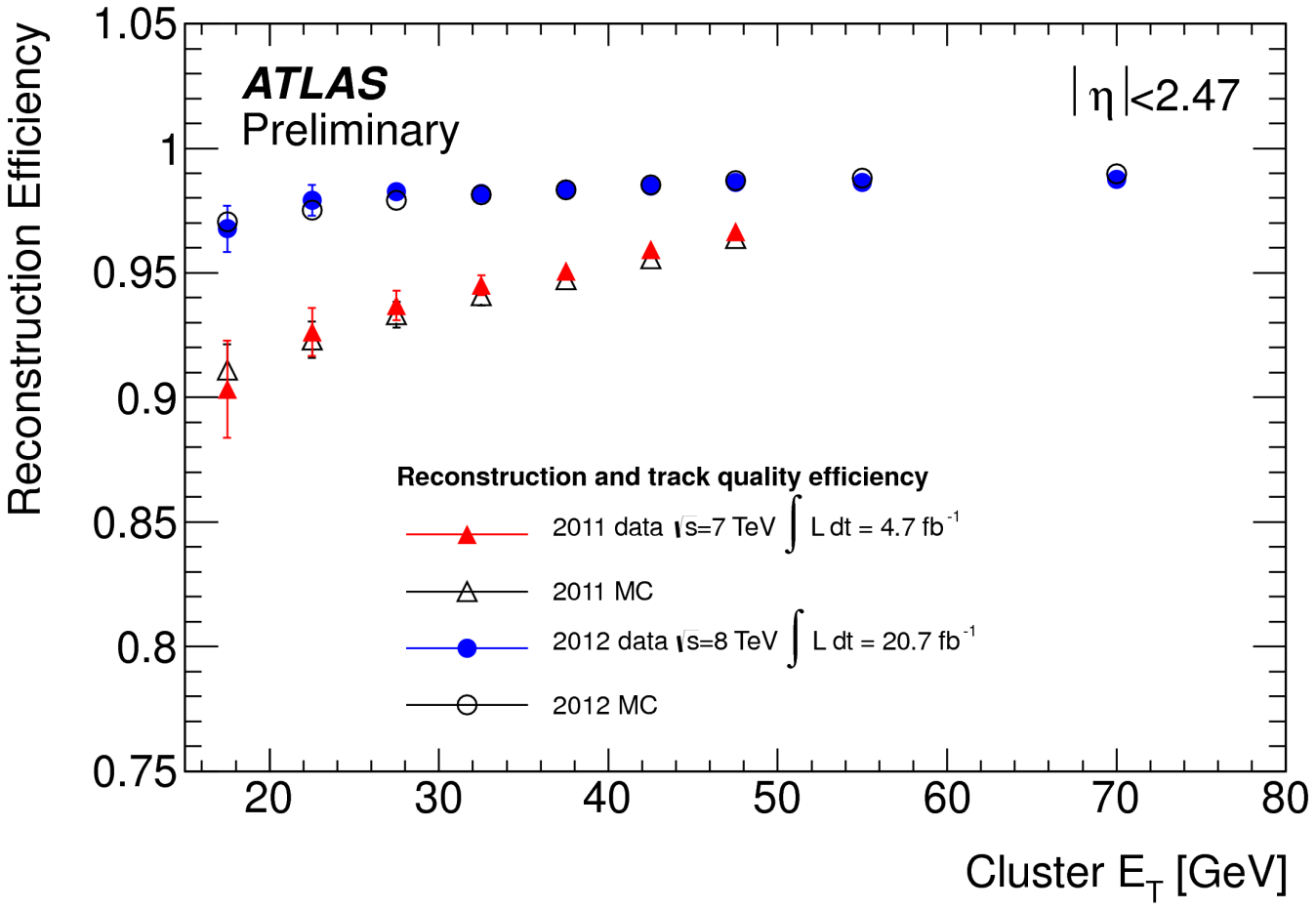
- ➔ Uta - leader from CERN part, L. Kalinovskaya from Dubna
- ➔ 3-years period 2012-2014 (based on yearly success the next year will be granted → travel money for Russian theorists)
- ➔ HO EW corrections for High mass DY, Z', W' and precision SM resonant W and Z production : new methodologies developed, e.g mass-dependent significant systematic uncertainty for HO EW corrections derived for first time
- ➔ consistent definition of EW and SM parameters developed as needed to match 2011 resonant NC and DY precision data
- ➔ new : γγ→ ll and γq→ ll di-lepton contributions for a wide mass range

DiRAC : PPSC20: PRECISION MODELLING OF HADRON STRUCTURE AT HIGHEST ENERGIES
(Cambridge cluster, award worth 15k£)

- → Uta in co-operation with US theorist Frank Petriello (author of NNLO QCD code FEWZ)
- → John Bland DiRAC set-ups of code
- → world-new comparisons of theory codes for NC and CC DY over very wide mass ranges
- → close discussion with theorists like Massimiliano Grazzini (NNLO QCD code), Lance Dixon (VRAP NNLO QCD code), Robert Thorne (photon in proton) and within LPCC EW working group
- → intense cross checks and benchmarking of QCD codes : MCFM (used for APPLgrid productions), FEWZ, DYNNLO, VRAP, MadGraph (W' and Z'), Pythia (W' and Z') and MCSANC (QC and EW), HORACE (EW)
- → triggered updates of codes, e.g. DYNNLO v1.4 now working also for non-resonant DY, other issues still to be worked on

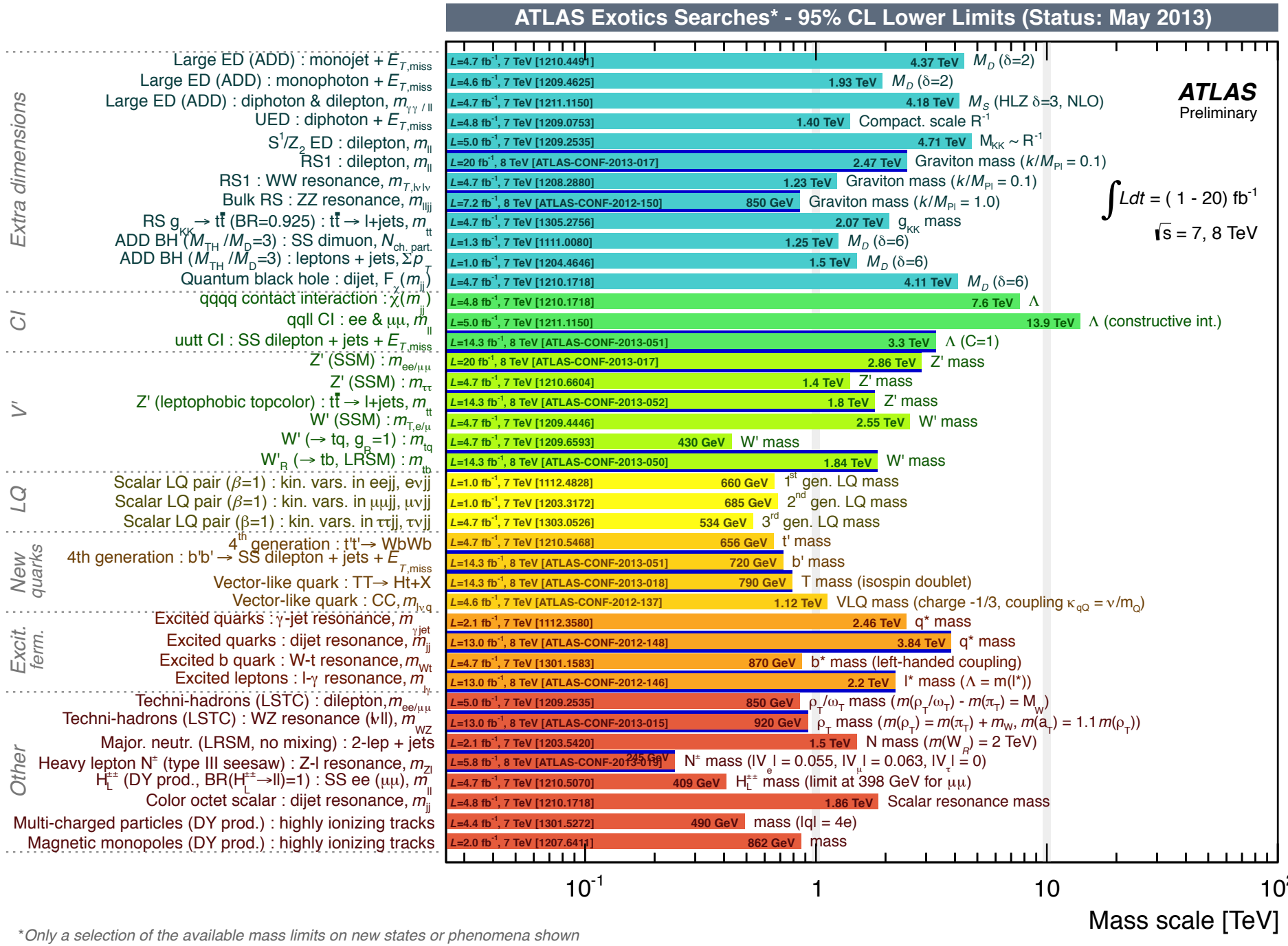
Work initiated and largely performed by Uta in cooperation with many theorists (SANC and beyond)

Work on Performance “e/γ”



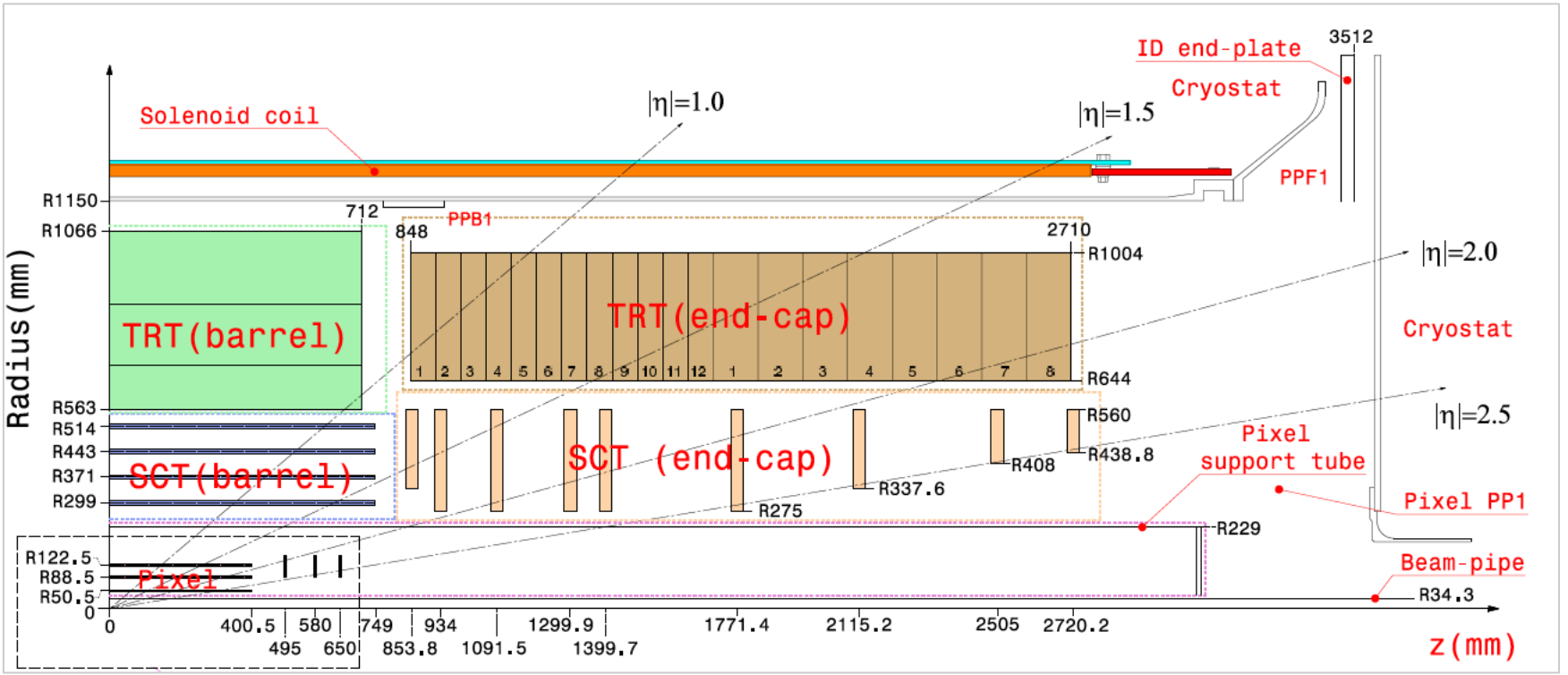
on ATLAS: central performance groups: D/MC corrections for analyses

Jan: electron efficiency responsible until he became W,Z co-convenor



*Only a selection of the available mass limits on new states or phenomena shown

Preparations for Run 2 - SCT

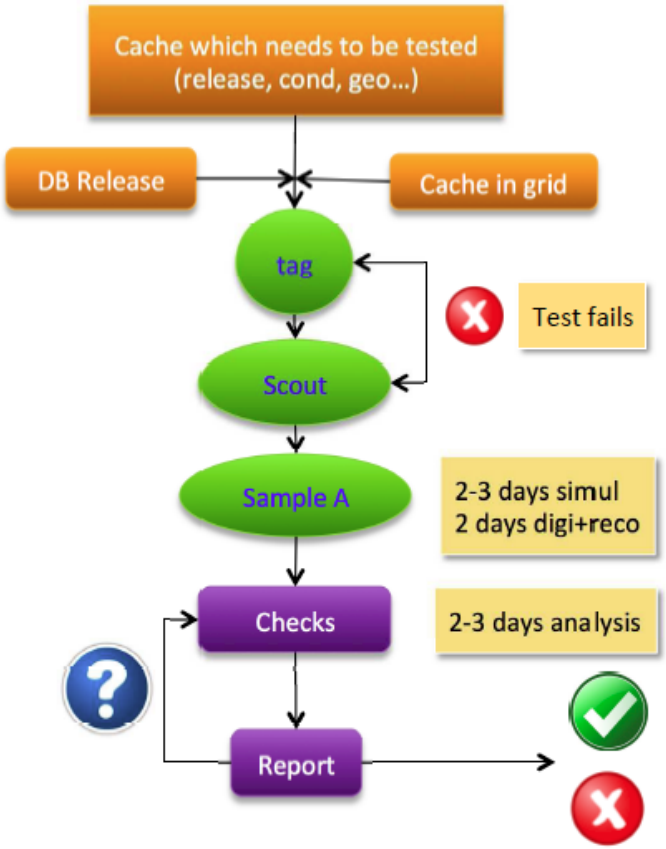


Liverpool have built endcap C. **High performance during run 1** (paper imminent).
Carl: work on DAQ upgrade (his talk yesterday), Joost SCT institute's board chair, UK PL

Shutdown:installation new thermo-siphon cooling system, New control & monitor system for heater pads + some repairs; new off-detector optical transmitters

Physics Validation

- Responsible for ensuring correct output of simul-digi-reco chain
  - Prevent unexpected side effects of changes
- Many things to validate (80 tasks/year):
  - Simulation: full/fast improvements/fixes
  - Digi+reco: changes for prod/Tier-0
  - Upgrade activities: IBL, ITK
  - Developments: ISF, Multi-core athena, ...
- Procedure:
  - Run a representitve set of physics processes
  - Phys/Perf groups analyse these compared to previously validated reference sample
  - Result flagged and discussed in meeting
- Essential to ensure get the most out of the "Data Challenge" & are prepared for run 2
  - Need to migrate to new data format

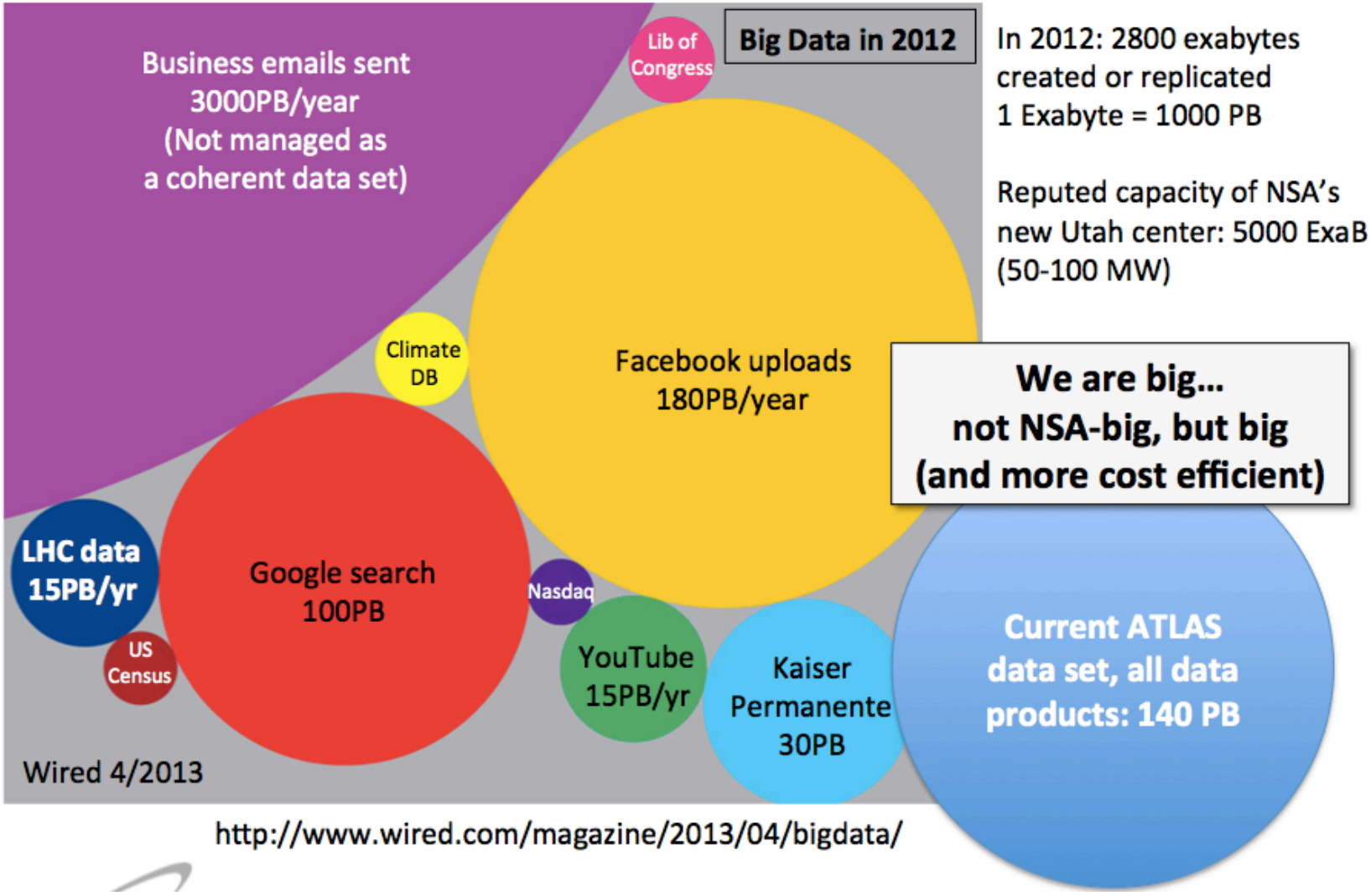


Carl Gwilliam – new convenor for ATLAS physics validation

ATLAS Data - It's BIG

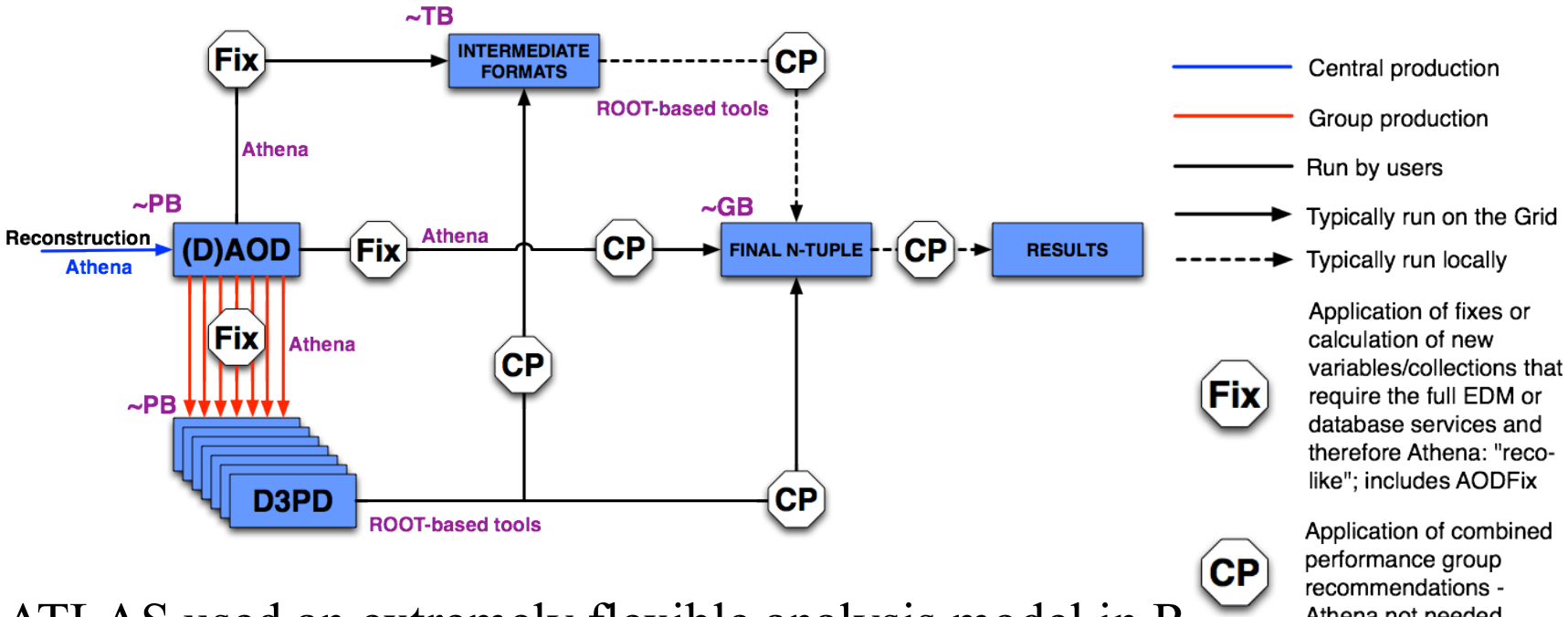
Few slides for /from Paul L.

Data Management
Where is HEP in Big Data Terms?



http://www.wired.com/magazine/2013/04/bigdata/

ATLAS Run 1 Analysis model

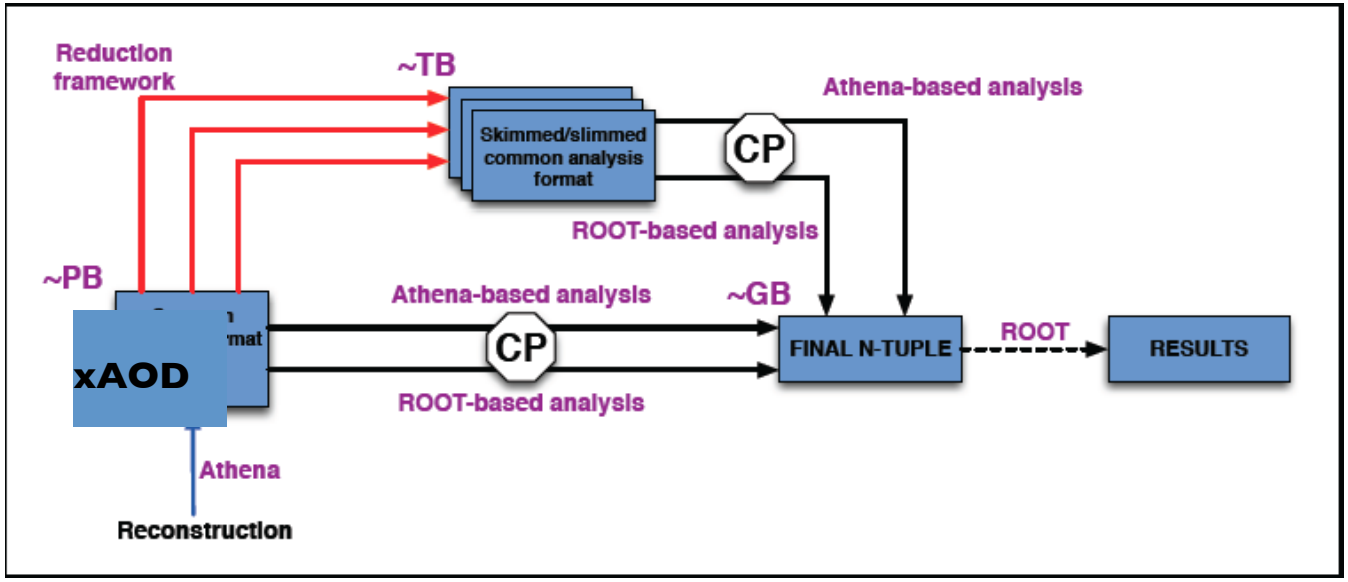


- ATLAS used an extremely flexible analysis model in Run 1
  - Each group produced its own customised ntuple, eventually managed centrally (PL)
  - The software incorporated all of the latest/best knowledge
  - Groups were free to dictate their own schedules, nearly 300 publications
- The cost was eventually too much though, the total CPU usage was the same as for full event reconstruction from RAW data and the outputs occupied the same space as AOD
- ntuple production took months to run, and we'd soon run out of space to store the output

Meet Godzilla

- The ntuple production team (PL) initiated a project to merge all of the ntuples into one
- Nicknamed Godzilla because it even scares the ROOT experts
  - The Common ntuple is an improvement by a factor of 3 in computing resources, which does actually fit in our Computing budget (also for Run 2)
- This Common ntuple is the legacy format for Run 1, but it has also taught us a lot about how we can more forward for Run 2
- Meanwhile a Study Group worked out the key elements for a better analysis model and a new group - the Analysis Software Group (ASG) - was created, convened by PL

ATLAS Computing



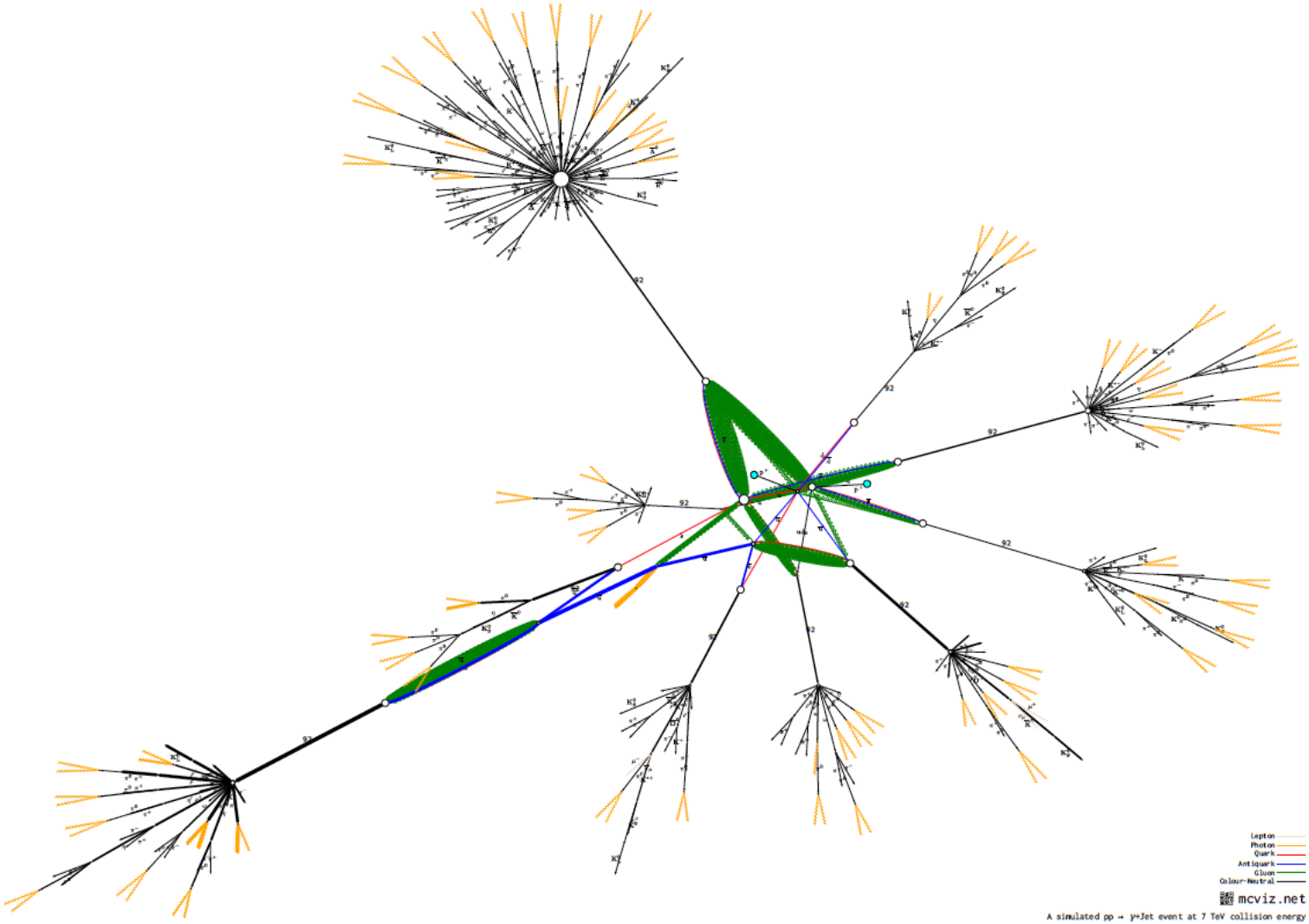
- The complete overhaul is being performed by a series of Task Forces under ASG
- Some of the key features :
  - It will be possible to directly analyse the output of Tier-0, the AOD, using ROOT
  - A new Reduction framework will take care of the PB → TB Grid processing step to do the heavy-lifting as efficiently as possible, using a train model
  - The trains allow multiple outputs per input job, several for each group
  - Common analysis tools will be packaged up into an Analysis release
- The new model will be stress-tested in a Data Challenge in 2014, in the meantime we're working with Godzilla and trying to introduce him to trains...

Godzilla meets trains

- I'm sure everything will be fine eventually...

Regards from Paul @ HEP in Chile

Merry Christmas and a Healthy 2014



Thanks to all of HEP Liverpool, from ground to higher floors for support and understanding.

ATLAS and its support