Weekly report

Qiyu Sha

Overview

- CEPC Higgs CP (EPJC Accept)

- Quantum Computer (Have prepared $\nu\bar{\nu}$/ $q\bar{q}$ +Higgs->bb/cc/gg sample by yongfeng's guide for the next analysis.)

- Di-higgs (write some code to get the theoretical uncertainties. Will get a preliminary result this week.)

- Zprime->mumu (create the workspace and do some quickfit first.)

Theoretical Uncertainties---PDF+AlphaS

- Nominal PDF set is 90400(PDF4LHC)

- PDF uncertainties(PDF4LHC, 30items, Hessian symmetric) set: 90401-90430

- AlphaS up/down uncertainties(PDF4LHC)set: 90431/90432

https://arxiv.org/pdf/1510.03865.pdf

α_S **Uncertainties:**

$$\delta^{\alpha_s}\sigma = \frac{\sigma(\alpha_s^{down}) - \sigma(\alpha_s^{up})}{2}$$

PDF Uncertainties:

$$\delta^{pdF}\sigma = \sqrt{\sum_{k=1}^{N_{mean}} (\sigma^{(k)} - \sigma^{(0)})^2}$$

PDF + α_S **Uncertainties:**

$$\delta^{\alpha_s + PDF}\sigma = \sqrt{(\delta^{PDF}\sigma)^2 + (\delta^{\alpha_s}\sigma)^2}$$

ME provider	Pythia8	MG5aMC, Powheg, Herwig7	Sherpa
ME order	LO	LO/NLO	LO/NLO
Baseline	NNPDF23_lo_as_0130_qed (247000)	NNPDF30_nlo_as_0118 (260000)	NNPDF30_nnlo_as_0118 (261000)
		NNPDF30_nlo_as_0118_mc (260800)	NNPDF30_nnlo_as_0118_hessian (303200)
Alternative baseline	x	PDF4LHC15_nlo_30_pdfas (90400)	PDF4LHC15_nnlo_30_pdfas (91400)
α_s variations	NNPDF23_lo_as_0119_qed (246800)	NNPDF30_nlo_as_0119 (266000)	NNPDF30_nnlo_as_0119 (270000)
		NNPDF30_nlo_as_0117 (265000)	NNPDF30_nnlo_as_0117 (269000)
Alternative PDFs	CT14llo (13205)	CT14nlo (13100)	CT14nnlo (13000)
	MMHT2014lo68cl (25000)	MMHT2014nlo68clas118 (25200)	MMHT2014nnlo68cl (25300)

Theoretical Uncertainties---QCD

- Take the envelope of the scale variations as prescribed in the PMG recommendations.

- Considered diagonal variations of the renormalization(μ_r) and the factorization scale (μ_f):

$$\{\mu_r, \mu_f\} \times \{0.5, 0.5\}, \{1, 0.5\}, \{0.5, 1\}, \{1, 1\}, \{2, 1\}, \{1, 2\}, \{2, 2\}$$

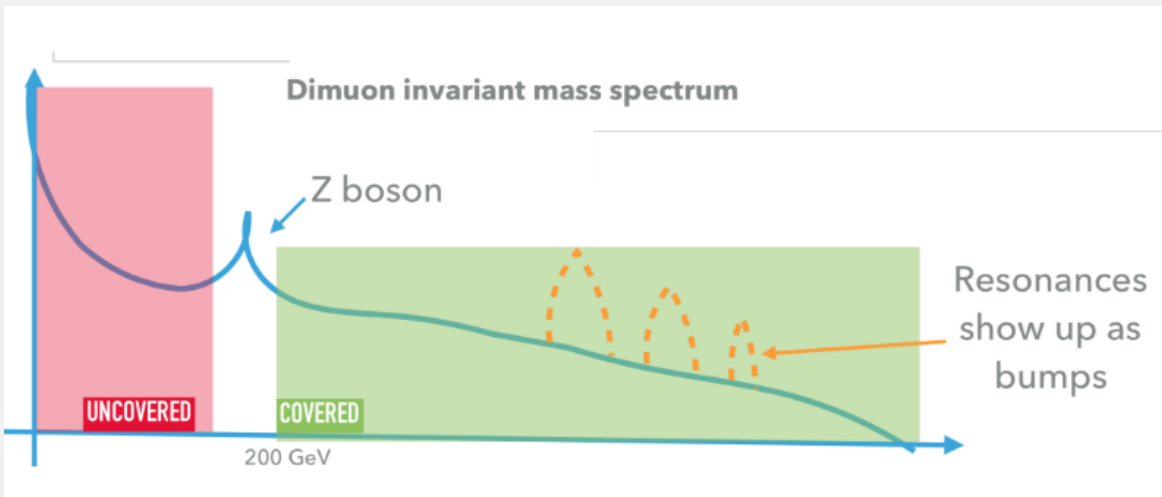- How to apply: (choose the max variation with sign)

$$\max[\mathcal{O}(\mu_{R,i}, \mu_{F,i}) - \mathcal{O}((\mu_{R,0}, \mu_{F,0})]$$

Zprime->mumu
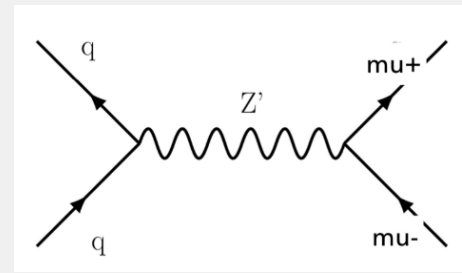
- Search for resonances in the **10-68 GeV** range:

To avoid the quarkonium background between 4-10GeV, and the Z boson around 90GeV.

Zprime->mumu

- BKG MC samples:

MC Type	DSID	Generator Used
Z > $\mu\mu$	364100 - 364113 , 364198-364203	Fast Simulation through PYTHIA
Z > $\tau\tau$	364128 - 364141 , 364210-364215	Sherpa
$t\bar{t}$	410472	Sherpa
Diboson	364253 - 364255 , 363355 - 363360 ; 363489 ; 364250 ; 364288 - 364290	Sherpa
Top decay	410644 - 410645 , 410658 - 410659 ; 410648 - 410649	Powheg+Pythia8
W+ jets$\mu\nu$	364156 - 364169	Sherpa
$b\bar{b}$	363833	Pythia8b
$c\bar{c}$	363834	Pythia8b

- For signal:

Just never got to producing the full signal grid.

Prepare signal template sample with various widths and size, they are better for testing the stats framework