

Measurement of the speed of muons

International muon week

<http://www.i2u2.org/elab/cosmic/home/project.jsp>

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Measurement of the muon speed

«Dear Cosmic Ray Experimenters,

International Muon Week has begun! It's not too late to participate if you'd like to join in!

We have asked participants to measure the speed of muons, but if you want to tackle something a

bit easier, your group can take data measuring the flux of muons as usual. Even if you can't

participate this week, consider measuring the muon speed sometime over the next few weeks and sharing your results with others.

I've also cced this as a late invitation to our Global Cosmics colleagues. Please contact me if you have any questions.

Regards,
Mark»

Measurement of the muon speed



High school students use cutting-edge tools to do scientific investigations.



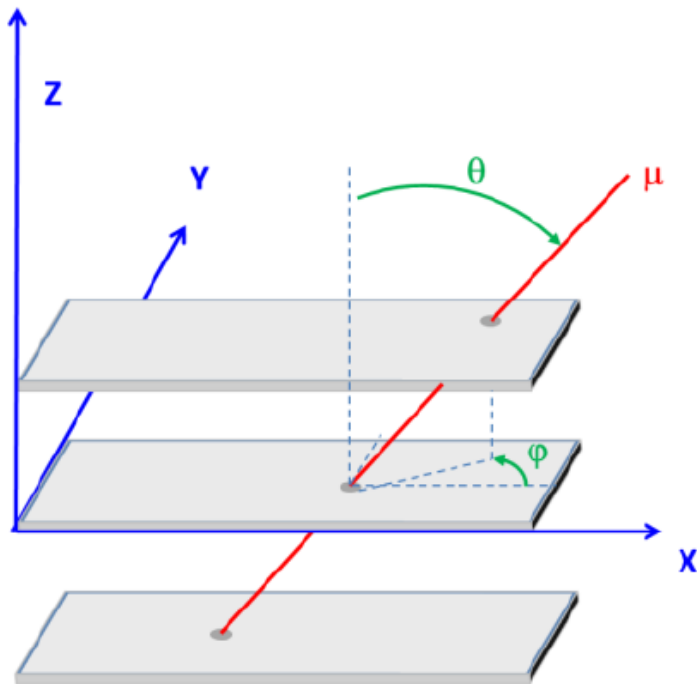
The Cosmic Ray e-Lab provides an online environment in which students experience the excitement of scientific collaboration in this series of investigations into high-energy cosmic rays. Schools with cosmic ray detectors upload data to a "virtual data" portal where ALL the data resides. This approach allows students to analyze a much larger body of data and to share analysis code. Also, it allows schools that do not have cosmic ray detectors to participate in research by analyzing shared data.

Students learn what cosmic rays are, where they come from and how they hit the Earth. While scientists understand cosmic rays with low to moderate energies, some cosmic rays have so much energy that scientists are not sure where they come from. A number of research projects are looking at this question. Students will have a chance to gain their own understanding of cosmic rays and may be fortunate enough to capture a rare highly-energetic cosmic ray shower on their classroom detector and analyze their results with this e-Lab. The Cosmic Ray e-Lab addresses ALL science and engineering practices in the Next Generation Science Standards.

[Information common for all e-Labs](#)
[Check out our online resources](#)

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A perfect tool for the purpose: an EEE telescope



...an its data

[EEE Monitor] RUN4: October 2, 2017 - May 30, 2018
[EEE Monitor] RUN 4 - Data Taking - Day number: 176
Total number of candidate tracks ($X^2 < 10$) in the database: 64256720661

SCHOOLS ELOGBOOK for RUN 4

SHIFTERS ELOGBOOK

Set Automatic Shift REPORT Messages

Automatic Shift Report ARCHIVE

Home Page EEE

Masterclass

Download the Excel Sheet

Coincidences

Connectivity Report

Data Request

La tabella qui sotto mostra la situazione dei telescopi in acquisizione:
In **verde** sono indicati i telescopi in presa dati e trasferimento nelle ultime 3 ore e con parametri di acquisizione ragionevoli nell'ultimo run analizzato.
In **giallo** sono indicati i telescopi in cui trasferimento e/o acquisizione sono sospesi da più di 3 ore o con tracce ($X^2 < 10$) minori di 10 Hz nell'ultimo run analizzato.
In **rosso** sono indicati i telescopi in cui trasferimento e/o acquisizione sono sospesi da più di due giorni o con tracce ($X^2 < 10$) minori di 5 Hz nell'ultimo run analizzato.

Tweets by @centrofermi

Centro Fermi Retweeted

PolarQuest2018
@Polarquest2018

Happy #WorldWaterDay to all of you!
#WorldWaterForum8 #WorldWaterWeek
#22march2018


Spread the word & RT to reduce inequalities in water supply! #Water4all #SDGs

TODAY IS WORLD WATER DAY!
LEARN HOW POLARQUEST2018 WILL...

Embed View on Twitter

School	Day	Time	Name of the last transferred File	Number of Files transferred today	Last Entry in the e-logbook of the Schools	Name of the last File analyzed by DQM	DQM daily report	RATE of Triggers for the last Run in DQM	RATE of Tracks for the last Run in DQM	Link DQM
ALTA-01 [Event Display]	lun 26 marzo	09:07	ALTA-01-2018-03-26-00018.bin	17 [History]	11:30 24/03/2018	ALTA-01-2018-03-26-00018.bin	26/03 [History]	27.0	22.0	ALTA-01
ANCO-01 [Event Display]	lun 26 marzo	08:22	ANCO-01-2018-03-26-00012.bin	12 [History]	13:47 22/03/2018	ANCO-01-2018-03-26-00012.bin	26/03 [History]	19.0	15.0	ANCO-01

Access to data

← → ↻ 🏠  Sicuro | <https://iatw.cnaf.infn.it/eee/elog/Query/?cmd=New>

Request a subset of data

Submit Preview Back

Fields marked with * are required

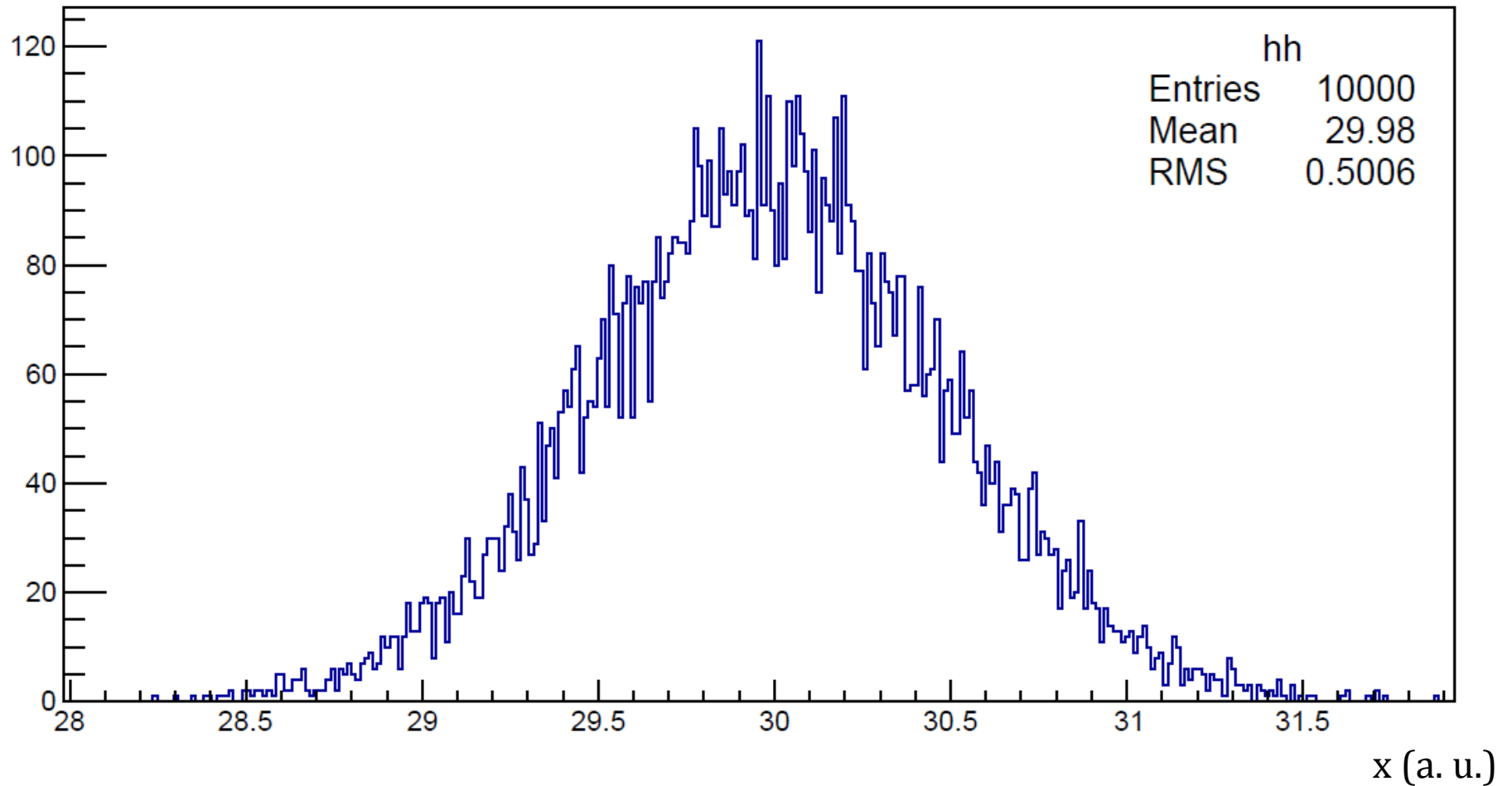
Entry time:	FrI Oct 20 10:36:49 2017
Author*:	CATA-01
Output format:	CSV ▼
MC:	<input type="checkbox"/>
Telescope ID:	CATA-02 ▼
Start time:	October ▼ 12 ▼ Year: 2017 📅
Stop time:	October ▼ 12 ▼ Year: 2017 📅
RunNumber:	<input type="checkbox"/>
Seconds:	<input type="checkbox"/>
Nanoseconds:	<input type="checkbox"/>
Theta:	<input checked="" type="checkbox"/>
Phi:	<input type="checkbox"/>
ChiSquare:	<input type="checkbox"/>
TimeOfFlight:	<input type="checkbox"/>
TrackLength:	<input type="checkbox"/>
DeltaTime:	<input type="checkbox"/>
Cut:	ChiSquare < 10 && RunNumber < 10

How to perform and **optimize** the measurement?

- What are the relevant variables?
- How do we get to the muon speed?
- How do we extract the final value?
- How many data points? How many stations to be included? The more the better?
- What is the precision of the measurement?
- How to optimize it?
- **Comment on the results: how the measured value compares with other fundamental quantities (e.g., c)?**

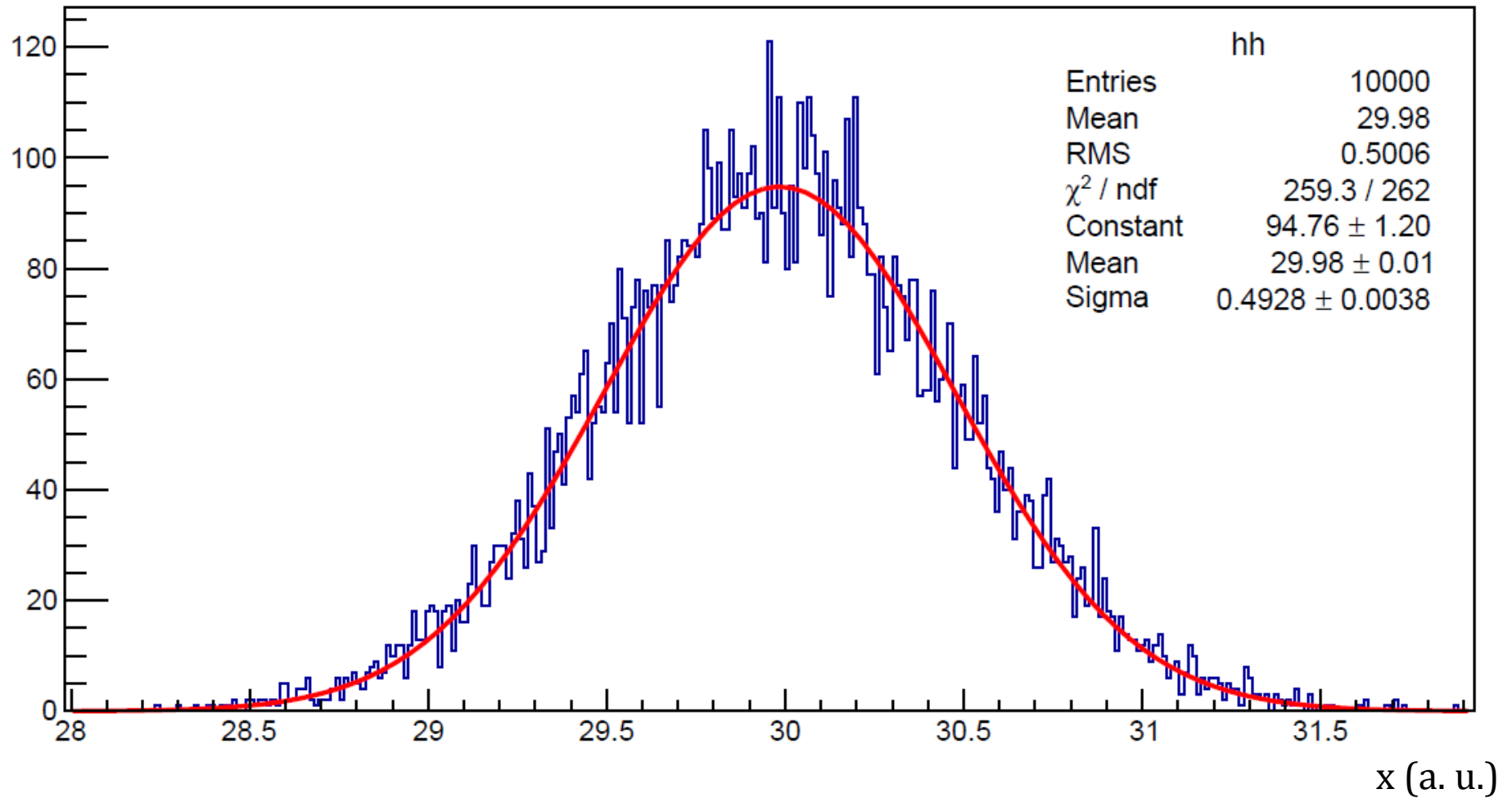
Statistics: mean

Gaussian distributed variable



Statistics: *fitted* mean

Gaussian distributed variable



- The measurement can be done at different levels: it is left to your own initiative to optimize it
- Final results will be presented in the next EEE run coordination meeting on a voluntary base
- If no volunteers will be found, schools will be extracted randomly to present their results
- **Best measurement/presentation will be awarded**

**Do not try to corrupt
your local referent
to get help!**