Studies of Generator-level Selection

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I. Proposal

II. Procedure

III. Example distributions and acceptance curves

IV. Conclusions and final remarks

Proposal

- **Present Monte Carlo generation in LHCb:**
  - (pre-)selection cut @ Pythia level for B-signal events:

    400 mrad cut on true direction of B-meson of interest

    -> geometrical acceptance $\varepsilon_{400mrad}$ ~ 35 %

- **Proposal investigated:**
  - Can we do better in a more adequate/efficient way by rejecting as early as possible events that will not pass the selection though the whole reconstruction and analysis chain?
  - apply to all event generation some (e.g. multiplicity, P, P_T) cuts

    @ Pythia level and in offline analyses …

    -> how could it be implemented?

    -> what and where can we then gain?

Procedure

- **B-signal (offline selected) events:**
  - apply Pythia cuts -> small loss on offline selected events (a few – 10 % acceptable?)
  - apply cuts on offline tracks -> small loss on offline selected events
  - ➢ requirement: loss when applying Pythia after track cuts = 0%
- **Minimum bias events:**
  - σ_{tot} = 102.4 mb , $\sigma_{b\text{-}bbar}$ = 500 μb

    -> $\sigma_{tot} / (\sigma_{b\text{-}bbar} \times \varepsilon_{400mrad}) \approx 600$

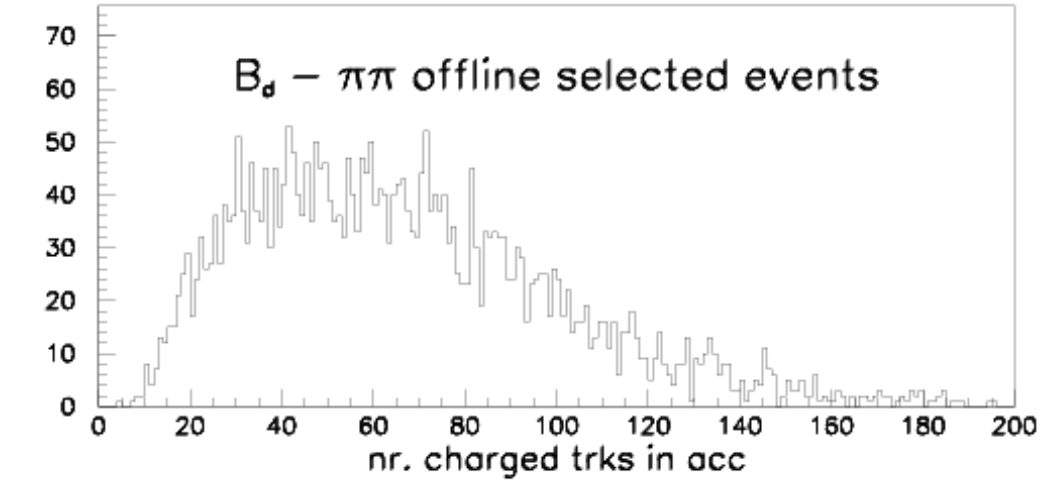
    if reduction in M.B. acceptance by ≈ 600

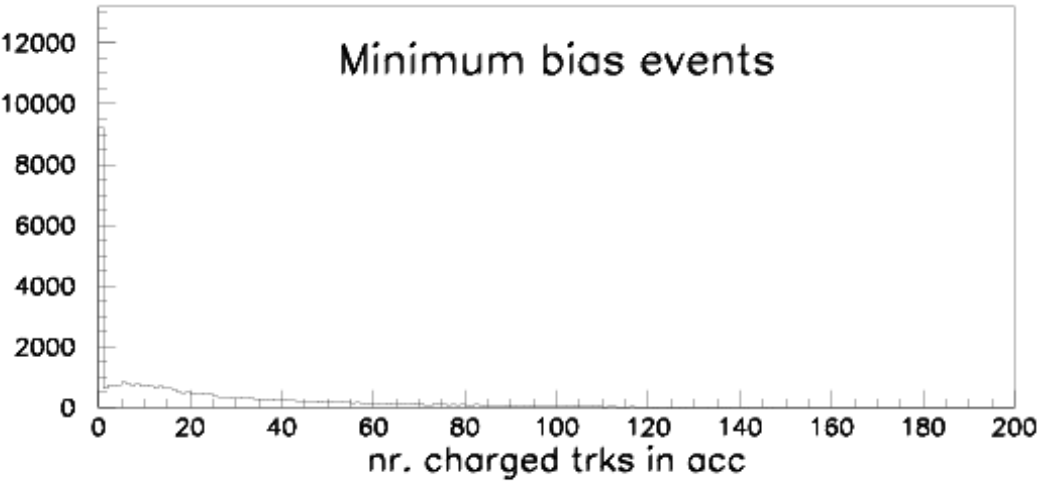
    -> amount of events to simulate less than what we would now get for the b-background
  - ➢ gain in CPU time + storage space
  - ➢ gain in knowledge <-> possibility to study non-b background & improvement in B/S?
- **b bbar-inclusive events:**
  - need to cross-check that loss when applying Pythia after track cuts = 0%

    ➔ all analyses would have to apply theses cuts …

Limited at prese
by statistics

Example Distributions (I)



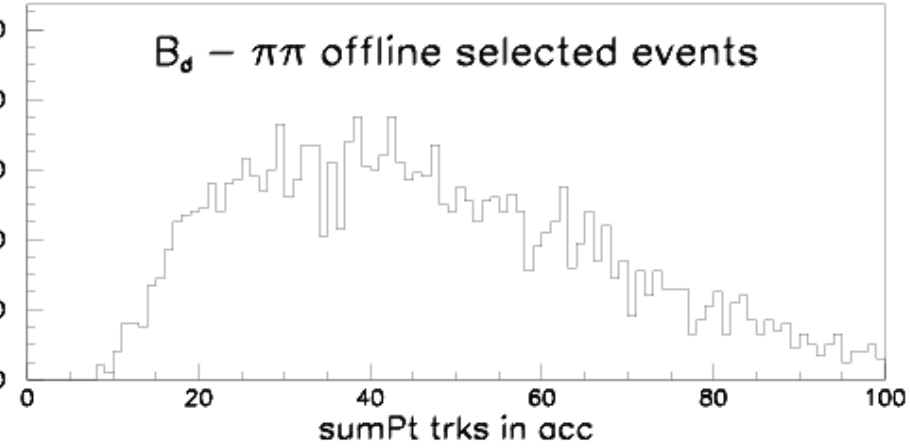


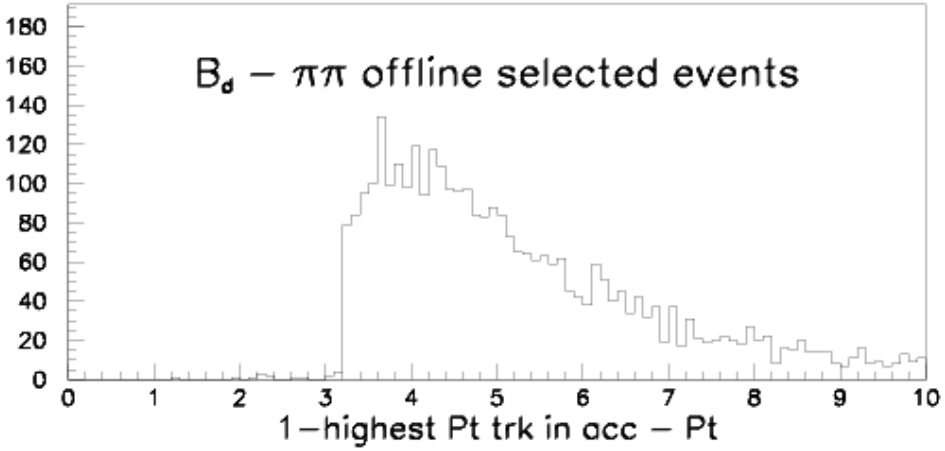
Distributions for MC particles in the LHCb acceptance

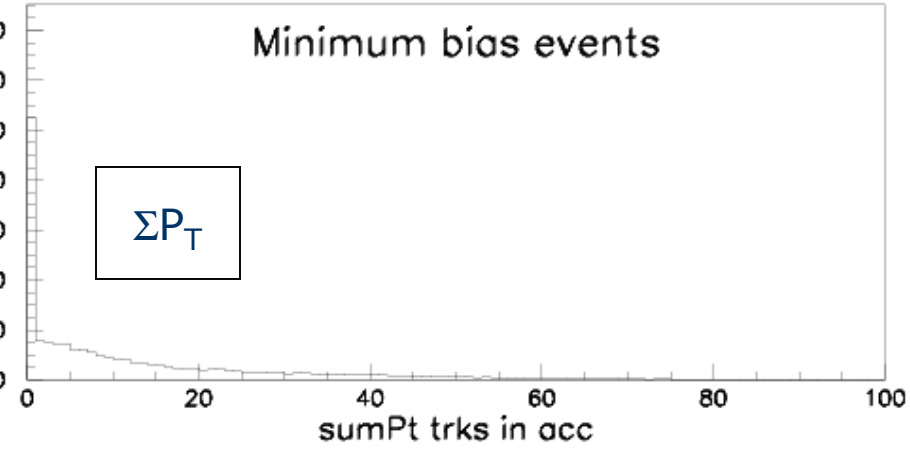
($1.8 < \eta < 4.9$)

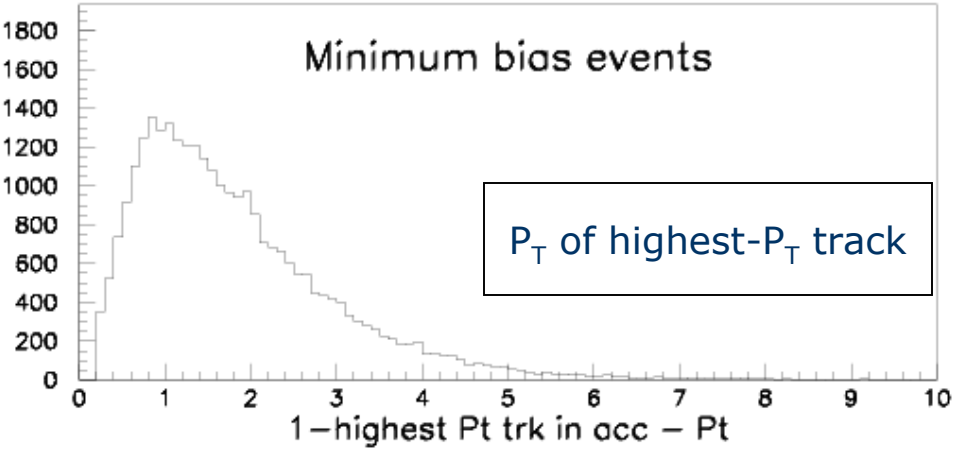
Example Distributions (II)

Distributions for MC particles in the LHCb acceptance (1.8 < η < 4.9)



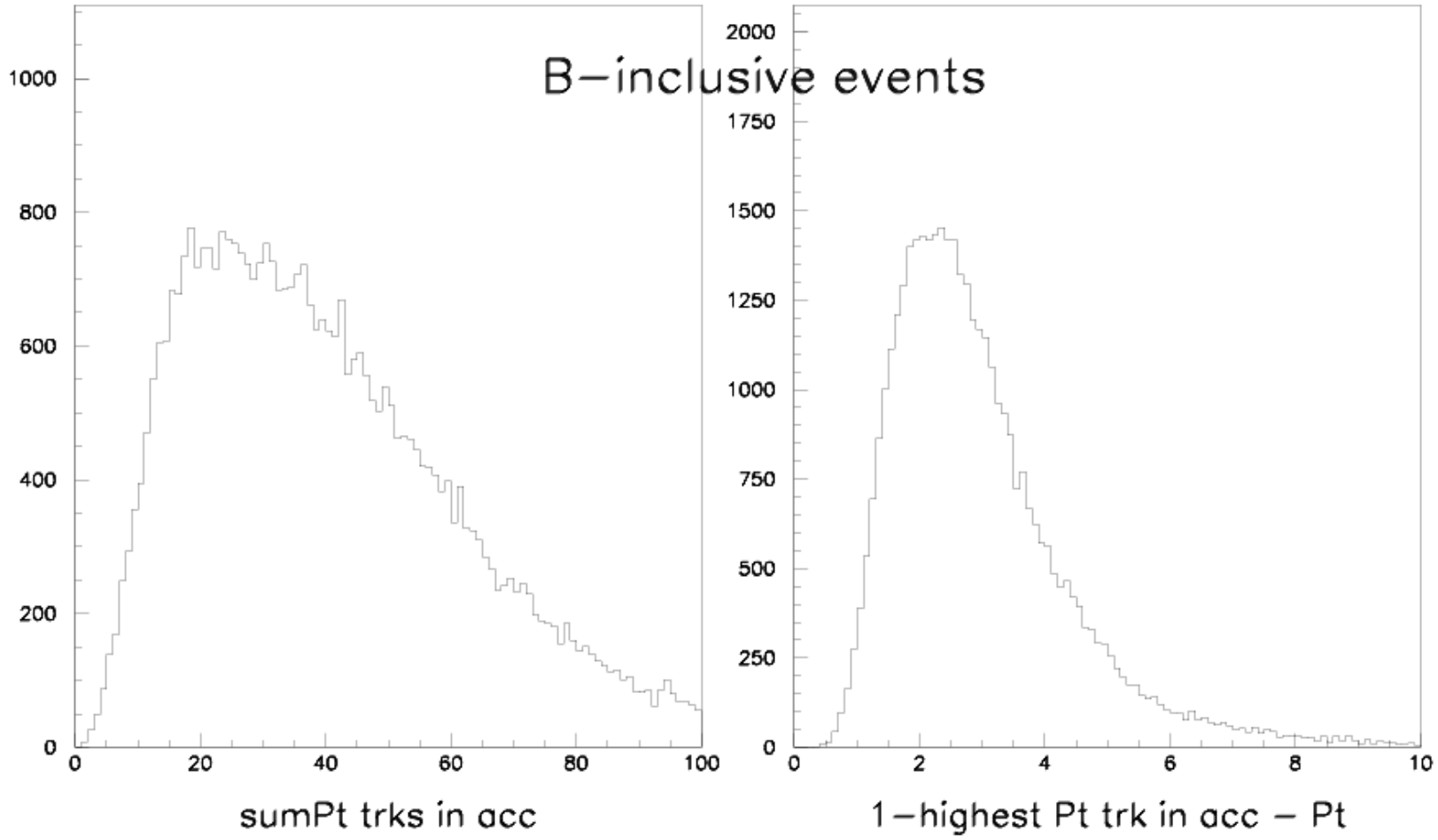






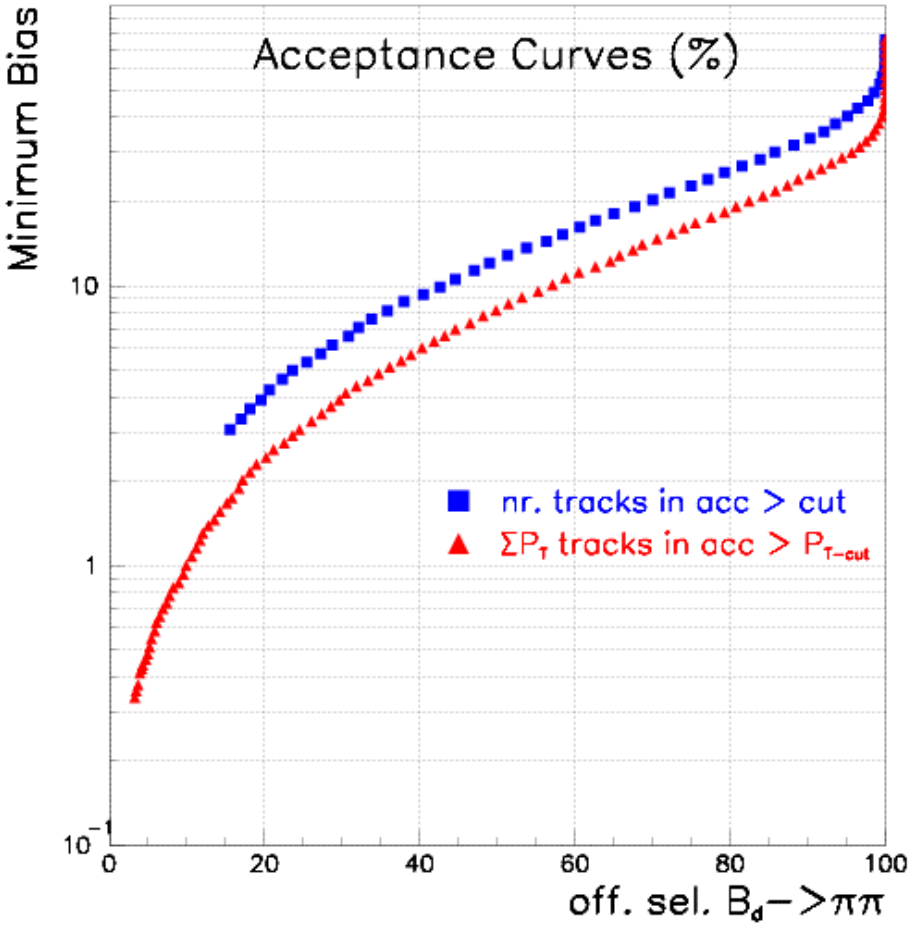
Example Distributions (III)

Distributions for MC particles in the LHCb acceptance ($1.8 < \eta < 4.9$)



Acceptance curves (I)

Correlations in acceptance for a given selection cut



Example for B_d -> $\pi\pi$

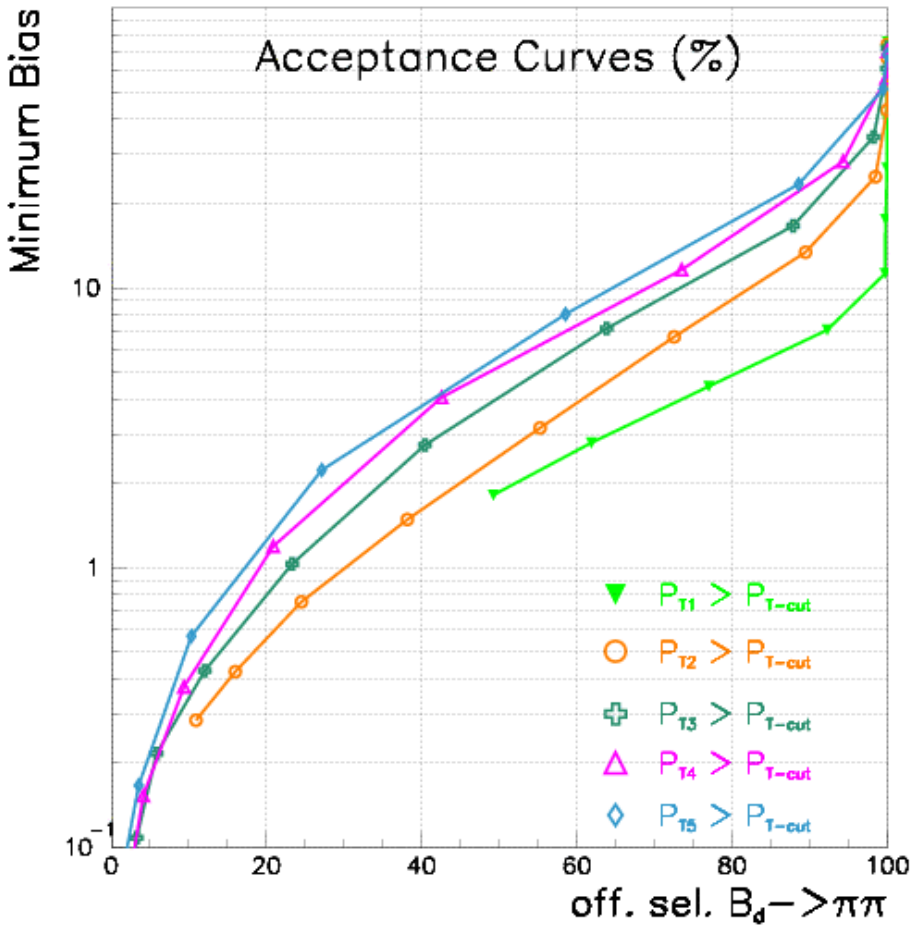
offline selected events

Acceptance curves (II)

Correlations in acceptance for a given selection cut

Example for B_d -> $\pi\pi$

offline selected events



Conclusions and Final Remarks

- main idea exposed and several cuts studied
  - needs further investigation
  - need to cross-check feasibility with other B-signal decays
    (large multiplicity decays, decays with mainly neutrals)
  - need to investigate influence on bb-inclusive events
- distributions were shown for the MC information
  -> similar for the distributions of offline tracks (those with momentum info & hits in VELO)
- comments / suggestions welcome …