

Systematic Studies On Track Reconstruction Efficiency At Belle II

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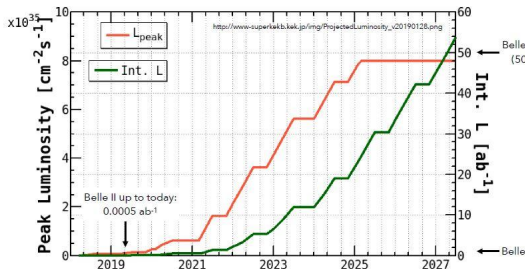
Johannes Gutenberg-Universität Mainz

- Overview on the Belle II experiment
- Bhabha kinematics at Belle II
- Preparation for calculating the tracking efficiency
- Phase2 tracking efficiency
- Phase3 tracking efficiency
- Comparing phase2 with phase3
- Conclusion

- At an electron-positron accelerator most outgoing particles are again electrons and positrons (these events are called Bhabha events).
- These events can be used to estimate the performance of the tracking detectors.
- If the *tag* particle in a Bhabha event has a track than the *probe* particle also should have a track associated
→ a tracking efficiency can be calculated

Belle II Schedule And Luminosity Goals

- Phase1: accelerator commissionin and background estimation (completed in 2016)
- Phase2: collision runs and background studies with partially installed detector (completed in 2018)
- Phase3: data taking with the whole detector (started in April 2019)



content...

- I am performing an analysis to estimate the tracking efficiency on phase 2 data
- The process I am considering is Bhabha events $e^+ + e^- \rightarrow e^+ + e^-$
- The definition of efficiency I am going to use is:

$$\epsilon = \frac{\text{Number of Bhabha events with exactly 2 tracks}}{\text{Number of Bhabha events with 1 or more tracks}}$$

- After selecting Bhabha events where at least one of the tracks was detected, one can look how many times the second one is found
- This idea comes from some plots presented by Sam Cunliffe in previous [tracking](#) and [ECL](#) meetings.

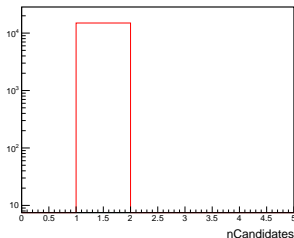
Best Candidate Selection

$$\nu_{\text{pho}} \rightarrow \text{ECL-Object(HclE)} + \text{ECL-Object(LclE)}$$

HclE: particle with the higher cluster Energy; LclE: particle with the lower cluster Energy

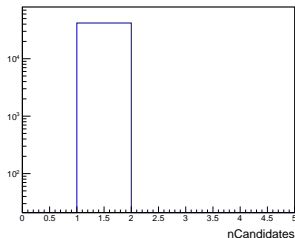
- $0.296706 < \theta_{\text{ECL Object}} < 2.61799 \rightarrow$ It has to hit the ECL
- Exactly two clusters with at least 3.5 GeV per event and one cluster has to have at least 4.5 GeV
- $8 \text{ GeV} < M_{\nu_{\text{pho}}} < 12 \text{ GeV}$
- $n\text{Tracks} < 7$
- Total Energy in the ECL $< 15 \text{ GeV}$

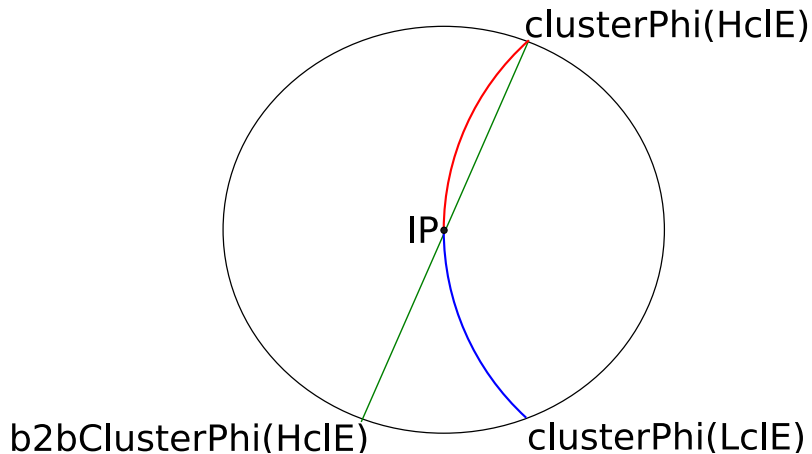
1 MC ee \rightarrow ee File



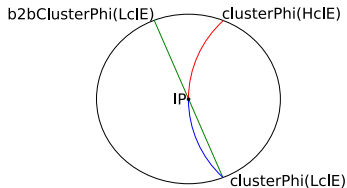
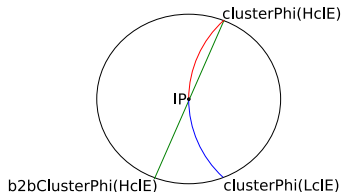
Phase 2 data

r02608/all/mdst/sub00/*.root

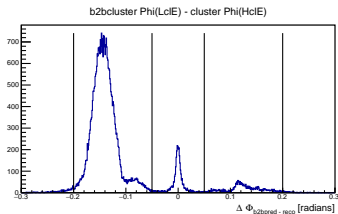
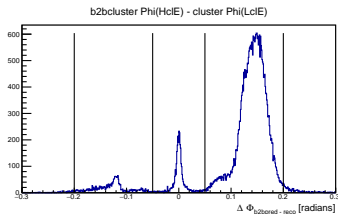




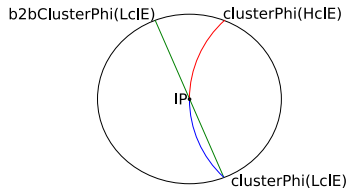
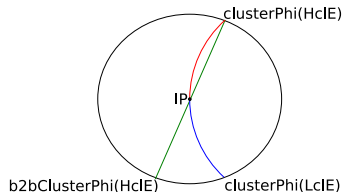
Bhabha Event Selection (Phase 2 data)



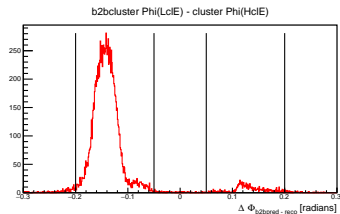
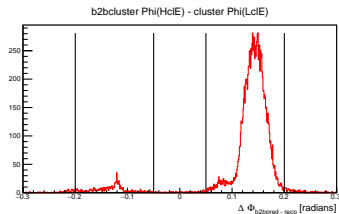
Phase 2 data r02608



Bhabha Event Selection (MC)



MC: $ee \rightarrow ee$



MC:

- `/belle/MC/release-02-00-01/DB00000411/MC11/prod00006731/s00/e1002/4S/r00000/3600520000/mdst/sub00`
- 5272146 candidates selected

Phase 2 data:

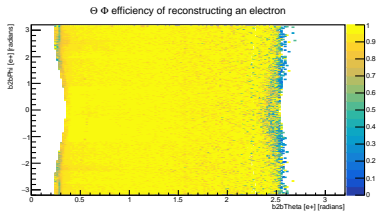
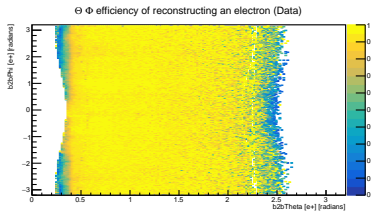
- `/ghi/fs01/belle2/bdata//Data/release-03-00-03/DB00000528/proc00000008/e0003/4S/r02*/all/mdst/sub00/*.root`
- `proc8`
- 3669759 candidates selected

Compare MC And Phase 2 data Efficiency

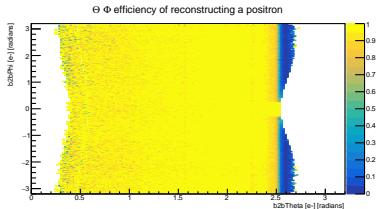
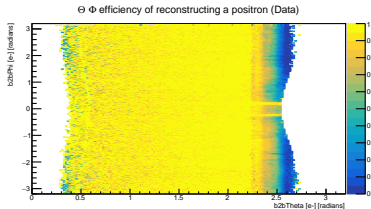
Phase 2 data

MC

e^-



e^+



Theta And Phi Projection

