

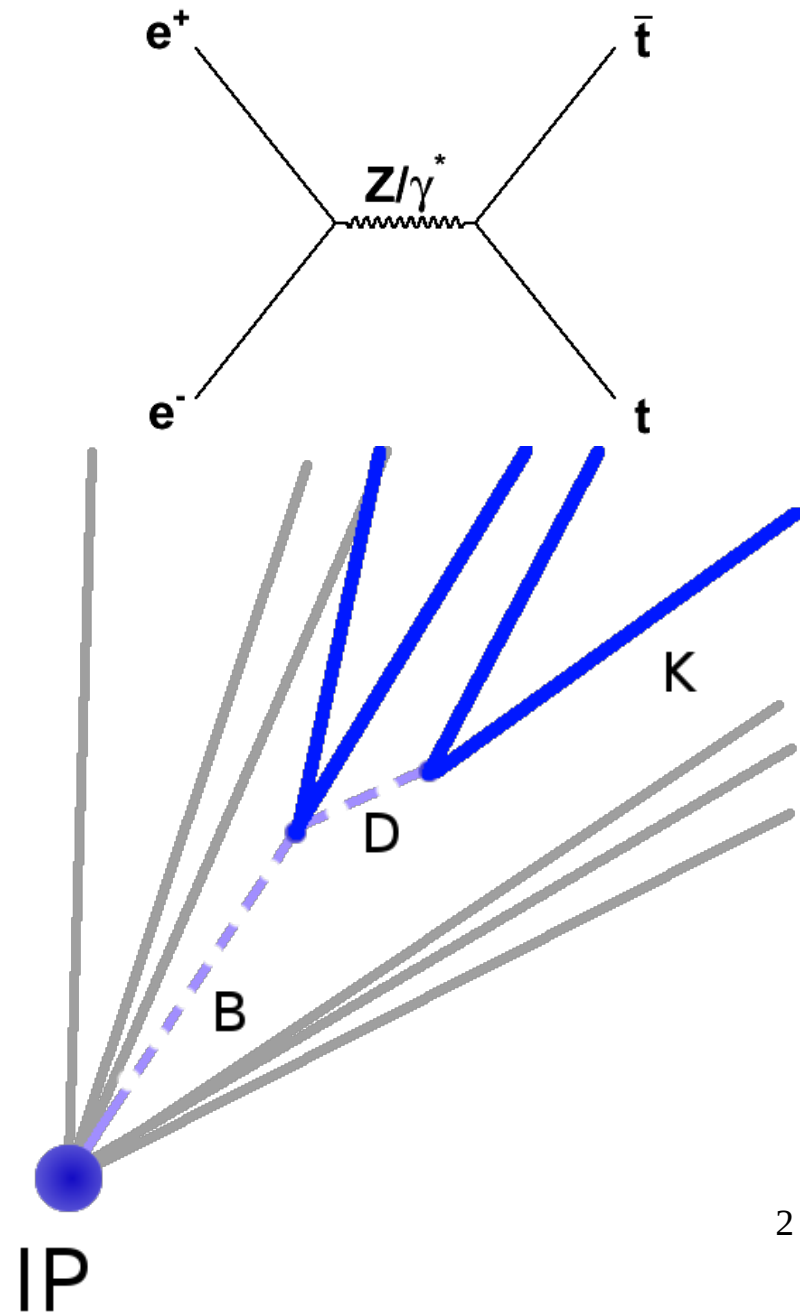
Studies on b-charge measurement

Poeschl R., Richard F., Bilokin S.
LAL, Orsay



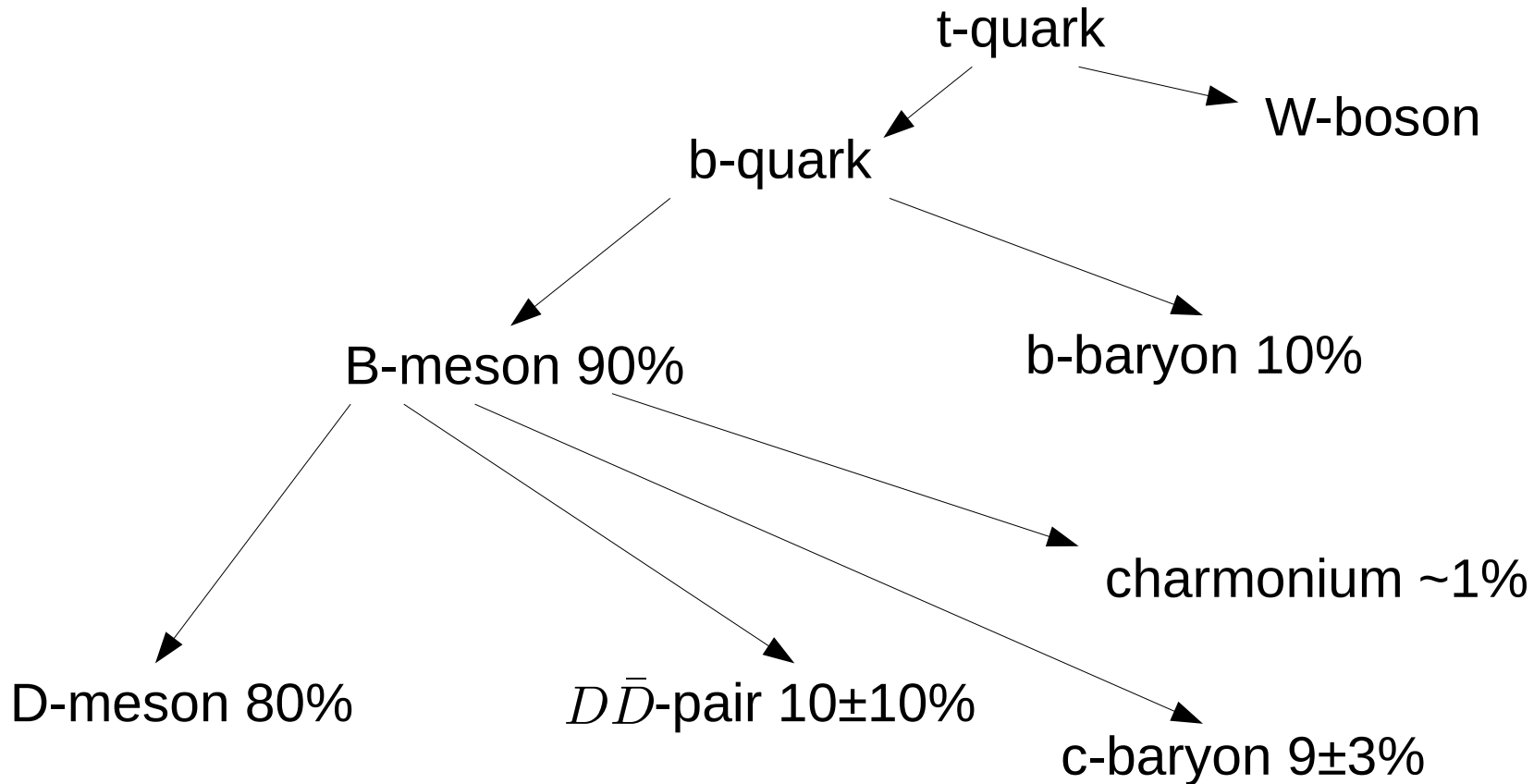
Research method

- Main purpose of this work is to detect the charge of top and antitop quarks. This is crucial for calculation of forward-backward asymmetry A_{fb} in $t\bar{t}$ process at ILC
- We use properties of decay products from the B-hadrons to determine the charge of initial t-quark
- The charge of K-meson from ternary vertex is directly connected to the charge of t-quark



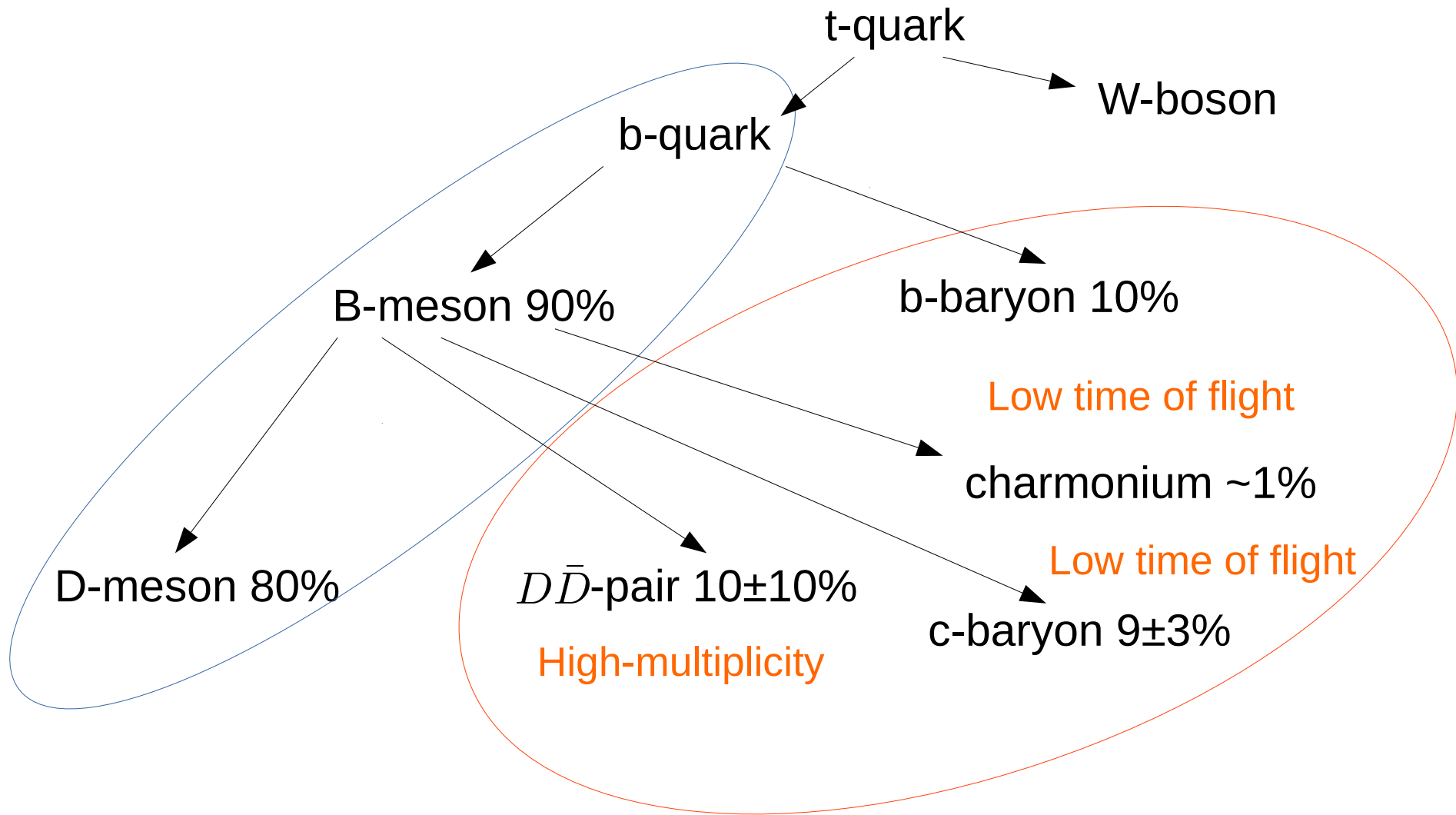
Process overview

- Hadronization and decay modes of b-quark:



Process overview

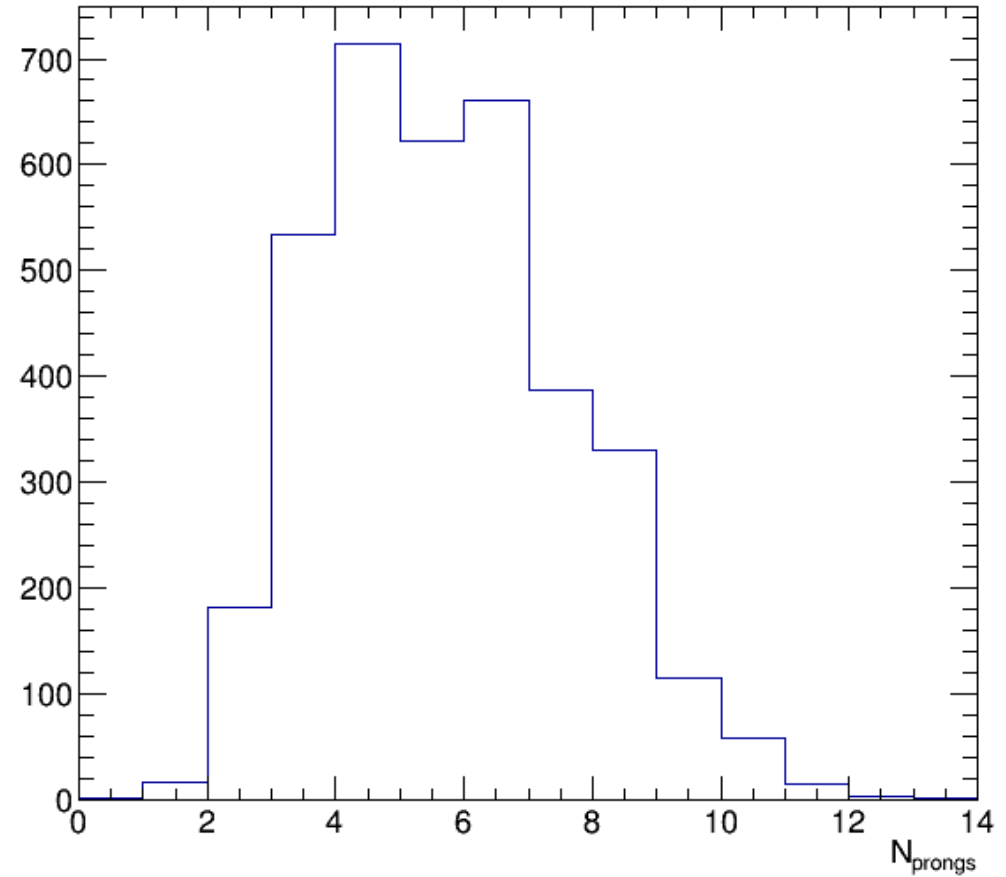
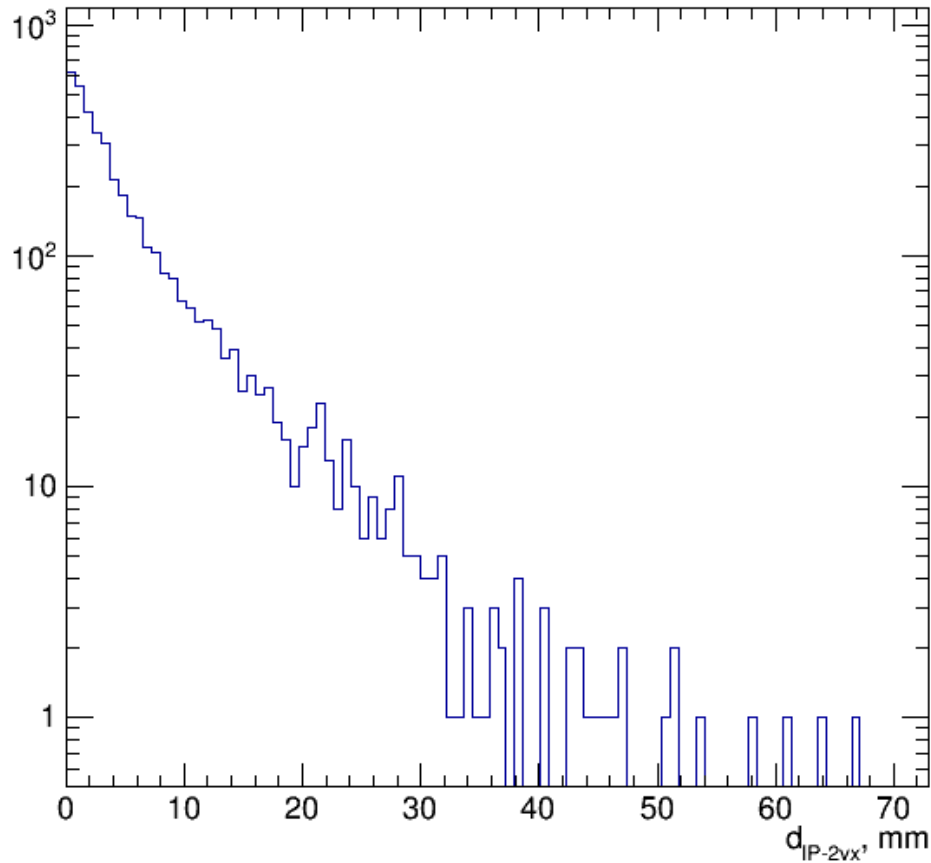
- Hadronization and decay modes of b-quark:



Current status

- There was developed a code that can extract vertices from generator collections by particle type or PDG
- This code creates a collection of generated vertices that are tagged by a charge of initial b-quark
- For each generated vertex we select prongs – particles, that leave tracks in detector
- We use JetVertexRefiner collection from LCFI+ algorithm in reconstructed slcio files to get the reconstructed vertices
- Tag the reconstructed one by properties of generated vertex if a difference in direction < some angle cut
- Dataset: $e_L^+ e_R^- \rightarrow t\bar{t} \rightarrow \nu l^\pm b\bar{b}q\bar{q}$ (no $\gamma\gamma$ bkg)

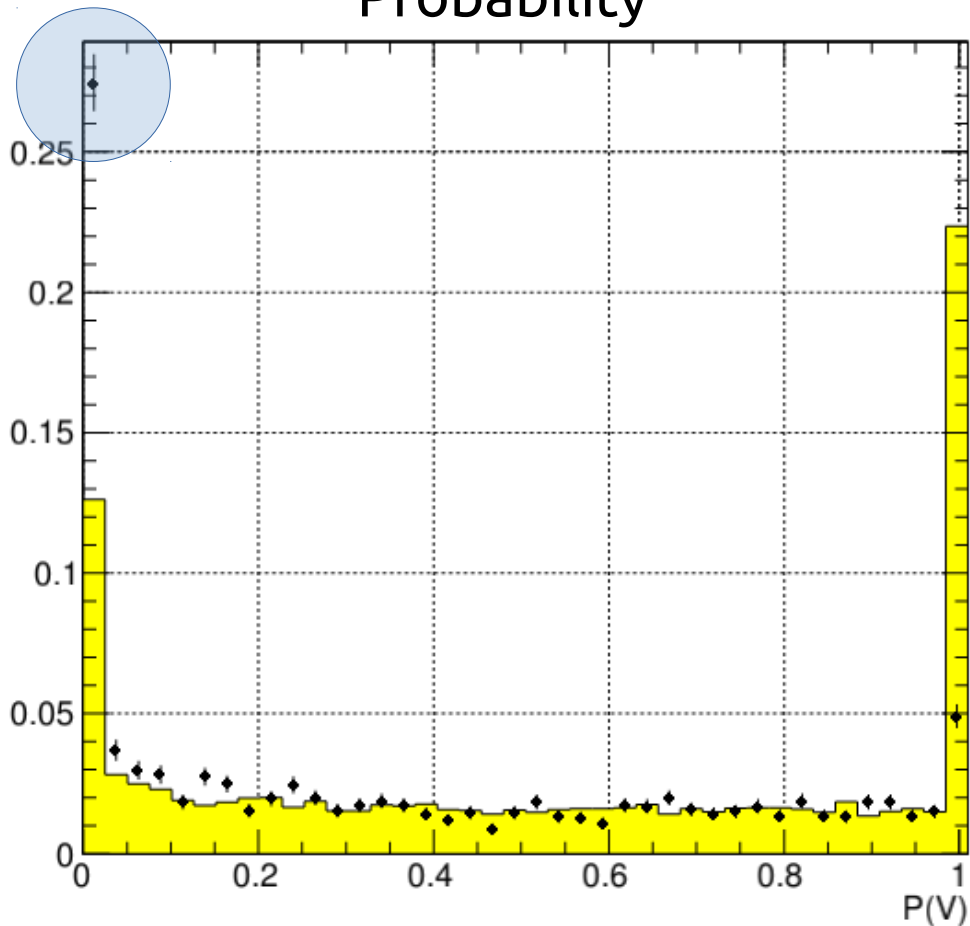
Generated vertices



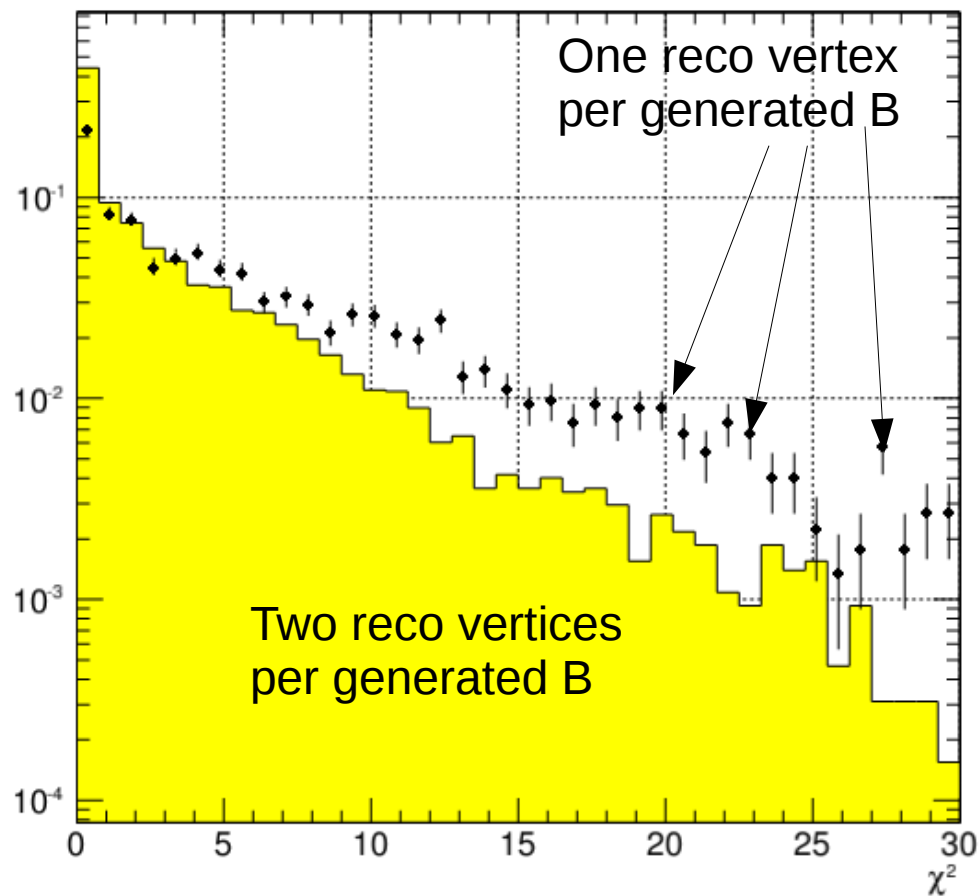
- Distance from IP to B-meson decay vertex (left), prongs of initial B-meson (right)

Reconstructed vertices

Probability

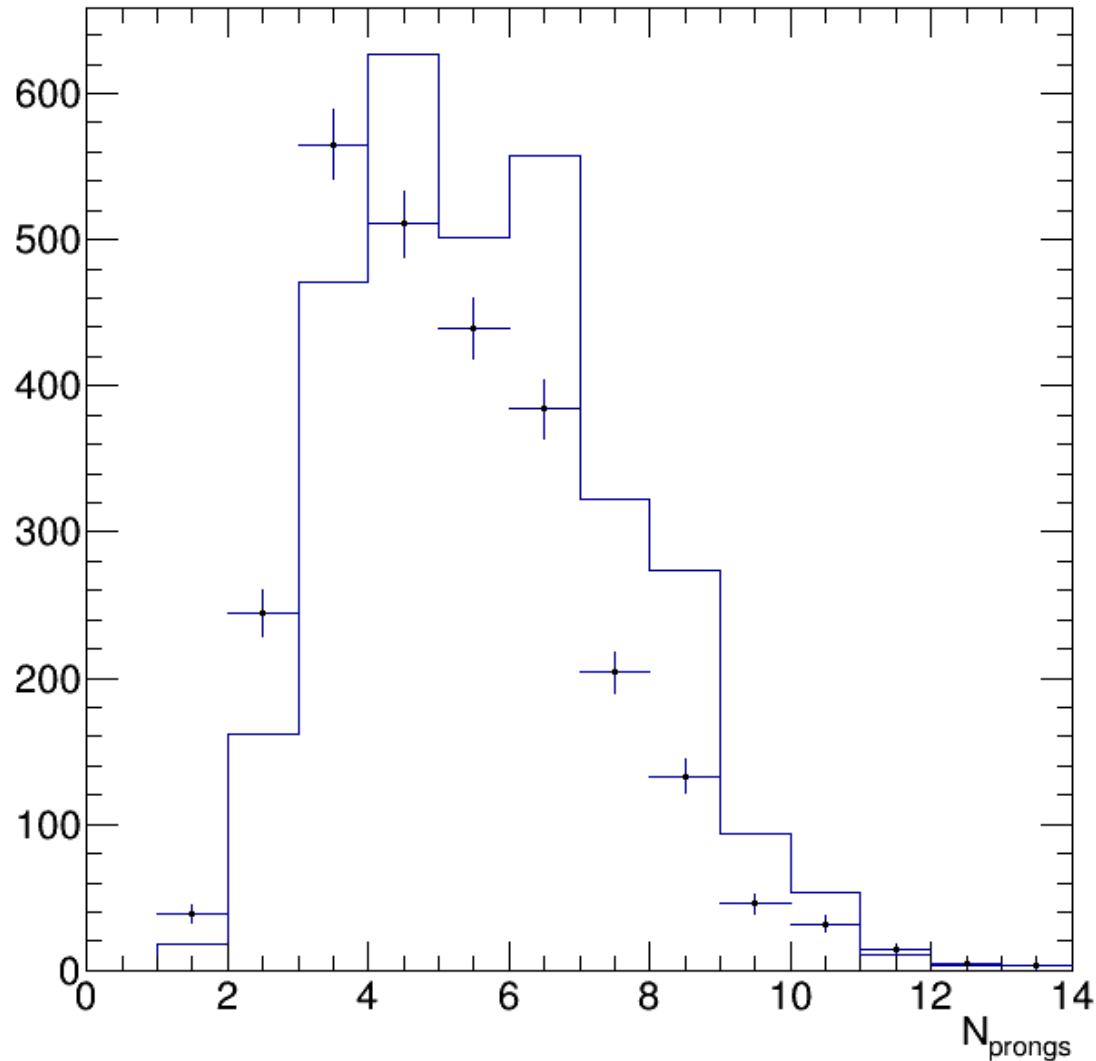


χ^2



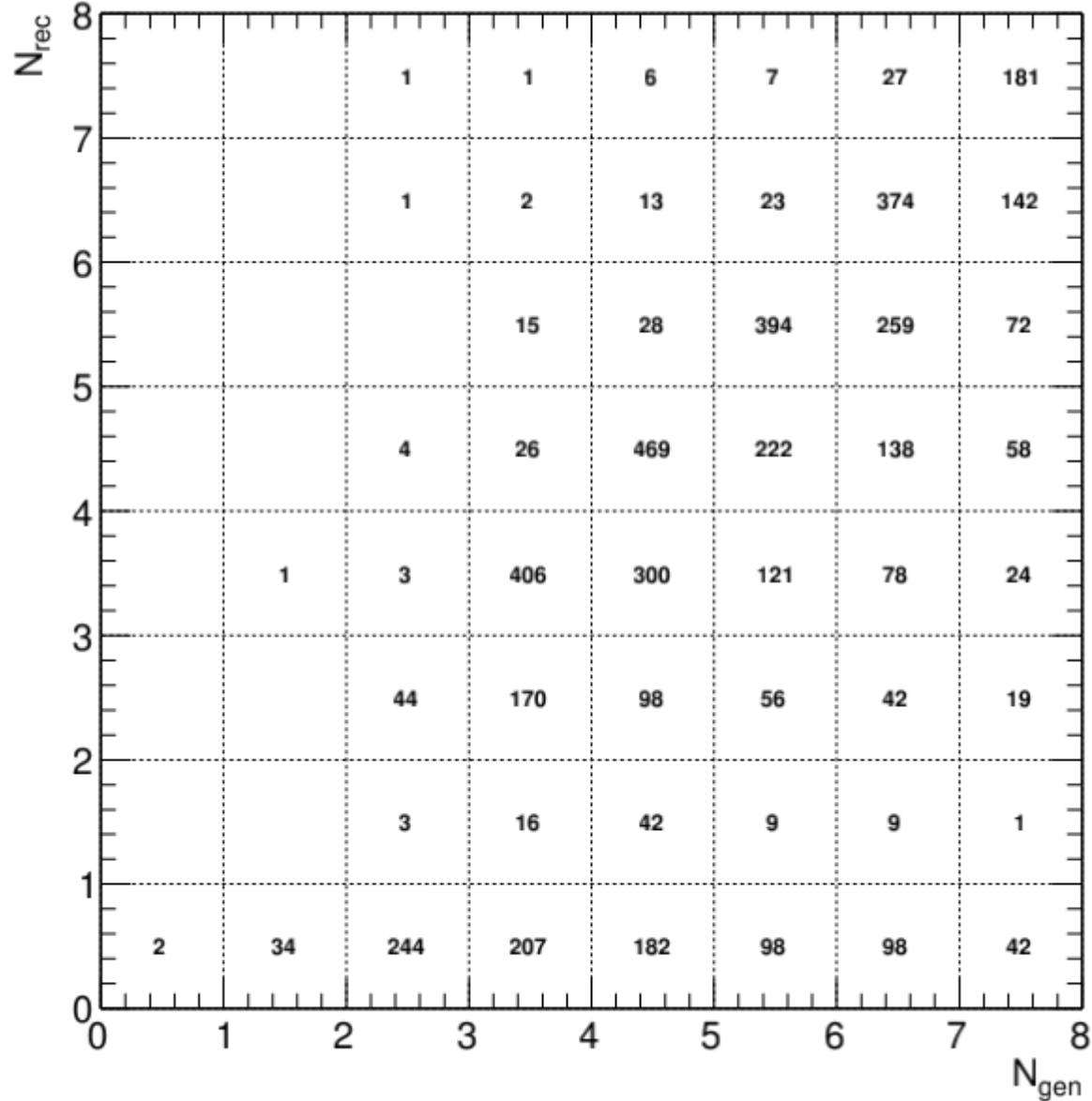
- Probability (left) and chi-square from LCFI+ (right) comparison for 1 vertex per b-jet (dots) and 2 vertices per b-jet (yellow). The presence of ternary vertex increase chi-square value of vertex fitting.

Reconstructed vertices



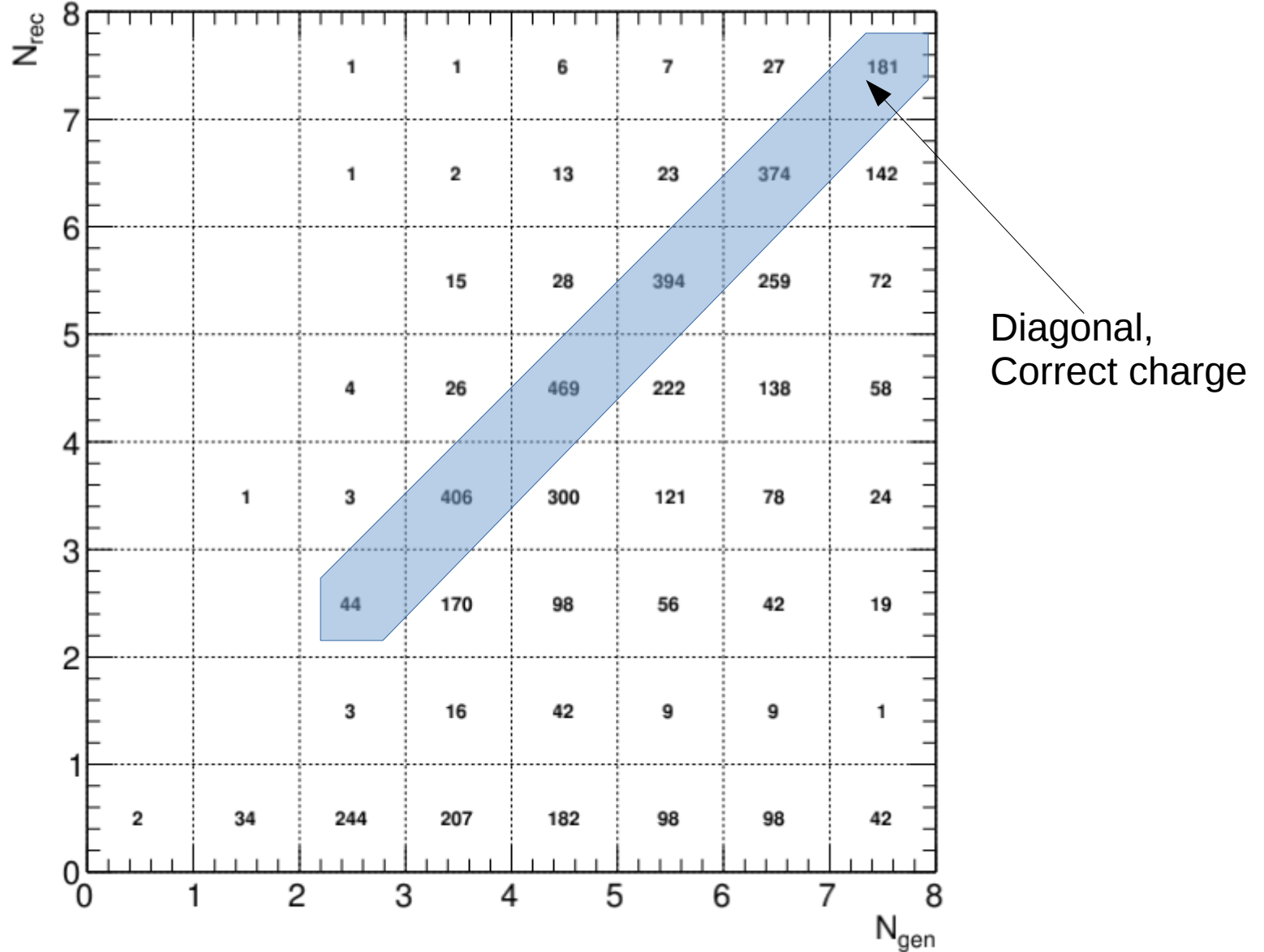
- Number of tracks from generated vertices (yellow) and reconstructed (crosses). Distributions do not coincide

Number of tracks comparison



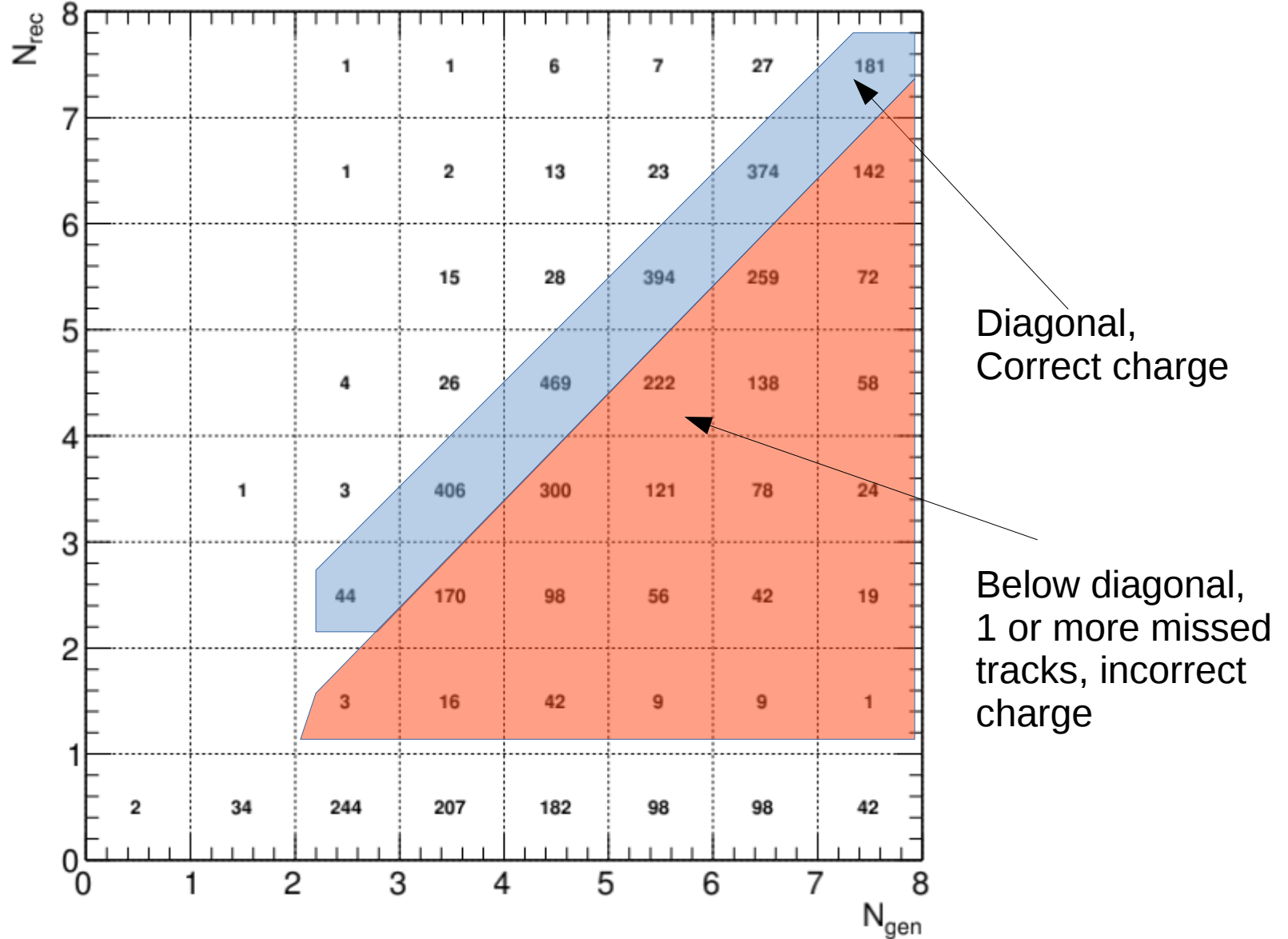
- Comparison of reconstructed and generated tracks from B-meson

Number of tracks comparison



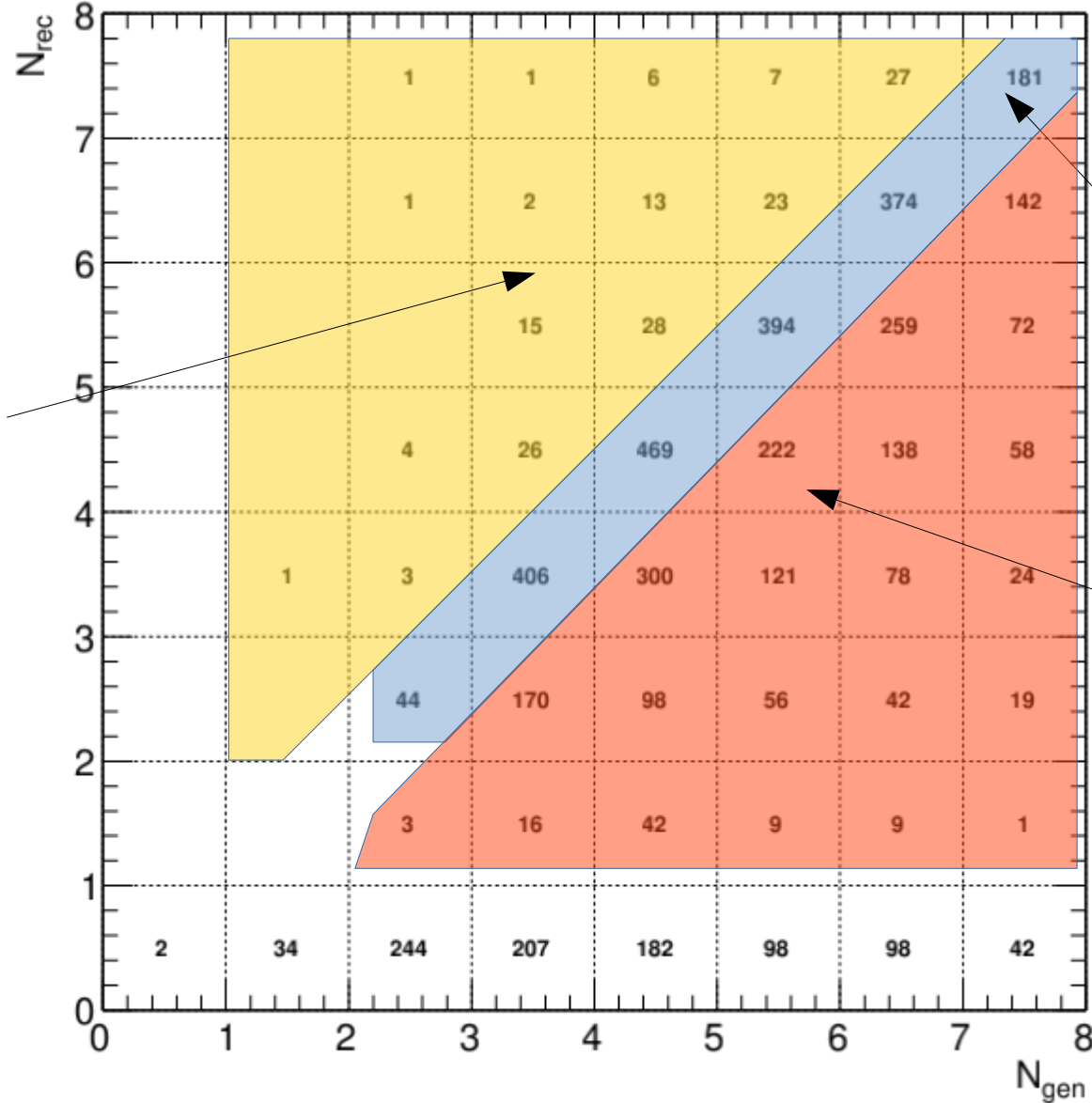
- Comparison of reconstructed and generated tracks from B-meson

Number of tracks comparison



- Comparison of reconstructed and generated tracks from B-meson

Number of tracks comparison



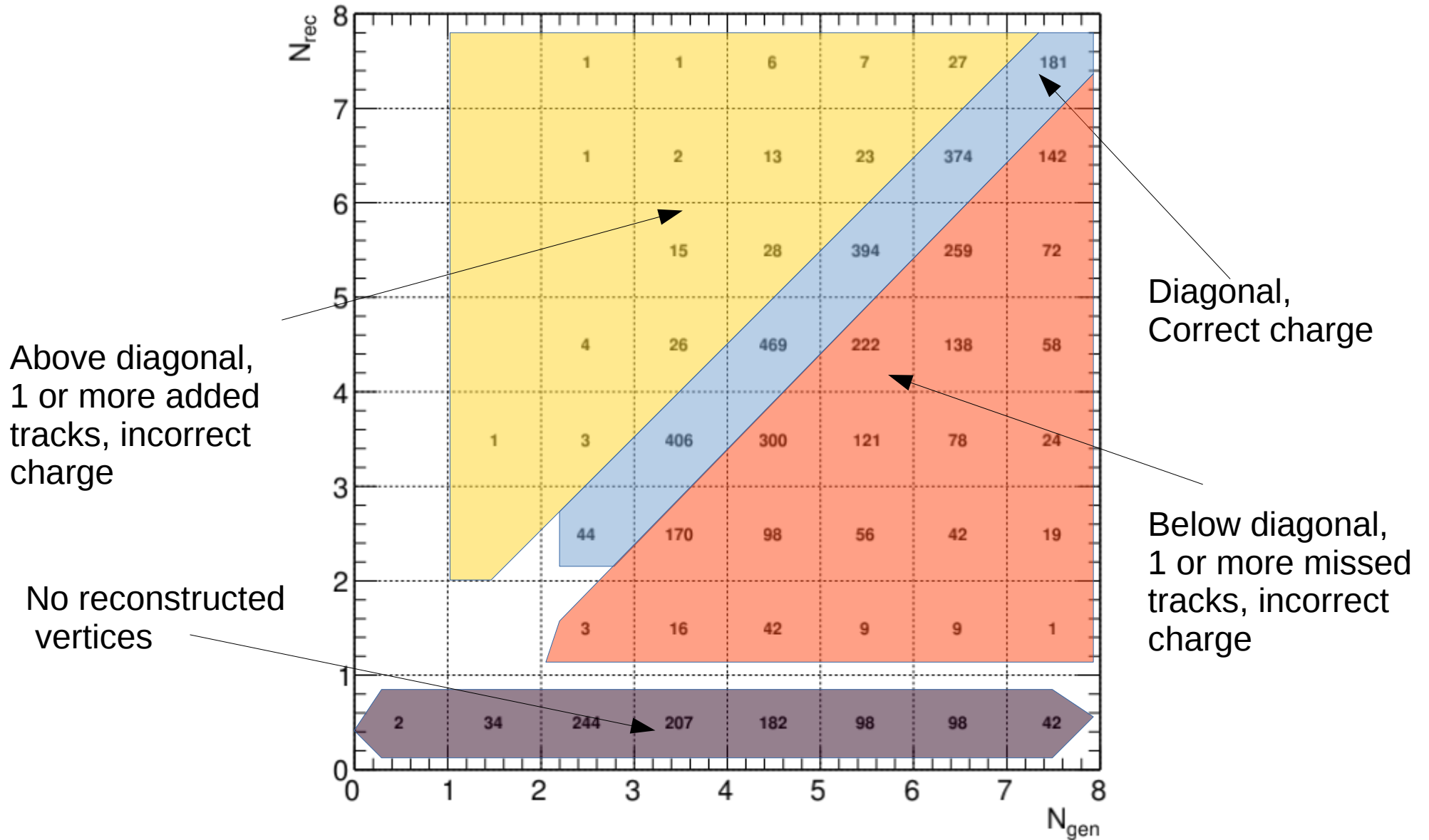
Above diagonal,
1 or more added
tracks, incorrect
charge

Diagonal,
Correct charge

Below diagonal,
1 or more missed
tracks, incorrect
charge

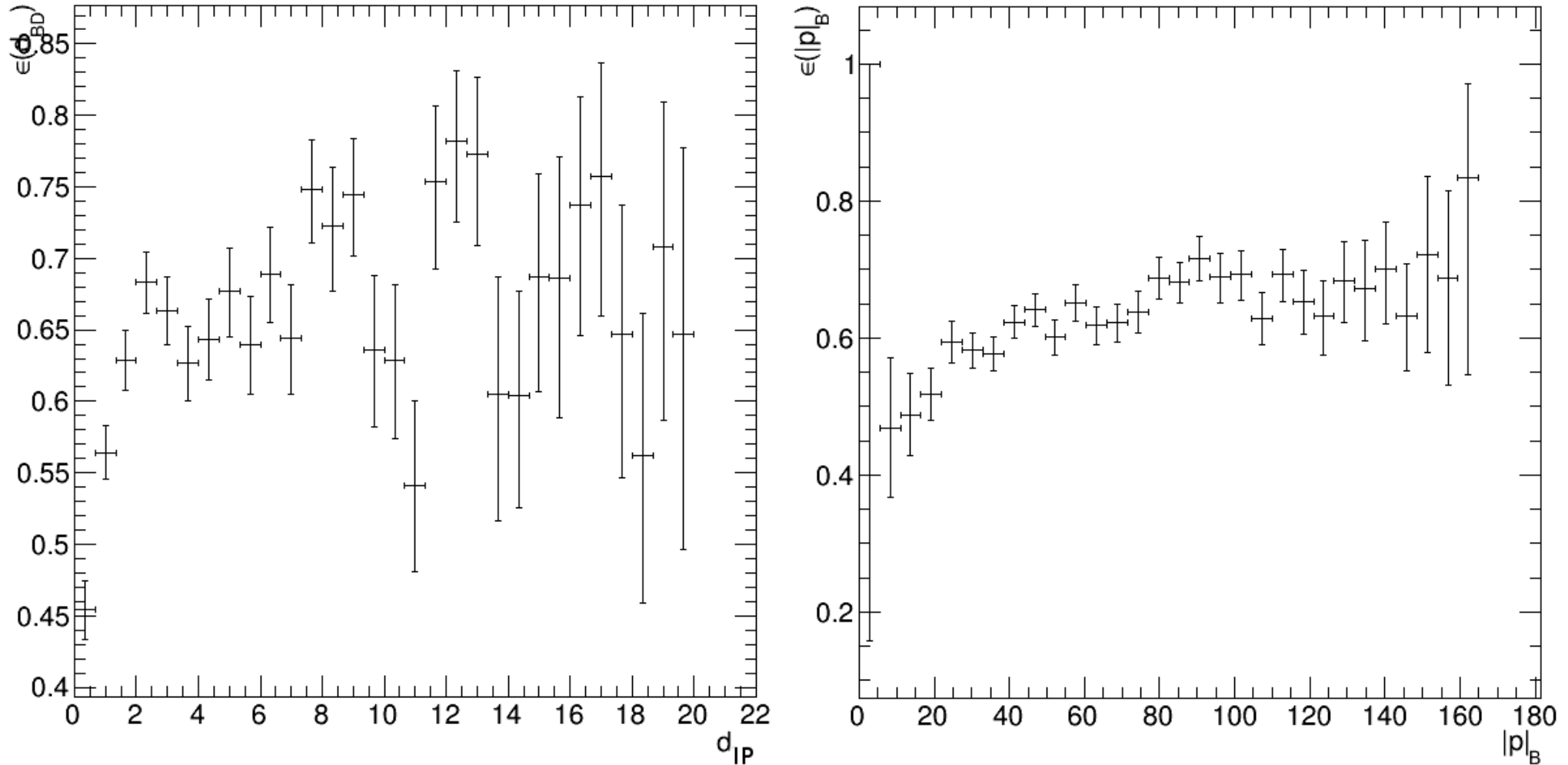
- Comparison of reconstructed and generated tracks from B-meson

Number of tracks comparison



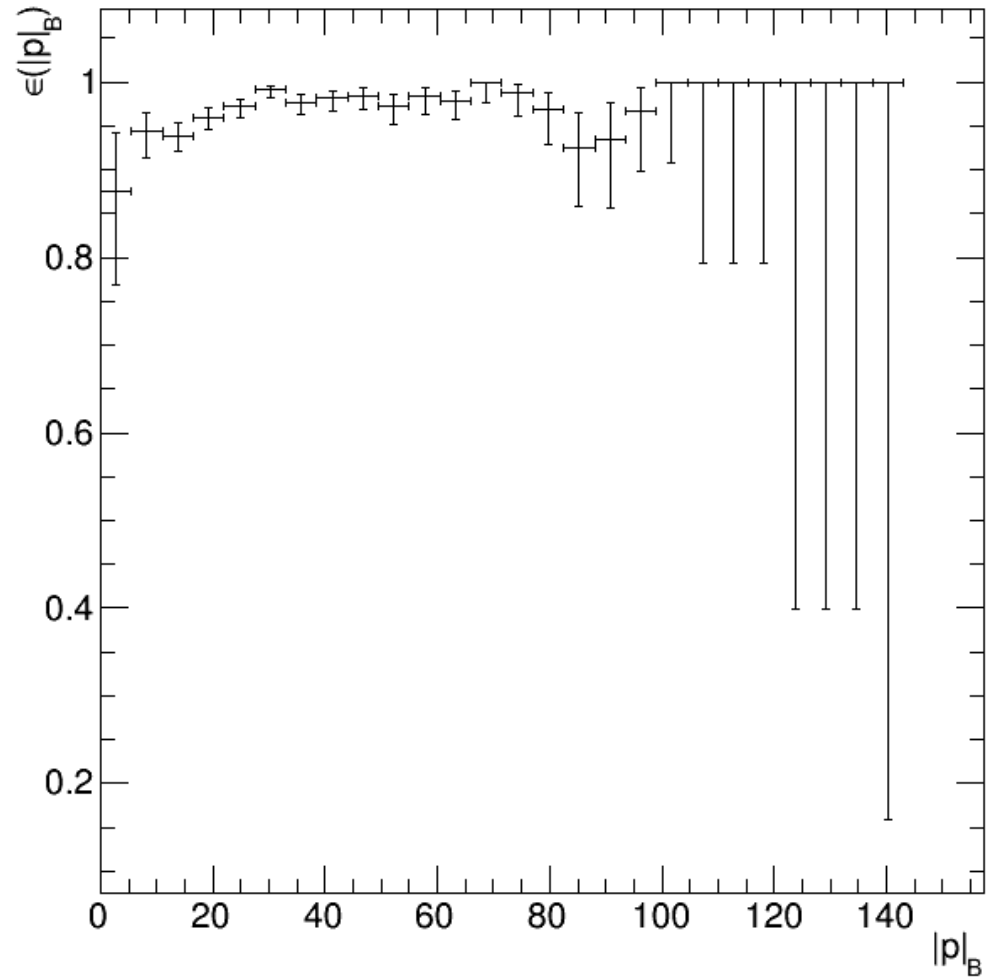
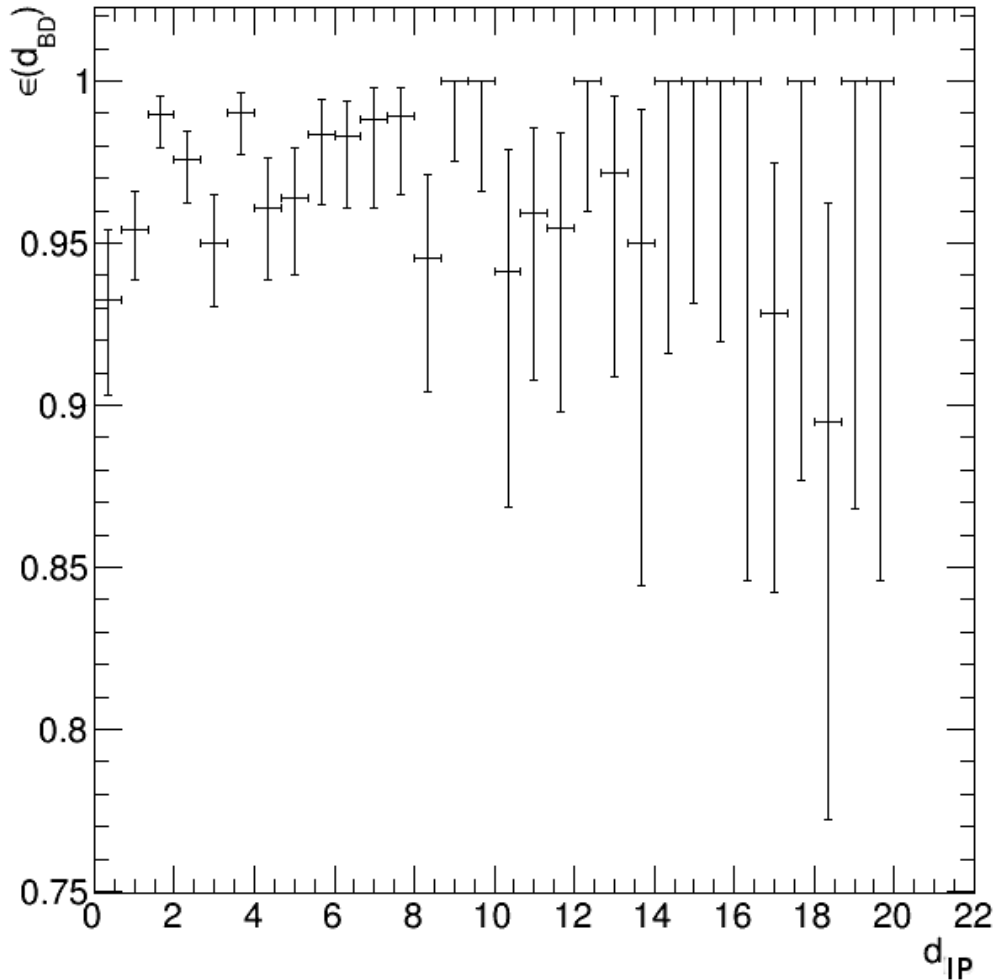
- Comparison of reconstructed and generated tracks from B-meson

Charge efficiency



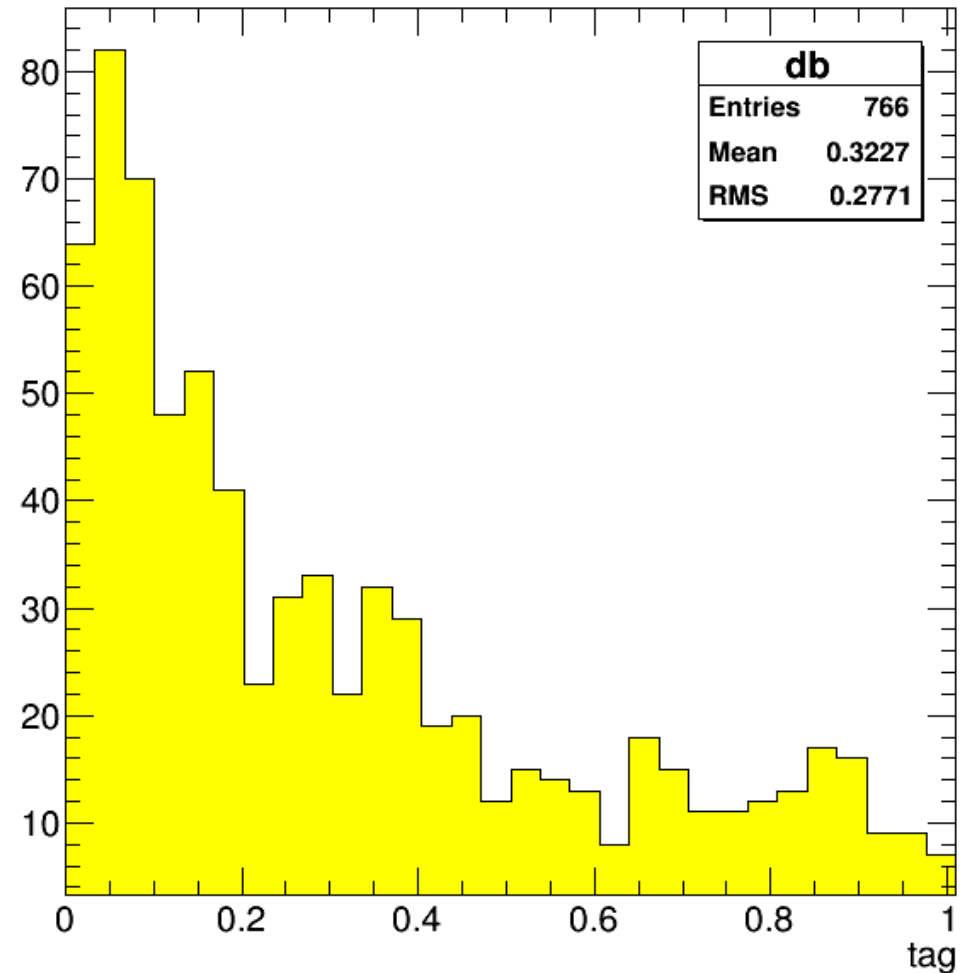
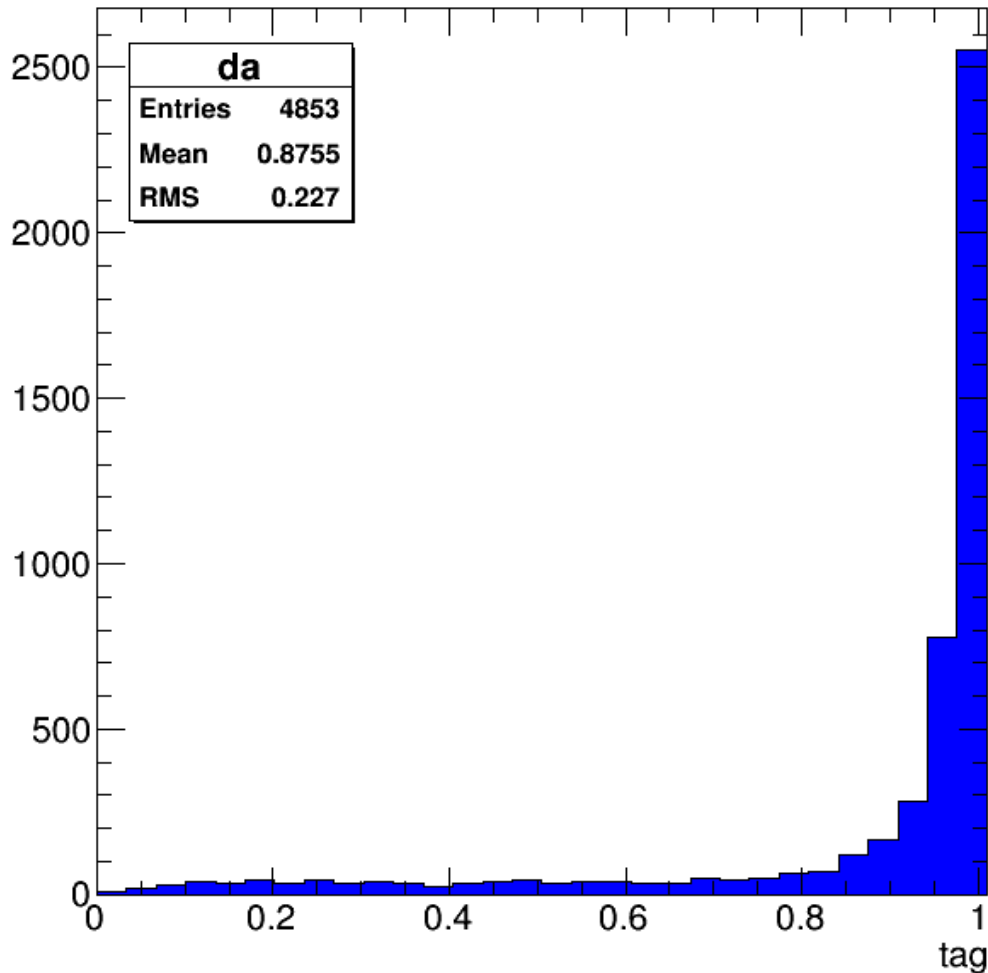
- Preliminary B-meson charge efficiency before selection cuts – 63.0%. Consistent with S. Amjad result

Charge efficiency on diagonal



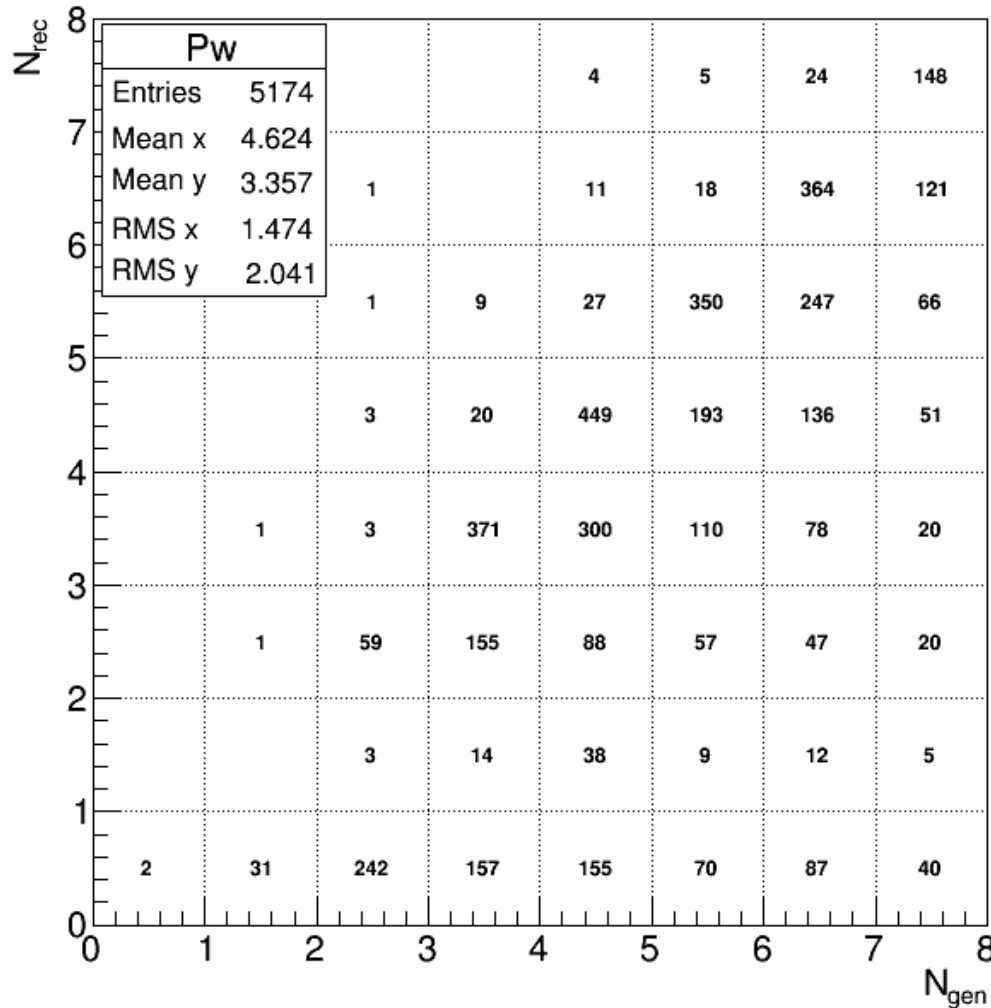
- Preliminary B-meson charge efficiency for events on diagonal – 97.1%. We should diagonalize the previous table as much as possible

Jet flavour tagging

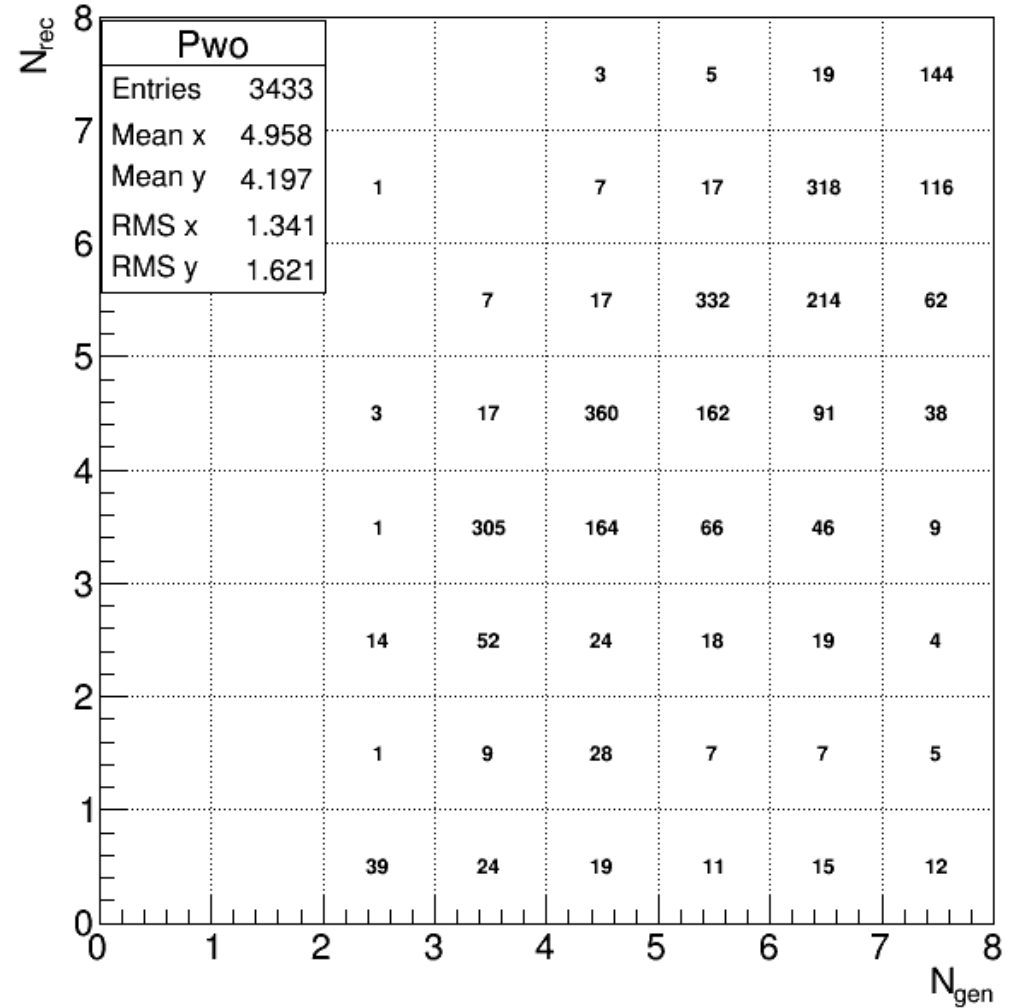


- Left: b-tag for a jet with vertices, Right: b-tag for b-jet without vertex. Value of b-tag has high discriminative power for 0-vertex events.

Number of tracks comparison



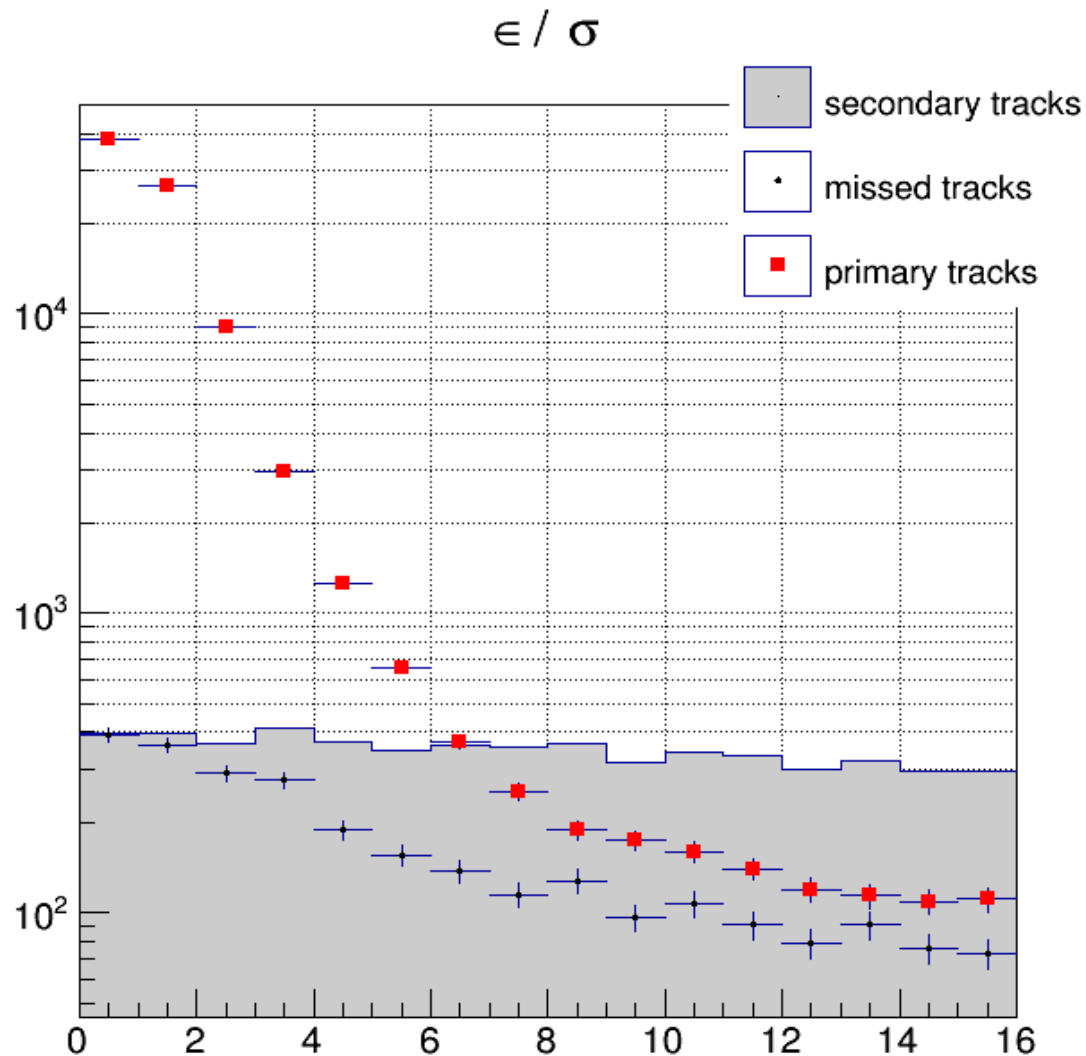
44.4% on diagonal



49.9% on diagonal

- Left: raw comparison, Right: comparison after b-tag > 0.3 cut for each b-jet. Events without vertices are suppressed.

Offset deviation



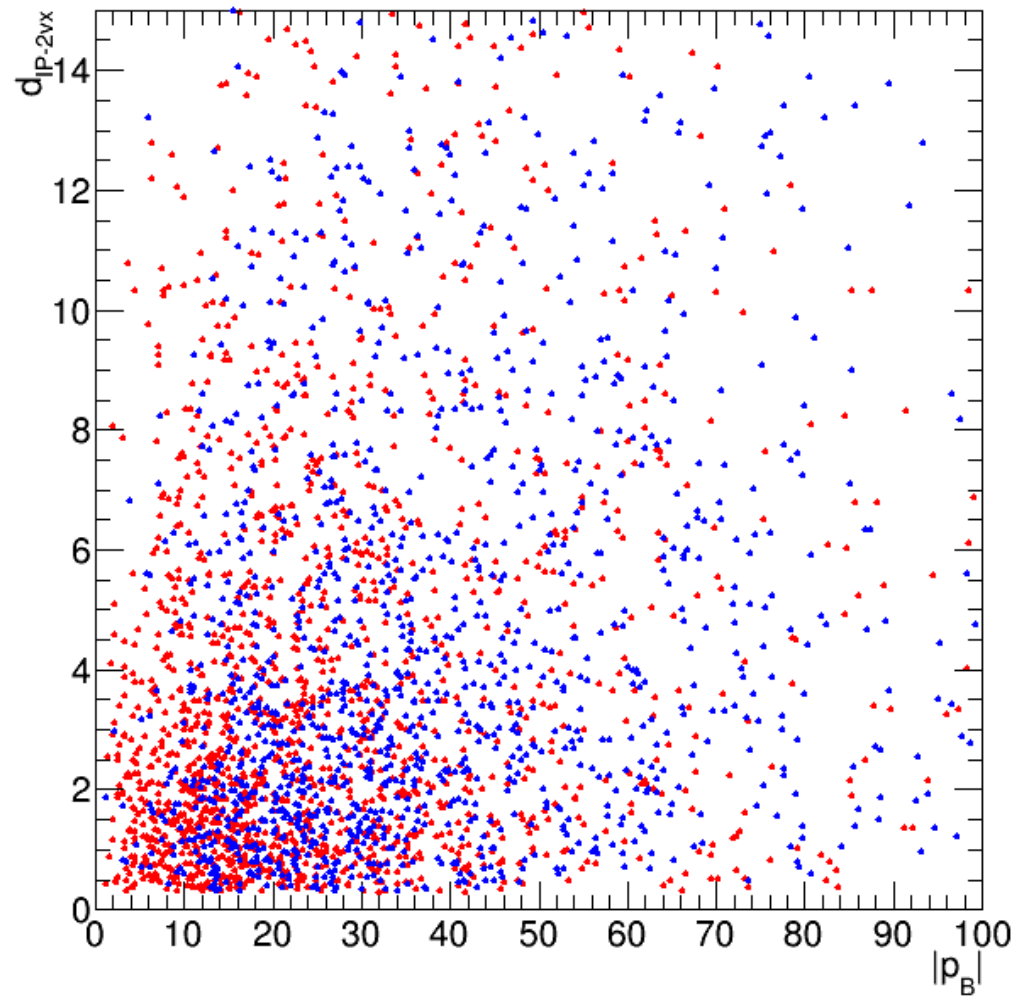
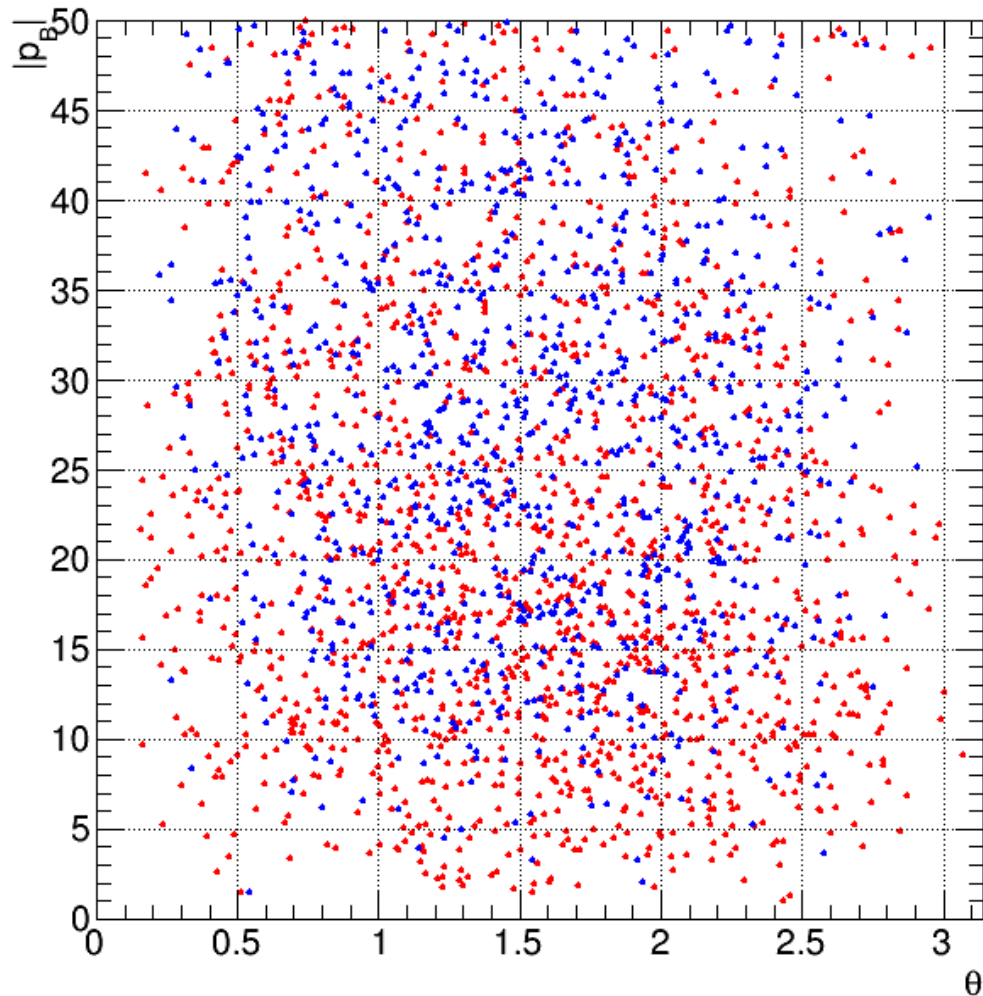
- Histogram of track offset divided by uncertainty for different types of tracks. Secondary tracks with less than 3 sigma deviation are missed.

Summary

- There was developed a code that can extract vertices from generator collections by particle PDG
- The generated vertices were compared to reconstructed ones
- We are currently working on missed track problem. Most probable reason is low offset – from b-tag study
- Further work:
 - Recover missed vertices and missed tracks
 - Explore 1 reconstructed vertex of a B-meson with bad chi-square and try to separate it into two vertices
 - Use particle id for kaon identification
 - Use information from ternary vertex

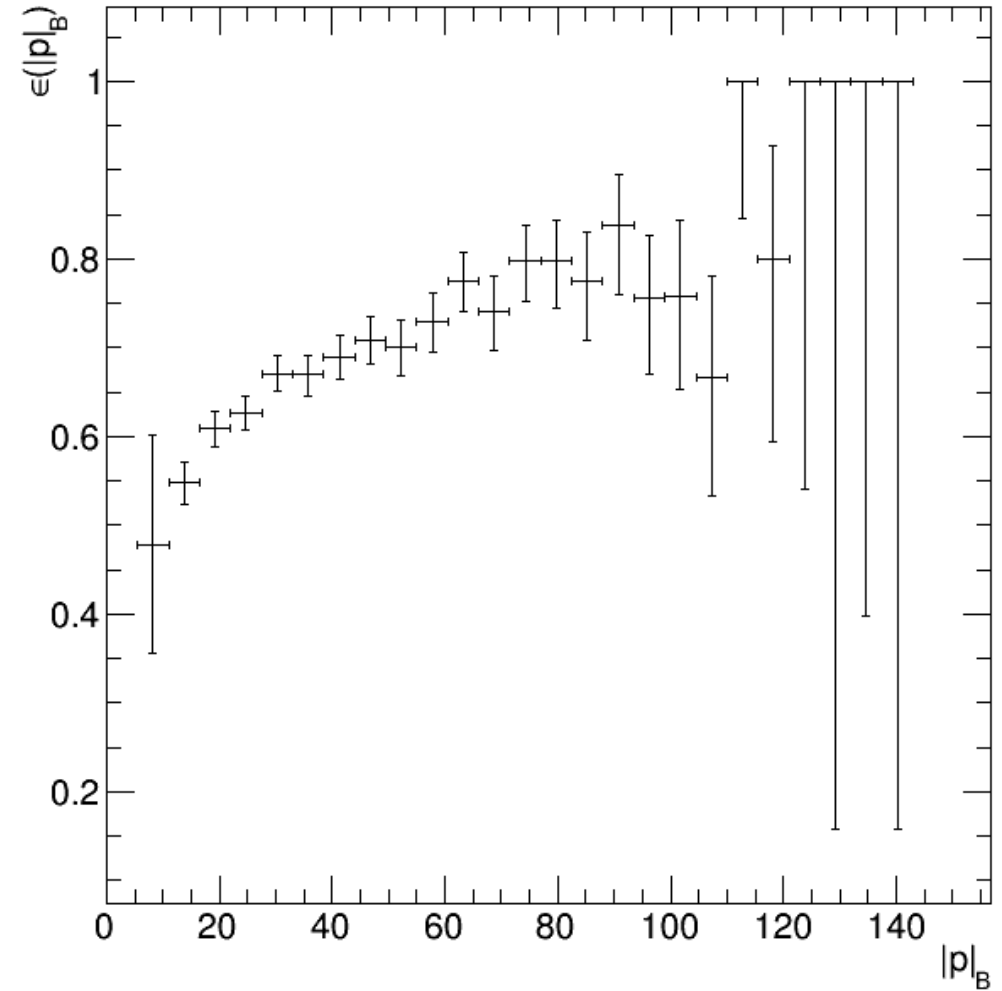
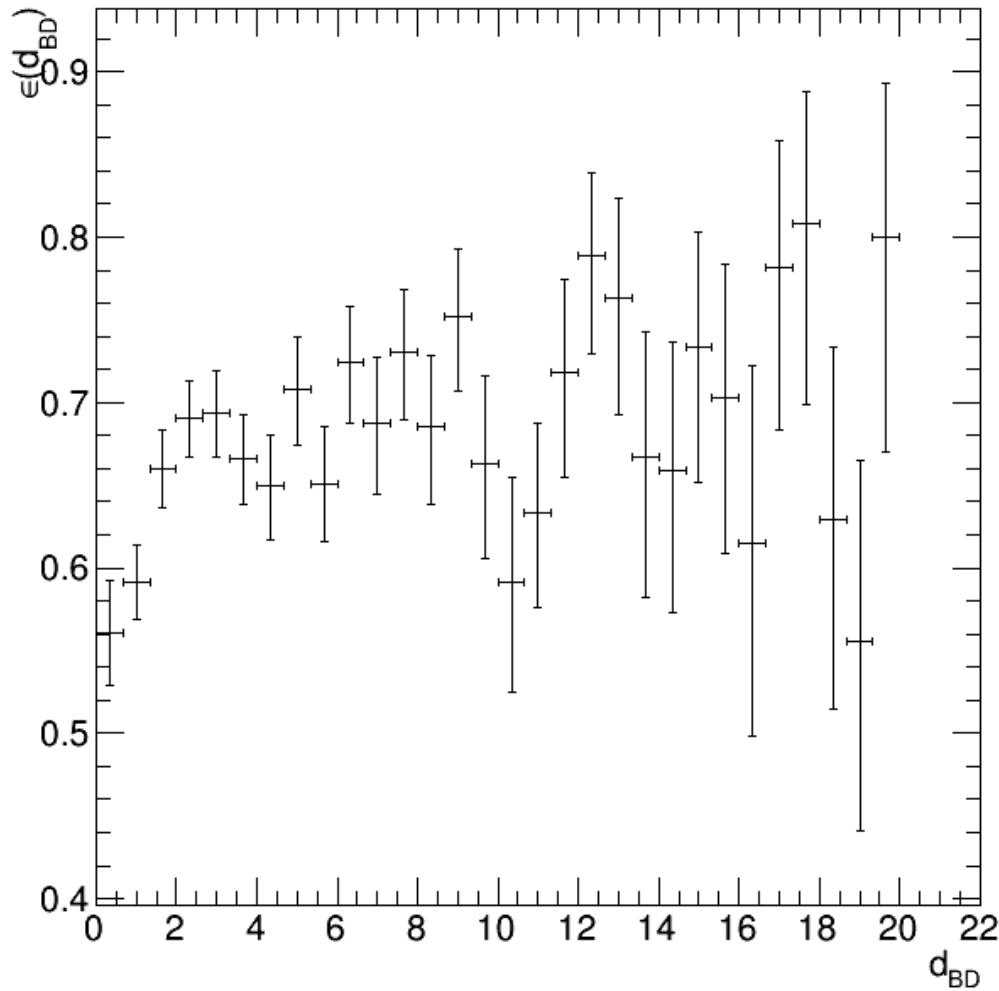
Thank you!

Selection cuts



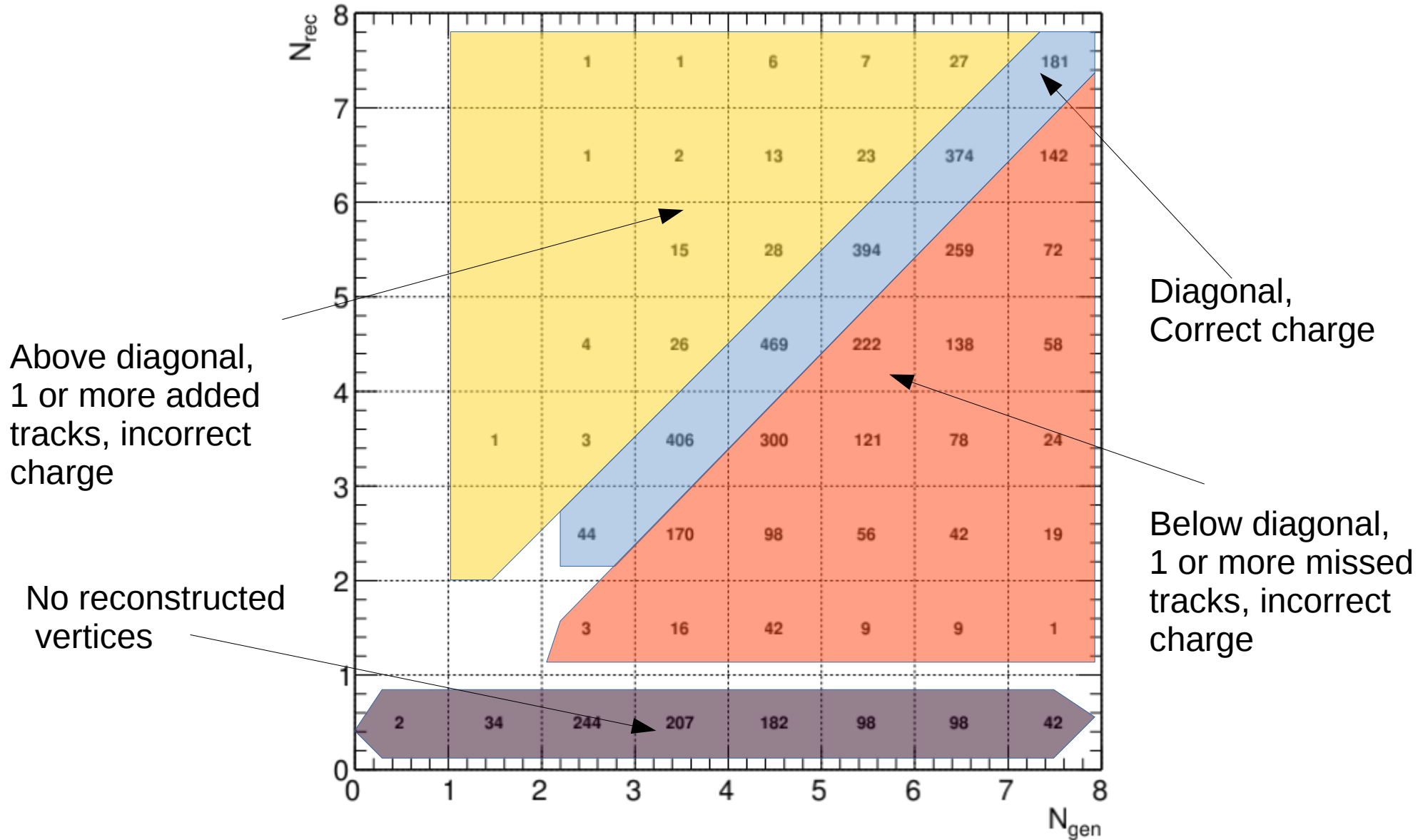
- Blue dots – diagonal events, red dots – off-diagonal from reconstruction

Charge efficiency after cuts



- Preliminary B-meson charge efficiency after selection cuts – 66.8%

Number of tracks comparison



- Comparison of reconstructed and generated tracks from B-meson