MadMarmoset
The power of MadGraph with OSETS

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(work in progress report)

MC4BSM, Princeton, March 24, 2007
Marmoset

Model production processes and decays by “blobs”

- Matrix elements in Pythia – pure phase space or truncated power series

\[ q \quad \tilde{q} \quad g \quad \tilde{g} \]

\[ q \quad \tilde{q} \quad q^* \quad \tilde{q}^* \]

\[ \tilde{g} \quad q \quad \tilde{g} \quad q^* \quad \tilde{q} \quad \tilde{q}^* \quad \tilde{g} \quad \tilde{g}^* \]

\[ Q' \quad \text{Adj} \quad \text{Adj} \quad \text{Ne} \quad q \quad \bar{q} \]
MadGraph/MadEvent

- Production with MG/ME instead of Pythia:
  - Matrix elements from spin structure of particles
  - t- and s-channel production correctly described
- Interference can be taken into account
  - Complicated processes like WBF
production + decay:
  → full spin correlations kept throughout decay chain
  → long decay chains (very) soon to be implemented

(this diagram is present MG/ME though)
MadMarmoset

- Use MG/ME to generate parton level events and (partial) decay chains
- Automatically run through Pythia and PGS for additional decays, hadronization and detector simulation (using present Marmoset framework)
- Generation time slightly larger than Pythia (but dwarfed by PGS)
- Checkout (see http://marmoset-mc.net):
  ```
  cvs checkout MG_ME
  ```
  (done automatically by `make install` from Marmoset)
OSET file

Model (oset) file MadExample.oset:

```
# New Particles

Adj    : charge=0 color=8 mass=800 spin=F
TP TP~  : charge=2 color=3 mass=800 spin=S

Adj > u ubar MPT
TP > t MPT

g g > Adj Adj

u ubar > TP TP~ : s-channel=g
g g > TP TP~  : t-channel=TP

QCD couplings
```
Running MadMARMOSET

Run command:

GenerateProcess --MadGraph --MadGraphLevel 1 --all

• Copies all files necessary for MadGraph/MadEvent
• Writes all necessary files (particles.dat, interactions.dat and input cards)
• Uses the User Model framework to generate all necessary MadEvent Fortran files
• Runs MadGraph and MadEvent
• Passes the events on to Pythia and PGS

First decay by MadGraph
Comparison between Pythia MEs and MadGraph MEs
Pair-produced fermionic QCD octets at 800 GeV decaying to two jets
Different production mechanisms:
MadGraph:
- S-channel QCD (gluon)
- T-channel QCD (adjoint)
- Full QCD
- Light t-channel QCD singlet at 100 GeV
Pythia (Marmoset):
- Flat
- 1-1/X
- etc.
Example - Results

H_T by (Mad)MARMOSE}

- t-ch singlet (MG)
- t-ch QCD (MG)
- s-ch QCD (MG)
- 1 (MARM)
- 1-1/X (MARM)

number of events (normalized)

H_T, GeV/c

500 1000 1500 2000 2500 3000 3500
Example - Results

**Leading jet $P_T$ by (Mad)MARMOSE**

**2nd leading jet $P_T$ by (Mad)MARMOSE**
Conclusions

- Inclusion of MadGraph/MadEvent in Marmoset now there!
- Particle have spins
- Allows choice of s- and t-channel particles, or full QCD interactions
- Allows decays with full spin correlations
- Automatically gets matrix element right for
  - Different final state masses
  - Different spins
  - Light t-channel particles
  - QCD interference
- More features underway – work in progress!