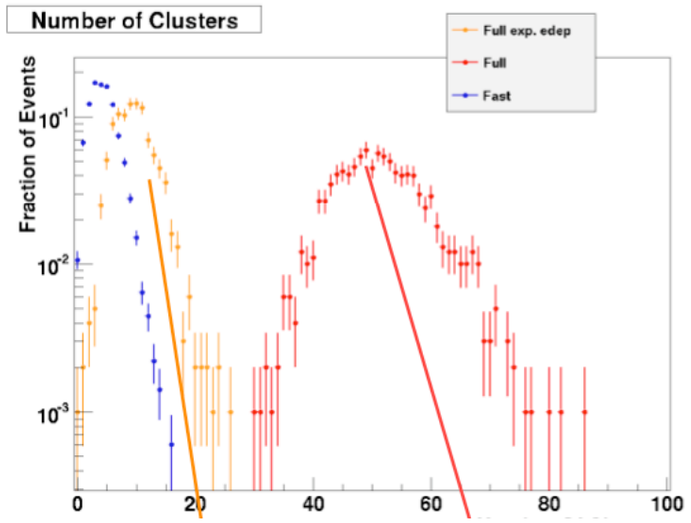
Rad. Bhabha Background at EMC

Chih-hsiang Cheng
Caltech
SuperB Fastsim Meeting
2010/04/29

EMC full/fastsim discrepancy

Stefano Germani, March 25, 2010

Fast - Full sim comparison: Number of Clusters



Number of Clusters in 1 μs

CAVEAT

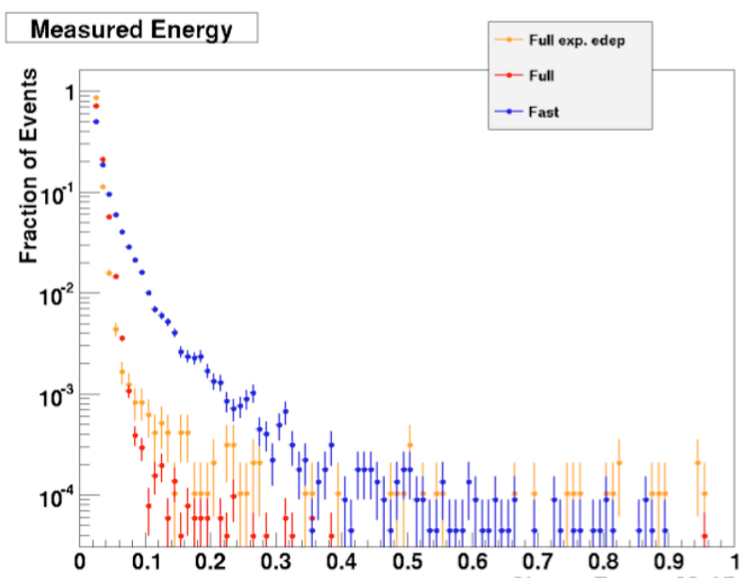
–FastSim entries related to candidate photons

–FullSim entries related to ECAL Clusters

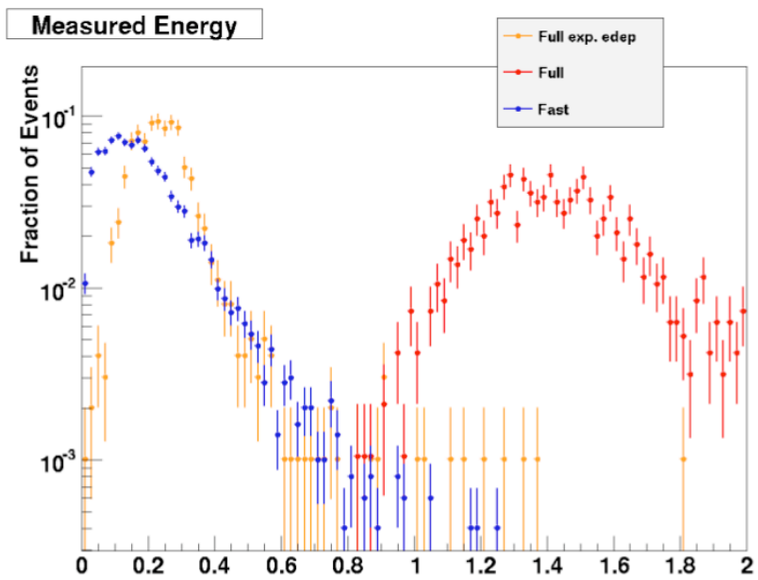
- May be produced by any kind of particle (not only gammas)

Blue: Fastsim neutrino events with Bruno rad. Bhabha bkg input.
Red: G4 EMC model, using particles scored at EMC boundary from Bruno.

Cluster E>20 MeV are kept.



Cluster Energy



Total Energy in One Event

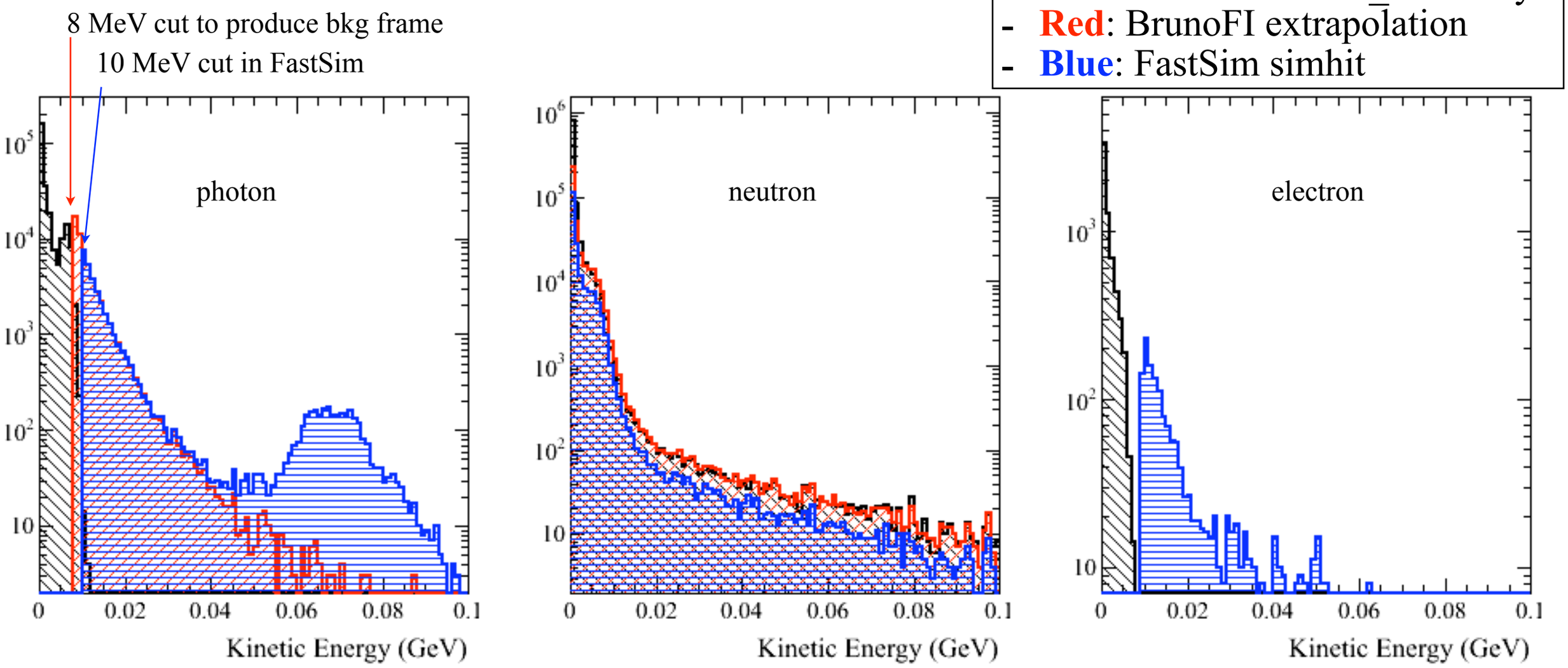
- There are a lot more clusters in an event (1μs) in full sim than in fast sim.
- Full sim cluster energy spectrum is softer.
- The total energy in an event is much higher in full sim than in fast sim.

Compare the sources

- I compare the particles (flux, energy) that go through the EMC front surface in three sources:
  - Bruno output T tree branch EMCA_boundary (only select the front surface, not the outside boundary).
  - BrunoFI tree branch Particles used as background frames of FastSim production. Extrapolate the particle momenta to the front surface of EMC (for photons and neutrons only).
  - Run fastsim (neutrino), enabling background mixing, recording particles at the first measurement at EMC.
- Plots shown in the next two pages are for 200,000 bunch crossings.

Kinetic energy

- **Black**: Bruno EMCA_boundary
- **Red**: BrunoFI extrapolation
- **Blue**: FastSim simhit



- I was using files in /storage/gpfs_babar6/sb/prod/2010_02_bgframes/FullSim/SuperB/RadBhaBha/, for EMCA_boundary, where QED has been turned off after the machine elements. That is why there are no photons and electrrons greater than 10 MeV.

Kinetic energy

- **Black**: Bruno EMCA_boundary
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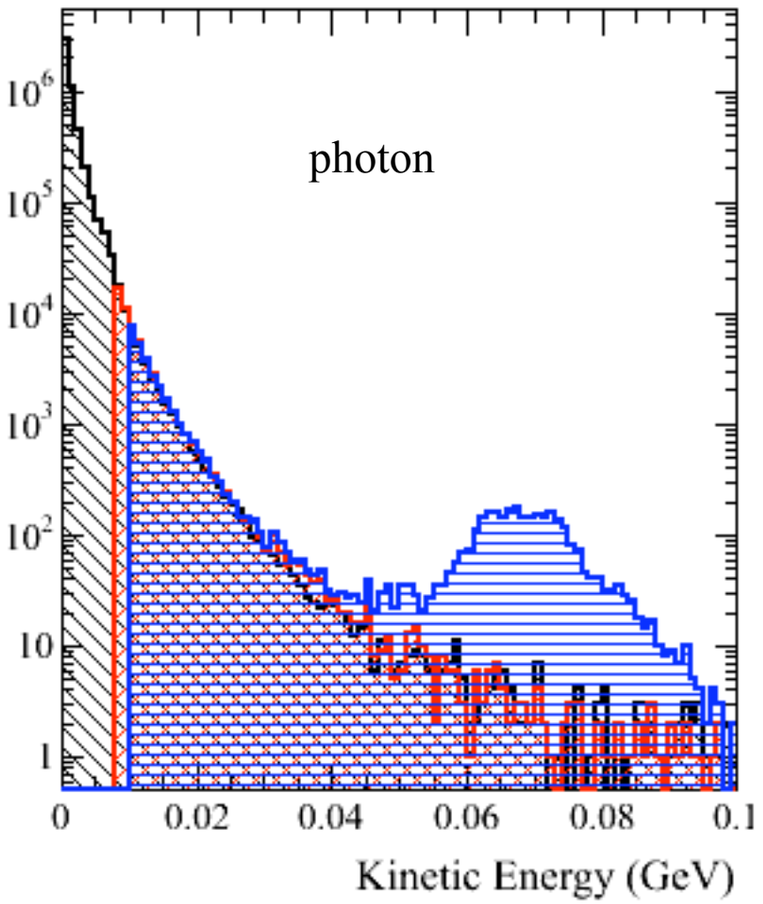
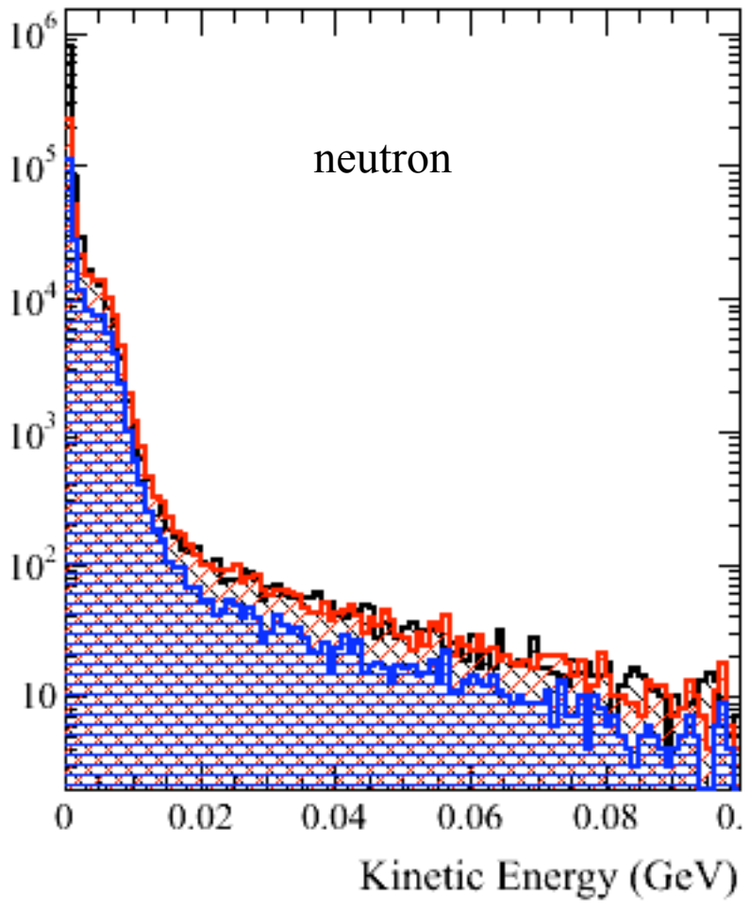
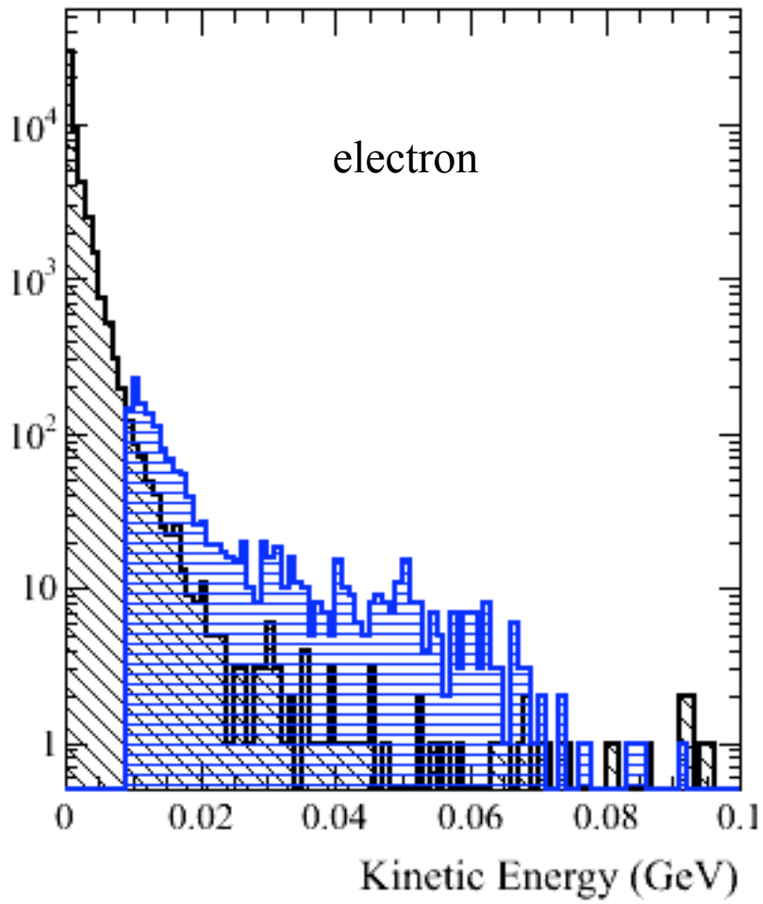
- **Blue**: FastSim simhit



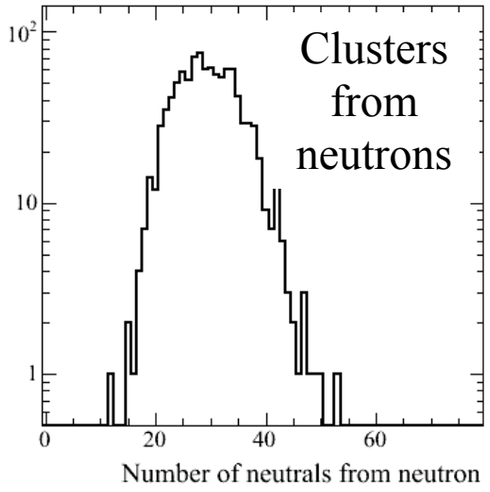


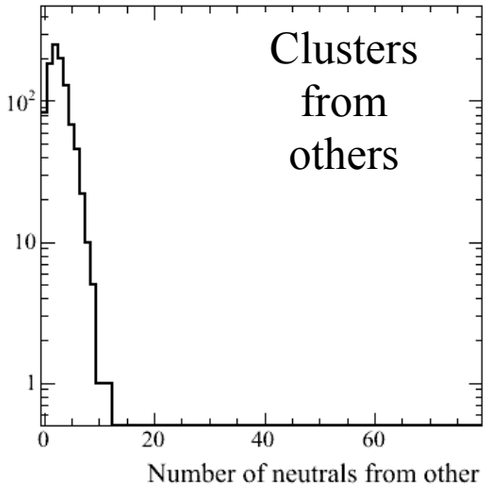


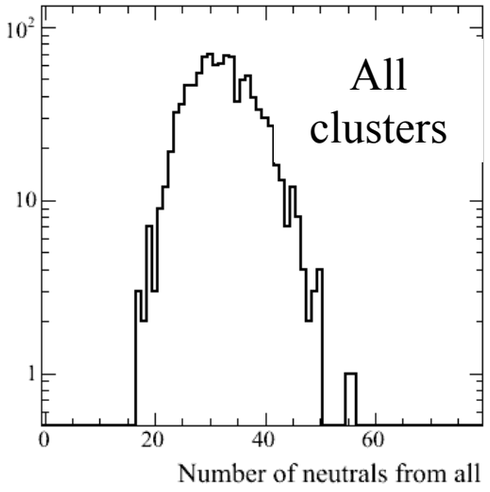
- Here I use files in /storage/gpfs_babar6/sb/prod/2010_02_full/FullSim/SuperB_Wolf_shielded/RadBhaBha/ for EMCA_boundary, where QED has NOT been turned off.
- These files are also what Stefano has been using.

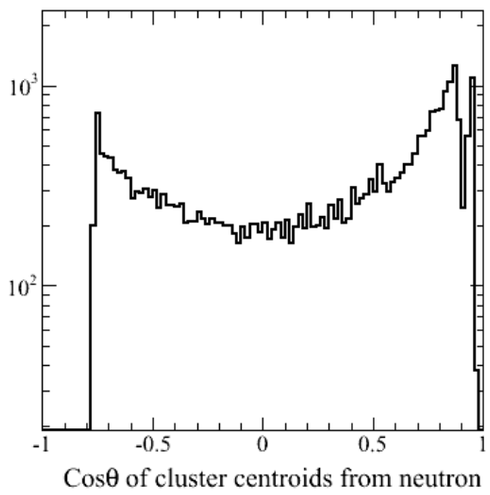
Fastsim responses

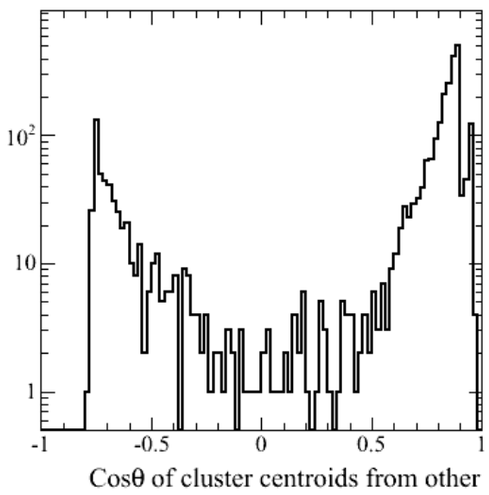
- There was a (kinetic) energy cut at 10 MeV for background particles. This essentially cuts away most of the neutrons.
- I move it to 1MeV. Now I get a lot more clusters per event (200 bunch crossings)

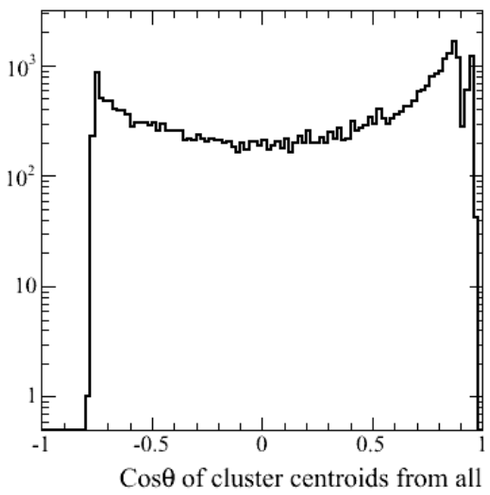


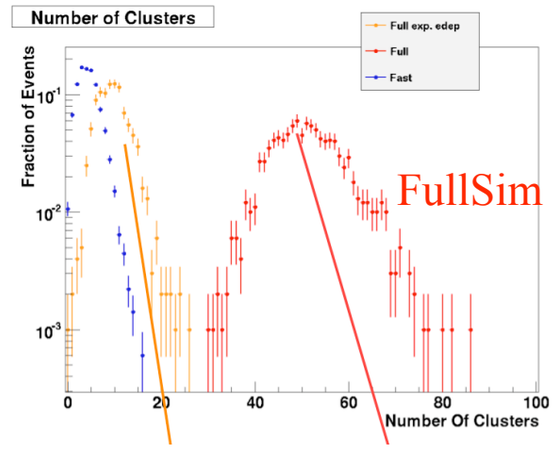




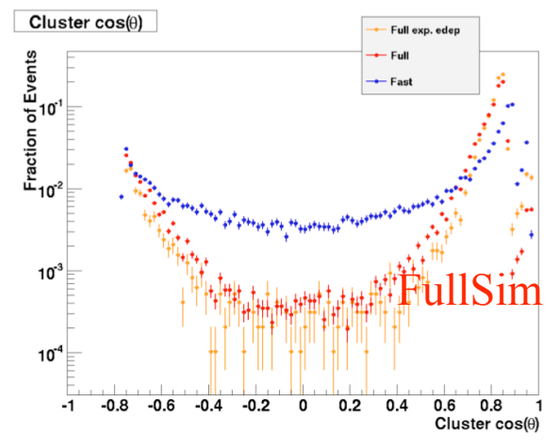






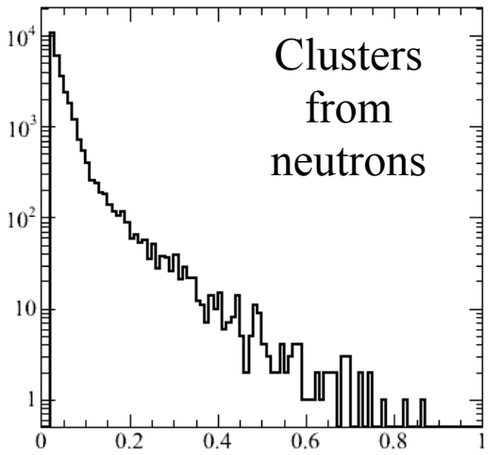


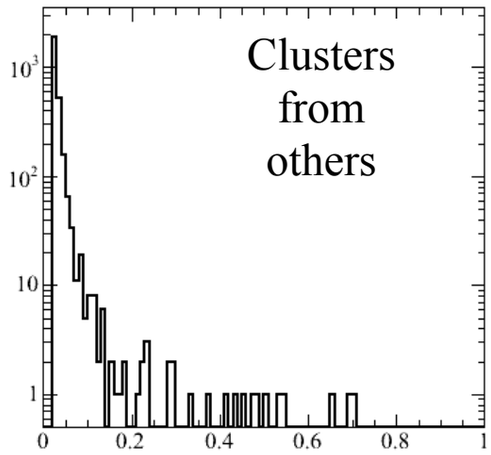
Stefano Germani, March 25, 2010

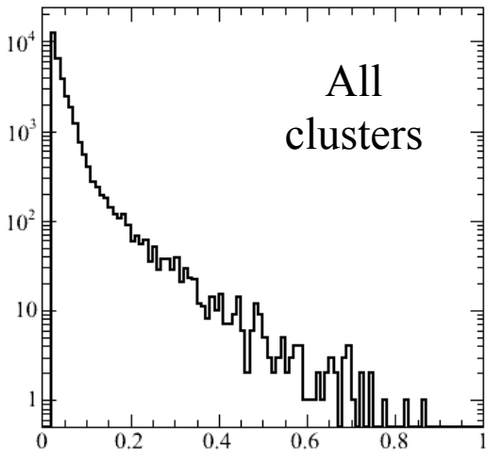


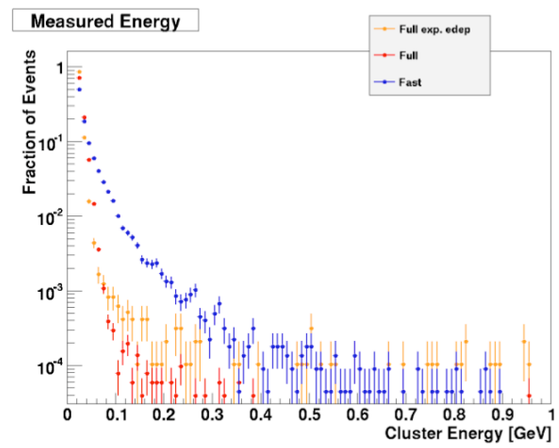
Energy distribution

- Cluster energy

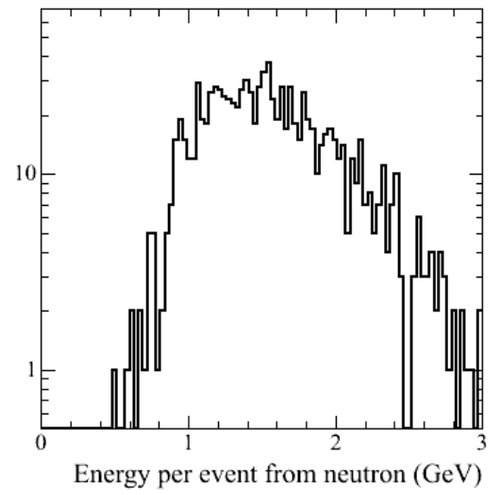


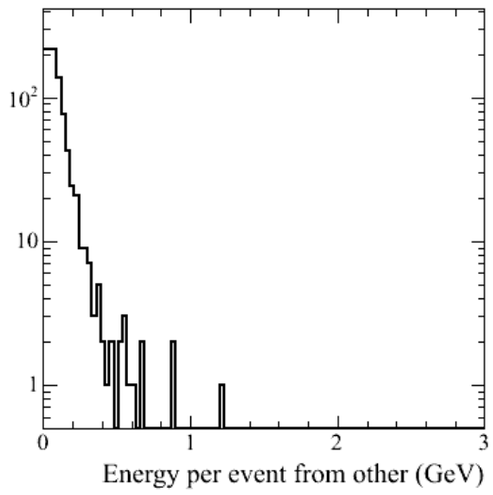


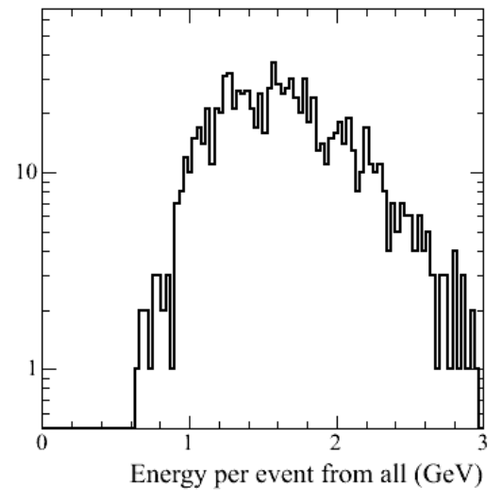


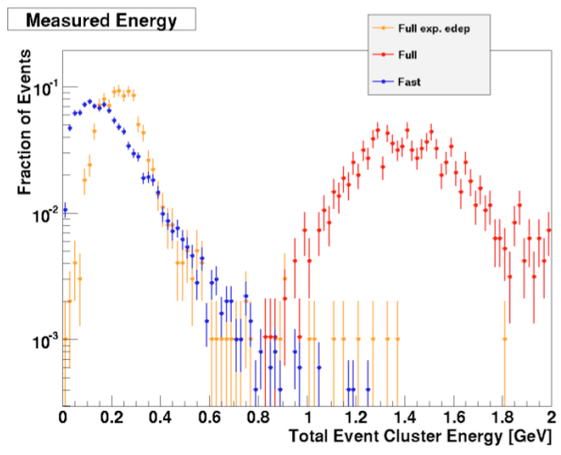


- Event energy









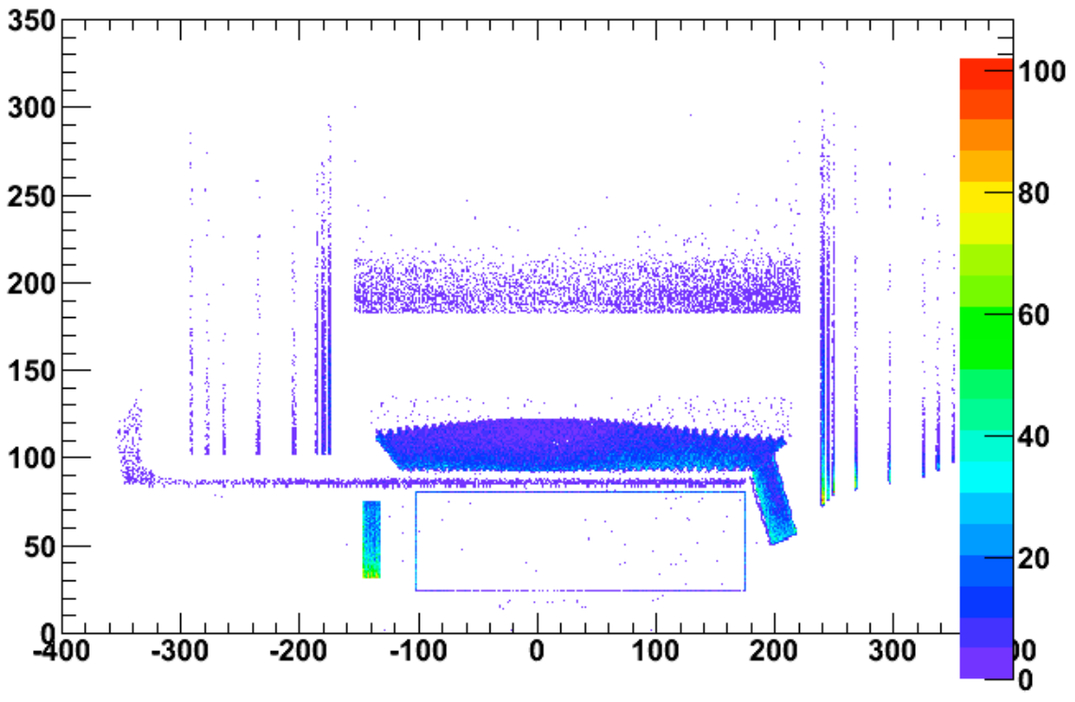
per event = 200 bunch crossings ~ 1 micro second

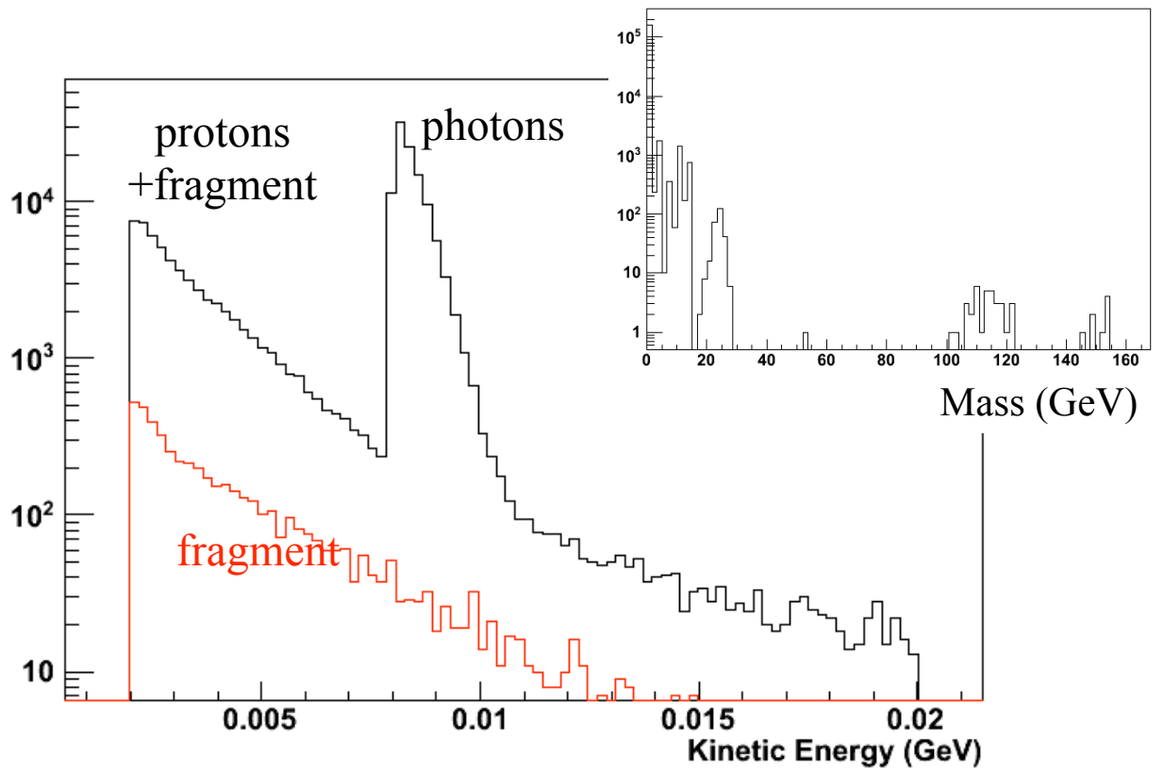
Comments

- Missing higher energy photons and electrons in FullSim Bruno EMC boundary photons are due to the use of wrong files.
- The low #clusters and total energy per event in fastsim was clearly due to the kinetic energy cut (10MeV) being too high. Lowering it to 1MeV, they are closer to fullsim study.
- However, we don't know how reliable the fastsim hadron shower model is at all. The improvement may be a coincident.
- The cluster energy and polar angle distributions still are not compatible.
- Fastsim slows down by almost a factor of four.

NeutronInt branch in bkg frame

- To solve speed problem, a plan was devised (for Feb. production but was not carried out due to a bug). In addition to particles coming out of materials near beam line, the bkg frames store another branch containing neutron interactions in EMC (and other components). This branch stores neutron's immediate daughters. The plan is to convert all non-photons to photon with the same kinetic energy and let fastim to deal with them.





Comments

- There are photons, protons and other nuclear fragments in NeutronInt branch. Kinetic energy thresholds are 8 MeV for photons and 2MeV for others.
- Using that branch (in stead of neutrons in Particles branch), I found very little difference from the one *without* neutrons.
- I have requested fullsim team to produce background frames with lower energy threshold.
- This scheme doens't seem to be able to simulate neutron showers.
- D.Brown proposes to sum up the kinetic energy of all particles produced by each neutron interaction and create a single pseudo-particle with the same kinetic energy for the background frames.
  - Will this be the same as hadron shower energy (e.g., what Stefano records)?