Preparing Scoping Scenario studies

Aleandro Nisati
Ist. Naz. Fisica Nucleare, Roma

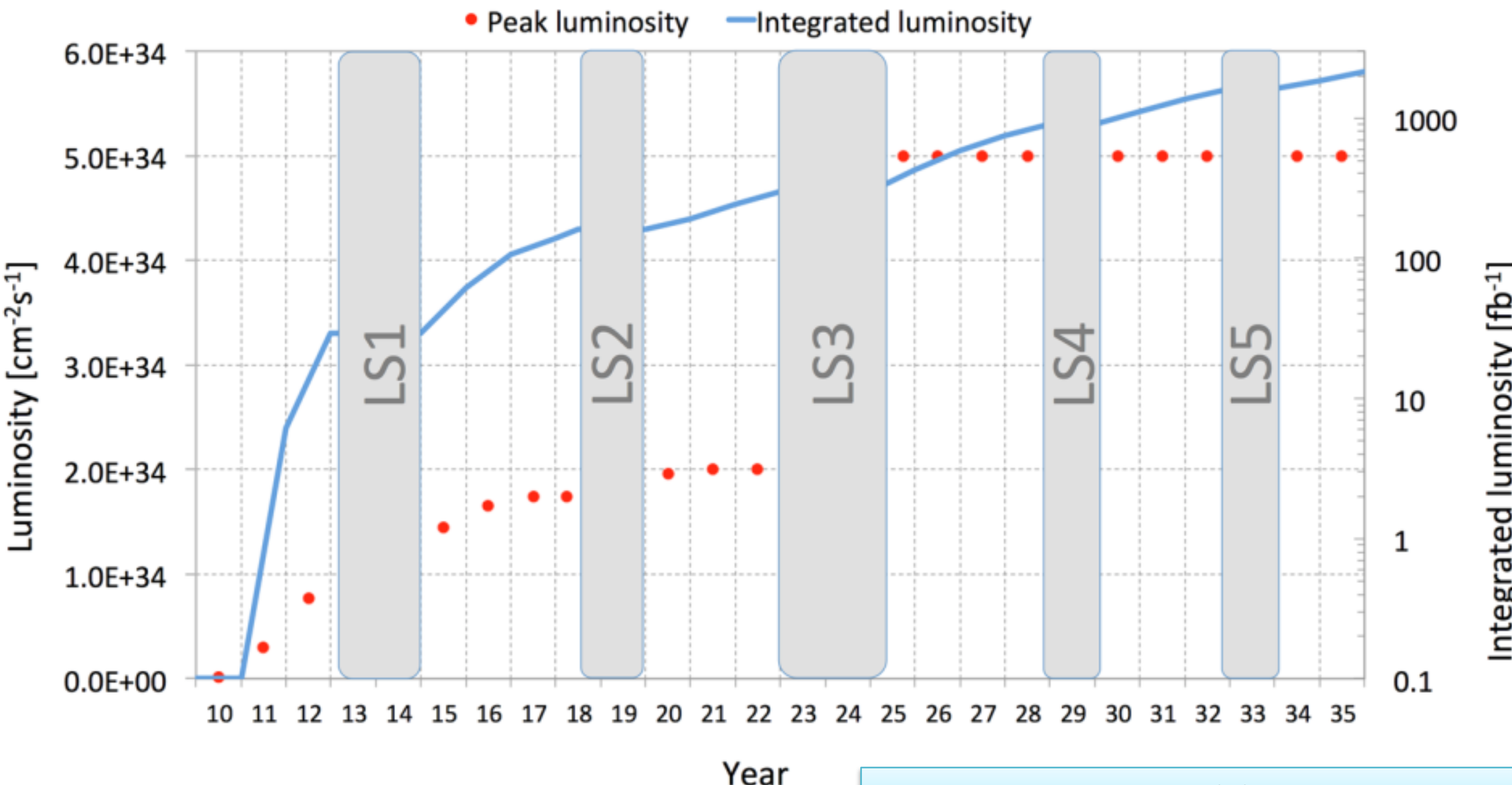
ATLAS-Italia, Milano

10-12 Febbraio 2015

Index

- HL-LHC
- Physics simulation in ATLAS for HL-LHC
  - Physics objects simulation
- Large Eta TF and Scoping documents
- Physics Programme at HL-LHC: some examples from Higgs Prospects

HL-LHC timeline

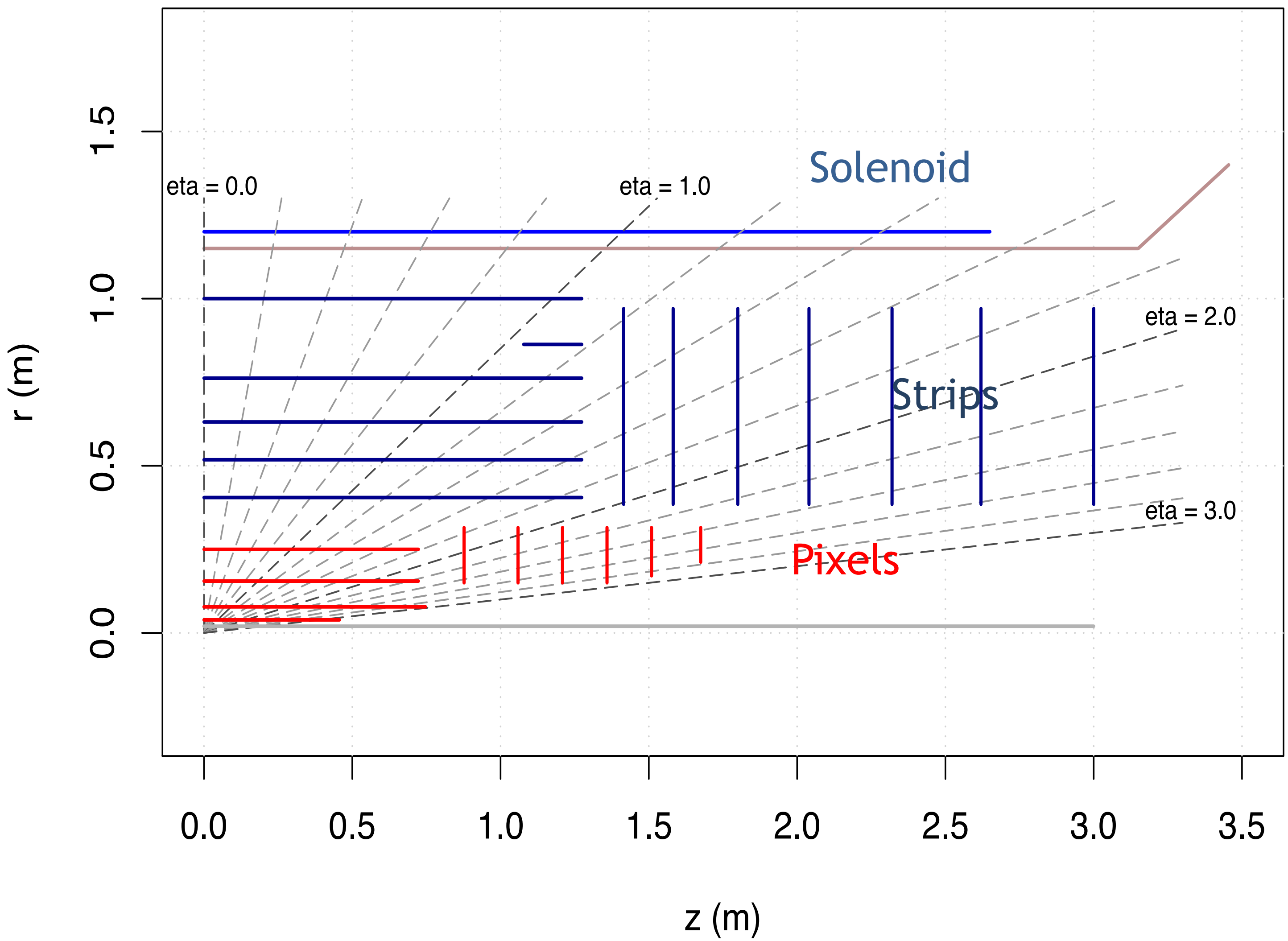


M. Lamont @ Recontre workshop, Vietnam 2014

Simulation methods

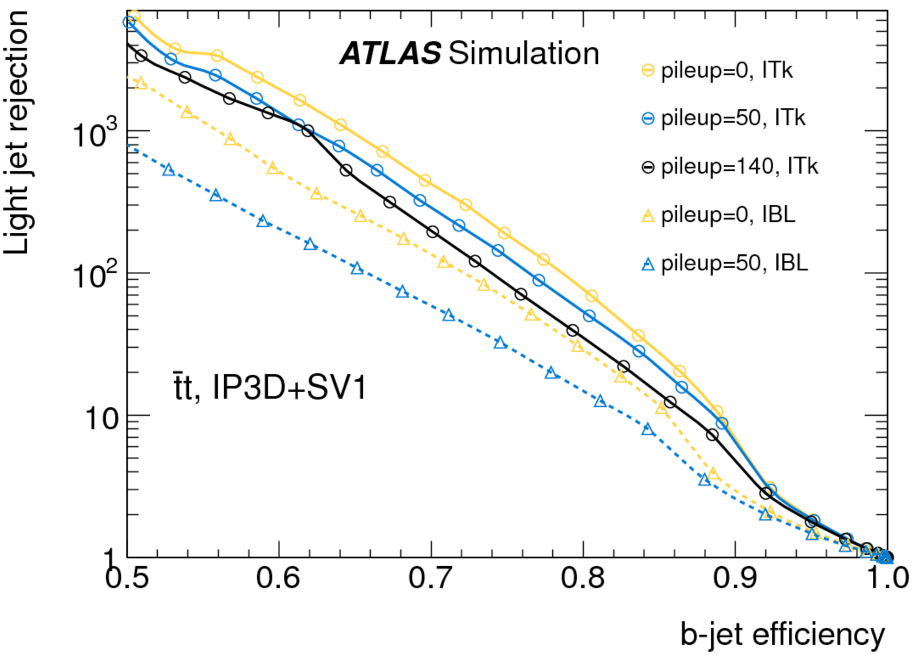
- ATLAS:
  - Efficiency and resolution functions are applied to physics objects
  - Performance of the new detector will not be worse than the current detector at Run I conditions
- CMS:
  - Scale signal and background yields of current analyses
  - Two scenarios for systematic uncertainties
    - Scenario 1: Systematic uncertainties remain the same
    - Scenario 2: Theoretical uncertainties scaled by ½, other systematic uncertainties scaled by $1/\sqrt{L}$
  - For Upgrade studies, CMS is planning to use full/fast simulation (similarly to what done/in progress by ATLAS)

The ITK LoI Layout

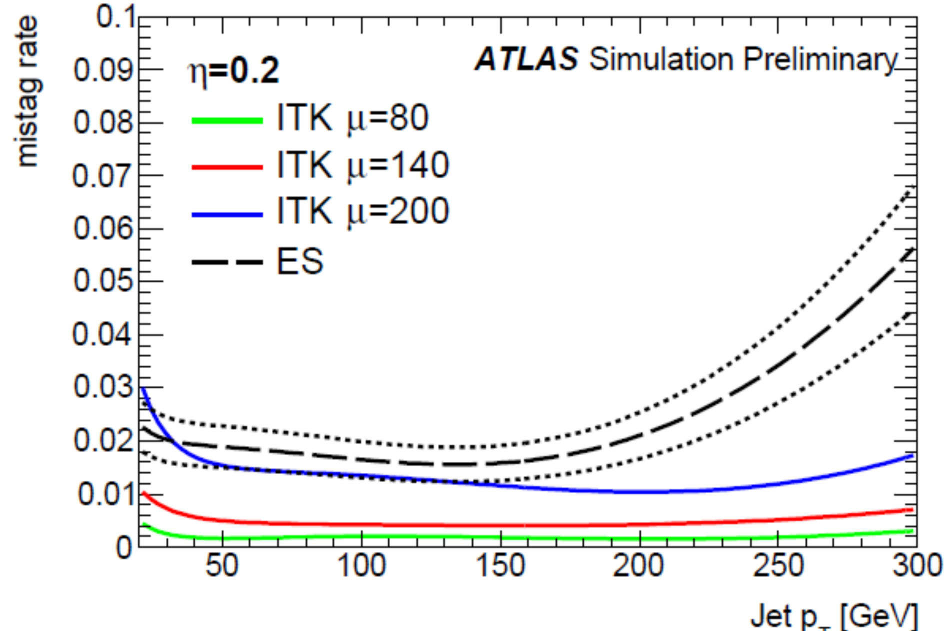


Full simulation object studies: **b-tagging**

Letter of Intent for the Phase-II Upgrade of the ATLAS Experiment



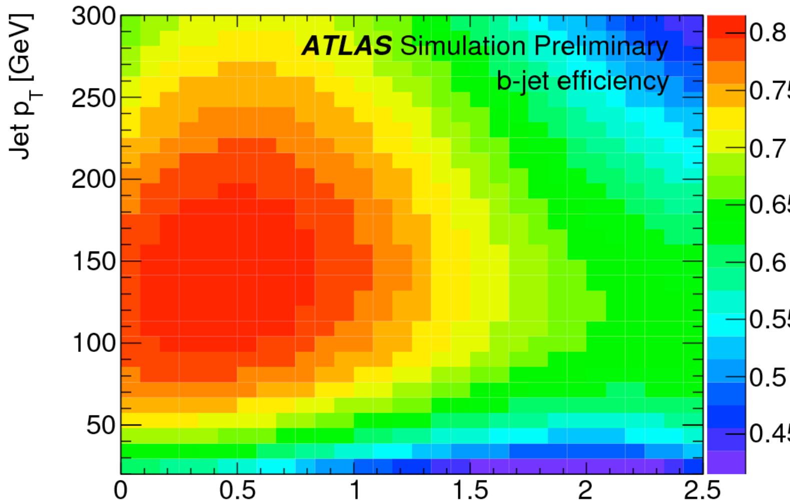
ATL-PHYS-PUB-2013-009

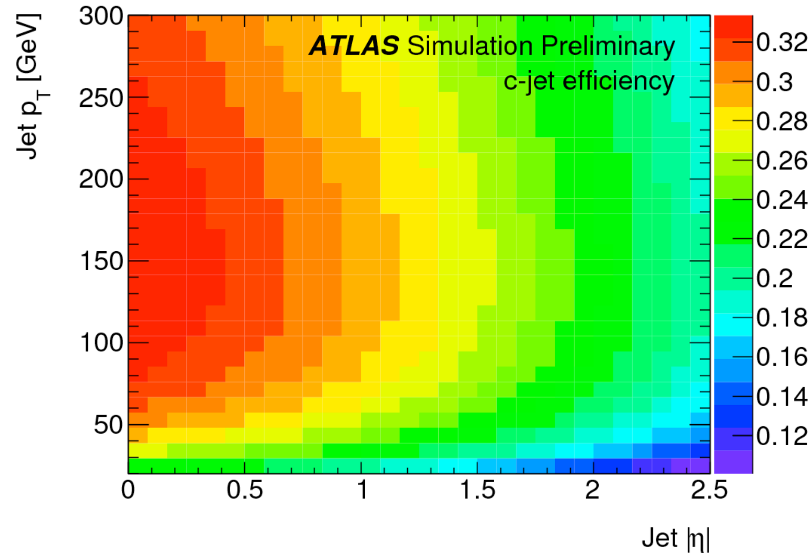


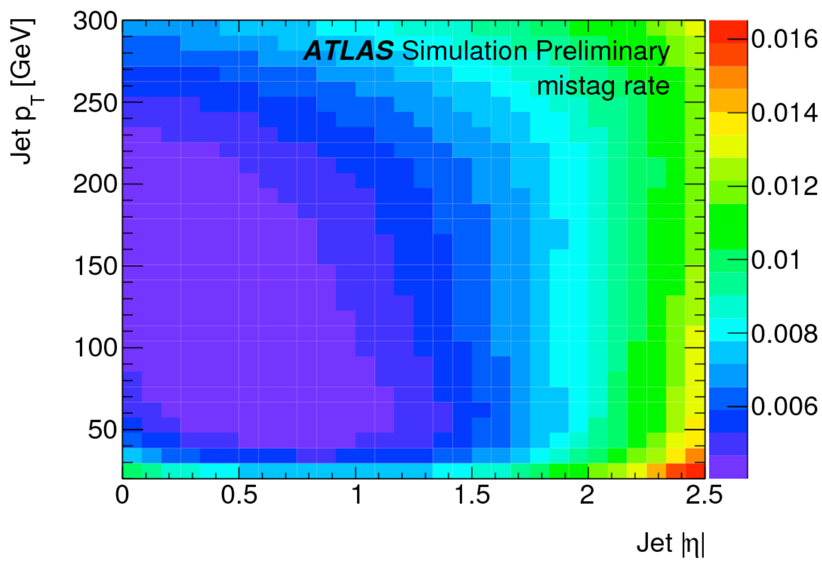
Performance of b-tagging in ttbar events, for a range of pile-up levels for the proposed Phase-II Tracker layout in comparison with ID+IBL.

- ATLAS b-tag fake rate for 70% efficiency compared with rate assumed for ES studies
  - ITK brings enhanced tracking
  - Mistag below 0.5% for $<\mu>=140$ $p_T=100$ GeV

Full simulation object studies: **b-tagging**





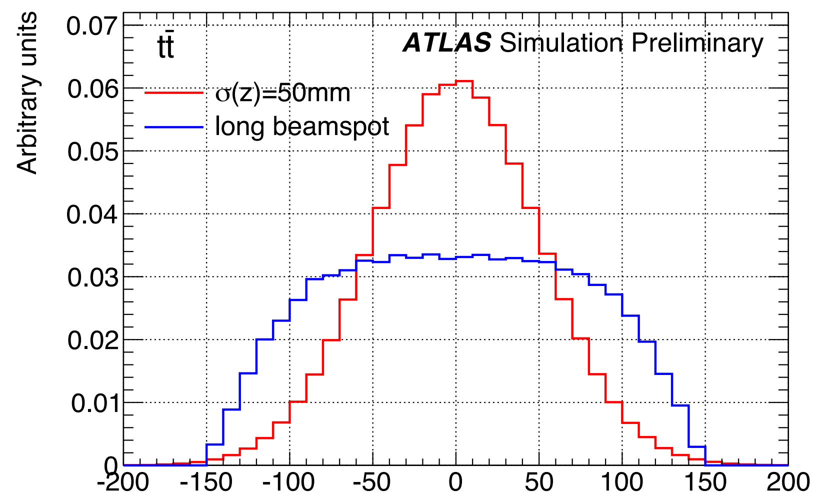


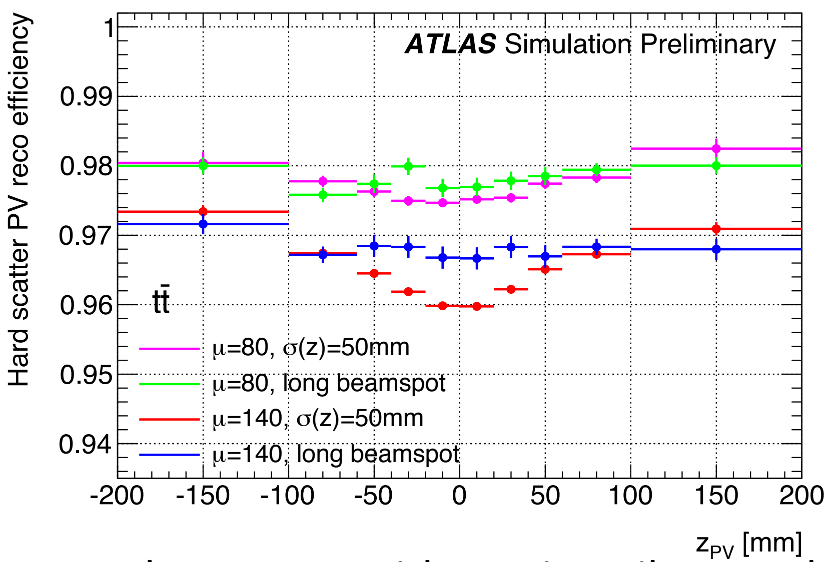
b-jet, c-jet (top left, right) and light jet (bottom) b-tagging efficiencies as function of p_T and $|\eta|$ in a sample of ttbar events

Effects of a longer beam spot

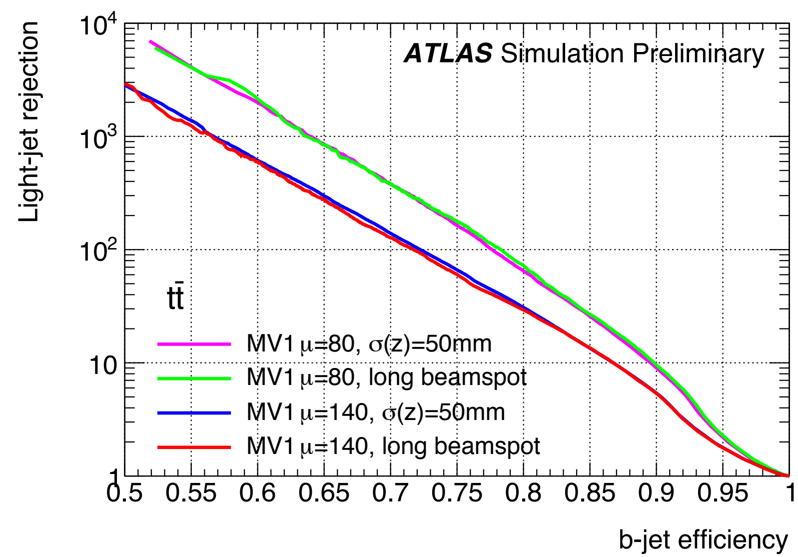
- Generate ttbar events with pileup, Phase II tracker, μ=140
  - Different longitudinal (z) beam spot profiles: Gaussian with σ=5cm or Long beam spot, ~flat to ±15cm

Reconstructed vertices





ttbar events with varying pileup and beam spot z distributions

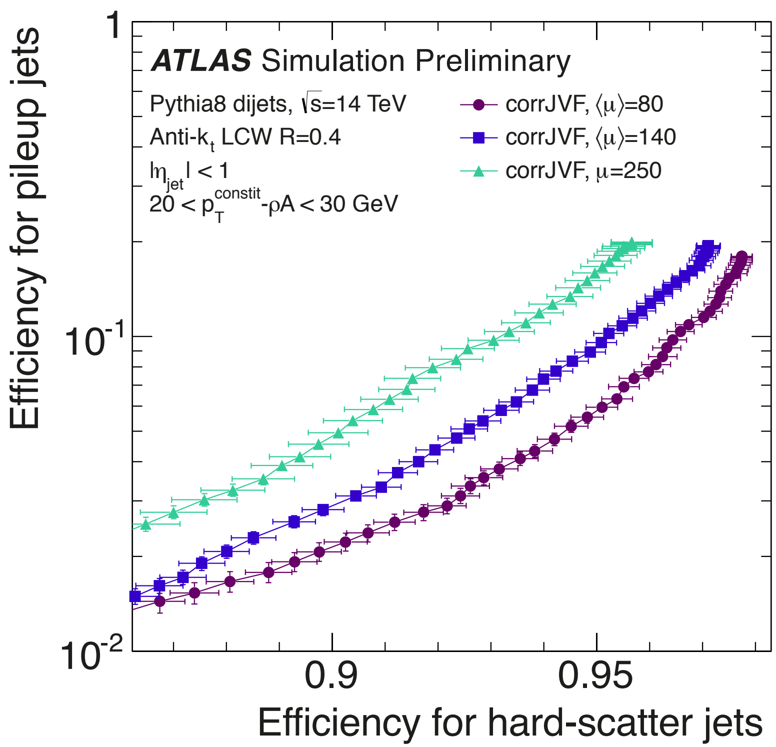


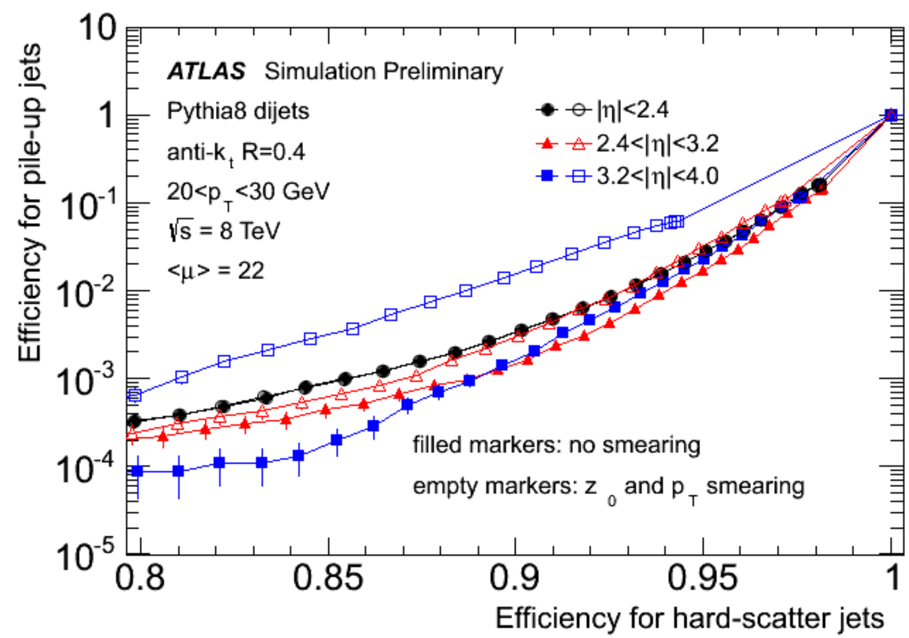
Only events with the correct primary vertex enter the plot

Pileup jet suppression with tracks

- Efficiency for pileup jets vs. hard-scatter jets (20-30 GeV), scanning a track-vertex match variable
- Pileup jets do not match any true jet
- Performance degrades with μ

Forward tracker:
studies just started
Needs MC samples and manpower





Full simulation object studies: **MET**

- Simple approach used in 2012 for the ***European Strategy*** studies
- More accurate parametrization of MET prepared for ECFA Workshops

- Basic approach:
  - $E_T^{miss}{}_{x,y} = E_t^{miss,true}{}_{x,y}$ + **Gauss(0,σ_{ETmiss})**
  - The task is in the calculation of **σ_{ETmiss}**
- The resolution **σ_{ETmiss}** has been studied as a function of $\sqrt{\Sigma E_T}$ using MC events of MinimumBias, Z'→ttbar and dijet processes

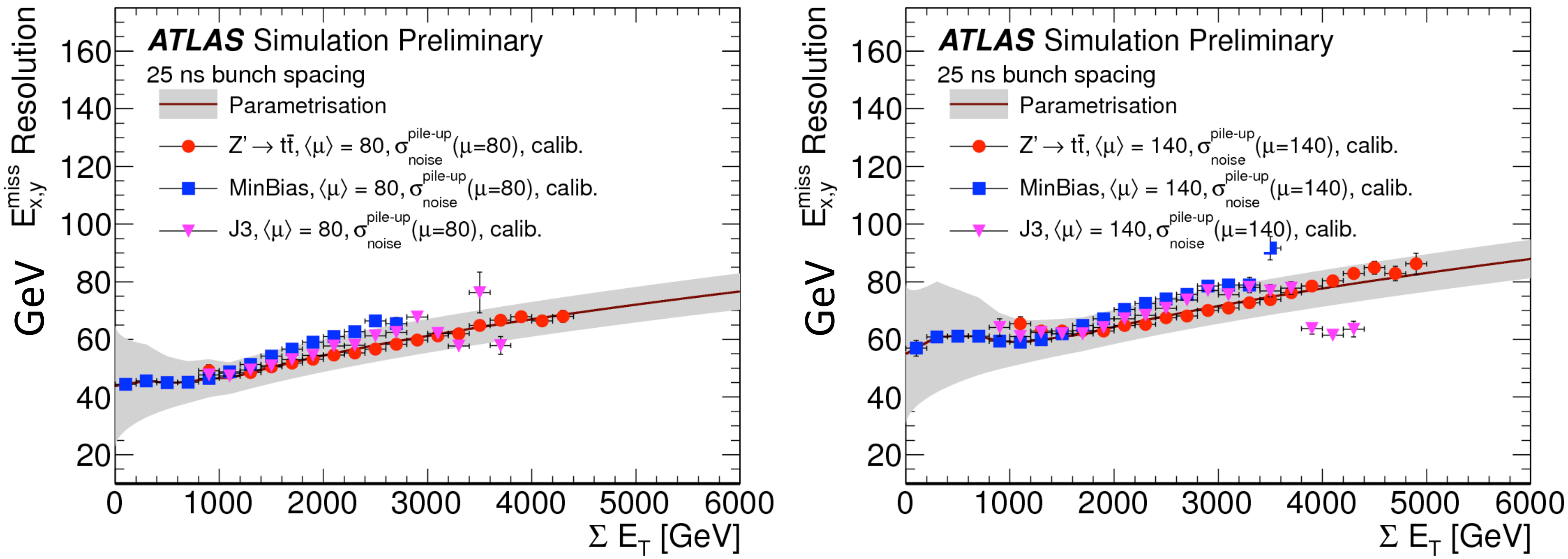
Full simulation object studies: **MET**

- Either parametrizations or fits to MC results are used to describe $\boldsymbol{\sigma_{ETmiss}}$ as a function of the number of pile-up events μ and $\sqrt{\Sigma E_T}$

E_T^{miss} resolution			
μ	Nominal		Systematic
	ΣE_T range	Res(E_T^{miss})	
140	$\Sigma E_T < 1300$ GeV	min-bias interp.	$\sigma^{Up,Down} = \pm\sqrt{\sigma^2_{Thresh.} + \sigma^2_{Process}}$ $\sigma_{Thresh.} = 5\text{GeV}$ $\sigma_{Process} = \text{Res}(E_T^{miss}) - 0.95 \times \text{Res}(Z'\,fit)$
	$1300 < \Sigma E_T < 1700$ GeV	Linear interp. min-bias$\rightarrow Z'$	
	$\Sigma E_T > 1700$ GeV	Z' fit: $32.1 + 0.720 \times \sqrt{\Sigma E_T}$	
80	$\Sigma E_T < 900$ GeV	min-bias interp.	
	$900 < \Sigma E_T < 1100$ GeV	Linear interp. min-bias$\rightarrow Z'$	
	$\Sigma E_T > 1100$ GeV	Z' fit: $24.0 + 0.679 \times \sqrt{\Sigma E_T}$	
60	$\Sigma E_T < 700$ GeV	min-bias interp.	
	$700 < \Sigma E_T < 1100$ GeV	Linear interp. min-bias$\rightarrow Z'$	
	$\Sigma E_T > 1100$ GeV	Z' fit: $18.7 + 0.650 \times \sqrt{\Sigma E_T}$	

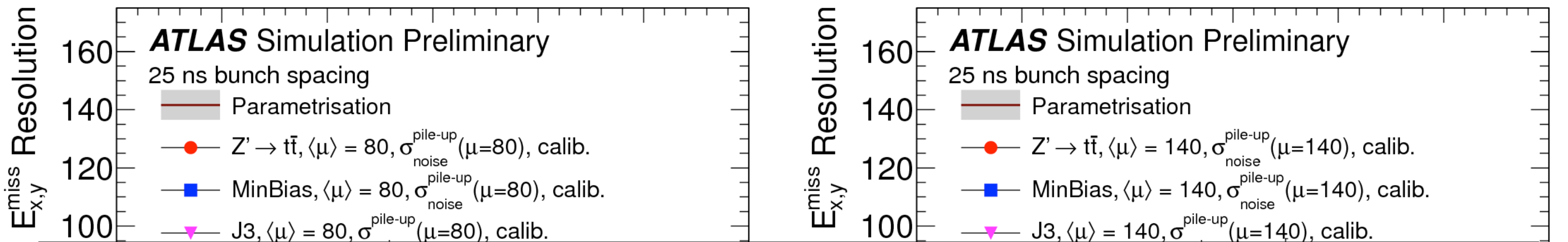
Table 5: Overview of the simulated samples used to define the parametrisation of the E_T^{miss} resolution.

Full simulation object studies: **MET**



The E_T^{miss} resolution as a function of $\sum E_T$ obtained from different physics samples, and compared with the parametrisation. They are all consistent with the nominal value obtained from the parametrisation within the systematic uncertainties .

Full simulation object studies: **MET**



M. Testa is producing important new studies on MET

This is another crucial area where lack of human resources is problematic

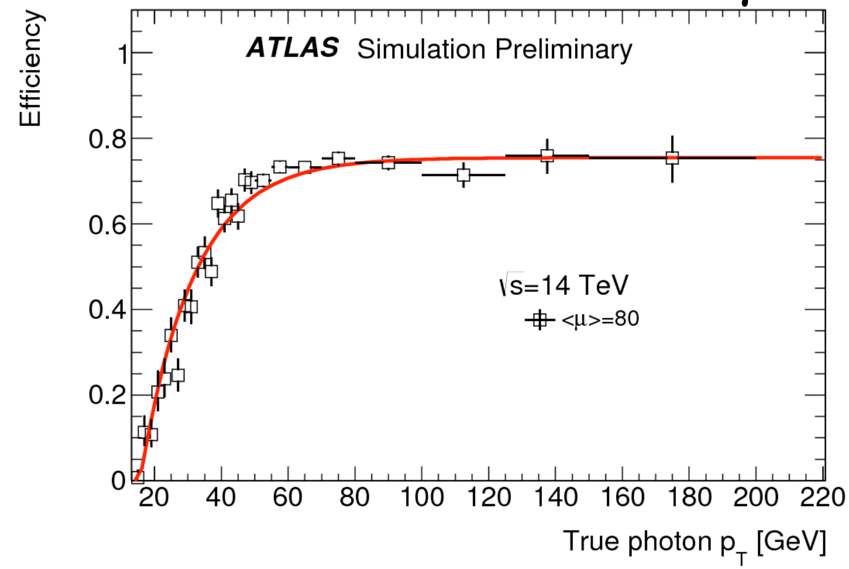
The

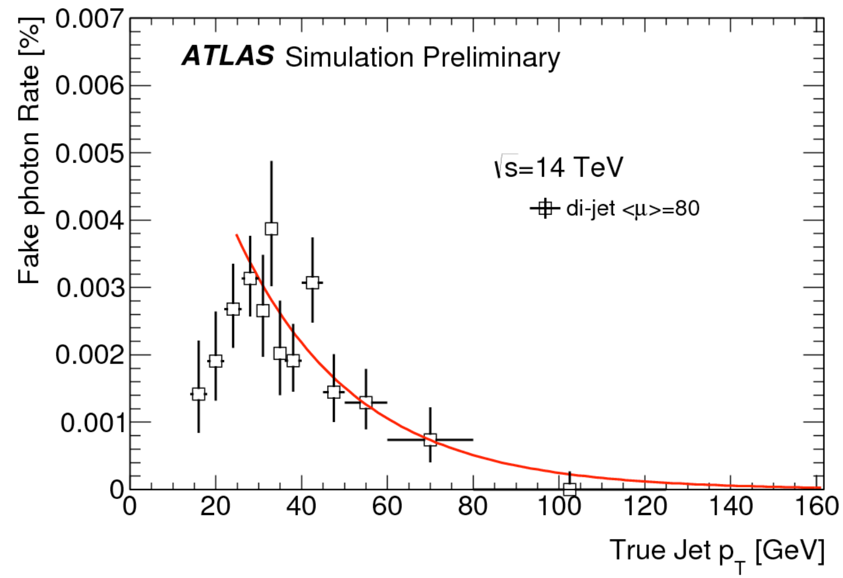
from different physics samples, and compared with the parametrisation. They are all consistent with the nominal value obtained from the parametrisation within the systematic uncertainties .

Full simulation object studies: γ

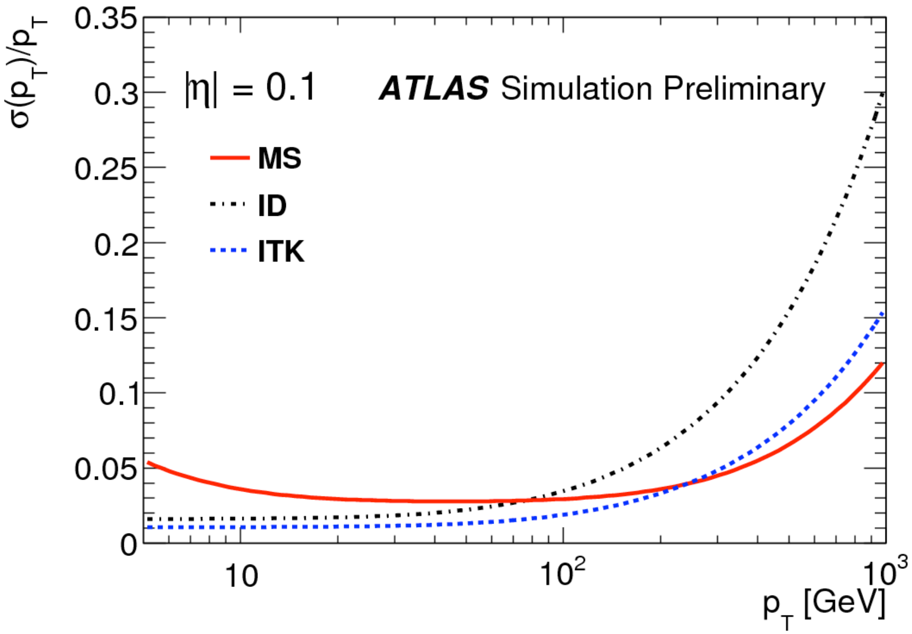
- The efficiency of the photon identification and isolation requirements as a function of the true photon p_T. Fitted parametrisation is superimposed.
  - Simulation corresponds to an average value of $\langle\mu\rangle=80$. It is assumed "correct" also for $\langle\mu\rangle = 140$.
- The fake rate after applying photon identification and isolation requirements as a function of true jet p_T . The fitted parametrisations are also displayed.

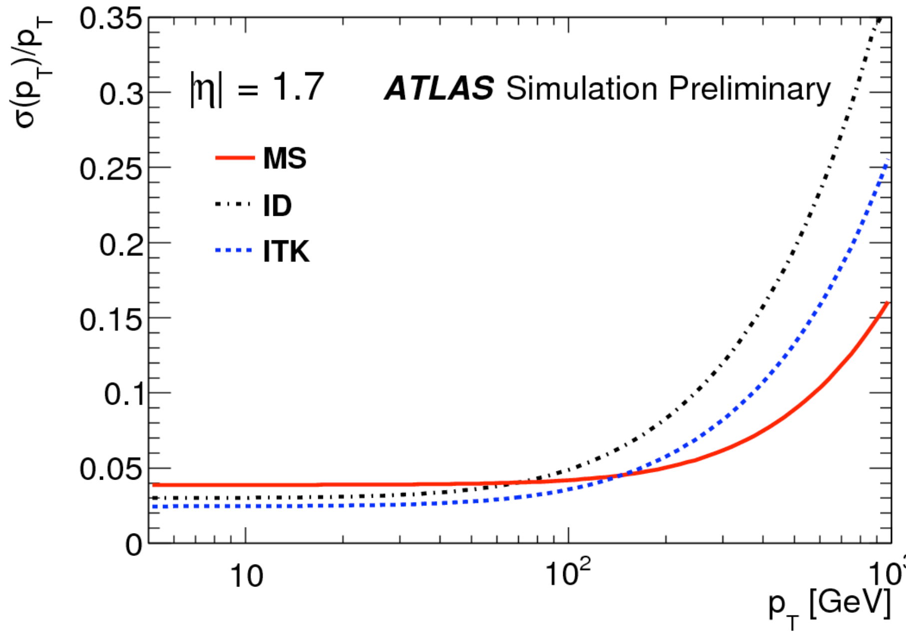
γ-ID





Full simulation object studies: **muons**

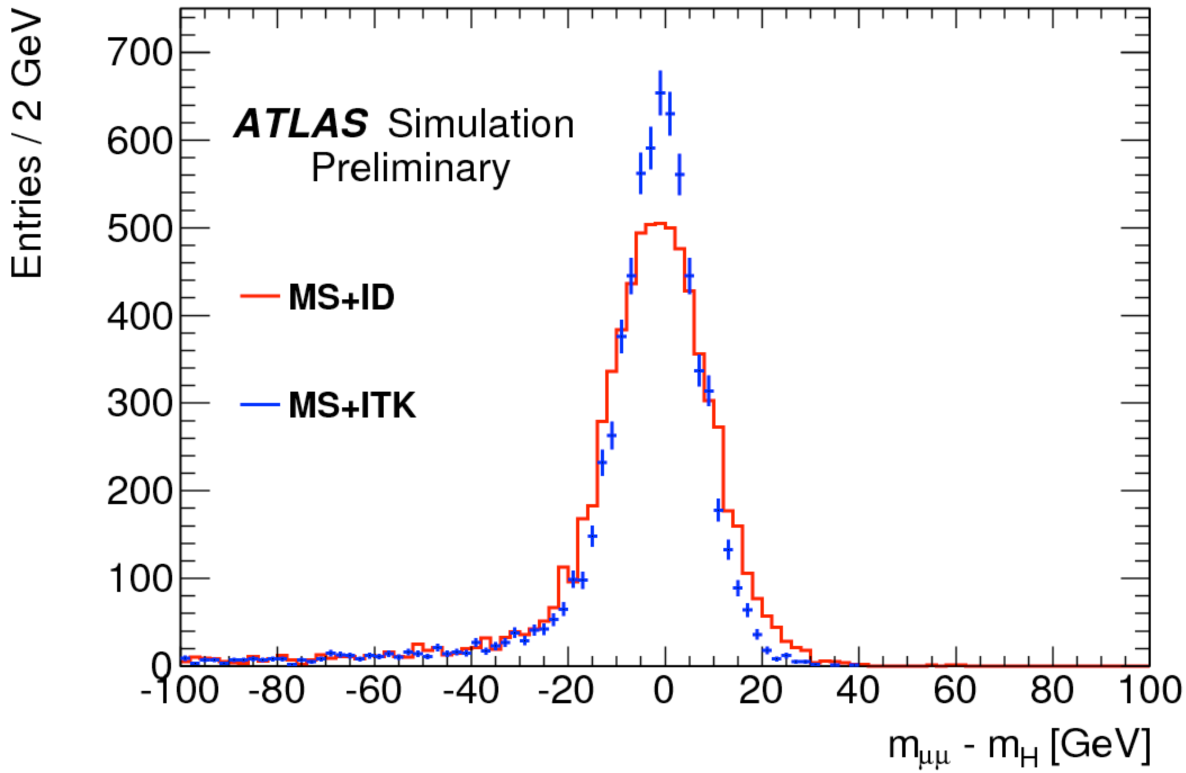




Muon resolution as a function of p_T for the MS, the Run 1 ID and for the Phase-II inner tracker (ITK), where the left plot corresponds to central rapidity ($|\eta|=0.1$) and the right plot corresponds to $|\eta|=1.7$.

No pile-up effects are taken into account

Full simulation object studies: **muons**

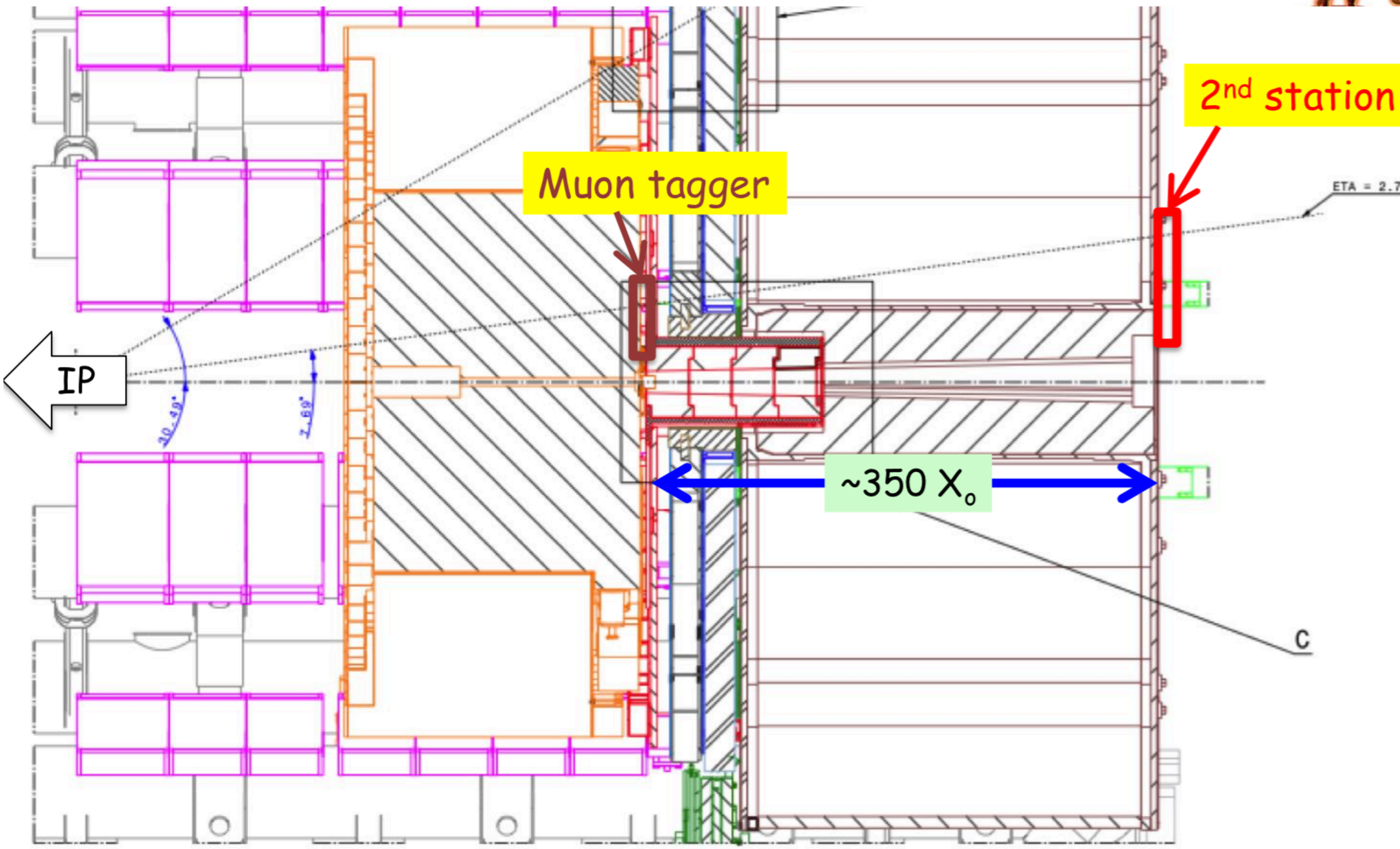


Distribution of the difference between the reconstructed and true mass for a 400 GeV Higgs-like resonance for the current ID configuration (MS+ID) and for the Phase-II configuration (MS+ITK).

Extending Muon Coverage

T Kawamoto (Tokyo) and C Young (SLAC)

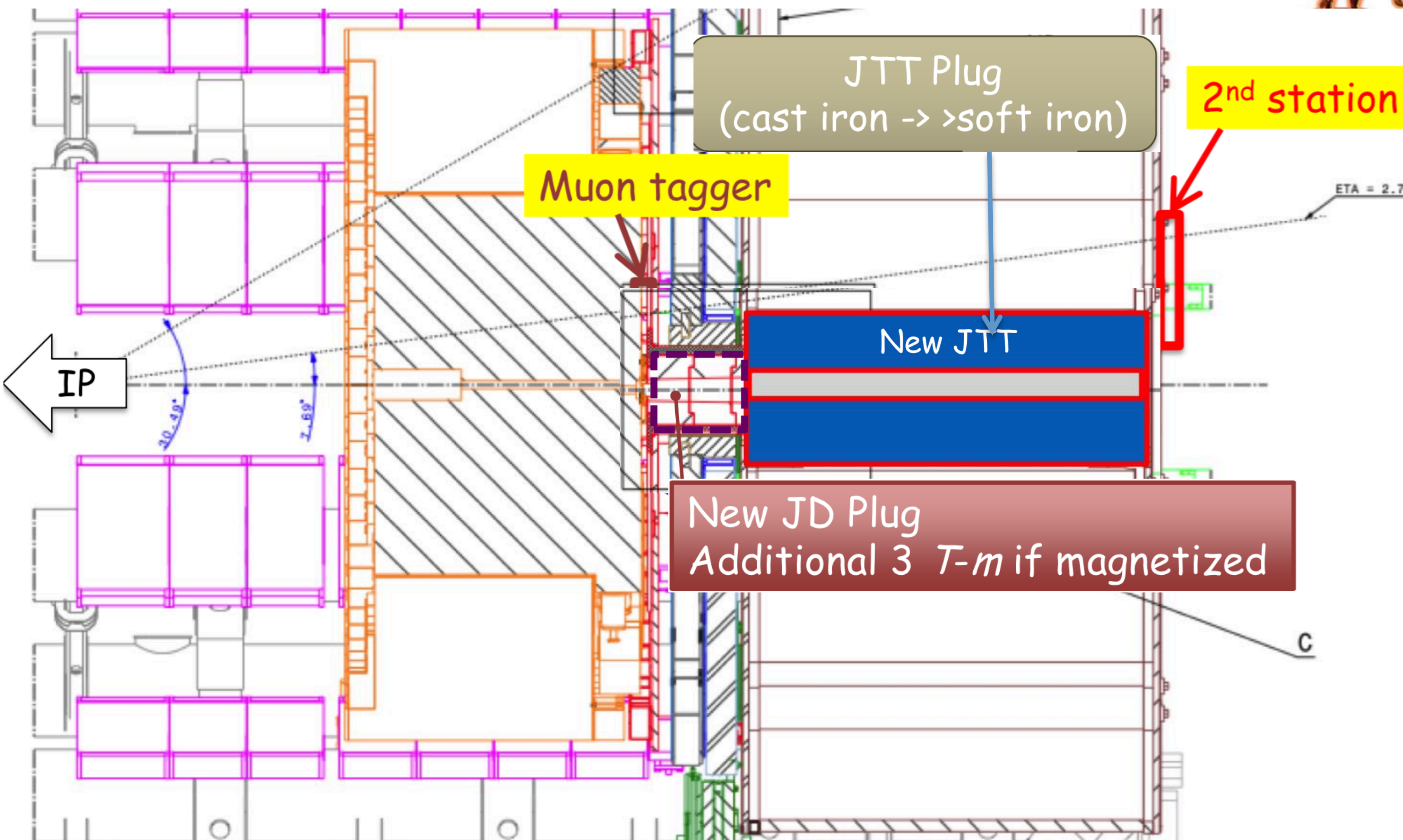
Conceptual Layout



Extending Muon Coverage

T Kawamoto (Tokyo) and C Young (SLAC)

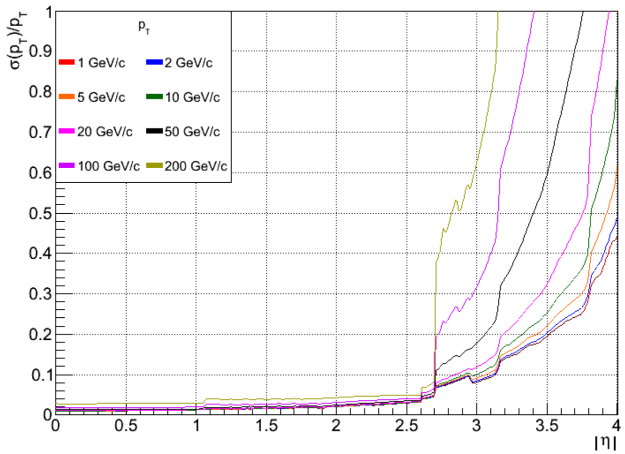
Conceptual Layout



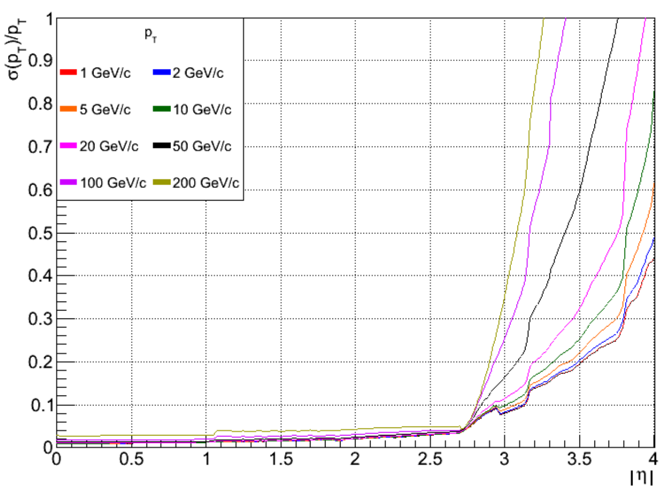
Extending Muon Coverage

- 25µm pixels

ITK + segment tagging

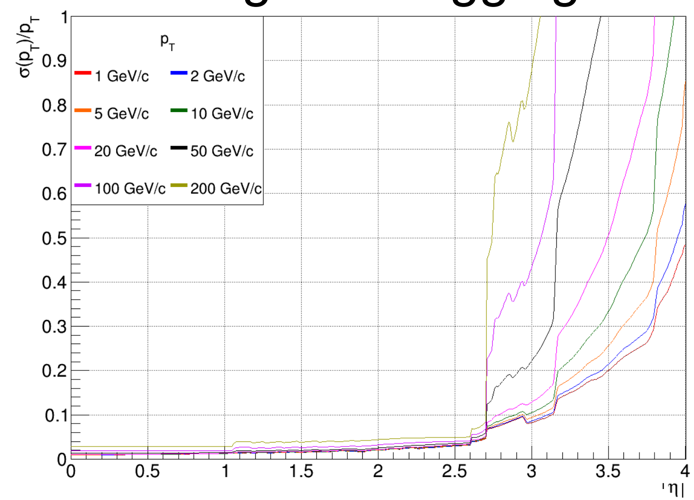


ITK + CB muons

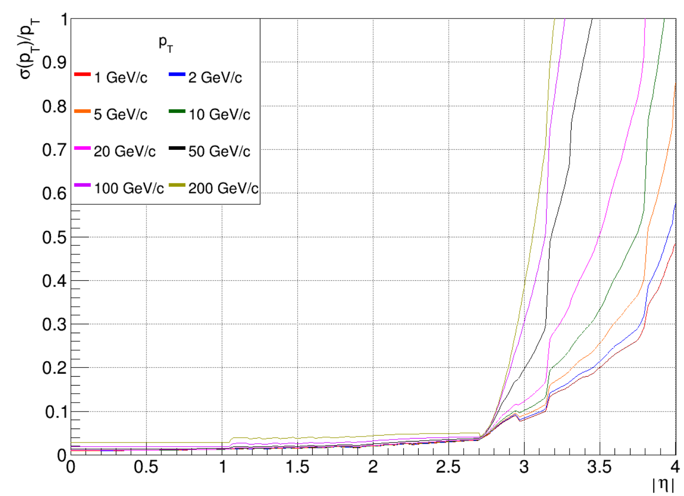


50µm pixels

ITK + segment tagging



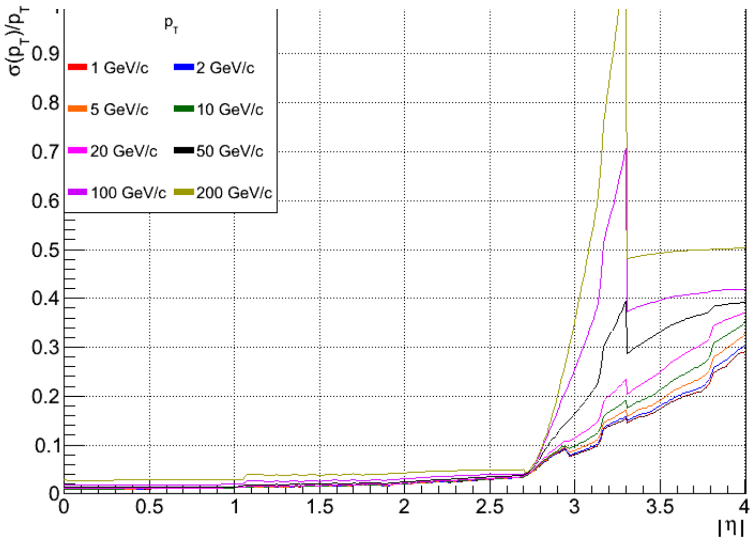
ITK + CB muons



Extending Muon Coverage

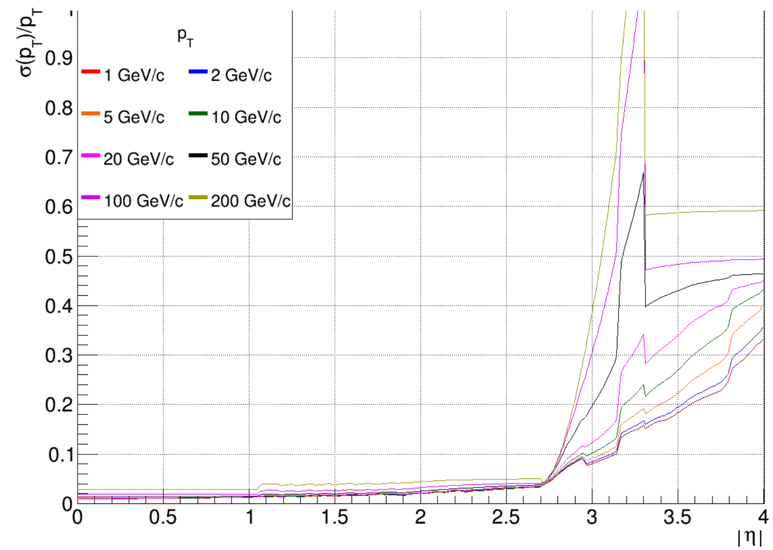
- 25μm pixels

ITK + CB muons + warm toroid



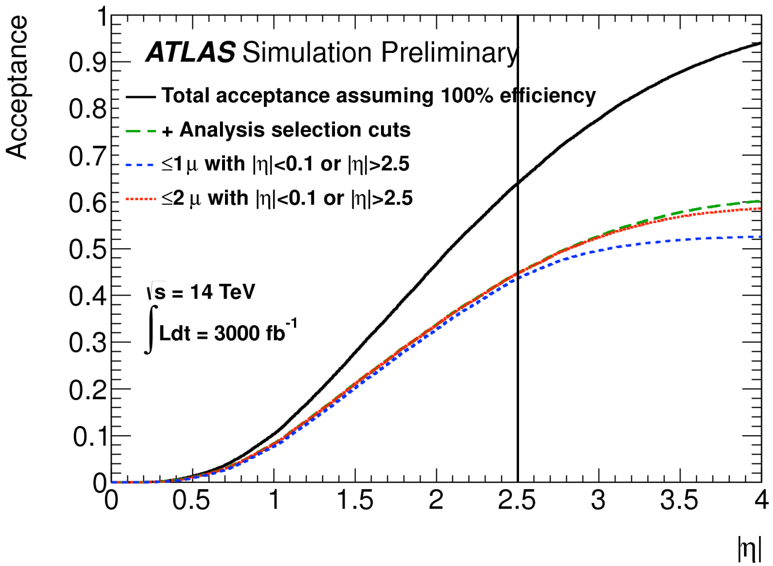
50μm pixels

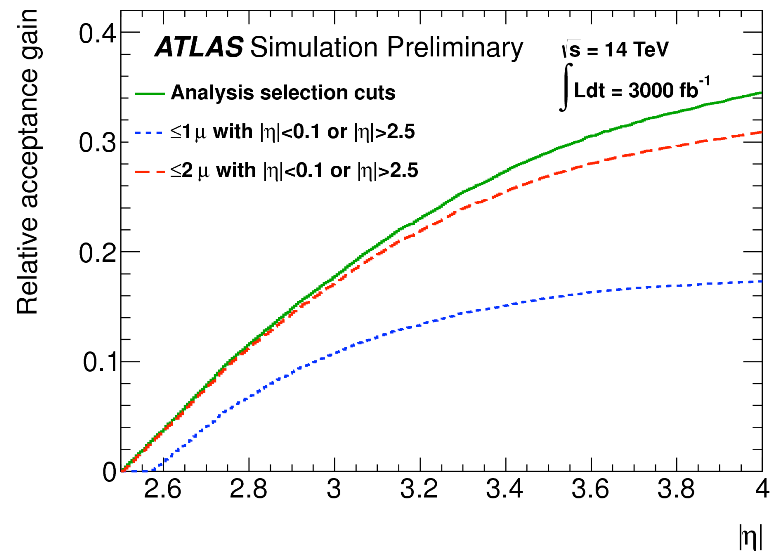
ITK + CB muons + warm toroid



S. Rosati
M. Wielers

Extending Muon Coverage



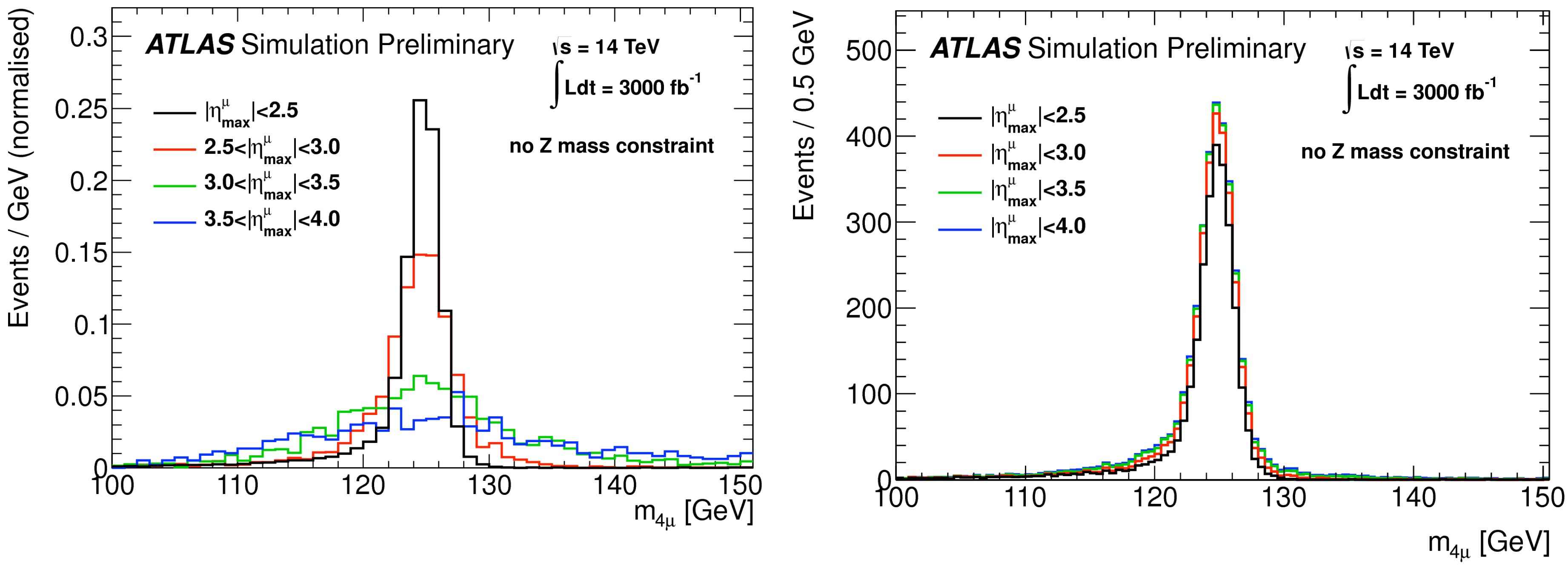


Muon reco eff.: 100%
p_T > 20, 15, 10, 6 GeV
≤1 mu |η|>2.5 in m_{12}
50 < m_{12} < 106 GeV
12 < m_{34} < 115 GeV
ΔR > 0.1

Acceptance as a function of the rapidity coverage in which the muons from H → 4 μ events are contained. The acceptance is also shown separately for the categories in which at most one (blue) or two (red) of the muons are either segment-tagged or in the very forward region. In these regions the background rejection is reduced, or for |η|>2.5, where the momentum resolution is also worse. This figure has been made with the best resolution option for the very forward muons, assuming a 7 μm point resolution in |η| >2.5 (compared to 14μm in |η|<2.5), and the presence of a warm toroid, which is located at a smaller radius than the endcap toroid. Depending on the η and p_T of the muon from the Higgs decay the momentum resolution varies between 15 and 40% in |η|>3.3.

S. Rosati
M. Wielers

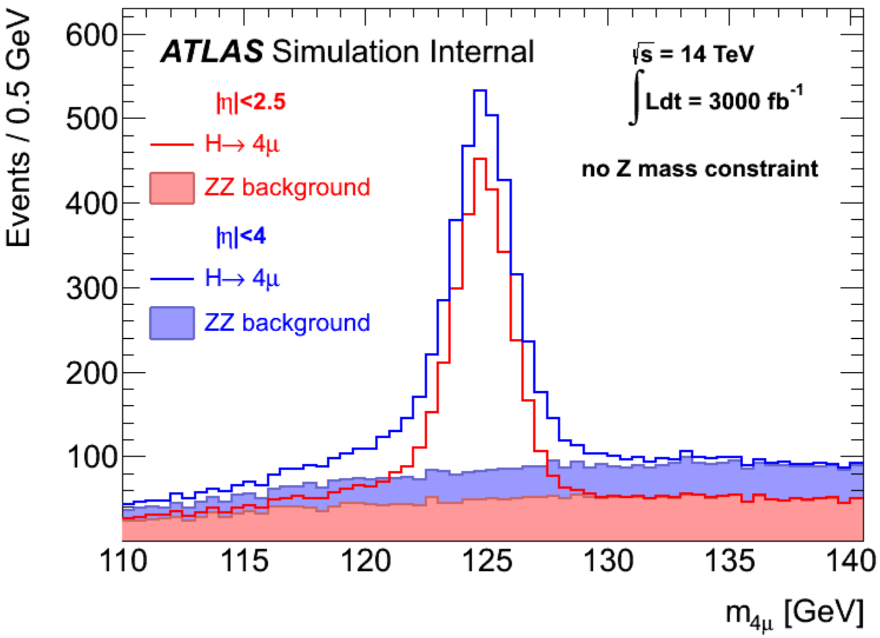
Extending Muon Coverage

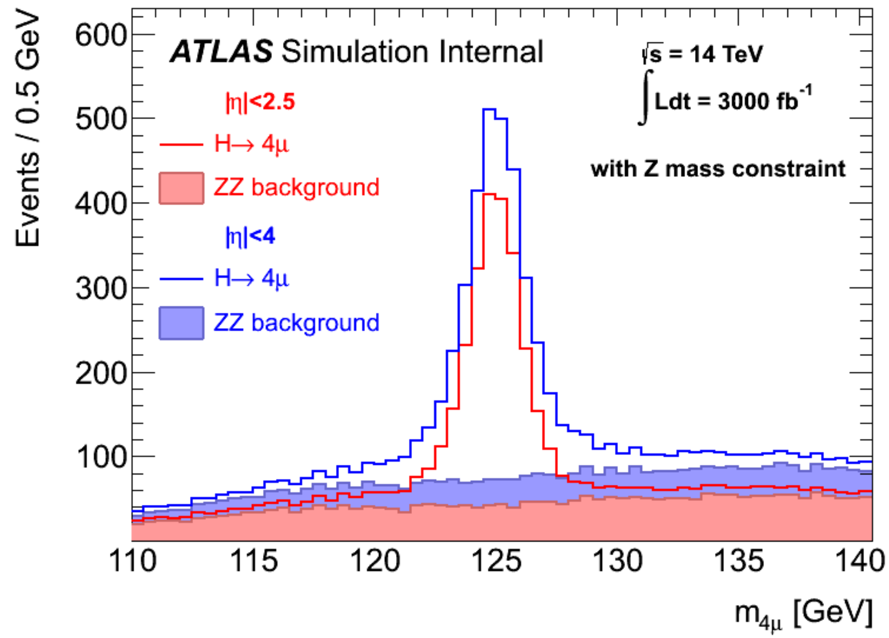


The mass resolution for the H → 4 μ mass, displayed in bins of the lepton with the largest η value. Each of the distributions is normalised to unity. The black curve corresponds approximately to the present Run 1 analysis (the ITK has better momentum resolution than the current Run 1 tracking detector) but without a Z mass constraint applied. The reduced resolution for larger lepton η values is evident. This figure has been made with the best resolution option for the very forward muons, assuming a 7 μm point resolution in |η|>2.5 (compared to 14μm in |η|<2.5) and the presence of a warm toroid. Depending on the η and p_T of the muon from the Higgs decay the momentum resolution varies between 15 and 40% in |η|>3.3.

S. Rosati
M. Wielers

Extending Muon Coverage





Width of Higgs peak [GeV] for H→4μ				
mass constraint:	$\lvert\eta_{max}\rvert<2.5$	$2.5<\lvert\eta_{max}\rvert<3.0$	$3.0<\lvert\eta_{max}\rvert<3.5$	$3.5<\lvert\eta_{max}\rvert<4.0$
No constraint	1.23±0.01	2.13±0.06	5.53±0.24	10.40±0.65
Z mass constraint	1.11±0.01	1.75±0.05	2.57±0.09	3.74±0.22

Large Eta Task Force schedule

Considering: ITK extension beyond |η| of 2.7, modified FCAL, increased muon coverage, possibly with warm toroid magnets in the JD shielding region

milestones from Kevin and Ana (9.1.2015):

- **January 23rd** - detailed outline from section editors
- **February 20th** complete draft with prelim numbers
- **March 6th** almost final draft for discussion
- **March 20th** final TF meeting to approve the document → distribution
- **March 26th** final draft discussion at Upgrade Simulation Committee for approval

P. Wells, A. Canepa
January P&P Week

Scoping document

- ATLAS is asked to produce a "Scoping document" to update the Phase II LoI with latest plans and costs, showing options and the impact on physics of each choice. https://indico.cern.ch/event/286490/contribution/0/material/slides/1.pdf
  - **Three layouts costing ~200, 235 and 275 MCHF**
- Schedule: https://indico.cern.ch/event/286502/contribution/3/material/0/0.pdf
  - **Jan/Feb** – define three overall layouts (possibly refine these later with LETF conclusions and interim report from the ILTF – Inner Layout TF)
  - **end April** – First draft in circulation
  - **2-4 June** – First draft to LHCC
  - **1 Aug** – Final draft to ATLAS
  - **22-24 Sep** Final document discussed by LHCC
  - **26-28 Oct** Final presentation to RRB
- *Upgrade Physics group must coordinate the associated performance studies of the three layouts, and the impact on physics results*
  - Very tight, especially in view of difficulties making MC samples

P. Wells, A. Canepa
January P&P Week

Scoping document

- ATLAS is asked to produce a "Scoping document" to update the Phase II LoI with latest plans and costs, showing options and the impact on physics of each choice. https://indico.cern.ch/event/286490/contribution/0/material/slides/1.pdf
  - **Three layouts costing ~200, 235 and 275 MCHF**
- Schedule: https://indico.cern.ch/event/286502/contribution/3/material/0/0.pdf

The layout used in European Strategy and ECFA studies (including its large-η extension, that most likely will be approved by the Collaboration) corresponds somehow to the "275 MCHF" scenario.

LETF and ILTF

- **Large Eta Task Force** (Ana Henriques, Kevin Einsweiler)
  - Established last year to examine the case for upgrades in the forward region for the HL-LHC
  - Considering: ITK extension beyond $|\eta|$ of 2.7, modified FCAL, increased muon coverage, possibly with warm toroid magnets in the JD shielding region
  - Recommendations due for March 2015. Internal document
- **ITK Layout Task Force** (**Claudia Gemme**, Andi Salzburger)
  - Planned since September 2014, to define the layout by the end of 2015 for the Technical Design Reports: Strip TDR end 2016, Pixel TDR end 2017.
  - Linked to a costing exercise which was also planned for the ITK in 2015, but which has now been extended to the whole of the Phase II upgrade (see next slide)
  - ILTF will also produce an interim set of three broadly defined layouts by Feb/March 2015 for the new costing exercise.

Important to Note

- The work of the ITk costing group is ongoing. Some issues have been identified and will be resolved in coming weeks (2 day face-to-face meeting on Feb 2nd and 3rd). We will have a more complete picture and probable new costing ahead of the Feb 26th USC meeting.
- The aim is to also provide input to the Layout Task force and a costing profile.
- It is important for us (and CMS) that we do a cross check of the tracker costing before freezing on the 26th Feb as it might be very hard to reconcile any differences after the effect.

P. Wells, A. Canepa
January P&P Week

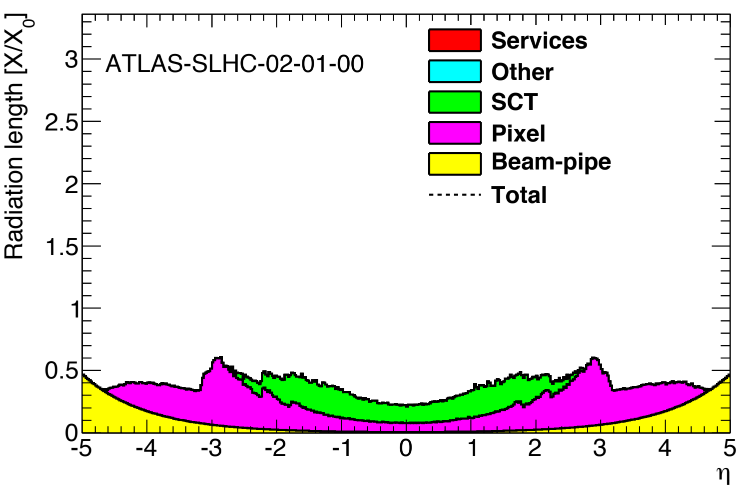
Additional considerations

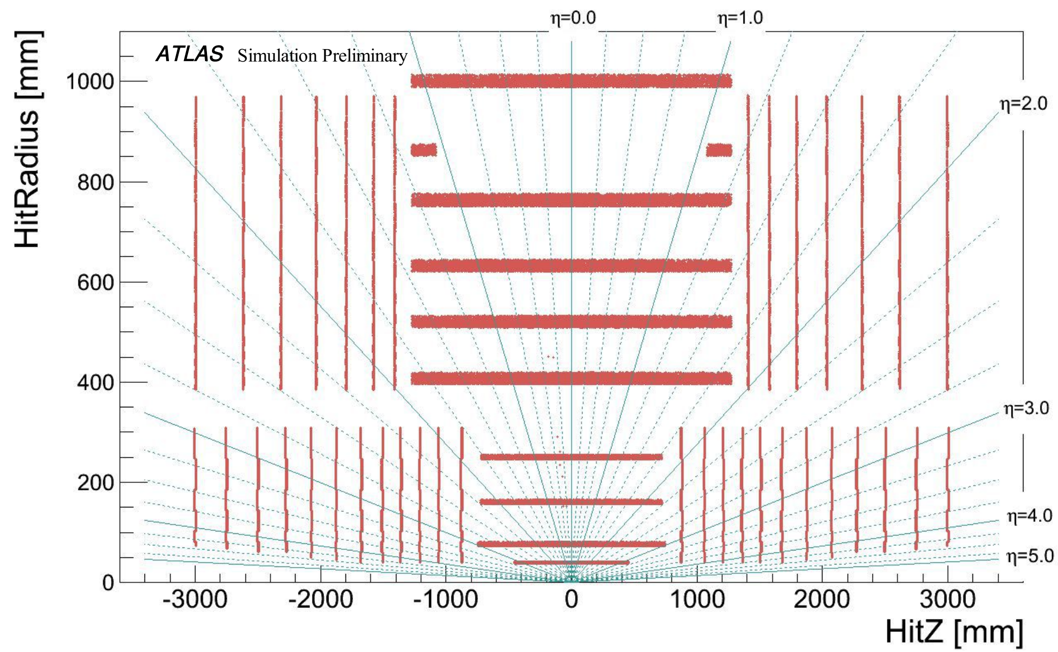
- Phase I – some high priority items
  - NSW integration to allow studies for NSW Trigger Processor
  - Phase I L1 Calo becames Phase II L0 Calo. Requires super-cell implementation. (For scoping doc and for TDAQ IDR in Q1 2016)
- **Phase II physics and performance studies**
  - Performance studies are performed where possible using full simulation, combined with some informed guesses of how performance would evolve with pileup
  - Parametrised as “smearing functions” to translate generator objects to reconstructed objects. Improved documentation under construction. https://twiki.cern.ch/twiki/bin/view/AtlasProtected/SmearingForUpgradePhysics
  - **Continue to use this approach to support the Large Eta TF, ITK Layout TF and Scoping Document with available layouts**
  - ➔ **Inlcude also BIL/BIS RPC!!**
  - When a Phase I layout has been validated, integrate the ITK (and maybe other Phase II detectors) with the Phase I “rest of ATLAS”

P. Wells, A. Canepa
January P&P Week

LoI-VF layout in release 17

- All services are switched off to make space for tracker extension
  - caution using this layout for |η|<2.5 because of missing material
- Extra pixel disks added to cover to |η|<4.0
  - For scoping document, use this for perf. between 2.5 and 4.0
  - Ignore tracks between 3.2 and 4.0 for the options with reduced coverage

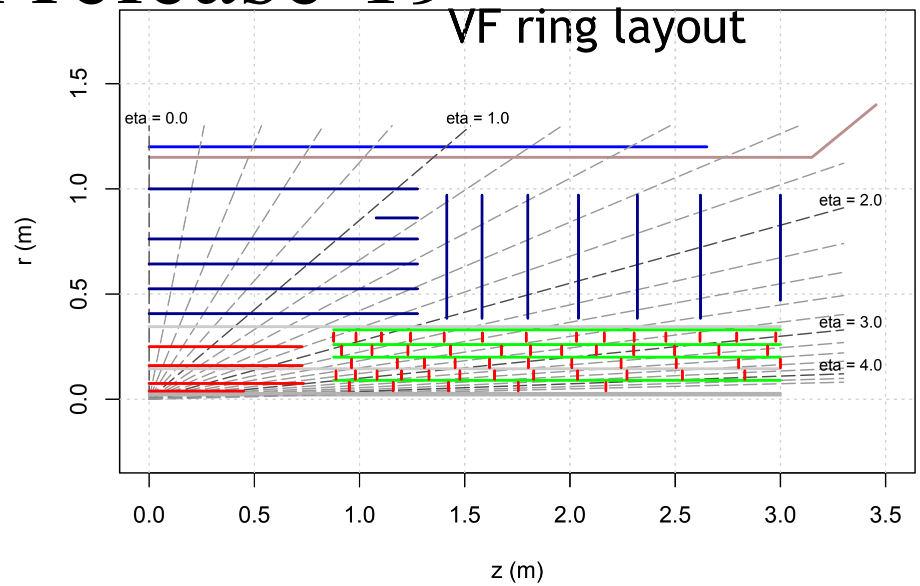




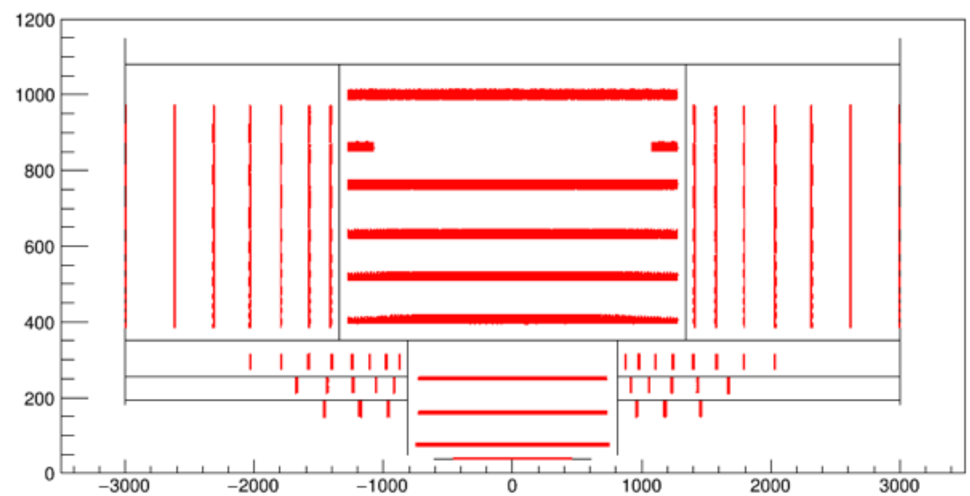
P. Wells, A. Canepa
January P&P Week

Studies in release 19

- More realistic pixel ring layouts should be available.
  - Hope to validate forward tracking in these layouts in time for the scoping document
  - Will also be able to make alternative strip layouts more easily using new tools in FATRAS (Fast Tarcking simulation) (Essential for the detailed work c the layout task force)



Fatras hits in a Ring Layout



Evaluating performance for scoping document

- Performance studies for baseline LoI layout and LoI-VF layout are based on rel17 as is the case for the LETF
- When release 19/20 is ready (19 for sim, 20 for digi+reco)
  - First studies with the new VF ring layout
  - FATRAS will allow different geometries to be defined more easily, and a fast simulation of the tracker to run
  - → new smearing functions based on full/fast simulation
  - Note that release 19/20 studies have to move to xAOD
- If release 19/20 samples are not available
  - Modify the smearing functions based on release 17 with our best knowledge of the alternative layouts. Explore the impact of eg. degraded resolution
  - In any case, not all aspects of the Phase II detector configurations will have been implemented in full simulation
- So in all cases, the demonstration of the physics case will be largely based on smearing functions for the scoping document
  - Release 19/20 studies will then continue eg. for ITK Layout TF

Example: Higgs Physics Programme

1. Measurement of couplings to elementary fermions and bosons
2. Precision measurement of the mass and width of this new particle
3. Determination of the quantum numbers: spin and CP properties
4. Measurement of the self-coupling (di-Higgs boson production)
5. Search for possible partners (neutral and/or charged) of this boson
6. Fundamental/composite particle
7. Strongly associate to this: Vector Boson Scattering

Physics Analyses: Higgs Prospects

TOPIC	Large Eta Task Force	Scoping Document	Benchmark in full simulation	Groups/People
VBF H→ZZ→4l	**YES**	**YES**	**-**	**See group A**
VBF H→ττ	**YES**	**YES**	**-**	**Alex Tuna**
H→μμ (+VBF?)	**possibly**	**YES**	**YES**	**Paris VI**
HH→bbbb (+VBF)	possibly	YES	YES	UCL
VBF H→γγ	YES	YES	-	**See group B**
HH→bbγγ	possibly	YES	-	**See group C**
H→ZZ→4l res. studies	YES	YES	-	S.Rosati + M.Wielers

A
1. Carleton University
2. New York University
3. Hong Kong University of Science and Technology

B
1. Huijun Zhang
2. Jin Wang

C
1. Wei Ming Yao
2. Marc Escalier
3. Nick Styles ?
4. Magdalena Slawinska + Wouter van den Wollenberg ?

Higgs Prospects PUB Notes in 2014

1. HH→$bb\gamma\gamma$	ATL-PHYS-PUB-2014-019
2. SM H couplings interpretation	ATL-PHYS-PUB-2014-016
3. BSM H couplings interpretation	ATL-PHYS-PUB-2014-017
4. VBF H→$\tau\tau$	ATL-PHYS-PUB-2014-018
5. H→4l large η plots	PLOT-UPGRADE-2014-002
6. H→$Z\gamma$	ATL-PHYS-PUB-2014-006
7. ttH/ZH,H→$\gamma\gamma$	ATL-PHYS-PUB-2014-012
8. VH, H→bb	ATL-PHYS-PUB-2014-011

See details in

https://twiki.cern.ch/twiki/bin/view/AtlasProtected/HiggsProspects

Higgs Couplings

- New: VH->bb included in ATLAS, updates for H->Zγ, VH/ttH->$\gamma\gamma$ (*)
- No BSM Higgs decay modes assumed

–Comparable numbers for κ_W,κ_Z, κ_t, and κ_γ between the experiments

–Couplings can be determined with 2-10% precision at 3000 fb^{-1} for CMS Scenario 2

Coupling accuracy, %

		κ_γ	κ_W	κ_Z	κ_g	κ_b	κ_t	κ_τ	$\kappa_{Z\gamma}$	κ_μ
300fb^{-1}	ATLAS	[9,9]	[9,9]	[8,8]	[11,14]	[22,23]	[20,22]	[13,14]	[24,24]	[21,21]
300fb^{-1}	CMS	[5,7]	[4,6]	[4,6]	[6,8]	[10,13]	[14,15]	[6,8]	[41,41]	[23,23]
3000fb^{-1}	ATLAS	[4,5]	[4,5]	[4,4]	[5,9]	[10,12]	[8,11]	[9,10]	[14,14]	[7,8]
3000fb^{-1}	CMS	[2,5]	[2,5]	[2,4]	[3,5]	[4,7]	[7,10]	[2,5]	[10,12]	[8,8]

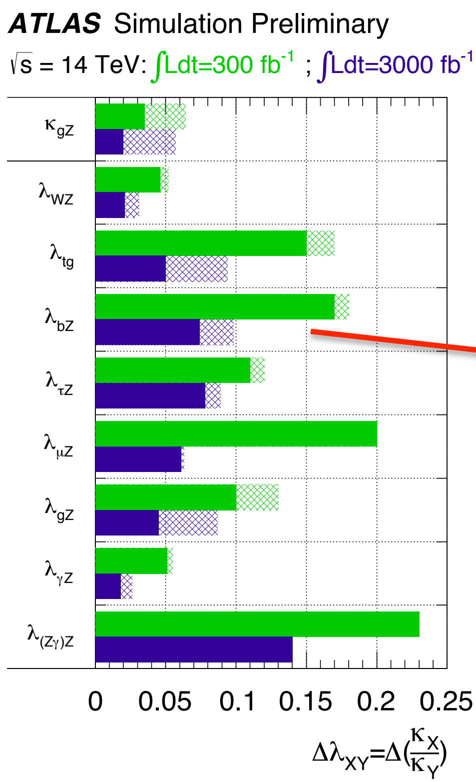
–ATLAS: [no theory uncert., full theory uncert.]

–CMS: [Scenario 2, Scenario1]

(*)
ATL-PHYS-PUB-2014-011
ATL-PHYS-PUB-2014-006
ATL-PHYS-PUB-2014-012
ATL-PHYS-PUB-2014-016

Higgs Couplings

- Remove the assumption on the total width
  - Only ratios of the coupling scale factors can be determined at LHC
  - Use given process as a reference



CMS[Scenario2,Scenario1]

L (fb^{-1})	$\kappa_g \cdot \kappa_Z / \kappa_H$	κ_γ / κ_Z	κ_W / κ_Z	κ_b / κ_Z	κ_τ / κ_Z	κ_Z / κ_g	κ_t / κ_g	κ_μ / κ_Z	$\kappa_{Z\gamma} / \kappa_Z$
300	[4,6]	[5,8]	[4,7]	[8,11]	[6,9]	[6,9]	[13,14]	[22,23]	[40,42]
3000	[2,5]	[2,5]	[2,3]	[3,5]	[2,4]	[3,5]	[6,8]	[7,8]	[12,12]

5.7	2.6	3.1	9.8	8.9	8.7	9.4	6.3	14

- 2-3% accuracy on few coupling constants at HL-LHC
  - Reduced theoretical uncertainties needed

Studies of VBF H→ττ

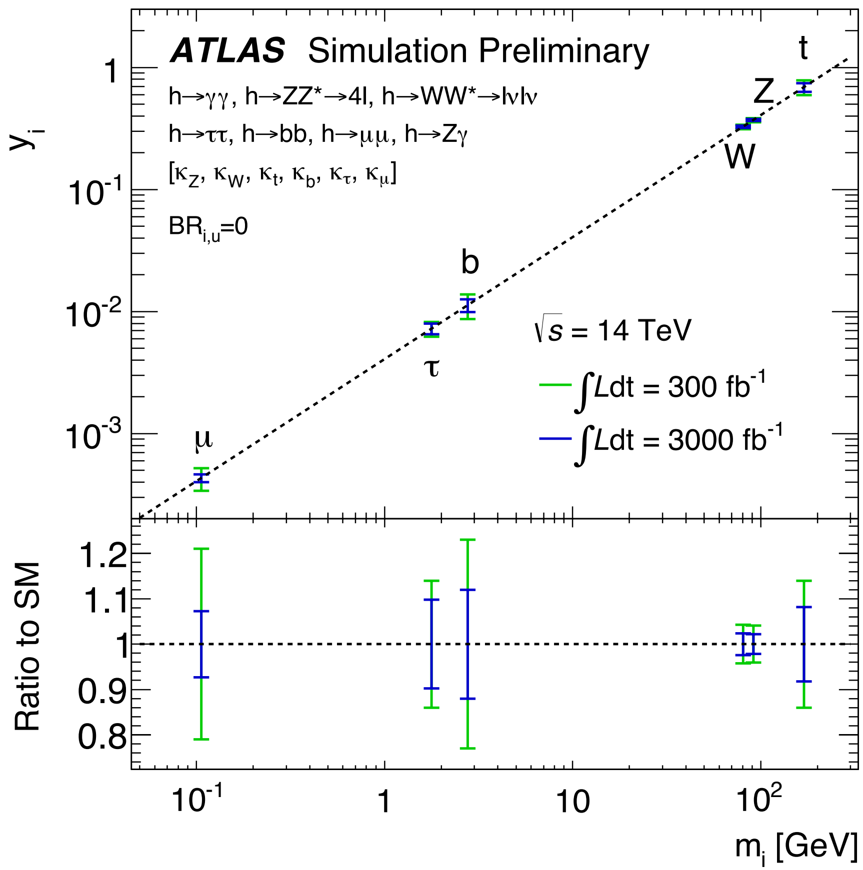
ATL-PHYS-PUB-2014-018

forward pile-up jet rejection	50%	75%	90%
forward tracker coverage	$\Delta\mu$		
Run-I tracking volume	0.24		
$\|\eta\| < 3.0$	0.18	0.15	0.14
$\|\eta\| < 3.5$	0.18	0.13	0.11
$\|\eta\| < 4.0$	0.16	0.12	0.08

Uncertainty on the signal strength (Δμ) for different scenarios of forward tracking. Negligible loss of HS jets to forward pile-up jet rejection is assumed. A 10% systematic uncertainty is assumed for backgrounds, a 5% experimental systematic uncertainty is assumed for signals, and theoretical uncertainties on signals are ignored.

Higgs Couplings

- Higgs boson couplings versus the SM particle masses
- Define 'reduced' coupling parameters

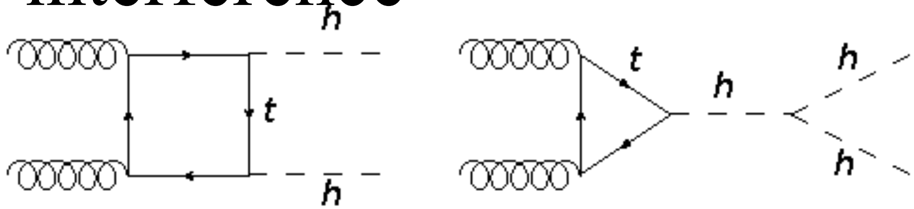


$$y_{V,i} = \sqrt{\kappa_{V,i}\frac{g_{V,i}}{2v}} = \sqrt{\kappa_{V,i}}\frac{m_{V,i}}{v}$$

$$y_{F,i} = \kappa_{F,i}\frac{g_{F,i}}{\sqrt{2}} = \kappa_{F,i}\frac{m_{F,i}}{v}$$

Di-Higgs production

- One of the exciting prospects of HL-LHC
  - Cross section at $\sqrt{s}$=14 TeV is 40.2 fb [NNLO]
  - Challenging measurement
    - New preliminary results from ATLAS and CMS
- Destructive interference



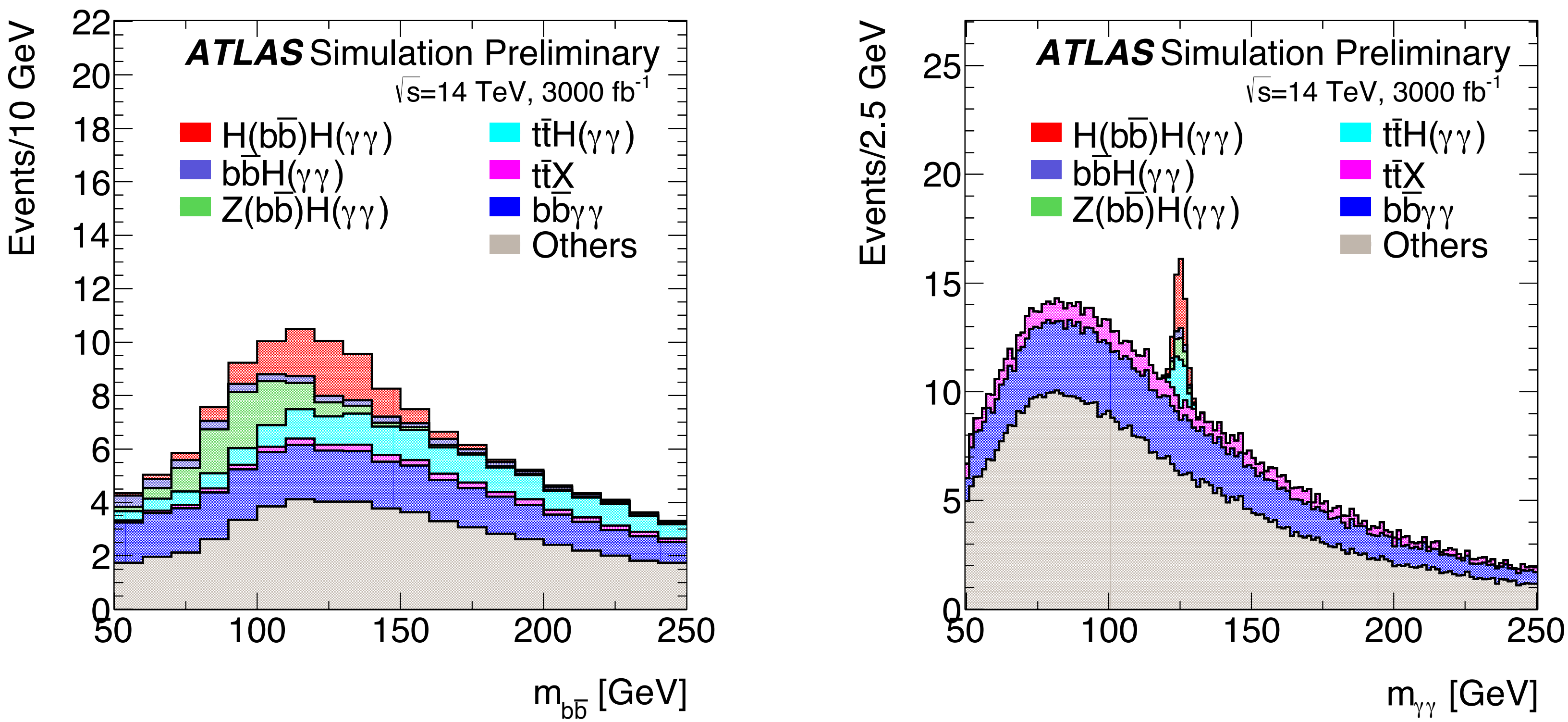
- Final states shown today
  - $bb\gamma\gamma$ [320 expected events at HL-LHC, 3000fb^{-1}]
    - But relatively clean signature
  - bbWW [30000 expected events at HL-LHC, 3000fb^{-1}]
    - But large backgrounds
- bbbb and $bb\tau\tau$ final states under consideration

Di-Higgs production

–Nominal performance for Phase II scenario and $3000 fb^{-1}$

- CMS:
  - Parameterized object performance tuned to CMS Phase II detector at <PU>=140
  - 2D fit of M_{bb} and $M_{\gamma\gamma}$ distributions
- ATLAS:
  - Parameterized object performance obtained from full simulation
  - Cut based analysis
  - Electron to photon misidentification probability of 2% (5%) in barrel (endcap) is assumed
  - ATL-PHYS-PUB-2014-019

Mass distribution



The distributions of m_{bb} / m_{bb} in 3000 fb^{-1} after applying all the selection criteria except for m_{bb}/ $m_{\gamma\gamma}$. The individual shaped of the contributions are obtained using the events surviving event selection before the mass criteria and angular cuts are applied, but normalized to the number of expected events after the full event selection. The *ttX* contribution includes *tt*(≥ 1 lepton) and *tt*γ, while 'Others' includes *cc*γγ, *bb*γ*j*, *bbjj* and *j j*γγ.

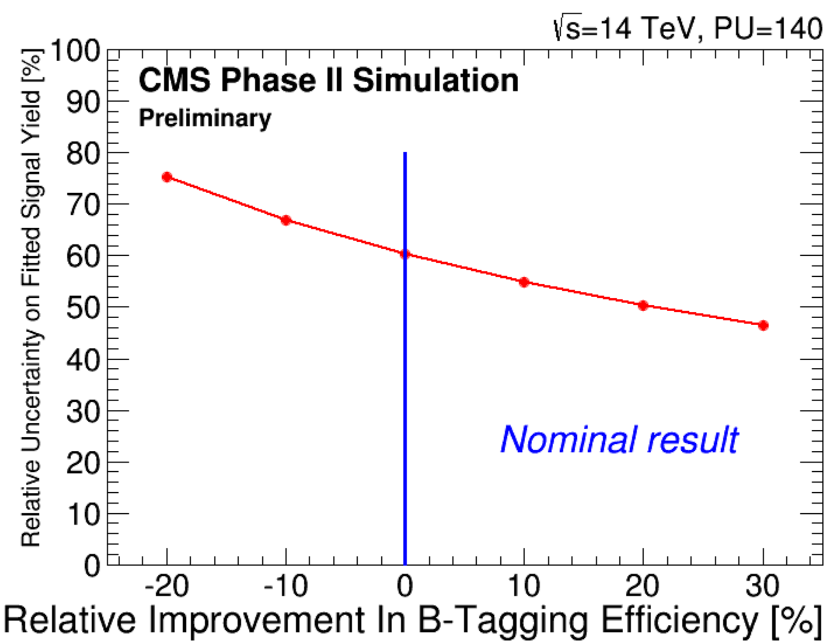
ATLAS prediction

process	Expected events in 3000 fb^{-1}
SM HH→bbγγ	8.4± 0.1
bbγγ	9.7 ± 1.5
ccγγ, bbγj, bbjj, jjγγ	24.1 ± 2.2
top background	3.4 ± 2.2
ttH(γγ)	6.1 ± 0.5
Z(bb)H(γγ)	2.7 ± 0.1
bbH(γγ)	1.2 ± 0.1
Total background	47.1 ± 3.5
S/√B (barrel+endcap)	1.2
S/√B (split barrel and endcap)	1.3

CMS results

Process / Selection Stage	HH	ZH	$t\bar{t}H$	$b\bar{b}H$	$\gamma\gamma$+jets	γ+jets	jets	$t\bar{t}$
Object Selection & Fit Mass Window	22.8	29.6	178	6.3	2891	1616	292	113
Kinematic Selection	14.6	14.6	3.3	2.0	128	96.9	20	20
Mass Windows	9.9	3.3	1.5	0.8	8.5	6.3	1.1	1.1

Table 3: The expected event yields of the signal and background processes for 3000 fb^{-1} of integrated luminosity are shown at various stages of the cut-based selection for the both photons in the barrel region. Mass window cuts are 120 GeV to 130 GeV for $M_{\gamma\gamma}$ and 105 GeV to 145 GeV for M_{bb}. A large fit mass window, 100 GeV to 150 GeV for $M_{\gamma\gamma}$ and 70 GeV to 200 GeV for M_{bb}, is used for the likelihood fit analysis. The statistical uncertainties on the yields are of the order of percent or smaller.



ATLAS and CMS are discussing the analyses to continue to better understand remaining differences and avenues for sensitivity improvement

Conclusions

- Upgrade physics strategy to provide results for Large Eta Task Force and Scoping Document continues to rely on truth-to-reco smearing functions
  - Concerted effort needed from CP groups to improve the existing smearing functions, and provide variables corresponding to the three layout choices
  - Particularly difficult to understand tracking in the Large Eta region
- Physics analyses based on generator level do not need the sophisticated study of systematic uncertainties of analyses with data
- ATLAS-Italia should/could improve contributions also to performance and physics studies, crucial to the finalization of the detector upgrade layout