

# *Status of MG/ME production*

Simon de Visscher

on behalf of the MG/ME Team

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CMS Generator Meeting - CERN - 31/03/08

# Plan

The motivations

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# What?

MG/ME team proposes to provide reference samples of parton level events for standard processes

- First stage: SM processes ( $V$ +jets,  $VV$ +jets,  $t\bar{t}$ +jets,  $H$ +jets,  $VVV$ , ...)
- Second stage: Other SM processes (photon + jets, only jets, ...)
- Third stage: MSSM + other BSM processes, biased SM samples, ...

Production of the form:

- One sample per jet multiplicity
- "mini-soupes": (ex:  $W$ +0,1,2,3,4 jets in one sample)  
[New in the plans]

Contributors: Johan Alwall, SDV, Michel Herquet, Rikkert Frederix, Fabio Maltoni + UCL/CP3 students

# Multi-jets process generation (I)

## The motivations

Jet generation with high multiplicity need both ME and PS simulations

## The status

Hard partons: ME, Soft partons:PS

## Summary

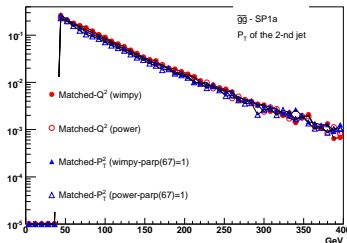
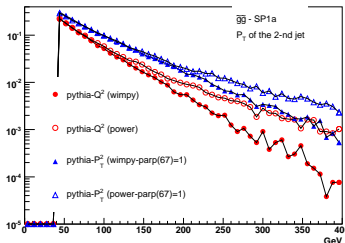
**The problem:** Double counting between phase-spaces accessible from ME and PS  $\Rightarrow$  need a matching/merging procedure: in MG/ME, we use the Modified MLM

- Use  $K_T$  algo like CKKW method
- No Sudakov reweighting: event rejection, like MLM

# Multi-jets process generation (II)

**In practice:** To avoid double-counting, use a cutoff to separate the phase-space into two independent parts.

**Good corollary:** relative insensitivity to shower parametrization



**The tricky point** Choice of cutoff has to be controlled:

- Too low: the ME has infra-red instabilities problems
- Too high: the PS is not able to fill its assigned phase-space.

# Validation?

- 0-level: consistency check of distributions with run parameters used.
- 1-level: Multi-jet process validation: check the good choice of matching parameters (differential jet rates)
  - **xqcut**: at MadEvent level, minimal  $K_T$  between partons: increase efficiency
  - **Qcut**: at Pythia level, maximal  $K_T$  between matched partons and jets

# The procedure

- Test samples validation and grid packages production on our clusters by the team
- Grid package: self containing, plug and produce, frozen tarball
  - Step 1: warming up phase on our clusters
  - Step 2: compilation on a Grid standard machine
  - Step 3: run over the Grid for a specific random seed and a specific number of events
- Each step is driven by one single script



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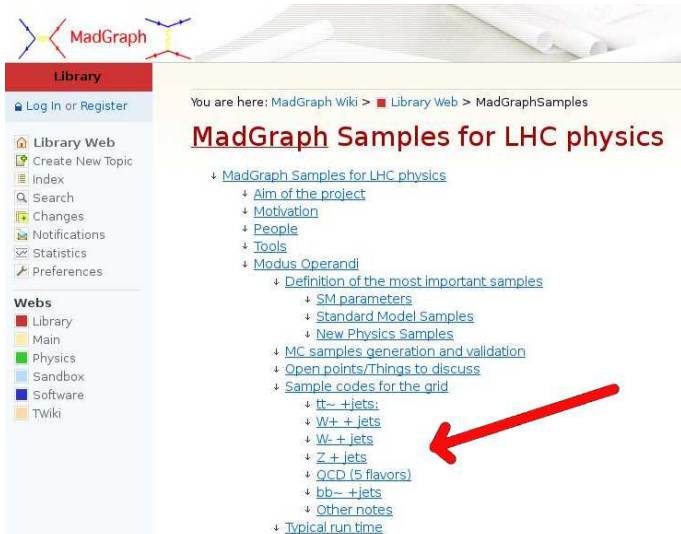
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# The gridpacks

The reference/retrieve place is on the "MadGraphSample" page on the MG/ME wiki



The screenshot shows the MadGraph Wiki Library page. At the top, there is a navigation breadcrumb: "You are here: MadGraph Wiki > Library Web > MadGraphSamples". The main heading is "MadGraph Samples for LHC physics". Below this, there is a tree structure of links. A red arrow points to the "Z + jets" link.

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You are here: MadGraph Wiki > Library Web > MadGraphSamples

## MadGraph Samples for LHC physics

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## The status for $t\bar{t}+0,1,2,3$ jets

- $\eta_{jet} < 5$
- CTEQ6L1
- unfixed scales
- $P_t^{min}(\text{jet}) = \text{xqcut} = 20$  GeV
- 5 flavors: u,d,s,c,b,g: available as a mini-soupe
- 4 flavors: u,d,s,c,g: available as a mini-soupe AND 1 multiplicity/sample

Note: at Pythia level:

- If virtuality-ordered ( $Q^2$ ) showers (MSTP(81)=0)  
⇒ **Qcut** around 30
- If pt-ordered ( $P_T^2$ ) showers (MSTP(81)=20)  
⇒ **Qcut** can be equal to **xqcut**

## The status for $W^{\pm}+0,1,2,3,4$ jets

- $W$  goes into leptons:  $e, \mu, \tau$ , no cuts on leptons
- $\eta_{jet} < 5$
- CTEQ6L1
- unfixed fac. and ren. scales
- $P_t^{min}(\text{jet}) = xqcut = 10 \text{ GeV} \Rightarrow Qcut = 15 \text{ or } 20$
- 4-flavors partially available (up to 3 partons),  $W^+$  and  $W^-$  separated
- 5-flavor soon available as minisoupe AND 1 multiplicity/sample (both signs together)
- Test of underlying events (D6T tune: MSTP(5)=109), little problem at the cutoff, need to be fixed...

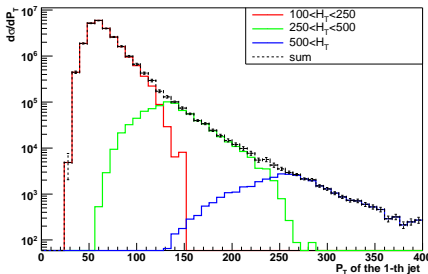
## The status for $Z+0,1,2,3,4$ jets

- $Z$  goes into leptons:  $e, \mu, \tau$ , no cuts on them
- $\eta_{jet} < 5$
- CTEQ6L1
- unfixed fac. and ren. scales
- $P_t^{min}(\text{jet}) = x_{qcut} = 10 \text{ GeV} \Rightarrow Q_{cut} = 15 \text{ or } 20$
- 5-flavor soon available as minisoupe
- Test of underlying events (D6T tune: MSTP(5)=109), little problem at the cutoff, need to be fixed...

# The status for 5-flavors QCD sample

More tricky case: how to cut the phase-space?

- $H_T$  slicing using  $H_T = \sum P_T(jets)$ 
  - $100 < H_t < 250$  GeV
  - $250 < H_t < 500$  GeV
  - $500 < H_t$



Tests with different **Qcuts**: 20,30,40 and 50 GeV

[Available]:  $xqcut=20 \Rightarrow$  **Qcut** at around 30

## What's next?

Plans and priorities have changed from first schedule

We propose now the following things:

- soon: Higgs production
- soon:  $b\bar{b}$ +light jets,  $b_j$ +jets,  $\gamma$ +jets.
  - Validation? Seems ok
  - Parameter space slicing still to define
- biased ( $Z \rightarrow \nu\nu$ )+jets
- $VV$ +jets (matched)
- $VVV$
- BSM processes

# Plan

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## Summary

- MG/ME is proposed to be a generator for mass-productions at the LHC
- Multi-jet process generation is possible thanks to matching
- Validation is mandatory
- Status of productions:
  - $t\bar{t}$ +jets is done
  - W and Z + jets is partially done (1 mult./sample and mini-soupe)
  - 5-f QCD with simple parameter-space slicing is done
  - other samples will follow: requires validation/Gridpack generation time.