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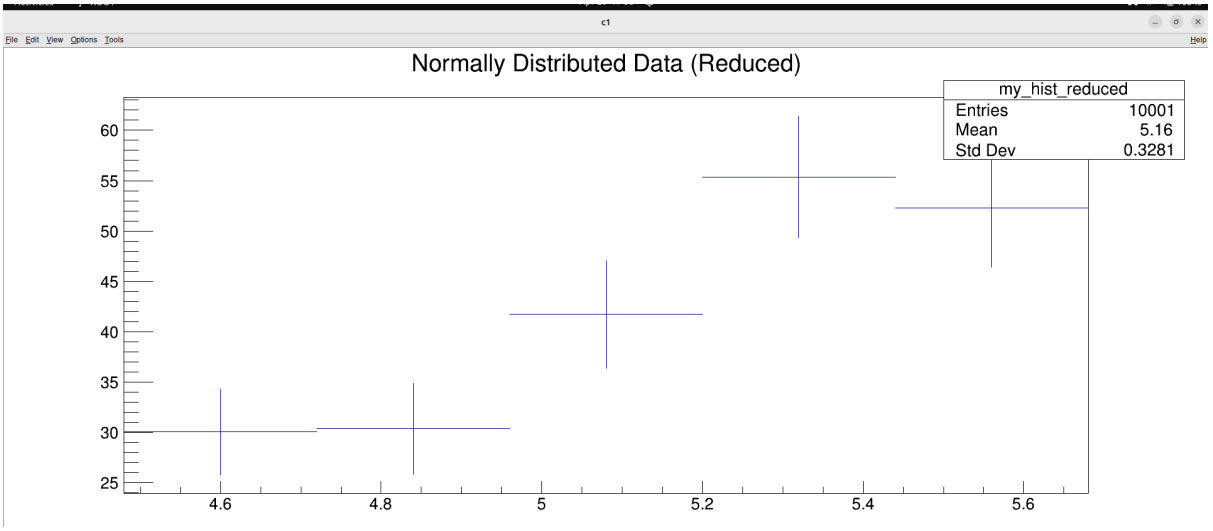
Task - Exercise2
Project: Histogram Pythonization
Improve Python Interface for Histograms

1) Create a new histogram in a reduced range, given the histogram h, and implement the code creating a reduced (zoomed) histogram. The corresponding UHI function is h[ifirst:ilast], where ifirst and ilast are arbitrary values provided by the user.

Corresponding code file to be found here : `root\tutorials\tasks\Exercise2\test3.py`
Approach:
I am using the hist generated in `Exercise 1` by the '.Clone' method and reducing(zooming) it to the range(ifirst,ilast).
Output: ifirst= 3 ilast= 7 ; Total bins =7-3+1(since inclusive)=5;



reduce_his() function:

```python
from ROOT import *
import numpy as np

def reduce_his(h, ifirst, ilast):


  # Check for valid range
  print(h.GetNbinsX()) #Range should have less bins than total bins.


  # Create the new histogram with the reduced range
  h_reduced = h.Clone(h.GetName() + "_reduced")
  h_reduced.SetBinContent(h_reduced.GetNbinsX(), h.GetBinContent(ifirst, ilast))
  h_reduced.SetBinError(h_reduced.GetNbinsX(), h.GetBinError(ifirst, ilast))

  # Set axis ranges and labels for the reduced histogram
  h_reduced.GetXaxis().SetRange(ifirst, ilast)
  h_reduced.GetXaxis().SetTitle(h.GetXaxis().GetTitle())
  h_reduced.SetTitle(h.GetTitle() + " (Reduced)")

  return h_reduced
```

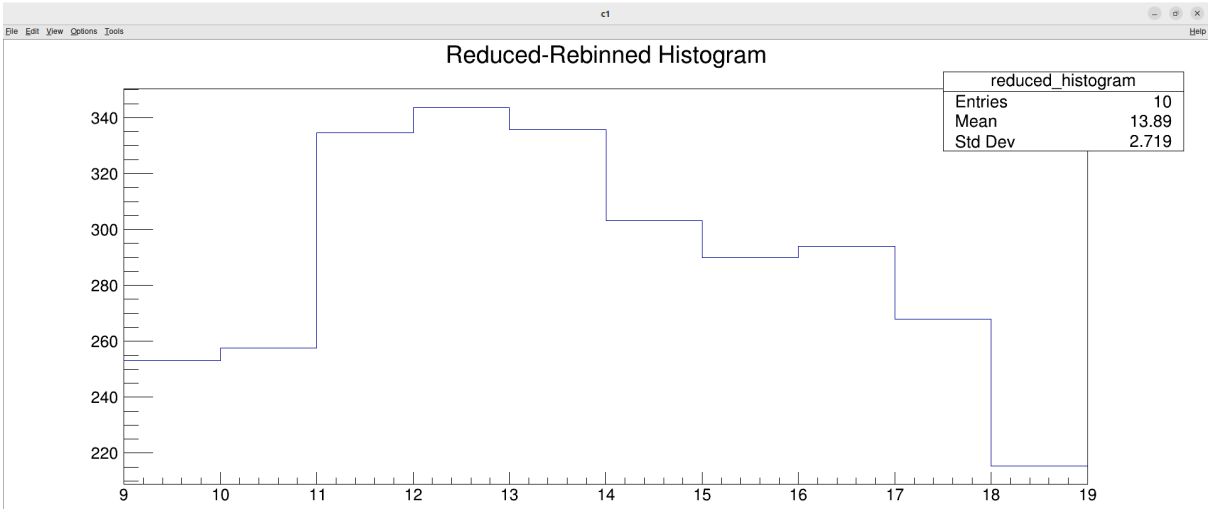
```python
def reduce_his(h, ifirst, ilast):
  return h_reduced


num_data = 10000
data = np.random.normal(loc=10, scale=3, size=num_data)
weights = np.random.rand(num_data)

# Create ROOT histogram (using efficient TH1D constructor)
hist = TH1F("my_hist", "Normally Distributed Data", 50, 4, 16)  # 50 bins from 4 to 16
for i in range(num_data):
    hist.Fill(data[i], weights[i])
h_reduced =reduce_his(hist,3,7)
c1=TCanvas()
h_reduced.Draw()
input()
```

2) Same operation as before, but adding a rebin of 2, i.e. merge the bins by 2 to reduce the total number of bins by 2: h[ifirst:ilast:rebin(2)]

Corresponding code file to be found here : `root\tutorials\tasks\Exercise2\test4.py`



The output histogram is reduced(zoomed) in the range of 11 to 30 inclusive.
Bins are refactored by 2. I am logging the no. of bins in the new hist after Rebin.
Initially there were 50 bins but after rebinning, it became 25 which was expected.

```
shardul@shardul:~/Downloads$ python3 test4.py
25
```

reduce_rebin_Hist() : Code

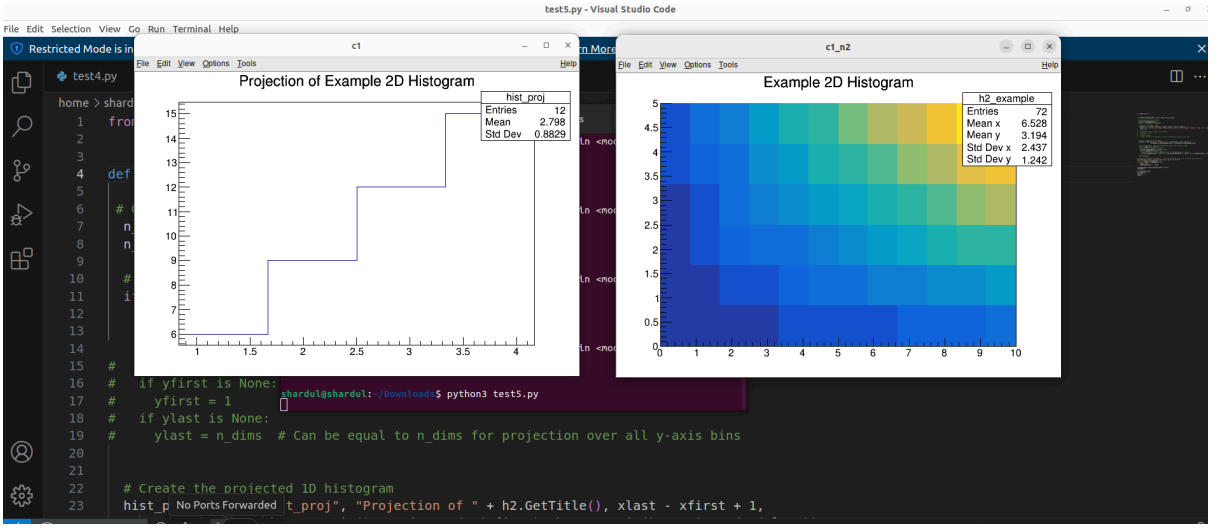
```
5
6   def reduce_rebin_Hist(h, ifirst, ilast, rebin_factor):
7       # Clone the original histogram
8       h_clone = h.Clone("h_clone")
9
10      # Rebin the cloned histogram
11      h_clone.Rebin(rebin_factor)
12      reduced_histogram = TH1F("reduced_histogram", "Reduced-Rebinned Histogram", ilast - ifirst + 1, ifirst, ilast + 1)
13      print(h_clone.GetNbinsX())
14      # Filling the new histogram with the summed bin contents from the original histogram
15      for i in range(ifirst, ilast + 1):
16          reduced_histogram.SetBinContent(i - ifirst + 1, h_clone.GetBinContent(i))
17      return reduced_histogram
18
19  num_data = 10000
20  data = np.random.normal(loc=10, scale=3, size=num_data)
21  weights = np.random.rand(num_data)
22
23  # Create ROOT histogram (using efficient TH1D constructor)
24  hist = TH1F("my_hist", "Normally Distributed Data", 50, 4, 16)  # 50 bins from 4 to 16
25  for i in range(num_data):
```

```python
# Create ROOT histogram (using efficient TH1D constructor)
hist = TH1F("my_hist", "Normally Distributed Data", 50, 4, 16)  # 50 bins from 4 to 16
for i in range(num_data):
    hist.Fill(data[i], weights[i])
h_reduced =reduce_rebin_Hist(hist,9,18,2)
c1=TCanvas()
h_reduced.Draw()
input()
```

3) Given a multidimensional histogram, h2 implement a function performing a projection in one-dimensional histogram, doing the following: a projection in the first axis (x) between xfirst and xlast by summing the bins in the y axis between yfirst and ylast: `h[xfirst:xlast, yfirst:ylast:sum]`

Corresponding code file to be found here : `root\tutorials\tasks\Exercise2\test5.py`

Output: 2D Hist created and displayed along with its 1D projection.



Project_histogram_1d() ; Code