Status of physics analysis of ATLAS Chinese Cluster

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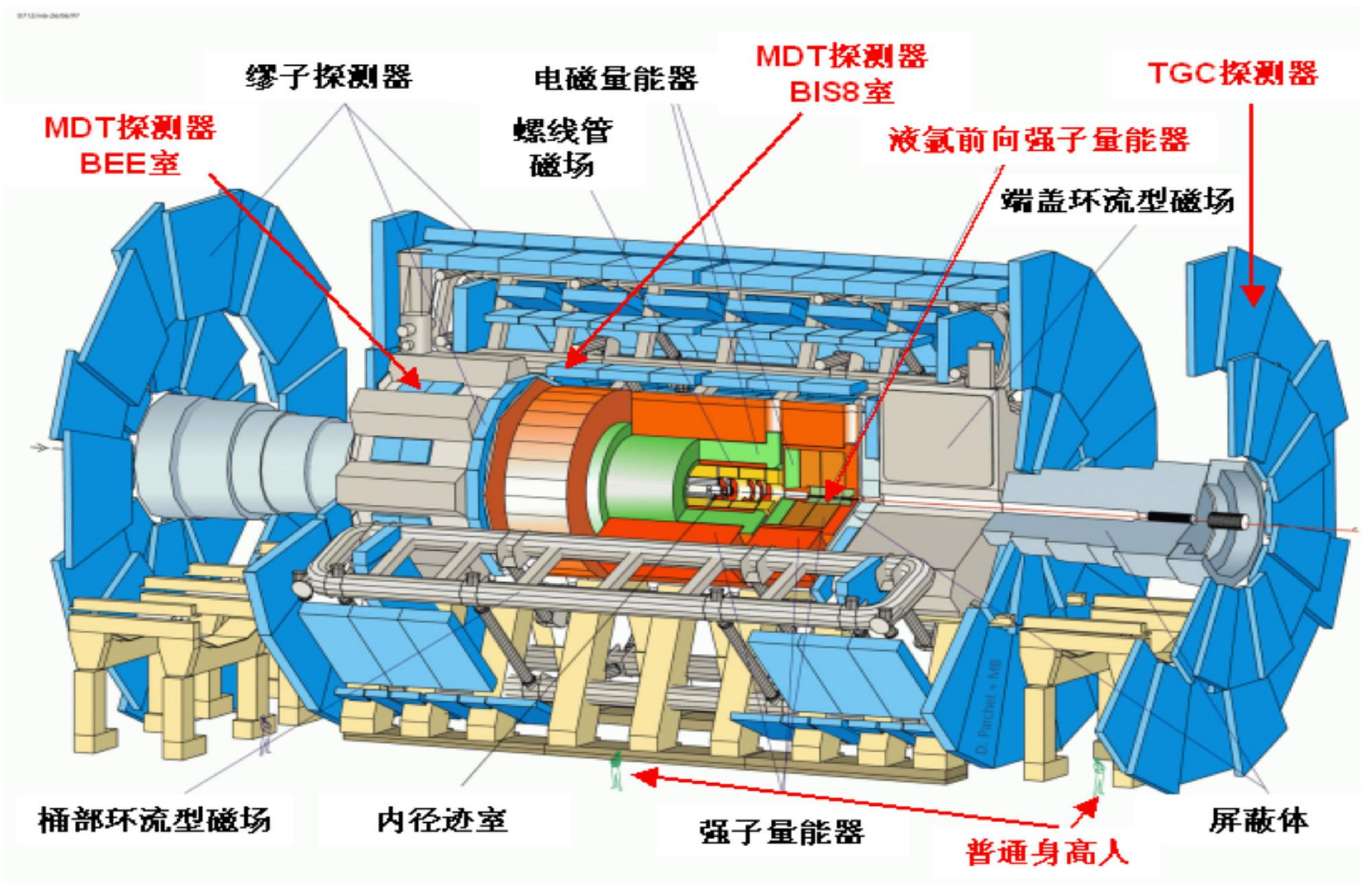
Preliminary Remarks

- As in previous TeV workshops, this talk is a progress report to the TeV Working Group, i.e., mainly to summarize the status and contributions of ATLAS Chinese Cluster activities since last TeV workshop, rather than to summarize the ATLAS physics results.

ATLAS Chinese Cluster (ACC)

- Formed by 5 institutions:
  - Institute of High Energy Physics (IHEP), Beijing
  - Nanjing University (NJU), Nanjing
  - Shandong University (SDU), Jinan
  - Shanghai Jiaotong University（SJTU）, Shanghai
  - University of Science and Technology of China (USTC), Hefei

- 19 staffs, ~25 students and postdocs.

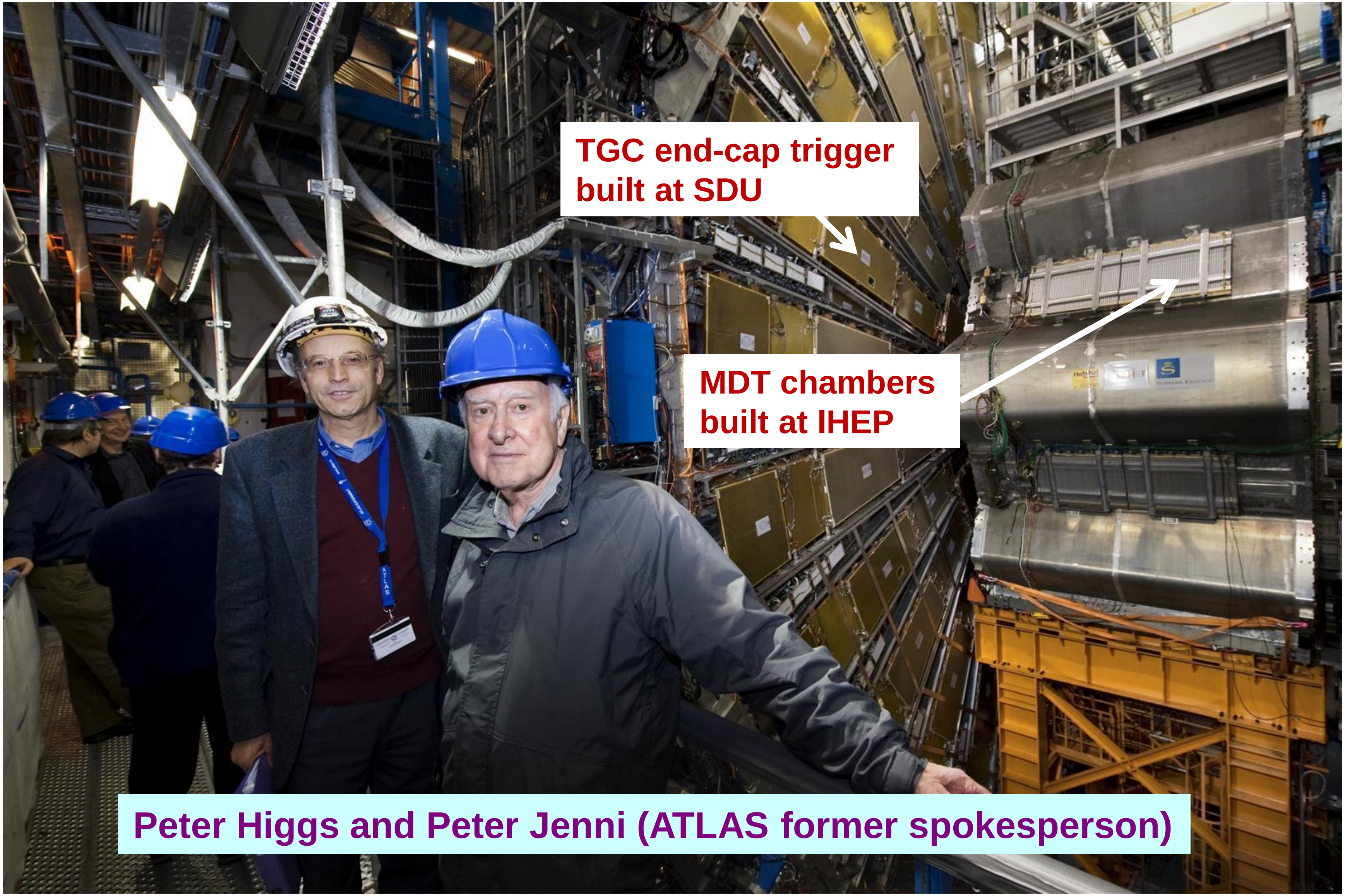


ATLAS 探测器总貌. 其中红字部分为中国组承担建造（占总经费~0.5%）

ACC's contributions to the ATLAS detector construction

- MDT (Monitor Drift Tubes) muon chambers by IHEP
- TGC (Thin Gas Chamber) trigger by SDU
- TGC electronics by USTC
- LAr (Liquid Argon) calorimeter by NJU

Chinese muon chambers installed in the ATLAS detector



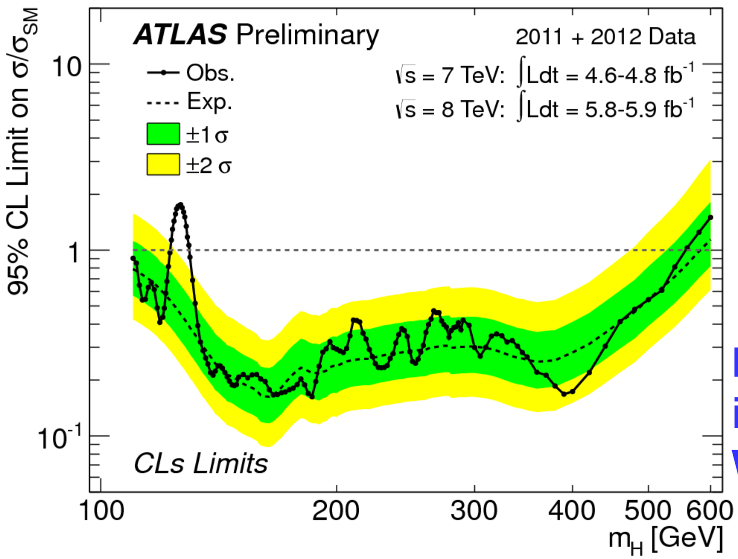
Peter Higgs and Peter Jenni (ATLAS former spokesperson)

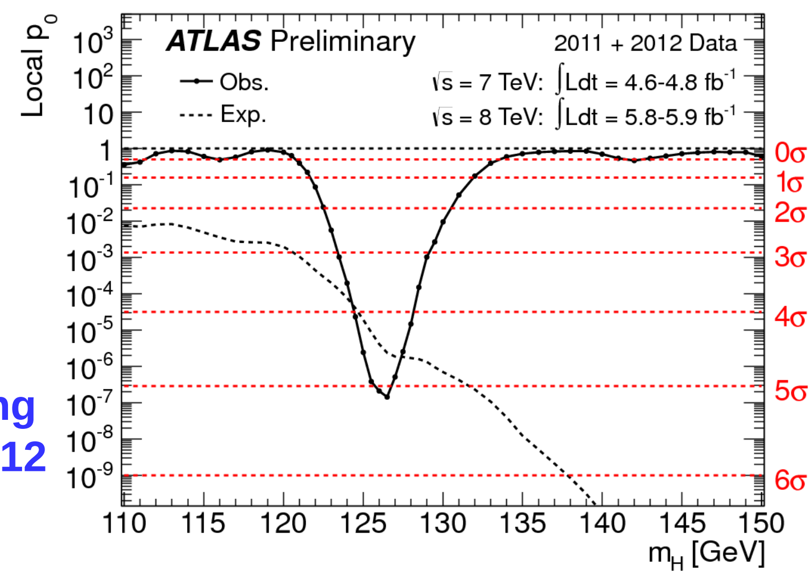
ACC activities in the ATLAS physics analysis

- Higgs boson searches (IHEP & USTC)
  - H → $\gamma\gamma$, WW, ZZ
- SUSY particle searches (IHEP & USTC)
  - Stau
  - Soft-lepton
  - R-parity violation eμ resonance search
- Top physics (SDU, IHEP & NJU)
  - Single top production
  - Top pair production
  - W polarization
- SM physics (USTC)
  - Di-boson production (→ Prof. HAN Liang's talk)

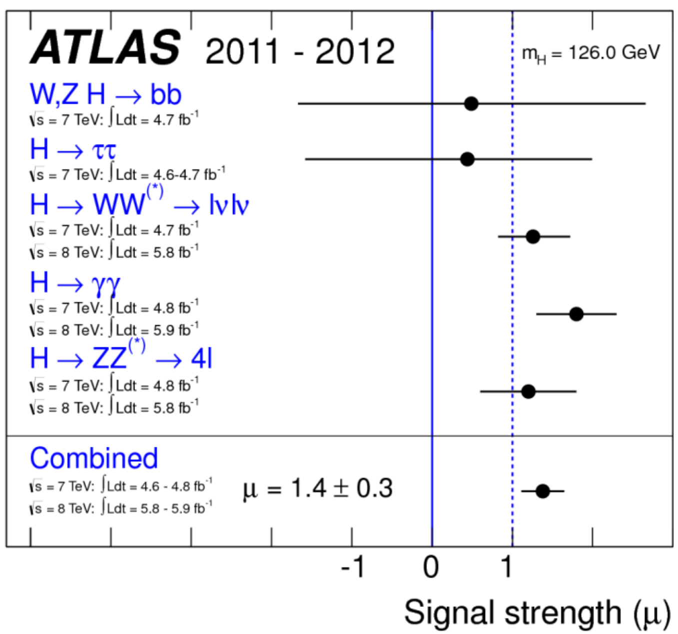
Higgs boson searches

Results on ATLAS Higgs search

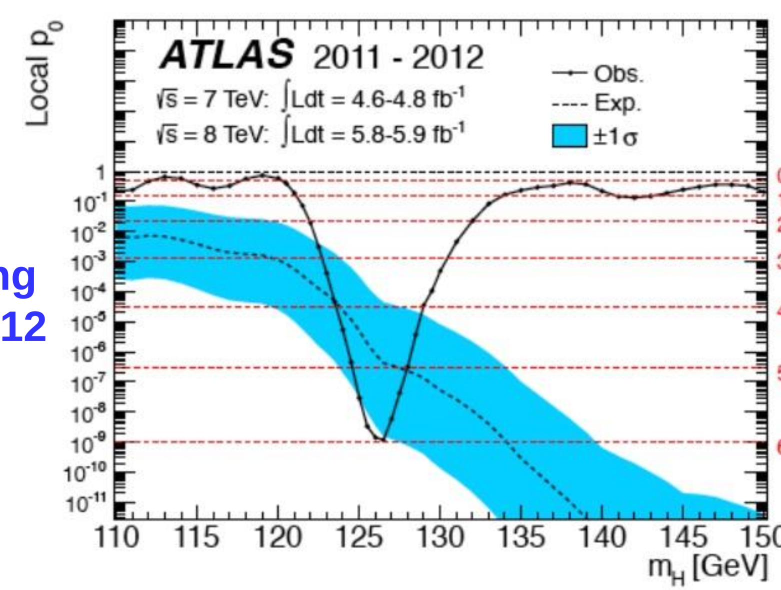




Not including WW 2012



including WW 2012



ACC involved in the ATLAS Higgs boson searches

- **Photon trigger efficiency and photon ID efficiency studies in $H \rightarrow \gamma\gamma$. (IHEP&USTC)**
- **2D photon isolation energy fit method to determine the signal number and different background compositions in $H \rightarrow \gamma\gamma$. (IHEP)**
- **$H \rightarrow ZZ \rightarrow 4l$ to study Z+jets background and to measure Higgs mass and spin-parity. (USTC)**
- **New method on data-driven top pair background study in $H \rightarrow WW$. (IHEP)**
- **Corrections on missing Et in $H \rightarrow WW$. (IHEP&USTC)**

Photon trigger efficiency

- **Trigger efficiency measurement:**

$$\varepsilon = \frac{tight\ selected\ reco\ \gamma\ matching\ with\ trigger\ object}{tight\ selected\ reco\ \gamma}$$

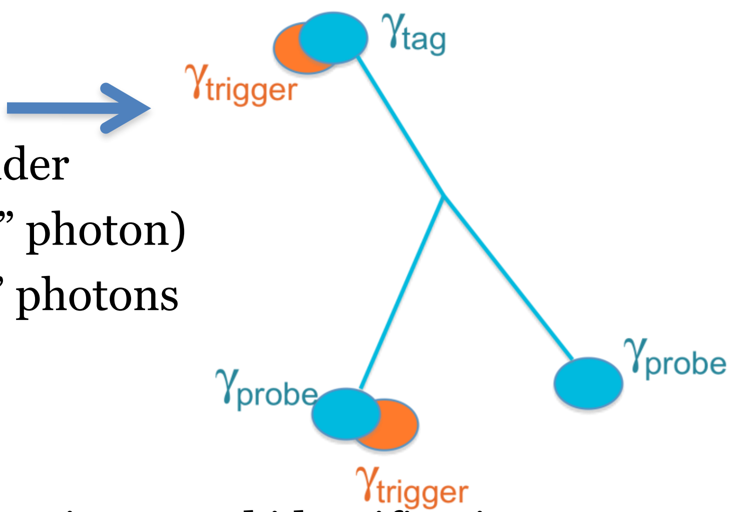
- **Importance:**
  - photon related cross section measurement.
  - Check if trigger selection introduces additional event loss after offline selection.
- **Difficulty: no pure photon sample with high statistics for early data.**
- **Possible solution:**
  - **photon sample:** $\varepsilon = \varepsilon_{true}P + \varepsilon_{fake}(1 - P) = \varepsilon_{true} - (\varepsilon_{true} - \varepsilon_{fake})(1 - P)$, **if** $\varepsilon_{true} \approx \varepsilon_{fake}$, **then** $\varepsilon \approx \varepsilon_{true}$
  - extrapolate from electron.
- **Study a single photon trigger** ($E_T > 20$ GeV + loose photon identification)
  - Important trigger for inclusive photon analysis and $H \rightarrow \gamma\gamma$ analysis.
  - Evaluate the efficiency based on 20pb^{-1} MC sample.
  - Measure with real data.

Three possible methods

➢ Bootstrap:

- select events with leading photon passing lower threshold trigger
- Measure the photon trigger efficiency with this photon

➢ "tag & probe" method



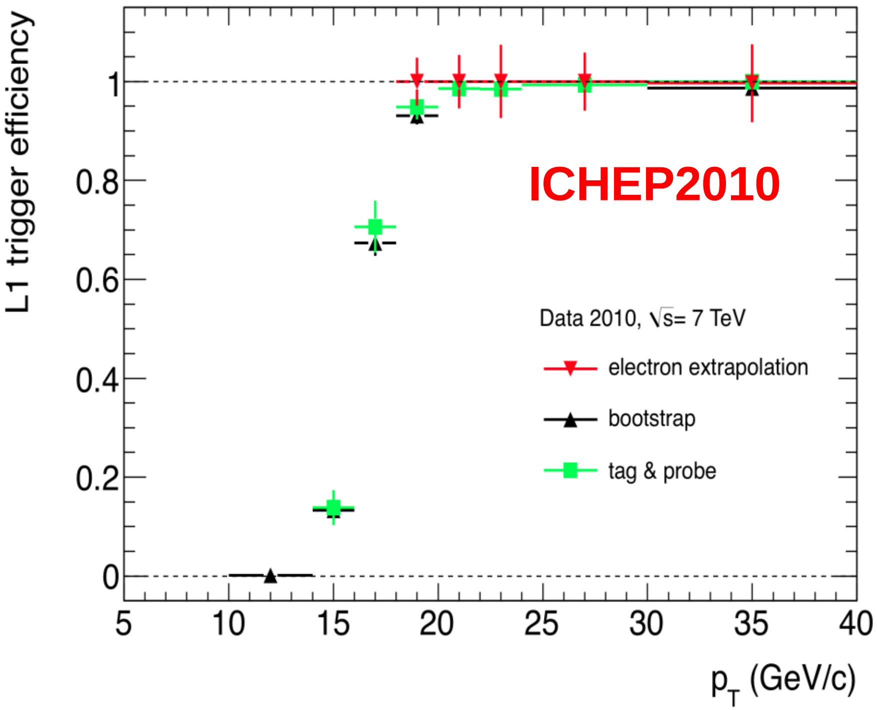
- Select di-photon events in single photon trigger under
- Match one photon with photon trigger object ("tag" photon)
- Measure the trigger efficiency on the other "probe" photons

➢ Electron to photon extrapolation

- Select pure electron sample from $Z \rightarrow ee$, with kinematic cut and identification selection on tag electron
- Check the photon trigger efficiency with the probe electron

Photon Trigger Efficiency with 2010 data

	N candidates
Tag&probe	3792 (L1), 3697 (L2), 3666 (EF)
bootstrap	23766
extrapolation	1162 (unconv) 1986 (conv)

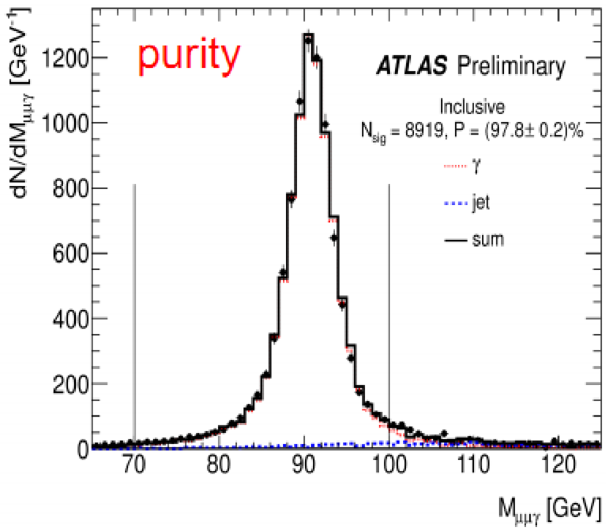


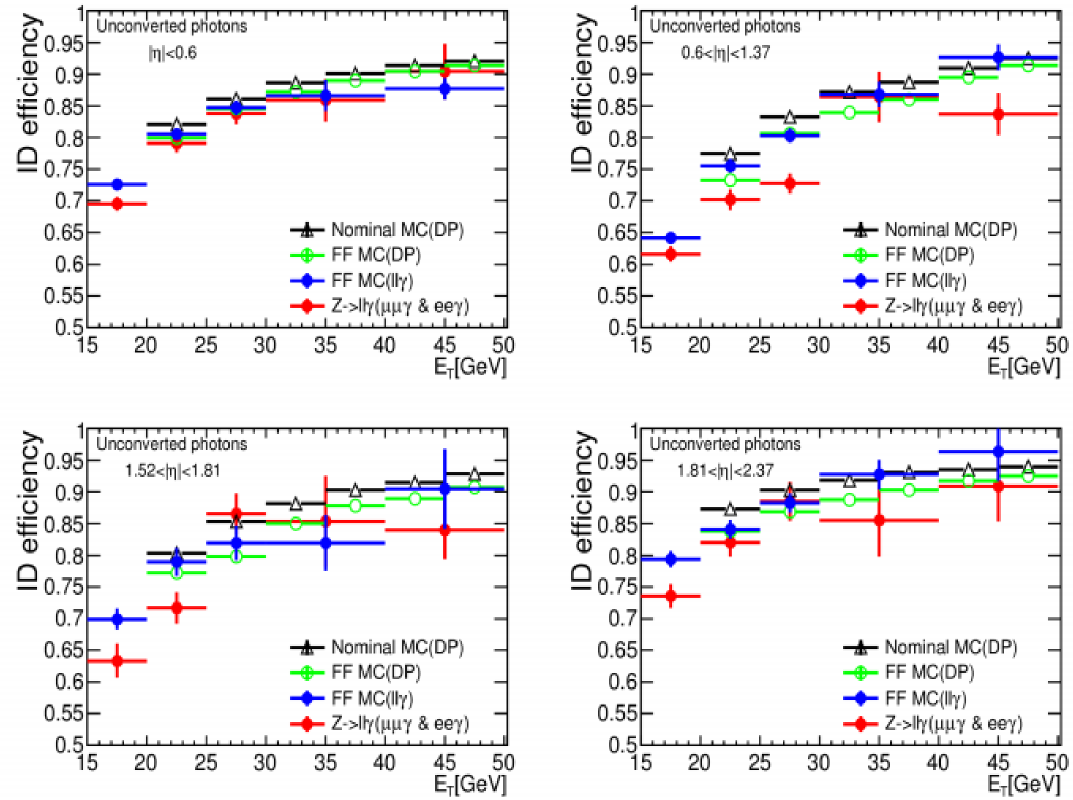
Results from tag&probe and bootstrap are in agreement, expected from MC study.

Low statistics obtained from electron extrapolation method, hard to conclude.

Photon ID efficiency measurement

- With radiative Z decays : select pure photon sample in radiative Z decays:

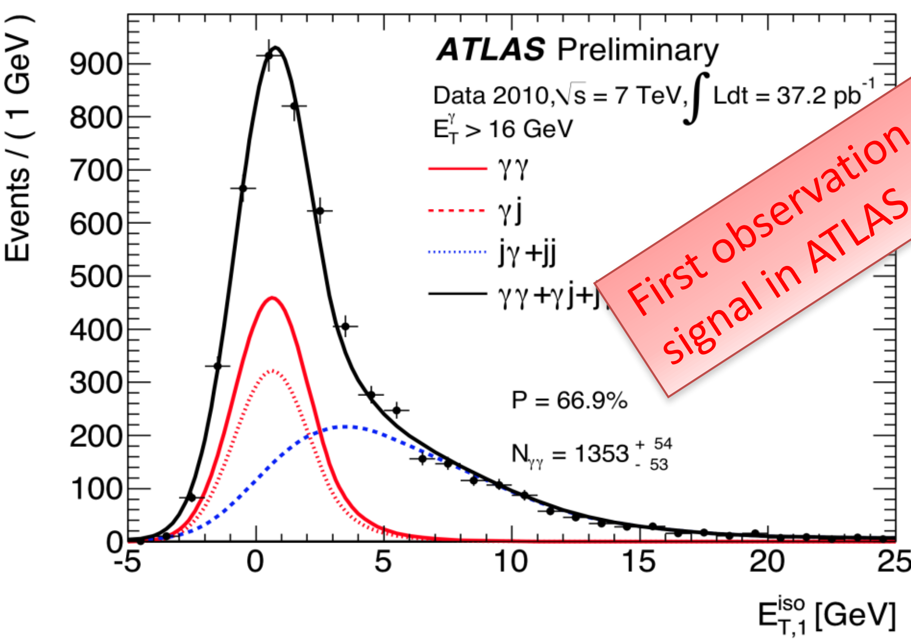


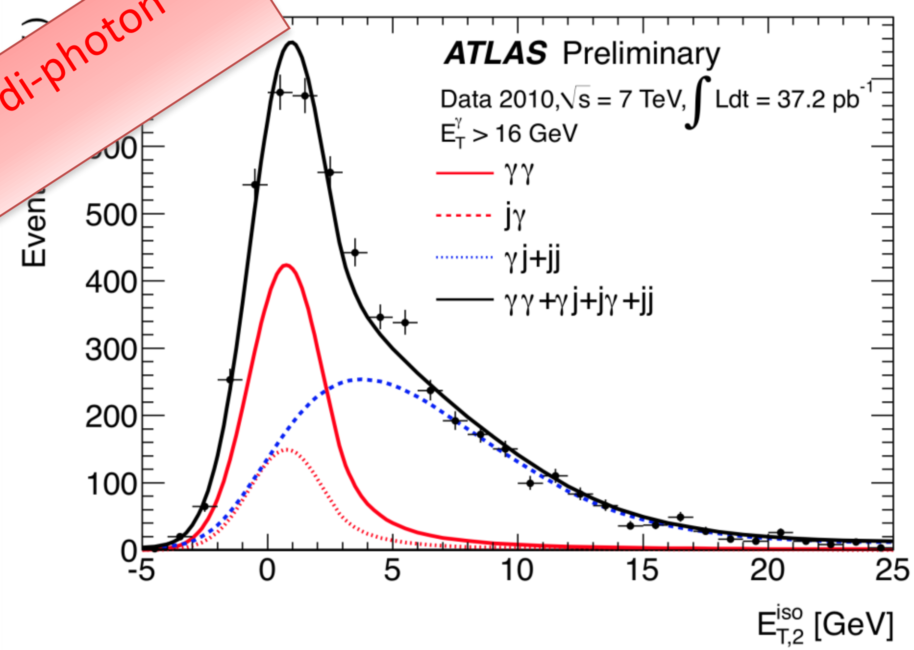


- Matrix method : shown a preliminary results in Egamma (https://indico.cern.ch/conferenceDisplay.py?confId=200320) but we are looking for people working on that currently.

2D-fit method to study γγ process

category	Isolated yields: $E_T^{iso} < 3$ GeV
$N_{\gamma\gamma}$	1353±53
$N_{\gamma j}$	348±19
$N_{j\gamma}$	168±14
N_{jj}	174±7

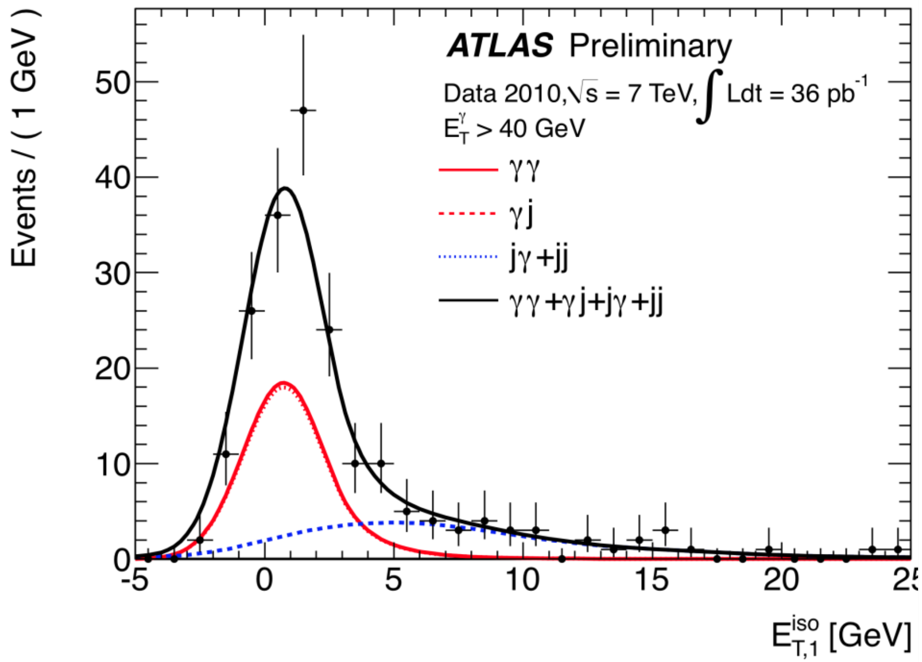


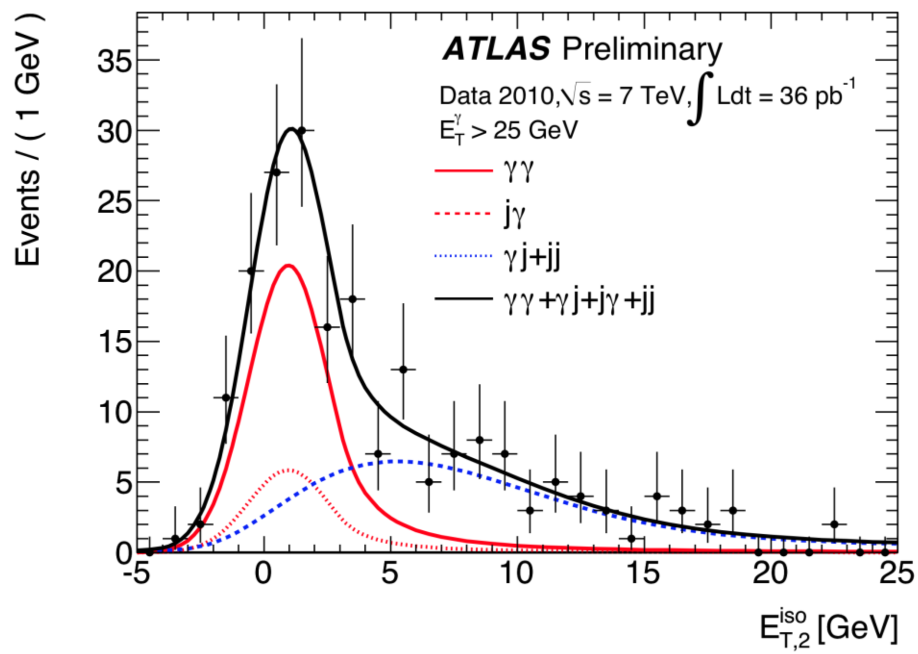


First observation of di-photon signal in ATLAS.

2D-fit method was used in the H→γγ background decomposition

After H→γγ event selection：





New method on data-driven top background estimation in H→WW

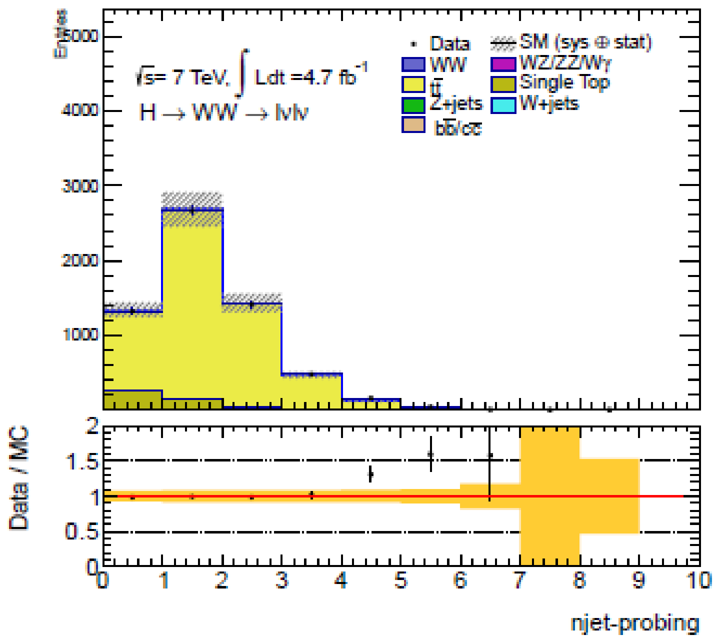
- Consider all jets reconstructed with the nominal jet selection in each event with at least one tagged b-jet,
- For events with more than one tagged b-jets, select the b-jet which has the largest b-tagged weight,
- Any remaining jet is counted as a probe jet if it has a ΔR with the b-tagged jet greater than 1.

Final top number in 0 jet bin:

$$
\begin{aligned}
N^{\mathrm{Exp}}_{\mathrm{Top}}(\ell\ell + E^{\mathrm{miss}}_{\mathrm{T}}, 0j) &\approx N^{\mathrm{Exp}}_{\mathrm{Top}}(\ell\ell + E^{\mathrm{miss}}_{\mathrm{T}}) \times P^{\mathrm{Exp}}_{2} \\
&\approx N^{\mathrm{Exp}}_{\mathrm{Top}}(\ell\ell + E^{\mathrm{miss}}_{\mathrm{T}}) \boxed{\left(P^{\mathrm{Btag,Exp}}_{1}\right)}^{2} \boxed{\frac{P_2}{\boxed{\left(P^{\mathrm{Btag}}_{1}\right)^{2}}}}
\end{aligned}
$$

Correction on P2_MC

Systematic cancellation



P1_btag=0jet/all

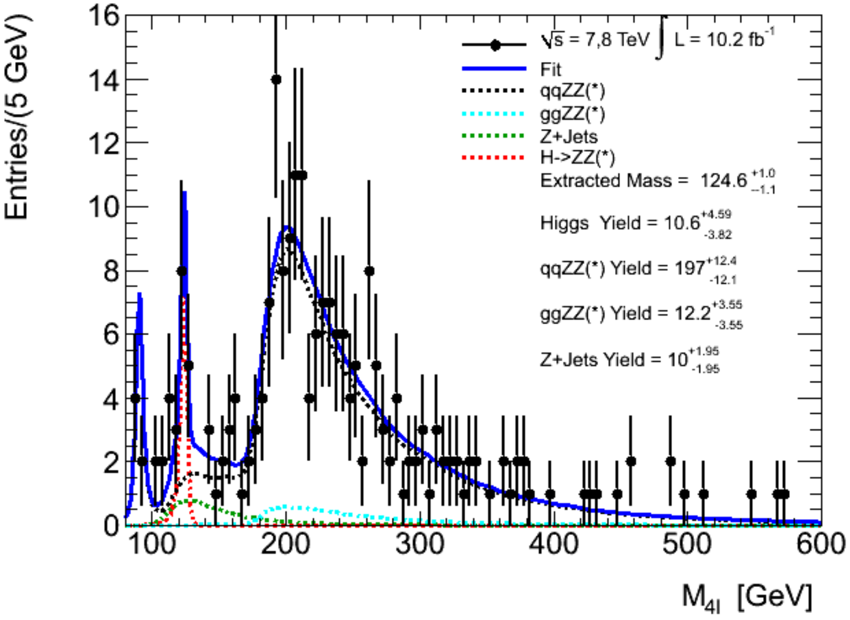
B.Mellado, X. Ruan, Z. Zhang, PRD.84 (2011) 096005

H->ZZ->4l mass measurement (I)

Unbinned likelihood fit based on "Eur.Phys.J. C71(2011) 1746"

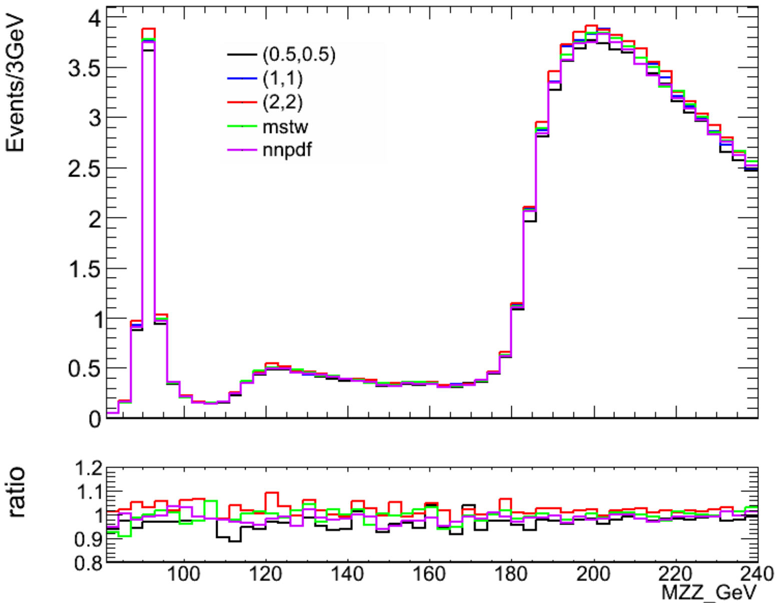
Input shapes:
- **ZZ*: from MC,**
- **Z+X: MC, only use Z->bb**
- **Higgs: MC, mH=120,125,130 GeV**
- **Data: 7 and 8 TeV combined**

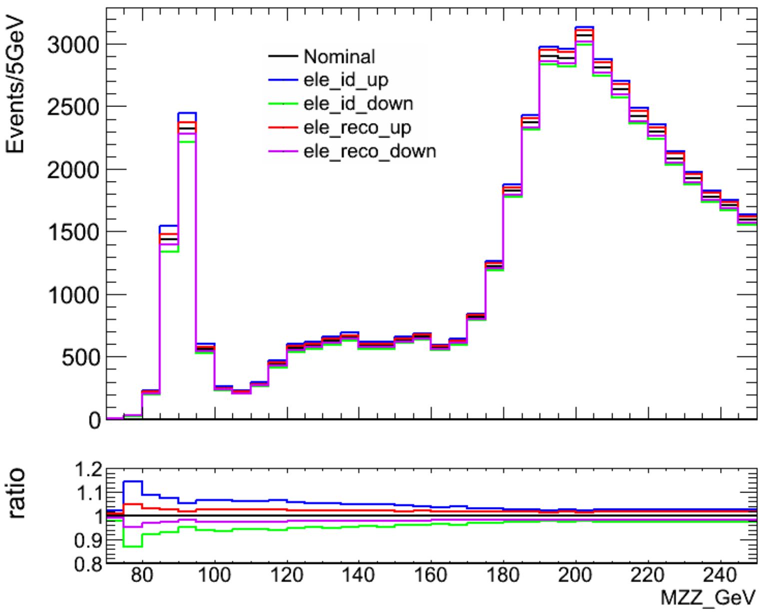
USTC contribution: ZZ* uncertainties(theoretical and experimental)



H->ZZ->4l mass measurement (II)

PowHeg MC with different scales and PDFs to study theoretical uncertainties of ZZ* spectrum
Vary ± 1σ in resolution, scale, trigger and reconstruction identifications to study experimental uncertainties of ZZ* spectrum

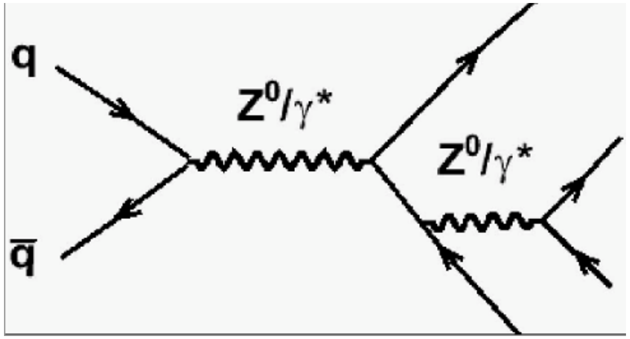




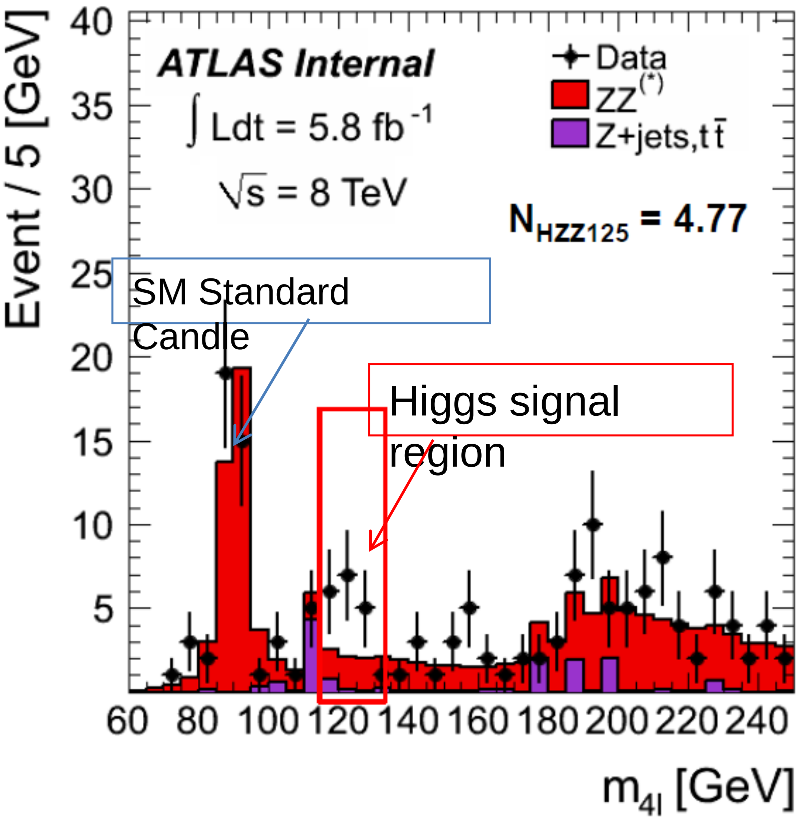
theoretical uncertainty:
due to different pdfs and scales
green: mstw with (muR, muF) = (1, 1)
violet: nnpdf with (muR, muF) = (1, 1)
black, blue and red: ct10 with (muR, muF) = (0.5, 0.5), (1, 1) and (2, 2)

experimental uncertainty:
mainly from electron id/reco scale factor
black: nominal set
blue/green: electron identification scale factor +/- 1σ
red/violet: electron reconstruction scale factor +/- 1σ

Z→ 4l Cross-section Measurement (I)



Compared to Standard Higgs selection, single resonance selection is enhanced by relaxing cuts on m12, m34 and lepton pT, cross-section measured within Z mass window of 76-106 GeV,



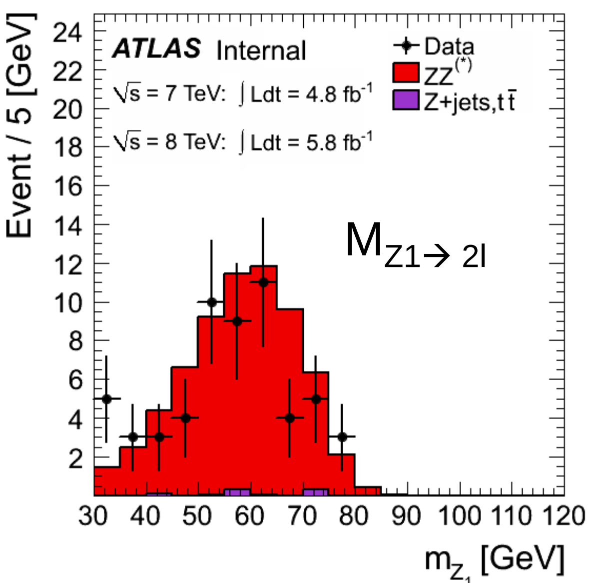
USTC contribution: systematics(theoretical and experimental)

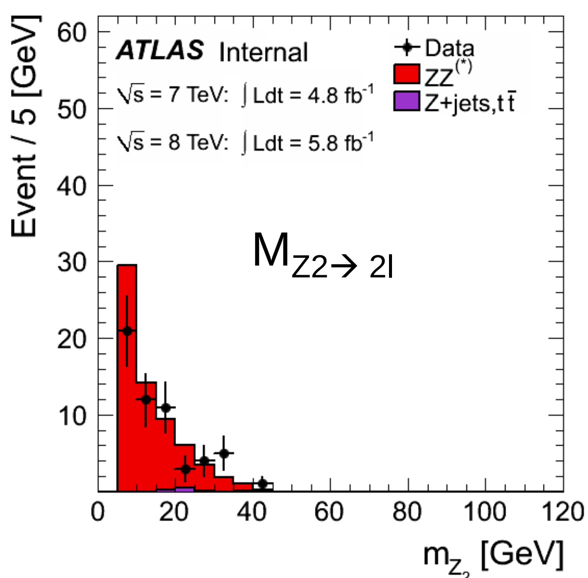
Z→ 4l Cross-section Measurement (II)

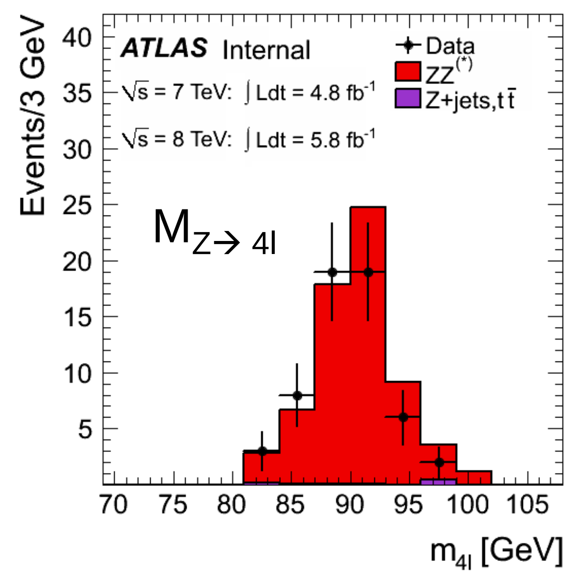
	Z Total Cross Section [pb]	Branching Ratio
7 TeV	27659.17	4.47×10^{-6}
8 TeV	33229.54	4.76×10^{-6}

57 single resonance Z→ 4l events observed in 2011 (4.8 fb^{-1}) and 2012 (5.8 fb^{-1}) data with MC expected 64±6 events

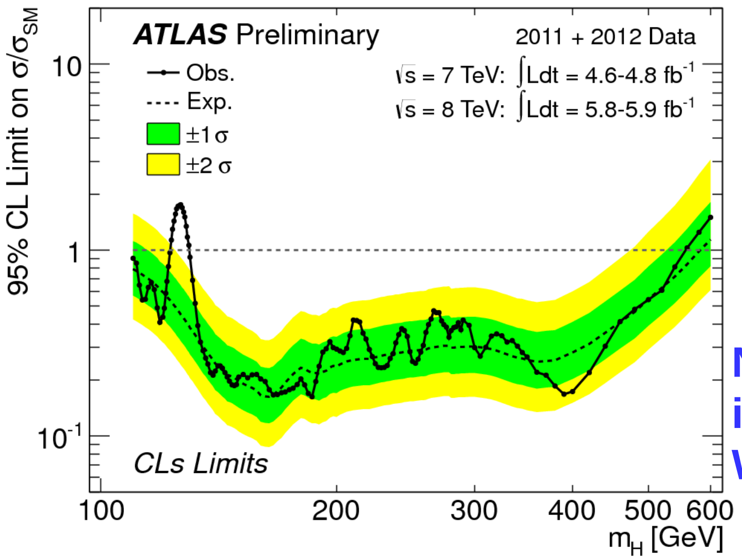
	Expected [fb]	Measured [fb]	Stat [fb]	Syst [fb]	Lumi [fb]
7 TeV	133.82 +- 5.58	123.57	±28.15	±8.61	±2.22
8 TeV	153.95 +- 6.42	158.16	±26.14	±10.91	±5.69



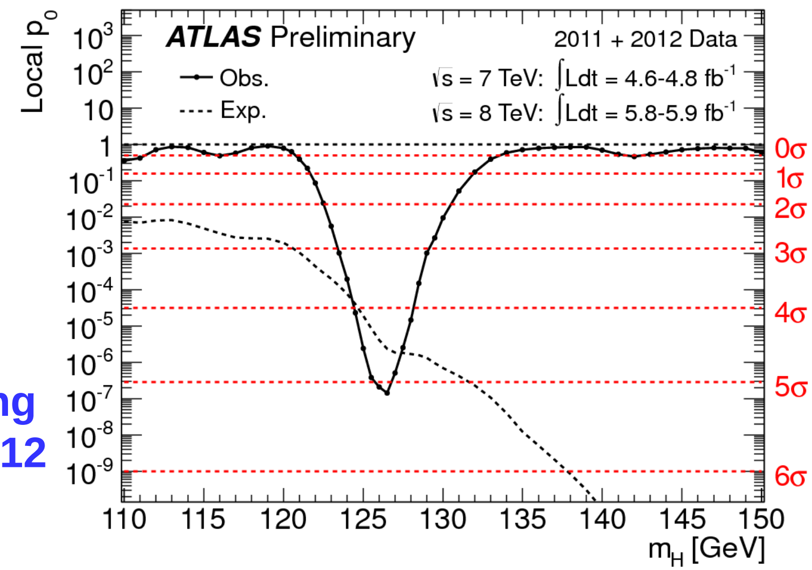


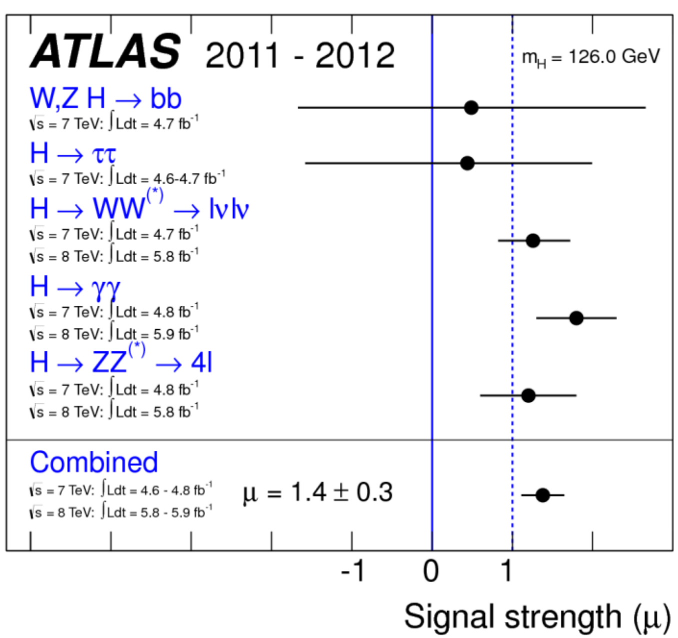


Results on ATLAS Higgs search

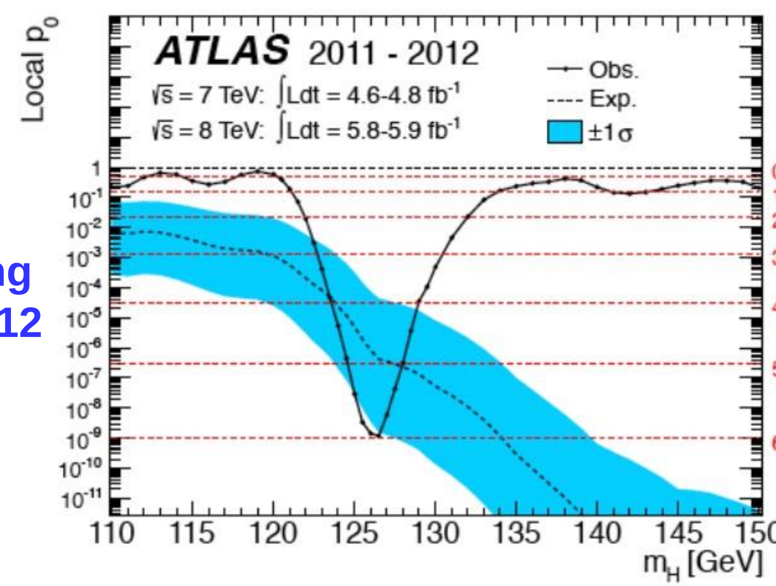


Not including WW 2012





including WW 2012



Improve the H→$\gamma\gamma$ analysis by MVA

- **The cut based analysis of H→$\gamma\gamma$ was used in the published paper on the discovery of a new boson.**
- **So there could be much room to improve this most sensitive analysis by MVA (Multi-Variable Analysis), which is very important to improve the sensitivity of the signal strength, mass and spin measurement.**
- **Now we have one staff, one postdoc and one student working on this analysis and Dr. Yaquan FANG from IHEP is assigned as one of the two editors on MVA of H→$\gamma\gamma$.**
- **We aim to have the MVA results at Moriond2013.**

Measuring Yukawa coupling Y_t via ttH(H→WW)

N_{data} - N_{bkg}

$$Y_t = \left(\frac{N^{nl}}{L\varepsilon_{nl} I^2(M_H) Br_{H\to WW} C_{nl}}\right)^{\frac{1}{2}}$$

Systematic errors

- N^{nl}(n=2,3): observed events in ttH-WW* n-lepton final states
- L: LHC integrated luminosity
- ε_{nl}: total efficiency of n-lepton final states
- $I(M_H)$: the integral over the parton momentum in initial states, propagator of gluon or quark in middle states and lepton/jet phase space in the final states
- C_{nl}: the combination factor of branching of W decays

Directly measures only: $\sigma(ttH)*Br(H\to WW)=N^{nl}/(L\varepsilon_{nl}C_{nl})$

Results from Monte Carlo Study ($30fb^{-1}$@14TeV)

$$\sigma_{t\bar{t}H/WH} \times BR(H \to WW) = \frac{S^{nL}}{\mathcal{L} \cdot \varepsilon_{nL} \cdot C_{nL}}$$

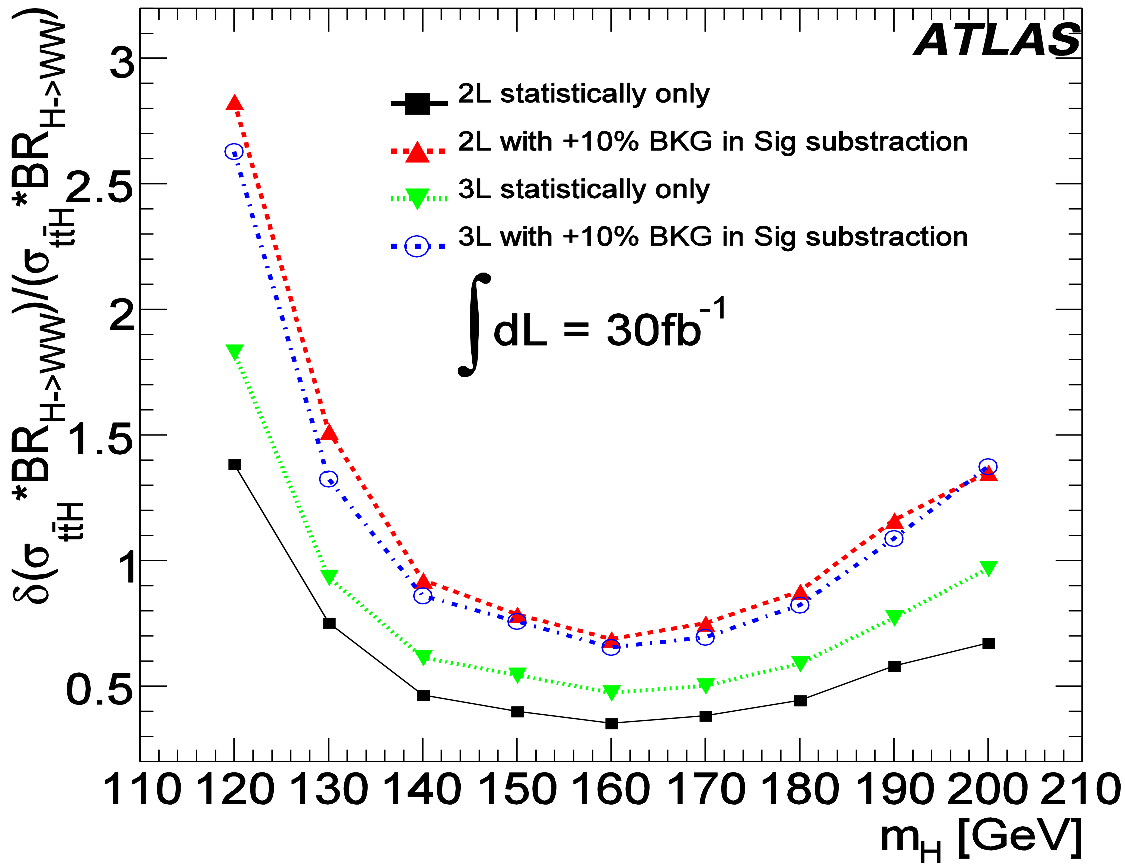
$$\frac{\delta(\sigma \times BR)}{\sigma \times BR} = \frac{\sqrt{S + B + (a \cdot B)^2}}{S}$$

$\frac{\delta(\sigma \times BR)}{\sigma \times BR}$ precision(160GeV):

2L : **69%**

3L : **66%**

Combined: **47%**



Very big sys. error mainly from background uncertainty, which shows the difficulty in measuring top Yukawa coupling at LHC → ILC is needed.

IHEP made major contribution to this analysis

SUSY particle searches

ACC Contributions to ATLAS SUYS Searches

- **strong production**

  1l (soft) + 2jets + E_t^{miss}

  (IHEP)

- **3rd generation squark**

  $\geq$ 1bjet + muilti-jet(7-8)+ 1l + E_t^{miss}

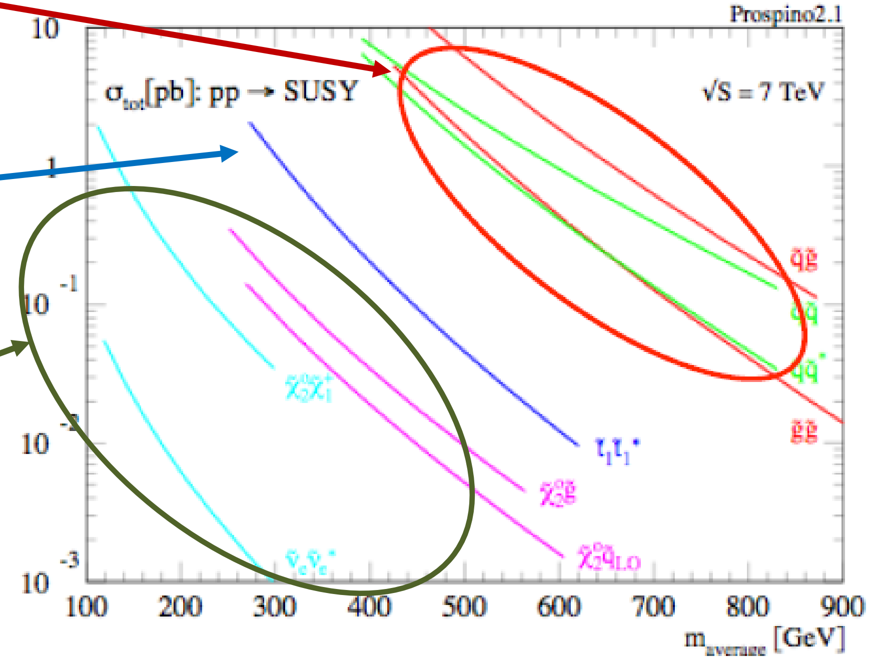
  (IHEP)

- **weak production**
  - ✓ direct gaugino production
  - ✓ direct slepton production

    at least one tau in final states

    (e-tau, mu-tau, tau-tau)

    (IHEP)



- **RPV e-mu resonance search**

  (USTC)

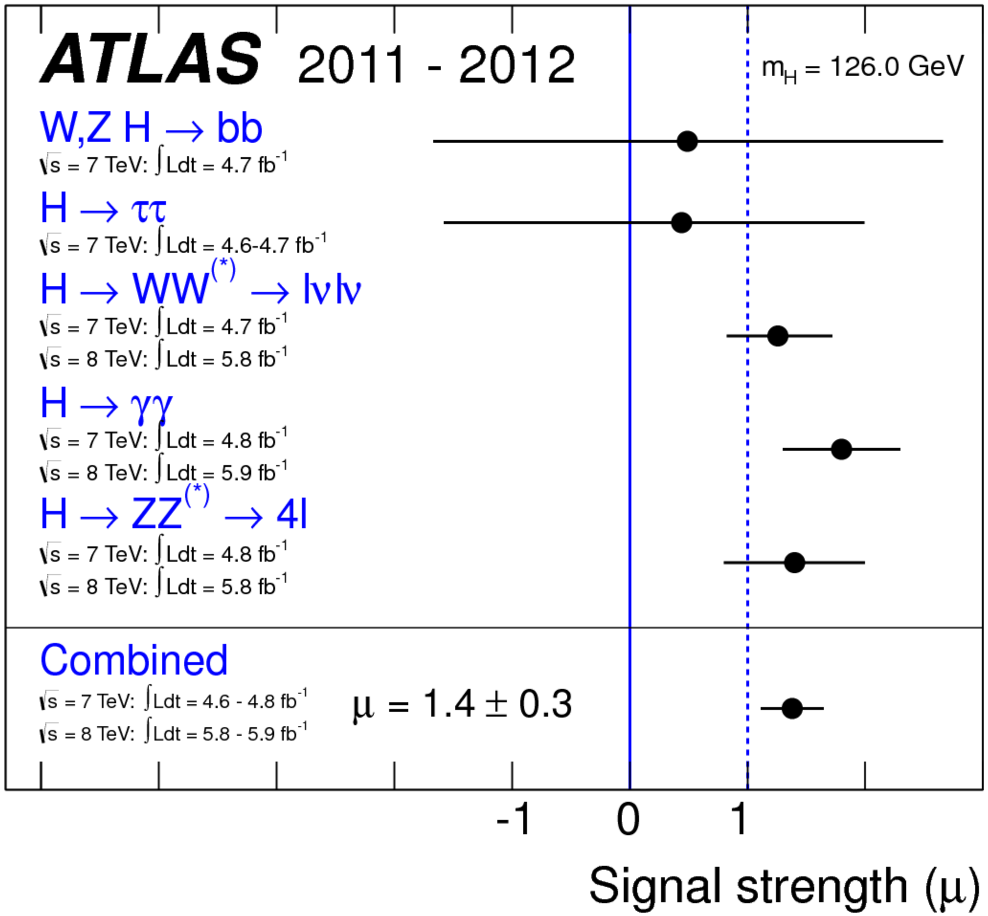
SUSY Weak Production with taus

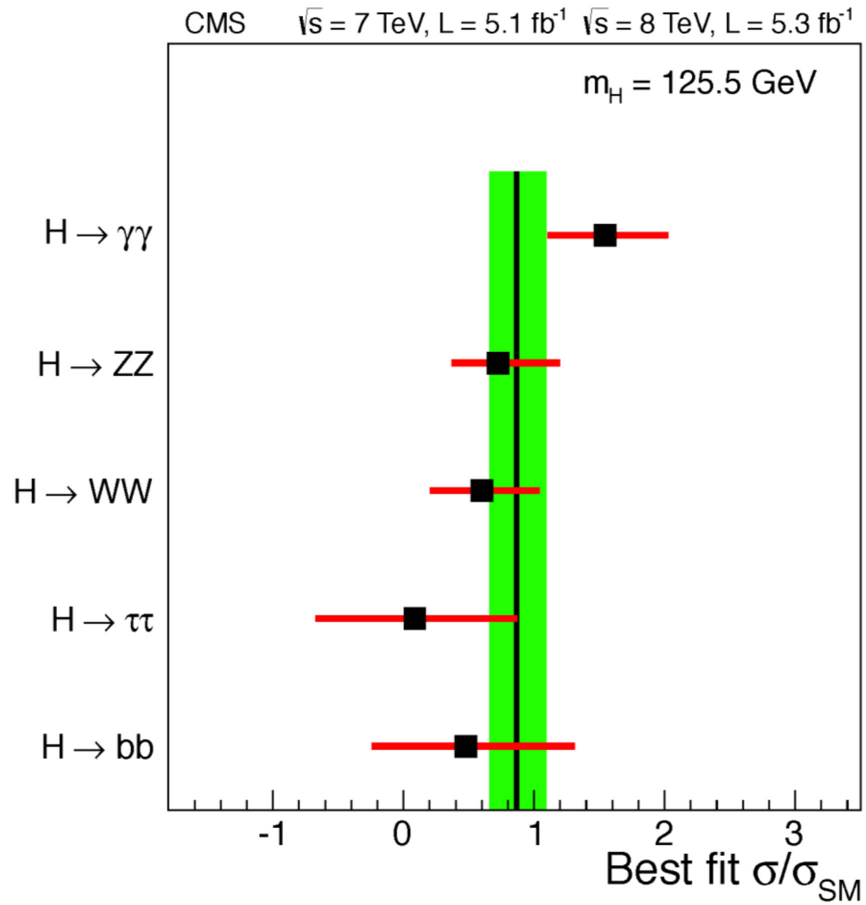
- **3rd Generation dominated final states (eg: stau) is a good place to search for SUSY (especially with the possible enhanced signal strength of H→γγ.)**

- **IHEP group first look at these channels in the ATLAS SUSY group** (prepare one CONF note now ATL-COM-PHYS-2012-1438)

First proposed by Dr. Xuai ZHUANG on March 9, 2012 at ATLAS SUSY 2lepton meeting:
https://indico.cern.ch/contributionDisplay.py?contribId=1&confId=175402

Consistent with SM Higgs?





➔ Consistent with SM (μ=1)

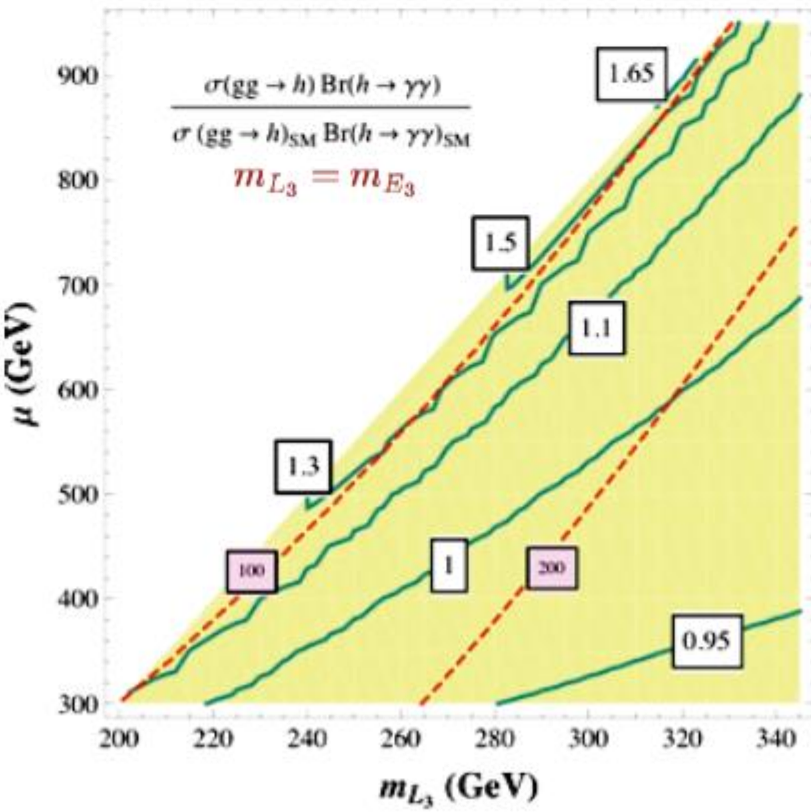
- only γγ channel are significant high in both experiments
- ATLAS ττ, bb precision to be improved with 8TeV data

http://www.phy.pku.edu.cn/~susy2012/resources/conf_day2/plenary/5_Carena-SUSY2012.pdf

Higgs Production in the di-photon channel in the MSSM

Charged scalar particles with no color charge can change di-photon rate without modification of the gluon production process

$m_A = 1$ TeV GeV, $A_\tau = 0$ GeV



M. C, S. Gori, N. Shah, C.Wagner,'11 +L.T.Wang'12

$$\mathcal{M}_{\tilde\tau}^2 \simeq \begin{bmatrix} m_{L_3}^2 + m_\tau^2 + D_L & h_\tau v(A_\tau \cos\beta - \mu\sin\beta) \\ h_\tau v(A_\tau \cos\beta - \mu\sin\beta) & m_{E_3}^2 + m_\tau^2 + D_R \end{bmatrix}$$

Light staus with large mixing

[sizeable μ and tan beta]:

➔ enhancement of the Higgs to di-photon decay rate

Contours of constant

$$\frac{\sigma(gg \to h) Br(h \to \gamma\gamma)}{\sigma(gg \to h)_{SM} Br(h \to \gamma\gamma)_{SM}}$$

for $M_h \sim 125$ GeV

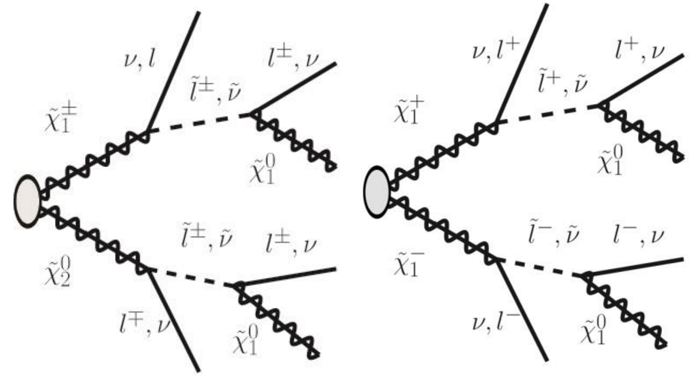
Higgs into di-photon rate can be enhanced via Staus without changing the Higgs into WW/ZZ rates

Signal Region (SR) definitions

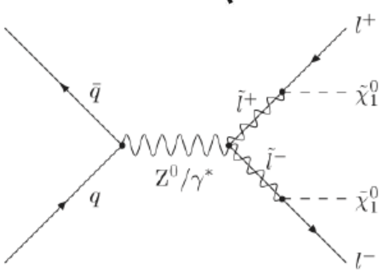
Signal region	requirements
OS jet veto OS ττ	signal jet veto Z-veto $\Delta\phi(\tau,\tau) < 2.7$ $\not{E}_T > 110$ GeV
OS m_{T2} OS ττ	signal jet veto Z-veto $\not{E}_T > 40$ GeV $m_{T2} > 100$ GeV

Table 5: Signal region definition.

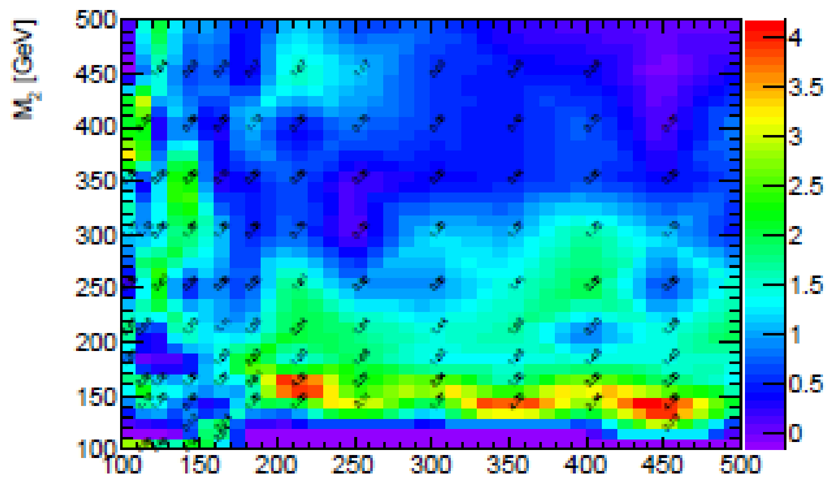
Chargino-chargino (neutralino) production



Direct stau production



- **Only di-τ channel covered so far, eτ & μτ will be included for Moriond and paper**
- **The SRs have been optimized**



mT2>100GeV

Background Composition

SM process	SR OS jet veto	SR OS m_{T2}
$t\bar{t}$	0.21 ± 0.21	0.0 ± 0.0
single top	0.00 ± 0.00	0.0 ± 0.0
Z+jets	0.00 ± 0.00	0.0 ± 0.0
diboson	1.40 ± 0.49	0.7 ± 0.3
QCD & W+jets	13.24 ± 2.48	7.04 ± 1.46
SM total	14.8 ± 2.5	7.7 ± 1.5

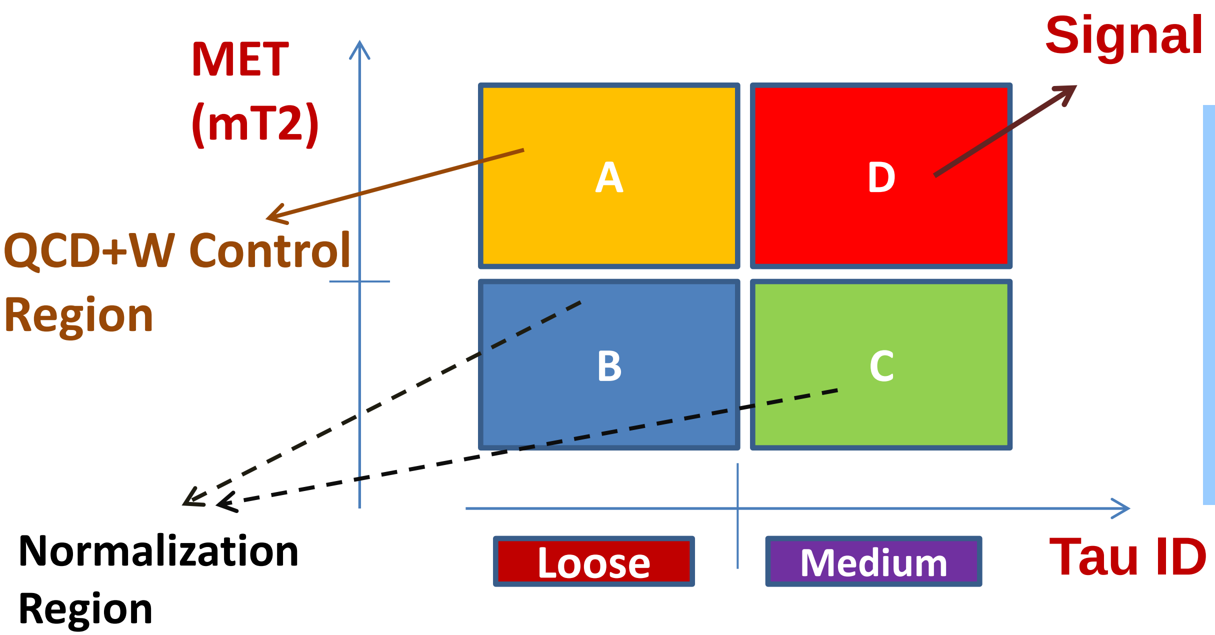
Table 6: Event yields from SM processes in different signal regions, normalized to 13.02 fb^{-1}.

- **Dominant background is from fake tau (QCD with 2 fake taus and W+jets with 1 fake tau) ~ 90%**
  - estimated with data-driven method
  - QCD+W can be estimated together due to similar characteristics of the fake tau
- **Other SM background only ~10%, estimated from MC-driven**

ABCD method (QCD+W)

- D: SR (medium + tight tau, MET>110GeV(or mT2>100GeV)
- A: QCD+W Control Region: close to SR except using loose tauID:
- CB: Normalization Region, close to DA except MET<40 GeV

→ We can extrapolate from QCD+W Control region A to signal region D trough a transfer factor from C/B: D = A* C/B



It works only when:

- Weak correlation between tauID and MET (mT2)
- Pure QCD+W at QCD+W control region ABC

tauID and MET (mT2) Correlation check

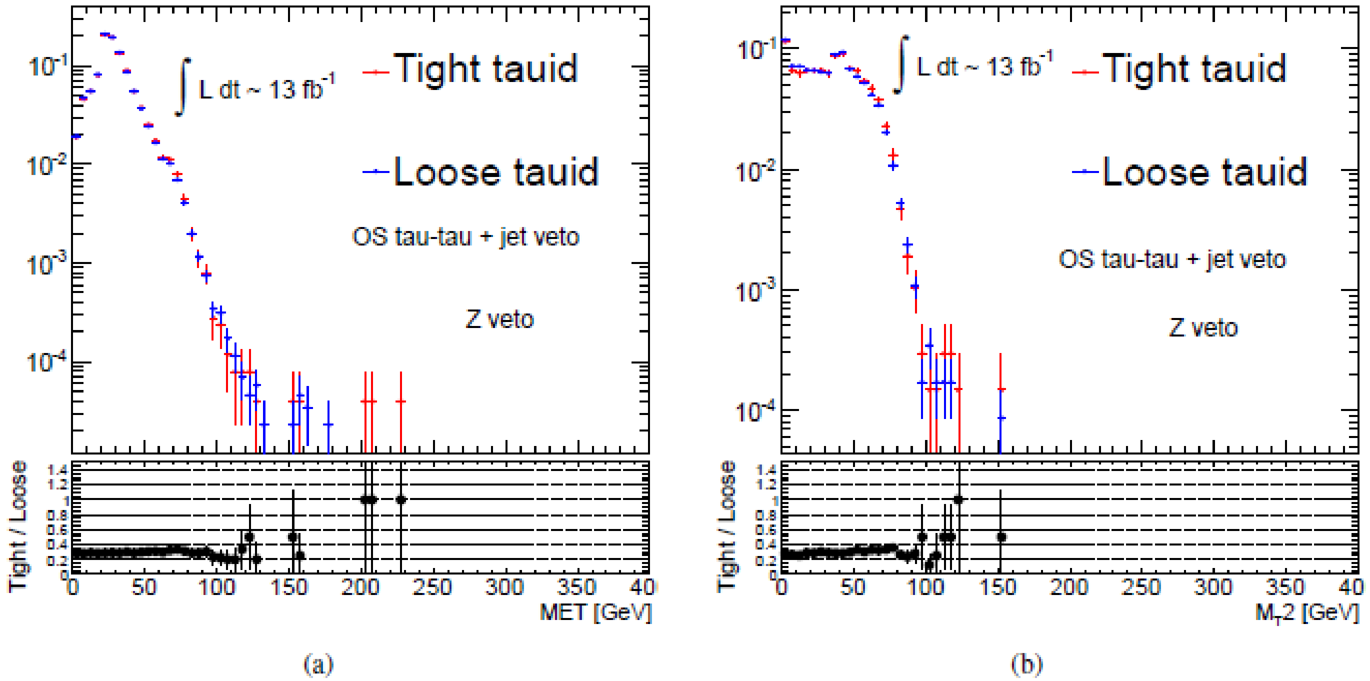
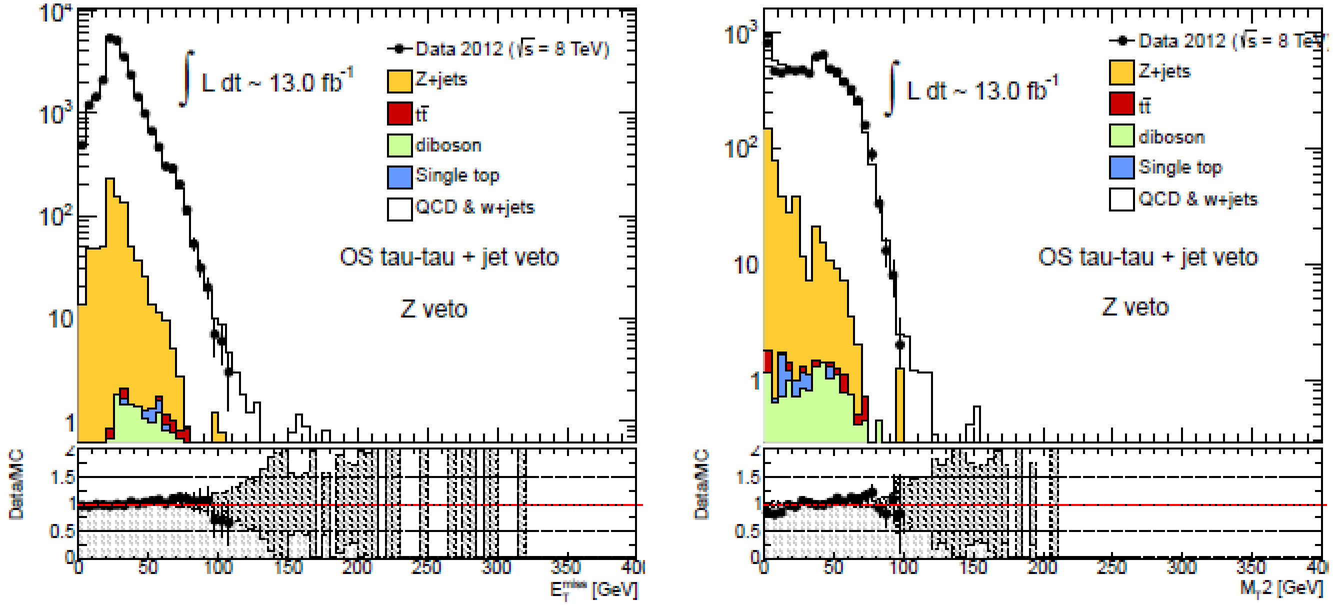


Figure 9: $\not{E}_T$ (m_{T2}) distribution with loose and tight tau id for SR OS-jet veto (left) and SR OS-m_{T2} (right). The distributions of their ratio are plotted at the bottom.

- **Very small difference between tight tauID and loose tauID**

Estimation Result (13 fb^{-1} SR box not open for data)



(a) (b)

Figure 11: $\not{E}_T$ (or m_{T2}) distributions for SR OS-jet veto (left) and SR OS-m_{T2}(right) . The error bar is from data and the stacked colored histograms are from SM MC backgrounds except QCD+W. The white histogram is from QCD+W estimate from data using ABCD method. Other SM backgrounds from MC prediction are normalized to 13.02 fb^{-1} integrated luminosity. The data in the signal region are not included in the plots.

- **There is good data/MC agreement in non-SUSY signal region (MET<110 GeV, mT2< 100GeV)**

➡ **ABCD method works well for QCD+W backgrounds**

Data/MC comparisons

(qcd: from data-driven method, others: MC simulation, data-driven later)

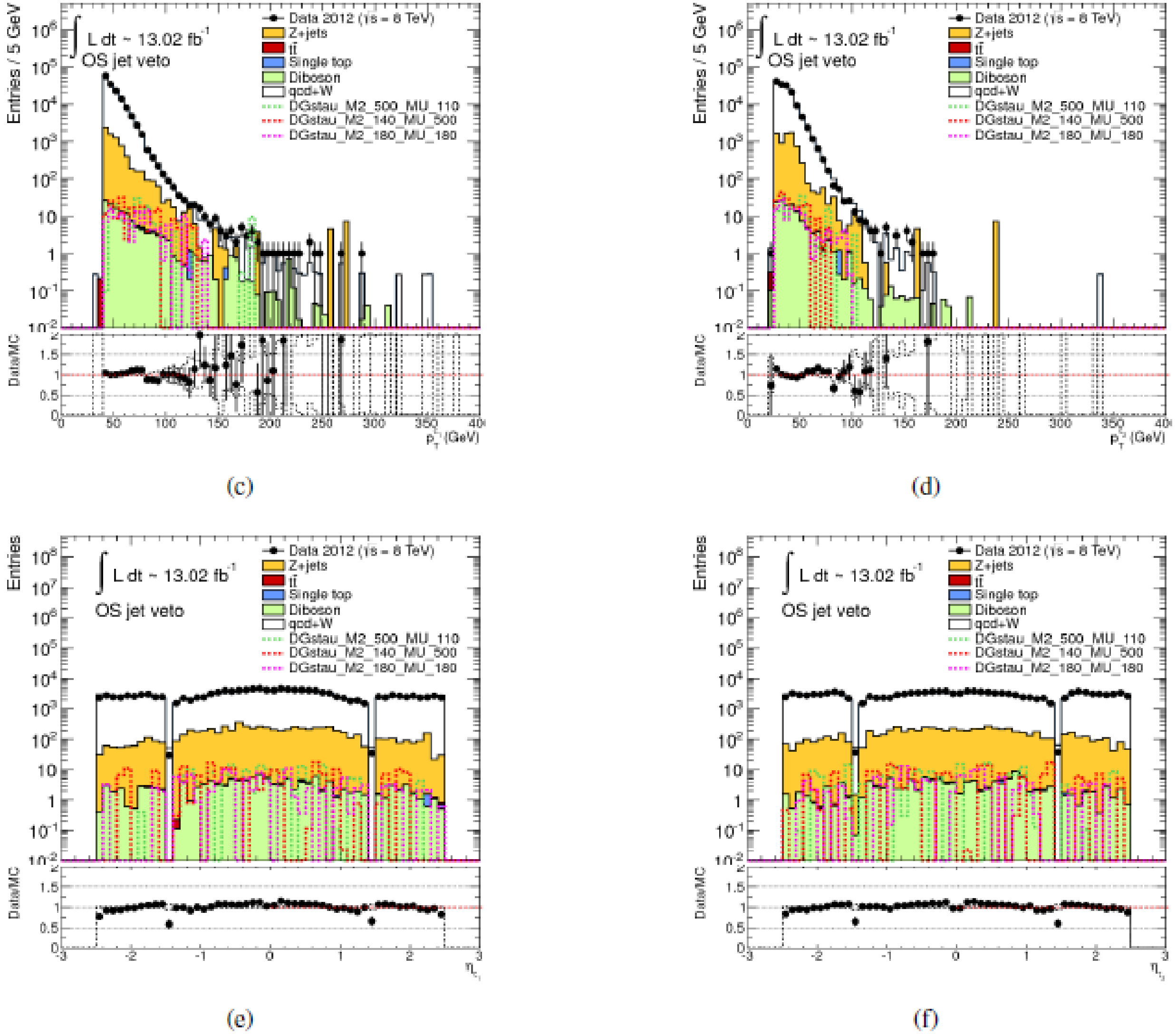


Figure 12: Kinematic distributions for OS events: Invariant mass of 2 OS τ (top left plot); $\Delta\phi$ between 2 OS τ (top right plot); p_T of leading τ, OS (medium left plot); p_T of next leading τ, OS (medium right plot); η of leading τ, OS (bottom left plot); η of next leading τ, OS (bottom right plot).

- **Good data/MC agreement**
- **QCD+W estimation works reasonably**

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Syst. and Estimation Result on QCD+W

Syst. Sources	SR OS jet veto	SR OS m_{T2}
Correlation	4.8%	11.9%
TF difference	10%	2.2%
Non-QCD subtraction	0.73%	1.91%
Statistics	15.0%	20.0%
Total	18.7%	23.4%

Table 9: Summary of systematic uncertainty source and numbers.

- **Syst. is mainly from statistics of data (will be reduced with more data at the end of 2012)**

		region A	region B	region C	transfer factor	QCD+W background estimation
OS jet veto	Data	47±6.9	72690±270	21408±146	0.2892 ± 0.0017	13.24 ±2.47(*sys.*)
	Z+jets	0	1192±71	718±55		
	di-boson	0.84±0.17	13.4±3.5	20.4±3.1		
	single top	0	2.0±1.3	0.16±0.16		
	$t\bar{t}$	0.39±0.28	0.89±0.34	0.86±0.32		
OS m_{T2}	Data	25±5	The same as OS jet veto		0.2892±0.0017	7.04 ±1.65(*sys.*)
	Z+jets	0				
	di-boson	0.47±0.13				
	single top	0				
	$t\bar{t}$	0.18±0.18				

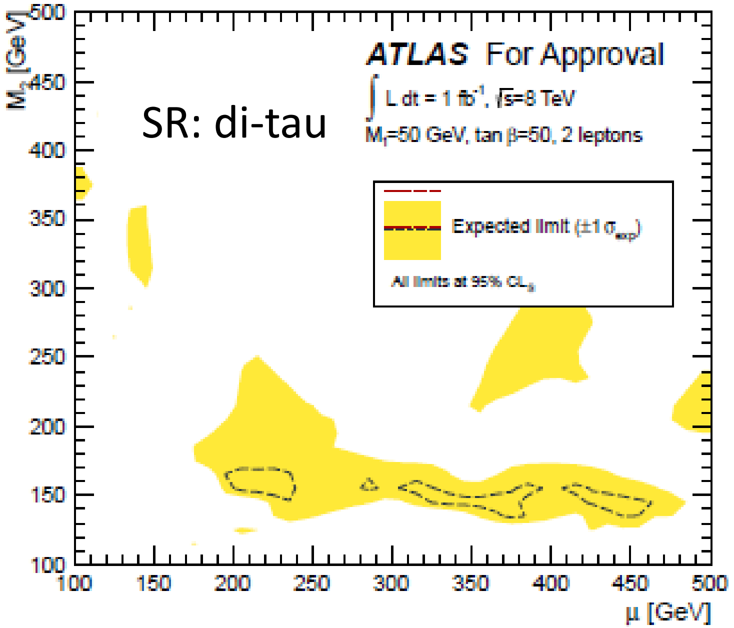
Table 10: The estimated backgrounds in each region.

- Good purity in region ABC

Any Excess?

- No observed results due to blind Signal Region boxes at the moment.

- **Aim to Moriond 2013**



(b)

Inclusive SUSY search: 1l + jets + EtMiss

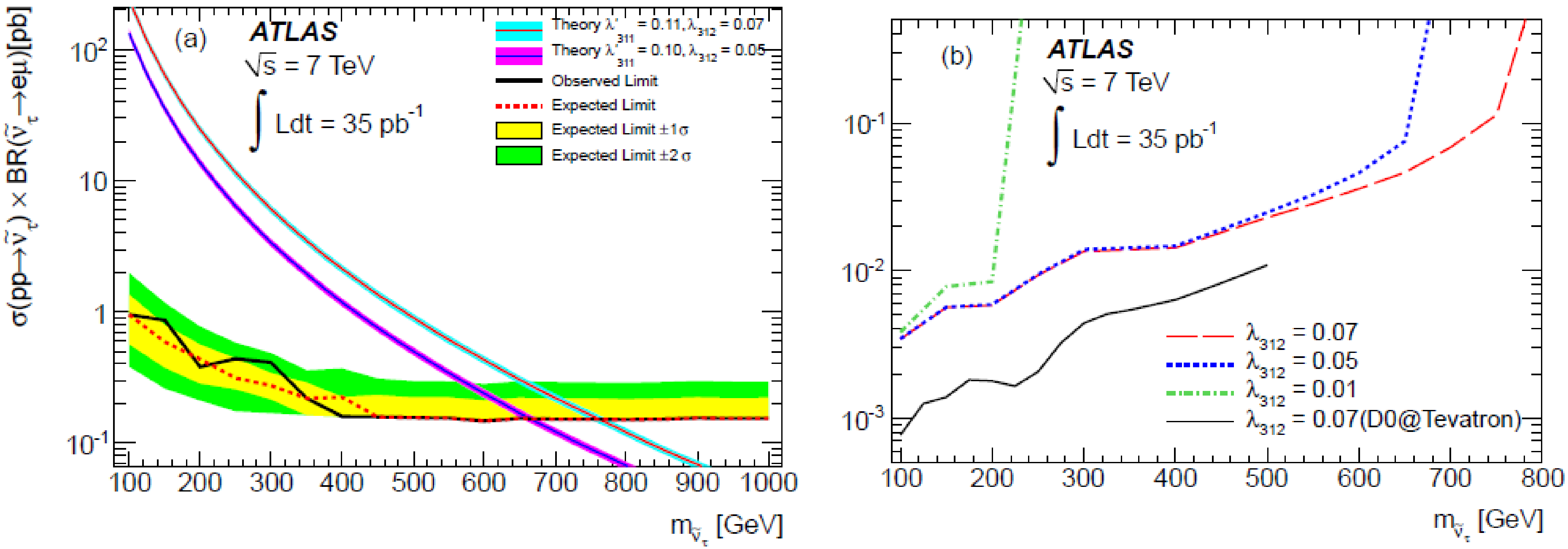
- Large production cross section, Low SM BGs
- Essential to address models which may escape standard E_T^{miss}+jets analysis because of soft hadronic part: (e.g. longer gluino decay chains : $\tilde{g} \to \tilde{q}q \to qq\tilde{\chi}_1^{\pm} \to qqW\tilde{\chi}_1^0$)
- One soft lepton to probe models with compressed SUSY spectra

  pT< 30(25)GeV for e(mu)

- Aim for Moriond 2013 and paper
  - ✓ Soft MET trigger has been studied and fixed
  - ✓ Data/MC comparisons have been checked for SRs and ttbar and W control regions with 5.8 fb^{-1} 2012 data
  - ✓ Dominant systematic uncertainties studied
  - ✓ New SR and SR optimization are going on

SUSY R-parity violation eμ resonance search

ATLAS @ 7TeV

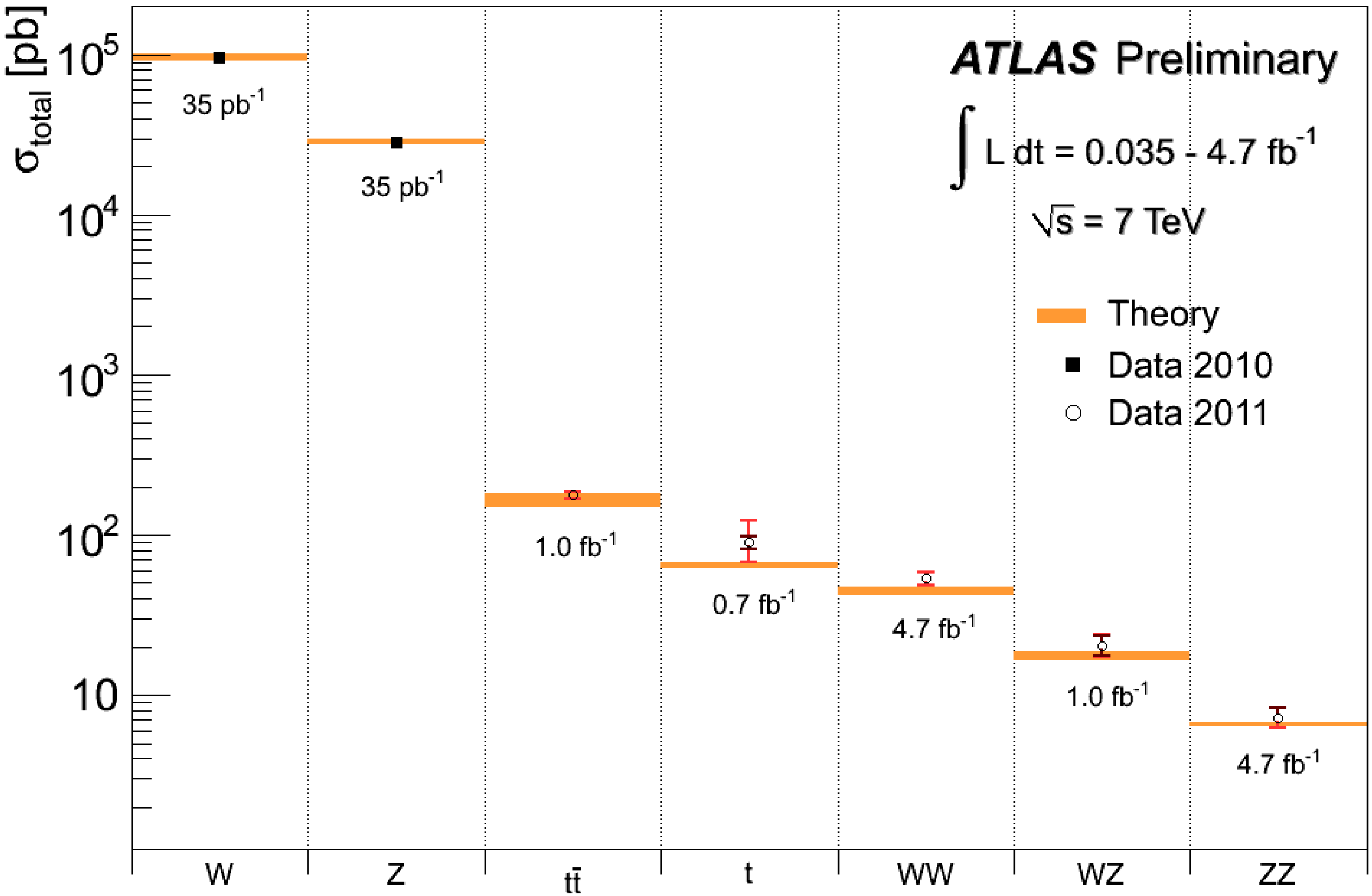


- **Lower mass limit @95% CL > 800 GeV with 35pb^{-1}@7TeV**
  Phys. Rev.Lett. 106 (2011) 251801
- **Lower mass limit @95% CL > 1.32 TeV with 1.1 fb^{-1}@7TeV**
  Eur. Phys. J. C 71 (2011) 1809

USTC made major contribution to this analysis

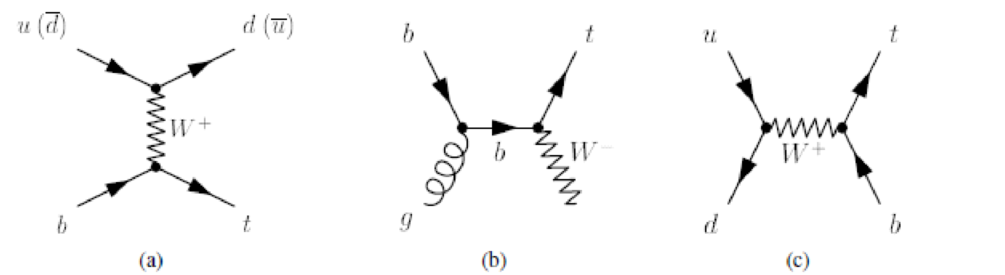
SM and top physics studies

A summary of ATLAS Standard Model measurements at 7 TeV

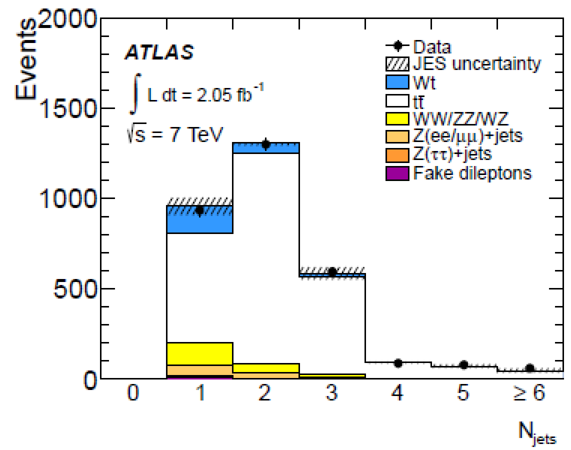


USTC strongly involved in di-boson cross-section measurements
NJU involved in the top pair cross-section measurement
SDU involved in the single top production measurement

First evidence of single top Wt-channel in dilepton final state



- According to the Standard Model, single top quarks can be produced via the three mechanisms at LHC: t-channel, Wt-channel, s-channel



- **Perform the analysis in the dilepton (dielectron, dimuon, electron-muon) final state with 2.05 fb^{-1} data at $\sqrt{s}$ = 7 TeV**
- **Use data-driven background estimations for W+jets, QCD, and Drell-Yan processes.**

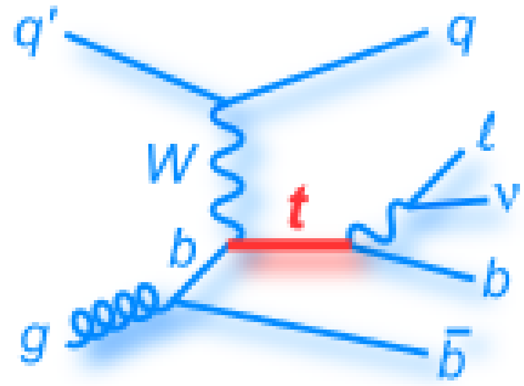
- **The measurement gives an observed significance of 3.0 standard deviations, and the corresponding cross-section:**

$$\sigma_{Wt} = 16.8 \pm 2.9\ (\mathrm{stat}) \pm 4.9\ (\mathrm{syst})\ \mathrm{pb},$$

- This is the first evidence of single top Wt-channel, submitted to PLB: http://arxiv.org/abs/1205.5764

SDU involved in the analysis

t-channel cross section measurement (1fb^{-1} @ 7TeV)



t-channel signatures

- a high p_T lepton
- large $E_{\mathrm{T}}^{\mathrm{miss}}$ from neutrino
- 2-3 jets
  - 2 b-jet, 1 undetected
  - 1 forward light jet

Cross Section Measurement Results

Measured Cross Section (Fitted value of β^s)	
Channels	t-channel
Combined	1.506551
2-jet	1.653824
3-jet	0.945393

Systematics	
Source	$\Delta\sigma_{obs}/\sigma_{obs}$ [%]
Data Statistics	±7.4
Major Systematics	
ISR/FSR	+18.0/-17.6
Parton shower	+15.4/-15.4
b-tagging efficiency	+14.6/-14.6
All Systematics	**+30.8/-30.1 (%)**
Total	**+31.6/-31.0 (%)**

- Expected: $\sigma_t = 64.6^{+22.0}_{-21.6}$ pb
    - Measurement with only Monte Carlo samples
- Measured: $\sigma_t = 97.3^{+30.7}_{-30.2}$ **pb**

SDU involved in the analysis

W-polarization in top decay

- As the heaviest known fundamental particle, top quark may accommodate new physics in its decay to W and b following this parameterization:

$$\mathcal{L}_{Wtb} = -\frac{g}{\sqrt{2}}\bar{b}\,\gamma^{\mu}\,(V_{\mathrm{L}}P_{\mathrm{L}} + V_{\mathrm{R}}P_{\mathrm{R}})\,t\,W_{\mu}^{-} - \frac{g}{\sqrt{2}}\bar{b}\,\frac{i\sigma^{\mu\nu}q_{\nu}}{M_{W}}\,(g_{\mathrm{L}}P_{\mathrm{L}} + g_{\mathrm{R}}P_{\mathrm{R}})\,t\,W_{\mu}^{-} + \mathrm{h.c.}$$

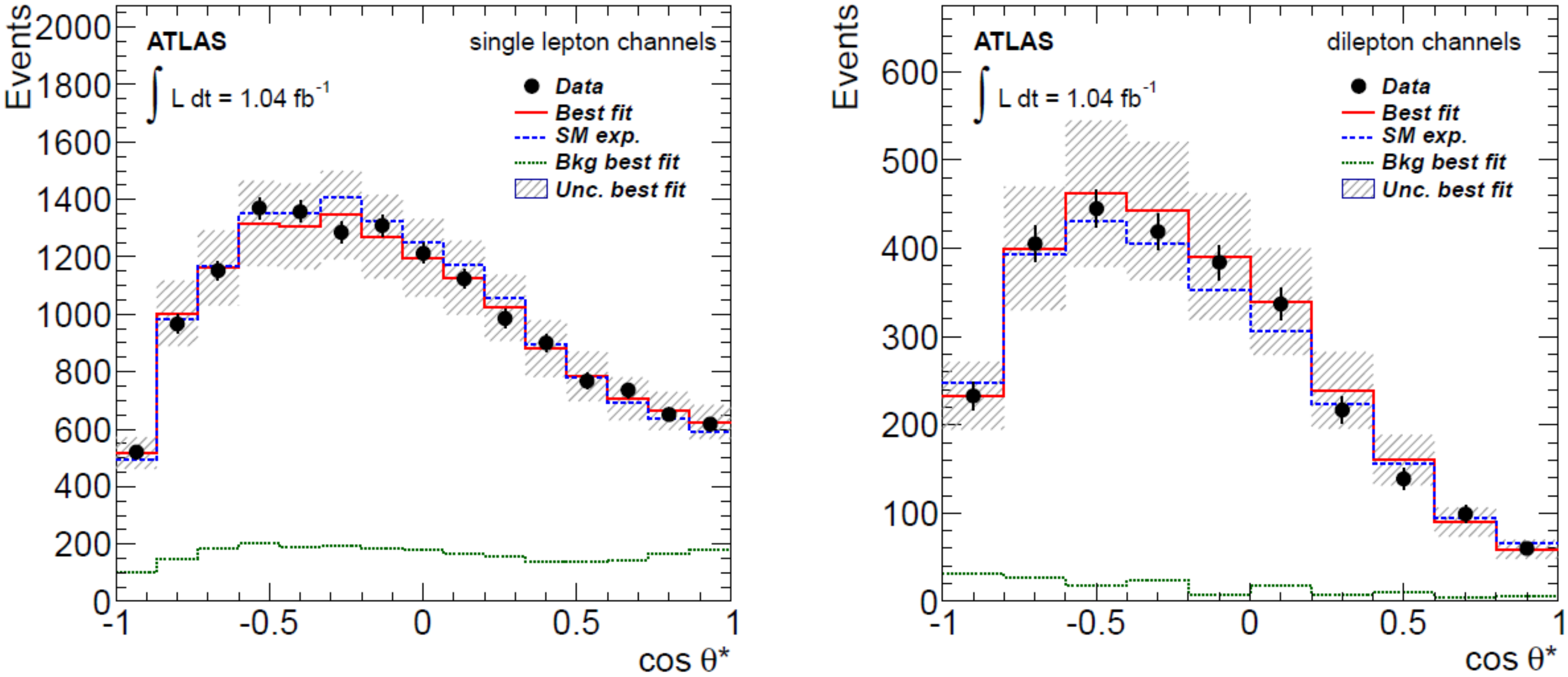
  - $V_L = CKM\ V_{tb},\ V_R = g_L = g_R = 0\ in\ SM$

- NP could be probably observed in the W-polarization angle distribution in top quark decay events :

$$\frac{1}{\sigma}\frac{\mathrm{d}\sigma}{\mathrm{d}\cos\theta^{*}} = \frac{3}{4}\left(1-\cos^{2}\theta^{*}\right)\ F_{0} + \frac{3}{8}\left(1-\cos\theta^{*}\right)^{2}\ F_{\mathrm{L}} + \frac{3}{8}\left(1+\cos\theta^{*}\right)^{2}\ F_{\mathrm{R}}$$

  - θ^* is the angle between the momentum direction of the charged lepton from W decay and the reverse direction of f b-quark momentum from top, both boosted into W rest frame
  - F_0, F_L, F_R *are bilinear combination of* V_L, V_R, g_L, g_R

ATLAS results



$$F_0 = 0.67 \pm 0.03\ \text{(stat.)} \pm 0.06\ \text{(syst.)}$$
$$F_{\mathrm{L}} = 0.32 \pm 0.02\ \text{(stat.)} \pm 0.03\ \text{(syst.)}$$
$$F_{\mathrm{R}} = 0.01 \pm 0.01\ \text{(stat.)} \pm 0.04\ \text{(syst.)}$$

JHEP 1206 (2012) 088

W-polar angle distribution agrees with SM prediction:

F_0= 0.687, F_L=0.311, F_R=0.0017

SDU&IHEP strongly involved in the analysis

Summary

- **ATLAS Chinese Cluster has made important contributions to the Higgs boson searches, SUSY particle searches and SM and top physics studies**

- **With more and more young talents joining ACC, we will play more and more active role in the ATLAS experiments.**

感谢邝宇平院士对ATLAS中国组长期的支持和指导！

ATLAS中国组全体同仁恭贺

邝老师、易老师八十华诞！

祝邝老师、易老师健康长寿！