

Cherenkov Transparency Coefficient: status & plans

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Cherenkov Transparency Coefficient

$$\text{CTC} = \frac{1}{N} \sum_i^N \frac{\left[\frac{1}{M} R_i(\theta_{\text{zen}} = 0^\circ) \right]^{\frac{1}{1.7}}}{\mu_i \cdot g_i}$$

→ developed for H.E.S.S. data
by J.Hahn et al.
(Astropart. Phys. 54, 25, 2014)

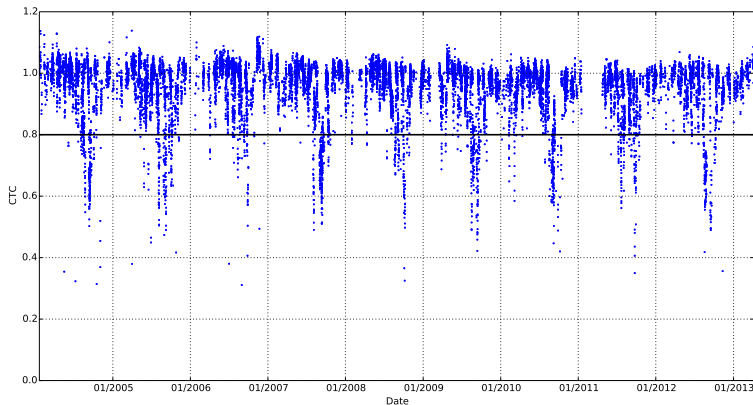
General concept:

- ① reproduce CTC for H.E.S.S. data and Monte Carlo (current stage)
- ② fine tune the definition
 - ▶ multiplicity correction M does not account for different patterns of telescope layout
- ③ extend the definition for CTA MC
 - ▶ M is now hard-coded
 - ▶ for H.E.S.S. I not a big problem: 1 dish size, only 2 different multiplicities taken into account (3 or 4)
 - ▶ look-ups for CTA would get really messy... →
... better try to avoid that



CTC in data

- the code identifies well the presence of atmospheric absorbers, e.g. the regular decrease in atmospheric transparency
- September – October: periods of biomass burning near the H.E.S.S. site



CTC in Monte Carlo

- we investigated the relation between data and MC variables for H.E.S.S. I
- after relevant corrections, the MC CTC generally fits with the data taken at good atmospheric conditions (as expected)
- in CTA, we can only use MC to define CTC
→ I would like to encourage a central place in which all details of MC simulations would be collected and described, for example in a table describing for each simulation assumed hardware conditions, atmospheric profiles, used definitions etc. :

Profile	Array layout	Ntels	(x_i, y_i, z_i)	μ_i	g_i	...
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...

Current status

We need to improve several issues. CTC has some residuals from the mean due to:

- *hardware maintenance* (e.g. refurbishment of mirrors) of individual telescopes (i.e. not all at the same time)
- *pattern of telescopes* participating in central trigger events
 - if the telescopes are not located within a regular polygon, each contributes to the trigger events with different participation fraction
- *different multiplicities and sizes* of active telescopes
- ...?

Correction M is now a mean over all scenarios with different patterns of telescopes and hardware conditions \implies gives RMS of CTC $\approx 9\%$

Things to be done

- Make CTC fully hardware independent.
- Reduce RMS of CTC.
- Extend the definition for CTA, i.e. effectively cope with different telescope sizes and array layouts.

Future plans

Provided CTC is fully hardware-independent, try to exploit its potential.



Assume that muon efficiencies and gains are stable on the scale of several days and use their values from previous day to calculate CTC.



Extension of the CTC use for CTA: online monitoring

- Atmospheric monitoring
 - ▶ if the transparency suddenly decreases during a run (clouds, mist), CTC notices this
 - ▶ one can then define Good Time Intervals (e.g. $CTC > 0.8$)
 - ▶ good for ToO observations
- Array calibration
 - ▶ use CTC as an indicator of bad performance of a telescope