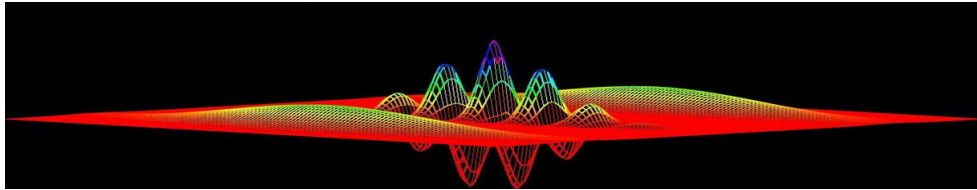


Computational Physics

numerical methods with C++ (and UNIX)



Fernando Barao

Instituto Superior Tecnico, Dep. Fisica

email: barao@lip.pt

Computational Physics

ROOT

A data analysis graphics tool with a C++ interpreter

Fernando Barao, Phys Department IST (Lisbon)

ROOT - outline

- ✓ ROOT installation
- ✓ general concepts
- ✓ interactive use and macros
- ✓ canvas and graphics style
- ✓ histograms and other objects
- ✓ fitting
- ✓ input/output
- ✓ using ROOT from user programs
- ✓ DUBNA

site : <http://root.cern.ch>

Users Guide : <http://root.cern.ch/drupal/content/root-users-guide-600>

ROOT - start

✓ root command help

```
> root --help # get help

Usage: root [-l] [-b] [-n] [-q] [dir] [[file:]data.root] [file1.C ... fileN.C]
Options:
  -b : run in batch mode without graphics
  -n : do not execute logon and logoff macros as specified in .rootrc
  -q : exit after processing command line macro files
  -l : do not show splash screen
  -x : exit on exception
  dir : if dir is a valid directory cd to it before executing

  -?      : print usage
  -h      : print usage
  --help  : print usage
  -config : print ./configure options
  -memstat : run with memory usage monitoring
```

✓ start root

```
> root -l
```

✓ quit root

```
> .q
```

ROOT - CINT interpreter

✓ CINT commands

```
root> .<command>

        .q : quit
        .? : list of commands
        .x <macro.C> : execute C++ macro
        .L <macro.C> : load macro
        .!<shell cmd> : run shell cmd
                .!ls - list files on current directory
                .!pwd - print current directory name
        .func : list all functions
```

✓ ROOT global pointers

gROOT instance of the *TROOT* class works as an entry point to the ROOT system, providing access to the stored ROOT objects

gSystem defines an interface to the underlying operating system (*TUnixSystem*)

gStyle defines attributes of objects : lines, canvas, pad, histograms,...

gRandom instance of *TRandom3* class providing a quick access to random number generator

ROOT - calculator

□ ROOT used as a calculator

```
> root -l
root [0] 7+2/6 //do not put ";" at the end to get answer
(const int)7
root [1] 7+2/6.
(const double)7.33333333333333304e+00
root [2] 1>2 //evaluate expression
(const int)0
root [3] TMath::Pi()
(Double_t)3.14159265358979312e+00
root [4] TMath::Sin(10.*TMath::Pi()/180.) //compute sin(10 degrees)
(Double_t)1.73648177666930331e-01

root [18] double result = 0.
(const double)0.00000000000000000e+00
root [19] for (int i=0;i<10;i++) {result += TMath::Power(0.5,i);}
root [20] result
(double)1.99804687500000000e+00
```

ROOT - graphics window

- The graphics window in ROOT is made using the *TCanvas* class
- Let's open a canvas and divide it in three pads where the graphics objects will be drawn

```
[0] gROOT->Reset();
[1] gStyle->SetOptTitle(0);
[2] TF1 *f1 = new TF1("f1", "1.+ [0]*sin([1]*x)/x + [2]*exp(-x)", 0.1, 40.);
[3] f1->SetParameters(1., 1., 1.);
[4] f1->SetLineColor(kBlue);
[5] f1->SetRange(5., 40.);
[6] TCanvas *c = new TCanvas("c", "Phys Comput canvas", 0, 0, 900, 500);
[7] TPad *pad1 = new TPad("pad1", "The 2nd pad", 0.02, 0.02, 0.48, 0.98, 21);
[8] TPad *pad2 = new TPad("pad2", "The 2nd pad", 0.51, 0.52, 0.98, 0.98, 21);
[9] TPad *pad3 = new TPad("pad3", "The 3rd pad", 0.51, 0.02, 0.98, 0.49, 21);
[10] pad1->Draw(); pad2->Draw(); pad3->Draw();
[11] pad1->cd(); f1->SetLineWidth(4); f1->DrawCopy();
[12] TF1 *f2 = new TF1("f2", "expo(0)", 0., 10.); //expo=exp(A+Bx)
[13] f2->SetParameters(1., 0.1);
[14] pad2->cd(); f2->SetLineWidth(4); f2->Draw();
[15] TF1 *f3 = new TF1("f3", "expo(0)+gaus(2)", 0., 10.);
[16] f3->SetParameters(1., 0.1, 10., 5., 1.); //exp+gau
[17] pad3->cd(); f3->SetLineWidth(4); f3->Draw();
[18] c->Modified();
```

root.cern.ch/root/html/TFormula.html

