

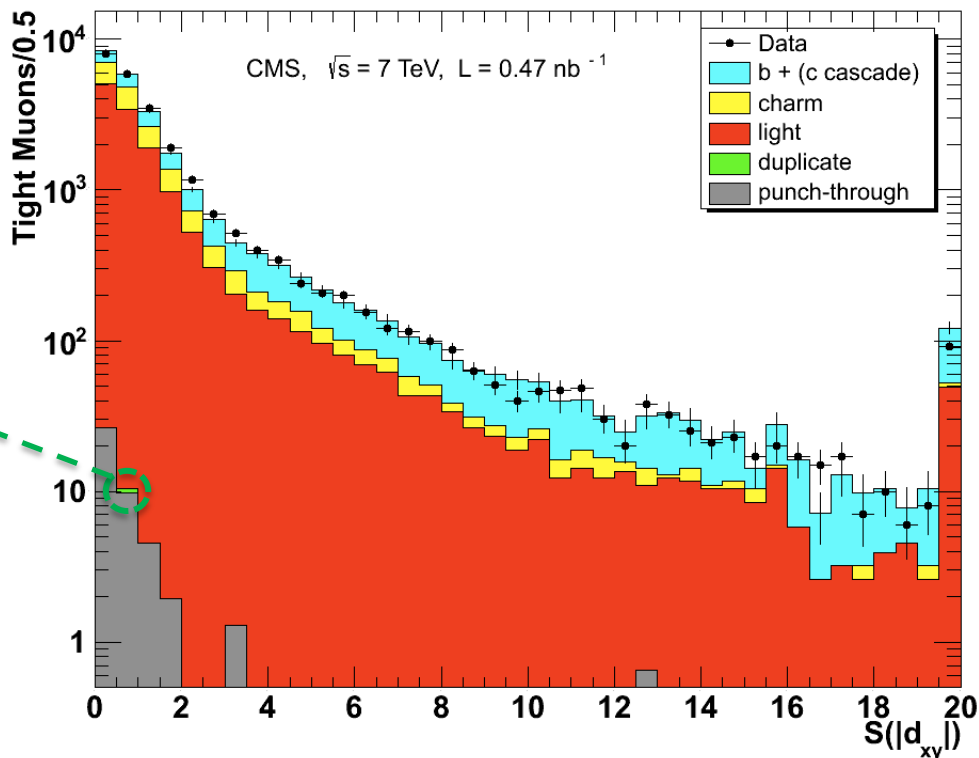
## Exercise for home (was given as exam test in february 2013) with quick solutions

Starting from the files already provided in the lab lesson, namely:

*Histos\_Mc\_MinBias\_1aprnew\_goodZB\_last.root* (file of simulated data)

*Histos\_Data\_ZeroBias\_1aprnew\_goodZB\_last.root* (file of real data)

Try to obtain the following plot of **data-MC comparison for the variable *signif2d*** and for TIGHT muons [that is the significance of the transverse impact parameter for the (*tight*) muons of *minimum bias*]:



Note: only 1 case of duplicate in the tight muons sample

## Tips to perform the exercise:

the needed changes to the code are really marginal:

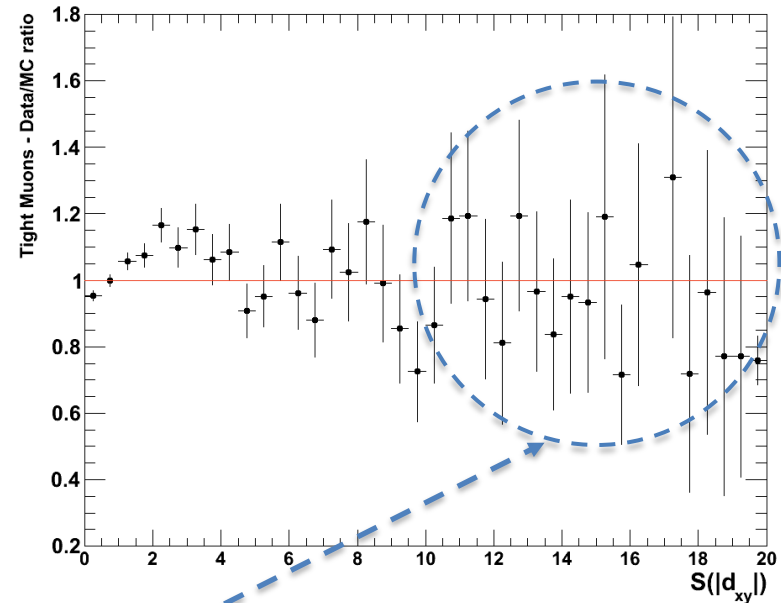
- muonType: "SOFT" → "TIGHT"
- variable: "qtimespt" → "signif2d" (note that these two variables are both *double*)

... and other micro-changes

Make a sub-directory **Homework**, copy in it the **main1.C** macro, apply the changes properly and rerun!

## Further exercise:

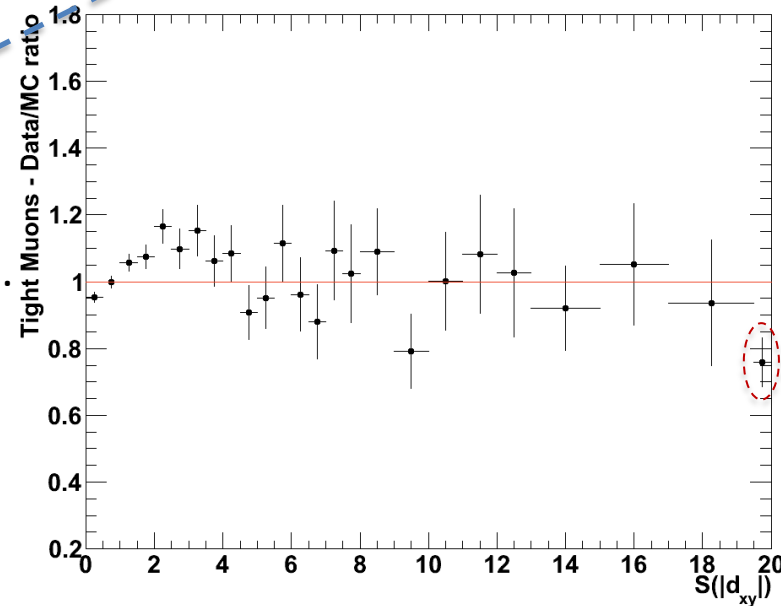
Moreover, obtain the following plot of the data/MC ratio for the same observable:



Finally, produce the following plot of the ratio by partially redefining the binning in a more significant way (namely avoiding to be prone to **fluctuations**) [suggestion: use the method **Rebin** of TH1D]:

Note that binning is chosen ad hoc along the spectrum.

Note that the last bin has the overflows included so better to preserve it as it is, without involving it in a rebinning approach.



## Tips to perform the exercise / step-I :

the easiest piece of code to get the **ratio** is the following:

```
TH1D *hMc = (TH1D*) h4->Clone("hMc");
TH1D *hRatio = (TH1D*) hData->Clone("hRatio");
// hRatio->Sumw2(); // not required:
// error propagation is taken into account correctly by the Divide() function
// you can check explicitly that the error is correct (if you want as exercise)
hRatio->Divide (hData,hMc,1.,1.)
//
hRatio->SetMaximum(1.8);
hRatio->SetMinimum(0.2);
// -- esthetics
hRatio->GetYaxis()->SetTitle("Tight Muons - Data/MC ratio");
hRatio->GetYaxis()->SetTitleSize(0.03);
hRatio->GetYaxis()->SetTitleOffset(1.4);
hRatio->GetYaxis()->SetLabelSize(0.035);
hRatio->GetXaxis()->SetLabelSize(.03);
//
hRatio->Draw("EP");
//
TLine *line = new TLine(0., 1., 20., 1.);
line->SetLineColor(2);
line->Draw("same");
```

## Tips to perform the exercise / step-II :

the easiest piece of code to get the **rebinned ratio** is the following:

```
//TH1D *hMc = (TH1D*) h4->Clone("hMc"); // already in previous step-I
//TH1D *hRatio = (TH1D*) hData->Clone("hRatio"); // already in previous step-I
//
Double_t xbins[26] =
{0.,0.5,1.0,1.5,2.0,2.5,3.0,3.5,4.0,4.5,5.0,5.5,6.0,6.5,7.0,7.5,8.0,9.0,10.0,11.0,12.0,13.0,15.
0,17.0,19.5,20.}; // the bins are 25 so we have 26 "border numbers" to define them !
//
// -- first rebin and then do the ratio
TH1D * hDataRebin = (TH1D*) hData->Rebin(25,"hDataRebin",xbins);
TH1D * hMcRebin = (TH1D*) hMc->Rebin(25," hMcRebin",xbins);
TH1D *hRatioRebin = (TH1D*) hDataRebin->Clone("hRatioRebin");
hRatioRebin->Divide(hDataRebin,hMcRebin,1.,1.);
//
// -- prepare the rebinned ratio plot
hRatioRebin->SetMaximum(1.8);
hRatioRebin->SetMinimum(0.2);
hRatioRebin->GetYaxis()->SetTitle("Tight Muons - Data/MC ratio");
//
hRatioRebin->Draw("EP");
line->Draw("same"); // note: same TLine object defined in the previous slide
```