DMWG t-channel studies: S3D_uR

Sukanya Sinha
University of Witwatersrand
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S3D_uR setup (For inclusive kfactor)

XX process: generate p p > dm dm /excluded (**LO** with ptj > 100 GeV)

generate p p > dm dm /excluded [QCD] (**NLO** wih ptj > 100 GeV)

XY process: generate p p > dm yy /excluded (**LO**, ptj > 30 GeV, cut_decays=True)

generate p p > dm yy /excluded [QCD] (**NLO**, ptj > 30 GeV)

YY process: generate p p > yy yy /excluded (**LO**, ptj > 30 GeV)

generate p p > yy yy /excluded (**NLO**, ptj > 30 GeV)

YY t-channel process: {YY qcd process and DMT=2 QCD=0 QED=0}

k-factor = sigma(NLO)/sigma(LO)

Inclusive k-factors : S3D_uR model

M_x = 150 GeV, M_Y = 500 GeV

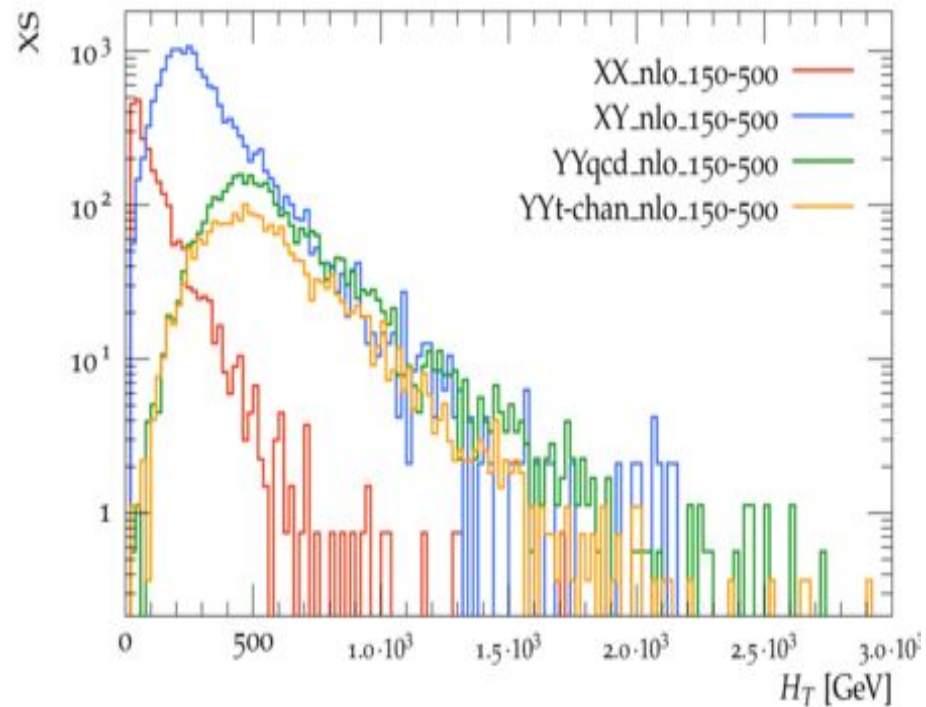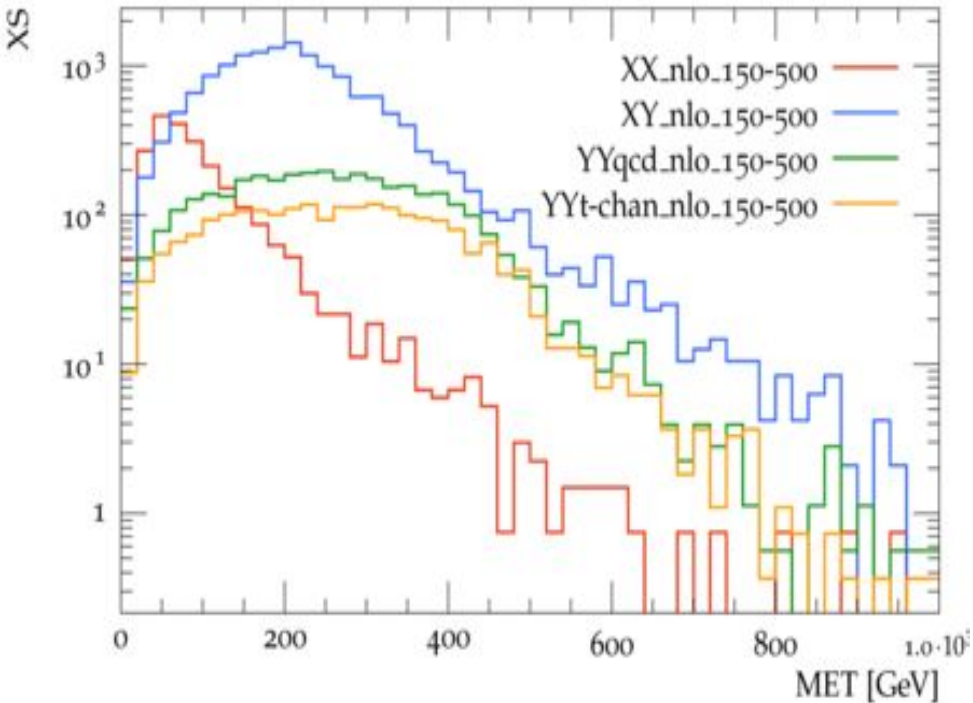| Process	NLO (pb)	LO(pb)	k-factor
XX	9.31E-01	7.07E-01	1.316187168
XY	2.210244	1.6201	1.364263934
YY qcd	4.84E-01	3.23E-01	1.497439319
YY t-chan	3.14E-01	2.60E-01	1.207931154

Similar k-factor variations for
M_x = 100, 250 GeV
M_y = 400, 500, 800, 1000 GeV

K factor ranges between 0.8 - 1.5

Sensitivity varies wrt dm and mediator mass

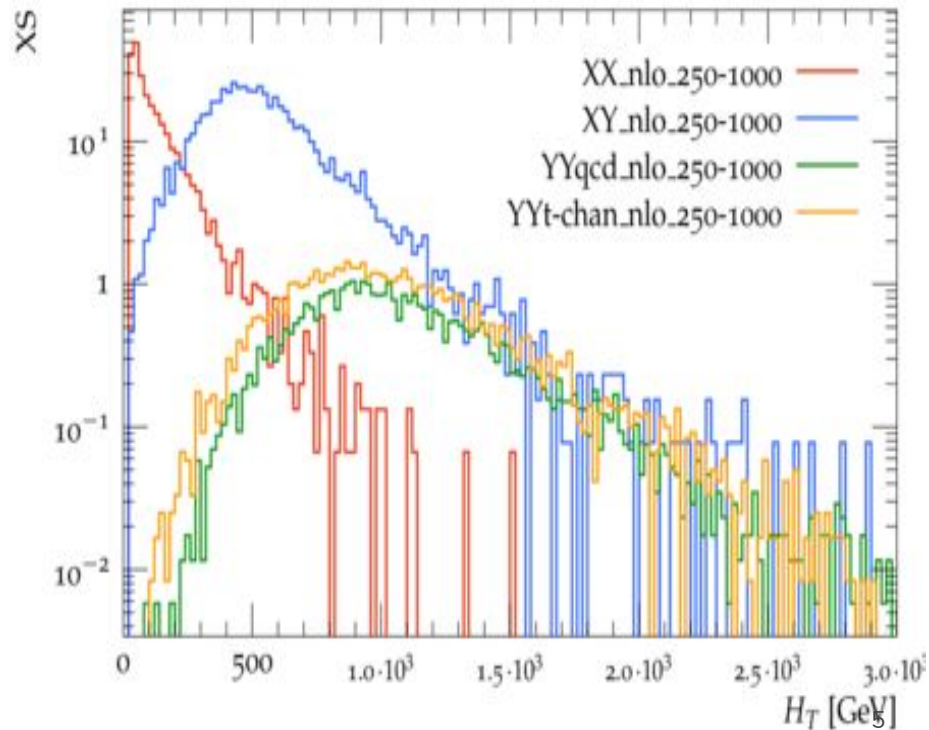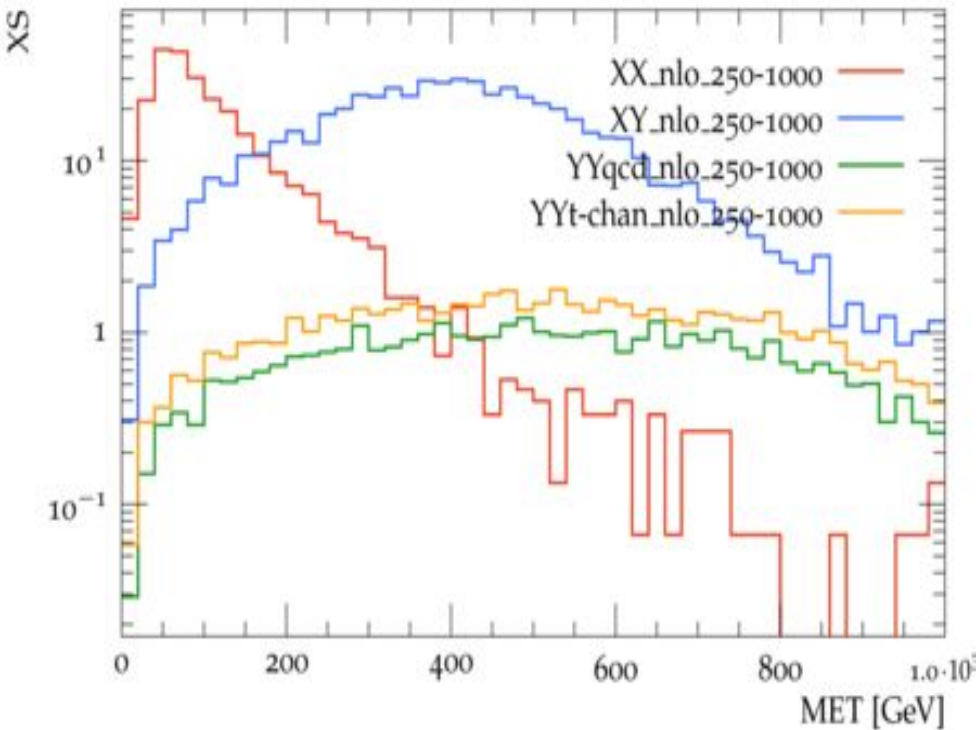# NLO generation: XX, XY, YY-qcd, YY-tchan

$M_x = 150$ GeV, $M_y = 500$ GeV

NLO generation: XX, XY, YY-qcd, YY-tchan

M_x = 250 GeV, M_y = 1000 GeV

S3D_uR setup (For kinematic distributions)

XX process: generate p p > dm dm /excluded ; add process p p > dm dm /excluded $yy (**LO** with ptj > 100 GeV)

generate p p > dm dm /excluded [QCD] (**NLO** with ptj > 100 GeV)

XY process: generate p p > dm yy /excluded; add process p p > dm yy j /excluded $yy (**LO**, ptj > 30 GeV, cut_decays=True)

generate p p > dm yy /excluded [QCD] (**NLO**, ptj > 30 GeV)

YY qcd process: generate p p > yy yy /excluded (**LO**, ptj > 30 GeV)

generate p p > yy yy /excluded [QCD] (**NLO**, ptj > 30 GeV)

YY t-channel process: {YY qcd process and DMT=2 QCD=0 QED=0}

Mediator decays in MadSpin

k-factor = bin by bin NLO/LO xsection ratio
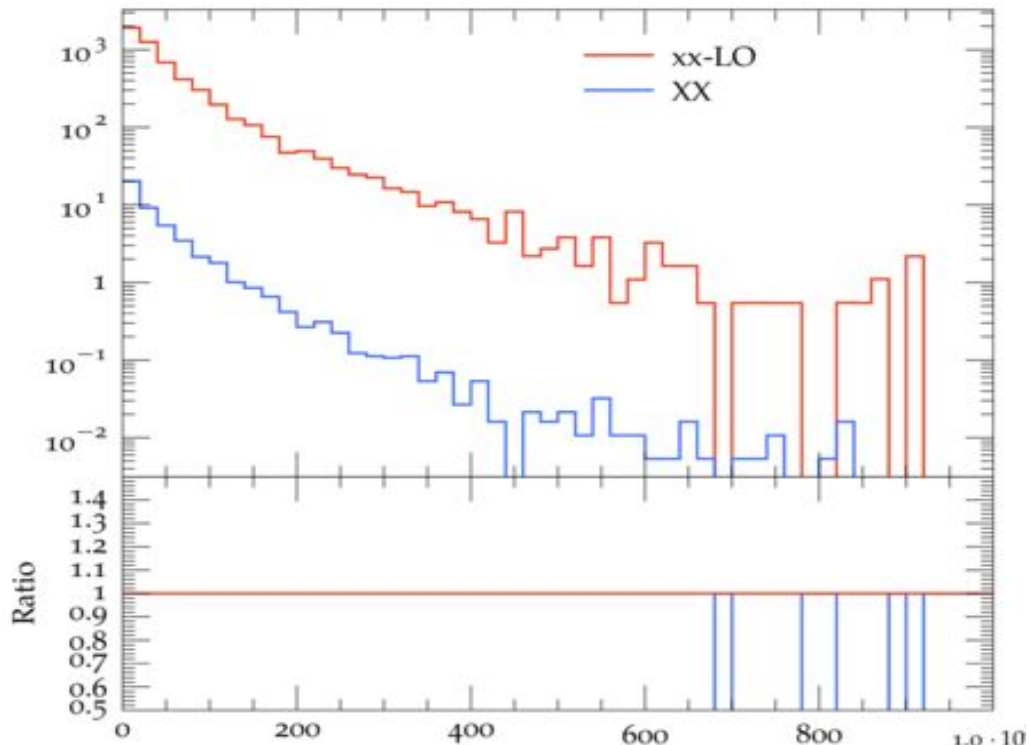
Kinematic distributions LO vs NLO

Was using Rivet in lxplus, there is difference between LO & NLO plots, of the order of 2.

Identified the issue with Rivet when running LO hepmc:

`Rivet.AnalysisHandler: WARN  Could not identify nominal weight. Will continue assuming variations-only run.`

In discussions with ATLAS Rivet experts, suggested to try a newer version and will get a workaround in a couple of days.

Kinematic Distributions: LO vs NLO

On untarring the hepmc, there's a list of weights:

"DYN_SCALE=1_MUF=0.5_MUR=0.5_PDF=260000_MERGING=0.000"
"DYN_SCALE=1_MUF=0.5_MUR=1.0_PDF=260000_MERGING=0.000"
"DYN_SCALE=1_MUF=0.5_MUR=2.0_PDF=260000_MERGING=0.000"
"DYN_SCALE=1_MUF=1.0_MUR=0.5_PDF=260000_MERGING=0.000"
"DYN_SCALE=1_MUF=1.0_MUR=1.0_PDF=260000_MERGING=0.000"
"DYN_SCALE=1_MUF=1.0_MUR=2.0_PDF=260000_MERGING=0.000"
"DYN_SCALE=1_MUF=2.0_MUR=0.5_PDF=260000_MERGING=0.000"

…

On taking:

**DYN_SCALE=1_MUF=1.0_MUR=1.0_PDF=260000
_MERGING=0.000**

But LO > NLO by ~ 0.5