Generator Vadiation
W jet-binned sample validation

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2024.6.21

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Validation task

> **MadGraph**
- The most commonly used **generator** within CMS
- Generator is the bridge between theory and experiment, the generator is based on the theory, and generate events through the Monte Carlo (MC) method.
- We can obtain the cross section, distribution from MadGraph, then we can compare the MC events with data.

> **Validation in this talk:**
- **Compare the process** $p\,p\ \rightarrow\ W^* \rightarrow l\upsilon + n\,jet$
  $(l = e, \mu, \tau;\quad n = 0, 1, 2)$
  between Madgraph v2_9_18 and v3_5_2
  for both LO and NLO

Update today

```
set low_mem_multicore_nlo_generation True

#import model loop_sm-ckm_no_b_mass
#switch to diagonal ckm matrix if needed for speed
import model loop_sm-no_b_mass

define ell+ = e+ ta+
define ell- = e- ta-

generate p p > ell+ vl j j $$ t t~ h [QCD] @0
add process p p > ell- vl~ j j $$ t t~ h [QCD] @1

output LNu_NLO_2j -nojpeg
```

```
set low_mem_multicore_nlo_generation True

#import model loop_sm-ckm_no_b_mass
#switch to diagonal ckm matrix if needed for speed
import model loop_sm-no_b_mass

define ell+ = e+ ta+
define ell- = e- ta-

generate p p > ell+ vl j $$ t t~ h [QCD] @0
add process p p > ell- vl~ j $$ t t~ h [QCD] @1

output LNu_NLO_1j_NoMu -nojpeg

~
```

**LNu_NLO_2j without ckm and mu
(last week)**

**LNu_NLO_1j without ckm and mu
For XS comparison (today)**

Rebin the plot (today)

The code will be uploaded later

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Cross section comparison

$$p\,p \;\rightarrow\; W^* \rightarrow lv + n\,jet$$

Normal card

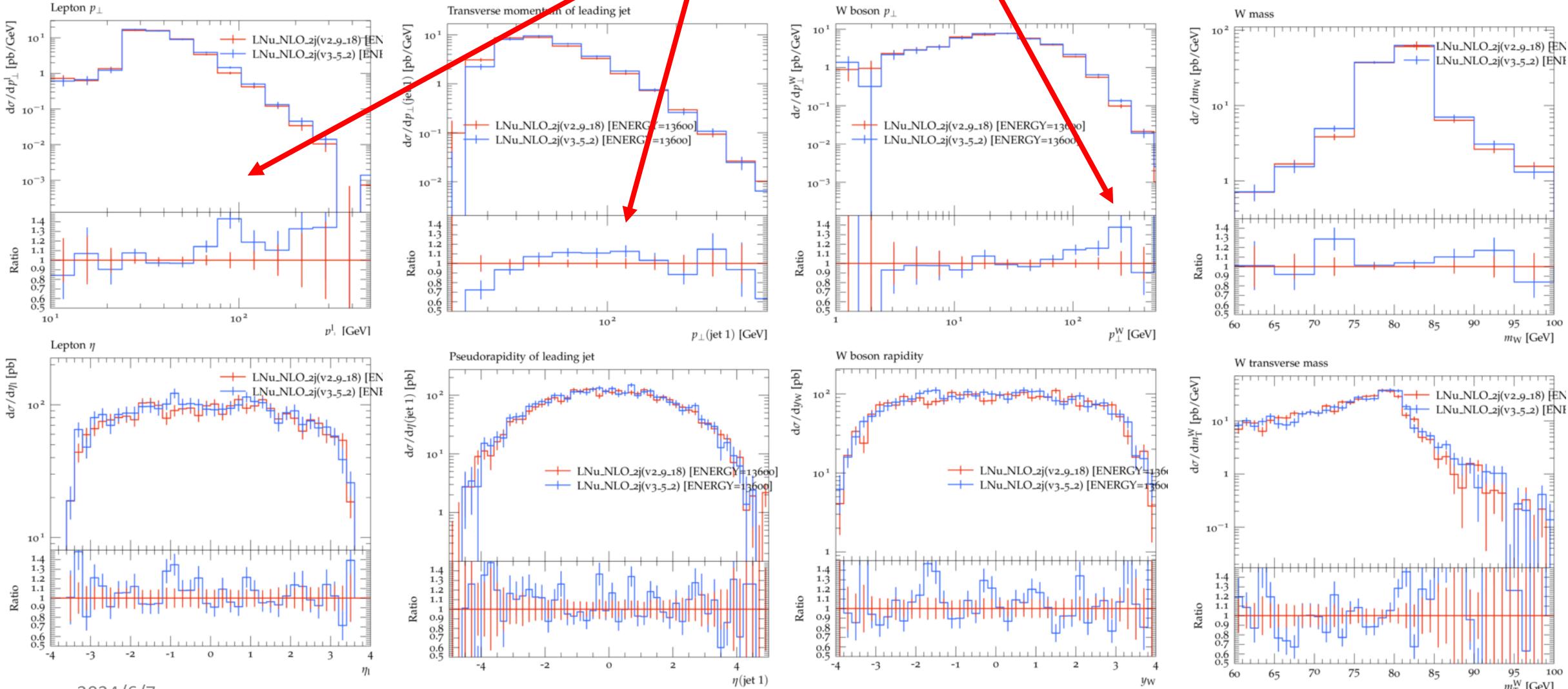|	Before matching		After matching	
process	Cross section v2_9_18 (pb)	Cross section v3_5_2 (pb)	Cross section v2_9_18 (pb)	Cross section v3_5_2 (pb)
LNu_LO_0j	54440 ± 33.41	54380 ± 33.30	54440.00 ± 33.41	54380.00 ± 33.30
LNu_LO_1j	37340 ± 179.00	37190 ± 172.00	9353.56 ± 47.67	9311.89 ± 45.98
LNu_LO_2j	26130 ± 81.73	25960 ± 80.62	3045.48 ± 12.69	3025.64 ± 12.56
LNu_NLO_0j	61190 ± 72.45	61170 ± 76.11	61190.00 ± 72.45	61170.00 ± 76.11
LNu_NLO_1j	35580 ± 70.28	32630 ± 61.55	12222.74 ± 47.79	11820.78 ± 43.78
LNu_NLO_1j	23740 ± 50.24	21770 ± 42.96	8109.74 ± 32.45	7880.91 ± 29.59
LNu_NLO_2j	10750 ± 43.11	12570 ± 56.86	2337 ± 21.11	2469.72 ± 25.17

Without mu and ckm

- LO: consistent within the uncertainty
- NLO_0j: consistent within the uncertainty
- NLO_1j: v3 is lower than v2
- NLO_2j: v2 is lower than v3

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LNu_NLO_2j

$pp \rightarrow W^* \rightarrow l\nu + 0\,jet$, LO

Seems different in high PT region