

EvtGen: status and plans

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- Latest version (v1.3.0) is available from [\[http://evtgen.warwick.ac.uk/\]](http://evtgen.warwick.ac.uk/).
- Includes separation of “core” code and external generator libraries:

libEvtGen.so	EvtGen base + models (with HepMC for I/O)
libEvtGenExternal.so	Dependent on external generators

- External generators:

Pythia8	[http://home.thep.lu.se/~torbjorn/Pythia.html]
Tauola++	[http://tauolapp.web.cern.ch/tauolapp/]
Photos++	[http://photospp.web.cern.ch/photospp/]
...	

- Can use Pythia8/Tauola models for hadronic/ τ decays.

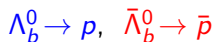
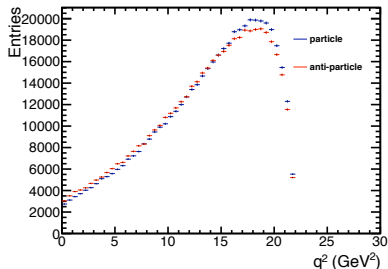
- Decay files can now be written in an XML format (EvtParserXml).
 - Parameters can be given descriptive names and tags.
 - convertDecayFile.py script provided for conversion of ascii decay files to XML.
- Introduced EvtGenericDalitz model for modeling of B or D to hhh Dalitz plots.
 - Replaces EvtDDalitz for D modes.
 - Advantage is that new modes can be added or resonance parameters updated without need to re-compile the code.
- Improved code compliance with gcc 4.8, clang & Mac OS.

Snapshot of DECAFY_2010.XML

```
185 <!--Enddecay -->
186 <!-- use new VSS_BMIX mixing decay model (DK,28-Oct-1999) -->
187   <decay name="Upsilon(4S)">
188     <channel br="0.515122645" daughters="B+ B-" model="VSS"/>
189   <!--[Reconstructed PDG2011] -->
190     <channel br="0.483122645" daughters="B0 anti-B0" model="VSS_BMIX" params="dm"/>
191   <!--[Reconstructed PDG2011] -->
192     <channel br="0.000015583" daughters="e+ e-" model="VLL" photos="true"/>
193   <!--[Reconstructed PDG2011] -->
194     <channel br="0.000015766" daughters="mu+ mu-" model="VLL" photos="true"/>
195   <!--[Reconstructed PDG2011] -->
196     <channel br="0.000015766" daughters="tau+ tau-" model="VLL" photos="true"/>
197   <!--[Reconstructed PDG2011] -->
198     <channel br="0.000084099" daughters="Upsilon(2S) pi+ pi-" model="VVPIPI"/>
199   <!--[Reconstructed PDG2011] -->
200     <channel br="0.000044342" daughters="Upsilon(2S) pi0 pi0" model="VVPIPI"/>
201   <!--[Reconstructed PDG2011] -->
202     <channel br="0.000080123" daughters="Upsilon pi+ pi-" model="VVPIPI"/>
203   <!--[Reconstructed PDG2011] -->
204     <channel br="0.000044342" daughters="Upsilon pi0 pi0" model="VVPIPI"/>
205   <!--[Reconstructed PDG2011]-->
206     <channel br="0.000194392" daughters="Upsilon eta" model="PARTWAVE" params="0.0 0.0 1.0 0.0 0.0
0.0"/>
```

- Bug fix for Bs mixing decay/CP violation amplitudes. Added the capability to use either coherent or incoherent mixing in EvtCPUUtil.
- Changed EvtWilsonCoeficients to EvtWilsonCoefficients, used by EvtLb2LL.
- Added two sub-amplitude types LASS_ELASTIC and LASS_RESONANT to the EvtLASSAmp model.

- We have noticed a long-standing issue with the treatment of anti-baryon decays in EvtSemileptonicBaryonAmp.
- $\pi/2$ phase-change between particle and anti-particle in matrix element expression (in the pseudo-scalar term).
- Small effect for $\Lambda_b^0 \rightarrow \Lambda_c \ell \nu$, more visible for $\Lambda_b^0 \rightarrow p \ell \nu$.



This will be updated for the next release

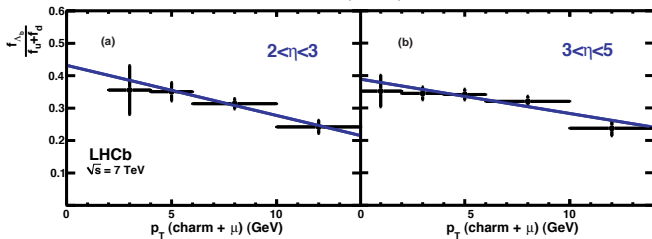
- Updates of DECAY.DEC file are always ongoing, see talk from Michal for more details.
 - Internally, within LHCb, we maintain a repository of models that are not yet part of the full EvtGen release (see next slides). These could be merged into the release if there is sufficient demand?
 - Can add other new/updated models from other experiments:
- Easiest if the models become part of EvtGenModels and external library dependancies go into EvtGenExternal.

- EvtBToKStarIIDurham07
 - Detailed model of the $B^0 \rightarrow K^{*0} \mu^+ \mu^-$ decay, depends on the GNU Scientific Library for numeric integration routines.
- Evtbs2IIGammaMNT
 - Model for $B_{(s)}^0 \rightarrow \mu^+ \mu^- \gamma$ with hard γ emission.
- EvtbsToLLLL and EvtbsToLLLLHyperCP
 - Model for $B_{(s)}^0 \rightarrow \mu^+ \mu^- \mu^+ \mu^-$.
- EvtbTosIIMSExt
 - Model for $b \rightarrow s \ell^+ \ell^-$ decays, similar to EvtbTosIIBall (etc).
- EvtBcVHad
 - Model for B_c^+ decays to hadrons ($B_c^+ \rightarrow \psi + n\pi + mK$).

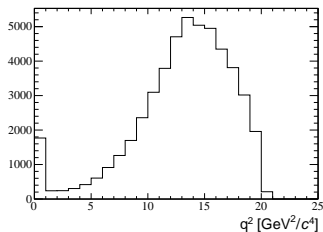
- EvtDTohhhh
 - Dalitz model for $D \rightarrow hhhh$ decays, using the [\[MINT\]](#) Dalitz plot fitter.
- EvtFlatSqDalitz
 - Model for generating $B \rightarrow hhh$ decays with a flat square Dalitz plot.
- EvtSLBaryonAmp, EvtLb2plnuLCSR, EvtLb2plnuLQCD
 - Routines to implement $\Lambda_b^0 \rightarrow N^* \ell \nu$ semileptonic decays with $N^* J^P = 1/2^+, 1/2^-, 3/2^+, 3/2^-$ according to [\[arXiv:0503030v1\]](#).
 - Includes form-factors from Lattice QCD [\[arXiv:1306.0446\]](#) and LCSR [\[arXiv:1108.2971\]](#).

At the LHC we have a very large Λ_b^0 production cross-section.

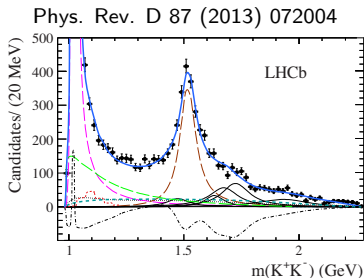
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- Work ongoing to produce models for rare $\Lambda_b^0 \rightarrow \Lambda^{(*)} \ell^+ \ell^-$ decays with $\Lambda^* J^P = 1/2^+, 1/2^-, 3/2^+, 3/2^-$ (driven by ongoing analyses in LHCb).



- Another topic, driven by analysis at LHCb, is the treatment of overlapping S-, P-, D-, ... Wave states in $B \rightarrow Vhh$ decays, e.g. in $B_s^0 \rightarrow J/\psi K^+ K^-$.
- Testing possibility to move to a model based on Helicity amplitudes, with overlapping states.



Fin

