Testing hps-sim

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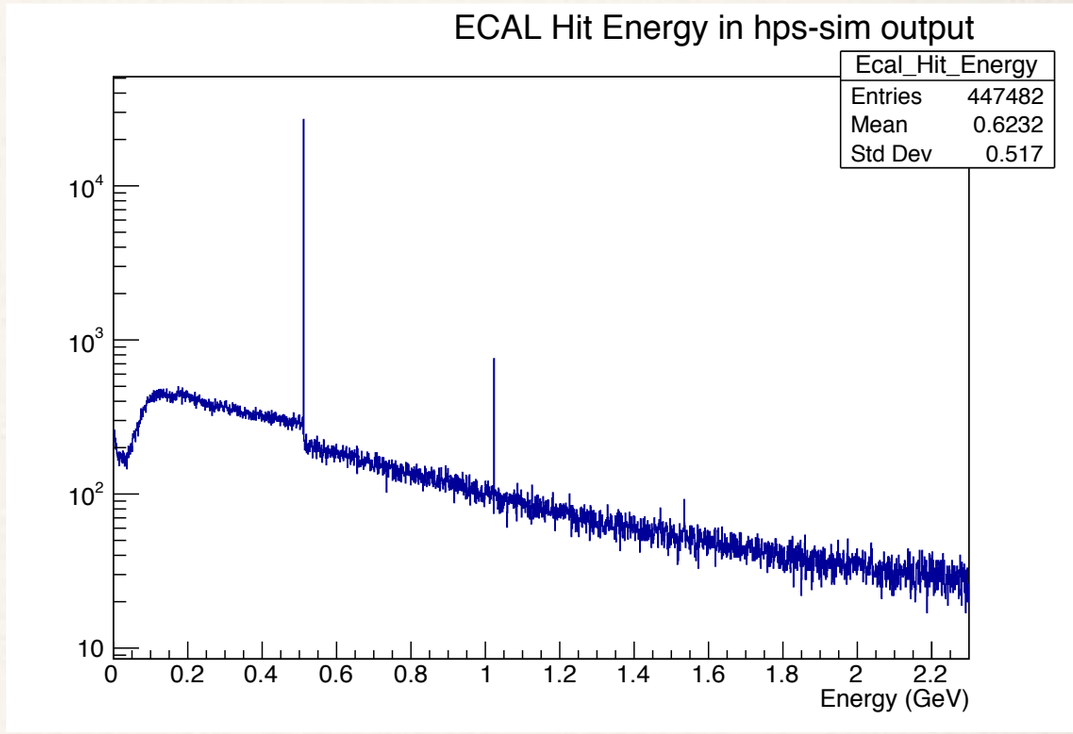
Simple test of hps-sim

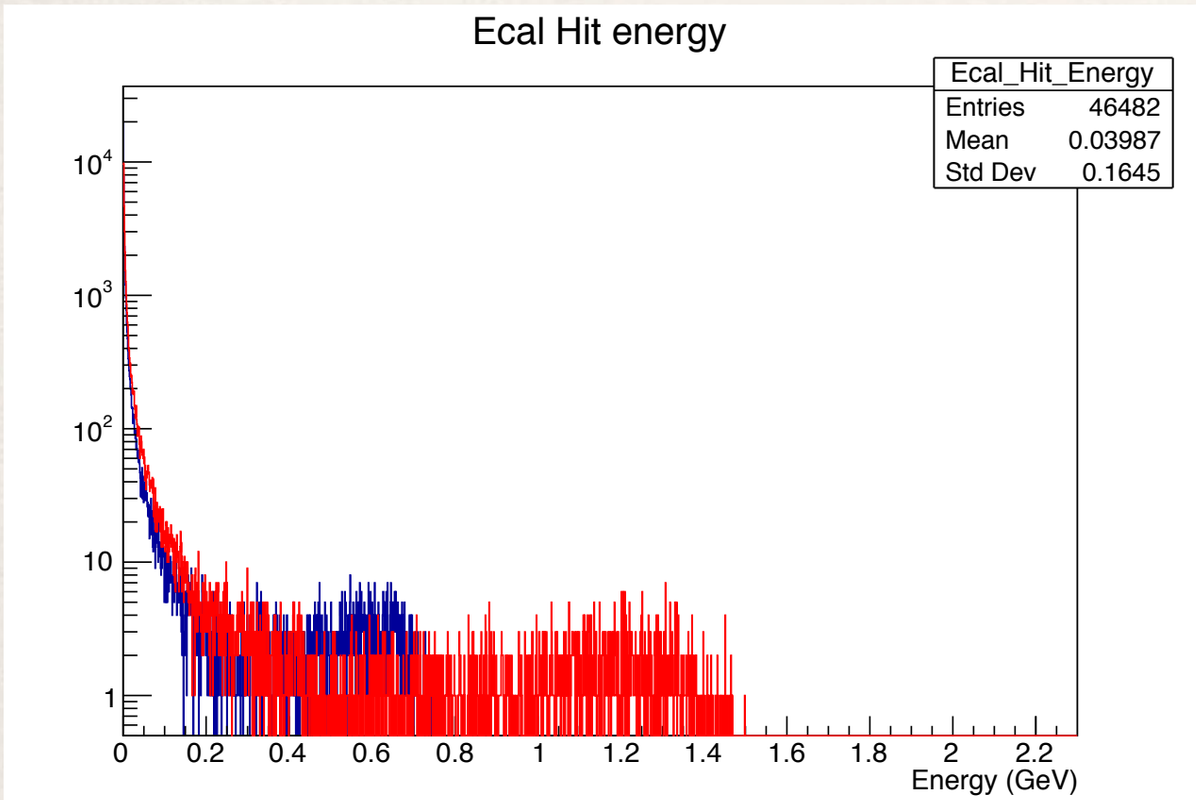
Simple comparison of SLIC and hps-sim output:

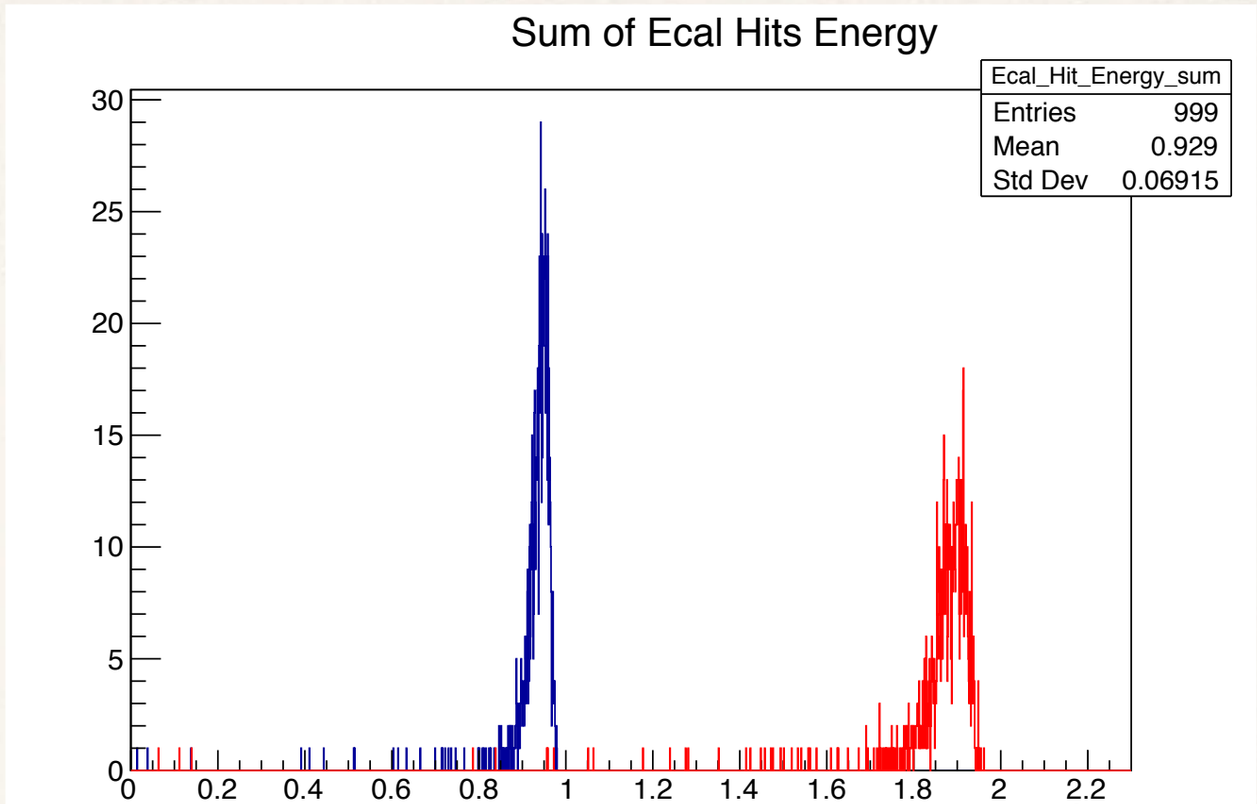
- Create an stdhep file with 10000 events, each event has only one electron, 1 GeV, θ=30mrad, $\phi=\pi/2$
- Run file through SLIC and hps-sim.
- Directly compare the output of hits.

- First conclusion:
  - ECal hit scale is off, MeV instead of GeV
  - Fixed by scaling to GeV in hps-sim code.



Simple Test initial comparison.



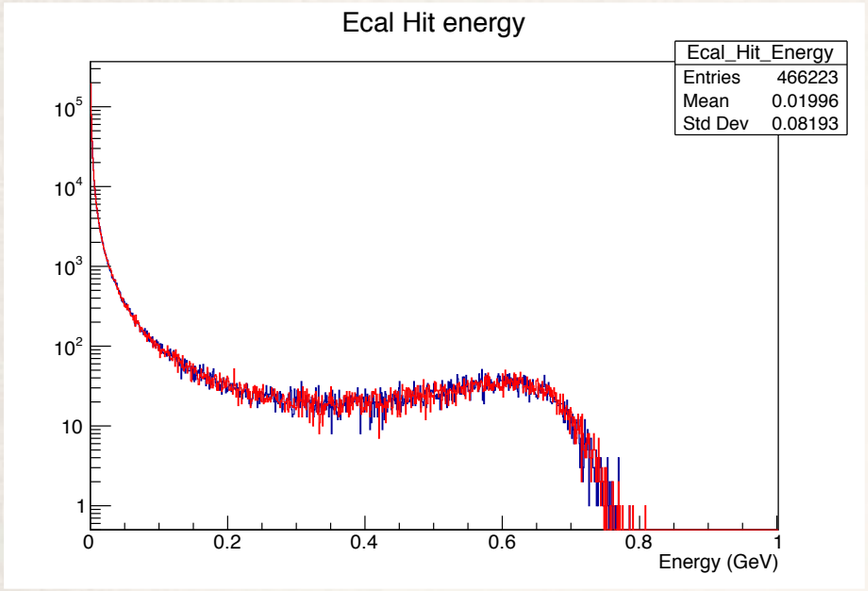


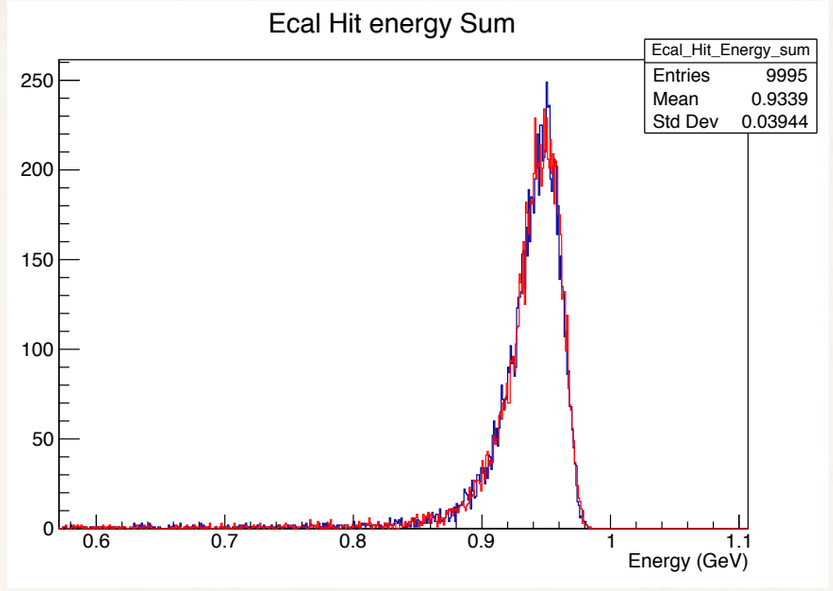
The energy for each individual hit was added twice, once directly and again by adding each of the contributing MCParticles to the hit. The LCIO SimCalorimeterHitImpl class adds the energy of each added MCParticle to the total of the hit.

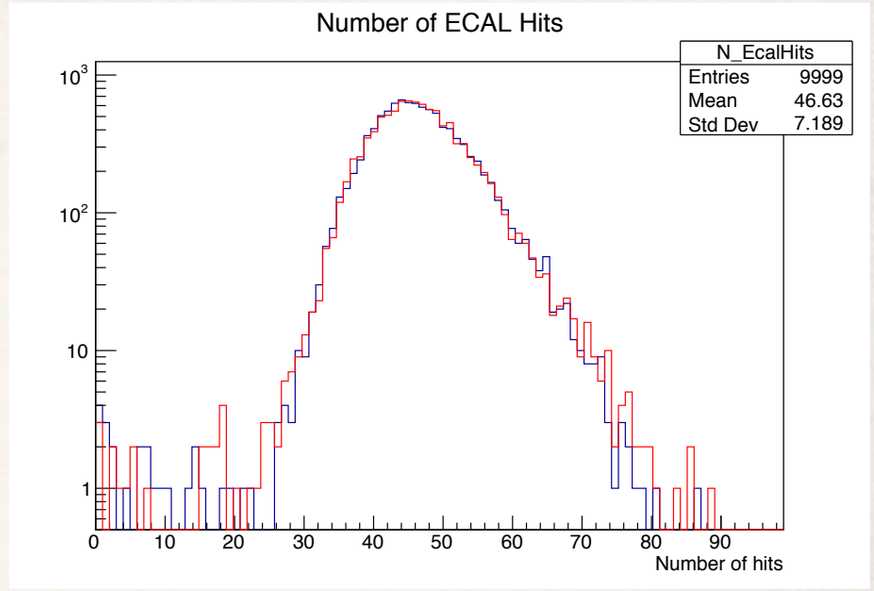
Code detail: LcioPersistencyManager.h around line 477:

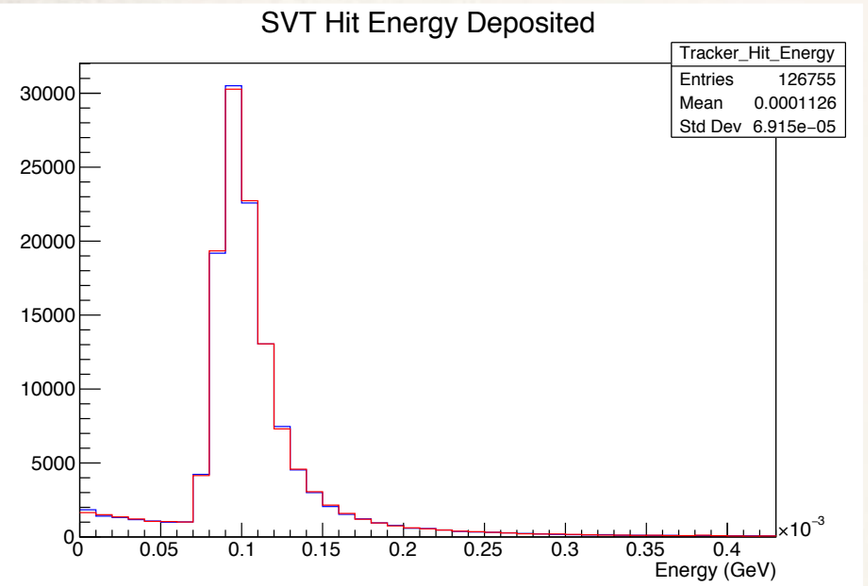
```
simCalHit->setEnergy(calHit->getEdep()/GeV);  // This line must be commented out!
…
for (auto contrib : contribs) {
…
simCalHit->addMCParticleContribution(static_cast<EVENT::MCParticle*>(mcp), (float)edep, (float)hitTime, (int)pdg, (float*)contribPos);
```

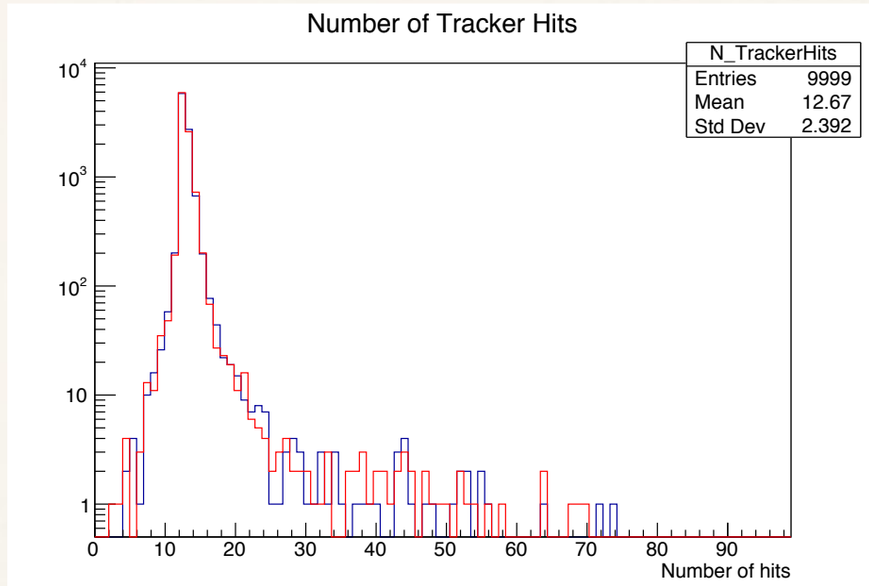
Simple Comparison after fix:











Blue: SLIC output
Red: hps-sim output

- After commenting out the first energy addition, the distributions are identical

Further comparison

- Space the output by 500 events.
- Run readout: Single0 triggers.
- Run reconstruction.
- Commands:

java -cp $HPSJAVA org.hps.util.FilterMCBunches slic_electrons.slcio slic_electrons_s500.slcio -e500 -a

java -DdisableSvtAlignmentConstants -Xmx512m -jar ${HPSJAVA} -r /org/hps/steering/readout/PhysicsRun2016TrigSingles0.lcsim -i slic_electrons_s500.slcio -DoutputFile=slic_readout

java -DdisableSvtAlignmentConstants -Xmx512m -jar ${HPSJAVA} -r /org/hps/steering/recon/PhysicsRun2016FullReconMC.lcsim -i slic_readout.slcio -DoutputFile=slic_recon.slcio -r7800 -dHPS-PhysicsRun2016-Nominal-v4-4-fieldmap

- Further comparison between SLIC and hps-sim for these single electron input files got stuck:
  - Too few triggers: Modify thresholds?
  - No tracks found, at all. Must be doing something wrong.

Why hps-sim?

- The simple example of finding this error shows (to me) that the hps-sim code is *a lot* easier to understand and maintain.
  - We can modify the code without approval of the ILC community.
- The hps-sim code stores the relation of the hit and the MCParticle, and stores enough of the MCParticle tree that you can find the original particle associated with the hit.
- The hps-sim code allow the MC chain to be simplified.
  - Merge lcio files.
  - Can add additional functionality (i.e. space output already.)
- The hps-sim code allow for plug-in code that can make very specific event selection.
  - See Takashi's comments on why 😉.