


# EEE – Extreme Energy Events

## Slewing Time Correction Simulation



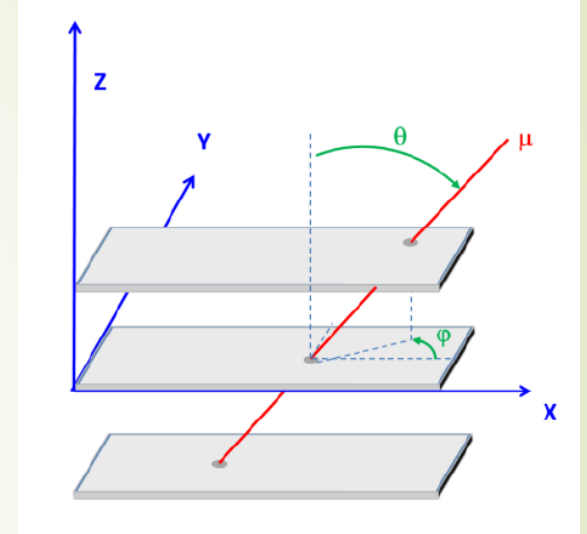
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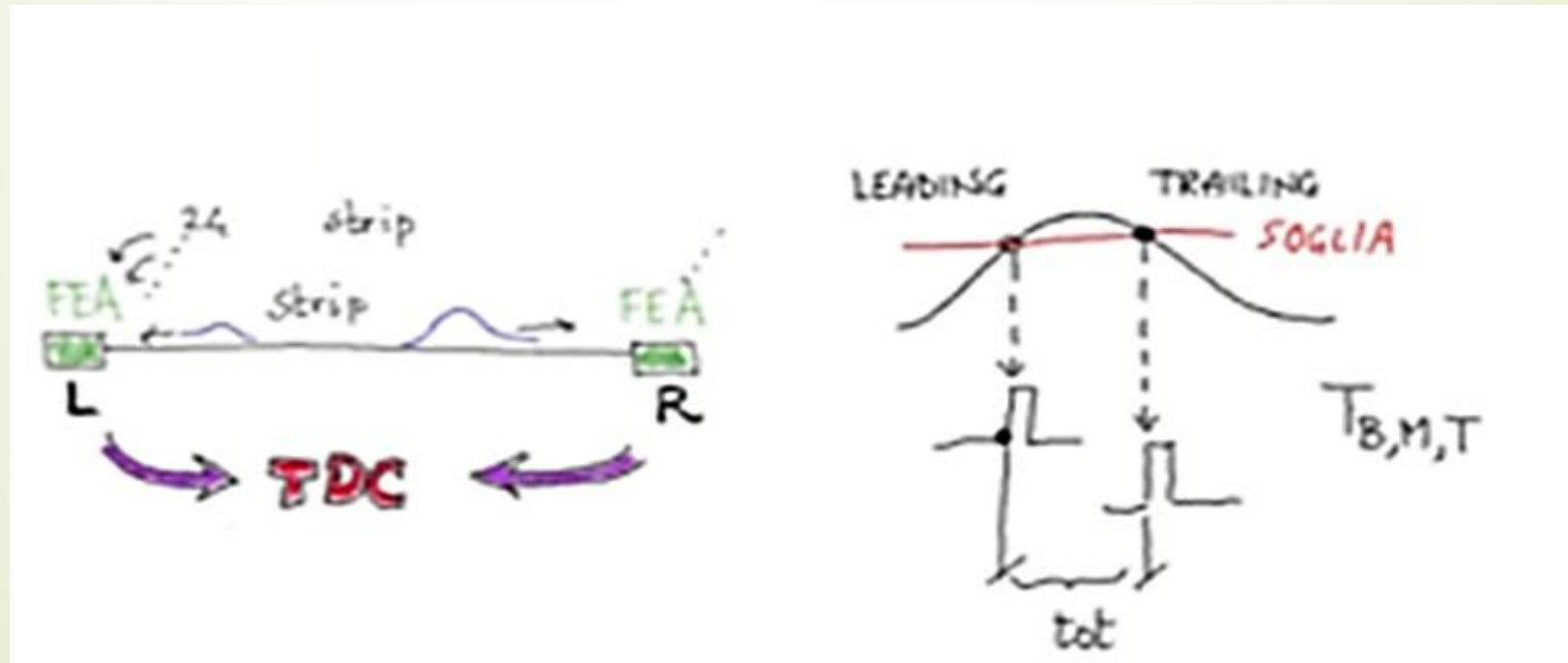
# Slewing Time Correction Simulation

- EEE telescopes consist of three chambers vertically arranged; the passage of a particle through three different chambers allows to determine the muon trajectory; each chamber is also equipped with metal strips that allow to detect the passage of a charged particle through the ionization of a gas contained in the chambers.
- The EEE project telescopes get experimental data that, like all experimental data, are affected by errors that the researchers try to minimize using appropriate methods for data processing.
- The present work takes into account the "slewing time correction" which deals with the correction of the time measured by the telescopes at the passage of a cosmic ray and proposes a simulation model for this kind of correction



# Slewing Time Correction Simulation

When a charged particle passes through a telescope chamber, the electronics of the device are activated to determine the crossing time. This is accounted by the time during which the signal is kept above a fixed threshold level



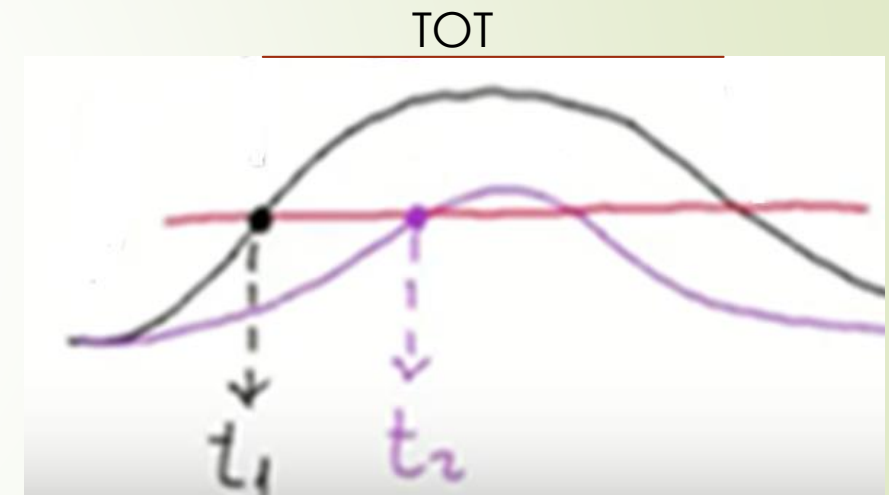
# Slewing Time Correction Simulation

- It may happen that two signals generated at the same time cross the threshold in different ways.
- In this case an error occurs which must be corrected.
- The correction takes into account the times  $t_1$  and  $t_2$  of the different signals that arrivals at the threshold line, and connects this difference to the time during which the signal remained above the threshold (tot: time over threshold) ; this data are finally related to a reference time



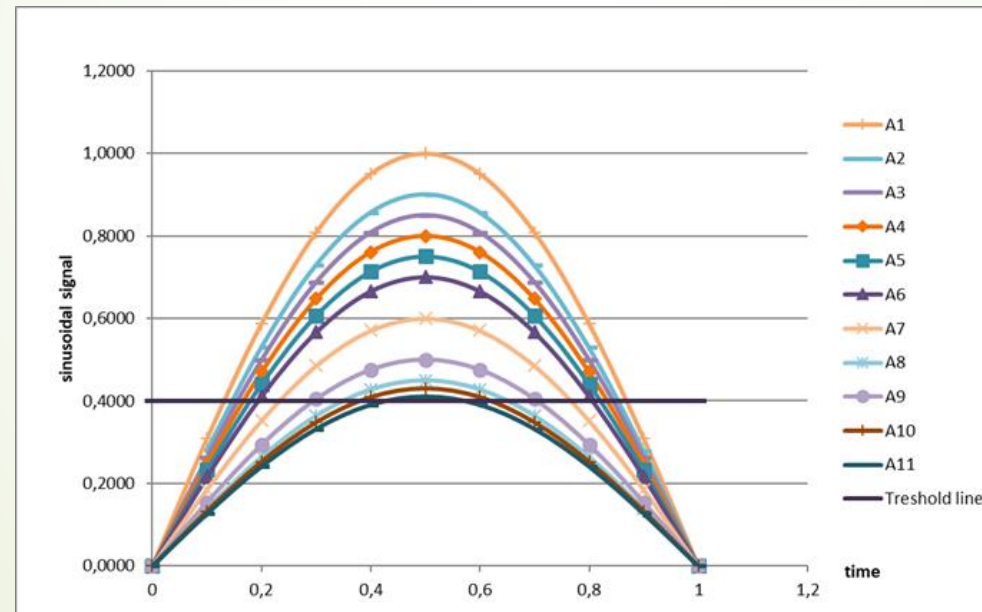
# Slewing Time Correction Simulation

- In the proposed simulation, realized with Excel software, the signals are represented by sinusoids of different amplitude that can be varied modifying the value of certain cells. The threshold line is set to a value that can be varied to simulate different situations. The times  $t_1$  and  $t_2$  and their difference are calculated in the simulation. The tot is measured as the time difference between the moment of rising of the signal (Leading) and that of falling (Trailing) these times are represented by the points of intersection between the curve of the signal and the threshold line.
- A graph is constructed that relates temporal differences with tots. We verify that experimental points are interpolated by a third degree polynomial.



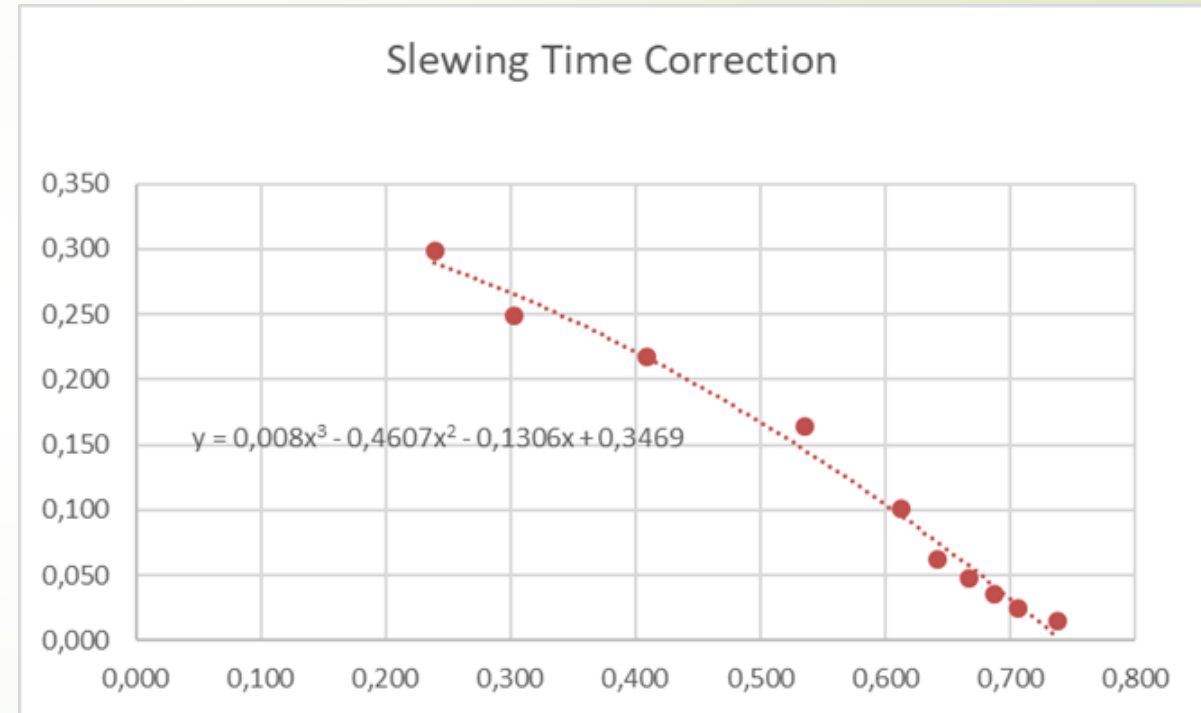
# Slewing Time Correction Simulation

- Several sinusoids with different amplitudes were created and a threshold line was set to simulate the time signals arriving on the strip with different times within a single measurement operation.



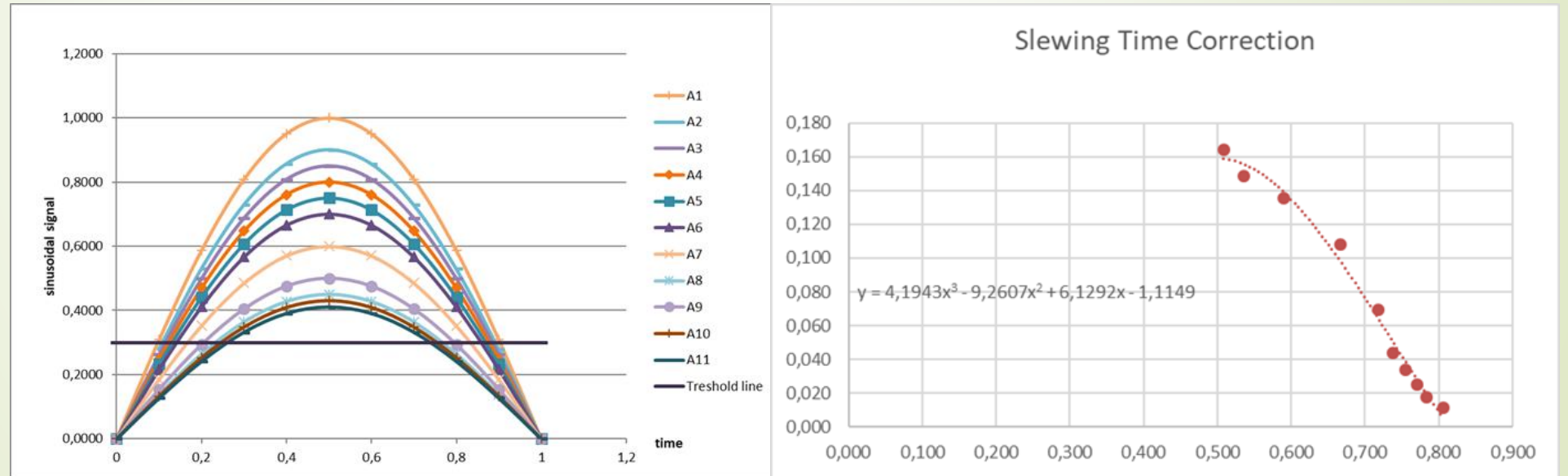
# Slewing Time Correction Simulation

- The time during which the signal remains above the threshold value was measured, calculating the time ( $t_{ot} = t_2 - t_1$ ) between two points of intersection of each signal with the threshold line and the delay with respect to the leading time ( $t_1$ ).
- The delay times have been plotted with respect to the  $t_{ot}$  and it has been verified that the polynomial that interpolates the data is of the third degree.



# Slewing Time Correction Simulation

- Moving the threshold line automatically changes the data and then the graphs







# Slewing Time Correction Simulation

- ▶ The results show that the simulation correctly interprets the phenomenon and is able to provide different interpolating polynomials by modifying the parameters on which the model depends, for example the threshold line. The program allows to selectively or simultaneously vary the amplitudes of the signals.
- ▶ The simulation could be constructed using data from experimental surveys and used for the study and analysis of slewing time correction.



Thanks for the attention.

Questions?