Weekly Report

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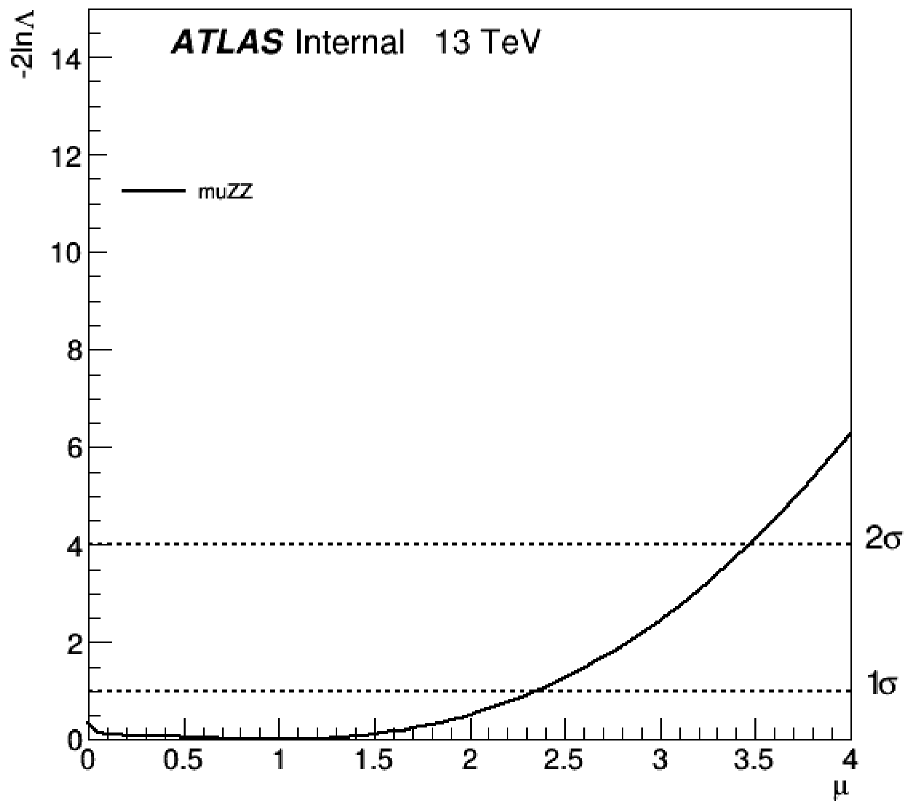
The results with a lot of problems



	Strength Value
μ_{qqZZ}	$1^{+1.36}_{-1.16}$

This figure has a lot of problems,
so it does not have any useful information.

The results with a lot of problems

- VBF Sample used:
  - mc16_13TeV.500372.MGPy8EG_A14_NNPDF23LO_VBFH125_sbi_4l_m4l130.root
  - mc16_13TeV.500374.MGPy8EG_A14_NNPDF23LO_VBFH125_sbi5_4l_m4l130.root
  - mc16_13TeV.500375.MGPy8EG_A14_NNPDF23LO_VBFH125_sbi10_4l_m4l130.root
  - mc16_13TeV.500373.MGPy8EG_A14_NNPDF23LO_VBFH125_bkg_4l_m4l100.root

The results with a lot of problems

- categories:
- VBF_4mu_13TeV, VBF_4e_13TeV, VBF_2e2mu_TeV, VBF_4l_13TeV
- mcsets:
- qqZZ, VBFSBI, VBFSBI5, VBFSBI10, VBFBKG, ggHSIG, ggHSBI
- cut:
- 220<m4l_fsr<2000

The results with a lot of problems

- coefficients

```
qqZZ = factors:n_qqZZ,bkgyields.txt ; sys:norm_NormShape_Both_qqZZ.txt ; global:ATLAS_LUMI(139./0.97/1.03)
ggHSIG = factors:n_ggHSIG,bkgyields.txt; poi:mu*munnlo[1.7]-sqrt(mu5[5.]*mu)*munnlo[1.7] ;  global:ATLAS_LUMI(139./0.97/1.03)
ggHSBI = factors:n_ggHSBI,bkgyields.txt; poi:sqrt(mu/mu5[5.])*munnlo[1.7] ;  global:ATLAS_LUMI(139./0.97/1.03)
VBFBKG = factors:n_VBFBKG,bkgyields.txt ; poi:((sqrt(mu)-1)*(sqrt(mu)-sqrt(mu5[5.])))/sqrt(mu5[5.]) ;  global:ATLAS_LUMI(139./0.97/1.03)
VBFSBI = factors:n_VBFSBI,bkgyields.txt ; poi:(mu5[5.]*sqrt(mu)-sqrt(mu5[5.])*mu)/(mu5[5.]-sqrt(mu5[5.])) ;  global:ATLAS_LUMI(139./0.97/1.03)
VBFSBI5 = factors:n_VBFSBI5,bkgyields.txt ; poi:(mu-sqrt(mu))/(mu5[5.]-sqrt(mu5[5.])) ;  global:ATLAS_LUMI(139./0.97/1.03)
VBFSBI10 = factors:n_VBFSBI10,bkgyields.txt ; poi:(mu-sqrt(mu))/(mu5[5.]-sqrt(mu5[5.])) ;  global:ATLAS_LUMI(139./0.97/1.03)
```

Why with problems and next

- for the poi, at first I don’t know how to deal with the VBF parametrisation when concerned with VBFSBI10
- and next, I will try another way

Why with problems

- The poi of SBI and SBI5

poi of SBI: $\frac{(5\sqrt{\mu}-\sqrt{5}\mu)}{5-\sqrt{5}}$

poi of SBI5: $\frac{\mu-\sqrt{\mu}}{5-\sqrt{5}}$

Parametrisation

What is the signal and the bkg?

- off-shell Higgs boson signal cannot be treated independently from the bkg as **negative interference effects** appear
    - SBI = Signal + Interference + Background
    - SBI5 = 5.Signal + $\sqrt{5}$.Interference + Background

1.Approach: currently used

- Signal: implicitly defined from SBI and SBI5 MC samples (2 eq and 2 unkn (S, I))
- bkg: VBS processes with TGCs and QGCs

- This approach was used in the previous round of the analysis.
- problem: bkg sample misses on-shell Higgs produced in VBF u-channel

2. Approach: more precise

- signal: implicitly defined from SBI, SBI5, SBI10 MC samples (3 eq and 3 unkn (S, B, I))
- bkg: implicitly defined from SBI, SBI5, SBI10 MC samples

- This approach can be done in the full RunII analysis (?)

Parametrisation

- About VBF parametrisation

Parametrisation in the VBF production

Parametrisation (1st approach)

- $\mathrm{MC}_{pp\to(H^*jj\to)ZZjj}(\mu_{\mathrm{off-shell}}) = \mu_{\mathrm{off-shell}} \cdot \mathrm{MC}^{\mathrm{SM}}_{pp\to H^*jj\to ZZjj} + \sqrt{\mu_{\mathrm{off-shell}}} \cdot \mathrm{MC}^{\mathrm{Interference}}_{pp\to ZZjj} + \mathrm{MC}^{\mathrm{Cont.bkg}}_{pp\to ZZjj}$
- Where signal and interference are implicitly defined:

$$\begin{cases} \mathrm{MC}^{\mathrm{SM}}_{pp\to(H^*jj\to)ZZjj} = \mathrm{MC}^{\mathrm{SM}}_{pp\to H^*jj\to ZZjj} + \mathrm{MC}^{\mathrm{Interference}}_{pp\to ZZjj} + \mathrm{MC}^{\mathrm{Cont.bkg}}_{pp\to ZZjj} \equiv \mathrm{SBI} \\ \mathrm{MC}^{\kappa_V^4=5}_{pp\to(H^*jj\to)ZZjj} = 5 \cdot \mathrm{MC}^{\mathrm{SM}}_{pp\to H^*jj\to ZZjj} + \sqrt{5} \cdot \mathrm{MC}^{\mathrm{Interference}}_{pp\to ZZjj} + \mathrm{MC}^{\mathrm{Cont.bkg}}_{pp\to ZZjj} \equiv \mathrm{SBI5} \end{cases}$$

$$\Rightarrow \mathrm{MC}_{pp\to(H^*jj\to)ZZjj}(\mu_{\mathrm{off-shell}}) = \frac{\mu_{\mathrm{off-shell}} - \sqrt{\mu_{\mathrm{off-shell}}}}{5-\sqrt{5}} \cdot \mathrm{SBI5} + \frac{5 \cdot \sqrt{\mu_{\mathrm{off-shell}}} - \sqrt{5} \cdot \mu_{\mathrm{off-shell}}}{5-\sqrt{5}} \cdot \mathrm{SBI} + \frac{(\sqrt{\mu_{\mathrm{off-shell}}} - 1) \cdot (\sqrt{\mu_{\mathrm{off-shell}}} - \sqrt{5})}{\sqrt{5}} \mathrm{MC}^{\mathrm{Cont.bkg}}_{pp\to ZZjj}$$

- the parametrization when concerned with VBFSBI10

Parametrization

$$\begin{bmatrix} VBF_{SBI10} \\ VBF_{SBI5} \\ VBF_{SBI1} \end{bmatrix} = \begin{bmatrix} 10 & \sqrt{10} & 1 \\ 5 & \sqrt{5} & 1 \\ 1 & 1 & 1 \end{bmatrix} \cdot \begin{bmatrix} VBF_{sig} \\ VBF_{int} \\ VBF_{bkg} \end{bmatrix} \Rightarrow \begin{bmatrix} VBF_{sig} \\ VBF_{int} \\ VBF_{bkg} \end{bmatrix} = \begin{bmatrix} 10 & \sqrt{10} & 1 \\ 5 & \sqrt{5} & 1 \\ 1 & 1 & 1 \end{bmatrix}^{-1} \cdot \begin{bmatrix} VBF_{SBI10} \\ VBF_{SBI5} \\ VBF_{SBI1} \end{bmatrix}$$

$$\begin{bmatrix} VBF_{sig} \\ VBF_{int} \\ VBF_{bkg} \end{bmatrix} = \frac{1}{9\sqrt{5} - 5 - 4\sqrt{10}} \begin{bmatrix} \sqrt{5} - 1 & 1 - \sqrt{10} & \sqrt{10} - \sqrt{5} \\ -4 & 9 & -5 \\ 5 - \sqrt{5} & \sqrt{10} - 10 & 10\sqrt{5} - 5\sqrt{10} \end{bmatrix} \cdot \begin{bmatrix} VBF_{SBI10} \\ VBF_{SBI5} \\ VBF_{SBI1} \end{bmatrix}$$

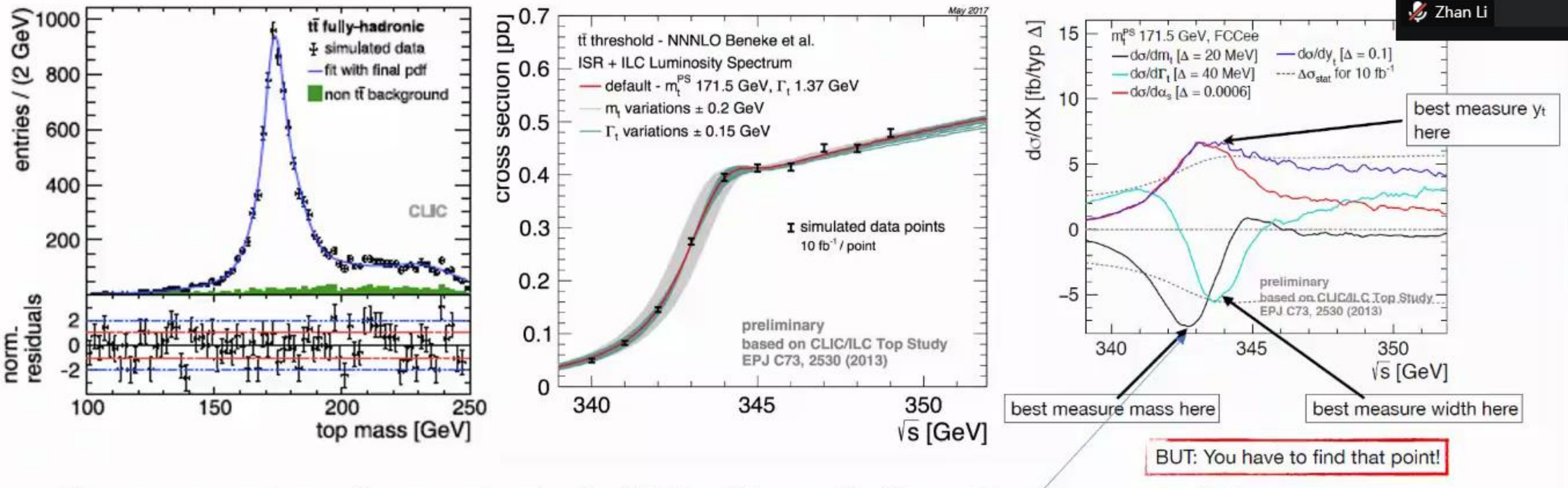
Next

- Next, I will use the second way, which means using SBI, SBI5 and SBI10. For BKG I will use SBI and SBI5

CEPC side

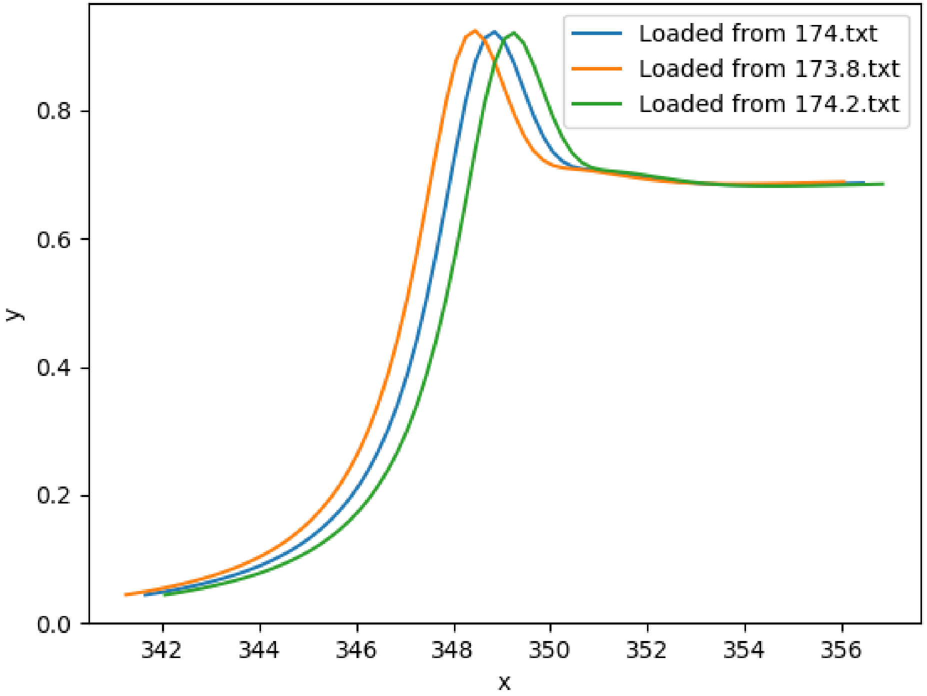
- Use an indirect way to measure the top quark mass more precisely

Top mass measurement at e^+e^- with energy scan around 340-35



- Top mass can be well reconstructed with the kinematic fit on W mass constraint.
- 10 energy points (1 GeV step) are scanned with a global fit to measure the top mass.
- More aggressively, 4 energy points can be scanned to fit the mass.
  - A pre-scan (e.g. 30% data) can help to determine the central point.
  - Need to study which scanning points are more sensitive for the error of the measured mass.

A simple result



- change the mass of top mass
- just a simple test
- agreed with others' result

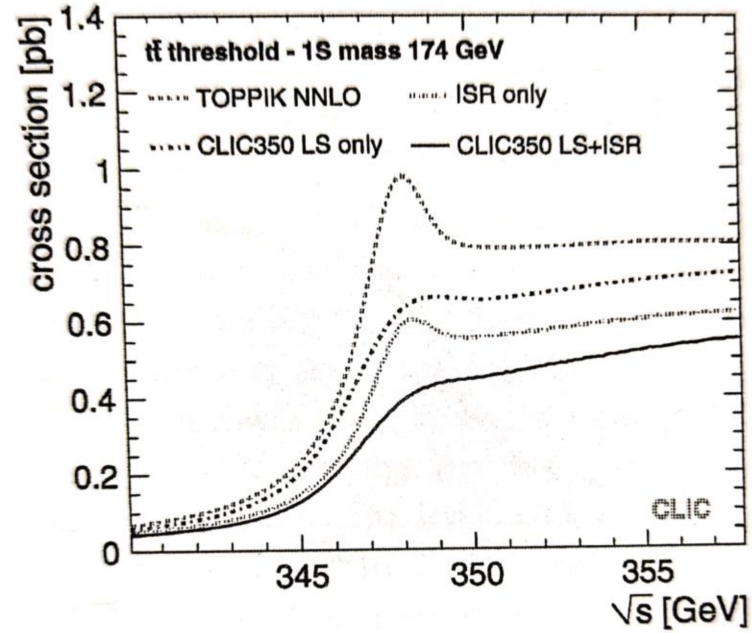


Fig. 4 Top pair production cross section from theory calculations, with the luminosity spectrum (LS) of CLIC at 350 GeV and ISR as well as for all effects combined

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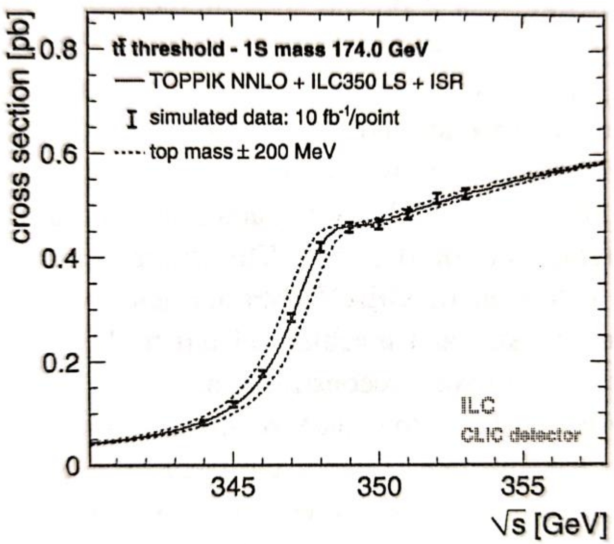

Fig. 7 Background-subtracted simulated cross section measurements with the ILC luminosity spectrum for 10 fb^{-1} per data point, together with the cross section for the generator mass of 174 GeV as well as for a shift in mass of ±200 MeV