Bhabha Tracking Efficiencies

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Motivation

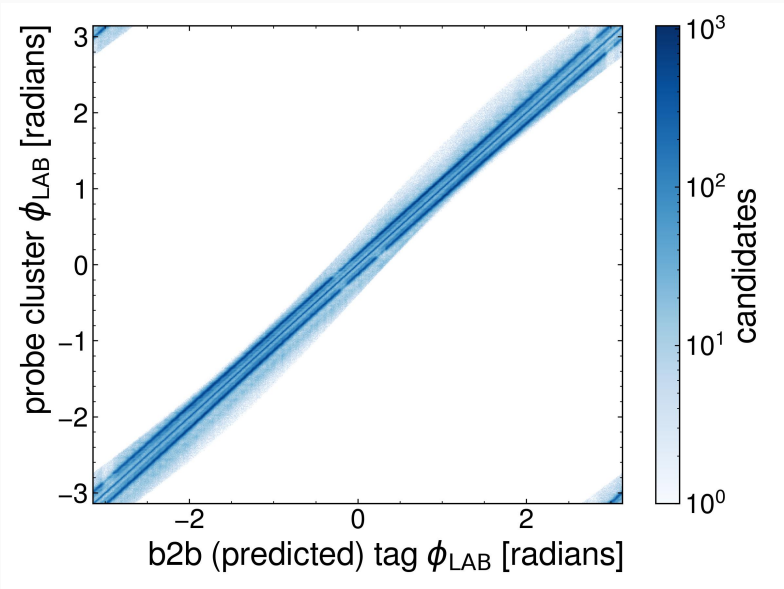
- I would like to estimate the tracking efficiency Bhabha events
- One possible way to do it is to select the electrons using only information coming from the ECL (they are therefore labeled and treated as gammas)
- Once selected a pure electron sample, one can than look at the Tracks related to ECLClusters
- The ratio between the ECLClusters with a Track associated and all the ECLClusters will provide an estimation of tracking efficiency
- This idea comes from some plots presented by Sam in previous tracking and ECL meetings.

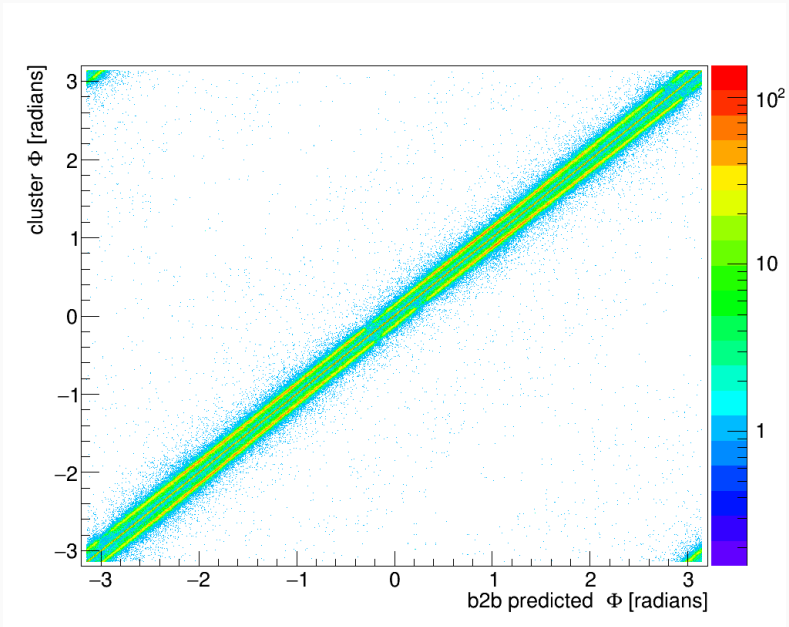
Getting Started

- All cuts were taken from Sam's studies:
  - gamma:probe '$(\mathrm{E} > 0.1)$'
  - gamma:tag '$(\mathrm{clusterE} > 3.0)$'
  - vpho:cand 'reconstructed from gamma:probe and gamma:tag'
  - $0.296706 < \theta < 2.61799 \rightarrow$ It has to hit the ECL
  - $\mathrm{nCleanedTracks}[\mathrm{abs(dz)} < 2.0 \text{ and } \mathrm{abs(dr)} < 0.5 \text{ and } \mathrm{nCDCHits} > 0 \text{ and } \mathrm{pt} > 0.15] < 1 \rightarrow$ bad quality hits
  - $\mathrm{M(vpho)} > 8.0\,\mathrm{GeV} \rightarrow$ To cut away background (not from his email but surely he is using something like that)

Reproducing Plots

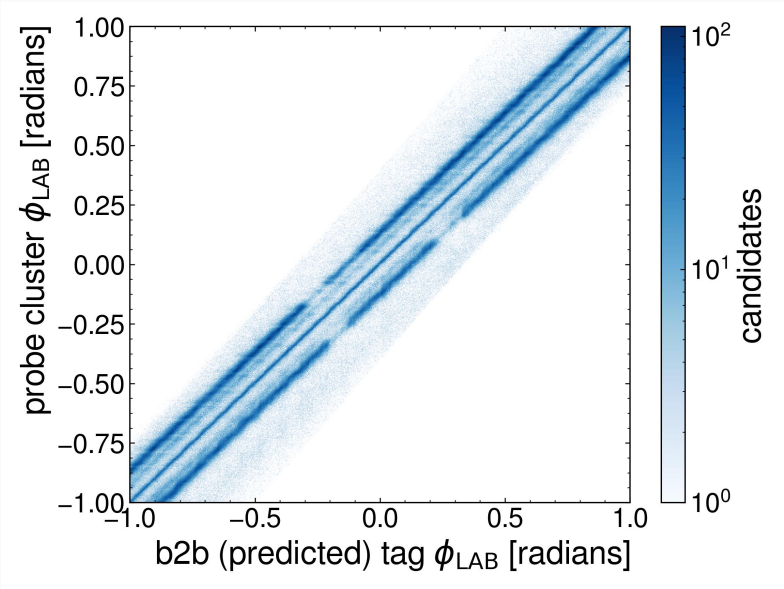
- The plots in the following slides are produced using prod6 (this is because as a starting point I tried to reproduce Sam's plots)
- Sam used all Prod6 data. I am only using the following: /hsm/belle2/bdata/Data/release-02-01-00/DB00000438 /prod00000006/e0003/4S/r02*/all/mdst.sub00/*.root
- Sam's plots are on the left.
- Three lines. The middle one is $\mathrm{ee} \to \gamma\gamma$ the two others are $\mathrm{ee} \to \mathrm{ee}$

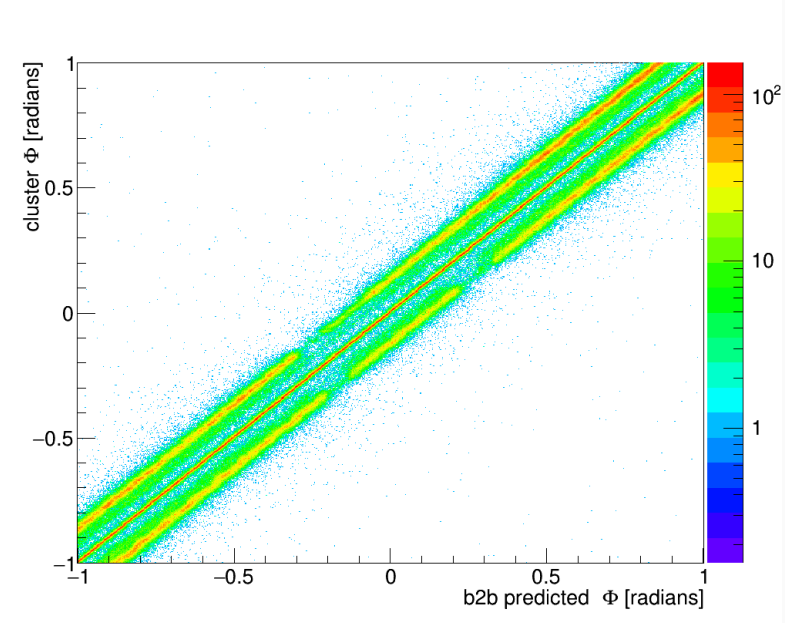




Reproducing Plots

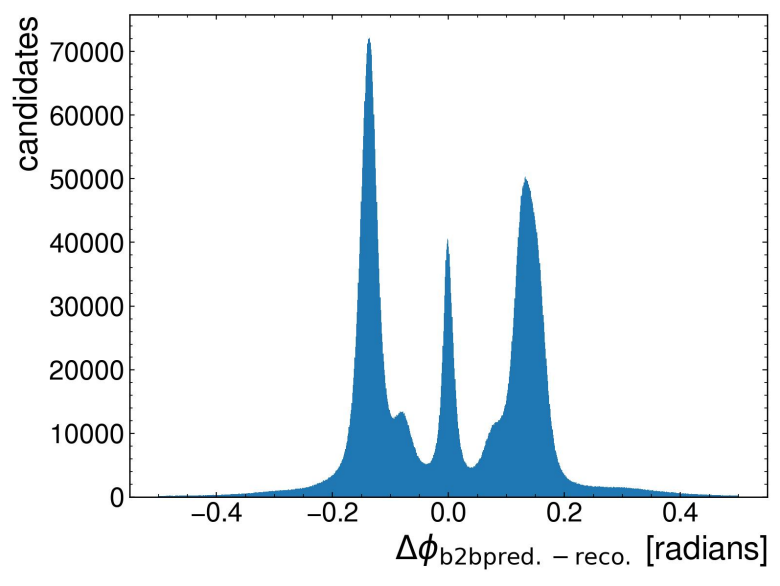
Same plots but zoomed in:

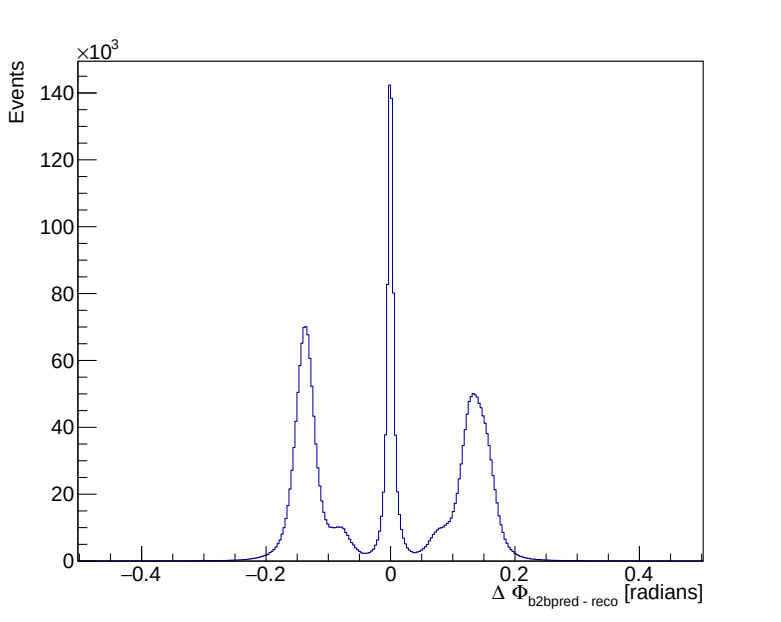




Reproducing Plots

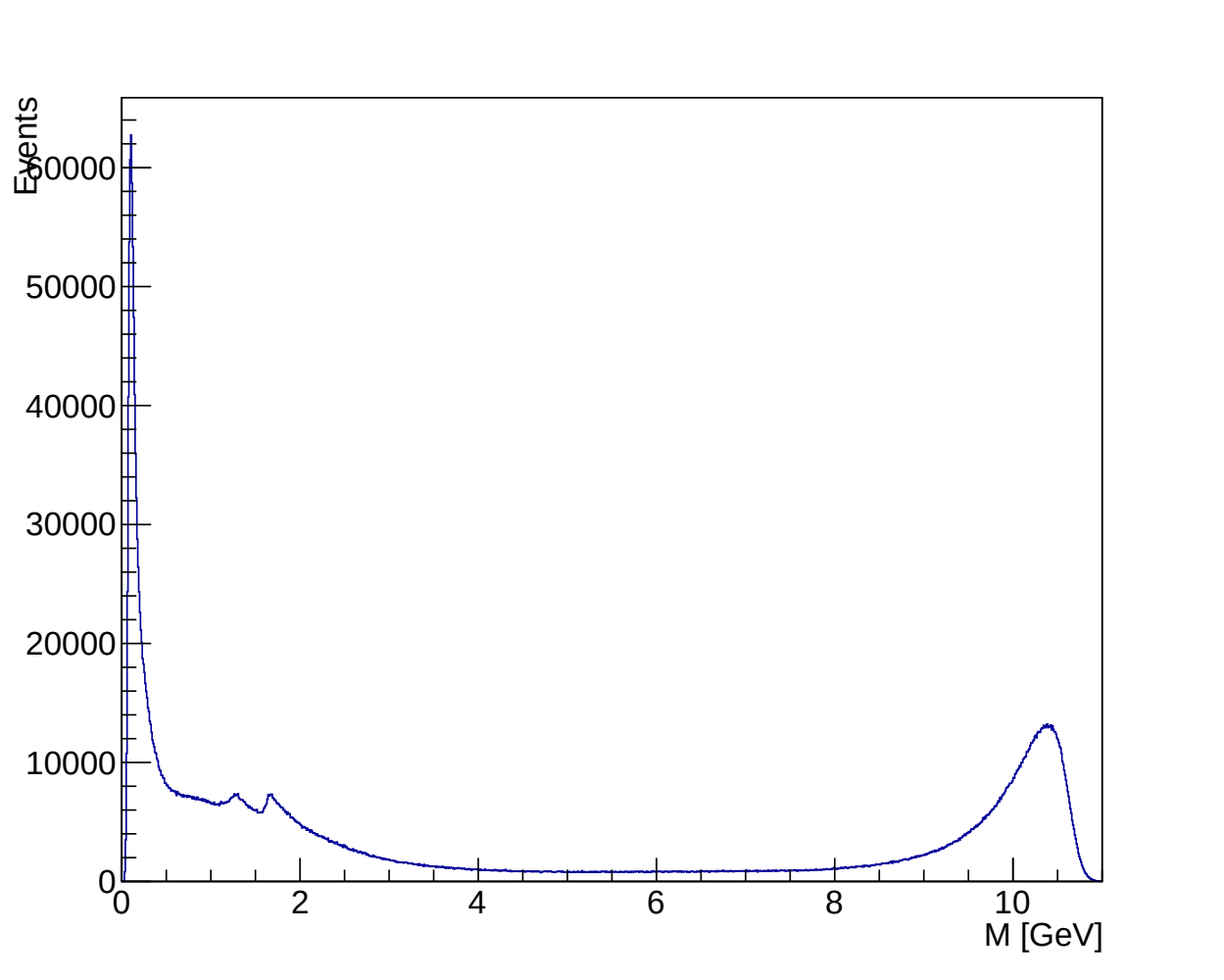
- The middle peak is $\mathrm{ee} \to \gamma\gamma$, the two other peaks are $\mathrm{ee} \to \mathrm{ee}$
- My $\mathrm{ee} \to \gamma\gamma$ peak is way higher (Maybe there are some cuts that I am not considering?)





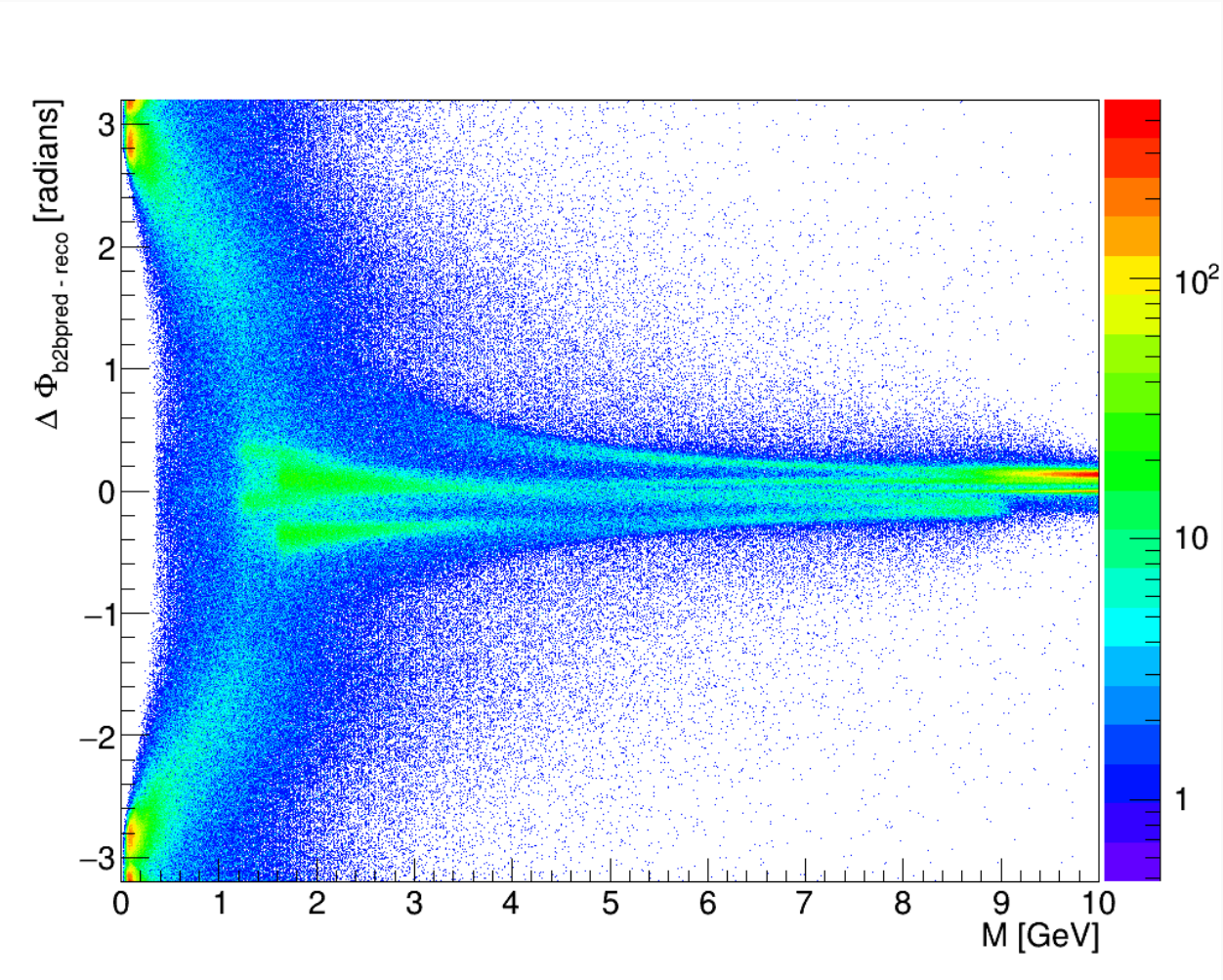
Some more plots

Here the invariant mass of the virtual photon (vpho) is plotted



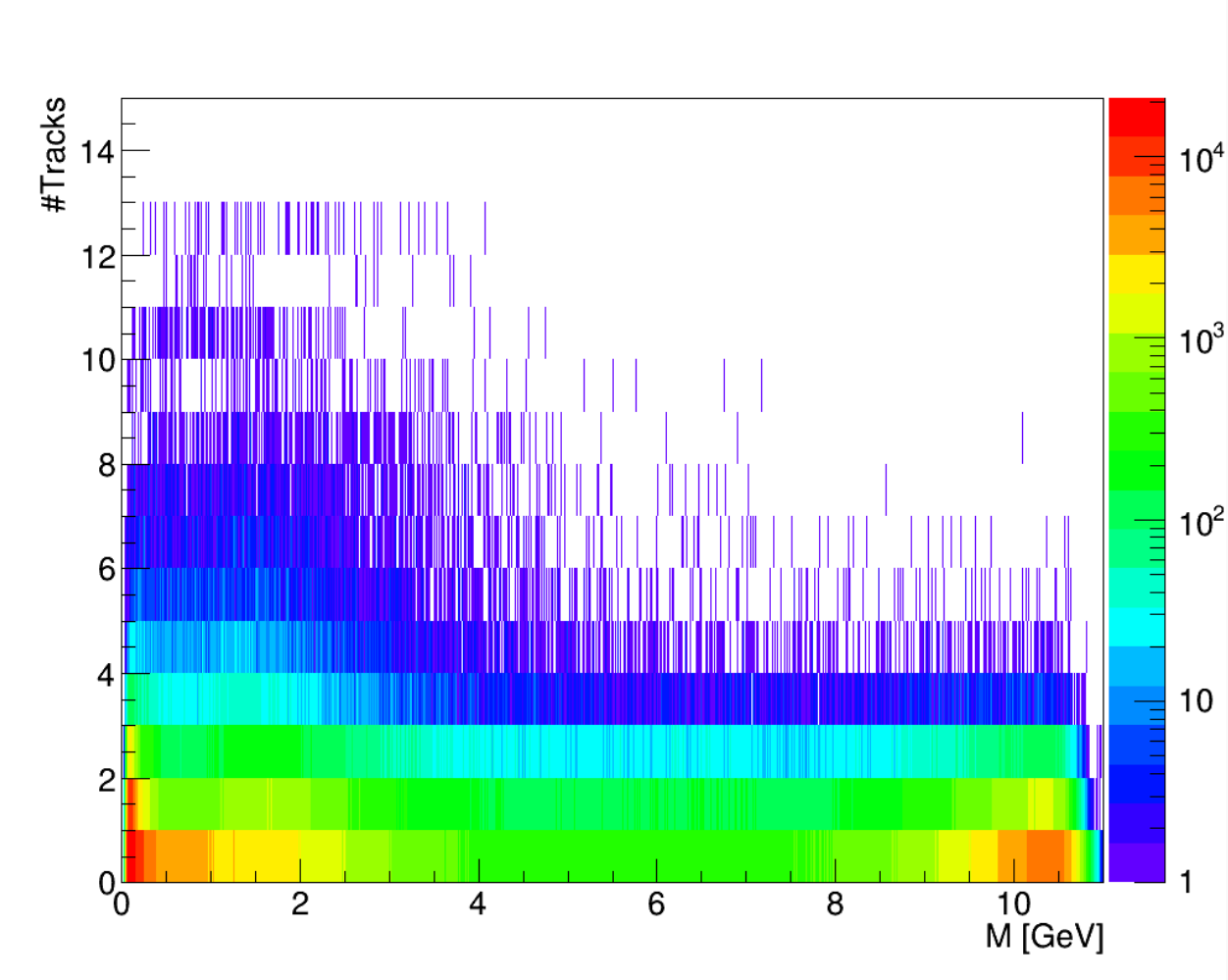
Some more plots

Here the invariant mass of the virtual photon is plotted against the difference between the b2bpredicted and the reconstructed Φ angel



Some more plots

Here the invariant mass of the virtual photon is plotted against the number of reconstructed Tracks.



The next Steps

- Investigate the best cuts for our purposes and apply them
- Select only the $\mathrm{ee} \to \mathrm{ee}$ candidates and study the tracking efficiency using that sample
- Produce the same plots shown here using MC sample (from a preliminary study using MC10 it looks like very few events survive applying the described selection)