EvtGen Upgrade

RickT 3/12/03

Motivation:

- CDFSOFT v4.9.1 & earlier.
  - + Decays of prompt B_u, B_d, B_s mesons.
  - + Prompt charm decays.
  - – Prompt charm incompatible with $B_u B_d B_s$.
  - – No B_c decays.
  - – No b-onium decays.
  - – No b-baryon decays.

- CDFSOFT upgrade.
  - + B_u,B_d,B_s, B_c, Υ(1S,2S,3S,4S), χ_b(0,1,2).
  - + Few b-baryon decays.
    (Λ_b^0, Ξ_b^0, Ξ_b^-, Σ_b^+, Σ_b^-, Σ_b^0).
  - – Prompt charm incompatible with prompt b-particle decay.
  - – Limited decay tables for B_c, b-baryons.
  - – Decay models for baryons lacking.

Details follow…

Meson Decays

Enabled more meson decays

- $\Upsilon(1s,2s,3s,4s)$, $\chi_b(0,1,2)$
  - + Decays already in decay table
  - – Other b-bbar states disabled
    (missing entries in decay table)
- B_c
  - + Semileptonic decays in decay table
    $B_c^+ \to J/\psi\, l^+ \nu$ ISGW2
    $B_c^+ \to B_s\, l^+ \nu$ PHSP
  - – No decays to excited states.
  - – No hadronic decays in decay table
    (need estimates of BRs).
  - – Decay models need testing.

Prompt b-meson decays enabled

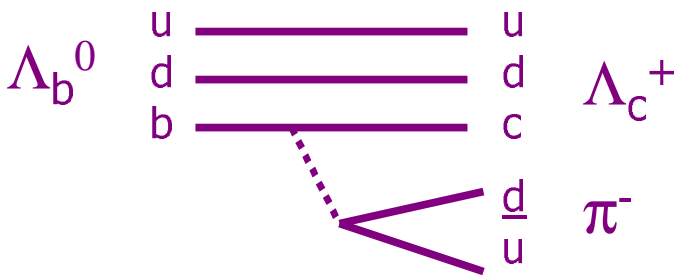
`decayBMeson=true`

B-baryon Decays

Enable Λ_b^0 Ξ_b^0 Ξ_b^- Σ_b^+ Σ_b^- Σ_b^0

Λ_b^0 decays:

Quark level diagrams to guess at decays



Branching ratio estimates from B^0 decays

Normalization = $\frac{BR(\Lambda_b^0 \rightarrow J/\psi\ \Lambda^0)}{BR(B^0 \rightarrow J/\psi\ K_s)}$

b-meson decay mode		branching ratio	b-baryon decay mode		branching ratio
B^0	$\rightarrow D^- \ell^+ \nu$	2.11×10^{-2}	Λ_b^0	$\rightarrow \Lambda_c \ell^- \nu$	1.1×10^{-2}
	$\rightarrow D^- \pi^+$	3.0×10^{-3}		$\rightarrow \Lambda_c \pi^-$	1.6×10^{-3}
	$\rightarrow D^- \pi^+ \pi^- \pi^+$	8.0×10^{-3}		$\rightarrow \Lambda_c \pi^- \pi^+ \pi^-$	1.3×10^{-3}
	$\rightarrow D^- K^+$	2.0×10^{-4}		$\rightarrow \Lambda_c K^-$	1.1×10^{-4}
	$\rightarrow D^- D_s^+$	8.0×10^{-3}		$\rightarrow \Lambda_c D_s^-$	1.3×10^{-3}
	$\rightarrow J/\psi K^0$	3.0×10^{-3}		$\rightarrow \Lambda^0 J/\psi$	1.7×10^{-4}
	$\rightarrow \overline{D^0} \pi^0$	2.9×10^{-3}		$\rightarrow n D^0$	1.6×10^{-4}

B-Baryon Decays (cont)

Ξ_b^0 Ξ_b^- decays:

- SU(3) flavor symmetry (u<- ->s)
- Similar decay table as Λ_b^0

  Ξ_b^0-> Ξ_c^- Ξ_b^- -> Ξ_c^0

Σ_b^+ Σ_b^- Σ_b^0 decays:

- Hadronic decays only(similar to charm hadrons)

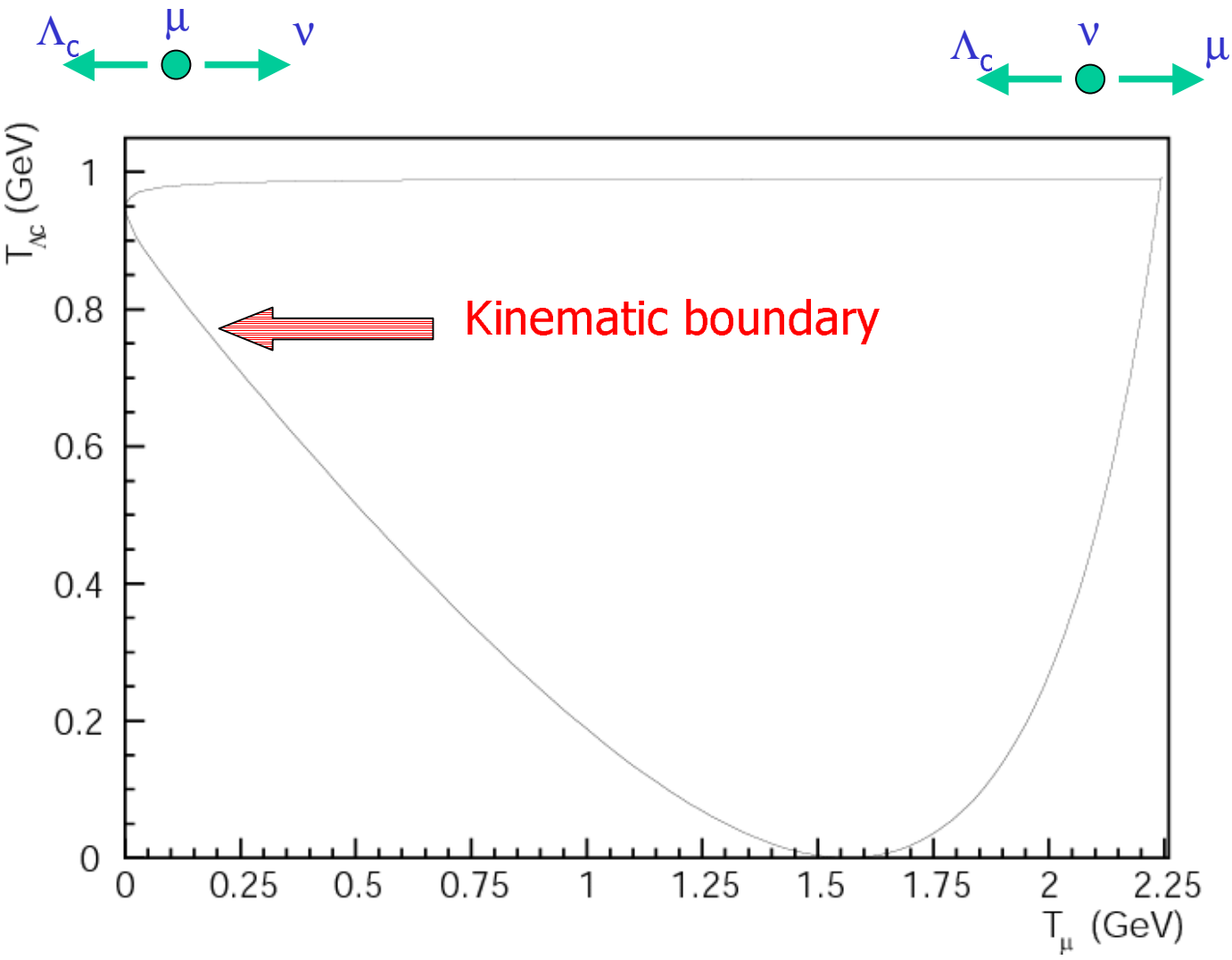
Summary

+ Many b-baryon decays enabled.
+ First decay tables (PHSP).
– Need more work on decay modes and BRs.

Semileptonic Baryon Decays

Lorentz structure and Dalitz plot

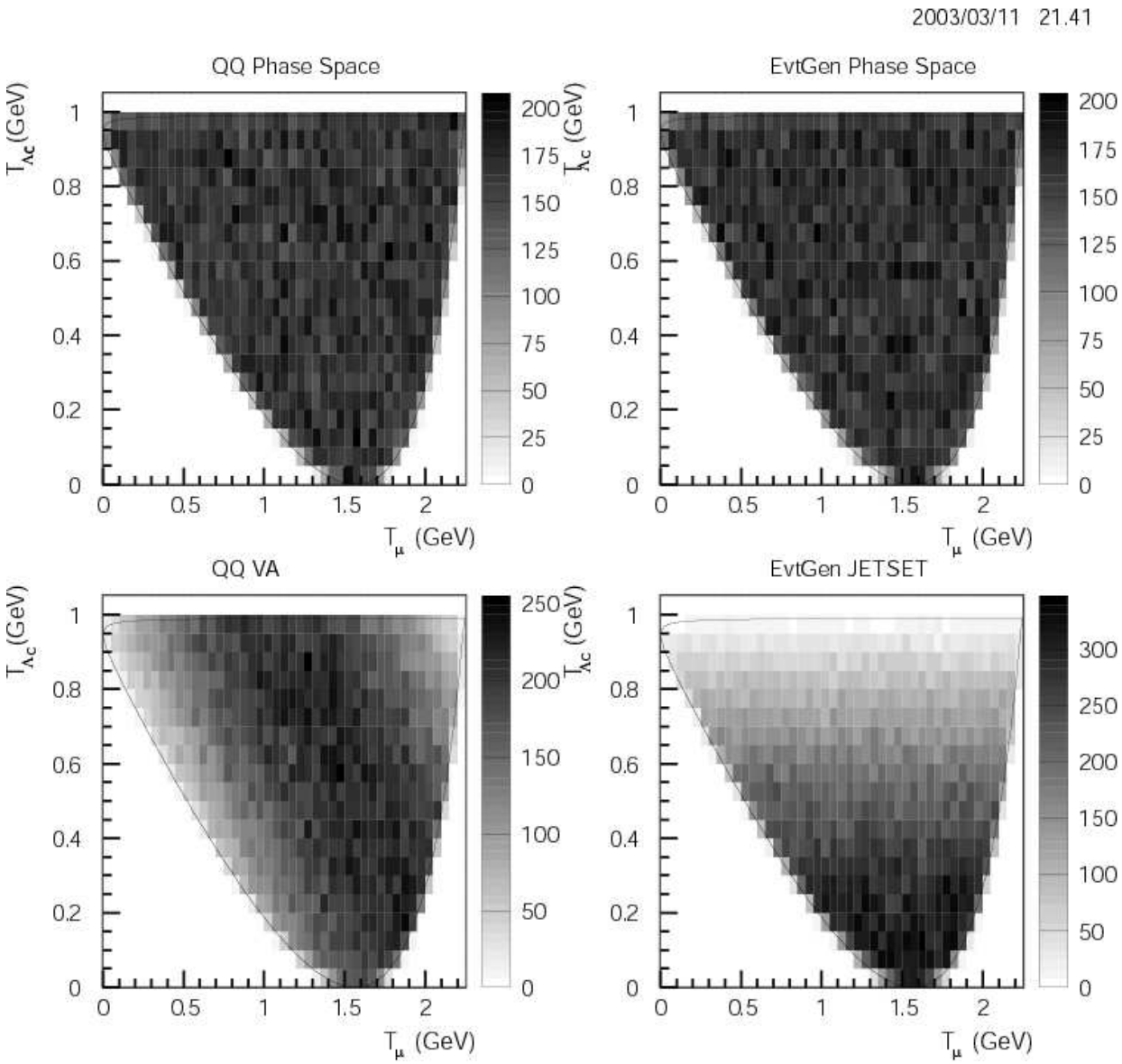
$\Lambda_b^0 \rightarrow \Lambda_c^+ l^- \nu$



Semileptonic Λ_b decay

Compare QQ and EvtGen models

Note: EvtGen decays baryons using JETSET



Running EvtGen

Running updated EvtGen

1) Check out EvtGen & generatorMods.
2) Copy .tgz files from the URL below to your release area.
3) Compile both packages.
4) Run according to instructions in the users guide.

http://ncdf67.fnal.gov/~tesarek/EvtGen.tgz
http://ncdf67.fnal.gov/~tesarek/generatorMods.tgz

Report problems with this procedure to:
tesarek@fnal.gov

Summary

New particle decays in EvtGen

- Mesons:

  $\Upsilon(1s,2s,3s,4s)$ $\chi_b(0,1,2)$ B_c

- Baryons:

  Λ_b^0 Ξ_b^0 Ξ_b^- Σ_b^+ Σ_b^- Σ_b^0

Need more decay modes

No baryon decay models

- Work in progress

Help is welcome