Matching Validation and kinematics of W+ and extra-jets

MadReport

September 18, 2007

Contents

1 Production 1 details

```
#*********************************************************************
#                                                                    *
#                        MadGraph/MadEvent                           *
#                                                                    *
#                       The new web generation                       *
#                                                                    *
#                    http://madgraph.hep.uiuc.edu                    *
#                    http://madgraph.phys.ucl.ac.be                  *
#                    http://madgraph.roma2.infn.it                   *
#                                                                    *
#             CP3 team                      Tim Stelzer              *
#       Universite de Louvain          University of Illinois        *
#                                                                    *
#....................................................................*
#                                                                    *
# This file contains all the information necessary to reproduce      *
# the events generated:                                              *
#                                                                    *
# 1. software version                                                *
# 2. proc_card.dat      : code generation info including model       *
# 3. param_card.dat     : model primary parameters in the LH format  *
# 4. run_card.dat       : running parameters (collider and cuts)     *
# 5. pythia_card.dat    : present only in the pythia event file      *
# 6. pgs_card.dat       : present only in the pgs event file         *
#                                                                    *
#                                                                    *
#....................................................................*
#>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
# Begin version
#
# MG/ME version    : 4.1.39
# madgraph version : 4.1.8
# template version : 2.1.33
# helas version    : 3.2
# model version    : sm_1.1
#
# End version
#<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<
#>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
# Begin proc_card.dat
#
#*********************************************************************
#                         MadGraph/MadEvent                          *
#                    http://madgraph.hep.uiuc.edu                    *
#                                                                    *
#                           proc_card.dat                            *
#                                                                    *
# This file is used to generate the code for a specific process.     *
# Some notation/conventions:                                         *
#                                                                    *
# 0. Do not modify the TAGS and their order.                         *
# 1. hash/pound is a comment.                                        *
# 2. The charcter after the @ is used as an identifier for the class *
#    of processes. It can be a single or a digit.                    *
# 3. The number of lines for the max couplings depends on how many   *
#    different classes of couplings are present in the model         *
#    In the SM these are just two: QED (which include EW) and QCD    *
# 4. Write "end_coup" after  the couplings list,                     *
#    to tell MG that the couplings input is over.                    *
# 5. Write "done" after the proc list to                             *
#    to tell MG that the proc input is over.                         *
# 6. Some model names available at present are:                      *
#    sm     =  Standard Model                                        *
#    sm_ckm =  Standard Model with Cabibbo matrix                    *
#    mssm   =  Minimal Supersymmetric Standard Model                 *
#    2hdm   =  Generic Two Higgs Doublet model                       *
#    heft   =  Higgs EFT (+Standard Model)                           *
#    usrmod =  User Model                                            *
# 7. Don't leave spaces between the particles name in the            *
#    definition of the multiparticles.                               *
#*********************************************************************
#*********************************************************************
# Process(es) requested : mg2 input                                  *
#*********************************************************************
# Begin PROCESS # This is TAG. Do not modify this line
pp>w+jjjj   #  Process
```

```
QCD=99   # max qcd order
QED=1   # max qed order
end_coup   # the coupling list is over
done       # the process list is over
# End PROCESS  # This is TAG. Do not modify this line
#*********************************************************************
# Model information                                                  *
#*********************************************************************
# Begin MODEL  # This is TAG. Do not modify this line
sm
# End   MODEL  # This is TAG. Do not modify this line
#*********************************************************************
# Start multiparticle definitions                                    *
#*********************************************************************
# Begin MULTIPARTICLES # This is TAG. Do not modify this line
p uu~dd~ss~cc~g
j uu~dd~ss~cc~g
l+ e+mu+
l- e-mu-
vl vevm
vl~ ve~vm~
# End  MULTIPARTICLES # This is TAG. Do not modify this line
#
# End proc_card.dat
#<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<
#>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
# Begin param_card.dat
#
#******************************************************************
#                      MadGraph/MadEvent                          *
#******************************************************************
#   Les Houches friendly file for the SM parameters of MadGraph   *
#        Spectrum and decay widths produced by SMCalc             *
#******************************************************************
#*Please note the following IMPORTANT issues:                     *
#                                                                 *
#0. REFRAIN from editing this file by hand! Some of the parame-   *
#   ters are not independent                                      *
#   (such as G_Fermi, alpha_em, sin(theta_W),MZ,MW) and serious   *
#   problems might be encountered (such as violation of unitarity *
#   or gauge invariance).  Always use a calculator.               *
#                                                                 *
#1. alpha_S(MZ) has been used in the calculation of the parameters*
#   but, for consistency, it will be reset by madgraph to the     *
#   value expected IF the pdfs for collisions with hadrons are    *
#   used. This value is KEPT by madgraph when no pdf are used     *
#   lpp(i)=0 .                                                    *
#                                                                 *
#2. Values of the charm and bottom kinematic (pole) masses are    *
#   those used in the matrix elements and phase space UNLESS they *
#   are set to ZERO from the start in the model (particles.dat)   *
#   This happens, for example,  when using 5-flavor QCD where     *
#   charm and bottom are treated as partons in the initial state  *
#   and a zero mass might be hardwired in the model definition.   *
#                                                                 *
#******************************************************************
Block MODSEL # Select Model
     0   1   #  0 1 = SM
Block SMINPUTS      # Standard Model inputs
     1         1.32506980E+02   # alpha_em(MZ)(-1) SM MSbar
     2         1.16639000E-05   # G_Fermi
     3         1.18000000E-01   # alpha_s(MZ) SM MSbar
     4         9.11880000E+01   # Z mass (as input parameter)
Block MGSMPARAM      # Standard Model parameters for MadGraph
     1         2.22246533E-01   # sin(theta_W)^2
     2         8.04190000E+01   # W mass (as input parameter)
Block MGYUKAWA     # Yukawa masses m/v=y/sqrt(2)
#    PDG          YMASS
     5         4.70000000E+00   # mbottom for the Yukawa  y_b
     4         1.42000000E+00   # mcharm  for the Yukawa  y_c
     6         1.74300000E+02   # mtop    for the Yukawa  y_t
    15         1.77700000E+00   # mtau    for the Yukawa  y_ta
Block MGCKM     # CKM elements for MadGraph
     1   1     9.75000000E-01   # Vud for Cabibbo matrix
#===========================================================
# QUANTUM NUMBERS OF NEW STATE(S) (NON SM PDG CODE) IF ANY
# (see below for masses and decay tables)
# These blocks are automatically created by the MadGraph
```

```
# qnumbers.pl script from the particles.dat model file
#===========================================================
# END of QNUMBERS blocks
#===========================================================
Block MASS      #  Mass spectrum (kinematic masses)
#       PDG       Mass
         5     4.70000000E+00   # bottom   pole mass
         6     1.74300000E+02   # top      pole mass
        15     1.77700000E+00   # tau      mass
        23     9.11880000E+01   # Z        mass
        24     8.04190000E+01   # W        mass
        25     1.20000000E+02   # H        mass
#            PDG       Width
DECAY         6     1.50833649E+00   # top width
DECAY        23     2.44140351E+00   # Z   width
DECAY        24     2.04759951E+00   # W   width
DECAY        25     6.79485838E-03   # H   width
#        BR           NDA       ID1       ID2
     7.00588389E-02    2           4        -4   # BR( H -> c  cbar  )
     7.61074375E-01    2           5        -5   # BR( H -> b  bbar  )
     0.00000000E+00    2           6        -6   # BR( H -> t  tbar  )
     3.65529942E-02    2          15       -15   # BR( H -> tau- tau+)
     5.84716539E-03    2          23        23   # BR( H -> Z   Z^(*))
     6.31545979E-02    2          24       -24   # BR( H -> W   W^(*))
     2.55499652E-02    2          21        21   # BR( H -> g   g    )
     1.20906932E-03    2          22        22   # BR( H -> A   A    )
#
# End param_card.dat
#<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<
#>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
# Begin run_card.dat
#
#*********************************************************************
#                       MadGraph/MadEvent                            *
#                  http://madgraph.hep.uiuc.edu                      *
#                                                                    *
#                        run_card.dat                                *
#                                                                    *
#  This file is used to set the parameters of the run.               *
#                                                                    *
#  Some notation/conventions:                                        *
#                                                                    *
#   Lines starting with a '# ' are info or comments                  *
#                                                                    *
#   mind the format:   value    = variable     ! comment             *
#*********************************************************************
#
#*******************
# Running parameters
#*******************
#
#*********************************************************************
# Tag name for the run (one word)                                    *
#*********************************************************************
  'fermi'     = run_tag ! name of the run
#*********************************************************************
# Number of events and rnd seed                                      *
#*********************************************************************
  50000       = nevents ! Number of unweighted events requested
      945 = iseed   ! rnd seed (0=assigned automatically=default))
#*********************************************************************
# Collider type and energy                                           *
#*********************************************************************
        1     = lpp1  ! beam 1 type (0=NO PDF)
        1     = lpp2  ! beam 2 type (0=NO PDF)
     7000     = ebeam1  ! beam 1 energy in GeV
     7000     = ebeam2  ! beam 2 energy in GeV
#*********************************************************************
# PDF CHOICE: this automatically fixes also alpha_s and its evol.    *
#*********************************************************************
 'cteq6l1'    = pdlabel     ! PDF set
#*********************************************************************
# Renormalization and factorization scales                           *
#*********************************************************************
 F        = fixed_ren_scale  ! if .true. use fixed ren scale
 F        = fixed_fac_scale  ! if .true. use fixed fac scale
 174.0    = scale            ! fixed ren scale
 174.0    = dsqrt_q2fact1    ! fixed fact scale for pdf1
```

```
 174.0    = dsqrt_q2fact2    ! fixed fact scale for pdf2
 1        = scalefact        ! scale factor for event-by-event scales
#*********************************************************************
# Matching - Warning! ickkw > 0 is still beta
#*********************************************************************
 1        = ickkw            ! 0 no matching, 1 MLM, 2 CKKW matching
#*********************************************************************
#
#*******************
# Standard Cuts
#*******************
#
#*********************************************************************
# Minimum pt's                                                       *
#*********************************************************************
 7  = ptj ! minimum pt for the jets
  0  = ptb ! minimum pt for the b
 10  = pta ! minimum pt for the photons
 10  = ptl ! minimum pt for the charged leptons
#*********************************************************************
# Maximum rapidity                                                   *
#*********************************************************************
 5  = etaj ! max rap for the jets
 1d2  = etab ! max rap for the b
 2.5  = etaa ! max rap for the photons
 5  = etal ! max rap for the charged leptons
#*********************************************************************
# Minimum DeltaR distance                                            *
#*********************************************************************
 0.001 = drjj ! distance between jets
 0   = drbb ! distance between b's
 0.1 = drll ! distance between leptons
 0.4 = draa ! distance between gammas
 0   = drbj ! distance between b and jet
 0.4 = draj ! distance between gamma and jet
 0.3 = drjl ! distance between jet and lepton
 0   = drab ! distance between gamma and b
 0   = drbl ! distance between b and lepton
 0.4 = dral ! distance between gamma and lepton
#*********************************************************************
# Minimum invariant mass for pairs                                   *
#*********************************************************************
 0  = mmjj ! min invariant mass of a jet pair
 0  = mmbb ! min invariant mass of a b pair
 0  = mmaa ! min invariant mass of gamma gamma pair
 0  = mmll ! min invariant mass of l+l- (same flavour) lepton pair
#*********************************************************************
# Inclusive cuts                                                     *
#*********************************************************************
 0  = xptj ! minimum pt for at least one jet
 0  = xptb ! minimum pt for at least one b
 0  = xpta ! minimum pt for at least one photon
 0  = xptl ! minimum pt for at least one charged lepton
#*********************************************************************
# WBF cuts                                                           *
#*********************************************************************
 0  = xetamin ! minimum rapidity for two jets in the WBF case
#*********************************************************************
# Jet measure cuts                                                   *
#*********************************************************************
 7  = xqcut   ! minimum kt jet measure between partons
#*********************************************************************
#
# End run_card.dat
#<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<
#
#*******************
# Event information
#*******************
#
#*********************************************************************
#  Number of Events        :       20535
#  Integrated weight (pb)  :  .53553E+05
#  Truncated wgt (pb)      :  .38128E+03
#  Unit wgt                :  .26079E+01
#*********************************************************************
#>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
# Begin pythia_card.dat
```

```
#
#>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
# Begin pythia_card.dat
#
!...Fix (0) or event-based (1) PS scale
      PSSCALE=1

!...Parton showering on or off
      MSTP(61)=1
      MSTP(71)=1

!...Fragmentation/hadronization on or off
      MSTJ(1)=1

!...Multiple interactions on or off
      MSTP(81)=0

!...Cutoff in jet measure for matching
      QCUT = 11
      IFILE = 3

!...Remove W decays to quarks
      MDME(190,1)=0
      MDME(191,1)=0
      MDME(194,1)=0
      MDME(195,1)=0
      MDME(198,1)=0
      MDME(199,1)=0

!...ETCLUS: Relative ET in jet (KTCLUS)
      ETCLUS = 20
!...ETMIN: min ET per jet (GETJET)
      ETMIN = 20
!...RMAX: Jet cone radius (GETJET)
      RMAX = 0.4
!...ETAMAX: Maximum Eta for calorimeter/tracker
      ETAMAX = 5
!...ETAJETMAX: Maximum Eta for jet
      ETAJETMAX = 4.5
!...NCY: Eta cells in calorimeter
      NCY = 100
!...NCPHI: Phi cells in calorimeter
      NCPHI = 60



      LHAPATH=/home/madgraph/MG_ME/WebBin/pythia-pgs/PDFsets
      LHAPATH=/home/madgraph/MG_ME/WebBin/pythia-pgs/PDFsets
      LHAPATH=/home/madgraph/MG_ME/WebBin/pythia-pgs/PDFsets
      LHAPATH=/home/madgraph/MG_ME/WebBin/pythia-pgs/PDFsets
      LHAPATH=/home/madgraph/MG_ME/WebBin/pythia-pgs/PDFsets
      LHAPATH=/home/madgraph/MG_ME/WebBin/pythia-pgs/PDFsets
      LHAPATH=/home/madgraph/MG_ME/WebBin/pythia-pgs/PDFsets
      LHAPATH=/home/madgraph/MG_ME/WebBin/pythia-pgs/PDFsets
      LHAPATH=/home/madgraph/MG_ME/WebBin/pythia-pgs/PDFsets
      LHAPATH=/home/madgraph/MG_ME/WebBin/pythia-pgs/PDFsets
#
# End pythia_card.dat
#<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<

      LHAPATH=/home/madgraph/MG_ME/WebBin/pythia-pgs/PDFsets
      LHAPATH=/home/madgraph/MG_ME/WebBin/pythia-pgs/PDFsets
#
# End pythia_card.dat
#<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<
```

2 Differential Jet Rate

2.1 Production 1

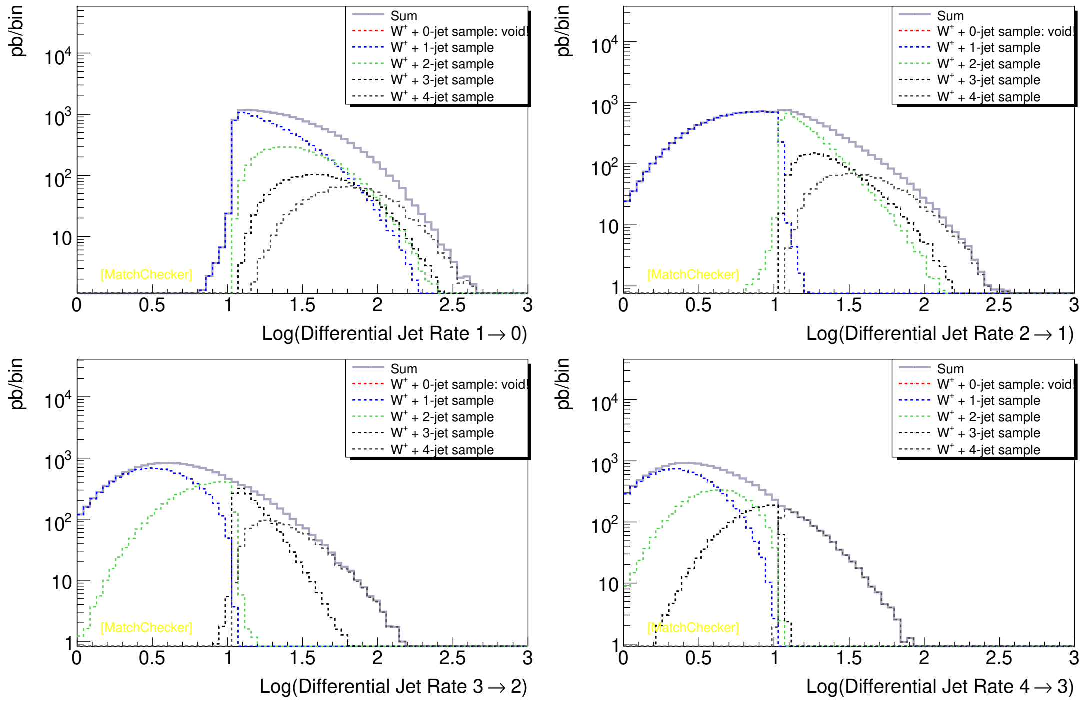

Figure 1: Differential jet rate with $Qcut$= 11 GeV.

2.2 Comparison of differential jet rates (global shapes) between productions

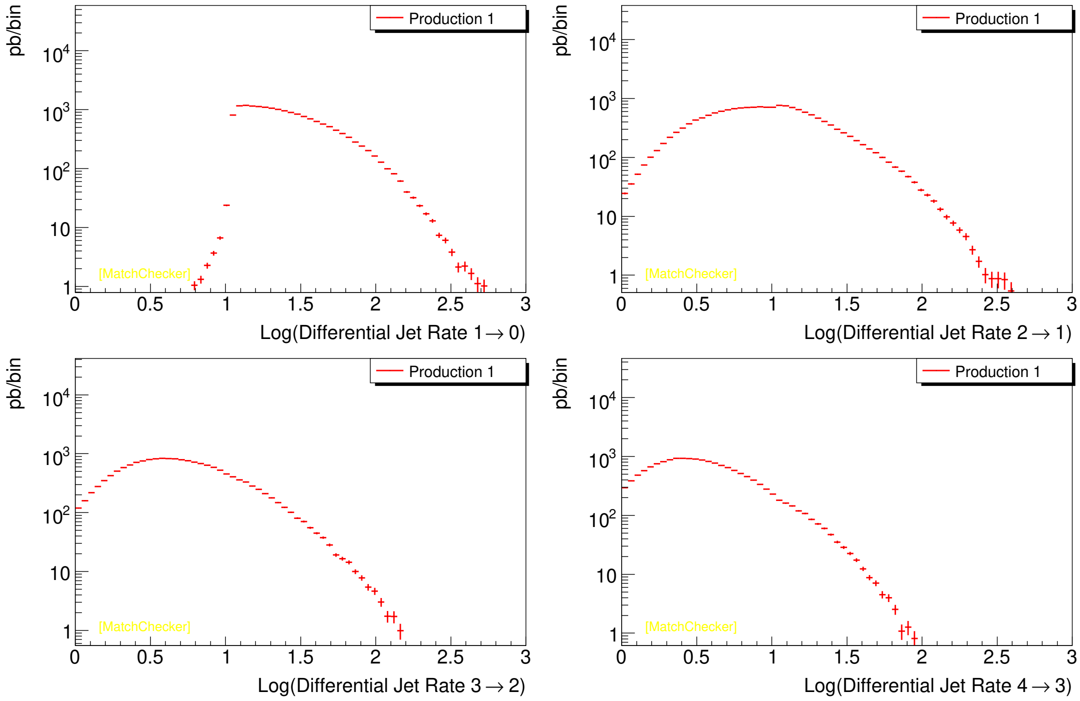

Figure 2: Comparison of differential jet rates between different parametrization .

3 X kinematics

3.1 Production 1

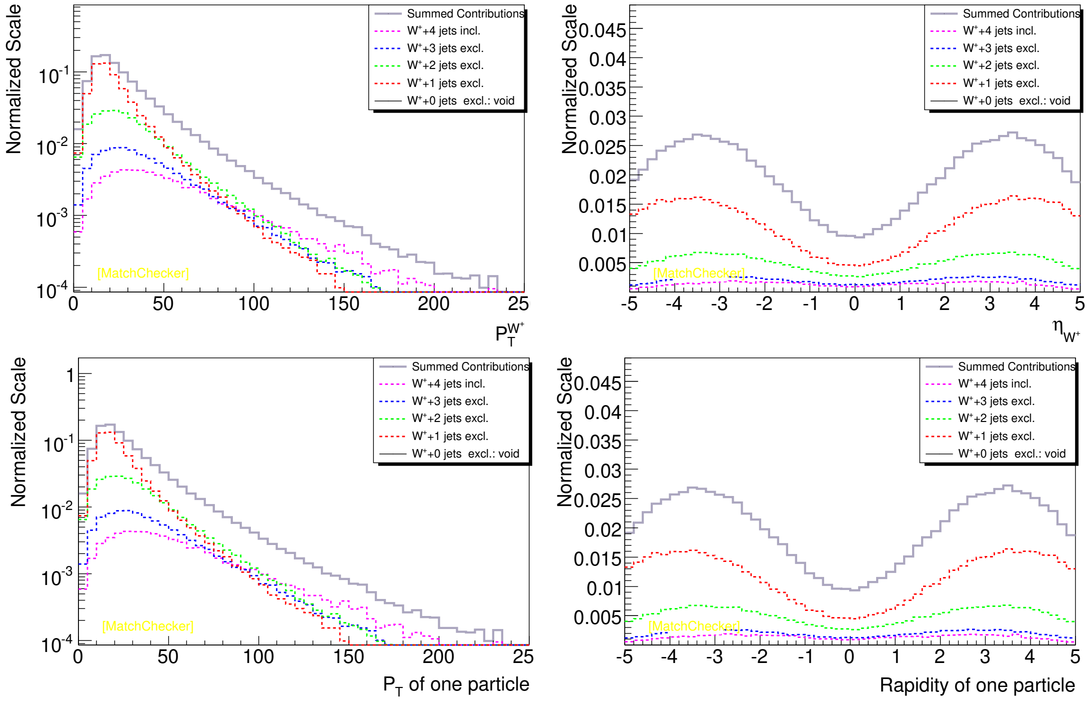

Figure 3: Kinematics variables for W^+ with a multiplicity up to 4 using MadGraph, .

4 Jet P_T

4.1 Production 1

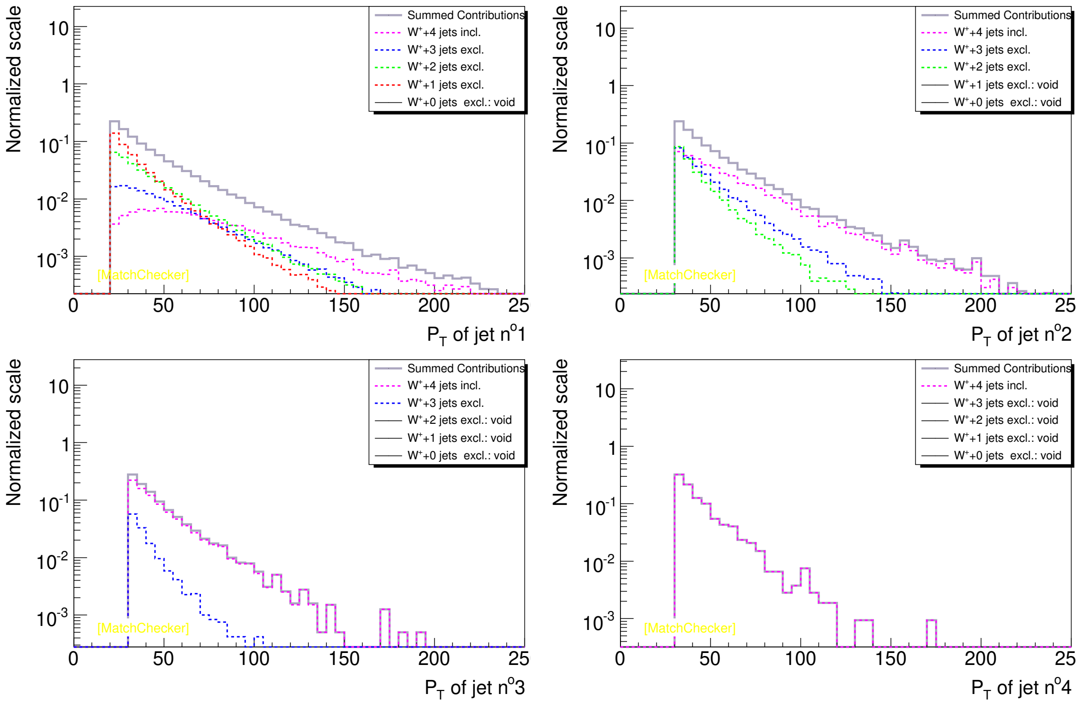

Figure 4: Pt of the four first extra-jets in Pt for W^+ using MadGraph, .

5 Jet rapidity

5.1 Jet Rapidity: Production 1, jets with minimal P_T of 20 Gev

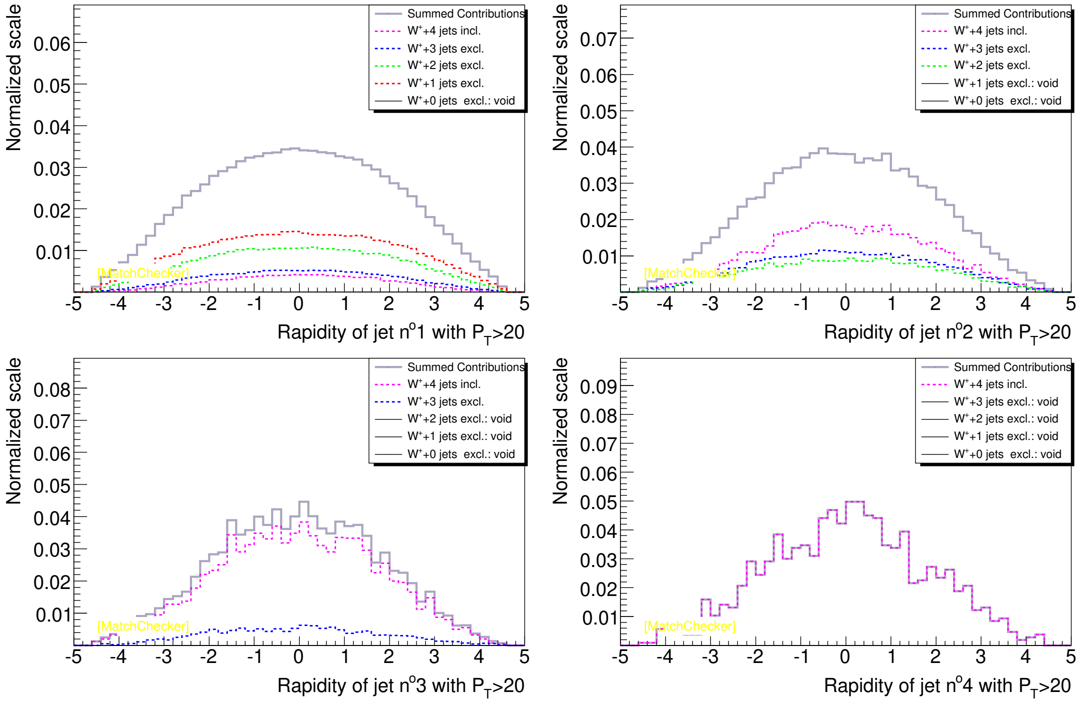

Figure 5: Pt of the four first extra-jets in Pt for W^+ using MadGraph, .

5.2 Jet Rapidity: Production 1, jets with minimal P_T of 50 Gev

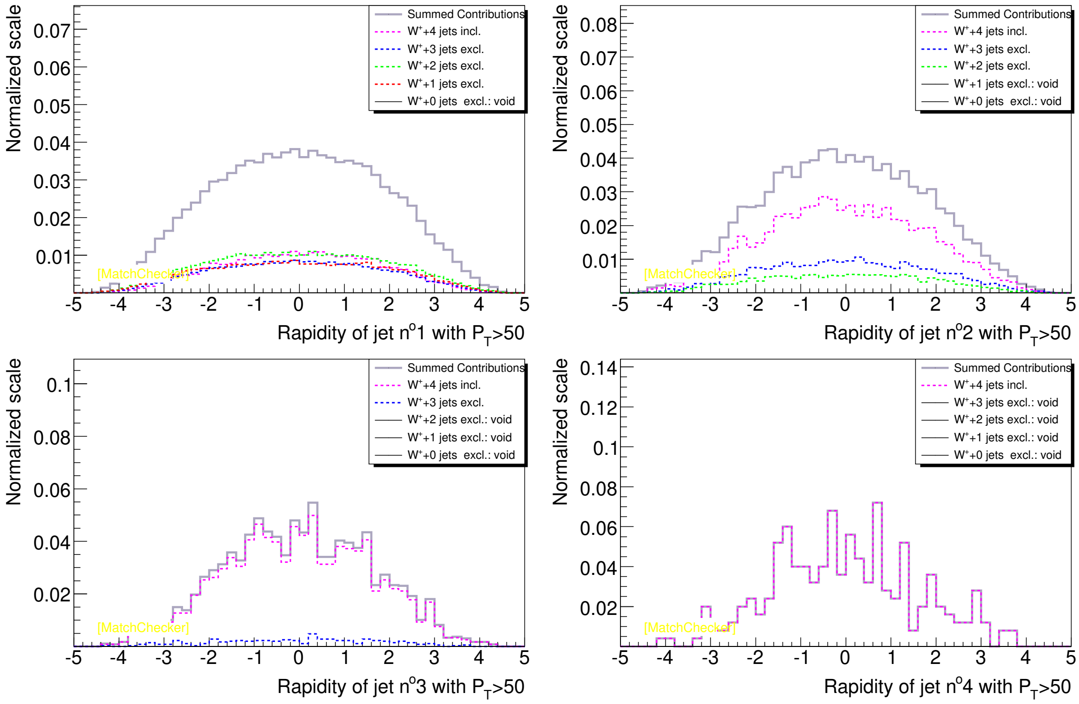

Figure 6: Pt of the four first extra-jets in Pt for W^+ using MadGraph, .

5.3 Jet Rapidity: Production 1, jets with minimal P_T of 100 Gev

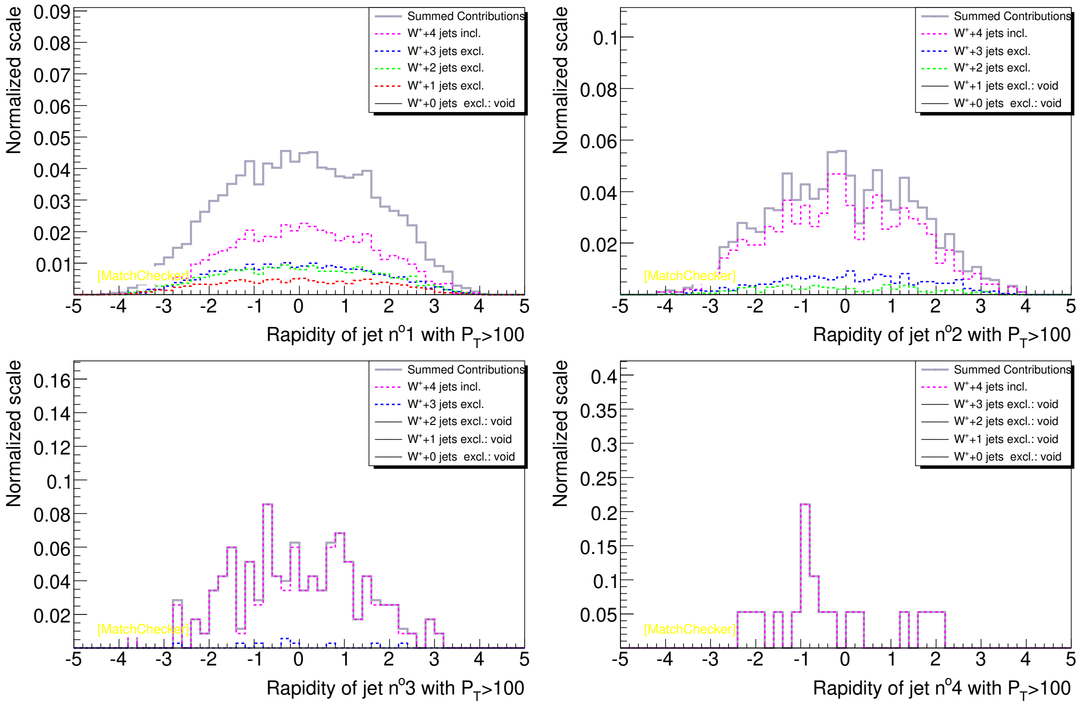

Figure 7: Pt of the four first extra-jets in Pt for W^+ using MadGraph, .