Data Quality Integration Tests

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Integration Tests I

- In the process of refactoring, improving, replacing a lot of code in preparation for final(?) analysis pass of 2015 data, next pass of 2016 data and first physics run.
- Want to ensure that changes to the code base are positive, with no uncaught side effects.
- Need to strengthen our unit/component tests.
- Need to develop integration tests.

Integration Tests II

- Selecting “golden” samples of physics/calibration events allows us to measure various metrics of performance and follow their improvement and catch unintended consequences of code changes.
- Full Energy Electrons
- Møller Candidates
- Tridents (V0 skims)

Calibration Files

- Have selected calibration events from run 5772 (2015) and 7796(2016)
  - FEE (Full Energy Electrons) 10k events top/bottom
  - Møller Candidates 10k events
  - V0 Candidates 10k events
- Have skimmed off the events in evio format
- Implementing integration tests which can run over these samples as part of the release or manually.

Testing the software 2015

- Running from the master branch:

> java

-cp hps-distribution-3.11-SNAPSHOT-bin.jar

org.hps.evio.EvioToLcio

-x /org/hps/steering/recon/EngineeringRun2015FullRecon.lcsim

-r -d HPS-EngRun2015-Nominal-v6-0-fieldmap

-DoutputFile=TestFile

/path/to/evioFile

Testing the software 2016

- Running from the master branch:

> java

-cp hps-distribution-3.11-SNAPSHOT-bin.jar

org.hps.evio.EvioToLcio

-x /org/hps/steering/recon/PhysicsRun2016FullRecon.lcsim -r -d HPS-PhysicsRun2016-v5-3-fieldmap_globalAlign

-DoutputFile=TestFile

/path/to/evioFile

Analysis

- Each test sample has a dedicated analysis Driver which analyzes events and writes the output histograms to an aida file.
- Comparison Driver will then compare the output to a known, standard set of histograms.
  - Differences will be flagged, assertions thrown if necessary.

org.hps.test.it

- Targets:
  - EngRun2015FeeRecon (Analysis Driver)
  - EngRun2015FeeReconTest
  - EngRun2015MollerRecon (Analysis Driver)
  - EngRun2015MollerReconTest
  - EngRun2015V0Recon (Analysis Driver)
  - EngRun2015V0ReconTest
- After building hps-java, run test target:
  - cd integration-tests
  - mvn verify -Dit.test=EngRun2015FeeReconTest

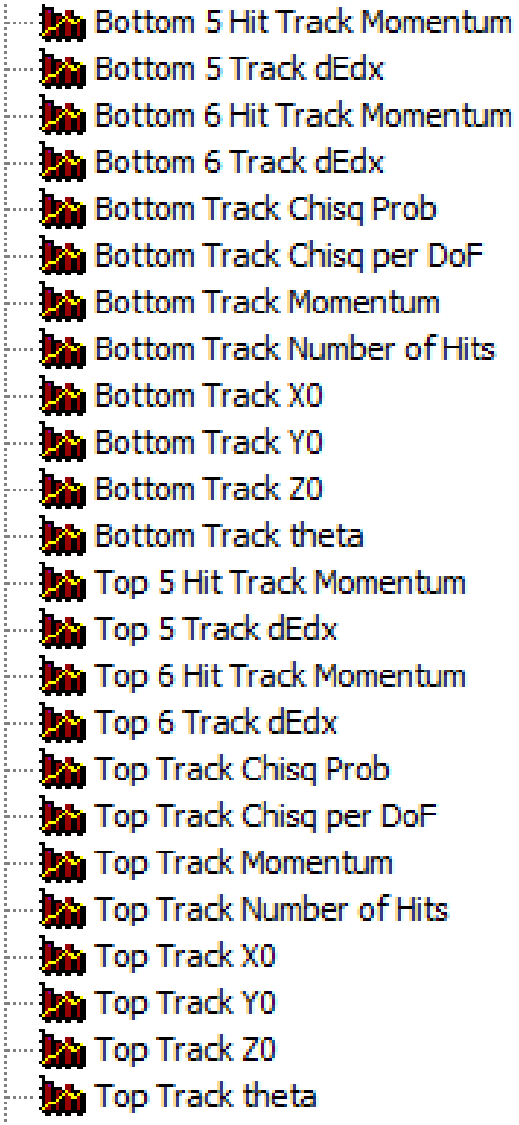
Input Data Samples

- http://www.lcsim.org/test/hps-java/calibration
  - hps_005772_feeskim_10k.evio
  - hps_005772_mollerskim_10k.evio
  - hps_005772_v0skim_10k.evio
- Will be downloaded from the web, then cached for later re-use

Test Output

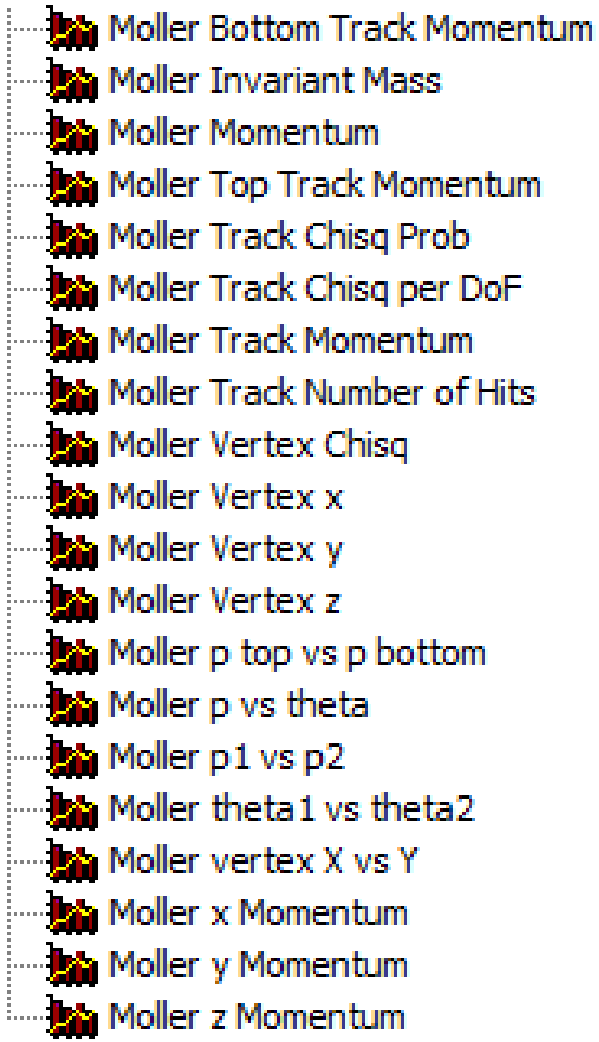
- integration-tests /target/test-output/
  - EngRun2015FeeReconTest
    - EngRun2015V0ReconTest. Aida, .slcio
  - EngRun2015MollerReconTest
    - EngRun2015MollerReconTest.aida, .slcio
  - EngRun2015V0ReconTest
    - EngRun2015V0ReconTest.aida, .slcio

Fee Histograms



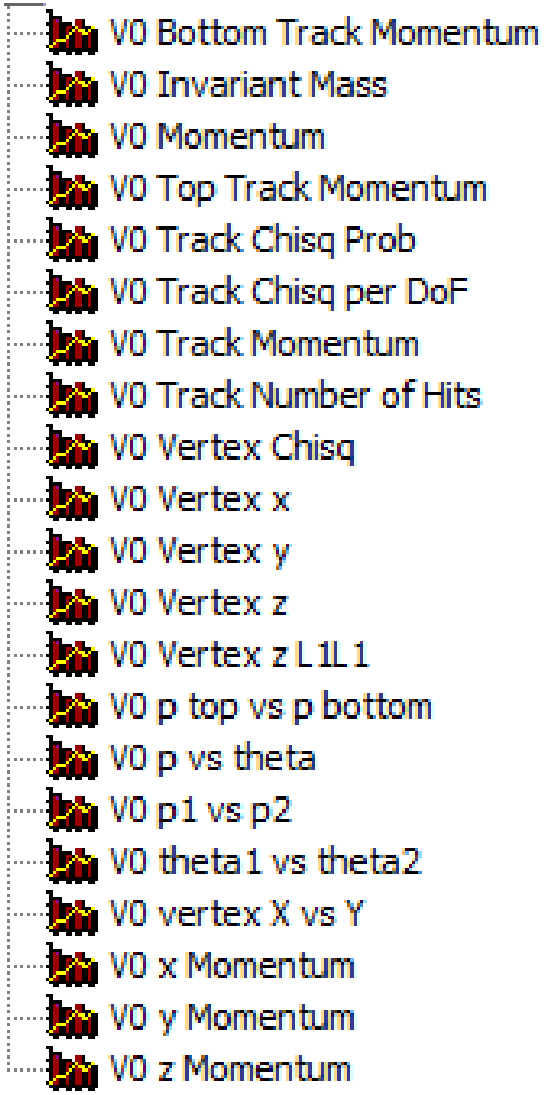
- Separately for Top and Bottom Tracks

Møller Histograms



- Separately for each Vertex Collection
  - BeamspotConstrained
  - TargetConstrained
  - Unconstrained

V0 Histograms



- Separately for each Vertex Collection
  - BeamspotConstrained
  - TargetConstrained
  - Unconstrained

Status

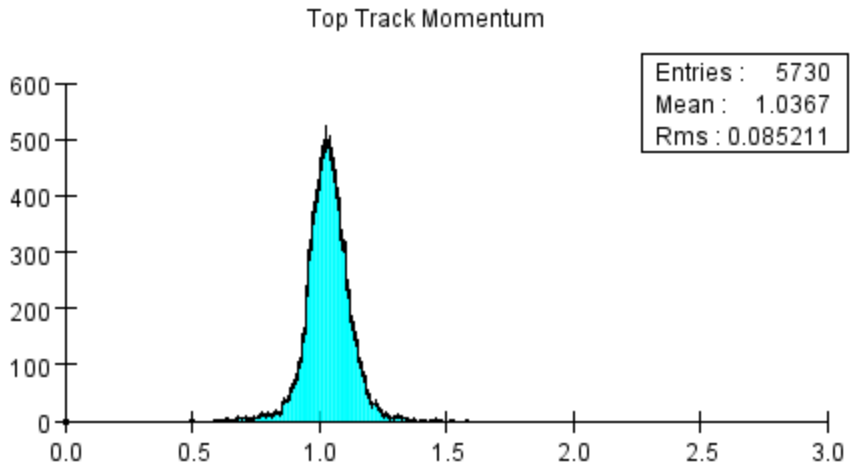
- Work proceeding on branch iss83
- Event samples identified and events skimmed and available in evio format (for 2015).
- Concentrating on the 2015 data at the moment.
- Integrated tests processing the evio files finished
- Analysis Drivers and first pass at histograms finished.
- Histogram comparisons need to be done.
- Feedback appreciated on selection of performance metrics to be analyzed and procedures for comparing output.
- Histograms will be made available on confluence.
- Note being prepared

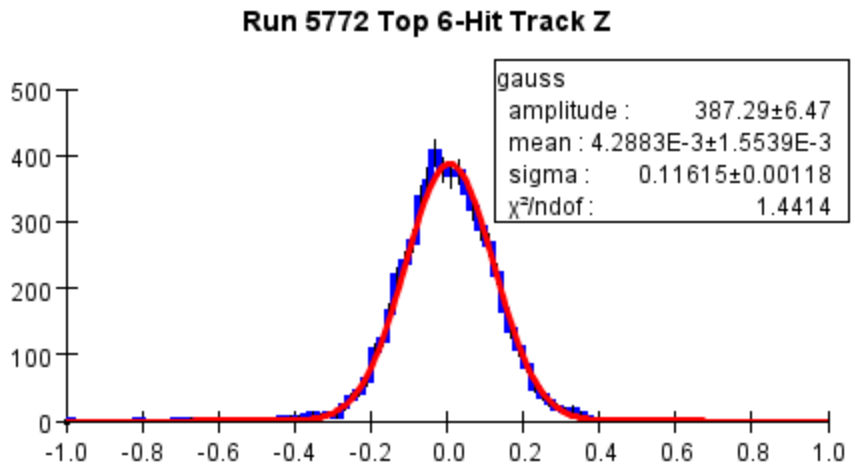
OK, so where's the target?

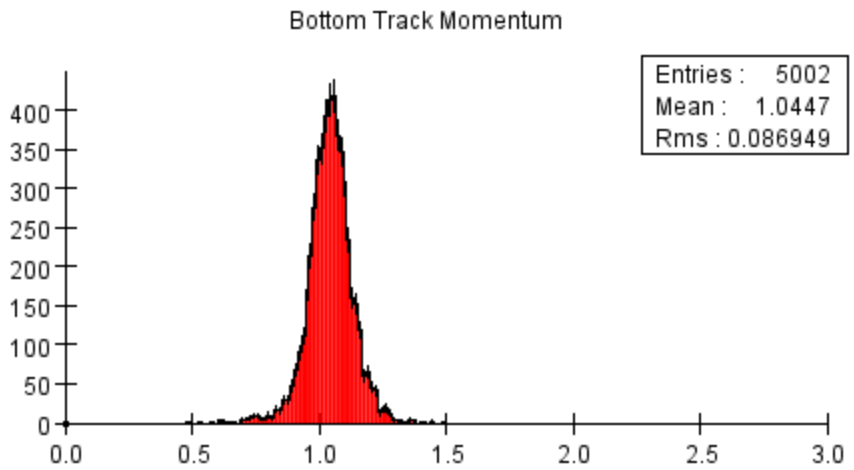
- FEE sample favors 0.
  - Not much discriminating power
- Unconstrained Møller indicates 0.6mm
  - Agreement between fitted vertex z and target-constrained mass at that z position give strong constraints
- Unconstrained V0 sample gives 0.1mm
  - Missing recoil electron broadens the distribution
  - No associated mass constraint.

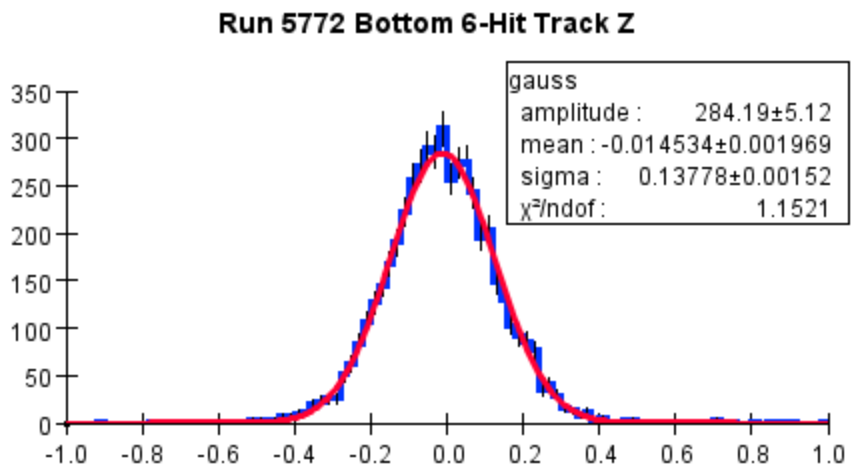
- Either stick with z=0. or go with +0.5mm from Møllers
- We still have some work to do. Even though FEE momentum scale is ~1% low, the Møller invariant mass is ~1.4% high, indicating work is still needed on energy scale determination and final tweaking of alignment.

FEE

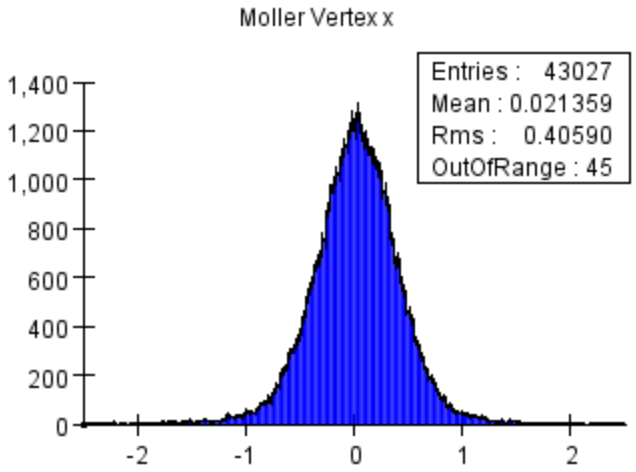

Top Track Momentum
Entries : 5730
Mean : 1.0367
Rms : 0.085211
600
500
400
300
200
100
0
0.0
0.5
1.0
1.5
2.0
2.5
3.0

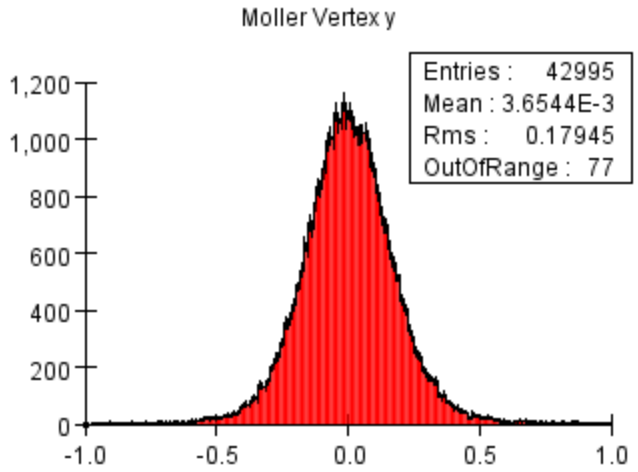

Run 5772 Top 6-Hit Track Z
gauss
amplitude : 387.29±6.47
mean : 4.2883E-3±1.5539E-3
sigma : 0.11615±0.00118
χ²/ndof : 1.4414
500
400
300
200
100
0
-1.0
-0.8
-0.6
-0.4
-0.2
0.0
0.2
0.4
0.6
0.8
1.0

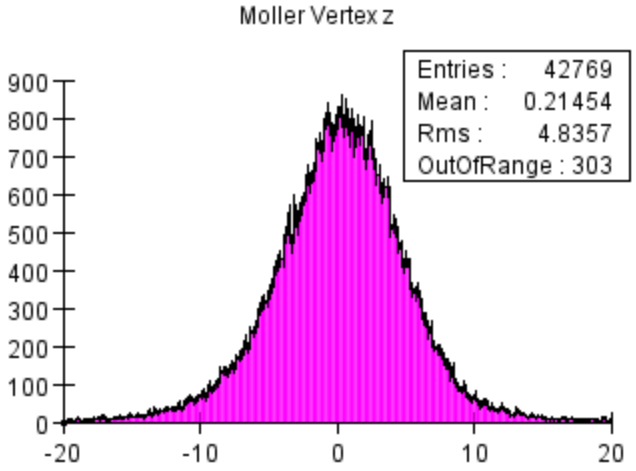

Bottom Track Momentum
Entries : 5002
Mean : 1.0447
Rms : 0.086949
400
350
300
250
200
150
100
50
0
0.0
0.5
1.0
1.5
2.0
2.5
3.0

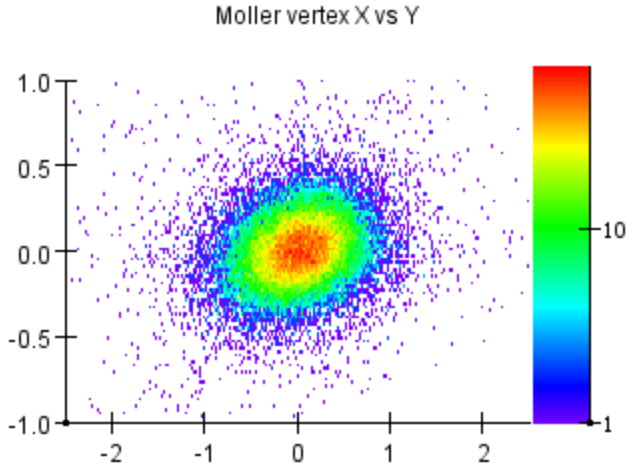

Run 5772 Bottom 6-Hit Track Z
gauss
amplitude : 284.19±5.12
mean : -0.014534±0.001969
sigma : 0.13778±0.00152
χ²/ndof : 1.1521
350
300
250
200
150
100
50
0
-1.0
-0.8
-0.6
-0.4
-0.2
0.0
0.2
0.4
0.6
0.8
1.0

Møllers

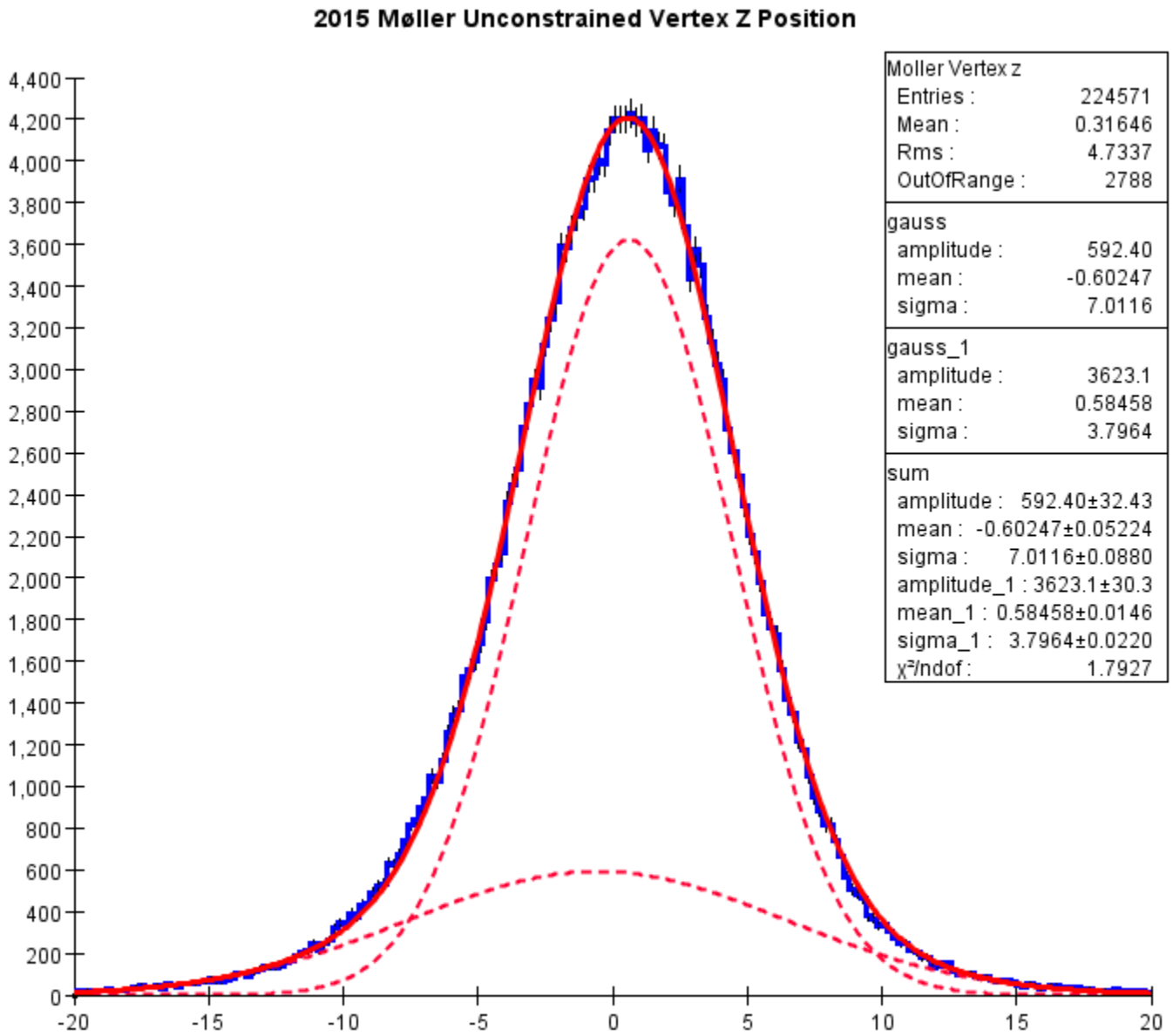

Moller Vertex x
Entries : 43027
Mean : 0.021359
Rms : 0.40590
OutOfRange : 45
1,400
1,200
1,000
800
600
400
200
0
-2
-1
0
1
2


Moller Vertex y
Entries : 42995
Mean : 3.6544E-3
Rms : 0.17945
OutOfRange : 77
1,200
1,000
800
600
400
200
0
-1.0
-0.5
0.0
0.5
1.0


Moller Vertex z
Entries : 42769
Mean : 0.21454
Rms : 4.8357
OutOfRange : 303
900
800
700
600
500
400
300
200
100
0
-20
-10
0
10
20


Moller vertex X vs Y
1.0
0.5
0.0
-0.5
-1.0
-2
-1
0
1
2
10
1

Møller Vertex Z Position



V0 Vertex Z Position