

Q2_test

January 17, 2023

```
[1]: import ROOT
```

Welcome to JupyROOT 6.26/08

```
[2]: # Reminder of quarter arrangement
#   3 | 2
# -----
#   1 | 0
# A-side is towards positive x
# with z going into the tafelebene, <- x going left and y going up the
#   ↪ arrangement is
#   2 | 3
# -----
#   0 | 1
# isn't it?
```

```
[3]: ### these tuples are made on e5 cluster where i only had 1 file lets see if it
#   ↪ worked

# paths to files
path_v1="/interactive_storage/nbreer/build_stack/tracking/PlotFiles/
#   ↪ TEMP_ROOT_FILES/v1"
path_v2="/interactive_storage/nbreer/build_stack/tracking/PlotFiles/
#   ↪ TEMP_ROOT_FILES/v2"
path_lowmu="/interactive_storage/nbreer/build_stack/tracking/PlotFiles/
#   ↪ TEMP_ROOT_FILES/lowmu"

# v1
file_v1_Q1=ROOT.TFile(f"{path_v1}/Q1/
#   ↪ pr_LongModulesv1_branchTuples_Q1_VeloSciFiAligned_RN256145_slice0.root")
file_v1_Q2=ROOT.TFile(f"{path_v1}/Q2/
#   ↪ pr_LongModulesv1_branchTuples_Q2_VeloSciFiAligned_RN256145_slice0.root")
file_v1_Q3=ROOT.TFile(f"{path_v1}/Q3/
#   ↪ pr_LongModulesv1_branchTuples_Q3_VeloSciFiAligned_RN256145_slice0.root")
file_v1_Q4=ROOT.TFile(f"{path_v1}/Q4/
#   ↪ pr_LongModulesv1_branchTuples_Q4_VeloSciFiAligned_RN256145_slice0.root")
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# v2
file_v2_Q1=ROOT.TFile(f"{path_v2}/Q1/
↳pr_LongModulesv2_branch_Tuples_Q1_VeloSciFiAligned_RN256145_slice0.root")
file_v2_Q2=ROOT.TFile(f"{path_v2}/Q2/
↳pr_LongModulesv2_branch_Tuples_Q2_VeloSciFiAligned_RN256145_slice0.root")
file_v2_Q3=ROOT.TFile(f"{path_v2}/Q3/
↳pr_LongModulesv2_branch_Tuples_Q3_VeloSciFiAligned_RN256145_slice0.root")
file_v2_Q4=ROOT.TFile(f"{path_v2}/Q4/
↳pr_LongModulesv2_branch_Tuples_Q4_VeloSciFiAligned_RN256145_slice0.root")

file_lowmu_Q1=ROOT.TFile(f"{path_lowmu}/Q1/
↳pr_LongModulesLM_branchTuples_Q1_VeloSciFiAligned_RN256145_slice0.root")
file_lowmu_Q2=ROOT.TFile(f"{path_lowmu}/Q2/
↳pr_LongModulesLM_branchTuples_Q2_VeloSciFiAligned_RN256145_slice0.root")
file_lowmu_Q3=ROOT.TFile(f"{path_lowmu}/Q3/
↳pr_LongModulesLM_branchTuples_Q3_VeloSciFiAligned_RN256145_slice0.root")
file_lowmu_Q4=ROOT.TFile(f"{path_lowmu}/Q4/
↳pr_LongModulesLM_branchTuples_Q4_VeloSciFiAligned_RN256145_slice0.root")

# path for retested v2 and lowmu bc they were the sa
path_retest="/interactive_storage/nbreer/build_stack/tracking/PlotFiles/
↳TEMP_ROOT_FILES/retest_v2_lowmu"
# v2_hists="pr_LongModulesV2_Q1_VeloSciFiAligned_RN256145_slice0_new"
v2_tuple="pr_LongModulesV2Tuples_Q1_VeloSciFiAligned_RN256145_slice0"
# lowmu_histo="pr_LongModulesLOW_Q1_VeloSciFiAligned_RN256145_slice0_new"
lowmu_tuple="pr_LongModulesLOWTuple_Q1_VeloSciFiAligned_RN256145_slice0"

file_v2_Q1_re=ROOT.TFile(f"{path_retest}/v2_Q1/{v2_tuple}.root")
file_lowmu_Q1_re=ROOT.TFile(f"{path_retest}/lowmu_Q1/{lowmu_tuple}.root")

```

```

[4]: # Q1
tracktuple_v1_Q1=file_v1_Q1.AlignTracksInFTTrackMonitor.FTTrackTuple_tracks
nodetuple_v1_Q1=file_v1_Q1.AlignTracksInFTTrackMonitor.FTTrackTuple_nodes

tracktuple_v2_Q1=file_v2_Q1.AlignTracksInFTTrackMonitor.FTTrackTuple_tracks
nodetuple_v2_Q1=file_v2_Q1.AlignTracksInFTTrackMonitor.FTTrackTuple_nodes

tracktuple_lowmu_Q1=file_lowmu_Q1.AlignTracksInFTTrackMonitor.
↳FTTrackTuple_tracks
nodetuple_lowmu_Q1=file_lowmu_Q1.AlignTracksInFTTrackMonitor.FTTrackTuple_nodes

# Q2
tracktuple_v1_Q2=file_v1_Q2.AlignTracksInFTTrackMonitor.FTTrackTuple_tracks
nodetuple_v1_Q2=file_v1_Q2.AlignTracksInFTTrackMonitor.FTTrackTuple_nodes

tracktuple_v2_Q2=file_v2_Q2.AlignTracksInFTTrackMonitor.FTTrackTuple_tracks

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nodetuple_v2_Q2=file_v2_Q2.AlignTracksInFTTrackMonitor.FTTrackTuple_nodes

tracktuple_lowmu_Q2=file_lowmu_Q2.AlignTracksInFTTrackMonitor.
↪FTTrackTuple_tracks
nodetuple_lowmu_Q2=file_lowmu_Q2.AlignTracksInFTTrackMonitor.FTTrackTuple_nodes

# Q3
tracktuple_v1_Q3=file_v1_Q3.AlignTracksInFTTrackMonitor.FTTrackTuple_tracks
nodetuple_v1_Q3=file_v1_Q3.AlignTracksInFTTrackMonitor.FTTrackTuple_nodes

tracktuple_v2_Q3=file_v2_Q3.AlignTracksInFTTrackMonitor.FTTrackTuple_tracks
nodetuple_v2_Q3=file_v2_Q3.AlignTracksInFTTrackMonitor.FTTrackTuple_nodes

tracktuple_lowmu_Q3=file_lowmu_Q3.AlignTracksInFTTrackMonitor.
↪FTTrackTuple_tracks
nodetuple_lowmu_Q3=file_lowmu_Q3.AlignTracksInFTTrackMonitor.FTTrackTuple_nodes

# Q4
tracktuple_v1_Q4=file_v1_Q4.AlignTracksInFTTrackMonitor.FTTrackTuple_tracks
nodetuple_v1_Q4=file_v1_Q4.AlignTracksInFTTrackMonitor.FTTrackTuple_nodes

tracktuple_v2_Q4=file_v2_Q4.AlignTracksInFTTrackMonitor.FTTrackTuple_tracks
nodetuple_v2_Q4=file_v2_Q4.AlignTracksInFTTrackMonitor.FTTrackTuple_nodes

tracktuple_lowmu_Q4=file_lowmu_Q4.AlignTracksInFTTrackMonitor.
↪FTTrackTuple_tracks
nodetuple_lowmu_Q4=file_lowmu_Q4.AlignTracksInFTTrackMonitor.FTTrackTuple_nodes

```

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[5]: nodetuples_Q1 = [nodetuple_v1_Q1, nodetuple_v2_Q1, nodetuple_lowmu_Q1]
      nodetuples_Q2 = [nodetuple_v1_Q2, nodetuple_v2_Q2, nodetuple_lowmu_Q2]
      nodetuples_Q3 = [nodetuple_v1_Q3, nodetuple_v2_Q3, nodetuple_lowmu_Q3]
      nodetuples_Q4 = [nodetuple_v1_Q4, nodetuple_v2_Q4, nodetuple_lowmu_Q4]

```

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[6]: # previous tuples
      # tracktuple_v2_Q1=file_v2_Q1.AlignTracksInFTTrackMonitor.FTTrackTuple_tracks
      # nodetuple_v2_Q1=file_v2_Q1.AlignTracksInFTTrackMonitor.FTTrackTuple_nodes

      # tracktuple_lowmu_Q1=file_lowmu_Q1.AlignTracksInFTTrackMonitor.
      ↪FTTrackTuple_tracks
      # nodetuple_lowmu_Q1=file_lowmu_Q1.AlignTracksInFTTrackMonitor.
      ↪FTTrackTuple_nodes

      # tracktuple_Q1=file_Q1.AlignTracksInFTTrackMonitor.FTTrackTuple_tracks
      # nodetuple_Q1=file_Q1.AlignTracksInFTTrackMonitor.FTTrackTuple_nodes

      ## put in Q1 track and nodetuples

```

```
# tracktuples=[tracktuple_Q1, tracktuple_v2_Q1, tracktuple_lowmu_Q1]
# nodetuples=[nodetuple_Q1, nodetuple_v2_Q1, nodetuple_lowmu_Q1]
```

```
[7]: # nodelabel="Q2"

# ROOT.gStyle.SetOptStat(1)
# c8=ROOT.TCanvas("", "", 1000, 800)

# nodetuples_Q2[0].Draw("node_X >> hist8(100, -2500, 2500)",
↳ "globalModuleIndex>1", "")
# hist8=ROOT.gDirectory.Get("hist8")
# hist8.SetTitle("node_X comparison")
# hist8.SetLineColor(ROOT.kBlack)
# hist8.SetLineWidth(3)
# # hist8.Scale(1.0/hist8.GetEntries())

# nodetuples_Q2[1].Draw("node_X >> hist9(100, -2500, 2500)",
↳ "globalModuleIndex>1", "")
# hist9=ROOT.gDirectory.Get("hist9")
# hist9.SetTitle("node_X comparison")
# hist9.SetLineColor(ROOT.kGreen)
# hist9.SetLineWidth(3)
# # hist9.Scale(1.0/hist9.GetEntries())

# nodetuples_Q2[2].Draw("node_X >> hist10(100, -2500, 2500)",
↳ "globalModuleIndex>1", "")
# hist10=ROOT.gDirectory.Get("hist10")
# hist10.SetTitle("node_X comparison")
# hist10.SetLineColor(ROOT.kRed)
# hist10.SetLineWidth(3)
# # hist10.Scale(1.0/hist10.GetEntries())

# stack=ROOT.THStack("stack", "node_X in Q1")
# stack.Add(hist8)
# stack.Add(hist9)
# stack.Add(hist10)
# stack.Draw("nostack")

# if nodelabel in ["Q2", "Q0"]:
#     stack.GetAxis().SetLimits(-50, 2500)
# else:
#     stack.GetAxis().SetLimits(-2500, 50)
# stack.GetAxis().SetTitle("x in Q1 [mm]")
# stack.GetYaxis().SetTitle("#hits")

# legend = ROOT.TLegend(0.65, 0.55, 0.85, 0.75)
# legend.AddEntry(hist8, "data v1", "l")
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# legend.AddEntry(hist9,"data v2","l")
# legend.AddEntry(hist10,"data low mu","l")
# legend.Draw()

# c8.Draw()
# c8.SaveAs(f"tuples_out/DataSeedsTupled_node_X_All_{nodelabel}.pdf")

```

```

[8]: # compare all quarters in node x

nodelabel="v1"

ROOT.gStyle.SetOptStat(0)
c8=ROOT.TCanvas("", "", 1200, 900)

nodetuples_Q1[0].Draw("node_X >> hist8(100,0,2000)", "globalModuleIndex>1","")
hist8=ROOT.gDirectory.Get("hist8")
hist8.SetTitle("node_X comparison")
hist8.SetLineColor(ROOT.kBlack)
hist8.SetLineWidth(3)
# hist8.Scale(1.0/hist8.GetEntries())

nodetuples_Q2[0].Draw("node_X >> hist9(100,-1500,0)", "globalModuleIndex>1","")
hist9=ROOT.gDirectory.Get("hist9")
hist9.SetTitle("node_X comparison")
hist9.SetLineColor(ROOT.kGreen)
hist9.SetLineWidth(3)
# hist9.Scale(1.0/hist9.GetEntries())

nodetuples_Q3[0].Draw("node_X >> hist10(100,0,2000)", "globalModuleIndex>1","")
hist10=ROOT.gDirectory.Get("hist10")
hist10.SetTitle("node_X comparison")
hist10.SetLineColor(ROOT.kRed)
hist10.SetLineWidth(3)
# hist10.Scale(1.0/hist10.GetEntries())

nodetuples_Q4[0].Draw("node_X >> hist11(100,-1500,0)", "globalModuleIndex>1","")
hist11=ROOT.gDirectory.Get("hist11")
hist11.SetTitle("node_X comparison")
hist11.SetLineColor(ROOT.kBlue)
hist11.SetLineWidth(3)
# hist10.Scale(1.0/hist10.GetEntries())

stack=ROOT.THStack("stack","node_X, run256145, v1 alignment")
stack.Add(hist8)
stack.Add(hist9)
stack.Add(hist10)
stack.Add(hist11)

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stack.Draw("nostack")

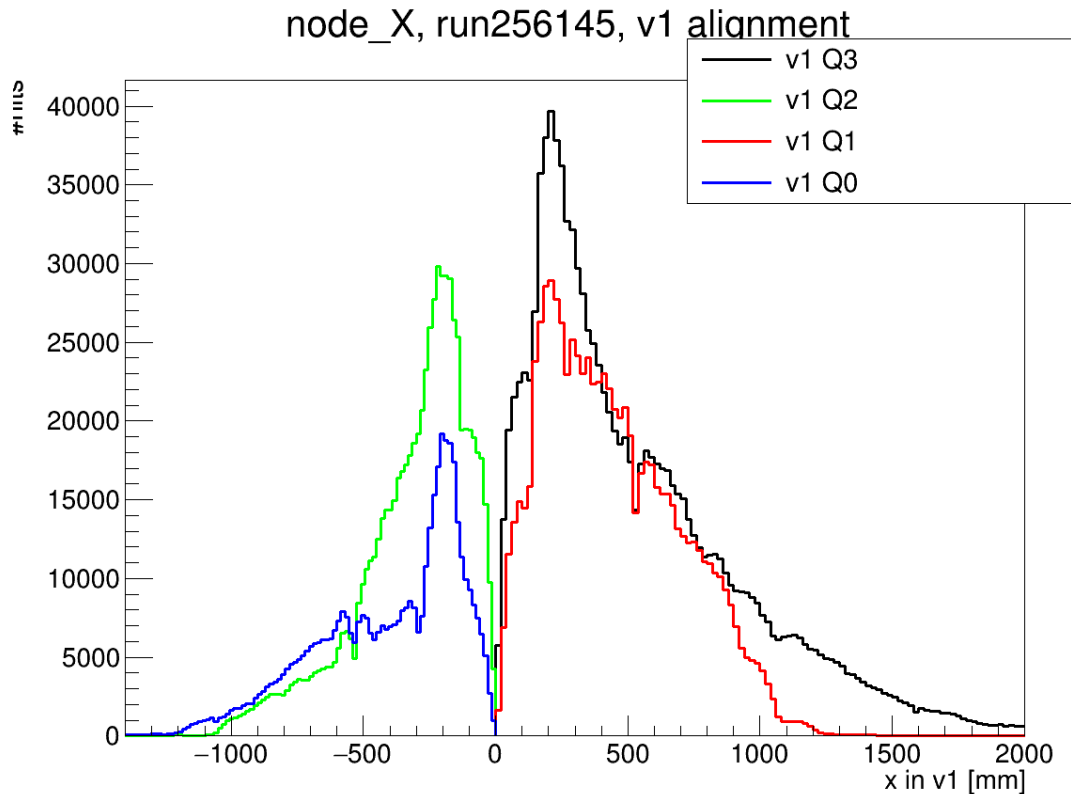
stack.GetAxis().SetLimits(-1400,2000)
stack.GetAxis().SetTitle("x in v1 [mm]")
stack.GetYaxis().SetTitle("#hits")

# try other labeling, commented out is the previous one
legend = ROOT.TLegend(0.6,0.75,0.95,0.95)
legend.AddEntry(hist8,"v1 Q3","l") # Q2
legend.AddEntry(hist9,"v1 Q2","l") # Q0
legend.AddEntry(hist10,"v1 Q1","l") # Q3
legend.AddEntry(hist11,"v1 Q0","l") # Q1
legend.Draw()

c8.Draw()
c8.SaveAs(f"tuples_out/DataSeedsTupled_node_X_All_{nodelabel}.pdf")

```

Info in <TCanvas::Print>: pdf file tuples_out/DataSeedsTupled_node_X_All_v1.pdf has been created



```

[9]: # compare all quarters from v2 in node x

nodeLabel="v2"

ROOT.gStyle.SetOptStat(0)
c8=ROOT.TCanvas("", "", 1200, 900)

nodetuples_Q1[1].Draw("node_X >> hist8(100,0,2000)", "globalModuleIndex>1", "")
hist8=ROOT.gDirectory.Get("hist8")
hist8.SetTitle("node_X comparison")
hist8.SetLineColor(ROOT.kBlack)
hist8.SetLineWidth(3)
# hist8.Scale(1.0/hist8.GetEntries())

nodetuples_Q2[1].Draw("node_X >> hist9(100,-1500,0)", "globalModuleIndex>1", "")
hist9=ROOT.gDirectory.Get("hist9")
hist9.SetTitle("node_X comparison")
hist9.SetLineColor(ROOT.kGreen)
hist9.SetLineWidth(3)
# hist9.Scale(1.0/hist9.GetEntries())

nodetuples_Q3[1].Draw("node_X >> hist10(100,0,2000)", "globalModuleIndex>1", "")
hist10=ROOT.gDirectory.Get("hist10")
hist10.SetTitle("node_X comparison")
hist10.SetLineColor(ROOT.kRed)
hist10.SetLineWidth(3)
# hist10.Scale(1.0/hist10.GetEntries())

nodetuples_Q4[1].Draw("node_X >> hist11(100,-1500,0)", "globalModuleIndex>1", "")
hist11=ROOT.gDirectory.Get("hist11")
hist11.SetTitle("node_X comparison")
hist11.SetLineColor(ROOT.kBlue)
hist11.SetLineWidth(3)
# hist10.Scale(1.0/hist10.GetEntries())

stack=ROOT.THStack("stack", "node_X, run256145, v2 alignment")
stack.Add(hist8)
stack.Add(hist9)
stack.Add(hist10)
stack.Add(hist11)
stack.Draw("nostack")

stack.GetXaxis().SetLimits(-1500, 2000)
stack.GetXaxis().SetTitle("x in v2 [mm]")
stack.GetYaxis().SetTitle("#hits")

legend = ROOT.TLegend(0.6, 0.75, 0.95, 0.95)

```

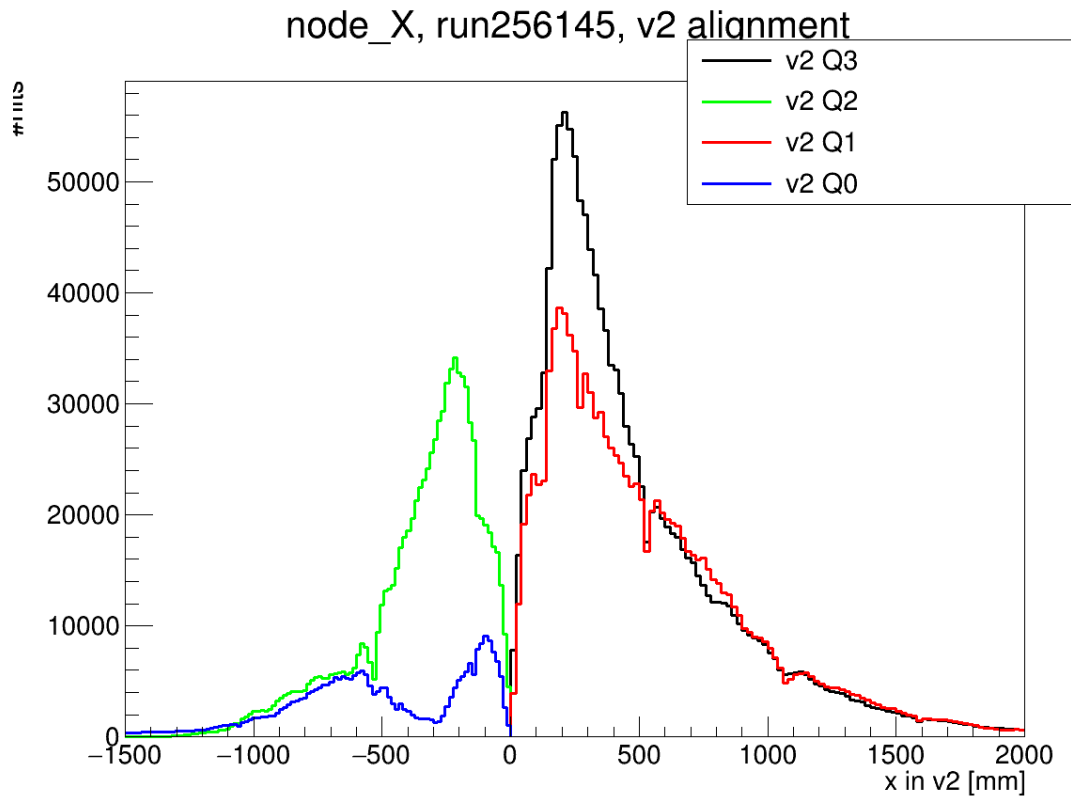
```

legend.AddEntry(hist8,"v2 Q3","l")
legend.AddEntry(hist9,"v2 Q2","l")
legend.AddEntry(hist10,"v2 Q1","l")
legend.AddEntry(hist11,"v2 Q0","l")
legend.Draw()

c8.Draw()
c8.SaveAs(f"tuples_out/DataSeedsTupled_node_X_All_{nodelabel}.pdf")

```

Info in <TCanvas::Print>: pdf file tuples_out/DataSeedsTupled_node_X_All_v2.pdf has been created



```

[10]: # compare all quarters from v2 in node x

nodelabel="lowmu"

ROOT.gStyle.SetOptStat(0)
c8=ROOT.TCanvas("", "", 1200, 900)

nodetuples_Q1[2].Draw("node_X >> hist8(100,0,2000)", "globalModuleIndex>1", "")
hist8=ROOT.gDirectory.Get("hist8")

```



```

hist8.SetTitle("node_X comparison")
hist8.SetLineColor(ROOT.kBlack)
hist8.SetLineWidth(3)
# hist8.Scale(1.0/hist8.GetEntries())

nodetuples_Q2[2].Draw("node_X >> hist9(100,-1500,0)", "globalModuleIndex>1","")
hist9=ROOT.gDirectory.Get("hist9")
hist9.SetTitle("node_X comparison")
hist9.SetLineColor(ROOT.kGreen)
hist9.SetLineWidth(3)
# hist9.Scale(1.0/hist9.GetEntries())

nodetuples_Q3[2].Draw("node_X >> hist10(100,0,2000)", "globalModuleIndex>1","")
hist10=ROOT.gDirectory.Get("hist10")
hist10.SetTitle("node_X comparison")
hist10.SetLineColor(ROOT.kRed)
hist10.SetLineWidth(3)
# hist10.Scale(1.0/hist10.GetEntries())

nodetuples_Q4[2].Draw("node_X >> hist11(100,-1500,0)", "globalModuleIndex>1","")
hist11=ROOT.gDirectory.Get("hist11")
hist11.SetTitle("node_X comparison")
hist11.SetLineColor(ROOT.kBlue)
hist11.SetLineWidth(3)
# hist10.Scale(1.0/hist10.GetEntries())

stack=ROOT.THStack("stack","node_X, run256145, low mu alignment")
stack.Add(hist8)
stack.Add(hist9)
stack.Add(hist10)
stack.Add(hist11)
stack.Draw("nostack")

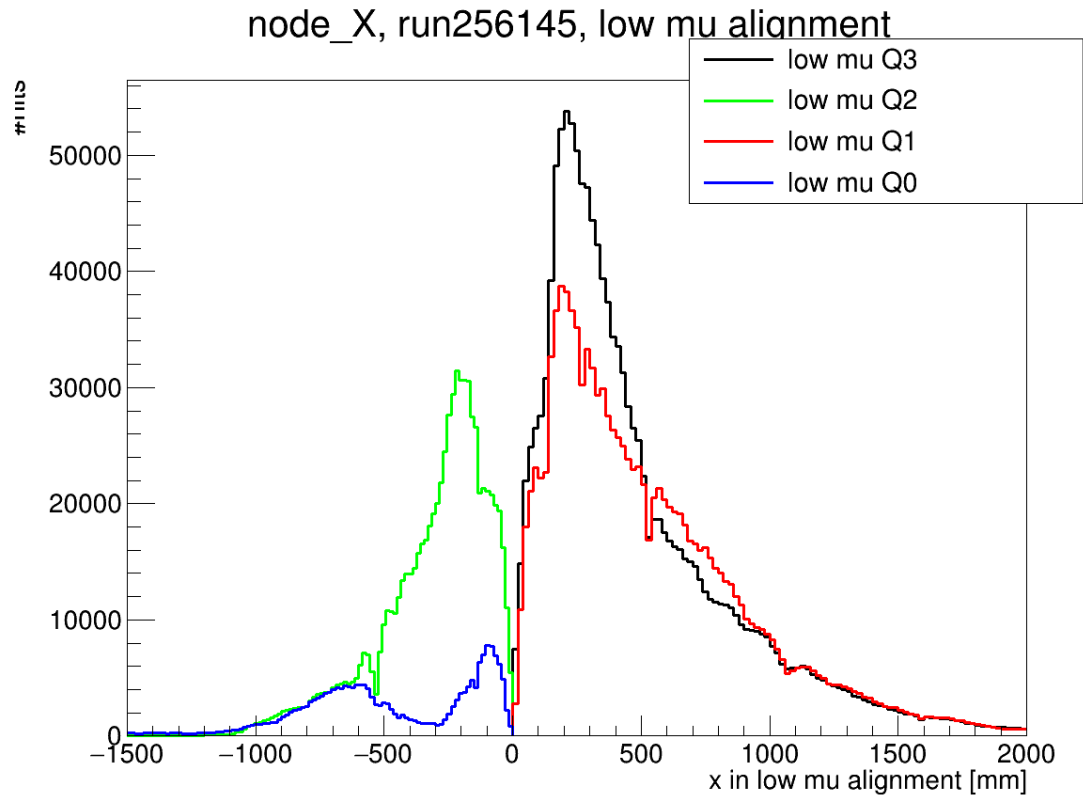
stack.GetXaxis().SetLimits(-1500,2000)
stack.GetXaxis().SetTitle("x in low mu alignment [mm]")
stack.GetYaxis().SetTitle("#hits")

legend = ROOT.TLegend(0.6,0.75,0.95,0.95)
legend.AddEntry(hist8,"low mu Q3","l")
legend.AddEntry(hist9,"low mu Q2","l")
legend.AddEntry(hist10,"low mu Q1","l")
legend.AddEntry(hist11,"low mu Q0","l")
legend.Draw()

c8.Draw()
c8.SaveAs(f"tuples_out/DataSeedsTupled_node_X_All_{nodelabel}.pdf")

```

Info in <TCanvas::Print>: pdf file
 tuples_out/DataSeedsTupled_node_X_All_lowmu.pdf has been created



```
[11]: # compare all quarters in node x

nodelabel="all_Q3"

ROOT.gStyle.SetOptStat(1)
c8=ROOT.TCanvas("", "", 1200, 900)

# for i in ["Q1", "Q2", "Q3", "Q4"]
nodetuples_Q1[0].Draw("node_X >> hist8(100,0,2000)", "globalModuleIndex>1", "")
hist8=ROOT.gDirectory.Get("hist8")
hist8.SetTitle("node_X comparison")
hist8.SetLineColor(ROOT.kBlack)
hist8.SetLineWidth(3)
# hist8.Scale(1.0/hist8.GetEntries())

nodetuples_Q1[1].Draw("node_X >> hist9(100,2000,0)", "globalModuleIndex>1", "")
hist9=ROOT.gDirectory.Get("hist9")
hist9.SetTitle("node_X comparison")
hist9.SetLineColor(ROOT.kBlue)
```

```

hist9.SetLineWidth(3)
# hist9.Scale(1.0/hist9.GetEntries())

nodetuples_Q1[2].Draw("node_X >> hist10(100,0,2000)", "globalModuleIndex>1","")
hist10=ROOT.gDirectory.Get("hist10")
hist10.SetTitle("node_X comparison")
hist10.SetLineColor(ROOT.kRed)
hist10.SetLineWidth(3)
# hist10.Scale(1.0/hist10.GetEntries())

stack=ROOT.THStack("stack","node_X: all alignments Q3, run256145")
stack.Add(hist8)
stack.Add(hist9)
stack.Add(hist10)
stack.Draw("nostack")

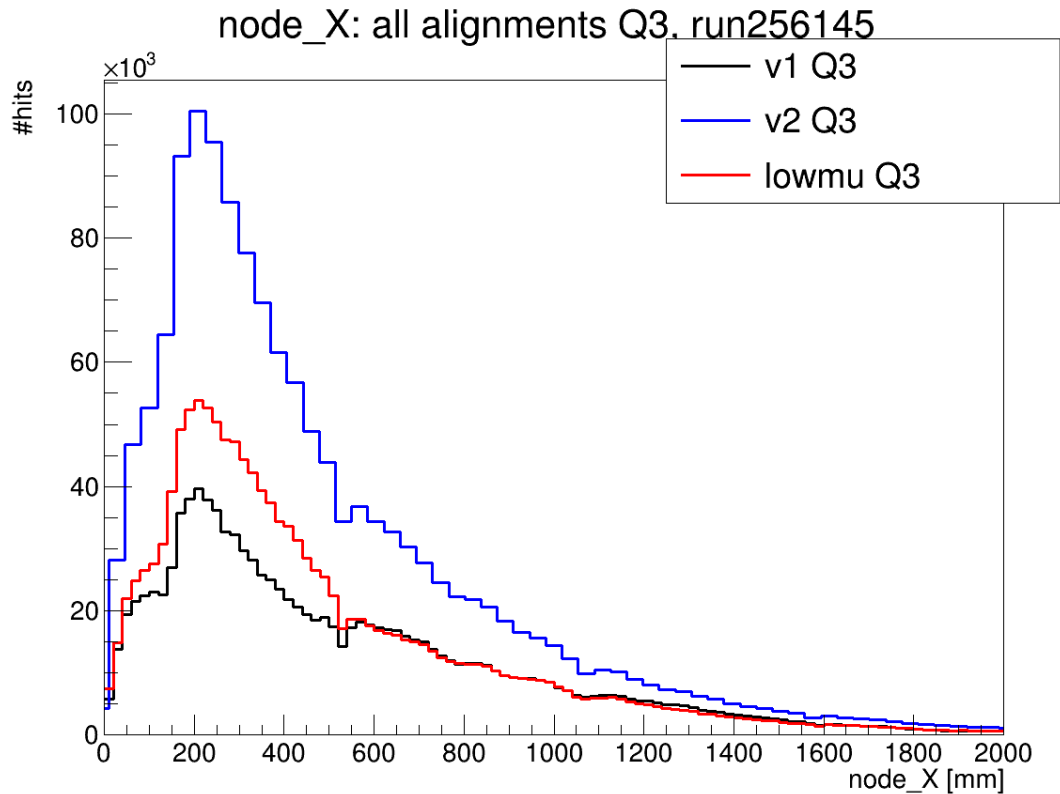
stack.GetXaxis().SetLimits(0,2000)
stack.GetXaxis().SetTitle("node_X [mm]")
stack.GetYaxis().SetTitle("#hits")

# try other labeling, commented out is the previous one
legend = ROOT.TLegend(0.6,0.75,0.95,0.95)
legend.AddEntry(hist8,"v1 Q3","l")
legend.AddEntry(hist9,"v2 Q3","l")
legend.AddEntry(hist10,"lowmu Q3","l")
legend.Draw()

c8.Draw()
c8.SaveAs(f"tuples_out/DataSeedsTupled_node_X_All_{nodelabel}.pdf")

```

Info in <TCanvas::Print>: pdf file
tuples_out/DataSeedsTupled_node_X_All_all_Q3.pdf has been created



```
[12]: # compare all quarters in node x

nodelabel="all_Q2"

ROOT.gStyle.SetOptStat(1)
c8=ROOT.TCanvas("", "", 1200, 900)

# for i in ["Q1", "Q2", "Q3", "Q4"]
nodetuples_Q2[0].Draw("node_X >> hist8(100,-1400,0)", "globalModuleIndex>1", "")
hist8=ROOT.gDirectory.Get("hist8")
hist8.SetTitle("node_X comparison")
hist8.SetLineColor(ROOT.kBlack)
hist8.SetLineWidth(3)
# hist8.Scale(1.0/hist8.GetEntries())

nodetuples_Q2[1].Draw("node_X >> hist9(100,-1400,0)", "globalModuleIndex>1", "")
hist9=ROOT.gDirectory.Get("hist9")
hist9.SetTitle("node_X comparison")
hist9.SetLineColor(ROOT.kBlue)
hist9.SetLineWidth(3)
# hist9.Scale(1.0/hist9.GetEntries())
```

```

nodetuples_Q2[2].Draw("node_X >> hist10(100,-1400,0)", "globalModuleIndex>1","")
hist10=ROOT.gDirectory.Get("hist10")
hist10.SetTitle("node_X comparison")
hist10.SetLineColor(ROOT.kRed)
hist10.SetLineWidth(3)
# hist10.Scale(1.0/hist10.GetEntries())

stack=ROOT.THStack("stack","node_X: all alignments Q2, run256145")
stack.Add(hist8)
stack.Add(hist9)
stack.Add(hist10)
stack.Draw("nostack")

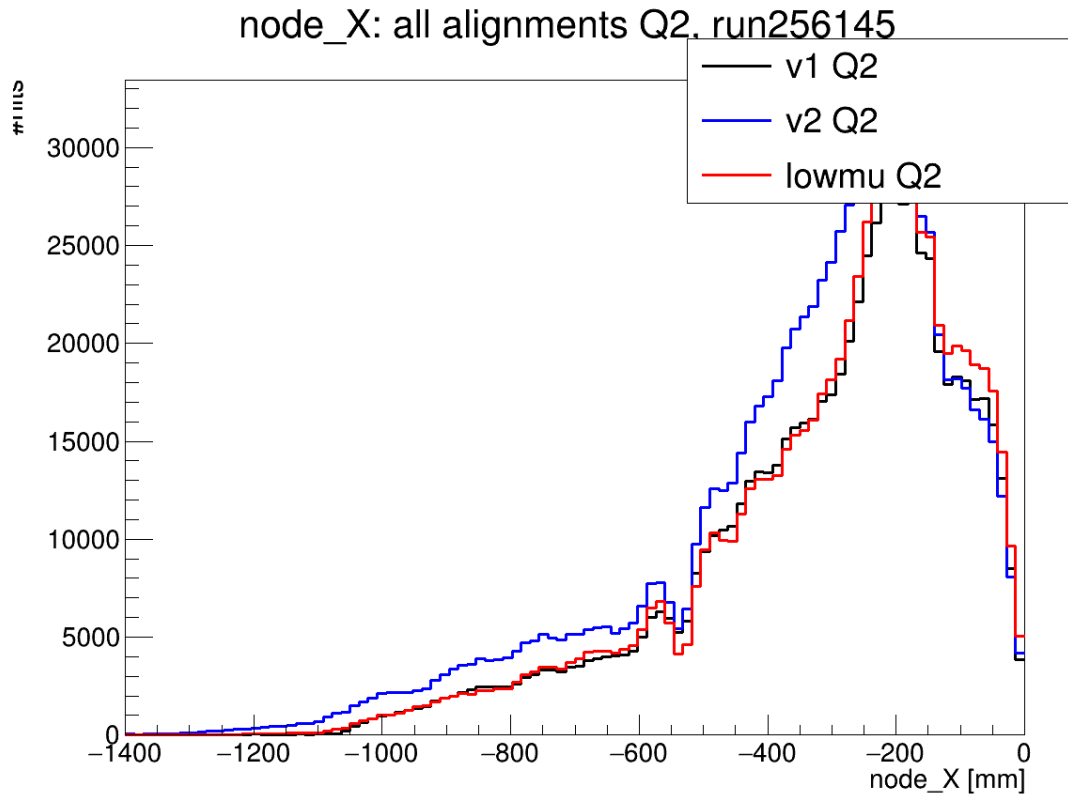
stack.GetXaxis().SetLimits(-1400,0)
stack.GetXaxis().SetTitle("node_X [mm]")
stack.GetYaxis().SetTitle("#hits")

# try other labeling, commented out is the previous one
legend = ROOT.TLegend(0.6,0.75,0.95,0.95)
legend.AddEntry(hist8,"v1 Q2","l")
legend.AddEntry(hist9,"v2 Q2","l")
legend.AddEntry(hist10,"lowmu Q2","l")
legend.Draw()

c8.Draw()
c8.SaveAs(f"tuples_out/DataSeedsTupled_node_X_All_{nodelabel}.pdf")

```

Info in <TCanvas::Print>: pdf file
tuples_out/DataSeedsTupled_node_X_All_all_Q2.pdf has been created



```
[13]: # compare all quarters in node x

nodeLabel="all_Q1"

ROOT.gStyle.SetOptStat(1)
c8=ROOT.TCanvas("", "", 1200, 900)

# for i in ["Q1", "Q2", "Q3", "Q4"]
nodetuples_Q3[0].Draw("node_X >> hist8(100,0,2000)", "globalModuleIndex>1", "")
hist8=ROOT.gDirectory.Get("hist8")
hist8.SetTitle("node_X comparison")
hist8.SetLineColor(ROOT.kBlack)
hist8.SetLineWidth(3)
# hist8.Scale(1.0/hist8.GetEntries())

nodetuples_Q3[1].Draw("node_X >> hist9(100,0,2000)", "globalModuleIndex>1", "")
hist9=ROOT.gDirectory.Get("hist9")
hist9.SetTitle("node_X comparison")
hist9.SetLineColor(ROOT.kBlue)
hist9.SetLineWidth(3)
# hist9.Scale(1.0/hist9.GetEntries())
```

```

nodetuples_Q3[2].Draw("node_X >> hist10(100,0,2000)", "globalModuleIndex>1","")
hist10=ROOT.gDirectory.Get("hist10")
hist10.SetTitle("node_X comparison")
hist10.SetLineColor(ROOT.kRed)
hist10.SetLineWidth(3)
# hist10.Scale(1.0/hist10.GetEntries())

stack=ROOT.THStack("stack","node_X: all alignments Q1, run256145")
stack.Add(hist8)
stack.Add(hist9)
stack.Add(hist10)
stack.Draw("nostack")

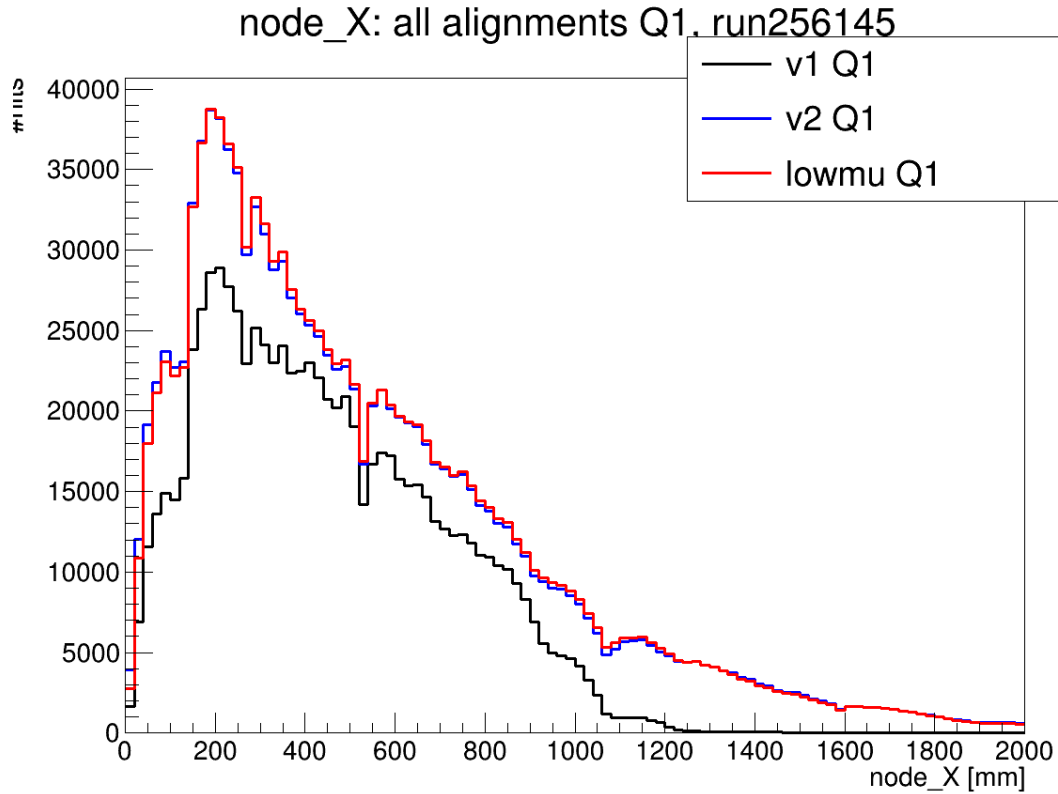
stack.GetXaxis().SetLimits(0,2000)
stack.GetXaxis().SetTitle("node_X [mm]")
stack.GetYaxis().SetTitle("#hits")

# try other labeling, commented out is the previous one
legend = ROOT.TLegend(0.6,0.75,0.95,0.95)
legend.AddEntry(hist8,"v1 Q1","l")
legend.AddEntry(hist9,"v2 Q1","l")
legend.AddEntry(hist10,"lowmu Q1","l")
legend.Draw()

c8.Draw()
c8.SaveAs(f"tuples_out/DataSeedsTupled_node_X_All_{nodelabel}.pdf")

```

Info in <TCanvas::Print>: pdf file
tuples_out/DataSeedsTupled_node_X_All_all_Q1.pdf has been created



```
[14]: # compare all quarters in node x

nodelabel="all_Q0"

ROOT.gStyle.SetOptStat(1)
c8=ROOT.TCanvas("", "", 1200, 900)

# for i in ["Q1", "Q2", "Q3", "Q4"]
nodetuples_Q4[0].Draw("node_X >> hist8(100,-1400,0)", "globalModuleIndex>1", "")
hist8=ROOT.gDirectory.Get("hist8")
hist8.SetTitle("node_X comparison")
hist8.SetLineColor(ROOT.kBlack)
hist8.SetLineWidth(3)
# hist8.Scale(1.0/hist8.GetEntries())

nodetuples_Q4[1].Draw("node_X >> hist9(100,-1400,0)", "globalModuleIndex>1", "")
hist9=ROOT.gDirectory.Get("hist9")
hist9.SetTitle("node_X comparison")
hist9.SetLineColor(ROOT.kBlue)
hist9.SetLineWidth(3)
# hist9.Scale(1.0/hist9.GetEntries())
```



```

nodetuples_Q4[2].Draw("node_X >> hist10(100,-1400,0)", "globalModuleIndex>1","")
hist10=ROOT.gDirectory.Get("hist10")
hist10.SetTitle("node_X comparison")
hist10.SetLineColor(ROOT.kRed)
hist10.SetLineWidth(3)
# hist10.Scale(1.0/hist10.GetEntries())

stack=ROOT.THStack("stack","node_X: all alignments Q0, run256145")
stack.Add(hist8)
stack.Add(hist9)
stack.Add(hist10)
stack.Draw("nostack")

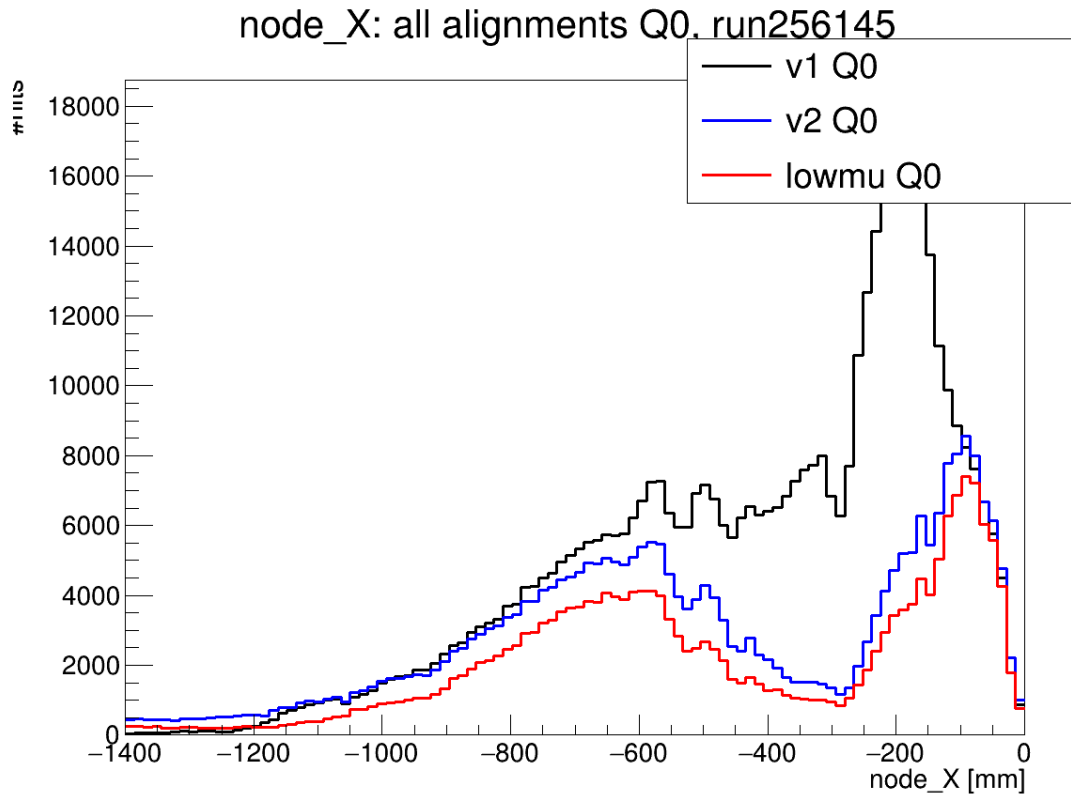
stack.GetXaxis().SetLimits(-1400,0)
stack.GetXaxis().SetTitle("node_X [mm]")
stack.GetYaxis().SetTitle("#hits")

# try other labeling, commented out is the previous one
legend = ROOT.TLegend(0.6,0.75,0.95,0.95)
legend.AddEntry(hist8,"v1 Q0","l")
legend.AddEntry(hist9,"v2 Q0","l")
legend.AddEntry(hist10,"lowmu Q0","l")
legend.Draw()

c8.Draw()
c8.SaveAs(f"tuples_out/DataSeedsTupled_node_X_All_{nodelabel}.pdf")

```

Info in <TCanvas::Print>: pdf file
tuples_out/DataSeedsTupled_node_X_All_all_Q0.pdf has been created



```
[15]: test_params=["residual",
                  "node_Y",
                  "node_Z",
                  "p",
                  "tx",
                  "ty",
                  "errResidual"
                ]

# TODO: pt/p and node_X:node_Y as 2D plot
```

```
[16]: nodelabel="Q3"

ROOT.gStyle.SetOptStat(0)
c8=ROOT.TCanvas("", "", 1200, 900)

limits={"residual":[-1,1], "node_Y":[0,2000], "node_Z":[7800,9400], "p":[0,5], "tx":[-0.5, 0.5], "ty":[-0.3,0.3], "errResidual":[0.04,0.085]}

for var in test_params:
    lower_limit, upper_limit=limits[var][0], limits[var][1]
```

```

    nodetuples_Q1[0].Draw(f"{var} >> hist8(100,{lower_limit},{upper_limit})",
↳"globalModuleIndex>1", "")
    hist8=ROOT.gDirectory.Get("hist8")
    hist8.SetTitle(f"{var} comparison")
    hist8.SetLineColor(ROOT.kBlack)
    hist8.SetLineWidth(3)
    hist8.Scale(1.0/hist8.GetEntries())

    nodetuples_Q1[1].Draw(f"{var} >> hist9(100,{lower_limit},{upper_limit})",
↳"globalModuleIndex>1", "")
    hist9=ROOT.gDirectory.Get("hist9")
    hist9.SetTitle(f"{var} comparison")
    hist9.SetLineColor(ROOT.kBlue)
    hist9.SetLineWidth(3)
    hist9.Scale(1.0/hist9.GetEntries())

    nodetuples_Q1[2].Draw(f"{var} >> hist10(100,{lower_limit},{upper_limit})",
↳"globalModuleIndex>1", "")
    hist10=ROOT.gDirectory.Get("hist10")
    hist10.SetTitle(f"{var} comparison")
    hist10.SetLineColor(ROOT.kRed)
    hist10.SetLineWidth(3)
    hist10.Scale(1.0/hist10.GetEntries())

    stack=ROOT.THStack("stack",f"{var}, {nodelabel}, all alignments, run256145")
    stack.Add(hist8)
    stack.Add(hist9)
    stack.Add(hist10)
    stack.Draw("nostack")

    stack.GetXaxis().SetTitle(f"{var}")
    stack.GetYaxis().SetTitle("#hits")

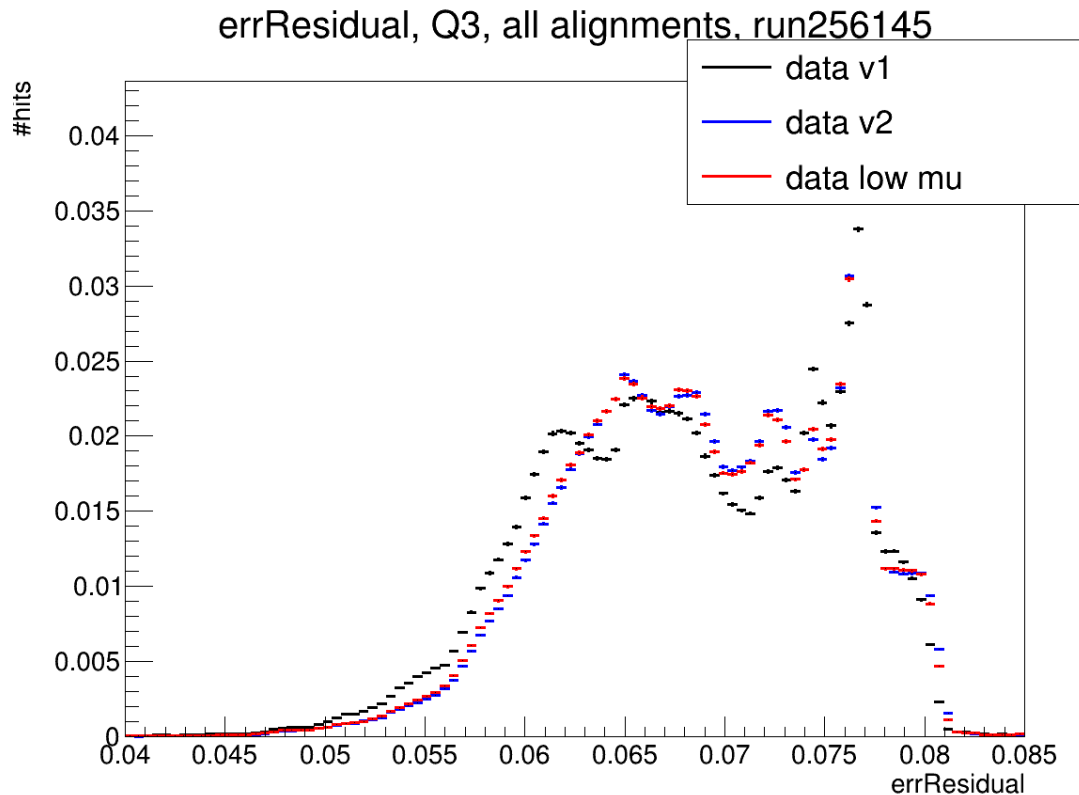
    legend = ROOT.TLegend(0.6,0.75,0.95,0.95)
    legend.AddEntry(hist8,"data v1","l")
    legend.AddEntry(hist9,"data v2","l")
    legend.AddEntry(hist10,"data low mu","l")
    legend.Draw()

    c8.Draw()
    c8.SaveAs(f"tuples_out/compareAlignments_normalized_{var}_{nodelabel}.pdf")

```

Info in <TCanvas::Print>: pdf file
tuples_out/compareAlignments_normalized_residual_Q3.pdf has been created
Info in <TCanvas::Print>: pdf file
tuples_out/compareAlignments_normalized_node_Y_Q3.pdf has been created
Info in <TCanvas::Print>: pdf file

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tuples_out/compareAlignments_normalized_node_Z_Q3.pdf has been created
Info in <TCanvas::Print>: pdf file
tuples_out/compareAlignments_normalized_p_Q3.pdf has been created
Info in <TCanvas::Print>: pdf file
tuples_out/compareAlignments_normalized_tx_Q3.pdf has been created
Info in <TCanvas::Print>: pdf file
tuples_out/compareAlignments_normalized_ty_Q3.pdf has been created
Info in <TCanvas::Print>: pdf file
tuples_out/compareAlignments_normalized_errResidual_Q3.pdf has been created
```



```
[17]: nodelabel="Q2"

ROOT.gStyle.SetOptStat(0)
c8=ROOT.TCanvas("", "", 1200, 900)

limits={"residual": [-1, 1], "node_Y": [0, 2000], "node_Z": [7800, 9400], "p": [0, 5], "
↳ "tx": [-0.5, 0.5], "ty": [-0.3, 0.3], "errResidual": [0.04, 0.085]}

for var in test_params:
    lower_limit, upper_limit=limits[var][0], limits[var][1]
```

```

    nodetuples_Q2[0].Draw(f"{var} >> hist8(100,{lower_limit},{upper_limit})",
↳"globalModuleIndex>1", "")
    hist8=ROOT.gDirectory.Get("hist8")
    hist8.SetTitle(f"{var} comparison")
    hist8.SetLineColor(ROOT.kBlack)
    hist8.SetLineWidth(3)
    hist8.Scale(1.0/hist8.GetEntries())

    nodetuples_Q2[1].Draw(f"{var} >> hist9(100,{lower_limit},{upper_limit})",
↳"globalModuleIndex>1", "")
    hist9=ROOT.gDirectory.Get("hist9")
    hist9.SetTitle(f"{var} comparison")
    hist9.SetLineColor(ROOT.kBlue)
    hist9.SetLineWidth(3)
    hist9.Scale(1.0/hist9.GetEntries())

    nodetuples_Q2[2].Draw(f"{var} >> hist10(100,{lower_limit},{upper_limit})",
↳"globalModuleIndex>1", "")
    hist10=ROOT.gDirectory.Get("hist10")
    hist10.SetTitle(f"{var} comparison")
    hist10.SetLineColor(ROOT.kRed)
    hist10.SetLineWidth(3)
    hist10.Scale(1.0/hist10.GetEntries())

    stack=ROOT.THStack("stack",f"{var} in {node_label}, all alignments")
    stack.Add(hist8)
    stack.Add(hist9)
    stack.Add(hist10)
    stack.Draw("nostack")

    stack.GetXaxis().SetTitle(f"{var}")
    stack.GetYaxis().SetTitle("#hits")

    legend = ROOT.TLegend(0.6,0.75,0.95,0.95)
    legend.AddEntry(hist8,"data v1","l")
    legend.AddEntry(hist9,"data v2","l")
    legend.AddEntry(hist10,"data low mu","l")
    legend.Draw()

    c8.Draw()
    c8.SaveAs(f"tuples_out/compareAlignments_normalized_{var}_{node_label}.pdf")

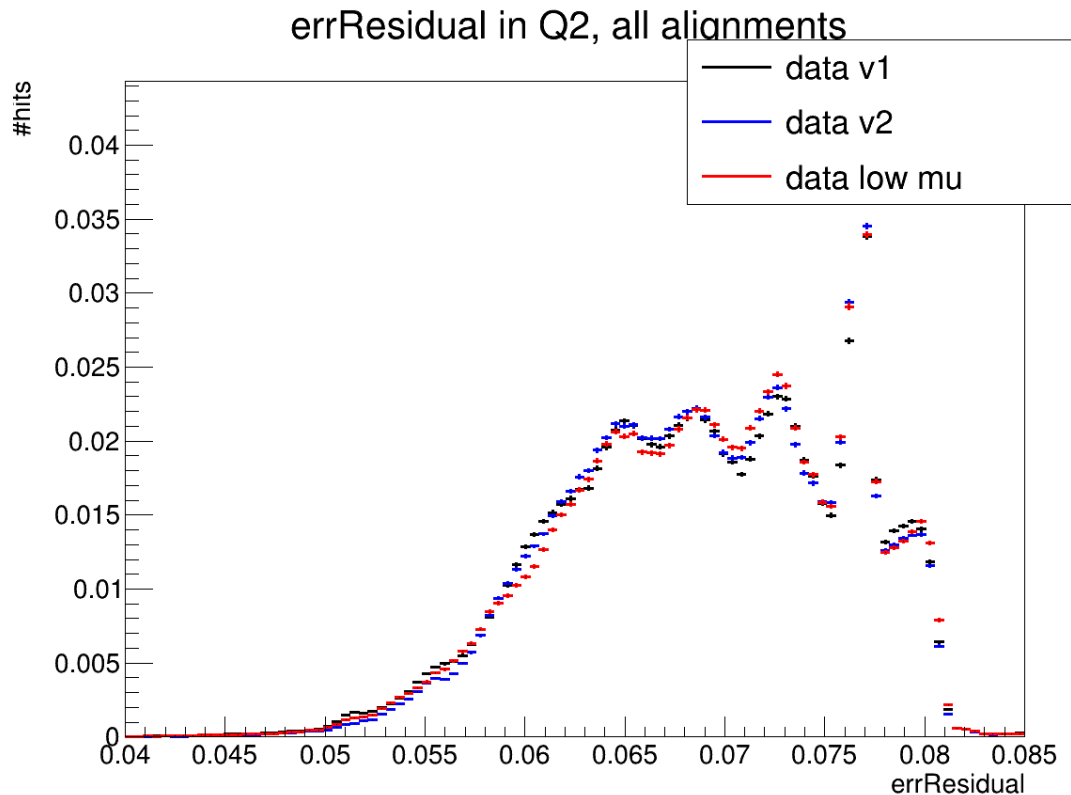
```

```

Info in <TCanvas::Print>: pdf file
tuples_out/compareAlignments_normalized_residual_Q2.pdf has been created
Info in <TCanvas::Print>: pdf file
tuples_out/compareAlignments_normalized_node_Y_Q2.pdf has been created
Info in <TCanvas::Print>: pdf file

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tuples_out/compareAlignments_normalized_node_Z_Q2.pdf has been created
Info in <TCanvas::Print>: pdf file
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Info in <TCanvas::Print>: pdf file
tuples_out/compareAlignments_normalized_tx_Q2.pdf has been created
Info in <TCanvas::Print>: pdf file
tuples_out/compareAlignments_normalized_ty_Q2.pdf has been created
Info in <TCanvas::Print>: pdf file
tuples_out/compareAlignments_normalized_errResidual_Q2.pdf has been created
```



```
[18]: nodelabel="Q1"

ROOT.gStyle.SetOptStat(0)
c8=ROOT.TCanvas("", "", 1200, 900)

limits={"residual": [-1, 1], "node_Y": [0, 2000], "node_Z": [7800, 9400], "p": [0, 5], "
↳ "tx": [-0.5, 0.5], "ty": [-0.3, 0.3], "errResidual": [0.04, 0.085]}

for var in test_params:
    lower_limit, upper_limit=limits[var][0], limits[var][1]
```

```

    nodetuples_Q3[0].Draw(f"{var} >> hist8(100,{lower_limit},{upper_limit})",
↳"globalModuleIndex>1", "")
    hist8=ROOT.gDirectory.Get("hist8")
    hist8.SetTitle(f"{var} comparison")
    hist8.SetLineColor(ROOT.kBlack)
    hist8.SetLineWidth(3)
    hist8.Scale(1.0/hist8.GetEntries())

    nodetuples_Q3[1].Draw(f"{var} >> hist9(100,{lower_limit},{upper_limit})",
↳"globalModuleIndex>1", "")
    hist9=ROOT.gDirectory.Get("hist9")
    hist9.SetTitle(f"{var} comparison")
    hist9.SetLineColor(ROOT.kBlue)
    hist9.SetLineWidth(3)
    hist9.Scale(1.0/hist9.GetEntries())

    nodetuples_Q3[2].Draw(f"{var} >> hist10(100,{lower_limit},{upper_limit})",
↳"globalModuleIndex>1", "")
    hist10=ROOT.gDirectory.Get("hist10")
    hist10.SetTitle(f"{var} comparison")
    hist10.SetLineColor(ROOT.kRed)
    hist10.SetLineWidth(3)
    hist10.Scale(1.0/hist10.GetEntries())

    stack=ROOT.THStack("stack",f"{var} in {node_label}, all alignments")
    stack.Add(hist8)
    stack.Add(hist9)
    stack.Add(hist10)
    stack.Draw("nostack")

    stack.GetXaxis().SetTitle(f"{var}")
    stack.GetYaxis().SetTitle("#hits")

    legend = ROOT.TLegend(0.6,0.75,0.95,0.95)
    legend.AddEntry(hist8,"data v1","l")
    legend.AddEntry(hist9,"data v2","l")
    legend.AddEntry(hist10,"data low mu","l")
    legend.Draw()

    c8.Draw()
    c8.SaveAs(f"tuples_out/compareAlignments_normalized_{var}_{node_label}.pdf")

```

```

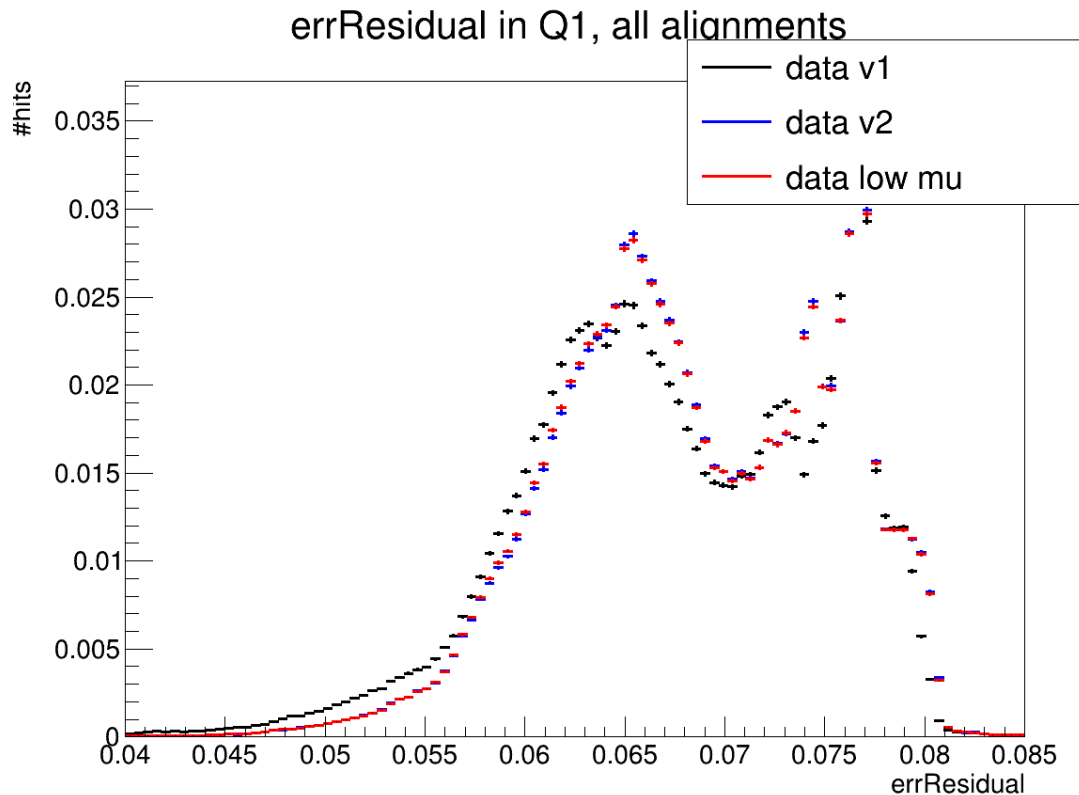
Info in <TCanvas::Print>: pdf file
tuples_out/compareAlignments_normalized_residual_Q1.pdf has been created
Info in <TCanvas::Print>: pdf file
tuples_out/compareAlignments_normalized_node_Y_Q1.pdf has been created
Info in <TCanvas::Print>: pdf file

```

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tuples_out/compareAlignments_normalized_node_Z_Q1.pdf has been created
Info in <TCanvas::Print>: pdf file
tuples_out/compareAlignments_normalized_p_Q1.pdf has been created
Info in <TCanvas::Print>: pdf file
tuples_out/compareAlignments_normalized_tx_Q1.pdf has been created
Info in <TCanvas::Print>: pdf file
tuples_out/compareAlignments_normalized_ty_Q1.pdf has been created
Info in <TCanvas::Print>: pdf file
tuples_out/compareAlignments_normalized_errResidual_Q1.pdf has been created

```



```

[19]: nodelabel="Q0"

ROOT.gStyle.SetOptStat(0)
c8=ROOT.TCanvas("", "", 1200, 900)

limits={"residual": [-1, 1], "node_Y": [0, 2000], "node_Z": [7800, 9400], "p": [0, 5], "
↳ "tx": [-0.5, 0.5], "ty": [-0.3, 0.3], "errResidual": [0.04, 0.085]}

for var in test_params:
    lower_limit, upper_limit=limits[var][0], limits[var][1]

```



```

    nodetuples_Q4[0].Draw(f"{var} >> hist8(100,{lower_limit},{upper_limit})",
↳"globalModuleIndex>1", "")
    hist8=ROOT.gDirectory.Get("hist8")
    hist8.SetTitle(f"{var} comparison")
    hist8.SetLineColor(ROOT.kBlack)
    hist8.SetLineWidth(3)
    hist8.Scale(1.0/hist8.GetEntries())

    nodetuples_Q4[1].Draw(f"{var} >> hist9(100,{lower_limit},{upper_limit})",
↳"globalModuleIndex>1", "")
    hist9=ROOT.gDirectory.Get("hist9")
    hist9.SetTitle(f"{var} comparison")
    hist9.SetLineColor(ROOT.kBlue)
    hist9.SetLineWidth(3)
    hist9.Scale(1.0/hist9.GetEntries())

    nodetuples_Q4[2].Draw(f"{var} >> hist10(100,{lower_limit},{upper_limit})",
↳"globalModuleIndex>1", "")
    hist10=ROOT.gDirectory.Get("hist10")
    hist10.SetTitle(f"{var} comparison")
    hist10.SetLineColor(ROOT.kRed)
    hist10.SetLineWidth(3)
    hist10.Scale(1.0/hist10.GetEntries())

    stack=ROOT.THStack("stack",f"{var} in {node_label}, all alignments")
    stack.Add(hist8)
    stack.Add(hist9)
    stack.Add(hist10)
    stack.Draw("nostack")

    stack.GetXaxis().SetTitle(f"{var}")
    stack.GetYaxis().SetTitle("#hits")

    legend = ROOT.TLegend(0.6,0.75,0.95,0.95)
    legend.AddEntry(hist8,"data v1","l")
    legend.AddEntry(hist9,"data v2","l")
    legend.AddEntry(hist10,"data low mu","l")
    legend.Draw()

    c8.Draw()
    c8.SaveAs(f"tuples_out/compareAlignments_normalized_{var}_{node_label}.pdf")

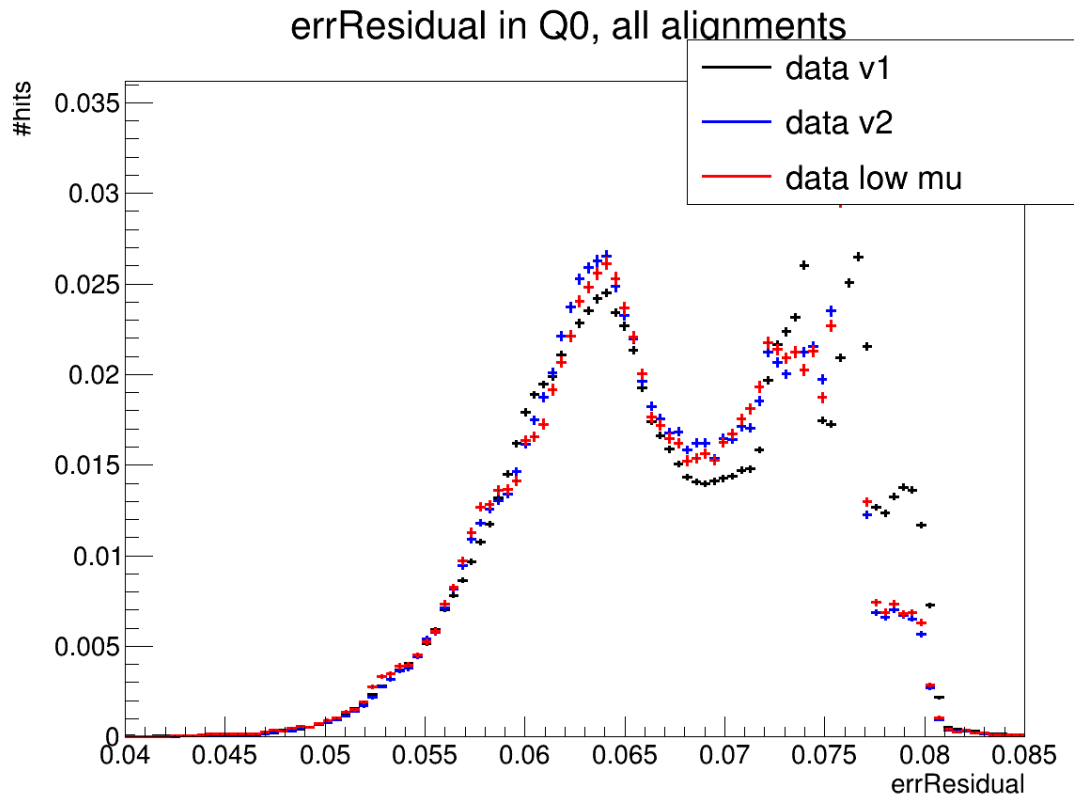
```

```

Info in <TCanvas::Print>: pdf file
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Info in <TCanvas::Print>: pdf file
tuples_out/compareAlignments_normalized_node_Y_Q0.pdf has been created
Info in <TCanvas::Print>: pdf file

```

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tuples_out/compareAlignments_normalized_node_Z_Q0.pdf has been created
Info in <TCanvas::Print>: pdf file
tuples_out/compareAlignments_normalized_p_Q0.pdf has been created
Info in <TCanvas::Print>: pdf file
tuples_out/compareAlignments_normalized_tx_Q0.pdf has been created
Info in <TCanvas::Print>: pdf file
tuples_out/compareAlignments_normalized_ty_Q0.pdf has been created
Info in <TCanvas::Print>: pdf file
tuples_out/compareAlignments_normalized_errResidual_Q0.pdf has been created
```



```
[20]: nodelabel="v1"

ROOT.gStyle.SetOptStat(0)
c8=ROOT.TCanvas("", "", 1200, 900)

limits={"residual": [-1, 1], "node_Y": [0, 2000], "node_Z": [7800, 9400], "p": [0, 5], "tx": [-0.5, 0.5], "ty": [-0.3, 0.3], "errResidual": [0.04, 0.085]}

index = [0, 1, 2]
alignments=["v1", "v2", "lowmu"]
for idx in index:
```

```

for var in test_params:
    lower_limit, upper_limit=limits[var][0], limits[var][1]
    nodetuples_Q1[idx].Draw(f"{var} >>␣
↪hist8(100,{lower_limit},{upper_limit})", "globalModuleIndex>1","")
    hist8=ROOT.gDirectory.Get("hist8")
    hist8.SetTitle(f"{var} comparison")
    hist8.SetLineColor(ROOT.kBlack)
    hist8.SetLineWidth(3)
#     hist8.Scale(1.0/hist8.GetEntries())

    nodetuples_Q2[idx].Draw(f"{var} >>␣
↪hist9(100,{lower_limit},{upper_limit})", "globalModuleIndex>1","")
    hist9=ROOT.gDirectory.Get("hist9")
    hist9.SetTitle(f"{var} comparison")
    hist9.SetLineColor(ROOT.kGreen)
    hist9.SetLineWidth(3)
#     hist9.Scale(1.0/hist9.GetEntries())

    nodetuples_Q3[idx].Draw(f"{var} >>␣
↪hist10(100,{lower_limit},{upper_limit})", "globalModuleIndex>1","")
    hist10=ROOT.gDirectory.Get("hist10")
    hist10.SetTitle(f"{var} comparison")
    hist10.SetLineColor(ROOT.kRed)
    hist10.SetLineWidth(3)
#     hist10.Scale(1.0/hist10.GetEntries())

    nodetuples_Q4[idx].Draw(f"{var} >>␣
↪hist11(100,{lower_limit},{upper_limit})", "globalModuleIndex>1","")
    hist11=ROOT.gDirectory.Get("hist11")
    hist11.SetTitle(f"{var} comparison")
    hist11.SetLineColor(ROOT.kBlue)
    hist11.SetLineWidth(3)
#     hist11.Scale(1.0/hist11.GetEntries())

    stack=ROOT.THStack("stack",f"{var}")
    stack.Add(hist8)
    stack.Add(hist9)
    stack.Add(hist10)
    stack.Add(hist11)
    stack.Draw("nostack")

    stack.GetXaxis().SetTitle(f"{var}")
    stack.GetYaxis().SetTitle("#hits")

    legend = ROOT.TLegend(0.6,0.75,0.95,0.95)
    legend.AddEntry(hist8,f"{alignments[idx]} Q3","l")
    legend.AddEntry(hist9,f"{alignments[idx]} Q2","l")

```

```

legend.AddEntry(hist10,f"{alignments[idx]} Q1","1")
legend.AddEntry(hist11,f"{alignments[idx]} Q0","1")
legend.Draw()

c8.Draw()
c8.SaveAs(f"tuples_out/compare_Allquarters_{var}_{alignments[idx]}.pdf")

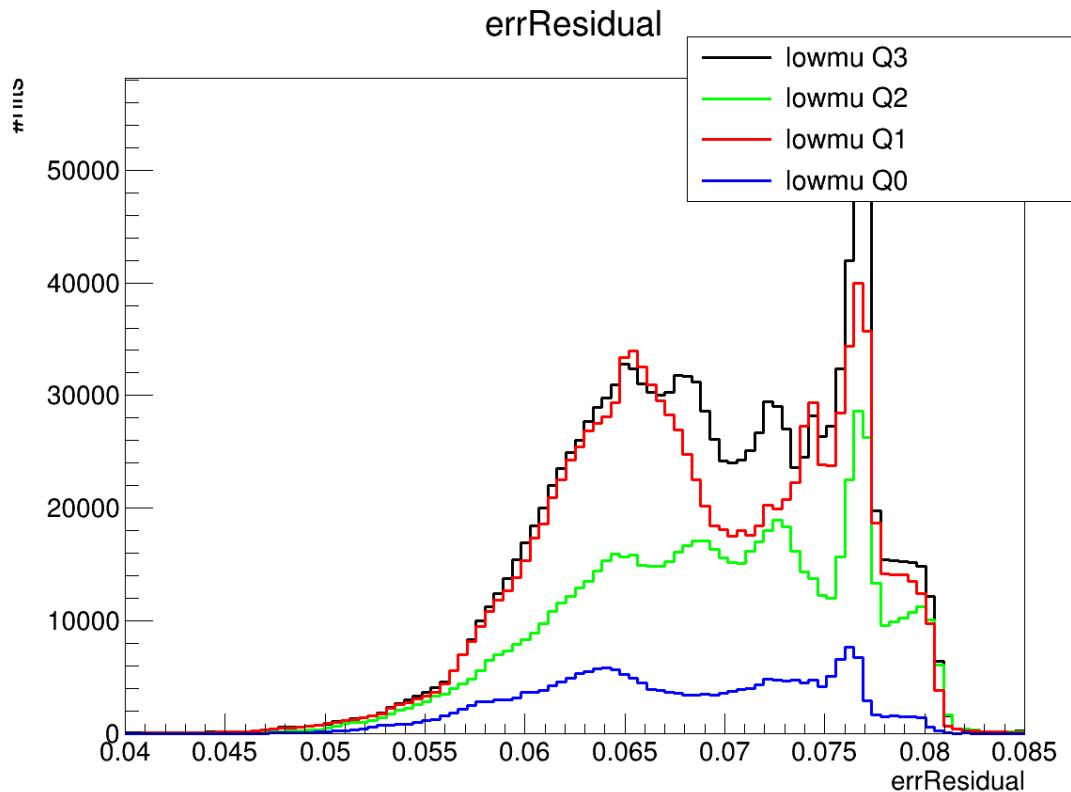
```

```

Info in <TCanvas::Print>: pdf file
tuples_out/compare_Allquarters_residual_v1.pdf has been created
Info in <TCanvas::Print>: pdf file tuples_out/compare_Allquarters_node_Y_v1.pdf
has been created
Info in <TCanvas::Print>: pdf file tuples_out/compare_Allquarters_node_Z_v1.pdf
has been created
Info in <TCanvas::Print>: pdf file tuples_out/compare_Allquarters_p_v1.pdf has
been created
Info in <TCanvas::Print>: pdf file tuples_out/compare_Allquarters_tx_v1.pdf has
been created
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been created
Info in <TCanvas::Print>: pdf file
tuples_out/compare_Allquarters_errResidual_v1.pdf has been created
Info in <TCanvas::Print>: pdf file
tuples_out/compare_Allquarters_residual_v2.pdf has been created
Info in <TCanvas::Print>: pdf file tuples_out/compare_Allquarters_node_Y_v2.pdf
has been created
Info in <TCanvas::Print>: pdf file tuples_out/compare_Allquarters_node_Z_v2.pdf
has been created
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been created
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been created
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been created
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Info in <TCanvas::Print>: pdf file
tuples_out/compare_Allquarters_node_Y_lowmu.pdf has been created
Info in <TCanvas::Print>: pdf file
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has been created
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has been created
Info in <TCanvas::Print>: pdf file tuples_out/compare_Allquarters_ty_lowmu.pdf
has been created

```

Info in <TCanvas::Print>: pdf file
 tuples_out/compare_Allquarters_errResidual_lowmu.pdf has been created



```
[21]: modelabel="v1"

ROOT.gStyle.SetOptStat(0)
c8=ROOT.TCanvas("", "", 1200, 900)

limits={"residual":[-1,1], "node_Y":[0,2000], "node_Z":[7800,9400], "p":[0,5],
↳"tx":[-0.5, 0.5], "ty":[-0.3,0.3], "errResidual":[0.04,0.085]}

index = [0,1,2]
alignments=["v1", "v2", "lowmu"]
for idx in index:
    for var in test_params:
        lower_limit, upper_limit=limits[var][0], limits[var][1]
        nodetuples_Q1[idx].Draw(f"{var} >>↳
↳hist8(100,{lower_limit},{upper_limit})", "globalModuleIndex>1", "")
        hist8=ROOT.gDirectory.Get("hist8")
        hist8.SetTitle(f"{var} comparison")
        hist8.SetLineColor(ROOT.kBlack)
```

```

hist8.SetLineWidth(3)
hist8.Scale(1.0/hist8.GetEntries())

nodetuples_Q2[idx].Draw(f"{var} >>␣
↪hist9(100,{lower_limit},{upper_limit})", "globalModuleIndex>1","")
hist9=ROOT.gDirectory.Get("hist9")
hist9.SetTitle(f"{var} comparison")
hist9.SetLineColor(ROOT.kGreen)
hist9.SetLineWidth(3)
hist9.Scale(1.0/hist9.GetEntries())

nodetuples_Q3[idx].Draw(f"{var} >>␣
↪hist10(100,{lower_limit},{upper_limit})", "globalModuleIndex>1","")
hist10=ROOT.gDirectory.Get("hist10")
hist10.SetTitle(f"{var} comparison")
hist10.SetLineColor(ROOT.kRed)
hist10.SetLineWidth(3)
hist10.Scale(1.0/hist10.GetEntries())

nodetuples_Q4[idx].Draw(f"{var} >>␣
↪hist11(100,{lower_limit},{upper_limit})", "globalModuleIndex>1","")
hist11=ROOT.gDirectory.Get("hist11")
hist11.SetTitle(f"{var} comparison")
hist11.SetLineColor(ROOT.kBlue)
hist11.SetLineWidth(3)
hist11.Scale(1.0/hist11.GetEntries())

stack=ROOT.THStack("stack",f"{var}")
stack.Add(hist8)
stack.Add(hist9)
stack.Add(hist10)
stack.Add(hist11)
stack.Draw("nostack")

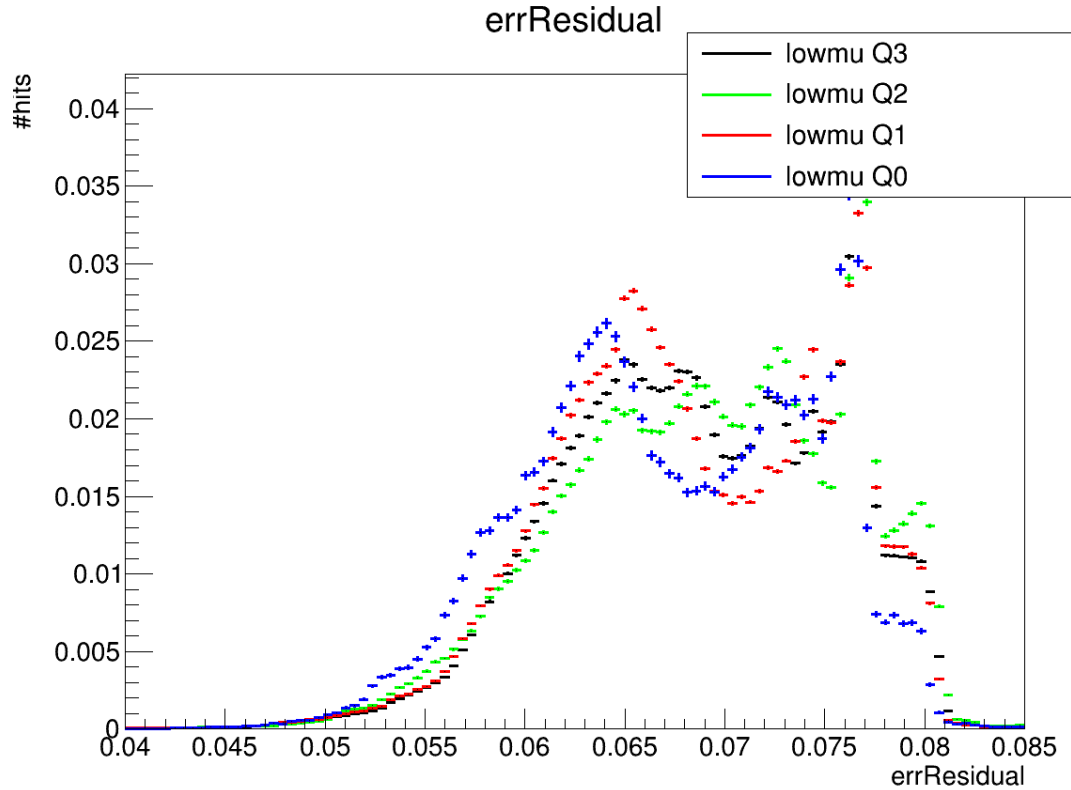
stack.GetXaxis().SetTitle(f"{var}")
stack.GetYaxis().SetTitle("#hits")

legend = ROOT.TLegend(0.6,0.75,0.95,0.95)
legend.AddEntry(hist8,f"{alignments[idx]} Q3","l")
legend.AddEntry(hist9,f"{alignments[idx]} Q2","l")
legend.AddEntry(hist10,f"{alignments[idx]} Q1","l")
legend.AddEntry(hist11,f"{alignments[idx]} Q0","l")
legend.Draw()

c8.Draw()
c8.SaveAs(f"tuples_out/
↪compare_Allquarters_normalized_{var}_{alignments[idx]}.pdf")

```

Info in <TCanvas::Print>: pdf file
 tuples_out/compare_Allquarters_normalized_residual_v1.pdf has been created
 Info in <TCanvas::Print>: pdf file
 tuples_out/compare_Allquarters_normalized_node_Y_v1.pdf has been created
 Info in <TCanvas::Print>: pdf file
 tuples_out/compare_Allquarters_normalized_node_Z_v1.pdf has been created
 Info in <TCanvas::Print>: pdf file
 tuples_out/compare_Allquarters_normalized_p_v1.pdf has been created
 Info in <TCanvas::Print>: pdf file
 tuples_out/compare_Allquarters_normalized_tx_v1.pdf has been created
 Info in <TCanvas::Print>: pdf file
 tuples_out/compare_Allquarters_normalized_ty_v1.pdf has been created
 Info in <TCanvas::Print>: pdf file
 tuples_out/compare_Allquarters_normalized_errResidual_v1.pdf has been created
 Info in <TCanvas::Print>: pdf file
 tuples_out/compare_Allquarters_normalized_residual_v2.pdf has been created
 Info in <TCanvas::Print>: pdf file
 tuples_out/compare_Allquarters_normalized_node_Y_v2.pdf has been created
 Info in <TCanvas::Print>: pdf file
 tuples_out/compare_Allquarters_normalized_node_Z_v2.pdf has been created
 Info in <TCanvas::Print>: pdf file
 tuples_out/compare_Allquarters_normalized_p_v2.pdf has been created
 Info in <TCanvas::Print>: pdf file
 tuples_out/compare_Allquarters_normalized_tx_v2.pdf has been created
 Info in <TCanvas::Print>: pdf file
 tuples_out/compare_Allquarters_normalized_ty_v2.pdf has been created
 Info in <TCanvas::Print>: pdf file
 tuples_out/compare_Allquarters_normalized_errResidual_v2.pdf has been created
 Info in <TCanvas::Print>: pdf file
 tuples_out/compare_Allquarters_normalized_residual_lowmu.pdf has been created
 Info in <TCanvas::Print>: pdf file
 tuples_out/compare_Allquarters_normalized_node_Y_lowmu.pdf has been created
 Info in <TCanvas::Print>: pdf file
 tuples_out/compare_Allquarters_normalized_node_Z_lowmu.pdf has been created
 Info in <TCanvas::Print>: pdf file
 tuples_out/compare_Allquarters_normalized_p_lowmu.pdf has been created
 Info in <TCanvas::Print>: pdf file
 tuples_out/compare_Allquarters_normalized_tx_lowmu.pdf has been created
 Info in <TCanvas::Print>: pdf file
 tuples_out/compare_Allquarters_normalized_ty_lowmu.pdf has been created
 Info in <TCanvas::Print>: pdf file
 tuples_out/compare_Allquarters_normalized_errResidual_lowmu.pdf has been created



```
[22]: # nodelabel="Q3"

# ROOT.gStyle.SetOptStat(0)
# c8=ROOT.TCanvas("", "", 1200, 900)

# limits={"residual":[-1,1], "node_Y":[0,2000], "node_Z":[7800,9400], "p":
#         [0,5], "tx":[-0.5, 0.5], "ty":[-0.3,0.3], "errResidual":[0.04,0.085]}

# for var in test_params:
#     lower_limit, upper_limit=limits[var][0], limits[var][1]
#     nodetuples_Q3[0].Draw(f"{var} >> hist8(100,{lower_limit},{upper_limit})",
#         "globalModuleIndex>1", "")
#     hist8=ROOT.gDirectory.Get("hist8")
#     hist8.SetTitle(f"{var} comparison")
#     hist8.SetLineColor(ROOT.kBlack)
#     hist8.SetLineWidth(3)
#     hist8.Scale(1.0/hist8.GetEntries())

#     nodetuples_Q3[1].Draw(f"{var} >> hist9(100,{lower_limit},{upper_limit})",
#         "globalModuleIndex>1", "")
#     hist9=ROOT.gDirectory.Get("hist9")
```



```

#     hist9.SetTitle(f"{var} comparison")
#     hist9.SetLineColor(ROOT.kGreen)
#     hist9.SetLineWidth(3)
# #     hist9.Scale(1.0/hist9.GetEntries())

#     nodetuples_Q3[2].Draw(f"{var} >>
→hist10(100,{lower_limit},{upper_limit})", "globalModuleIndex>1", "")
#     hist10=ROOT.gDirectory.Get("hist10")
#     hist10.SetTitle(f"{var} comparison")
#     hist10.SetLineColor(ROOT.kRed)
#     hist10.SetLineWidth(3)
# #     hist10.Scale(1.0/hist10.GetEntries())

#     stack=ROOT.THStack("stack",f"{var} in Q3 all alignments")
#     stack.Add(hist8)
#     stack.Add(hist9)
#     stack.Add(hist10)
#     stack.Draw("nostack")

# #     stack.GetAxis().SetLimits(-1500,2000)
#     stack.GetAxis().SetTitle(f"{var}")
#     stack.GetAxis().SetTitle("#hits")

#     legend = ROOT.TLegend(0.6,0.75,0.95,0.95)
#     legend.AddEntry(hist8,"data v1","l")
#     legend.AddEntry(hist9,"data v2","l")
#     legend.AddEntry(hist10,"data low mu","l")
#     legend.Draw()

#     c8.Draw()
#     c8.SaveAs(f"tuples_out/DataSeedsTupled_{var}_All_{nodelabel}.pdf")

```

```

[23]: # nodelabel="Q4"

# ROOT.gStyle.SetOptStat(0)
# c8=ROOT.TCanvas("", "", 1200, 900)

# limits={"residual":[-1,1], "node_Y":[0,2000], "node_Z":[7800,9400], "p":
→[0,5], "tx":[-0.5, 0.5], "ty":[-0.3,0.3], "errResidual":[0.04,0.085]}

# for var in test_params:
#     lower_limit, upper_limit=limits[var][0], limits[var][1]
#     nodetuples_Q4[0].Draw(f"{var} >> hist8(100,{lower_limit},{upper_limit})",
→"globalModuleIndex>1", "")
#     hist8=ROOT.gDirectory.Get("hist8")
#     hist8.SetTitle(f"{var} comparison")
#     hist8.SetLineColor(ROOT.kBlack)

```

```

#      hist8.SetLineWidth(3)
# #      hist8.Scale(1.0/hist8.GetEntries())

#      nodetuples_Q4[1].Draw(f"{var} >> hist9(100,{lower_limit},{upper_limit})",
↪ "globalModuleIndex>1", "")
#      hist9=ROOT.gDirectory.Get("hist9")
#      hist9.SetTitle(f"{var} comparison")
#      hist9.SetLineColor(ROOT.kGreen)
#      hist9.SetLineWidth(3)
# #      hist9.Scale(1.0/hist9.GetEntries())

#      nodetuples_Q4[2].Draw(f"{var} >>
↪ hist10(100,{lower_limit},{upper_limit})", "globalModuleIndex>1", "")
#      hist10=ROOT.gDirectory.Get("hist10")
#      hist10.SetTitle(f"{var} comparison")
#      hist10.SetLineColor(ROOT.kRed)
#      hist10.SetLineWidth(3)
# #      hist10.Scale(1.0/hist10.GetEntries())
# #      scale10 = 1.0/hist10.Integral()

#      stack=ROOT.THStack("stack",f"{var} in Q1, all alignments")
#      stack.Add(hist8)
#      stack.Add(hist9)
#      stack.Add(hist10)
#      stack.Draw("nostack")

# #      stack.GetAxis().SetLimits(-1500,2000)
#      stack.GetAxis().SetTitle(f"{var}")
#      stack.GetAxis().SetTitle("#hits")

#      legend = ROOT.TLegend(0.6,0.75,0.95,0.95)
#      legend.AddEntry(hist8,"data v1","l")
#      legend.AddEntry(hist9,"data v2","l")
#      legend.AddEntry(hist10,"data low mu","l")
#      legend.Draw()

#      c8.Draw()
#      c8.SaveAs(f"tuples_out/DataSeedsTupled_{var}_All_{nodelabel}.pdf")

```

[24]: # bottom right (Quarter 0)

[25]: # v1 all plots combined for each quarter
ROOT.gStyle.SetOptStat(1)
c1 = ROOT.TCanvas("c1","c1",1200,1200)

Q2

```

nodetuples_Q2[0].Draw("node_Y:node_X >> hist1(200,-2500,2000,200,-1800,2150)",
↳"globalModuleIndex>0")
hist1=R00T.gDirectory.Get("hist1")
# Q0
nodetuples_Q4[0].Draw("node_Y:node_X >> hist2(100,-2300,0,100,-2300,0)",
↳"globalModuleIndex>0")
hist2=R00T.gDirectory.Get("hist2")
# Q1
nodetuples_Q3[0].Draw("node_Y:node_X >> hist3(100,0,2300,100,-2300,0)",
↳"globalModuleIndex>0")
hist3=R00T.gDirectory.Get("hist3")
# Q3
nodetuples_Q1[0].Draw("node_Y:node_X >> hist4(100,0,2300,100,0,2300)",
↳"globalModuleIndex>0")
hist4=R00T.gDirectory.Get("hist4")
R00T.gPad.SetLogz()
hist1.Draw("colz")
hist2.Draw("col same")
hist3.Draw("col same")
hist4.Draw("col same")
c1.Draw()

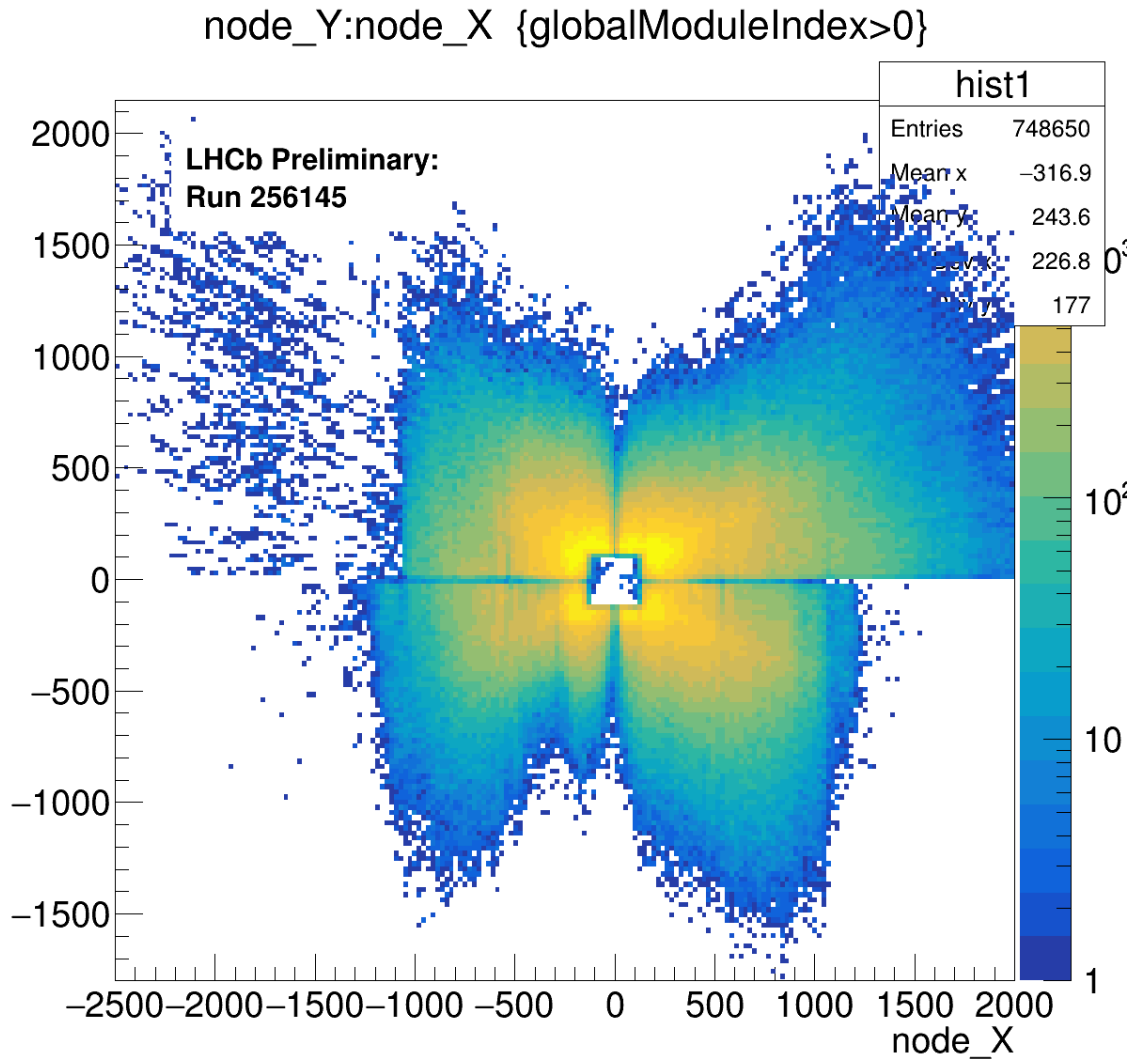
hist1.GetXaxis().SetTitle("node_X")
hist1.GetYaxis().SetTitle("node_Y")

lhcbName = R00T.TPaveText(0.15, 0.78, 0.40, 0.88,"BRNDC" )
lhcbName.AddText('#splitline{LHCb Preliminary:}{#scale[1.0]{Run 256145}}')
lhcbName.SetFillColor(0)
lhcbName.SetTextAlign(12)
lhcbName.SetBorderSize(0)
lhcbName.Draw()

c1.SaveAs("tuples_out/combining_2D_nodeXY_v1.pdf")

```

Warning in <TCanvas::Constructor>: Deleting canvas with same name: c1
Info in <TCanvas::Print>: pdf file tuples_out/combining_2D_nodeXY_v1.pdf has
been created



```
[26]: # v2 all plots combined for each quarter
ROOT.gStyle.SetOptStat(1)
c2 = ROOT.TCanvas("c1", "c1", 1200, 1200)

# Q2
nodetuples_Q2[1].Draw("node_Y:node_X >> hist5(200,-2500,2500,200,-2000,2300)",
    →"globalModuleIndex>0")
hist5=ROOT.gDirectory.Get("hist5")
# Q0
nodetuples_Q4[1].Draw("node_Y:node_X >> hist6(100,-2300,0,100,-2400,0)",
    →"globalModuleIndex>0")
hist6=ROOT.gDirectory.Get("hist6")
# Q1
```

```

nodetuples_Q3[1].Draw("node_Y:node_X >> hist7(100,0,2500,100,-2300,0)",
↳"globalModuleIndex>0")
hist7=ROOT.gDirectory.Get("hist7")
# Q3
nodetuples_Q1[1].Draw("node_Y:node_X >> hist8(100,0,2600,100,0,2700)",
↳"globalModuleIndex>0")
hist8=ROOT.gDirectory.Get("hist8")
ROOT.gPad.SetLogz()
hist5.Draw("colz")
hist6.Draw("col same")
hist7.Draw("col same")
hist8.Draw("col same")
c2.Draw()

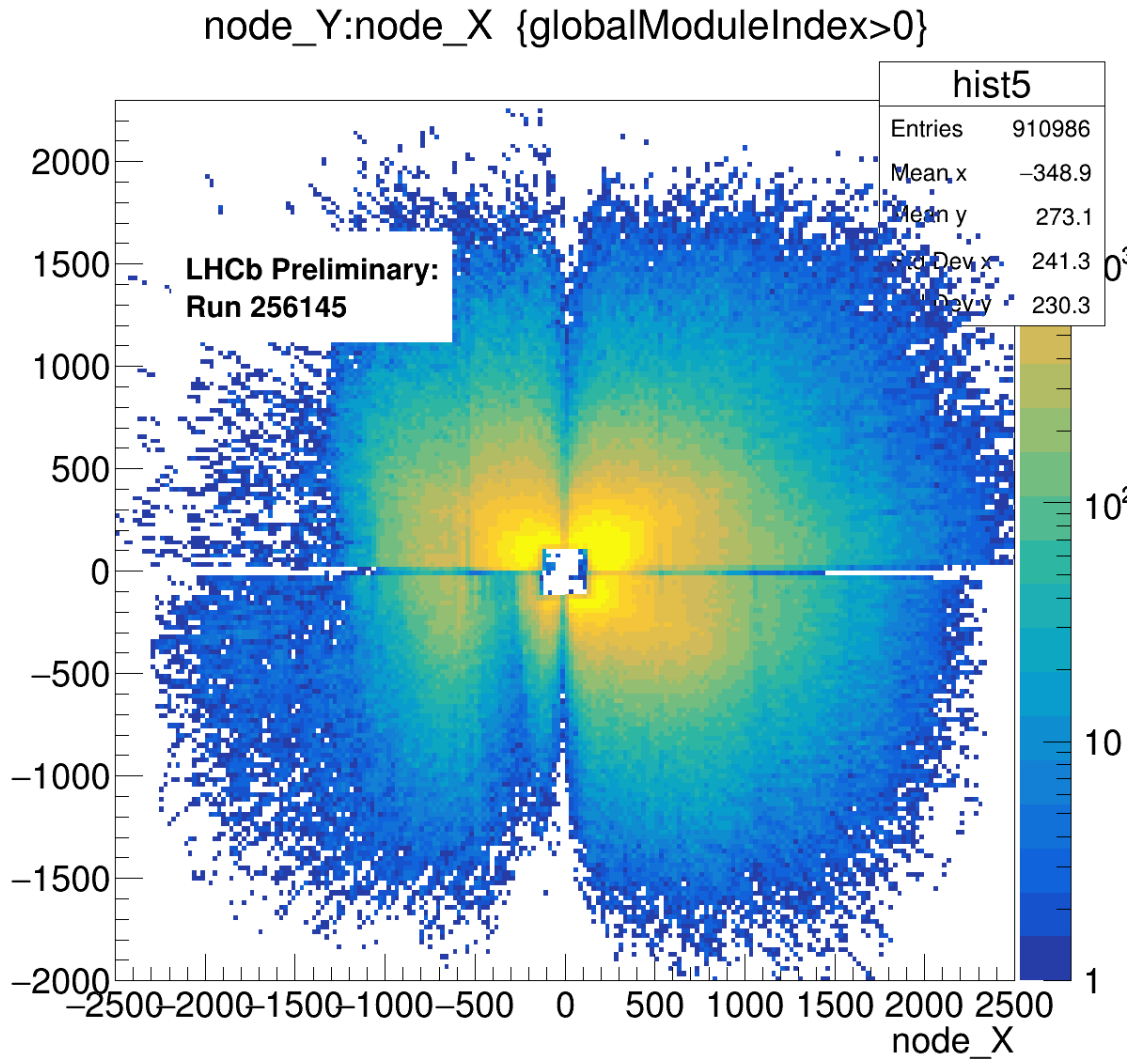
hist5.GetXaxis().SetTitle("node_X")
hist5.GetYaxis().SetTitle("node_Y")

lhcbName = ROOT.TPaveText(0.15, 0.68, 0.40, 0.78,"BRNDC" )
lhcbName.AddText('#splitline{LHCb Preliminary:}{#scale[1.0]{Run 256145}}')
lhcbName.SetFillColor(0)
lhcbName.SetTextAlign(12)
lhcbName.SetBorderSize(0)
lhcbName.Draw()

c2.SaveAs("tuples_out/combining_2D_nodeXY_v2.pdf")

```

Warning in <TCanvas::Constructor>: Deleting canvas with same name: c1
Info in <TCanvas::Print>: pdf file tuples_out/combining_2D_nodeXY_v2.pdf has
been created



```
[27]: # v2 all plots combined for each quarter
ROOT.gStyle.SetOptStat(1)
c3 = ROOT.TCanvas("c1", "c1", 1200, 1200)

# Q2
nodetuples_Q2[2].Draw("node_Y:node_X >> hist9(200,-2300,2500,200,-2050,2500)",
    →"globalModuleIndex>0")
hist9=ROOT.gDirectory.Get("hist9")
# Q0
nodetuples_Q4[2].Draw("node_Y:node_X >> hist10(100,-2300,0,100,-2400,0)",
    →"globalModuleIndex>0")
hist10=ROOT.gDirectory.Get("hist10")
# Q1
```

```

nodetuples_Q3[2].Draw("node_Y:node_X >> hist11(100,0,2300,100,-2300,0)",
↳"globalModuleIndex>0")
hist11=ROOT.gDirectory.Get("hist11")
# Q3
nodetuples_Q1[2].Draw("node_Y:node_X >> hist12(100,0,2600,100,0,2700)",
↳"globalModuleIndex>0")
hist12=ROOT.gDirectory.Get("hist12")
ROOT.gPad.SetLogz()
hist9.Draw("colz")
hist10.Draw("col same")
hist11.Draw("col same")
hist12.Draw("col same")
c3.Draw()

hist9.GetXaxis().SetTitle("node_X")
hist9.GetYaxis().SetTitle("node_Y")

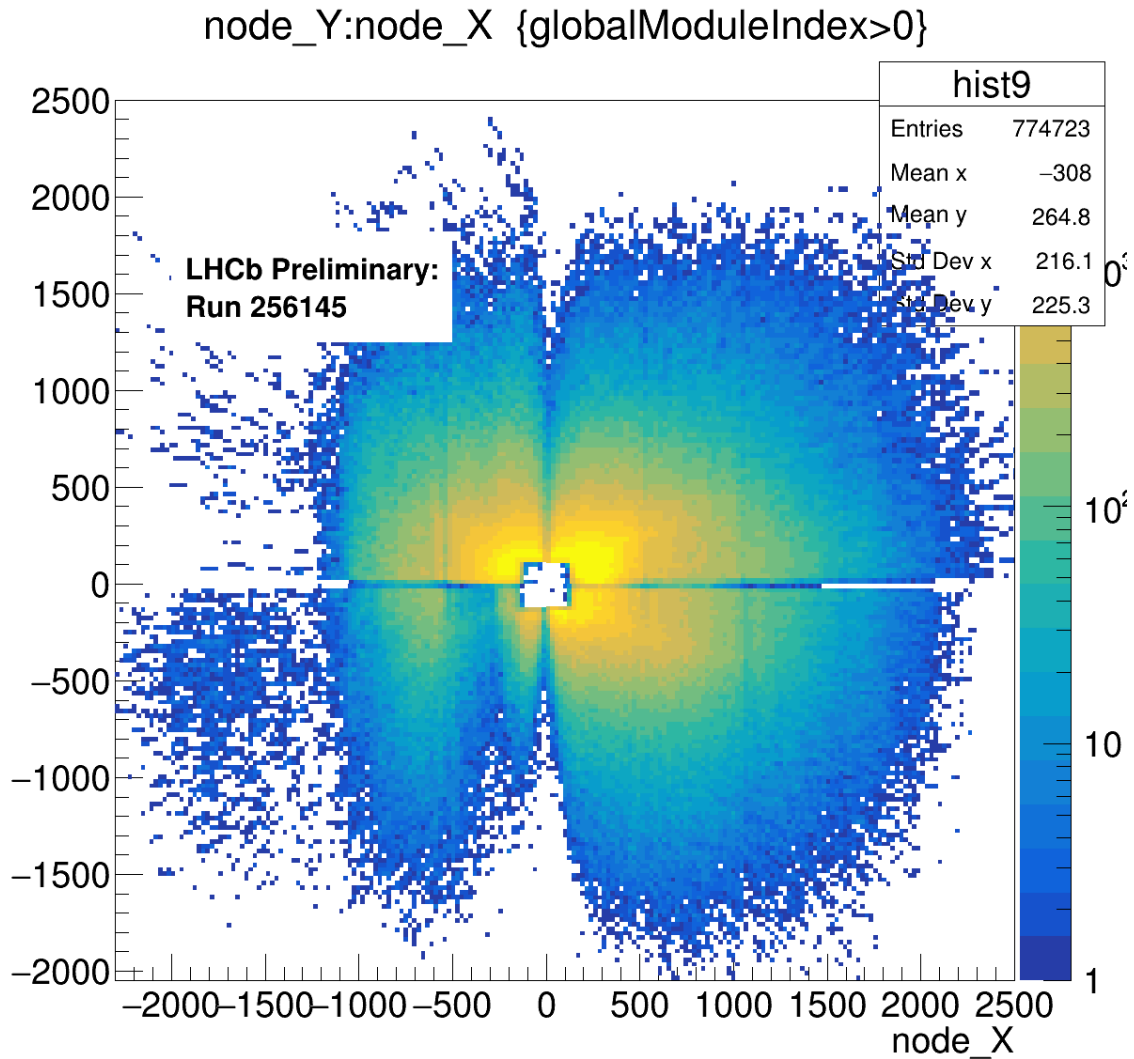
lhcbName = ROOT.TPaveText(0.15, 0.68, 0.40, 0.78,"BRNDC" )
lhcbName.AddText('#splitline{LHCb Preliminary:}{#scale[1.0]{Run 256145}}')
lhcbName.SetFillColor(0)
lhcbName.SetTextAlign(12)
lhcbName.SetBorderSize(0)
lhcbName.Draw()

c3.SaveAs("tuples_out/combining_2D_nodeXY_lowmu.pdf")

#####
# Here is something wrong:                                     #
# the bothalf c-side plot is scaled wrong                       #
# it should be in line with the histogram coming from          #
# tophalf c-side as well as bot a-side                          #
#####

```

Warning in <TCanvas::Constructor>: Deleting canvas with same name: c1
Info in <TCanvas::Print>: pdf file tuples_out/combining_2D_nodeXY_lowmu.pdf has
been created



```
[28]: # ROOT.gStyle.SetOptStat(0)
# c6 = ROOT.TCanvas("", "", 1200, 900)
# nodetuples_Q2[0].Draw("node_X:node_Y >> hist(100,-50,2500,100,-2000,50)",
↳ "globalModuleIndex>0", "COLZ")
# ROOT.gPad.SetLogz()
# c6.Draw()
# c6.SaveAs("dataTests/node_XY_Q2_v1.pdf")
```

```
[29]: # # v2
# ROOT.gStyle.SetOptStat(0)
# c6 = ROOT.TCanvas("", "", 1200, 900)
# nodetuples_Q2[1].Draw("node_X:node_Y >> hist(100,-50,2500,100,-2000,50)",
↳ "globalModuleIndex>0", "COLZ")
```



```
# ROOT.gPad.SetLogz()
# c6.Draw()
# c6.SaveAs("dataTests/node_XY_Q2_v2.pdf")
```

```
[30]: # # lowmu
# ROOT.gStyle.SetOptStat(0)
# c6 = ROOT.TCanvas("", "", 1200, 900)
# nodetuples_Q2[2].Draw("node_X:node_Y >> hist(100,-50,2500,100,-2000,50)",
↳ "globalModuleIndex>0", "COLZ")
# ROOT.gPad.SetLogz()
# c6.Draw()
# c6.SaveAs("dataTests/node_XY_Q2_lowmu.pdf")
```

```
[31]: # botoom left (quarter 1) make the color scale logarithmic
```

```
[32]: # # v1
# ROOT.gStyle.SetOptStat(0)
# c6 = ROOT.TCanvas("", "", 1200, 900)
# nodetuples_Q4[0].Draw("node_X:node_Y >> hist(80,-2300,0,80,-2400,0)",
↳ "globalModuleIndex>0", "COLZ")
# ROOT.gPad.SetLogz()
# c6.Draw()
# c6.SaveAs("dataTests/node_XY_Q4_v1.pdf")
```

```
[33]: # # v2
# ROOT.gStyle.SetOptStat(0)
# c6 = ROOT.TCanvas("", "", 1200, 900)
# nodetuples_Q4[1].Draw("node_X:node_Y >> hist(80,-2300,0,80,-2400,0)",
↳ "globalModuleIndex>0", "COLZ")
# ROOT.gPad.SetLogz()
# c6.Draw()
# c6.SaveAs("dataTests/node_XY_Q4_v2.pdf")
```

```
[34]: # # low mu
# ROOT.gStyle.SetOptStat(0)
# c6 = ROOT.TCanvas("", "", 1200, 900)
# nodetuples_Q4[2].Draw("node_X:node_Y >> hist(80,-2300,0,80,-2400,0)",
↳ "globalModuleIndex>0", "COLZ")
# ROOT.gPad.SetLogz()
# c6.Draw()
# c6.SaveAs("dataTests/node_XY_Q4_lowmu.pdf")
```

```
[35]: # top right (quarter 2) --> in my data labeled as Q1 because the order is
↳ mirrored
```

```
[36]: # # v1
# ROOT.gStyle.SetOptStat(0)
# c6 = ROOT.TCanvas("", "", 1200, 900)
# nodetuples_Q1[0].Draw("node_X:node_Y >> hist(100,0,2600,100,0,2700)",
↳ "globalModuleIndex>0", "COLZ")
# ROOT.gPad.SetLogz()
# c6.Draw()
# c6.SaveAs("dataTests/node_XY_Q1_v1.pdf")
```

```
[37]: # # v2
# ROOT.gStyle.SetOptStat(0)
# c6 = ROOT.TCanvas("", "", 1200, 900)
# nodetuples_Q1[1].Draw("node_X:node_Y >> hist(100,0,2600,100,0,2700)",
↳ "globalModuleIndex>0", "COLZ")
# ROOT.gPad.SetLogz()
# c6.Draw()
# c6.SaveAs("dataTests/node_XY_Q1_v2.pdf")
```

```
[38]: # # low mu
# ROOT.gStyle.SetOptStat(0)
# c6 = ROOT.TCanvas("", "", 1200, 900)
# nodetuples_Q1[2].Draw("node_X:node_Y >> hist(100,0,2600,100,0,2700)",
↳ "globalModuleIndex>0", "COLZ")
# ROOT.gPad.SetLogz()
# c6.Draw()
# c6.SaveAs("dataTests/node_XY_Q1_lowmu.pdf")
```

```
[39]: # top left (quarter 3)
```

```
[40]: # # v1
# c6 = ROOT.TCanvas("", "", 1200, 900)
# nodetuples_Q3[0].Draw("node_X:node_Y >> hist(100,-2500,0,100,0,2600)",
↳ "globalModuleIndex>0", "COLZ")
# ROOT.gPad.SetLogz()
# c6.Draw()
# c6.SaveAs("dataTests/node_XY_Q3_v1.pdf")
```

```
[41]: # # v2
# c6 = ROOT.TCanvas("", "", 1200, 900)
# nodetuples_Q3[1].Draw("node_X:node_Y >> hist(100,-2500,0,100,0,2600)",
↳ "globalModuleIndex>0", "COLZ")
# ROOT.gPad.SetLogz()
# c6.Draw()
# c6.SaveAs("dataTests/node_XY_Q3_v2.pdf")
```

```
[42]: # # low mu
# c6 = ROOT.TCanvas("", "", 1200, 900)
# nodetuples_Q3[2].Draw("node_X:node_Y >> hist(100,-2500,0,100,0,2600)",
↳ "globalModuleIndex>0", "COLZ")
# ROOT.gPad.SetLogz()
# c6.Draw()
# c6.SaveAs("dataTests/node_XY_Q3_lowmu.pdf")
```

```
[43]: # histograms for RMS residual outliers in v1
path_v1="/interactive_storage/nbreer/build_stack/tracking/PlotFiles/
↳ TEMP_ROOT_FILES/v1"
for fileintag,outname in zip([f"{path_v1}/Q1/
↳ pr_LongModulesv1_branch_Q1_VeloSciFiAligned_RN256145_slice0_new",
f"{path_v1}/Q2/
↳ pr_LongModulesv1_branch_Q2_VeloSciFiAligned_RN256145_slice0_new",
f"{path_v1}/Q3/
↳ pr_LongModulesv1_branch_Q3_VeloSciFiAligned_RN256145_slice0_new",
f"{path_v1}/Q4/
↳ pr_LongModulesv1_branch_Q4_VeloSciFiAligned_RN256145_slice0_new"
],
["v1_Q1",
"v1_Q2",
"v1_Q3",
"v1_Q4"
]):
    filein=ROOT.TFile(f"{fileintag}.root")
    filein.Draw()
    for tracktype, monitorname in
↳ zip(["SciFiSeed", "BestLong", "GoodLongAlign"], ["SciFiSeedsInFTTrackMonitor", "BestLongInFTTra
↳
        source=getattr(filein,monitorname)
        ROOT.gStyle.SetOptStat(0)
        for name in
↳ ["xdistT1", "xdistT2", "xdistT3", "biasedResidualLayer", "unbiasedResidualLayer", "RMSResidualQu
↳
            c4 = ROOT.TCanvas("", "", 1200, 900)
            source.FindObjectAny(name).Draw()
            lhcbName = ROOT.TPaveText( 0.70 - 0.05,
                                0.85 - 0.05,
                                0.95 - 0.05,
                                0.95 - 0.05,
                                "BRNDC" )
            lhcbName.AddText('#splitline{LHCb}{#scale[1.0]{Internal: Run
↳ 256145}}')
            lhcbName.SetFillColor(0)
            lhcbName.SetTextAlign(12)
```

```
lhcbName.SetBorderSize(0)
lhcbName.Draw()
c4.Draw()
c4.SaveAs(f"histograms/{outname}_{tracktype}_{name}.pdf")
```

Info in <TCanvas::Print>: pdf file histograms/v1_Q1_SciFiSeed_xdistT1.pdf has been created

Info in <TCanvas::Print>: pdf file histograms/v1_Q1_SciFiSeed_xdistT2.pdf has been created

Info in <TCanvas::Print>: pdf file histograms/v1_Q1_SciFiSeed_xdistT3.pdf has been created

Info in <TCanvas::Print>: pdf file histograms/v1_Q1_SciFiSeed_biasedResidualLayer.pdf has been created

Info in <TCanvas::Print>: pdf file histograms/v1_Q1_SciFiSeed_unbiasedResidualLayer.pdf has been created

Info in <TCanvas::Print>: pdf file histograms/v1_Q1_SciFiSeed_RMSResidualQuarters.pdf has been created

Info in <TCanvas::Print>: pdf file histograms/v1_Q1_SciFiSeed_RMSResidualModulesT1.pdf has been created

Info in <TCanvas::Print>: pdf file histograms/v1_Q1_SciFiSeed_RMSResidualModulesT3.pdf has been created

Info in <TCanvas::Print>: pdf file histograms/v1_Q1_SciFiSeed_RMSResidualModulesT2.pdf has been created

Info in <TCanvas::Print>: pdf file histograms/v1_Q1_BestLong_xdistT1.pdf has been created

Info in <TCanvas::Print>: pdf file histograms/v1_Q1_BestLong_xdistT2.pdf has been created

Info in <TCanvas::Print>: pdf file histograms/v1_Q1_BestLong_xdistT3.pdf has been created

Info in <TCanvas::Print>: pdf file histograms/v1_Q1_BestLong_biasedResidualLayer.pdf has been created

Info in <TCanvas::Print>: pdf file histograms/v1_Q1_BestLong_unbiasedResidualLayer.pdf has been created

Info in <TCanvas::Print>: pdf file histograms/v1_Q1_BestLong_RMSResidualQuarters.pdf has been created

Info in <TCanvas::Print>: pdf file histograms/v1_Q1_BestLong_RMSResidualModulesT1.pdf has been created

Info in <TCanvas::Print>: pdf file histograms/v1_Q1_BestLong_RMSResidualModulesT3.pdf has been created

Info in <TCanvas::Print>: pdf file histograms/v1_Q1_BestLong_RMSResidualModulesT2.pdf has been created

Info in <TCanvas::Print>: pdf file histograms/v1_Q1_GoodLongAlign_xdistT1.pdf has been created

Info in <TCanvas::Print>: pdf file histograms/v1_Q1_GoodLongAlign_xdistT2.pdf has been created

Info in <TCanvas::Print>: pdf file histograms/v1_Q1_GoodLongAlign_xdistT3.pdf has been created

Info in <TCanvas::Print>: pdf file
 histograms/v1_Q1_GoodLongAlign_biasedResidualLayer.pdf has been created
 Info in <TCanvas::Print>: pdf file
 histograms/v1_Q1_GoodLongAlign_unbiasedResidualLayer.pdf has been created
 Info in <TCanvas::Print>: pdf file
 histograms/v1_Q1_GoodLongAlign_RMSResidualQuarters.pdf has been created
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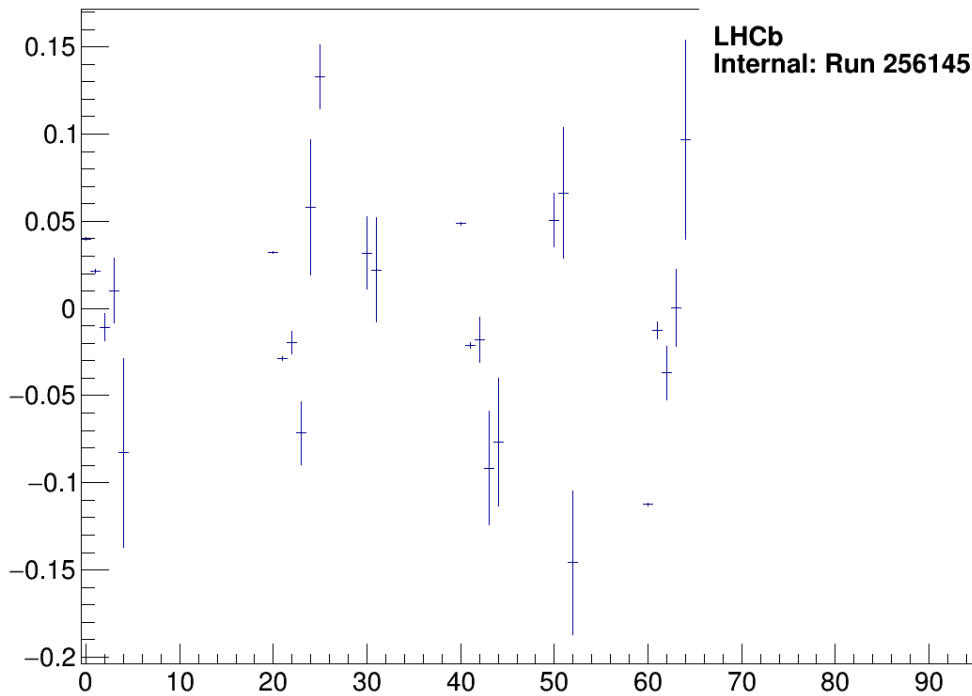
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Residual (rms-unbiased) in FTStation T2



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                             ]):
    filein=ROOT.TFile(f"{fileintag}.root")
    filein.Draw()
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↳
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        for name in_
↳["xdistT1", "xdistT2", "xdistT3", "biasedResidualLayer", "unbiasedResidualLayer", "RMSResidualQu
↳
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            source.FindObjectAny(name).Draw()
            lhcbName = ROOT.TPaveText( 0.70 - 0.05,
                                     0.85 - 0.05,
                                     0.95 - 0.05,
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                                     "BRNDC" )
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↳256145}}')
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            lhcbName.Draw()

            if "Q1" in filein:
                source.GetXaxis().SetTitle(f"{var}, Q1")
            if "Q2" in filein:
                source.GetXaxis().SetTitle(f"{var}, Q2")
            if "Q3" in filein:
                source.GetXaxis().SetTitle(f"{var}, Q3")
            if "Q4" in filein:
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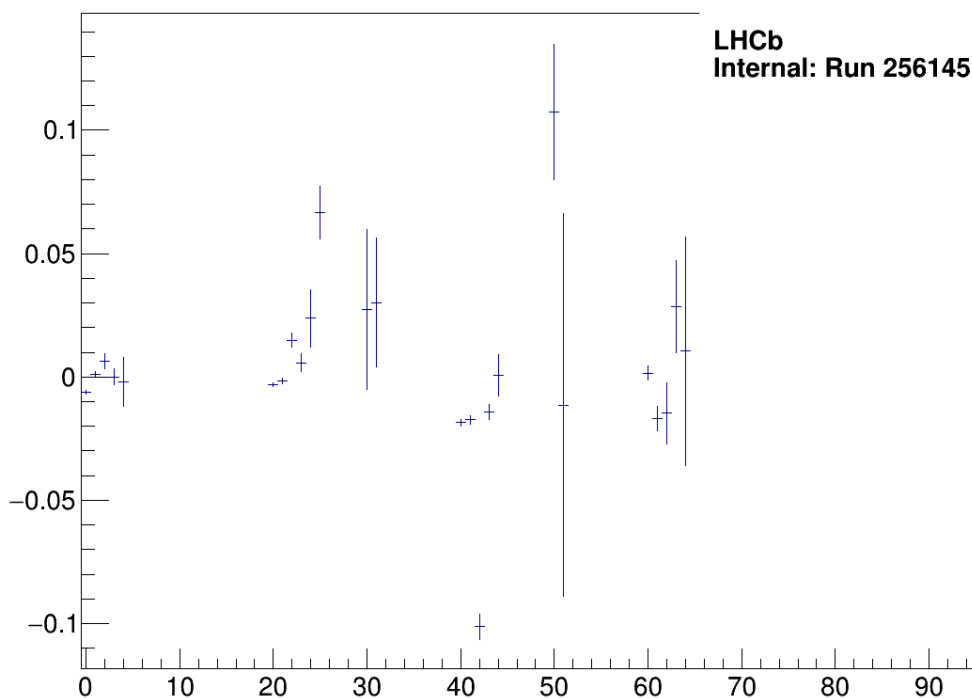
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Residual (rms-unbiased) in FTStation T2



```

[45]: # histograms for RMS residual outliers in lowmu
path_lowmu="/interactive_storage/nbreer/build_stack/tracking/PlotFiles/
↳TEMP_ROOT_FILES/lowmu"
for fileintag,outname in zip([f"{path_lowmu}/Q1/
↳pr_LongModulesLM_branch_Q1_VeloSciFiAligned_RN256145_slice0_new",
                             f"{path_lowmu}/Q2/
↳pr_LongModulesLM_branch_Q2_VeloSciFiAligned_RN256145_slice0_new",
                             f"{path_lowmu}/Q3/
↳pr_LongModulesLM_branch_Q3_VeloSciFiAligned_RN256145_slice0_new",

```

```

                                f"{path_lowmu}/Q4/
↪pr_LongModulesLM_branch_Q4_VeloSciFiAligned_RN256145_slice0_new"
                                ],
                                ["lowmu_Q1",
                                "lowmu_Q2",
                                "lowmu_Q3",
                                "lowmu_Q4"
                                ]):
    filein=ROOT.TFile(f"{fileintag}.root")
    filein.Draw()
    for tracktype, monitorname in_
↪zip(["SciFiSeed", "BestLong", "GoodLongAlign"], ["SciFiSeedsInFTTTrackMonitor", "BestLongInFTTra
↪
        source=getattr(filein,monitorname)
        ROOT.gStyle.SetOptStat(0)
        for name in_
↪["xdistT1", "xdistT2", "xdistT3", "biasedResidualLayer", "unbiasedResidualLayer", "RMSResidualQu
↪
            c4 = ROOT.TCanvas("", "", 1200, 900)
            source.FindObjectAny(name).Draw()
            lhcbName = ROOT.TPaveText( 0.70 - 0.05,
                                    0.85 - 0.05,
                                    0.95 - 0.05,
                                    0.95 - 0.05,
                                    "BRNDC" )
            lhcbName.AddText( '#splitline{LHCb}{#scale[1.0]{Internal: Run_
↪256145}}')
            lhcbName.SetFillColor(0)
            lhcbName.SetTextAlign(12)
            lhcbName.SetBorderSize(0)
            lhcbName.Draw()
            c4.Draw()
            c4.SaveAs(f"histograms/{outname}_{tracktype}_{name}.pdf")

```

Info in <TCanvas::Print>: pdf file histograms/lowmu_Q1_SciFiSeed_xdistT1.pdf has been created

Info in <TCanvas::Print>: pdf file histograms/lowmu_Q1_SciFiSeed_xdistT2.pdf has been created

Info in <TCanvas::Print>: pdf file histograms/lowmu_Q1_SciFiSeed_xdistT3.pdf has been created

Info in <TCanvas::Print>: pdf file histograms/lowmu_Q1_SciFiSeed_biasedResidualLayer.pdf has been created

Info in <TCanvas::Print>: pdf file histograms/lowmu_Q1_SciFiSeed_unbiasedResidualLayer.pdf has been created

Info in <TCanvas::Print>: pdf file histograms/lowmu_Q1_SciFiSeed_RMSResidualQuarters.pdf has been created

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histograms/lowmu_Q1_SciFiSeed_RMSResidualModulesT1.pdf has been created
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histograms/lowmu_Q2_SciFiSeed_biasedResidualLayer.pdf has been created
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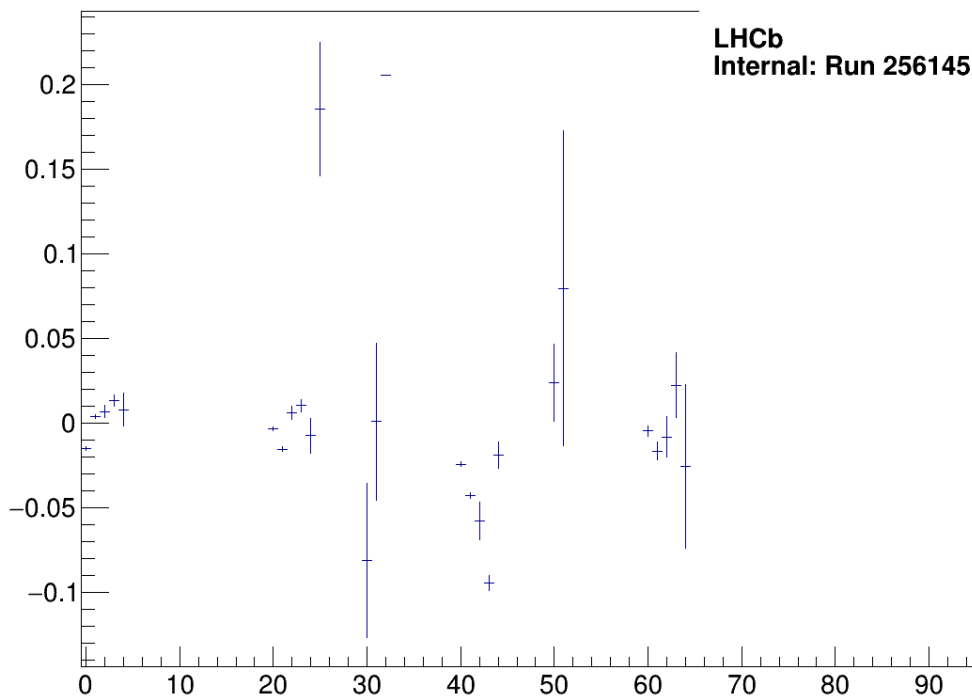
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histograms/lowmu_Q4_GoodLongAlign_biasedResidualLayer.pdf has been created
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 Info in <TCanvas::Print>: pdf file
 histograms/lowmu_Q4_GoodLongAlign_RMSResidualModulesT2.pdf has been created

Residual (rms-unbiased) in FTStation T2



```

[46]: # histogram paths
path_histo_v1="/interactive_storage/nbreer/build_stack/tracking/PlotFiles/
↳TEMP_ROOT_FILES/v1"
histfile_v1_Q1=ROOT.TFile(f"{path_histo_v1}/Q1/
↳pr_LongModulesv1_branch_Q1_VeloSciFiAligned_RN256145_slice0_new.root")
histfile_v1_Q2=ROOT.TFile(f"{path_histo_v1}/Q2/
↳pr_LongModulesv1_branch_Q2_VeloSciFiAligned_RN256145_slice0_new.root")
histfile_v1_Q3=ROOT.TFile(f"{path_histo_v1}/Q3/
↳pr_LongModulesv1_branch_Q3_VeloSciFiAligned_RN256145_slice0_new.root")
  
```

```

histfile_v1_Q4=ROOT.TFile(f"{path_histo_v1}/Q4/
↳pr_LongModulesv1_branch_Q4_VeloSciFiAligned_RN256145_slice0_new.root")

histos_v1_Q1=histfile_v1_Q1.AlignTracksInFTTrackMonitor
histos_v1_Q2=histfile_v1_Q2.AlignTracksInFTTrackMonitor
histos_v1_Q3=histfile_v1_Q3.AlignTracksInFTTrackMonitor
histos_v1_Q4=histfile_v1_Q4.AlignTracksInFTTrackMonitor

```

```

[47]: modelabel="lowmu"

# limits={"RMSResidualQuarters": [0,45]}
filein=[]
path_lowmu="/interactive_storage/nbreer/build_stack/tracking/PlotFiles/
↳TEMP_ROOT_FILES/lowmu"
for fileintag,outname in zip([f"{path_lowmu}/Q1/
↳pr_LongModulesLM_branch_Q1_VeloSciFiAligned_RN256145_slice0_new",
f"{path_lowmu}/Q2/
↳pr_LongModulesLM_branch_Q2_VeloSciFiAligned_RN256145_slice0_new",
f"{path_lowmu}/Q3/
↳pr_LongModulesLM_branch_Q3_VeloSciFiAligned_RN256145_slice0_new",
f"{path_lowmu}/Q4/
↳pr_LongModulesLM_branch_Q4_VeloSciFiAligned_RN256145_slice0_new"
],
["lowmu_Q3",
"lowmu_Q2",
"lowmu_Q1",
"lowmu_Q0"
]):
    filein.append(ROOT.TFile(f"{fileintag}.root"))

# consider label trafo: Q1 -> Q2; Q2 -> Q0; Q3 -> Q3; Q4 -> Q1
legendLabels=["Q3","Q2","Q1","Q0"]

for tracktype, folder, monitorname in_
↳zip(["GoodLongAlign"],["Long"],["AlignTracksInTrackMonitor"]):
    ROOT.gStyle.SetOptStat(1)
    source=[getattr(thisfile,monitorname) for thisfile in filein]
    source=[getattr(label,folder) for label in source]

    for var in ["FTResidual"]:
        c8=ROOT.TCanvas("", "",1400,1000)
        stack=ROOT.THStack("hs","FTResidual lowmu (rms-unbiased)")
        hist=source[0].FindObjectAny(var)
        hist.SetLineColor(ROOT.kBlack)
        hist.SetLineWidth(3)
        stack.Add(hist)

```

```

hist2=source[1].FindObjectAny(var)
hist2.SetLineColor(ROOT.kAzure)
hist2.SetLineWidth(3)
stack.Add(hist2)
hist3=source[2].FindObjectAny(var)
hist3.SetLineColor(ROOT.kOrange-3)
hist3.SetLineWidth(3)
stack.Add(hist3)
hist4=source[3].FindObjectAny(var)
hist4.SetLineColor(ROOT.kGreen)
hist4.SetLineWidth(3)
stack.Add(hist4)
stack.Draw()
stack.GetXaxis().SetLimits(-0.4,0.4)
stack.GetXaxis().SetTitle("FTResidual")
stack.GetYaxis().SetTitle("#hits")

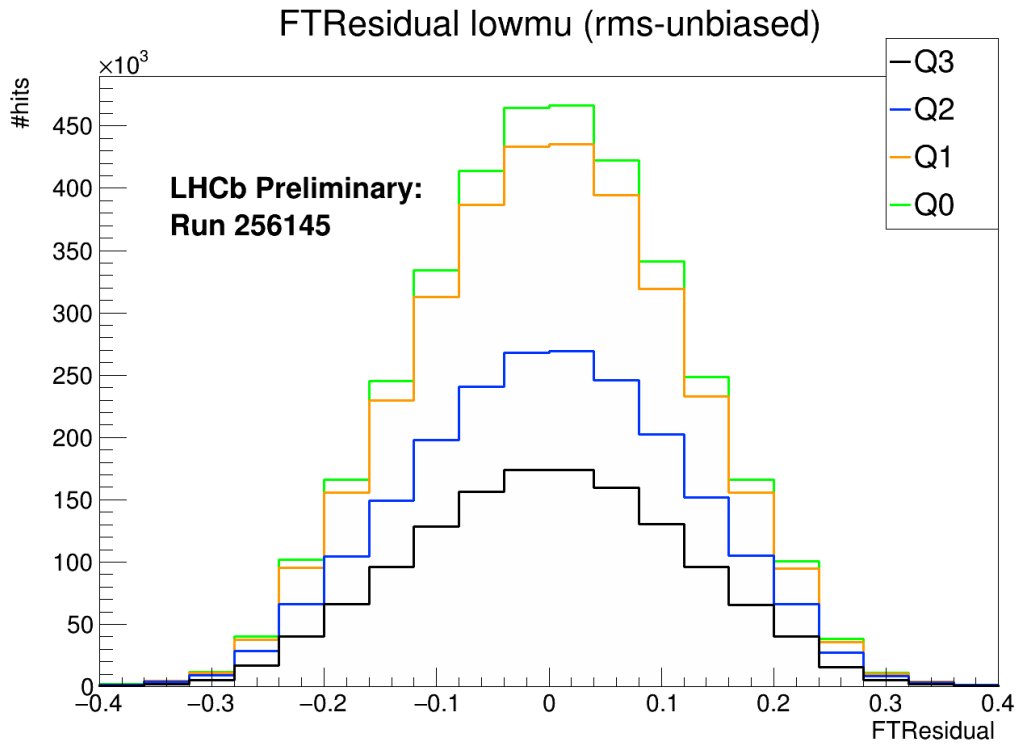
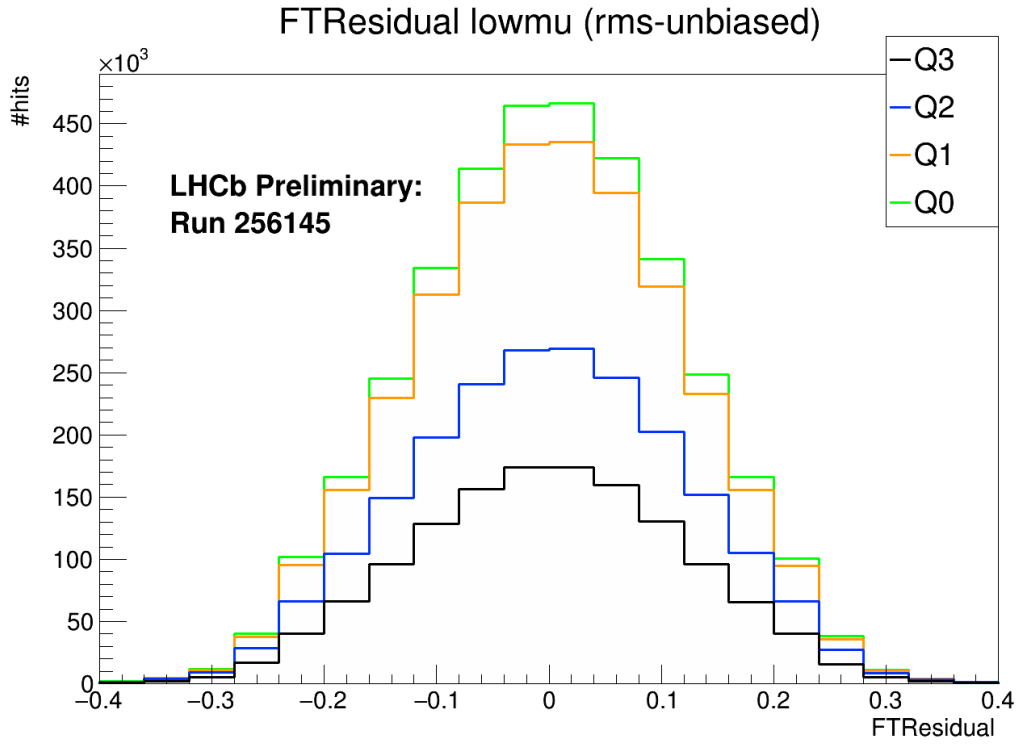
legend = ROOT.TLegend(0.8,0.7,0.9,0.95)
legend.AddEntry(hist,legendLabels[0],"1")
legend.AddEntry(hist2,legendLabels[1],"1")
legend.AddEntry(hist3,legendLabels[2],"1")
legend.AddEntry(hist4,legendLabels[3],"1")
legend.Draw()

lhcbName = ROOT.TPaveText(0.15, 0.68, 0.40, 0.78,"BRNDC" )
lhcbName.AddText('#splitline{LHCb Preliminary:}{#scale[1.0]{Run_
↪256145}}')
lhcbName.SetFillColor(0)
lhcbName.SetTextAlign(12)
lhcbName.SetBorderSize(0)
lhcbName.Draw()

c8.Draw()
c8.SaveAs(f"tuples_out/RMSResidualQuarters_{var}_{nodelabel}.pdf")

```

Info in <TCanvas::Print>: pdf file
tuples_out/RMSResidualQuarters_FTResidual_lowmu.pdf has been created




```

[48]: # v1
filein=[]
path_v1="/interactive_storage/nbreer/build_stack/tracking/PlotFiles/
↳TEMP_ROOT_FILES/v1"
for fileintag,outname in zip([f"{path_v1}/Q1/
↳pr_LongModulesv1_branch_Q1_VeloSciFiAligned_RN256145_slice0_new",
f"{path_v1}/Q2/
↳pr_LongModulesv1_branch_Q2_VeloSciFiAligned_RN256145_slice0_new",
f"{path_v1}/Q3/
↳pr_LongModulesv1_branch_Q3_VeloSciFiAligned_RN256145_slice0_new",
f"{path_v1}/Q4/
↳pr_LongModulesv1_branch_Q4_VeloSciFiAligned_RN256145_slice0_new"
],
["v1_Q3",
"v1_Q2",
"v1_Q1",
"v1_Q0"
]):
    filein.append(ROOT.TFile(f"{fileintag}.root"))

legendLabels=["Q3","Q2","Q1","Q0"]

for tracktype, folder, monitorname in_
↳zip(["GoodLongAlign"],["Long"],["AlignTracksInTrackMonitor"]):
    ROOT.gStyle.SetOptStat(1)
    source=[getattr(thisfile,monitorname) for thisfile in filein]
    source=[getattr(label,folder) for label in source]

    for var in ["FTResidual"]:
        c8=ROOT.TCanvas("", "", 1400, 1000)
        stack=ROOT.THStack("hs", "FTResidual v1 (rms-unbiased)")
        hist=source[0].FindObjectAny(var)
        hist.SetLineColor(ROOT.kBlack)
        hist.SetLineWidth(3)
        stack.Add(hist)
        hist2=source[1].FindObjectAny(var)
        hist2.SetLineColor(ROOT.kAzure)
        hist2.SetLineWidth(3)
        stack.Add(hist2)
        hist3=source[2].FindObjectAny(var)
        hist3.SetLineColor(ROOT.kOrange-3)
        hist3.SetLineWidth(3)
        stack.Add(hist3)
        hist4=source[3].FindObjectAny(var)
        hist4.SetLineColor(ROOT.kGreen)
        hist4.SetLineWidth(3)
        stack.Add(hist4)

```

```

stack.Draw()
stack.GetAxis().SetLimits(-0.5,0.5)
stack.GetAxis().SetTitle("FTResidual")
stack.GetYaxis().SetTitle("#Hits")

legend = ROOT.TLegend(0.8,0.7,0.9,0.95)
legend.AddEntry(hist,legendLabels[0],"1")
legend.AddEntry(hist2,legendLabels[1],"1")
legend.AddEntry(hist3,legendLabels[2],"1")
legend.AddEntry(hist4,legendLabels[3],"1")
legend.Draw()

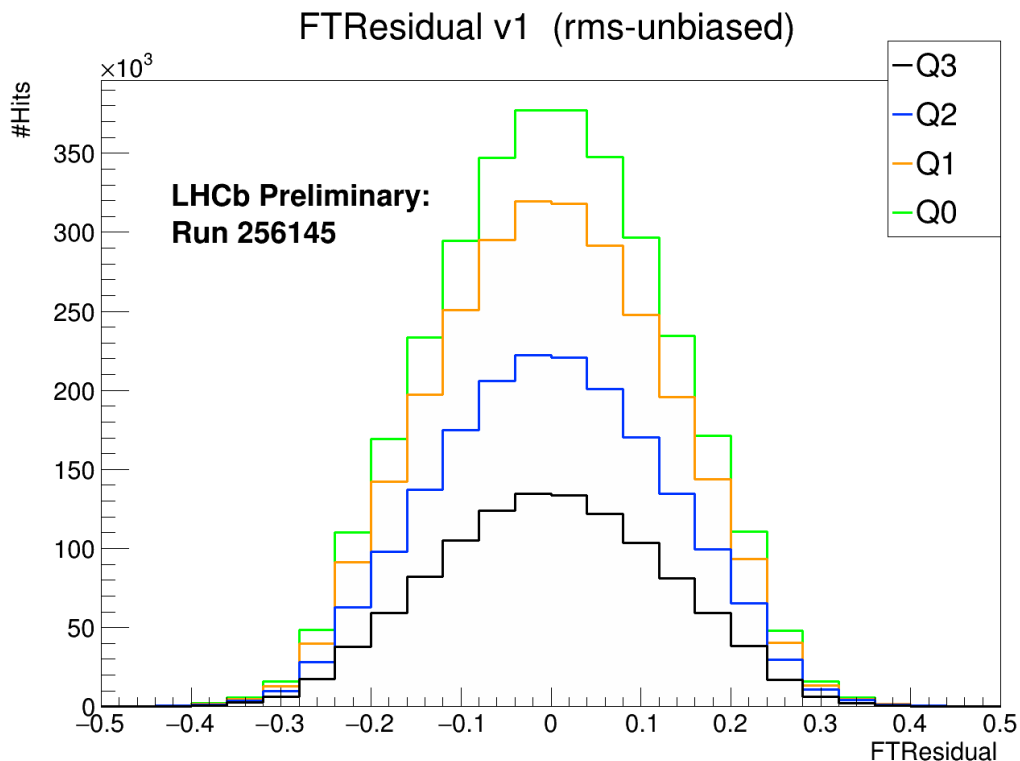
lhcbName = ROOT.TPaveText(0.15, 0.68, 0.40, 0.78,"BRNDC" )
lhcbName.AddText('#splitline{LHCb Preliminary:}{#scale[1.0]{Run_
↪256145}}')
lhcbName.SetFillColor(0)
lhcbName.SetTextAlign(12)
lhcbName.SetBorderSize(0)
lhcbName.Draw()

c8.Draw()
c8.SaveAs(f"tuples_out/RMSResidualQuarters_{var}_{nodelabel}.pdf")

```

Info in <TCanvas::Print>: pdf file

tuples_out/RMSResidualQuarters_FTResidual_lowmu.pdf has been created



```

[49]: # v2
filein=[]
path_v2="/interactive_storage/nbreer/build_stack/tracking/PlotFiles/
↳TEMP_ROOT_FILES/v2"
for fileintag,outname in zip([
    f"{path_v2}/Q1/
↳pr_LongModulesv2_branch_Q1_VeloSciFiAligned_RN256145_slice0_new",
    f"{path_v2}/Q2/
↳pr_LongModulesv2_branch_Q2_VeloSciFiAligned_RN256145_slice0_new",
    f"{path_v2}/Q3/
↳pr_LongModulesv2_branch_Q3_VeloSciFiAligned_RN256145_slice0_new",
    f"{path_v2}/Q4/
↳pr_LongModulesv2_branch_Q4_VeloSciFiAligned_RN256145_slice0_new",
    f"{path_v2}/
↳pr_LongModulesV2ReTest_Q1_VeloSciFiAligned_RN256145_slice0_new"
],
[
    "v2_Q3",
    "v2_Q2",
    "v2_Q1",
    "v2_Q0",
    "V2_Q3_mshape"
]):
    filein.append(ROOT.TFile(f"{fileintag}.root"))

legendLabels=[
    "Q3",
    "Q2",
    "Q1",
    "Q0",
    "Q2 M-shape"
]

variables=[
    "chi2PerDofVelo",
    "HitVeloALayers",
    "HitVeloCLayers",
]
variables2=["xdistT1"]
for monitorname in ["AlignTracksInFTTrackMonitor"]:
    ROOT.gStyle.SetOptStat(1)
    source=[getattr(thisfile,monitorname) for thisfile in filein]
#     source=[getattr(label,folder) for label in source]

```

```

for var in variables2:
    c8=ROOT.TCanvas("", "", 1400, 1000)
    stack=ROOT.THStack("hs", f"{var} v2")
    hist=source[0].FindObjectAny(var)
    hist.SetLineColor(ROOT.kBlack)
    hist.SetLineWidth(3)
    stack.Add(hist)
    hist2=source[1].FindObjectAny(var)
    hist2.SetLineColor(ROOT.kAzure)
    hist2.SetLineWidth(3)
    stack.Add(hist2)
    hist3=source[2].FindObjectAny(var)
    hist3.SetLineColor(ROOT.kOrange-3)
    hist3.SetLineWidth(3)
    stack.Add(hist3)
    hist4=source[3].FindObjectAny(var)
    hist4.SetLineColor(ROOT.kGreen)
    hist4.SetLineWidth(3)
    stack.Add(hist4)
#     hist6=source[4].FindObjectAny(var)
#     hist6.SetLineColor(ROOT.kPink)
#     hist6.SetLineWidth(3)
#     stack.Add(hist6)
    stack.Draw()
    stack.GetXaxis().SetLimits(-1200, 1200)
#     stack.GetXaxis().SetLimits(-0.22, 0.22)
    stack.GetXaxis().SetTitle(f"{var}")
    stack.GetYaxis().SetTitle("Reconstructed Tracks")

    legend = ROOT.TLegend(0.8, 0.7, 0.95, 0.95)
    legend.AddEntry(hist, legendLabels[0], "l")
    legend.AddEntry(hist2, legendLabels[1], "l")
    legend.AddEntry(hist3, legendLabels[2], "l")
    legend.AddEntry(hist4, legendLabels[3], "l")
#     legend.AddEntry(hist6, legendLabels[4], "l")
    legend.Draw()

    lhcbName = ROOT.TPaveText(0.15, 0.68, 0.40, 0.78, "BRNDC" )
    lhcbName.AddText('#splitline{LHCb Preliminary:}{#scale[1.0]{Run_1  
→256145}}}')
    lhcbName.SetFillColor(0)
    lhcbName.SetTextAlign(12)
    lhcbName.SetBorderSize(0)
    lhcbName.Draw()

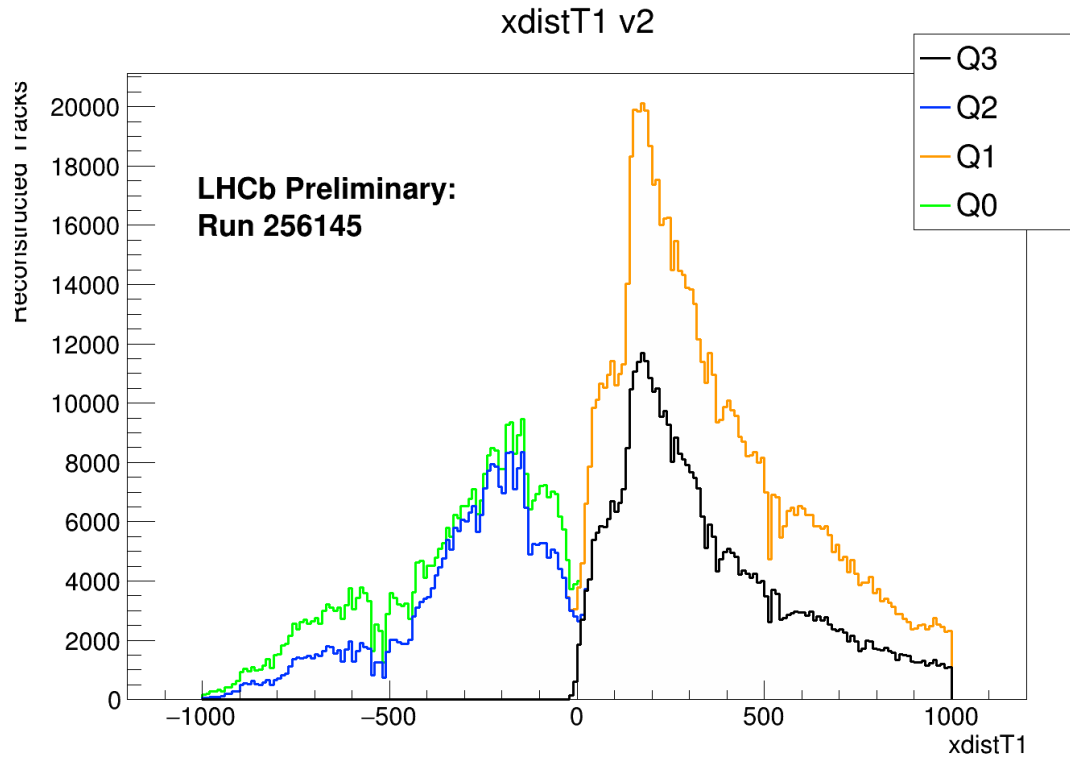
    c8.Draw()

```

```
c8.SaveAs(f"tuples_out/{outname}_RMSResidualQuarters_{var}_{nodelabel}.\n→pdf")
```

Info in <TCanvas::Print>: pdf file

tuples_out/V2_Q3_mshape_RMSResidualQuarters_xdistT1_lowmu.pdf has been created



```
[50]: # v1
filein=[]
path_v1="/interactive_storage/nbreer/build_stack/tracking/PlotFiles/\n→TEMP_ROOT_FILES/v1"
for fileintag,outname in zip([
    f"{path_v1}/Q1/\n→pr_LongModulesv1_branch_Q1_VeloSciFiAligned_RN256145_slice0_new",
    f"{path_v1}/Q2/\n→pr_LongModulesv1_branch_Q2_VeloSciFiAligned_RN256145_slice0_new",
    f"{path_v1}/Q3/\n→pr_LongModulesv1_branch_Q3_VeloSciFiAligned_RN256145_slice0_new",
    f"{path_v1}/Q4/\n→pr_LongModulesv1_branch_Q4_VeloSciFiAligned_RN256145_slice0_new",
],
    [
        "v1_Q1_xdist",

```

```

        "v1_Q2_xdist",
        "v1_Q3_xdist",
        "v1_Q4_xdist",
    ]):
    filein.append(ROOT.TFile(f"{fileintag}.root"))

legendLabels=[
    "Q2",
    "Q3",
    "Q0",
    "Q1",
    "Q2 M-shape"
]

variables=[
    "chi2PerDofVelo",
    "HitVeloALayers",
    "HitVeloCLayers",
]
variables2=["xdistT1"]
for monitorname in ["AlignTracksInFTTrackMonitor"]:
    ROOT.gStyle.SetOptStat(1)
    source=[getattr(thisfile,monitorname) for thisfile in filein]
    #     source=[getattr(label,folder) for label in source]

    for var in variables2:
        c8=ROOT.TCanvas("", "", 1400, 1000)
        stack=ROOT.THStack("hs", f"{var} v1")
        hist=source[0].FindObjectAny(var)
        hist.SetLineColor(ROOT.kBlack)
        hist.SetLineWidth(3)
        stack.Add(hist)
        hist2=source[1].FindObjectAny(var)
        hist2.SetLineColor(ROOT.kAzure)
        hist2.SetLineWidth(3)
        stack.Add(hist2)
        hist3=source[2].FindObjectAny(var)
        hist3.SetLineColor(ROOT.kOrange-3)
        hist3.SetLineWidth(3)
        stack.Add(hist3)
        hist4=source[3].FindObjectAny(var)
        hist4.SetLineColor(ROOT.kGreen)
        hist4.SetLineWidth(3)
        stack.Add(hist4)
        stack.Draw()
        stack.GetXaxis().SetLimits(-1200, 1200)
    #     stack.GetXaxis().SetLimits(-0.22, 0.22)

```

```

stack.GetAxis().SetTitle(f"{var}")
stack.GetYaxis().SetTitle("Reconstructed Tracks")

legend = ROOT.TLegend(0.8,0.7,0.95,0.95)
legend.AddEntry(hist,legendLabels[0],"1")
legend.AddEntry(hist2,legendLabels[1],"1")
legend.AddEntry(hist3,legendLabels[2],"1")
legend.AddEntry(hist4,legendLabels[3],"1")
legend.Draw()

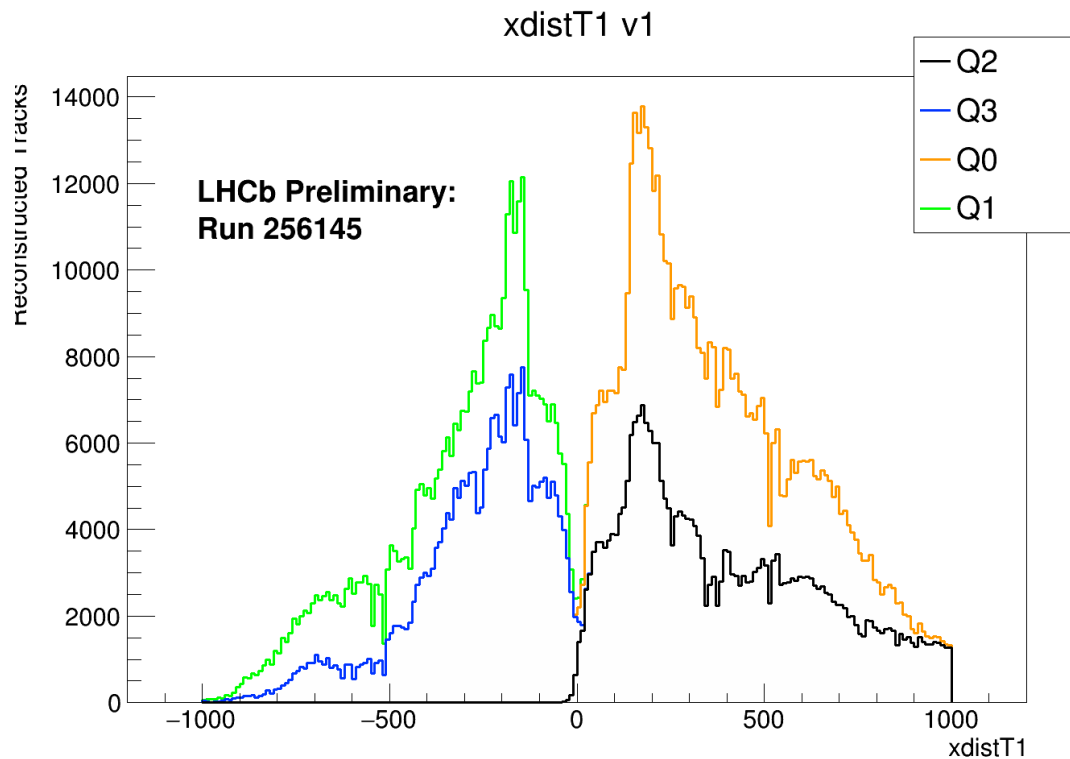
lhcbName = ROOT.TPaveText(0.15, 0.68, 0.40, 0.78,"BRNDC" )
lhcbName.AddText('#splitline{LHCb Preliminary:}{#scale[1.0]{Run_
↪256145}}}')
lhcbName.SetFillColor(0)
lhcbName.SetTextAlign(12)
lhcbName.SetBorderSize(0)
lhcbName.Draw()

c8.Draw()
c8.SaveAs(f"tuples_out/{outname}_RMSResidualQuarters_{var}_{nodelabel}.
↪pdf")

```

Info in <TCanvas::Print>: pdf file

tuples_out/v1_Q4_xdist_RMSResidualQuarters_xdistT1_lowmu.pdf has been created



```

[51]: # lowmu
filein=[]
path_lowmu="/interactive_storage/nbreer/build_stack/tracking/PlotFiles/
↳TEMP_ROOT_FILES/lowmu"
for fileintag,outname in zip([
    f"{path_lowmu}/Q1/
↳pr_LongModulesLM_branch_Q1_VeloSciFiAligned_RN256145_slice0_new",
    f"{path_lowmu}/Q2/
↳pr_LongModulesLM_branch_Q2_VeloSciFiAligned_RN256145_slice0_new",
    f"{path_lowmu}/Q3/
↳pr_LongModulesLM_branch_Q3_VeloSciFiAligned_RN256145_slice0_new",
    f"{path_lowmu}/Q4/
↳pr_LongModulesLM_branch_Q4_VeloSciFiAligned_RN256145_slice0_new",
    ],
    [
        "lm_Q1",
        "lm_Q2",
        "lm_Q3",
        "lm_Q4",
    ]):
    filein.append(ROOT.TFile(f"{fileintag}.root"))

legendLabels=[
    "Q2",
    "Q3",
    "Q0",
    "Q1",
]

variables=[
    "chi2PerDofVelo",
    "HitVeloALayers",
    "HitVeloCLayers",
]
variables2=["xdistT1"]
for monitorname in ["AlignTracksInFTTrackMonitor"]:
    ROOT.gStyle.SetOptStat(1)
    source=[getattr(thisfile,monitorname) for thisfile in filein]
    # source=[getattr(label,folder) for label in source]

    for var in variables2:
        c8=ROOT.TCanvas("", "", 1400, 1000)
        stack=ROOT.THStack("hs", f"{var} low mu")
        hist=source[0].FindObjectAny(var)

```



```

hist.SetLineColor(ROOT.kBlack)
hist.SetLineWidth(3)
stack.Add(hist)
hist2=source[1].FindObjectAny(var)
hist2.SetLineColor(ROOT.kAzure)
hist2.SetLineWidth(3)
stack.Add(hist2)
hist3=source[2].FindObjectAny(var)
hist3.SetLineColor(ROOT.kOrange-3)
hist3.SetLineWidth(3)
stack.Add(hist3)
hist4=source[3].FindObjectAny(var)
hist4.SetLineColor(ROOT.kGreen)
hist4.SetLineWidth(3)
stack.Add(hist4)
stack.Draw()
stack.GetAxis().SetLimits(-1200,1200)
#    stack.GetAxis().SetLimits(-0.22,0.22)
stack.GetAxis().SetTitle(f"{var}")
stack.GetYaxis().SetTitle("Reconstructed Tracks")

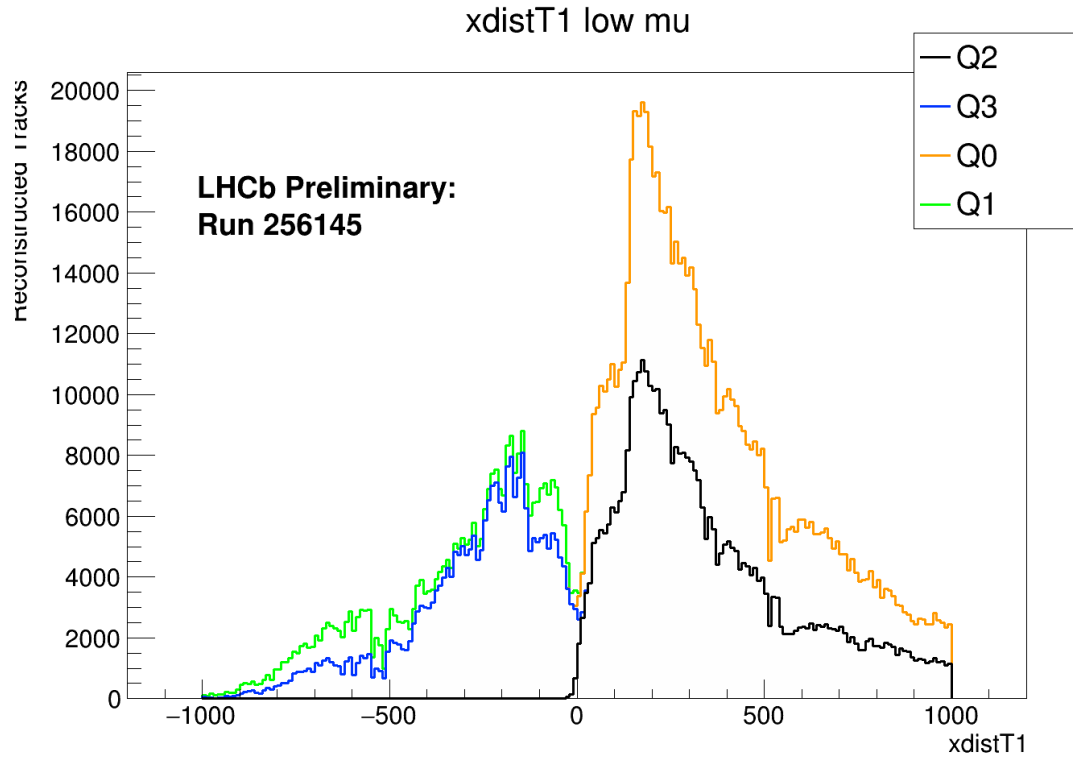
legend = ROOT.TLegend(0.8,0.7,0.95,0.95)
legend.AddEntry(hist,legendLabels[0],"1")
legend.AddEntry(hist2,legendLabels[1],"1")
legend.AddEntry(hist3,legendLabels[2],"1")
legend.AddEntry(hist4,legendLabels[3],"1")
legend.Draw()

lhcbName = ROOT.TPaveText(0.15, 0.68, 0.40, 0.78,"BRNDC" )
lhcbName.AddText('#splitline{LHCb Preliminary:}{#scale[1.0]{Run_
→256145}}')
lhcbName.SetFillColor(0)
lhcbName.SetTextAlign(12)
lhcbName.SetBorderSize(0)
lhcbName.Draw()

c8.Draw()
c8.SaveAs(f"tuples_out/{outname}_RMSResidualQuarters_{var}_{nodelabel}.
→pdf")

```

Info in <TCanvas::Print>: pdf file
tuples_out/lm_Q4_RMSResidualQuarters_xdistT1_lowmu.pdf has been created



```
[52]: # lowmu all plots combined for each quarter
ROOT.gStyle.SetOptStat(1)
c3 = ROOT.TCanvas("c1", "c1", 1200, 1200)

# Q2
nodetuples_Q2[2].Draw("ty:tx >> hist(200,-0.4,0.4,200,-0.4,0.4)",
↳"globalModuleIndex>0")
hist=ROOT.gDirectory.Get("hist")
# Q0
nodetuples_Q4[2].Draw("ty:tx >> hist1(100,-0.4,0,100,-0.4,0)",
↳"globalModuleIndex>0")
hist1=ROOT.gDirectory.Get("hist1")
# Q1
nodetuples_Q3[2].Draw("ty:tx >> hist2(100,0,0.4,100,-0.4,0)",
↳"globalModuleIndex>0")
hist2=ROOT.gDirectory.Get("hist2")
# Q3
nodetuples_Q1[2].Draw("ty:tx >> hist3(100,0,0.4,100,0,0.4)",
↳"globalModuleIndex>0")
hist3=ROOT.gDirectory.Get("hist3")
ROOT.gPad.SetLogz()
hist.Draw("colz")
```

```

hist1.Draw("col same")
hist2.Draw("col same")
hist3.Draw("col same")
c3.Draw()

hist.GetXaxis().SetTitle("tx")
hist.GetYaxis().SetTitle("ty")

lhcbName = ROOT.TPaveText(0.15, 0.68, 0.40, 0.78,"BRNDC" )
lhcbName.AddText('#splitline{LHCb Preliminary:}{#scale[1.0]{Run 256145}}')
lhcbName.SetFillColor(0)
lhcbName.SetTextAlign(12)
lhcbName.SetBorderSize(0)
lhcbName.Draw()

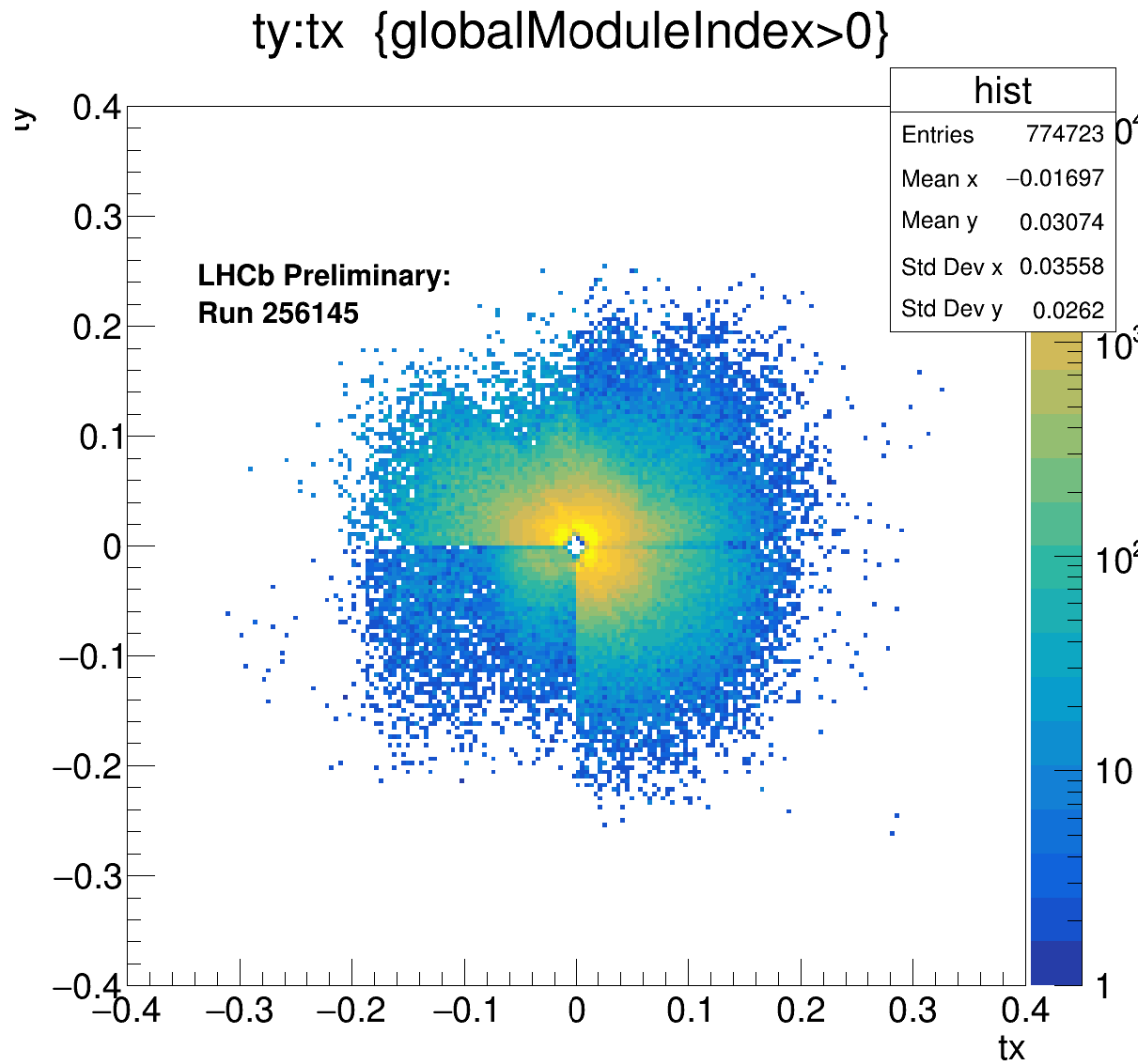
c3.SaveAs("tuples_out/all_tx_ty_lowmu.pdf")

```

```

Warning in <TCanvas::Constructor>: Deleting canvas with same name: c1
Info in <TCanvas::Print>: pdf file tuples_out/all_tx_ty_lowmu.pdf has been
created

```



```
[53]: # lowmu all plots combined for each quarter
ROOT.gStyle.SetOptStat(1)
c3 = ROOT.TCanvas("c1", "c1", 1200, 1200)

# Q2
nodetuples_Q2[1].Draw("ty:tx >> hist(200,-0.4,0.4,200,-0.4,0.4)",
    ↪ "globalModuleIndex>0")
hist=ROOT.gDirectory.Get("hist")
# Q0
nodetuples_Q4[1].Draw("ty:tx >> hist1(100,-0.4,0,100,-0.4,0)",
    ↪ "globalModuleIndex>0")
hist1=ROOT.gDirectory.Get("hist1")
# Q1
```

```

nodetuples_Q3[1].Draw("ty:tx >> hist2(100,0,0.4,100,-0.4,0)",
↳"globalModuleIndex>0")
hist2=ROOT.gDirectory.Get("hist2")
# Q3
nodetuples_Q1[1].Draw("ty:tx >> hist3(100,0,0.4,100,0,0.4)",
↳"globalModuleIndex>0")
hist3=ROOT.gDirectory.Get("hist3")
ROOT.gPad.SetLogz()
hist.Draw("colz")
hist1.Draw("col same")
hist2.Draw("col same")
hist3.Draw("col same")
c3.Draw()

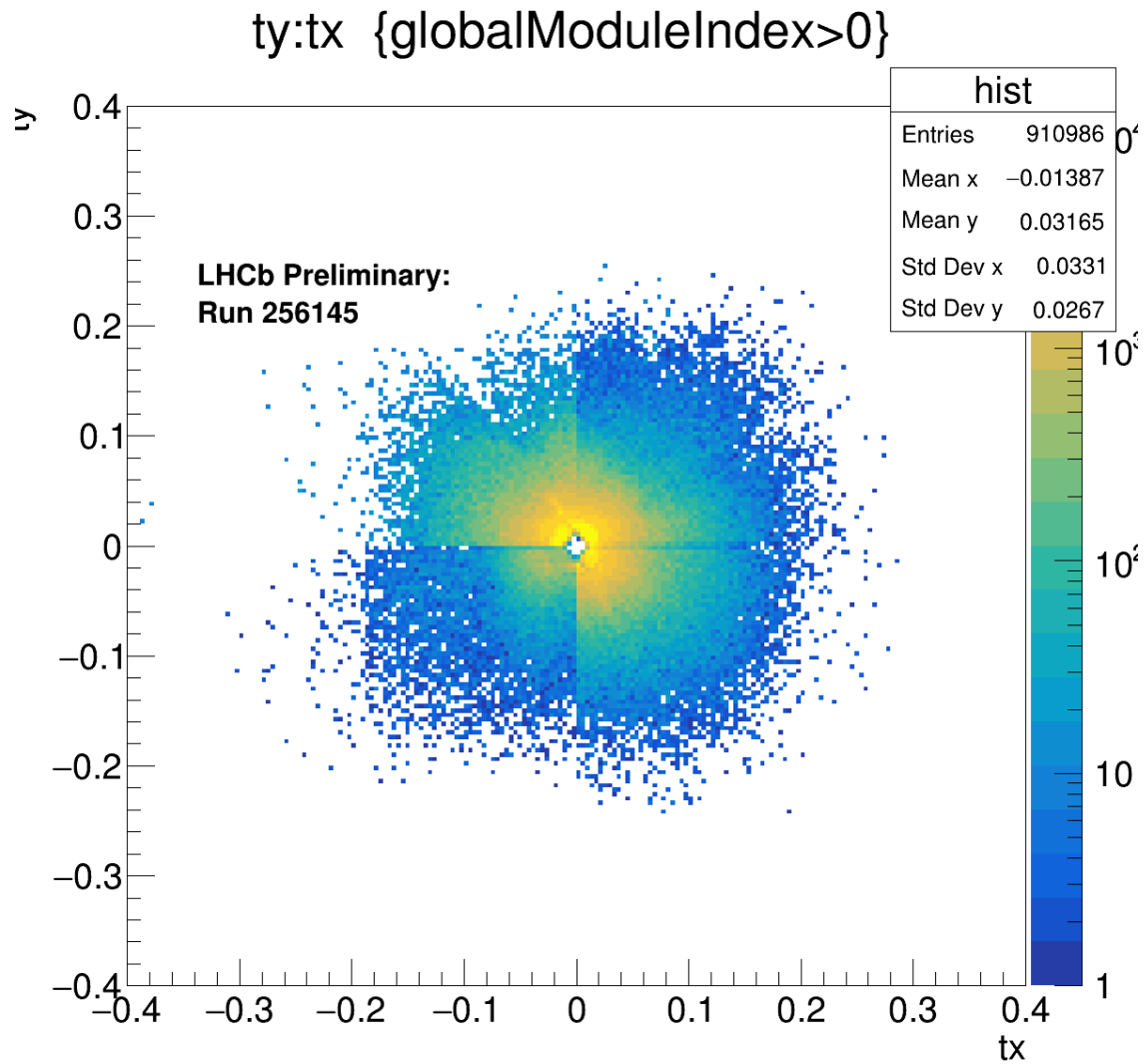
hist.GetXaxis().SetTitle("tx")
hist.GetYaxis().SetTitle("ty")

lhcbName = ROOT.TPaveText(0.15, 0.68, 0.40, 0.78,"BRNDC" )
lhcbName.AddText('#splitline{LHCb Preliminary:}{#scale[1.0]{Run 256145}}')
lhcbName.SetFillColor(0)
lhcbName.SetTextAlign(12)
lhcbName.SetBorderSize(0)
lhcbName.Draw()

c3.SaveAs("tuples_out/all_tx_ty_v2.pdf")

```

Warning in <TCanvas::Constructor>: Deleting canvas with same name: c1
Info in <TCanvas::Print>: pdf file tuples_out/all_tx_ty_v2.pdf has been created



```
[54]: # lowmu all plots combined for each quarter
ROOT.gStyle.SetOptStat(1)
c3 = ROOT.TCanvas("c1", "c1", 1200, 1200)

# Q2
nodetuples_Q2[0].Draw("ty:tx >> hist(200,-0.4,0.4,200,-0.4,0.4)",
    ↪ "globalModuleIndex>0")
hist=ROOT.gDirectory.Get("hist")
# Q0
nodetuples_Q4[0].Draw("ty:tx >> hist1(100,-0.4,0,100,-0.4,0)",
    ↪ "globalModuleIndex>0")
hist1=ROOT.gDirectory.Get("hist1")
# Q1
```

```

nodetuples_Q3[0].Draw("ty:tx >> hist2(100,0,0.4,100,-0.4,0)",
↳"globalModuleIndex>0")
hist2=ROOT.gDirectory.Get("hist2")
# Q3
nodetuples_Q1[0].Draw("ty:tx >> hist3(100,0,0.4,100,0,0.4)",
↳"globalModuleIndex>0")
hist3=ROOT.gDirectory.Get("hist3")
ROOT.gPad.SetLogz()
hist.Draw("colz")
hist1.Draw("col same")
hist2.Draw("col same")
hist3.Draw("col same")
c3.Draw()

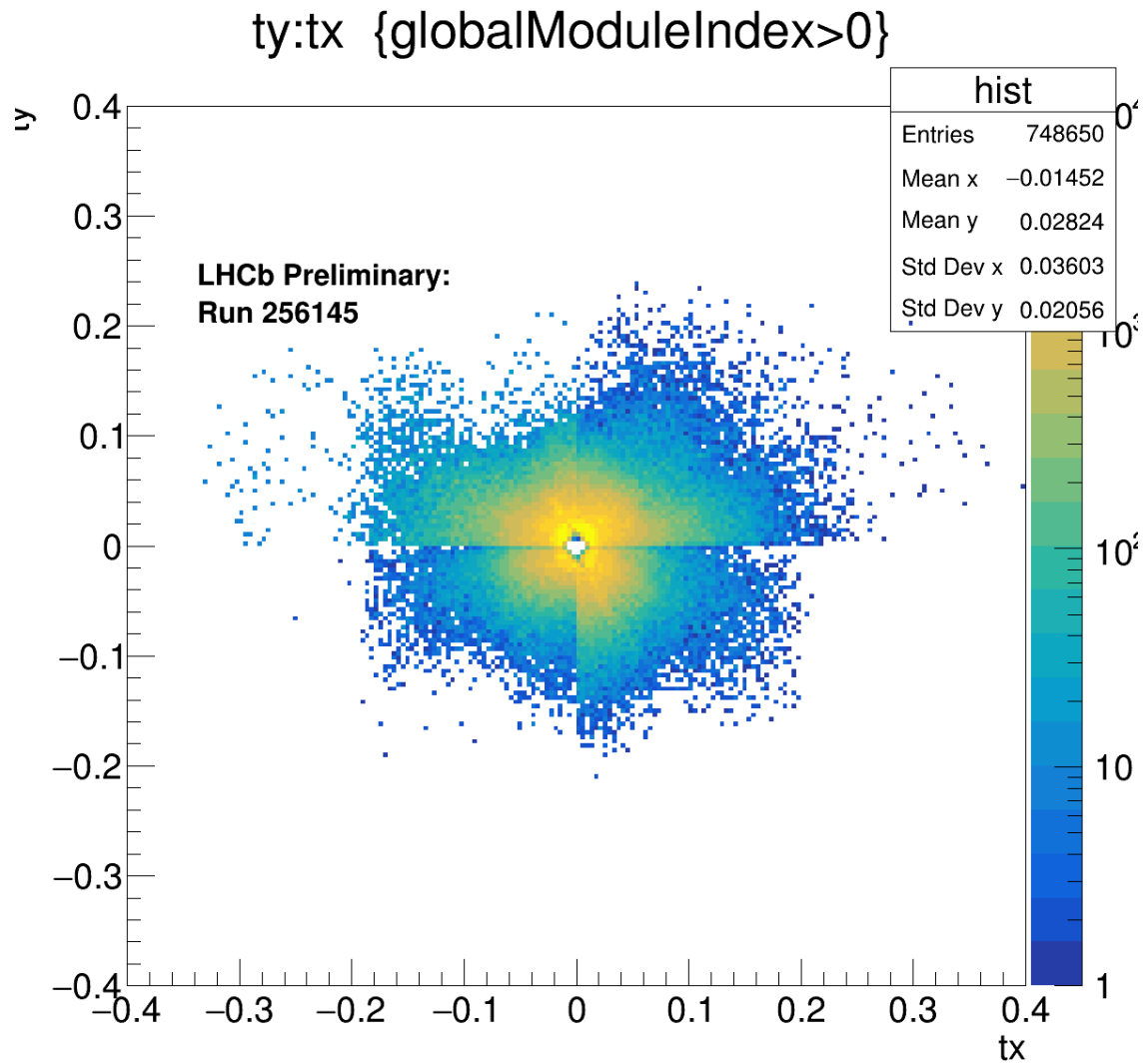
hist.GetXaxis().SetTitle("tx")
hist.GetYaxis().SetTitle("ty")

lhcbName = ROOT.TPaveText(0.15, 0.68, 0.40, 0.78,"BRNDC" )
lhcbName.AddText('#splitline{LHCb Preliminary:}{#scale[1.0]{Run 256145}}')
lhcbName.SetFillColor(0)
lhcbName.SetTextAlign(12)
lhcbName.SetBorderSize(0)
lhcbName.Draw()

c3.SaveAs("tuples_out/all_tx_ty_v1.pdf")

```

Warning in <TCanvas::Constructor>: Deleting canvas with same name: c1
Info in <TCanvas::Print>: pdf file tuples_out/all_tx_ty_v1.pdf has been created



```
[55]: # for tx vs. ty plot everything separte to see the overflow to other quarters
      # when i select 9 hits minimum in a quarter there are up to 3 more hits that
      ↪ can be in a
      # different quarter
```

```
[56]: # for v2
      ROOT.gStyle.SetOptStat(1)
      c3 = ROOT.TCanvas("c1","c1",1200,1200)

      # Q2
      nodetuples_Q2[2].Draw("ty:tx >> hist(200,-0.4,0.4,200,-0.4,0.4)",
      ↪ "globalModuleIndex>0")
      hist=ROOT.gDirectory.Get("hist")
```



```

ROOT.gPad.SetLogz()
hist.Draw("colz")
c3.Draw()

hist.GetXaxis().SetTitle("tx")
hist.GetYaxis().SetTitle("ty")

lhcbName = ROOT.TPaveText(0.15, 0.68, 0.40, 0.78,"BRNDC" )
lhcbName.AddText('#splitline{LHCb Preliminary:}{#scale[1.0]{Run 256145}}')
lhcbName.SetFillColor(0)
lhcbName.SetTextAlign(12)
lhcbName.SetBorderSize(0)
lhcbName.Draw()

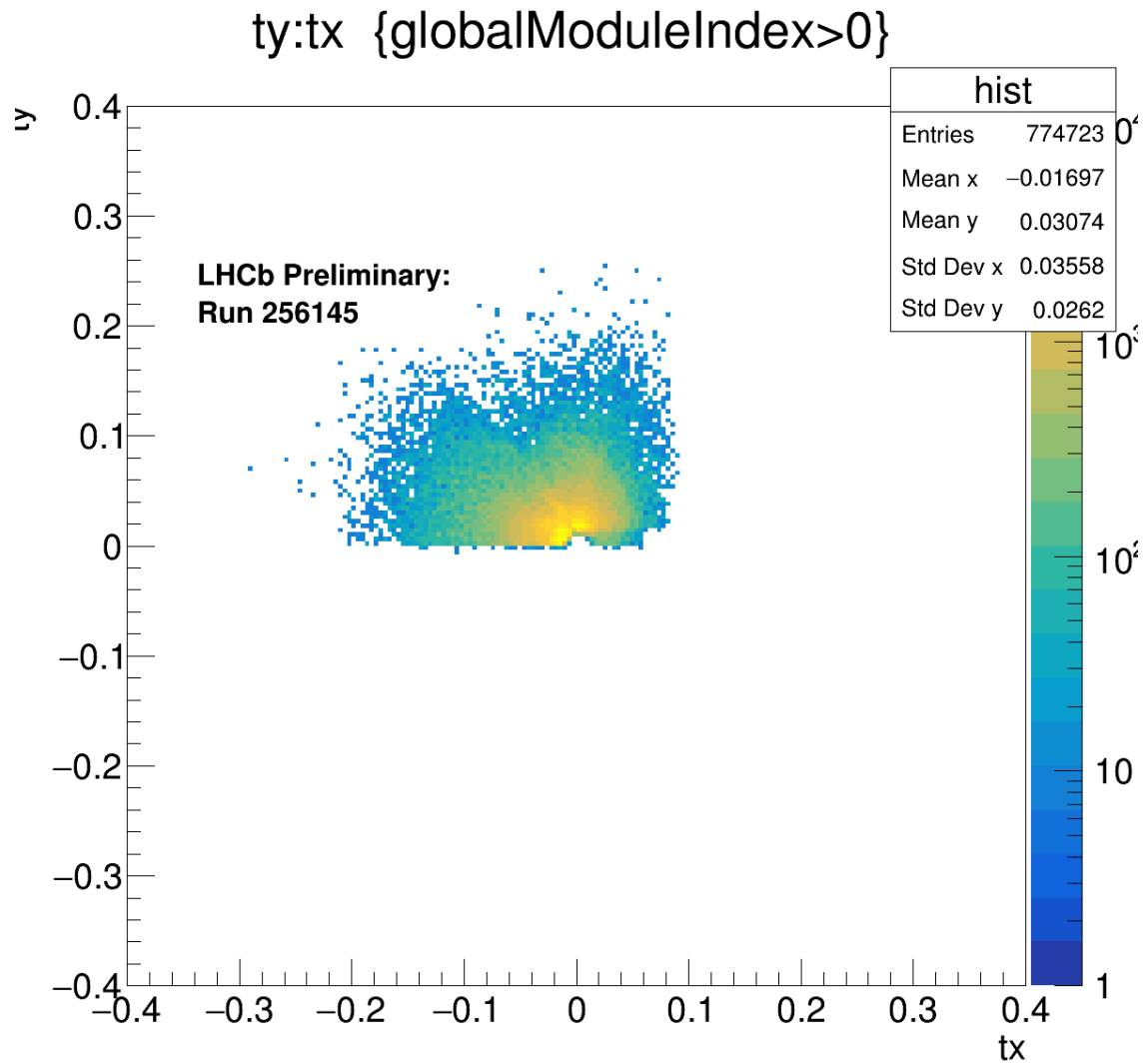
c3.SaveAs("tuples_out/all_tx_ty_lowmu_Q2.pdf")

```

```

Warning in <TCanvas::Constructor>: Deleting canvas with same name: c1
Info in <TCanvas::Print>: pdf file tuples_out/all_tx_ty_lowmu_Q2.pdf has been
created

```



```
[57]: ROOT.gStyle.SetOptStat(1)
c3 = ROOT.TCanvas("c1","c1",1200,1200)

# Q0
nodetuples_Q4[2].Draw("ty:tx >> hist1(100,-0.4,0.4,100,-0.4,0.4)",
    →"globalModuleIndex>0")
hist1=ROOT.gDirectory.Get("hist1")

ROOT.gPad.SetLogz()
hist1.Draw("colz")
c3.Draw()

hist1.GetXaxis().SetTitle("tx")
```

```

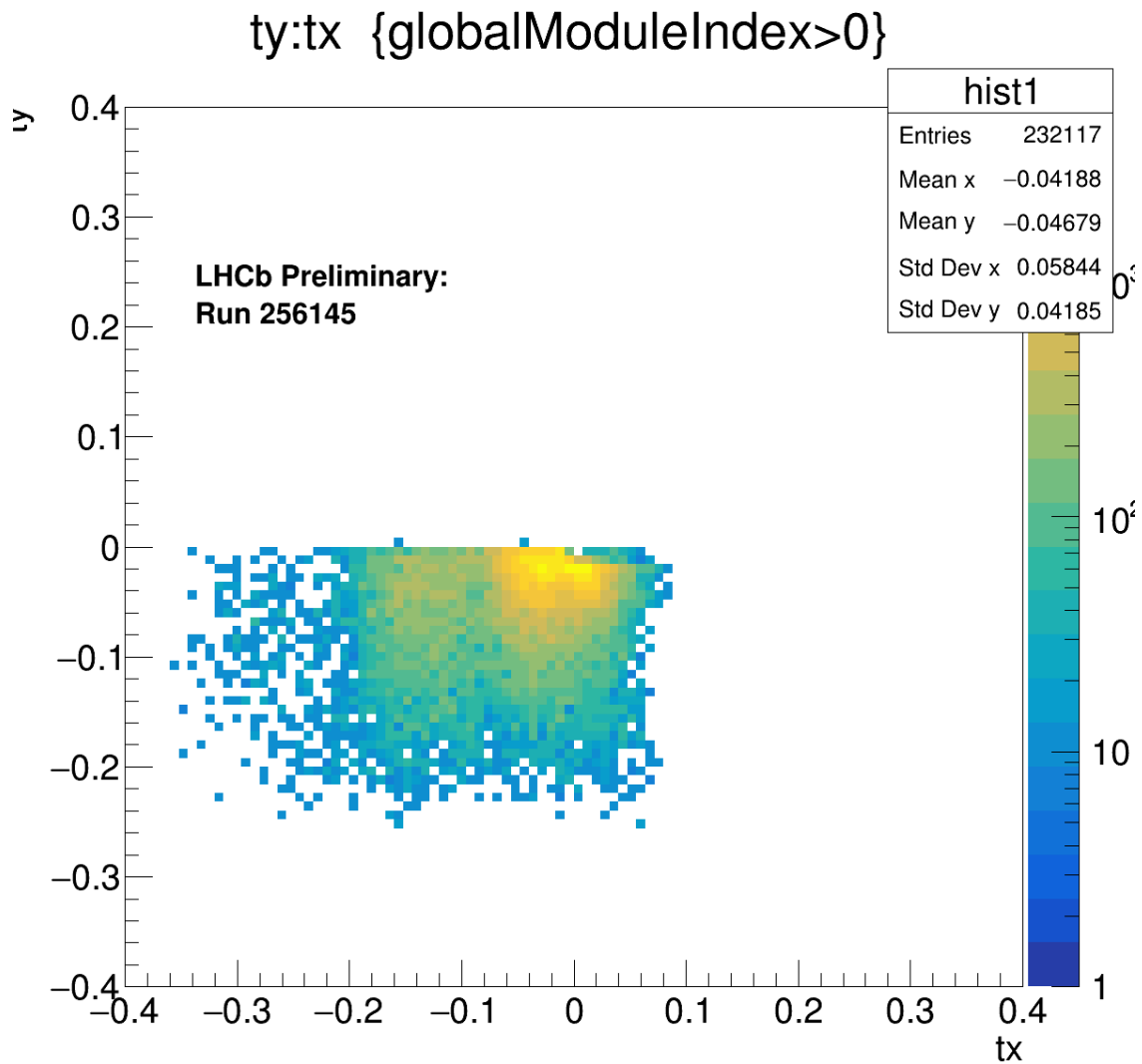
hist1.GetYaxis().SetTitle("ty")

lhcbName = ROOT.TPaveText(0.15, 0.68, 0.40, 0.78,"BRNDC" )
lhcbName.AddText('#splitline{LHCb Preliminary:}{#scale[1.0]{Run 256145}}')
lhcbName.SetFillColor(0)
lhcbName.SetTextAlign(12)
lhcbName.SetBorderSize(0)
lhcbName.Draw()

c3.SaveAs("tuples_out/all_tx_ty_lowmu_Q0.pdf")

```

Warning in <TCanvas::Constructor>: Deleting canvas with same name: c1
Info in <TCanvas::Print>: pdf file tuples_out/all_tx_ty_lowmu_Q0.pdf has been created



```
[58]: ROOT.gStyle.SetOptStat(1)
      c3 = ROOT.TCanvas("c1", "c1", 1200, 1200)

      # Q1
      nodetuples_Q3[2].Draw("ty:tx >> hist2(100,-0.4,0.4,100,-0.4,0.4)",
      ↪ "globalModuleIndex>0")
      hist2=ROOT.gDirectory.Get("hist2")

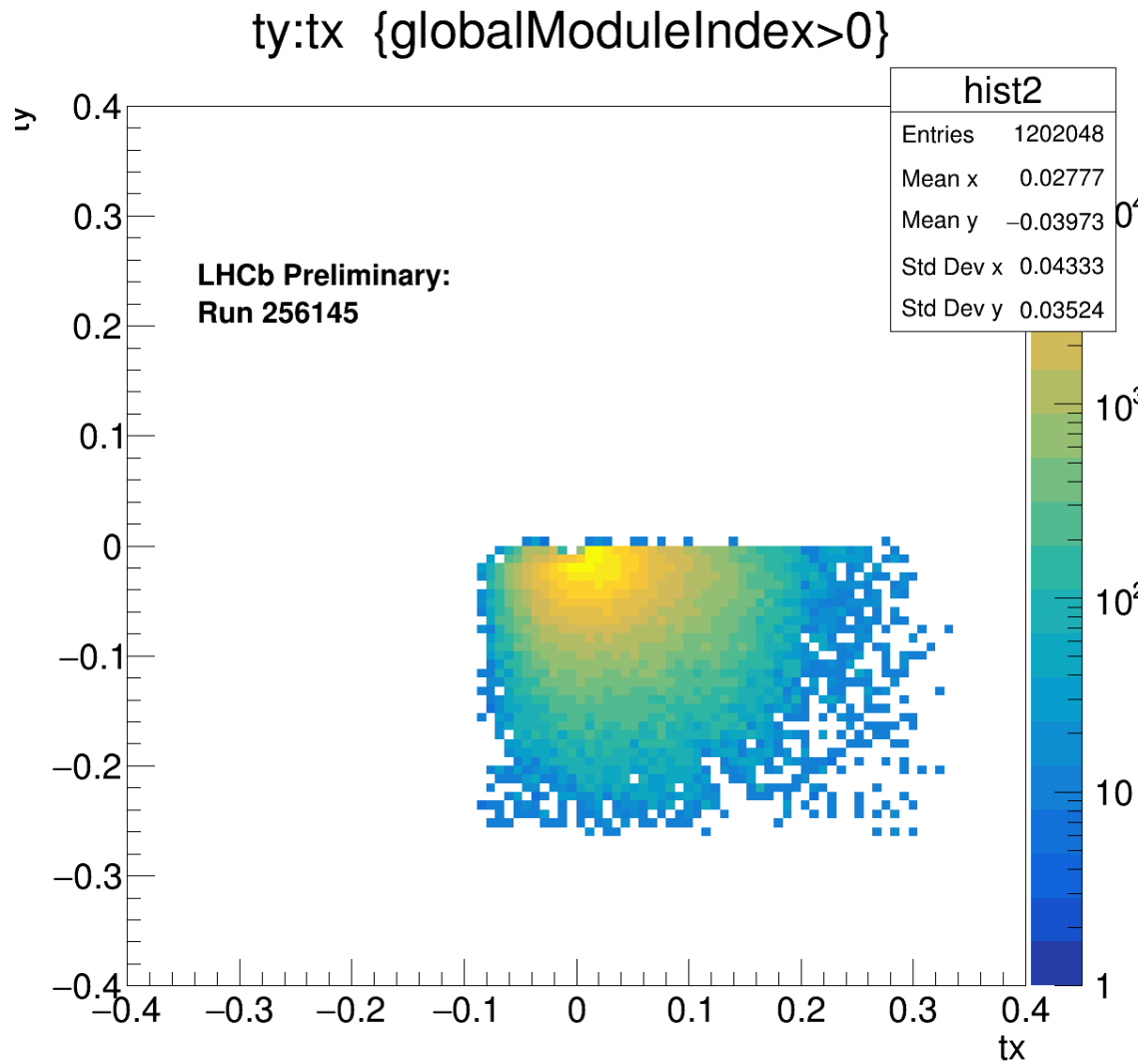
      ROOT.gPad.SetLogz()
      hist2.Draw("colz")
      c3.Draw()

      hist2.GetXaxis().SetTitle("tx")
      hist2.GetYaxis().SetTitle("ty")

      lhcbName = ROOT.TPaveText(0.15, 0.68, 0.40, 0.78, "BRNDC" )
      lhcbName.AddText('#splitline{LHCb Preliminary:}{#scale[1.0]{Run 256145}}')
      lhcbName.SetFillColor(0)
      lhcbName.SetTextAlign(12)
      lhcbName.SetBorderSize(0)
      lhcbName.Draw()

      c3.SaveAs("tuples_out/all_tx_ty_lowmu_Q1.pdf")
```

```
Warning in <TCanvas::Constructor>: Deleting canvas with same name: c1
Info in <TCanvas::Print>: pdf file tuples_out/all_tx_ty_lowmu_Q1.pdf has been
created
```



```
[59]: # Q3
nodetuples_Q1[2].Draw("ty:tx >> hist3(100,-0.4,0.4,100,-0.4,0.4)",
    →"globalModuleIndex>0")
hist3=ROOT.gDirectory.Get("hist3")

ROOT.gPad.SetLogz()
hist3.Draw("colz")
c3.Draw()

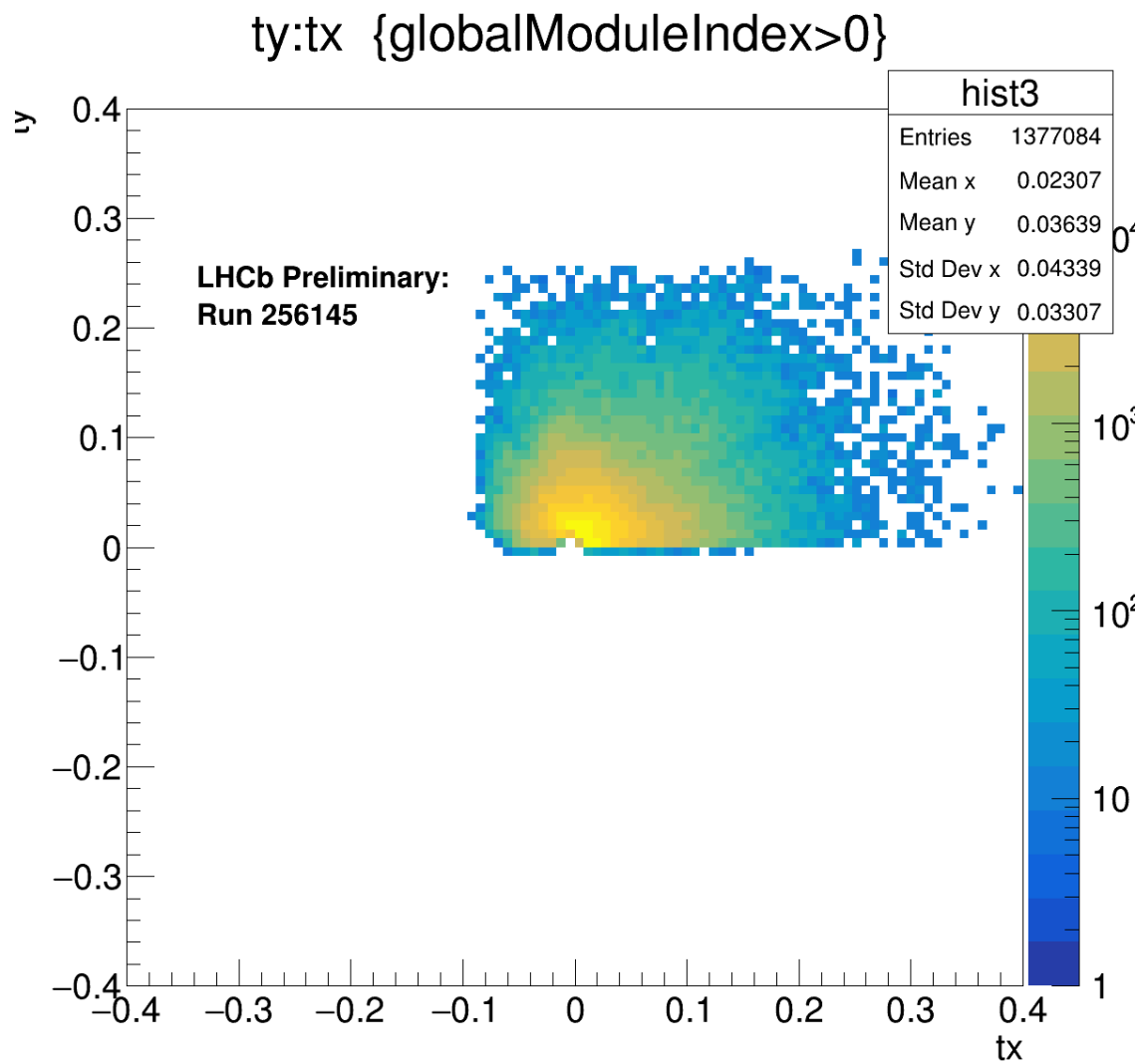
hist3.GetXaxis().SetTitle("tx")
hist3.GetYaxis().SetTitle("ty")

lhcbName = ROOT.TPaveText(0.15, 0.68, 0.40, 0.78,"BRNDC" )
```

```
lhcbName.AddText('#splitline{LHCb Preliminary:}{#scale[1.0]{Run 256145}}')
lhcbName.SetFillColor(0)
lhcbName.SetTextAlign(12)
lhcbName.SetBorderSize(0)
lhcbName.Draw()

c3.SaveAs("tuples_out/all_tx_ty_lowmu_Q0.pdf")
```

Info in <TCanvas::Print>: pdf file tuples_out/all_tx_ty_lowmu_Q0.pdf has been created



[]: