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Energy calibration for EMC multi-thread

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Review from CM

- Logic

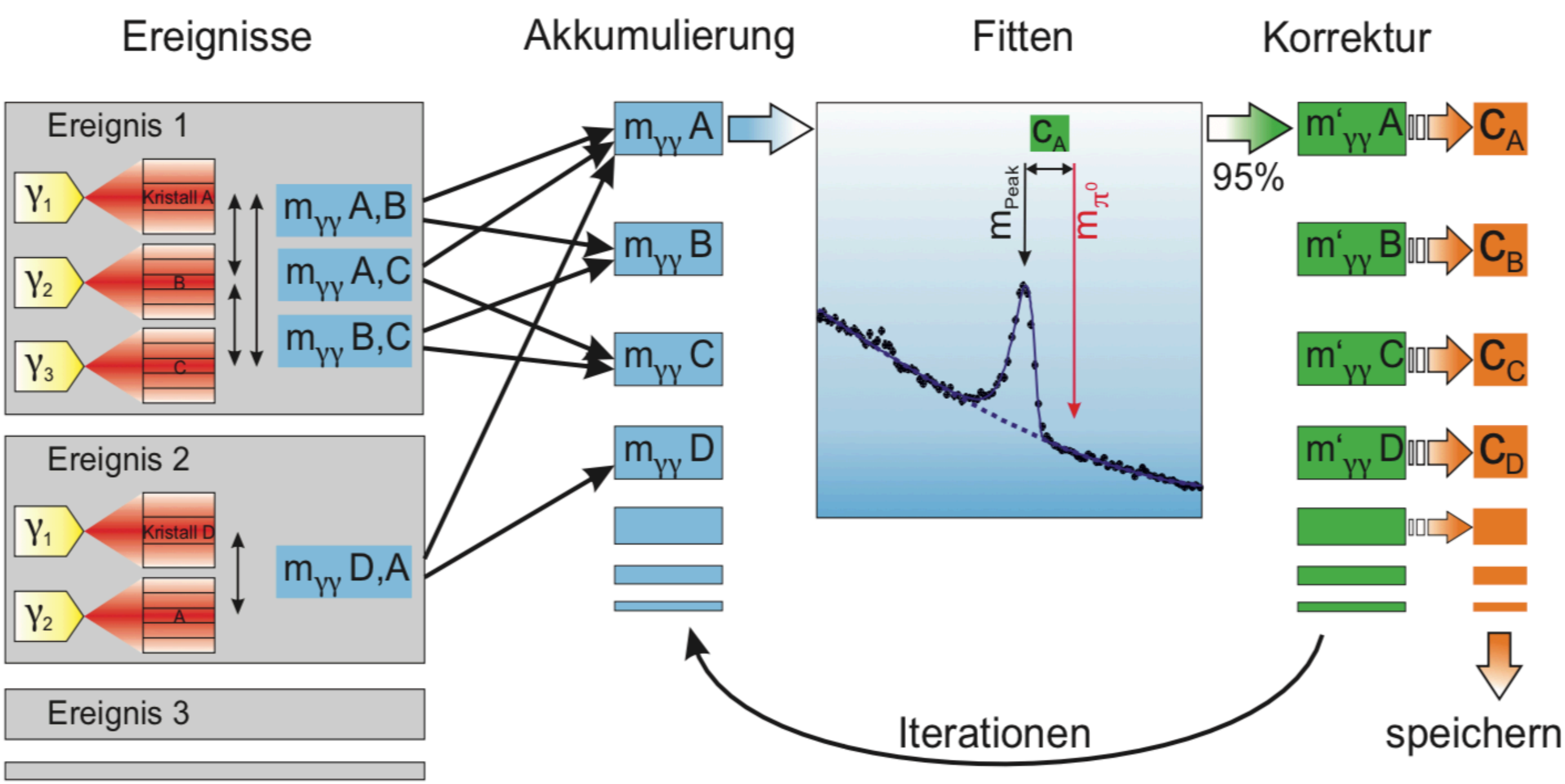
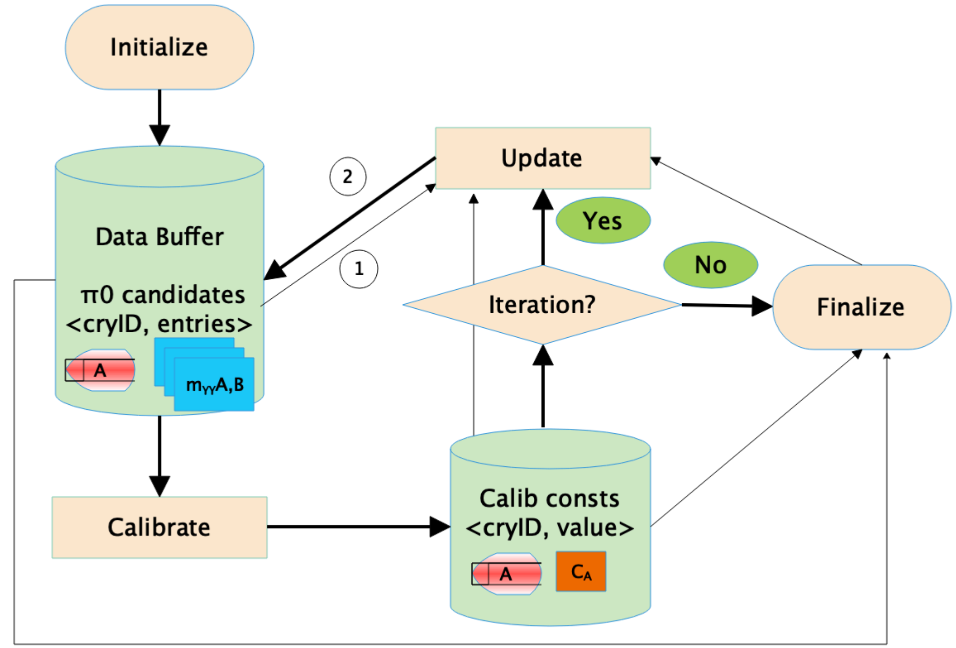


Abbildung 6.1: Schematische Darstellung des iterativen Verfahrens zur Kalibrierung des elektromagnetischen Kalorimeters.

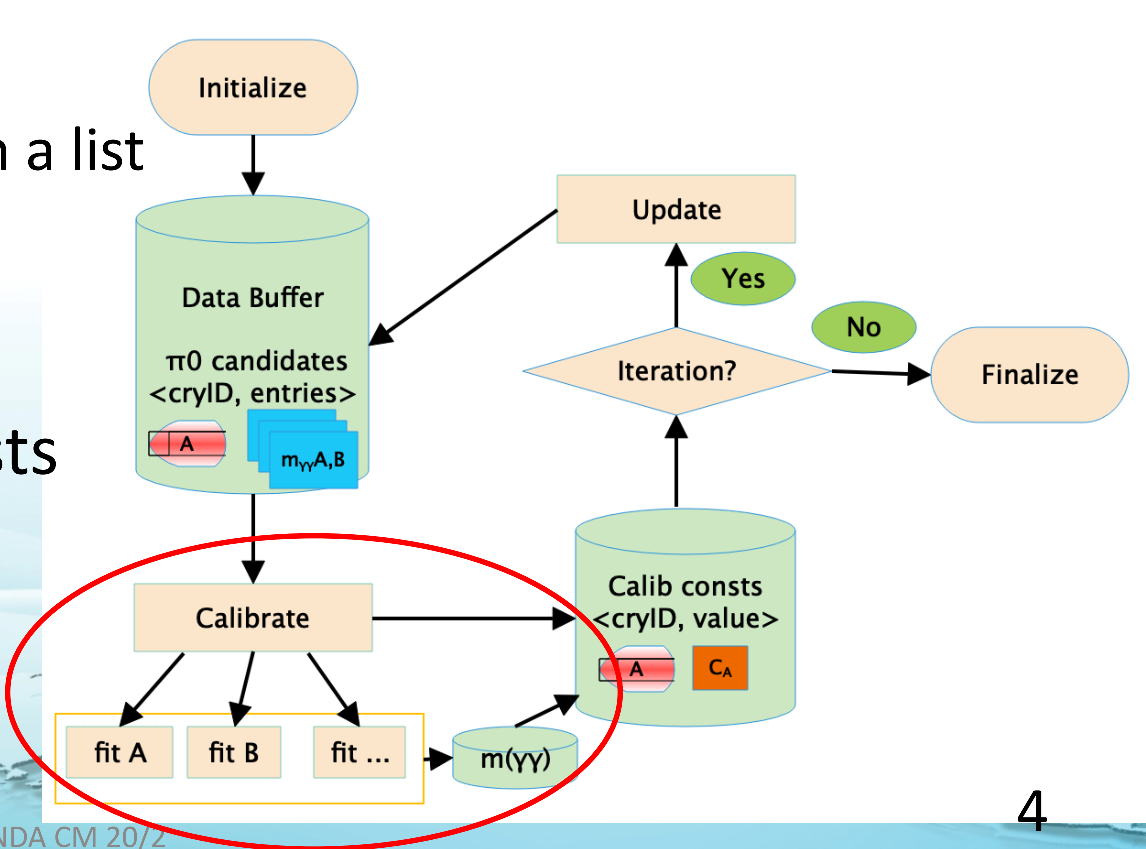
Review from CM

- Run and test the calibration algorithm
  - Calibration samples preparation
  - ROOT file as input, cached in memory
  - Calibrate
  - Update all hits
  - Validation
- Extend to single cluster case
  - Same data format
  - Change calibration goal
- Work to do
  - Optimize the algorithm
  - Test with MC closer to physics events
  - Multi-threads implementation and test
  - Database
  - PandaRoot



Multithreads

- In calibrate
  - Split xtals to n lists
  - Create a thread for each list
  - In each thread
    - Fit m(γγ) for xtals in a list
    - Cache fit results
  - Check fit results
  - Calculate calib consts



Multithreads

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- In calibrat
  - Split xtal
  - Create a
  - In each t
    - Fit m(γ
    - Cache
  - Check fit
  - Calculate

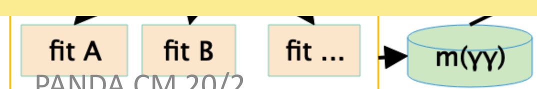
```
// assign xtal to threads
mapThreadXtals.clear();
int ixtal = 0;
int nxtal = xtal_index.size();
while (ixtal<nxtal) {
        for (int i=0; i<nthreads; i++) {
--- 11 行： if (mapThreadXtals.find(i)==mapThreadXtals.end()) {--------------------
                int cpnr = xtal_index.at(ixtal);
                mapThreadXtals[i].push_back(cpnr);
                ixtal++;
                if (ixtal>=nxtal) break;
        }
}
// create multithreads
thread th[100]; // no more than 100 thread
for (int i=0; i<nthreads; i++) {
        th[i] = thread(getCinThread, i);
}
// wait for all threads
for (int i=0; i<nthreads; i++) {
        th[i].join();
}

// check
// deal with the result
for (int i=0; i<nthreads; i++) {
      cout<<"Info: size of calibMap "<<mapThreadErgebnis[i].size()<<endl;
-- 81 行： for (int icry=0; icry<mapThreadXtals[i].size(); icry++) {------------
}
```

Create n lists

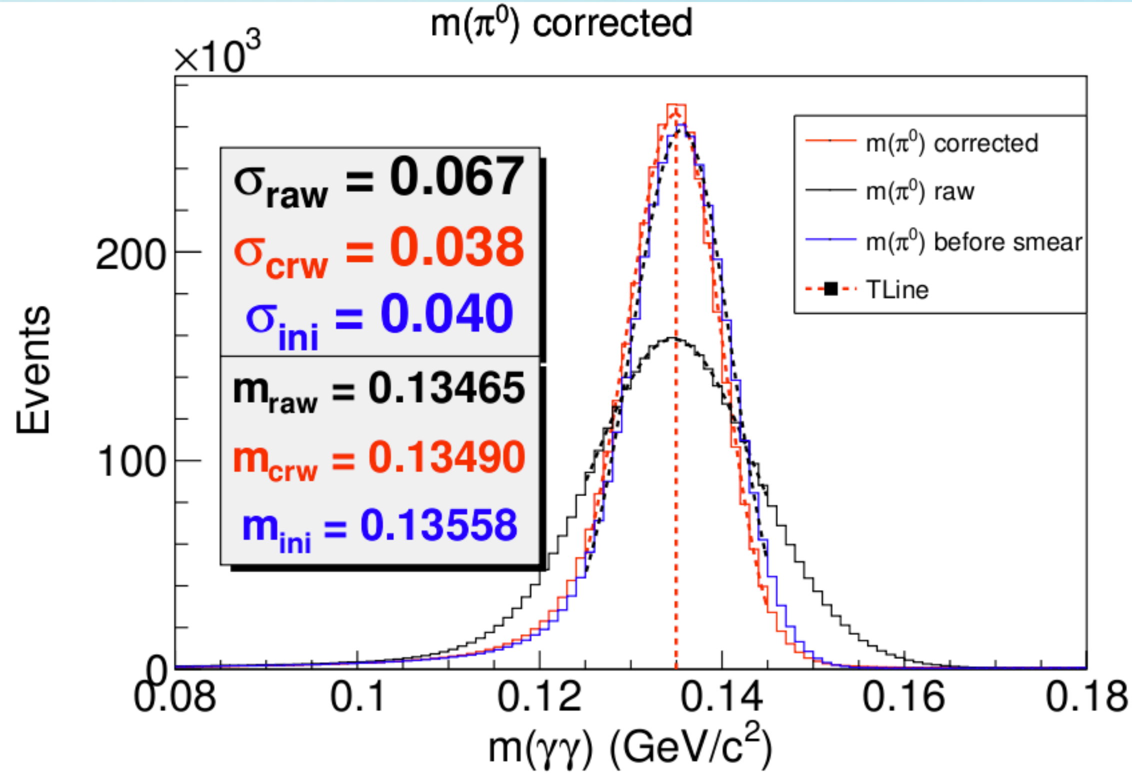
work in n threads

single thread to analysis the result



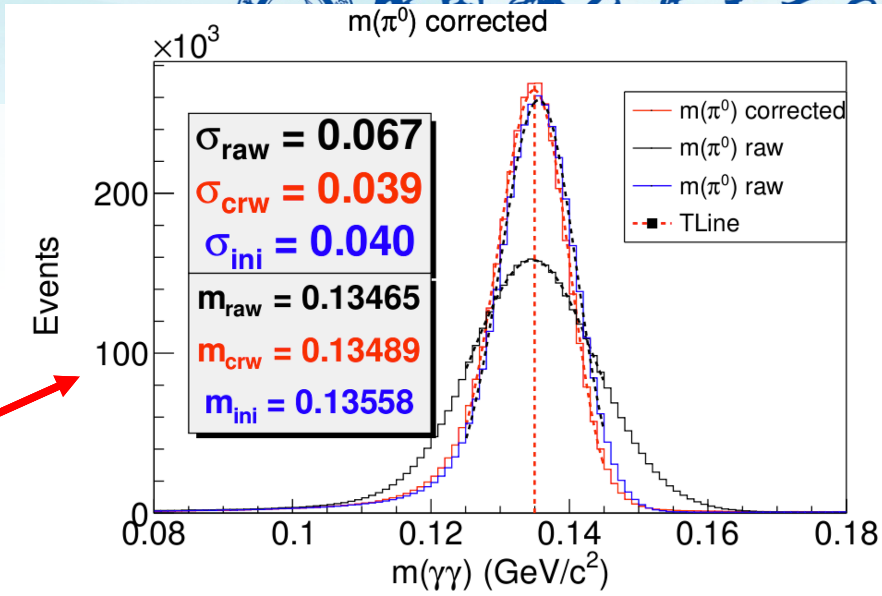
Multithreads

- Test
  - Single thread
    - Iterations: 7
    - Time: ~3h30min
  - 8 threads
    - Iterations: 7
    - Time: ~41min (5.9min/iteration)
  - Same result as single thread case
  - Improvement
    - Reduce 80% consuming time (1/5)

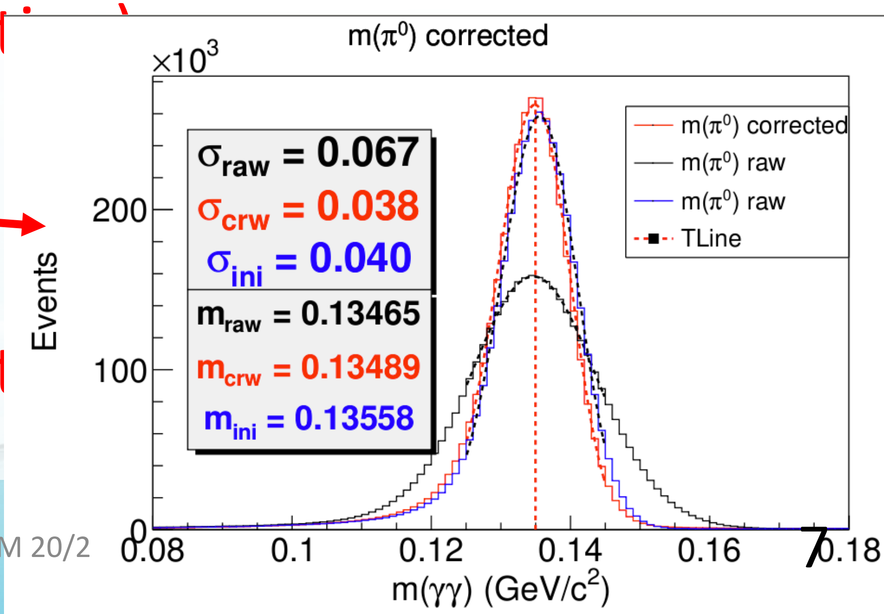


update

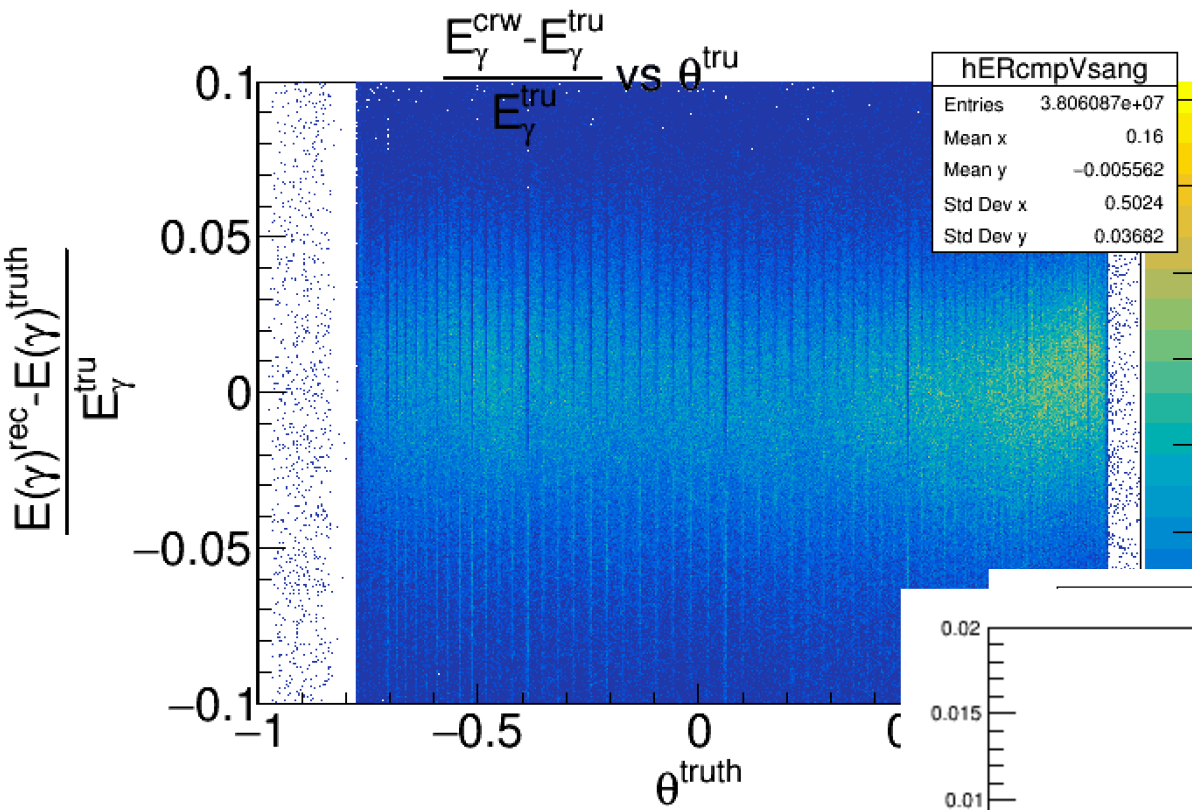
- In update
  - Split xtals to n lists
- 8 threads
  - Iterations: 11
  - Time: 47min (4.3min/iterat

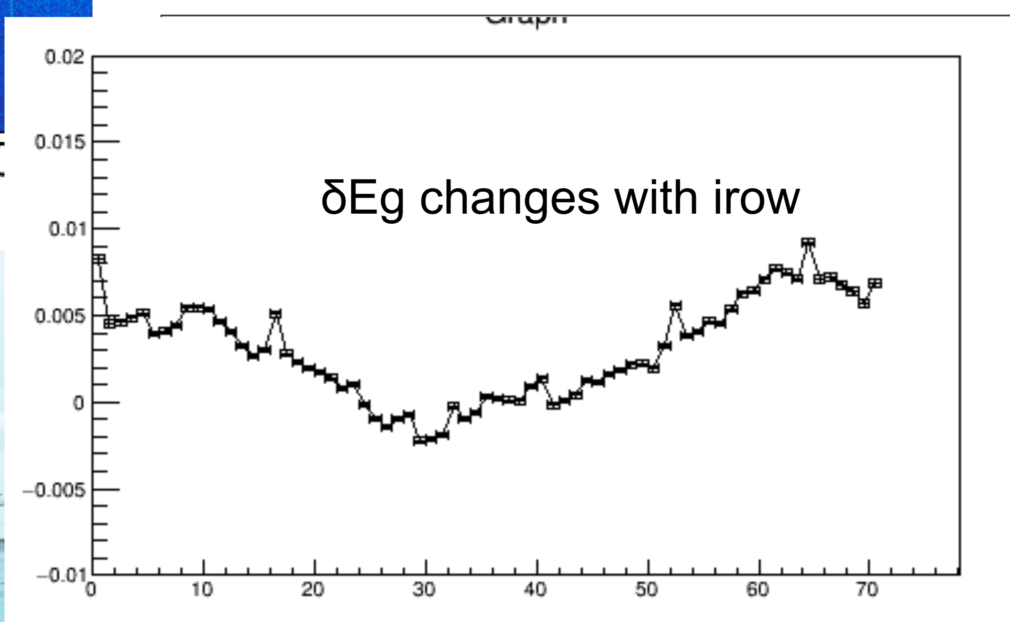


- 10 threads
  - Iterations: 8
  - Time: 29min (3.6min/iterat

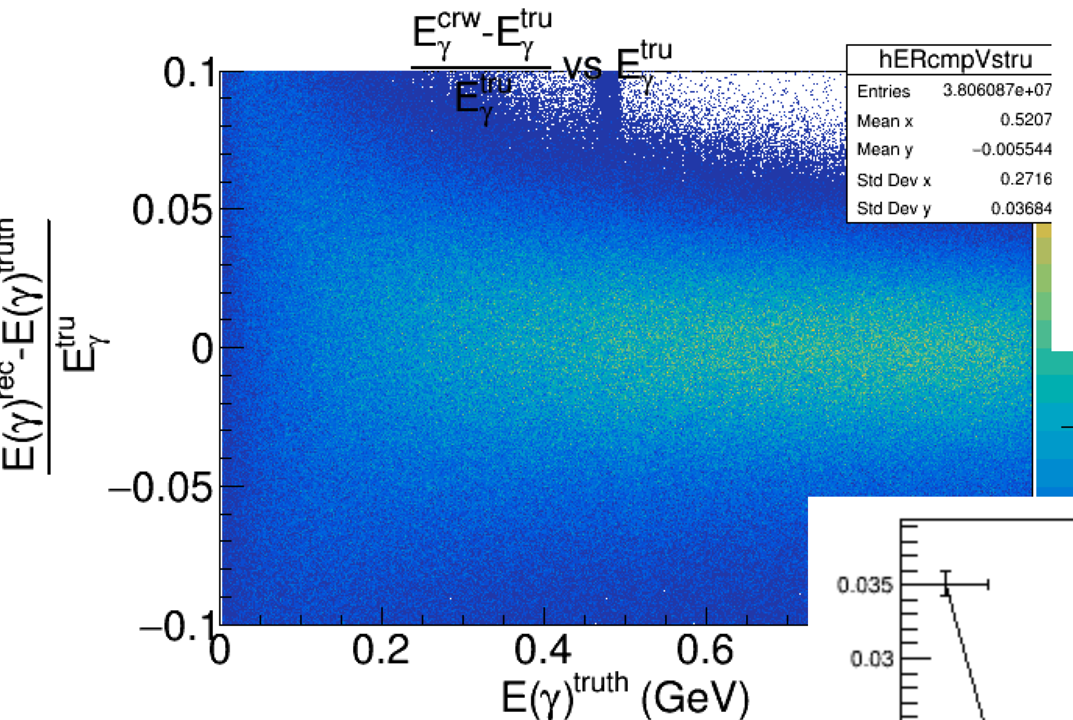


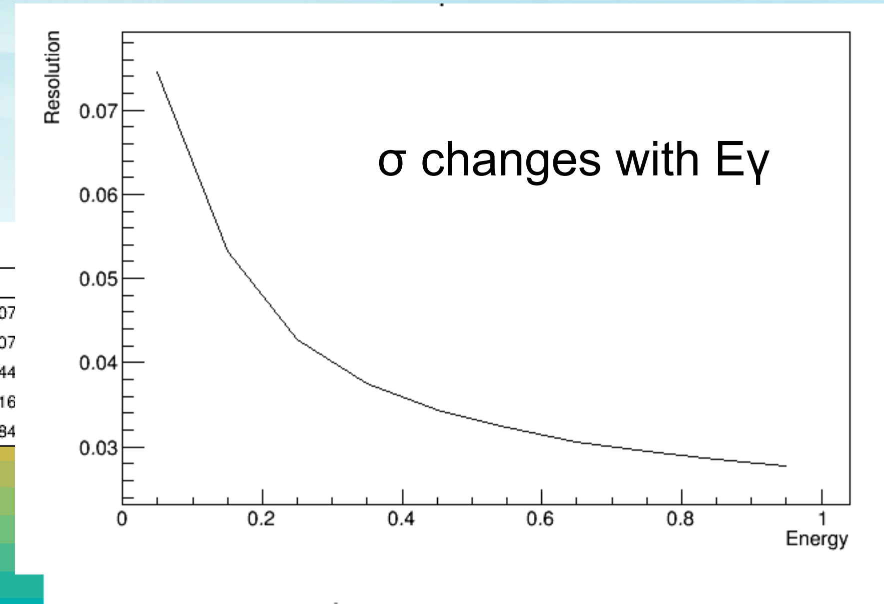
Relation with polar angle

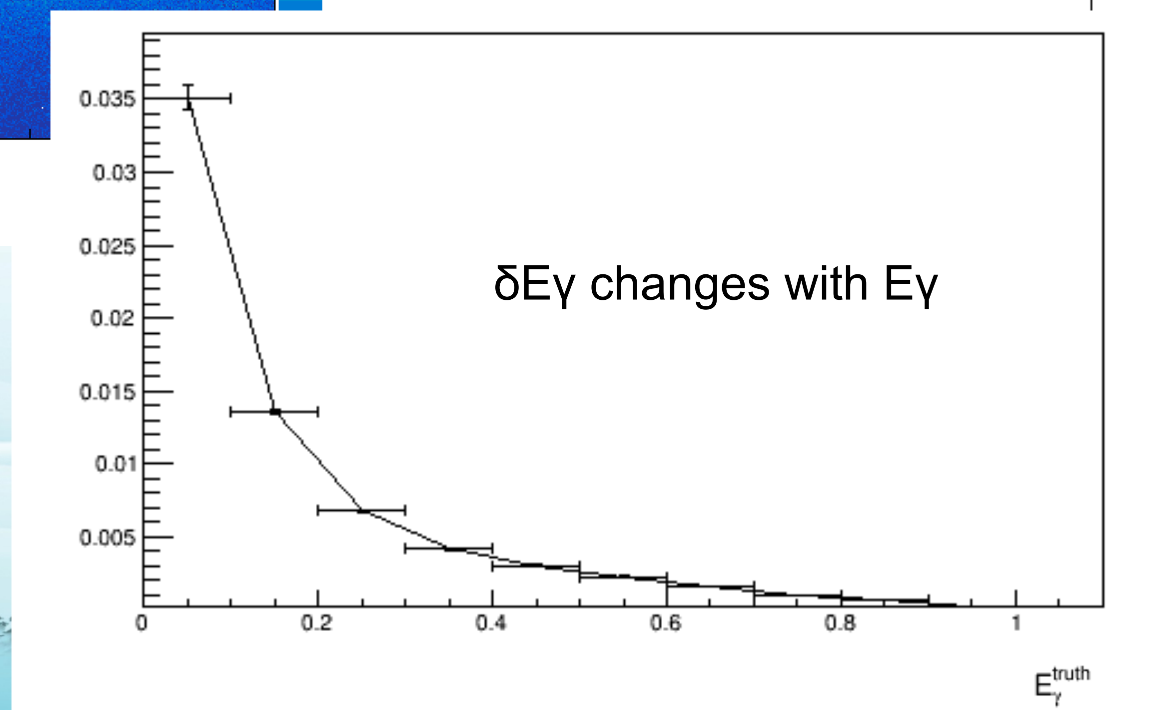




Relation with Eγ







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Mπ Relation with Eγ

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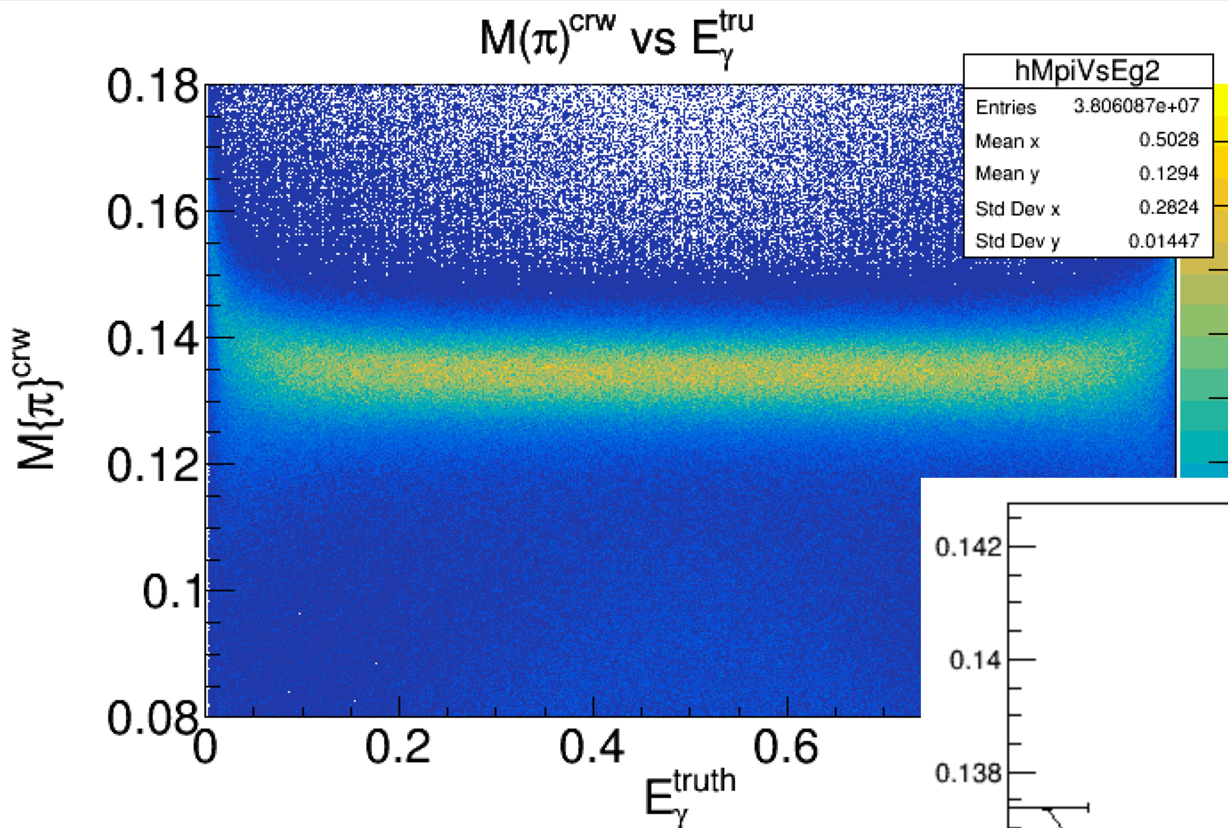

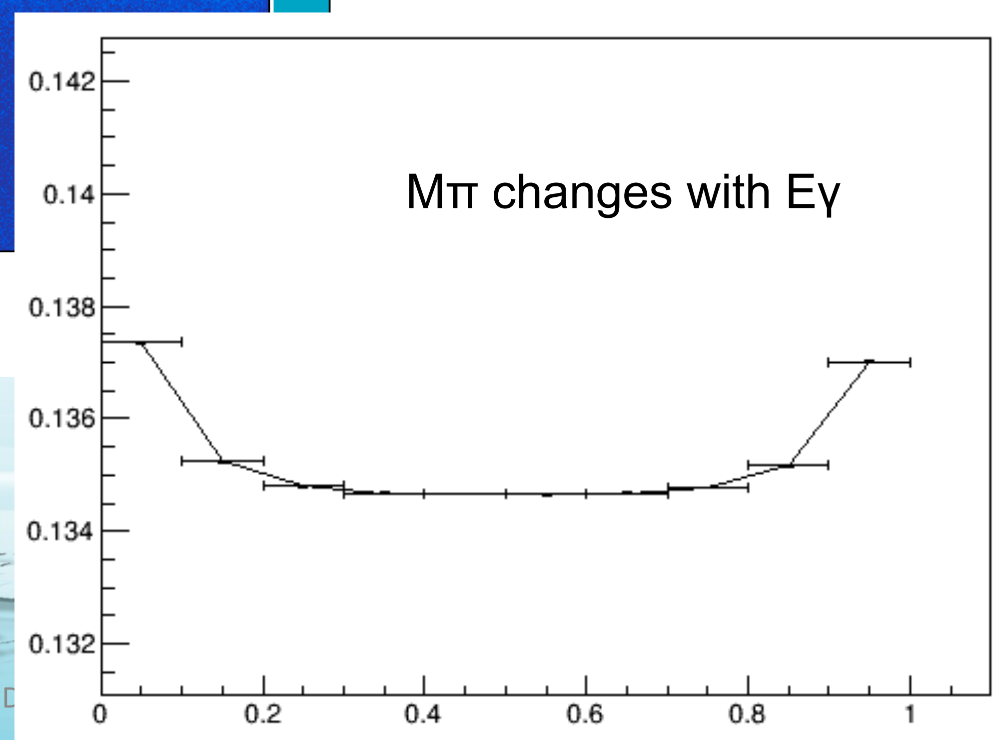

Summary

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- Optimization of the code
  - Code reorganization
- Multi-threads
  - Implemented with <thread>
  - Test with MC, save much time, with same quality
  - Energy and angle related calibration constants
- Plan
  - Energy and angle relation of the calibration constants

Thank you!