

# ROOT: Histograms

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# Outline

- Creating, filling and plotting 1D, 2D and profile histograms
- Constant or variable bin width, Rebinning
- Normalizing histograms
- Adding, multiplying and dividing histograms
- Different plotting and display options
- Fitting histograms

# Making histograms

- Histograms can be 1-d, 2-d and 3-d
- Declare a histogram to be filled with floating point numbers:

```
TH1F *histName = new TH1F("histName", "histTitle", num_bins, x_low, x_high)
```

```
TH1F *my_hist = new TH1F("my_hist", "My First Histogram", 100, 2, 200)
```

```
TH2F *myhist = new TH2F("myhist", "My Hist", 100, 2, 200, 200, 0, 500)
```

Note: Bin 0 underflow (i.e. entries  $< x_{low}$ )

Bin (num\_bins+1) overflow (i.e. entries  $> x_{high}$ )

# Histogram Cosmetics

*Add axis labels*

*Add a legend*

*Add a textbox*

# Plotting histograms

To draw:

```
my_hist->Draw();
```

- To fill a histogram: `my_hist->Fill(50);`

```
my_hist->Fill(100, 3); // the number 100 has weight=3
```

- Update the histogram:

```
my_hist->Draw();
```

Histogram attributes:

- Change line color:

```
my_hist->SetLineColor(2); //red
```

```
(or my_hist->SetLineColor(kRed);)
```

```
my_hist->Draw();
```

1	Black
2	Red
3	Light green
4	Blue
5	Yellow
6	Magenta
7	Cyan
8	Green

# More histogram attributes

- Drawing Options: Colors, Marker styles, Line styles, Fill Styles

- Display statistics:

Set up with:

- `gStyle->SetOptStat(mode)`
- (k siourmen)
- Default is (000001111):
- To show overflows and underflows:
  - `gStyle->SetOptStat(111111);`
- To remove entirely:
  - `gStyle->SetOptStat(0);`

k=1	kurtosis
K=2	Kurtosis+error
s=1	Skewness
S=2	Skewness+error
i=1	Integral
o=1	Overflow
u=1	Underflow
r=1	RMS
R=2	RMS+error
m=1	Mean
M=2	Mean+error
e=1	Entries
n=1	Name

# Superimpose histograms

Draw a second histogram on top of the first:

- First book the histogram
- Use another color to differentiate - Fill the histogram
- Draw the histogram
- `my_hist_2->Draw("same")`

Errors:

- `my_hist_2->Draw("esame")`
- Default: `errors = sqrt(entries)`
- To get error as `sqrt(sumofweights)`, enter
- `my_hist_2->Sumw2()` before filling the histogram

# Save histograms

Save Histograms:

```
c1->SaveAs("myhisto.eps");
```

```
c1->SaveAs("myhisto.ps");
```

```
c1->SaveAs("myhisto.gif");
```

Also can save source code for histogram:

```
c1->SaveAs("myhisto.C");
```

# Reference

- <https://root.cern.ch/root/html534/guides/users-guide/ROOTUsersGuideChapters/Histograms.pdf>