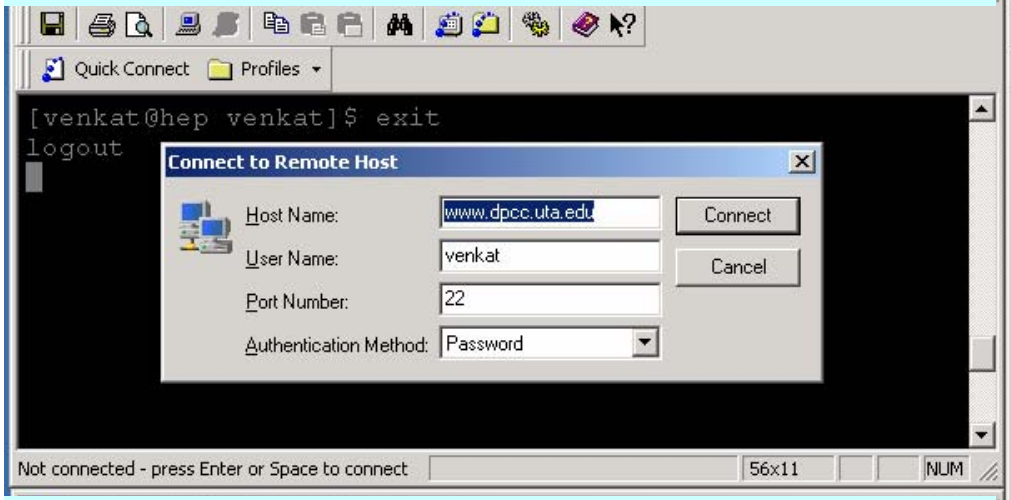
DØ Data Analysis with ROOT

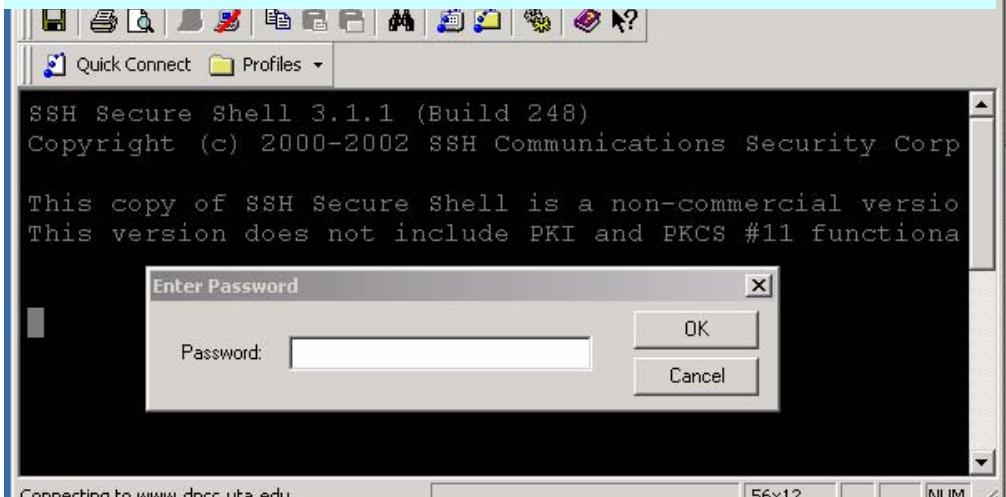
Venkat (for Dr.Yu)

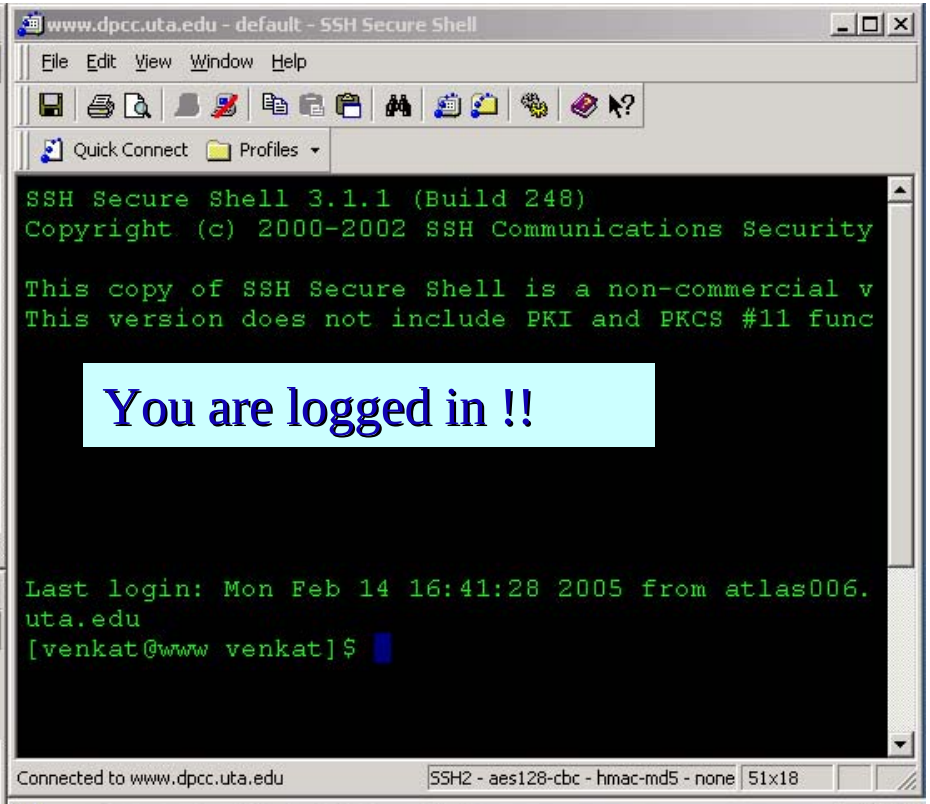
02-16-05

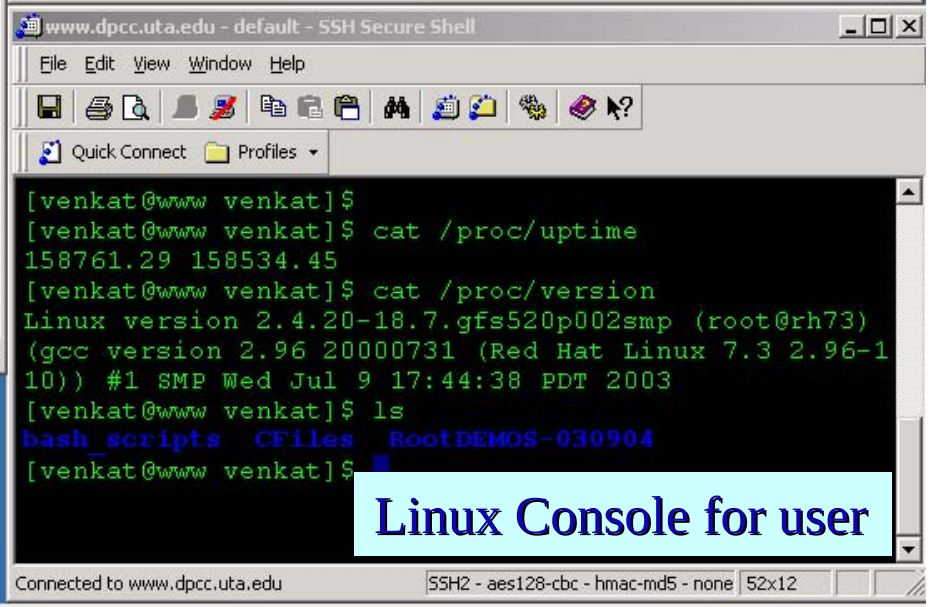
Enter hostname username and click Connect



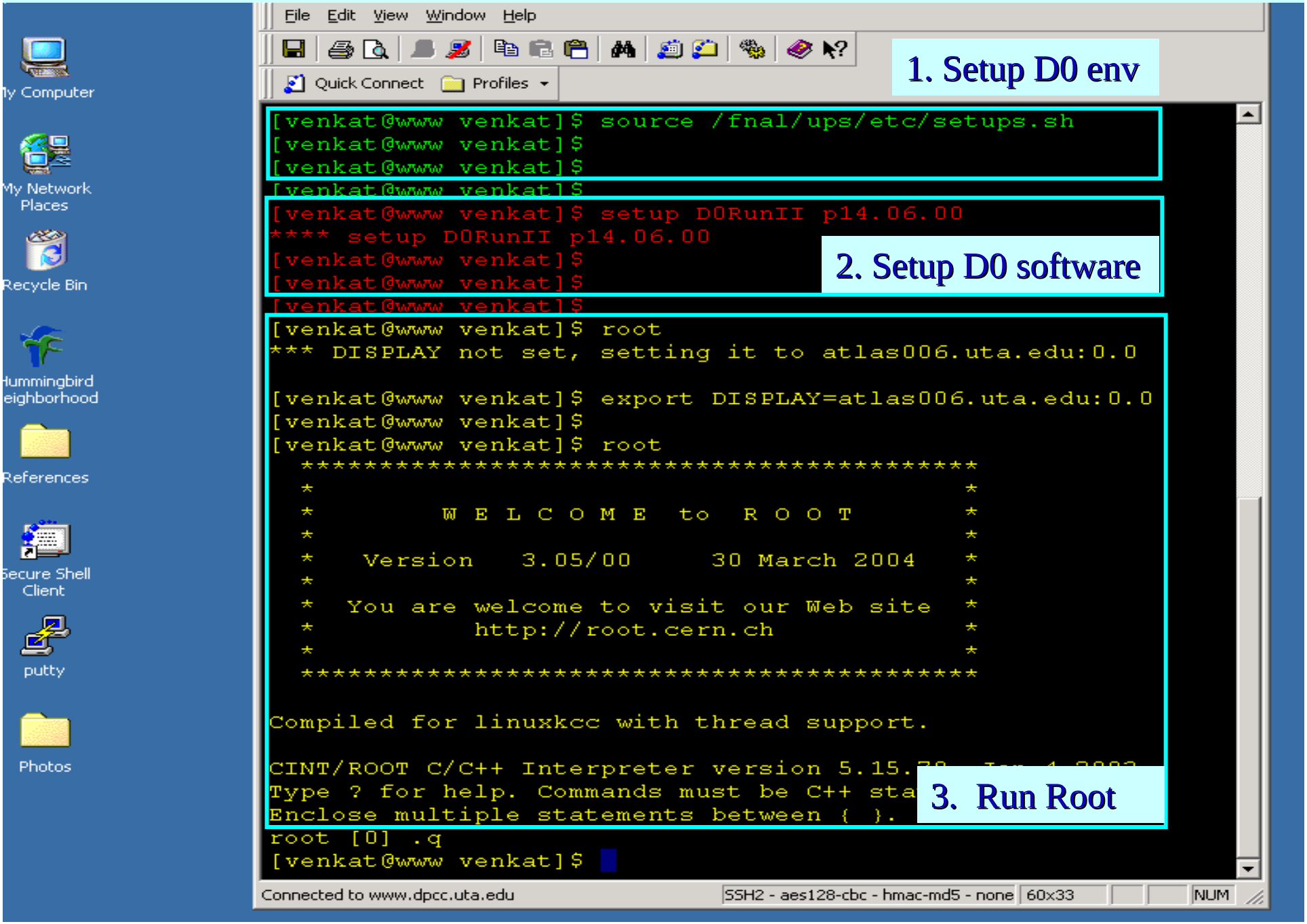
Enter password, Click OK





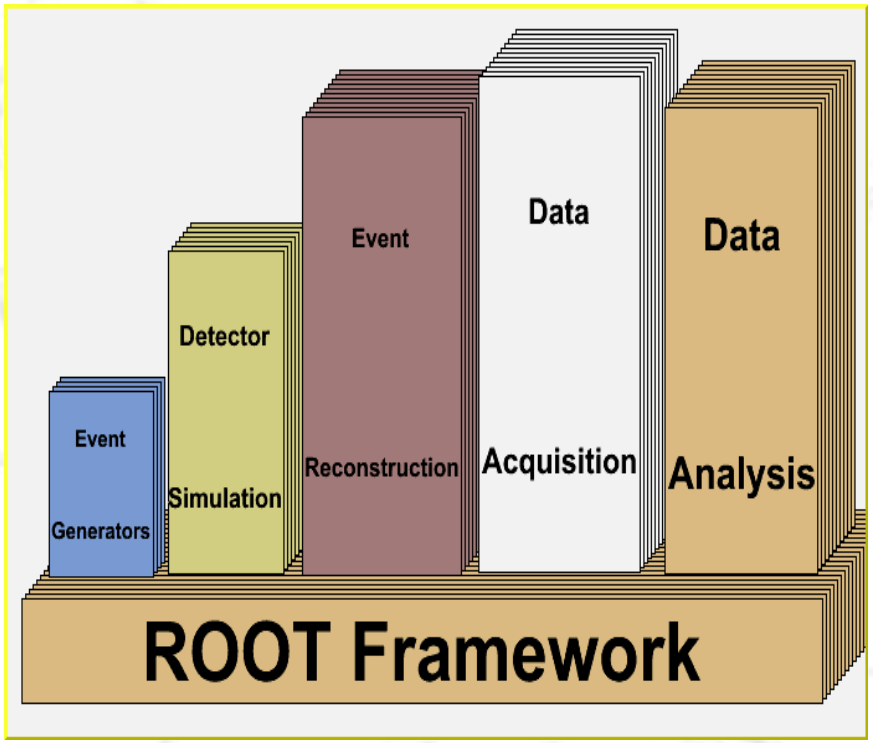


IP Address for your machine is given on the top left hand corner of your monitor



ROOT- Architecture

- The ROOT system provides a set of OO framework
- Histograming methods in 1, 2 and 3 dimensions
- Curve Fitting, Minimization, Graphics Class libraries
- CINT C++ command line interpreter
- Mainly “useful for data analysis” tools



Example 1 (Simple)

- Open a root file
- Save a root file
- Use browser to view a root file

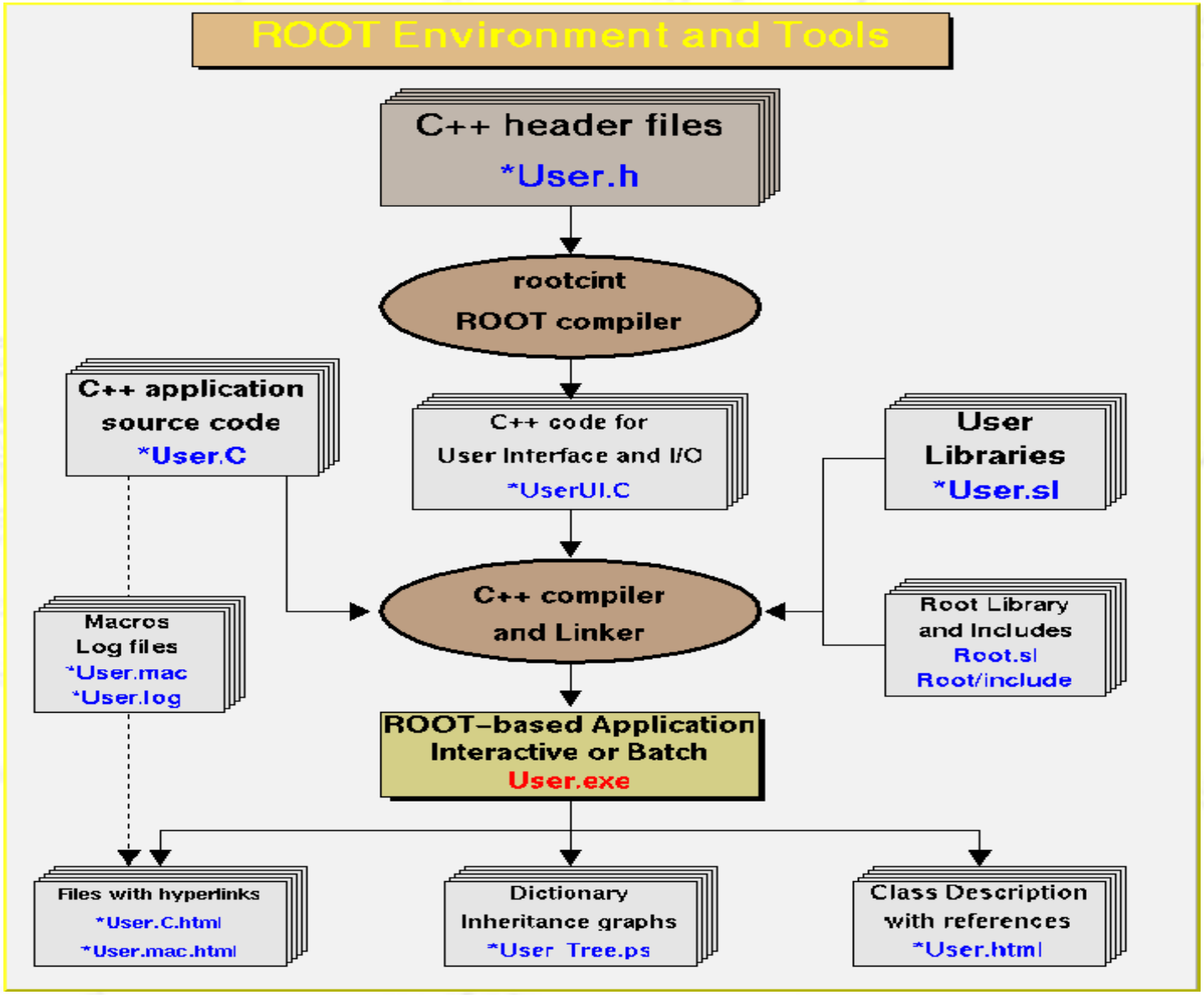
Example 2 (Programming)

- Histogram filling, fitting with Gaussian
- Drawing a legend and some other options
- Save the histogram as .gif file / .root file

Example 3 (Complex)

- Adding your own class with a shared library
- TObject
- rootcint (C++ interpreter and how to use it)

Root CINT: Overview



Step 1: MyVector.h

```
#include <iostream.h>
#include "TObject.h"

class MyVector: public TObject {
private:
  Float_t fX;// X position
  Float_t fY;// Y position
  Int_t fTempValue; //!temporary state value
public:
  MyVector(){ fX = -1; fY = -1; }// Default Constructor
  void Print() const;
  void SetX(float x){ fX = x; }
  void SetY(float y){ fY = y; }

ClassDef (MyVector, 1)
};
```

Step 2: MyVector.cxx

```
#include "MyVector.h"
ClassImp (MyVector);

void MyVector::Print() const {
cout << fX << "i + " << fY << "j " << endl;
}
```

Step 3: MyVector_LinkDef.h

```
#ifdef __CINT__
#pragma link off all globals;
#pragma link off all classes;
#pragma link off all functions;
#pragma link C++ class MyVector;
#endif
```

Step 4: MainVector.cxx

```
#include "stdlib.h"

#include "Riostream.h"
#include "TROOT.h"
#include "MyVector.h"

int main(int argc, char **argv) {
 double numx, numy;
 MyVector *vector = new MyVector();
 vector->SetX(atof(argv[1]));
 vector->SetY(atof(argv[2]));
 vector->Print();
 cout << " Bye " << endl;
 return 0;
}
```

Useful Links

UTA

http://www-hep.uta.edu/~venkat/talks/Analysis_phys5326.ppt (W to mu nu)

http://www-hep.uta.edu/hep_notes/d0.html (Intro to Data Analysis and W/Z analyses)

DØ

http://www-d0.fnal.gov/phys_id/emid/d0_private/EM_Particle_Documentation_EMID.html (EM Particle Documentation)

http://www-d0.fnal.gov/phys_id/muon_id/d0_private/certif/p14/index.html (Muon ID/Certification document)

http://www-d0.fnal.gov/computing/algorithms/calgo/jet_met/certification.html (Missing Transverse Energy (E_T) page)

http://quarknet.fnal.gov/run2/hdecay.shtml (Getting to Higgs .. Very Very Very useful)

ROOT / TMBTree

http://root.cern.ch/ (ROOT System Homepage)

http://root.cern.ch/root/Tutorials.html (ROOT Tutorials and numerous examples)

http://root.cern.ch/root/HowTo.html (ROOT How To and Gotcha !!)

http://www-d0.fnal.gov/~serban/tmb_tree/TMBTreeIntro.html (How to use TMBTrees)

http://www-d0.fnal.gov/nikhef/?doc/tmb_tree.html (TMBTree class definitions and their description)

C++ , Scripting, Linux etc..

http://root.cern.ch/root/Cint.html (ROOT C++ Interpreter)

http://linux.ctyme.com/ (Linux MAN pages)

http://www.tldp.org/LDP/abs/html/ (Bash Scripting Guide)

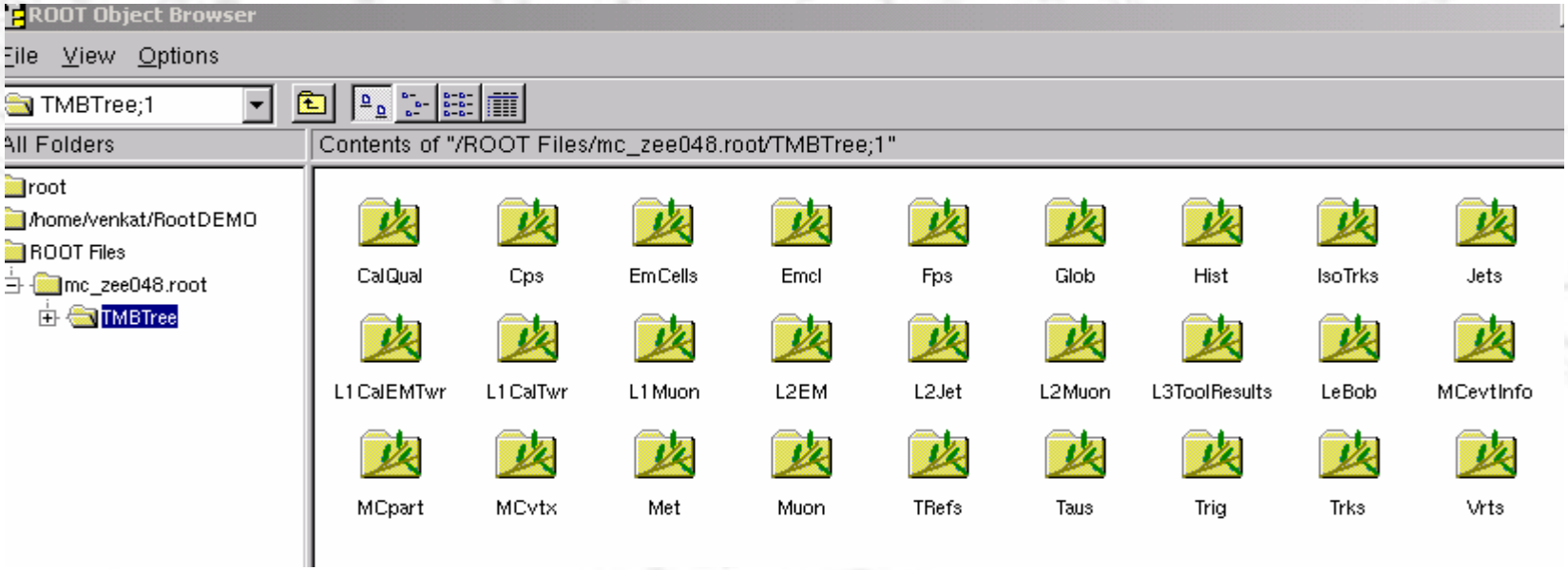
http://amath.colorado.edu/documentation/LaTeX/basics/ (How to use LaTeX)

Assignment 1

- Copy the Input file containing the W mass data to your home area. It can be found at /home/venkat/RootDEMO/WTransDEMO/Input.data
- Look at the contents of the file. You will see 3 columns. The first one denotes the Run number, the second Event number and the third column is the calculated W Transverse mass.
- Write a macro to
  - read in the values from the input file
  - plot the data as a 1D histogram. (Select suitable bin size and range for your histogram)
  - Save the output as a ".root" file for later use.
  - Save the same file as ".gif" for your presentation.
- Refer to the macro in /home/venkat/RootDEMO/HistogramDEMO/Hist1D.C for more help on creating root macros.

Assignment 2

- Open a root session. Issue the command
- root [0] TBrowser br (Its case sensitive!!) You will see a browser pop up on your screen. Open the ".root" file given below.
- /home/venkat/RootDEMO/mc_zee048.root
- Double click on the root-file and you will see a subfolder containing TMBTree. Click on TMBTree and you will see a subfolder that looks like this -



Assignment 2 (contd..)

- Select the following and view their contents
  - EMCL object
  - Muon object
  - MET object
- View/Save the following histograms
  - Emcl._calE, Emcl._calPhi, Emcl._calEta, Emcl._emfrac, Emcl._HMx7, Emcl._iso, Emcl._id, Emcl._pT
  - Muon._pT, Muon._calPhi, Muon._calEta, Muon._isTight, Muon._charge, Muon._E
  - _MEy, _MEx, ScalarET_weta, _MET

Phase I of the Project

- You will be working with the Data samples similar to the one in assignment 2, and writing macros/c++ code to filter the data according to the signal you are looking for.
- The data samples are divided into four categories

$W \longrightarrow e + \nu$	$W \longrightarrow \mu + \nu$
$Z \longrightarrow \mu + \mu$	$Z \longrightarrow e + e$

- Look at the reference for TMBTrees and get acquainted with what the variables mean.
- Learn more about your physics process and how to use the selection criteria for your specific physics process.