



MadGraph/MadEvent 4.0

New tools for New Physics

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Plan



- What is new ?
- The big picture
- MG/ME structure + a step by step tutorial
- New models
- Work in progress
- Conclusion



What is new ?

- New software structure, web oriented
- Multi processes
- New models easier to implement
 - Higgs EFT, SUSY and 2HDM
 - LHA compliant parameter file
- Pythia interface for hadronization
- PGS interface for detector simulation
- Local cluster installation/updating now easy with CVS (contact me for more info !)



The Big Picture



Detector simulation

PGS,
...

PYTHIA,...

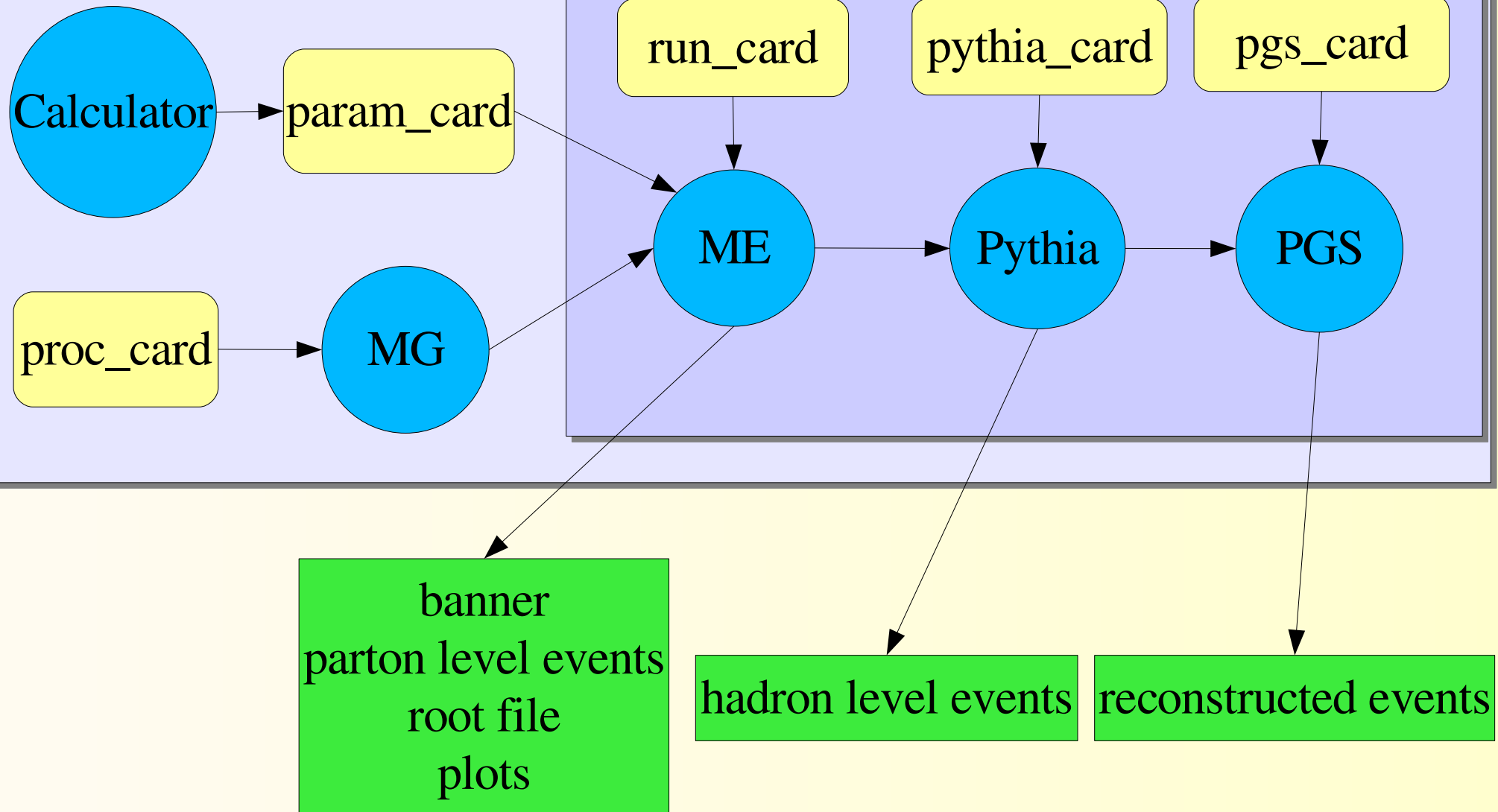
MG/ME

Hadronization

Hard interaction



MG/ME new structure





MG/ME step by step



- Surf on one of our cluster (register, it's free!):
 - <http://madgraph.phys.ucl.ac.be>
 - <http://madgraph.hep.uiuc.edu> (still old version)
 - <http://madgraph.roma2.infn.it>
- Select a model, input a process and define max QCD/QED order and p,j,l definitions (proc_card)

I. Fill the form:

Model: [Particle names](#)

Input Process: [Examples](#)

Max QCD Order:

Max QED Order:

p and j definitions:

sum over leptons:



MG/ME step by step



- MadGraph returns a list of subprocesses with related Feynman diagrams and HELAS amplitudes
- Either you generate events online on our clusters or you download the stand-alone code

MadEvent Card for $pp > w + jj$

Created: Mon Jun 19 16:15:24 CEST 2006

Process: $pp > w + jj$ QCD=99 QED=99 Model: sm	
Links Process Information Code Download On-line Event Generation Results and Event Database	Status Generation Complete Available Available (access restricted) No runs available
Notes:	

Last Update: Mon Jun 19 16:15:26 CEST 2006



MG/ME step by step



- 4 “cards” (txt files) are needed for events generation
 - param_card : LHA compliant file with values for all the model parameters, should ALWAYS be produced by a “Calculator”
 - run_card : Collider parameters, # events, scales, cuts, ...
 - pythia_card : Pythia configuration (showering ...)
 - pgs_card : PGS configuration (detector type, ...)
- All these cards can be filled online (with web form) or by manually editing text files

Cards for input parameters			
Model	Run	Pythia	PGS
param_card.dat	run_card.dat	pythia_card.dat	pgs_card.dat



MG/ME step by step



- During event generation, MadEvent returns the current status of the computation

Run Name	Cards	Status	Results	Jobs on the cluster			
				Queued	Running	Done	Total
Web	param_card run_card	Running 2 nd Refine	5669.739± 35.407(pb)	3	7	0	12

- When the run is finished, a full detailed set of output is available

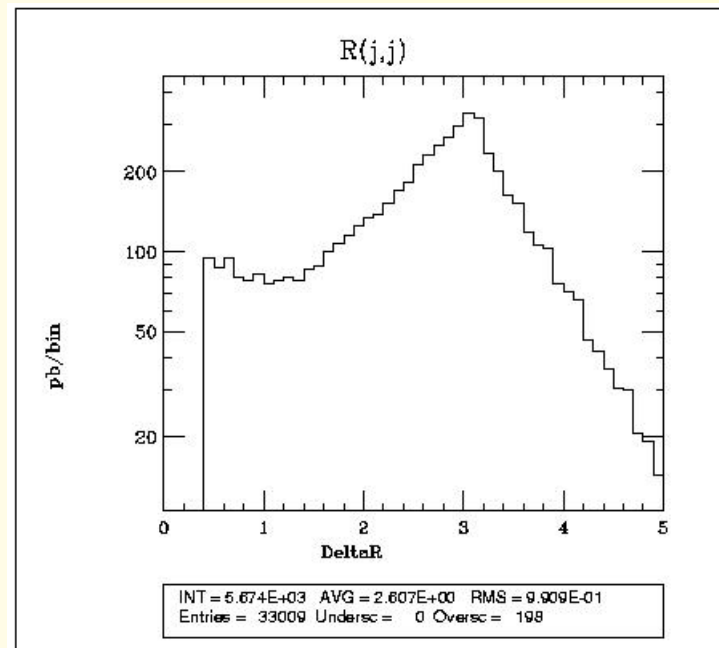
Links	Events	Tag	Run	Collider	Cross section (pb)	Events
results plots banner	parton-level rootfile hadron-level (Pythia) reconstructed objects (PGS)	fermi	run1	p p 7000 x 7000 GeV	.57088E+04	10004



MG/ME step by step



Graph	Cross Sect(pb)	Error(pb)	Events (K)	Eff	Unwgt	Luminosity
Sum	5700.109	12.197	3536	4.0		
P_gu_w+dg	1582.500	7.536	321	2.7		2.47
P_ug_w+dg	1580.600	7.688	323	2.8		2.74
P_dxg_w+uxg	631.410	3.878	46	1.3		2.46
P_gdx_w+uxg	630.880	2.927	129	1.7		7.07
P_udx_w+gg	152.470	0.867	47	1.2		19.10
P_dxu_w+gg	150.450	1.261	32	1.5		2.21
P_gg_w+uxd	145.470	0.688	48	1.0		16.90
P_gg_w+scx	145.440	0.897	30	1.1		14.40
P_uu_w+ud	95.099	0.510	69	1.4		24.20

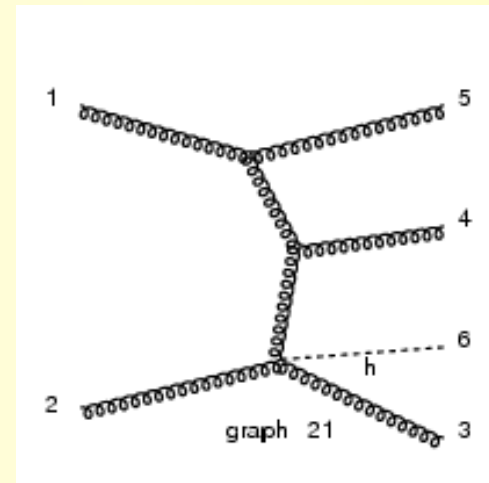




User model & Higgs EFT



- User model (**de Visscher**)
 - General framework for user-defined model
 - User only needs to introduce its new particles, new interactions, new parameters and new couplings. A PERL script takes care of the rest!
 - Currently tested for a technicolor-like model (**Gudnason**)
- Higgs Effective Theory (**Frederix**)
 - Non renormalizable interactions like ggH



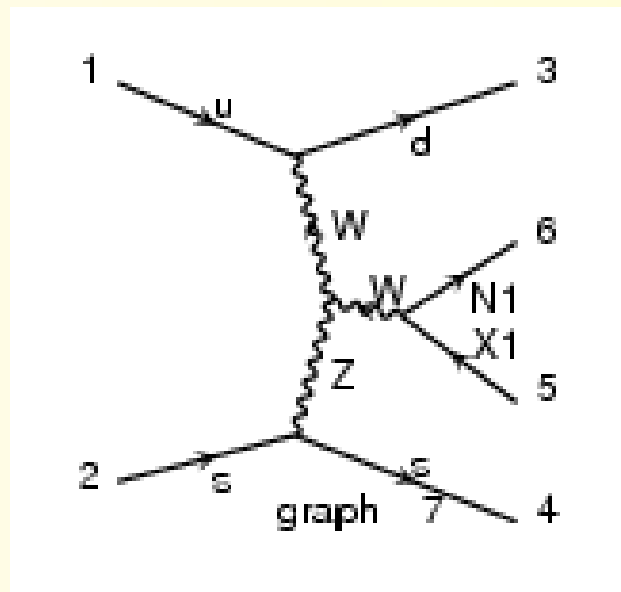


MSSM

Hagiwara, Kaoru, Plehn, Rainwater, Stelzer + Alwall



- CP and R-parity conserving MSSM
- Reads Les Houches input files
- Detailed comparison of cross sections between SMadGraph, Omega and Amegic++ (hep-ph/0512260)
- Input files for the 10 SPS points available

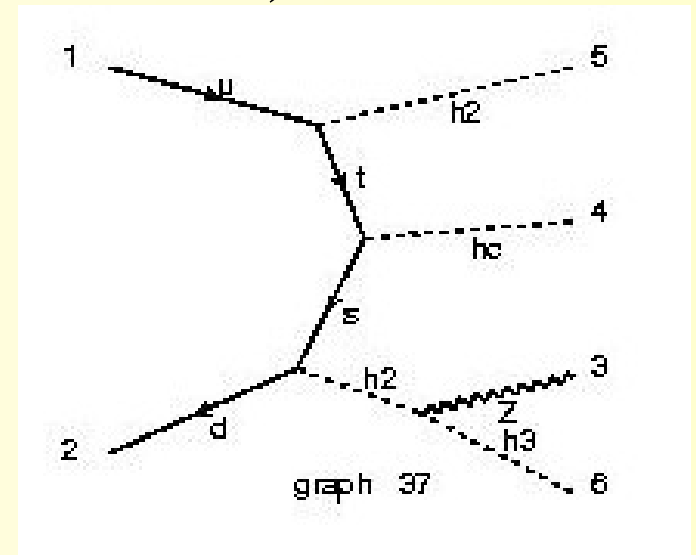




General 2HDM

de Vissher, Herquet, Ovyn

- Completely general 2HDM, with FCNC and CP violation
- New tree-level calculator with a web interface, TwoHiggsCalc, to generate the LHA param_card needed by madgraph
- Generic basis or Higgs basis, intensive use of recent basis invariance techniques (e.g. hep-ph/0504050)
- Tested in the SM & MSSM limit
- Sample files for various cases





Work in progress



- Specification of complete decay chains (for models with large number of new particles)
- Fully integrated ROOT analysis package
- Matrix elements techniques for signal selection



Future



- Move the widths computation task from calculators to MG/ME
- Other new models (Leptoquark, UED, Top anomalous couplings ...)
- Interface to the CMS simulation software suite
- Model guessing from data (BARD, inverse problem, ...)



Conclusion



- MadGraph/MadEvent 4.0 is available now!
- Key points of its philosophy:
 - **Multi purpose** : new models are now easy to implement, and some of them are already there (MSSM, 2HDM, Higgs EFT, ...)
 - **Complete** : a unique interface from model to detector
 - **Easy input method** : OSOC (one step, one card)
 - **User friendly** : thanks to the all-web design
 - **Fast** : thanks to the cluster oriented structure
 - **Open** : LHA compliant, interfaces for Pythia, PGS, ROOT, Herwig and more soon