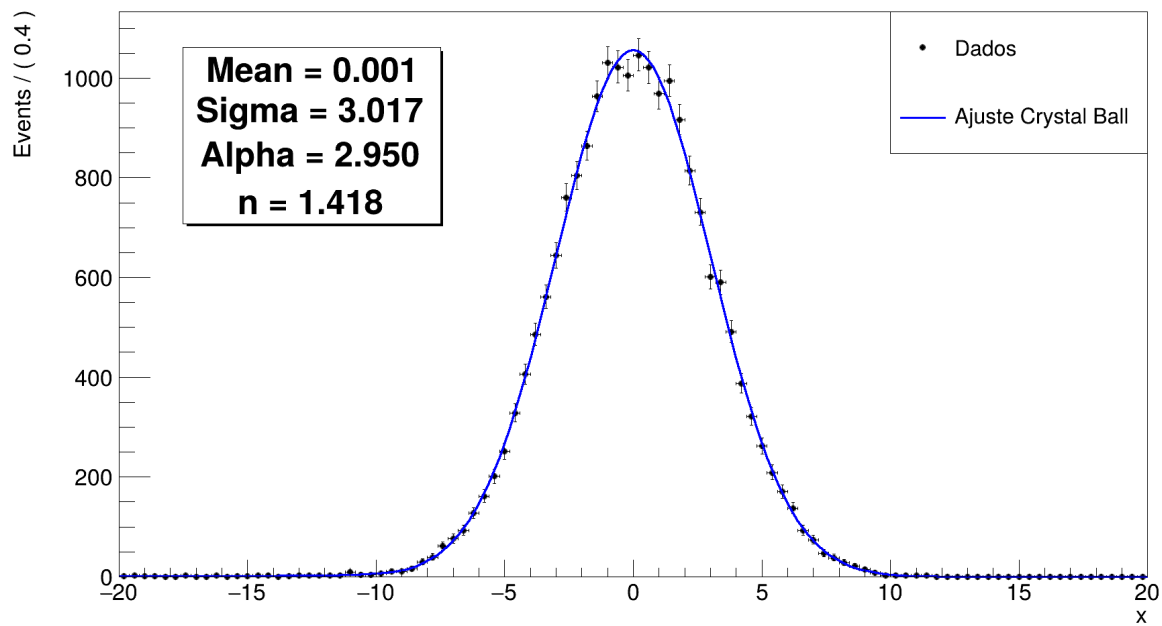# Lista 4

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EXERCICIO 1

```cpp
     #include "RooRealVar.h"
#include "RooCBShape.h"
#include "RooDataSet.h"
#include "RooFitResult.h"
#include "RooPlot.h"
#include "RooAddPdf.h"
#include "TCanvas.h"
#include "TRandom3.h"
#include "TLegend.h"
#include "TPaveText.h"

void crystal_ball(){
    RooRealVar x("x","x",-20,20);
    RooRealVar mean("mean","Mean", 0, -20,20);
    RooRealVar sigma("sigma","sigma",3,0.2,20);
    RooRealVar alpha("alpha", "alpha",3,0.2,20);
    RooRealVar n("n","n",2,0.1,20);
    RooCBShape crystalball("crystalball", "C-B PDF", x, mean, sigma, alpha, n);

    //

    RooDataSet* data = crystalball.generate(x,20000);
    RooFitResult* fit_res = crystalball.fitTo(*data,RooFit::Save());
    RooPlot* x_frame = x.frame(RooFit::Title("Ajuste por Crystal Ball"));
    data->plotOn(x_frame);
    crystalball.plotOn(x_frame);
    gStyle->SetOptStat(1111111);

    //
    TCanvas* c1 = new TCanvas("c1", "Ajuste por Crystal Ball", 1920, 1080);
    x_frame->Draw();

    //
    TLegend* legend = new TLegend(0.7, 0.7, 0.9, 0.9);
    legend->AddEntry(x_frame->getObject(0), "Dados", "P");
    legend->AddEntry(x_frame->getObject(1), "Ajuste Crystal Ball", "L");
    legend->Draw();
    //
    TPaveText* pave = new TPaveText(0.15, 0.6, 0.35, 0.85, "NDC");
    pave->SetFillColor(0);
    pave->AddText(Form("Mean = %.3f", mean.getVal()));
    pave->AddText(Form("Sigma = %.3f", sigma.getVal()));
    pave->AddText(Form("Alpha = %.3f", alpha.getVal()));
    pave->AddText(Form("n = %.3f", n.getVal()));
    pave->Draw();

    c1->SaveAs("c-b_fit.png");
}
```

Ajuste por Crystal Ball

EXERCICIO 2

```cpp
    #include "RooRealVar.h"
#include "RooCBShape.h"
#include "RooDataSet.h"
#include "RooFitResult.h"
#include "RooPlot.h"
#include "RooAddPdf.h"
#include "TCanvas.h"
#include "TRandom3.h"
#include "TLegend.h"
#include "TPaveText.h"

void exp_fit() {
    RooRealVar x("x","x",5,10);
    RooRealVar lambda("lambda","lambda",1,0.1,2);
    RooRealVar mean("mean","mean",0,5,10);
    RooRealVar sigma("sigma","sigma",1,0.1,5);
    RooRealVar alpha("alpha","alpha",1.5,0.1,10);
    RooExponential exp("exp","Exponential PDF", x, lambda);
    //
    RooDataSet* data = exp.generate(x,1500);
    RooFitResult* fit_res = exp.fitTo(*data,RooFit::Save());
    RooPlot* x_frame = x.frame(RooFit::Title(""));
    data->plotOn(x_frame);
    exp.plotOn(x_frame);
        gStyle->SetOptStat(1111111);

    //
    TCanvas* c1 = new TCanvas("c1", "Ajuste Exponencial", 1920, 1080);
    x_frame->Draw();
    //
    TPaveText* pave = new TPaveText(0.15, 0.6, 0.35, 0.85, "NDC");
    pave->SetFillColor(0);
    pave->AddText(Form("Mean = %.3f", mean.getVal()));
```
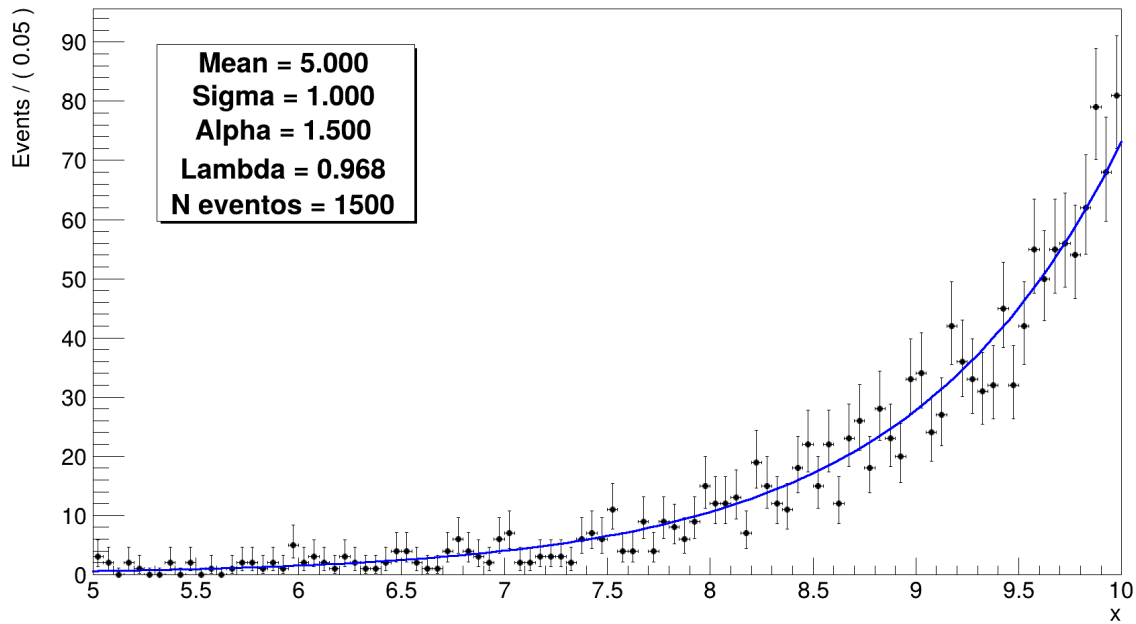
```
34      pave->AddText(Form("Sigma = %.3f", sigma.getVal()));
35      pave->AddText(Form("Alpha = %.3f", alpha.getVal()));
36      pave->AddText(Form("Lambda = %.3f", lambda.getVal()));
37      pave->AddText(Form("N eventos = %d", (int)data->numEntries()));
38      pave->Draw();
39
40      c1->SaveAs("exp_fit.png");
41  }
```

A RooPlot of "x"

EXERCICIO 3

```
1       #include "RooRealVar.h"
2   #include "RooCBShape.h"
3   #include "RooDataSet.h"
4   #include "RooFitResult.h"
5   #include "RooPlot.h"
6   #include "RooAddPdf.h"
7   #include "TCanvas.h"
8   #include "TRandom3.h"
9   #include "TLegend.h"
10  #include "TPaveText.h"
11  #include <iostream>
12
13  void fit_data(){
14      TFile *file = TFile::Open("DataSet_lowstat.root");
15      RooDataSet *data = (RooDataSet*)file->Get("data");
16      RooRealVar mass("mass","mass",2,6);
17      RooRealVar mean("mean","mean",3.09,2.80,3.20);
18      RooRealVar sigma("sigma","sigma",0.3,0.001,1.);
19      RooRealVar alpha("alpha","alpha",1.5,-5.,5.);
20      RooRealVar n("n","n",1.5,0.5,5.);
21      RooCBShape CB("CB","C-B",mass,mean,sigma,alpha,n);
22      //
23      RooRealVar a0("a0","a0",-0.7,-2.,2.);
```

```cpp
24      RooRealVar a1("a1","a1",-0.5,-2.,2.);
25      RooRealVar a2("a2","a2",-0.3,-2.,2.);
26      RooPolynomial bg("background","bg PDF", mass, RooArgList(a0,a1,a2));
27      RooRealVar frac("frac","frac", 0.5, 0,1.0);
28      RooAddPdf model("model","Modelo Signal/Noise", RooArgList(CB,bg), RooArgList(frac
            ));
29      //
30      RooFitResult *fit_res = model.fitTo(*data,RooFit::Save());
31      RooPlot *frame = mass.frame();
32      data->plotOn(frame);
33      model.plotOn(frame);
34      model.paramOn(frame);
35      //
36      double chi_sq = frame->chiSquare();
37      int ndf = data->numEntries() - fit_res->floatParsFinal().getSize();
38      std::cout << "chi_square/ndf" << chi_sq << "/" << ndf << std::endl;
39      //
40      TPaveText* pave = new TPaveText(0.15, 0.6, 0.35, 0.85, "NDC");
41      pave->SetFillColor(0);
42      pave->AddText(Form("Mean = %.3f", mean.getVal()));
43      pave->AddText(Form("Sigma = %.3f", sigma.getVal()));
44      pave->AddText(Form("Alpha = %.3f", alpha.getVal()));
45      pave->AddText(Form("Chi square = %.3f", chi_sq));
46      pave->AddText(Form("N eventos = %d", (int)data->numEntries()));
47      pave->Draw();
48      //
49      TCanvas* c1 = new TCanvas("c1", "Ajuste chi_sq", 1920, 1080);
50      frame->Draw();
51      c1->SaveAs("fit_3.png");
52
53  }
```


A RooPlot of "mass"
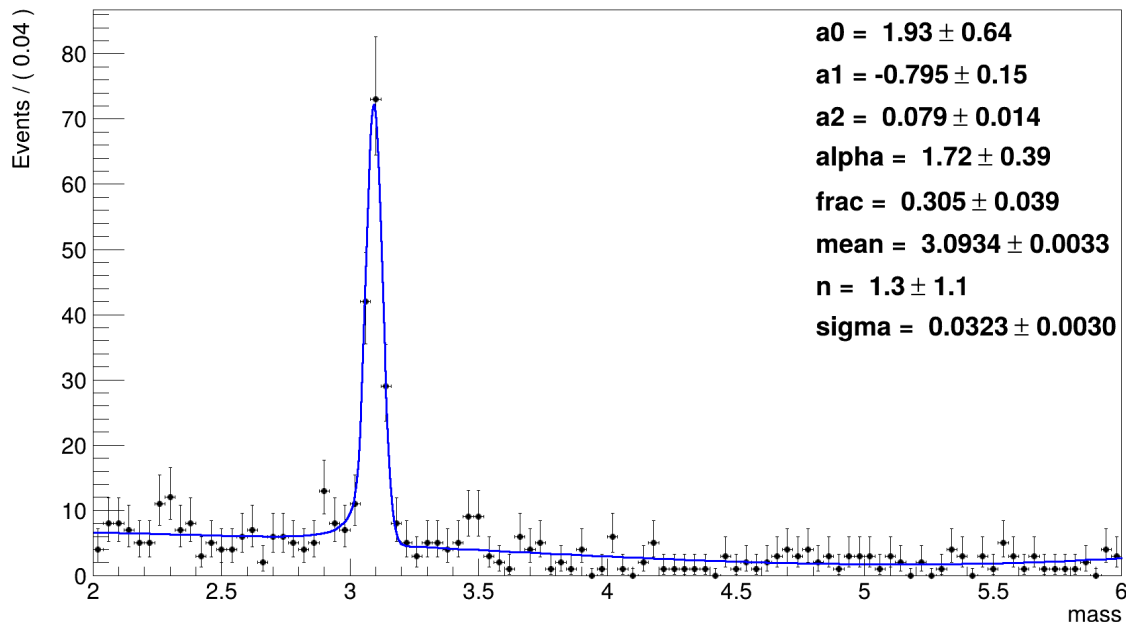
Por mais que no código eu tenha adicionado o termo χ^2 para ser plotado na imagem (linha 45), ele não apareceu... Mas seu valor foi calculado e encontrou-se 0.54.