# A Generator for $B$-physics Planted into BES

# (Preliminary)

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1. Introduction of EvtGen
2. What needed at runtime by EvtGen
3. Access to EvtGen with a sober job
4. Examples and simple checks
5. Summary

## 1. Introduction of EvtGen

- C++(125 classes and 25000 lines of code)
- Modularity($\sim$60 models) to simulate decays

  Easy implementation of additional models
- Interface with the packages JETSET and QQ
- Amplitudes instead of probabilities used for the

  simulation of decays, angular correaltions included
- $\cdots$ Something I haven't found

## 2. What needed at runtime by EvtGen

⊙ **pdt.table** : the list of particles and properties

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| add | p | Lepton | mu- | 13 | 0.1056584 | 0 | 0 | -3 | 1 | 658654. | 13 |
| add | p | Lepton | mu+ | -13 | 0.1056584 | 0 | 0 | 3 | 1 | 658654. | 0 |
| add | p | Meson | pi+ | 211 | 0.139570 | 0 | 0 | 3 | 0 | 7804.5 | 101 |
| add | p | Meson | pi- | -211 | 0.139570 | 0 | 0 | -3 | 0 | 7804.5 | 0 |
| add | p | Meson | rho+ | 213 | 0.7685 | 0.151 | 0.4 | 3 | 2 | 0 | 121 |
| add | p | Meson | rho- | -213 | 0.7685 | 0.151 | 0.4 | -3 | 2 | 0 | 0 |
| add | p | Meson | D0 | 421 | 1.86451 | 0 | 0 | 0 | 0 | 0.1244 | 105 |
| add | p | Meson | anti-D0 | -421 | 1.86451 | 0 | 0 | 0 | 0 | 0.1244 | 0 |

The first three columns are not used in EvtGen. The fourth column corresponds to the particle name. The fifth column is the particle StdHep number. The sixth through eighth columns contain the mass, width, and maximum allowed deviation from the nominal mass, respectively. The nineth column contains 3 times the charge of the particle. The tenth column contains twice the spin. The eleventh column is $c\tau$ in meters. The twelvth column is the Lund-KC number *?*.

## ⊙ **DECAY.DEC** : default list of particle decay channels

|  |  |  |  |
|---|---|---|---|
|  | . |  |  |
|  | . |  |  |
| **Decay** | J/psi |  |  |
| 0.0602 | e+ e- | PHOTOS | **VLL**; |
| 0.0602 | mu+ mu- |  | **VLL**; |
| 0.0042 | rho0 pi0 |  | **VVS_PWAVE** 1.0 0.0 0.0 0.0 0.0 0.0; |
| 0.0043 | rho+ pi- |  | **VVS_PWAVE** 1.0 0.0 0.0 0.0 0.0 0.0; |
| 0.0043 | rho- pi+ |  | **VVS_PWAVE** 1.0 0.0 0.0 0.0 0.0 0.0; |
| 0.0036 | a_20 rho0 |  | **PHSP**; |
| 0.0036 | a_2+ rho- |  | **PHSP**; |
| 0.0036 | a_2- rho+ |  | **PHSP**; |
| 0.0130 | gamma | eta_c | **PHSP**; |
| 0.8430 | rndmflav | anti-rndmflav | **JETSET** 12; |
| **Enddecay** |  |  |  |
|  | . |  |  |
|  | . |  |  |
| **End** |  |  |  |

## ⊙ **DECAY.user** : user decay file

|  |  |  |  |
|---|---|---|---|
| Define | 2pi | 6.283185 |  |
| Alias | myJ/psi | J/psi |  |
| **Decay** | myJ/psi |  |  |
| 1.0 | J/psi | **SINGLE** | 0.0 0.000001 -0.7 0.7 0. 2pi; |
| **Enddecay** |  |  |  |

#The following will override the standard decay of J/psi in DECAY.DEC

|  |  |  |  |
|---|---|---|---|
| **Decay** | J/psi |  |  |
| 0.333 | rho+ pi- | **VVS_PWAVE** | 1.00 0.0 0.0 0.0 0.0 0.0; |
| 0.333 | rho- pi+ | **VVS_PWAVE** | 1.00 0.0 0.0 0.0 0.0 0.0; |
| 0.333 | rho0 pi0 | **VVS_PWAVE** | 1.00 0.0 0.0 0.0 0.0 0.0; |
| **Enddecay** |  |  |  |
| **End** |  |  |  |

⊙ Models available

| | |
|---|---|
| ◦ BHADRONIC | |
| ◦ BTO3PI_CP | |
| ◦ CB3PI-MPP | |
| ◦ CB3PI-P00 | |
| ◦ BTOKPIPI_CP | |
| ◦ BTO4PI_CP | |
| ◦ BTO2PI_CP_ISO | |
| ◦ BTOKPI_CP_ISO | |
| ◦ D_DALITZ; | |
| ◦ GOITY_ROBERTS | |
| ◦ HQET | |
| ◦ ISGW | |
| ◦ ISGW2 | |
| ◦ JETSET | calling jetset |
| ◦ JSCONT | |
| ◦ KLL3P | |
| ◦ KSLLLCQCD | |
| ◦ KSLL3PQCD | |
| ◦ MELIKHOV | |
| ◦ OMEGA_DALITZ | |
| ◦ PHIGAMMA | |
| ◦ PHSP | phase space |
| ◦ SINGLE | single particle generator |
| ◦ SLN | scalar to a lepton and a neutrino |
| ◦ SLPOLE | |
| ◦ SSS_CP | |
| ◦ SSS_CP_PNG | |
| ◦ STS | |
| ◦ STS_CP | |
| ◦ SVP_HELAMP | a scalar to a vector and a photon |
| ◦ SVS | |
| ◦ SVS_CP | |
| ◦ SVS_CP_ISO | |
| ◦ SVS_NONCPEIGEN | |
| ◦ SVV_CP | |
| ◦ SVV_HELAMP | scalar to two vectors |
| ◦ TAULNUNU | a tau to a lepton and two neutrinos |
| ◦ TAUSCALARNU | a tau to a scalar and a tau neutrino |
| ◦ TAUVECTORNU | a tau to a vector and a tau neutrino |
| ◦ TSS | |
| ◦ TVS_PWAVE | |
| ◦ VLL | vector to a pair of leptons |
| ◦ VSP_PWAVE | vector to a scalar and a photon |
| ◦ VSS | vector to two scalars |
| ◦ VSS_MIX | |
| ◦ VVS_PWAVE | vector to a vector and a scalar |
| ◦ WSB | |

## 3. Access to EvtGen with a sober job

In beslx01,

alias sob_drk ~chengbs/bin/sob_drk
ln -s -f user-decay-file DECAY.user
sober -jjc -v101 -r -d -f (-c) evtgen

evtgen.sobcard is in ~chengbs/EvtGen/
*LINK ~chengbs/EvtGen/EvtGen.opt
sober idconv wheres clock1 datez gheadr left1a

some user-decay-files can also be found there:
DECAY.ee : $J/\psi \to e^+e^-$ decay file
DECAY.mm : $J/\psi \to \mu^+\mu^-$ decay file
DECAY.rhopi : $J/\psi \to \rho\pi$ decay file
. . .

# 4. Examples and simple checks

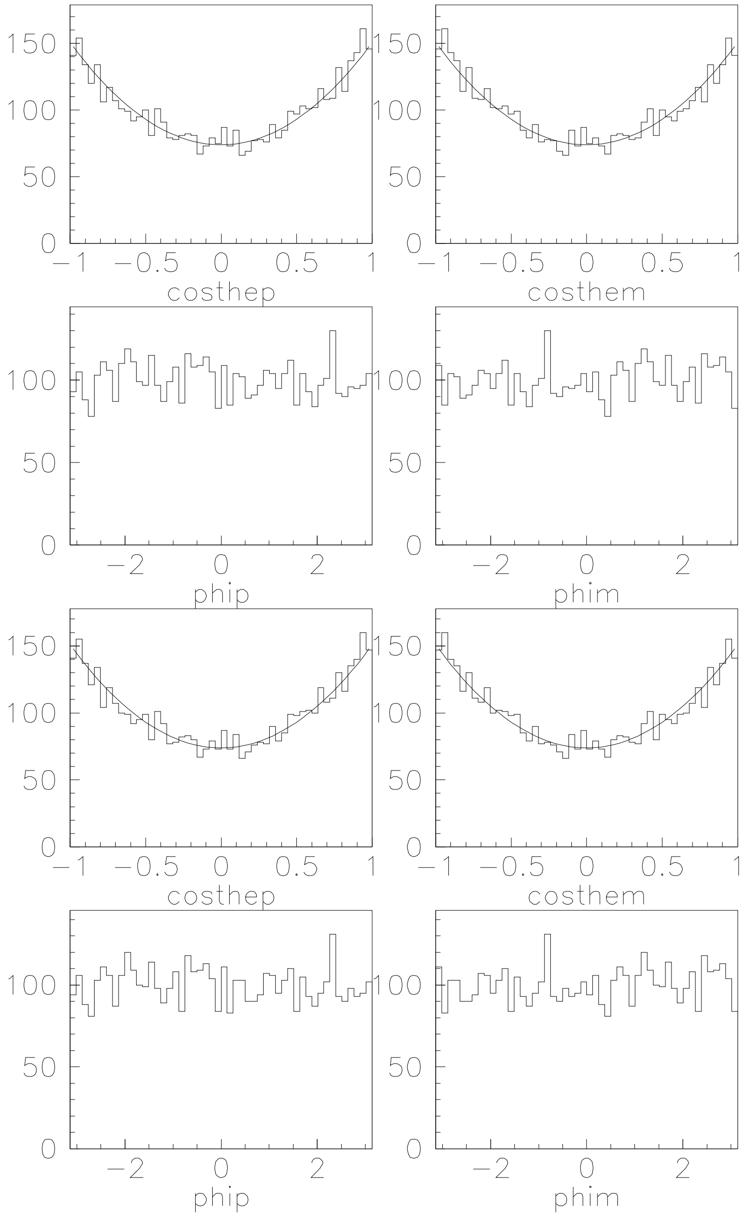


Figure 1: $\cos\theta$ and $\phi$ distribution for $J/\psi \to \mu^+\mu^-(up), e^+e^-(down)$

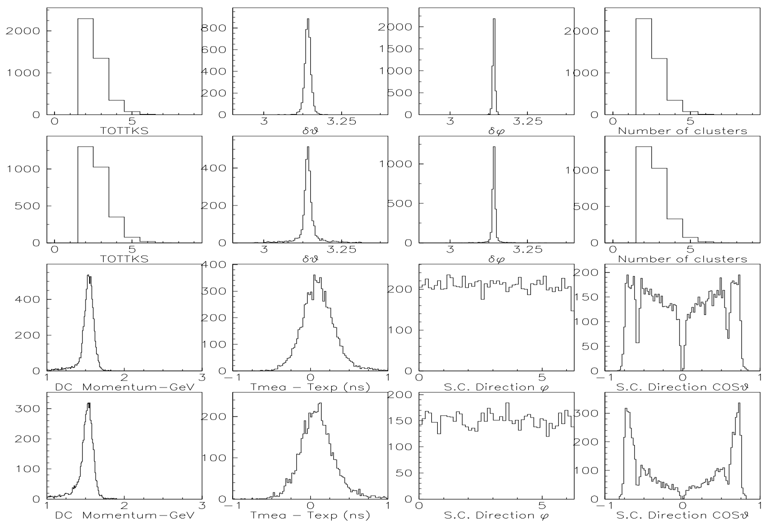


Figure 2: Track information for EvtGen(up) and SOBER(down) $J/\psi \to e^+e^-$

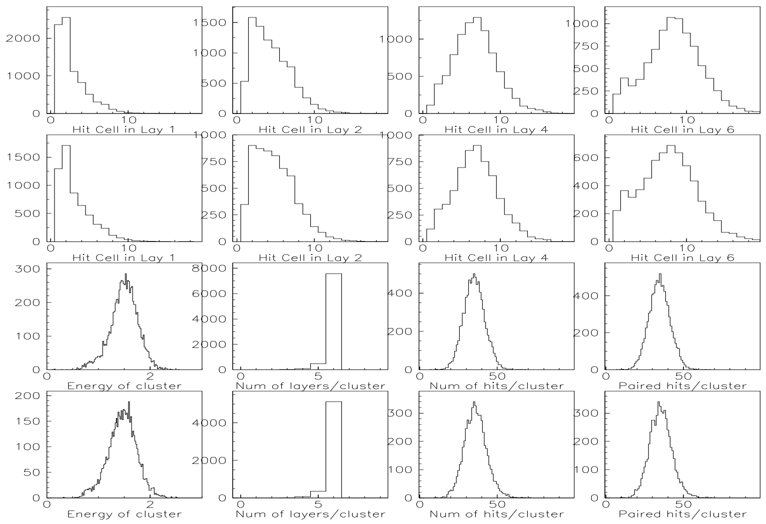


Figure 3: BSC information for EvtGen(up) and SOBER(down) $J/\psi \to e^+e^-$

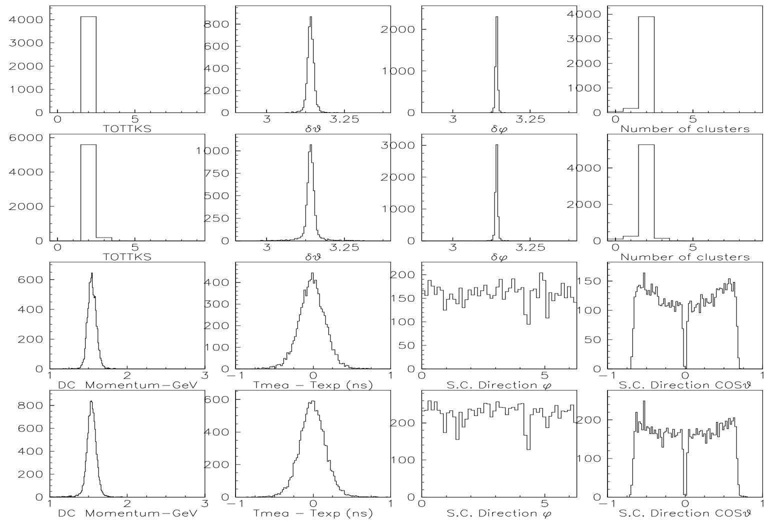


Figure 4: Track information for EvtGen(up) and SOBER(down) $J/\psi \to \mu^+\mu^-$

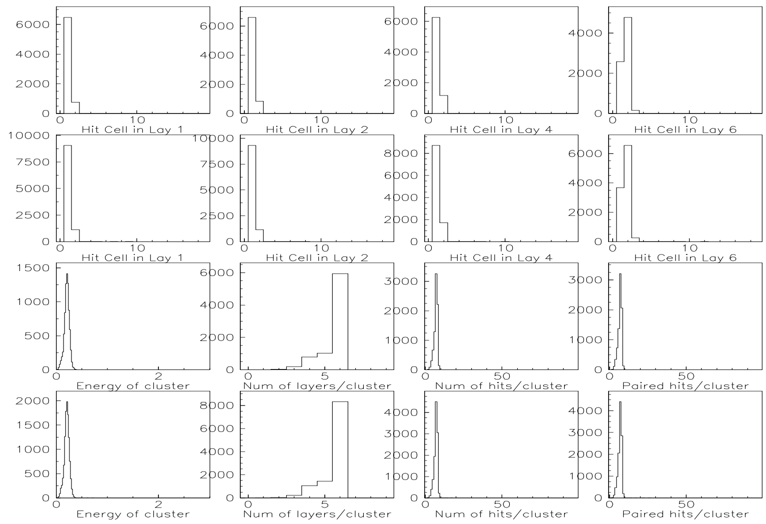


Figure 5: BSC information for EvtGen(up) and SOBER(down) $J/\psi \to \mu^+\mu^-$

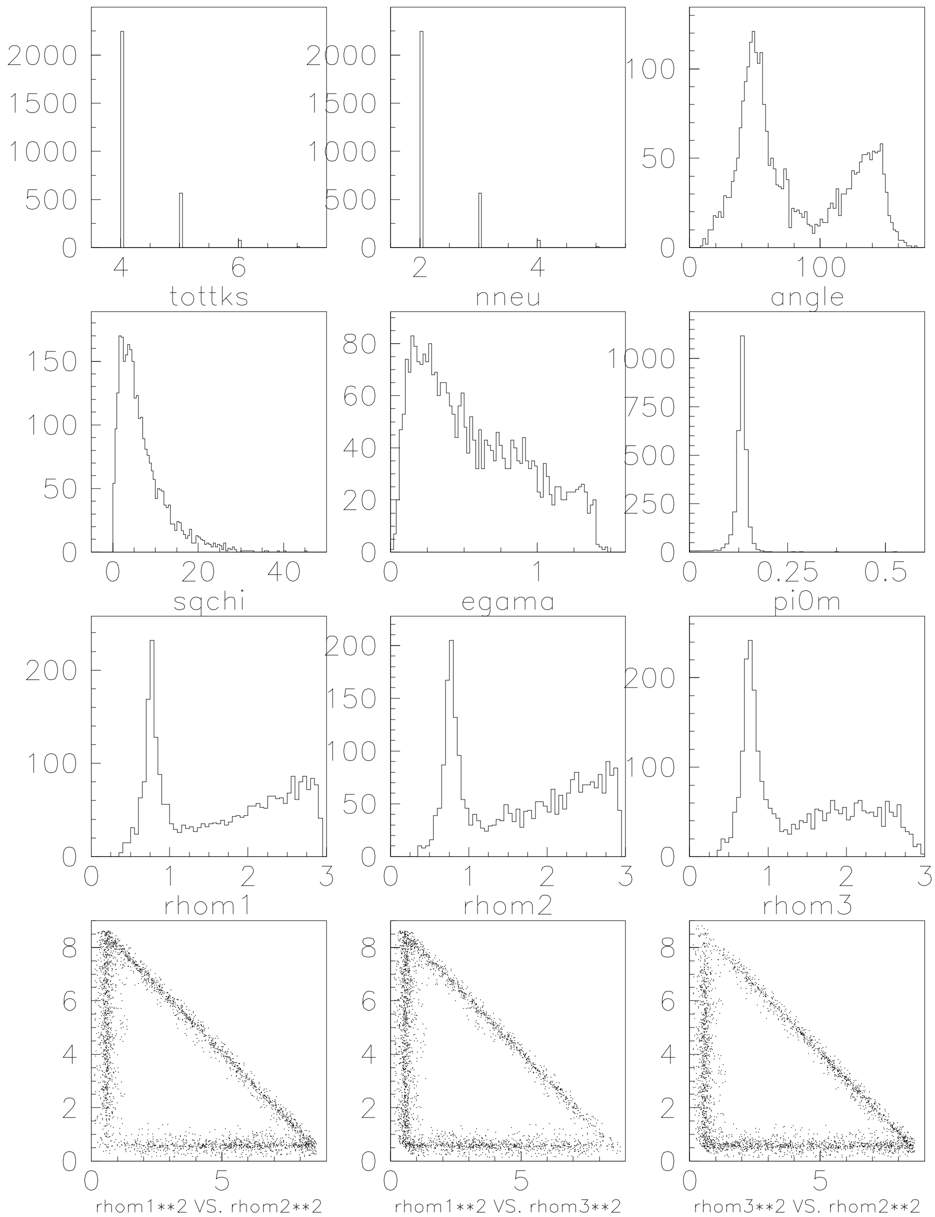


Figure 6: $J/\psi \rightarrow \rho\pi$ information

## 5. Summary

- ⊙ **The generator runable at BES**
- ⊙ **Random seed have not been transfered to the generator**
- ⊙ **More detail job need to be done for the specific topic**
- ⊙ $\cdots$