EMC FastSim with New Shielding

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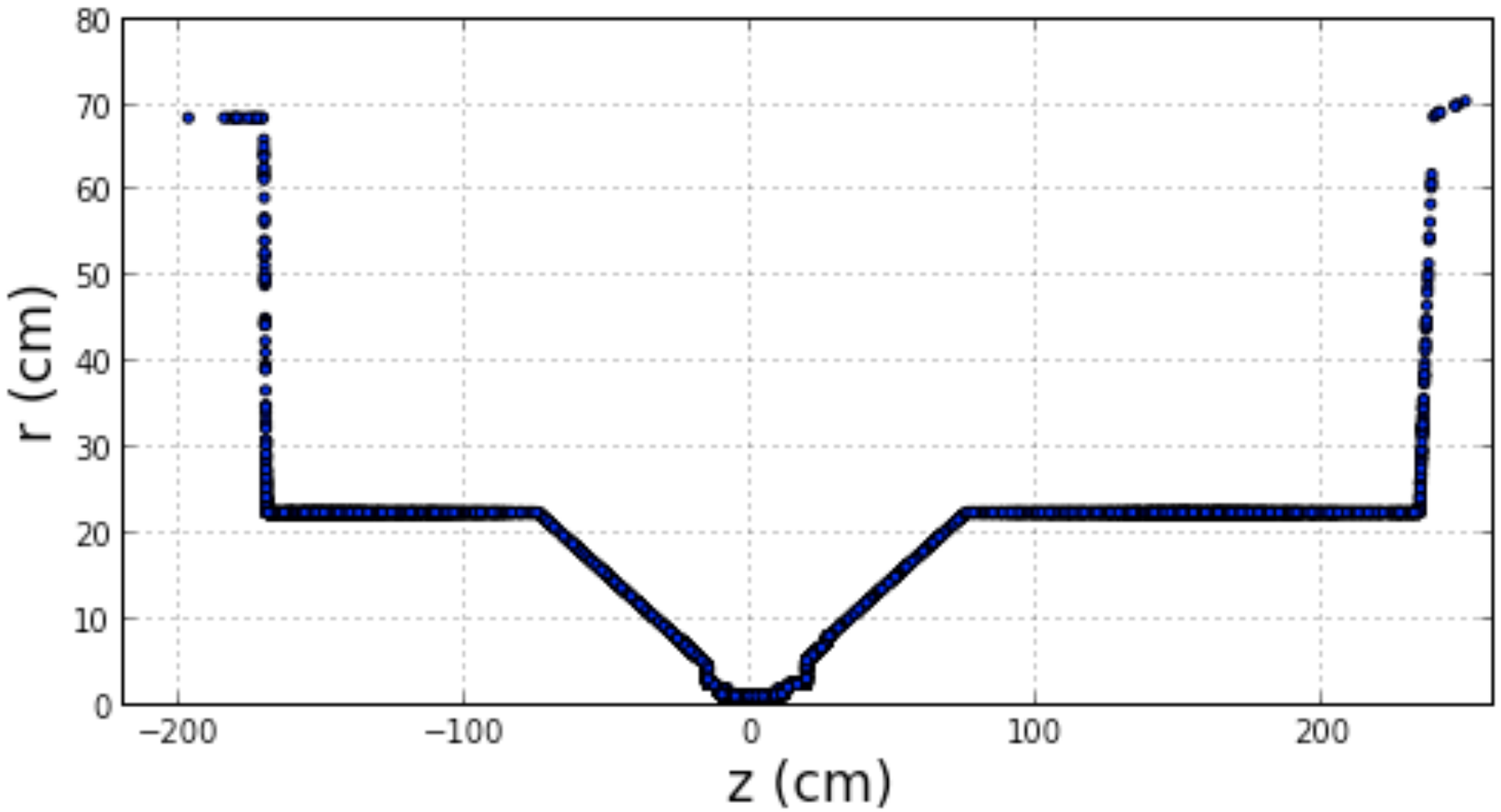
Changes in Background Production

- Tungsten shielding increased from 30 mm to 45 mm.
- Some minor fixes in materials like quadruples, etc.
- Background frame kinetic energy cut lowered from 8 MeV to 0.1 MeV.
  - ✦ There is a small test production in March using the same configuration as in November ’11, with cut at 0.1 MeV.
- NeutronInt does not have energy cut (thus it includes interaction energy as low as ~keV).
  - ✦ We purged the entries below 0.1 MeV ourselves afterwards.

Inspect the bgframe files

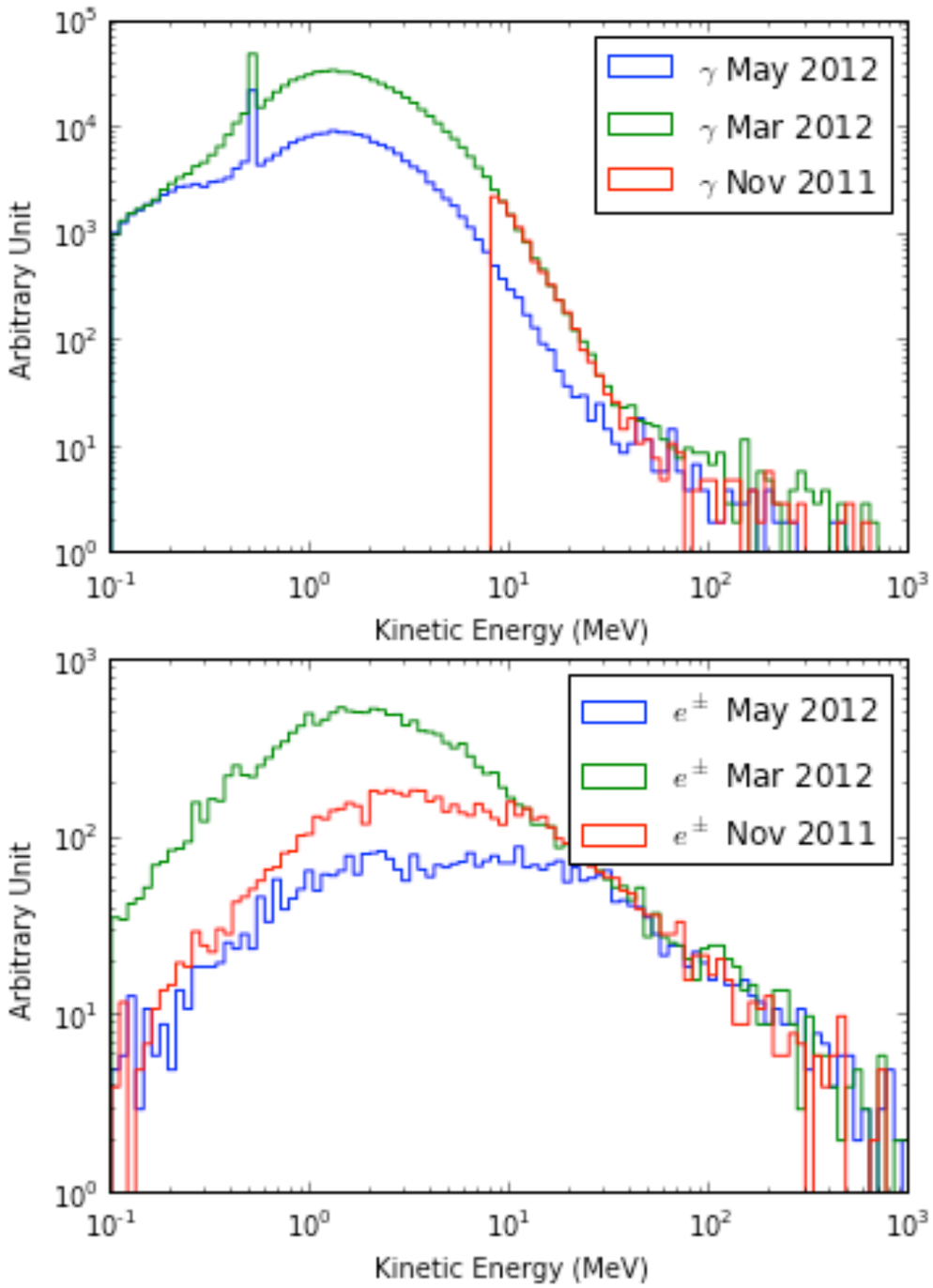
- Particles boundaries (photons and electrons/positrons)

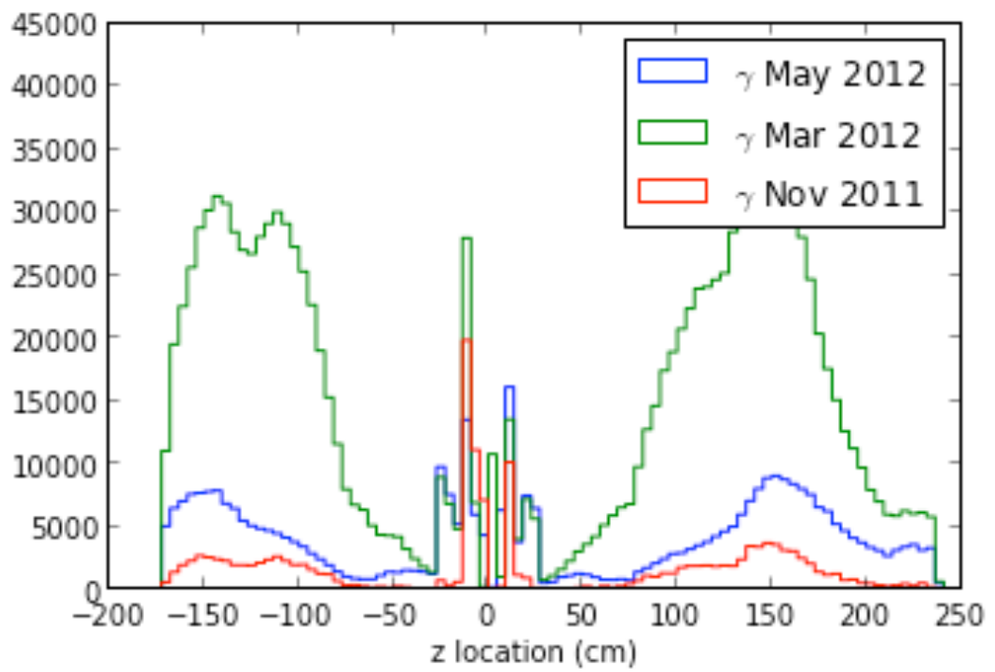


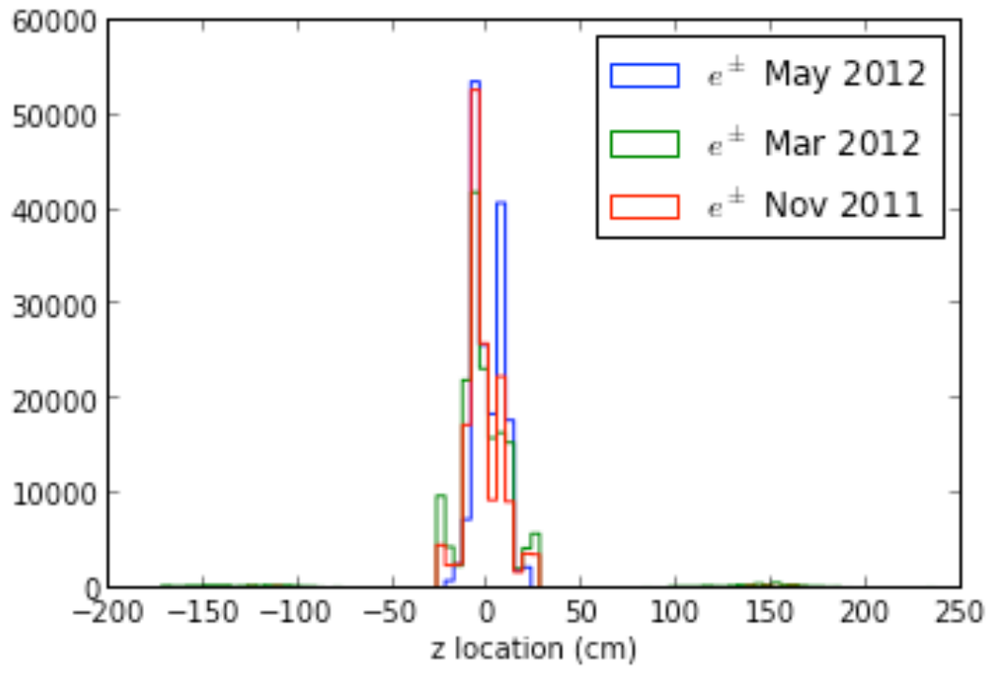
Energy spectra

20,000 beam crossings

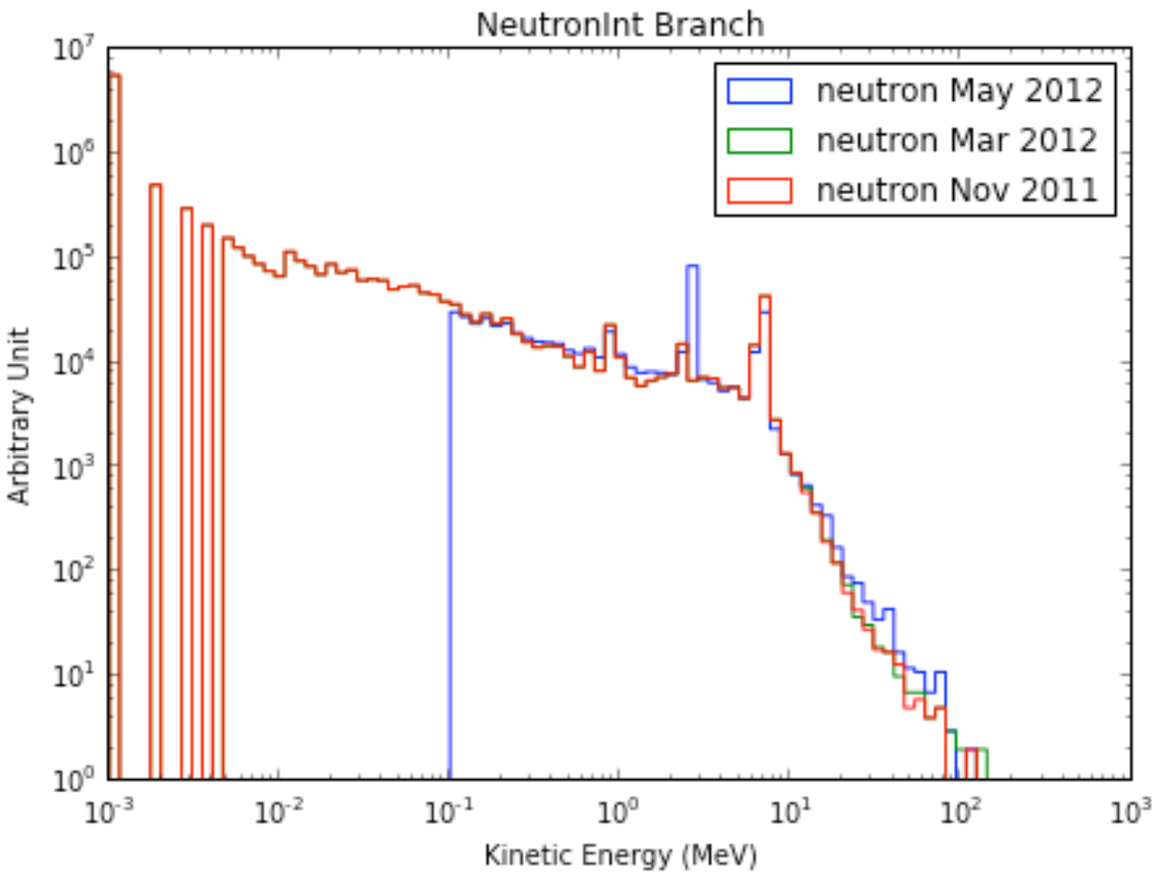
Particles Branch



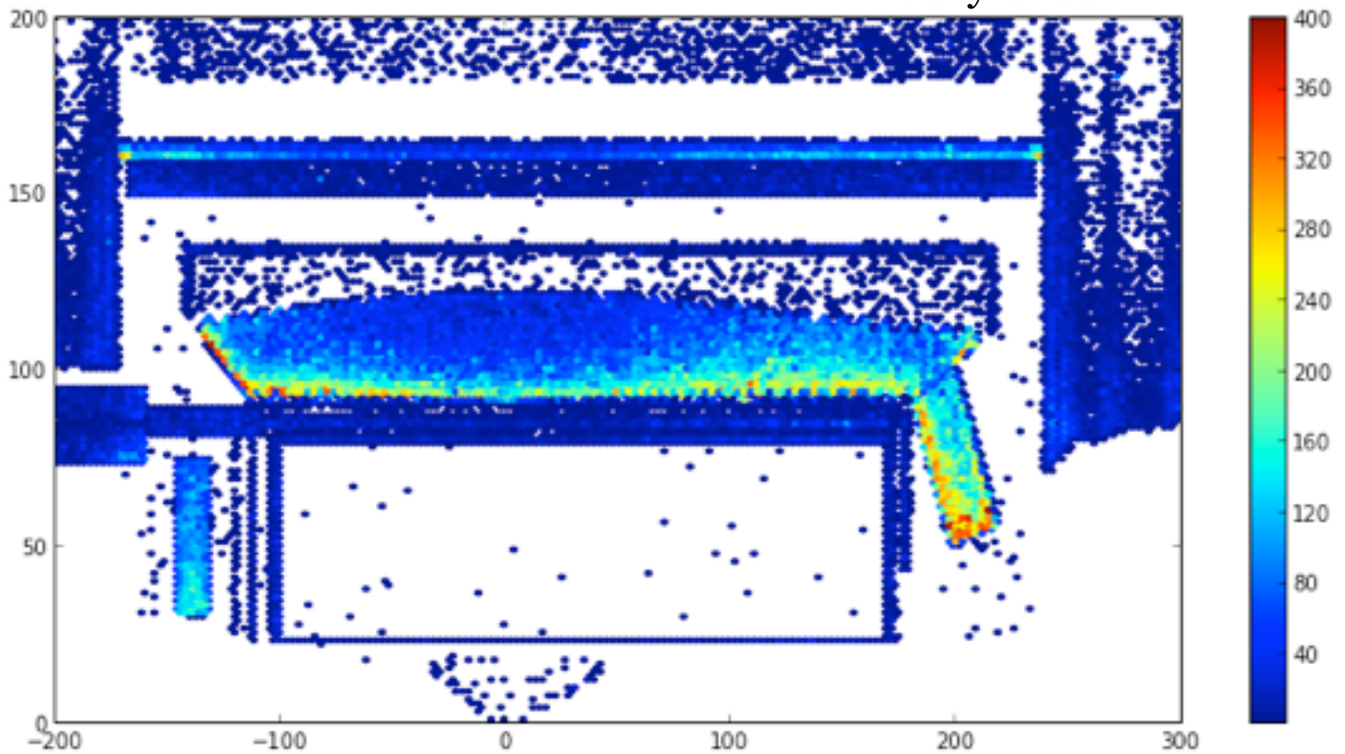




Energy spectra (NeutronInt)



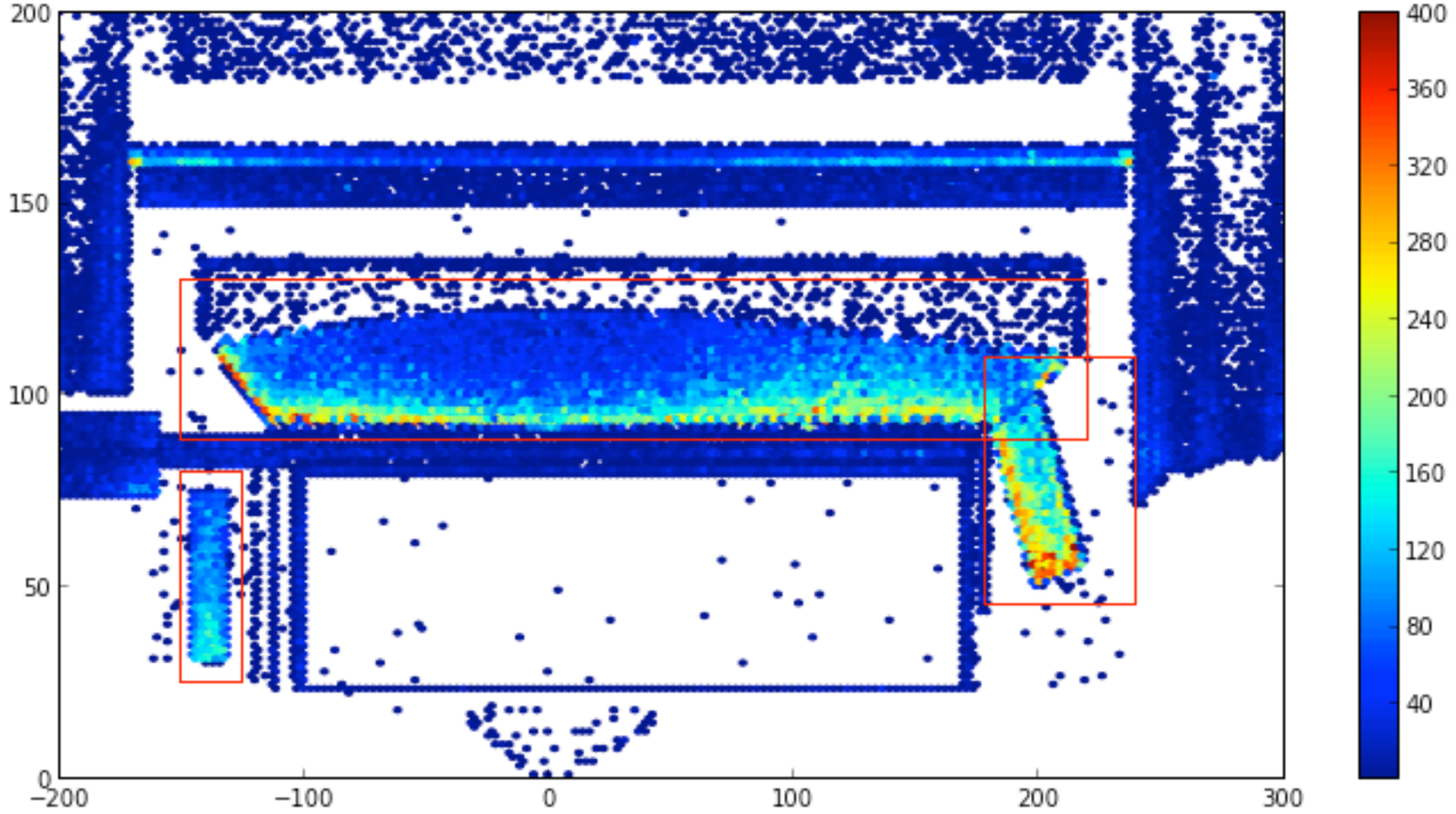
May 2012



All particles in NeutronInt, regardless whether they are in EMC or not.
Spectra very similar.

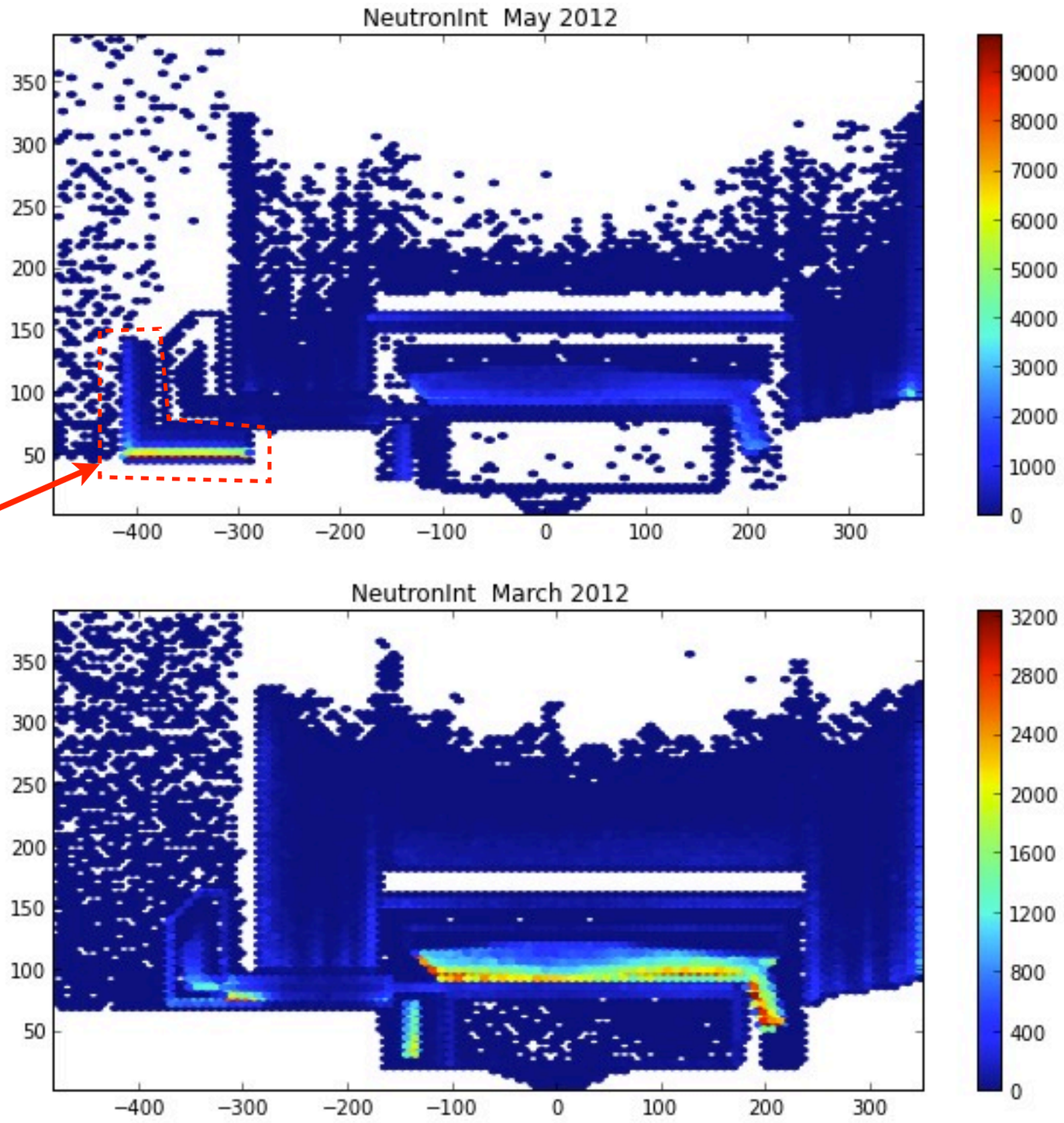
BG frame bug

- A bug in background frame production due to re-configuration of detector elements geometry hierarchy was found very late in the game. The code `TParticle::GetSecondMother()` used to identify the detector element that interacted with neutrons is no longer valid. So FastSim saw no neutron interactions.
- A temporary patch was added last week to identify EMC by neutron interaction location.



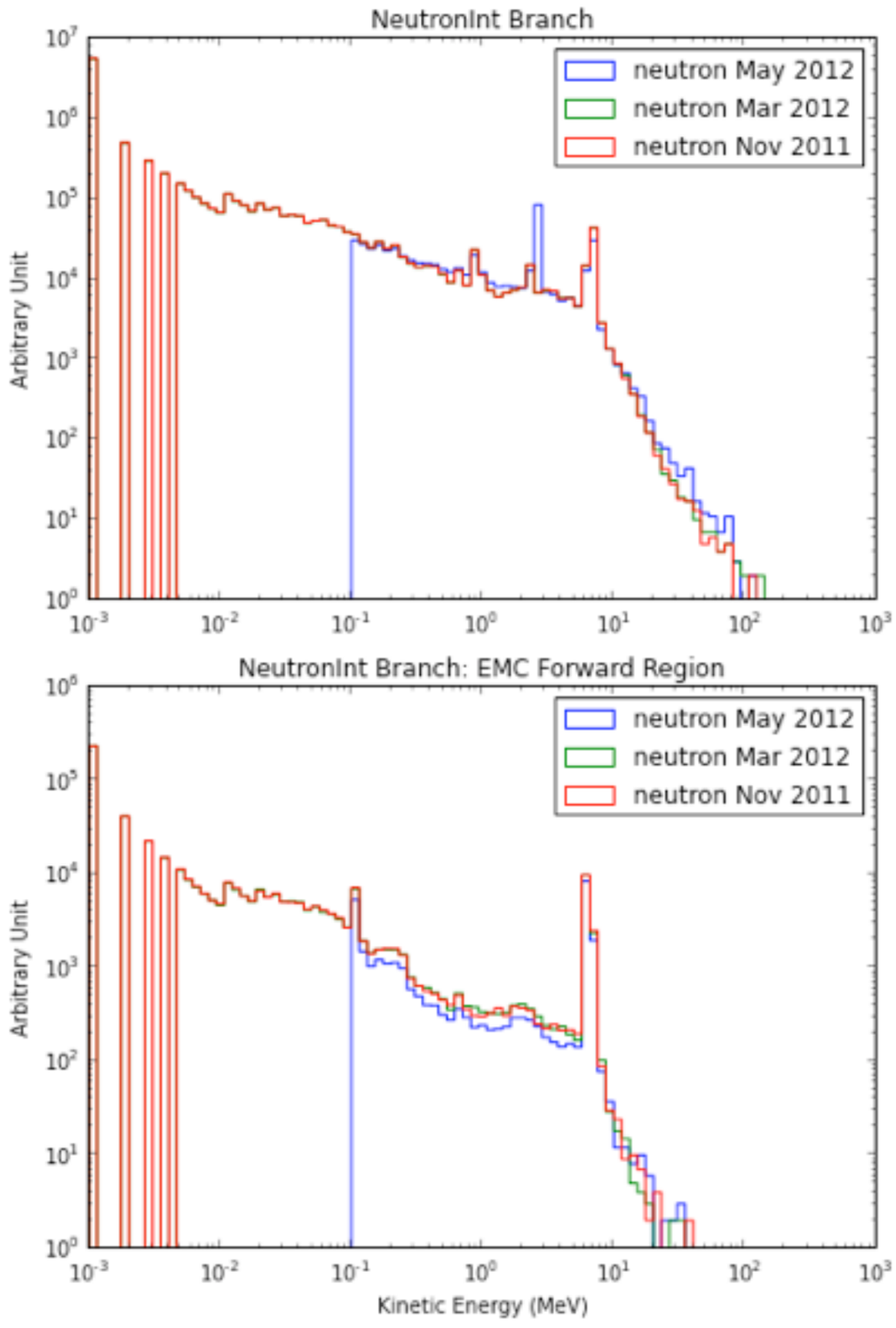
NeutronInt: March and May

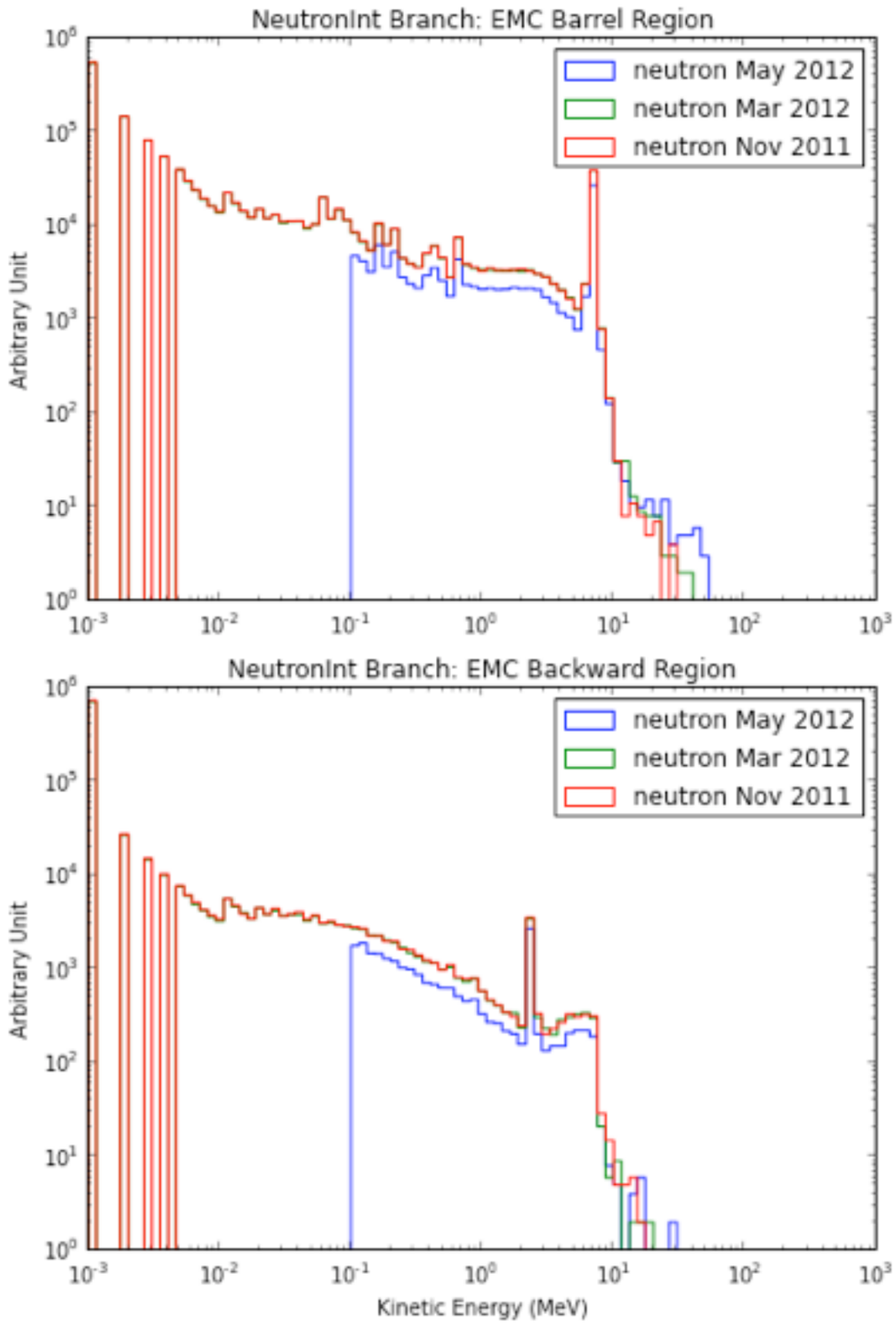
Dirc shielding: Boron-enriched polyethylene, lead, steel



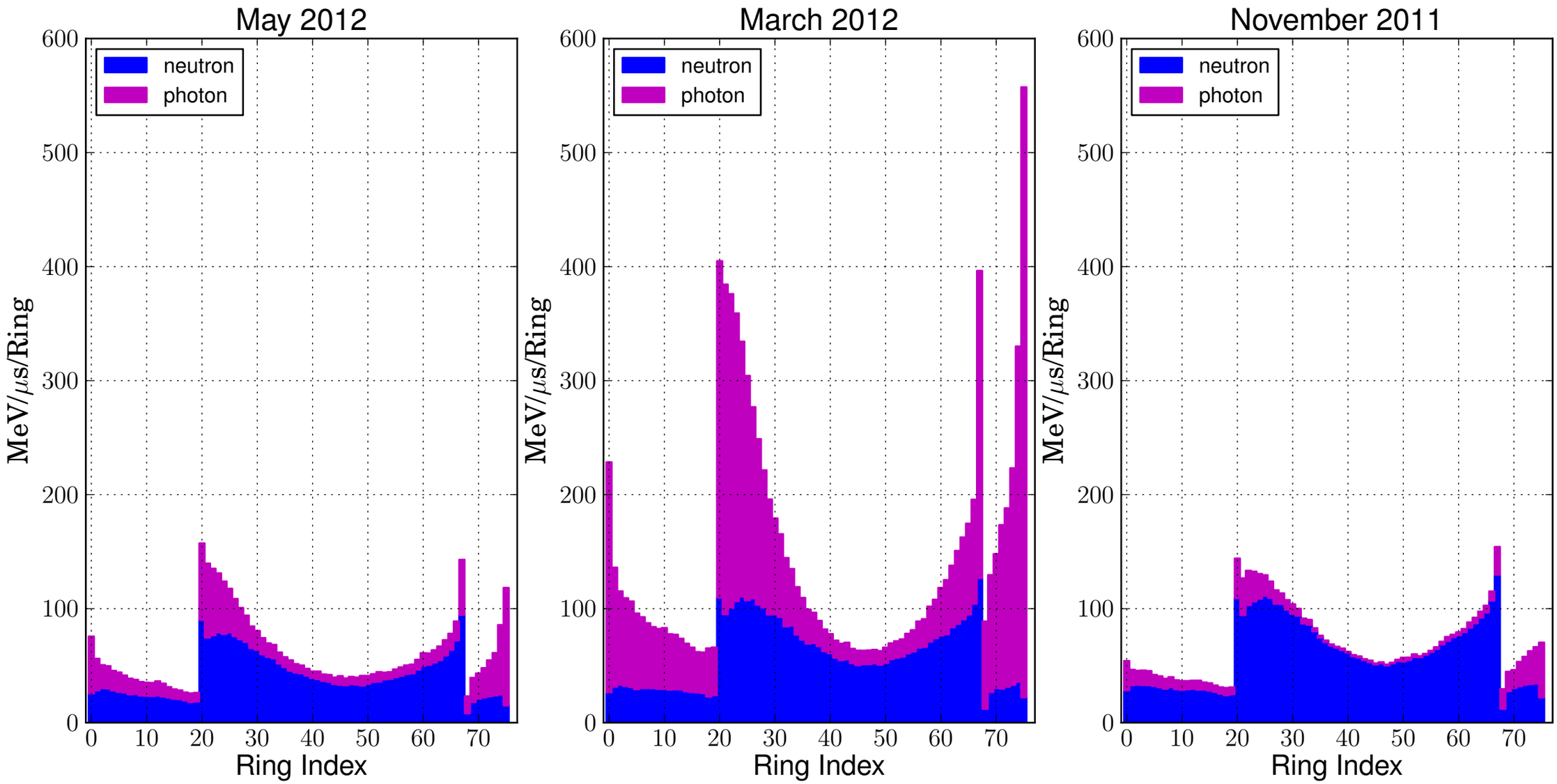
March 2012 picture has lots more entries because of lower kinetic energy cut. But the energy-weighted (color bar scale) should be comparable.

NeutronInt spectra in EMC

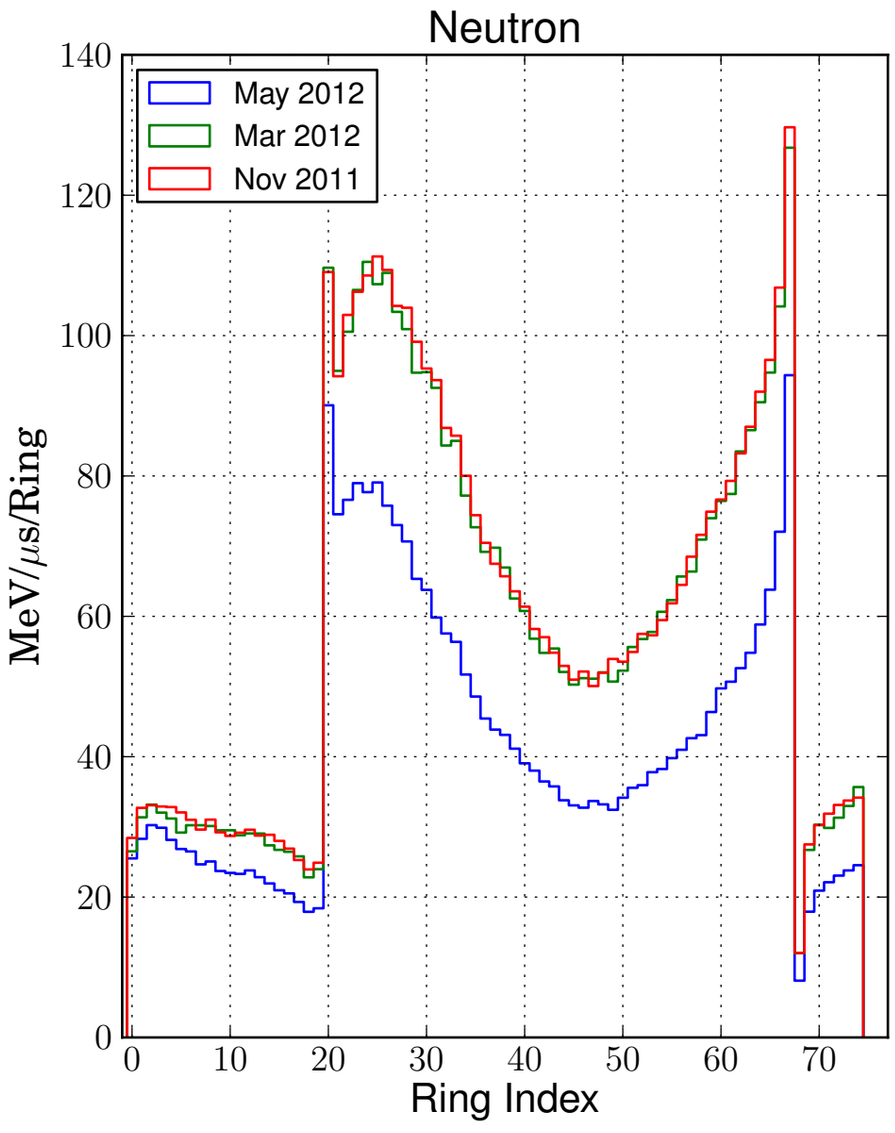


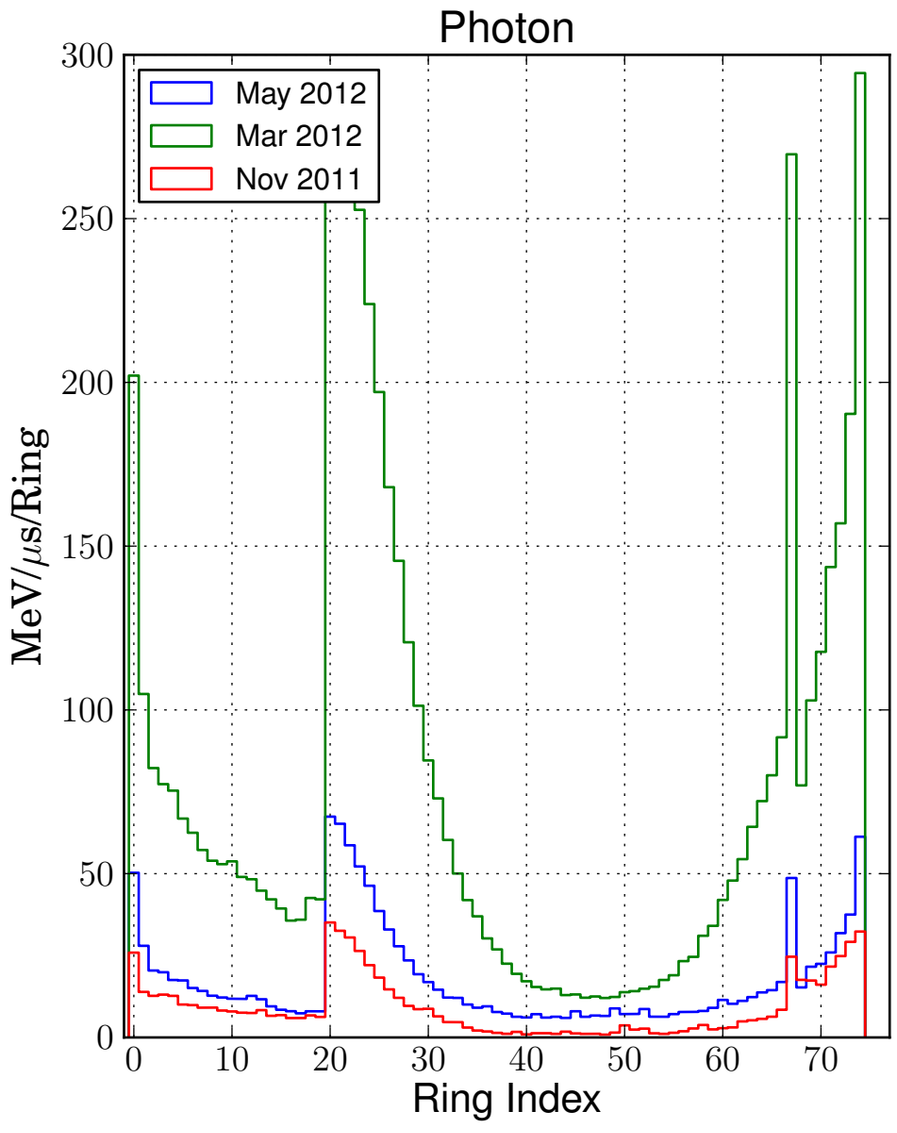


Energy flux per ring



Energy flux per ring



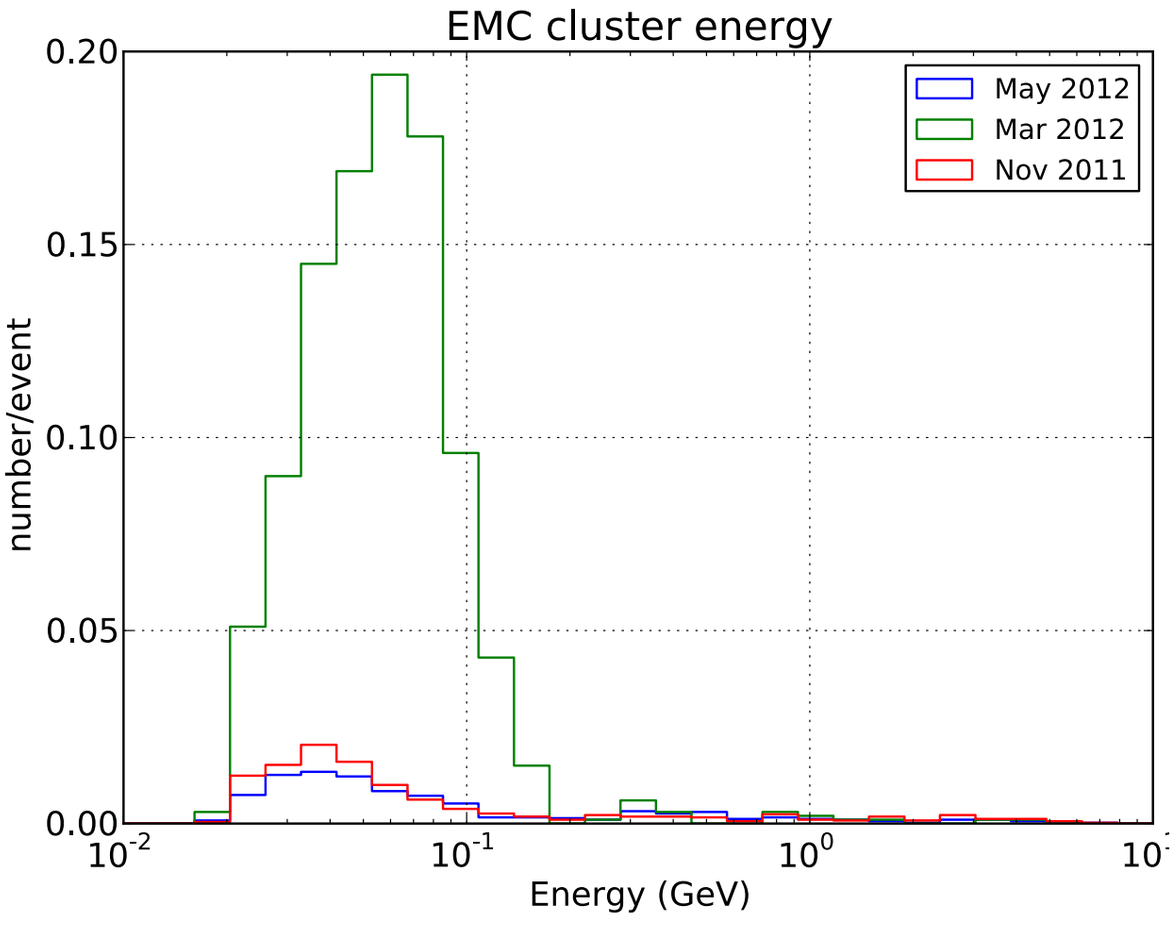


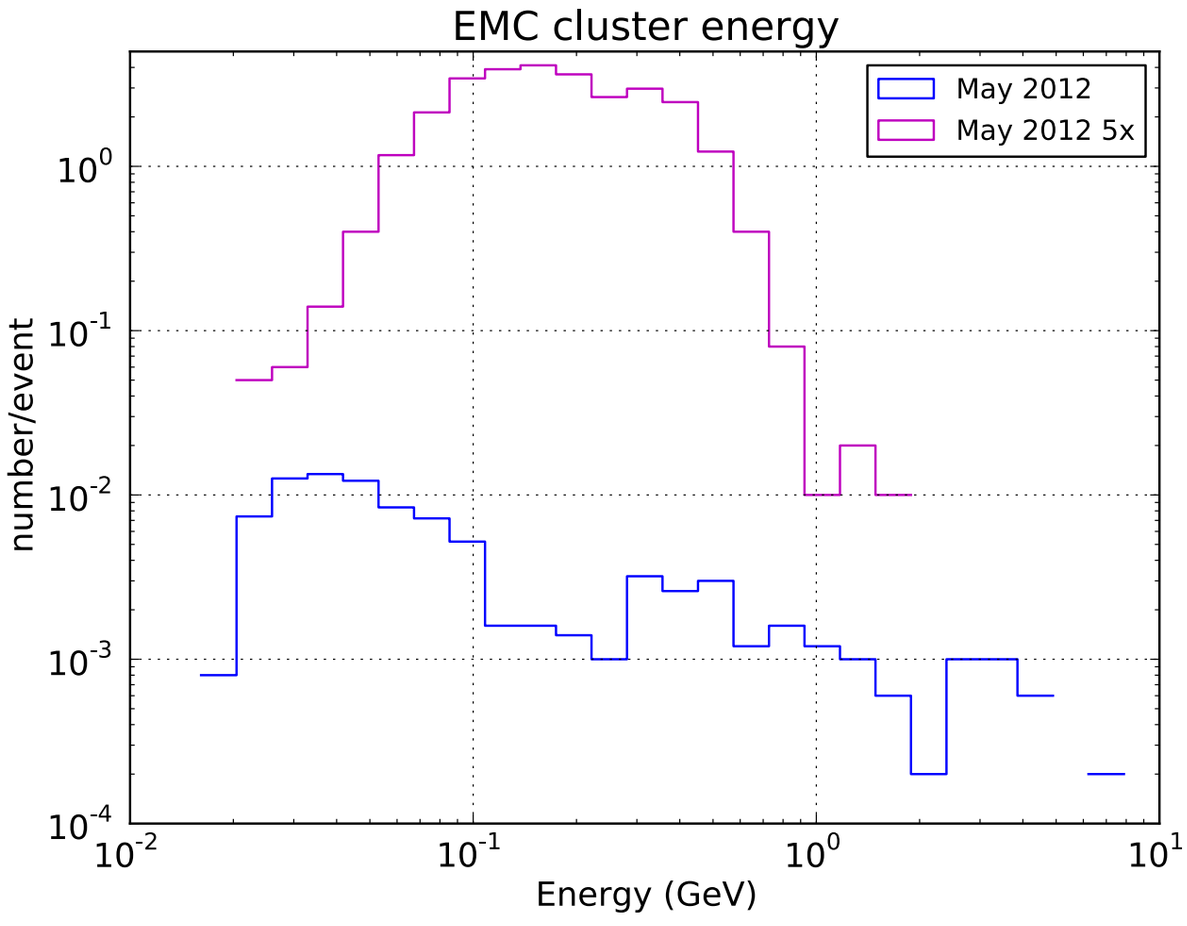
Neutron energy flux reduced by 20% –30% with new shielding

Photon energy flux reduced by ~4x with new shielding

Extra reconstructed clusters

- Shoot neutrinos; count EMC clusters. There is less than 1 cluster (above 20 MeV) per event at nominal bkg, but more than 100x higher at 5x background.



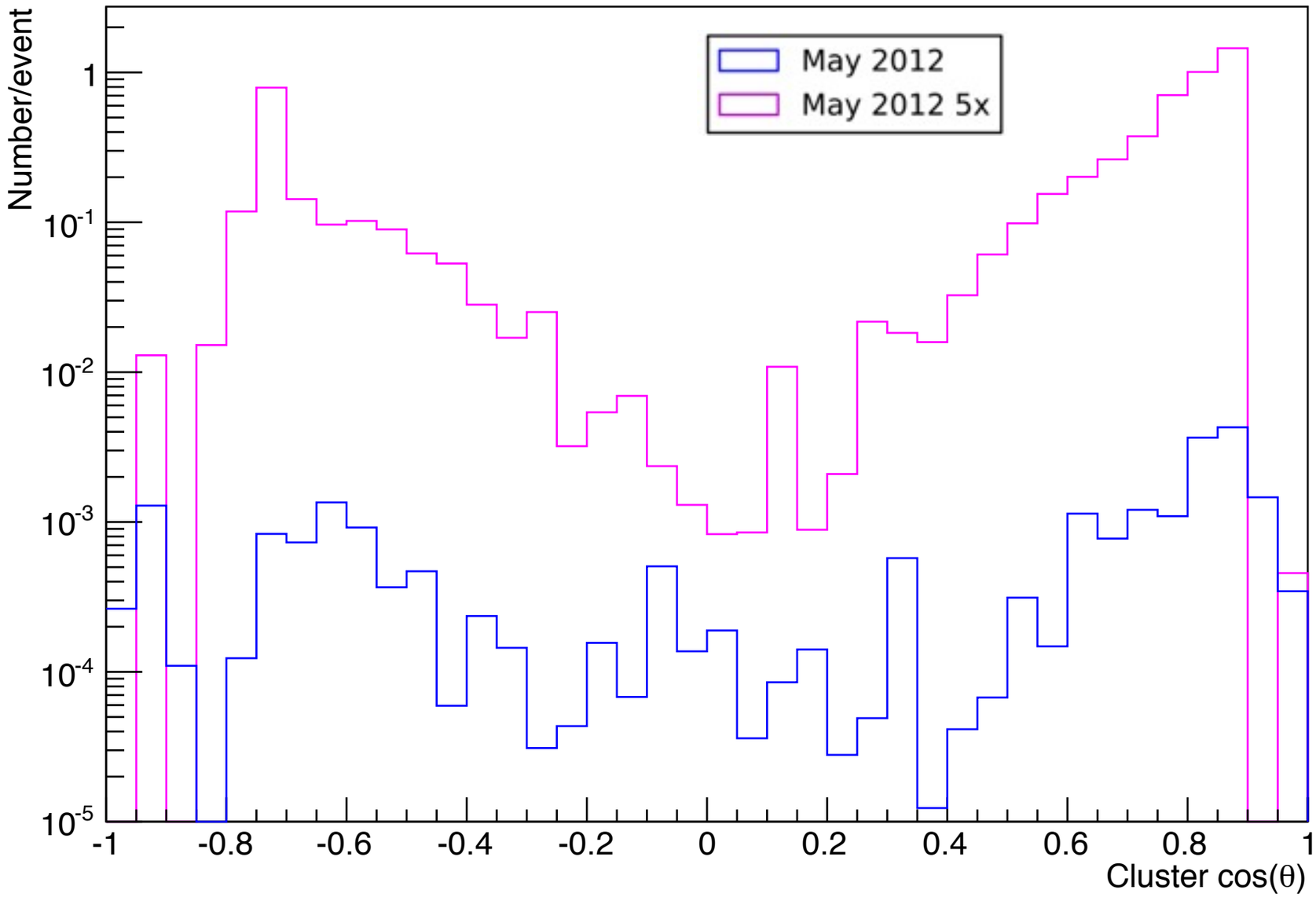


Pulse model: PacEmc/preamp-models/LYSO-140u-100n-Luigi.txt,
PacEmc/preamp-models/CsI-140u-300n-Luigi.txt,

Sensitive window set at 6 micro seconds (>25k background particles are included per event). Signal window is ±120 ns for barrel and ±25 ns for forward.

Extra reconstructed clusters

- Polar angle



Summary

- Both photon and neutron energy cuts are set at 0.1 MeV.
- New shielding reduced photon energy flux by ~4x; neutron flux by ~30% in barrel, and ~20% in forward.
- Background clusters that pass physics selection (>20MeV) are rare at nominal background (<<1 per event), but grows non-linearly at higher background; more than 2 orders of magnitude at 5x background.