Performance studies with FastSim and new shielding

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IV SuperB Collaboration Meeting – Isola d'Elba

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Outline

- Barrel + FWD LYSO studies
  - samples and config
  - different bkg scenarions in FastSim
  - FastSim/FullSim comparison

- Conclusions and To-Do-List

(almost a list of thinks to be investigated and understood)

Samples and config

- FastSim release V0.3.1 with latest patches from Daniel and Chih-hsiang
  - BaBar barrel, lookup table : CsI-140u-300n-Luigi.txt
  - LYSO FWD, lookup table : LYSO-140u-100n-Luigi.txt

- single-γ samples: $\cos\theta \in [-0.805, 0.965]$, $E_{gen} = \{0.03, 0.1, 0.25, 0.5, 0.8, 1., 2.\}$ GeV

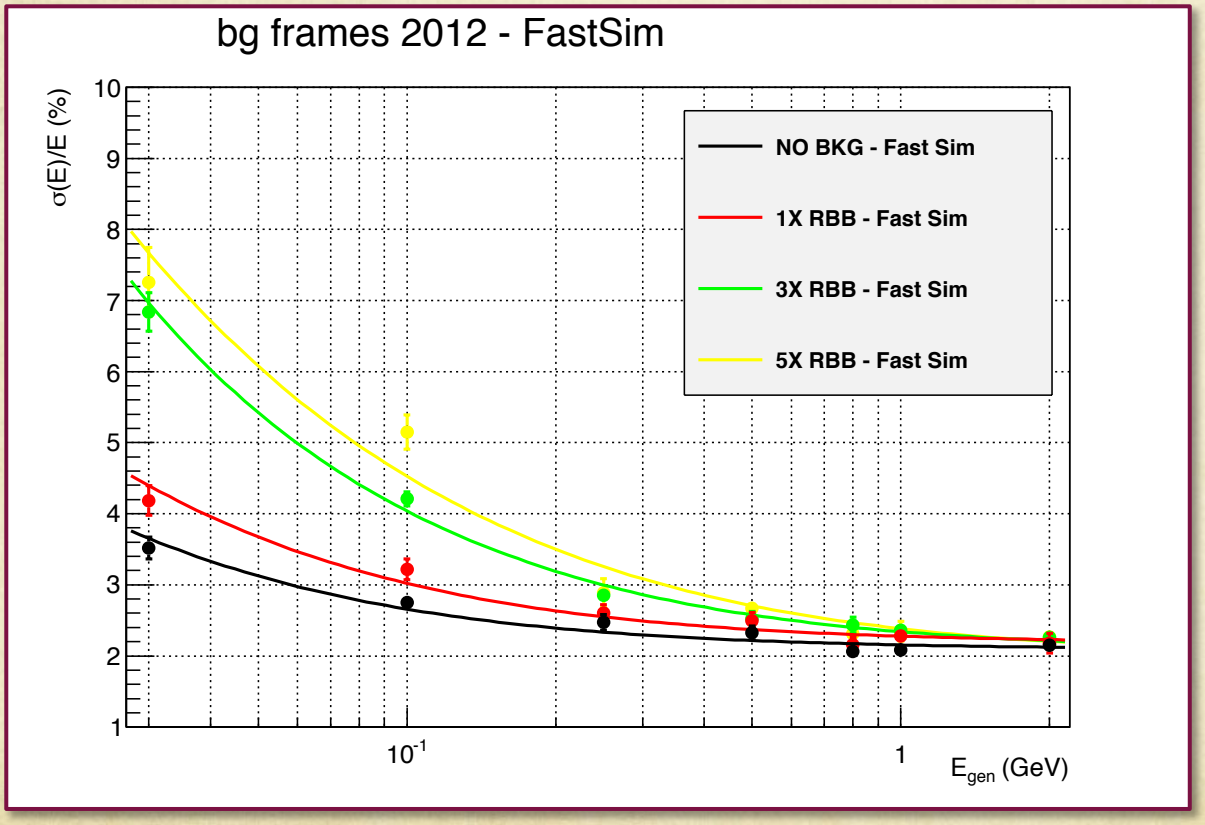
- bg-frames from may2012 and nov2011 productions (RadBhabha+RadBhabhaNeutrons)

- bkg configs:
  - no bkg
  - 1x bkg (may2012 prod)
  - 3x bkg (may2012 prod)
  - 5x bkg (may2012 prod)
  - 1xbkg_nov11 (nov2011 prod)

Remarks on bg-frames

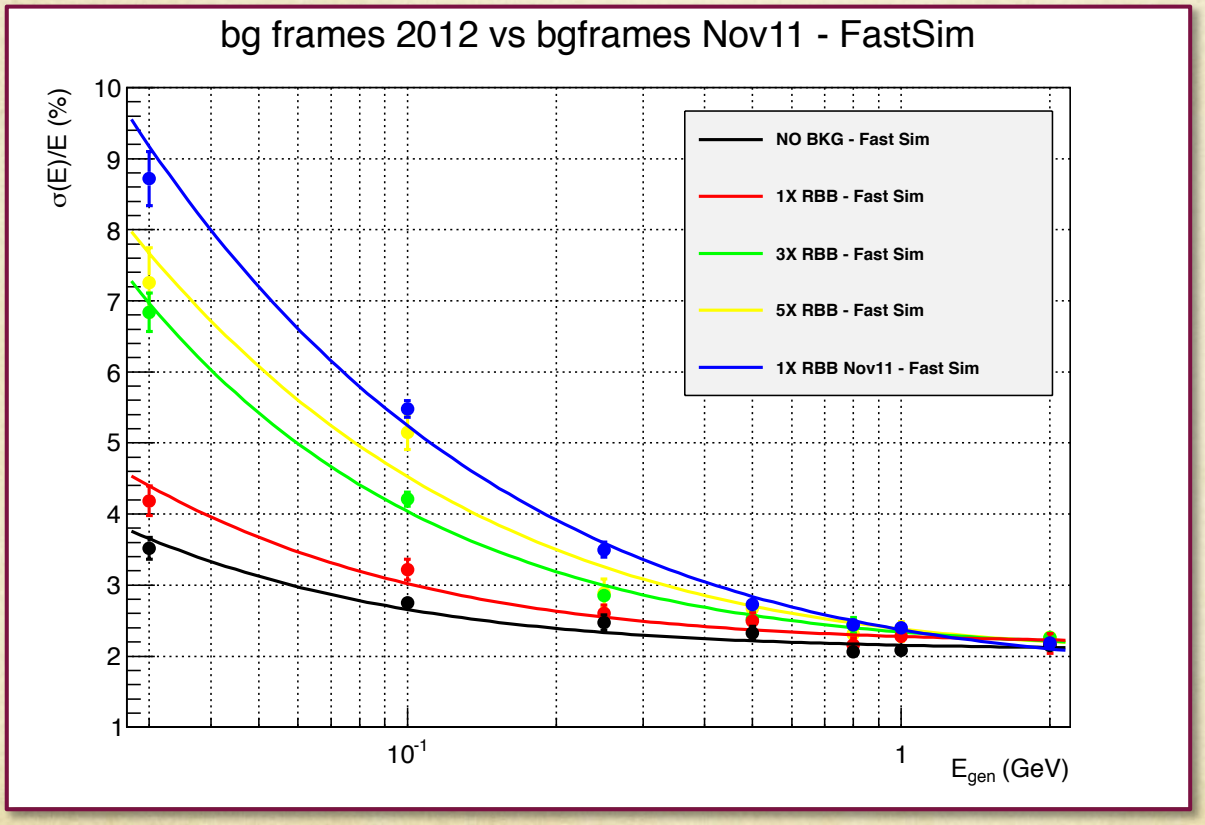
- May2012 frames produced right before this meeting
- Changes wrt Nov2011 production:
  - new shielding (from 3 cm to 4.5 cm) – FullSim side → lower bkg expected
  - lowered threshold for minimum energy of bg-frame particles to be propagated in FastSim (from 8 MeV to 0.1 MeV) – FastSim side → higher bkg expected
- NB : new FullSim geometry → mismatch with FastSim code which needed to be patched in order to correctly include neutron contributions; done few days ago right after the end of the production

FastSim: resolution vs machine bkg (I)



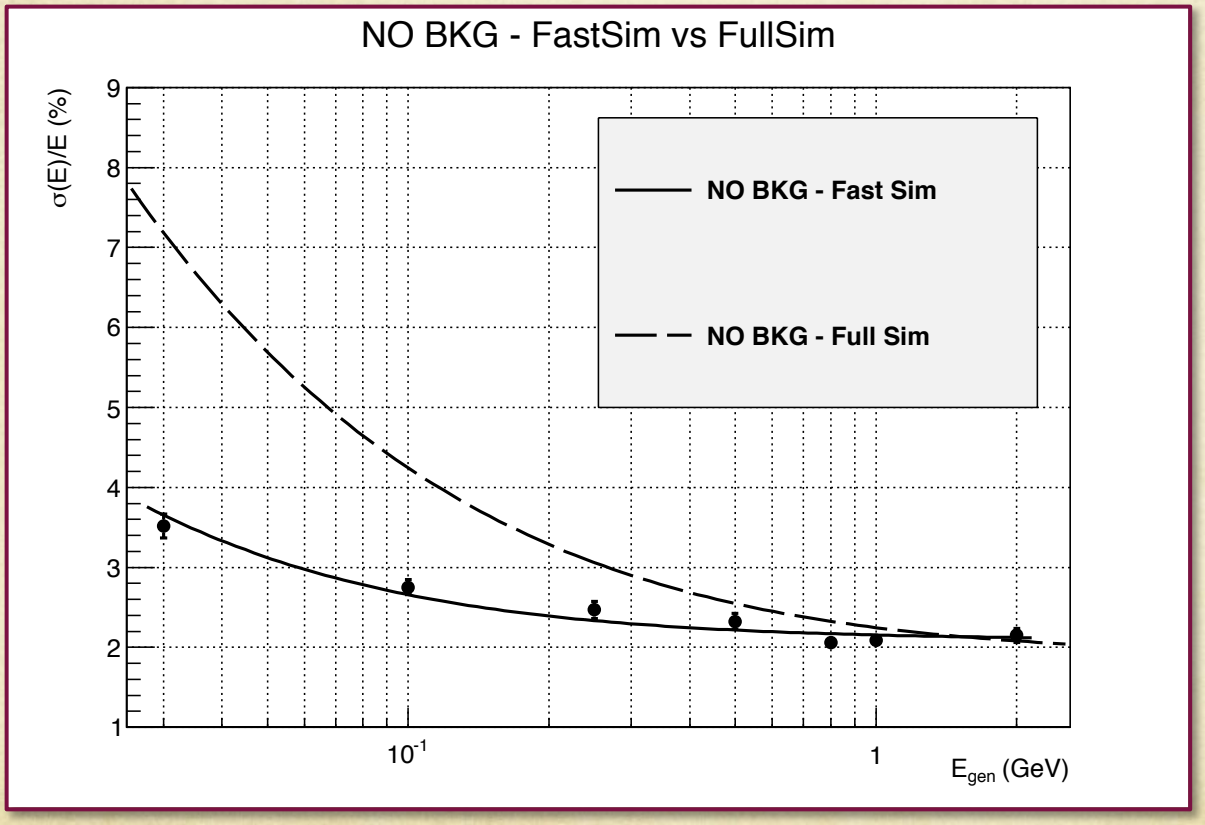
- resolution scaling with machine bkg
- may 2012 production

FastSim: resolution vs machine bkg (II)



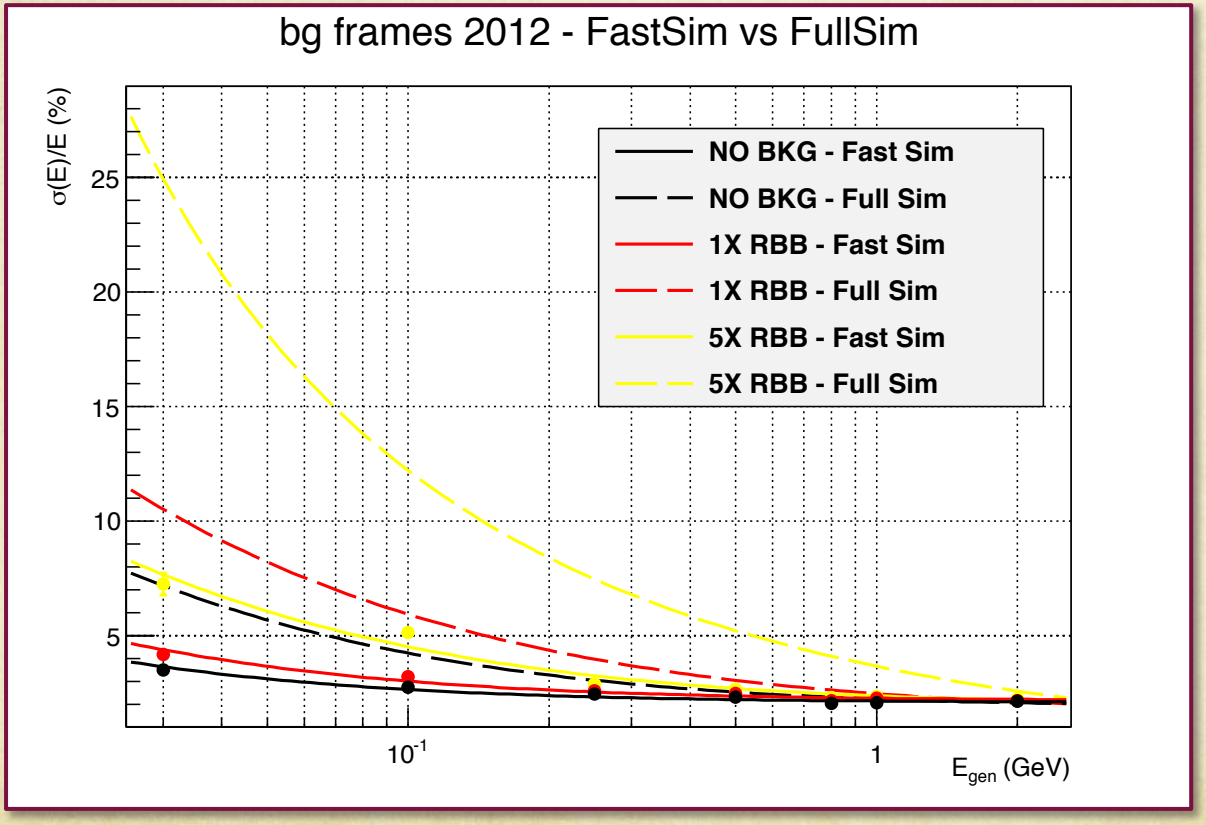
- resolution scaling with machine bkg
- may2012 production vs nov2011 production
- 5x may 2012 looks better than 1x nov2011

FastSim vs FullSim: resolution (I)



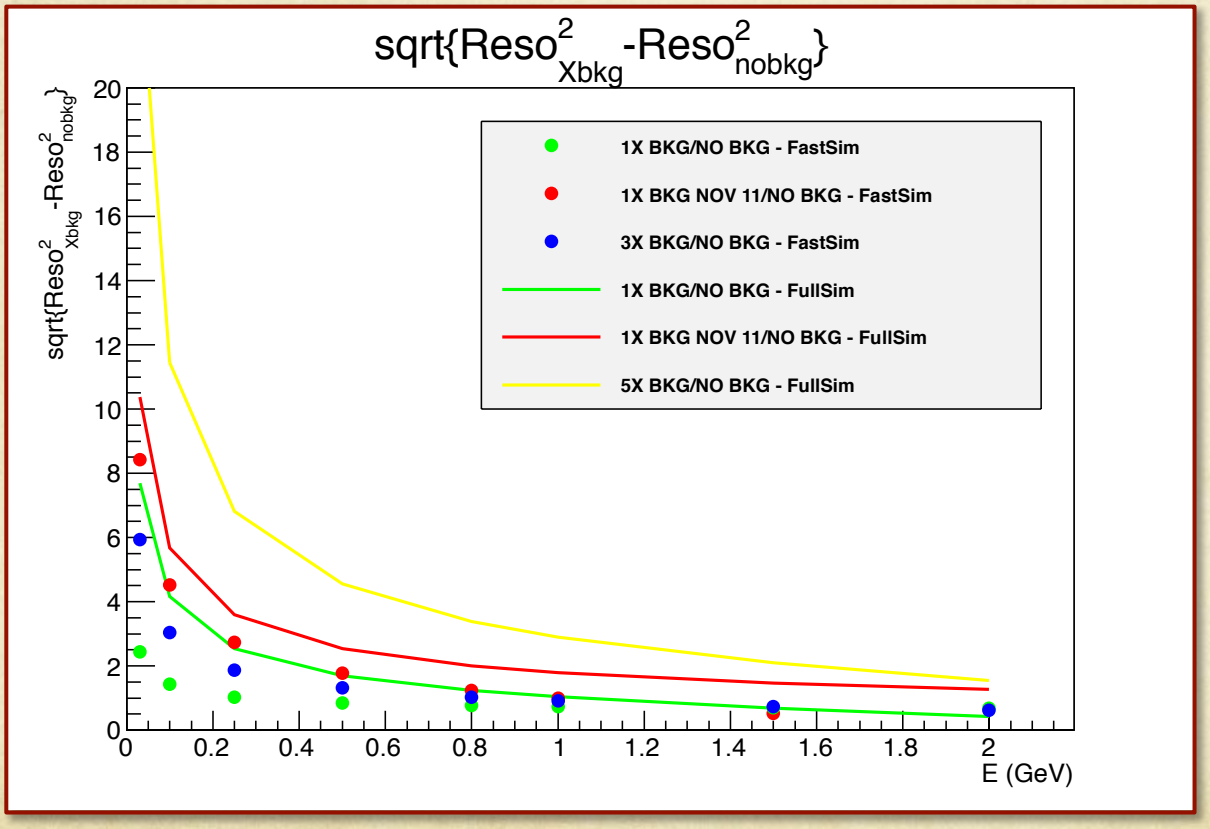
- no machine bkg
- Fast vs Full
- Fast reso better than Full one (which reproduce BaBar barrel performances)
- FastSim reso parameterization needs to be improved

FastSim vs FullSim: resolution (II)



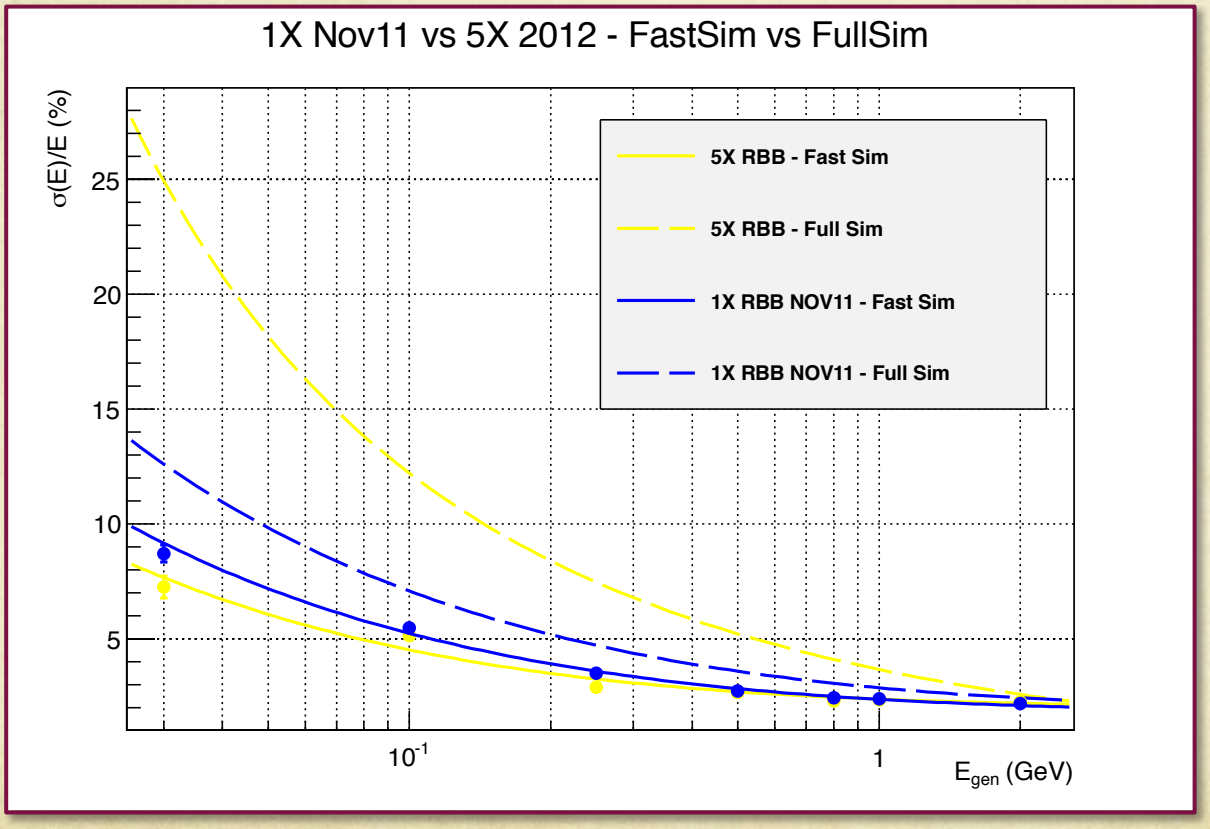
- Fast vs Full
- several bkg scenarios
- may2012 background production
- starting point (NO BKG) is different: is it the only source of disagreement?

FastSim vs FullSim: resolution (III)



- difference in quadrature between NO BKG and X BKG resolutions
- disentangle BKG effect and NO BKG reso parameterization
- Fast and Full show different trends

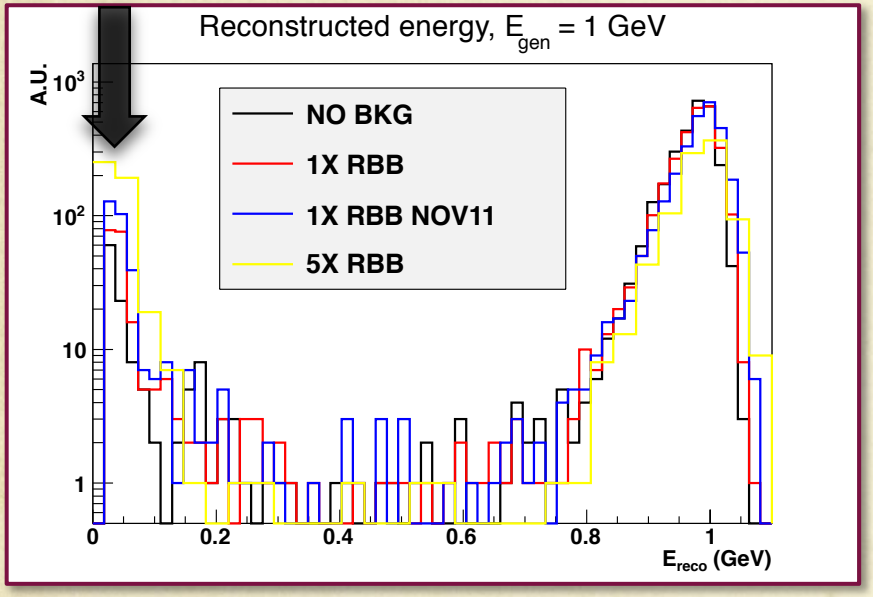
FastSim vs FullSim: resolution (IV)

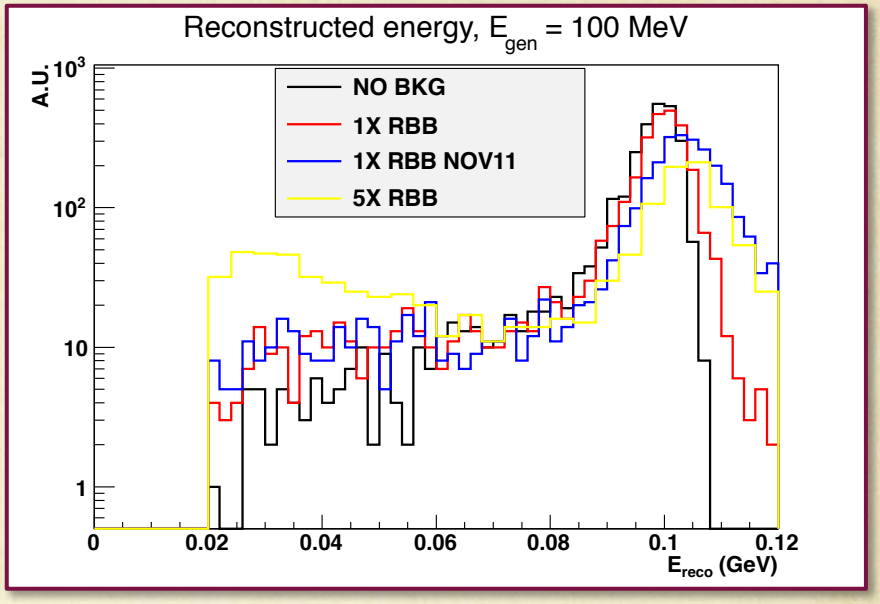


- compare 5X may2012 and 1X nov2011 (same FastSim code used for the two productions)
- Fast vs Full
- Fast and Full show different trends: treatment of bg frames needs to be investigated

Reconstructed energy

FastSim

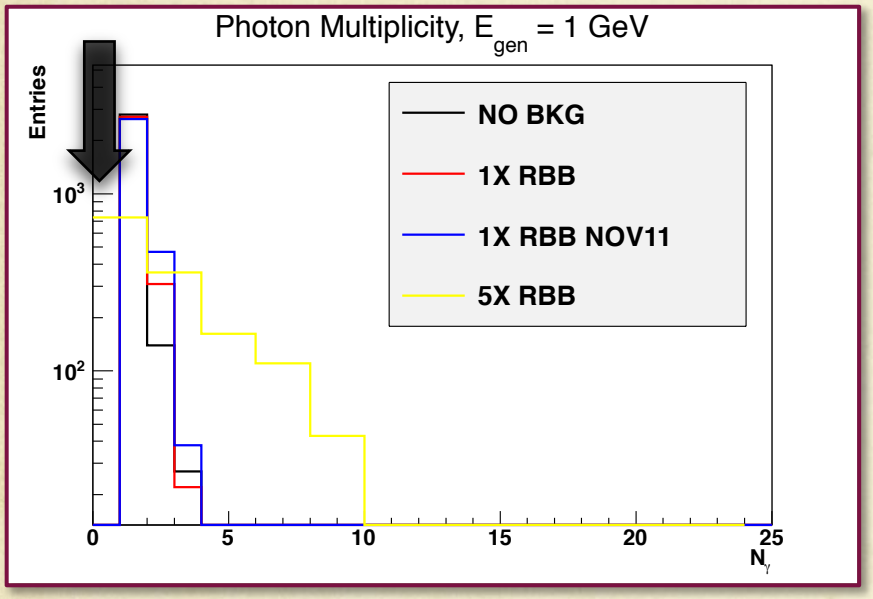


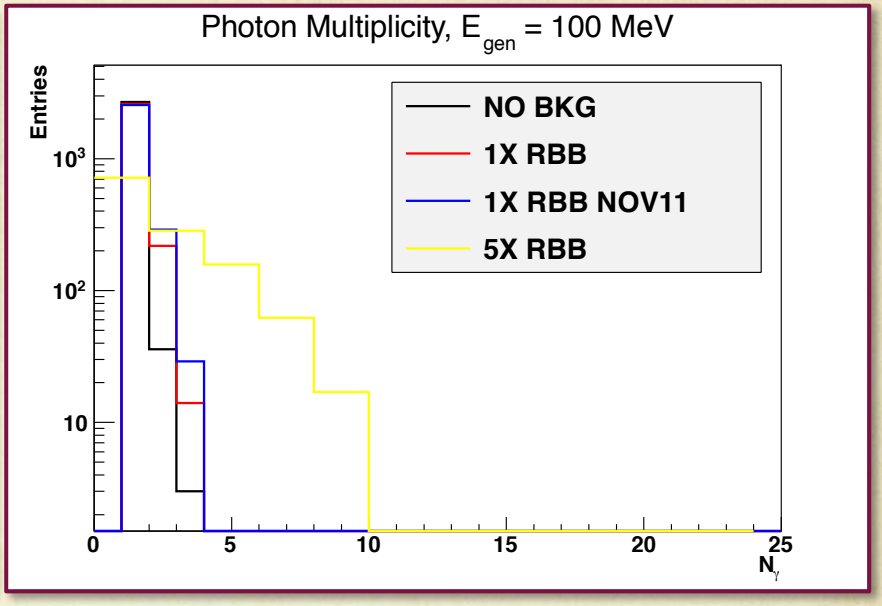


- 5X has higher tails in the low energy region, far from the main peak position, which are not accounted for in resolution estimations

Reco Gamma multiplicity

FastSim

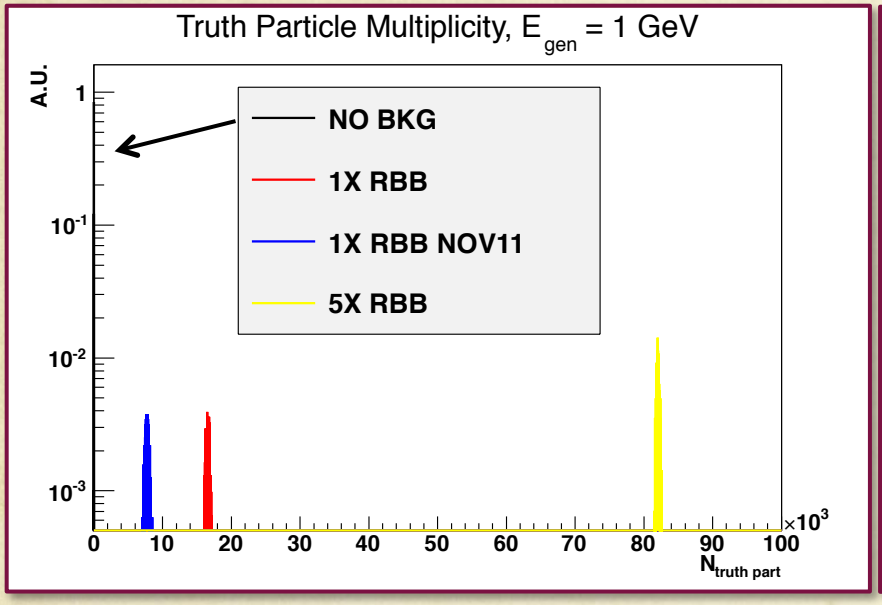


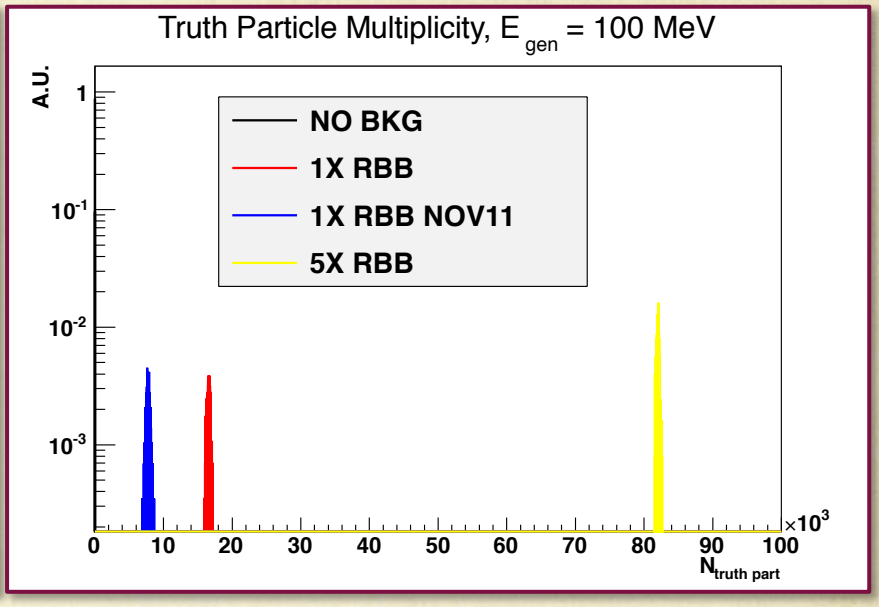


- gamma multiplicity trend almost as expected
- events with 0 reco gamma in 5X config?

MC candidates multiplicity

FastSim





- most of them are gamma
- 1X may2012 has higher MC multiplicity wrt 1X nov2011 (in opposition to the resolution trends)

Conclusions and To-do-list

- Resolution studies with new bg-frames performed
- 2 main issues to be addressed
  - FastSim resolution parameterization (agreement between FastSim and FullSim resolution needed)
  - understanding of new bg-frames wrt to Nov11 production and FullSim results
- Next steps
  - Repeat single particle studies for different FWD options
  - evaluate impact of bkg on physics performances (π^0 reconstruction, B_{reco} efficiency, E_{extra} in $B \to K^{(*)}\nu\nu$)