ATLAS Status Report

114 LHCC Open Session 12/6/2013

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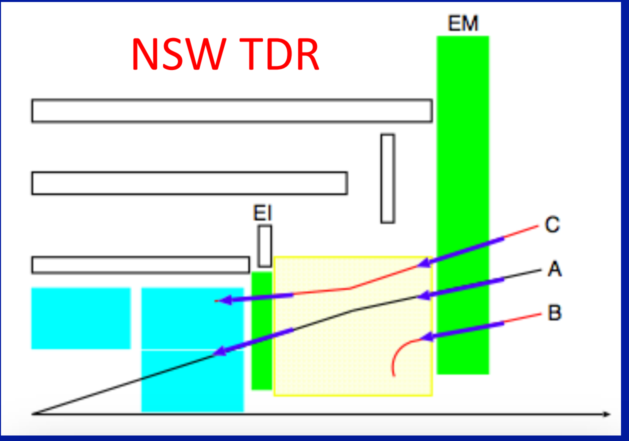
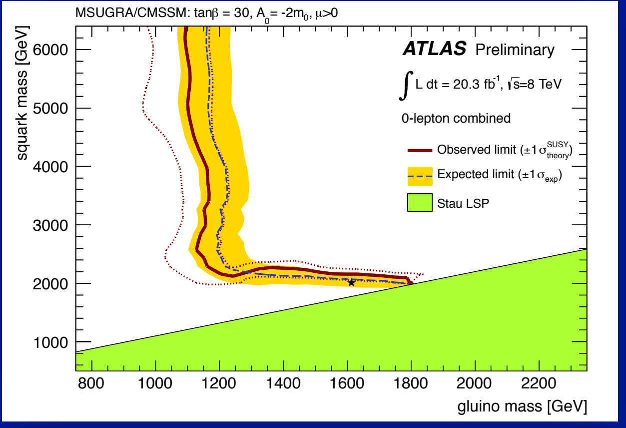
Outline

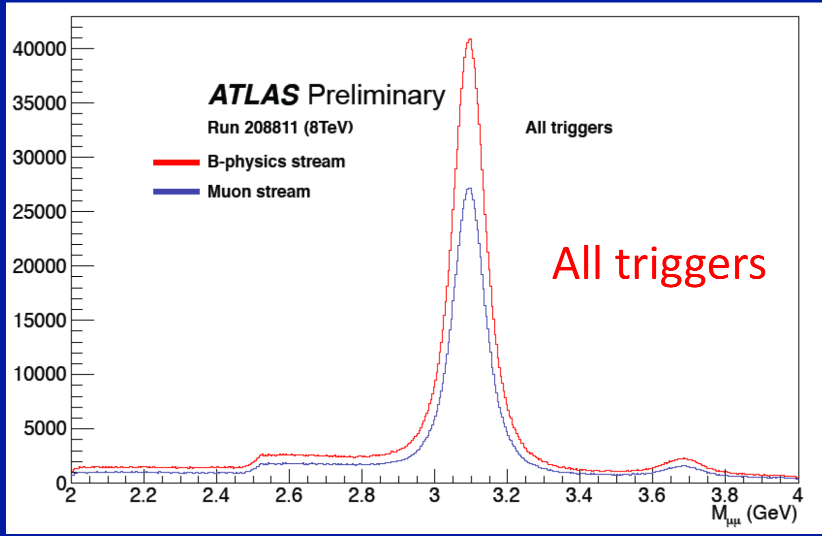
- Computing
- LS1 status
  - Focus on : Pixel, IBL, Muon system
- Upgrade TDRs
  - NSW TDR
  - FTK TDR
- News from Physics



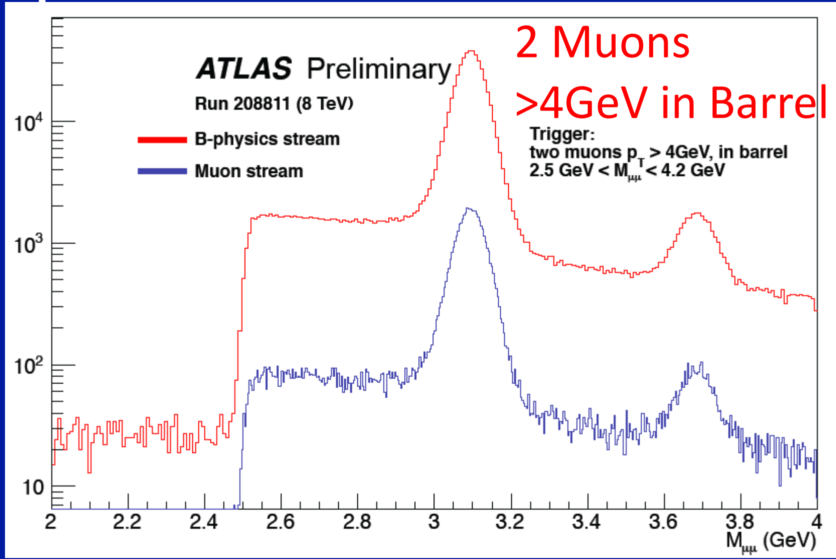


Computing

- Reprocessing Campaigns:
  - B Physics delayed stream
  - Hadron delayed stream
    - Larger phase space and statistics with lower threshold triggers
  - 2.76 TeV pp 2011 data:
    - Successful use of the new Russian Tier 1
  - All reprocessing campaigns finished !



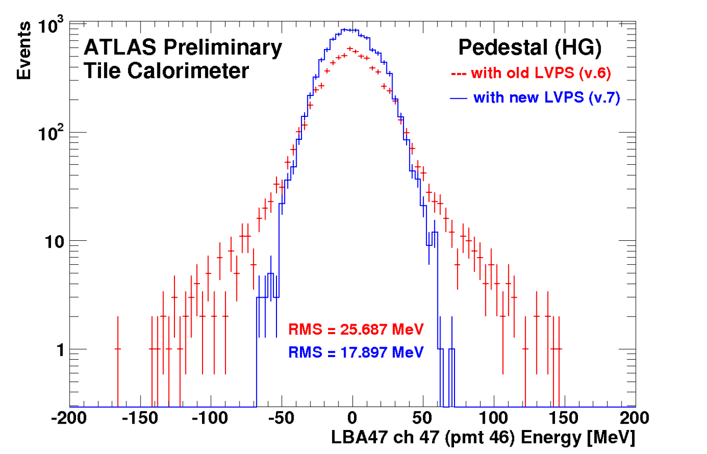
B physics yield increased by ≈1.7



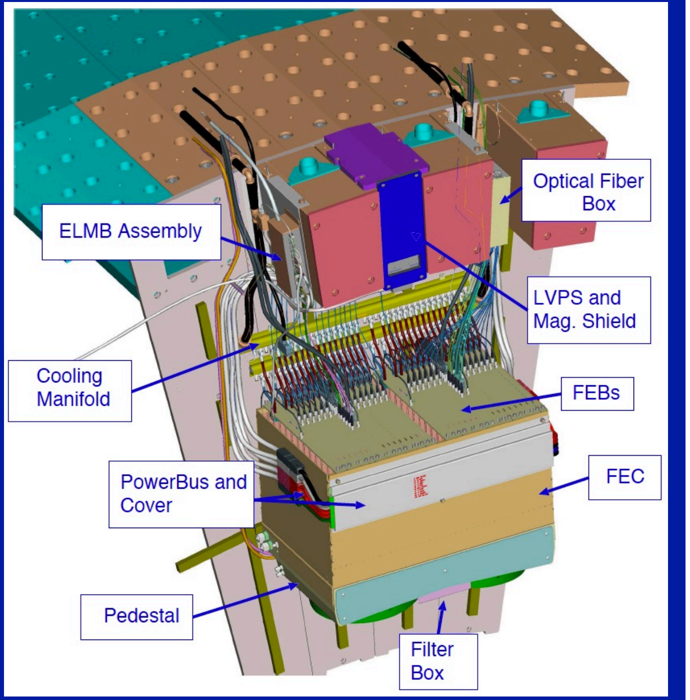
Specific analyses (eg J/Psi polarization) yield increased by up to 10

LS1 Status: Calorimeters

- **Refurbishment of Tile Calorimeter:**
  - Finish new LV power supplies assembly and Installation 45% done
    - Reduce LV trips + better noise
  - Front end electronics drawers consolidation 18% done
  - Install in each Ext. barrel missing crack scintillators (8 out of 64)

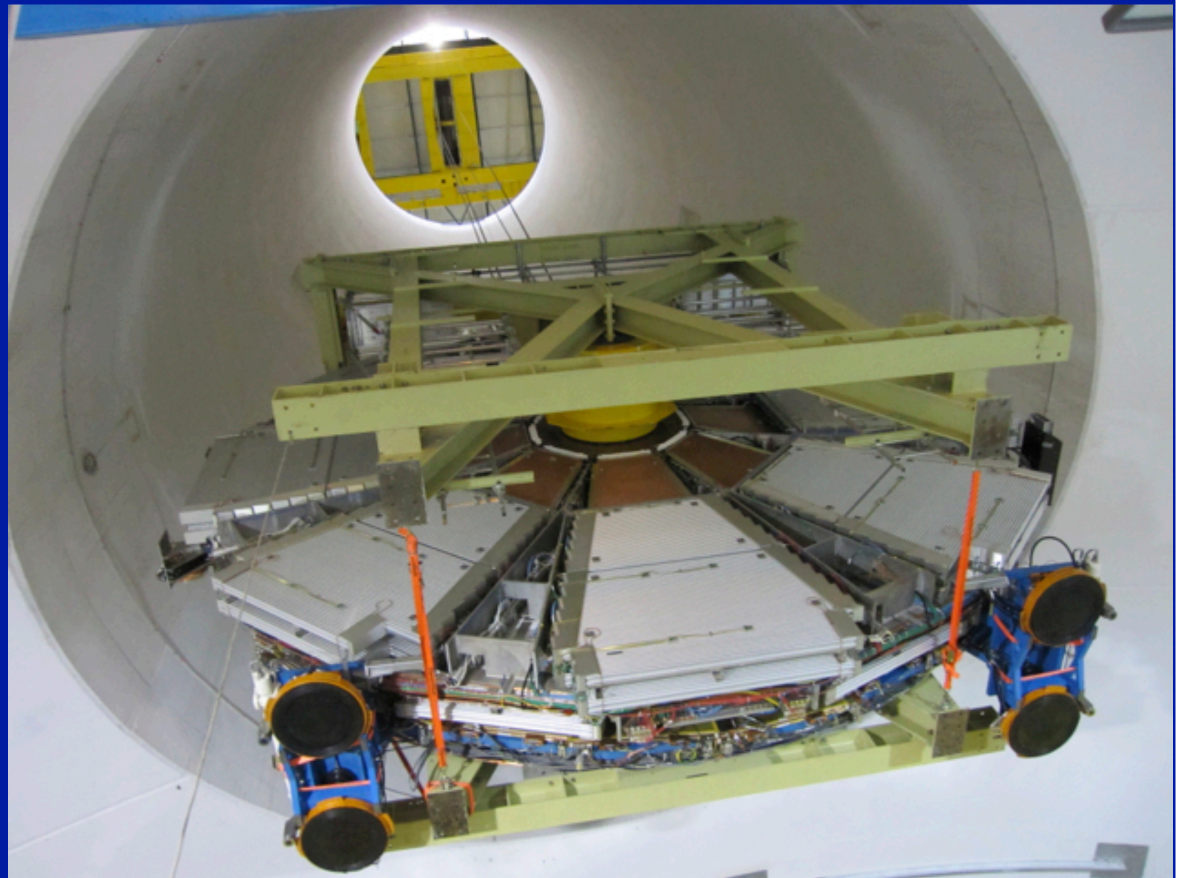


- **Refurbishment of the Lar Calorimeter:**
  - Installation of new low voltage power supplies (LVPS)
    - 44 LVPS out of 58 have been replaced already and are operating since then.
  - Extraction and repair of 10-20 front end boards (FEBs). Total of 1524 FEBs.



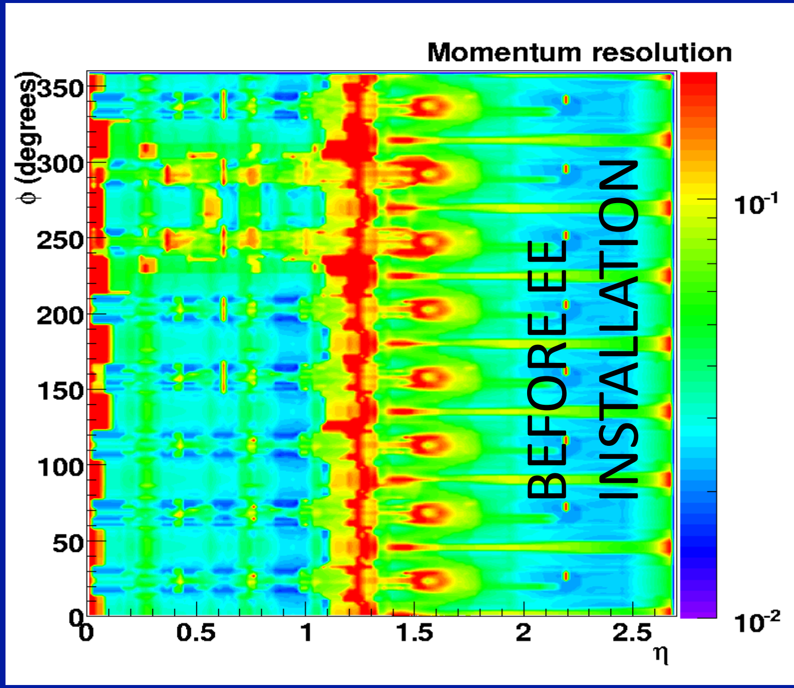
LS1: Muon Spectrometer

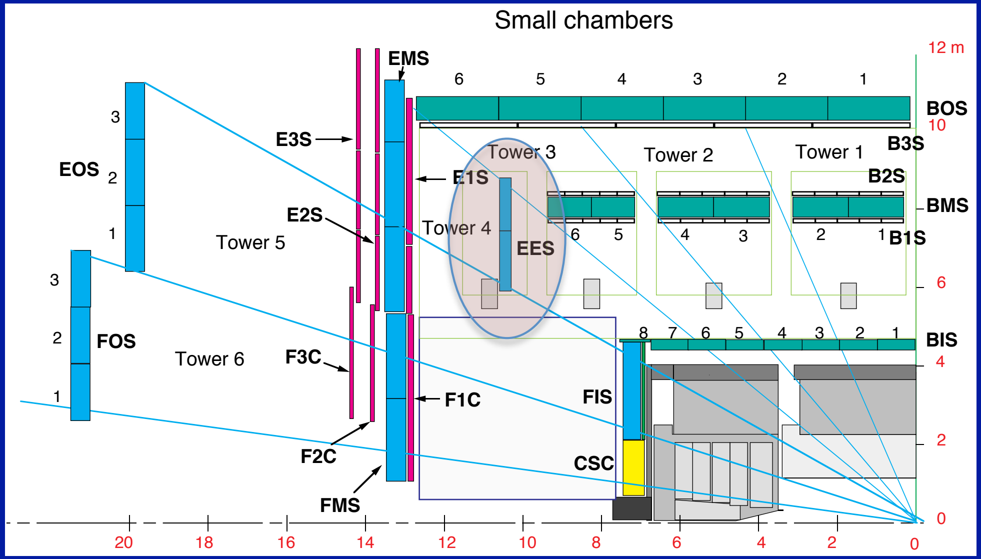
- Removal of the Small Wheel Side C to allow the pixel and the IBL insertion.
- Delicate operation due to the very crowded environment in UX15
- Successfully completed on 19-3-2013



LS1: Muon Spectrometer

- Completion of the Muon Spectrometer as described in the original Muon TDR:
  - Installation and commissioning of the EE chambers in side A





Improvement of momentum resolution in the region $1<|\eta|<1.3$

Improve acceptance for high Pt analyses

LS1: Muon Spectrometer

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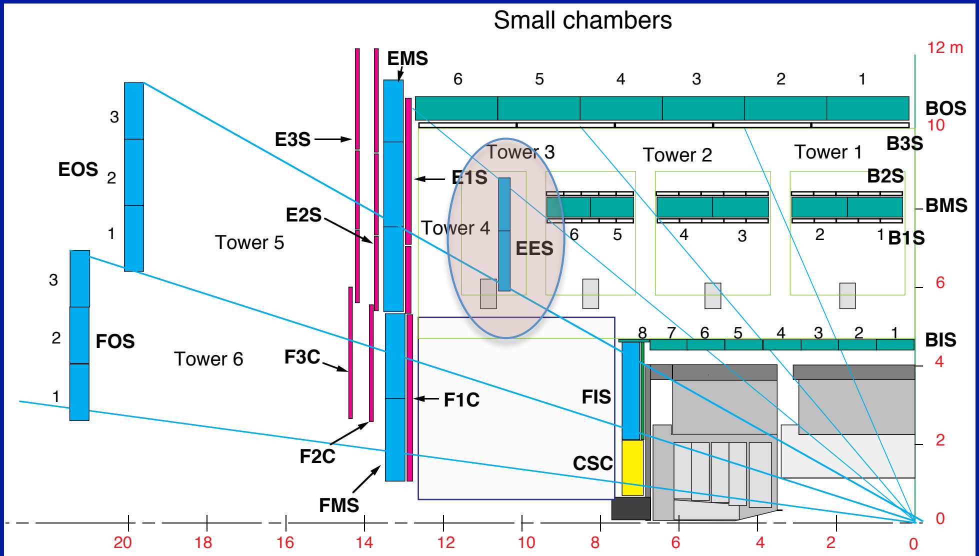
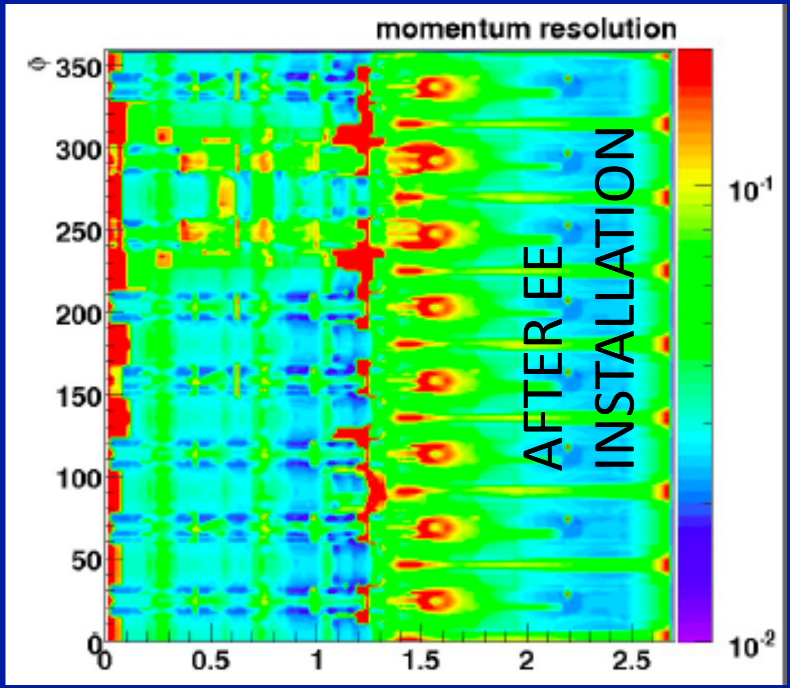




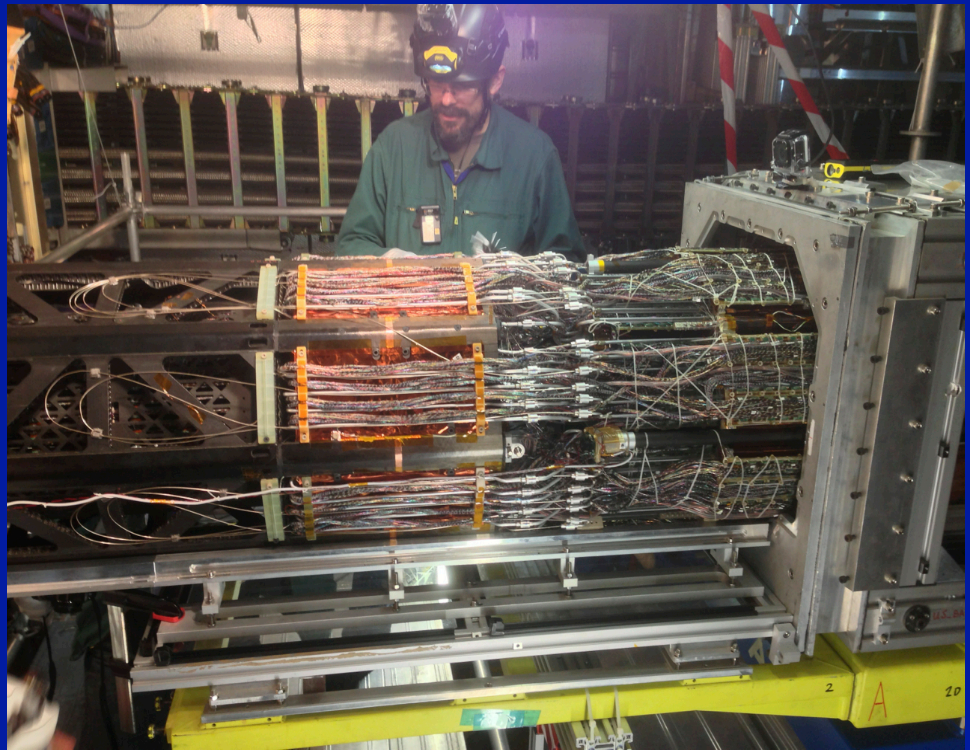
Improvement of momentum resolution in the region $1<|\eta|<1.3$

Improve acceptance for high Pt analyses

Pixel

- The Pixel Detector extracted on 9th of April now in clean room

- New Service Quarter Panels (nSQP) will replace current Pixel services (SQP):
  - move new opto-boards outside the Pixel detector volume for maintainability



Pixel

- All SQPs are now dismounted with no damages
- Beam pipe removed, now preparing for installation of IBL support tube (IST)

- Mid July start re-integration of detector
  - Connectivity test with nSQP being mounted to Pixel + functional checks (up to early November)

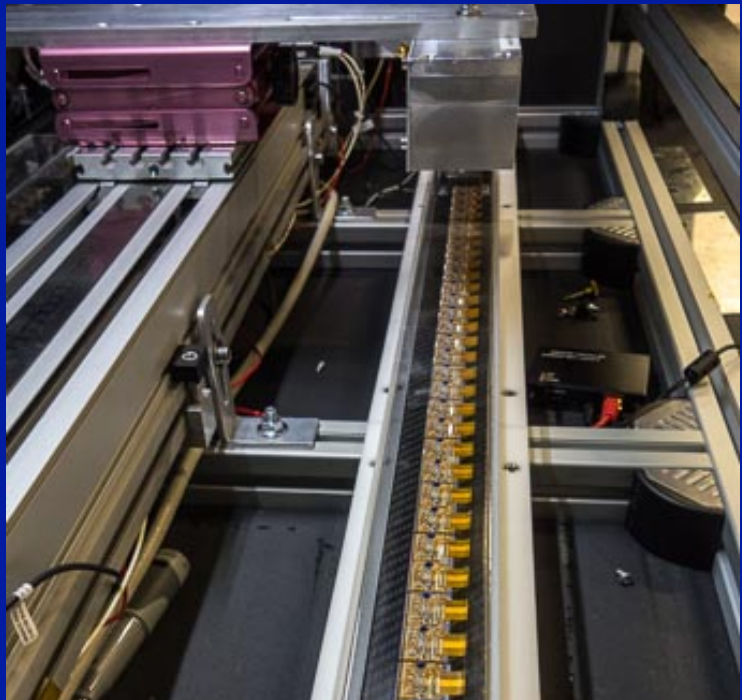
- Aim at reinstallation of Pixel in January 2014

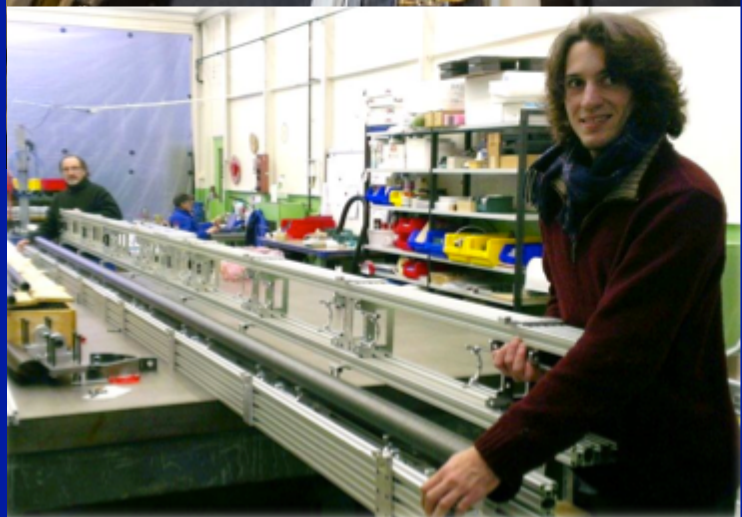
Pixel in clean room in SR1

- Fraction of non operational modules at the end of 2012 run: 5%
- Expect <1.5% of non operational modules for the data taking restart

IBL

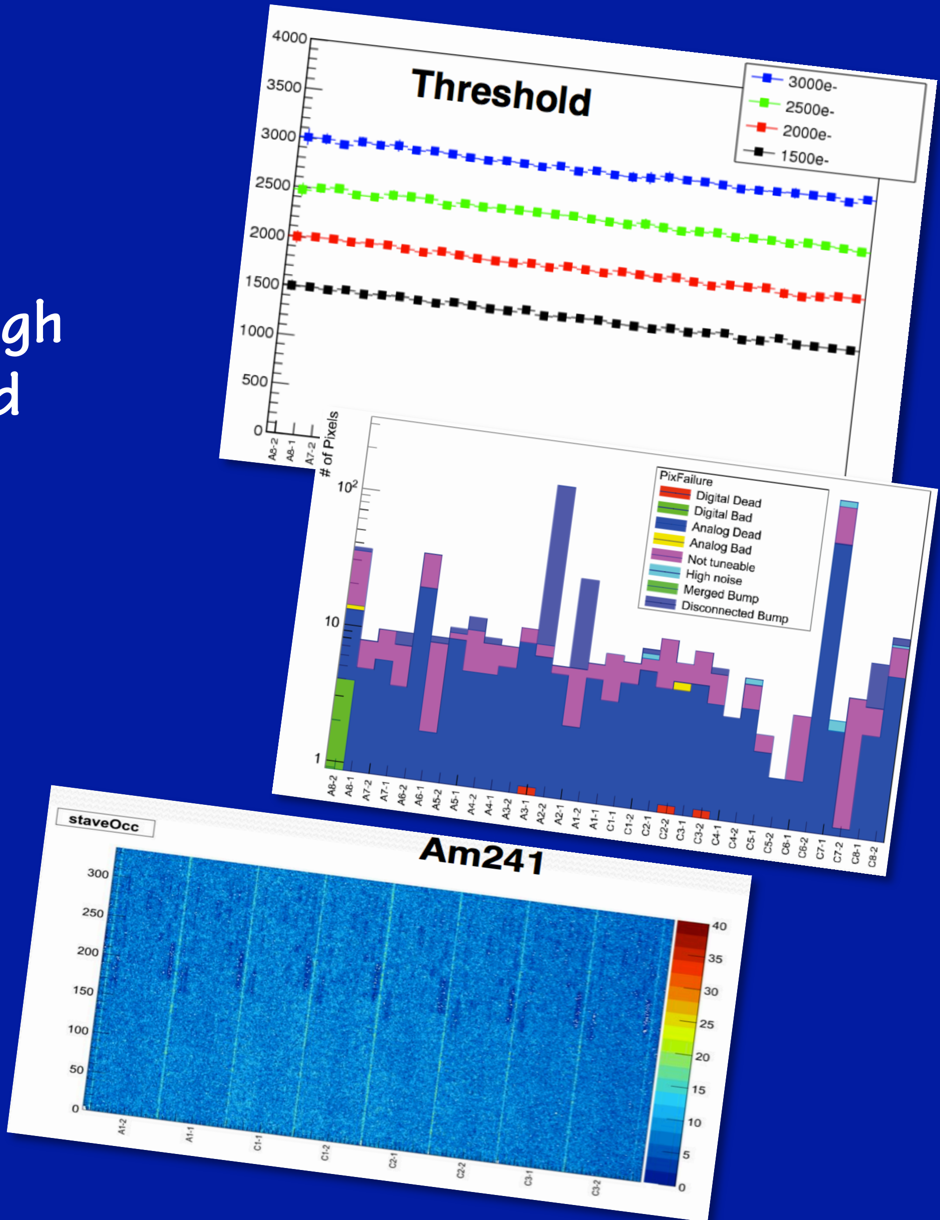
- IBL Module and Staves
  - Module production now in full swing , expect to finish in September
  - Stave loading with modules has started with first 3 staves
  - First tests on production stave in SR1 show good results
- IBL integration
  - Expect to start integration during August
    - Tooling prepared
    - Work now on final assembly of support structures

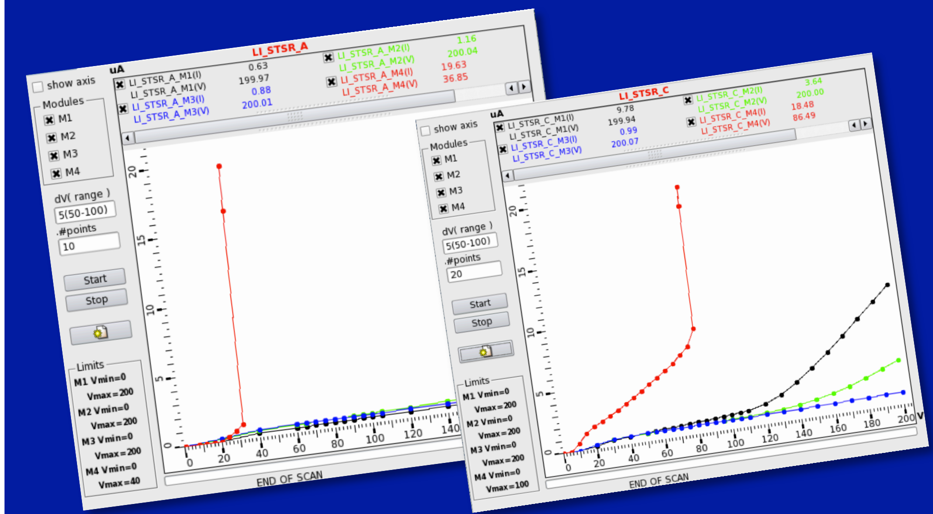




IBL: first stave tests

- Stave 1 already in SR1 in integration tests (first production-quality stave)
  - Stave 1 has passed through qualification → Looks good 99.815% of all pixels are operational ☺
  - Stave 2 and 3 very soon

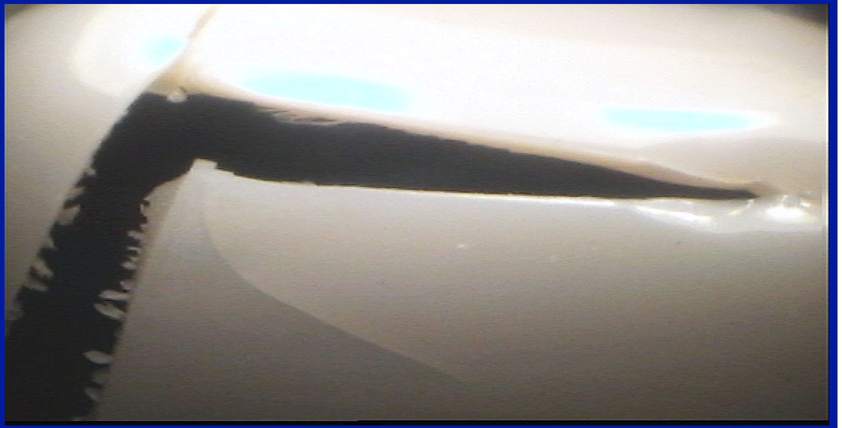




TRT leaks

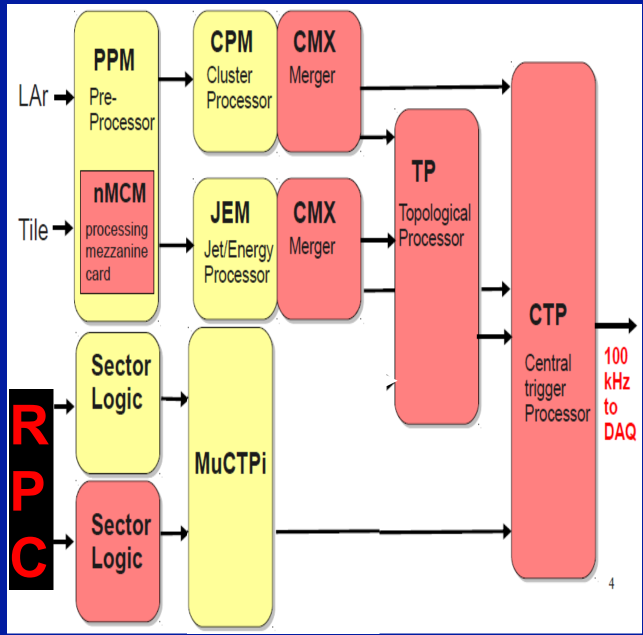
- Leaks developed in the active gas exit pipes during the 2012 run.
  - Gained better understanding on the mechanism producing the leaks
- Leak repair only possible on ECs but not all EC leaks accessible

Pictures from inside of the gas pipes taken with Endoscope showing crack.



TDAQ

- Preparations to run at 100 KHz LVL1 rate
  - New RODs for ID and Muon spectrometer, new firmware for improved data compression
- Level-1 highlights:
  - New calo tower digitiser module with features to combat high pileup (nMCM)
  - New topological processor allows more complex combinations (TP & CMX)
  - Additional coincidence in muon TGC sector logic
  - Increase inputs to Central Trigger Processor
  - Possible inclusion of Tile info in muon trigger
- Readout system and network evolution
  - Higher bandwidth and readout rates
  - New ROBinNP mezzanine card
- Dataflow and HLT design simplified
  - L2 and EF merged into single node
- HLT software performance optimisation
  - Increase use of advanced offline algorithms
  - Aiming for factor 3 speed up
- Developing new trigger menus for up to $2x10^{34}$ $cm^{-2}s^{-1}$

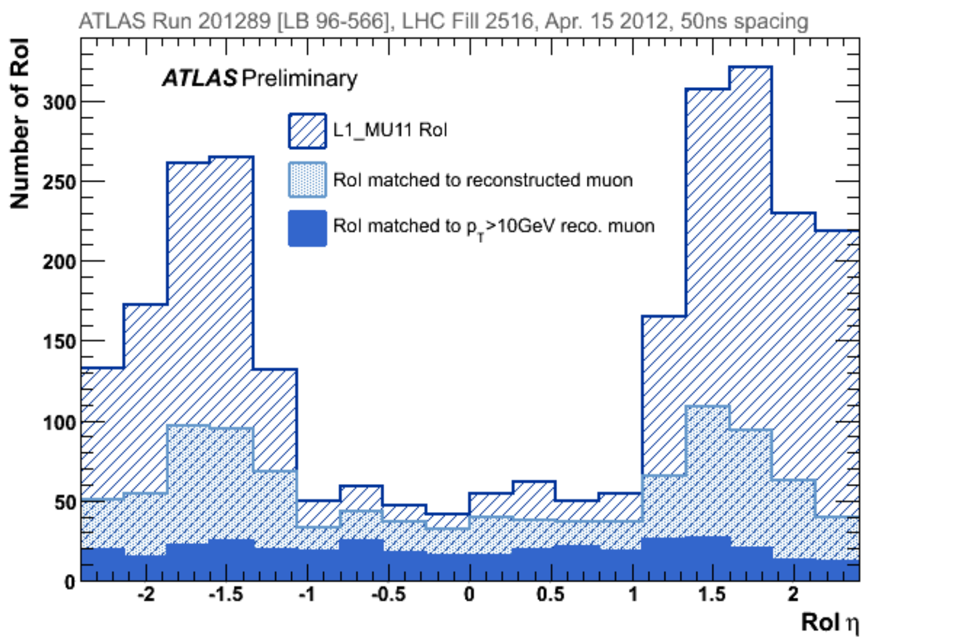


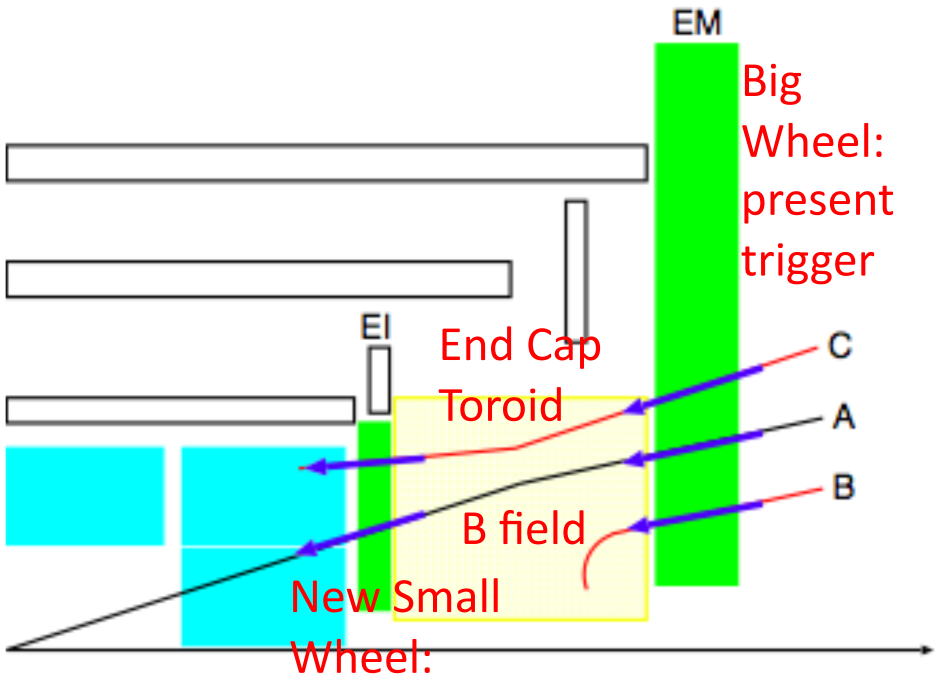
Infrastructures improvements

- A huge amount of work on Infrastructures:
  - Installation of new beam pipes
  - New evaporative cooling for ID
  - New neutron shielding for End Cap Toroid
  - Improvements of shielding for personnel
  - Consolidation of Cryogenics and Magnets
    - Independent operations of Toroid and Solenoid
  - Consolidation of cooling and ventilation infrastructure

Phase 1 Upgrades: NSW

- Advanced draft of New Small Wheel TDRs released to LHCC on 1st of June
- NSW will enable to:
  - reduce the LVL1 Muon trigger rate in the End Cap
    - Now dominated by fake triggers
  - maintain excellent tracking capabilities at very high background rate



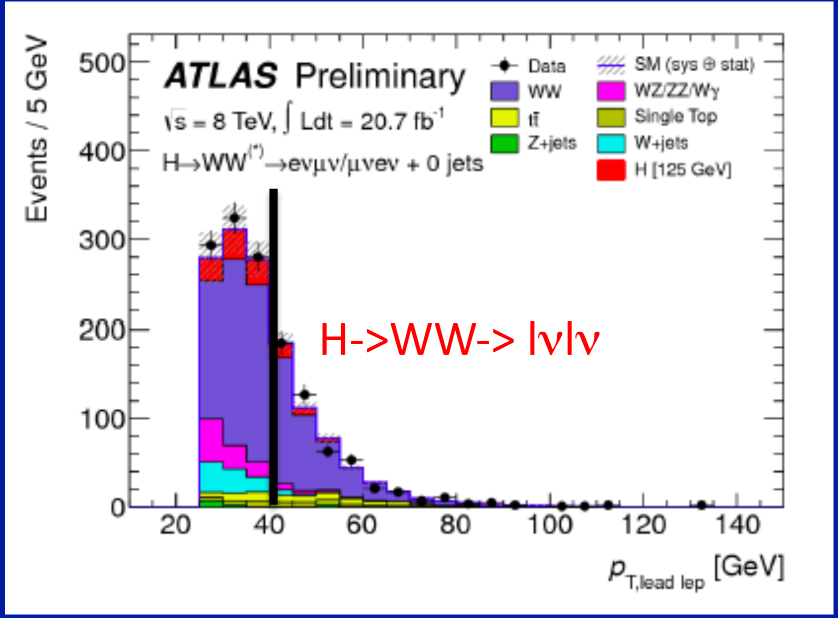


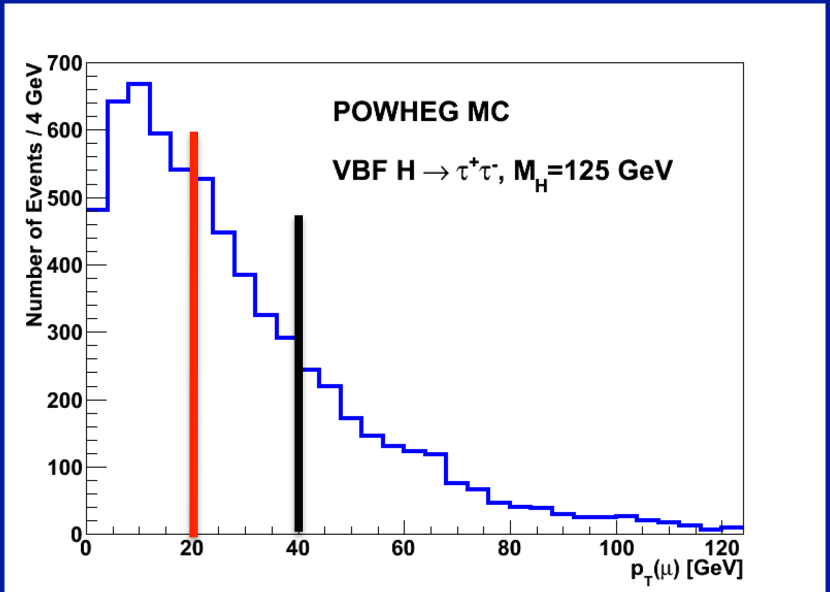
Phase 1 Upgrades: NSW Trigger

The Problem:
expected trigger rates at $3x10^{34}$

L1MU threshold (GeV)	Level-1 rate (kHz)
$p_T > 20$	60
$p_T > 40$	29
$p_T > 20$ barrel only	7
$p_T > 20$ with NSW	22

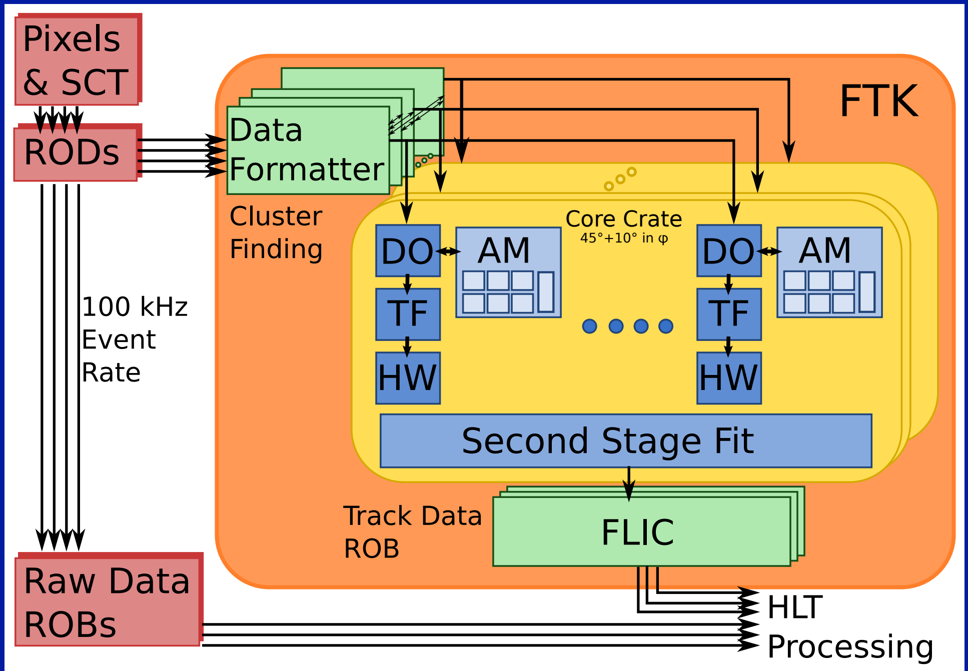
- Lepton spectrum from Higgs decays is rather soft
- Solution:
  - reduce fakes by asking a pointing segment in the NSW
    - Angular precision 1 mrad
    - Within 1 μsec from BC

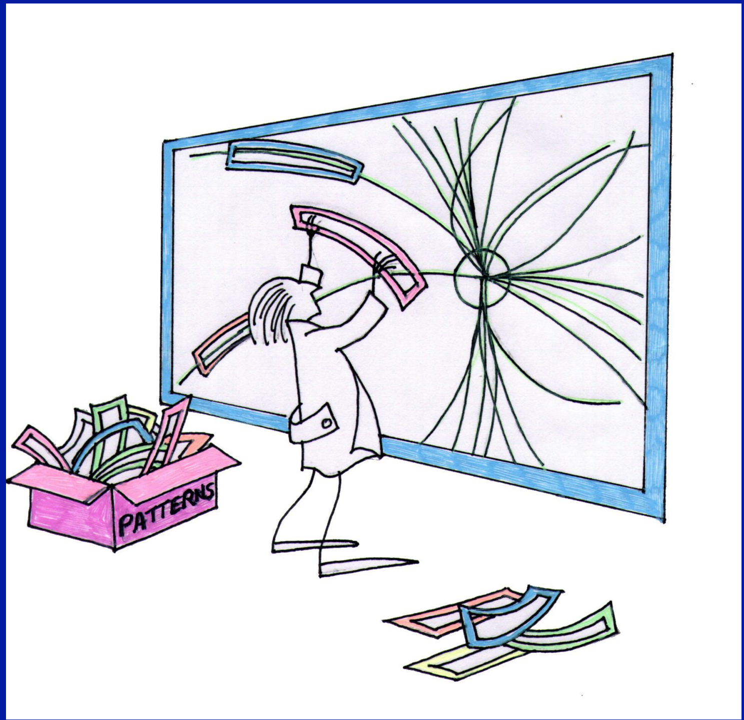




Phase 1 Upgrades: FTK

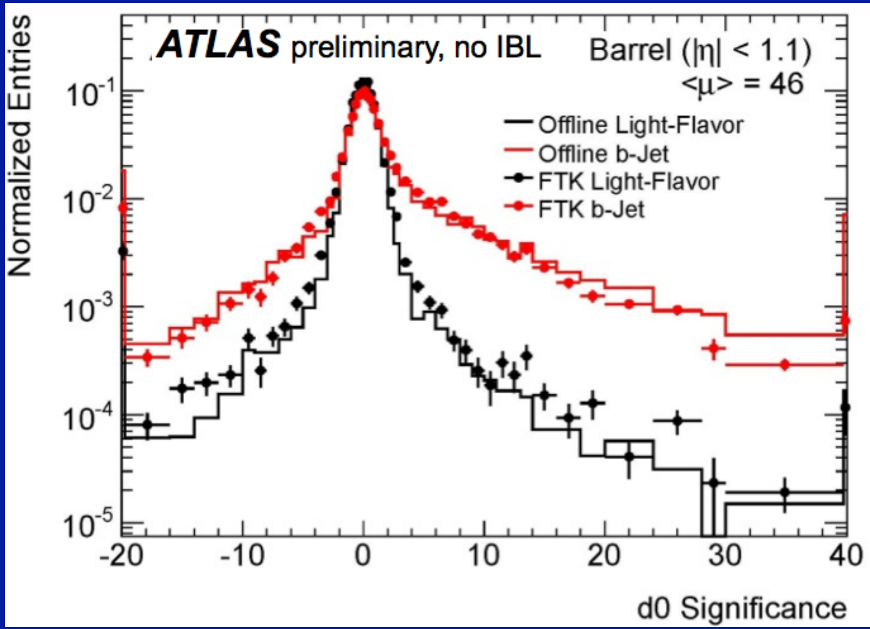
- Advanced draft of FTK TDRs released to LHCC on 1st of June
- FTK will enable to:
  - Tracking of entire event as input to HLT.
  - Highly parallel processing based on Associative Memories
  - Benefits in B tagging, Tau Tagging, Pile up suppression at higher level trigger.



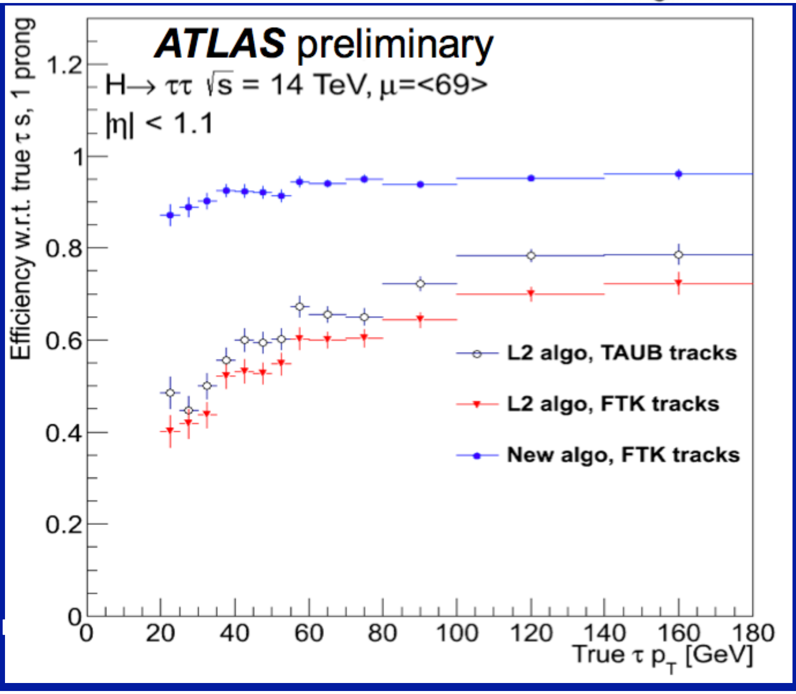


Phase 1 Upgrades: FTK performance

- Light Jet Rejection by d_0 significance
  - FTK gives performance similar to offine at the input of HLT

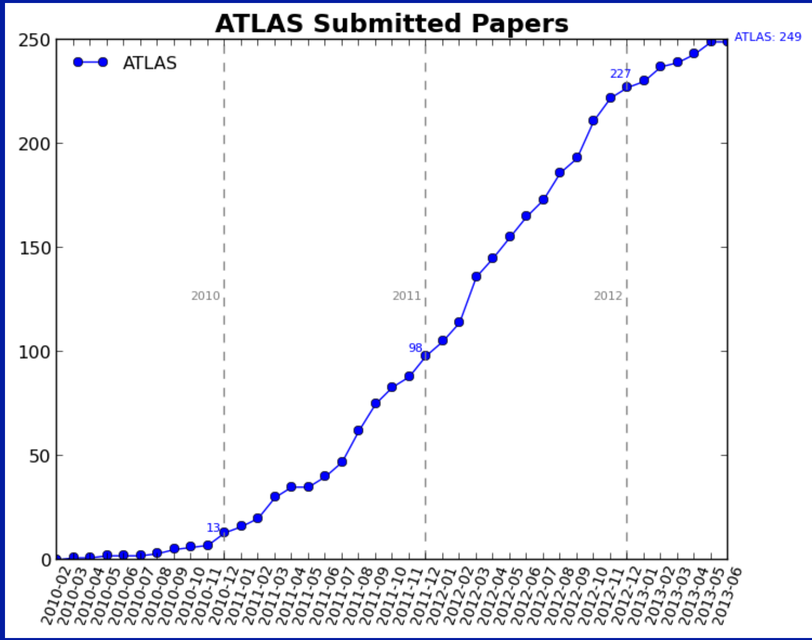


- Tau trigger efficiency improved by removing the need of calorimeter isolation in the LVL2 selection
  - More refined algorithms can be used at HLT

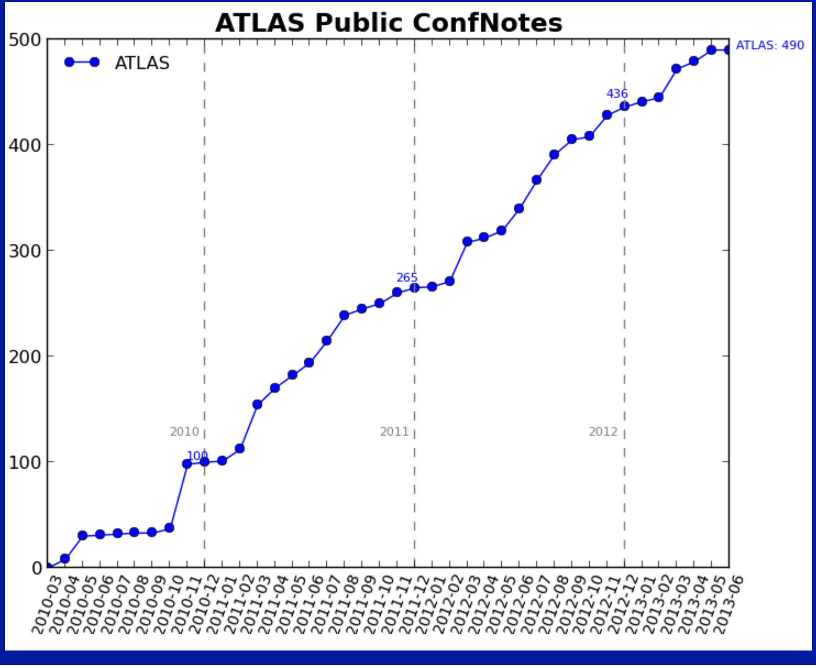


Physics Results

- **249 ATLAS submitted papers**
  +9 from last LHCC

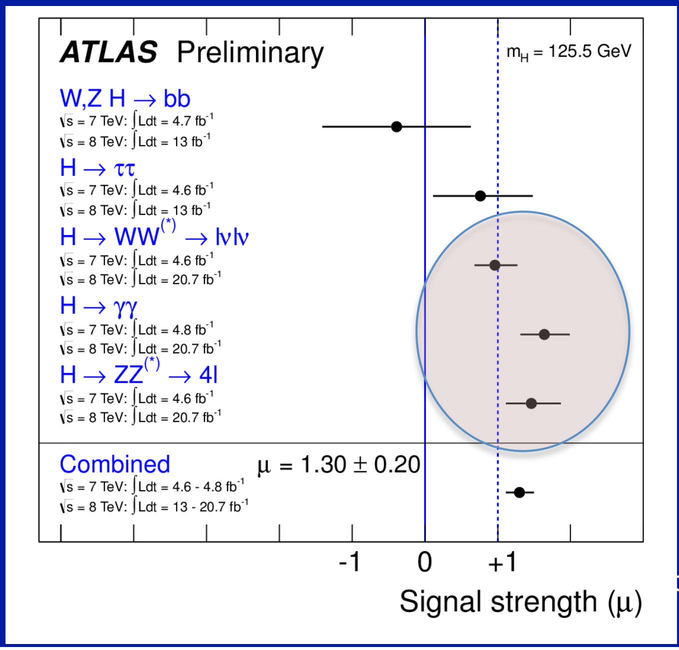


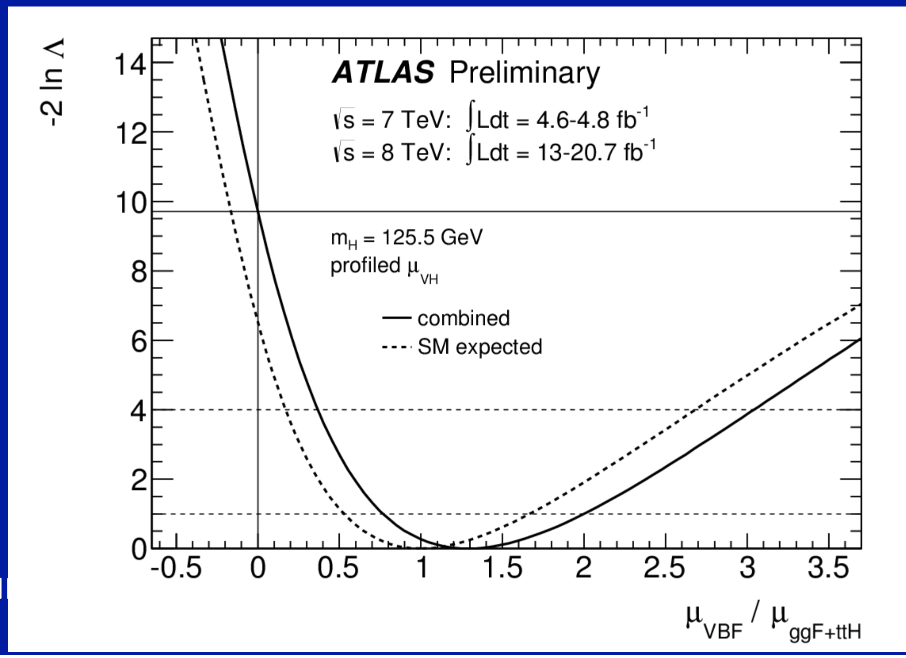
- **490 Conf notes**
  + 21 from last LHCC



Higgs: Update on Couplings

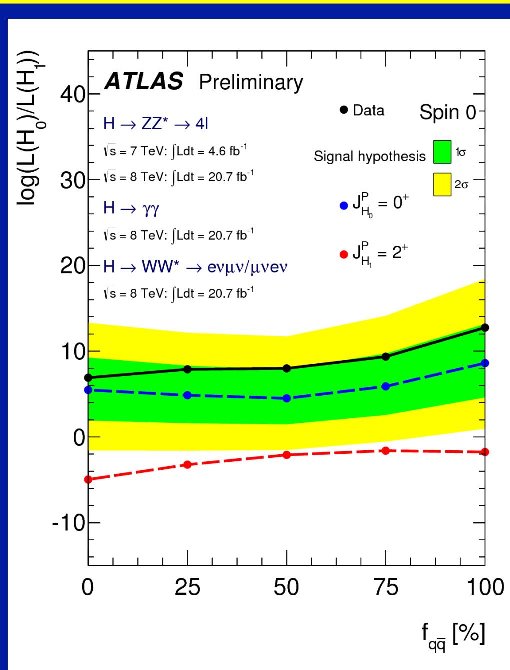
- New combined coupling determination including:
  - $H \to \gamma\gamma$, $H \to ZZ^*$ (4l), $H \to WW^* \to l\nu l\nu$ (Full 2011+2012 Data)
  - $H \to \tau\tau$, $H \to bb$ (Full 2011+13 fb^{-1} 2012 Data)
- Combined signal strength:
  - $\mu = 1.30 \pm 0.13(stat) \pm 0.14(syst)$ $(M_H = 125.5\ GeV)$
- 3 σ evidence for VBF Higgs production:
  - $\mu_{VBF}/\mu_{ggF+ttH} = 1.2^{+0.7}_{-0.5}$

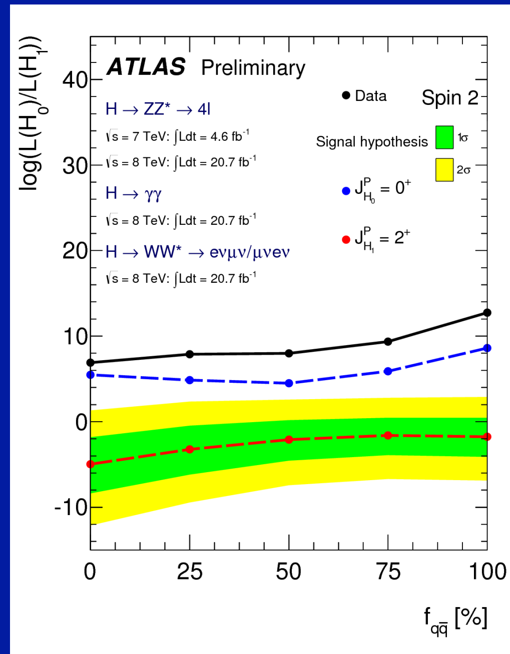


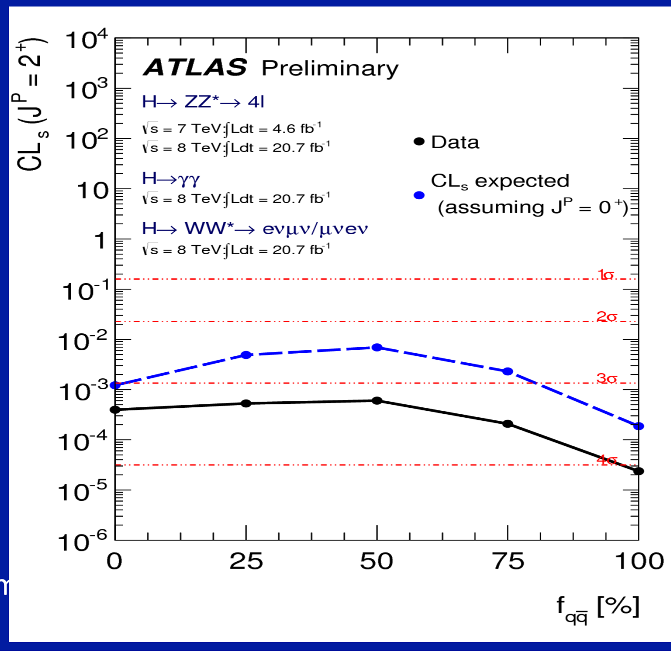


Higgs: Spin combination

- Study the Spin of the Higgs boson combining the H->γγ, H-> WW and H-> ZZ results.
- The Standard Model $J^p = 0^+$ is compared to a graviton-inspired $J^p=2^+$ model with minimal couplins to SM particles
- Data are in good agreement with the SM 0^+ assignment
- The $J^p=2^+$ Assignment is excluded at 99.9% CL.







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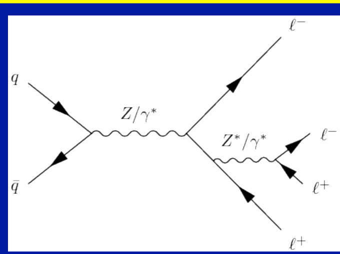
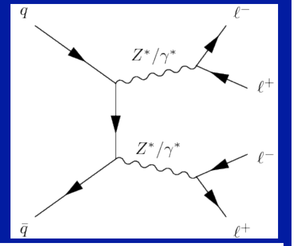
Standard Model: Z -> 4l

- Single resonant Z decays selected by a looser selection compared to H->ZZ* analysis





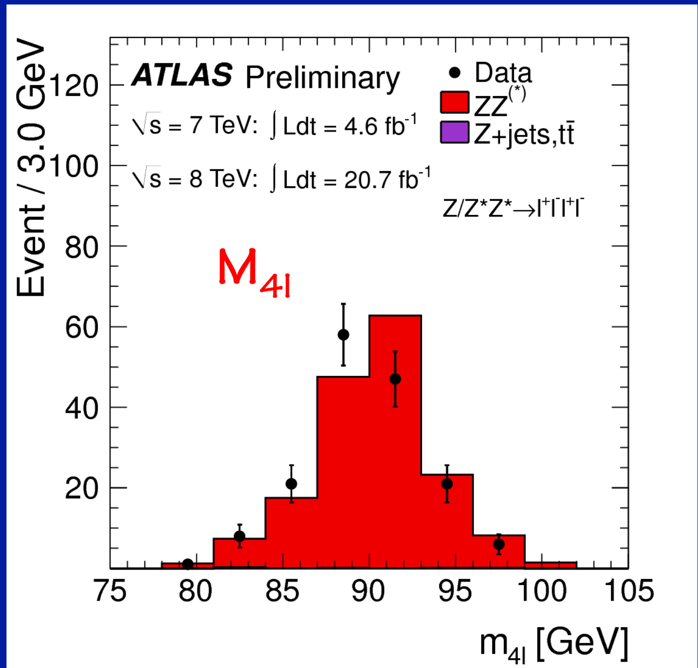
- Total Cross section in measurement phase space (M_{Z2}> 4 GeV, 76<M_{4l}<106)

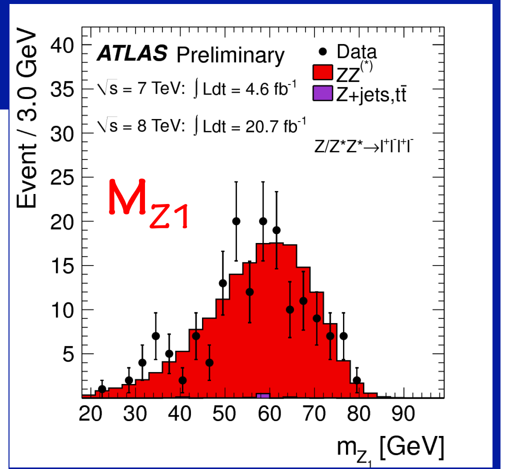
- 114±27±7±2 fb @ 7 TeV

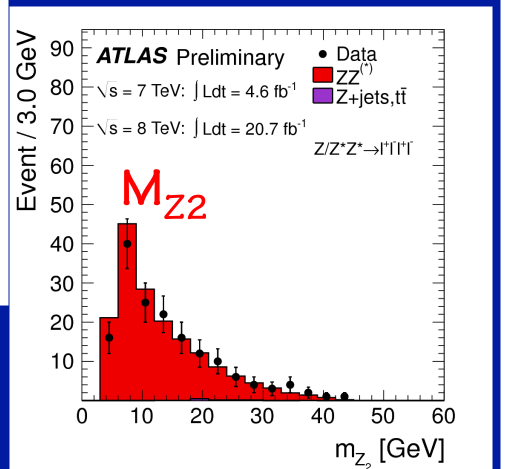
- 150±13±7± 5 fb @ 8 TeV

- Branching fraction = (4.2±0.4)x10^{-6}

- All consistent with SM expectations







ATLAS-CONF 2013-055

New Top Mass Measurement: l+jets

- New Top Mass measurement using a 3D template fit
  - Fitted Distributions:
    - M_{top}^{reco}, M_{w}^{reco} and Rl_{b}
  - Reduces systematics by 40%
    - Main improvement on the relative scale Bjet-Light Jets
- M_{top}=172.31±0.75(stat +JSF+bJSF) ±1.35 (Syst) GeV

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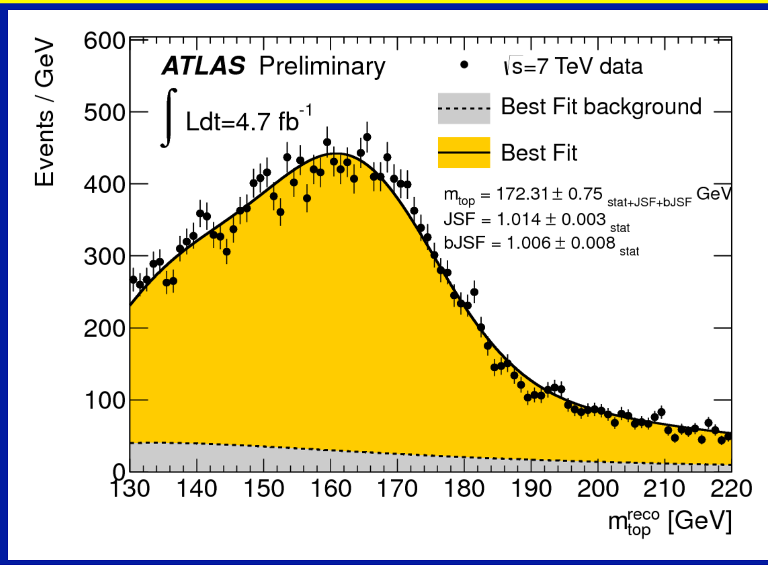
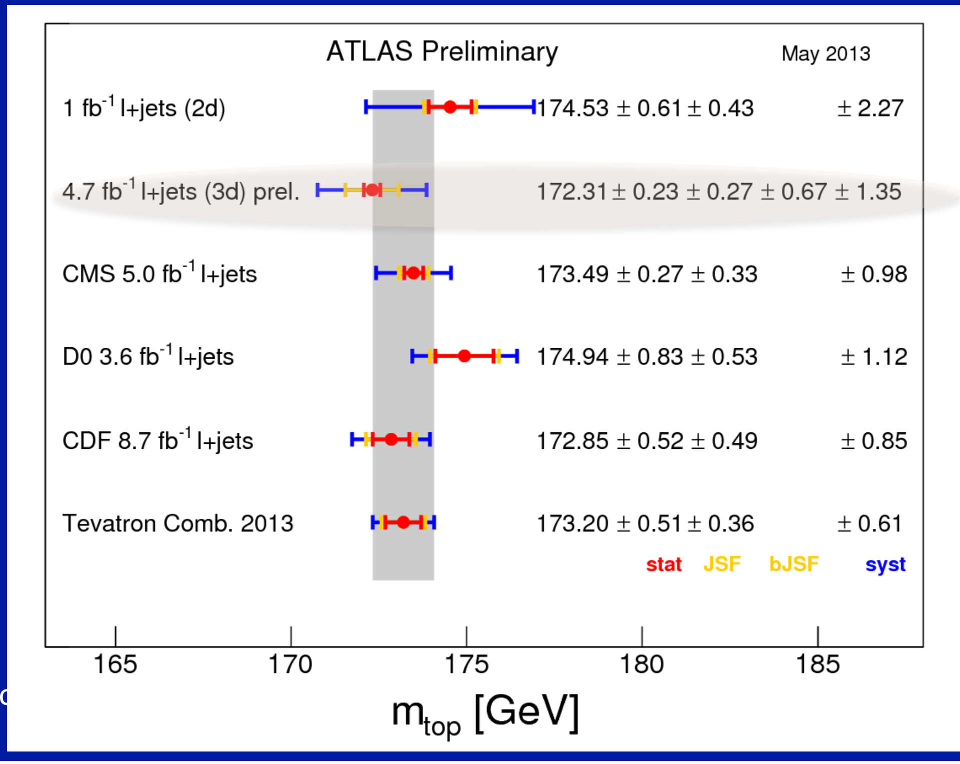
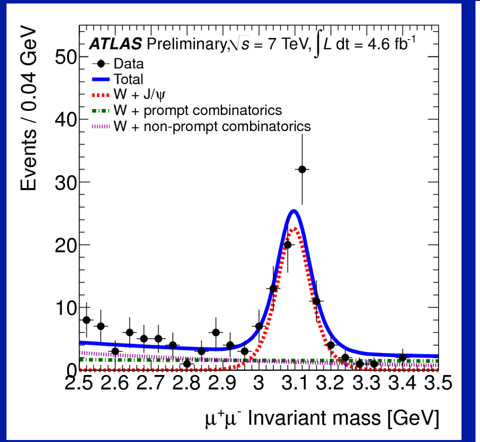
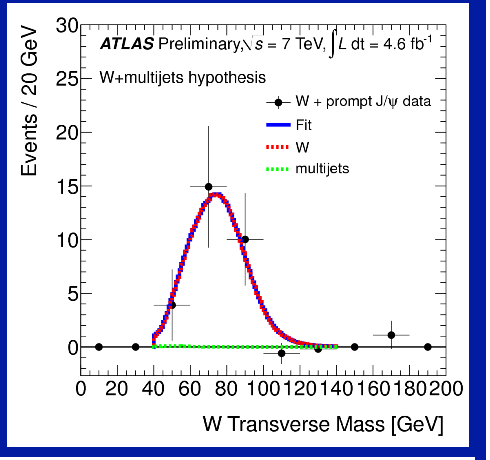


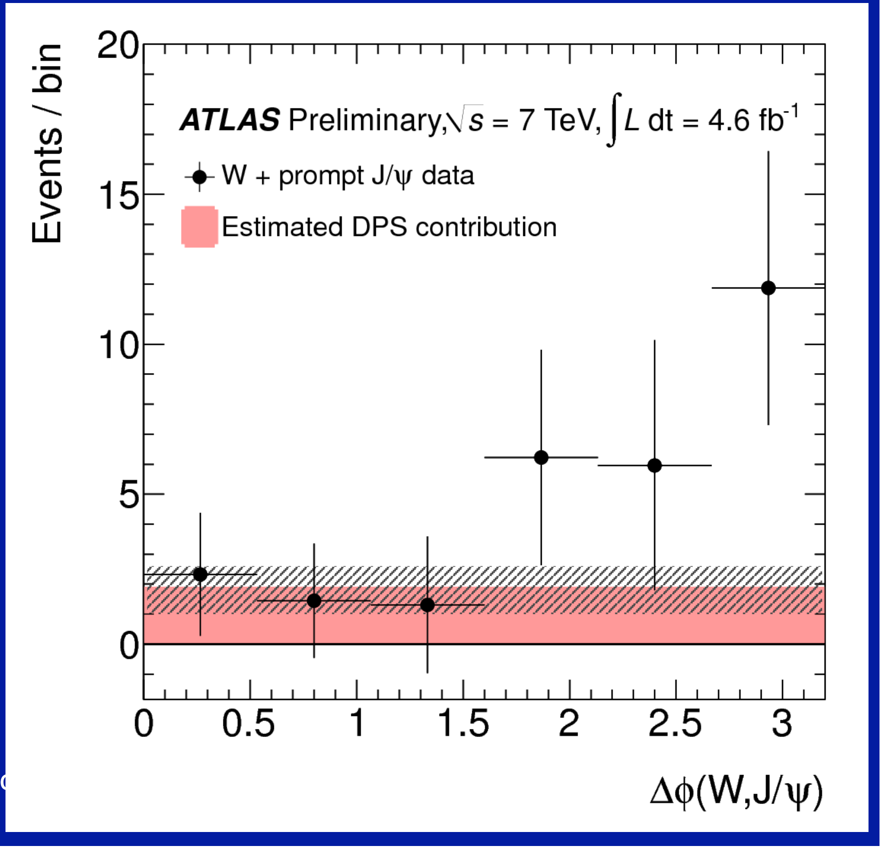


B Physics: W+ J/psi

- First observation of W+ prompt J/psi production in pp collisions in events with 3 μ and MET
- Prompt and non prompt W+J/PSI yields obtained via a 2D fit on the J/PSI mass and pseudo proper time
  - Observed W+prompt J/PSI
    - $29.2^{+7.5}_{-6.5}$ Events
  - Double Parton Scattering contribution:
    - 10.8 ±4.2 Events
- Statistical significance: 5.3 σ







New highlights from SUSY

- 25 papers at 7 TeV with full 2011 statistics finalized
- 13 preliminary 8 TeV results on part of 2012 dataset (HCP dataset)
- So far : 13 preliminary 8 TeV results on complete 2012 dataset (20 fb^{-1})
- No discovery yet……

New Mass limits from inclusive Squark and Gluino searches in Jets (2-10) + MET Signatures

Approximate limits from this model (95% CL):

$$m(\tilde{q}) > 2.0 TeV \forall m(\tilde{g})$$

$$m(\tilde{g}) > 1.0 TeV \forall m(\tilde{q})$$

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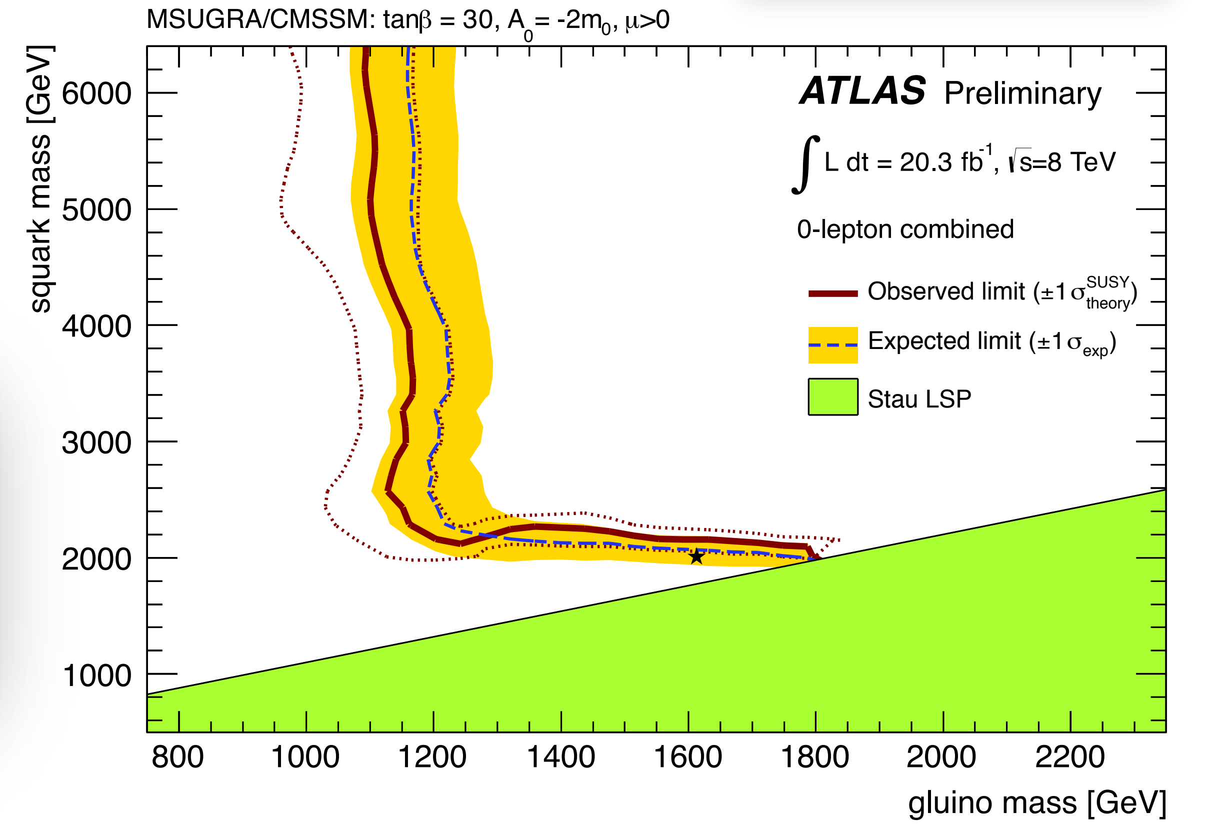
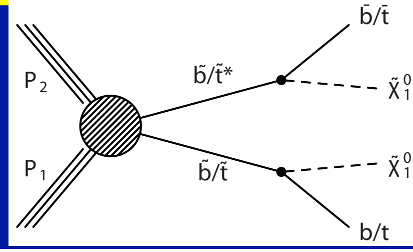
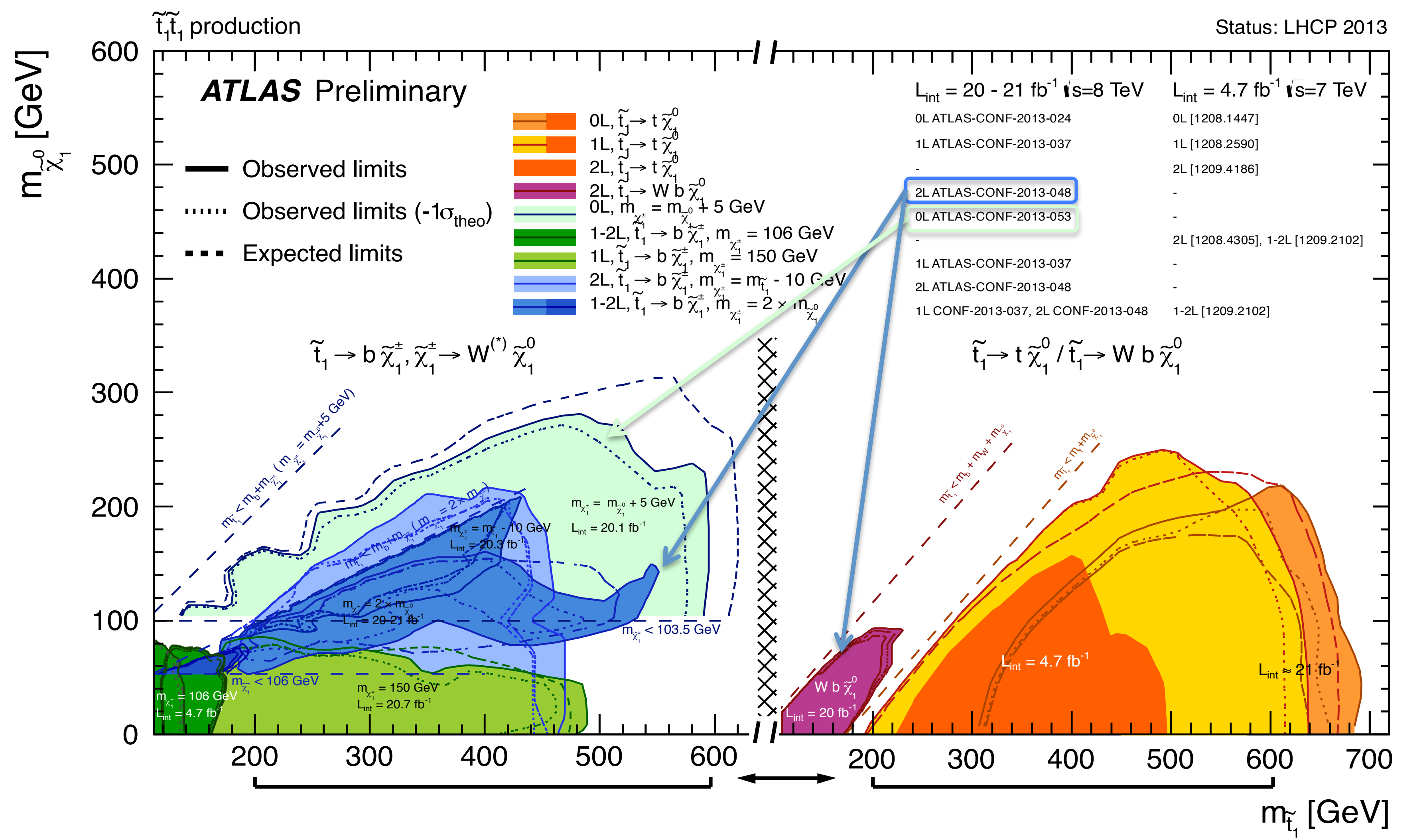


Search for "Natural" SUSY scenarios: Direct stop pair production

- New results with signatures involving 1-2 Leptons and MET and 2bJets+MET





ATLAS-CONF 2013-048 ATLAS-CONF 2013-053

Conclusions

- The LS1 works are going on in full steam and according to schedule (sometimes also ahead of schedule)
- The Upgrade TDRs for FTK and NSW (Advanced drafts) have been delivered to the LHCC
  - LAr and TDAQ TDR will be delivered for the next LHCC meeting
- ATLAS scientific production is ongoing:
  - Many interesting new results from all areas.

Back Up

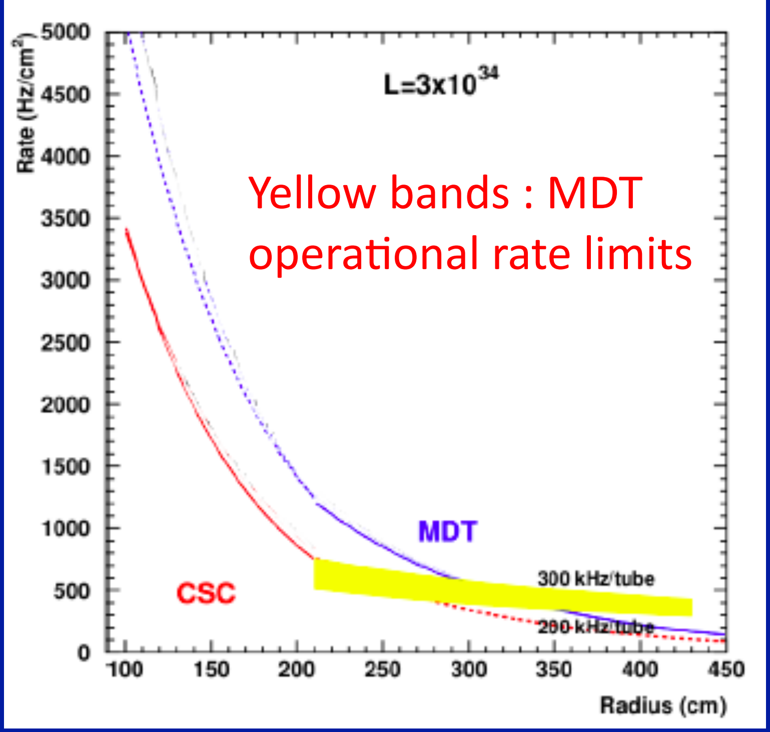
Preparation for 100 KHz Lvl1 Accept rate

- Inner detector
  - SCT with expanded DAQ (40% more RODs) ok to μ~87
    - FE limit also μ~87 at 100kHz
  - TRT preparing firmware for improved data compression
    - 27bit to 23bit readout extends max rate from 89 to 105kHz
  - PIX installing new SQPs and new RODs to overcome bandwidth limitations
    - Using RODs developed for IBL
- Liquid argon
  - Ready to run in 4-sample read-out mode with 100kHz L1-accept rate and 0% busy (demonstrated in tests in September 2012)
- Tile
  - Ready to run at 100 KHz
- Muon spectrometer
  - New CSC ROD under development based on ATCA technology
  - Doubling of MDT RODs for the inner MDT chambers of the Small wheel

Upgrades: NSW Tracking

The Problem:

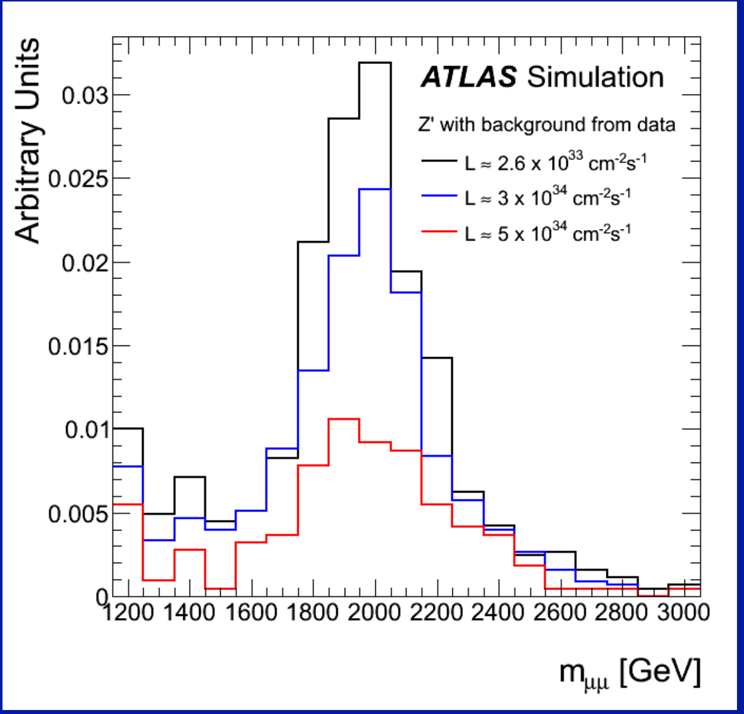
expected hit rates at 3x10^{34}



- MDT Hit efficiency much reduced in EI at high luminosity
- Track Segment required in the EI station to measure momentum

The Effect:

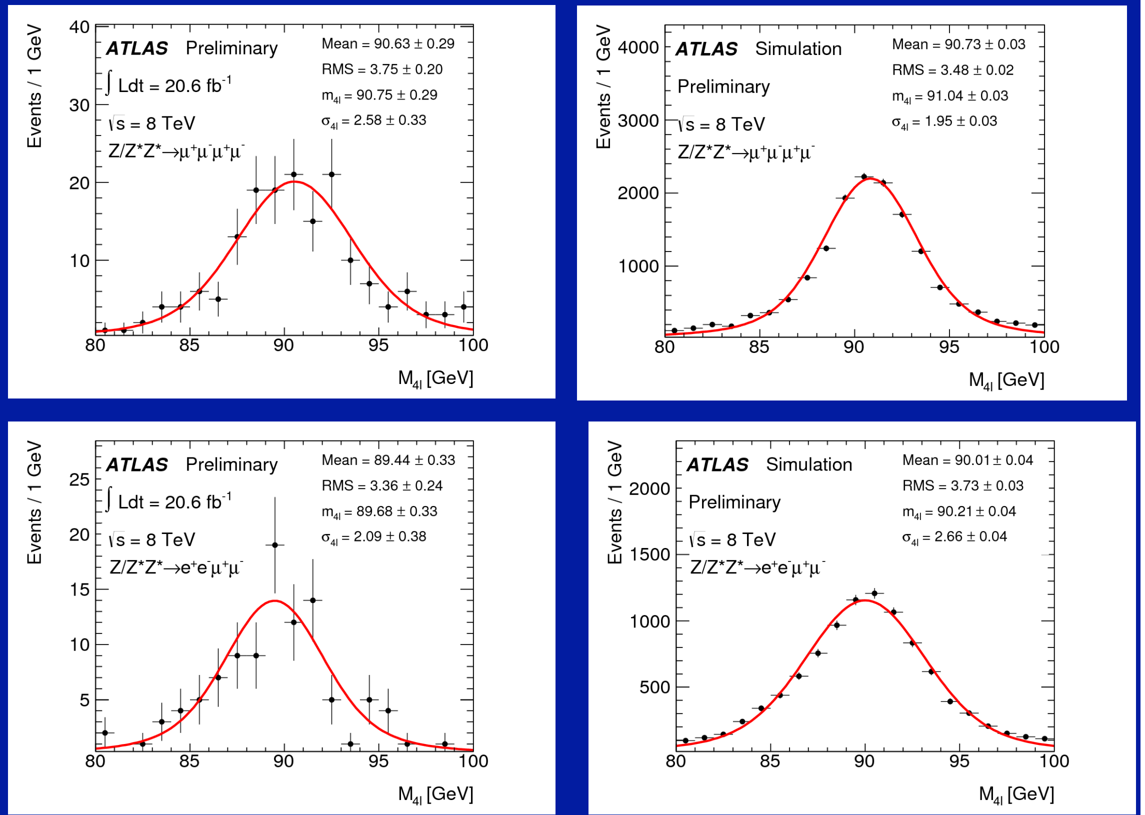
Simulated Z' (2TeV) at luminosities of 0.2, 3, 5x10^{34} - 2 muons in End Cap



- The Solution :
- high precision high granularity detectors for efficient tracking and triggering at high luminosity: Micromegas and sTGC

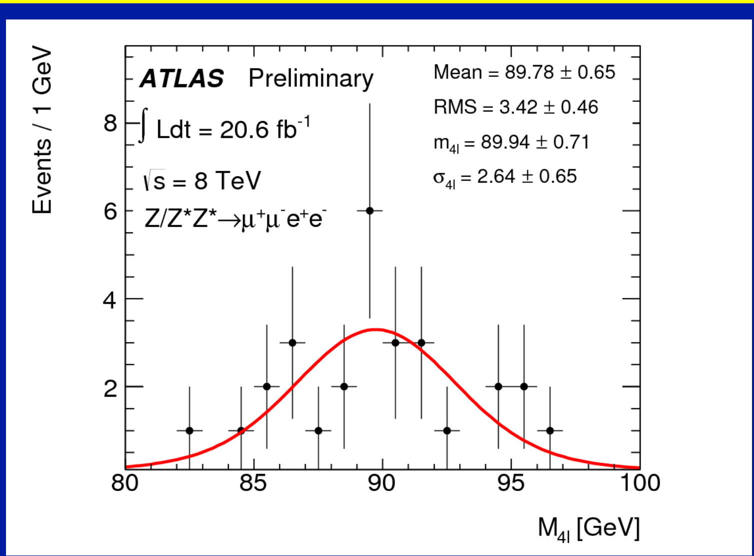
Standard Model : Z->4l

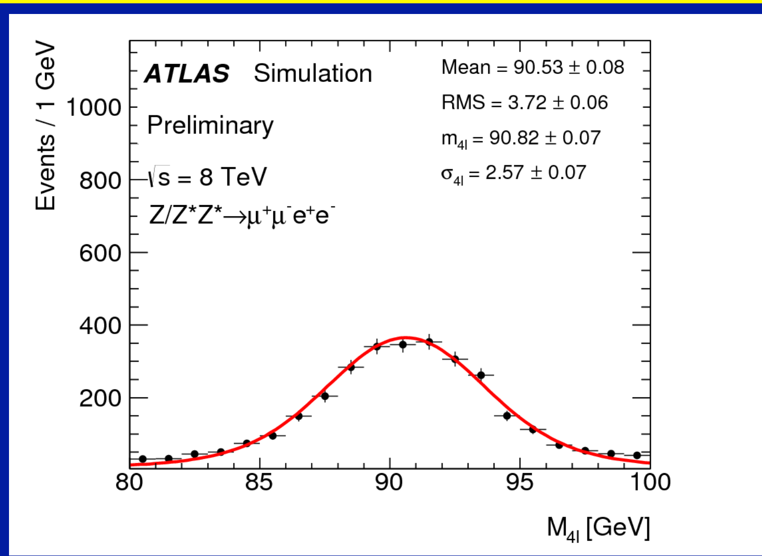
- Fit of reconstructed Mass in the 4 channels compared with MC
- Looser selection to improve statistics
  - $M_{Z2}>1$ GeV

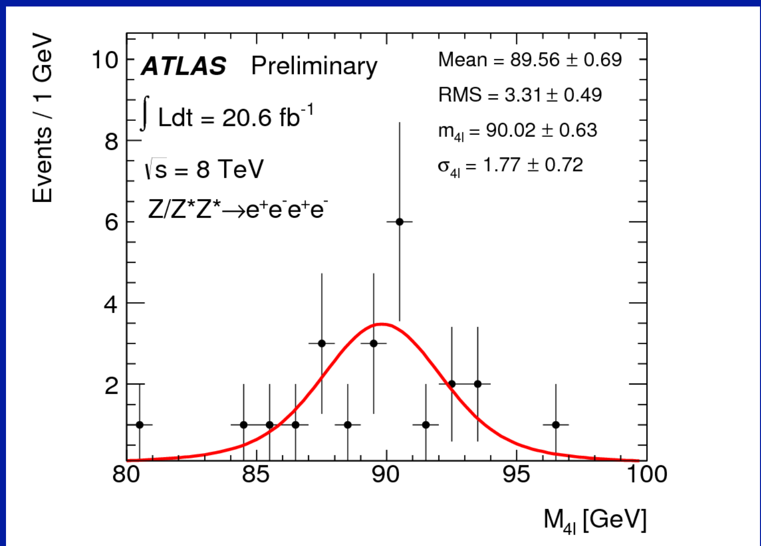


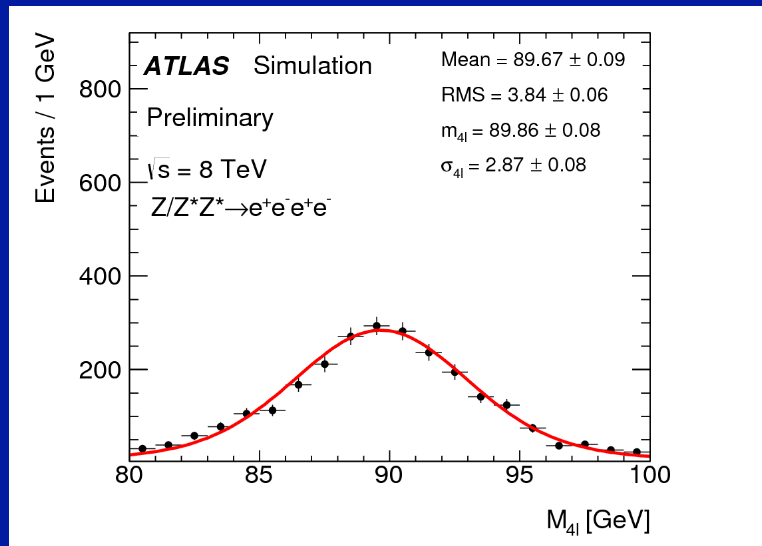
	4e	2μ2e	2e2μ	4μ
M4l Fit MC	89.86 ±0.08	90.82 ±0.07	90.21 ±0.04	91.04 ±0.03
M4l Fit Data	90.02±0.63	89.94±0.71	89.68±0.33	90.75±0.29

Standard Model : Z->4l







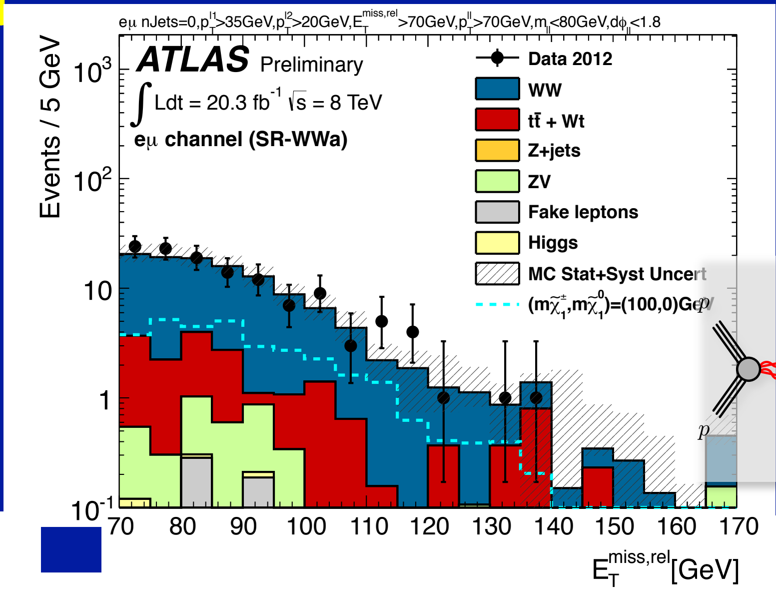


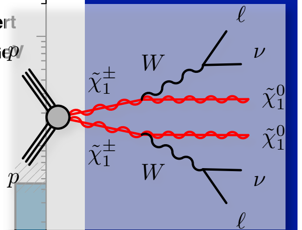
Searches for “Natural” SUSY scenarios

Electroweak neutralino, chargino and slepton pair production

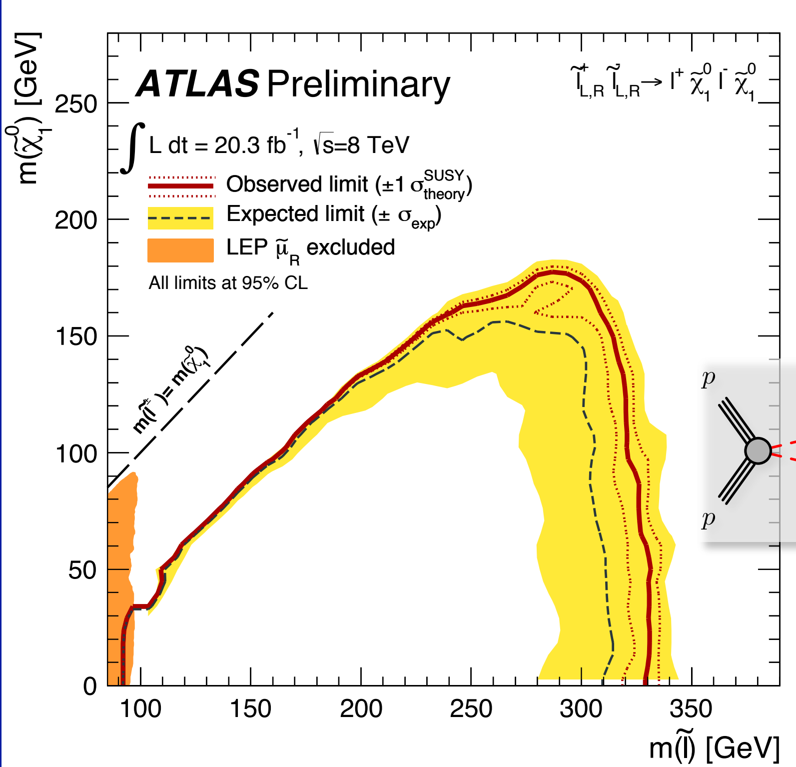
Preliminary results with complete 2012 statistics: ATLAS-CONF-2013-049

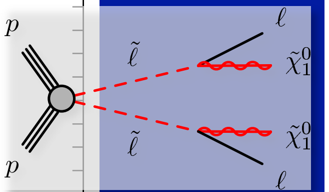
- Production & decay depends on sparticle nature; sleptons increase acceptance
- Most challenging (but possible in natural SUSY): heavy slepton scenarios, or only light stau





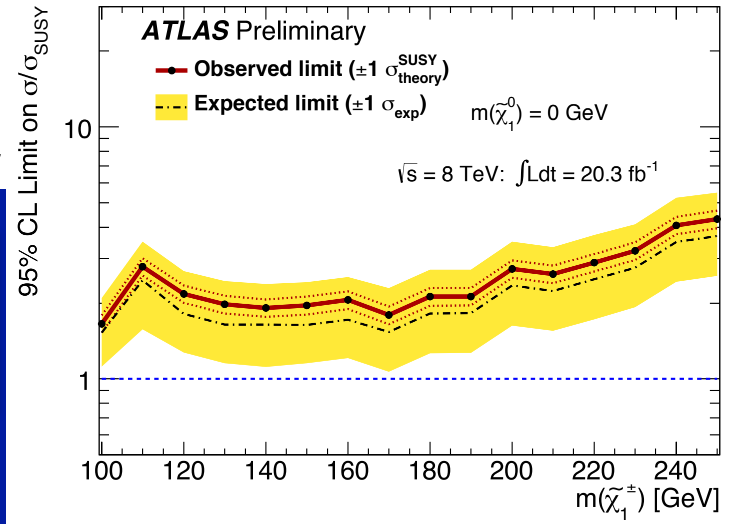
MET in signal region sensitive to C1C1 → WW + MET





Exclusion of slepton pair production

First limits on slepton-right production only



C1C1 → WW + MET exclusion limits

Barely sensitive to chargino pair production with heavy sleptons

SUSY Summary

...arches* - 95% CL Lower Limits ***ATLAS*** Preliminary

$\int Ldt = (4.4 - 20.7)\ \text{fb}^{-1}$ $\sqrt{s}$ = 7, 8 TeV

Incl. searches

e, μ, τ, γ	Jets	E_T^{miss}	$\int Ldt\ [\text{fb}^{-1}]$	Mass limit		Reference
0	2-6 jets	Yes	20.3	$\tilde{q}, \tilde{g}$ 1.8 TeV	$m(\tilde{q})=m(\tilde{g})$	ATLAS-CONF-2013-047
1 e, μ	4 jets	Yes	5.8	$\tilde{q}, \tilde{g}$ 1.24 TeV	$m(\tilde{q})=m(\tilde{g})$	ATLAS-CONF-2012-104
0	7-10 jets	Yes	20.3	$\tilde{g}$ 1.1 TeV	any $m(\tilde{q})$	ATLAS-CONF-2013-054
0	2-6 jets	Yes	20.3	$\tilde{q}$ 740 GeV	$m(\tilde{\chi}_1^0) = 0$ GeV	ATLAS-CONF-2013-047
0	2-6 jets	Yes	20.3	$\tilde{g}$ 1.3 TeV	$m(\tilde{\chi}_1^0) = 0$ GeV	ATLAS-CONF-2013-047
1 e, μ	2-4 jets	Yes	4.7	$\tilde{g}$ 900 GeV	$m(\tilde{\chi}_1^0) < 200$ GeV, $m(\tilde{\chi}^\pm) = 0.5(m(\tilde{\chi}_1^0)+m(\tilde{g}))$	1208.4688
2 e, μ (SS)	3 jets	Yes	20.7	$\tilde{g}$ 1.1 TeV	$m(\tilde{\chi}_1^0) < 650$ GeV	ATLAS-CONF-2013-007
2 e, μ	2-4 jets	Yes	4.7	$\tilde{g}$ 1.24 TeV	$\tan\beta < 15$	1208.4688
1-2 τ	0-2 jets	Yes	20.7	$\tilde{g}$ 1.4 TeV	$\tan\beta > 18$	ATLAS-CONF-2013-026
2 γ	0	Yes	4.8	$\tilde{g}$ 1.07 TeV	$m(\tilde{\chi}_1^0) > 50$ GeV	1209.0753
1 e, $\mu + \gamma$	0	Yes	4.8	$\tilde{g}$ 619 GeV	$m(\tilde{\chi}_1^0) > 50$ GeV	ATLAS-CONF-2012-144
γ	1 b	Yes	4.8	$\tilde{g}$ 900 GeV	$m(\tilde{\chi}_1^0) > 220$ GeV	1211.1167
2 e, μ (Z)	0-3 jets	Yes	5.8	$\tilde{g}$ 690 GeV	$m(\tilde{H}) > 200$ GeV	ATLAS-CONF-2012-152
0	mono-jet	Yes	10.5	$F^{1/2}$ scale 645 GeV	$m(\tilde{G}) > 10^{-4}$ eV	ATLAS-CONF-2012-147

Natural SUSY

e, μ, τ, γ	Jets	E_T^{miss}	$\int Ldt\ [\text{fb}^{-1}]$	Mass limit		Reference
0	3 b	Yes	12.8	$\tilde{g}$ 1.24 TeV	$m(\tilde{\chi}_1^0) < 200$ GeV	ATLAS-CONF-2012-145
2 e, μ (SS)	0-3 b	No	20.7	$\tilde{g}$ 900 GeV	$m(\tilde{\chi}_1^0) < 500$ GeV	ATLAS-CONF-2013-007
0	7-10 jets	Yes	20.3	$\tilde{g}$ 1.14 TeV	$m(\tilde{\chi}_1^0) < 200$ GeV	ATLAS-CONF-2013-054
0	3 b	Yes	12.8	$\tilde{g}$ 1.15 TeV	$m(\tilde{\chi}_1^0) < 200$ GeV	ATLAS-CONF-2012-145
0	2 b	Yes	20.1	$\tilde{b}_1$ 100-630 GeV	$m(\tilde{\chi}_1^0) < 100$ GeV	ATLAS-CONF-2013-053
2 e, μ (SS)	0-3 b	Yes	20.7	$\tilde{b}_1$ 430 GeV	$m(\tilde{\chi}_1^\pm) = 2\,m(\tilde{\chi}_1^0)$	ATLAS-CONF-2013-007
1-2 e, μ	1-2 b	Yes	4.7	$\tilde{t}_1$ 167 GeV	$m(\tilde{\chi}_1^0) = 55$ GeV	1208.4305, 1209.2102
2 e, μ	0-2 jets	Yes	20.3	$\tilde{t}_1$ 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
2 e, μ	0-2 jets	Yes	20.3	$\tilde{t}_1$ 150-440 GeV	$m(\tilde{\chi}_1^0) = 0$ GeV, $m(\tilde{t}_1)-m(\tilde{\chi}_1^\pm) = 10$ GeV	ATLAS-CONF-2013-048
0	2 b	Yes	20.1	$\tilde{t}_1$ 150-580 GeV	$m(\tilde{\chi}_1^0) < 200$ GeV, $m(\tilde{\chi}_1^\pm)-m(\tilde{\chi}_1^\pm) = 5$ GeV	ATLAS-CONF-2013-053
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
0	2 b	Yes	20.5	$\tilde{t}_1$ 320-660 GeV	$m(\tilde{\chi}_1^0) = 0$ GeV	ATLAS-CONF-2013-024
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
3 e, μ (Z)	1 b	Yes	20.7	$\tilde{t}_2$ 520 GeV	$m(\tilde{t}_1) = m(\tilde{\chi}_1^0) + 180$ GeV	ATLAS-CONF-2013-025
2 e, μ	0	Yes	20.3	$\tilde{l}$ 85-315 GeV	$m(\tilde{\chi}_1^0) = 0$ GeV	ATLAS-CONF-2013-049
2 e, μ	0	Yes	20.3	$\tilde{\chi}_1^\pm$ 125-450 GeV	$m(\tilde{\chi}_1^0) = 0$ GeV, $m(\tilde{l},\tilde{\nu}) = 0.5(m(\tilde{\chi}_1^\pm) + m(\tilde{\chi}_1^0))$	ATLAS-CONF-2013-049
2 τ	0	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
3 e, μ	0	Yes	20.7	$\tilde{\chi}_1^\pm, \tilde{\chi}_2^0$ 600 GeV	$m(\tilde{\chi}_1^\pm) = m(\tilde{\chi}_2^0)$, $m(\tilde{\chi}_1^0) = 0$, $m(\tilde{l},\tilde{\nu}) = 0.5(m(\tilde{\chi}_1^\pm) + m(\tilde{\chi}_1^0))$	ATLAS-CONF-2013-035
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

LLP + RPV

e, μ, τ, γ	Jets	E_T^{miss}	$\int Ldt\ [\text{fb}^{-1}]$	Mass limit		Reference
0	1 jet	Yes	4.7	$\tilde{\chi}_1^\pm$ 220 GeV	$1 < \tau(\tilde{\chi}_1^\pm) < 10$ ns	1210.2852
0-2 e, μ	0	Yes	4.7	$\tilde{g}$ 985 GeV		1211.1597
2 e, μ	0	Yes	4.7	$\tilde{\tau}$ 300 GeV	$5 < \tan\beta < 20$	1211.1597
2 γ	0	Yes	4.7	$\tilde{\chi}_1^0$ 230 GeV	$0.4 < \tau(\tilde{\chi}_1^0) < 2$ ns	1304.6310
1 e, μ	0	Yes	4.4	$\tilde{q}$ 700 GeV	1 mm $< c\tau <$ 1 m, $\tilde{g}$ decoupled	1210.7451
2 e, μ	0	-	4.6	$\tilde{\nu}_\tau$ 1.61 TeV	$\lambda'_{311}=0.10$, $\lambda_{132}=0.05$	1212.1272
1 e,$\mu + \tau$	0	-	4.6	$\tilde{\nu}_\tau$ 1.1 TeV	$\lambda'_{311}=0.10$, $\lambda_{1(2)33}=0.05$	1212.1272
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
4 e, μ	0	Yes	20.7	$\tilde{\chi}_1^\pm$ 760 GeV	$m(\tilde{\chi}_1^0) > 300$ GeV, $\lambda_{121} > 0$	ATLAS-CONF-2013-036
3 e, $\mu + \tau$	0	Yes	20.7	$\tilde{\chi}_1^\pm$ 350 GeV	$m(\tilde{\chi}_1^0) > 80$ GeV, $\lambda_{133} > 0$	ATLAS-CONF-2013-036
0	6 jets	-	4.6	$\tilde{g}$ 666 GeV		1210.4813
2 e, μ (SS)	0-3 b	Yes	20.7	$\tilde{g}$ 880 GeV		ATLAS-CONF-2013-007

Extended MSSM

e, μ, τ, γ	Jets	E_T^{miss}	$\int Ldt\ [\text{fb}^{-1}]$	Mass limit		Reference
0	4 jets	-	4.6	sgluon 100-287 GeV	incl. limit from 1110.2693	1210.4826
0	mono-jet	Yes	10.5	M* scale 704 GeV	$m(\chi) < 80$ GeV, limit of < 687 GeV for D8	ATLAS-CONF-2012-147

Mass scale [TeV] (10^{-1} – 1)

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

...ble mass limits on new states or phenomena is shown. All limits quoted are observed minus 1σ theoretical signal cross section uncertainty.

Exotics: Z' ->ttbar

- Search for t-tbar resonances in final states with lepton, MET and N-Jets
- Narrow Leptophobic Z' excluded in range:
  - 0.5<mz'<1.8 TeV (95% CL)
  - (0.5<mz'<1.9 TeV expected)
- Broad KK gluon excluded in range:
  - $0.5<mg_{kk}<2.0$ TeV (95% CL)
  - (0.5<mz'<2.1 TeV expected)

ATLAS-CONF 2013-052