Digi timing

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The preamps in the region $39 \leq \phi \leq 68, \theta > 8$ have longer shaping times than those in the rest of the calorimeter.

The signal shape is highly asymmetric and so convolution with the preamp response gives a timing shift.

Before clustering, we throw out digis that are likely to be due to machine background. The average event time is computed from the energy-weighted time of all digis with $E > 30$ MeV. We keep digis with 120 ns of this time.

I fixed this by adding a constant time shift in EmcReco/EmcDigiSweep, and tested the result by reconstructing 50000 events with and without the fix. I used the first 50000 events of run 64197.
The average digi time in the long shaping time region of the calorimeter is 56 ns later than in the short shaping time region. I used generic $B - \bar{B}$ MC.

The error bars are the errors on the mean, and the scales are different for the two plots.
Another look at digi timing in data

- Comparison of the digi times in the long shaping time region (red) with the short shaping time region (black).
- The asymmetric tails in the digi timing distribution in the long shaping time region suggests that we may be selecting some digis incorrectly.
Comparison of the digi times in the long shaping time region (red) with the short shaping time region (black) after the digi times have been shifted.
Timing in data and MC

- The average digi time in the long shaping time region of the calorimeter is about 56 ns later than in the short shaping time region.
- The error bars are the errors on the mean. The scales on the two plots are approximately the same, but the data is shifted by about 24 ns from the MC (is this relevant when mixing in background in MC?).
Does the “fix” actually do anything?

- Does the fix affect any relevant physics quantities? I looked at several plots automatically produced by Elf for data quality purposes: digi phi multiplicity, bump phi multiplicity, number of EmCCands per event, and pi0 mass plots.
- In all the plots that follow, the fixed data is on the left and the unfixed data is on the right. Some plots have suppressed zeros.
Does the “fix” actually do anything? – Digi $\phi$ multiplicity

- Fewer digis in the long shaping time region and more in the short shaping time region.
Does the “fix” actually do anything? – Bump $\phi$ multiplicity

- More background!
Does the “fix” actually do anything? – Number of EmcCands per event

Number of EmcCands per event essentially unchanged.
Does the “fix” actually do anything? – EmcCand Energy

Average EmcCand energy essentially unchanged.
Does the “fix” actually do anything? – $\pi^0$

- Unchanged resolution.
- Statistics not high enough to make definitive statements regarding the mass and efficiency: 0.2 MeV increase in $\pi^0$ mass (but with an error of 0.3 MeV) and 0.7% more events (with an error of 2.6%).