$B^0 \to K^{0*}(K\pi)\mu\mu$ full angular analysis

Status update

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CERN, 27 Aug 2015

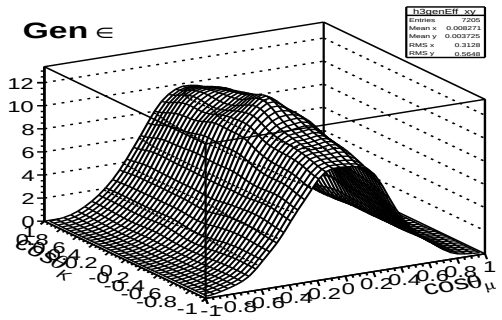
Status update

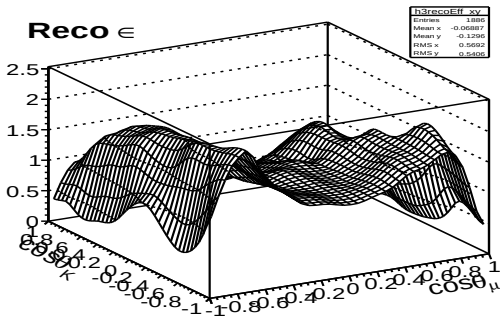
- following Mauro's suggestion at last meeting, we tried a workaround for our show stopper:
  - MAJOR issue and totally unexpected: `root` **is not able to save the output pdf produced by** `RooNDKeysPdf`
- sample the `pdf` as an 3D histogram (`TH3`) with suitable binning and save that to a root file;
- Get histograms for $N/D_{gen/reco}$;
- Get efficiency by dividing histograms
  - much faster than dividing the `pdf` and then get the histograms!
- perform `closure test` from the saved histogram.

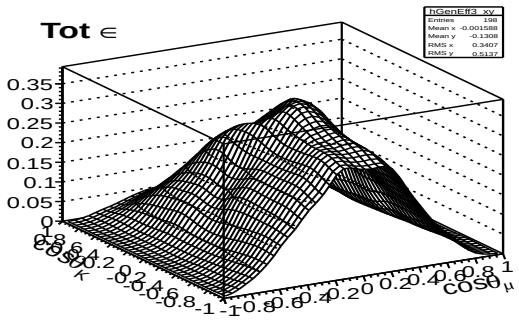
$$\epsilon(q^2, \theta_L, \theta_K, \phi) = \frac{N_{gen}}{D_{gen}} \times \frac{N_{reco}}{D_{reco}}$$

Efficiency for Q^2 bin 1: 2D projections

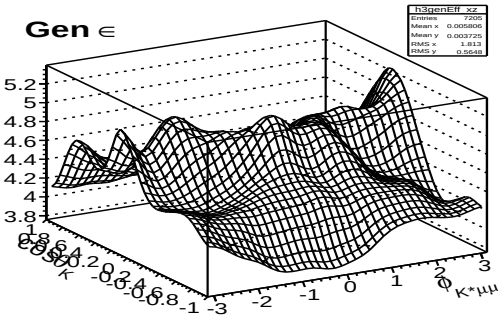
$$\frac{N_{gen}}{D_{gen}} \times \frac{N_{reco}}{D_{reco}} = \epsilon(q^2, \theta_L, \theta_K, \phi)$$

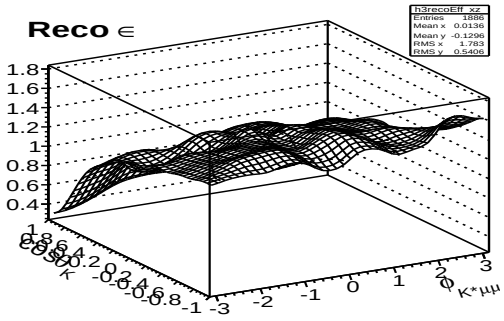


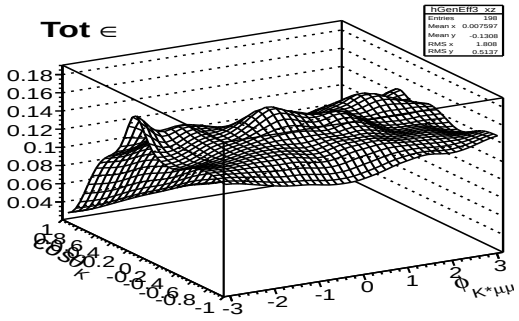




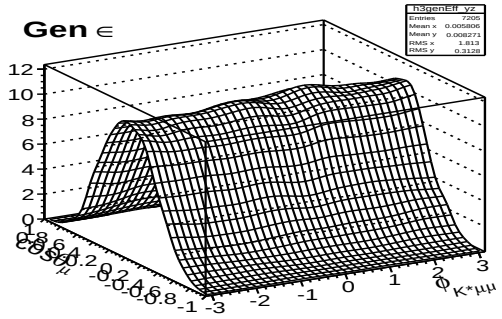
$\cos\theta_K$ *vs* $\cos\theta_\mu$

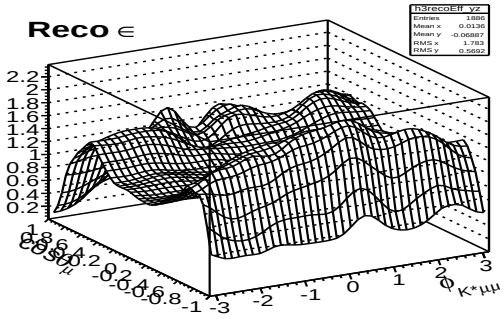


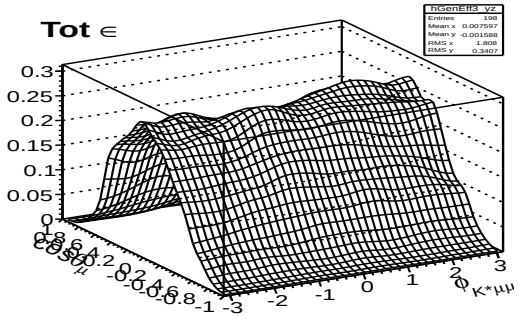




$\cos\theta_K$ *vs* ϕ



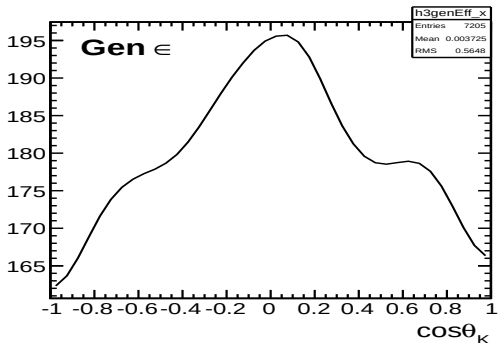


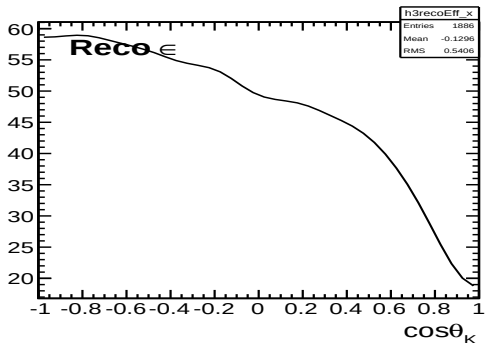


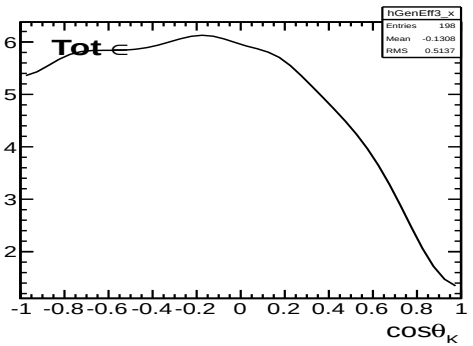
$\cos\theta_\mu$ *vs* ϕ

Efficiency for Q^2 bin 1: 1D projections

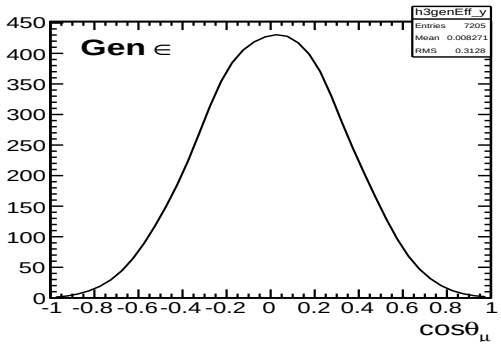
$$\frac{N_{gen}}{D_{gen}} \times \frac{N_{reco}}{D_{reco}} = \epsilon(q^2, \theta_L, \theta_K, \phi)$$

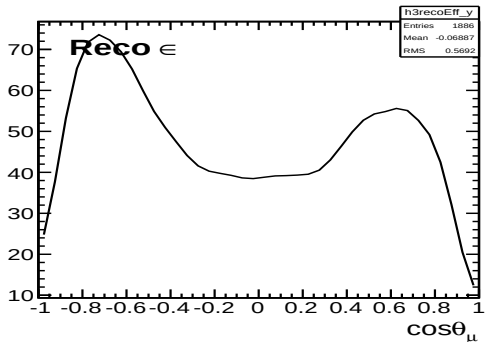


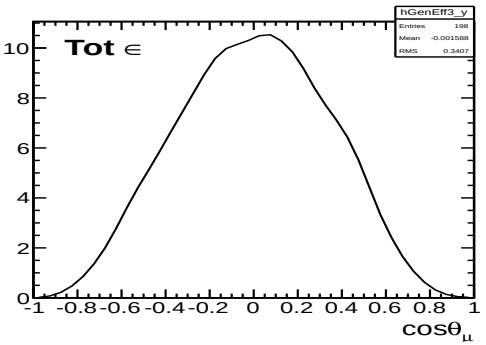




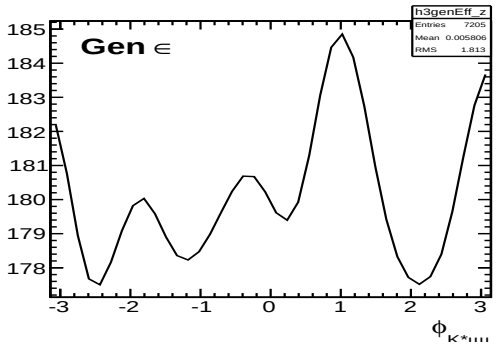
$\cos\theta_K$

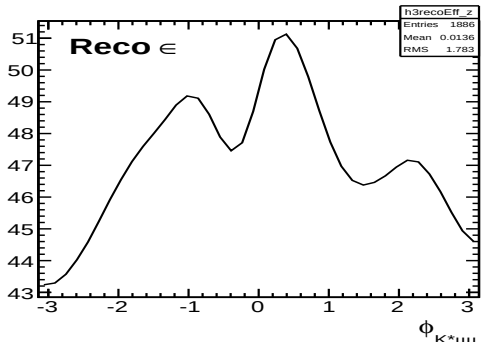


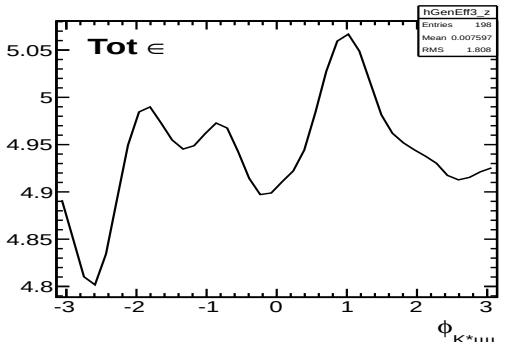




$\cos\theta_\mu$

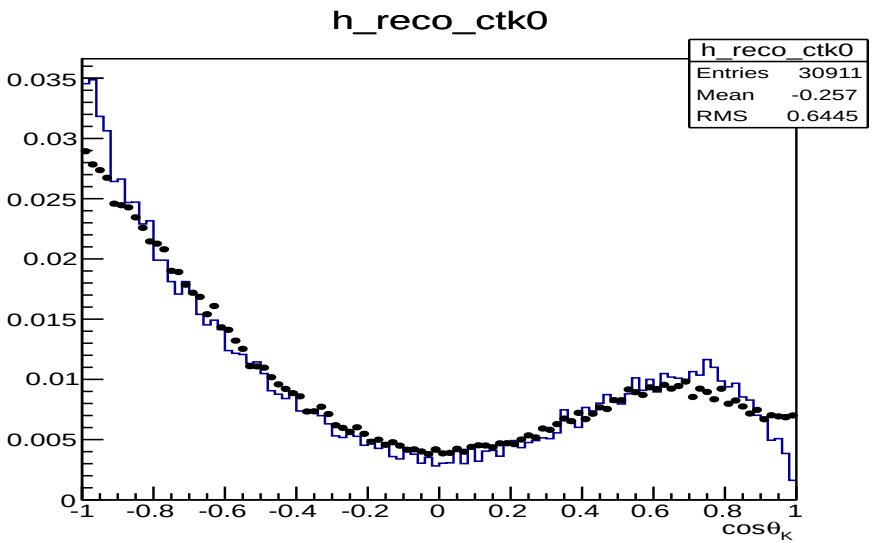


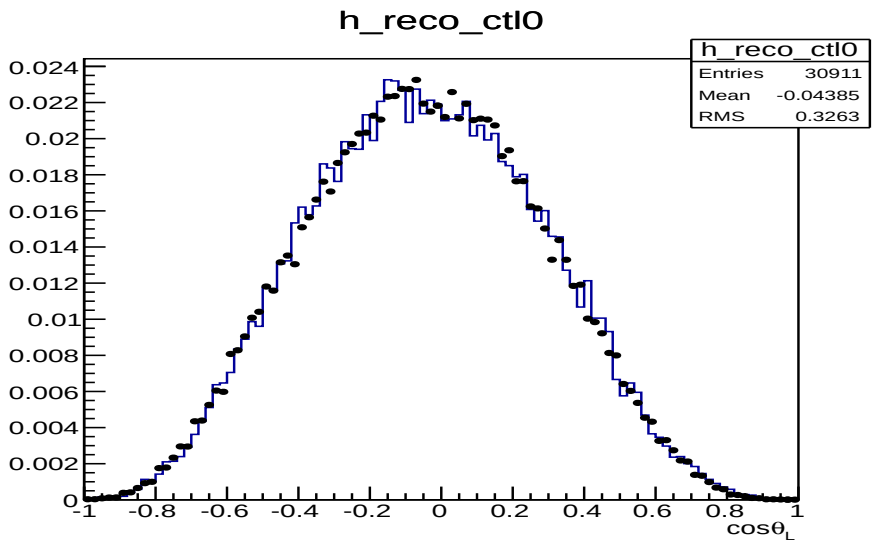


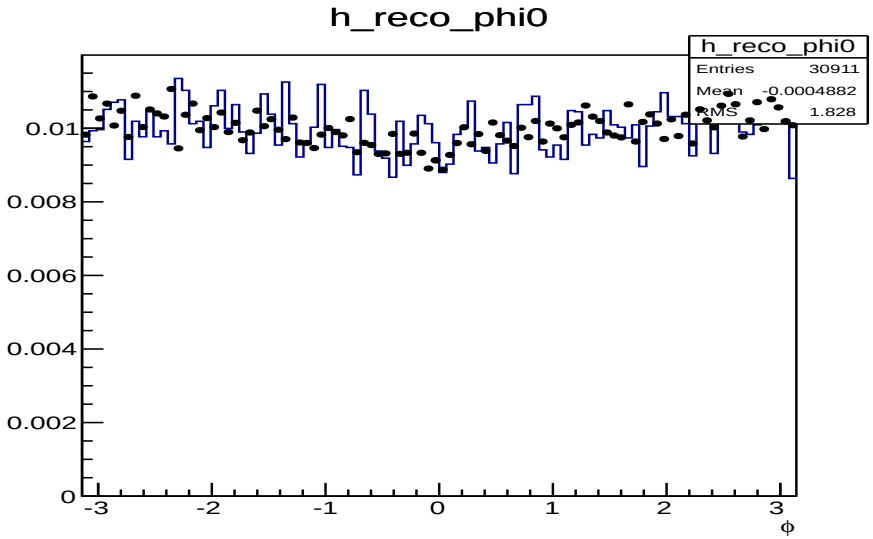


ϕ

Closure test: 1D

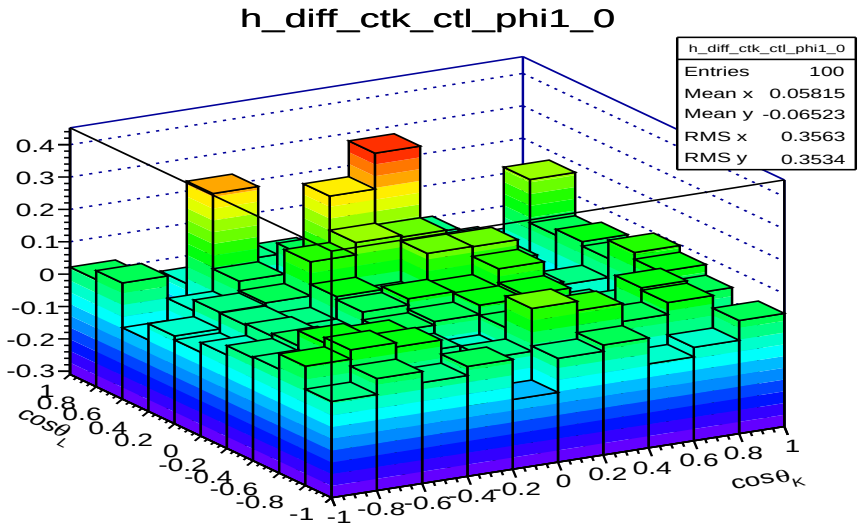


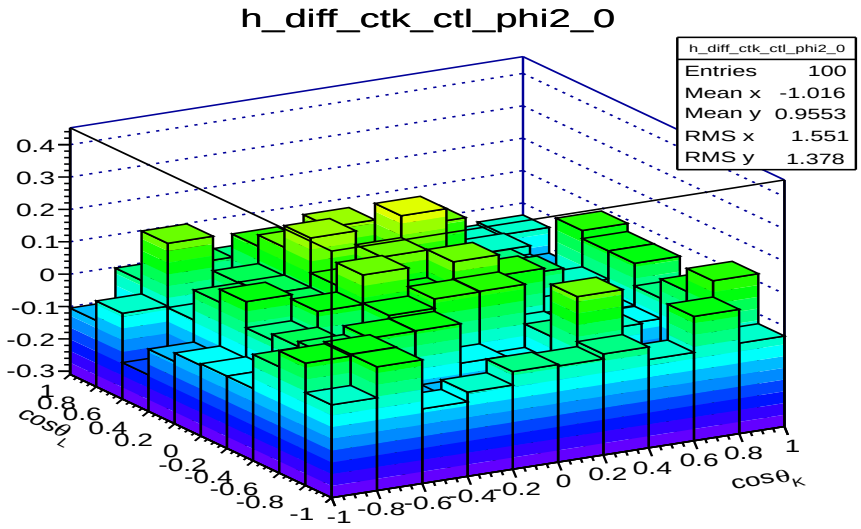


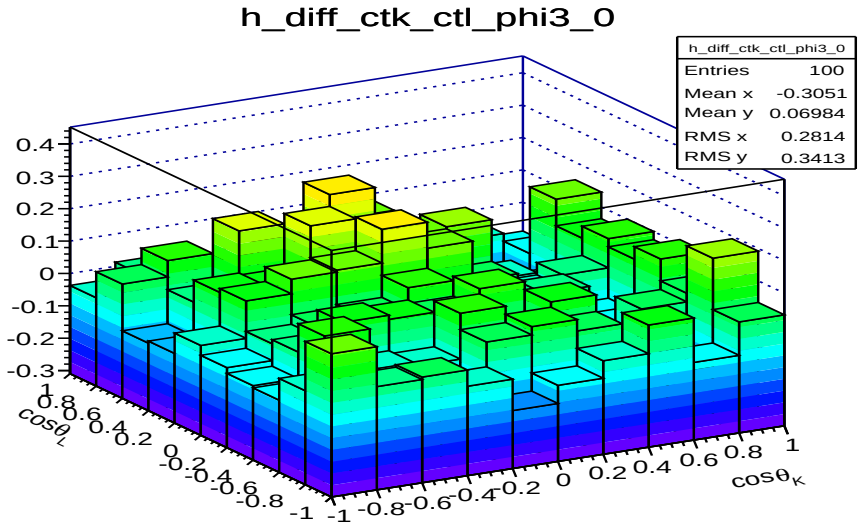


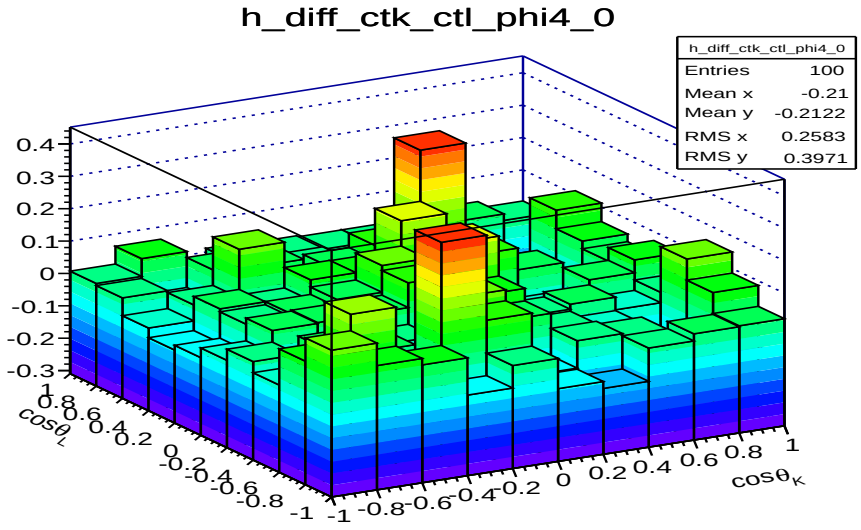
- Very nice agreement;
- using binning $40 \otimes 40 \otimes 40$ seems fine;
- Still some problem at $\cos\theta_K$ boundary, some tuning of `RooNDKeysPdf` needed

Closure test: 1D









Next steps

- tuning of algorithm: try to play with gaussian width and mirroring at the boundaries;
- produce efficiency for all bins (running)
- also for
  - wrong tag;
  - J/ψ and ψ' control sample;
- try to convert back `TH3` to `rooAbsPdf` for fitting (should be easy);
- Move to final choice of variables ($\cos\theta$ vs θ)
- Move to final range for variables (folding)
- Document the work done