

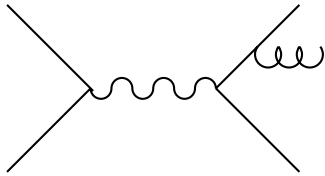
Particle IDs/Names in Monte Carlo

11 June 2004

R.J. Tesarek
Fermilab

Typical Event Simulation

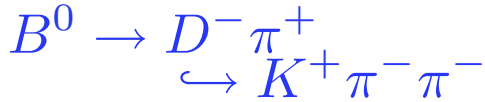
Hard Scatter



Simulation Program

Particle ID/Properties

Particle Decay



Detector Simulation

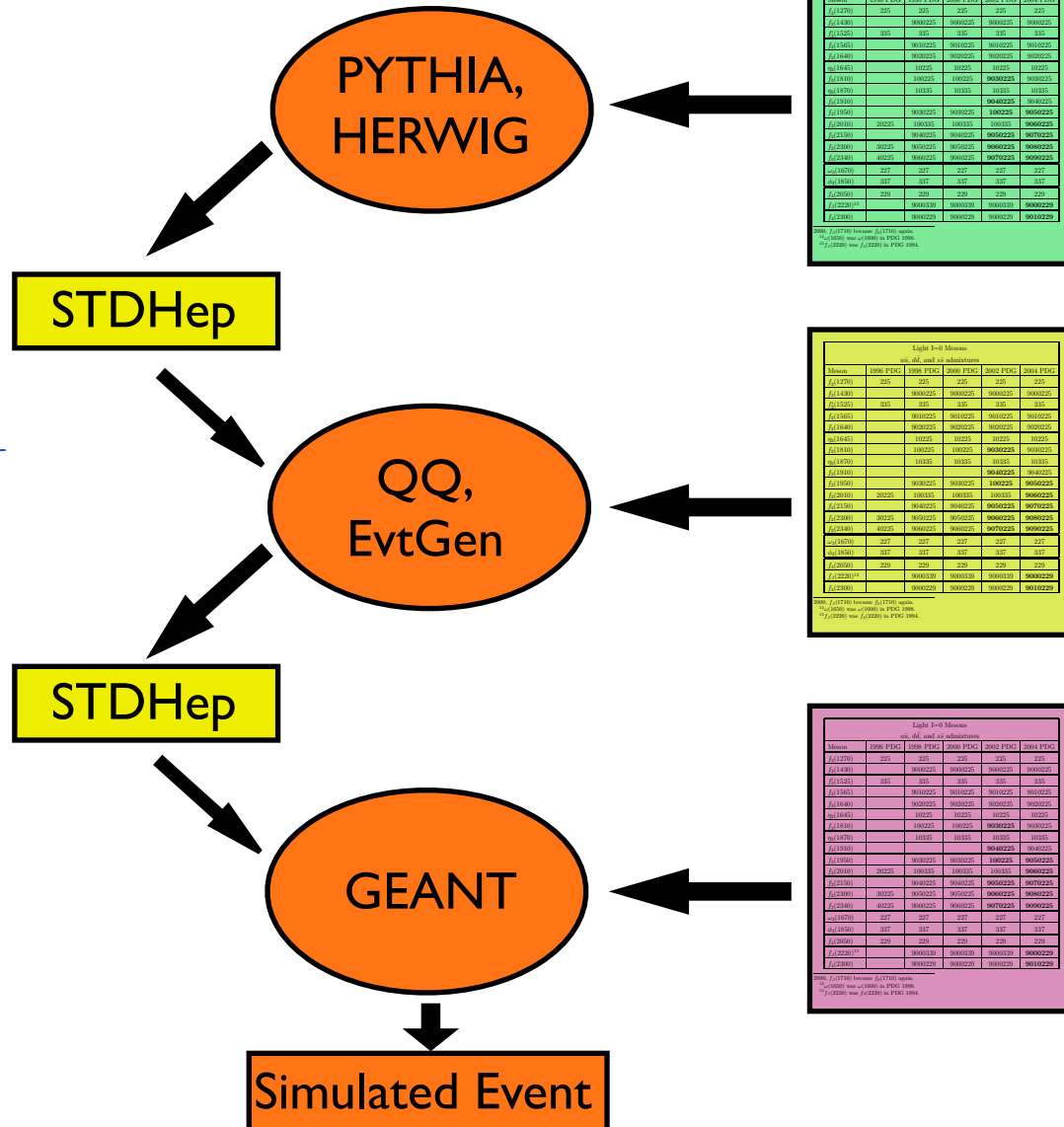
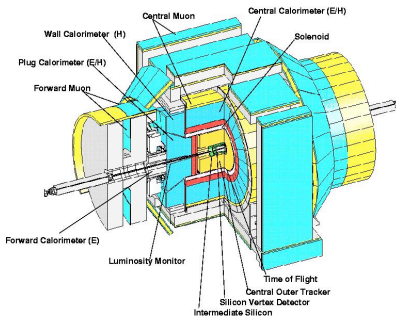


Table 1-6 Moments					
at 40. and 45. degrees					
Mom.	1000 PFC	1000 PFC	2000 PFC	2000 PFC	3000 PFC
J(1270)	225	225	225	225	225
J(1300)	900225	900225	900225	900225	900225
J(1350)	335	335	335	335	335
J(1365)	900225	900225	900225	900225	900225
J(1380)	900225	900225	900225	900225	900225
J(1405)	1025	1025	1025	1025	1025
J(1430)	100225	100225	100225	100225	100225
J(1470)	900225	900225	900225	900225	900225
J(1500)	2025	100225	100225	100225	900225
J(1530)	1025	100225	100225	100225	900225
J(1570)	227	227	227	227	227
J(1600)	337	337	337	337	337
J(2050)	220	220	220	220	220
J(2200)	900225	900225	900225	900225	900225
J(2300)	900225	900225	900225	900225	900225

From J(1270) to J(1370) spin 0
J(1380) spin = 1(000) in PFC 1000
J(1570) spin = J(2200) in PFC 1000

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at 40. and 45. degrees					
Mom.	1000 PFC	1000 PFC	2000 PFC	2000 PFC	3000 PFC
J(1270)	225	225	225	225	225
J(1300)	900225	900225	900225	900225	900225
J(1350)	335	335	335	335	335
J(1365)	900225	900225	900225	900225	900225
J(1380)	900225	900225	900225	900225	900225
J(1405)	1025	1025	1025	1025	1025
J(1430)	100225	100225	100225	100225	100225
J(1470)	900225	900225	900225	900225	900225
J(1500)	2025	100225	100225	100225	900225
J(1530)	1025	100225	100225	100225	900225
J(1570)	227	227	227	227	227
J(1600)	337	337	337	337	337
J(2050)	220	220	220	220	220
J(2200)	900225	900225	900225	900225	900225
J(2300)	900225	900225	900225	900225	900225

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J(1350)	335	335	335	335	335
J(1365)	900225	900225	900225	900225	900225
J(1380)	900225	900225	900225	900225	900225
J(1405)	1025	1025	1025	1025	1025
J(1430)	100225	100225	100225	100225	100225
J(1470)	900225	900225	900225	900225	900225
J(1500)	2025	100225	100225	100225	900225
J(1530)	1025	100225	100225	100225	900225
J(1570)	227	227	227	227	227
J(1600)	337	337	337	337	337
J(2050)	220	220	220	220	220
J(2200)	900225	900225	900225	900225	900225
J(2300)	900225	900225	900225	900225	900225

From J(1270) to J(1370) spin 0
J(1380) spin = 1(000) in PFC 1000
J(1570) spin = J(2200) in PFC 1000

Problem

Multiple programs to simulate physics

- Particle IDs/properties from program specific data
- Translate only IDs (properties still unique to program)
 - **STDHep:** <http://www-cpd.fnal.gov/psm/stdhep/>
 - Translate only between few numbering schemes (PDG, JETSET, Pythia, HERWIG, QQ)
 - Particle names not always standard
- CDF uses additional layer to identify “new particles”

Example

Particle Data Group (2004)		Pythia (v6.208)		EvtGen (v00-09-39-02)	
Name	ID	Name	ID	Name	ID
$\pi(1300)^0$	100111	-	-	pi(2S)0	20111
$\psi(2S)$	100443	psi'	100443	psi(2S)	30443
$\Upsilon(2S)$	100553	Upsilon'	100553	Upsilon(2S)	30553

Moving Target

Draft for 2004 PDG Summary

Particle codes change

- Re-assignment of ID codes over time.
- Particle names change.

Particle properties change

- New measurements

Light I=0 Mesons <i>uū, dđ, and sš admixtures</i>					
Meson	1996 PDG	1998 PDG	2000 PDG	2002 PDG	2004 PDG
$f_2(1270)$	225	225	225	225	225
$f_2(1430)$		9000225	9000225	9000225	9000225
$f'_2(1525)$	335	335	335	335	335
$f_2(1565)$		9010225	9010225	9010225	9010225
$f_2(1640)$		9020225	9020225	9020225	9020225
$\eta_2(1645)$		10225	10225	10225	10225
$f_2(1810)$		100225	100225	9030225	9030225
$\eta_2(1870)$		10335	10335	10335	10335
$f_2(1910)$				9040225	9040225
$f_2(1950)$		9030225	9030225	100225	9050225
$f_2(2010)$	20225	100335	100335	100335	9060225
$f_2(2150)$		9040225	9040225	9050225	9070225
$f_2(2300)$	30225	9050225	9050225	9060225	9080225
$f_2(2340)$	40225	9060225	9060225	9070225	9090225
$\omega_3(1670)$	227	227	227	227	227
$\phi_3(1850)$	337	337	337	337	337
$f_4(2050)$	229	229	229	229	229
$f_J(2220)^{13}$		9000339	9000339	9000339	9000229
$f_4(2300)$		9000229	9000229	9000229	9010229

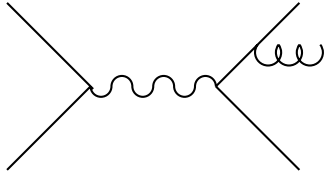
2000, $f_J(1710)$ became $f_0(1710)$ again.

¹² $\omega(1650)$ was $\omega(1600)$ in PDG 1998.

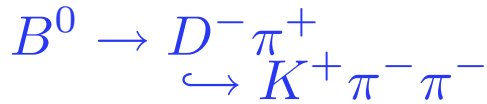
¹³ $f_J(2220)$ was $f_4(2220)$ in PDG 1994.

“A Modest Proposal”

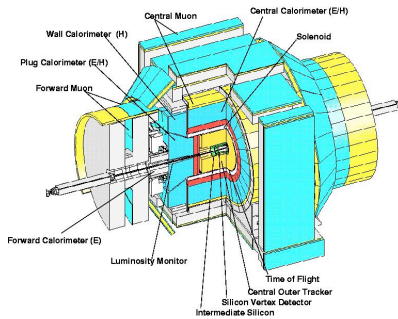
Hard Scatter



Particle Decay

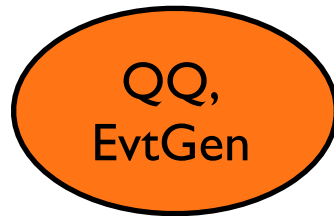
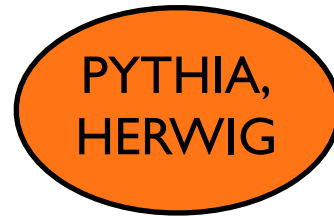


Detector Simulation



Simulation Program

Particle ID/Properties

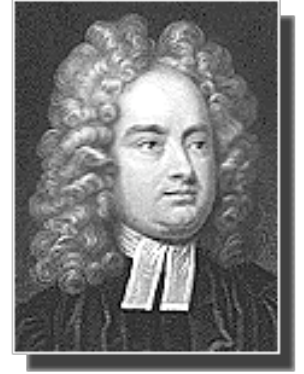


Simulated Event

Mass	1000 PFC1	1000 PFC2	1000 PFC3	1000 PFC4	1000 PFC5
$J/\psi(1S)$	3095	3095	3095	3095	3095
$J/\psi(2S)$	3686	3686	3686	3686	3686
$\psi(3770)$	3770	3770	3770	3770	3770
$\psi(4040)$	4040	4040	4040	4040	4040
$\psi(4180)$	4180	4180	4180	4180	4180
$\psi(4415)$	4415	4415	4415	4415	4415
$\psi(4660)$	4660	4660	4660	4660	4660
$\psi(4740)$	4740	4740	4740	4740	4740
$\psi(5041)$	5041	5041	5041	5041	5041
$\psi(5400)$	5400	5400	5400	5400	5400
$\psi(5775)$	5775	5775	5775	5775	5775
$\psi(6040)$	6040	6040	6040	6040	6040
$\psi(7460)$	7460	7460	7460	7460	7460
$\psi(7470)$	7470	7470	7470	7470	7470
$\psi(7480)$	7480	7480	7480	7480	7480
$\psi(7490)$	7490	7490	7490	7490	7490
$\psi(7500)$	7500	7500	7500	7500	7500
$\psi(7510)$	7510	7510	7510	7510	7510
$\psi(7520)$	7520	7520	7520	7520	7520
$\psi(7530)$	7530	7530	7530	7530	7530
$\psi(7540)$	7540	7540	7540	7540	7540
$\psi(7550)$	7550	7550	7550	7550	7550
$\psi(7560)$	7560	7560	7560	7560	7560
$\psi(7570)$	7570	7570	7570	7570	7570
$\psi(7580)$	7580	7580	7580	7580	7580
$\psi(7590)$	7590	7590	7590	7590	7590
$\psi(7600)$	7600	7600	7600	7600	7600
$\psi(7610)$	7610	7610	7610	7610	7610
$\psi(7620)$	7620	7620	7620	7620	7620
$\psi(7630)$	7630	7630	7630	7630	7630
$\psi(7640)$	7640	7640	7640	7640	7640
$\psi(7650)$	7650	7650	7650	7650	7650
$\psi(7660)$	7660	7660	7660	7660	7660
$\psi(7670)$	7670	7670	7670	7670	7670
$\psi(7680)$	7680	7680	7680	7680	7680
$\psi(7690)$	7690	7690	7690	7690	7690
$\psi(7700)$	7700	7700	7700	7700	7700
$\psi(7710)$	7710	7710	7710	7710	7710
$\psi(7720)$	7720	7720	7720	7720	7720
$\psi(7730)$	7730	7730	7730	7730	7730
$\psi(7740)$	7740	7740	7740	7740	7740
$\psi(7750)$	7750	7750	7750	7750	7750
$\psi(7760)$	7760	7760	7760	7760	7760
$\psi(7770)$	7770	7770	7770	7770	7770
$\psi(7780)$	7780	7780	7780	7780	7780
$\psi(7790)$	7790	7790	7790	7790	7790
$\psi(7800)$	7800	7800	7800	7800	7800
$\psi(7810)$	7810	7810	7810	7810	7810
$\psi(7820)$	7820	7820	7820	7820	7820
$\psi(7830)$	7830	7830	7830	7830	7830
$\psi(7840)$	7840	7840	7840	7840	7840
$\psi(7850)$	7850	7850	7850	7850	7850
$\psi(7860)$	7860	7860	7860	7860	7860
$\psi(7870)$	7870	7870	7870	7870	7870
$\psi(7880)$	7880	7880	7880	7880	7880
$\psi(7890)$	7890	7890	7890	7890	7890
$\psi(7900)$	7900	7900	7900	7900	7900
$\psi(7910)$	7910	7910	7910	7910	7910
$\psi(7920)$	7920	7920	7920	7920	7920
$\psi(7930)$	7930	7930	7930	7930	7930
$\psi(7940)$	7940	7940	7940	7940	7940
$\psi(7950)$	7950	7950	7950	7950	7950
$\psi(7960)$	7960	7960	7960	7960	7960
$\psi(7970)$	7970	7970	7970	7970	7970
$\psi(7980)$	7980	7980	7980	7980	7980
$\psi(7990)$	7990	7990	7990	7990	7990
$\psi(8000)$	8000	8000	8000	8000	8000

“A Modest Proposal”

*“A child will make two dishes at an entertainment for friends”
-- Jonathan Swift (1729)*



Single source of particles & their properties

- Computer readable format
- Human interface
- Official releases attend 2-year Particle Data Group publication cycle.

Example:

- cross sections maintained in files by COMPAS group.