Quarkonia polarization method using unbinned fitting and background subtraction method

Estágio de Verão Lip

Beatriz Lopes

Supervisor: João Seixas

Quarkonium

- Meson made of a heavy quark and its antiquark bounded by a strong interaction (e.g. J/ψ).

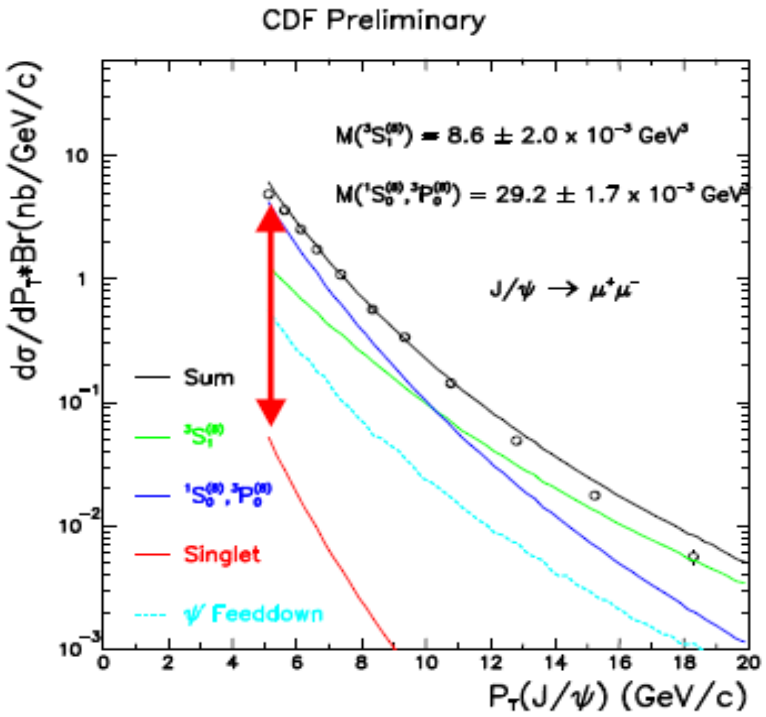
- Quarks can’t live alone, there must be at least two of them together. We can’t see their colours, they must combine to “white”.

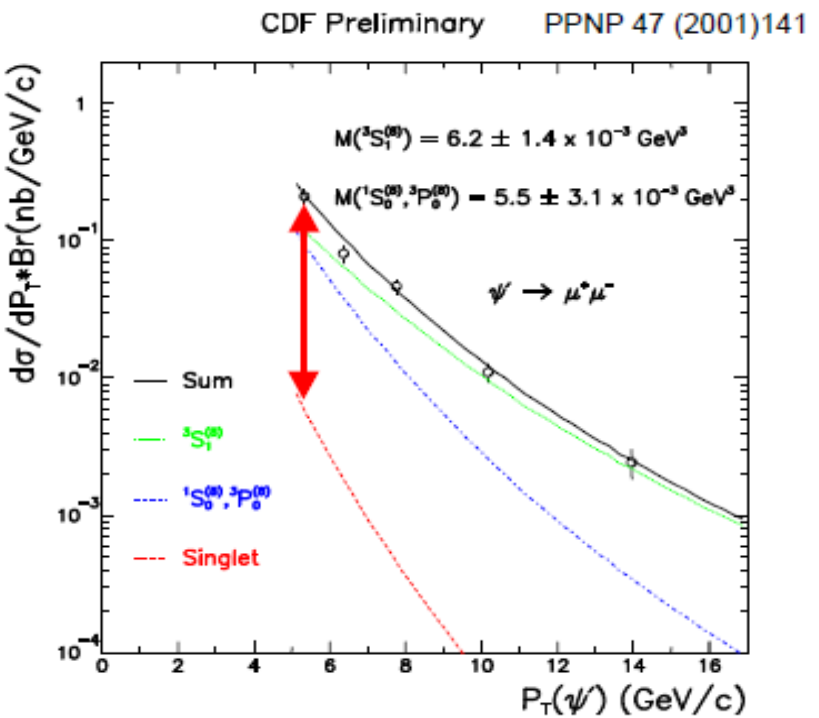
- By studying it we can improve our knowledge about the strong force.

QCD and NRQCD

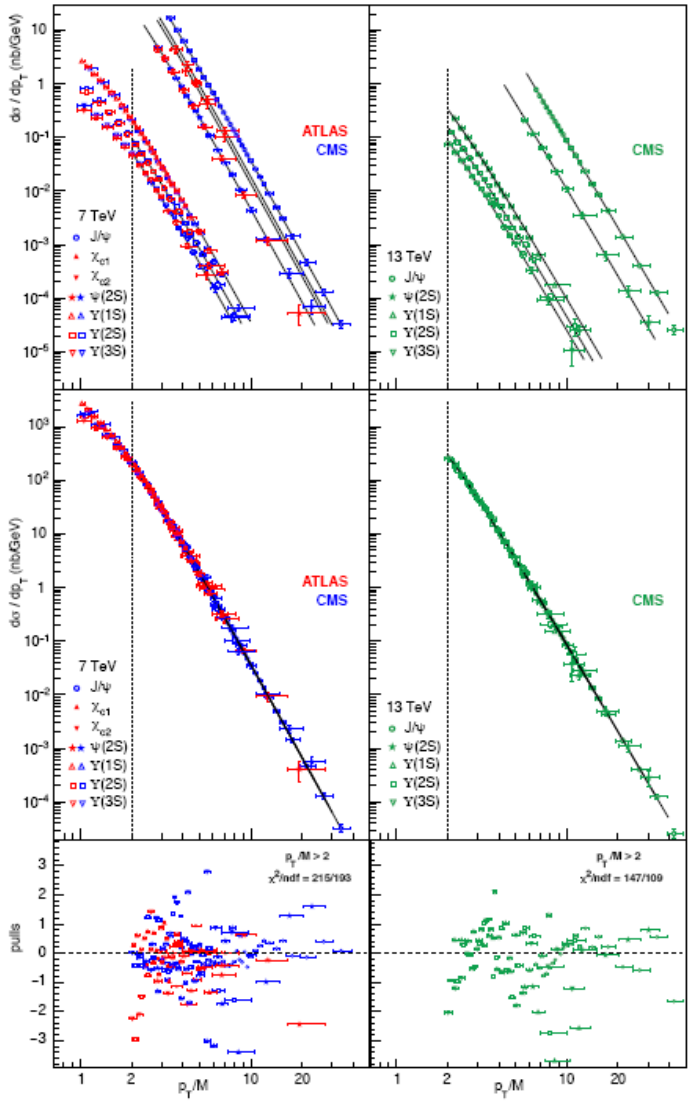
- The theory wasn't in accordance with the measurements that were seen to be around 50 times larger than the expectations .
- The QCD model wasn't working.

$$\sigma = S_1^{[0]} + \sum_{j=1}^{\infty} cj\, S_j^{[8]}$$



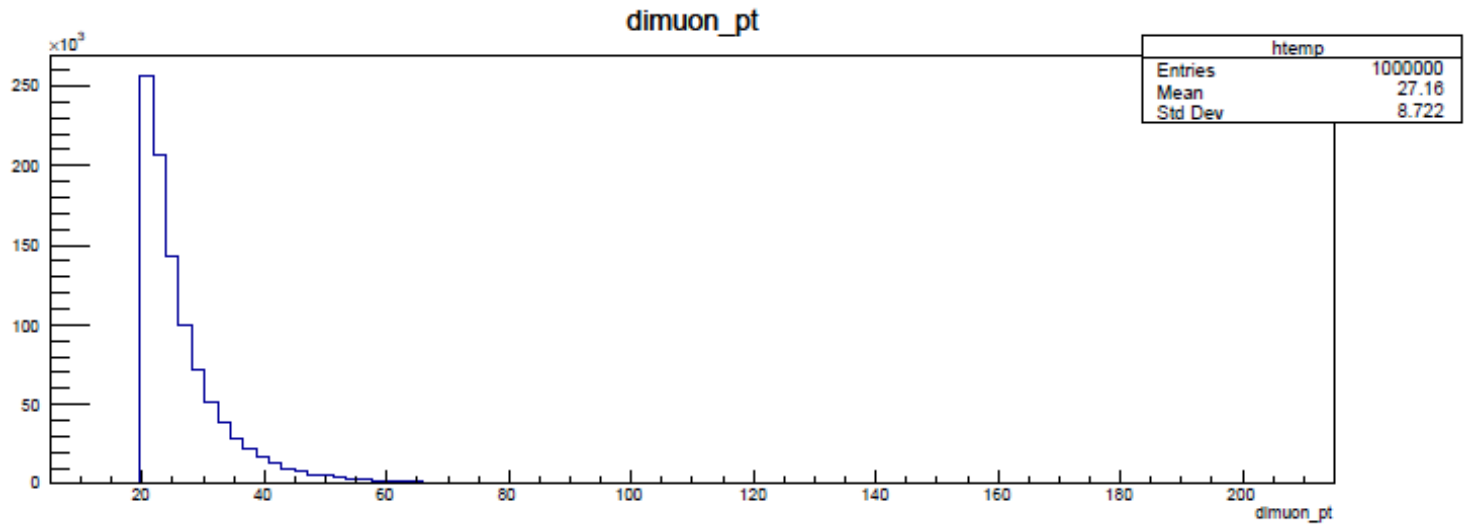


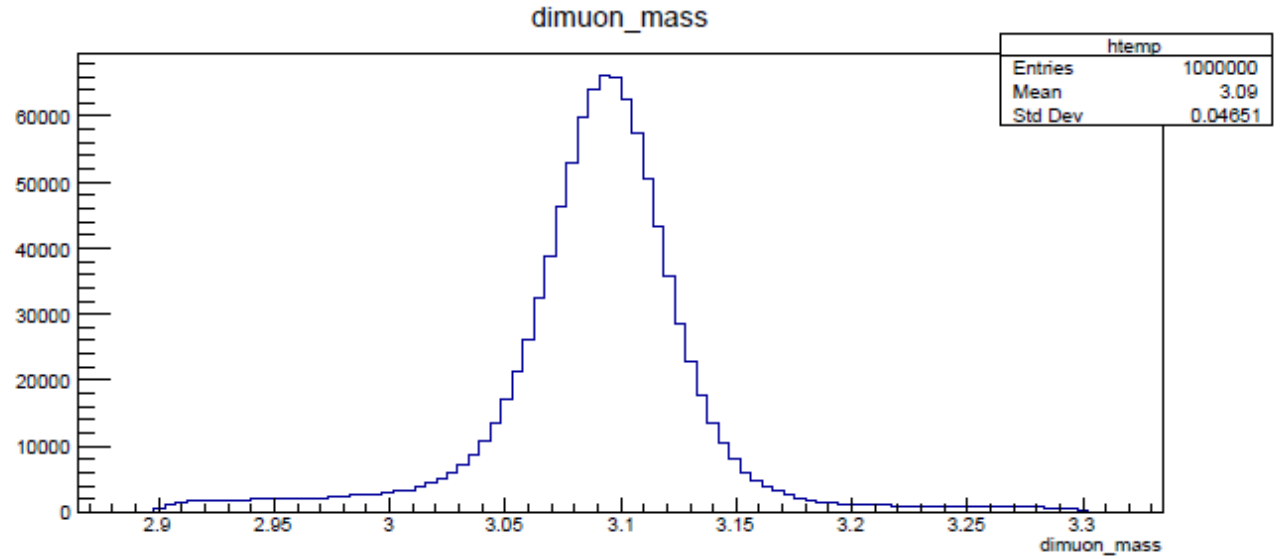
- It has been discovered recently that when we plot the cross section in function of pt/M, all types of particles obey to one law.



The plots of pt and mass of the dimuon

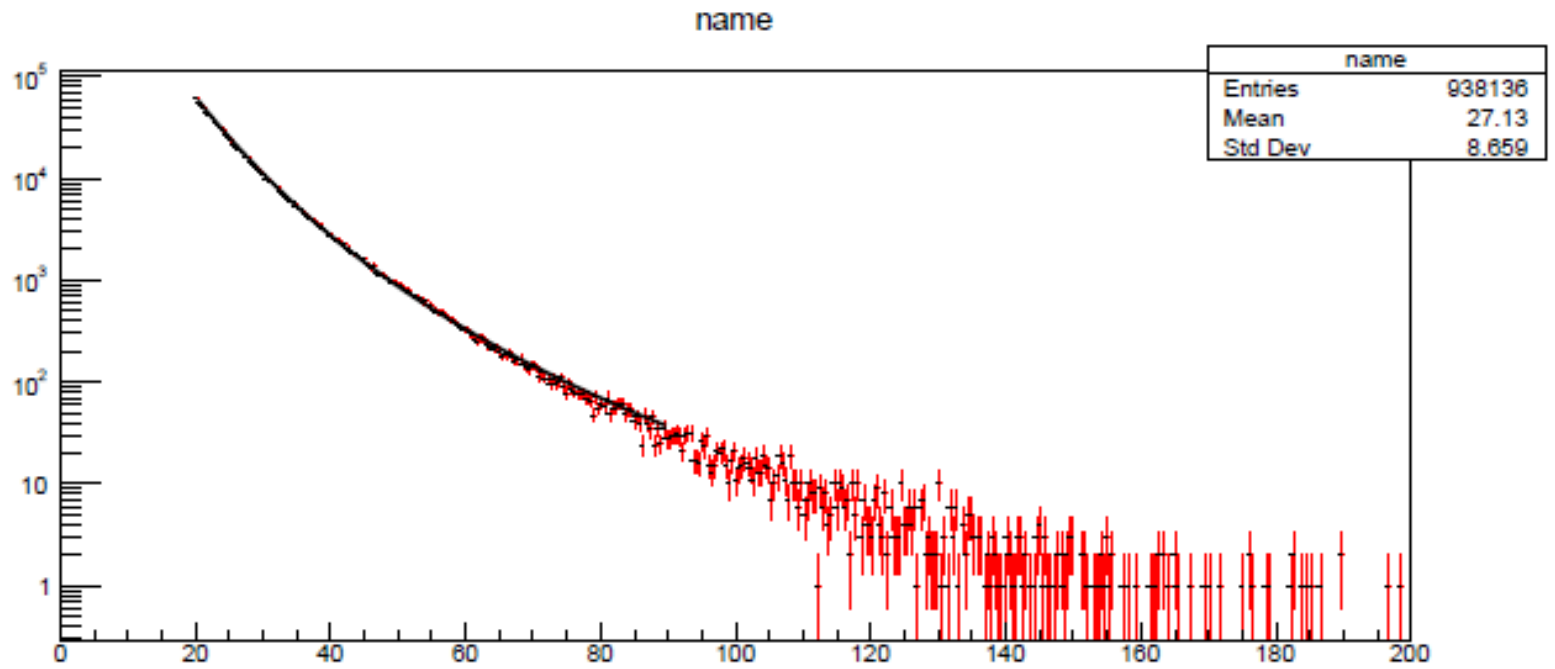
```
#include <TFile.h>
#include <TTree.h>
#include <TH1.h>
#include <TCanvas.h>
#include <TF1.h>

void plot1()
{
  TFile *f = TFile::Open("rootuple-Run2016-2017-Jpsi.root'
  TTree *tree = (TTree*)f->Get("dimuontree");
  gDirectory->ls();

  TCanvas *c1 = new TCanvas();
  c1->Divide(1,2);

  c1->cd(1);
  tree->Draw("dimuon_pt");
  c1->SaveAs("plotpt.pdf");

  tree->Draw("dimuon_mass");

  c1->cd(2);

  TH1F *hptj = new TH1F("name", "name", 500, 0, 200);
  tree->Draw("dimuon_pt>>name","dimuon_mass>3.0&&dimuon_mass<3.2"
  hptj->SetLineColor(kRed);
  hptj->Draw("same");
```





Fit the plot of dimuon's pt

```
TF1 *fit = new TF1 ("fit", "[2]*x*pow(1+1/([0]-2)*x*x/[1],-[0])", 10, 100);
fit->SetParameter(0,3.5);
fit->SetParameter(1,5);
fit->SetParameter(2,1e3);
//fit->SetParameter(3,2);
fit->SetLineColor(kBlack);
fit->SetParNames("beta", "gama","N");
//fit->Draw("lsame");

hptj->Fit("fit","","",20,90);
c1->SetLogy();
hptj->Draw("E");
//fit->Draw("lsame");
}
```



Conclusion

- These new techniques improve our knowledge about quark bound states.

- Quarkonium helps us to understand more about strong interactions.