

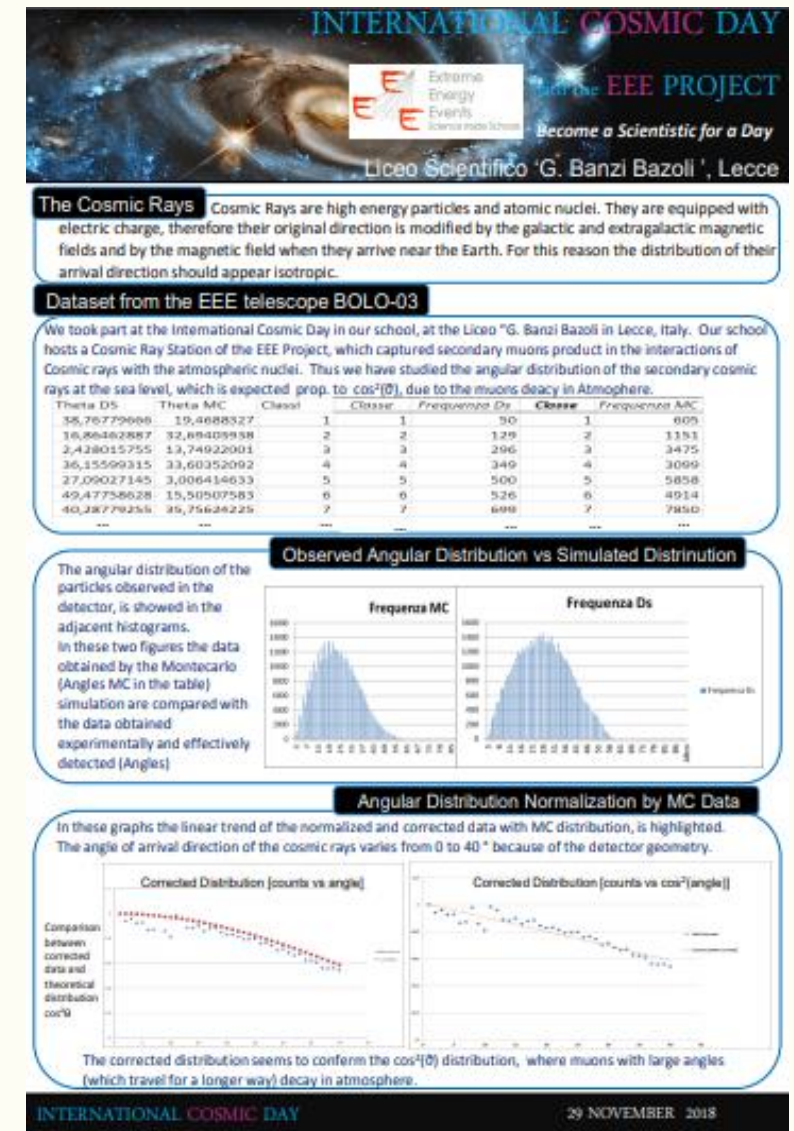
FIRST STEP IN ROOT ANALYSIS: THE ANGULAR DISTRIBUTION OF COSMIC RAYS

Liceo Scientifico Giulietta Banzi Bazoli
Lecce

Azzurra Melcarne Manolo Cafaro

PRESENTATION OF THE SCHOOL

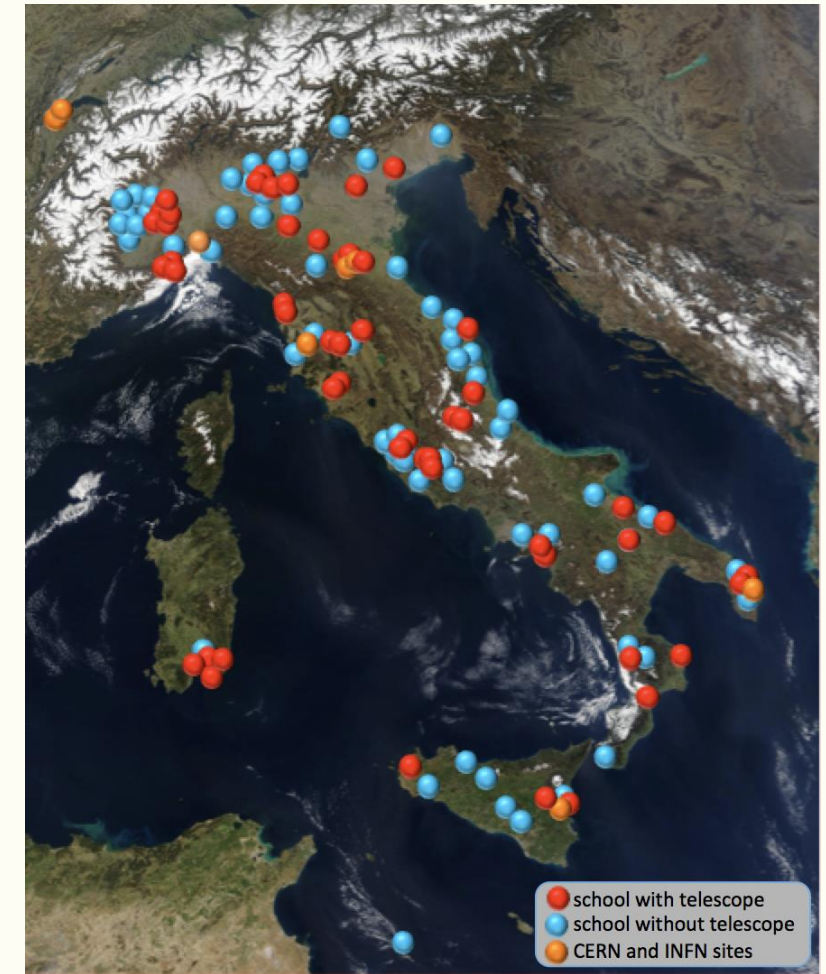
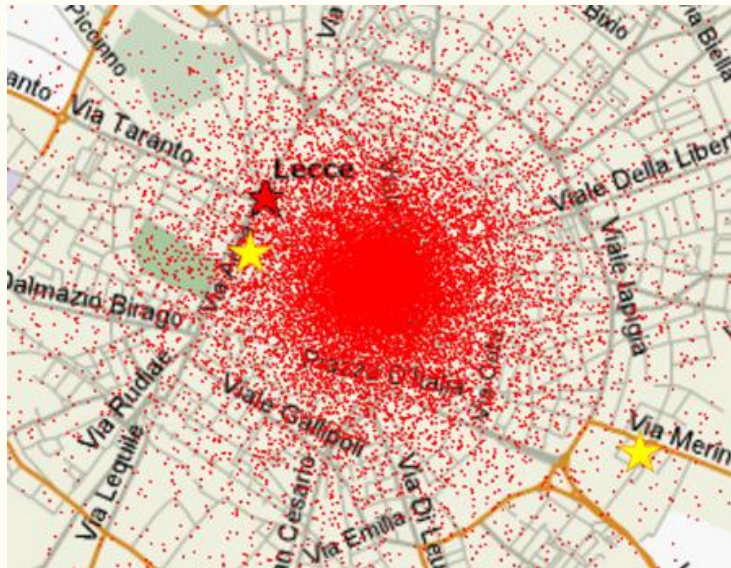
- EEE project in our school
LECC-01 Telescope since 2005
Elog BOOK
- Activities about EEE project:
 1. International Cosmic Day 2018/19
 2. Specialization course of second classes
 3. Data analysis didactic project
 - First approach with software
 - Histogram plot
 - Discussion of results



DATA ANALYSIS DIDACTIC PROJECT

The course's targets were:

- Analyze data of telescopes scattered in Italy
- Understand how energy of the particles affects on THETA and BETA.



FIRST APPROACH WITH SOFTWARE

- DATA REQUEST

Request a subset of data

Submit Preview Back

Entry time: Tue Mar 5 16:05:51 2019

Author: LECC-01

MC: ☐

Output format: ROOT

Telescope ID: ALTA-01

Start time: February 28 Year: 2019

Stop time: February 28 Year: 2019

RunNumber: ☒

Seconds: ☐

Nanoseconds: ☐

Theta: ☒

Phi: ☐

ChiSquare: ☒

TimeOfFlight: ☒

TrackLength: ☒

DeltaTime: ☐

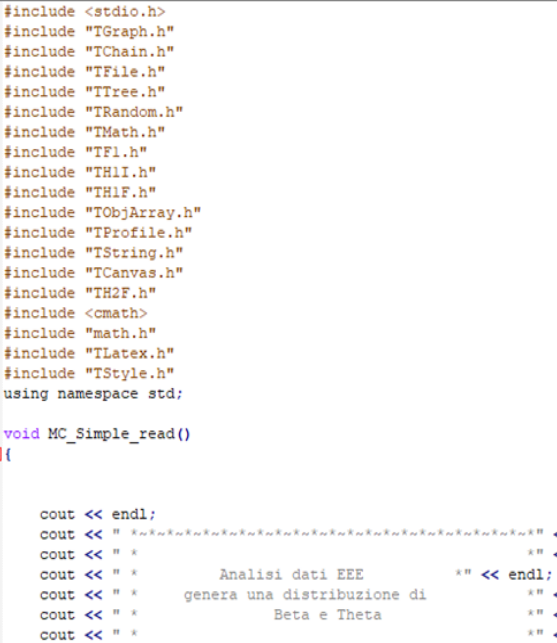
Pressure: ☐

Cut: ChiSquare < 10 && RunNumber > 20 && RunNumber < 30

- EXCEL

	A	B	C	D	E	F	G	H	I	J	K
1		n entries					LECC-01	n entries		media(theta)	
2	<0.7	482				>0.75<0.92		115767		22,88	
3	>0.7<1.2	42785				>0.92<1.09		147769		22,24	
4	>1.2	888				>1.09<1.25		18471		20,17	
5											
6	M<0.7	1260									
7	M>0.7<1.2	157145									
8	M>1.2	13153									
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

- NOTEPAD ++



The screenshot shows a C++ code editor with the file name "MC_Simple_read.c". The code includes several headers and defines a function `MC_Simple_read()`. The function prints a message about data analysis.

```

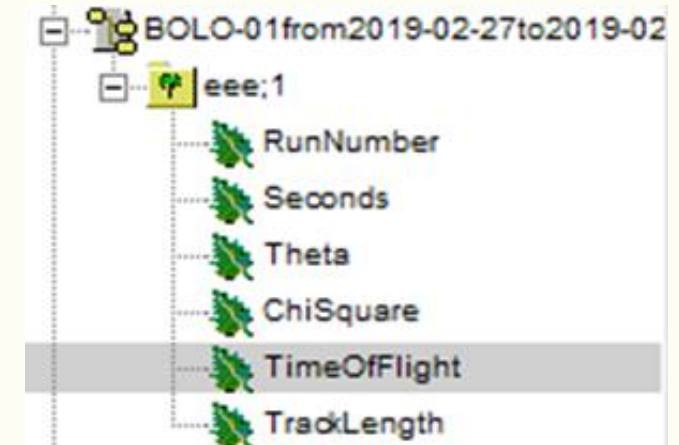
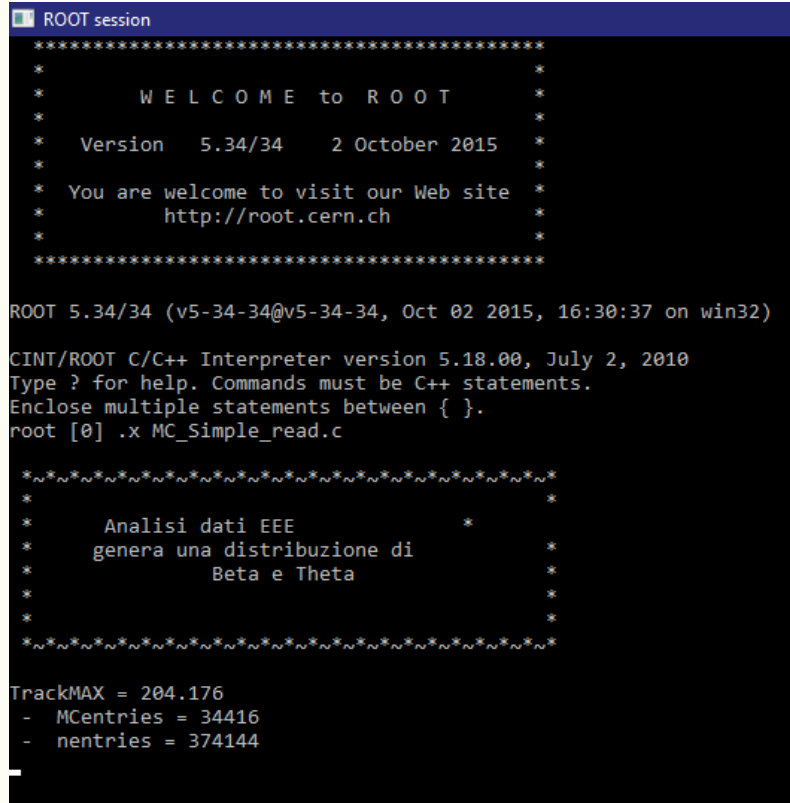
1  #include <stdio.h>
2  #include "TGraph.h"
3  #include "TChain.h"
4  #include "TFile.h"
5  #include "TTree.h"
6  #include "TRandom.h"
7  #include "TMath.h"
8  #include "TFl.h"
9  #include "TH1I.h"
10 #include "TH1F.h"
11 #include "TObjArray.h"
12 #include "TProfile.h"
13 #include "TString.h"
14 #include "TCanvas.h"
15 #include "TH2F.h"
16 #include <cmath>
17 #include "math.h"
18 #include "TLatex.h"
19 #include "TStyle.h"
20 using namespace std;
21
22 void MC_Simple_read()
23 {
24
25
26     cout << endl;
27     cout << " " << endl;
28     cout << " " << endl;
29     cout << " " << endl;
30     cout << " " << endl;
31     cout << " " << endl;
32     cout << " " << endl;
33     cout << " " << endl;
34     cout << " " << endl;
35     cout << endl;
36
37     //

```

<https://notepad-plus-plus.org/download/v7.6.3.html>

- ROOT

It subdivide files in tree diagrams with branches and leaves



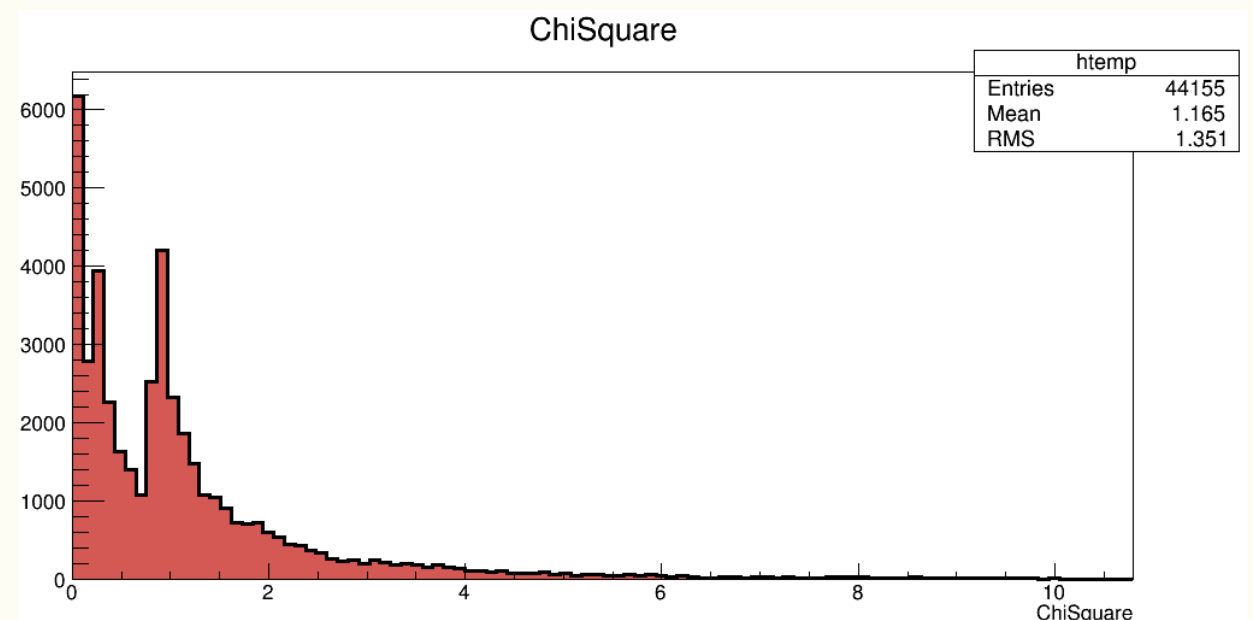
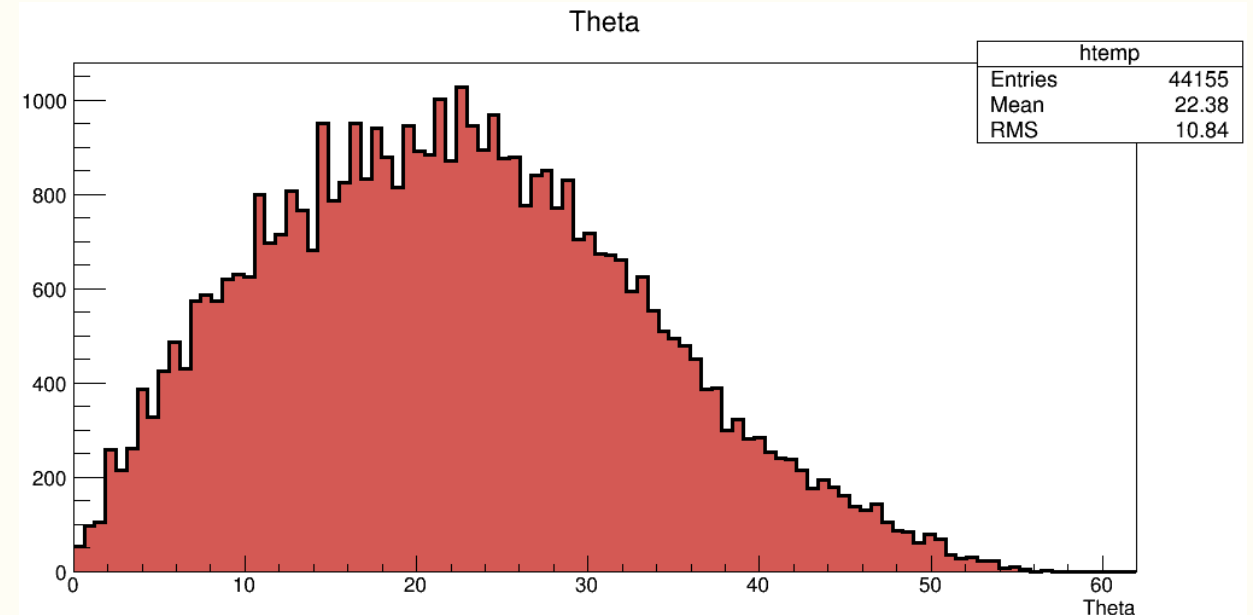
New TBrowser

https://root.cern.ch/download/root_v5.34.34.win32.vc10.debug.exe

ROOT

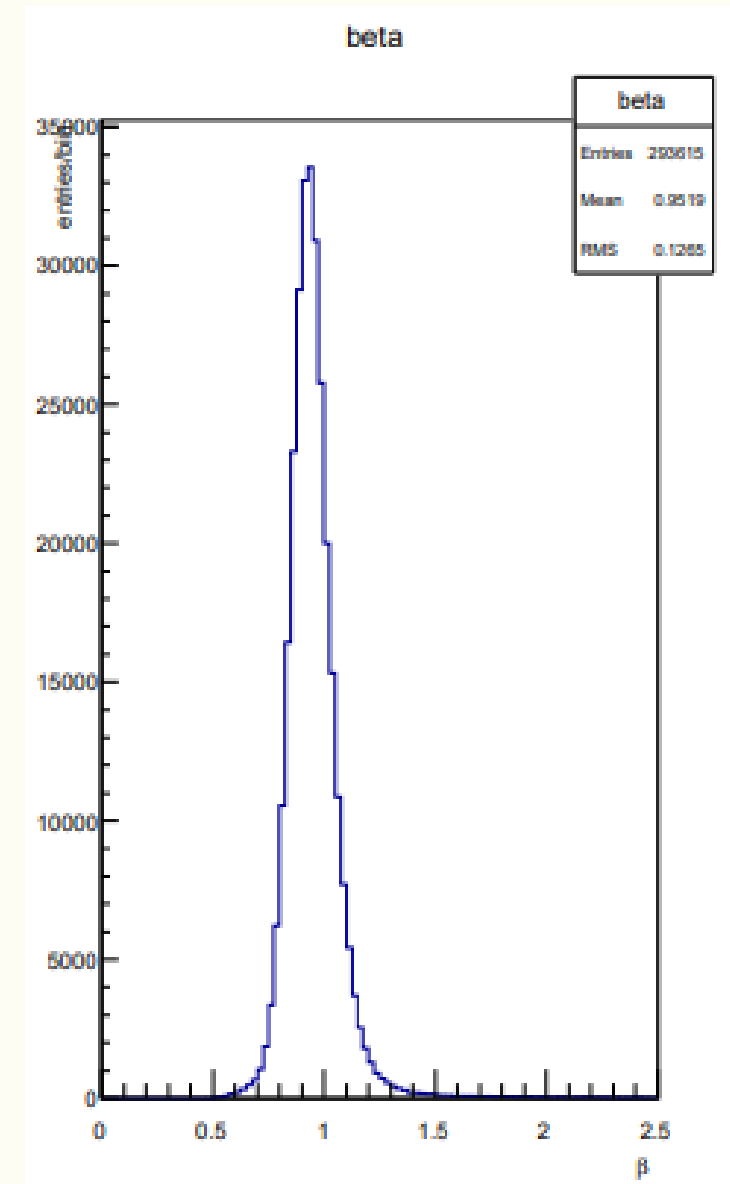
ROOT is a software created by CERN, which has the target to analyze a very large amount of data.

Before you can create the graphs, you need to write down a macro to analyze the data.



BETA

- What is BETA?
BETA is the report between particle velocity and speed of light.
- How do you calculate?
$$(Tl/ToF)/c = Tl/(ToF \times c)$$
- Why sometimes BETA is higher than 1?



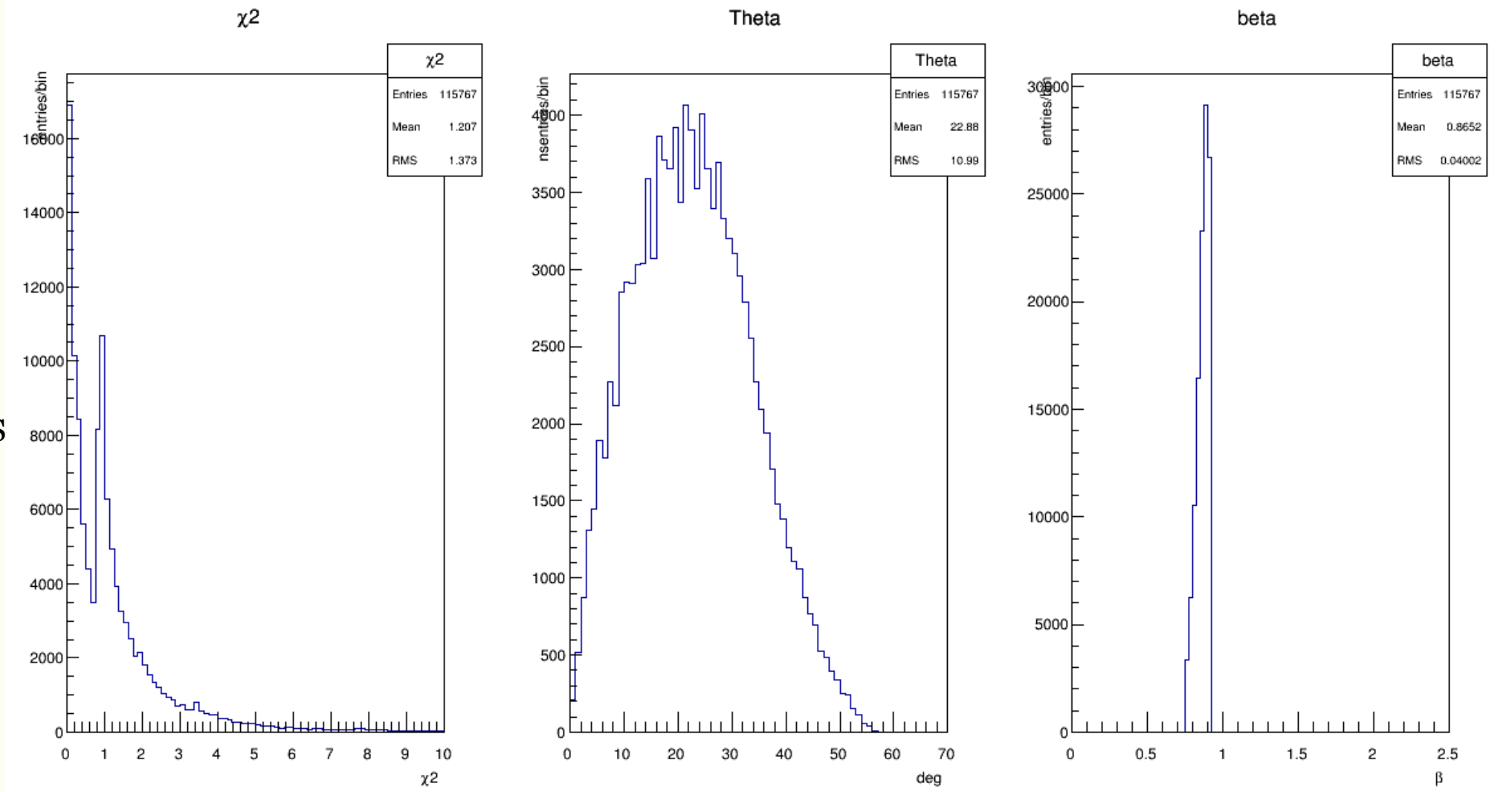
LECC-o1

DOWNLOADED AND ANALYZED TELESCOPES

LECC-01

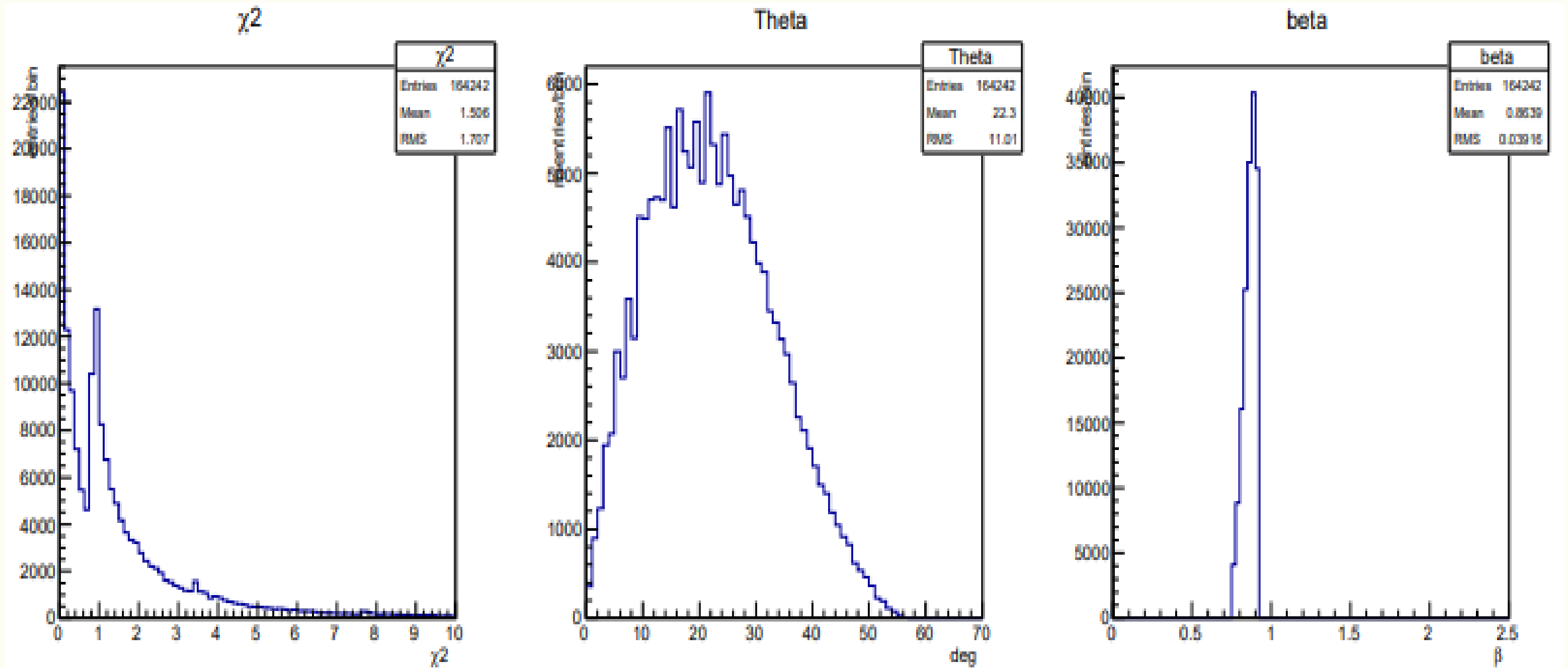
$0,75 < \text{BETA} < 0,92$
 $0,92 < \text{BETA} < 1,09$
 $1,09 < \text{BETA} < 1,25$

χ^2 : PARAMETER
THAT INDICATES
THE CORRECTNESS
OF THE TRACE



MEDIA THETA: 22,88

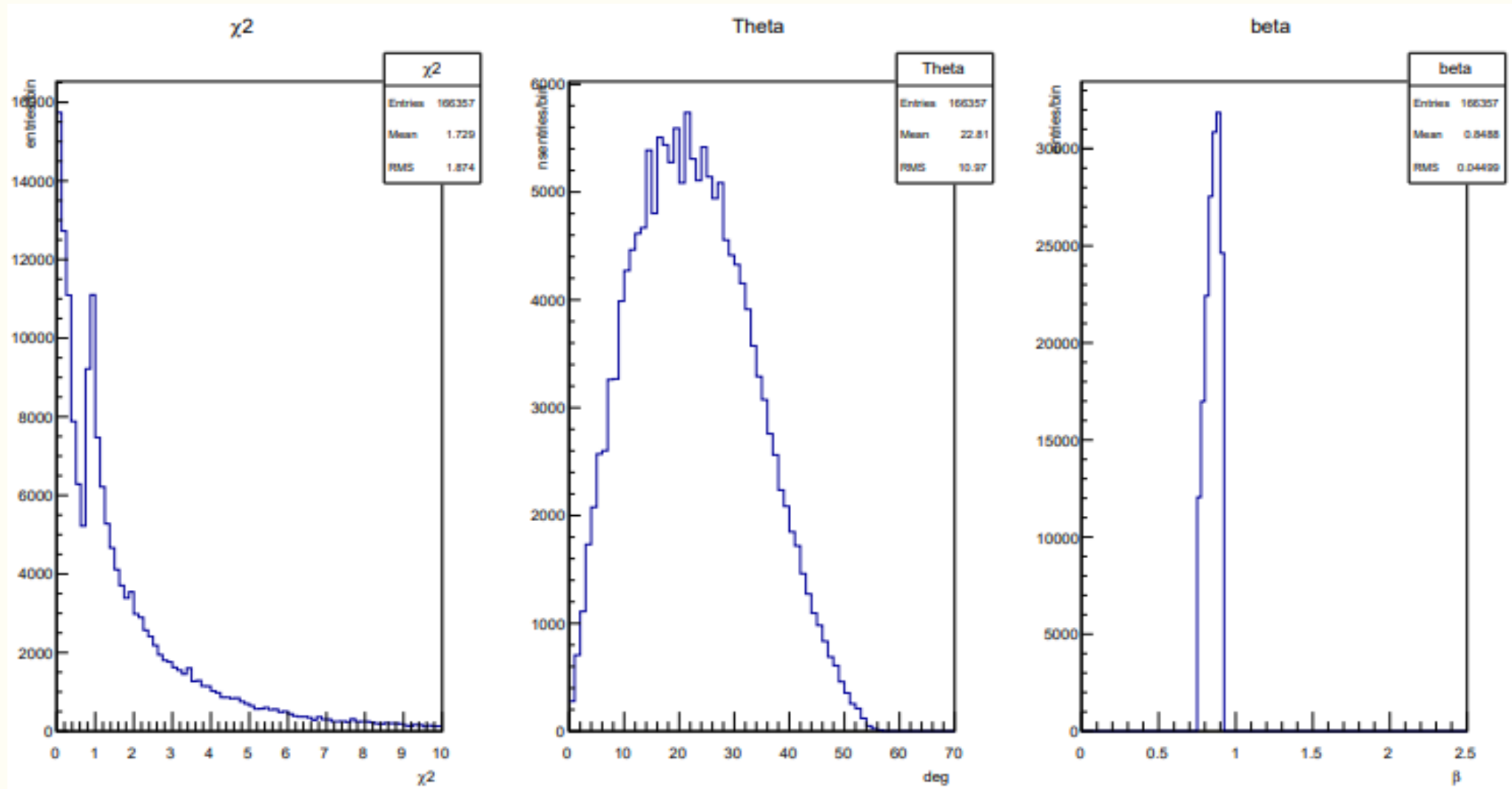
ALTA-O1



MEDIA THETA: 22,30

0,75>BETA>0,92

GROS-01



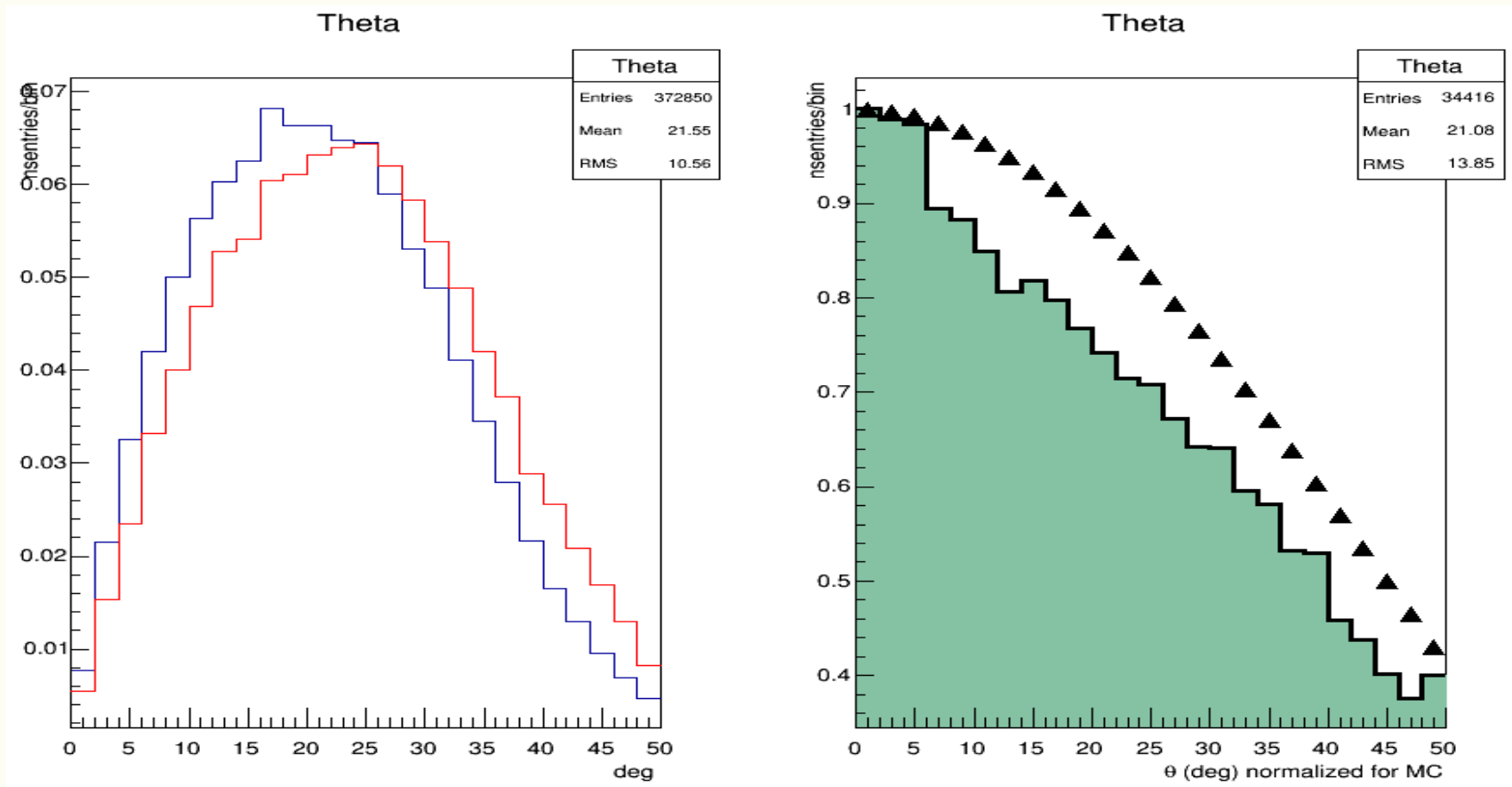
MEDIA THETA: 22,81

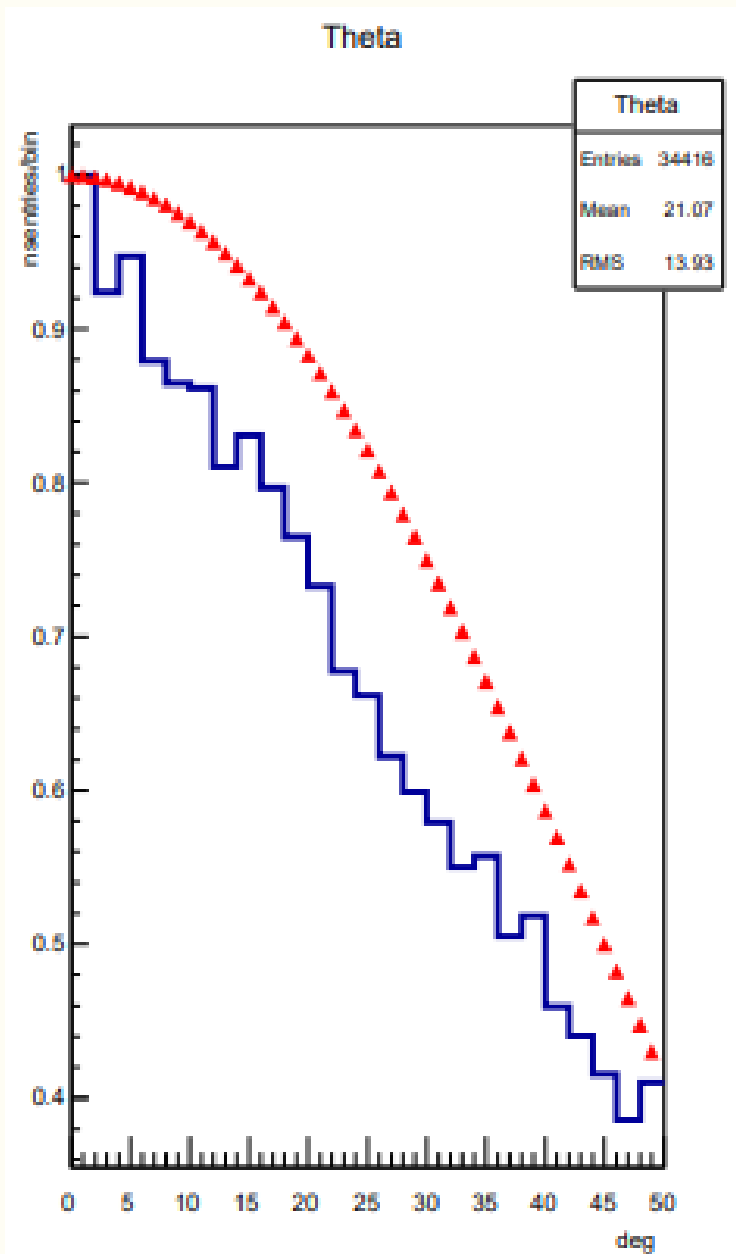
0,75<BETA<0,92

MC DATA AND REAL DATA *ICD 2018*

Montecarlo data are randomly generated data.

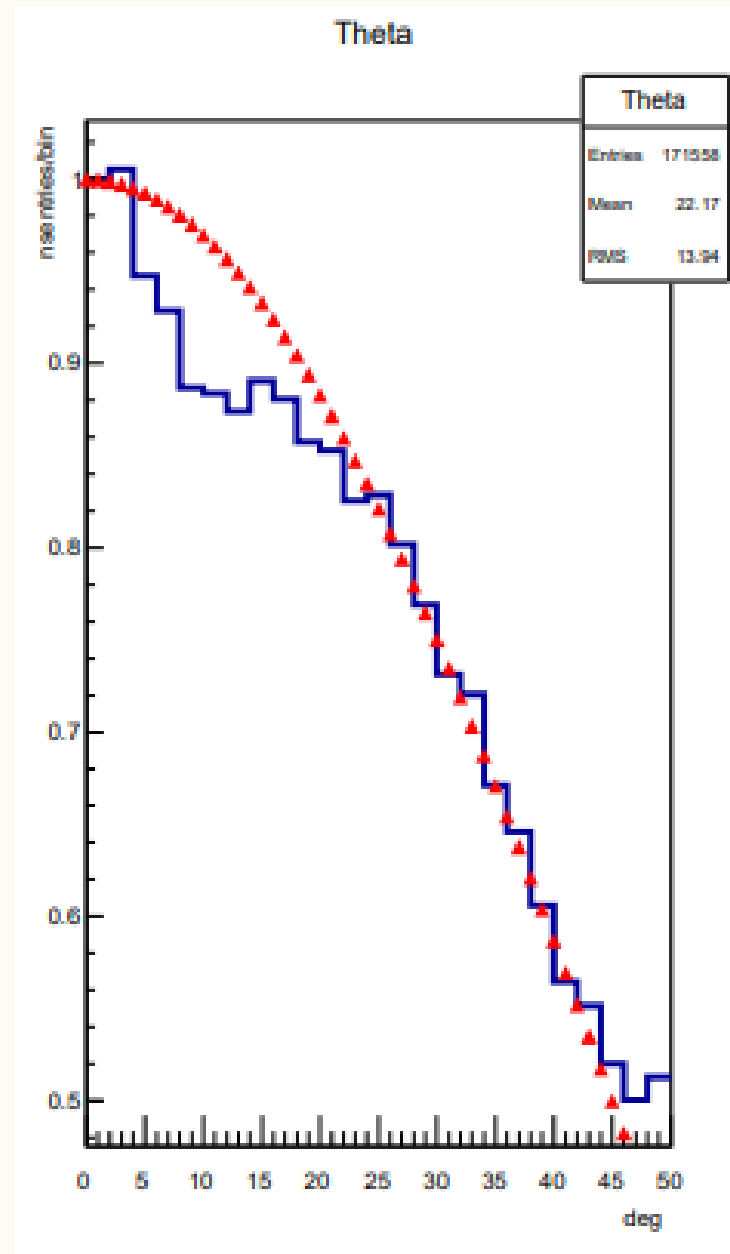
They are used to make the detector geometry independent to obtain a graph similar to the function: $\cos^2\theta$





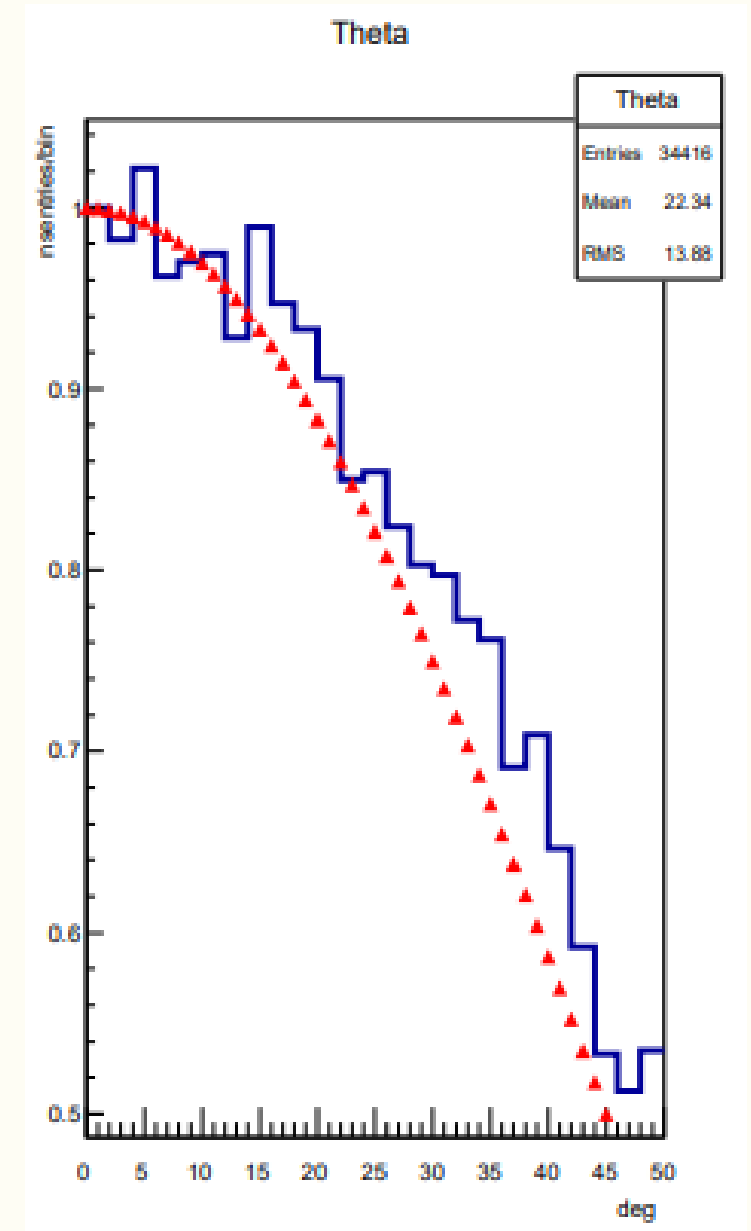
ALTA-o1

07/03/2019



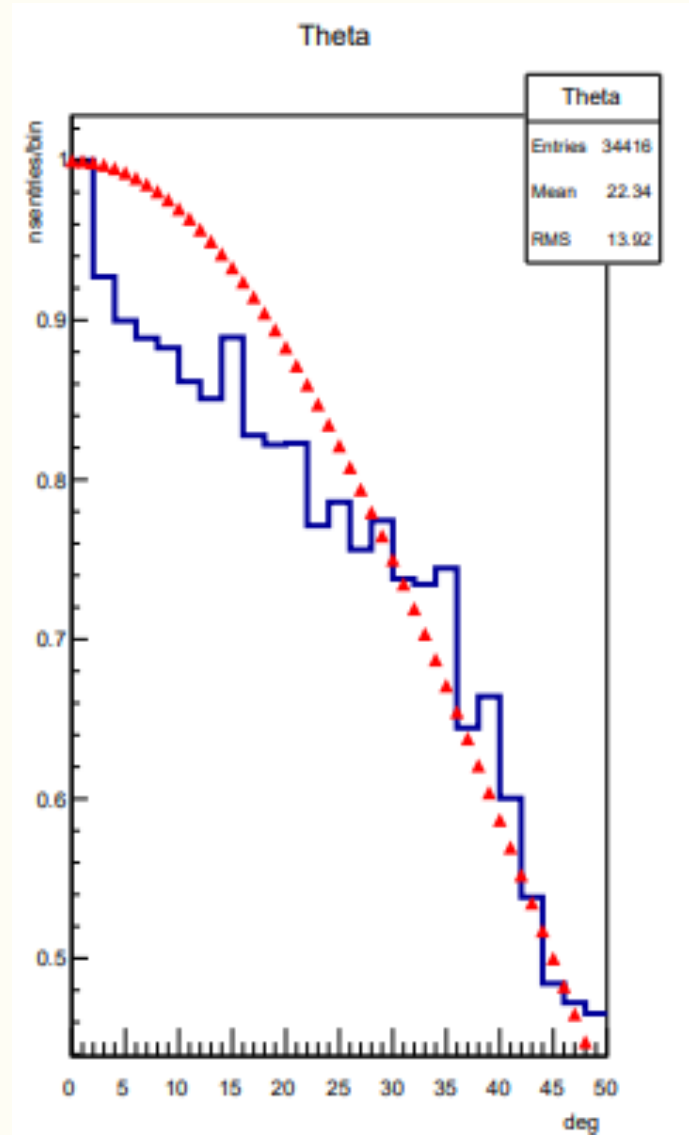
LECC-o1

X Conferenza Progetto EEE A. Melcarne M. Cafaro



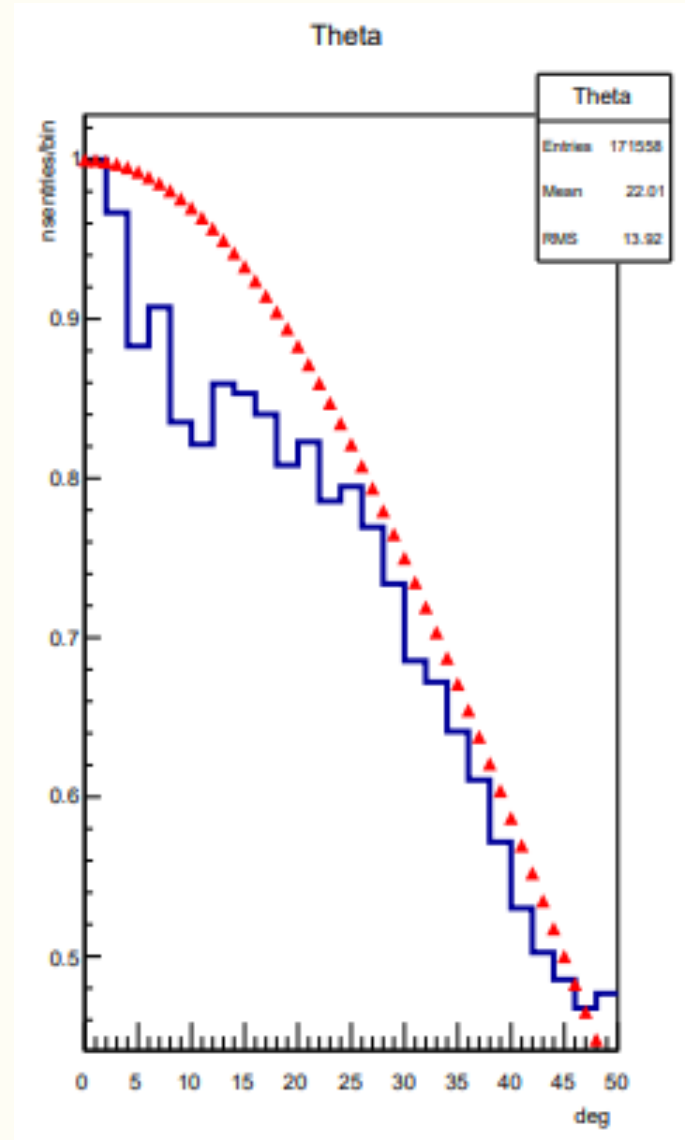
GROSS-o2

Cut: $0,92 < \text{BETA} < 1,09$



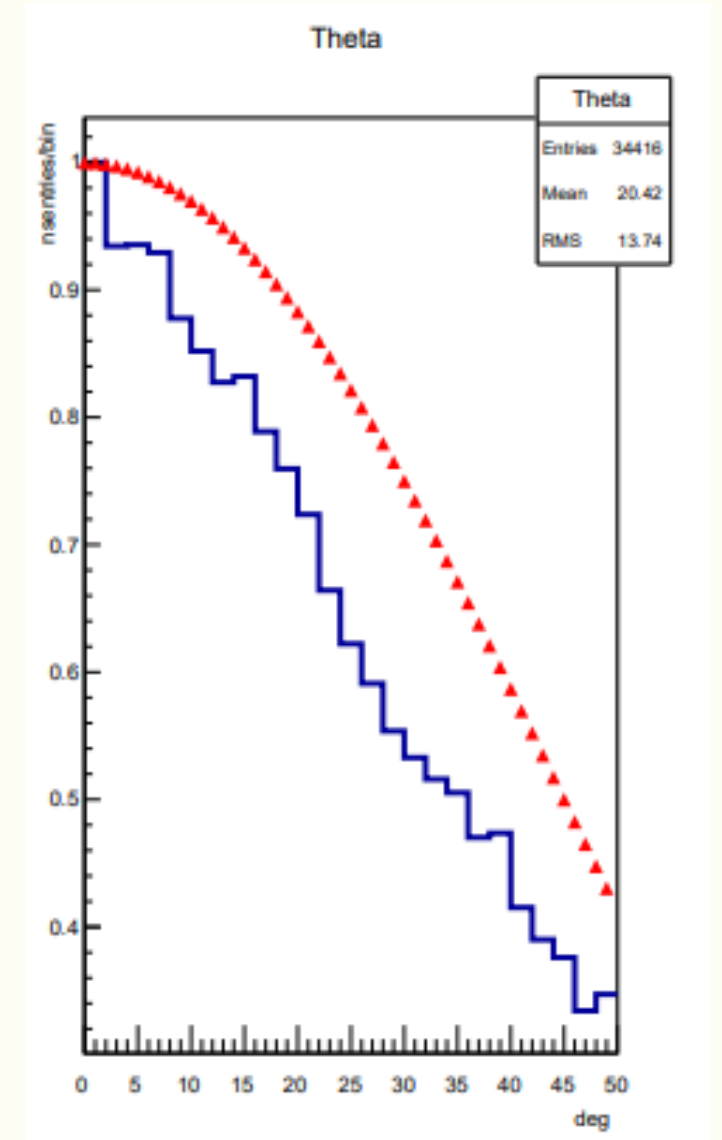
LECC-o1

07/03/2019



GROS-o2

X Conferenza Progetto EEE A. Melcarne M. Cafaro



ALTA-o1

RESULTS

- THETA depends on BETA
- Influence of altitude
- The values are different from $\cos^2\theta$ due to the absorption of the buildings

FUTURE PROJECT

- Study new telescopes
- Better understand normalization with MC data

