

# PFA on sidloi3: update

Ron Cassell

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# Proposed changes

- Calibration
- Tracking
- Extrapolation
- Subcluster finding
- Muon finding
- Structure

# Calibration

- Modified classes:  
org.lcsim.recon.cheater.QCalibrationFrom  
Data.java,  
org.lcsim.recon.pfa.structural.FuzzyQNeut  
ralHadronClusterEnergyCalculator
- Minimal changes to use  
CalorimeterInformation class

# Tracking

- `org.lcsim.recon.tracking.seedtracker.trackingdrivers.sidloi2.MainTrackingDriver.java`
- Change strategy file.
- `org.lcsim.recon.tracking.seedtracker.FastCheck.java`
- Catch exception on 2 pt circle fit.

# Extrapolation

- Add helix extrapolation to regular n-sided polyhedra. `org.lcsim.util.swim.Helix.java`, `HelixSwimmer.java`.
- Added method `getDistanceToPoyhedra`, returns positive pathlength of helix to intersection point with n-sided polyhedron

# getDistanceToPolyhedra

```
• public double getDistanceToPolyhedra(double r, int nsides)
• {
•     double mins = 9999999.;
•     double period = Math.abs(2.*Math.PI*radius/cosLambda);
•     for(int i=0;i<nsides;i++)
•     {
•         double dphi = i*2.*Math.PI/nsides;
•         double beta = (r - Math.cos(dphi)*xCenter - Math.sin(dphi)*yCenter)/radius;
•         if(Math.abs(beta) <= 1.)
•         {
•             double s1 = radius/cosLambda*(Math.asin(beta) - dphi + phi);
•             double s2 = radius/cosLambda*(Math.PI - Math.asin(beta) - dphi + phi);
•             while(s1 < 0.){s1 += period;}
•             while(s2 < 0.){s2 += period;}
•             s1 = s1%period;
•             s2 = s2%period;
•             double s = Math.min(s1,s2);
•             if(s1 < mins)mins = s1;
•         }
•     }
•     if(mins == 9999999.)return Double.NaN;
•     return mins;
• }
```

# Extrapolation

- Modified extrapolation classes used in PFA to key on number of sides of the calorimeter for extrapolation methods
- Package `org.lcsim.recon.pfa.identifier`
- `FlexibleHelixExtrapolator`
- `HelixExtrapolationResult`
- `HelixExtrapolator`
- `LocalHelixExtrapolator`
- `TrackHelixExtrapolator`

# Subcluster finding

- `org.lcsim.recon.cluster.mipfinder.NonProjectiveMipFinder`
- Try to mitigate order dependent code by at least presenting the same data in the same order.



# Muon finding

- Many problems remain, but at least fix obvious bugs and get it to execute.
- `org.lcsim.recon.cluster.muonfinder`
- `MuonFinder`
- `SimpleMipQualityDecision`
- `MipTrackMap`

# Structure

- `org.lcsim.recon.ui.ReconDriverLoi` – need different tracking driver
- `org.lcsim.recon.pfa.structural.SetUpPFA` – pass the correct hit collections
- `org.lcsim.recon.pfa.structural.ReclusterDriver` – fix bug at 90 degrees in momentum calculation
- `org.lcsim.recon.pfa.identifier.TrackToElectronMapMaker` – bypass “# of exactly matched cell cut” for polyhedron

# Changes to sidloi3

- Compact.xml – segmentation classes of barrel calorimeters changed to extensions to allow clustering across borders.
- Most of the auxillary files are missing, need to be added. (Mainly copy from sid02). Replace hadron and photon calibration files.

# Results

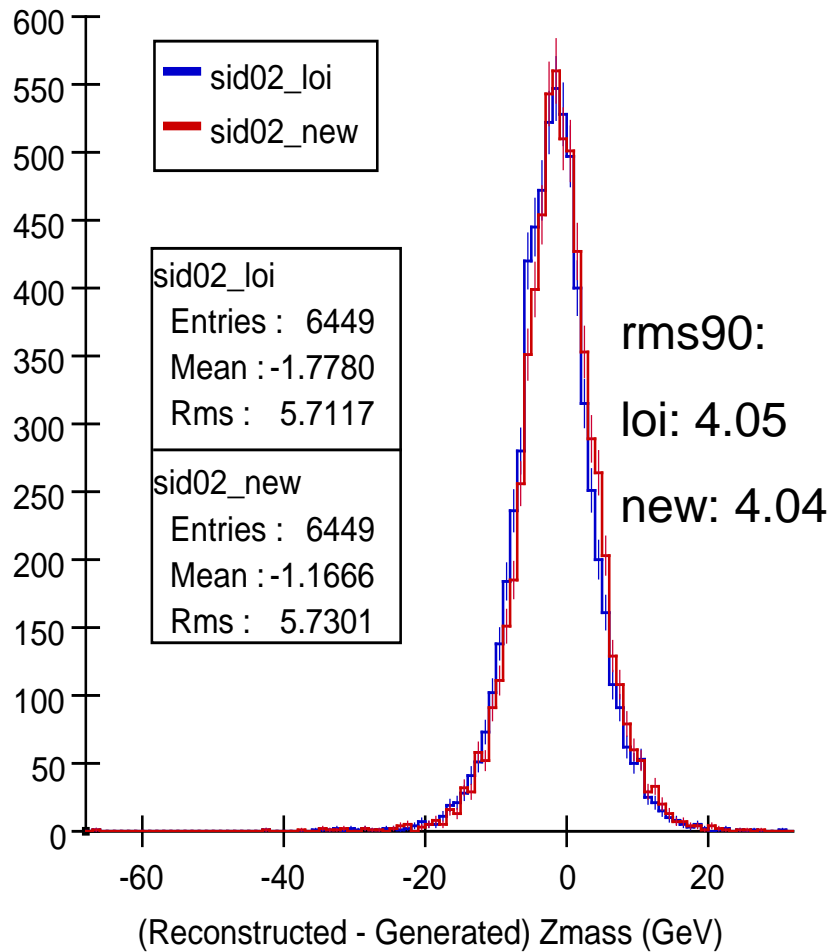
- With these changes, pfa runs to completion on 9900 events of the ZZ(500) sample. (~100 events missing from SLIC output)
- Some events where tracking takes large amount of cpu.
- PFA (excluding tracking) ~ 2 times slower on sidloi3 compared to sid02

# Results

- First compare (sid02 for loi) with (sid02 with changes) to make sure we haven't broken something.
- Look at Mass and Energy reconstruction

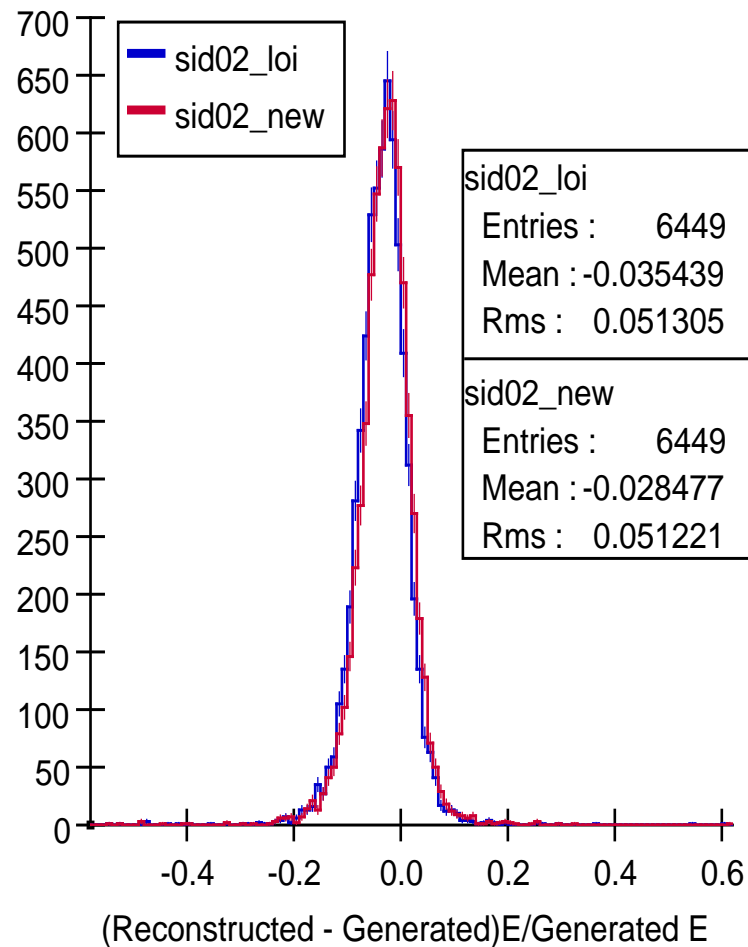
### dM: min cos(theta) < 0.95

entries/1 GeV



### dE/E: min cos(theta) < .95

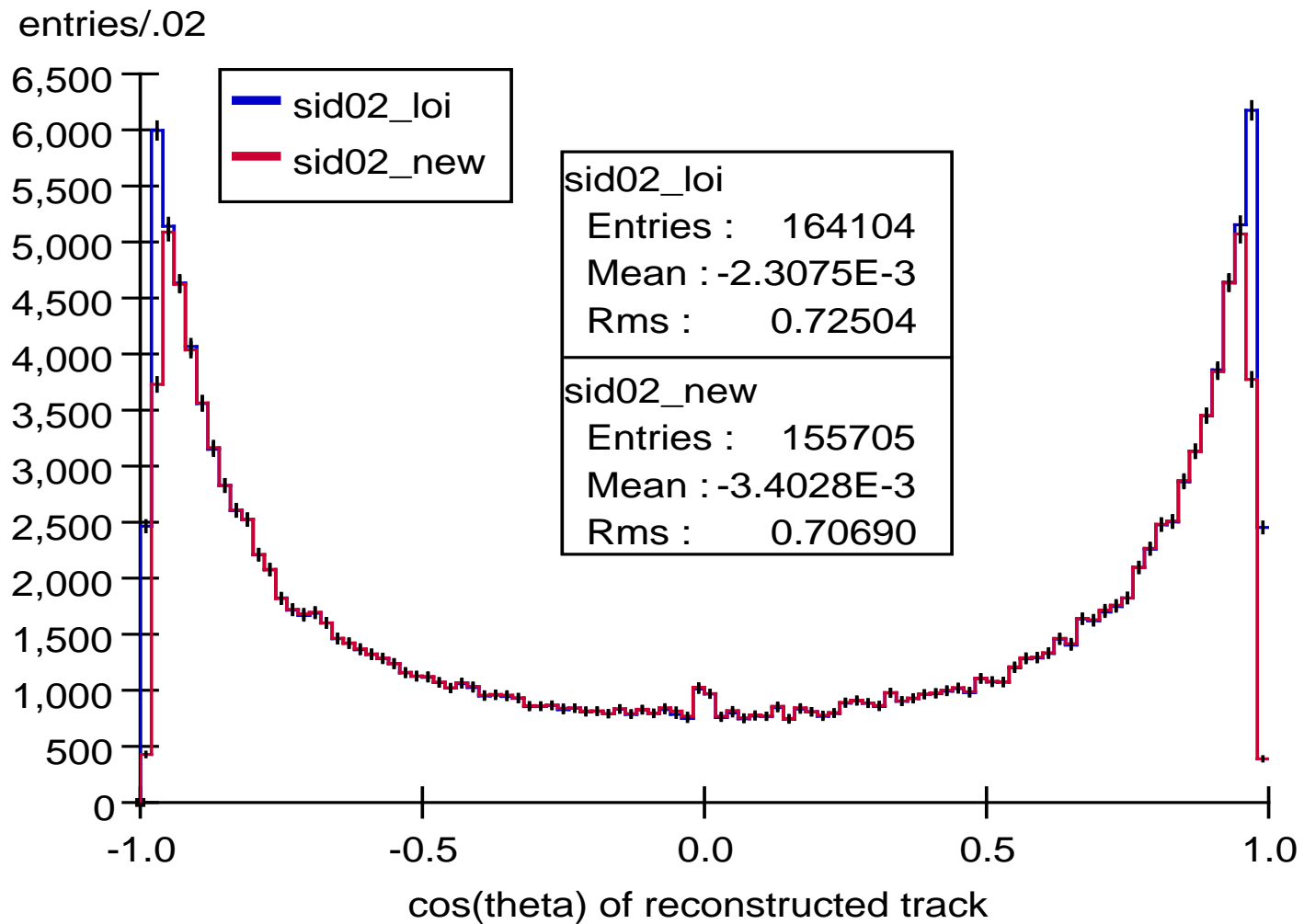
entries/.01



# Sid02: loi - new

- No degradation, but what has changed.
- Some minor improvements, bug fix in photon finding, improved subclustering, tracking.
- Look at tracking:

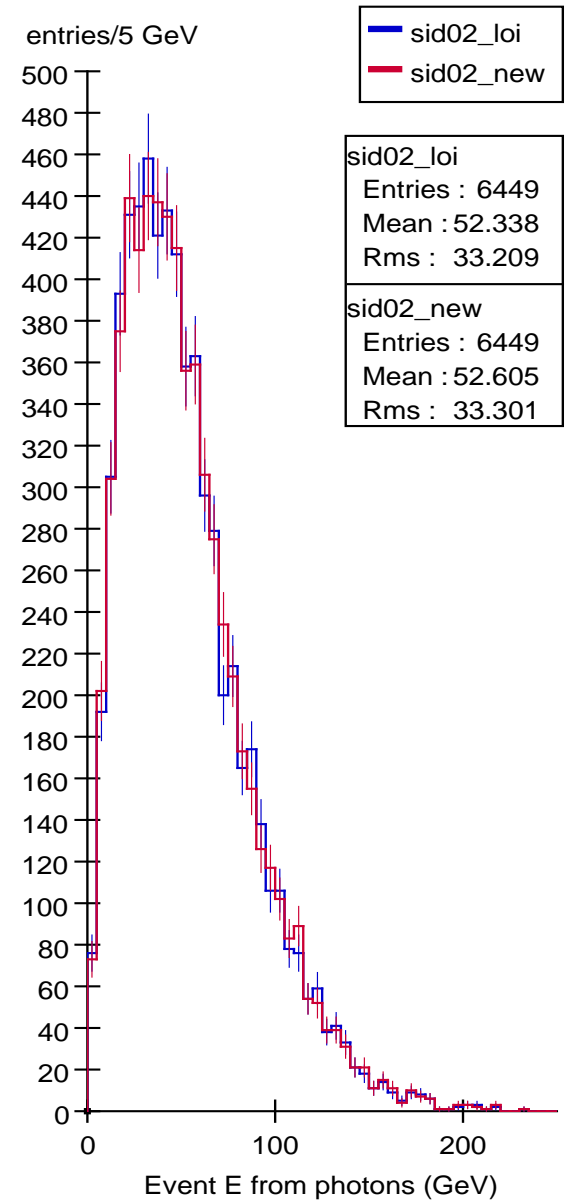
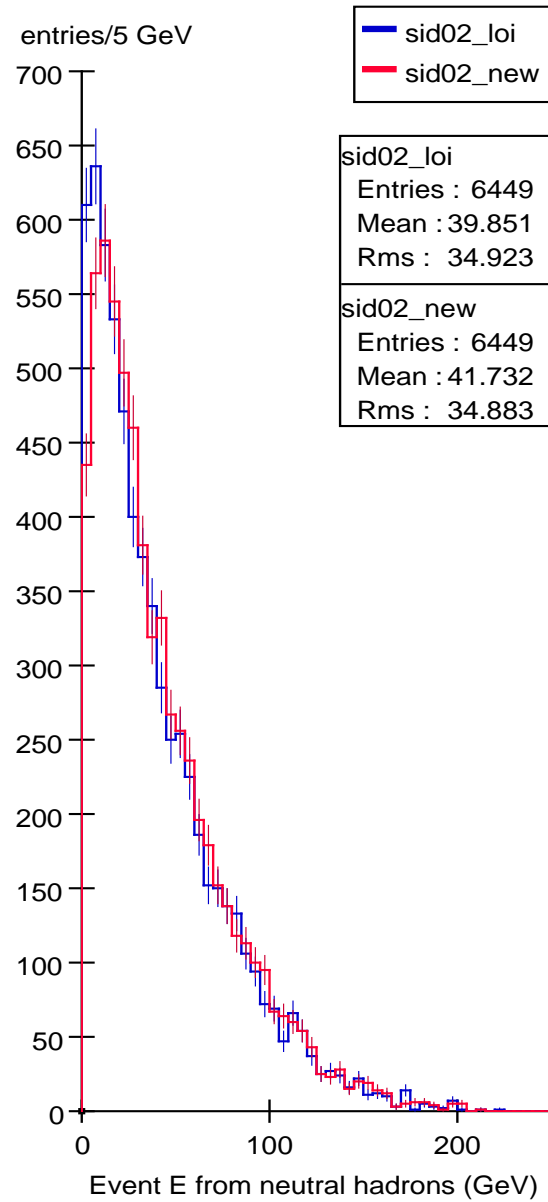
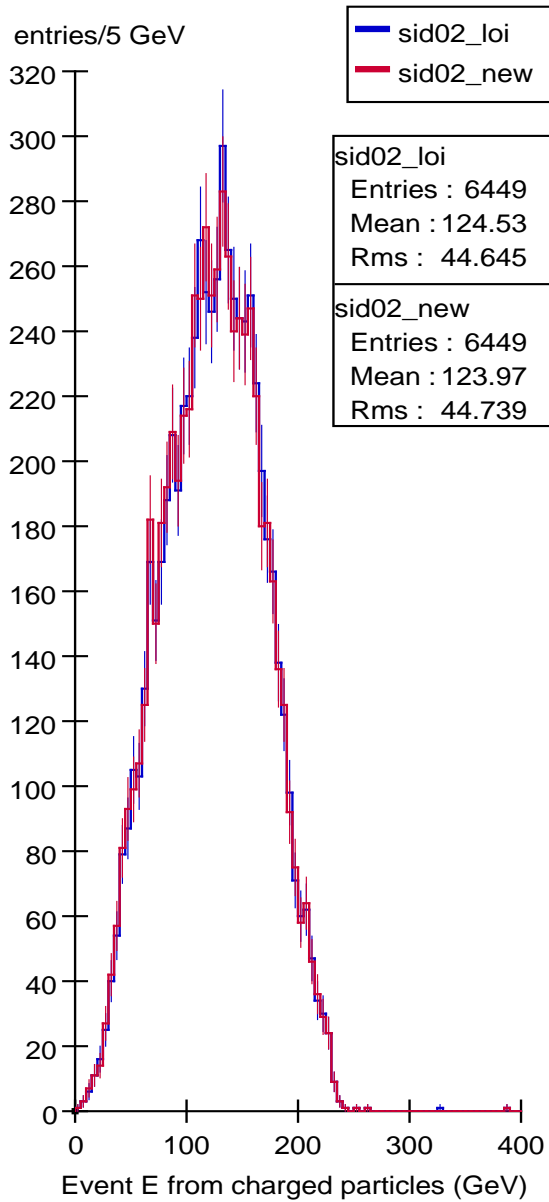
## All events - single track cosTheta





# Sid02: loi - new

- Look at energy distributions vs particle type



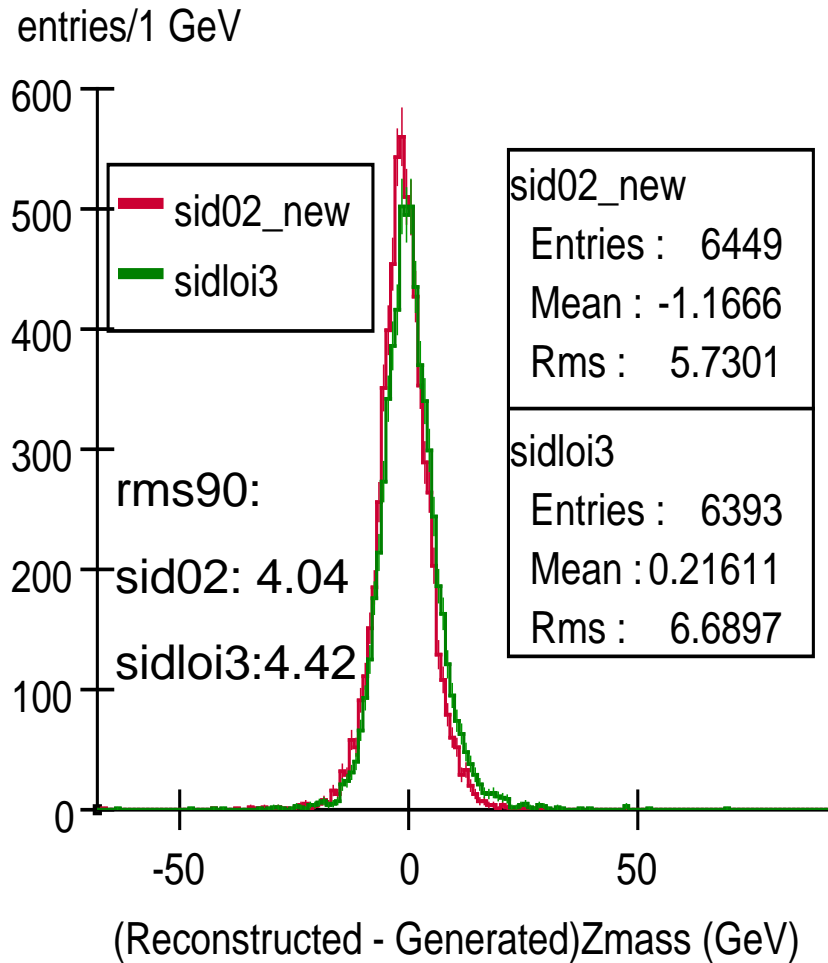
# Sid02: loi – new: conclusions

- Many changes since loi: distributions are not identical.
- However, no degradation in energy or mass resolutions.

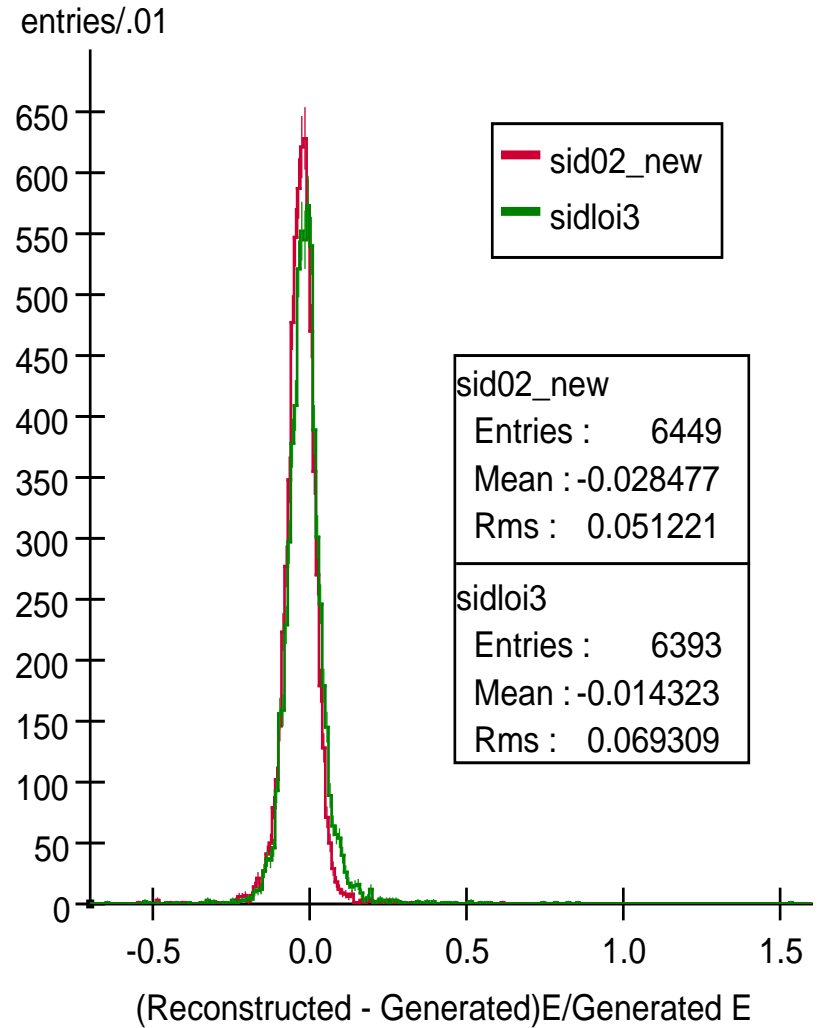
# sidloi3

- Compare reconstructed mass and energy distributions with sid02.

### dM: min cos(theta) < .95

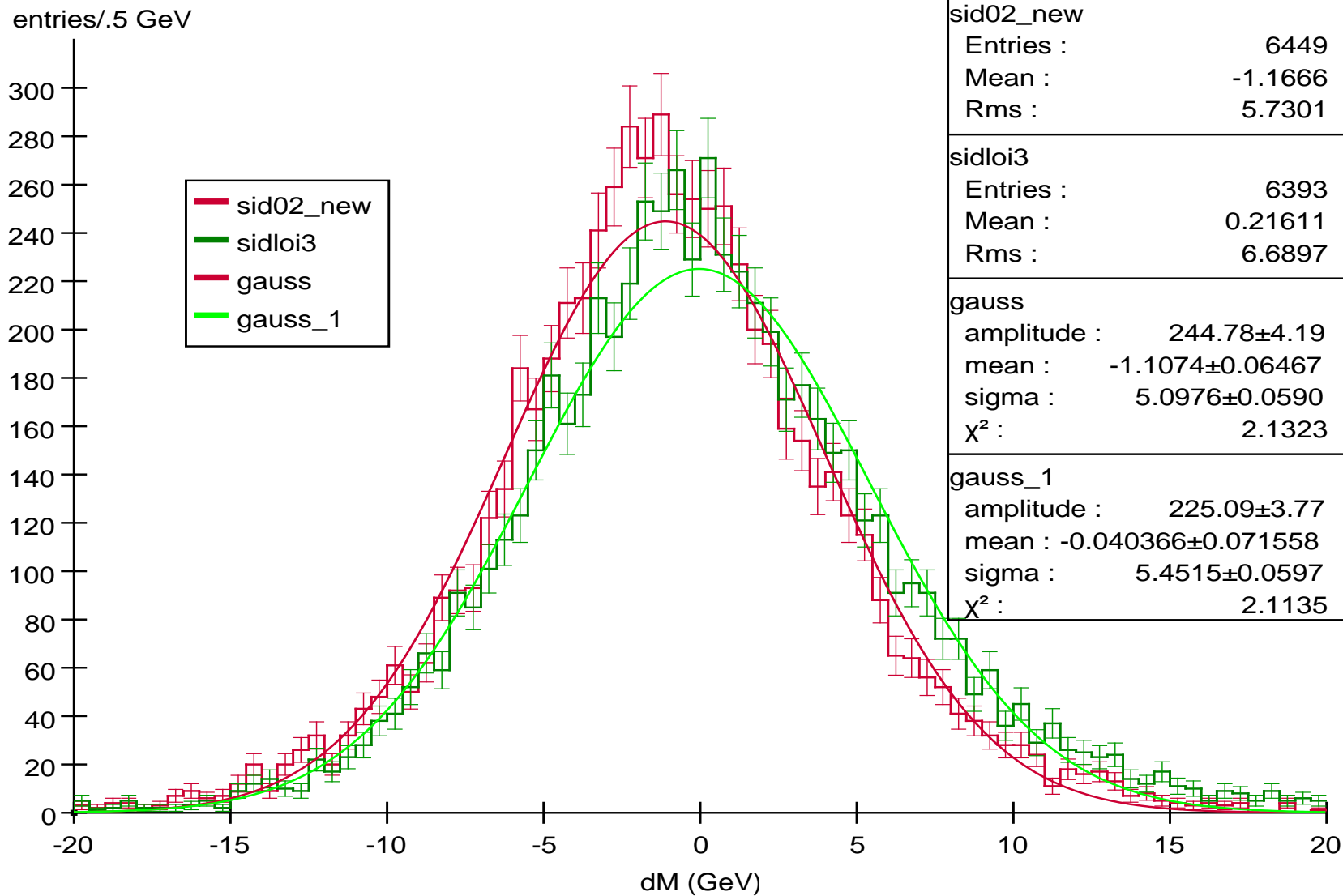


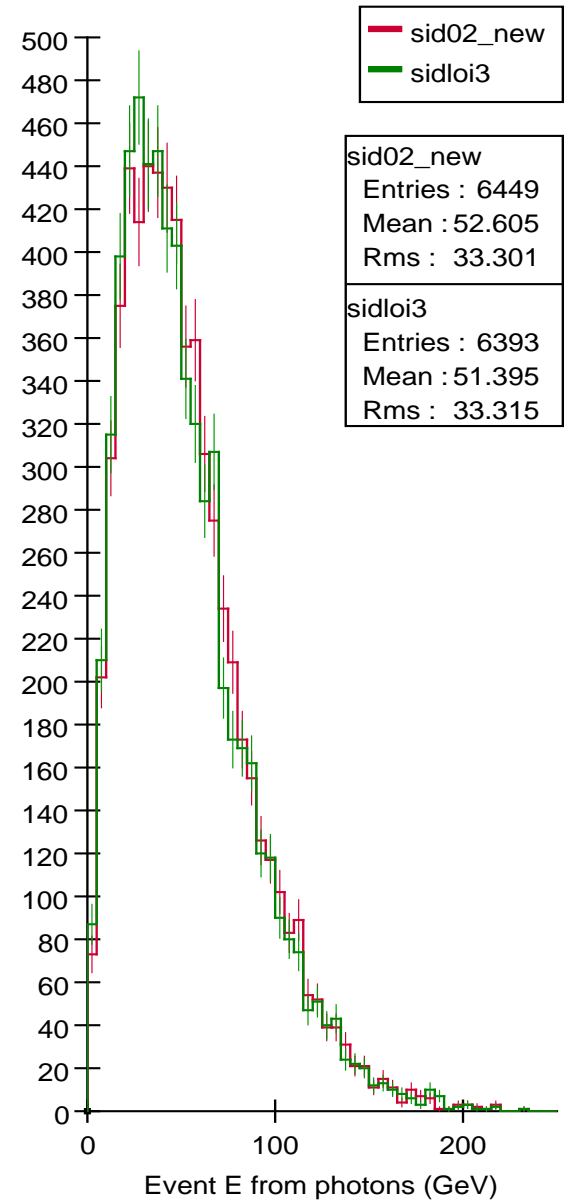
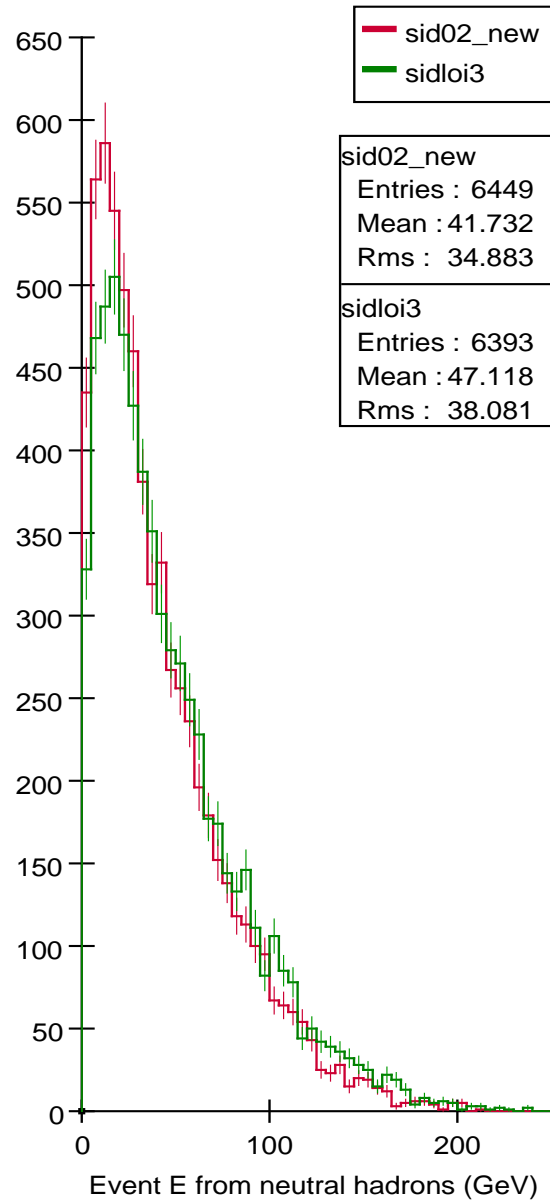
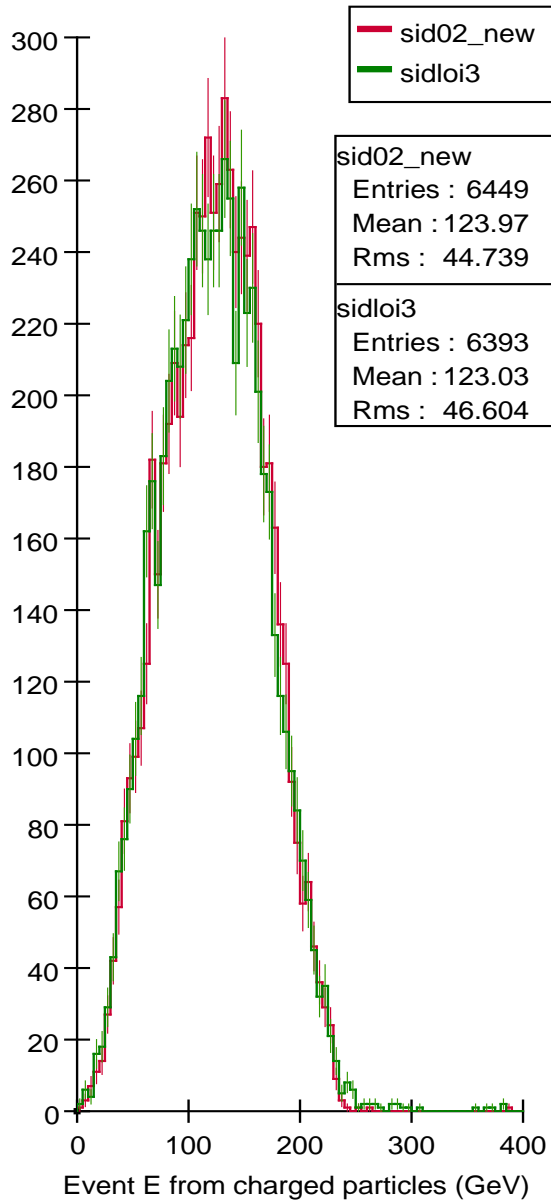
### dE/E: min cos(Theta) < .95



# sidloi3

- Tails of mass and energy distributions extend much farther in sidloi3.
- ~10% worse mass resolution using rms90.
- Not great, not crazy either.
- A few more plots.







# sidloi3: conclusion

- Many problems have been addressed to get the current algorithm to run on sidloi3.
- Still many unresolved problems related to performance.
- Propose to commit all the changes to CVS, and use as a starting point for performance studies.
- Need Christoph to run on qq(100,200,350,500) events to verify no degradation in sid02 performance.
- Need SLIC on sidloi3 for same events to study performance.