SMT Efficiency studies

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Package :

smt_eff

SMT Efficiency studies :

- Motivation : calculate SMT efficiencies for individual ladders/ wedges. The goal is to provide a root/hbook packages which does the job for us, so that literally anybody can monitor/study SMT efficiencies depending on the broad scale of parameters (dead, noisy strips, position of the device in the detector, HV biases, radiation dose collected, noise, parameter settings…etc.)

- Method : Start with CFT stereo tracks and propagate them to SMT (skip one layer) and study the difference between the 1dim cluster position and tracking parameter for (p-side separately from n-side)

Run # 147897, (130 kevts), 109k analyzed, magnetic field ON
1st layer of SMT skipped (lyr =1, lad = 1),
CFT instrumented only out of 1/5 (wedge in ϕ)

- efficiency for a given device

eff = # of tracks with the hit / good tracks

CFT-SMT geometry (run 147897):

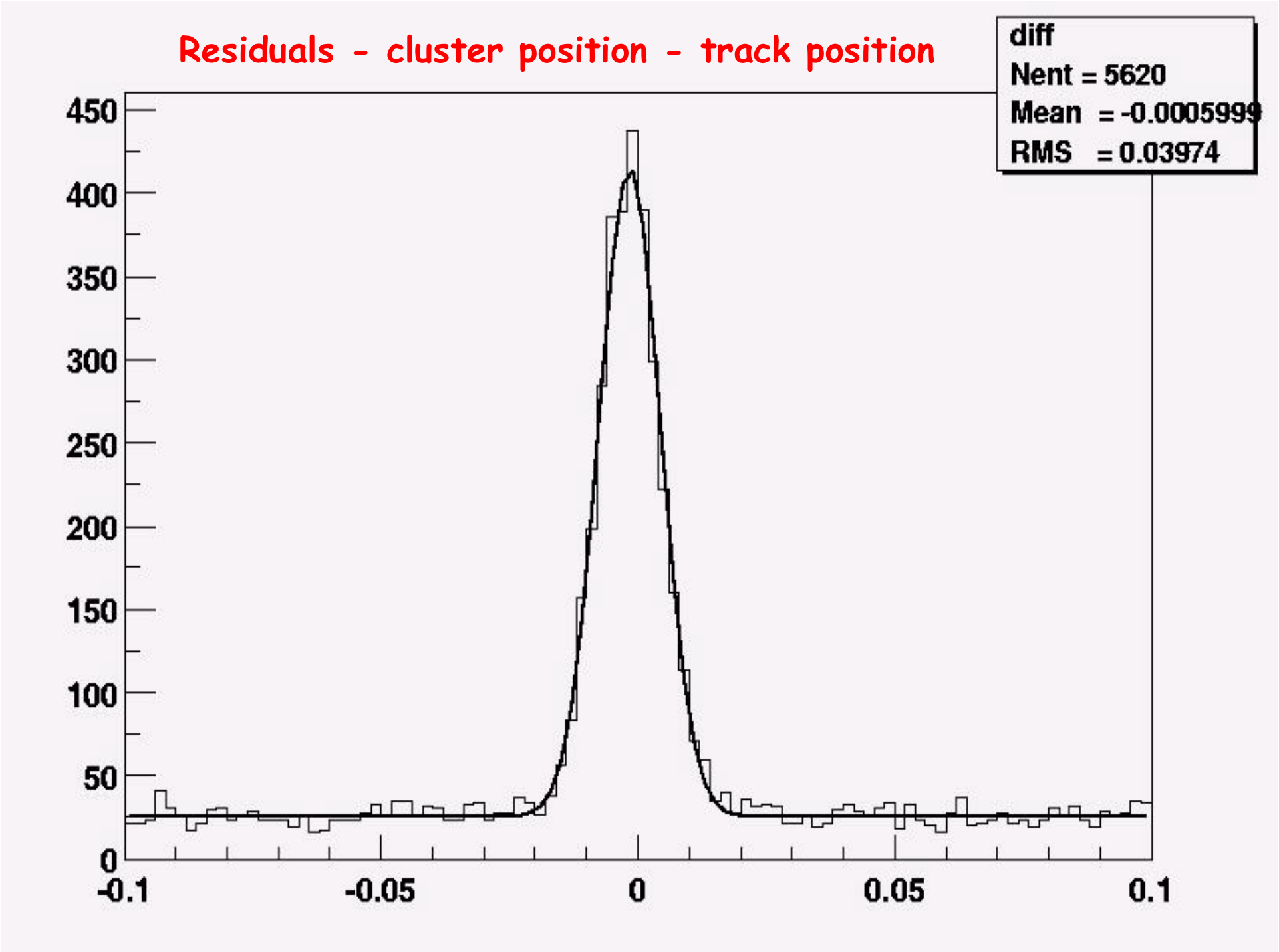
Cuts and choice of good tracks :

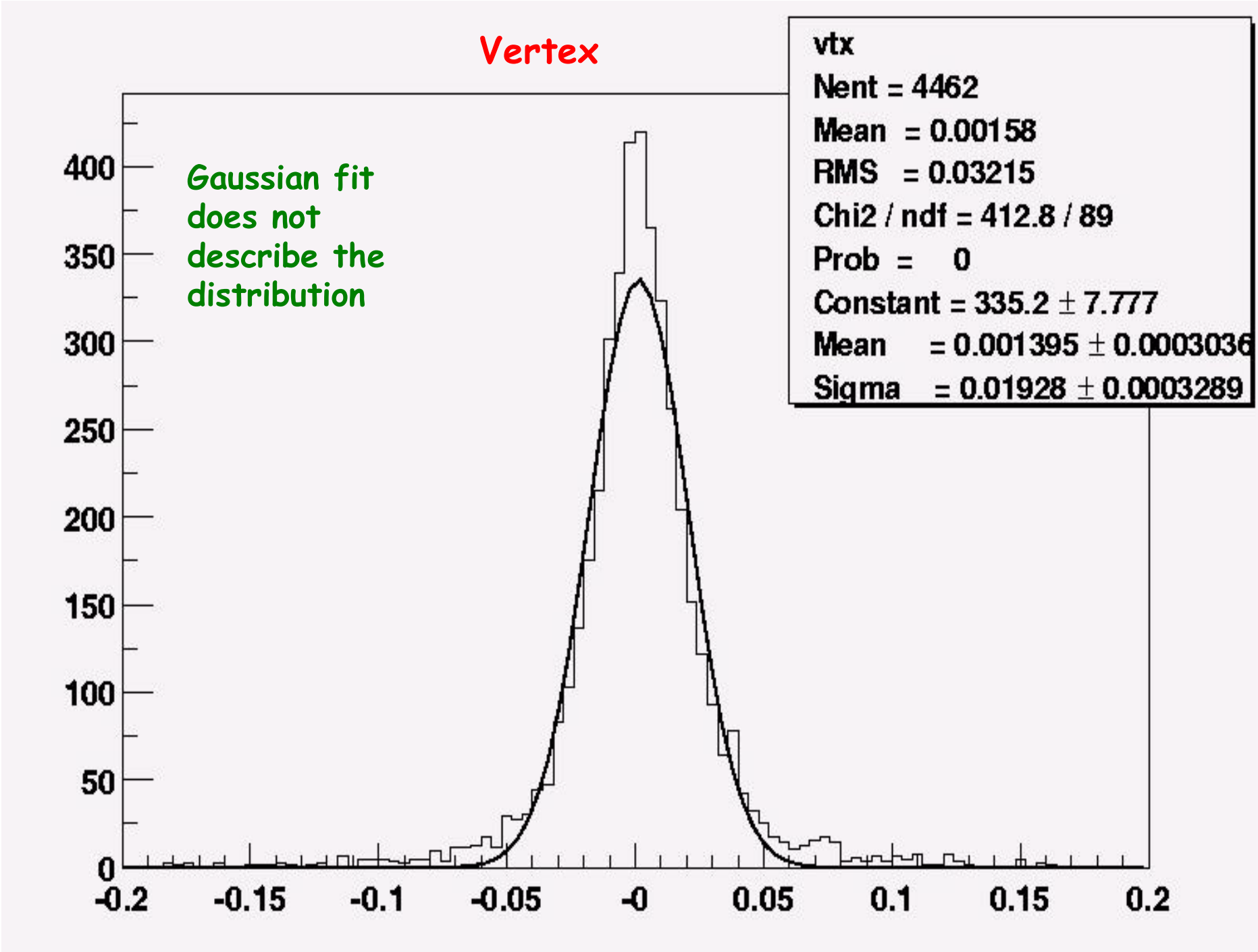
- cuts : pt > 0.5 GeV/c
  nhit > 19 (in principal, misses in CFT are allowed)
  lyr =1, lad = 1
  (4 devices, crates 0x6A and 0x6B)
  there are 6 devices (4x 6-chippers + 2x 3-chippers)
  in total. We have started with 6-chippers (p-sides),
  90° stereo devices

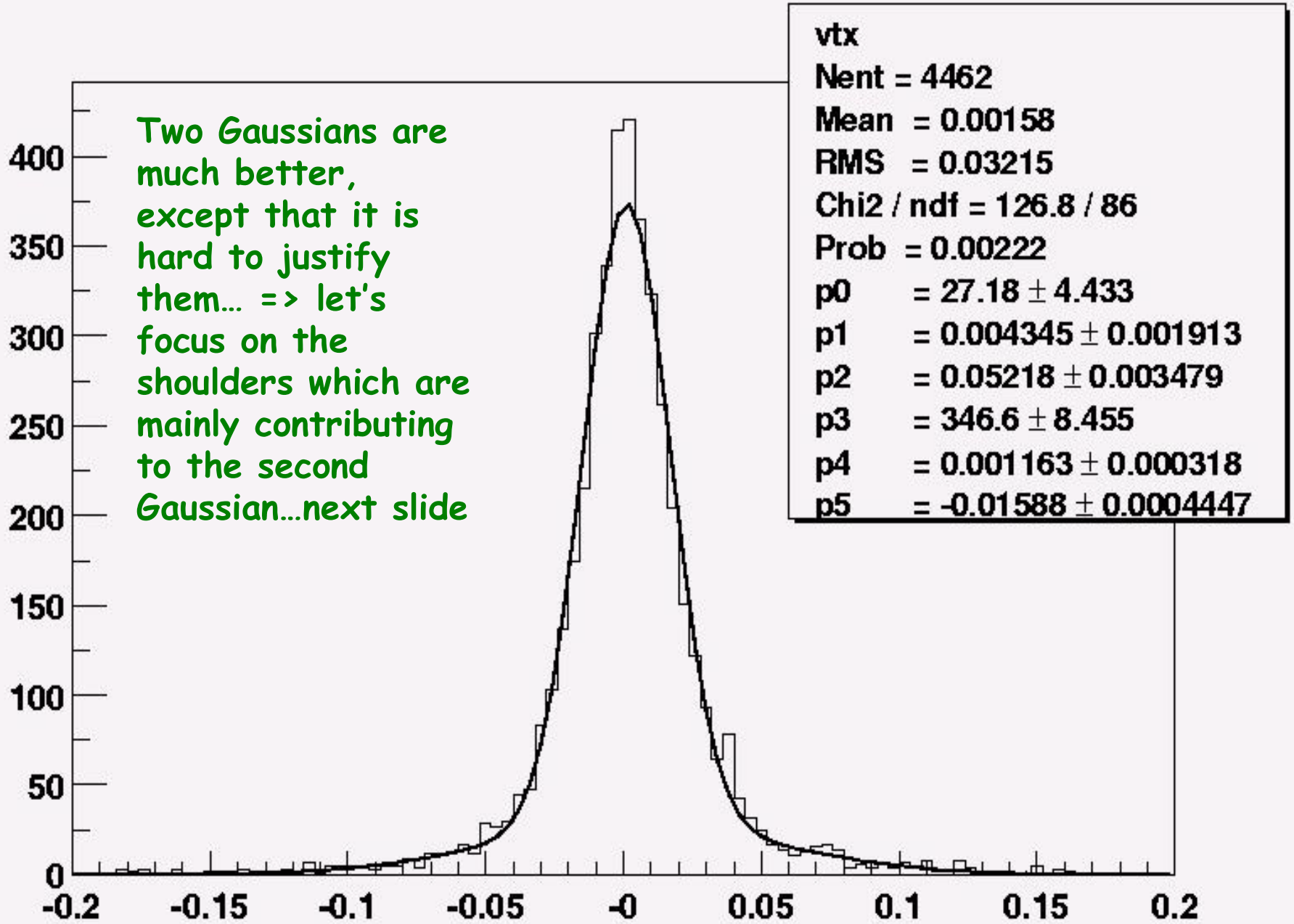
vtx fit : **xv = -332 μm**
yv = -685 μm

dca fit : **DCA < 30 μm**

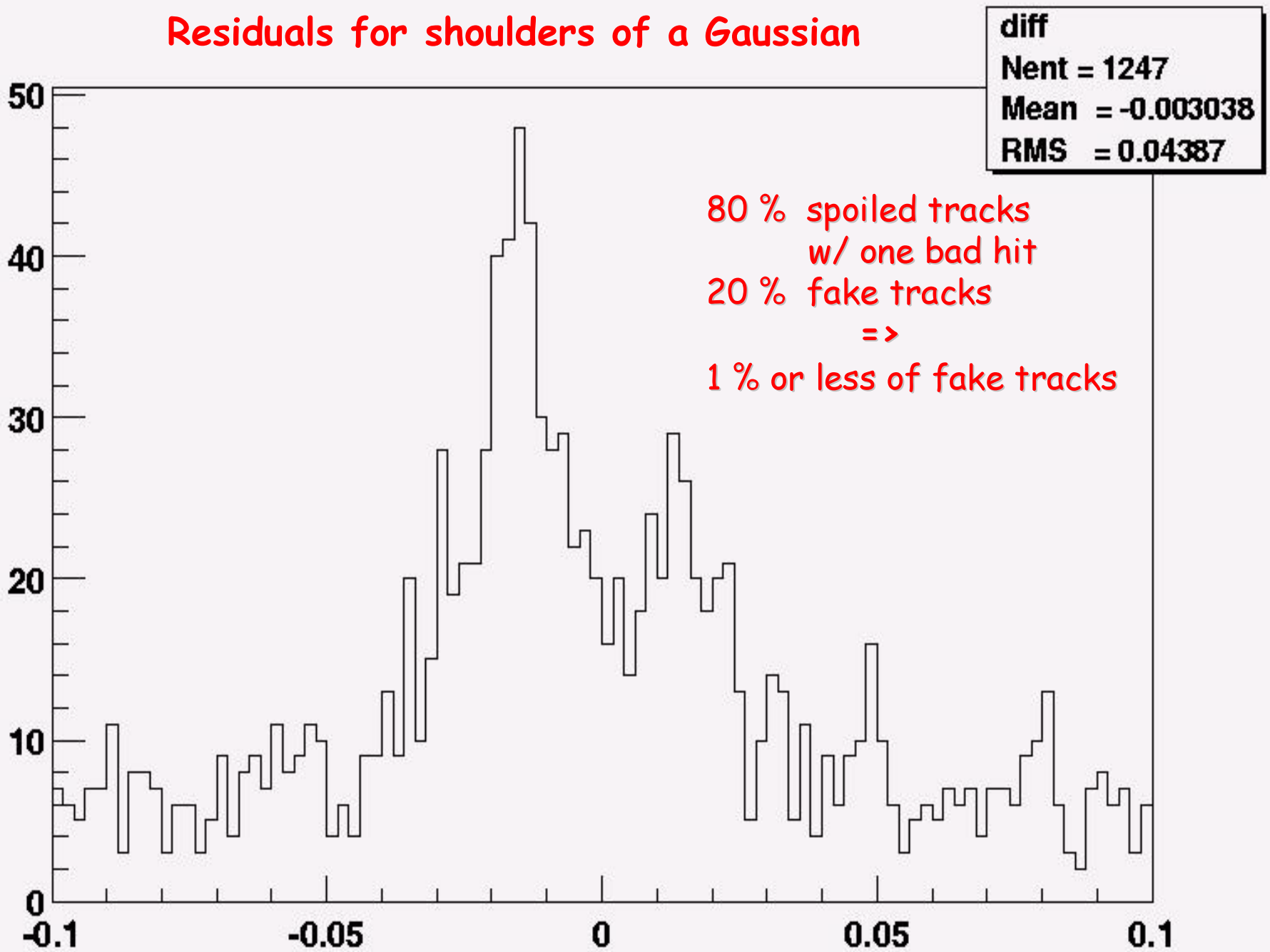
xstat = 0 - this is a cut on the fiducial volume
(we disregard everything which is 5 sigma away from the track. It naturally creates borders (1mm) around the edges of the device)


Residuals - cluster position - track position
diff
Nent = 5620
Mean = -0.0005999
RMS = 0.03974
450
400
350
300
250
200
150
100
50
0
-0.1
-0.05
0
0.05
0.1


Vertex
vtx
Nent = 4462
Mean = 0.00158
RMS = 0.03215
Chi2 / ndf = 412.8 / 89
Prob = 0
Constant = 335.2 ± 7.777
Mean = 0.001395 ± 0.0003036
Sigma = 0.01928 ± 0.0003289
Gaussian fit does not describe the distribution
400
350
300
250
200
150
100
50
0
-0.2
-0.15
-0.1
-0.05
-0
0.05
0.1
0.15
0.2


vtx
Nent = 4462
Mean = 0.00158
RMS = 0.03215
Chi2 / ndf = 126.8 / 86
Prob = 0.00222
p0 = 27.18 ± 4.433
p1 = 0.004345 ± 0.001913
p2 = 0.05218 ± 0.003479
p3 = 346.6 ± 8.455
p4 = 0.001163 ± 0.000318
p5 = -0.01588 ± 0.0004447
Two Gaussians are much better, except that it is hard to justify them… => let's focus on the shoulders which are mainly contributing to the second Gaussian…next slide
400
350
300
250
200
150
100
50
0
-0.2
-0.15
-0.1
-0.05
-0
0.05
0.1
0.15
0.2

Residuals for shoulders of a Gaussian



80 % spoiled tracks
w/ one bad hit
20 % fake tracks
=>
1 % or less of fake tracks

SMT efficiencies - preliminary results :

no. of fakes in [-0.2, -0.03] & [0.03, 0.2] = 171 tracks

- cut on vtx : [-0.03, 0.03]
  Ntrack = 3,617
  fake = 0.03/0.17 * 171 = 30
  Nggood = 3,064 ± 80
  eff = (85.5 ± 3) % (4x 6-chip devices, lay=1, lad=1) p-sides only !
- cut on vtx : [-0.01, 0.01]
  Ntrack = 1,865
  fake = 0.01/0.17 * 171 = 10
  Ngood = 1,600
  eff = (85.8 ± 3.5) %
- cut on vtx : [-0.05, 0.05]
  Ntrack = 4,101
  fake = 0.05/0.17 * 171 = 50
  Ngood = 3,502
  eff = (85.4 ± 3.4) %
- cut on vtx : [-0.05, 0.05]
  Ntrack = 4,353
  fake = 0.1/0.17 * 171 = 100
  Ngood = 3,769
  eff = (83.8 ± 4) %