

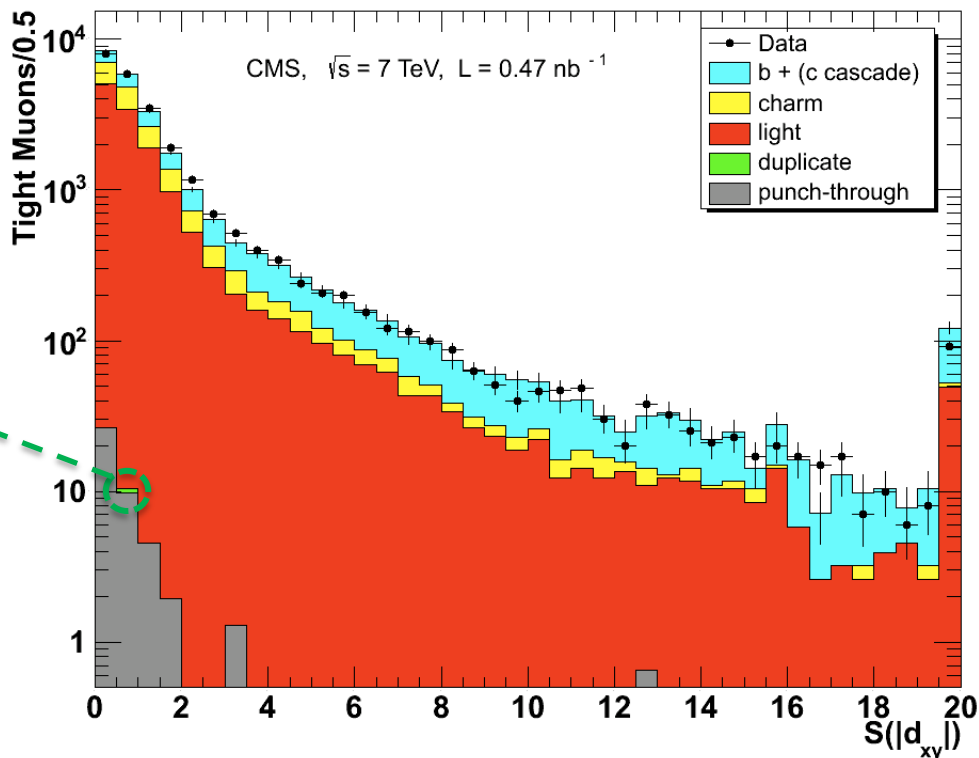
Exercise for home (was given as exam test in february 2013) with quick solutions

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

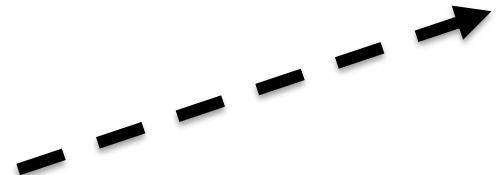
Tips to perform the exercise:

the needed changes to the code are really marginal:

```
if (muonType == "TIGHT" && par2 == "doub" && par == "signif2d")  
{  
    ...  
}
```

and the macro itself must be run passing different options now:

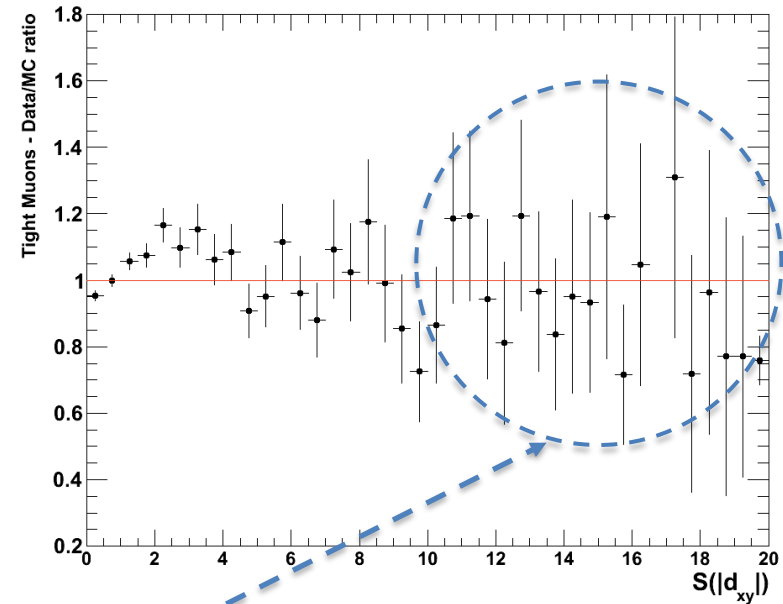
```
root [0] .x main1.C ("png", "TIGHT", "signif2d", "doub", "1gpv", "Log", "Step3")
```



Suggestion : do the exercise on a clean sheet: use a **/Step3** working sub-directory, where you can copy the previous **main2a.C** and modify accordingly.

Further exercise:

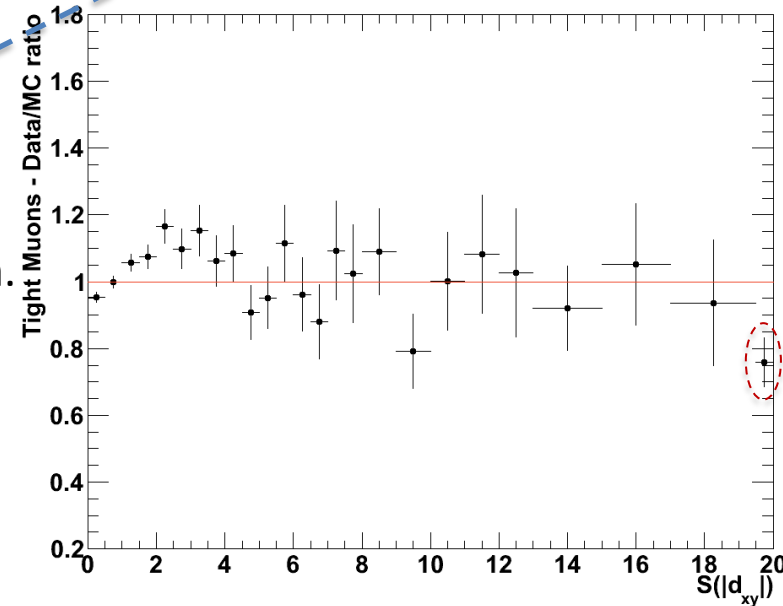
Moreover, obtain the following plot of the data/MC ratio for the same observable:



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 :

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 :

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

```
TH1D *hMc = (TH1D*) h4->Clone("hMc");
TH1D *hRatio = (TH1D*) hData->Clone("hRatio");
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
hData->Rebin(25,"hDataRebin",xbins);
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->Draw("EP");
line->Draw("same"); // note: same Tline object defined in the previous slide
```