Introdução à Análise de dados em FAE **(05/09/2024)**

Exercicios de estatística para análise de dados em HEP

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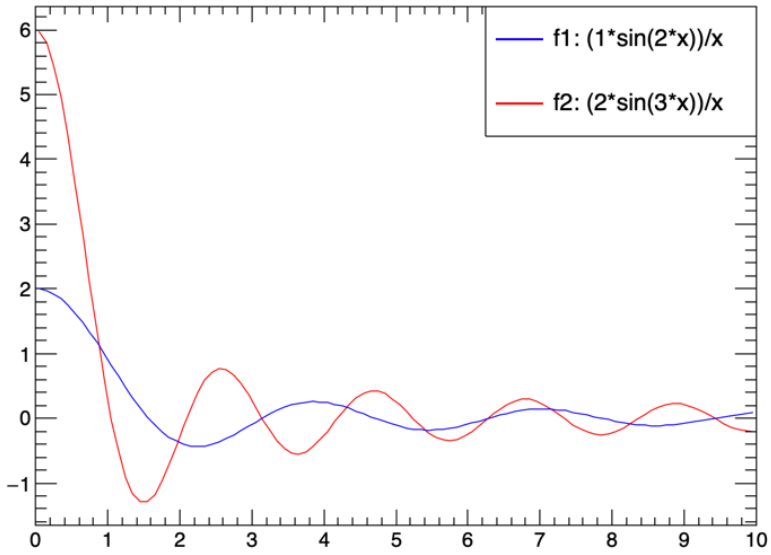
EXERCÍCIO 1

```
1
2  void exercicio_1(){
3
4      TCanvas *c1 = new TCanvas("c1", "c1", 800, 600);
5      c1->SetTicks(1,1);
6      TF1 *f1 = new TF1("f1", "([0]*sin([1]*x))/x", 0, 10);
7      TF1 *f2 = new TF1("f2", "([0]*sin([1]*x))/x", 0, 10);
8
9      f1->SetTitle("");
10     f1->SetParameters(1, 2);
11     f1->SetLineColor(kBlue);
12
13     f2->SetTitle("");
14     f2->SetParameters(2,3);
15     f2->SetLineColor(kRed);
16
17     double valor_em_1 = f1->Eval(1);
18     std::cout << "Valor da funcao em x=1: " << valor_em_1 << std::endl;
19
20     double derivada_em_1 = f1->Derivative(1);
21     std::cout << "Derivada da funcao em x=1: " << derivada_em_1 << std::endl;
22
23     double valor_integral = f1->Integral(0, 3);
24     std::cout << "Integral da funcao entre 0 e 3: " << valor_integral << std::endl;
25
26     TLegend *leg = new TLegend(0.6, 0.7, 0.9, 0.9);
27     leg->AddEntry(f1, "f1: (1*sin(2*x))/x", "l");
28     leg->AddEntry(f2, "f2: (2*sin(3*x))/x", "l");
29
30     f2->Draw();
31     f1->Draw("SAME");
32     leg->Draw();
33     c1->SaveAs("exercicio_1.png");
34 }
```

output:

```
1 Valor da funcao em x=1: 0.909297
2 Derivada da funcao em x=1: -1.74159
3 Integral da funcao entre 0 e 3: 1.42469
```



EXERCÍCIO 2a

```
    void exercicio_2_a() {

    TCanvas *c1 = new TCanvas("c1", "Canvas Title", 800, 600);
    TGraph *gr = new TGraph();

    std::ifstream file("/Users/thiagorangel/UERJ/Introducao_Analise_de_Dados_FAE/data
        /graphdata.txt");

    double x, y;
    while (1) {
        file >> x >> y;
        gr->SetPoint(gr->GetN(), x, y);
        if (file.eof()){break;}
    }

    gr->SetMarkerStyle(21);
    gr->SetMarkerSize(1.5);
    gr->SetMarkerColor(kBlack);

    gr->Draw("APL");
    c1->SaveAs("graph_2.png");
}
```

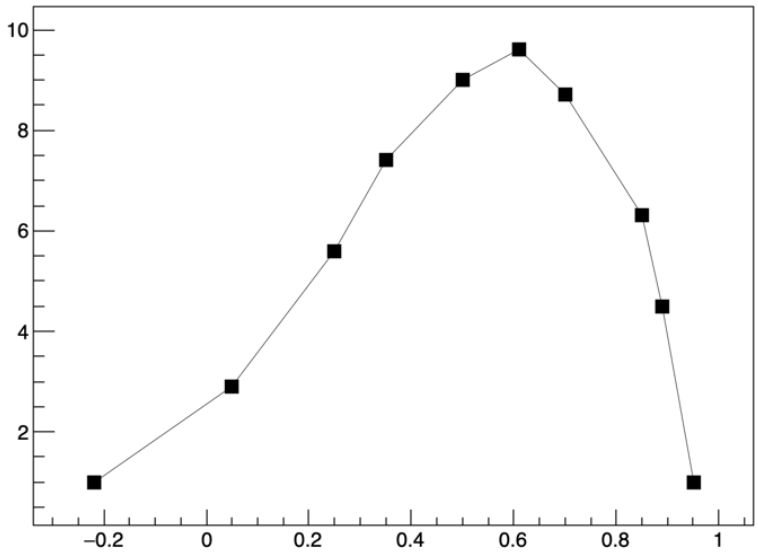


Figura 1: Caption

EXERCÍCIO 2b

```
1
2     void exercicio_2_b() {
3
4     TCanvas *c1 = new TCanvas("c1", "Canvas Title", 800, 600);
5     TGraphErrors *gr_err = new TGraphErrors();
6
7     std::ifstream file("/Users/thiagorangel/UERJ/Introducao_Analise_de_Dados_FAE/data
          /graphdata_error.txt");
8
9     double x, y, ex, ey;
10
11    while (1) {
12        file >> x >> y >> ex >> ey;
13        gr_err->SetPoint(gr_err->GetN(), x, y);
14        gr_err->SetPointError(gr_err->GetN()-1, ex, ey);
15        if (file.eof()){break;}
16
17    }
18
19    gr_err->SetMarkerStyle(21);
20    gr_err->SetMarkerSize(1.5);
21    gr_err->SetMarkerColor(kRed);
22
23    gr_err->Draw("APL");
24    c1->SaveAs("graph_2_errors.png");
25 }
```

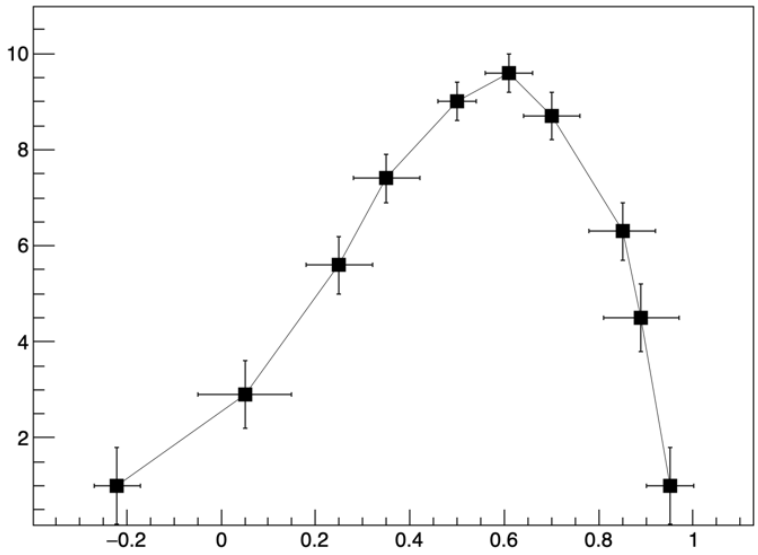
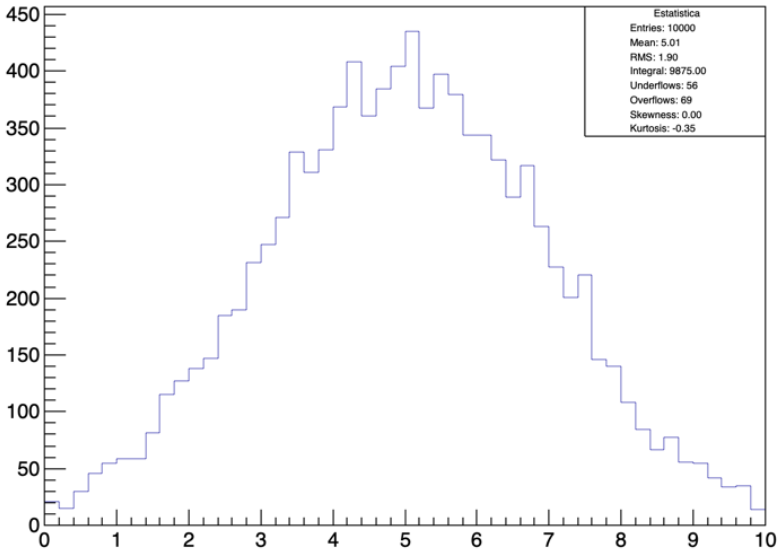


Figura 2: Caption

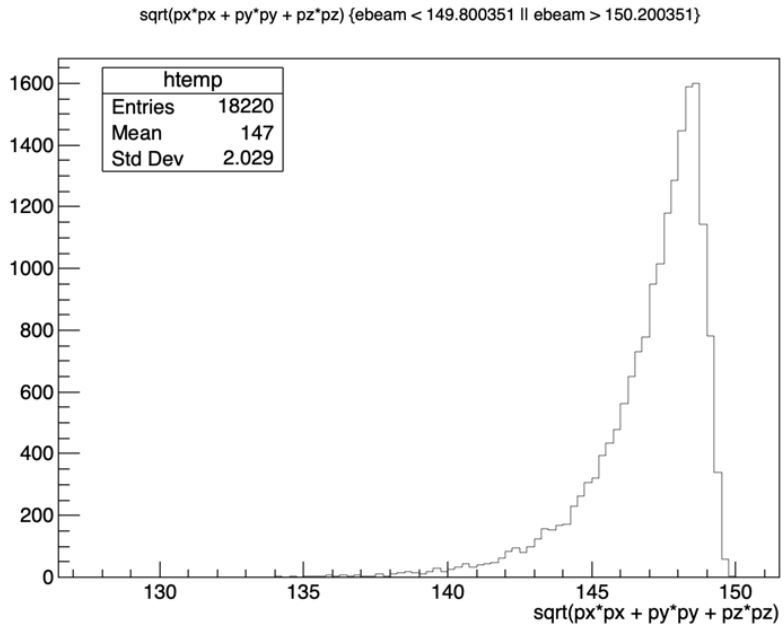
EXERCÍCIO 3

```
    void exercicio_3() {

    TCanvas *c1 = new TCanvas("c1", "Canvas", 800, 600);
    TH1F *hist = new TH1F("hist", "", 50, 0, 10);
    TRandom3 *rand = new TRandom3();

    for (int i = 0; i < 10000; ++i) {
        double value = rand->Gaus(5, 2);
        hist->Fill(value);
    }

    hist->Draw();
    hist->SetStats(0);
    TLegend *legend = new TLegend(0.7, 0.7, 0.9, 0.9);
    legend->SetHeader("Estatistica", "C");

    legend->AddEntry((TObject*)0, Form("Entries: %d", (int)hist->GetEntries()), "");
    legend->AddEntry((TObject*)0, Form("Mean: %.2f", hist->GetMean()), "");
    legend->AddEntry((TObject*)0, Form("RMS: %.2f", hist->GetRMS()), "");
    legend->AddEntry((TObject*)0, Form("Integral: %.2f", hist->Integral()), "");
    legend->AddEntry((TObject*)0, Form("Underflows: %d", (int)hist->GetBinContent(0))
        , "");
    legend->AddEntry((TObject*)0, Form("Overflows: %d", (int)hist->GetBinContent(hist
        ->GetNbinsX() + 1)), "");
    legend->AddEntry((TObject*)0, Form("Skewness: %.2f", hist->GetSkewness()), "");
    legend->AddEntry((TObject*)0, Form("Kurtosis: %.2f", hist->GetKurtosis()), "");
    legend->Draw();

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



EXERCÍCIO 4

```
    void exercicio_4() {

    TCanvas *c1 = new TCanvas("c1", "Histograma de Momento", 800, 600);
    TFile *file = new TFile("/Users/thiagorangel/UERJ/Introducao_Analise_de_Dados_FAE
        /data/tree.root");
    TTree *tree = (TTree*)file->Get("tree1");

    TH1F *hist = new TH1F("hist", "Distribui  o do Momento Total", 100, 0, 200);

    float px, py, pz, ebeam;
    tree->SetBranchAddress("ebeam", &ebeam);
    tree->SetBranchAddress("px", &px);
    tree->SetBranchAddress("py", &py);
    tree->SetBranchAddress("pz", &pz);

    float sumEbeam = 0;
    Int_t nEntries = tree->GetEntries();

    for (Int_t i = 0; i < nEntries; i++) {
        tree->GetEntry(i);
        sumEbeam += ebeam;
    }

    float meanEbeam = sumEbeam / nEntries;

    TCut *cutEbeam = new TCut(Form("ebeam < %f || ebeam > %f", meanEbeam - 0.2,
        meanEbeam + 0.2));
    tree->Draw("sqrt(px*px + py*py + pz*pz)", *cutEbeam);
    c1->SaveAs("histograma_momento.png");
}
```


sqrt(px*px + py*py + pz*pz) {ebeam < 149.800351 || ebeam > 150.200351}
htemp
Entries 18220
Mean 147
Std Dev 2.029
1600
1400
1200
1000
800
600
400
200
0
130
135
140
145
150
sqrt(px*px + py*py + pz*pz)