

Study of Higgs Self-couplings at ILC

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status

- investigating the strangeness about the stdhep file generated by Physsim, problem found, but not final solved.

progress

- with Tanabe-san's tool StdHepEditor (java), we can modify the particle information in the stdhep file by hand.
- found the real mother-daughter problem (not the problem shown in last meeting).

problems about stdhep (previous meeting)

- using Miyamoto-san's JSF framework, the stdhep file can be successfully generated. But from the particles list, there are some wrong mother-daughter relationships in case of Higgs concerned generators.

ZH

Event listing (HEP format)				Event:		99				
I	particle/jet	ISTHEP	IDHEP	JMOHEP	JDAHEP	PHEP(1,I)	PHEP(2,I)	PHEP(3,I)	PHEP(4,I)	PHEP(5,I)
1	(H_10)	2	25	0 0	0 -1	60.75512	-24.07762	8.47056	136.90385	120.00000
2	(Z0)	2	23	0 0	3 4	-60.75512	24.07762	-7.60404	112.52689	91.28836
3	(nu_e)	2	12	2 0	0 -1	-72.37788	16.75378	-34.81501	82.04470	0.00000
4	(nu_e~)	2	-12	2 0	0 -1	11.62277	7.32384	27.21097	30.48220	0.00000
5	!H 10!	13	25	3 0	0 0	60.75512	-24.07762	8.47056	136.90385	120.00000
6	(W+)	2	24	5 0	8 9	72.10799	-10.33225	-6.34192	107.28300	78.50546
7	!W-!	13	-24	5 0	10 11	-11.35287	-13.74537	14.81248	29.62085	18.44349
8	e+	1	-11	6 0	0 0	47.46394	32.09433	-9.66548	58.10588	0.00051
9	nu_e	1	12	6 0	0 0	24.64405	-42.42658	3.32356	49.17713	0.00000
10	!s!	13	3	7 0	0 0	-9.22176	2.11457	4.21949	10.37142	0.50000
11	!c~!	13	-4	7 0	0 0	-2.13111	-15.85994	10.59299	19.24943	1.50000
12	(s)	2	3	10 0	14 14	-9.22176	2.11457	4.21949	10.37142	0.50000
13	(c~)	2	-4	11 0	14 14	-2.13111	-15.85994	10.59299	19.24943	1.50000

ZZH

Event listing (HEP format)				Event:		1				
I	particle/jet	ISTHEP	IDHEP	JMOHEP	JDAHEP	PHEP(1,I)	PHEP(2,I)	PHEP(3,I)	PHEP(4,I)	PHEP(5,I)
1	(H_10)	2	25	0 0	0 -1	64.76461	36.89882	-85.27080	165.00632	120.00000
2	(Z0)	2	23	0 0	4 5	-20.93803	74.93719	-46.09124	128.13017	90.76869
3	(Z0)	2	23	0 0	6 7	-43.82658	-111.83601	135.70969	202.97218	91.39216
4	(e-)	2	11	2 0	0 -1	-52.27536	39.18375	-5.40356	65.55363	0.00051
5	(e+)	2	-11	2 0	0 -1	31.33734	35.75344	-40.68767	62.57654	0.00051
6	(b)	2	5	3 0	0 -1	-46.32804	-126.68961	118.36577	179.52463	4.70000
7	(b~)	2	-5	3 0	0 -1	2.50146	14.85360	17.34391	23.44756	4.70000
8	!b!	13	5	1 0	0 0	-46.32804	-126.68961	118.36577	179.52463	4.70000
9	!b~!	13	-5	0 0	0 0	2.50146	14.85360	17.34391	23.44756	4.70000
10	!gen. code!	13	94	8 0	11 12	-43.82658	-111.83601	135.70969	202.97218	91.39217
11	!b!	13	5	10 0	0 0	-32.17294	-87.78651	82.77557	125.47591	12.28167
12	!b~!	13	-5	10 0	0 0	-11.65365	-24.04950	52.93412	77.49628	49.89456
13	!b!	13	5	11 0	0 0	-28.83106	-70.58688	67.73966	102.29365	7.84792
14	!g!	13	21	11 0	0 0	-3.34188	-17.19963	15.03590	23.18226	2.08411
15	!b~!	13	-5	12 0	0 0	-8.46566	12.69089	19.39651	26.00661	8.20933

when passed to Mokka

(HepLCIOInterface.cc)

- only particles with ISTHEP equals 1 (stable) or 2 (preassigned decay) are considered.
- only check the daughter relation: for particles which have daughters, events should find the daughter particles in the list.
- the wrong mother-daughter relations found last time are only concerned with ISTHEP = 13 particles. there should be other problems.

real problem in the stdhep file

Event listing (HEP format)			Event: 8									
I	particle/jet	ISTHEP	IDHEP	JMOHEP	JDAHEP	PHEP(1,I)	PHEP(2,I)	PHEP(3,I)	PHEP(4,I)	PHEP(5,I)		
1	(H_10)	2	25	0	0	-119.69611	118.14014	-56.63255	214.22301	120.00000		
2	(Z0)	2	23	0	0	105.29938	-93.98820	65.05679	178.00587	86.78691		
3	(Z0)	2	23	0	0	14.39673	-24.15195	2.92115	95.70161	91.43130		
4	(e-)	2	11	2	0	-8.76509	-29.83354	-1.60823	31.13605	0.00051		
5	(e+)	2	-11	2	0	114.06447	-64.15465	66.66502	146.86983	0.00051		
6	(b)	2	5	3	0	-36.53677	-24.91580	2.52804	44.54451	4.70000		
7	(b~)	2	-5	3	0	50.93349	0.76385	0.39311	51.15710	4.70000		
95	gamma	1	22	94	0	0	1.29694	0.12431	0.17347	1.31438	0.00000	
96	gamma	1	22	94	0	0	1.04682	0.22026	0.16846	1.08292	0.00000	
97	!H_10!	13	25	6	0	0	-119.69611	118.14014	-56.63255	214.22301	120.00000	
98	(tau-)	2	15	97	0	101	101	-23.45309	105.42308	-42.62871	116.12251	1.77700
99	(tau+)	2	-15	97	0	102	102	-96.24302	12.71706	-14.00384	98.10049	1.77700
100	(gen. code)	2	94	98	0	101	102	-119.69611	118.14014	-56.63255	214.22301	120.00000
101	(tau-)	2	15	100	0	105	109	-23.45302	105.42277	-42.62858	116.12217	1.77700
102	!tau+!	13	-15	100	0	****	****	-96.24309	12.71737	-14.00397	98.10084	1.78895
103	(tau+)	2	-15	102	0	110	112	-96.22060	12.71297	-14.00348	98.07793	1.77700
104	gamma	1	22	102	0	0	0	-0.02248	0.00441	-0.00049	0.02291	0.00000
105	nu_tau	1	16	101	0	0	0	-1.52889	7.16411	-2.94919	7.89682	0.00000
106	(rho(770)-)	2	-213	101	0	113	114	-11.41998	51.25730	-20.75523	56.47355	0.86930
107	(pi0)	2	111	101	0	115	116	-3.40950	16.06532	-6.58380	17.69418	0.13498
108	(pi0)	2	111	101	0	117	118	-3.01599	12.60566	-5.22815	13.97679	0.13498
109	(pi0)	2	111	101	0	119	120	-4.07866	18.33037	-7.11221	20.08083	0.13498
110	nu_tau~	1	-16	103	0	0	0	-4.94714	0.72840	-0.84628	5.07159	0.00000

- 99: (tau+) has daughter 102, however ISTHEP of 102 is 13 (means 102 is neglected by Mokka), then particle 99 couldn't find the daughter
- this bug only exists in case of Higgs decays into tau+tau- and one tau has daughter number ****

similar with problem shown by Miyamoto-san (meeting 17th, Sep.)

one solution

- By using Tanabe-san's tool, I can force the status code of particle which has daughter status code 13 to be 13 (originally possible 2). (following the strategy of Mokka, ISTHEP 13 particle will not be checked)
- then the stdhep file could be successfully used by Mokka.
- but there maybe some information lost in the converted stdhep file and the reading of the converted stdhep file caused error after 199 events. (still under investigation)

another solution

- modify the JSFWriteStdHep.cxx

change to:

“pd->GetFirstDaughter() >1000” ?

```
    }  
    else if ( p->GetNDAughter() > 0 ) {  
        Int_t id=p->GetFirstDaughter();  
        JSFGeneratorParticle *pd=id>0 && id<1000 ? (JSFGeneratorParticle*)pa->At(id-1) : 0 ;  
        if( !pd || pd->GetNDAughter() > 1000 ) {  
            hepevt_.isthep[j]=13;  
            //          hepevt_.jdahep[j][0]=p->GetNDAughter();  
            //hepevt_.jdahep[j][1]=p->GetFirstDaughter();  
        }  
        else {  
            hepevt_.isthep[j]=2;  
        }  
    }  
}
```

backup

problems about framework

- using Miyamoto-san's JSF framework, the stdhep file can be successfully generated, no matter how many events specified.
- using my JSF framework (20101024), stdhep file could be generated if I specified small number of events (about 100). If 10,000 events specified, every time the generation will be stopped at some event (only for Higgs concerned generators):

```
Error: Symbol G_exception is not defined in current scope  sim.C:49:
Error: type G_exception not defined FILE:/data17/jlc/tianjp/lcsoft/physsim/20101024/higgs/ZHStudy++/prod/./sim.C LINE:49
*** Interpreter error recovered ***
Processed event 3289  End event 3289
```

differences between Miyamoto-san's and my JSF framework

	my	Miyamoto-san's
clhep	2.0.4.0	2.0.4.3
java	1.5.0_14	1.4.2_12
geant4	4.9.1.p03	4.9.2.p01

problems emerged in Mokka

- using Miyamoto-san's JSF framework, the stdhep file can be successfully generated, then be passed to Mokka.
- however, for ZZH and ZHH stdhep file, Mokka stopped after a few events:

```
Mokka: src/HepLCIOInterface.cc:307: virtual void  
HepLCIOInterface::GeneratePrimaryVertex(G4Event*): Assertion `mcplT != Map.end()' fa  
iled.  
tmp/DST06-07-p01_kek-ppr004_pythia_physsim_e1e1bbh_01_s001.sh: line 2: 17009  
Aborted
```