DIRC status

- Minor bugfix: 'Zero-momentum' tracks.

- Minor bugfix: Tracks hitting two bars.

- Medium update: New QA scripts.

- Medium adaptation: Default algorithm changed to not rely on Kalman filter.

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Minor bugfixes

- A very few tracks (one in several hundred thousand events) have 'zero' momentum at the DIRC, which confuses the fitter through divisions by zero.

- Fix is twofold:

  - Avoid immediate problem by returning 'no Cherenkov information' for tracks with momentum below one keV.
  - David Brown tracked down the source of the problem: This line

    ```
    Hep3Vector recoMom = transf.transTo(fitres->momentum(resp->fltLen));
    ```

    will, in the absence of the Kalman filter, usually return the momentum at the origin, and that works fine for most tracks. But some tracks have hit merging, and therefore have a Kalman filter for the inner detector but not the outer. So in some cases the assumption of having the track momentum at the origin is not accurate, and correcting for it does strange things. Fix is obvious: Just explicitly ask for the origin momentum, since that's what we assume we've got anyway.

- Tracks with two or more DIRC hits no longer cause a memory leak. A possible refinement is to merge such hits; this would go along with a better simulation of the flight length within the bar - currently this is assumed to be the bar width in all cases except decays within the bar.
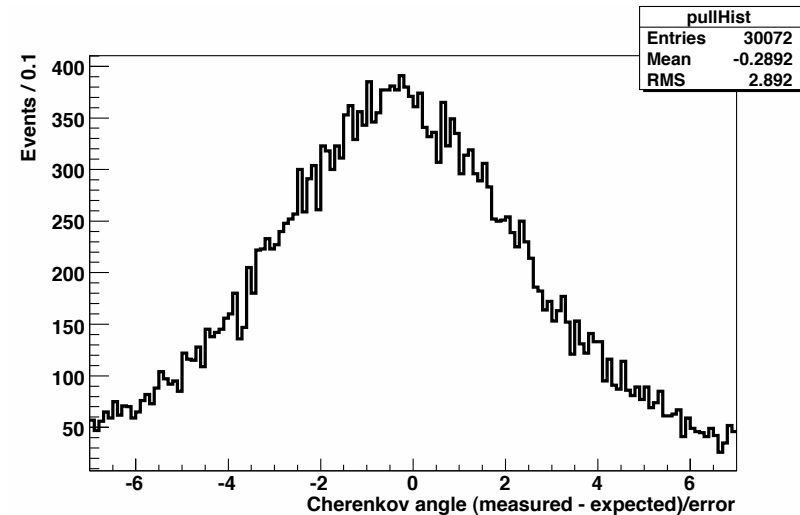
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PacQA script update

- PacQA/PacQADirc class was written before BtaTruthMap was implemented in FastSim, and also relied on very old code in some other places.

- Updated PacQADirc to work with recent code.

- Old checkDIRC script mainly intended for comparing BaBar MC and FastSim results.

- Wrote new checkSuperBDIRC script for direct sanity checks on SuperB setup.

- Produces plots of Cherenkov angle, pull, and number of photons, versus azimuthal and polar angles and momentum, for π, e, μ, K, p.

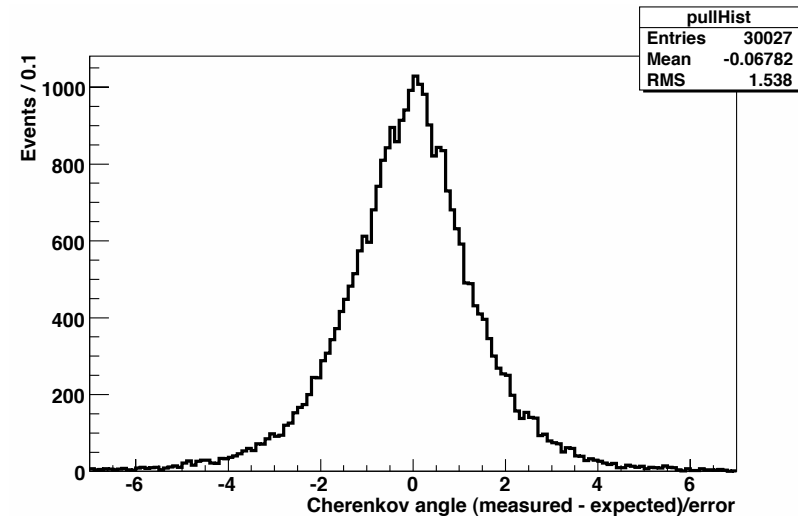Mike Sokoloff

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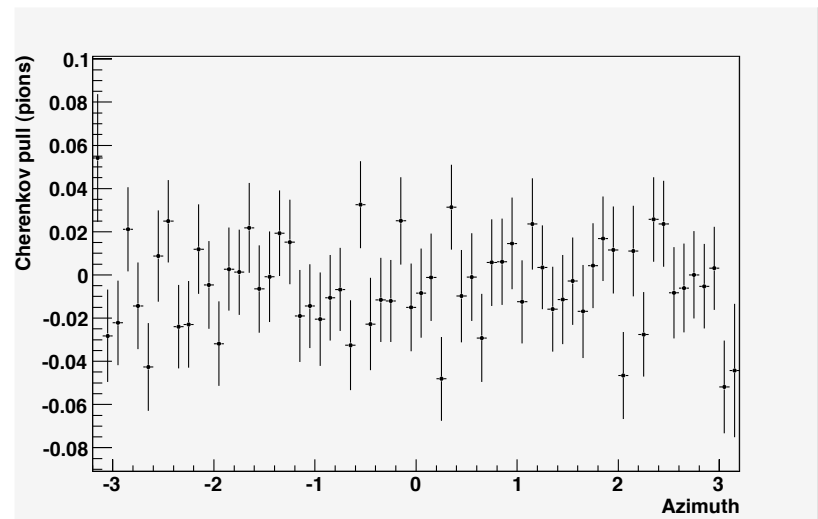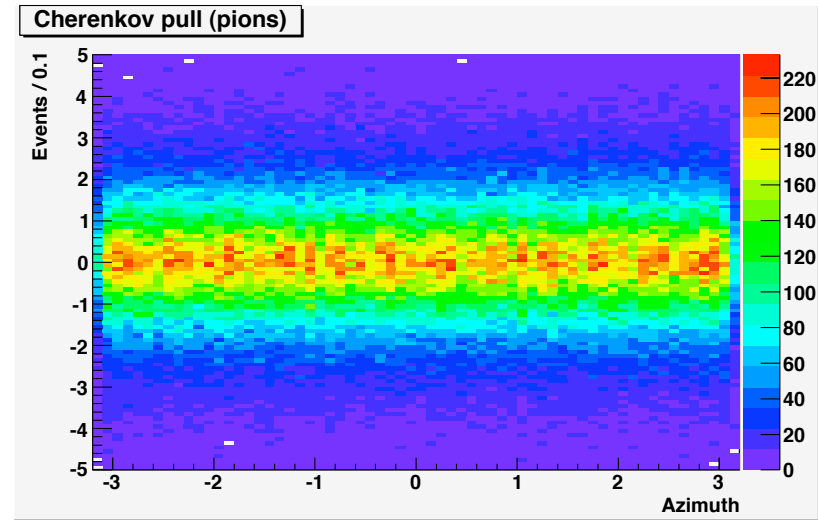
New ring algorithm

- Nicolas Arnaud discovered a major problem with the PacDirc modelling: The reconstructed Cherenkov angles showed a clear bias relative to the expected angles, and the reported error is clearly too small.

- Source of the difficulty: The `PacDircFitter` class relies on information from a full Kalman filter. In recent versions of FastSim, this is turned off to save time.

- Solution: Create new `PacSimpleDircModel` and `PacSimpleDircFitter` classes which do not rely on the Kalman information.

pullHist	
Entries	30072
Mean	-0.2892
RMS	2.892

Events / 0.1

Cherenkov angle (measured - expected)/error

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Reminder: Kalman-dependent algorithm

- At the simulation stage, for each Cherenkov photon, create a Cherenkov angle θ (distribution is Gaussian around true value) and azimuthal angle ϕ (uniform in the geometrically allowed regions).

- At the reconstruction stage, make the vector of each Cherenkov photon by using the above angles and the true track momentum.

- Calculate the reconstructed angle of each photon by taking the angle of its vector with the reconstructed track momentum *at the DIRC*. NB! This requires full Kalman information!

- In the absence of full Kalman information, you will get the reconstructed track momentum *at the origin*, which is systematically larger, leading to higher expected Cherenkov angles.

pullHist	
Entries	30027
Mean	-0.06782
RMS	1.538

Events / 0.1

Cherenkov angle (measured - expected)/error

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New simplified algorithm

- Create Gaussian-distributed Cherenkov angles as before.

- Ignore the azimuthal angles.

- At reconstruction time, take the average of the generated Cherenkov angles. Add a Gaussian random number, with mean at zero and sigma equal to the RMS of the Cherenkov angles plus (added in quadrature) a term proportional to the angle between true and reconstructed track momentum *at the origin*. (Full Kalman information not needed.)

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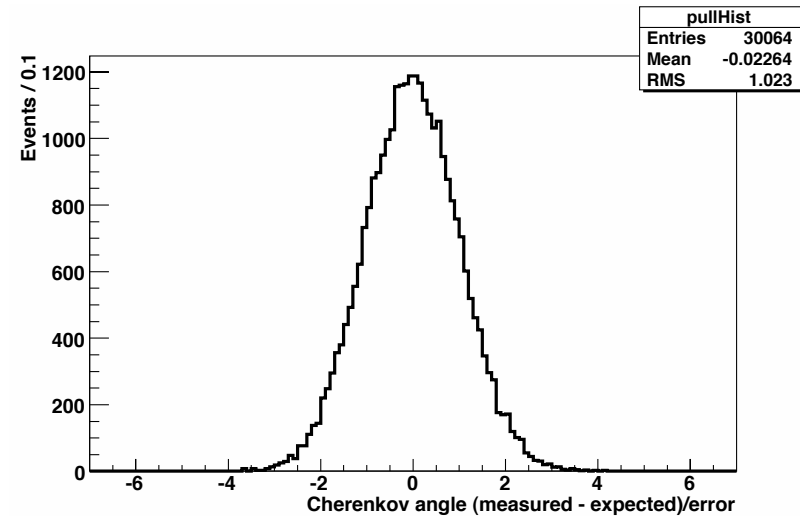
Changed default model

- `PacSimpleDircFitter` is now default. (Committed to V0.1.1 trunk, revision 1701).

- Change should be invisible to users.

- Still working on patching `PacDircFitter` to make it behave reasonably in the absence of a Kalman filter. As a temporary expedient, it will kick up a serious fuss if it is run without the full filter:

	`PacSimpleDircFitter`	`PacDircFitter`
Kalman filter on	Works ok	Works ok-ish
Kalman filter off	Default, ok	Crashes!

- The crash has an error message with instructions for turning the Kalman filter on and for switching to `PacSimpleDirc`.

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Summary

- Adjustment to deal with the Kalman filter change.

- Updates in `PacQA` should make it easier to check effects of playing around with the DIRC.

- Minor bugfixes.

- Changes are invisible to non-experts.

- We will keep improving.

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