SLAC

MadMarmoset

The power of MadGraph with OSETS

Johan Alwall (SLAC)

with Jesse Thaler

(work in progress report)

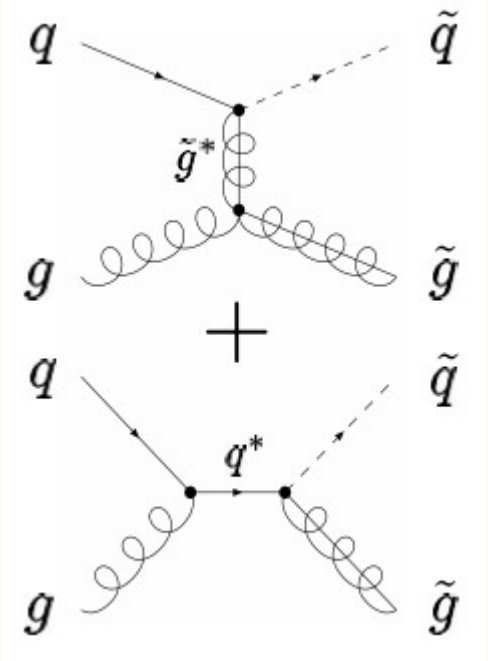
MC4BSM, Princeton, March 24, 2007

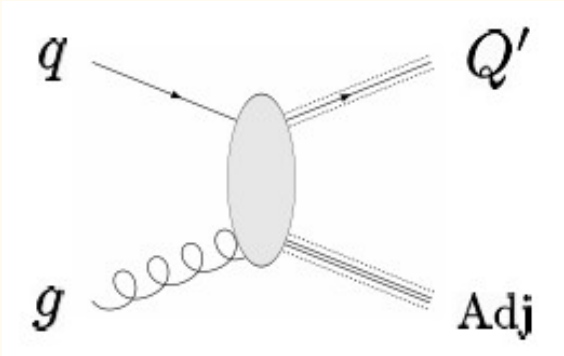
SLAC

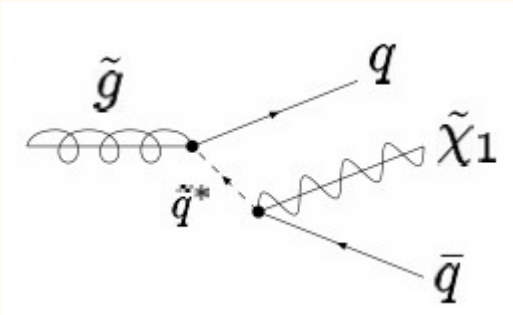
Marmoset

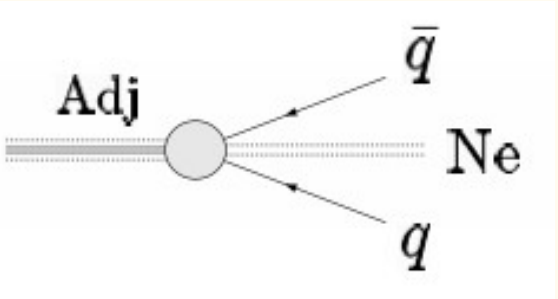
Model production processes and decays by "blobs"

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



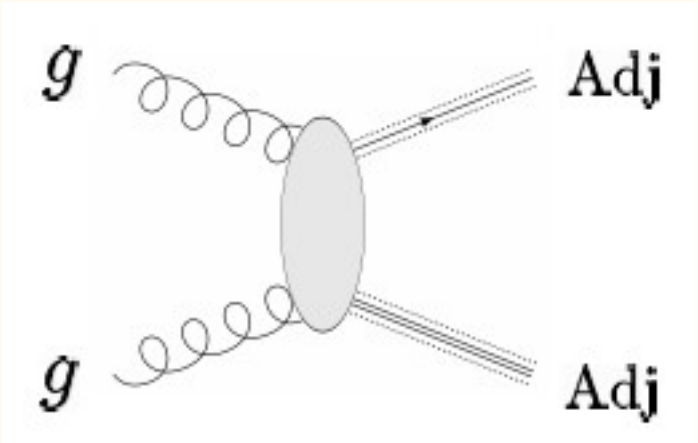


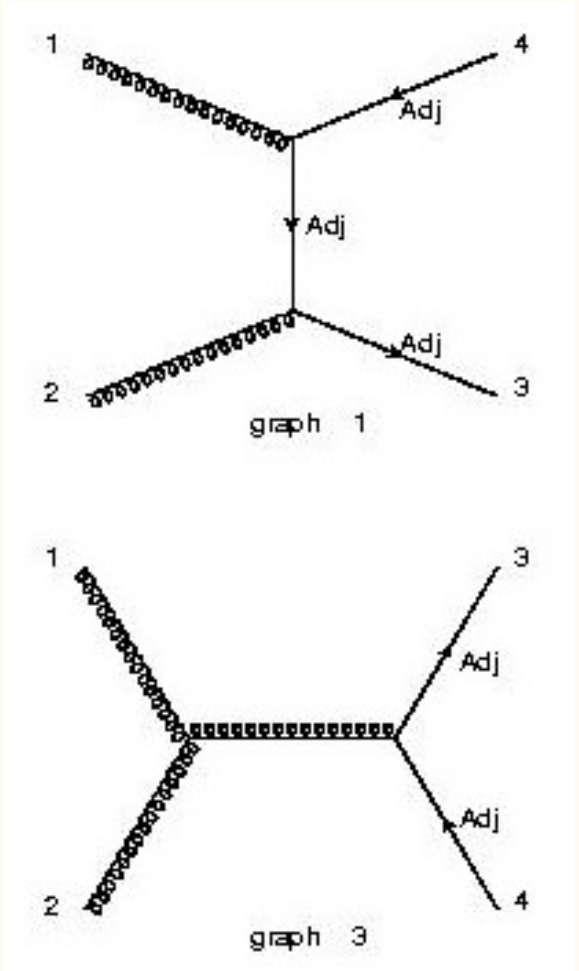




MadGraph/MadEvent

- 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

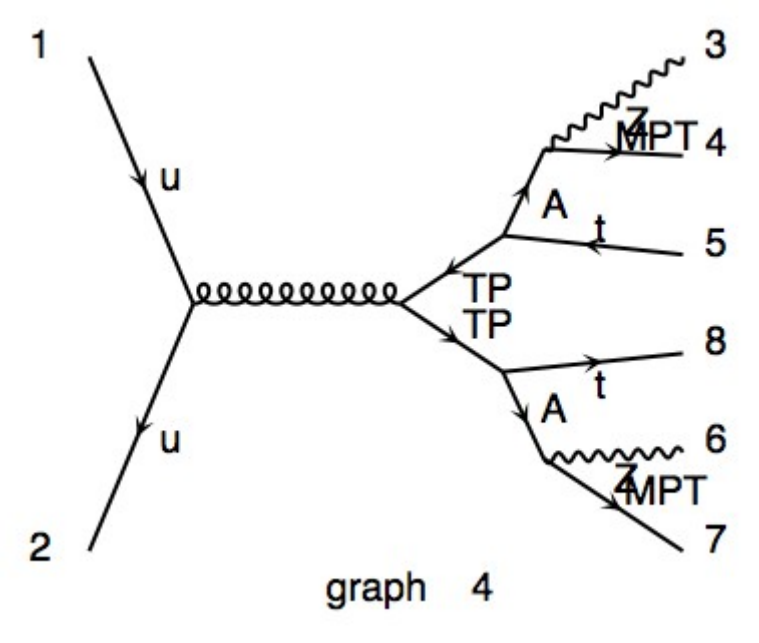




SLAC

MadGraph/MadEvent

- Production + decay:
  - Full spin correlations kept thoughout decay chain
  - Long decay chains (very) soon to be implemented



(this diagram is present MG/ME though)

SLAC

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)

SLAC

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
g g > TP TP~
```

QCD couplings

Running MadMARMOSET

Run command:

First decay by MadGraph

```
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

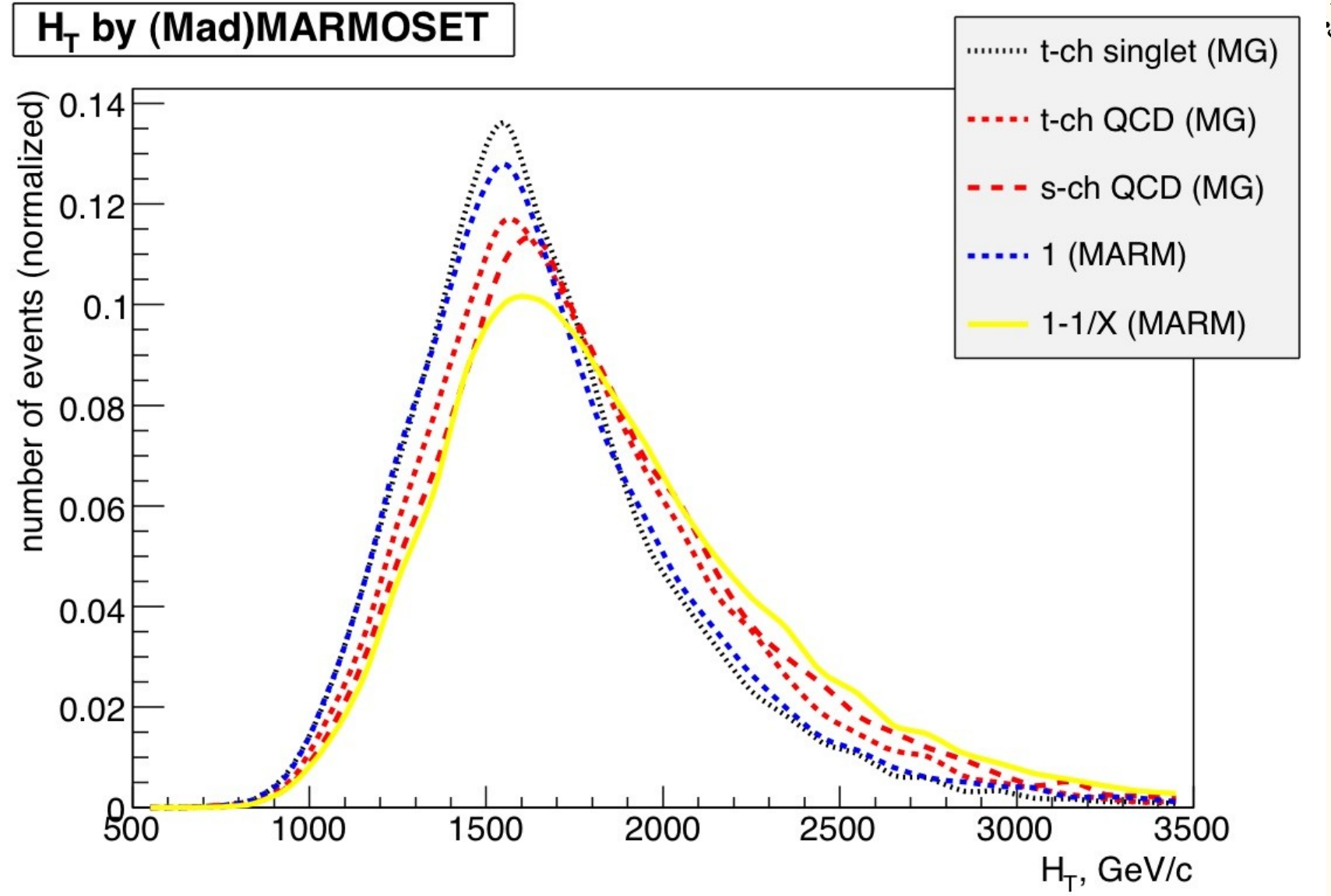
SLAC

Example

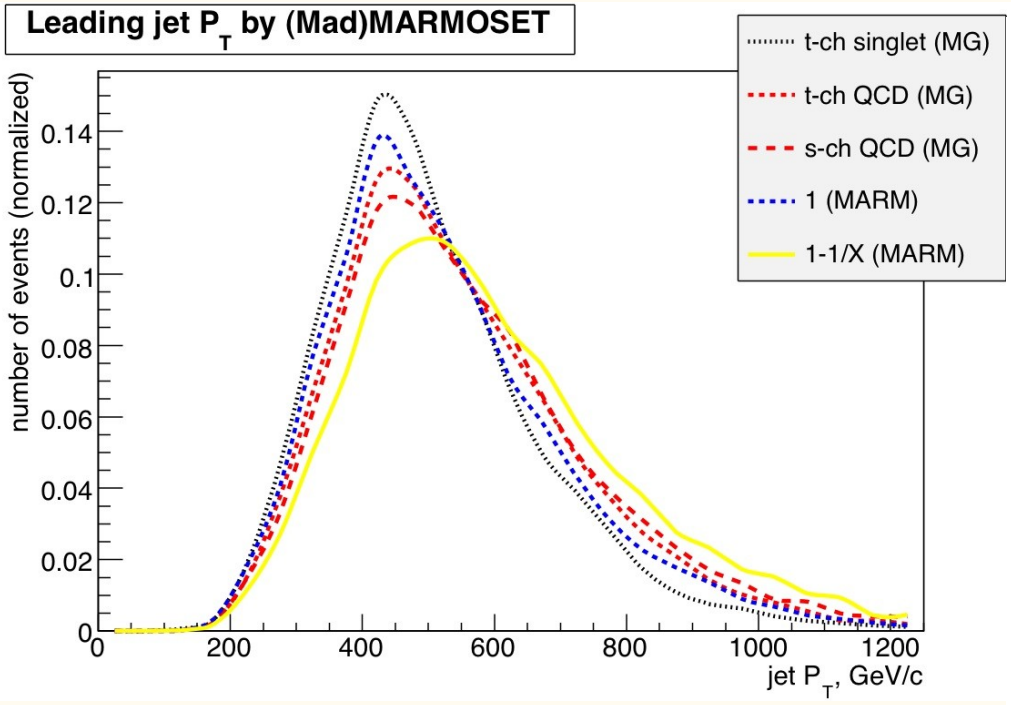
- Comparison between Pythia MEs and MadGraph MEs
- Pair-produced fermionic QCD octets at 800 GeV decaying to two jets
- Different production mechanisms:
- MadGraph:
  - S-channel QCD (gluon)
  - T-channel QCD (adjoint)
  - Full QCD
  - Light t-channel QCD singlet at 100 GeV
- Pythia (Marmoset):
  - Flat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

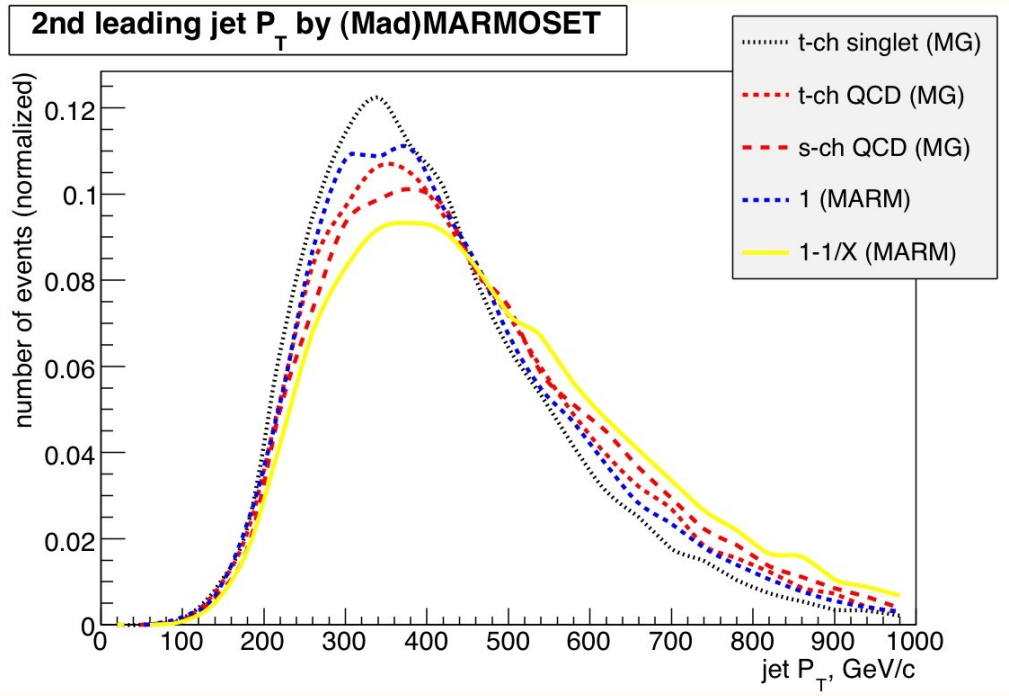
SLAC

Example - Results



Example - Results





SLAC

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!