HERWIG7 Generation

W+jets and Z+jets Validation

Camilo A Salazar G+

*José Ruíz**

+camilo.salazar@cern.ch

*jose.ruiz@cern.ch

November 14, 2018

1. Introduction
2. Strategy
3. Herwig 7 generation in CMSSW_10_2_6
4. Rivet Interface
5. Some
6. Present issues and Conclusions

Introduction

We are working on validation with Herwig 7 (H7). We would like to understand the degree of adjustment between the data and H7 MC, and if gives any different prediction than MG+pythia8.

Processes under study:

1. Z+Jets.
2. W+Jets.

Strategy

Use the different combinations between matrix elements and NLO corrections offered by H7 to generate W+jets and Z+jets samples

Validation:

- Rivet validate against data samples.
- Validate against MG+pythia8 samples.

Herwig 7 generation in CMSSW_10_2_6

Herwig have some matrix element build in, and also have support for some external LO and NLO matrix element(ME) providers, and also several showers

ME

- MadGraph-GoSam
- MadGraph-MadGraph
- MadGraph-OpenLoops
- MadGraph-NJet
- HJets
- VBFNLO

Matching and shower

- MCat[LO-NLO]-[Default-DipoleShower]Shower
- Powheg-[Default-DipoleShower]Shower
- LO-[Default-DipoleShower]Shower
- .[LO-NLO]-NoShower

Build in, $pp \to W + Jets$ and $pp \to Z + Jets$


```
Matchbox = cms.vstring('read snippets/PPCollider.in',
        'cd /Herwig/Generators',
        'set EventGenerator:EventHandler:LuminosityFunction:Energy 7000.0',
        'cd /Herwig/MatrixElements/',
        '# W+jet',
        'insert SubProcess:MatrixElements[0] MEWJet',
        'cd /Herwig/Generators',
        '# analysis of W/Z events',
        'insert EventGenerator:AnalysisHandlers 0 /Herwig/Analysis/DrellYan',
        'saverun LHC EventGenerator')
```

In the similar way it is the $pp \to Z$ process.

`https://github.com/casfisica/Herwig7-Interface/blob/master/Herwig7_ppToW_Build_In.py`

External ME providers


```
process.generator = cms.EDFilter("Herwig7GeneratorFilter",
    Matchbox = cms.vstring('read snippets/Matchbox.in',
        'read snippets/PPCollider.in',
        'cd /Herwig/EventHandlers',
        'set EventHandler:LuminosityFunction:Energy 13000*GeV',
        '## Model assumptions',
        'read Matchbox/StandardModelLike.in',
        'read Matchbox/DiagonalCKM.in',
        '## Set the order of the couplings',
        'cd /Herwig/MatrixElements/Matchbox',
        'set Factory:OrderInAlphaS 0',
        'set Factory:OrderInAlphaEW 2',
        '## Select the process',
        'do Factory:Process p p -> Z0',
        '# read Matchbox/MadGraph-GoSam.in',
        '# read Matchbox/MadGraph-MadGraph.in',
        'read Matchbox/MadGraph-OpenLoops.in',
        '# set /Herwig/Cuts/ChargedLeptonPairMassCut:MinMass 60*GeV',
        '# set /Herwig/Cuts/ChargedLeptonPairMassCut:MaxMass 120*GeV',
        'cd /Herwig/MatrixElements/Matchbox',
        'set Factory:ScaleChoice /Herwig/MatrixElements/Matchbox/Scales/LeptonPairMassScale',
        'read Matchbox/MCatNLO-DefaultShower.in',
        '# read Matchbox/NLO-NoShower.in',
        '# read Matchbox/LO-NoShower.in',
        'read Matchbox/FiveFlavourScheme.in',
        'read Matchbox/MMHT2014.in',
        'do /Herwig/MatrixElements/Matchbox/Factory:ProductionMode'),
```

Generate events using CMSSW

https://github.com/casfisica/Herwig7-Interface/blob/master/Herwig7_Matchbox_90X_ppToW_GEN_SIM.py

Rivet Interface

The Rivet package can be used directly from Herwig

```
# customisation of the process.

process.load('GeneratorInterface.RivetInterface.rivetAnalyzer_cfi')

# Automatic addition of the customisation function from Configuration.GenProduction.rivet_customize

#from Configuration.GenProduction.rivet_customize import customise


def customise(process):
        process.load('GeneratorInterface.RivetInterface.rivetAnalyzer_cfi')
        process.rivetAnalyzer.AnalysisNames = cms.vstring('CMS_2015_I1384119')
        process.rivetAnalyzer.CrossSection = cms.double(9757000000)
        process.rivetAnalyzer.OutputFile = cms.string('output.yoda')
        process.generation_step+=process.rivetAnalyzer
        process.schedule.remove(process.RAWSIMoutput_step)
        return(process)
#call to customisation function customise imported from Configuration.GenProduction.rivet_customize

process = customise(process)

# End of customisation functions
```

CMSSW create a Yoda file

Rivet Interface

The Rivet package can be used directly from Herwig

```
# customisation of the process.

process.load('GeneratorInterface.RivetInterface.rivetAnalyzer_cfi')

# Automatic addition of the customisation function from Configuration.GenProduction.rivet_customize

#from Configuration.GenProduction.rivet_customize import customise


def customise(process):
        process.load('GeneratorInterface.RivetInterface.rivetAnalyzer_cfi')
        process.rivetAnalyzer.AnalysisNames = cms.vstring('CMS_2015_I1384119')
        process.rivetAnalyzer.CrossSection = cms.double(9757000000)
        process.rivetAnalyzer.OutputFile = cms.string('output.yoda')
        process.generation_step+=process.rivetAnalyzer
        process.schedule.remove(process.RAWSIMoutput_step)
        return(process)
#call to customisation function customise imported from Configuration.GenProduction.rivet_customize

process = customise(process)

# End of customisation functions
```

CMSSW create a Yoda file

Present issues and conclusions

Present issues

Not able to produce:

- MadGraph-MadGraph.
- MadGraph-NJet.

Conclusions

We produce a $pp \rightarrow Z + Jets$ and $pp \rightarrow W^{\pm} + Jets$ samples using:

- Build-in ME.
- MadGraph-OpenLoops.

Many thanks to Andrej for your help.

Thank You.

Camilo A Salazar G+ *José Ruíz**