

Status Report

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SNU Internal Meeting

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Introduction

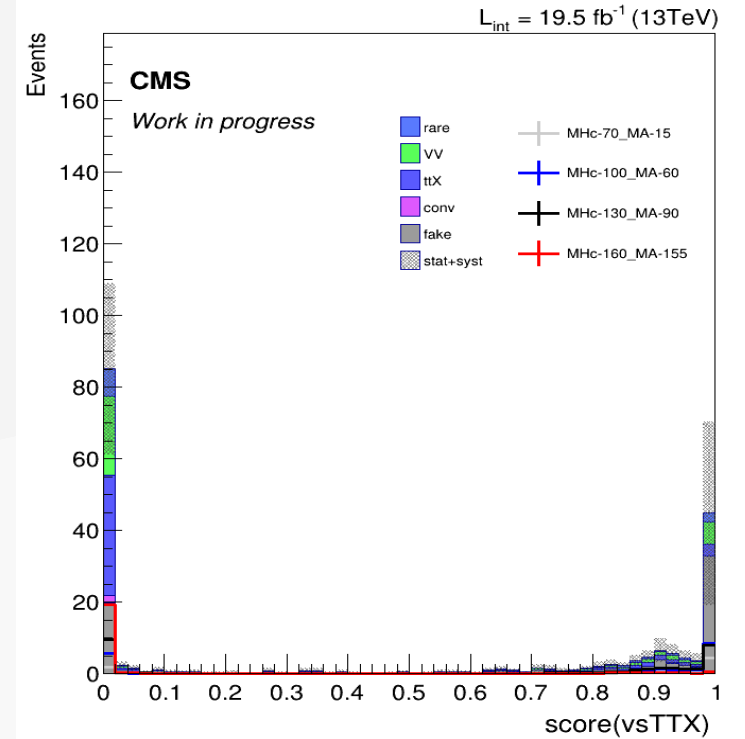
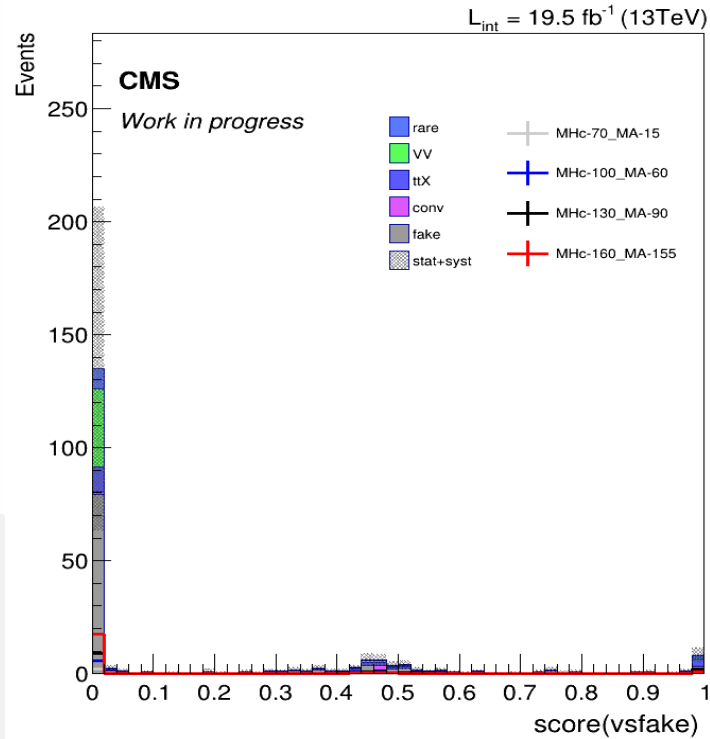
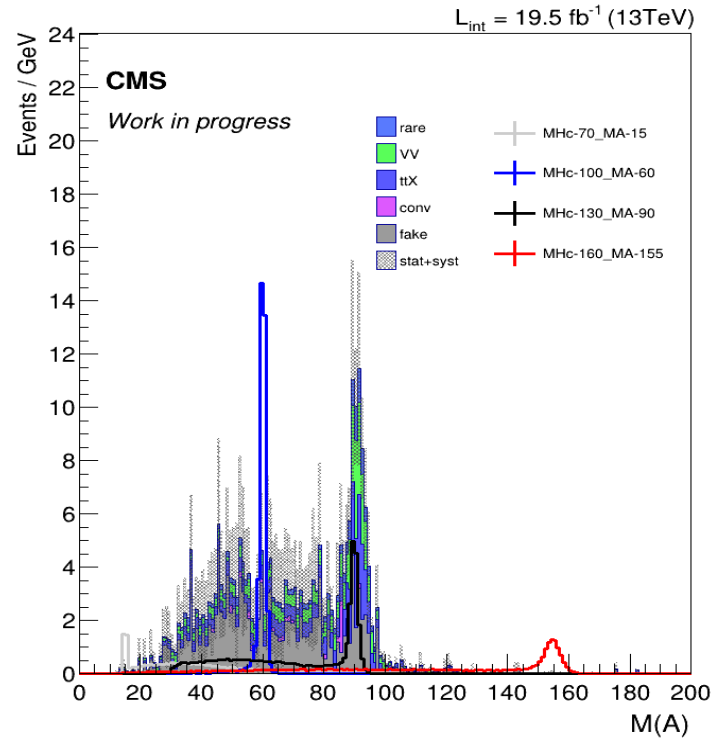
About status

- Training ML discriminators done in early Feb.
- Currently moved on limit extraction in 3μ channel

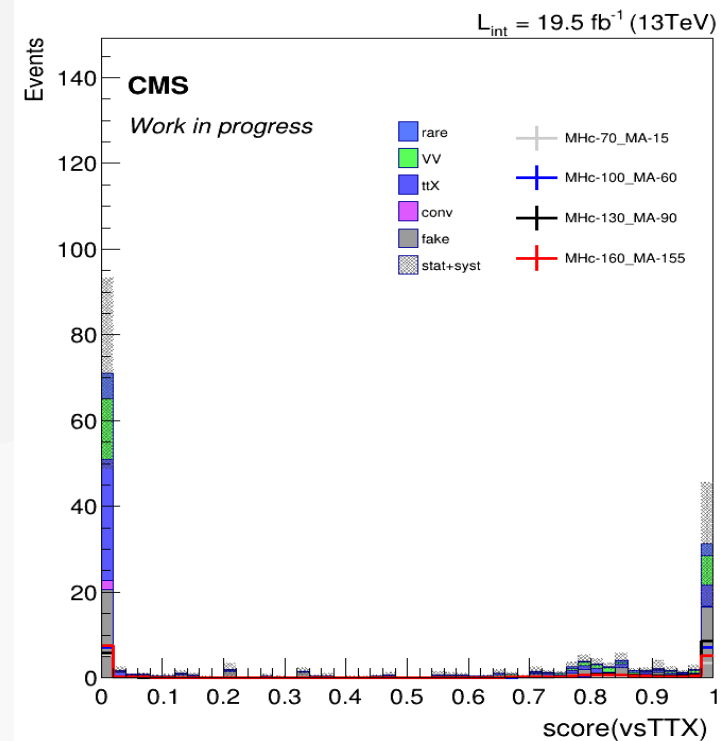
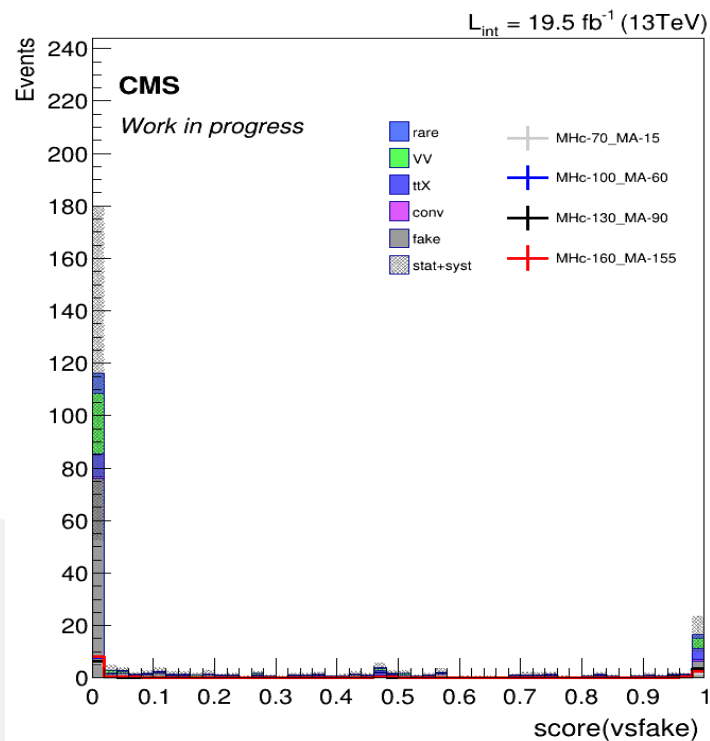
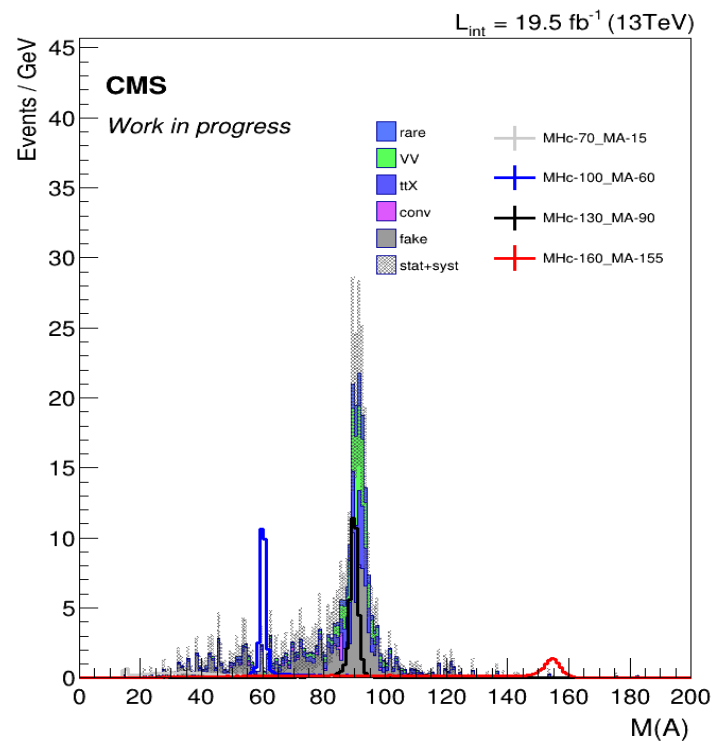
Using 3 discriminant observables:

1. $M(\mu^+\mu^-)$
2. signal vs. tt+Fake score
3. signal vs. tt+X(W, Z, H) score

Plots - Signal Regions (MHc-100 / MA-60)



Plots - Signal Regions (MHc-130 / MA-90)



Method

Baseline Limit Extraction

- Using only $M(\mu^+ \mu^-)$ distribution
- shape analysis (intrinsic width of Z and A is different)

Limit Extraction with ML scores

- Optimize the event selection with scores within M_A resolution
- regenerate M_A templates
- not presented today

Method

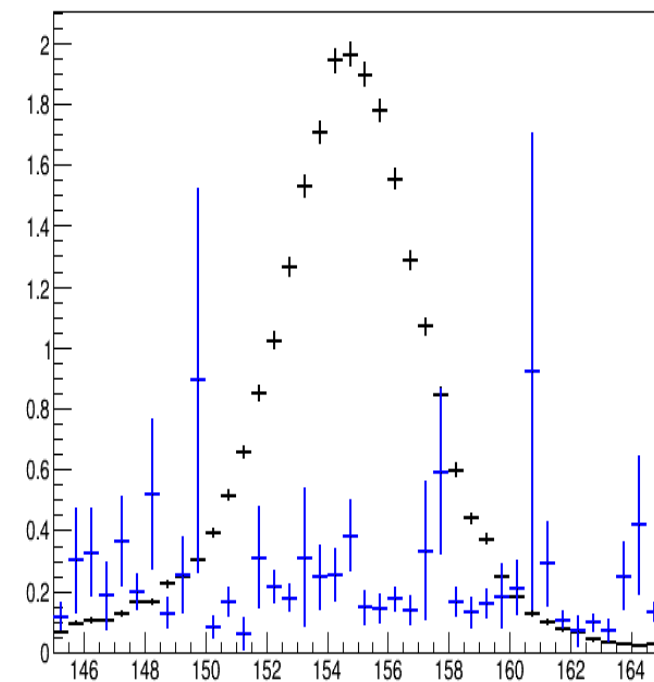
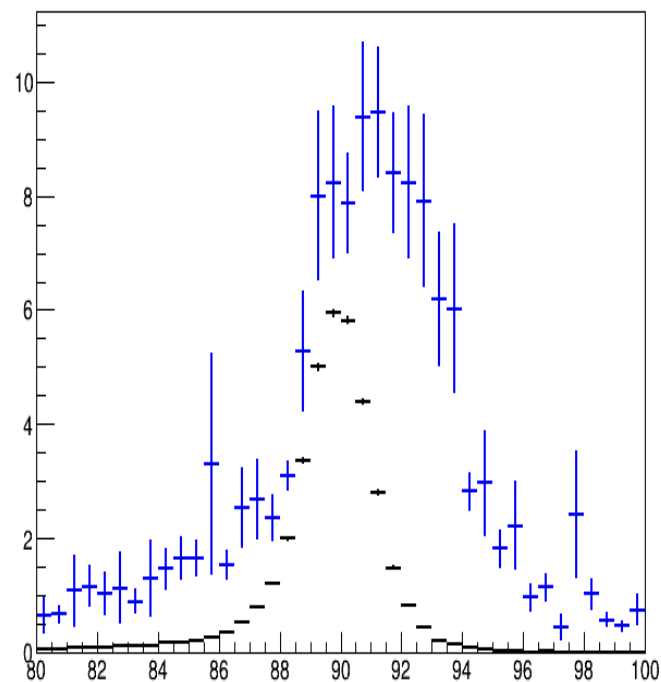
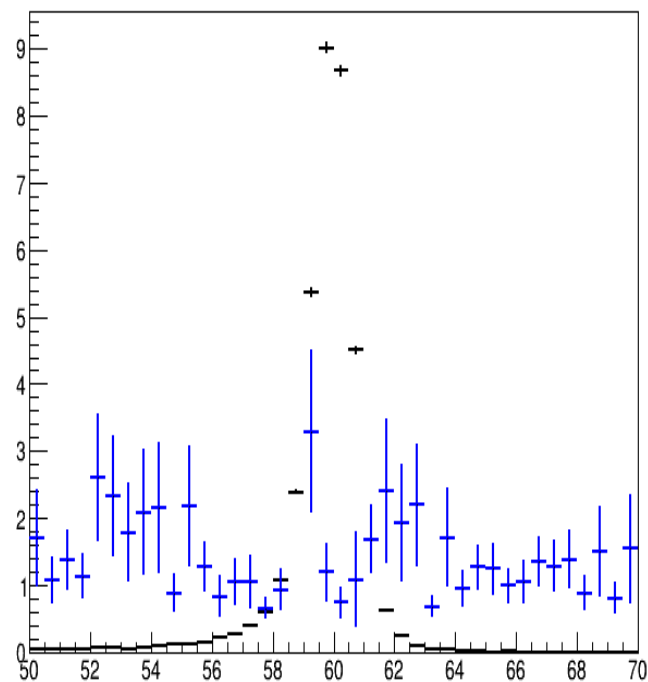
Making template

- Events Selection: Baseline Selection + $M_A \pm 5$ GeV with 0.1 GeV binning (3 GeV for $M_A = 15$ GeV)
- For weight variations: vary weights only after the final selection
- For scale variations: redefine the object and re-select the events
- Final limit extraction done with Asymptotic manner:

```
combine -M AsymptoticLimits workspace_nocut.root -m 125 --run blind
```

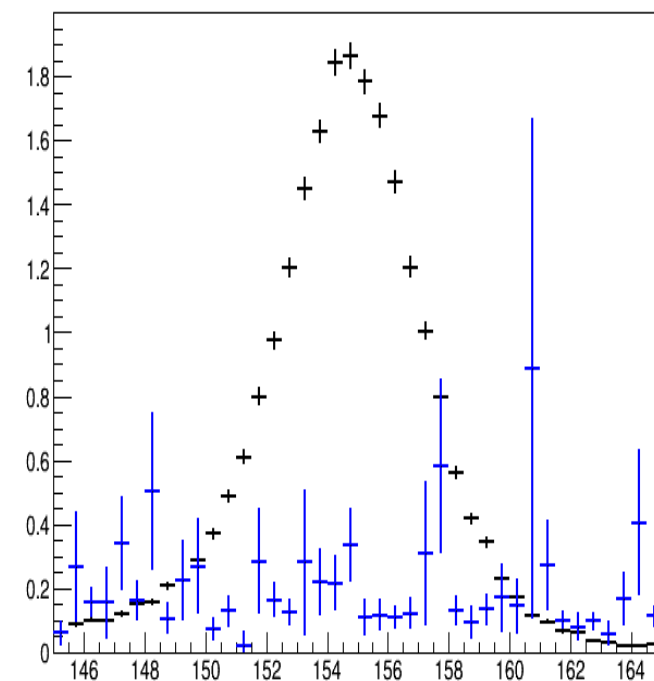
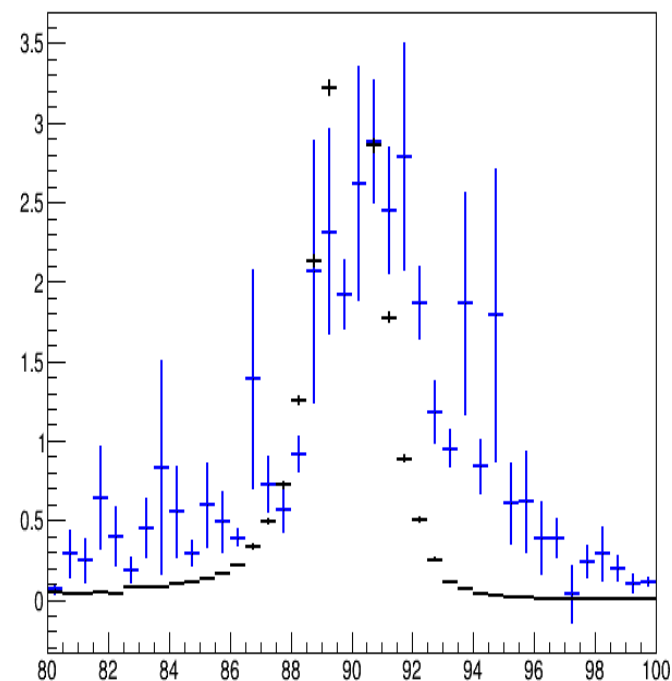
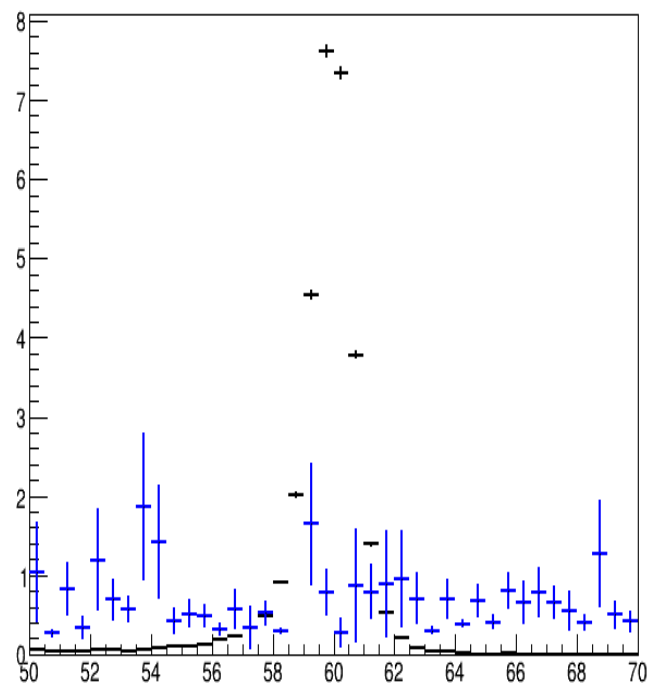
Templates

No ML cuts



Templates

With DNN cuts



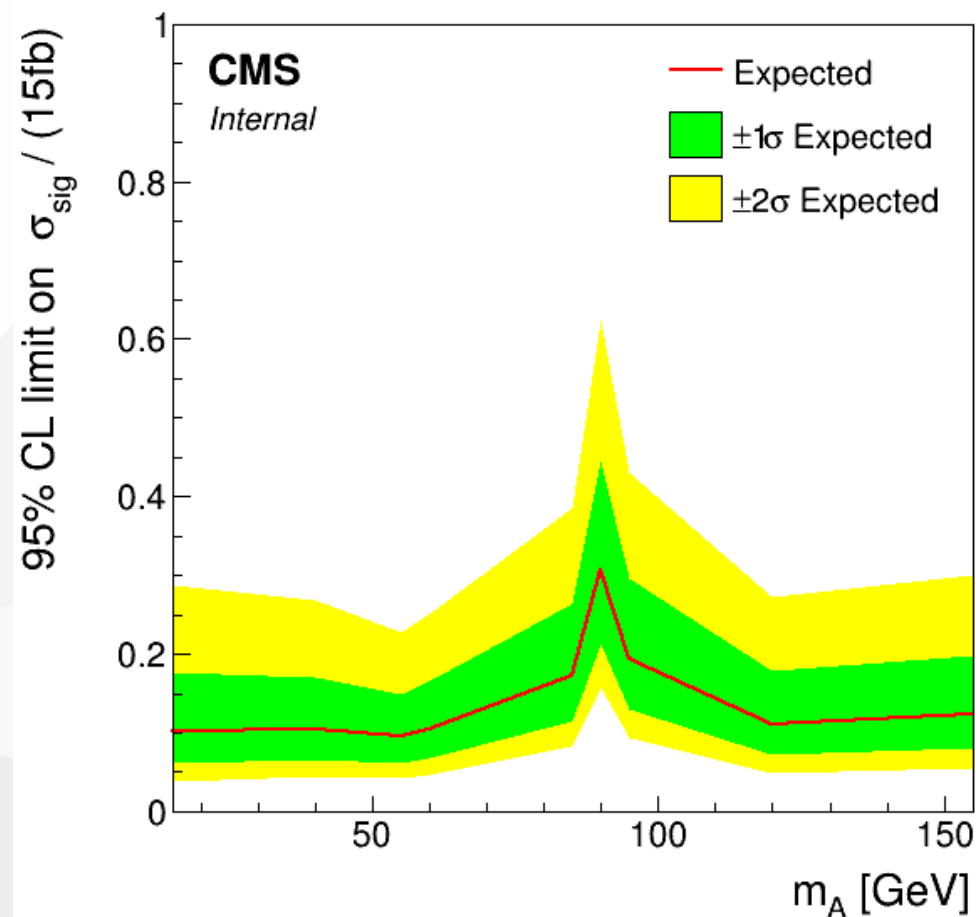
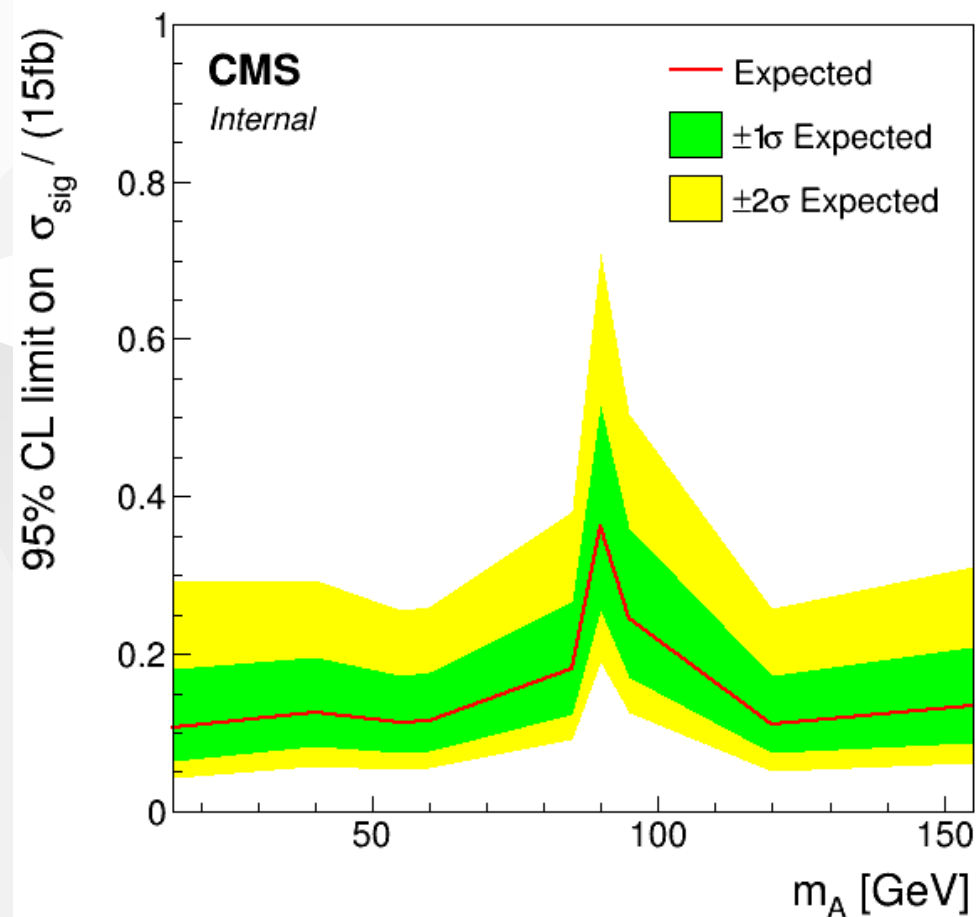
Systematics

- Partial systematic tables
- For fake bkg, $\pm 30\%$ variations in fake rates
- For conversion bkg, $\pm 80\%$ variations (dominant from stat & fake contribution)
- For other MC samples,
 1. Scale Variations: Jet Energy, Jet Resolution
 2. Weight Variations: Muon ID eff, DbIMuTrig eff.

Notes

- $\sigma_{sig} = \sigma(pp \rightarrow t\bar{t}) Br(t \rightarrow H^+ b) Br(H^+ \rightarrow W^+ A) Br(A \rightarrow \mu\mu)$
assumed to be 15 fb (POI = 1)
- Experimental sensitivity is almost indep. of M_{H^+} , so the limit will be presented in ascending order of M_A
- For $M_A \sim 60$ GeV, tt+Fake is the most dominant bkg
- For $M_A \sim 90$ GeV, tt+Z is the most dominant bkg
- For $M_A > 120$ GeV, almost no bkg. exists

Results - Limit plots / 2016, 3μ channel only



Conclusion

- Expected limits using 2016 data only / 3μ channel results have been shown
- How to use the ML discriminants?

To do

- Limit plots / tables will be updated sequentially right after the data processing finished (~Next Week?)
- Comparison of Traditional / DNN / GNN method will be presented (~2 weeks?)
- Adding $1e2\mu$ channel (~after KPS?)

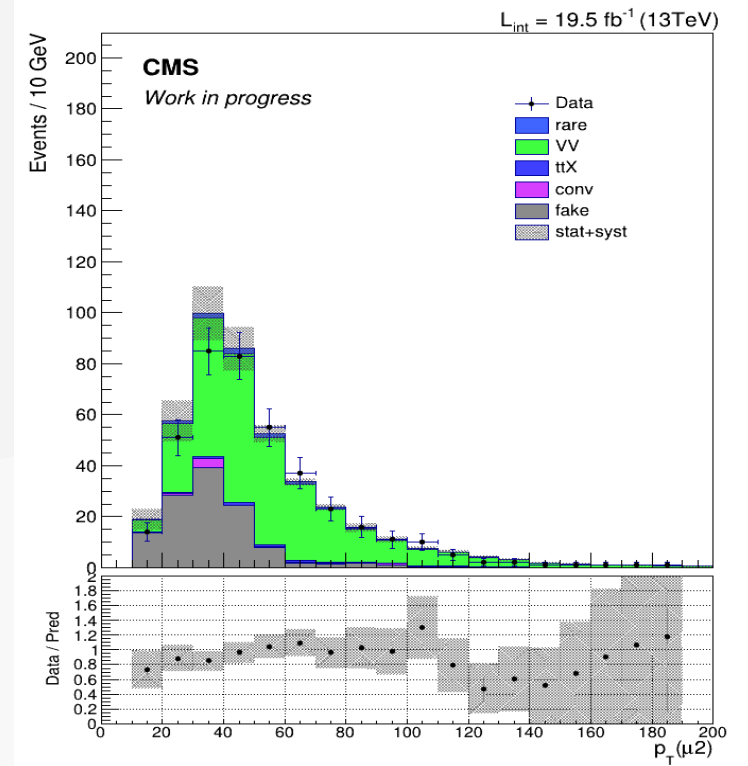
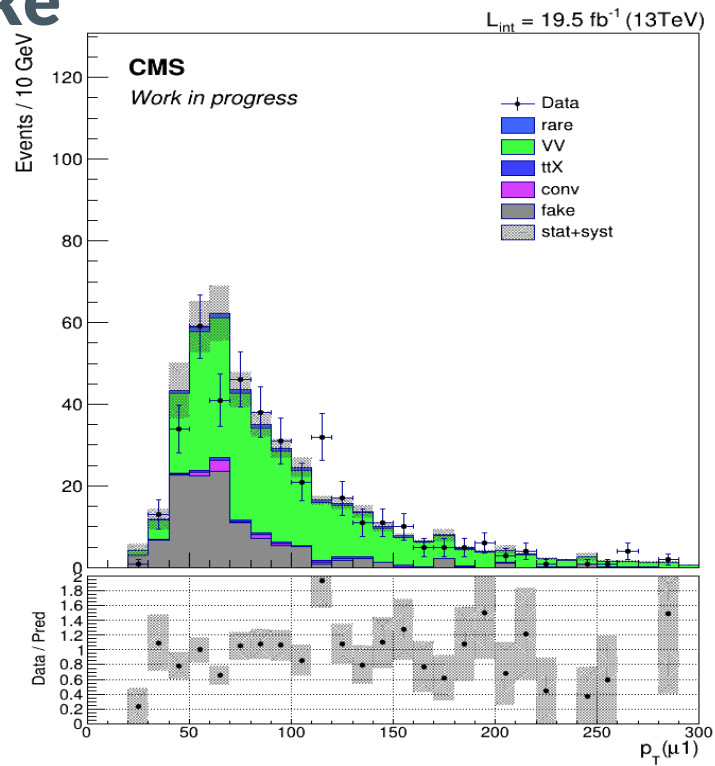
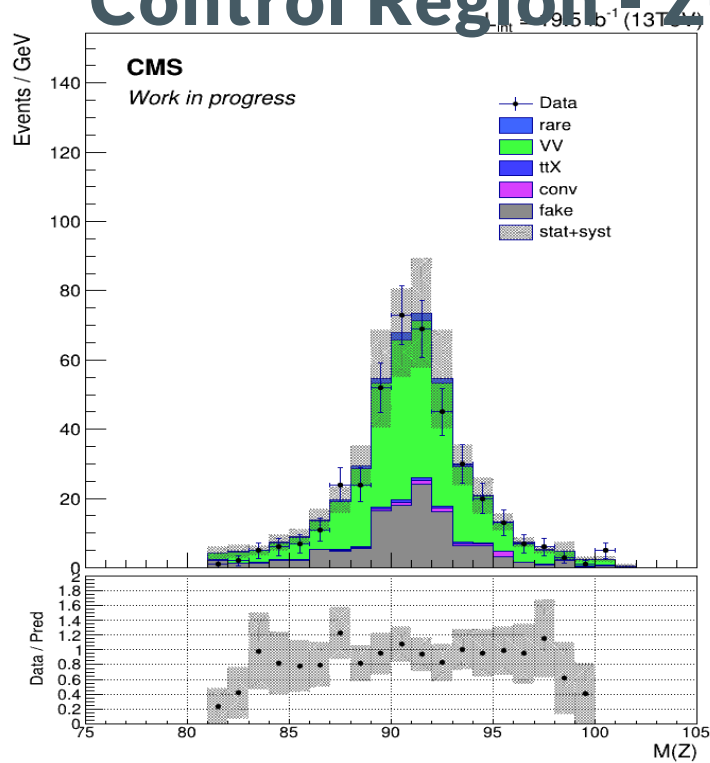
Back Ups

Using 35.9 \fb (2016) only

M_{H^+} M_A [GeV]	70 15	70 40	130 55	100 60	160 85	130 90	100 95	160 120	160 155
exp-2 [fb]	0.63	0.86	0.78	0.81	1.35	2.83	1.86	0.77	0.92
exp-1 [fb]	0.96	1.22	1.10	1.14	1.86	3.82	2.56	1.10	1.31
exp 0 [fb]	1.60	1.88	1.67	1.71	2.71	5.42	3.67	1.67	1.99

Back Ups

Control Region - Z+Fake



Back Ups

Control Region - $Z+\gamma$

