Background Mixing

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FastSim Background Strategy

- Generate backgrounds in standalone jobs

  - Each bkg 'event' = 1 beam crossing

  - Fullsim OR FastSim

- Overlay background particles on physics event

  - 'Indistinguishable' from physics particles

    - Separate origin codes

- Simulate and reconstruct normally

  - hit/cluster merging includes background effects

Background Mixing Code

- PmcBkgInput, PmcBGTFromRoot (G. Simi)
  - read root tree of TParticle TClonesArray, convert to PacSimTracks
  - Add beam xings randomly across active time window
    - Beam parameters (luminosity, F_{bx}) and time window set by hand
- PmcWriteParticles
  - Write selected SimTracks as TParticle TClonesArray
    - Particles creating EmcClusters with E>1.0GeV
    - Charged particles which generate tracking hits with Pt > 2MeV
  - Particle origin chosen at relevant PacSimHit
  - Integrate interactions to correspond to 1 beam xing
   - Must input process X-section + beam parameters by hand

Background Generation

- Beam particles from low-angle Rad Bhabhas
  - particles are photons and neutrons from 2ndary interactions with machine elements near IP
  - Fullsim
- Bhabhas
  - 'ghost' of high-energy Bhabha electron clusters
    - exponential decay
  - FastSim
- e^+e^- pairs
  - very low-mass pairs hit Svt inner layers
  - FastSim
- Example generation scripts in PacProduction

Emc time response

Bhabha background

Cluster Energy/ particle energy
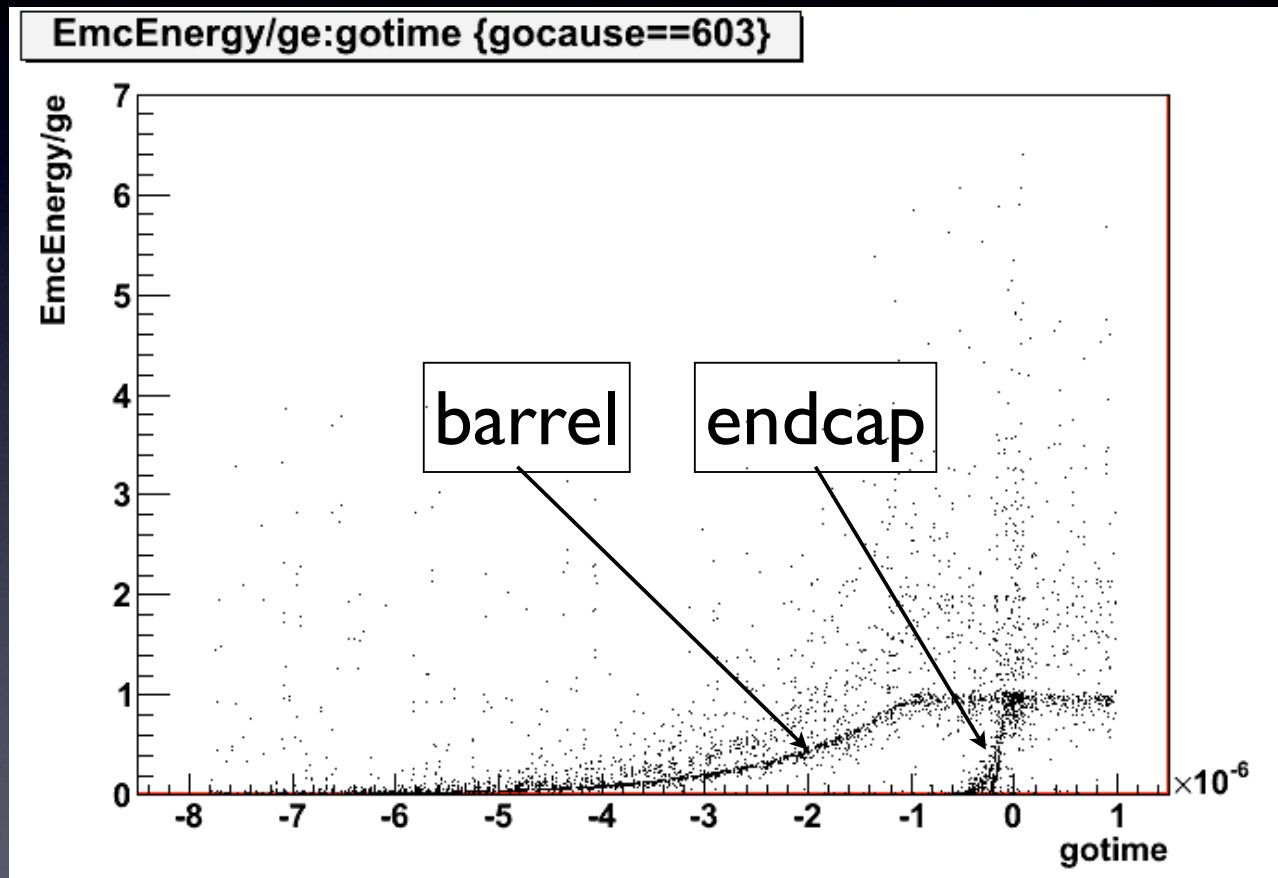
Bhabha time WRT physics event (sec)

Very Preliminary Numbers

- $\mathcal{L} = 10^{36}$ cm^{-2}s^{-1}, $F_{bx} = 200$ MHz

- beam particles (rad Bhabhas)
  - ~0.5 γ E > 10 MeV, ~0.5 n per bx E > 5 MeV
    - few hundred low-energy clusters per physics event

- Bhabhas
  - ~10^{-4} electrons in Emc acceptance per bx
    - ~0.1 electrons in active time window per physics event

- e$^+$e$^-$ pairs
  - ~2 electrons per bx
    - ~500 electrons at L_0 per physics event

Pair Hits per Svt layer
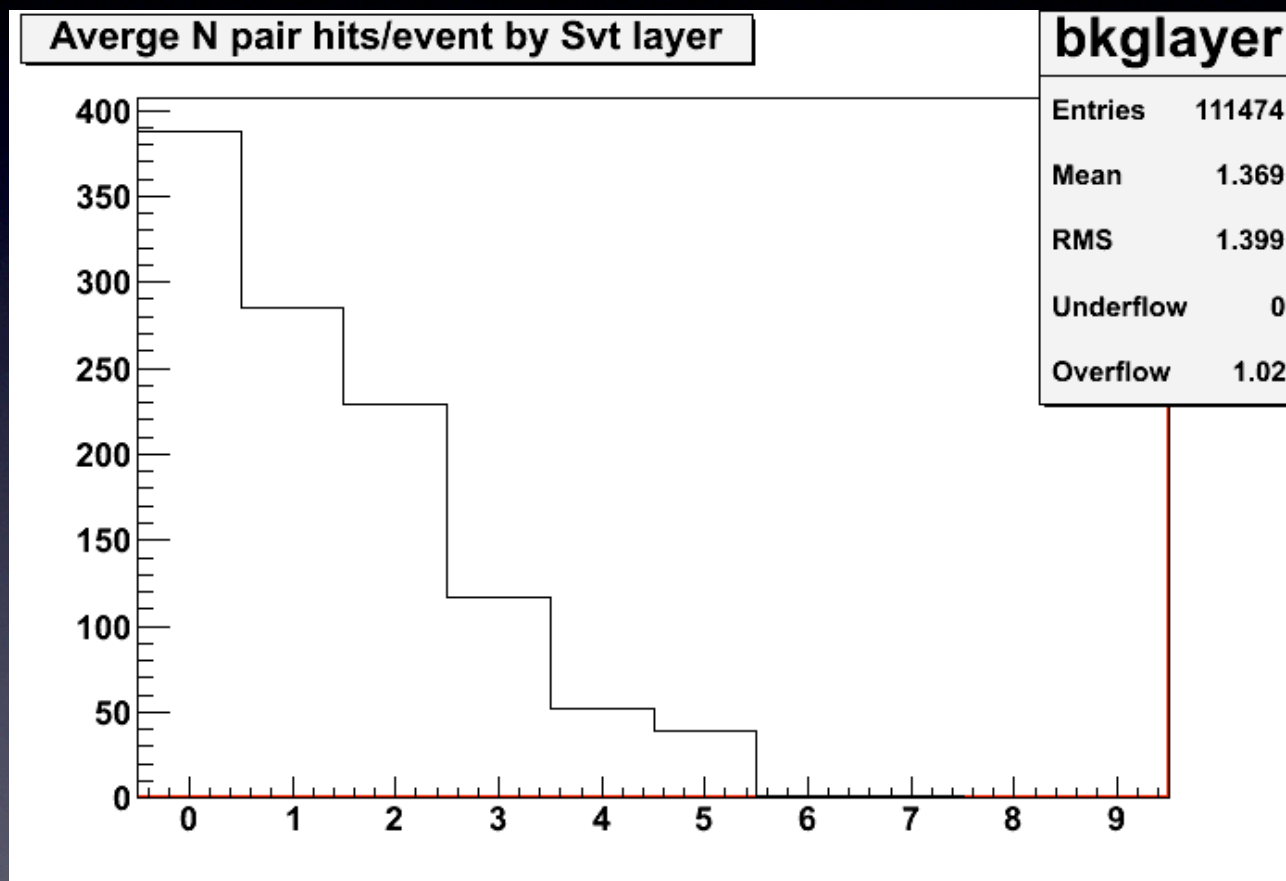
PacMC Performance for full SuperB background rates

- PmcBkgInput time is negligible

- PmcSimulate time up by factor of 3

- PmcMergeHits time up by factor of 10

- PmcReconstruct up by factor of 3+

  - Grows with # of events read

  - Memory leak + vector not cleared?

- Overall PacProduction is up by ~factor of 2

  - Assumes physics algorithms do not increase in time

Conclusions

- Full suite of background mixing in FastSim now availble

- Some known problems

  - memory leak(?)

- Time windows need to be tuned

  - parameter now present in all measurements

- Official bkg frames will be generated next week

- Preliminary numbers are concerning

  - more tests needed